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Stage-Discharge Relations for Selected Culverts and Bridges in the Big Lost River Flood Plain at the Idaho National Engineering and Environmental Laboratory, Idaho

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Water-Resources Investigations Report 03–4066

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Idaho Falls, Idaho
2003

U.S. DEPARTMENT OF THE INTERIOR
GALE A. NORTON, Secretary

U.S. GEOLOGICAL SURVEY
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Multiply	By	To obtain
inch (in.)	2.54	centimeter (cm)
foot (ft)	0.3048	meter (m)
foot per mile (ft/mi)	0.1894	meter per kilometer (m/km)
mile (mi)	1.609	kilometer (km)
cubic foot per second (ft^3/s)	0.02832	cubic meter per second (m^3/s)

Sea level: In this report "sea level" refers to the National Geodetic Vertical Datum of 1929—a geodetic datum derived from a general adjustment of the first-order level nets of the United States and Canada, formerly called Sea Level Datum.

Stage-Discharge Relations for Selected Culverts and Bridges in the Big Lost River Flood Plain at the Idaho National Engineering and Environmental Laboratory, Idaho

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Abstract

Information is needed by the U.S. Department of Energy at the Idaho National Engineering and Environmental Laboratory to determine the extent and severity of potential flooding at facilities along the Big Lost River. Two computer programs—the Culvert Analysis Program (CAP) and the HEC-RAS model—were used to define stage-discharge relations for 31 culverts and 2 bridge sites in a 10-mile reach of the river. These relations can be used to improve surface-water-flow models to evaluate potential flooding.

Relations between headwater, tailwater, and discharge through each structure were unique. Discharge through the culverts as computed by the CAP ranged from about 0 cubic feet per second to as much discharge as could be conveyed, and tailwater elevations ranged from about 0 to 30 feet above the outlet elevation. Discharge through the bridges, as computed by the HEC-RAS model, ranged from nearly 0 to 7,000 cubic feet per second, and tailwater elevations ranged from nearly 0 to 30 feet above the streambed on the downstream cross section of each bridge.

Stage-discharge relations provided in lookup tables in this report can be incorporated into numerical surface-water-flow models to simulate the effects of hydraulic structures on flood flows. One limitation of the CAP and HEC-RAS models is that changes in flow conditions, such as obstruction by sediment and debris, are not simulated. If flow through a hydraulic structure is obstructed by sediment or debris, then model-simulated discharges through the structure might be greater than would be experienced under actual conditions.

INTRODUCTION

Over the past 5 years, concerns about flooding on the Big Lost River at the Idaho National Engineering and Environmental Laboratory (INEEL), especially to facilities near the river, have prompted a number of flood-plain studies. In the reach between the INEEL diversion dam and Pioneer diversion structures (fig. 1), Ostenaa and others (1999) used a combination of the elevation of paleostage indicator sites and a two-dimensional surface-water model to estimate paleoflood discharge. Two-dimensional models are ideally suited for simulating flows over complex topography having spatially variable resistance. These models allow flexibility in representing flows in and around geometric features such as irregular-shaped water boundaries, channels, islands, dikes, and embankments. Most two-dimensional surface-water models use defined stage-discharge relations to simulate flow through culverts and (or) bridges.

In 2001, the U.S. Geological Survey (USGS), in cooperation with the U.S. Department of Energy (DOE), began a study to evaluate the hydraulics of culverts and bridges in the Big Lost River and flood plain (fig. 1) from the INEEL diversion dam to about 1 mi downstream from the U.S. Government railroad near the Idaho Nuclear Technology and Engineering Center (INTEC). The resulting stage-discharge relations for culverts and bridges can be incorporated into numerical surface-water-flow models so that the effects of these hydraulic structures on flood flows can be simulated more accurately.

Purpose and Scope

This report documents the methods for and results of determining stage-discharge relations for 31 culvert sites in the study area using the USGS Culvert Analysis Program (CAP) (Fulford, 1998) and for two bridge sites using the U.S. Army Corps of Engineers HEC-

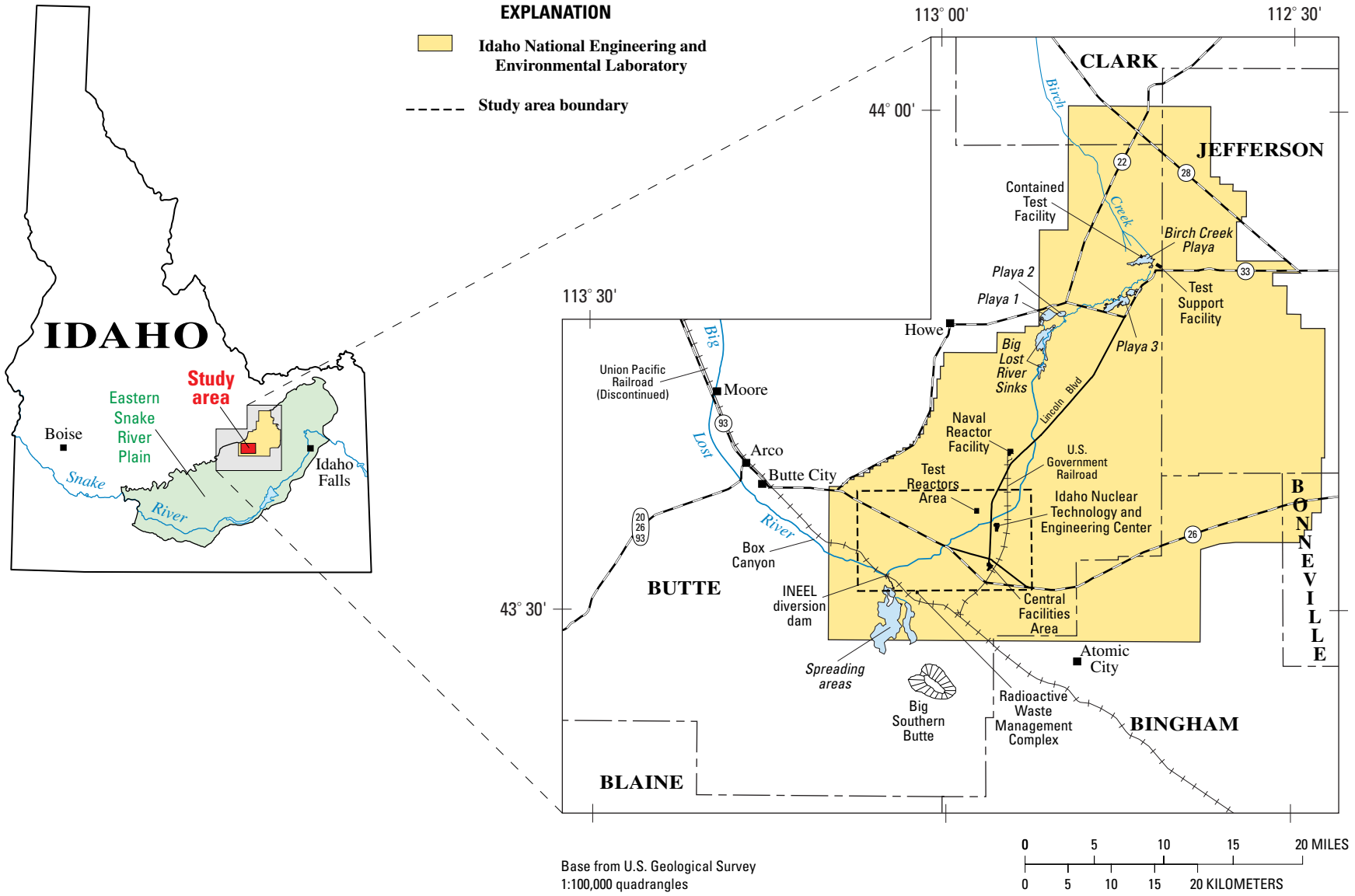

Figure 1. Location of study area and facilities and features at the Idaho National Engineering and Environmental Laboratory, Idaho.

RAS model (Brunner, 2001a, 2001b; Warner and others, 2001). Model-computed stage-discharge relations are described in lookup tables by relating three parameters—headwater elevation, tailwater elevation, and discharge—through each structure. These relations can be incorporated into surface-water models of the Big Lost River and flood plain.

Description of the Study Area

The study area is a 10-mi reach located between the INEEL diversion dam and about 1 mi downstream from the U.S. Government railroad bridge near the INTEC facility (fig. 2). The Big Lost River is an ephemeral stream in the study area. Near the western boundary of the INEEL, the river exits Box Canyon, a narrow gorge with nearly vertical walls cut into basaltic rocks. On the INEEL, the river typically is incised less than 20 ft into surficial sediments and basalts. Channel slope from the INEEL diversion dam to State Highway 20/26 is 0.0024. Downstream from State Highway 20/26, the flood plain broadens and is characterized by braided channels and remnants of old meander channels. Channel slope is 0.0024 from State Highway 20/26 to Lincoln Boulevard near INTEC and 0.0031 from there to the U.S. Government railroad. The channel downstream from the railroad ends in a series of playas in the northern part of the INEEL (fig. 1).

Many anthropogenic features in the Big Lost River and flood plain affect flood hydraulics and flow. The INEEL diversion dam is located in the upstream part of the study area. The diversion dam, a low, earthen dam, was constructed in 1958 and enlarged in 1984 to reduce the threat of floods from the Big Lost River. Water is diverted southeastward at the dam through a diversion channel and is stored in a connected series of spreading areas (figs. 1 and 2). Two culverts with control valves regulate flow through the dam (culvert site 1 on fig. 2). Immediately downstream is another pair of culverts under a discontinued railroad. A complete description of these culverts can be found in reports by INEEL (2001) and Kingsford (2001).

About 3 mi downstream from the diversion dam are the Pioneer weir and canal diversion structures (fig. 2), concrete structures constructed to divert water to canals on both sides of the river. The weir and canals were constructed for agricultural interests before the inception of the INEEL in 1949 and have been abandoned. The canals have been filled in at their heads and in many other places and have been breached in many places to prevent water from flowing in them. The canal west of the river is about 20 mi long and intersects the Test Reactor Area (TRA) facility. The canal east of the river intersects other canals and ends at the Big Lost River just before Lincoln Boulevard.

About 6 mi downstream from the INEEL diversion dam, State Highway 20/26 crosses the river and its flood plain. A concrete bridge, 61 ft long and 40 ft wide, spans the river at an angle of 38 degrees in relation to the river channel (INEEL, 2001; Kingsford, 2001). The streambed is about 8 ft below the bottom of the bridge girders.

Near INTEC, Lincoln Boulevard crosses the Big Lost River and its flood plain. Three corrugated, circular, steel culverts, 7.5 ft high and about 150 ft long, pass water under Lincoln Boulevard. The upstream and downstream ends of the culverts are embedded in concrete headwalls. The channel from Lincoln Boulevard to the railroad bridge has been straightened and deepened, and the riverbanks have been raised with excavated materials.

About 1 mi east of Lincoln Boulevard near INTEC, a U.S. Government railroad bridge crosses the Big Lost River at nearly a right angle. The bridge, 37 ft long and 12 ft wide, is supported by concrete abutments and a 2-ft-wide concrete pier in the middle of the channel.

Structures within the river and flood plain downstream from the railroad bridge are beyond the scope and area of this study. In the study area, many paved and dirt roads crisscross the flood plain. Culverts were placed where roads cross over drainage features. Kingsford (2001), in a study to document all culverts in the study area, located 31 culvert sites. Some sites have multiple culverts. For example, site 9, shown on figure 2, comprises four different-sized corrugated culverts underneath a gravel road. Five culvert sites exist on Monroe Boulevard (fig. 2). Of the 31 culvert sites, all but three are associated with roads. Culverts at those three sites convey water through the railroad embankment near INTEC.

Riparian vegetation in the study area is mainly sagebrush and grass; vegetation is denser near the river. Sparse stands of cottonwood trees grow along the river. Most of these trees are now dead because streamflow has been infrequent and a wildfire in the study area occurred in May 2001.

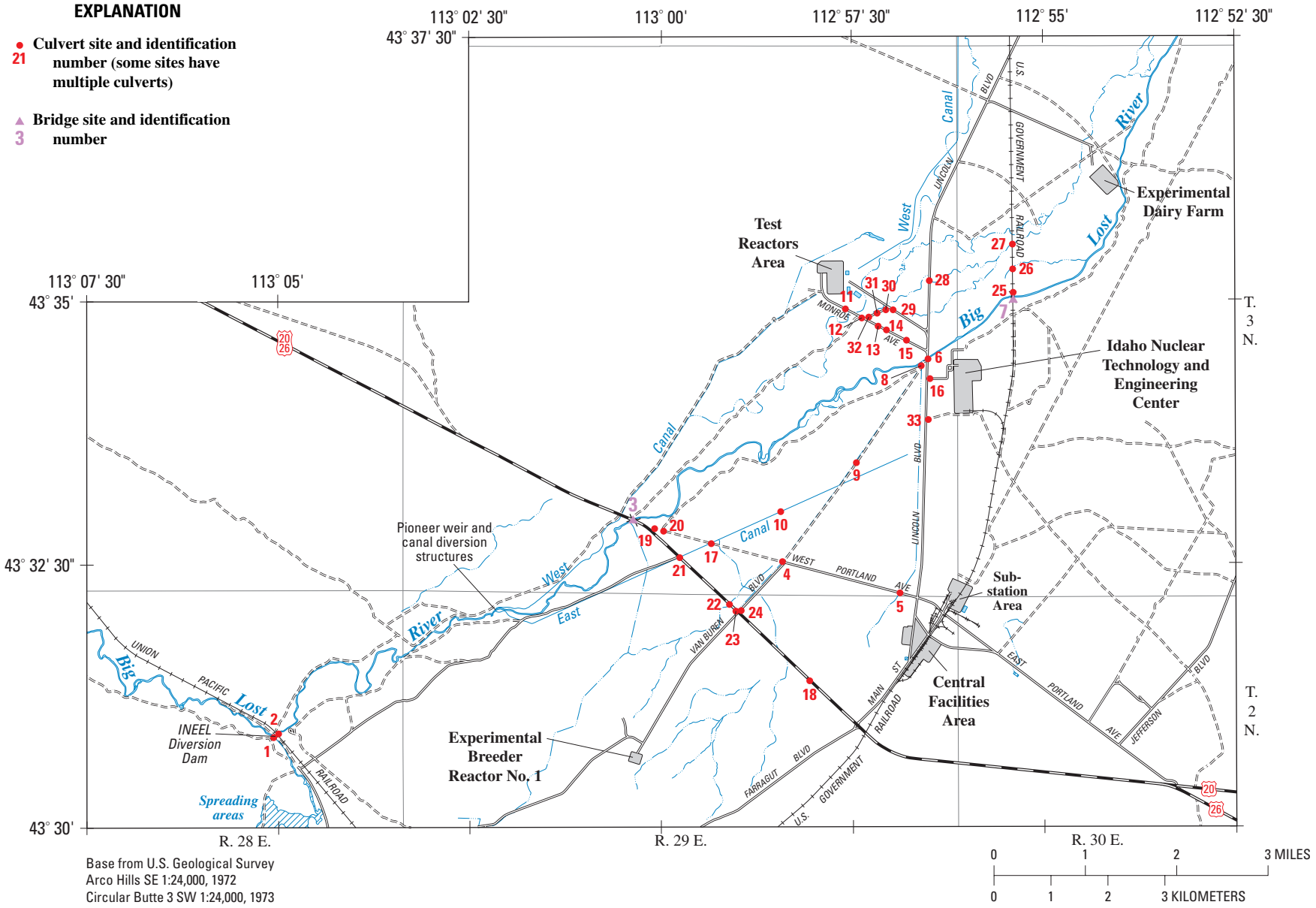

Figure 2. Location of study area and culvert and bridge sites at the Idaho National Engineering and Environmental Laboratory, Idaho.

Acknowledgments

The authors gratefully acknowledge the support of Clint O. Kingsford and Jeff A. Lawrence, U.S. Department of Energy at the INEEL, who provided data needed for this study and obtained additional data on culverts. Appreciation also is extended to Ken Beard, INEEL, who obtained horizontal and vertical controls for culverts by use of a Global Positioning System (GPS) and converted these data for our use.

METHODS OF ANALYSIS

The hydraulic analysis for this study was based on an assumption of unobstructed flow; in other words, the channel, flood plain, and structures (culverts and bridges) were assumed to be free of debris. This assumption is probably reasonable for the bridge at State Highway 20/26, as this bridge was classified as a nonscour, critical bridge site in a statewide bridge assessment study (Lotwick Reese, Idaho Transportation Department, oral commun., 2002). Because only highway and road bridges were evaluated in the statewide study, the assumption of unobstructed flow might not be valid for the other hydraulic structures in the study area, as several culverts were completely or partially filled with sediment (Kingsford, 2001). The models used for the present study can simulate discharge through hydraulic structures that are partially or completely filled with sediment or debris; however, cross-sectional shape must be constant throughout the structure. All elevations were referenced to the National Geodetic Vertical Datum of 1929 (NGVD), in feet.

Culverts

Stage-discharge relations for the 31 culvert sites were computed using CAP (Fulford, 1998) for a range of discharges and stages at each culvert site. CAP is a mathematical model that computes discharge through a culvert on the basis of the conservation of energy (Bernoulli's equation) and mass (continuity equation) between the approach section and a downstream section. CAP computes headwater elevations by determining flow type from specified combinations of tailwater elevation and discharge through a culvert and using appropriate equations. The procedures and computations in CAP are based on USGS methods documented by Bodhaine (1968), which, in turn, are based on field investigations (Carter, 1957) and on laboratory investigations by the USGS, the Bureau of Public Roads, and many universities.

CAP incorporates several simplifying assumptions about culvert flow. CAP assumes ponded conditions only for sluice-gate flow (type 5) and orifice flow (type 6). Stage-discharge relations for these two types of flow may not be computed accurately because velocity head at the approach section and friction losses between the approach section and the culvert inlet are ignored in the program. When supercritical conditions exist in the approach section, CAP cannot be used because flow equations used in CAP are structured for solving only subcritical flow. Subcritical flows exist throughout the study area, including the vicinity around culverts and bridges, as shown in the previous USGS model of the Big Lost River (Berenbrock and Kjelstrom, 1998); therefore, the use of CAP was deemed appropriate for this study. However, CAP cannot simulate flows over roads and (or) embankments because equations to simulate these features were not included in the program. CAP cannot simulate partially or fully blocked flows. Other assumptions are constant culvert dimensions and material type throughout its length, constant slope (no breaks), no severe adverse slopes, and no control valves.

Culvert-geometry data given in reports by INEEL (2001) and Kingsford (2001) for the 31 sites were used in CAP, and selected data from these reports are presented in table 1. Twenty-six culvert sites were made of corrugated metal pipe, three were made of concrete pipe, and two were made of multiplate pipe (table 1). Most culverts were circular in shape; however, three sites were elliptical—site 2 (taller than wide), and sites 4 and 5 (wider than tall). Also, sites 1, 2, and 6 had mitered entrances, whereas all others were considered to have vertical headwalls.

Bridges

The computer model HEC-RAS (Brunner, 2001a, Brunner, 2001b) commonly is used to determine the water-surface profile in a stream reach for a specified discharge. The model also can determine the water-surface profile through bridges, culverts, and in flood plains. Version 3.0.1 of the model was used for this study to determine stage-discharge relations for bridge structures. HEC-RAS computes one-dimensional, gradually varied, steady flow in open channels with fixed boundaries. The model uses the standard-step

Table 1. Culvert-geometry and other data for 31 culvert sites at the Idaho National Engineering and Environmental Laboratory, Idaho

[Invert elevations are based on the National Geodetic Vertical Datum of 1929; H, height of culvert; W, width of culvert; vhw, vertical headwall; latitude and longitude, in degrees, minutes and seconds, are based on the North American Datum of 1927]

Site	Culvert roughness (*n*)	Shape	Dimensions (inches)	Culvert material	Barrell length (feet)	Invert elevation (feet)		Inlet type	Outlet type
						Inlet	Outlet		
1-east	0.035	circular	72	corrugated	148	5,043.38	5,042.65	mitered	mitered
1-west	.024	circular	72	corrugated	148	5,043.06	5,042.25	mitered	mitered
2-west	.034	nonstandard	75H x 63W	multiplate	76	5,043.97	5,043.36	mitered	mitered
2-west	.034	nonstandard	75H x 63W	multiplate	76	5,044.01	5,042.70	mitered	mitered
4-east	.024	elliptical	18H x 27H	corrugated	45	4,954.81	4,954.61	vhw	vhw
4-west	.024	elliptical	18H x 27W	corrugated	45	4,954.71	4,954.51	vhw	vhw
5	.024	elliptical	36H x 40W	corrugated	67	4,934.03	4,933.93	vhw	vhw
6-north	.033	circular	90	multiplate	149	4,911.68	4,911.03	mitered	mitered
6-center	.033	circular	90	multiplate	149	4,911.49	4,911.03	mitered	mitered
6-south	.033	circular	90	multiplate	149	4,911.49	4,910.93	mitered	mitered
8	.024	circular	48	corrugated	61	4,916.81	4,916.51	vhw	vhw
9-1	.024	circular	18	corrugated	26	4,934.61	4,934.01	vhw	vhw
9-2	.024	circular	36	corrugated	26	4,933.81	4,933.51	vhw	vhw
9-3	.024	circular	18	corrugated	26	4,934.31	4,933.91	vhw	vhw
9-4	.024	circular	18	corrugated	26	4,934.41	4,933.81	vhw	vhw
10	.024	circular	36	corrugated	50	4,947.91	4,947.91	vhw	vhw
11	.024	circular	24	corrugated	121	4,919.50	4,918.40	vhw	vhw
12	.024	circular	18	corrugated	72	4,920.60	4,920.30	vhw	vhw
13	.024	circular	18	corrugated	80	4,919.30	4,919.10	vhw	vhw
14	.024	circular	18	corrugated	72	4,918.60	4,918.30	vhw	vhw
15	.024	circular	18	corrugated	74	4,917.90	4,917.40	vhw	vhw
16	.024	circular	24	corrugated	73	4,918.41	4,918.21	vhw	vhw
17	.015	circular	18	concrete	34	4,965.61	4,965.61	vhw	vhw
18	.024	circular	18	corrugated	85	4,948.93	4,948.53	vhw	vhw
19	.015	circular	18	concrete	32	4,967.30	4,967.20	vhw	vhw
20	.015	circular	18	concrete	36	4,966.80	4,966.90	vhw	vhw
21	.024	circular	24	corrugated	56	4,973.90	4,972.20	vhw	vhw
22	.024	circular	18	corrugated	64	4,968.41	4,967.71	vhw	vhw
23	.024	circular	24	corrugated	48	4,967.71	4,966.41	vhw	vhw
24	.024	circular	24	corrugated	68	4,967.21	4,966.71	vhw	vhw
25	.024	circular	24	corrugated	41	4,898.21	4,897.71	vhw	vhw
26	.024	circular	24	corrugated	30	4,896.91	4,896.61	vhw	vhw
27	.024	circular	24	corrugated	34	4,890.41	4,890.31	vhw	vhw
28	.024	circular	24	corrugated	74	4,909.50	4,909.30	vhw	vhw
29	.024	circular	18	corrugated	61	4,916.30	4,915.80	vhw	vhw
30	.024	circular	12	corrugated	48	4,917.20	4,916.40	vhw	vhw
31	.024	circular	12	corrugated	60	4,918.00	4,918.40	vhw	vhw
32	.024	circular	12	corrugated	49	4,919.60	4,919.50	vhw	vhw
33	.024	circular	18	corrugated	53	4,922.21	4,921.91	vhw	vhw

method (Chow, 1959, p. 265) to determine changes in water-surface elevation from a downstream cross section to an upstream cross section by balancing the total energy at the sections. In sections that include bridges or culverts, HEC-RAS computes the energy loss caused by these structures. The model also allows for multiple bridge openings and (or) many culverts at a site.

HEC-RAS incorporates several simplifying assumptions about flow. HEC-RAS assumes energy is

Table 1. Culvert-geometry and other data for 31 culvert sites at the Idaho National Engineering and Environmental Laboratory, Idaho—continued

Site	Inlet				Outlet			
	Latitude		Longitude		Latitude		Longitude	
1-east	43° 30' 53.140938"		113° 05' 04.334264"		43° 30' 53.030538"		113° 05' 02.186911"	
1-west	43° 30' 53.245097"		113° 05' 04.348470"		43° 30' 53.132984"		113° 05' 02.330114"	
2-east	43° 30' 53.307415"		113° 05' 01.470093"		43° 30' 53.879541"		113° 05' 00.559513"	
2-west	43° 30' 53.412654"		113° 05' 01.582633"		43° 30' 53.987864"		113° 05' 00.677574"	
4-east	43° 32' 31.292820"		112° 58' 24.329687"		43° 30' 31.313451"		112° 58' 24.371111"	
4-west	43° 32' 30.945609"		112° 58' 24.694838"		43° 32' 30.965203"		112° 58' 24.733495"	
5	43° 32' 13.191964"		112° 56' 52.646250"		43° 32' 13.738245"		112° 56' 52.127145"	
6-north	43° 32' 51.260225"		113° 00' 07.224659"		43° 34' 27.165524"		112° 56' 30.344028"	
6-center	43° 34' 26.302302"		112° 56' 31.966913"		43° 34' 27.052251"		112° 56' 30.254060"	
6-south	43° 34' 26.188017"		112° 56' 31.876961"		43° 32' 50.961644"		113° 00' 07.368848"	
8	43° 34' 24.026667"		112° 56' 35.197172"		43° 34' 24.626094"		112° 56' 35.169969"	
9-1	43° 33' 27.513973"		112° 57' 27.477821"		43° 33' 27.678728"		112° 57' 27.327340"	
9-2	43° 33' 27.501591"		112° 57' 27.452964"		43° 33' 27.664320"		112° 57' 27.302517"	
9-3	43° 33' 27.485132"		112° 57' 27.425391"		43° 33' 27.649887"		112° 57' 27.274909"	
9-4	43° 33' 27.472775"		112° 57' 27.403318"		43° 33' 27.641581"		112° 57' 27.252767"	
10	43° 33' 05.329967"		112° 58' 08.928039"		43° 33' 05.528954"		112° 58' 08.303504"	
11	43° 34' 52.918568"		112° 57' 30.920282"		43° 34' 53.351351"		112° 57' 29.391244"	
12	43° 34' 47.832773"		112° 57' 17.085603"		43° 34' 48.367930"		112° 57' 16.454908"	
13	43° 34' 42.156578"		112° 57' 02.105371"		43° 34' 42.930290"		112° 57' 01.863427"	
14	43° 34' 39.510184"		112° 56' 54.995367"		43° 34' 40.192663"		112° 56' 54.746629"	
15	43° 34' 35.617885"		112° 56' 44.607990"		43° 34' 36.142041"		112° 56' 43.888274"	
16	43° 34' 14.891277"		112° 56' 30.115957"		43° 34' 15.607435"		112° 56' 30.114560"	
17	43° 32' 41.799711"		112° 59' 21.078611"		43° 32' 42.137801"		112° 59' 20.936491"	
18	43° 31' 20.381973"		112° 57' 58.886377"		43° 31' 20.805589"		112° 57' 58.347388"	
19	43° 32' 50.962681"		113° 00' 07.371616"		43° 32' 51.259286"		113° 00' 07.233031"	
20	43° 32' 49.312944"		113° 00' 00.232532"		43° 32' 49.658381"		113° 00' 00.118197"	
21	43° 32' 34.249544"		112° 59' 45.161316"		43° 32' 34.230105"		112° 59' 45.139359"	
22	43° 32' 06.705793"		112° 59' 06.293759"		43° 32' 07.155138"		112° 59' 05.676383"	
23	43° 32' 02.959864"		112° 59' 00.715006"		43° 32' 03.323781"		112° 59' 00.288417"	
24	43° 32' 02.380781"		112° 58' 58.817292"		43° 32' 02.851514"		112° 58' 59.466543"	
25	43° 35' 03.901842"		112° 55' 24.291825"		43° 35' 03.930119"		112° 55' 23.745088"	
26	43° 35' 18.011312"		112° 55' 24.383138"		43° 35' 18.114085"		112° 55' 24.002263"	
27	43° 35' 31.871924"		112° 55' 24.618244"		43° 35' 31.985313"		112° 55' 24.181410"	
28	43° 35' 07.972424"		112° 56' 29.846528"		43° 35' 07.944928"		112° 56' 28.846493"	
29	43° 34' 52.899492"		112° 56' 55.422801"		43° 34' 53.402909"		112° 56' 54.979303"	
30	43° 34' 55.365395"		112° 57' 01.962299"		43° 34' 55.054266"		112° 57' 01.505096"	
31	43° 34' 53.465319"		112° 57' 08.062111"		43° 34' 52.907739"		112° 57' 08.344885"	
32	43° 34' 50.878581"		112° 57' 16.400312"		43° 34' 50.384764"		112° 57' 16.456233"	
33	43° 33' 52.195736"		112° 56' 31.984350"		43° 33' 52.727408"		112° 56' 31.969473"	

uniform at cross sections, flow varies gradually from one cross section to the next except at hydraulic structures where changes in flow conditions can be quite abrupt, and channel boundaries are not moveable. HEC-RAS can simulate subcritical, critical, and supercritical flows in a reach.

For this study, HEC-RAS was used only for bridge sites and not for culvert sites. This model is able to simulate discharge through culverts but was not used for this purpose because culvert hydraulic representation in HEC-RAS is based on design charts and nomographs (Federal Highway Administration, 1965, 1972,

Table 2. Bridge-geometry and other data for two bridge sites at the Idaho National Engineering and Environmental Laboratory, Idaho

Bridge length—distance or span measured between left and right abutments, with or without wingwalls.

Bridge-opening type—defined according to Shearman (1990, p. 50);
Type 1, for vertical embankments and vertical abutments, with or without wingwalls;
Type 2, for sloping embankments and vertical abutments, without wingwalls;
Type 3, for sloping embankments and sloping spill through abutments;
Type 4, for sloping embankments and vertical abutments with wingwalls.

Main channel slope—slope in vicinity of the bridge crossing based on channel-section data, in feet per feet.

Predominant streambed material—classified by sediment grade scale (American Society of Civil Engineers, 1977, p. 20) from visual inspection in the field.

[—, data not applicable; invert elevations are based on the National Geodetic Vertical Datum of 1929; latitude and longitude, in degrees, minutes, and seconds, are based on the North American Datum of 1927]

	Bridge site name and No. (locations shown in figure 2)	
	State Highway 20/26 [3]	U.S. Government railroad [7]
Bridge length (feet)	46.6	37.4
Bridge-opening type	2	4
Bridge span (feet)	38.8	12
Main channel slope (feet/feet)	0.0020	0.0043
Flow angle to bridge (degrees)	52°	90°
Number of piers in channel	0	1
Pier width (feet)	—	2
Pier shape	—	Rectangular, pointed
Abutment	Vertical	Vertical
Wingwalls	—	Vertical
Channel roughness	0.035	0.035–0.040
Flood-plain roughness	0.055–0.070	0.055
Predominant streambed material	Medium sand	Medium to very coarse sand
Upstream bridge streambed elevation (feet)	4,966.2	4,895.3
Downstream bridge streambed elevation (feet)	4,966.1	4,895.3
Upstream bridge latitude	43° 32' 55.258397"	43° 35' 01.794624"
Upstream bridge longitude	113° 00' 21.864911"	112° 55' 24.050694"
Downstream bridge latitude	43° 32' 55.501091"	43° 35' 01.794508"
Downstream bridge longitude	113° 00' 21.234240"	112° 55' 23.930860"

and 1985) instead of actual surface-water equations, as in CAP. Ranges of discharge through the bridge and tailwater elevation (water-surface elevation at the exit section) were simulated in HEC-RAS to determine stage-discharge relations. Discharge through the bridge may be free-surface flow or pressure flow (unsubmerged or submerged). Road overflow was not represented in the model.

Two bridges, the bridge at State Highway 20/26 and the U.S. Government railroad bridge near INTEC (fig. 2), were analyzed. Cross-section and bridge-geometry data are needed by HEC-RAS for the upstream and downstream faces of the bridge opening and for the approach and exit sections. Cross-section data that were collected from a previous one-dimensional hydraulic model of the Big Lost River and flood plain (Berenbrock and Kjelstrom, 1998) were used in

this study. Bridge-geometry data were obtained from reports by Berenbrock and Kjelstrom (1998), INEEL (2001), and Kingsford (2001), and selected data from these reports are presented in table 2. Roughness coefficients (Manning's *n*) for the channel and flood plain needed by HEC-RAS also were obtained from Berenbrock and Kjelstrom's report (1998) and are presented in table 2.

RESULTS OF CULVERT ANALYSES

Discharge through the culverts, as computed by CAP, ranged from about 0 ft^3/s to as much discharge as could be conveyed, and tailwater elevations ranged from about 0 to 30 ft above the outlet elevation. If a site comprised multiple culverts, each culvert was analyzed separately. At site 6, for example, each of the three culverts was analyzed separately. Total discharge at site 6 can be obtained by adding results from the three culverts. One of the two culverts at site 21 was not analyzed because its characteristics and dimensions could not be determined (C.O. Kingsford, written commun., 2002).

Results from CAP for the 31 culvert sites are shown in appendix 1 (back of report). For each culvert, the outlet invert was set to zero elevation for ease in modeling and displaying results. Corrected elevations can be obtained by adding the datum corrections provided in the appendix to headwater and tailwater elevations. Stage-discharge relations for the 4-ft-diameter culvert at site 8 are shown in figure 3 as an example. Headwater elevations and discharge through the culvert are represented by the ordinate and abscissa axes, respectively, and tailwater elevations are represented by a series of curved isopleths. The lowest isopleth defines the lowest limit for tailwater conditions set at about 0 ft. No relations are computed below the lowest isopleth. Another stage-discharge relation example for the 1.5-ft culvert at site 22 is shown in figure 4. Figures 3 and 4 are similar (isopleths increase as discharges increase), except that the maximum discharge through the culvert at site 22 is about 50 ft^3/s and, at site 8, is about 350 ft^3/s. The main reason for this difference is the difference in diameter of the culverts.

The stage-discharge relation of headwater elevation, tailwater elevation, and discharge is unique for each culvert. Graphs similar to figures 3 and 4 can be developed for all other culverts in the study area using the results in appendix 1. These results, in turn, can be incorporated into numerical surface-water-flow models such as TRIM2D (Ostenaa and others, 1999) to simulate the effects of these culverts on flood flows in a continuous reach of the Big Lost River.

RESULTS OF BRIDGE ANALYSES

Discharge through the two bridges as computed by HEC-RAS ranged from nearly 0 to 7,000 ft^3/s, and tailwater elevations ranged from nearly 0 to 30 ft above the streambed on the downstream cross section of the bridge.

Results from HEC-RAS for the two bridges are given in appendix 2 (back of report). For each bridge, the lowest elevation on the downstream cross section of the bridge was set to zero for ease in modeling and displaying results. Corrected elevations can be obtained by adding the datum corrections provided in the appendix to headwater and tailwater elevations. Stage-discharge relations for site 7 (U.S. Government railroad bridge near INTEC) are shown in figure 5 as an example. If water-surface elevation through the bridge is below 7.3 ft (distance between streambed and lowest bridge girder) or at an elevation of 4,902.6 ft, discharge is considered to be free-surface flow. But when water-surface elevation is equal to or greater than 7.3 ft, discharge is considered pressurized through the bridge. For discharges equal to and greater than 2,000 ft^3/s, the lowest isopleth is about 7.3 ft; for discharges less than 2,000 ft^3/s, the lowest isopleth decreases to 0 ft.

Stage-discharge relations for the Highway 20/26 bridge site were similar to those for the railroad bridge—tailwater elevations increase as headwater elevations and discharge through the bridge increase. Stage-discharge relations for each bridge are different from one another because of the uniqueness of the bridges and stream geometries. These results (appendix 2) can be incorporated into numerical surface-water-flow models such as TRIM2D (Ostenaa and others, 1999) to simulate the effects of these bridges on flood flows.

LIMITATIONS

The CAP and HEC-RAS computer models can be useful tools for determining stage-discharge relations for culverts and bridges. However, results presented in this report are based on models which, in turn, are based on theoretical and laboratory experiments. To verify stage-discharge relations for each structure, discharge measurements are needed under a variety of dis-

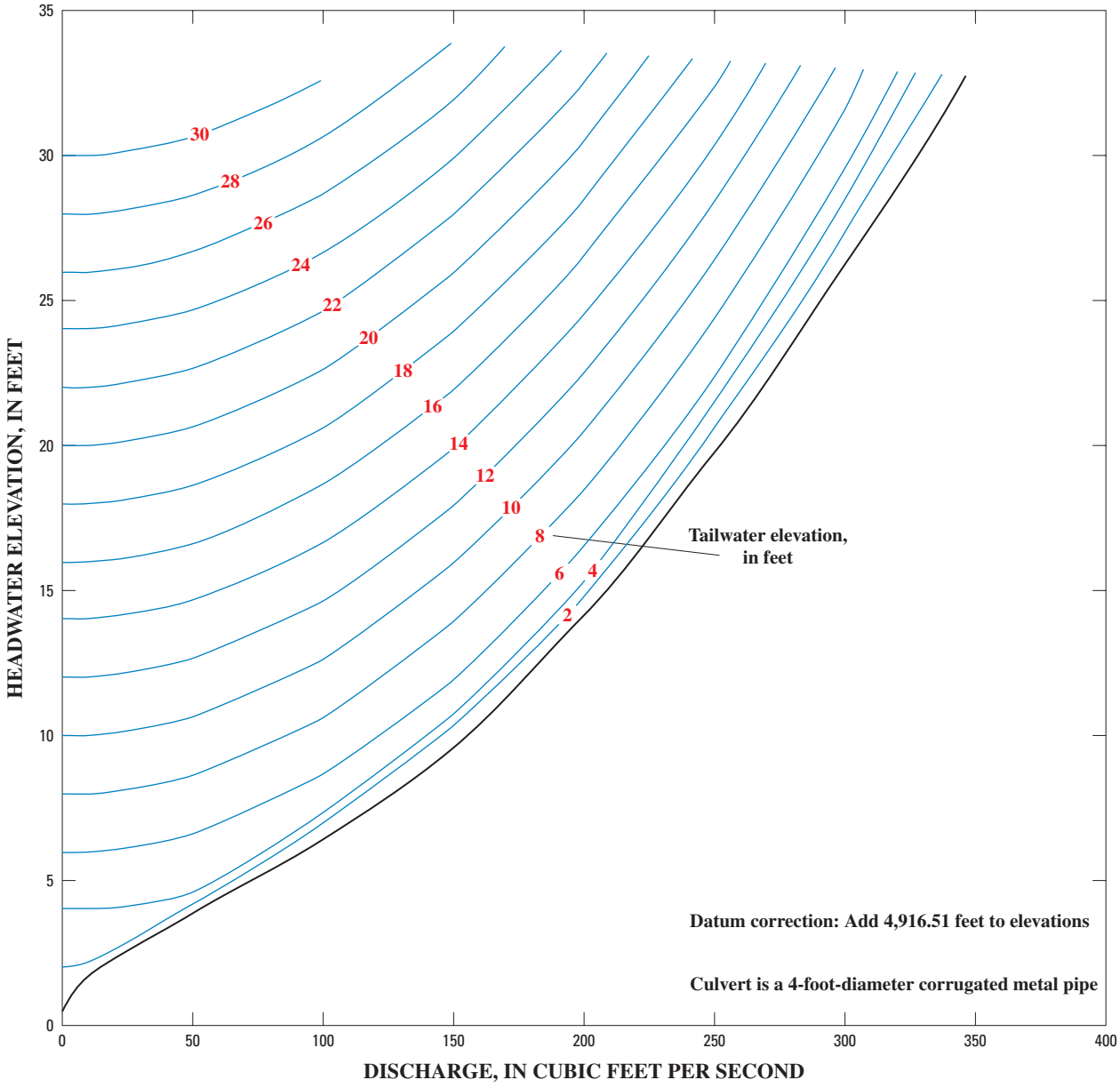

Figure 3. Relation of headwater to tailwater and discharge through the culvert at site 8, Idaho National Engineering and Environmental Laboratory, Idaho.

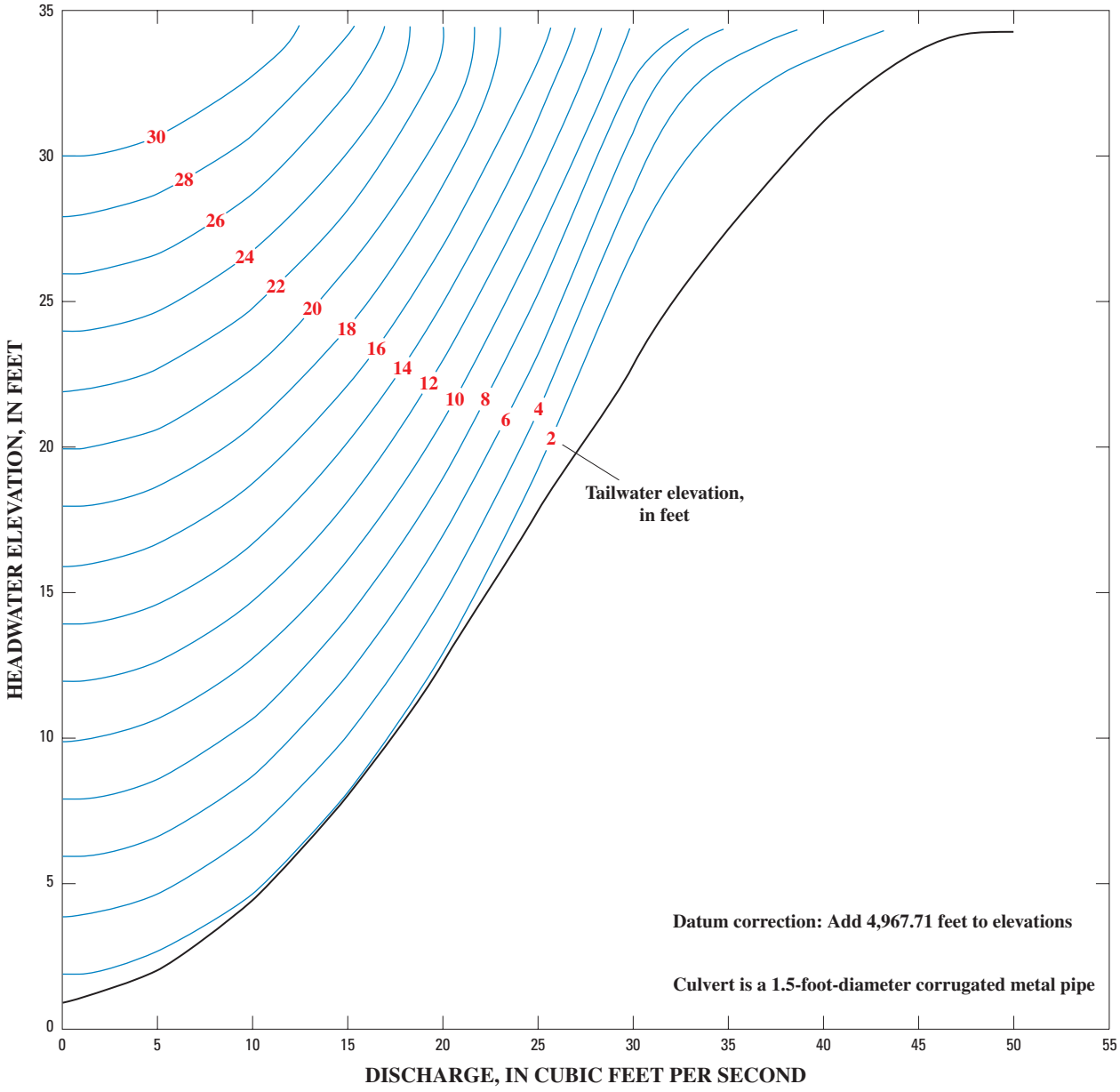

Figure 4. Relation of headwater to tailwater and discharge through the culvert at site 22, Idaho National Engineering and Environmental Laboratory, Idaho.

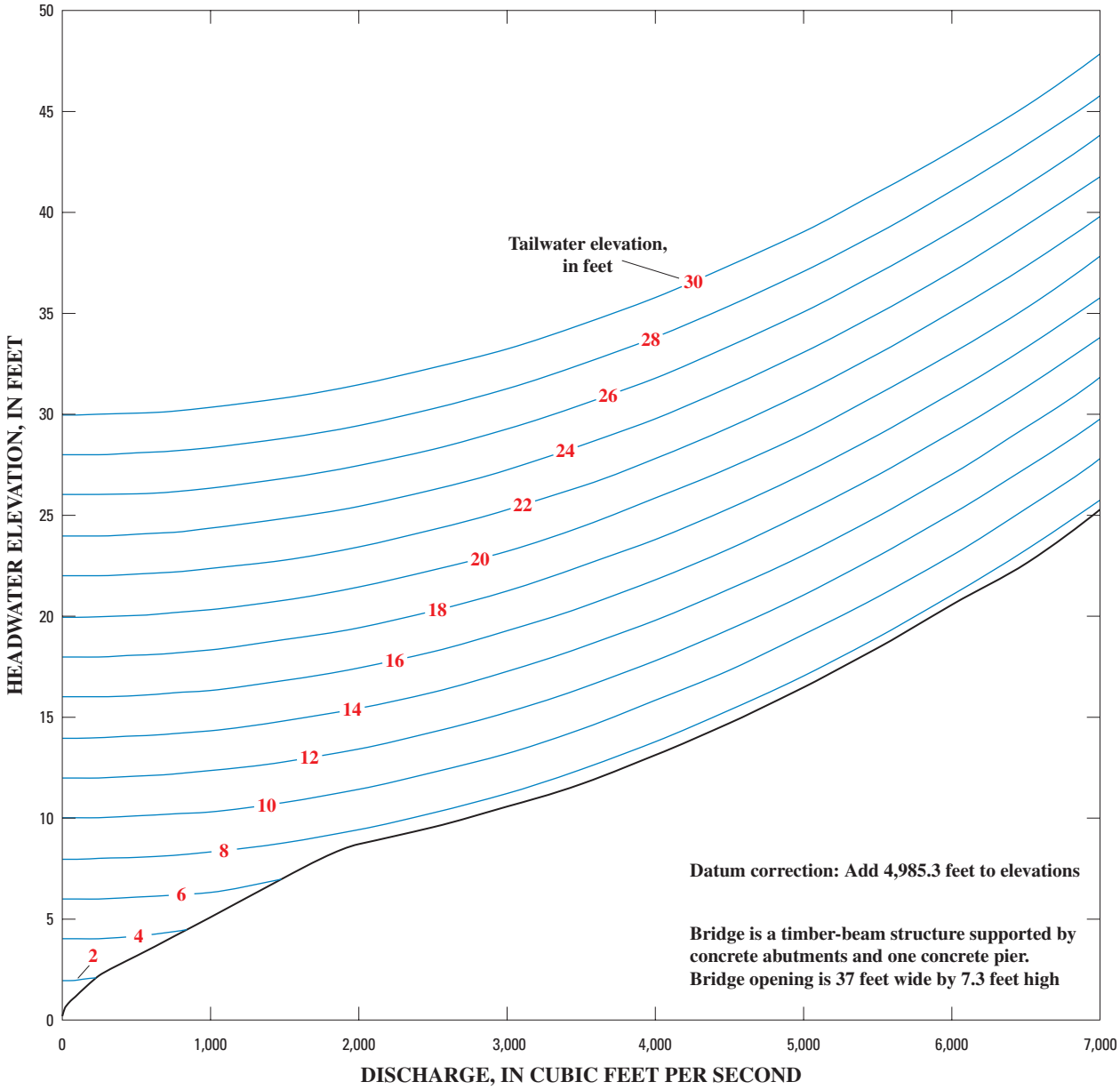

Figure 5. Relation of headwater to tailwater and discharge through the U.S. Government railroad bridge at site 7 near the Idaho Nuclear Technology and Engineering Center, Idaho National Engineering and Environmental Laboratory, Idaho.

charges and flow regimes (unsubmerged, or free-surface flow, and submerged, or pressurized flow). Headwater and tailwater elevations also must be measured at the time of the discharge measurement.

To use the CAP and HEC-RAS models, several assumptions must be satisfied as previously discussed. Although most of the assumptions for this study were satisfied, the assumption that culverts and bridges are free of sediment and debris is probably not representative of actual field conditions in the study area during overbank flows. INEEL (2001) and Kingsford (2001) noted that many of the culverts were partially filled with sediment and several culverts were completely filled with sediment. Because sediment might not be completely removed during flooding, model-simulated discharges through the hydraulic structures might be greater than would be experienced under actual conditions.

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APPENDIX 1

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 1 – West culvert (Datum correction +5042.22 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
1.0	1.33	0.25	10.0	30.01	30.00	50.0	28.13	28.00	200.0	28.15	26.00	400.0	32.58	24.00
1.0	1.40	0.50	25.0	2.88	0.25	50.0	30.13	30.00	200.0	30.15	28.00	400.0	34.58	26.00
1.0	1.62	0.75	25.0	2.88	0.50	100.0	5.05	0.25	200.0	32.15	30.00	500.0	18.33	0.25
1.0	1.84	1.00	25.0	2.88	0.75	100.0	5.05	0.50	300.0	10.41	0.25	500.0	18.33	0.50
1.0	2.00	2.00	25.0	2.88	1.00	100.0	5.05	0.75	300.0	10.41	0.50	500.0	18.33	0.75
1.0	4.00	4.00	25.0	2.73	2.00	100.0	5.05	1.00	300.0	10.41	0.75	500.0	18.33	1.00
1.0	6.00	6.00	25.0	4.07	4.00	100.0	5.05	2.00	300.0	10.41	1.00	500.0	18.33	2.00
1.0	8.00	8.00	25.0	6.03	6.00	100.0	5.02	4.00	300.0	10.41	2.00	500.0	18.33	4.00
1.0	10.00	10.00	25.0	8.03	8.00	100.0	6.51	6.00	300.0	10.41	4.00	500.0	18.33	6.00
1.0	12.00	12.00	25.0	10.03	10.00	100.0	8.54	8.00	300.0	10.41	6.00	500.0	21.41	8.00
1.0	14.00	14.00	25.0	12.03	12.00	100.0	10.54	10.00	300.0	12.83	8.00	500.0	23.41	10.00
1.0	16.00	16.00	25.0	14.03	14.00	100.0	12.54	12.00	300.0	14.83	10.00	500.0	25.41	12.00
1.0	18.00	18.00	25.0	16.03	16.00	100.0	14.54	14.00	300.0	16.83	12.00	500.0	27.41	14.00
1.0	20.00	20.00	25.0	18.03	18.00	100.0	16.54	16.00	300.0	18.83	14.00	500.0	29.41	16.00
1.0	22.00	22.00	25.0	20.03	20.00	100.0	18.54	18.00	300.0	20.83	16.00	500.0	31.41	18.00
1.0	24.00	24.00	25.0	22.03	22.00	100.0	20.54	20.00	300.0	22.83	18.00	500.0	33.41	20.00
1.0	26.00	26.00	25.0	24.03	24.00	100.0	22.54	22.00	300.0	24.83	20.00	600.0	23.85	0.25
1.0	28.00	28.00	25.0	26.03	26.00	100.0	24.54	24.00	300.0	26.83	22.00	600.0	23.85	0.50
1.0	30.00	30.00	25.0	28.03	28.00	100.0	26.54	26.00	300.0	28.83	24.00	600.0	23.85	0.75
10.0	2.16	0.25	25.0	30.03	30.00	100.0	28.54	28.00	300.0	30.83	26.00	600.0	23.85	1.00
10.0	2.16	0.50	50.0	3.73	0.25	100.0	30.54	30.00	300.0	32.83	28.00	600.0	23.85	2.00
10.0	2.16	0.75	50.0	3.73	0.50	200.0	7.56	0.25	300.0	34.83	30.00	600.0	23.85	4.00
10.0	2.07	1.00	50.0	3.73	0.75	200.0	7.56	0.50	400.0	13.70	0.25	600.0	23.85	6.00
10.0	2.18	2.00	50.0	3.73	1.00	200.0	7.56	0.75	400.0	13.70	0.50	600.0	27.31	8.00
10.0	4.01	4.00	50.0	3.67	2.00	200.0	7.56	1.00	400.0	13.70	0.75	600.0	29.31	10.00
10.0	6.01	6.00	50.0	4.28	4.00	200.0	7.56	2.00	400.0	13.70	1.00	600.0	31.31	12.00
10.0	8.01	8.00	50.0	6.13	6.00	200.0	7.49	4.00	400.0	13.70	2.00	600.0	33.31	14.00
10.0	10.01	10.00	50.0	8.13	8.00	200.0	8.15	6.00	400.0	13.70	4.00	700.0	30.16	0.25
10.0	12.01	12.00	50.0	10.13	10.00	200.0	10.15	8.00	400.0	13.70	6.00	700.0	30.16	0.50
10.0	14.01	14.00	50.0	12.13	12.00	200.0	12.15	10.00	400.0	16.58	8.00	700.0	30.16	0.75
10.0	16.01	16.00	50.0	14.13	14.00	200.0	14.15	12.00	400.0	18.58	10.00	700.0	30.16	1.00
10.0	18.01	18.00	50.0	16.13	16.00	200.0	16.15	14.00	400.0	20.58	12.00	700.0	30.16	2.00
10.0	20.01	20.00	50.0	18.13	18.00	200.0	18.15	16.00	400.0	22.58	14.00	700.0	30.16	4.00
10.0	22.01	22.00	50.0	20.13	20.00	200.0	20.15	18.00	400.0	24.58	16.00	700.0	30.16	6.00
10.0	24.01	24.00	50.0	22.13	22.00	200.0	22.15	20.00	400.0	26.58	18.00	700.0	34.28	8.00
10.0	26.01	26.00	50.0	24.13	24.00	200.0	24.15	22.00	400.0	28.58	20.00			
10.0	28.01	28.00	50.0	26.13	26.00	200.0	26.15	24.00	400.0	30.58	22.00			

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 1 – East culvert (Datum correction +5042.22 ft)

Dis-charge (ft^3/s)	Head-water (ft)	Tail-water (ft)	Dis-charge (ft^3/s)	Head-water (ft)	Tail-water (ft)	Dis-charge (ft^3/s)	Head-water (ft)	Tail-water (ft)	Dis-charge (ft^3/s)	Head-water (ft)	Tail-water (ft)	Dis-charge (ft^3/s)	Head-water (ft)	Tail-water (ft)
1.0	1.77	0.25	10.0	16.01	16.00	50.0	4.52	1.00	100.0	22.85	22.00	300.0	25.66	18.00
1.0	1.77	0.50	10.0	18.01	18.00	50.0	4.52	2.00	100.0	24.85	24.00	300.0	27.66	20.00
1.0	1.67	0.75	10.0	20.01	20.00	50.0	4.56	4.00	100.0	26.85	26.00	300.0	29.66	22.00
1.0	1.57	1.00	10.0	22.01	22.00	50.0	6.21	6.00	100.0	28.85	28.00	300.0	31.66	24.00
1.0	2.01	2.00	10.0	24.01	24.00	50.0	8.21	8.00	100.0	30.85	30.00	300.0	33.66	26.00
1.0	4.00	4.00	10.0	26.01	26.00	50.0	10.21	10.00	200.0	10.96	6.00	400.0	19.49	0.25
1.0	6.00	6.00	10.0	28.01	28.00	50.0	12.21	12.00	200.0	11.41	8.00	400.0	19.49	0.50
1.0	8.00	8.00	10.0	30.01	30.00	50.0	14.21	14.00	200.0	13.41	10.00	400.0	19.49	0.75
1.0	10.00	10.00	25.0	3.56	0.25	50.0	16.21	16.00	200.0	15.41	12.00	400.0	19.49	1.00
1.0	12.00	12.00	25.0	3.56	0.50	50.0	18.21	18.00	200.0	17.41	14.00	400.0	19.49	2.00
1.0	14.00	14.00	25.0	3.56	0.75	50.0	20.21	20.00	200.0	19.41	16.00	400.0	19.49	4.00
1.0	16.00	16.00	25.0	3.56	1.00	50.0	22.21	22.00	200.0	21.41	18.00	400.0	19.49	6.00
1.0	18.00	18.00	25.0	3.37	2.00	50.0	24.21	24.00	200.0	23.41	20.00	400.0	21.63	8.00
1.0	20.00	20.00	25.0	4.16	4.00	50.0	26.21	26.00	200.0	25.41	22.00	400.0	23.63	10.00
1.0	22.00	22.00	25.0	6.05	6.00	50.0	28.21	28.00	200.0	27.41	24.00	400.0	25.63	12.00
1.0	24.00	24.00	25.0	8.05	8.00	50.0	30.21	30.00	200.0	29.41	26.00	400.0	27.63	14.00
1.0	26.00	26.00	25.0	10.05	10.00	100.0	6.05	0.25	200.0	31.41	28.00	400.0	29.63	16.00
1.0	28.00	28.00	25.0	12.05	12.00	100.0	6.05	0.50	200.0	33.41	30.00	400.0	31.63	18.00
1.0	30.00	30.00	25.0	14.05	14.00	100.0	6.05	0.75	300.0	13.53	0.25	400.0	33.63	20.00
10.0	2.75	0.25	25.0	16.05	16.00	100.0	6.05	1.00	300.0	13.53	0.50	500.0	26.90	0.25
10.0	2.75	0.50	25.0	18.05	18.00	100.0	6.05	2.00	300.0	13.53	0.75	500.0	26.90	0.50
10.0	2.75	0.75	25.0	20.05	20.00	100.0	5.73	4.00	300.0	13.53	1.00	500.0	26.90	0.75
10.0	2.75	1.00	25.0	22.05	22.00	100.0	6.79	6.00	300.0	13.53	2.00	500.0	26.90	1.00
10.0	2.50	2.00	25.0	24.05	24.00	100.0	8.85	8.00	300.0	13.53	4.00	500.0	26.90	2.00
10.0	4.03	4.00	25.0	26.05	26.00	100.0	10.85	10.00	300.0	13.53	6.00	500.0	26.90	4.00
10.0	6.01	6.00	25.0	28.05	28.00	100.0	12.85	12.00	300.0	15.67	8.00	500.0	26.90	6.00
10.0	8.01	8.00	25.0	30.05	30.00	100.0	14.85	14.00	300.0	17.67	10.00	500.0	29.29	8.00
10.0	10.01	10.00	50.0	4.52	0.25	100.0	16.85	16.00	300.0	19.67	12.00	500.0	31.29	10.00
10.0	12.01	12.00	50.0	4.52	0.50	100.0	18.85	18.00	300.0	21.67	14.00	500.0	33.29	12.00
10.0	14.01	14.00	50.0	4.52	0.75	100.0	20.85	20.00	300.0	23.67	16.00			

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 2 – West culvert (Datum correction +5042.62 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
1.0	1.97	0.25	10.0	2.76	0.25	50.0	4.38	0.25	200.0	8.59	0.25	400.0	16.26	0.50
1.0	1.99	0.50	10.0	2.76	0.50	50.0	4.38	0.50	200.0	8.59	0.50	400.0	16.26	0.75
1.0	2.20	0.75	10.0	2.76	0.75	50.0	4.38	0.75	200.0	8.59	0.75	400.0	16.26	1.00
1.0	2.39	1.00	10.0	2.73	1.00	50.0	4.38	1.00	200.0	8.59	1.00	400.0	16.26	2.00
1.0	2.02	2.00	10.0	3.43	2.00	50.0	4.38	2.00	200.0	8.59	2.00	400.0	16.26	4.00
1.0	4.00	4.00	10.0	4.02	4.00	50.0	4.51	4.00	200.0	8.59	4.00	400.0	16.26	6.00
1.0	6.00	6.00	10.0	6.01	6.00	50.0	6.18	6.00	200.0	8.65	6.00	400.0	18.91	8.00
1.0	8.00	8.00	10.0	8.01	8.00	50.0	8.17	8.00	200.0	10.73	8.00	400.0	20.91	10.00
1.0	10.00	10.00	10.0	10.01	10.00	50.0	10.17	10.00	200.0	12.73	10.00	400.0	22.91	12.00
1.0	12.00	12.00	10.0	12.01	12.00	50.0	12.17	12.00	200.0	14.73	12.00	400.0	24.91	14.00
1.0	14.00	14.00	10.0	14.01	14.00	50.0	14.17	14.00	200.0	16.73	14.00	400.0	26.91	16.00
1.0	16.00	16.00	10.0	16.01	16.00	50.0	16.17	16.00	200.0	18.73	16.00	400.0	28.91	18.00
1.0	18.00	18.00	10.0	18.01	18.00	50.0	18.17	18.00	200.0	20.73	18.00	400.0	30.91	20.00
1.0	20.00	20.00	10.0	20.01	20.00	50.0	20.17	20.00	200.0	22.73	20.00	400.0	32.91	22.00
1.0	22.00	22.00	10.0	22.01	22.00	50.0	22.17	22.00	200.0	24.73	22.00	400.0	34.91	24.00
1.0	24.00	24.00	10.0	24.01	24.00	50.0	24.17	24.00	200.0	26.73	24.00	500.0	22.11	0.25
1.0	26.00	26.00	10.0	26.01	26.00	50.0	26.17	26.00	200.0	28.73	26.00	500.0	22.11	0.50
1.0	28.00	28.00	10.0	28.01	28.00	50.0	28.17	28.00	200.0	30.73	28.00	500.0	22.11	0.75
1.0	30.00	30.00	10.0	30.01	30.00	50.0	30.17	30.00	200.0	32.73	30.00	500.0	22.11	1.00
5.0	2.41	0.25	25.0	3.49	0.25	100.0	5.79	0.25	300.0	11.75	0.25	500.0	22.11	2.00
5.0	2.41	0.50	25.0	3.49	0.50	100.0	5.79	0.50	300.0	11.75	0.50	500.0	22.11	4.00
5.0	2.38	0.75	25.0	3.49	0.75	100.0	5.79	0.75	300.0	11.75	0.75	500.0	22.11	6.00
5.0	2.51	1.00	25.0	3.49	1.00	100.0	5.79	1.00	300.0	11.75	1.00	500.0	25.05	8.00
5.0	3.35	2.00	25.0	3.64	2.00	100.0	5.79	2.00	300.0	11.75	2.00	500.0	27.05	10.00
5.0	4.01	4.00	25.0	4.14	4.00	100.0	5.61	4.00	300.0	11.75	4.00	500.0	29.05	12.00
5.0	6.00	6.00	25.0	6.05	6.00	100.0	6.68	6.00	300.0	12.21	6.00	500.0	31.04	14.00
5.0	8.00	8.00	25.0	8.04	8.00	100.0	8.68	8.00	300.0	14.14	8.00	500.0	33.04	16.00
5.0	10.00	10.00	25.0	10.04	10.00	100.0	10.68	10.00	300.0	16.14	10.00	600.0	29.03	0.25
5.0	12.00	12.00	25.0	12.04	12.00	100.0	12.68	12.00	300.0	18.14	12.00	600.0	29.03	0.50
5.0	14.00	14.00	25.0	14.04	14.00	100.0	14.68	14.00	300.0	20.14	14.00	600.0	29.03	0.75
5.0	16.00	16.00	25.0	16.04	16.00	100.0	16.68	16.00	300.0	22.14	16.00	600.0	29.03	1.00
5.0	18.00	18.00	25.0	18.04	18.00	100.0	18.68	18.00	300.0	24.14	18.00	600.0	29.03	2.00
5.0	20.00	20.00	25.0	20.04	20.00	100.0	20.68	20.00	300.0	26.14	20.00	600.0	29.03	4.00
5.0	22.00	22.00	25.0	22.04	22.00	100.0	22.68	22.00	300.0	28.14	22.00	600.0	29.03	6.00
5.0	24.00	24.00	25.0	24.04	24.00	100.0	24.68	24.00	300.0	30.14	24.00	600.0	32.54	8.00
5.0	26.00	26.00	25.0	26.04	26.00	100.0	26.68	26.00	300.0	32.14	26.00	600.0	34.54	10.00
5.0	28.00	28.00	25.0	28.04	28.00	100.0	28.68	28.00	300.0	34.14	28.00			
5.0	30.00	30.00	25.0	30.04	30.00	100.0	30.68	30.00	400.0	16.26	0.25			

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 2 – East culvert (Datum correction +5042.62 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
1.0	1.98	0.25	5.0	30.00	30.00	25.0	28.05	28.00	100.0	26.76	26.00	300.0	30.88	24.00
1.0	1.98	0.50	10.0	2.88	0.25	25.0	30.05	30.00	100.0	28.76	28.00	300.0	32.88	26.00
1.0	1.98	0.75	10.0	2.88	0.50	50.0	4.62	0.25	100.0	30.76	30.00	300.0	34.88	28.00
1.0	1.98	1.00	10.0	2.88	0.75	50.0	4.62	0.50	200.0	8.97	0.25	400.0	18.22	0.25
1.0	2.03	2.00	10.0	2.88	1.00	50.0	4.62	0.75	200.0	8.97	0.50	400.0	18.22	0.50
1.0	4.00	4.00	10.0	2.72	2.00	50.0	4.62	1.00	200.0	8.97	0.75	400.0	18.22	0.75
1.0	6.00	6.00	10.0	4.03	4.00	50.0	4.62	2.00	200.0	8.97	1.00	400.0	18.22	1.00
1.0	8.00	8.00	10.0	6.01	6.00	50.0	4.64	4.00	200.0	8.97	2.00	400.0	18.22	2.00
1.0	10.00	10.00	10.0	8.01	8.00	50.0	6.19	6.00	200.0	8.97	4.00	400.0	18.22	4.00
1.0	12.00	12.00	10.0	10.01	10.00	50.0	8.19	8.00	200.0	8.95	6.00	400.0	18.22	6.00
1.0	14.00	14.00	10.0	12.01	12.00	50.0	10.19	10.00	200.0	11.06	8.00	400.0	20.23	8.00
1.0	16.00	16.00	10.0	14.01	14.00	50.0	12.19	12.00	200.0	13.06	10.00	400.0	22.23	10.00
1.0	18.00	18.00	10.0	16.01	16.00	50.0	14.19	14.00	200.0	15.06	12.00	400.0	24.23	12.00
1.0	20.00	20.00	10.0	18.01	18.00	50.0	16.19	16.00	200.0	17.06	14.00	400.0	26.23	14.00
1.0	22.00	22.00	10.0	20.01	20.00	50.0	18.19	18.00	200.0	19.06	16.00	400.0	28.23	16.00
1.0	24.00	24.00	10.0	22.01	22.00	50.0	20.19	20.00	200.0	21.06	18.00	400.0	30.23	18.00
1.0	26.00	26.00	10.0	24.01	24.00	50.0	22.19	22.00	200.0	23.06	20.00	400.0	32.23	20.00
1.0	28.00	28.00	10.0	26.01	26.00	50.0	24.19	24.00	200.0	25.06	22.00	400.0	34.23	22.00
1.0	30.00	30.00	10.0	28.01	28.00	50.0	26.19	26.00	200.0	27.06	24.00	500.0	24.75	0.25
5.0	2.48	0.25	10.0	30.01	30.00	50.0	28.19	28.00	200.0	29.06	26.00	500.0	24.75	0.50
5.0	2.48	0.50	25.0	3.66	0.25	50.0	30.19	30.00	200.0	31.06	28.00	500.0	24.75	0.75
5.0	2.48	0.75	25.0	3.66	0.50	100.0	6.15	0.25	200.0	33.06	30.00	500.0	24.75	1.00
5.0	2.48	1.00	25.0	3.66	0.75	100.0	6.15	0.50	300.0	13.04	0.25	500.0	24.75	2.00
5.0	2.33	2.00	25.0	3.66	1.00	100.0	6.15	0.75	300.0	13.04	0.50	500.0	24.75	4.00
5.0	4.01	4.00	25.0	3.66	2.00	100.0	6.15	1.00	300.0	13.04	0.75	500.0	24.75	6.00
5.0	6.00	6.00	25.0	4.18	4.00	100.0	6.15	2.00	300.0	13.04	1.00	500.0	27.11	8.00
5.0	8.00	8.00	25.0	6.05	6.00	100.0	5.99	4.00	300.0	13.04	2.00	500.0	29.11	10.00
5.0	10.00	10.00	25.0	8.05	8.00	100.0	6.74	6.00	300.0	13.04	4.00	500.0	31.11	12.00
5.0	12.00	12.00	25.0	10.05	10.00	100.0	8.77	8.00	300.0	13.04	6.00	500.0	33.11	14.00
5.0	14.00	14.00	25.0	12.05	12.00	100.0	10.76	10.00	300.0	14.88	8.00	600.0	32.43	0.25
5.0	16.00	16.00	25.0	14.05	14.00	100.0	12.76	12.00	300.0	16.88	10.00	600.0	32.43	0.50
5.0	18.00	18.00	25.0	16.05	16.00	100.0	14.76	14.00	300.0	18.88	12.00	600.0	32.43	0.75
5.0	20.00	20.00	25.0	18.05	18.00	100.0	16.76	16.00	300.0	20.88	14.00	600.0	32.43	1.00
5.0	22.00	22.00	25.0	20.05	20.00	100.0	18.76	18.00	300.0	22.88	16.00	600.0	32.43	2.00
5.0	24.00	24.00	25.0	22.05	22.00	100.0	20.76	20.00	300.0	24.88	18.00	600.0	32.43	4.00
5.0	26.00	26.00	25.0	24.05	24.00	100.0	22.76	22.00	300.0	26.88	20.00	600.0	32.43	6.00
5.0	28.00	28.00	25.0	26.05	26.00	100.0	24.76	24.00	300.0	28.88	22.00			

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 4 – West culvert (Datum correction +4954.51 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
0.1	0.34	0.25	1.0	1.02	1.00	5.0	6.21	6.00	10.0	18.84	18.00	25.0	29.23	24.00
0.1	0.50	0.50	1.0	2.01	2.00	5.0	8.21	8.00	10.0	20.84	20.00	25.0	31.23	26.00
0.1	0.75	0.75	1.0	4.01	4.00	5.0	10.21	10.00	10.0	22.84	22.00	25.0	33.23	28.00
0.1	1.00	1.00	1.0	6.01	6.00	5.0	12.21	12.00	10.0	24.84	24.00	50.0	19.36	0.25
0.1	2.00	2.00	1.0	8.01	8.00	5.0	14.21	14.00	10.0	26.84	26.00	50.0	19.36	0.50
0.1	4.00	4.00	1.0	10.01	10.00	5.0	16.21	16.00	10.0	28.84	28.00	50.0	19.36	0.75
0.1	6.00	6.00	1.0	12.01	12.00	5.0	18.21	18.00	10.0	30.84	30.00	50.0	19.36	1.00
0.1	8.00	8.00	1.0	14.01	14.00	5.0	20.21	20.00	25.0	6.72	0.25	50.0	22.94	2.00
0.1	10.00	10.00	1.0	16.01	16.00	5.0	22.21	22.00	25.0	6.72	0.50	50.0	24.94	4.00
0.1	12.00	12.00	1.0	18.01	18.00	5.0	24.21	24.00	25.0	6.72	0.75	50.0	26.94	6.00
0.1	14.00	14.00	1.0	20.01	20.00	5.0	26.21	26.00	25.0	6.72	1.00	50.0	28.94	8.00
0.1	16.00	16.00	1.0	22.01	22.00	5.0	28.21	28.00	25.0	7.23	2.00	50.0	30.94	10.00
0.1	18.00	18.00	1.0	24.01	24.00	5.0	30.21	30.00	25.0	9.23	4.00	50.0	32.94	12.00
0.1	20.00	20.00	1.0	26.01	26.00	10.0	2.67	1.00	25.0	11.23	6.00	50.0	34.94	14.00
0.1	22.00	22.00	1.0	28.01	28.00	10.0	2.84	2.00	25.0	13.23	8.00	100.0	33.63	0.25
0.1	24.00	24.00	1.0	30.01	30.00	10.0	4.84	4.00	25.0	15.23	10.00	100.0	33.63	0.50
0.1	26.00	26.00	5.0	1.37	0.25	10.0	6.84	6.00	25.0	17.23	12.00	100.0	33.63	0.75
0.1	28.00	28.00	5.0	1.37	0.50	10.0	8.84	8.00	25.0	19.23	14.00	100.0	33.63	1.00
0.1	30.00	30.00	5.0	1.34	0.75	10.0	10.84	10.00	25.0	21.23	16.00			
1.0	0.73	0.25	5.0	1.33	1.00	10.0	12.84	12.00	25.0	23.23	18.00			
1.0	0.67	0.50	5.0	2.21	2.00	10.0	14.84	14.00	25.0	25.23	20.00			
1.0	0.79	0.75	5.0	4.21	4.00	10.0	16.84	16.00	25.0	27.23	22.00			

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 4 – East culvert (Datum correction +4954.51 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
0.1	0.45	0.25	1.0	0.82	0.75	5.0	2.21	2.00	10.0	14.84	14.00	25.0	23.23	18.00
0.1	0.51	0.50	1.0	1.02	1.00	5.0	4.21	4.00	10.0	16.84	16.00	25.0	25.23	20.00
0.1	0.75	0.75	1.0	2.01	2.00	5.0	6.21	6.00	10.0	18.84	18.00	25.0	27.23	22.00
0.1	1.00	1.00	1.0	4.01	4.00	5.0	8.21	8.00	10.0	20.84	20.00	25.0	29.23	24.00
0.1	2.00	2.00	1.0	6.01	6.00	5.0	10.21	10.00	10.0	22.84	22.00	25.0	31.23	26.00
0.1	4.00	4.00	1.0	8.01	8.00	5.0	12.21	12.00	10.0	24.84	24.00	25.0	33.23	28.00
0.1	6.00	6.00	1.0	10.01	10.00	5.0	14.21	14.00	10.0	26.84	26.00	50.0	19.46	0.25
0.1	8.00	8.00	1.0	12.01	12.00	5.0	16.21	16.00	10.0	28.84	28.00	50.0	19.46	0.50
0.1	10.00	10.00	1.0	14.01	14.00	5.0	18.21	18.00	10.0	30.84	30.00	50.0	19.46	0.75
0.1	12.00	12.00	1.0	16.01	16.00	5.0	20.21	20.00	25.0	6.82	0.25	50.0	19.46	1.00
0.1	14.00	14.00	1.0	18.01	18.00	5.0	22.21	22.00	25.0	6.82	0.50	50.0	22.94	2.00
0.1	16.00	16.00	1.0	20.01	20.00	5.0	24.21	24.00	25.0	6.82	0.75	50.0	24.94	4.00
0.1	18.00	18.00	1.0	22.01	22.00	5.0	26.21	26.00	25.0	6.82	1.00	50.0	26.94	6.00
0.1	20.00	20.00	1.0	24.01	24.00	5.0	28.21	28.00	25.0	7.23	2.00	50.0	28.94	8.00
0.1	22.00	22.00	1.0	26.01	26.00	5.0	30.21	30.00	25.0	9.23	4.00	50.0	30.94	10.00
0.1	24.00	24.00	1.0	28.01	28.00	10.0	2.84	2.00	25.0	11.23	6.00	50.0	32.94	12.00
0.1	26.00	26.00	1.0	30.01	30.00	10.0	4.84	4.00	25.0	13.23	8.00	50.0	34.94	14.00
0.1	28.00	28.00	5.0	1.47	0.25	10.0	6.84	6.00	25.0	15.23	10.00	100.0	33.73	0.25
0.1	30.00	30.00	5.0	1.47	0.50	10.0	8.84	8.00	25.0	17.23	12.00	100.0	33.73	0.50
1.0	0.83	0.25	5.0	1.47	0.75	10.0	10.84	10.00	25.0	19.23	14.00	100.0	33.73	0.75
1.0	0.77	0.50	5.0	1.41	1.00	10.0	12.84	12.00	25.0	21.23	16.00	100.0	33.73	1.00

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 5 (Datum correction +4933.93 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
0.1	0.29	0.25	1.0	12.00	12.00	5.0	30.02	30.00	25.0	10.47	10.00	50.0	29.87	28.00
0.1	0.50	0.50	1.0	14.00	14.00	10.0	1.72	0.25	25.0	12.47	12.00	50.0	31.87	30.00
0.1	0.75	0.75	1.0	16.00	16.00	10.0	1.72	0.50	25.0	14.47	14.00	100.0	10.11	0.25
0.1	1.00	1.00	1.0	18.00	18.00	10.0	1.72	0.75	25.0	16.47	16.00	100.0	10.11	0.50
0.1	2.00	2.00	1.0	20.00	20.00	10.0	1.69	1.00	25.0	18.47	18.00	100.0	10.11	0.75
0.1	4.00	4.00	1.0	22.00	22.00	10.0	2.12	2.00	25.0	20.47	20.00	100.0	10.11	1.00
0.1	6.00	6.00	1.0	24.00	24.00	10.0	4.07	4.00	25.0	22.47	22.00	100.0	10.11	2.00
0.1	8.00	8.00	1.0	26.00	26.00	10.0	6.07	6.00	25.0	24.47	24.00	100.0	11.49	4.00
0.1	10.00	10.00	1.0	28.00	28.00	10.0	8.07	8.00	25.0	26.47	26.00	100.0	13.49	6.00
0.1	12.00	12.00	1.0	30.00	30.00	10.0	10.07	10.00	25.0	28.47	28.00	100.0	15.49	8.00
0.1	14.00	14.00	5.0	1.27	0.25	10.0	12.07	12.00	25.0	30.47	30.00	100.0	17.49	10.00
0.1	16.00	16.00	5.0	1.27	0.50	10.0	14.07	14.00	50.0	3.57	0.25	100.0	19.49	12.00
0.1	18.00	18.00	5.0	1.22	0.75	10.0	16.07	16.00	50.0	3.57	0.50	100.0	21.49	14.00
0.1	20.00	20.00	5.0	1.24	1.00	10.0	18.07	18.00	50.0	3.57	0.75	100.0	23.49	16.00
0.1	22.00	22.00	5.0	2.03	2.00	10.0	20.07	20.00	50.0	3.57	1.00	100.0	25.49	18.00
0.1	24.00	24.00	5.0	4.02	4.00	10.0	22.07	22.00	50.0	3.57	2.00	100.0	27.49	20.00
0.1	26.00	26.00	5.0	6.02	6.00	10.0	24.07	24.00	50.0	5.87	4.00	100.0	29.49	22.00
0.1	28.00	28.00	5.0	8.02	8.00	10.0	26.07	26.00	50.0	7.87	6.00	100.0	31.49	24.00
0.1	30.00	30.00	5.0	10.02	10.00	10.0	28.07	28.00	50.0	9.87	8.00	100.0	33.49	26.00
1.0	0.69	0.25	5.0	12.02	12.00	10.0	30.07	30.00	50.0	11.87	10.00	200.0	29.24	0.25
1.0	0.63	0.50	5.0	14.02	14.00	25.0	2.75	0.25	50.0	13.87	12.00	200.0	29.24	0.50
1.0	0.78	0.75	5.0	16.02	16.00	25.0	2.75	0.50	50.0	15.87	14.00	200.0	29.24	0.75
1.0	1.01	1.00	5.0	18.02	18.00	25.0	2.75	0.75	50.0	17.87	16.00	200.0	29.24	1.00
1.0	2.00	2.00	5.0	20.02	20.00	25.0	2.75	1.00	50.0	19.87	18.00	200.0	29.24	2.00
1.0	4.00	4.00	5.0	22.02	22.00	25.0	2.70	2.00	50.0	21.87	20.00	200.0	33.95	4.00
1.0	6.00	6.00	5.0	24.02	24.00	25.0	4.47	4.00	50.0	23.87	22.00			
1.0	8.00	8.00	5.0	26.02	26.00	25.0	6.47	6.00	50.0	25.87	24.00			
1.0	10.00	10.00	5.0	28.02	28.00	25.0	8.47	8.00	50.0	27.87	26.00			

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 6 – North culvert (Datum correction +4910.91 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
5.0	1.94	0.25	10.0	30.00	30.00	50.0	28.07	28.00	200.0	27.07	26.00	600.0	16.23	1.00
5.0	1.94	0.50	25.0	2.87	0.25	50.0	30.07	30.00	200.0	29.07	28.00	600.0	16.23	2.00
5.0	1.90	0.75	25.0	2.87	0.50	100.0	4.87	0.25	200.0	31.07	30.00	600.0	16.23	4.00
5.0	1.90	1.00	25.0	2.87	0.75	100.0	4.87	0.50	300.0	9.11	0.25	600.0	16.23	6.00
5.0	2.07	2.00	25.0	2.87	1.00	100.0	4.87	0.75	300.0	9.11	0.50	600.0	17.62	8.00
5.0	4.00	4.00	25.0	2.66	2.00	100.0	4.87	1.00	300.0	9.11	0.75	600.0	19.62	10.00
5.0	6.00	6.00	25.0	4.05	4.00	100.0	4.87	2.00	300.0	9.11	1.00	600.0	21.62	12.00
5.0	8.00	8.00	25.0	6.02	6.00	100.0	4.76	4.00	300.0	9.11	2.00	600.0	23.62	14.00
5.0	10.00	10.00	25.0	8.02	8.01	100.0	6.32	6.00	300.0	9.11	4.00	600.0	25.62	16.00
5.0	12.00	12.00	25.0	10.02	10.00	100.0	8.26	8.13	300.0	8.76	6.00	600.0	27.62	18.00
5.0	14.00	14.00	25.0	12.02	12.00	100.0	10.27	10.00	300.0	10.41	8.00	600.0	29.62	20.00
5.0	16.00	16.00	25.0	14.02	14.00	100.0	12.27	12.00	300.0	12.41	10.00	600.0	31.62	22.00
5.0	18.00	18.00	25.0	16.02	16.00	100.0	14.27	14.00	300.0	14.41	12.00	600.0	33.62	24.00
5.0	20.00	20.00	25.0	18.02	18.00	100.0	16.27	16.00	300.0	16.40	14.00	800.0	23.48	0.25
5.0	22.00	22.00	25.0	20.02	20.00	100.0	18.27	18.00	300.0	18.40	16.00	800.0	23.48	0.50
5.0	24.00	24.00	25.0	22.02	22.00	100.0	20.27	20.00	300.0	20.40	18.00	800.0	23.48	0.75
5.0	26.00	26.00	25.0	24.02	24.00	100.0	22.27	22.00	300.0	22.40	20.00	800.0	23.48	1.00
5.0	28.00	28.00	25.0	26.02	26.00	100.0	24.27	24.00	300.0	24.40	22.00	800.0	23.48	2.00
5.0	30.00	30.00	25.0	28.02	28.00	100.0	26.27	26.00	300.0	26.40	24.00	800.0	23.48	4.00
10.0	2.24	0.25	25.0	30.02	30.00	100.0	28.27	28.00	300.0	28.40	26.00	800.0	23.48	6.00
10.0	2.24	0.50	50.0	3.65	0.25	100.0	30.27	30.00	300.0	30.40	28.00	800.0	25.10	8.00
10.0	2.24	0.75	50.0	3.65	0.50	200.0	7.04	0.25	300.0	32.40	30.00	800.0	27.10	10.00
10.0	2.17	1.00	50.0	3.65	0.75	200.0	7.04	0.50	400.0	12.28	8.00	800.0	29.10	12.00
10.0	2.22	2.00	50.0	3.65	1.00	200.0	7.04	0.75	400.0	14.28	10.00	800.0	31.10	14.00
10.0	4.01	4.00	50.0	3.54	2.00	200.0	7.04	1.00	400.0	16.28	12.00	800.0	33.10	16.00
10.0	6.00	6.00	50.0	4.19	4.00	200.0	7.04	2.00	400.0	18.27	14.00	1000.0	32.53	0.25
10.0	8.00	8.00	50.0	6.08	6.00	200.0	6.87	4.00	400.0	20.27	16.00	1000.0	32.53	0.50
10.0	10.00	10.00	50.0	8.06	8.02	200.0	7.25	6.00	400.0	22.27	18.00	1000.0	32.53	0.75
10.0	12.00	12.00	50.0	10.07	10.00	200.0	9.07	8.00	400.0	24.27	20.00	1000.0	32.53	1.00
10.0	14.00	14.00	50.0	12.07	12.00	200.0	11.07	10.00	400.0	26.27	22.00	1000.0	32.53	2.00
10.0	16.00	16.00	50.0	14.07	14.00	200.0	13.07	12.00	400.0	28.27	24.00	1000.0	32.53	4.00
10.0	18.00	18.00	50.0	16.07	16.00	200.0	15.07	14.00	400.0	30.27	26.00	1000.0	32.53	6.00
10.0	20.00	20.00	50.0	18.07	18.00	200.0	17.07	16.00	400.0	32.27	28.00	1000.0	34.71	8.00
10.0	22.00	22.00	50.0	20.07	20.00	200.0	19.07	18.00	400.0	34.27	30.00			
10.0	24.00	24.00	50.0	22.07	22.00	200.0	21.07	20.00	600.0	16.23	0.25			
10.0	26.00	26.00	50.0	24.07	24.00	200.0	23.07	22.00	600.0	16.23	0.50			
10.0	28.00	28.00	50.0	26.07	26.00	200.0	25.07	24.00	600.0	16.23	0.75			

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 6 – Center culvert (Datum correction +4910.91 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
5.0	1.78	0.25	10.0	30.00	30.00	50.0	28.07	28.00	200.0	27.07	26.00	600.0	16.22	1.00
5.0	1.78	0.50	25.0	2.77	0.25	50.0	30.07	30.00	200.0	29.07	28.00	600.0	16.22	2.00
5.0	1.71	0.75	25.0	2.77	0.50	100.0	4.94	0.25	200.0	31.07	30.00	600.0	16.22	4.00
5.0	1.68	1.00	25.0	2.77	0.75	100.0	4.94	0.50	300.0	9.00	0.25	600.0	16.22	6.00
5.0	2.04	2.00	25.0	2.77	1.00	100.0	4.94	0.75	300.0	9.00	0.50	600.0	17.56	8.00
5.0	4.00	4.00	25.0	2.57	2.00	100.0	4.94	1.00	300.0	9.00	0.75	600.0	19.58	10.00
5.0	6.00	6.00	25.0	4.05	4.00	100.0	4.94	2.00	300.0	9.00	1.00	600.0	21.59	12.00
5.0	8.00	8.00	25.0	6.02	6.00	100.0	4.72	4.00	300.0	9.00	2.00	600.0	23.60	14.00
5.0	10.00	10.00	25.0	8.02	8.01	100.0	6.30	6.00	300.0	9.00	4.00	600.0	25.60	16.00
5.0	12.00	12.00	25.0	10.02	10.00	100.0	8.26	8.00	300.0	8.60	6.00	600.0	27.61	18.00
5.0	14.00	14.00	25.0	12.02	12.00	100.0	10.26	10.00	300.0	10.35	8.00	600.0	29.61	20.00
5.0	16.00	16.00	25.0	14.02	14.00	100.0	12.26	12.00	300.0	12.37	10.00	600.0	31.61	22.00
5.0	18.00	18.00	25.0	16.02	16.00	100.0	14.26	14.00	300.0	14.38	12.00	600.0	33.61	24.00
5.0	20.00	20.00	25.0	18.02	18.00	100.0	16.27	16.00	300.0	16.39	14.00	800.0	23.47	0.25
5.0	22.00	22.00	25.0	20.02	20.00	100.0	18.27	18.00	300.0	18.39	16.00	800.0	23.47	0.50
5.0	24.00	24.00	25.0	22.02	22.00	100.0	20.27	20.00	300.0	20.40	18.00	800.0	23.47	0.75
5.0	26.00	26.00	25.0	24.02	24.00	100.0	22.27	22.00	300.0	22.40	20.00	800.0	23.47	1.00
5.0	28.00	28.00	25.0	26.02	26.00	100.0	24.27	24.00	300.0	24.40	22.00	800.0	23.47	2.00
5.0	30.00	30.00	25.0	28.02	28.00	100.0	26.27	26.00	300.0	26.40	24.00	800.0	23.47	4.00
10.0	2.11	0.25	25.0	30.02	30.00	100.0	28.27	28.00	300.0	28.40	26.00	800.0	23.47	6.00
10.0	2.11	0.50	50.0	3.57	0.25	100.0	30.27	30.00	300.0	30.40	28.00	800.0	25.07	8.00
10.0	2.11	0.75	50.0	3.57	0.50	200.0	6.91	0.25	300.0	32.40	30.00	800.0	27.08	10.00
10.0	2.02	1.00	50.0	3.57	0.75	200.0	6.91	0.50	400.0	12.21	8.00	800.0	29.08	12.00
10.0	2.15	2.00	50.0	3.57	1.00	200.0	6.91	0.75	400.0	14.23	10.00	800.0	31.09	14.00
10.0	4.01	4.00	50.0	3.46	2.00	200.0	6.91	1.00	400.0	16.25	12.00	800.0	33.09	16.00
10.0	6.00	6.00	50.0	4.18	4.00	200.0	6.91	2.00	400.0	18.25	14.00	1000.0	32.52	0.25
10.0	8.00	8.00	50.0	6.08	6.00	200.0	6.73	4.00	400.0	20.26	16.00	1000.0	32.52	0.50
10.0	10.00	10.00	50.0	8.06	8.04	200.0	7.16	6.00	400.0	22.26	18.00	1000.0	32.52	0.75
10.0	12.00	12.00	50.0	10.07	10.00	200.0	9.03	8.00	400.0	24.27	20.00	1000.0	32.52	1.00
10.0	14.00	14.00	50.0	12.07	12.00	200.0	11.05	10.00	400.0	26.27	22.00	1000.0	32.52	2.00
10.0	16.00	16.00	50.0	14.07	14.00	200.0	13.06	12.00	400.0	28.27	24.00	1000.0	32.52	4.00
10.0	18.00	18.00	50.0	16.07	16.00	200.0	15.06	14.00	400.0	30.27	26.00	1000.0	32.52	6.00
10.0	20.00	20.00	50.0	18.07	18.00	200.0	17.06	16.00	400.0	32.27	28.00	1000.0	34.71	8.00
10.0	22.00	22.00	50.0	20.07	20.00	200.0	19.06	18.00	400.0	34.27	30.00			
10.0	24.00	24.00	50.0	22.07	22.00	200.0	21.07	20.00	600.0	16.22	0.25			
10.0	26.00	26.00	50.0	24.07	24.00	200.0	23.07	22.00	600.0	16.22	0.50			
10.0	28.00	28.00	50.0	26.07	26.00	200.0	25.07	24.00	600.0	16.22	0.75			

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 6 – South culvert (Datum correction +4910.91 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
5.0	1.82	0.25	10.0	30.00	30.00	50.0	28.07	28.00	200.0	27.07	26.00	600.0	16.12	1.00
5.0	1.82	0.50	25.0	2.79	0.25	50.0	30.07	30.00	200.0	29.07	28.00	600.0	16.12	2.00
5.0	1.79	0.75	25.0	2.79	0.50	100.0	4.85	0.25	200.0	31.07	30.00	600.0	16.12	4.00
5.0	1.79	1.00	25.0	2.79	0.75	100.0	4.85	0.50	300.0	8.99	0.25	600.0	16.12	6.00
5.0	2.05	2.00	25.0	2.79	1.00	100.0	4.85	0.75	300.0	8.99	0.50	600.0	17.62	8.00
5.0	4.00	4.00	25.0	2.61	2.00	100.0	4.85	1.00	300.0	8.99	0.75	600.0	19.62	10.00
5.0	6.00	6.00	25.0	4.05	4.00	100.0	4.85	2.00	300.0	8.99	1.00	600.0	21.62	12.00
5.0	8.00	8.00	25.0	6.02	6.00	100.0	4.80	4.00	300.0	8.99	2.00	600.0	23.62	14.00
5.0	10.00	10.00	25.0	8.02	8.01	100.0	6.31	6.00	300.0	8.99	4.00	600.0	25.62	16.00
5.0	12.00	12.00	25.0	10.02	10.00	100.0	8.26	8.00	300.0	8.65	6.00	600.0	27.62	18.00
5.0	14.00	14.00	25.0	12.02	12.00	100.0	10.27	10.00	300.0	10.40	8.00	600.0	29.62	20.00
5.0	16.00	16.00	25.0	14.02	14.00	100.0	12.27	12.00	300.0	12.41	10.00	600.0	31.62	22.00
5.0	18.00	18.00	25.0	16.02	16.00	100.0	14.27	14.00	300.0	14.41	12.00	600.0	33.62	24.00
5.0	20.00	20.00	25.0	18.02	18.00	100.0	16.27	16.00	300.0	16.40	14.00	800.0	23.37	0.25
5.0	22.00	22.00	25.0	20.02	20.00	100.0	18.27	18.00	300.0	18.40	16.00	800.0	23.37	0.50
5.0	24.00	24.00	25.0	22.02	22.00	100.0	20.27	20.00	300.0	20.40	18.00	800.0	23.37	0.75
5.0	26.00	26.00	25.0	24.02	24.00	100.0	22.27	22.00	300.0	22.40	20.00	800.0	23.37	1.00
5.0	28.00	28.00	25.0	26.02	26.00	100.0	24.27	24.00	300.0	24.40	22.00	800.0	23.37	2.00
5.0	30.00	30.00	25.0	28.02	28.00	100.0	26.27	26.00	300.0	26.40	24.00	800.0	23.37	4.00
10.0	2.12	0.25	25.0	30.02	30.00	100.0	28.27	28.00	300.0	28.40	26.00	800.0	23.37	6.00
10.0	2.12	0.50	50.0	3.61	0.25	100.0	30.27	30.00	300.0	30.40	28.00	800.0	25.10	8.00
10.0	2.12	0.75	50.0	3.61	0.50	200.0	6.90	0.25	300.0	32.40	30.00	800.0	27.10	10.00
10.0	2.03	1.00	50.0	3.61	0.75	200.0	6.90	0.50	400.0	12.28	8.00	800.0	29.10	12.00
10.0	2.17	2.00	50.0	3.61	1.00	200.0	6.90	0.75	400.0	14.28	10.00	800.0	31.10	14.00
10.0	4.01	4.00	50.0	3.46	2.00	200.0	6.90	1.00	400.0	16.28	12.00	800.0	33.09	16.00
10.0	6.00	6.00	50.0	4.22	4.00	200.0	6.90	2.00	400.0	18.27	14.00	1000.0	32.42	0.25
10.0	8.00	8.00	50.0	6.08	6.00	200.0	6.68	4.00	400.0	20.27	16.00	1000.0	32.42	0.50
10.0	10.00	10.00	50.0	8.06	8.04	200.0	7.18	6.00	400.0	22.27	18.00	1000.0	32.42	0.75
10.0	12.00	12.00	50.0	10.07	10.00	200.0	9.06	8.00	400.0	24.27	20.00	1000.0	32.42	1.00
10.0	14.00	14.00	50.0	12.07	12.00	200.0	11.07	10.00	400.0	26.27	22.00	1000.0	32.42	2.00
10.0	16.00	16.00	50.0	14.07	14.00	200.0	13.07	12.00	400.0	28.27	24.00	1000.0	32.42	4.00
10.0	18.00	18.00	50.0	16.07	16.00	200.0	15.07	14.00	400.0	30.27	26.00	1000.0	32.42	6.00
10.0	20.00	20.00	50.0	18.07	18.00	200.0	17.07	16.00	400.0	32.27	28.00	1000.0	34.71	8.00
10.0	22.00	22.00	50.0	20.07	20.00	200.0	19.07	18.00	400.0	34.27	30.00			
10.0	24.00	24.00	50.0	22.07	22.00	200.0	21.07	20.00	600.0	16.12	0.25			
10.0	26.00	26.00	50.0	24.07	24.00	200.0	23.07	22.00	600.0	16.12	0.50			
10.0	28.00	28.00	50.0	26.07	26.00	200.0	25.07	24.00	600.0	16.12	0.75			

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 8 (Datum correction +4916.51 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
0.1	0.49	0.25	1.0	28.00	28.00	25.0	24.16	24.00	100.0	22.60	20.00	200.0	28.42	18.00
0.1	0.51	0.50	1.0	30.00	30.00	25.0	26.16	26.00	100.0	24.60	22.00	200.0	30.42	20.00
0.1	0.75	0.75	10.0	1.77	0.25	25.0	28.16	28.00	100.0	26.60	24.00	200.0	32.42	22.00
0.1	1.00	1.00	10.0	1.77	0.50	25.0	30.16	30.00	100.0	28.60	26.00	200.0	34.42	24.00
0.1	2.00	2.00	10.0	1.77	0.75	50.0	3.84	0.25	100.0	30.60	28.00	250.0	19.68	0.25
0.1	4.00	4.00	10.0	1.72	1.00	50.0	3.84	0.50	100.0	32.60	30.00	250.0	19.68	0.50
0.1	6.00	6.00	10.0	2.10	2.00	50.0	3.84	0.75	150.0	9.51	0.25	250.0	19.68	0.75
0.1	8.00	8.00	10.0	4.02	4.00	50.0	3.84	1.00	150.0	9.51	0.50	250.0	19.68	1.00
0.1	10.00	10.00	10.0	6.03	6.00	50.0	3.84	2.00	150.0	9.51	0.75	250.0	19.68	2.00
0.1	12.00	12.00	10.0	8.03	8.00	50.0	4.60	4.00	150.0	9.51	1.00	250.0	19.68	4.00
0.1	14.00	14.00	10.0	10.03	10.00	50.0	6.65	6.00	150.0	9.51	2.00	250.0	22.27	6.00
0.1	16.00	16.00	10.0	12.03	12.00	50.0	8.65	8.00	150.0	9.51	4.00	250.0	24.27	8.00
0.1	18.00	18.00	10.0	14.03	14.00	50.0	10.65	10.00	150.0	11.86	6.00	250.0	26.27	10.00
0.1	20.00	20.00	10.0	16.03	16.00	50.0	12.65	12.00	150.0	13.86	8.00	250.0	28.27	12.00
0.1	22.00	22.00	10.0	18.03	18.00	50.0	14.65	14.00	150.0	15.86	10.00	250.0	30.27	14.00
0.1	24.00	24.00	10.0	20.03	20.00	50.0	16.65	16.00	150.0	17.86	12.00	250.0	32.27	16.00
0.1	26.00	26.00	10.0	22.03	22.00	50.0	18.65	18.00	150.0	19.86	14.00	250.0	34.27	18.00
0.1	28.00	28.00	10.0	24.03	24.00	50.0	20.65	20.00	150.0	21.86	16.00	300.0	26.15	0.25
0.1	30.00	30.00	10.0	26.03	26.00	50.0	22.65	22.00	150.0	23.86	18.00	300.0	26.15	0.50
1.0	0.80	0.25	10.0	28.03	28.00	50.0	24.65	24.00	150.0	25.86	20.00	300.0	26.15	0.75
1.0	0.72	0.50	10.0	30.03	30.00	50.0	26.65	26.00	150.0	27.86	22.00	300.0	26.15	1.00
1.0	0.80	0.75	25.0	2.65	0.25	50.0	28.65	28.00	150.0	29.86	24.00	300.0	26.15	2.00
1.0	1.01	1.00	25.0	2.65	0.50	50.0	30.65	30.00	150.0	31.86	26.00	300.0	26.15	4.00
1.0	2.00	2.00	25.0	2.65	0.75	100.0	6.39	0.25	150.0	33.86	28.00	300.0	29.43	6.00
1.0	4.00	4.00	25.0	2.65	1.00	100.0	6.39	0.50	200.0	14.07	0.25	300.0	31.43	8.00
1.0	6.00	6.00	25.0	2.58	2.00	100.0	6.39	0.75	200.0	14.07	0.50	300.0	33.43	10.00
1.0	8.00	8.00	25.0	4.15	4.00	100.0	6.39	1.00	200.0	14.07	0.75	350.0	33.25	0.25
1.0	10.00	10.00	25.0	6.16	6.00	100.0	6.39	2.00	200.0	14.07	1.00	350.0	33.25	0.50
1.0	12.00	12.00	25.0	8.16	8.00	100.0	6.39	4.00	200.0	14.07	2.00	350.0	33.25	0.75
1.0	14.00	14.00	25.0	10.16	10.00	100.0	8.60	6.00	200.0	14.07	4.00	350.0	33.25	1.00
1.0	16.00	16.00	25.0	12.16	12.00	100.0	10.60	8.00	200.0	16.42	6.00	350.0	33.25	2.00
1.0	18.00	18.00	25.0	14.16	14.00	100.0	12.60	10.00	200.0	18.42	8.00	350.0	33.25	4.00
1.0	20.00	20.00	25.0	16.16	16.00	100.0	14.60	12.00	200.0	20.42	10.00			
1.0	22.00	22.00	25.0	18.16	18.00	100.0	16.60	14.00	200.0	22.42	12.00			
1.0	24.00	24.00	25.0	20.16	20.00	100.0	18.60	16.00	200.0	24.42	14.00			
1.0	26.00	26.00	25.0	22.16	22.00	100.0	20.60	18.00	200.0	26.42	16.00			

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 9 – Culvert 1 (Datum correction +4933.51 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
0.1	1.27	0.25	1.0	2.02	2.00	10.0	11.55	10.00	20.0	24.19	18.00	40.0	21.76	1.00
0.1	1.27	0.50	1.0	4.02	4.00	10.0	13.55	12.00	20.0	26.19	20.00	40.0	21.76	2.00
0.1	1.27	0.75	1.0	6.02	6.00	10.0	15.55	14.00	20.0	28.19	22.00	40.0	28.74	4.00
0.1	1.27	1.00	1.0	8.02	8.00	10.0	17.55	16.00	20.0	30.19	24.00	40.0	30.74	6.00
0.1	2.00	2.00	1.0	10.02	10.00	10.0	19.55	18.00	20.0	32.19	26.00	40.0	32.74	8.00
0.1	4.00	4.00	1.0	12.02	12.00	10.0	21.55	20.00	20.0	34.19	28.00	40.0	34.74	10.00
0.1	6.00	6.00	1.0	14.02	14.00	10.0	23.55	22.00	30.0	14.51	0.25	50.0	28.43	0.25
0.1	8.00	8.00	1.0	16.02	16.00	10.0	25.55	24.00	30.0	14.51	0.50	50.0	28.43	0.50
0.1	10.00	10.00	1.0	18.02	18.00	10.0	27.55	26.00	30.0	14.51	0.75	50.0	28.43	0.75
0.1	12.00	12.00	1.0	20.02	20.00	10.0	29.55	28.00	30.0	14.51	1.00	50.0	28.43	1.00
0.1	14.00	14.00	1.0	22.02	22.00	10.0	31.55	30.00	30.0	14.51	2.00	50.0	28.43	2.00
0.1	16.00	16.00	1.0	24.02	24.00	20.0	7.96	0.25	30.0	17.92	4.00	60.0	33.22	0.25
0.1	18.00	18.00	1.0	26.02	26.00	20.0	7.96	0.50	30.0	19.92	6.00	60.0	33.22	0.50
0.1	20.00	20.00	1.0	28.02	28.00	20.0	7.96	0.75	30.0	21.92	8.00	60.0	33.22	0.75
0.1	22.00	22.00	1.0	30.02	30.00	20.0	7.96	1.00	30.0	23.92	10.00	60.0	33.22	1.00
0.1	24.00	24.00	10.0	3.49	0.25	20.0	7.96	2.00	30.0	25.92	12.00	60.0	33.22	2.00
0.1	26.00	26.00	10.0	3.49	0.50	20.0	10.19	4.00	30.0	27.92	14.00	70.0	34.84	0.25
0.1	28.00	28.00	10.0	3.49	0.75	20.0	12.19	6.00	30.0	29.92	16.00	70.0	34.84	0.50
0.1	30.00	30.00	10.0	3.49	1.00	20.0	14.19	8.00	30.0	31.92	18.00	70.0	34.84	0.75
1.0	1.63	0.25	10.0	3.49	2.00	20.0	16.19	10.00	30.0	33.92	20.00	70.0	34.84	1.00
1.0	1.63	0.50	10.0	5.55	4.00	20.0	18.19	12.00	40.0	21.76	0.25	70.0	34.84	2.00
1.0	1.63	0.75	10.0	7.55	6.00	20.0	20.19	14.00	40.0	21.76	0.50			
1.0	1.63	1.00	10.0	9.55	8.00	20.0	22.19	16.00	40.0	21.76	0.75			

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 9 – Culvert 2 (Datum correction +4933.51 ft)

Dis-charge (ft^3/s)	Head-water (ft)	Tail-water (ft)	Dis-charge (ft^3/s)	Head-water (ft)	Tail-water (ft)	Dis-charge (ft^3/s)	Head-water (ft)	Tail-water (ft)	Dis-charge (ft^3/s)	Head-water (ft)	Tail-water (ft)	Dis-charge (ft^3/s)	Head-water (ft)	Tail-water (ft)
0.1	0.53	0.25	1.0	16.00	16.00	25.0	2.81	1.00	50.0	23.75	22.00	100.0	13.00	6.00
0.1	0.50	0.50	1.0	18.00	18.00	25.0	2.74	2.00	50.0	25.75	24.00	100.0	15.00	8.00
0.1	0.75	0.75	1.0	20.00	20.00	25.0	4.44	4.00	50.0	27.75	26.00	100.0	17.00	10.00
0.1	1.00	1.00	1.0	22.00	22.00	25.0	6.44	6.00	50.0	29.75	28.00	100.0	19.00	12.00
0.1	2.00	2.00	1.0	24.00	24.00	25.0	8.44	8.00	50.0	31.75	30.00	100.0	21.00	14.00
0.1	4.00	4.00	1.0	26.00	26.00	25.0	10.44	10.00	75.0	6.57	0.25	100.0	23.00	16.00
0.1	6.00	6.00	1.0	28.00	28.00	25.0	12.44	12.00	75.0	6.57	0.50	100.0	25.00	18.00
0.1	8.00	8.00	1.0	30.00	30.00	25.0	14.44	14.00	75.0	6.57	0.75	100.0	27.00	20.00
0.1	10.00	10.00	10.0	1.77	0.25	25.0	16.44	16.00	75.0	6.57	1.00	100.0	29.00	22.00
0.1	12.00	12.00	10.0	1.77	0.50	25.0	18.44	18.00	75.0	6.57	2.00	100.0	31.00	24.00
0.1	14.00	14.00	10.0	1.77	0.75	25.0	20.44	20.00	75.0	7.94	4.00	100.0	33.00	26.00
0.1	16.00	16.00	10.0	1.77	1.00	25.0	22.44	22.00	75.0	9.94	6.00	150.0	17.64	0.25
0.1	18.00	18.00	10.0	2.12	2.00	25.0	24.44	24.00	75.0	11.94	8.00	150.0	17.64	0.50
0.1	20.00	20.00	10.0	4.07	4.00	25.0	26.44	26.00	75.0	13.94	10.00	150.0	17.64	0.75
0.1	22.00	22.00	10.0	6.07	6.00	25.0	28.44	28.00	75.0	15.94	12.00	150.0	17.64	1.00
0.1	24.00	24.00	10.0	8.07	8.00	25.0	30.44	30.00	75.0	17.94	14.00	150.0	17.64	2.00
0.1	26.00	26.00	10.0	10.07	10.00	50.0	4.55	0.25	75.0	19.94	16.00	150.0	19.74	4.00
0.1	28.00	28.00	10.0	12.07	12.00	50.0	4.55	0.50	75.0	21.94	18.00	150.0	21.74	6.00
0.1	30.00	30.00	10.0	14.07	14.00	50.0	4.55	0.75	75.0	23.94	20.00	150.0	23.74	8.00
1.0	0.76	0.25	10.0	16.07	16.00	50.0	4.55	1.00	75.0	25.94	22.00	150.0	25.74	10.00
1.0	0.83	0.50	10.0	18.07	18.00	50.0	4.55	2.00	75.0	27.94	24.00	150.0	27.74	12.00
1.0	0.79	0.75	10.0	20.07	20.00	50.0	5.75	4.00	75.0	29.94	26.00	150.0	29.74	14.00
1.0	1.01	1.00	10.0	22.07	22.00	50.0	7.75	6.00	75.0	31.94	28.00	150.0	31.74	16.00
1.0	2.00	2.00	10.0	24.07	24.00	50.0	9.75	8.00	75.0	33.94	30.00	150.0	33.74	18.00
1.0	4.00	4.00	10.0	26.07	26.00	50.0	11.75	10.00	100.0	9.57	0.25	200.0	27.59	0.25
1.0	6.00	6.00	10.0	28.07	28.00	50.0	13.75	12.00	100.0	9.57	0.50	200.0	27.59	0.50
1.0	8.00	8.00	10.0	30.07	30.00	50.0	15.75	14.00	100.0	9.57	0.75	200.0	27.59	0.75
1.0	10.00	10.00	25.0	2.81	0.25	50.0	17.75	16.00	100.0	9.57	1.00	200.0	27.59	1.00
1.0	12.00	12.00	25.0	2.81	0.50	50.0	19.75	18.00	100.0	9.57	2.00	200.0	27.59	2.00
1.0	14.00	14.00	25.0	2.81	0.75	50.0	21.75	20.00	100.0	11.00	4.00			

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 9 – Culvert 3 (Datum correction +4933.51 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
0.1	0.97	0.25	1.0	1.43	1.00	10.0	7.55	6.00	20.0	18.19	12.00	30.0	33.92	20.00
0.1	0.97	0.50	1.0	2.01	2.00	10.0	9.55	8.00	20.0	20.19	14.00	40.0	21.66	0.25
0.1	1.07	0.75	1.0	4.02	4.00	10.0	11.55	10.00	20.0	22.19	16.00	40.0	21.66	0.50
0.1	1.01	1.00	1.0	6.02	6.00	10.0	13.55	12.00	20.0	24.19	18.00	40.0	21.66	0.75
0.1	2.00	2.00	1.0	8.02	8.00	10.0	15.55	14.00	20.0	26.19	20.00	40.0	21.66	1.00
0.1	4.00	4.00	1.0	10.02	10.00	10.0	17.55	16.00	20.0	28.19	22.00	40.0	26.74	2.00
0.1	6.00	6.00	1.0	12.02	12.00	10.0	19.55	18.00	20.0	30.19	24.00	40.0	28.74	4.00
0.1	8.00	8.00	1.0	14.02	14.00	10.0	21.55	20.00	20.0	32.19	26.00	40.0	30.74	6.00
0.1	10.00	10.00	1.0	16.02	16.00	10.0	23.55	22.00	20.0	34.19	28.00	40.0	32.74	8.00
0.1	12.00	12.00	1.0	18.02	18.00	10.0	25.55	24.00	30.0	14.41	0.25	40.0	34.74	10.00
0.1	14.00	14.00	1.0	20.02	20.00	10.0	27.55	26.00	30.0	14.41	0.50	50.0	28.33	0.25
0.1	16.00	16.00	1.0	22.02	22.00	10.0	29.55	28.00	30.0	14.41	0.75	50.0	28.33	0.50
0.1	18.00	18.00	1.0	24.02	24.00	10.0	31.55	30.00	30.0	14.41	1.00	50.0	28.33	0.75
0.1	20.00	20.00	1.0	26.02	26.00	20.0	7.86	0.25	30.0	15.92	2.00	50.0	28.33	1.00
0.1	22.00	22.00	1.0	28.02	28.00	20.0	7.86	0.50	30.0	17.92	4.00	60.0	33.12	0.25
0.1	24.00	24.00	1.0	30.02	30.00	20.0	7.86	0.75	30.0	19.92	6.00	60.0	33.12	0.50
0.1	26.00	26.00	10.0	3.38	0.25	20.0	7.86	1.00	30.0	21.92	8.00	60.0	33.12	0.75
0.1	28.00	28.00	10.0	3.38	0.50	20.0	8.19	2.00	30.0	23.92	10.00	60.0	33.12	1.00
0.1	30.00	30.00	10.0	3.38	0.75	20.0	10.19	4.00	30.0	25.92	12.00	70.0	34.74	0.25
1.0	1.33	0.25	10.0	3.38	1.00	20.0	12.19	6.00	30.0	27.92	14.00	70.0	34.74	0.50
1.0	1.33	0.50	10.0	3.55	2.00	20.0	14.19	8.00	30.0	29.92	16.00	70.0	34.74	0.75
1.0	1.33	0.75	10.0	5.55	4.00	20.0	16.19	10.00	30.0	31.92	18.00	70.0	34.74	1.00

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 9 – Culvert 4 (Datum correction +4933.51 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
0.1	1.07	0.25	1.0	2.01	2.00	10.0	11.55	10.00	20.0	24.19	18.00	40.0	21.56	0.75
0.1	1.07	0.50	1.0	4.02	4.00	10.0	13.55	12.00	20.0	26.19	20.00	40.0	21.56	1.00
0.1	1.07	0.75	1.0	6.02	6.00	10.0	15.55	14.00	20.0	28.19	22.00	40.0	26.74	2.00
0.1	1.07	1.00	1.0	8.02	8.00	10.0	17.55	16.00	20.0	30.19	24.00	40.0	28.74	4.00
0.1	2.00	2.00	1.0	10.02	10.00	10.0	19.55	18.00	20.0	32.19	26.00	40.0	30.74	6.00
0.1	4.00	4.00	1.0	12.02	12.00	10.0	21.55	20.00	20.0	34.19	28.00	40.0	32.74	8.00
0.1	6.00	6.00	1.0	14.02	14.00	10.0	23.55	22.00	20.0	36.19	30.00	40.0	34.74	10.00
0.1	8.00	8.00	1.0	16.02	16.00	10.0	25.55	24.00	30.0	14.31	0.25	50.0	28.23	0.25
0.1	10.00	10.00	1.0	18.02	18.00	10.0	27.55	26.00	30.0	14.31	0.50	50.0	28.23	0.50
0.1	12.00	12.00	1.0	20.02	20.00	10.0	29.55	28.00	30.0	14.31	0.75	50.0	28.23	0.75
0.1	14.00	14.00	1.0	22.02	22.00	10.0	31.55	30.00	30.0	14.31	1.00	50.0	28.23	1.00
0.1	16.00	16.00	1.0	24.02	24.00	20.0	7.76	0.25	30.0	15.92	2.00	60.0	33.02	0.25
0.1	18.00	18.00	1.0	26.02	26.00	20.0	7.76	0.50	30.0	17.92	4.00	60.0	33.02	0.50
0.1	20.00	20.00	1.0	28.02	28.00	20.0	7.76	0.75	30.0	19.92	6.00	60.0	33.02	0.75
0.1	22.00	22.00	1.0	30.02	30.00	20.0	7.76	1.00	30.0	21.92	8.00	60.0	33.02	1.00
0.1	24.00	24.00	10.0	3.29	0.25	20.0	8.19	2.00	30.0	23.92	10.00	70.0	34.64	0.25
0.1	26.00	26.00	10.0	3.29	0.50	20.0	10.19	4.00	30.0	25.92	12.00	70.0	34.64	0.50
0.1	28.00	28.00	10.0	3.29	0.75	20.0	12.19	6.00	30.0	27.92	14.00	70.0	34.64	0.75
0.1	30.00	30.00	10.0	3.29	1.00	20.0	14.19	8.00	30.0	29.92	16.00	70.0	34.64	1.00
1.0	1.43	0.25	10.0	3.55	2.00	20.0	16.19	10.00	30.0	31.92	18.00			
1.0	1.43	0.50	10.0	5.55	4.00	20.0	18.19	12.00	30.0	33.92	20.00			
1.0	1.43	0.75	10.0	7.55	6.00	20.0	20.19	14.00	40.0	21.56	0.25			
1.0	1.43	1.00	10.0	9.55	8.00	20.0	22.19	16.00	40.0	21.56	0.50			

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 10 (Datum correction +4947.91 ft)

Dis-charge (ft^3/s)	Head-water (ft)	Tail-water (ft)	Dis-charge (ft^3/s)	Head-water (ft)	Tail-water (ft)	Dis-charge (ft^3/s)	Head-water (ft)	Tail-water (ft)	Dis-charge (ft^3/s)	Head-water (ft)	Tail-water (ft)	Dis-charge (ft^3/s)	Head-water (ft)	Tail-water (ft)
0.1	0.50	0.50	1.0	16.00	16.00	25.0	2.95	0.75	50.0	20.22	18.00	100.0	11.69	2.00
0.1	0.75	0.75	1.0	18.00	18.00	25.0	2.95	1.00	50.0	22.22	20.00	100.0	12.89	4.00
0.1	1.00	1.00	1.0	20.00	20.00	25.0	2.85	2.00	50.0	24.22	22.00	100.0	14.89	6.00
0.1	2.00	2.00	1.0	22.00	22.00	25.0	4.56	4.00	50.0	26.22	24.00	100.0	16.89	8.00
0.1	4.00	4.00	1.0	24.00	24.00	25.0	6.56	6.00	50.0	28.22	26.00	100.0	18.89	10.00
0.1	6.00	6.00	1.0	26.00	26.00	25.0	8.56	8.00	50.0	30.22	28.00	100.0	20.89	12.00
0.1	8.00	8.00	1.0	28.00	28.00	25.0	10.56	10.00	50.0	32.22	30.00	100.0	22.88	14.00
0.1	10.00	10.00	1.0	30.00	30.00	25.0	12.56	12.00	75.0	7.80	0.25	100.0	24.88	16.00
0.1	12.00	12.00	10.0	1.77	0.25	25.0	14.56	14.00	75.0	7.80	0.50	100.0	26.88	18.00
0.1	14.00	14.00	10.0	1.77	0.50	25.0	16.56	16.00	75.0	7.80	0.75	100.0	28.88	20.00
0.1	16.00	16.00	10.0	1.77	0.75	25.0	18.56	18.00	75.0	7.80	1.00	100.0	30.88	22.00
0.1	18.00	18.00	10.0	1.77	1.00	25.0	20.56	20.00	75.0	7.80	2.00	100.0	32.88	24.00
0.1	20.00	20.00	10.0	2.14	2.00	25.0	22.56	22.00	75.0	9.00	4.00	100.0	34.88	26.00
0.1	22.00	22.00	10.0	4.09	4.00	25.0	24.56	24.00	75.0	11.00	6.00	150.0	21.87	0.25
0.1	24.00	24.00	10.0	6.09	6.00	25.0	26.56	26.00	75.0	13.00	8.00	150.0	21.87	0.50
0.1	26.00	26.00	10.0	8.09	8.00	25.0	28.56	28.00	75.0	15.00	10.00	150.0	21.87	0.75
0.1	28.00	28.00	10.0	10.09	10.00	25.0	30.56	30.00	75.0	17.00	12.00	150.0	21.87	1.00
0.1	30.00	30.00	10.0	12.09	12.00	50.0	4.85	0.25	75.0	19.00	14.00	150.0	21.87	2.00
1.0	0.65	0.25	10.0	14.09	14.00	50.0	4.85	0.50	75.0	21.00	16.00	150.0	23.99	4.00
1.0	0.61	0.50	10.0	16.09	16.00	50.0	4.85	0.75	75.0	23.00	18.00	150.0	25.99	6.00
1.0	0.78	0.75	10.0	18.09	18.00	50.0	4.85	1.00	75.0	25.00	20.00	150.0	27.99	8.00
1.0	1.01	1.00	10.0	20.09	20.00	50.0	4.85	2.00	75.0	27.00	22.00	150.0	29.99	10.00
1.0	2.00	2.00	10.0	22.09	22.00	50.0	6.22	4.00	75.0	29.00	24.00	150.0	31.99	12.00
1.0	4.00	4.00	10.0	24.09	24.00	50.0	8.22	6.00	75.0	31.00	26.00	150.0	33.99	14.00
1.0	6.00	6.00	10.0	26.09	26.00	50.0	10.22	8.00	75.0	33.00	28.00	200.0	33.90	0.25
1.0	8.00	8.00	10.0	28.09	28.00	50.0	12.22	10.00	100.0	11.69	0.25	200.0	33.90	0.50
1.0	10.00	10.00	10.0	30.09	30.00	50.0	14.22	12.00	100.0	11.69	0.50	200.0	33.90	0.75
1.0	12.00	12.00	25.0	2.95	0.25	50.0	16.22	14.00	100.0	11.69	0.75	200.0	33.90	1.00
1.0	14.00	14.00	25.0	2.95	0.50	50.0	18.22	16.00	100.0	11.69	1.00	200.0	33.90	2.00

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 11 (Datum correction +4918.40 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
0.1	1.35	0.25	1.0	4.01	4.00	10.0	15.05	14.00	20.0	28.20	24.00	40.0	17.81	2.00
0.1	1.55	0.50	1.0	6.01	6.00	10.0	17.05	16.00	20.0	30.20	26.00	40.0	20.80	4.00
0.1	1.61	0.75	1.0	8.01	8.00	10.0	19.05	18.00	20.0	32.20	28.00	40.0	22.80	6.00
0.1	1.32	1.00	1.0	10.01	10.00	10.0	21.05	20.00	20.0	34.20	30.00	40.0	24.80	8.00
0.1	2.00	2.00	1.0	12.01	12.00	10.0	23.05	22.00	30.0	11.38	0.25	40.0	26.80	10.00
0.1	4.00	4.00	1.0	14.01	14.00	10.0	25.05	24.00	30.0	11.38	0.50	40.0	28.80	12.00
0.1	6.00	6.00	1.0	16.01	16.00	10.0	27.05	26.00	30.0	11.38	0.75	40.0	30.80	14.00
0.1	8.00	8.00	1.0	18.01	18.00	10.0	29.05	28.00	30.0	11.38	1.00	40.0	32.80	16.00
0.1	10.00	10.00	1.0	20.01	20.00	10.0	31.05	30.00	30.0	11.38	2.00	40.0	34.80	18.00
0.1	12.00	12.00	1.0	22.01	22.00	20.0	6.20	0.25	30.0	13.45	4.00	50.0	24.82	0.25
0.1	14.00	14.00	1.0	24.01	24.00	20.0	6.20	0.50	30.0	15.45	6.00	50.0	24.82	0.50
0.1	16.00	16.00	1.0	26.01	26.00	20.0	6.20	0.75	30.0	17.45	8.00	50.0	24.82	0.75
0.1	18.00	18.00	1.0	28.01	28.00	20.0	6.20	1.00	30.0	19.45	10.00	50.0	24.82	1.00
0.1	20.00	20.00	1.0	30.01	30.00	20.0	6.20	2.00	30.0	21.45	12.00	50.0	24.82	2.00
0.1	22.00	22.00	10.0	3.08	0.25	20.0	8.20	4.00	30.0	23.45	14.00	50.0	30.25	4.00
0.1	24.00	24.00	10.0	3.08	0.50	20.0	10.20	6.00	30.0	25.45	16.00	50.0	32.25	6.00
0.1	26.00	26.00	10.0	3.08	0.75	20.0	12.20	8.00	30.0	27.45	18.00	50.0	34.25	8.00
0.1	28.00	28.00	10.0	3.08	1.00	20.0	14.20	10.00	30.0	29.45	20.00	60.0	31.75	0.25
0.1	30.00	30.00	10.0	3.01	2.00	20.0	16.20	12.00	30.0	31.45	22.00	60.0	31.75	0.50
1.0	1.63	0.25	10.0	5.05	4.00	20.0	18.20	14.00	30.0	33.45	24.00	60.0	31.75	0.75
1.0	1.65	0.50	10.0	7.05	6.00	20.0	20.20	16.00	40.0	17.81	0.25	60.0	31.75	1.00
1.0	1.86	0.75	10.0	9.05	8.00	20.0	22.20	18.00	40.0	17.81	0.50	60.0	31.75	2.00
1.0	2.09	1.00	10.0	11.05	10.00	20.0	24.20	20.00	40.0	17.81	0.75			
1.0	2.02	2.00	10.0	13.05	12.00	20.0	26.20	22.00	40.0	17.81	1.00			

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 12 (Datum correction +4920.30 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
0.1	0.47	0.25	0.1	30.00	30.00	1.0	28.03	28.00	10.0	28.93	26.00	30.0	22.84	0.25
0.1	0.52	0.50	1.0	0.97	0.25	1.0	30.03	30.00	10.0	30.93	28.00	30.0	22.84	0.50
0.1	0.75	0.75	1.0	0.90	0.50	10.0	4.44	0.25	10.0	32.93	30.00	30.0	22.84	0.75
0.1	1.00	1.00	1.0	0.92	0.75	10.0	4.44	0.50	20.0	12.71	0.25	30.0	22.84	1.00
0.1	2.00	2.00	1.0	1.07	1.00	10.0	4.44	0.75	20.0	12.71	0.50	30.0	28.34	2.00
0.1	4.00	4.00	1.0	2.03	2.00	10.0	4.44	1.00	20.0	12.71	0.75	30.0	30.34	4.00
0.1	6.00	6.00	1.0	4.03	4.00	10.0	4.93	2.00	20.0	12.71	1.00	30.0	32.34	6.00
0.1	8.00	8.00	1.0	6.03	6.00	10.0	6.93	4.00	20.0	13.70	2.00	30.0	34.34	8.00
0.1	10.00	10.00	1.0	8.03	8.00	10.0	8.93	6.00	20.0	15.70	4.00	40.0	31.25	0.25
0.1	12.00	12.00	1.0	10.03	10.00	10.0	10.93	8.00	20.0	17.70	6.00	40.0	31.25	0.50
0.1	14.00	14.00	1.0	12.03	12.00	10.0	12.93	10.00	20.0	19.70	8.00	40.0	31.25	0.75
0.1	16.00	16.00	1.0	14.03	14.00	10.0	14.93	12.00	20.0	21.70	10.00	40.0	31.25	1.00
0.1	18.00	18.00	1.0	16.03	16.00	10.0	16.93	14.00	20.0	23.70	12.00	50.0	34.32	0.25
0.1	20.00	20.00	1.0	18.03	18.00	10.0	18.93	16.00	20.0	25.70	14.00	50.0	34.32	0.50
0.1	22.00	22.00	1.0	20.03	20.00	10.0	20.93	18.00	20.0	27.70	16.00	50.0	34.32	0.75
0.1	24.00	24.00	1.0	22.03	22.00	10.0	22.93	20.00	20.0	29.70	18.00	50.0	34.32	1.00
0.1	26.00	26.00	1.0	24.03	24.00	10.0	24.93	22.00	20.0	31.70	20.00			
0.1	28.00	28.00	1.0	26.03	26.00	10.0	26.93	24.00	20.0	33.70	22.00			

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 13 (Datum correction +4919.10 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
0.1	0.39	0.25	0.1	30.00	30.00	1.0	28.03	28.00	10.0	29.17	26.00	30.0	23.52	0.25
0.1	0.51	0.50	1.0	0.93	0.25	1.0	30.03	30.00	10.0	31.17	28.00	30.0	23.52	0.50
0.1	0.75	0.75	1.0	0.85	0.50	10.0	4.58	0.25	10.0	33.17	30.00	30.0	23.52	0.75
0.1	1.00	1.00	1.0	0.89	0.75	10.0	4.58	0.50	20.0	13.16	0.25	30.0	23.52	1.00
0.1	2.00	2.00	1.0	1.06	1.00	10.0	4.58	0.75	20.0	13.16	0.50	30.0	30.55	2.00
0.1	4.00	4.00	1.0	2.03	2.00	10.0	4.58	1.00	20.0	13.16	0.75	30.0	32.55	4.00
0.1	6.00	6.00	1.0	4.03	4.00	10.0	5.17	2.00	20.0	13.16	1.00	30.0	34.55	6.00
0.1	8.00	8.00	1.0	6.03	6.00	10.0	7.17	4.00	20.0	14.69	2.00	40.0	31.81	0.25
0.1	10.00	10.00	1.0	8.03	8.00	10.0	9.17	6.00	20.0	16.69	4.00	40.0	31.81	0.50
0.1	12.00	12.00	1.0	10.03	10.00	10.0	11.17	8.00	20.0	18.69	6.00	40.0	31.81	0.75
0.1	14.00	14.00	1.0	12.03	12.00	10.0	13.17	10.00	20.0	20.69	8.00	40.0	31.81	1.00
0.1	16.00	16.00	1.0	14.03	14.00	10.0	15.17	12.00	20.0	22.69	10.00	50.0	34.17	0.25
0.1	18.00	18.00	1.0	16.03	16.00	10.0	17.17	14.00	20.0	24.69	12.00	50.0	34.17	0.50
0.1	20.00	20.00	1.0	18.03	18.00	10.0	19.17	16.00	20.0	26.69	14.00	50.0	34.17	0.75
0.1	22.00	22.00	1.0	20.03	20.00	10.0	21.17	18.00	20.0	28.69	16.00	50.0	34.17	1.00
0.1	24.00	24.00	1.0	22.03	22.00	10.0	23.17	20.00	20.0	30.69	18.00			
0.1	26.00	26.00	1.0	24.03	24.00	10.0	25.17	22.00	20.0	32.69	20.00			
0.1	28.00	28.00	1.0	26.03	26.00	10.0	27.17	24.00	20.0	34.69	22.00			

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 14 (Datum correction +4918.30 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
0.1	0.47	0.25	0.1	30.00	30.00	1.0	28.03	28.00	10.0	28.93	26.00	30.0	22.84	0.25
0.1	0.52	0.50	1.0	0.97	0.25	1.0	30.03	30.00	10.0	30.93	28.00	30.0	22.84	0.50
0.1	0.75	0.75	1.0	0.90	0.50	10.0	4.44	0.25	10.0	32.93	30.00	30.0	22.84	0.75
0.1	1.00	1.00	1.0	0.92	0.75	10.0	4.44	0.50	20.0	12.71	0.25	30.0	22.84	1.00
0.1	2.00	2.00	1.0	1.07	1.00	10.0	4.44	0.75	20.0	12.71	0.50	30.0	28.34	2.00
0.1	4.00	4.00	1.0	2.03	2.00	10.0	4.44	1.00	20.0	12.71	0.75	30.0	30.34	4.00
0.1	6.00	6.00	1.0	4.03	4.00	10.0	4.93	2.00	20.0	12.71	1.00	30.0	32.34	6.00
0.1	8.00	8.00	1.0	6.03	6.00	10.0	6.93	4.00	20.0	13.70	2.00	30.0	34.34	8.00
0.1	10.00	10.00	1.0	8.03	8.00	10.0	8.93	6.00	20.0	15.70	4.00	40.0	31.25	0.25
0.1	12.00	12.00	1.0	10.03	10.00	10.0	10.93	8.00	20.0	17.70	6.00	40.0	31.25	0.50
0.1	14.00	14.00	1.0	12.03	12.00	10.0	12.93	10.00	20.0	19.70	8.00	40.0	31.25	0.75
0.1	16.00	16.00	1.0	14.03	14.00	10.0	14.93	12.00	20.0	21.70	10.00	40.0	31.25	1.00
0.1	18.00	18.00	1.0	16.03	16.00	10.0	16.93	14.00	20.0	23.70	12.00	50.0	34.32	0.25
0.1	20.00	20.00	1.0	18.03	18.00	10.0	18.93	16.00	20.0	25.70	14.00	50.0	34.32	0.50
0.1	22.00	22.00	1.0	20.03	20.00	10.0	20.93	18.00	20.0	27.70	16.00	50.0	34.32	0.75
0.1	24.00	24.00	1.0	22.03	22.00	10.0	22.93	20.00	20.0	29.70	18.00	50.0	34.32	1.00
0.1	26.00	26.00	1.0	24.03	24.00	10.0	24.93	22.00	20.0	31.70	20.00			
0.1	28.00	28.00	1.0	26.03	26.00	10.0	26.93	24.00	20.0	33.70	22.00			

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 15 (Datum correction +4917.40 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
0.1	0.75	0.25	0.1	30.00	30.00	1.0	28.03	28.00	10.0	28.99	26.00	30.0	23.05	0.25
0.1	0.95	0.50	1.0	1.11	0.25	1.0	30.03	30.00	10.0	30.99	28.00	30.0	23.05	0.50
0.1	0.76	0.75	1.0	1.04	0.50	10.0	4.48	0.25	10.0	32.99	30.00	30.0	23.05	0.75
0.1	1.00	1.00	1.0	1.02	0.75	10.0	4.48	0.50	20.0	12.85	0.25	30.0	23.05	1.00
0.1	2.00	2.00	1.0	1.11	1.00	10.0	4.48	0.75	20.0	12.85	0.50	30.0	28.89	2.00
0.1	4.00	4.00	1.0	2.03	2.00	10.0	4.48	1.00	20.0	12.85	0.75	30.0	30.89	4.00
0.1	6.00	6.00	1.0	4.03	4.00	10.0	4.99	2.00	20.0	12.85	1.00	30.0	32.89	6.00
0.1	8.00	8.00	1.0	6.03	6.00	10.0	6.99	4.00	20.0	13.95	2.00	30.0	34.89	8.00
0.1	10.00	10.00	1.0	8.03	8.00	10.0	8.99	6.00	20.0	15.95	4.00	40.0	31.43	0.25
0.1	12.00	12.00	1.0	10.03	10.00	10.0	10.99	8.00	20.0	17.95	6.00	40.0	31.43	0.50
0.1	14.00	14.00	1.0	12.03	12.00	10.0	12.99	10.00	20.0	19.95	8.00	40.0	31.43	0.75
0.1	16.00	16.00	1.0	14.03	14.00	10.0	14.99	12.00	20.0	21.95	10.00	40.0	31.43	1.00
0.1	18.00	18.00	1.0	16.03	16.00	10.0	16.99	14.00	20.0	23.95	12.00	50.0	34.29	0.25
0.1	20.00	20.00	1.0	18.03	18.00	10.0	18.99	16.00	20.0	25.95	14.00	50.0	34.29	0.50
0.1	22.00	22.00	1.0	20.03	20.00	10.0	20.99	18.00	20.0	27.95	16.00	50.0	34.29	0.75
0.1	24.00	24.00	1.0	22.03	22.00	10.0	22.99	20.00	20.0	29.95	18.00	50.0	34.29	1.00
0.1	26.00	26.00	1.0	24.03	24.00	10.0	24.99	22.00	20.0	31.95	20.00			
0.1	28.00	28.00	1.0	26.03	26.00	10.0	26.99	24.00	20.0	33.95	22.00			

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 16 (Datum correction +4918.21 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
0.1	0.37	0.25	1.0	10.01	10.00	10.0	24.72	24.00	30.0	8.71	2.00	40.0	31.59	20.00
0.1	0.51	0.50	1.0	12.01	12.00	10.0	26.72	26.00	30.0	10.52	4.00	40.0	33.59	22.00
0.1	0.75	0.75	1.0	14.01	14.00	10.0	28.72	28.00	30.0	12.52	6.00	50.0	19.22	0.25
0.1	1.00	1.00	1.0	16.01	16.00	10.0	30.72	30.00	30.0	14.52	8.00	50.0	19.22	0.50
0.1	2.00	2.00	1.0	18.01	18.00	20.0	4.91	0.25	30.0	16.52	10.00	50.0	19.22	0.75
0.1	4.00	4.00	1.0	20.01	20.00	20.0	4.91	0.50	30.0	18.52	12.00	50.0	19.22	1.00
0.1	6.00	6.00	1.0	22.01	22.00	20.0	4.91	0.75	30.0	20.52	14.00	50.0	19.22	2.00
0.1	8.00	8.00	1.0	24.01	24.00	20.0	4.91	1.00	30.0	22.52	16.00	50.0	22.11	4.00
0.1	10.00	10.00	1.0	26.01	26.00	20.0	4.91	2.00	30.0	24.52	18.00	50.0	24.11	6.00
0.1	12.00	12.00	1.0	28.01	28.00	20.0	6.90	4.00	30.0	26.52	20.00	50.0	26.11	8.00
0.1	14.00	14.00	1.0	30.01	30.00	20.0	8.90	6.00	30.0	28.52	22.00	50.0	28.11	10.00
0.1	16.00	16.00	10.0	2.45	0.25	20.0	10.90	8.00	30.0	30.52	24.00	50.0	30.11	12.00
0.1	18.00	18.00	10.0	2.45	0.50	20.0	12.90	10.00	30.0	32.52	26.00	50.0	32.11	14.00
0.1	20.00	20.00	10.0	2.45	0.75	20.0	14.90	12.00	30.0	34.52	28.00	50.0	34.11	16.00
0.1	22.00	22.00	10.0	2.45	1.00	20.0	16.90	14.00	40.0	13.61	0.25	60.0	25.15	0.25
0.1	24.00	24.00	10.0	2.97	2.00	20.0	18.90	16.00	40.0	13.61	0.50	60.0	25.15	0.50
0.1	26.00	26.00	10.0	3.36	2.00	20.0	20.90	18.00	40.0	13.61	0.75	60.0	25.15	0.75
0.1	28.00	28.00	10.0	4.72	4.00	20.0	22.90	20.00	40.0	13.61	1.00	60.0	25.15	1.00
0.1	30.00	30.00	10.0	6.72	6.00	20.0	24.90	22.00	40.0	13.61	2.00	60.0	25.15	2.00
1.0	0.86	0.25	10.0	8.72	8.00	20.0	26.90	24.00	40.0	15.59	4.00	60.0	30.08	4.00
1.0	0.78	0.50	10.0	10.72	10.00	20.0	28.90	26.00	40.0	17.59	6.00	60.0	32.08	6.00
1.0	0.84	0.75	10.0	12.72	12.00	20.0	30.90	28.00	40.0	19.59	8.00	60.0	34.08	8.00
1.0	1.03	1.00	10.0	14.72	14.00	20.0	32.90	30.00	40.0	21.59	10.00	70.0	30.99	0.25
1.0	2.01	2.00	10.0	16.72	16.00	30.0	8.71	0.25	40.0	23.59	12.00	70.0	30.99	0.50
1.0	4.01	4.00	10.0	18.72	18.00	30.0	8.71	0.50	40.0	25.59	14.00	70.0	30.99	0.75
1.0	6.01	6.00	10.0	20.72	20.00	30.0	8.71	0.75	40.0	27.59	16.00	70.0	30.99	1.00
1.0	8.01	8.00	10.0	22.72	22.00	30.0	8.71	1.00	40.0	29.59	18.00	70.0	30.99	2.00

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 17 (Datum correction +4965.61 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
0.1	0.27	0.25	1.0	2.01	2.00	10.0	11.11	10.00	20.0	22.45	18.00	40.0	16.19	0.25
0.1	0.50	0.50	1.0	4.01	4.00	10.0	13.11	12.00	20.0	24.45	20.00	40.0	16.19	0.50
0.1	0.75	0.75	1.0	6.01	6.00	10.0	15.11	14.00	20.0	26.45	22.00	40.0	16.19	0.75
0.1	1.00	1.00	1.0	8.01	8.00	10.0	17.11	16.00	20.0	28.45	24.00	40.0	16.19	1.00
0.1	2.00	2.00	1.0	10.01	10.00	10.0	19.11	18.00	20.0	30.45	26.00	40.0	19.80	2.00
0.1	4.00	4.00	1.0	12.01	12.00	10.0	21.11	20.00	20.0	32.45	28.00	40.0	21.80	4.00
0.1	6.00	6.00	1.0	14.01	14.00	10.0	23.11	22.00	20.0	34.45	30.00	40.0	23.80	6.00
0.1	8.00	8.00	1.0	16.01	16.00	10.0	25.11	24.00	30.0	10.41	0.25	40.0	25.80	8.00
0.1	10.00	10.00	1.0	18.01	18.00	10.0	27.11	26.00	30.0	10.41	0.50	40.0	27.80	10.00
0.1	12.00	12.00	1.0	20.01	20.00	10.0	29.11	28.00	30.0	10.41	0.75	40.0	29.80	12.00
0.1	14.00	14.00	1.0	22.01	22.00	10.0	31.11	30.00	30.0	10.41	1.00	40.0	31.80	14.00
0.1	16.00	16.00	1.0	24.01	24.00	20.0	5.58	0.25	30.0	12.02	2.00	40.0	33.80	16.00
0.1	18.00	18.00	1.0	26.01	26.00	20.0	5.58	0.50	30.0	14.02	4.00	50.0	22.17	0.25
0.1	20.00	20.00	1.0	28.01	28.00	20.0	5.58	0.75	30.0	16.02	6.00	50.0	22.17	0.50
0.1	22.00	22.00	1.0	30.01	30.00	20.0	5.58	1.00	30.0	18.01	8.00	50.0	22.17	0.75
0.1	24.00	24.00	10.0	2.23	0.25	20.0	6.45	2.00	30.0	20.01	10.00	50.0	22.17	1.00
0.1	26.00	26.00	10.0	2.23	0.50	20.0	8.45	4.00	30.0	22.01	12.00	50.0	29.82	2.00
0.1	28.00	28.00	10.0	2.23	0.75	20.0	10.45	6.00	30.0	24.01	14.00	50.0	31.82	4.00
0.1	30.00	30.00	10.0	2.23	1.00	20.0	12.45	8.00	30.0	26.01	16.00	50.0	33.82	6.00
1.0	0.62	0.25	10.0	3.11	2.00	20.0	14.45	10.00	30.0	28.01	18.00	75.0	33.32	0.25
1.0	0.62	0.50	10.0	5.11	4.00	20.0	16.45	12.00	30.0	30.01	20.00	75.0	33.32	0.50
1.0	0.79	0.75	10.0	7.11	6.00	20.0	18.45	14.00	30.0	32.01	22.00	75.0	33.32	0.75
1.0	1.02	1.00	10.0	9.11	8.00	20.0	20.45	16.00	30.0	34.01	24.00	75.0	33.32	1.00

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 18 (Datum correction +4948.53 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
0.1	0.56	0.25	0.1	28.00	28.00	1.0	24.03	24.00	10.0	23.38	20.00	20.0	29.54	16.00
0.1	0.57	0.50	0.1	30.00	30.00	1.0	26.03	26.00	10.0	25.38	22.00	20.0	31.54	18.00
0.1	0.75	0.75	1.0	1.07	0.25	1.0	28.03	28.00	10.0	27.38	24.00	20.0	33.54	20.00
0.1	1.00	1.00	1.0	0.99	0.50	1.0	30.03	30.00	10.0	29.38	26.00	30.0	24.49	0.25
0.1	2.00	2.00	1.0	0.98	0.75	10.0	4.80	0.25	10.0	31.38	28.00	30.0	24.49	0.50
0.1	4.00	4.00	1.0	1.09	1.00	10.0	4.80	0.50	10.0	33.38	30.00	30.0	24.49	0.75
0.1	6.00	6.00	1.0	2.03	2.00	10.0	4.80	0.75	20.0	13.83	0.25	30.0	24.49	1.00
0.1	8.00	8.00	1.0	4.03	4.00	10.0	4.80	1.00	20.0	13.83	0.50	30.0	32.46	2.00
0.1	10.00	10.00	1.0	6.03	6.00	10.0	5.38	2.00	20.0	13.83	0.75	30.0	34.46	4.00
0.1	12.00	12.00	1.0	8.03	8.00	10.0	7.38	4.00	20.0	13.83	1.00	40.0	32.54	0.25
0.1	14.00	14.00	1.0	10.03	10.00	10.0	9.38	6.00	20.0	15.54	2.00	40.0	32.54	0.50
0.1	16.00	16.00	1.0	12.03	12.00	10.0	11.38	8.00	20.0	17.54	4.00	40.0	32.54	0.75
0.1	18.00	18.00	1.0	14.03	14.00	10.0	13.38	10.00	20.0	19.54	6.00	40.0	32.54	1.00
0.1	20.00	20.00	1.0	16.03	16.00	10.0	15.38	12.00	20.0	21.54	8.00	50.0	33.72	0.25
0.1	22.00	22.00	1.0	18.03	18.00	10.0	17.38	14.00	20.0	23.54	10.00	50.0	33.72	0.50
0.1	24.00	24.00	1.0	20.03	20.00	10.0	19.38	16.00	20.0	25.54	12.00	50.0	33.72	0.75
0.1	26.00	26.00	1.0	22.03	22.00	10.0	21.38	18.00	20.0	27.54	14.00	50.0	33.72	1.00

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 19 (Datum correction +4967.20 ft)

Dis-charge (ft^3/s)	Head-water (ft)	Tail-water (ft)	Dis-charge (ft^3/s)	Head-water (ft)	Tail-water (ft)	Dis-charge (ft^3/s)	Head-water (ft)	Tail-water (ft)	Dis-charge (ft^3/s)	Head-water (ft)	Tail-water (ft)	Dis-charge (ft^3/s)	Head-water (ft)	Tail-water (ft)
0.1	0.28	0.25	1.0	2.01	2.00	10.0	11.09	10.00	20.0	22.36	18.00	40.0	15.88	0.25
0.1	0.50	0.50	1.0	4.01	4.00	10.0	13.09	12.00	20.0	24.36	20.00	40.0	15.88	0.50
0.1	0.75	0.75	1.0	6.01	6.00	10.0	15.09	14.00	20.0	26.36	22.00	40.0	15.88	0.75
0.1	1.00	1.00	1.0	8.01	8.00	10.0	17.09	16.00	20.0	28.36	24.00	40.0	15.88	1.00
0.1	2.00	2.00	1.0	10.01	10.00	10.0	19.09	18.00	20.0	30.36	26.00	40.0	19.42	2.00
0.1	4.00	4.00	1.0	12.01	12.00	10.0	21.09	20.00	20.0	32.36	28.00	40.0	21.42	4.00
0.1	6.00	6.00	1.0	14.01	14.00	10.0	23.09	22.00	20.0	34.36	30.00	40.0	23.42	6.00
0.1	8.00	8.00	1.0	16.01	16.00	10.0	25.09	24.00	30.0	10.21	0.25	40.0	25.42	8.00
0.1	10.00	10.00	1.0	18.01	18.00	10.0	27.09	26.00	30.0	10.21	0.50	40.0	27.42	10.00
0.1	12.00	12.00	1.0	20.01	20.00	10.0	29.09	28.00	30.0	10.21	0.75	40.0	29.42	12.00
0.1	14.00	14.00	1.0	22.01	22.00	10.0	31.09	30.00	30.0	10.21	1.00	40.0	31.42	14.00
0.1	16.00	16.00	1.0	24.01	24.00	20.0	5.48	0.25	30.0	11.80	2.00	40.0	33.42	16.00
0.1	18.00	18.00	1.0	26.01	26.00	20.0	5.48	0.50	30.0	13.80	4.00	50.0	21.81	0.25
0.1	20.00	20.00	1.0	28.01	28.00	20.0	5.48	0.75	30.0	15.80	6.00	50.0	21.81	0.50
0.1	22.00	22.00	1.0	30.01	30.00	20.0	5.48	1.00	30.0	17.80	8.00	50.0	21.81	0.75
0.1	24.00	24.00	10.0	2.24	0.25	20.0	6.36	2.00	30.0	19.80	10.00	50.0	21.81	1.00
0.1	26.00	26.00	10.0	2.24	0.50	20.0	8.36	4.00	30.0	21.80	12.00	50.0	29.22	2.00
0.1	28.00	28.00	10.0	2.24	0.75	20.0	10.36	6.00	30.0	23.80	14.00	50.0	31.22	4.00
0.1	30.00	30.00	10.0	2.24	1.00	20.0	12.36	8.00	30.0	25.80	16.00	50.0	33.22	6.00
1.0	0.65	0.25	10.0	3.09	2.00	20.0	14.36	10.00	30.0	27.80	18.00	75.0	33.09	0.25
1.0	0.64	0.50	10.0	5.09	4.00	20.0	16.36	12.00	30.0	29.80	20.00	75.0	33.09	0.50
1.0	0.79	0.75	10.0	7.09	6.00	20.0	18.36	14.00	30.0	31.80	22.00	75.0	33.09	0.75
1.0	1.02	1.00	10.0	9.09	8.00	20.0	20.36	16.00	30.0	33.80	24.00	75.0	33.09	1.00

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 20 (Datum correction +4966.80 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
0.1	0.30	0.25	1.0	2.01	2.00	10.0	11.14	10.00	20.0	22.55	18.00	40.0	16.58	0.25
0.1	0.50	0.50	1.0	4.01	4.00	10.0	13.14	12.00	20.0	24.55	20.00	40.0	16.58	0.50
0.1	0.75	0.75	1.0	6.01	6.00	10.0	15.14	14.00	20.0	26.55	22.00	40.0	16.58	0.75
0.1	1.00	1.00	1.0	8.01	8.00	10.0	17.14	16.00	20.0	28.55	24.00	40.0	16.58	1.00
0.1	2.00	2.00	1.0	10.01	10.00	10.0	19.14	18.00	20.0	30.55	26.00	40.0	20.19	2.00
0.1	4.00	4.00	1.0	12.01	12.00	10.0	21.14	20.00	20.0	32.55	28.00	40.0	22.19	4.00
0.1	6.00	6.00	1.0	14.01	14.00	10.0	23.14	22.00	20.0	34.55	30.00	40.0	24.19	6.00
0.1	8.00	8.00	1.0	16.01	16.00	10.0	25.14	24.00	30.0	10.71	0.25	40.0	26.19	8.00
0.1	10.00	10.00	1.0	18.01	18.00	10.0	27.14	26.00	30.0	10.71	0.50	40.0	28.19	10.00
0.1	12.00	12.00	1.0	20.01	20.00	10.0	29.14	28.00	30.0	10.71	0.75	40.0	30.19	12.00
0.1	14.00	14.00	1.0	22.01	22.00	10.0	31.14	30.00	30.0	10.71	1.00	40.0	32.19	14.00
0.1	16.00	16.00	1.0	24.01	24.00	20.0	5.78	0.25	30.0	12.23	2.00	40.0	34.19	16.00
0.1	18.00	18.00	1.0	26.01	26.00	20.0	5.78	0.50	30.0	14.23	4.00	50.0	22.64	0.25
0.1	20.00	20.00	1.0	28.01	28.00	20.0	5.78	0.75	30.0	16.23	6.00	50.0	22.64	0.50
0.1	22.00	22.00	1.0	30.01	30.00	20.0	5.78	1.00	30.0	18.23	8.00	50.0	22.64	0.75
0.1	24.00	24.00	10.0	2.41	0.25	20.0	6.55	2.00	30.0	20.23	10.00	50.0	22.64	1.00
0.1	26.00	26.00	10.0	2.41	0.50	20.0	8.55	4.00	30.0	22.23	12.00	50.0	30.42	2.00
0.1	28.00	28.00	10.0	2.41	0.75	20.0	10.55	6.00	30.0	24.23	14.00	50.0	32.42	4.00
0.1	30.00	30.00	10.0	2.41	1.00	20.0	12.55	8.00	30.0	26.23	16.00	50.0	34.42	6.00
1.0	0.70	0.25	10.0	3.14	2.00	20.0	14.55	10.00	30.0	28.23	18.00	75.0	33.62	0.25
1.0	0.69	0.50	10.0	5.14	4.00	20.0	16.55	12.00	30.0	30.23	20.00	75.0	33.62	0.50
1.0	0.80	0.75	10.0	7.14	6.00	20.0	18.55	14.00	30.0	32.23	22.00	75.0	33.62	0.75
1.0	1.02	1.00	10.0	9.14	8.00	20.0	20.55	16.00	30.0	34.23	24.00	75.0	33.62	1.00

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 21 (Datum correction +4972.20 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
0.1	1.85	0.25	1.0	18.01	18.00	20.0	6.32	4.00	30.0	33.23	28.00	60.0	20.06	0.25
0.1	1.85	0.50	1.0	20.01	20.00	20.0	8.32	6.00	40.0	10.70	0.25	60.0	20.06	0.50
0.1	1.85	0.75	1.0	22.01	22.00	20.0	10.32	8.00	40.0	10.70	0.50	60.0	20.06	0.75
0.1	1.85	1.00	1.0	24.01	24.00	20.0	12.32	10.00	40.0	10.70	0.75	60.0	20.06	1.00
0.1	2.00	2.00	1.0	26.01	26.00	20.0	14.32	12.00	40.0	10.70	1.00	60.0	20.06	2.00
0.1	4.00	4.00	1.0	28.01	28.00	20.0	16.32	14.00	40.0	10.70	2.00	60.0	24.92	4.00
0.1	6.00	6.00	1.0	30.01	30.00	20.0	18.32	16.00	40.0	13.30	4.00	60.0	26.92	6.00
0.1	8.00	8.00	10.0	3.33	0.25	20.0	20.32	18.00	40.0	15.30	6.00	60.0	28.92	8.00
0.1	10.00	10.00	10.0	3.33	0.50	20.0	22.32	20.00	40.0	17.30	8.00	60.0	30.92	10.00
0.1	12.00	12.00	10.0	3.33	0.75	20.0	24.32	22.00	40.0	19.30	10.00	60.0	32.92	12.00
0.1	14.00	14.00	10.0	3.33	1.00	20.0	26.32	24.00	40.0	21.30	12.00	60.0	34.92	14.00
0.1	16.00	16.00	10.0	3.33	2.00	20.0	28.32	26.00	40.0	23.30	14.00	70.0	25.15	0.25
0.1	18.00	18.00	10.0	4.58	4.00	20.0	30.32	28.00	40.0	25.30	16.00	70.0	25.15	0.50
0.1	20.00	20.00	10.0	6.58	6.00	20.0	32.32	30.00	40.0	27.30	18.00	70.0	25.15	0.75
0.1	22.00	22.00	10.0	8.58	8.00	30.0	6.93	0.25	40.0	29.30	20.00	70.0	25.15	1.00
0.1	24.00	24.00	10.0	10.58	10.00	30.0	6.93	0.50	40.0	31.30	22.00	70.0	25.15	2.00
0.1	26.00	26.00	10.0	12.58	12.00	30.0	6.93	0.75	40.0	33.30	24.00	70.0	32.47	4.00
0.1	28.00	28.00	10.0	14.58	14.00	30.0	6.93	1.00	50.0	15.16	0.25	70.0	34.47	6.00
0.1	30.00	30.00	10.0	16.58	16.00	30.0	6.93	2.00	50.0	15.16	0.50	80.0	30.18	0.25
1.0	2.17	0.25	10.0	18.58	18.00	30.0	9.23	4.00	50.0	15.16	0.75	80.0	30.18	0.50
1.0	2.17	0.50	10.0	20.58	20.00	30.0	11.23	6.00	50.0	15.16	1.00	80.0	30.18	0.75
1.0	2.17	0.75	10.0	22.58	22.00	30.0	13.23	8.00	50.0	15.16	2.00	80.0	30.18	1.00
1.0	2.17	1.00	10.0	24.58	24.00	30.0	15.23	10.00	50.0	18.53	4.00	80.0	30.18	2.00
1.0	2.17	2.00	10.0	26.58	26.00	30.0	17.23	12.00	50.0	20.53	6.00	90.0	34.91	0.25
1.0	4.01	4.00	10.0	28.58	28.00	30.0	19.23	14.00	50.0	22.53	8.00	90.0	34.91	0.50
1.0	6.01	6.00	10.0	30.58	30.00	30.0	21.23	16.00	50.0	24.53	10.00	90.0	34.91	0.75
1.0	8.01	8.00	20.0	4.54	0.25	30.0	23.23	18.00	50.0	26.53	12.00	90.0	34.91	1.00
1.0	10.01	10.00	20.0	4.54	0.50	30.0	25.23	20.00	50.0	28.53	14.00	90.0	34.91	2.00
1.0	12.01	12.00	20.0	4.54	0.75	30.0	27.23	22.00	50.0	30.53	16.00			
1.0	14.01	14.00	20.0	4.54	1.00	30.0	29.23	24.00	50.0	32.53	18.00			
1.0	16.01	16.00	20.0	4.54	2.00	30.0	31.23	26.00	50.0	34.53	20.00			

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 22 (Datum correction +4967.71 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
0.1	0.95	0.25	1.0	16.03	16.00	10.0	4.44	1.00	15.0	28.20	22.00	25.0	33.22	16.00
0.1	1.11	0.50	1.0	18.03	18.00	10.0	4.76	2.00	15.0	30.20	24.00	30.0	22.86	0.25
0.1	0.95	0.75	1.0	20.03	20.00	10.0	6.76	4.00	15.0	32.20	26.00	30.0	22.86	0.50
0.1	1.00	1.00	1.0	22.03	22.00	10.0	8.76	6.00	15.0	34.20	28.00	30.0	22.86	0.75
0.1	2.00	2.00	1.0	24.03	24.00	10.0	10.76	8.00	20.0	12.72	0.25	30.0	22.86	1.00
0.1	4.00	4.00	1.0	26.03	26.00	10.0	12.76	10.00	20.0	12.72	0.50	30.0	26.80	2.00
0.1	6.00	6.00	1.0	28.03	28.00	10.0	14.76	12.00	20.0	12.72	0.75	30.0	28.80	4.00
0.1	8.00	8.00	1.0	30.03	30.00	10.0	16.76	14.00	20.0	12.72	1.00	30.0	30.80	6.00
0.1	10.00	10.00	5.0	2.16	0.25	10.0	18.76	16.00	20.0	13.02	2.00	30.0	32.80	8.00
0.1	12.00	12.00	5.0	2.16	0.50	10.0	20.76	18.00	20.0	15.02	4.00	30.0	34.80	10.00
0.1	14.00	14.00	5.0	2.16	0.75	10.0	22.76	20.00	20.0	17.02	6.00	35.0	27.50	0.25
0.1	16.00	16.00	5.0	2.06	1.00	10.0	24.76	22.00	20.0	19.02	8.00	35.0	27.50	0.50
0.1	18.00	18.00	5.0	2.69	2.00	10.0	26.76	24.00	20.0	21.02	10.00	35.0	27.50	0.75
0.1	20.00	20.00	5.0	4.69	4.00	10.0	28.76	26.00	20.0	23.02	12.00	35.0	27.50	1.00
0.1	22.00	22.00	5.0	6.69	6.00	10.0	30.76	28.00	20.0	25.02	14.00	40.0	31.26	0.25
0.1	24.00	24.00	5.0	8.69	8.00	10.0	32.76	30.00	20.0	27.02	16.00	40.0	31.26	0.50
0.1	26.00	26.00	5.0	10.69	10.00	15.0	8.12	0.25	20.0	29.02	18.00	40.0	31.26	0.75
0.1	28.00	28.00	5.0	12.69	12.00	15.0	8.12	0.50	20.0	31.02	20.00	40.0	31.26	1.00
0.1	30.00	30.00	5.0	14.69	14.00	15.0	8.12	0.75	20.0	33.02	22.00	45.0	33.68	0.25
1.0	1.26	0.25	5.0	16.69	16.00	15.0	8.12	1.00	25.0	17.78	0.25	45.0	33.68	0.50
1.0	1.27	0.50	5.0	18.69	18.00	15.0	8.20	2.00	25.0	17.78	0.50	45.0	33.68	0.75
1.0	1.47	0.75	5.0	20.69	20.00	15.0	10.20	4.00	25.0	17.78	0.75	45.0	33.68	1.00
1.0	1.68	1.00	5.0	22.69	22.00	15.0	12.20	6.00	25.0	17.78	1.00	50.0	34.32	0.25
1.0	2.03	2.01	5.0	24.69	24.00	15.0	14.20	8.00	25.0	19.22	2.00	50.0	34.32	0.50
1.0	4.03	4.00	5.0	26.69	26.00	15.0	16.20	10.00	25.0	21.22	4.00	50.0	34.32	0.75
1.0	6.03	6.00	5.0	28.69	28.00	15.0	18.20	12.00	25.0	23.22	6.00	50.0	34.32	1.00
1.0	8.03	8.00	5.0	30.69	30.00	15.0	20.20	14.00	25.0	25.22	8.00			
1.0	10.03	10.00	10.0	4.44	0.25	15.0	22.20	16.00	25.0	27.22	10.00			
1.0	12.03	12.00	10.0	4.44	0.50	15.0	24.20	18.00	25.0	29.22	12.00			
1.0	14.03	14.00	10.0	4.44	0.75	15.0	26.20	20.00	25.0	31.22	14.00			

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 23 (Datum correction +4966.41 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
0.1	1.46	0.25	1.0	16.01	16.00	20.0	4.45	1.00	30.0	27.12	22.00	50.0	28.23	14.00
0.1	1.46	0.50	1.0	18.01	18.00	20.0	4.71	2.00	30.0	29.12	24.00	50.0	30.23	16.00
0.1	1.46	0.75	1.0	20.01	20.00	20.0	6.28	4.00	30.0	31.12	26.00	50.0	32.23	18.00
0.1	1.46	1.00	1.0	22.01	22.00	20.0	8.28	6.00	30.0	33.12	28.00	50.0	34.23	20.00
0.1	2.00	2.00	1.0	24.01	24.00	20.0	10.28	8.00	40.0	11.03	0.25	60.0	20.65	0.25
0.1	4.00	4.00	1.0	26.01	26.00	20.0	12.28	10.00	40.0	11.03	0.50	60.0	20.65	0.50
0.1	6.00	6.00	1.0	28.01	28.00	20.0	14.28	12.00	40.0	11.03	0.75	60.0	20.65	0.75
0.1	8.00	8.00	1.0	30.01	30.00	20.0	16.28	14.00	40.0	11.03	1.00	60.0	20.65	1.00
0.1	10.00	10.00	10.0	3.04	0.25	20.0	18.28	16.00	40.0	11.03	2.00	60.0	20.65	2.00
0.1	12.00	12.00	10.0	3.04	0.50	20.0	20.28	18.00	40.0	13.11	4.00	60.0	24.49	4.00
0.1	14.00	14.00	10.0	3.04	0.75	20.0	22.28	20.00	40.0	15.11	6.00	60.0	26.49	6.00
0.1	16.00	16.00	10.0	3.04	1.00	20.0	24.28	22.00	40.0	17.11	8.00	60.0	28.49	8.00
0.1	18.00	18.00	10.0	3.04	2.00	20.0	26.28	24.00	40.0	19.11	10.00	60.0	30.49	10.00
0.1	20.00	20.00	10.0	4.57	4.00	20.0	28.28	26.00	40.0	21.11	12.00	60.0	32.49	12.00
0.1	22.00	22.00	10.0	6.57	6.00	20.0	30.28	28.00	40.0	23.11	14.00	60.0	34.49	14.00
0.1	24.00	24.00	10.0	8.57	8.00	20.0	32.28	30.00	40.0	25.11	16.00	70.0	25.85	0.25
0.1	26.00	26.00	10.0	10.57	10.00	30.0	7.12	0.25	40.0	27.11	18.00	70.0	25.85	0.50
0.1	28.00	28.00	10.0	12.57	12.00	30.0	7.12	0.50	40.0	29.11	20.00	70.0	25.85	0.75
0.1	30.00	30.00	10.0	14.57	14.00	30.0	7.12	0.75	40.0	31.11	22.00	70.0	25.85	1.00
1.0	1.80	0.25	10.0	16.57	16.00	30.0	7.12	1.00	40.0	33.11	24.00	70.0	25.85	2.00
1.0	1.80	0.50	10.0	18.57	18.00	30.0	7.12	2.00	50.0	15.62	0.25	70.0	31.90	4.00
1.0	1.80	0.75	10.0	20.57	20.00	30.0	9.12	4.00	50.0	15.62	0.50	70.0	33.90	6.00
1.0	1.80	1.00	10.0	22.57	22.00	30.0	11.12	6.00	50.0	15.62	0.75	80.0	30.94	0.25
1.0	2.01	2.00	10.0	24.57	24.00	30.0	13.12	8.00	50.0	15.62	1.00	80.0	30.94	0.50
1.0	4.01	4.00	10.0	26.57	26.00	30.0	15.12	10.00	50.0	15.62	2.00	80.0	30.94	0.75
1.0	6.01	6.00	10.0	28.57	28.00	30.0	17.12	12.00	50.0	18.23	4.00	80.0	30.94	1.00
1.0	8.01	8.00	10.0	30.57	30.00	30.0	19.12	14.00	50.0	20.23	6.00	80.0	30.94	2.00
1.0	10.01	10.00	20.0	4.45	0.25	30.0	21.12	16.00	50.0	22.23	8.00			
1.0	12.01	12.00	20.0	4.45	0.50	30.0	23.12	18.00	50.0	24.23	10.00			
1.0	14.01	14.00	20.0	4.45	0.75	30.0	25.12	20.00	50.0	26.23	12.00			

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 24 (Datum correction +4966.71 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
0.1	0.75	0.25	1.0	14.01	14.00	20.0	4.59	0.50	30.0	22.08	16.00	50.0	22.88	6.00
0.1	0.91	0.50	1.0	16.01	16.00	20.0	4.59	0.75	30.0	24.08	18.00	50.0	24.88	8.00
0.1	0.75	0.75	1.0	18.01	18.00	20.0	4.59	1.00	30.0	26.08	20.00	50.0	26.88	10.00
0.1	1.00	1.00	1.0	20.01	20.00	20.0	4.59	2.00	30.0	28.08	22.00	50.0	28.88	12.00
0.1	2.00	2.00	1.0	22.01	22.00	20.0	6.70	4.00	30.0	30.08	24.00	50.0	30.88	14.00
0.1	4.00	4.00	1.0	24.01	24.00	20.0	8.70	6.00	30.0	32.08	26.00	50.0	32.88	16.00
0.1	6.00	6.00	1.0	26.01	26.00	20.0	10.70	8.00	30.0	34.08	28.00	50.0	34.88	18.00
0.1	8.00	8.00	1.0	28.01	28.00	20.0	12.70	10.00	40.0	12.49	0.25	60.0	23.24	0.25
0.1	10.00	10.00	1.0	30.01	30.00	20.0	14.70	12.00	40.0	12.49	0.50	60.0	23.24	0.50
0.1	12.00	12.00	10.0	2.43	0.25	20.0	16.70	14.00	40.0	12.49	0.75	60.0	23.24	0.75
0.1	14.00	14.00	10.0	2.43	0.50	20.0	18.70	16.00	40.0	12.49	1.00	60.0	23.24	1.00
0.1	16.00	16.00	10.0	2.43	0.75	20.0	20.70	18.00	40.0	12.49	2.00	60.0	23.24	2.00
0.1	18.00	18.00	10.0	2.43	1.00	20.0	22.70	20.00	40.0	14.81	4.00	60.0	28.31	4.00
0.1	20.00	20.00	10.0	2.62	2.00	20.0	24.70	22.00	40.0	16.81	6.00	60.0	30.31	6.00
0.1	22.00	22.00	10.0	4.68	4.00	20.0	26.70	24.00	40.0	18.81	8.00	60.0	32.31	8.00
0.1	24.00	24.00	10.0	6.68	6.00	20.0	28.70	26.00	40.0	20.81	10.00	60.0	34.31	10.00
0.1	26.00	26.00	10.0	8.68	8.00	20.0	30.70	28.00	40.0	22.81	12.00	70.0	28.84	0.25
0.1	28.00	28.00	10.0	10.68	10.00	20.0	32.70	30.00	40.0	24.81	14.00	70.0	28.84	0.50
0.1	30.00	30.00	10.0	12.68	12.00	30.0	8.02	0.25	40.0	26.81	16.00	70.0	28.84	0.75
1.0	1.04	0.25	10.0	14.68	14.00	30.0	8.02	0.50	40.0	28.81	18.00	70.0	28.84	1.00
1.0	0.98	0.50	10.0	16.68	16.00	30.0	8.02	0.75	40.0	30.81	20.00	70.0	28.84	2.00
1.0	0.97	0.75	10.0	18.68	18.00	30.0	8.02	1.00	40.0	32.81	22.00	80.0	34.15	0.25
1.0	1.07	1.00	10.0	20.68	20.00	30.0	8.02	2.00	40.0	34.81	24.00	80.0	34.15	0.50
1.0	2.01	2.00	10.0	22.68	22.00	30.0	10.08	4.00	50.0	17.68	0.25	80.0	34.15	0.75
1.0	4.01	4.00	10.0	24.68	24.00	30.0	12.08	6.00	50.0	17.68	0.50	80.0	34.15	1.00
1.0	6.01	6.00	10.0	26.68	26.00	30.0	14.08	8.00	50.0	17.68	0.75	80.0	34.15	2.00
1.0	8.01	8.00	10.0	28.68	28.00	30.0	16.08	10.00	50.0	17.68	1.00			
1.0	10.01	10.00	10.0	30.68	30.00	30.0	18.08	12.00	50.0	17.68	2.00			
1.0	12.01	12.00	20.0	4.59	0.25	30.0	20.08	14.00	50.0	20.88	4.00			

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 25 (Datum correction +4897.71 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
0.1	0.75	0.25	1.0	20.01	20.00	20.0	10.08	8.00	40.0	10.18	0.50	60.0	19.11	0.75
0.1	0.73	0.50	1.0	22.01	22.00	20.0	12.08	10.00	40.0	10.18	0.75	60.0	19.11	1.00
0.1	0.75	0.75	1.0	24.01	24.00	20.0	14.08	12.00	40.0	10.18	1.00	60.0	19.11	2.00
0.1	1.00	1.00	1.0	26.01	26.00	20.0	16.08	14.00	40.0	10.18	2.00	60.0	22.75	4.00
0.1	2.00	2.00	1.0	28.01	28.00	20.0	18.08	16.00	40.0	12.33	4.00	60.0	24.75	6.00
0.1	4.00	4.00	1.0	30.01	30.00	20.0	20.08	18.00	40.0	14.33	6.00	60.0	26.75	8.00
0.1	6.00	6.00	10.0	2.30	0.25	20.0	22.08	20.00	40.0	16.33	8.00	60.0	28.75	10.00
0.1	8.00	8.00	10.0	2.30	0.50	20.0	24.08	22.00	40.0	18.33	10.00	60.0	30.75	12.00
0.1	10.00	10.00	10.0	2.30	0.75	20.0	26.08	24.00	40.0	20.33	12.00	60.0	32.75	14.00
0.1	12.00	12.00	10.0	2.30	1.00	20.0	28.08	26.00	40.0	22.33	14.00	60.0	34.75	16.00
0.1	14.00	14.00	10.0	2.47	2.00	20.0	30.08	28.00	40.0	24.33	16.00	70.0	24.03	0.25
0.1	16.00	16.00	10.0	4.52	4.00	20.0	32.08	30.00	40.0	26.33	18.00	70.0	24.03	0.50
0.1	18.00	18.00	10.0	6.52	6.00	30.0	6.61	0.25	40.0	28.33	20.00	70.0	24.03	0.75
0.1	20.00	20.00	10.0	8.52	8.00	30.0	6.61	0.50	40.0	30.33	22.00	70.0	24.03	1.00
0.1	22.00	22.00	10.0	10.52	10.00	30.0	6.61	0.75	40.0	32.33	24.00	70.0	24.03	2.00
0.1	24.00	24.00	10.0	12.52	12.00	30.0	6.61	1.00	40.0	34.33	26.00	70.0	29.52	4.00
0.1	26.00	26.00	10.0	14.52	14.00	30.0	6.61	2.00	50.0	14.43	0.25	70.0	31.52	6.00
0.1	28.00	28.00	10.0	16.52	16.00	30.0	8.69	4.00	50.0	14.43	0.50	70.0	33.51	8.00
0.1	30.00	30.00	10.0	18.52	18.00	30.0	10.69	6.00	50.0	14.43	0.75	80.0	28.93	0.25
1.0	1.00	0.25	10.0	20.52	20.00	30.0	12.69	8.00	50.0	14.43	1.00	80.0	28.93	0.50
1.0	1.05	0.50	10.0	22.52	22.00	30.0	14.69	10.00	50.0	14.43	2.00	80.0	28.93	0.75
1.0	1.24	0.75	10.0	24.52	24.00	30.0	16.69	12.00	50.0	17.02	4.00	80.0	28.93	1.00
1.0	1.05	1.00	10.0	26.52	26.00	30.0	18.69	14.00	50.0	19.02	6.00	80.0	28.93	2.00
1.0	2.00	2.00	10.0	28.52	28.00	30.0	20.69	16.00	50.0	21.02	8.00	90.0	33.61	0.25
1.0	4.01	4.00	10.0	30.52	30.00	30.0	22.69	18.00	50.0	23.02	10.00	90.0	33.61	0.50
1.0	6.01	6.00	20.0	4.03	0.25	30.0	24.69	20.00	50.0	25.02	12.00	90.0	33.61	0.75
1.0	8.01	8.00	20.0	4.03	0.50	30.0	26.69	22.00	50.0	27.02	14.00	90.0	33.61	1.00
1.0	10.01	10.00	20.0	4.03	0.75	30.0	28.69	24.00	50.0	29.02	16.00	90.0	33.61	2.00
1.0	12.01	12.00	20.0	4.03	1.00	30.0	30.69	26.00	50.0	31.02	18.00			
1.0	14.01	14.00	20.0	4.03	2.00	30.0	32.69	28.00	50.0	33.02	20.00			
1.0	16.01	16.00	20.0	6.08	4.00	30.0	34.69	30.00	60.0	19.11	0.25			
1.0	18.01	18.00	20.0	8.08	6.00	40.0	10.18	0.25	60.0	19.11	0.50			

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 26 (Datum correction +4896.61 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
0.1	0.54	0.25	1.0	24.00	24.00	20.0	17.79	16.00	40.0	15.17	8.00	60.0	28.14	12.00
0.1	0.51	0.50	1.0	26.00	26.00	20.0	19.79	18.00	40.0	17.17	10.00	60.0	30.14	14.00
0.1	0.75	0.75	1.0	28.00	28.00	20.0	21.79	20.00	40.0	19.17	12.00	60.0	32.14	16.00
0.1	1.00	1.00	1.0	30.00	30.00	20.0	23.79	22.00	40.0	21.17	14.00	60.0	34.14	18.00
0.1	2.00	2.00	10.0	2.13	0.25	20.0	25.79	24.00	40.0	23.17	16.00	70.0	21.27	0.25
0.1	4.00	4.00	10.0	2.13	0.50	20.0	27.79	26.00	40.0	25.17	18.00	70.0	21.27	0.50
0.1	6.00	6.00	10.0	2.13	0.75	20.0	29.79	28.00	40.0	27.17	20.00	70.0	21.27	0.75
0.1	8.00	8.00	10.0	2.13	1.00	20.0	31.79	30.00	40.0	29.17	22.00	70.0	21.27	1.00
0.1	10.00	10.00	10.0	2.40	2.00	30.0	5.89	0.25	40.0	31.17	24.00	70.0	21.27	2.00
0.1	12.00	12.00	10.0	4.45	4.00	30.0	5.89	0.50	40.0	33.17	26.00	70.0	25.97	4.00
0.1	14.00	14.00	10.0	6.45	6.00	30.0	5.89	0.75	50.0	12.67	0.25	70.0	27.97	6.00
0.1	16.00	16.00	10.0	8.45	8.00	30.0	5.89	1.00	50.0	12.67	0.50	70.0	29.97	8.00
0.1	18.00	18.00	10.0	10.45	10.00	30.0	5.89	2.00	50.0	12.67	0.75	70.0	31.97	10.00
0.1	20.00	20.00	10.0	12.45	12.00	30.0	8.04	4.00	50.0	12.67	1.00	70.0	33.97	12.00
0.1	22.00	22.00	10.0	14.45	14.00	30.0	10.04	6.00	50.0	12.67	2.00	80.0	25.82	0.25
0.1	24.00	24.00	10.0	16.45	16.00	30.0	12.04	8.00	50.0	15.21	4.00	80.0	25.82	0.50
0.1	26.00	26.00	10.0	18.45	18.00	30.0	14.04	10.00	50.0	17.21	6.00	80.0	25.82	0.75
0.1	28.00	28.00	10.0	20.45	20.00	30.0	16.04	12.00	50.0	19.21	8.00	80.0	25.82	1.00
0.1	30.00	30.00	10.0	22.45	22.00	30.0	18.04	14.00	50.0	21.21	10.00	80.0	25.82	2.00
1.0	0.82	0.25	10.0	24.45	24.00	30.0	20.04	16.00	50.0	23.21	12.00	80.0	32.70	4.00
1.0	0.78	0.50	10.0	26.45	26.00	30.0	22.04	18.00	50.0	25.21	14.00	80.0	34.70	6.00
1.0	0.82	0.75	10.0	28.45	28.00	30.0	24.04	20.00	50.0	27.21	16.00	90.0	30.29	0.25
1.0	1.02	1.00	10.0	30.45	30.00	30.0	26.04	22.00	50.0	29.21	18.00	90.0	30.29	0.50
1.0	2.00	2.00	20.0	3.68	0.25	30.0	28.04	24.00	50.0	31.21	20.00	90.0	30.29	0.75
1.0	4.00	4.00	20.0	3.68	0.50	30.0	30.04	26.00	50.0	33.21	22.00	90.0	30.29	1.00
1.0	6.00	6.00	20.0	3.68	0.75	30.0	32.04	28.00	60.0	16.83	0.25	90.0	30.29	2.00
1.0	8.00	8.00	20.0	3.68	1.00	30.0	34.04	30.00	60.0	16.83	0.50	100.0	34.52	0.25
1.0	10.00	10.00	20.0	3.68	2.00	40.0	8.96	0.25	60.0	16.83	0.75	100.0	34.52	0.50
1.0	12.00	12.00	20.0	5.79	4.00	40.0	8.96	0.50	60.0	16.83	1.00	100.0	34.52	0.75
1.0	14.00	14.00	20.0	7.79	6.00	40.0	8.96	0.75	60.0	16.83	2.00	100.0	34.52	1.00
1.0	16.00	16.00	20.0	9.79	8.00	40.0	8.96	1.00	60.0	20.14	4.00	100.0	34.52	2.00
1.0	18.00	18.00	20.0	11.79	10.00	40.0	8.96	2.00	60.0	22.14	6.00			
1.0	20.00	20.00	20.0	13.79	12.00	40.0	11.18	4.00	60.0	24.14	8.00			
1.0	22.00	22.00	20.0	15.79	14.00	40.0	13.17	6.00	60.0	26.14	10.00			

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 27 (Datum correction +4890.31 ft)

Dis-charge (ft^3/s)	Head-water (ft)	Tail-water (ft)	Dis-charge (ft^3/s)	Head-water (ft)	Tail-water (ft)	Dis-charge (ft^3/s)	Head-water (ft)	Tail-water (ft)	Dis-charge (ft^3/s)	Head-water (ft)	Tail-water (ft)	Dis-charge (ft^3/s)	Head-water (ft)	Tail-water (ft)
0.1	0.29	0.25	1.0	20.00	20.00	20.0	9.90	8.00	40.0	9.40	0.50	60.0	17.66	0.50
0.1	0.50	0.50	1.0	22.00	22.00	20.0	11.90	10.00	40.0	9.40	0.75	60.0	17.66	0.75
0.1	0.75	0.75	1.0	24.00	24.00	20.0	13.90	12.00	40.0	9.40	1.00	60.0	17.66	1.00
0.1	1.00	1.00	1.0	26.00	26.00	20.0	15.90	14.00	40.0	9.40	2.00	60.0	17.66	2.00
0.1	2.00	2.00	1.0	28.00	28.00	20.0	17.90	16.00	40.0	11.59	4.00	60.0	21.08	4.00
0.1	4.00	4.00	1.0	30.00	30.00	20.0	19.90	18.00	40.0	13.59	6.00	60.0	23.08	6.00
0.1	6.00	6.00	10.0	2.12	0.25	20.0	21.90	20.00	40.0	15.59	8.00	60.0	25.08	8.00
0.1	8.00	8.00	10.0	2.12	0.50	20.0	23.90	22.00	40.0	17.59	10.00	60.0	27.08	10.00
0.1	10.00	10.00	10.0	2.12	0.75	20.0	25.90	24.00	40.0	19.59	12.00	60.0	29.08	12.00
0.1	12.00	12.00	10.0	2.12	1.00	20.0	27.90	26.00	40.0	21.59	14.00	60.0	31.08	14.00
0.1	14.00	14.00	10.0	2.47	2.00	20.0	29.90	28.00	40.0	23.59	16.00	60.0	33.08	16.00
0.1	16.00	16.00	10.0	4.47	4.00	20.0	31.90	30.00	40.0	25.59	18.00	70.0	22.28	0.25
0.1	18.00	18.00	10.0	6.47	6.00	30.0	6.15	0.25	40.0	27.59	20.00	70.0	22.28	0.50
0.1	20.00	20.00	10.0	8.47	8.00	30.0	6.15	0.50	40.0	29.59	22.00	70.0	22.28	0.75
0.1	22.00	22.00	10.0	10.47	10.00	30.0	6.15	0.75	40.0	31.59	24.00	70.0	22.28	1.00
0.1	24.00	24.00	10.0	12.47	12.00	30.0	6.15	1.00	40.0	33.59	26.00	70.0	22.28	2.00
0.1	26.00	26.00	10.0	14.47	14.00	30.0	6.15	2.00	50.0	13.30	0.25	70.0	27.24	4.00
0.1	28.00	28.00	10.0	16.47	16.00	30.0	8.27	4.00	50.0	13.30	0.50	70.0	29.24	6.00
0.1	30.00	30.00	10.0	18.47	18.00	30.0	10.27	6.00	50.0	13.30	0.75	70.0	31.24	8.00
1.0	0.71	0.25	10.0	20.47	20.00	30.0	12.27	8.00	50.0	13.30	1.00	70.0	33.24	10.00
1.0	0.66	0.50	10.0	22.47	22.00	30.0	14.27	10.00	50.0	13.30	2.00	80.0	26.96	0.25
1.0	0.80	0.75	10.0	24.47	24.00	30.0	16.27	12.00	50.0	15.86	4.00	80.0	26.96	0.50
1.0	1.02	1.00	10.0	26.47	26.00	30.0	18.27	14.00	50.0	17.86	6.00	80.0	26.96	0.75
1.0	2.00	2.00	10.0	28.47	28.00	30.0	20.27	16.00	50.0	19.86	8.00	80.0	26.96	1.00
1.0	4.00	4.00	10.0	30.47	30.00	30.0	22.27	18.00	50.0	21.86	10.00	80.0	26.96	2.00
1.0	6.00	6.00	20.0	3.73	0.25	30.0	24.27	20.00	50.0	23.86	12.00	80.0	34.36	4.00
1.0	8.00	8.00	20.0	3.73	0.50	30.0	26.27	22.00	50.0	25.86	14.00	90.0	31.53	0.25
1.0	10.00	10.00	20.0	3.73	0.75	30.0	28.27	24.00	50.0	27.86	16.00	90.0	31.53	0.50
1.0	12.00	12.00	20.0	3.73	1.00	30.0	30.27	26.00	50.0	29.86	18.00	90.0	31.53	0.75
1.0	14.00	14.00	20.0	3.73	2.00	30.0	32.27	28.00	50.0	31.86	20.00	90.0	31.53	1.00
1.0	16.00	16.00	20.0	5.90	4.00	30.0	34.27	30.00	50.0	33.86	22.00	90.0	31.53	2.00
1.0	18.00	18.00	20.0	7.90	6.00	40.0	9.40	0.25	60.0	17.66	0.25			

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 28 (Datum correction +4909.30 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
0.1	0.37	0.25	1.0	10.01	10.00	10.0	24.72	24.00	30.0	8.44	2.00	40.0	31.44	20.00
0.1	0.51	0.50	1.0	12.01	12.00	10.0	26.72	26.00	30.0	10.44	4.00	40.0	33.44	22.00
0.1	0.75	0.75	1.0	14.01	14.00	10.0	28.72	28.00	30.0	12.44	6.00	50.0	18.62	0.25
0.1	1.00	1.00	1.0	16.01	16.00	10.0	30.72	30.00	30.0	14.44	8.00	50.0	18.62	0.50
0.1	2.00	2.00	1.0	18.01	18.00	20.0	4.78	0.25	30.0	16.44	10.00	50.0	18.62	0.75
0.1	4.00	4.00	1.0	20.01	20.00	20.0	4.78	0.50	30.0	18.44	12.00	50.0	18.62	1.00
0.1	6.00	6.00	1.0	22.01	22.00	20.0	4.78	0.75	30.0	20.44	14.00	50.0	18.62	2.00
0.1	8.00	8.00	1.0	24.01	24.00	20.0	4.78	1.00	30.0	22.44	16.00	50.0	21.88	4.00
0.1	10.00	10.00	1.0	26.01	26.00	20.0	4.78	2.00	30.0	24.44	18.00	50.0	23.88	6.00
0.1	12.00	12.00	1.0	28.01	28.00	20.0	6.86	4.00	30.0	26.44	20.00	50.0	25.88	8.00
0.1	14.00	14.00	1.0	30.01	30.00	20.0	8.86	6.00	30.0	28.44	22.00	50.0	27.88	10.00
0.1	16.00	16.00	10.0	2.44	0.25	20.0	10.86	8.00	30.0	30.44	24.00	50.0	29.88	12.00
0.1	18.00	18.00	10.0	2.44	0.50	20.0	12.86	10.00	30.0	32.44	26.00	50.0	31.88	14.00
0.1	20.00	20.00	10.0	2.44	0.75	20.0	14.86	12.00	30.0	34.44	28.00	50.0	33.88	16.00
0.1	22.00	22.00	10.0	2.44	1.00	20.0	16.86	14.00	40.0	13.17	0.25	60.0	24.40	0.25
0.1	24.00	24.00	10.0	2.96	2.00	20.0	18.86	16.00	40.0	13.17	0.50	60.0	24.40	0.50
0.1	26.00	26.00	10.0	3.35	2.00	20.0	20.86	18.00	40.0	13.17	0.75	60.0	24.40	0.75
0.1	28.00	28.00	10.0	4.72	4.00	20.0	22.86	20.00	40.0	13.17	1.00	60.0	24.40	1.00
0.1	30.00	30.00	10.0	6.72	6.00	20.0	24.86	22.00	40.0	13.17	2.00	60.0	24.40	2.00
1.0	0.85	0.25	10.0	8.72	8.00	20.0	26.86	24.00	40.0	15.44	4.00	60.0	29.74	4.00
1.0	0.77	0.50	10.0	10.72	10.00	20.0	28.86	26.00	40.0	17.44	6.00	60.0	31.74	6.00
1.0	0.84	0.75	10.0	12.72	12.00	20.0	30.86	28.00	40.0	19.44	8.00	60.0	33.74	8.00
1.0	1.03	1.00	10.0	14.72	14.00	20.0	32.86	30.00	40.0	21.44	10.00	70.0	30.16	0.25
1.0	2.01	2.00	10.0	16.72	16.00	30.0	8.44	0.25	40.0	23.44	12.00	70.0	30.16	0.50
1.0	4.01	4.00	10.0	18.72	18.00	30.0	8.44	0.50	40.0	25.44	14.00	70.0	30.16	0.75
1.0	6.01	6.00	10.0	20.72	20.00	30.0	8.44	0.75	40.0	27.44	16.00	70.0	30.16	1.00
1.0	8.01	8.00	10.0	22.72	22.00	30.0	8.44	1.00	40.0	29.44	18.00	70.0	30.16	2.00

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 29 (Datum correction +4915.80 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
0.1	0.75	0.25	1.0	1.09	0.25	10.0	4.30	0.25	20.0	12.25	0.25	30.0	22.15	0.50
0.1	0.92	0.50	1.0	1.03	0.50	10.0	4.30	0.50	20.0	12.25	0.50	30.0	22.15	0.75
0.1	0.76	0.75	1.0	1.02	0.75	10.0	4.30	0.75	20.0	12.25	0.75	30.0	22.15	1.00
0.1	1.00	1.00	1.0	1.10	1.00	10.0	4.30	1.00	20.0	12.25	1.00	30.0	25.87	2.00
0.1	2.00	2.00	1.0	2.03	2.00	10.0	4.65	2.00	20.0	12.61	2.00	30.0	27.87	4.00
0.1	4.00	4.00	1.0	4.03	4.00	10.0	6.65	4.00	20.0	14.61	4.00	30.0	29.87	6.00
0.1	6.00	6.00	1.0	6.03	6.00	10.0	8.65	6.00	20.0	16.61	6.00	30.0	31.87	8.00
0.1	8.00	8.00	1.0	8.03	8.00	10.0	10.65	8.00	20.0	18.61	8.00	30.0	33.87	10.00
0.1	10.00	10.00	1.0	10.03	10.00	10.0	12.65	10.00	20.0	20.61	10.00	40.0	30.64	0.25
0.1	12.00	12.00	1.0	12.03	12.00	10.0	14.65	12.00	20.0	22.61	12.00	40.0	30.64	0.50
0.1	14.00	14.00	1.0	14.03	14.00	10.0	16.65	14.00	20.0	24.61	14.00	40.0	30.64	0.75
0.1	16.00	16.00	1.0	16.03	16.00	10.0	18.65	16.00	20.0	26.61	16.00	40.0	30.64	1.00
0.1	18.00	18.00	1.0	18.03	18.00	10.0	20.65	18.00	20.0	28.61	18.00	50.0	34.35	0.25
0.1	20.00	20.00	1.0	20.03	20.00	10.0	22.65	20.00	20.0	30.61	20.00	50.0	34.35	0.50
0.1	22.00	22.00	1.0	22.03	22.00	10.0	24.65	22.00	20.0	32.61	22.00	50.0	34.35	0.75
0.1	24.00	24.00	1.0	24.03	24.00	10.0	26.65	24.00	20.0	34.61	24.00	50.0	34.35	1.00
0.1	26.00	26.00	1.0	26.03	26.00	10.0	28.65	26.00	20.0	36.61	26.00			
0.1	28.00	28.00	1.0	28.03	28.00	10.0	30.65	28.00	20.0	38.61	28.00			
0.1	30.00	30.00	1.0	30.03	30.00	10.0	32.65	30.00	30.0	22.15	0.25			

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 30 (Datum correction +4916.40 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
0.1	1.05	0.25	2.0	4.65	4.00	4.0	16.60	14.00	6.0	29.84	24.00	9.0	21.15	8.00
0.1	1.20	0.50	2.0	6.65	6.00	4.0	18.60	16.00	6.0	31.84	26.00	9.0	23.15	10.00
0.1	1.05	0.75	2.0	8.65	8.00	4.0	20.60	18.00	6.0	33.84	28.00	9.0	25.15	12.00
0.1	1.02	1.00	2.0	10.65	10.00	4.0	22.60	20.00	7.0	8.12	0.25	9.0	27.15	14.00
0.1	2.00	2.00	2.0	12.65	12.00	4.0	24.60	22.00	7.0	8.12	0.50	9.0	29.15	16.00
0.1	4.00	4.00	2.0	14.65	14.00	4.0	26.60	24.00	7.0	8.12	0.75	9.0	31.15	18.00
0.1	6.00	6.00	2.0	16.65	16.00	4.0	28.60	26.00	7.0	8.12	1.00	9.0	33.15	20.00
0.1	8.00	8.00	2.0	18.65	18.00	4.0	30.60	28.00	7.0	9.96	2.00	10.0	13.76	0.25
0.1	10.00	10.00	2.0	20.65	20.00	4.0	32.60	30.00	7.0	11.96	4.00	10.0	13.76	0.50
0.1	12.00	12.00	2.0	22.65	22.00	5.0	4.81	0.25	7.0	13.96	6.00	10.0	13.76	0.75
0.1	14.00	14.00	2.0	24.65	24.00	5.0	4.81	0.50	7.0	15.96	8.00	10.0	13.76	1.00
0.1	16.00	16.00	2.0	26.65	26.00	5.0	4.81	0.75	7.0	17.96	10.00	10.0	18.24	2.00
0.1	18.00	18.00	2.0	28.65	28.00	5.0	4.81	1.00	7.0	19.96	12.00	10.0	20.24	4.00
0.1	20.00	20.00	2.0	30.65	30.00	5.0	6.06	2.00	7.0	21.96	14.00	10.0	22.24	6.00
0.1	22.00	22.00	3.0	2.27	0.25	5.0	8.06	4.00	7.0	23.96	16.00	10.0	24.24	8.00
0.1	24.00	24.00	3.0	2.27	0.50	5.0	10.06	6.00	7.0	25.96	18.00	10.0	26.24	10.00
0.1	26.00	26.00	3.0	2.57	0.75	5.0	12.06	8.00	7.0	27.96	20.00	10.0	28.24	12.00
0.1	28.00	28.00	3.0	2.57	1.00	5.0	14.06	10.00	7.0	29.96	22.00	10.0	30.24	14.00
0.1	30.00	30.00	3.0	3.46	2.00	5.0	16.06	12.00	7.0	31.96	24.00	10.0	32.24	16.00
1.0	1.39	0.25	3.0	5.46	4.00	5.0	18.06	14.00	7.0	33.96	26.00	10.0	34.24	18.00
1.0	1.41	0.50	3.0	7.46	6.00	5.0	20.06	16.00	8.0	9.96	0.25	12.0	17.36	0.25
1.0	1.59	0.75	3.0	9.46	8.00	5.0	22.06	18.00	8.0	9.96	0.50	12.0	17.36	0.50
1.0	1.81	1.00	3.0	11.46	10.00	5.0	24.06	20.00	8.0	9.96	0.75	12.0	17.36	0.75
1.0	2.16	2.00	3.0	13.46	12.00	5.0	26.06	22.00	8.0	9.96	1.00	12.0	17.36	1.00
1.0	4.16	4.00	3.0	15.46	14.00	5.0	28.06	24.00	8.0	12.39	2.00	12.0	25.38	2.00
1.0	6.16	6.00	3.0	17.46	16.00	5.0	30.06	26.00	8.0	14.39	4.00	12.0	27.38	4.00
1.0	8.16	8.00	3.0	19.46	18.00	5.0	32.06	28.00	8.0	16.39	6.00	12.0	29.38	6.00
1.0	10.16	10.00	3.0	21.46	20.00	5.0	34.06	30.00	8.0	18.39	8.00	12.0	31.38	8.00
1.0	12.16	12.00	3.0	23.46	22.00	6.0	6.39	0.25	8.0	20.39	10.00	12.0	33.38	10.00
1.0	14.16	14.00	3.0	25.46	24.00	6.0	6.39	0.50	8.0	22.39	12.00	14.0	20.36	0.25
1.0	16.16	16.00	3.0	27.46	26.00	6.0	6.39	0.75	8.0	24.39	14.00	14.0	20.36	0.50
1.0	18.16	18.00	3.0	29.46	28.00	6.0	6.39	1.00	8.0	26.39	16.00	14.0	20.36	0.75
1.0	20.16	20.00	3.0	31.46	30.00	6.0	7.85	2.00	8.0	28.39	18.00	14.0	20.36	1.00
1.0	22.16	22.00	4.0	3.44	0.25	6.0	9.84	4.00	8.0	30.39	20.00	14.0	33.82	2.00
1.0	24.16	24.00	4.0	3.44	0.50	6.0	11.84	6.00	8.0	32.39	22.00	16.0	22.34	0.25
1.0	26.16	26.00	4.0	3.44	0.75	6.0	13.84	8.00	8.0	34.39	24.00	16.0	22.34	0.50
1.0	28.16	28.00	4.0	3.44	1.00	6.0	15.84	10.00	9.0	11.86	0.25	16.0	22.34	0.75
1.0	30.16	30.00	4.0	4.60	2.00	6.0	17.84	12.00	9.0	11.86	0.50	16.0	22.34	1.00
2.0	1.72	0.25	4.0	6.60	4.00	6.0	19.84	14.00	9.0	11.86	0.75	18.0	22.88	0.25
2.0	1.72	0.50	4.0	8.60	6.00	6.0	21.84	16.00	9.0	11.86	1.00	18.0	22.88	0.50
2.0	1.67	0.75	4.0	10.60	8.00	6.0	23.84	18.00	9.0	15.15	2.00	18.0	22.88	0.75
2.0	1.70	1.00	4.0	12.60	10.00	6.0	25.84	20.00	9.0	17.15	4.00	18.0	22.88	1.00
2.0	2.65	2.00	4.0	14.60	12.00	6.0	27.84	22.00	9.0	19.15	6.00			

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 31 (Datum correction +4918.00 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
0.1	0.64	0.25	2.0	2.08	1.00	4.0	11.15	8.00	6.0	23.09	16.00	9.0	19.94	4.00
0.1	0.64	0.50	2.0	2.79	2.00	4.0	13.15	10.00	6.0	25.09	18.00	9.0	21.94	6.00
0.1	0.76	0.75	2.0	4.79	4.00	4.0	15.15	12.00	6.0	27.09	20.00	9.0	23.94	8.00
0.1	1.31	1.00	2.0	6.79	6.00	4.0	17.15	14.00	6.0	29.09	22.00	9.0	25.94	10.00
0.1	1.59	1.00	2.0	8.79	8.00	4.0	19.15	16.00	6.0	31.09	24.00	9.0	27.94	12.00
0.1	2.00	2.00	2.0	10.79	10.00	4.0	21.15	18.00	6.0	33.09	26.00	9.0	29.94	14.00
0.1	4.00	4.00	2.0	12.79	12.00	4.0	23.15	20.00	7.0	9.90	0.25	9.0	31.94	16.00
0.1	6.00	6.00	2.0	14.79	14.00	4.0	25.15	22.00	7.0	9.90	0.50	9.0	33.94	18.00
0.1	8.00	8.00	2.0	16.79	16.00	4.0	27.15	24.00	7.0	9.90	0.75	10.0	16.15	0.25
0.1	10.00	10.00	2.0	18.79	18.00	4.0	29.15	26.00	7.0	9.90	1.00	10.0	16.15	0.50
0.1	12.00	12.00	2.0	20.79	20.00	4.0	31.15	28.00	7.0	11.64	2.00	10.0	16.15	0.75
0.1	14.00	14.00	2.0	22.79	22.00	4.0	33.15	30.00	7.0	13.64	4.00	10.0	16.15	1.00
0.1	16.00	16.00	2.0	24.79	24.00	5.0	6.04	0.25	7.0	15.64	6.00	10.0	21.68	2.00
0.1	18.00	18.00	2.0	26.79	26.00	5.0	6.04	0.50	7.0	17.64	8.00	10.0	23.68	4.00
0.1	20.00	20.00	2.0	28.79	28.00	5.0	6.04	0.75	7.0	19.64	10.00	10.0	25.68	6.00
0.1	22.00	22.00	2.0	30.79	30.00	5.0	6.04	1.00	7.0	21.64	12.00	10.0	27.68	8.00
0.1	24.00	24.00	3.0	3.06	0.25	5.0	6.92	2.00	7.0	23.64	14.00	10.0	29.68	10.00
0.1	26.00	26.00	3.0	3.06	0.50	5.0	8.92	4.00	7.0	25.64	16.00	10.0	31.68	12.00
0.1	28.00	28.00	3.0	3.06	0.75	5.0	10.92	6.00	7.0	27.64	18.00	10.0	33.68	14.00
0.1	30.00	30.00	3.0	3.06	1.00	5.0	12.92	8.00	7.0	29.64	20.00	12.0	19.80	0.25
1.0	1.66	0.25	3.0	3.77	2.00	5.0	14.92	10.00	7.0	31.64	22.00	12.0	19.80	0.50
1.0	1.66	0.50	3.0	5.77	4.00	5.0	16.92	12.00	7.0	33.64	24.00	12.0	19.80	0.75
1.0	1.66	0.75	3.0	7.77	6.00	5.0	18.92	14.00	8.0	12.00	0.25	12.0	19.80	1.00
1.0	1.87	1.00	3.0	9.77	8.00	5.0	20.92	16.00	8.0	12.00	0.50	12.0	30.34	2.00
1.0	2.20	2.00	3.0	11.77	10.00	5.0	22.92	18.00	8.0	12.00	0.75	12.0	32.34	4.00
1.0	4.20	4.00	3.0	13.77	12.00	5.0	24.92	20.00	8.0	12.00	1.00	12.0	34.34	6.00
1.0	6.20	6.00	3.0	15.77	14.00	5.0	26.92	22.00	8.0	14.60	2.00	14.0	22.37	0.25
1.0	8.20	8.00	3.0	17.77	16.00	5.0	28.92	24.00	8.0	16.60	4.00	14.0	22.37	0.50
1.0	10.20	10.00	3.0	19.77	18.00	5.0	30.92	26.00	8.0	18.60	6.00	14.0	22.37	0.75
1.0	12.20	12.00	3.0	21.77	20.00	5.0	32.92	28.00	8.0	20.60	8.00	14.0	22.37	1.00
1.0	14.20	14.00	3.0	23.77	22.00	5.0	34.92	30.00	8.0	22.60	10.00	16.0	23.30	0.25
1.0	16.20	16.00	3.0	25.77	24.00	6.0	7.89	0.25	8.0	24.60	12.00	16.0	23.30	0.50
1.0	18.20	18.00	3.0	27.77	26.00	6.0	7.89	0.50	8.0	26.60	14.00	16.0	23.30	0.75
1.0	20.20	20.00	3.0	29.77	28.00	6.0	7.89	0.75	8.0	28.60	16.00	16.0	23.30	1.00
1.0	22.20	22.00	3.0	31.77	30.00	6.0	7.89	1.00	8.0	30.60	18.00	18.0	22.05	0.25
1.0	24.20	24.00	4.0	4.40	0.25	6.0	9.09	2.00	8.0	32.60	20.00	18.0	22.05	0.50
1.0	26.20	26.00	4.0	4.40	0.50	6.0	11.09	4.00	8.0	34.60	22.00	18.0	22.05	0.75
1.0	28.20	28.00	4.0	4.40	0.75	6.0	13.09	6.00	9.0	14.10	0.25	18.0	22.05	1.00
1.0	30.20	30.00	4.0	4.40	1.00	6.0	15.09	8.00	9.0	14.10	0.50			
2.0	2.08	0.25	4.0	5.15	2.00	6.0	17.09	10.00	9.0	14.10	0.75			
2.0	2.08	0.50	4.0	7.15	4.00	6.0	19.09	12.00	9.0	14.10	1.00			
2.0	2.08	0.75	4.0	9.15	6.00	6.0	21.09	14.00	9.0	17.94	2.00			

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 32 (Datum correction +4919.50 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
0.1	0.34	0.25	1.0	8.17	8.00	2.0	22.66	22.00	6.0	6.54	0.75	8.0	24.64	14.00
0.1	0.51	0.50	1.0	10.17	10.00	2.0	24.66	24.00	6.0	6.54	1.00	8.0	26.64	16.00
0.1	0.75	0.75	1.0	12.17	12.00	2.0	26.66	26.00	6.0	7.98	2.00	8.0	28.64	18.00
0.1	1.00	1.00	1.0	14.17	14.00	2.0	28.66	28.00	6.0	9.98	4.00	8.0	30.64	20.00
0.1	2.00	2.00	1.0	16.17	16.00	2.0	30.66	30.00	6.0	11.98	6.00	8.0	32.64	22.00
0.1	4.00	4.00	1.0	18.17	18.00	4.0	3.52	0.25	6.0	13.98	8.00	8.0	34.64	24.00
0.1	6.00	6.00	1.0	20.17	20.00	4.0	3.52	0.50	6.0	15.98	10.00	10.0	14.04	0.25
0.1	8.00	8.00	1.0	22.17	22.00	4.0	3.52	0.75	6.0	17.98	12.00	10.0	14.04	0.50
0.1	10.00	10.00	1.0	24.17	24.00	4.0	3.52	1.00	6.0	19.98	14.00	10.0	14.04	0.75
0.1	12.00	12.00	1.0	26.17	26.00	4.0	4.66	2.00	6.0	21.98	16.00	10.0	14.04	1.00
0.1	14.00	14.00	1.0	28.17	28.00	4.0	6.66	4.00	6.0	23.98	18.00	10.0	18.62	2.00
0.1	16.00	16.00	1.0	30.17	30.00	4.0	8.66	6.00	6.0	25.98	20.00	10.0	20.62	4.00
0.1	18.00	18.00	2.0	1.89	0.25	4.0	10.66	8.00	6.0	27.98	22.00	10.0	22.62	6.00
0.1	20.00	20.00	2.0	1.89	0.50	4.0	12.66	10.00	6.0	29.98	24.00	10.0	24.62	8.00
0.1	22.00	22.00	2.0	1.84	0.75	4.0	14.66	12.00	6.0	31.98	26.00	10.0	26.62	10.00
0.1	24.00	24.00	2.0	1.84	1.00	4.0	16.66	14.00	6.0	33.98	28.00	10.0	28.62	12.00
0.1	26.00	26.00	2.0	2.66	2.00	4.0	18.66	16.00	8.0	10.19	0.25	10.0	30.62	14.00
0.1	28.00	28.00	2.0	4.66	4.00	4.0	20.66	18.00	8.0	10.19	0.50	10.0	32.62	16.00
0.1	30.00	30.00	2.0	6.66	6.00	4.0	22.66	20.00	8.0	10.19	0.75	10.0	34.62	18.00
1.0	0.96	0.25	2.0	8.66	8.00	4.0	24.66	22.00	8.0	10.19	1.00	15.0	21.71	0.25
1.0	0.90	0.50	2.0	10.66	10.00	4.0	26.66	24.00	8.0	12.64	2.00	15.0	21.71	0.50
1.0	0.94	0.75	2.0	12.66	12.00	4.0	28.66	26.00	8.0	14.64	4.00	15.0	21.71	0.75
1.0	1.17	1.00	2.0	14.66	14.00	4.0	30.66	28.00	8.0	16.64	6.00	15.0	21.71	1.00
1.0	2.17	2.00	2.0	16.66	16.00	4.0	32.66	30.00	8.0	18.64	8.00			
1.0	4.17	4.00	2.0	18.66	18.00	6.0	6.54	0.25	8.0	20.64	10.00			
1.0	6.17	6.00	2.0	20.66	20.00	6.0	6.54	0.50	8.0	22.64	12.00			

Appendix 1: Stage-discharge results from the Culvert Analysis Program (CAP)
[ft^3/s, cubic feet per second; ft, feet]

Site 33 (Datum correction +4921.91 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
0.1	0.46	0.25	1.0	0.86	0.50	10.0	3.65	0.75	20.0	10.08	1.00	30.0	26.52	6.00
0.1	0.52	0.50	1.0	0.89	0.75	10.0	3.65	1.00	20.0	11.12	2.00	30.0	28.52	8.00
0.1	0.75	0.75	1.0	1.05	1.00	10.0	4.28	2.00	20.0	13.12	4.00	30.0	30.52	10.00
0.1	1.00	1.00	1.0	2.02	2.00	10.0	6.28	4.00	20.0	15.12	6.00	30.0	32.52	12.00
0.1	2.00	2.00	1.0	4.02	4.00	10.0	8.28	6.00	20.0	17.12	8.00	30.0	34.52	14.00
0.1	4.00	4.00	1.0	6.02	6.00	10.0	10.28	8.00	20.0	19.12	10.00	40.0	27.03	0.25
0.1	6.00	6.00	1.0	8.02	8.00	10.0	12.28	10.00	20.0	21.12	12.00	40.0	27.03	0.50
0.1	8.00	8.00	1.0	10.02	10.00	10.0	14.28	12.00	20.0	23.12	14.00	40.0	27.03	0.75
0.1	10.00	10.00	1.0	12.02	12.00	10.0	16.28	14.00	20.0	25.12	16.00	40.0	27.03	1.00
0.1	12.00	12.00	1.0	14.02	14.00	10.0	18.28	16.00	20.0	27.12	18.00	50.0	32.93	0.25
0.1	14.00	14.00	1.0	16.02	16.00	10.0	20.28	18.00	20.0	29.12	20.00	50.0	32.93	0.50
0.1	16.00	16.00	1.0	18.02	18.00	10.0	22.28	20.00	20.0	31.12	22.00	50.0	32.93	0.75
0.1	18.00	18.00	1.0	20.02	20.00	10.0	24.28	22.00	20.0	33.12	24.00	50.0	32.93	1.00
0.1	20.00	20.00	1.0	22.02	22.00	10.0	26.28	24.00	20.0	39.12	30.00	60.0	34.05	0.25
0.1	22.00	22.00	1.0	24.02	24.00	10.0	28.28	26.00	30.0	18.64	0.25	60.0	34.05	0.50
0.1	24.00	24.00	1.0	26.02	26.00	10.0	30.28	28.00	30.0	18.64	0.50	60.0	34.05	0.75
0.1	26.00	26.00	1.0	28.02	28.00	10.0	32.28	30.00	30.0	18.64	0.75	60.0	34.05	1.00
0.1	28.00	28.00	1.0	30.02	30.00	20.0	10.08	0.25	30.0	18.64	1.00			
0.1	30.00	30.00	10.0	3.65	0.25	20.0	10.08	0.50	30.0	22.52	2.00			
1.0	0.91	0.25	10.0	3.65	0.50	20.0	10.08	0.75	30.0	24.52	4.00			

APPENDIX 2

Appendix 2: Stage-discharge results from the HEC-RAS model
[ft^3/s, cubic feet per second; ft, feet]

Site 3 (Datum correction +4966.091 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
0.1	0.29	0.25	6500.0	24.39	12.12	5500.0	20.77	12.03	4500.0	16.98	11.24	3500.0	18.47	14.96
1.0	0.46	0.37	7000.0	26.53	12.28	6000.0	23.13	12.69	5000.0	18.82	11.65	4000.0	19.55	14.95
10.0	0.98	0.94	0.1	0.75	0.75	6500.0	24.39	12.12	5500.0	20.77	12.03	4500.0	20.78	14.93
25.0	1.40	1.35	1.0	0.76	0.75	7000.0	26.53	12.28	6000.0	23.13	12.69	5000.0	22.16	14.92
50.0	1.84	1.77	10.0	0.98	0.94	0.1	2.00	2.00	6500.0	24.39	12.12	5500.0	23.67	14.90
75.0	2.12	2.06	25.0	1.37	1.31	1.0	2.00	2.00	7000.0	26.53	12.28	6000.0	25.33	14.87
100.0	2.35	2.28	50.0	1.84	1.77	10.0	2.00	2.00	0.1	10.00	10.00	6500.0	27.14	14.85
250.0	3.36	3.26	75.0	2.12	2.06	25.0	2.04	2.02	1.0	10.00	10.00	7000.0	29.08	14.82
500.0	4.46	4.35	100.0	2.35	2.28	50.0	2.12	2.09	10.0	10.00	10.00	0.1	20.00	20.00
750.0	5.28	5.16	250.0	3.36	3.26	75.0	2.24	2.19	25.0	10.00	10.00	1.0	20.00	20.00
1000.0	5.96	5.83	500.0	4.46	4.35	100.0	2.38	2.31	50.0	10.00	10.00	10.0	20.00	20.00
1500.0	7.10	6.96	750.0	5.28	5.16	250.0	3.24	3.13	75.0	10.00	10.00	25.0	20.00	20.00
2000.0	8.52	7.91	1000.0	5.96	5.83	500.0	4.46	4.35	100.0	10.00	10.00	50.0	20.00	20.00
2500.0	9.95	8.77	1500.0	7.10	6.96	750.0	5.28	5.16	250.0	10.01	10.00	75.0	20.00	20.00
3000.0	11.56	9.53	2000.0	8.52	7.91	1000.0	5.96	5.83	500.0	10.05	10.01	100.0	20.00	20.00
3500.0	13.30	10.22	2500.0	9.95	8.77	1500.0	7.10	6.96	750.0	10.13	10.02	250.0	20.02	20.00
4000.0	15.16	10.77	3000.0	11.56	9.53	2000.0	8.52	7.91	1000.0	10.25	10.05	500.0	20.07	20.00
4500.0	16.98	11.24	3500.0	13.30	10.22	2500.0	9.95	8.77	1500.0	10.57	10.12	750.0	20.16	20.00
5000.0	18.82	11.65	4000.0	15.16	10.77	3000.0	11.56	9.53	2000.0	11.06	10.21	1000.0	20.29	20.00
5500.0	20.77	12.03	4500.0	16.98	11.24	3500.0	13.30	10.22	2500.0	11.74	10.31	1500.0	20.65	20.00
6000.0	23.13	12.69	5000.0	18.82	11.65	4000.0	15.16	10.77	3000.0	12.63	10.46	2000.0	21.16	20.00
6500.0	24.39	12.12	5500.0	20.77	12.03	4500.0	16.98	11.24	3500.0	13.81	10.63	2500.0	21.81	20.00
7000.0	26.53	12.28	6000.0	23.13	12.69	5000.0	18.82	11.65	4000.0	15.23	10.83	3000.0	22.61	20.00
0.1	0.50	0.50	6500.0	24.39	12.12	5500.0	20.77	12.03	4500.0	16.77	11.05	3500.0	23.55	20.00
1.0	0.53	0.52	7000.0	26.53	12.28	6000.0	23.13	12.69	5000.0	18.45	11.30	4000.0	24.64	20.00
10.0	0.97	0.92	0.1	1.00	1.00	6500.0	24.39	12.12	5500.0	20.28	11.55	4500.0	25.87	19.98
25.0	1.64	1.35	1.0	1.00	1.00	7000.0	26.53	12.28	6000.0	22.48	12.05	5000.0	27.25	19.98
50.0	1.84	1.77	10.0	1.09	1.07	0.1	4.00	4.00	6500.0	24.39	12.12	5500.0	28.78	19.98
75.0	2.12	2.06	25.0	1.38	1.30	1.0	4.00	4.00	7000.0	26.53	12.28	6000.0	30.45	19.97
100.0	2.35	2.28	50.0	1.78	1.70	10.0	4.00	4.00	0.1	15.00	15.00	6500.0	32.27	19.97
250.0	3.36	3.26	75.0	2.09	2.02	25.0	4.00	4.00	1.0	15.00	15.00	7000.0	34.24	19.96
500.0	4.46	4.35	100.0	2.35	2.28	50.0	4.00	4.00	10.0	15.00	15.00	0.1	25.00	25.00
750.0	5.28	5.16	250.0	3.36	3.26	75.0	4.03	4.01	25.0	15.00	15.00	1.0	25.00	25.00
1000.0	5.96	5.83	500.0	4.46	4.35	100.0	4.04	4.02	50.0	15.00	15.00	10.0	25.00	25.00
1500.0	7.10	6.96	750.0	5.28	5.16	250.0	4.17	4.13	75.0	15.00	15.00	25.0	25.00	25.00
2000.0	8.52	7.91	1000.0	5.96	5.83	500.0	4.59	4.48	100.0	15.00	15.00	50.0	25.00	25.00
2500.0	9.96	8.77	1500.0	7.10	6.96	750.0	5.16	5.02	250.0	15.02	15.00	75.0	25.00	25.00
3000.0	11.56	9.53	2000.0	8.52	7.91	1000.0	5.81	5.66	500.0	15.07	15.00	100.0	25.00	25.00
3500.0	13.30	10.22	2500.0	9.95	8.77	1500.0	7.10	6.96	750.0	15.16	15.01	250.0	25.02	25.00
4000.0	15.16	10.77	3000.0	11.56	9.53	2000.0	8.52	7.91	1000.0	15.28	15.00	500.0	25.07	25.00
4500.0	16.98	11.24	3500.0	13.30	10.22	2500.0	9.95	8.77	1500.0	15.62	15.00	750.0	25.16	25.00
5000.0	18.82	11.65	4000.0	15.16	10.77	3000.0	11.56	9.53	2000.0	16.11	14.99	1000.0	25.29	25.00
5500.0	20.77	12.03	4500.0	16.98	11.24	3500.0	13.30	10.22	2500.0	16.75	14.98	1500.0	25.66	25.00
6000.0	23.13	12.69	5000.0	18.82	11.65	4000.0	15.16	10.77	3000.0	17.53	14.97	2000.0	26.17	25.00

Appendix 2: Stage-discharge results from the HEC-RAS model--Continued
[ft^3/s, cubic feet per second; ft, feet]

Site 3—Continued.

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
2500.0	26.82	25.01	6000.0	35.49	25.00	50.0	30.00	30.00	1500.0	30.66	30.00	5000.0	37.29	30.00
3000.0	27.62	25.00	6500.0	37.31	25.00	75.0	30.00	30.00	2000.0	31.17	30.00	5500.0	38.82	30.00
3500.0	28.57	25.00	7000.0	39.27	24.98	100.0	30.00	30.00	2500.0	31.82	30.00	6000.0	40.50	30.00
4000.0	29.66	25.00	0.1	30.00	30.00	250.0	30.02	30.00	3000.0	32.63	30.01	6500.0	42.32	30.00
4500.0	30.90	25.00	1.0	30.00	30.00	500.0	30.07	30.00	3500.0	33.57	30.01	7000.0	44.29	30.00
5000.0	32.28	25.00	10.0	30.00	30.00	750.0	30.16	30.00	4000.0	34.67	30.01			
5500.0	33.81	25.00	25.0	30.00	30.00	1000.0	30.29	30.00	4500.0	35.90	30.00			

Appendix 2: Stage-discharge results from the HEC-RAS model--Continued
[ft^3/s, cubic feet per second; ft, feet]

Site 7 (Datum correction +4985.3 ft)

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
0.1	0.25	0.25	7000.0	25.29	7.50	0.1	6.70	6.70	2000.0	8.76	7.33	1000.0	10.36	10.00
1.0	0.27	0.26	0.1	1.00	1.00	1.0	6.70	6.70	2500.0	9.59	7.35	1500.0	10.82	10.01
10.0	0.39	0.36	1.0	1.00	1.00	10.0	6.70	6.70	3000.0	10.59	7.38	2000.0	11.45	10.01
25.0	0.63	0.59	10.0	1.02	1.01	25.0	6.70	6.70	3500.0	11.82	7.41	2500.0	12.26	10.01
50.0	0.94	0.90	25.0	1.06	1.03	50.0	6.70	6.70	4000.0	13.23	7.44	3000.0	13.26	10.01
75.0	1.20	1.15	50.0	1.13	1.10	75.0	6.70	6.70	4500.0	14.82	7.48	3500.0	14.45	10.01
100.0	1.41	1.35	75.0	1.26	1.21	100.0	6.71	6.70	5000.0	16.59	7.52	4000.0	15.82	10.01
250.0	2.32	2.17	100.0	1.39	1.33	250.0	6.72	6.70	5500.0	18.55	7.57	4500.0	17.36	10.01
500.0	3.34	3.07	250.0	2.27	2.10	500.0	6.76	6.70	6000.0	20.69	7.62	5000.0	19.08	10.01
750.0	4.18	3.77	500.0	3.34	3.07	750.0	6.83	6.70	6500.0	23.01	7.67	5500.0	20.99	10.01
1000.0	5.07	4.36	750.0	4.18	3.77	1000.0	6.95	6.72	7000.0	25.53	7.73	6000.0	23.08	10.01
3000.0	10.89	7.67	1000.0	5.07	4.36	6500.0	22.73	7.38	0.1	7.70	7.70	6500.0	25.35	10.00
3500.0	12.68	8.25	6500.0	22.70	7.36	7000.0	25.27	7.47	1.0	7.70	7.70	7000.0	27.80	10.00
6500.0	22.70	7.36	7000.0	25.29	7.50	0.1	7.20	7.20	10.0	7.70	7.70	0.1	15.00	15.00
7000.0	25.29	7.50	0.1	2.00	2.00	1.0	7.20	7.20	25.0	7.70	7.70	1.0	15.00	15.00
0.1	0.50	0.50	1.0	2.00	2.00	10.0	7.20	7.20	50.0	7.70	7.70	10.0	15.00	15.00
1.0	0.50	0.50	10.0	2.00	2.00	25.0	7.20	7.20	75.0	7.70	7.70	25.0	15.00	15.00
10.0	0.56	0.53	25.0	2.00	2.00	50.0	7.20	7.20	100.0	7.71	7.70	50.0	15.00	15.00
25.0	0.67	0.65	50.0	2.02	2.01	75.0	7.20	7.20	250.0	7.73	7.70	75.0	15.00	15.00
50.0	0.92	0.88	75.0	2.06	2.03	100.0	7.21	7.20	500.0	7.80	7.70	100.0	15.00	15.00
75.0	1.16	1.10	100.0	2.07	2.06	250.0	7.23	7.20	750.0	7.90	7.70	250.0	15.02	15.00
100.0	1.36	1.30	250.0	2.42	2.30	500.0	7.26	7.20	1000.0	8.06	7.70	500.0	15.09	15.00
250.0	2.32	2.17	500.0	3.25	2.96	750.0	7.31	7.20	1500.0	8.51	7.71	750.0	15.20	15.00
500.0	3.34	3.07	750.0	4.15	3.73	1000.0	7.40	7.20	2000.0	9.15	7.72	1000.0	15.36	15.00
750.0	4.18	3.77	1000.0	5.07	4.36	3500.0	11.73	7.32	2500.0	10.00	7.73	1500.0	15.82	15.00
1000.0	5.07	4.36	3000.0	10.89	7.67	4000.0	13.15	7.36	3000.0	10.99	7.76	2000.0	16.45	15.00
3000.0	10.89	7.67	3500.0	12.68	8.25	4500.0	14.74	7.40	3500.0	12.19	7.77	2500.0	17.27	15.00
3500.0	12.68	8.25	6500.0	22.70	7.36	5000.0	16.51	7.44	4000.0	13.59	7.79	3000.0	18.27	15.00
6500.0	22.70	7.36	7000.0	25.29	7.50	5500.0	18.48	7.49	4500.0	15.16	7.82	3500.0	19.45	15.01
7000.0	25.29	7.50	0.1	5.00	5.00	6000.0	20.62	7.55	5000.0	16.92	7.84	4000.0	20.82	15.01
0.1	0.75	0.75	1.0	5.00	5.00	6500.0	22.95	7.61	5500.0	18.86	7.88	4500.0	22.36	15.00
1.0	0.75	0.75	10.0	5.00	5.00	7000.0	25.47	7.68	6000.0	20.98	7.91	5000.0	24.09	15.01
10.0	0.79	0.76	25.0	5.00	5.00	0.1	7.30	7.30	6500.0	23.29	7.95	5500.0	25.99	15.01
25.0	0.82	0.81	50.0	5.00	5.00	1.0	7.30	7.30	7000.0	25.78	7.99	6000.0	28.08	15.01
50.0	0.99	0.95	75.0	5.01	5.00	10.0	7.30	7.30	0.1	10.00	10.00	6500.0	30.36	15.01
75.0	1.17	1.11	100.0	5.01	5.00	25.0	7.30	7.30	1.0	10.00	10.00	7000.0	32.81	15.01
100.0	1.35	1.28	250.0	5.05	5.01	50.0	7.30	7.30	10.0	10.00	10.00	0.1	20.00	20.00
250.0	2.32	2.17	500.0	5.18	5.07	75.0	7.30	7.30	25.0	10.00	10.00	1.0	20.00	20.00
500.0	3.34	3.07	750.0	5.41	5.16	100.0	7.31	7.30	50.0	10.00	10.00	10.0	20.00	20.00
750.0	4.18	3.77	1000.0	5.74	5.30	250.0	7.32	7.30	75.0	10.00	10.00	25.0	20.00	20.00
1000.0	5.07	4.36	3000.0	10.84	7.62	500.0	7.39	7.30	100.0	10.01	10.00	50.0	20.00	20.00
3000.0	10.89	7.67	3500.0	12.68	8.25	750.0	7.50	7.30	250.0	10.03	10.00	75.0	20.00	20.00
3500.0	12.68	8.25	6500.0	22.70	7.36	1000.0	7.65	7.30	500.0	10.10	10.01	100.0	20.00	20.00
6500.0	22.70	7.36	7000.0	25.29	7.50	1500.0	8.12	7.32	750.0	10.21	10.00	250.0	20.02	20.00

Appendix 2: Stage-discharge results from the HEC-RAS model--Continued
[ft^3/s, cubic feet per second; ft, feet]

Site 7—Continued.

Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)	Discharge (ft^3/s)	Headwater (ft)	Tailwater (ft)
500.0	20.09	20.00	6500.0	35.35	20.00	1500.0	25.82	25.00	1.0	30.00	30.00	3000.0	33.27	30.00
750.0	20.20	20.00	7000.0	37.81	20.01	2000.0	26.45	25.00	10.0	30.00	30.00	3500.0	34.45	30.00
1000.0	20.36	20.00	0.1	25.00	25.00	2500.0	27.27	25.00	25.0	30.00	30.00	4000.0	35.81	30.00
1500.0	20.82	20.00	1.0	25.00	25.00	3000.0	28.27	25.00	50.0	30.00	30.00	4500.0	37.36	30.00
2000.0	21.45	20.00	10.0	25.00	25.00	3500.0	29.45	25.00	75.0	30.00	30.00	5000.0	39.08	30.00
2500.0	22.27	20.00	25.0	25.00	25.00	4000.0	30.81	25.00	100.0	30.00	30.00	5500.0	40.99	30.00
3000.0	23.27	20.00	50.0	25.00	25.00	4500.0	32.36	25.00	250.0	30.02	30.00	6000.0	43.08	30.00
3500.0	24.45	20.00	75.0	25.00	25.00	5000.0	34.08	25.00	500.0	30.09	30.00	6500.0	45.35	30.00
4000.0	25.81	20.00	100.0	25.00	25.00	5500.0	35.99	25.00	750.0	30.20	30.00	7000.0	47.80	30.00
4500.0	27.36	20.00	250.0	25.02	25.00	6000.0	38.08	25.00	1000.0	30.36	30.00			
5000.0	29.08	20.00	500.0	25.09	25.00	6500.0	40.35	25.00	1500.0	30.82	30.00			
5500.0	30.99	20.00	750.0	25.20	25.00	7000.0	42.80	25.00	2000.0	31.45	30.00			
6000.0	33.08	20.00	1000.0	25.36	25.00	0.1	30.00	30.00	2500.0	32.27	30.00			