



Appendix B

HEC-RAS Report

HEC-RAS HEC-RAS 5.0.7 March 2019
 U.S. Army Corps of Engineers
 Hydrologic Engineering Center
 609 Second Street
 Davis, California

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X      X  XXXXXX      XXXX      XXXX      XX      XXXX
X      X  X          X      X      X  X      X  X      X
X      X  X          X          X  X      X  X      X
XXXXXXXX XXXX      X          XXX XXXX      XXXXXX      XXXX
X      X  X          X          X  X      X  X          X
X      X  X          X      X      X  X      X  X          X
X      X  XXXXXX      XXXX      X      X      X  X      XXXXX
  
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PROJECT DATA

Project Title: HEC-RAS Model
 Project File : Wingham.prj
 Run Date and Time:

Project in SI units

Project Description:

CRS Info=<Spatial Reference> <CoordinateSystem Code="2958" Unit="Meter"
 AcadCode="" /> <Registration OffsetX="0" OffsetY="0" OffsetZ="0" ScaleX="1"
 ScaleY="1" ScaleZ="1" /></Spatial Reference>

PLAN DATA

Plan Title: Validation_21OCT2019
 Plan File : C:\Users\Cailey\Documents\0 GeoProcess Files\Projects\P2019-391 MVCA
 Wingham Floodplain Mapping\HECRAS\V15 2020-01-13 CALIBRATION ONLY (GeoHECRAS)
 (CAM)\Wingham.p01

Geometry Title: 2D_2020-01-20

Geometry File : C:\Users\Cailey\Documents\0 GeoProcess
 Files\Projects\P2019-391 MVCA Wingham Floodplain Mapping\HECRAS\V15 2020-01-13
 CALIBRATION ONLY (GeoHECRAS) (CAM)\Wingham.g02

Flow Title :
 Flow File :

Plan Description:
 Default Scenario

Plan Summary Information:

Number of:	Cross Sections =	0	Multiple Openings =	0
	Culverts =	0	Inline Structures =	0
	Bridges =	0	Lateral Structures =	0

Computational Information

Water surface calculation tolerance =	0.01
Critical depth calculation tolerance =	0.01
Maximum number of iterations =	20
Maximum difference tolerance =	0.33
Flow tolerance factor =	0.001

Computation Options

Critical depth computed only where necessary
 Conveyance Calculation Method: At breaks in n values only
 Friction Slope Method: Average Conveyance
 Computational Flow Regime: Subcritical Flow

GEOMETRY DATA

Geometry Title: 2D_2020-01-20
 Geometry File : C:\Users\Cailey\Documents\0 GeoProcess Files\Projects\P2019-391
 MVCA Wingham Floodplain Mapping\HECRAS\V15 2020-01-13 CALIBRATION ONLY (GeoHECRAS)
 (CAM)\Wingham.g02

STORAGE AREA: MaitlandRiver
 Volume Method : Area times depth
 Area : 1302.94
 Min Elev :

CONNECTION: Amberly-02

Number of Culverts = 1

Culvert Name	Shape	Rise	Span				
Culvert #1	Box	2.64	5.5				
FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet							
FHWA Scale # 2 - Inlet edges beveled 1/2 inch at 45 degrees (1:1)							
Solution Criteria = Highest U.S. EG							
Culvert Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef	
1	45	.013	.035	0		.5	

Upstream Elevation = 302.1
 Centerline Station = 43
 Downstream Elevation = 302.028
 Centerline Station = 42.3

CONNECTION: B-Line

Number of Culverts = 1

Culvert Name	Shape	Rise	Span				
Culvert #1	Circular	2.14					
FHWA Chart # 2 - Corrugated Metal Pipe Culvert							
FHWA Scale # 2 - Mitered to conform to slope							
Solution Criteria = Highest U.S. EG							
Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance	Loss Coef
Exit	Loss Coef						
		23	.024	.024	0		.7
1							
Upstream	Elevation = 309.2						
	Centerline Station = 28.3						
Downstream	Elevation = 309.062						
	Centerline Station = 29.39						

CONNECTION: Casemore-St

Number of Culverts = 1

Culvert Name	Shape	Rise	Span				
Culvert #1	Circular	1.13					
FHWA Chart # 2 - Corrugated Metal Pipe Culvert							
FHWA Scale # 3 - Pipe projecting from fill							
Solution Criteria = Highest U.S. EG							
Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance	Loss Coef
Exit	Loss Coef						
		18	.024	.024	0		.9
1							
Upstream	Elevation = 305.2						
	Centerline Station = 23.57						
Downstream	Elevation = 305.166						
	Centerline Station = 22.69						

CONNECTION: Helena

Number of Culverts = 3

Culvert Name Shape Rise Span
 Culvert #1 Box 7.62 21.5
 FHWA Chart # 11- Skewed headwall; Chamfered or beveled Inlet
 FHWA Scale # 4 - Headwall skewed 10 to 45 deg.; inlet edges beveled
 Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef
 Exit Loss Coef
 12 .013 .035 0 .5
 1
 Upstream Elevation = 301.27
 Centerline Station = 44.2
 Downstream Elevation = 301.27
 Centerline Station = 46.2

Culvert Name Shape Rise Span
 Culvert #2 Box 7.23 21.5
 FHWA Chart # 11- Skewed headwall; Chamfered or beveled Inlet
 FHWA Scale # 4 - Headwall skewed 10 to 45 deg.; inlet edges beveled
 Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef
 Exit Loss Coef
 12 .013 .035 0 .5
 1
 Upstream Elevation = 301.27
 Centerline Station = 67.3
 Downstream Elevation = 301.27
 Centerline Station = 69.3

Culvert Name Shape Rise Span
 Culvert #3 Box 6.49 21.5
 FHWA Chart # 11- Skewed headwall; Chamfered or beveled Inlet
 FHWA Scale # 4 - Headwall skewed 10 to 45 deg.; inlet edges beveled
 Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef
 Exit Loss Coef
 12 .013 .035 0 .5
 1
 Upstream Elevation = 301.83
 Centerline Station = 90.3
 Downstream Elevation = 301.83
 Centerline Station = 92.3

CONNECTION: HowsonDam(str)

CONNECTIONHowsonDam(str) Gate #1
 Height = 2.14
 Width = 9.8
 Invert = 308.7
 Gate Type = Radial Radial Coefficient = .5
 Trunion Exponent = 0

Opening Exponent = 1
 Head Exponent = .5
 Trunion Height = 0
 Weir Coefficient = 2.01
 Weir crest shape = Ogee
 Number of Gate Openings = 4
 Sta Sta Sta Sta
 11.94 22.74 33.54 44.34

CONNECTION: Hwy-4

Number of Culverts = 1

Culvert Name Shape Rise Span
 Culvert #1 Pipe Arch 1.94 3.15
 FHWA Chart # 36- 31 inch corner radius; Corrugated metal
 FHWA Scale # 1 - Projecting
 Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef
 Exit Loss Coef
 1
 44 .024 .024 0 .7
 1
 Upstream Elevation = 303.3
 Centerline Station = 47.57
 Downstream Elevation = 303.252
 Centerline Station = 45.23

CONNECTION: Hwy-4-MAIN

Number of Culverts = 3

Culvert Name Shape Rise Span
 Culvert #1 Box 7.1 15.5
 FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
 FHWA Scale # 3 - Inlet edges beveled 1 in/ft at 33.7 degrees (1:1.5)
 Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef
 Exit Loss Coef
 1
 13 .013 .035 0 .5
 1
 Upstream Elevation = 301.2
 Centerline Station = 84
 Downstream Elevation = 301.2
 Centerline Station = 84

Culvert Name Shape Rise Span
 Page 5

Culvert #2 Box 6.09 18.25
 FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
 FHWA Scale # 3 - Inlet edges beveled 1 in/ft at 33.7 degrees (1:1.5)
 Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef
 Exit Loss Coef
 13 .013 .035 0 .5
 1
 Upstream Elevation = 302.18
 Centerline Station = 102
 Downstream Elevation = 302.18
 Centerline Station = 102

Culvert Name Shape Rise Span
 Culvert #3 Box 5.94 15.25
 FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
 FHWA Scale # 3 - Inlet edges beveled 1 in/ft at 33.7 degrees (1:1.5)
 Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef
 Exit Loss Coef
 13 .013 .035 0 .5
 1
 Upstream Elevation = 302.29
 Centerline Station = 119.8
 Downstream Elevation = 302.29
 Centerline Station = 119.8

CONNECTION: Hwy-4-OVERFLOW

Number of Culverts = 2

Culvert Name Shape Rise Span
 Culvert #1 Box 4.71 15.25
 FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
 FHWA Scale # 3 - Inlet edges beveled 1 in/ft at 33.7 degrees (1:1.5)
 Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef
 Exit Loss Coef
 13 .013 .035 0 .5
 1
 Upstream Elevation = 303.64
 Centerline Station = 52.53
 Downstream Elevation = 303.64
 Centerline Station = 52.53

Culvert Name Shape Rise Span
 Culvert #2 Box 4.91 15.25
 FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
 FHWA Scale # 3 - Inlet edges beveled 1 in/ft at 33.7 degrees (1:1.5)

Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
1		13	.013	.035	0		.5

Upstream Elevation = 303.44
Centerline Station = 68.88
Downstream Elevation = 303.44
Centerline Station = 68.88

CONNECTION: Hwy-86

Number of Culverts = 1

Culvert Name Shape Rise Span
Culvert #1 Box 1.22 1.03
FHWA Chart # 58- Rectangular concrete
FHWA Scale # 1 - Side tapered; Less favorable edges

Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
1		40	.013	.013	0		.5

Upstream Elevation = 306.391
Centerline Station = 67.31
Downstream Elevation = 306.106
Centerline Station = 68.66

CONNECTION: Hwy86-MAIN

Number of Culverts = 3

Culvert Name Shape Rise Span
Culvert #1 Box 6.79 15.7
FHWA Chart # 11- Skewed headwall; Chamfered or beveled Inlet
FHWA Scale # 4 - Headwall skewed 10 to 45 deg.; inlet edges beveled

Solution Criteria = Highest U.S. EG

Culvert	Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
1		17	.013	.035	0		.5

Upstream Elevation = 302.61
Centerline Station = 31
Downstream Elevation = 302.61
Centerline Station = 35.5

Culvert Name	Shape	Rise	Span

Culvert #2 Box 7.89 18.9
 FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
 FHWA Scale # 1 - Inlet edges chamfered 3/4 inch
 Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef
 Exit Loss Coef
 17 .013 .035 0 .5
 1
 Upstream Elevation = 301.36
 Centerline Station = 49.3
 Downstream Elevation = 301.36
 Centerline Station = 53.8

Culvert Name Shape Rise Span
 Culvert #3 Box 7.87 15.7
 FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
 FHWA Scale # 1 - Inlet edges chamfered 3/4 inch
 Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef
 Exit Loss Coef
 17 .013 .035 0 .5
 1
 Upstream Elevation = 301.2
 Centerline Station = 67.6
 Downstream Elevation = 301.2
 Centerline Station = 72.1

CONNECTION: Hwy86-OVERFLOW

Number of Culverts = 3

Culvert Name Shape Rise Span
 Culvert #1 Box 6.38 15.7
 FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
 FHWA Scale # 3 - Inlet edges beveled 1 in/ft at 33.7 degrees (1:1.5)
 Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef
 Exit Loss Coef
 17 .013 .035 0 .5
 1
 Upstream Elevation = 304.62
 Centerline Station = 55
 Downstream Elevation = 304.62
 Centerline Station = 55

Culvert Name Shape Rise Span
 Culvert #2 Box 6.13 18.9
 FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
 FHWA Scale # 1 - Inlet edges chamfered 3/4 inch

Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef
 Exit Loss Coef

1	17	.013	.035	0	.5
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Upstream Elevation = 304.74
 Centerline Station = 74
 Downstream Elevation = 304.74
 Centerline Station = 74

Culvert Name Shape Rise Span
 Culvert #3 Box 5.93 15.7
 FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
 FHWA Scale # 1 - Inlet edges chamfered 3/4 inch
 Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef
 Exit Loss Coef

1	17	.013	.035	0	.5
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Upstream Elevation = 304.75
 Centerline Station = 93
 Downstream Elevation = 304.75
 Centerline Station = 93

CONNECTION: Josephine-0F

Number of Culverts = 1

Culvert Name Shape Rise Span
 Culvert #1 Box 3.13 3
 FHWA Chart # 10- 90 degree headwall; Chamfered or beveled inlet
 FHWA Scale # 2 - Inlet edges beveled 1/2 inch at 45 degrees (1:1)
 Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef
 Exit Loss Coef

1	38	.013	.013	0	.5
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Upstream Elevation = 309.76
 Centerline Station = 42.06
 Downstream Elevation = 309.759
 Centerline Station = 34

CONNECTION: MacIntosh

Number of Culverts = 3

Culvert Name Shape Rise Span
 Page 9

Culvert #1 Box 5.56 15.5
 FHWA Chart # 11- Skewed headwall; Chamfered or beveled Inlet
 FHWA Scale # 4 - Headwall skewed 10 to 45 deg.; inlet edges beveled
 Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef
 Exit Loss Coef
 12 .013 .035 0 .5
 1
 Upstream Elevation = 302.89
 Centerline Station = 21
 Downstream Elevation = 302.89
 Centerline Station = 19

Culvert Name Shape Rise Span
 Culvert #2 Box 5.56 19
 FHWA Chart # 11- Skewed headwall; Chamfered or beveled Inlet
 FHWA Scale # 4 - Headwall skewed 10 to 45 deg.; inlet edges beveled
 Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef
 Exit Loss Coef
 12 .013 .035 0 .5
 1
 Upstream Elevation = 302.89
 Centerline Station = 39.1
 Downstream Elevation = 302.89
 Centerline Station = 37.1

Culvert Name Shape Rise Span
 Culvert #3 Box 5.41 15.5
 FHWA Chart # 11- Skewed headwall; Chamfered or beveled Inlet
 FHWA Scale # 4 - Headwall skewed 10 to 45 deg.; inlet edges beveled
 Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef
 Exit Loss Coef
 12 .013 .035 0 .5
 1
 Upstream Elevation = 303.04
 Centerline Station = 57
 Downstream Elevation = 303.04
 Centerline Station = 55

CONNECTION: McLean-Line

Number of Culverts = 1

Culvert Name Shape Rise Span
 Culvert #1 Circular 2.65
 FHWA Chart # 2 - Corrugated Metal Pipe Culvert
 FHWA Scale # 2 - Mitered to conform to slope
 Page 10

Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef
 Exit Loss Coef

1	20	.024	.024	0	.7
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Upstream Elevation = 311.1
 Centerline Station = 24.12
 Downstream Elevation = 311.005
 Centerline Station = 27.77

CONNECTION: Potter-St

Number of Culverts = 1

Culvert Name Shape Rise Span
 Culvert #1 Circular .62
 FHWA Chart # 2 - Corrugated Metal Pipe Culvert
 FHWA Scale # 3 - Pipe projecting from fill
 Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef
 Exit Loss Coef

1	21	.024	.024	0	.9
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Upstream Elevation = 307.7
 Centerline Station = 33.73
 Downstream Elevation = 307.677
 Centerline Station = 31.57

CONNECTION: Scott-Line

Number of Culverts = 2

Culvert Name Shape Rise Span
 Large-Pipe Circular 1.25
 FHWA Chart # 2 - Corrugated Metal Pipe Culvert
 FHWA Scale # 3 - Pipe projecting from fill
 Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef
 Exit Loss Coef

1	20	.024	.024	0	.9
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Upstream Elevation = 302.5
 Centerline Station = 22.16
 Downstream Elevation = 302.5
 Centerline Station = 22.16

Culvert Name Shape Rise Span
 Page 11

Small -Pipe Circular .6
 FHWA Chart # 2 - Corrugated Metal Pipe Culvert
 FHWA Scale # 3 - Pipe projecting from fill
 Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef
 Exit Loss Coef

		20	.024	.024	0	.9
--	--	----	------	------	---	----

1
 Upstream Elevation = 304.023
 Centerline Station = 23.42
 Downstream Elevation = 303.955
 Centerline Station = 23.42

CONNECTION: Turnberry-St

Number of Culverts = 1

Culvert Name Shape Rise Span
 Culvert #1 Circular 1
 FHWA Chart # 2 - Corrugated Metal Pipe Culvert
 FHWA Scale # 3 - Pipe projecting from fill
 Solution Criteria = Highest U.S. EG
 Culvert Upstrm Dist Length Top n Bottom n Depth Blocked Entrance Loss Coef
 Exit Loss Coef

		21	.024	.024	0	.9
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1
 Upstream Elevation = 304.1
 Centerline Station = 26.86
 Downstream Elevation = 303.832
 Centerline Station = 33.15

SUMMARY OF MANNING' S N VALUES

SUMMARY OF REACH LENGTHS

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS

ERRORS WARNINGS AND NOTES