Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Wednesday, Mar 20 2024

Curry Road Proposed Culvert - 100 Year Storm

Invert Elev Dn (ft)	=	934.75
Pipe Length (ft)	=	60.00
Slope (%)	=	4.58
Invert Elev Up (ft)	=	937.50
Rise (in)	=	108.0
Shape	=	Box
Span (in)	=	324.0
No. Barrels	=	1
n-Value	=	0.035
Culvert Type	=	Flared Wingwalls, Top Edge Bevel
Culvert Entrance	=	18D to 33.7D wingwall flare, d=0.083D
Coeff. K,M,c,Y,k	=	0.486, 0.667, 0.0249, 0.83, 0.2

Embankment

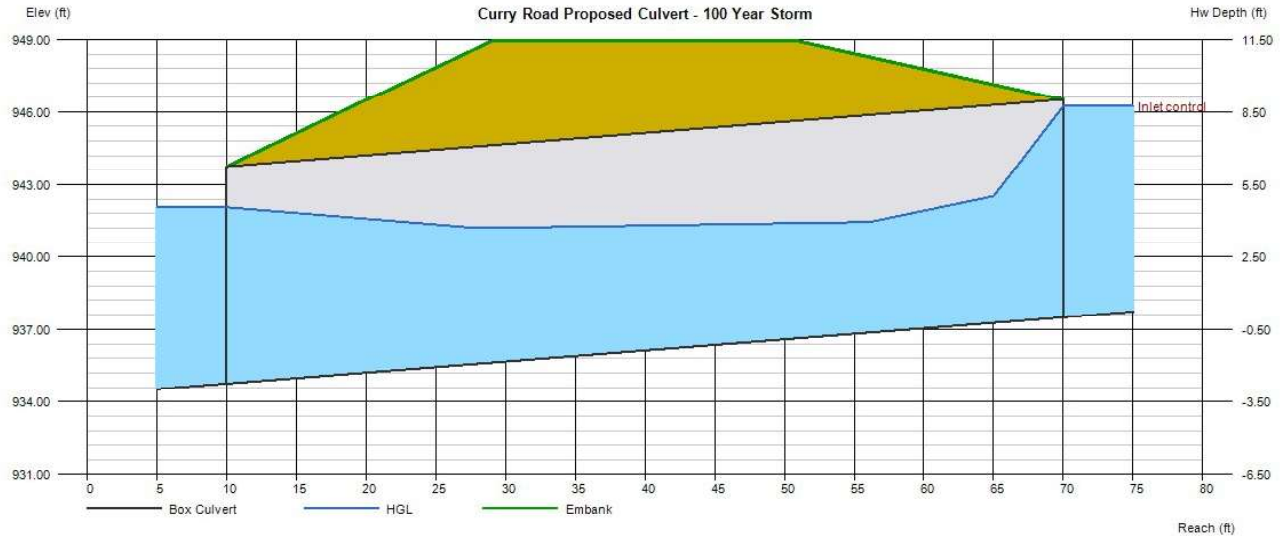
Top Elevation (ft)	=	948.94
Top Width (ft)	=	22.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	2050.00
Qmax (cfs)	=	2050.00
Tailwater Elev (ft)	=	(dc+D)/2

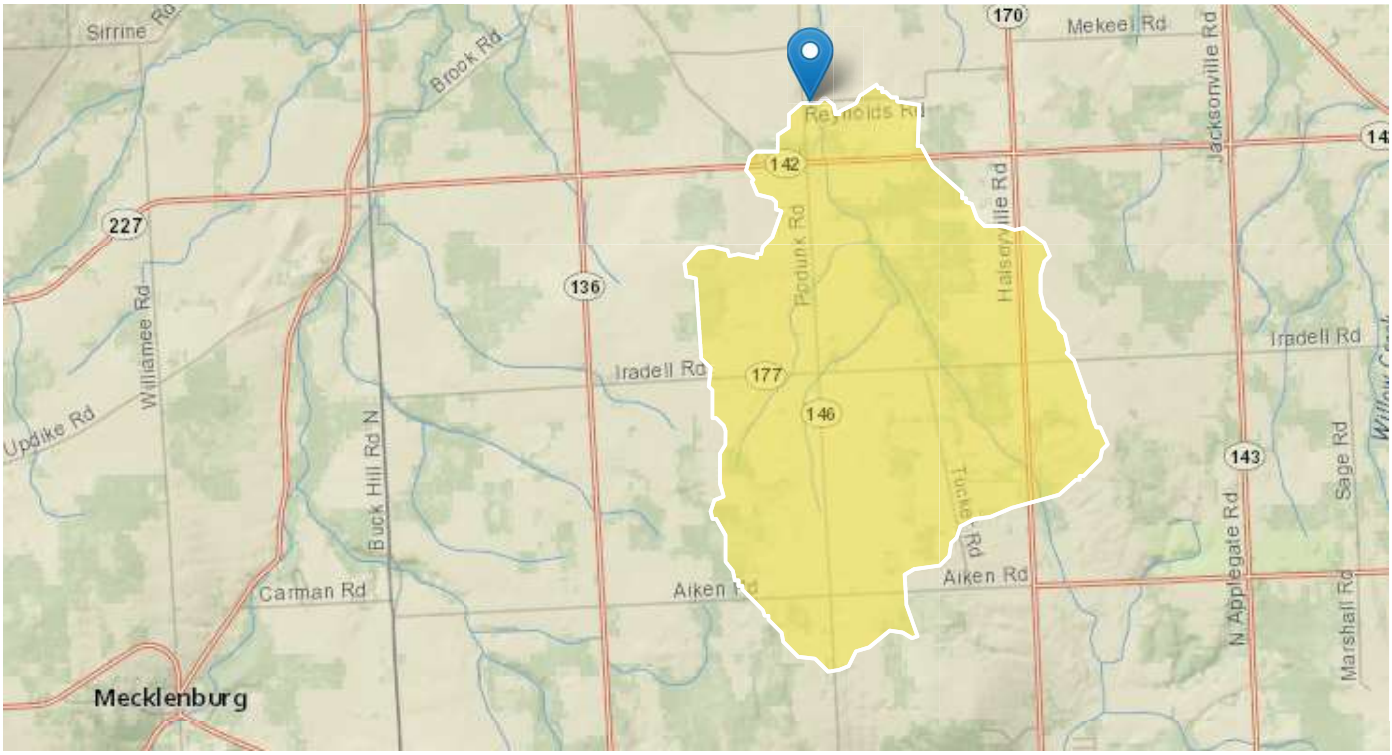
Highlighted

Qtotal (cfs)	=	2050.00
Qpipe (cfs)	=	2050.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	10.38
Veloc Up (ft/s)	=	13.49
HGL Dn (ft)	=	942.06
HGL Up (ft)	=	943.13
Hw Elev (ft)	=	946.22
Hw/D (ft)	=	0.97
Flow Regime	=	Inlet Control



Reynolds Road Culvert StreamStats Report

Region ID: NY
Workspace ID: NY20240229141509216000
Clicked Point (Latitude, Longitude): 42.49796, -76.65257
Time: 2024-02-29 09:15:29 -0500



Collapse All

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
BSLOPCM	Mean basin slope determined by summing lengths of all contours in basin mulitplying by contour interval and dividing product by drainage area	245	feet per mi
CENTROIDX	Basin centroid horizontal (x) location in state plane coordinates	364667.7	meters
CENTROIDY	Basin centroid vertical (y) location in state plane units	4704300.7	meters
CONTOUR	Total length of all elevation contours in drainage area in miles	7.99	miles
CSL1085LO	10-85 slope of lower half of main channel in feet per mile.	82.8	feet per mi

Parameter Code	Parameter Description	Value	Unit
CSL1085UP	10-85 slope of upper half of main channel in feet per mile.	91.7	feet per mi
CSL10_85	Change in elevation divided by length between points 10 and 85 percent of distance along main channel to basin divide - main channel method not known	104	feet per mi
DRNAREA	Area that drains to a point on a stream	3.26	square miles
EL1200	Percentage of basin at or above 1200 ft elevation	66.2	percent
FOREST	Percentage of area covered by forest	27	percent
JULAVPRE	Mean July Precipitation	3.56	inches
JUNAVPRE	Mean June Precipitation	4.11	inches
JUNMAXTMP	Maximum June Temperature, in degrees F	75.1	degrees F
LAGFACTOR	Lag Factor as defined in SIR 2006-5112	0.0376	dimensionless
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	5.14	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	0.56	percent
LENGTH	Length along the main channel from the measuring location extended to the basin divide	3.32	miles
MAR	Mean annual runoff for the period of record in inches	14	inches
MAYAVPRE	Mean May Precipitation	3.35	inches
MXSNO	50th percentile of seasonal maximum snow depth from Northeast Regional Climate Center atlas by Cember and Wilks, 1993	11.8	inches
OUTLETX	Basin outlet horizontal (x) location in state plane coordinates	364205	feet
OUTLETY	Basin outlet vertical (y) location in state plane coordinates	4706385	feet
PRECIP	Mean Annual Precipitation	33.3	inches
PRJUNAUG00	Basin average mean precip for June to August from PRISM 1971-2000	11.1	inches
SLOPERATIO	Ratio of main channel slope to basin slope as defined in SIR 2006-5112	0.42	dimensionless
SSURGOA	Percentage of area of Hydrologic Soil Type A from SSURGO	0.45	percent

Parameter Code	Parameter Description	Value	Unit
SSURGOB	Percentage of area of Hydrologic Soil Type B from SSURGO	43.5	percent
STORAGE	Percentage of area of storage (lakes ponds reservoirs wetlands)	0.0118	percent

Peak-Flow Statistics

Peak-Flow Statistics Parameters [2006 Full Region 6]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	3.26	square miles	0.58	2467
SLOPERATIO	Slope Ratio NY	0.42	dimensionless	0.019	0.698
EL1200	Percentage of Basin Above 1200 ft	66.2	percent	0	100
STORAGE	Percent Storage	0.0118	percent	0	5.98
MAR	Mean Annual Runoff in inches	14	inches	9.49	22.77

Peak-Flow Statistics Flow Report [2006 Full Region 6]

PIL: Lower 90% Prediction Interval, PIU: Upper 90% Prediction Interval, ASEp: Average Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SE	ASEp	Equiv. Yrs.
80-percent AEP flood	147	ft^3/s	34.7	34.7	2.3
66.7-percent AEP flood	188	ft^3/s	33.3	33.3	2
50-percent AEP flood	241	ft^3/s	32.3	32.3	1.9
20-percent AEP flood	381	ft^3/s	32.2	32.2	2.4
10-percent AEP flood	477	ft^3/s	32.9	32.9	3.1
4-percent AEP flood	603	ft^3/s	34.4	34.4	3.9
2-percent AEP flood	697	ft^3/s	35.8	35.8	4.5
1-percent AEP flood	792	ft^3/s	37.2	37.2	4.9
0.5-percent AEP flood	890	ft^3/s	39	39	5.2
0.2-percent AEP flood	1020	ft^3/s	41.4	41.4	5.5

Peak-Flow Statistics Citations

Lumia, Richard, Freehafer, D.A., and Smith, M.J.,2006, Magnitude and Frequency of Floods in New York: U.S. Geological Survey Scientific Investigations Report 2006–5112, 152 p. (http://pubs.usgs.gov/sir/2006/5112/)

Application Version: 4.19.4
StreamStats Services Version: 1.2.22
NSS Services Version: 2.2.1

Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Mar 1 2024

Reynolds Road Existing Culvert - 50 Year Storm

Invert Elev Dn (ft)	=	1062.51
Pipe Length (ft)	=	48.00
Slope (%)	=	0.10
Invert Elev Up (ft)	=	1062.56
Rise (in)	=	63.5
Shape	=	Elliptical
Span (in)	=	71.5
No. Barrels	=	2
n-Value	=	0.011
Culvert Type	=	Elliptical Inlet Face (E)
Culvert Entrance	=	Tapered inlet-thin edge, prejecting (E)
Coeff. K,M,c,Y,k	=	0.547, 0.8, 0.0598, 0.75, 0.7

Embankment

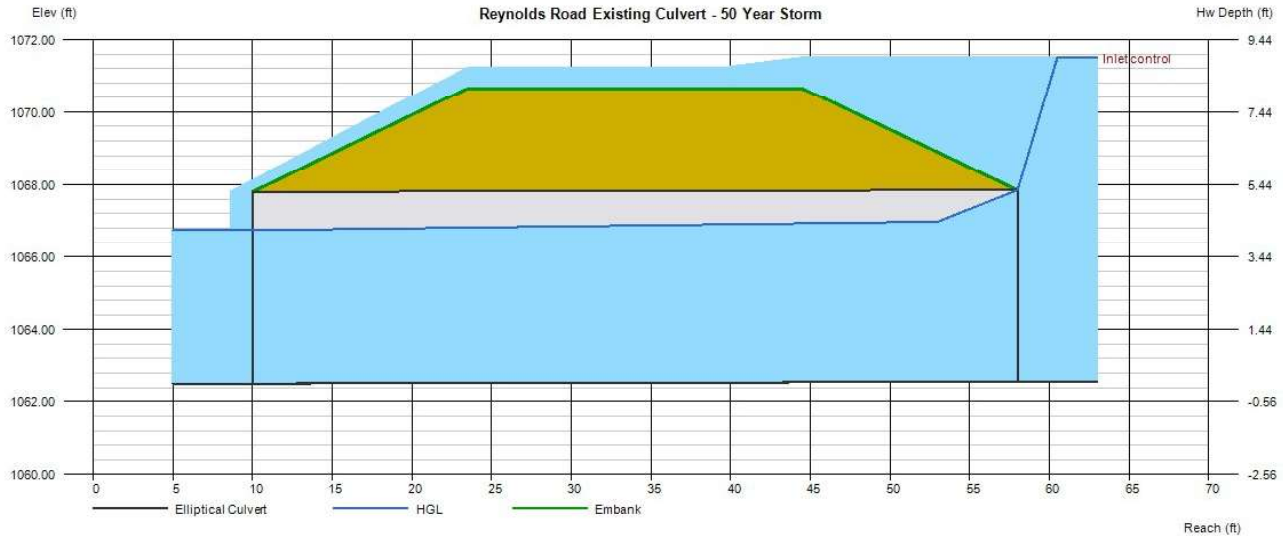
Top Elevation (ft)	=	1070.65
Top Width (ft)	=	21.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	697.00
Qmax (cfs)	=	697.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	697.00
Qpipe (cfs)	=	452.28
Qovertop (cfs)	=	244.72
Veloc Dn (ft/s)	=	10.50
Veloc Up (ft/s)	=	10.09
HGL Dn (ft)	=	1066.74
HGL Up (ft)	=	1067.01
Hw Elev (ft)	=	1071.51
Hw/D (ft)	=	1.69
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Mar 1 2024

Reynolds Road Existing Culvert - 100 Year Storm

Invert Elev Dn (ft)	=	1062.51
Pipe Length (ft)	=	48.00
Slope (%)	=	0.10
Invert Elev Up (ft)	=	1062.56
Rise (in)	=	63.5
Shape	=	Elliptical
Span (in)	=	71.5
No. Barrels	=	2
n-Value	=	0.011
Culvert Type	=	Elliptical Inlet Face (E)
Culvert Entrance	=	Tapered inlet-thin edge, prejecting (E)
Coeff. K,M,c,Y,k	=	0.547, 0.8, 0.0598, 0.75, 0.7

Embankment

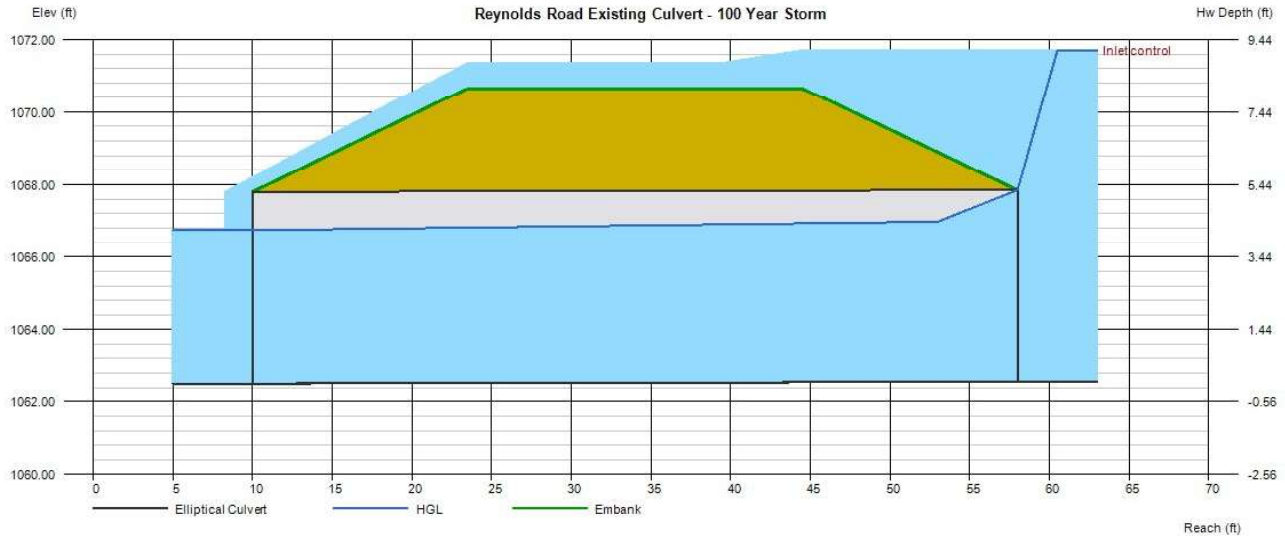
Top Elevation (ft)	=	1070.65
Top Width (ft)	=	21.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	792.00
Qmax (cfs)	=	792.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	792.00
Qpipe (cfs)	=	460.96
Qovertop (cfs)	=	331.04
Veloc Dn (ft/s)	=	10.70
Veloc Up (ft/s)	=	10.28
HGL Dn (ft)	=	1066.74
HGL Up (ft)	=	1067.01
Hw Elev (ft)	=	1071.71
Hw/D (ft)	=	1.73
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Mar 15 2024

Reynolds Road Proposed Culvert - 50 Year Storm

Invert Elev Dn (ft)	=	1062.25
Pipe Length (ft)	=	48.00
Slope (%)	=	0.65
Invert Elev Up (ft)	=	1062.56
Rise (in)	=	78.0
Shape	=	Box
Span (in)	=	234.0
No. Barrels	=	1
n-Value	=	0.035
Culvert Type	=	Flared Wingwalls, Top Edge Bevel
Culvert Entrance	=	18D to 33.7D wingwall flare, d=0.083D
Coeff. K,M,c,Y,k	=	0.486, 0.667, 0.0249, 0.83, 0.2

Embankment

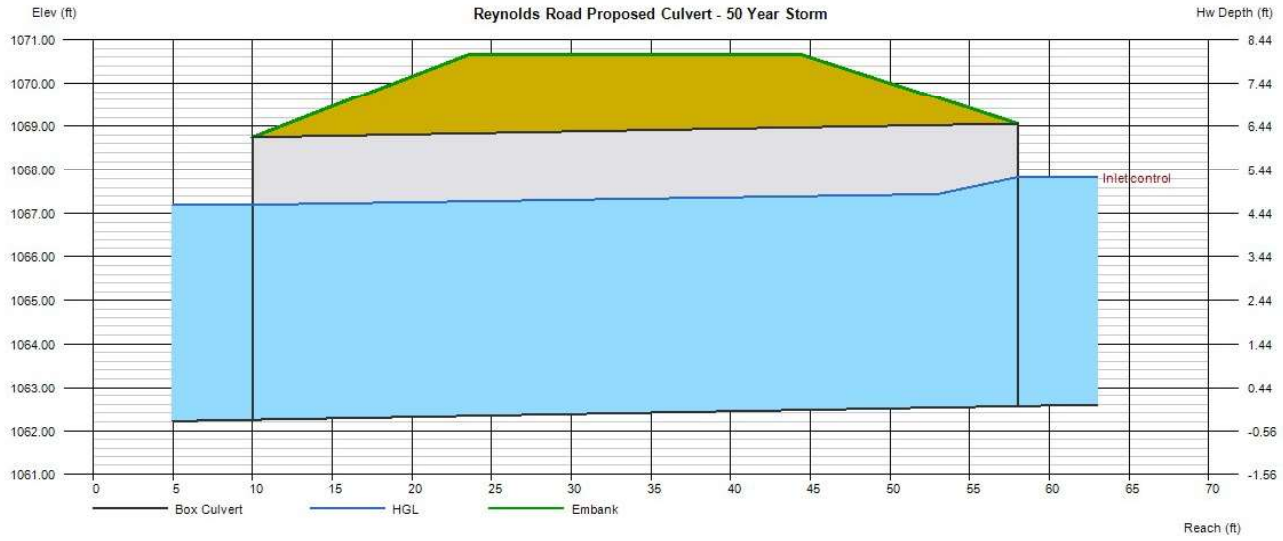
Top Elevation (ft)	=	1070.65
Top Width (ft)	=	21.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	697.00
Qmax (cfs)	=	697.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	697.00
Qpipe (cfs)	=	697.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	7.22
Veloc Up (ft/s)	=	7.27
HGL Dn (ft)	=	1067.20
HGL Up (ft)	=	1067.48
Hw Elev (ft)	=	1067.84
Hw/D (ft)	=	0.81
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Mar 15 2024

Reynolds Road Proposed Culvert - 100 Year Storm

Invert Elev Dn (ft)	=	1062.25
Pipe Length (ft)	=	48.00
Slope (%)	=	0.65
Invert Elev Up (ft)	=	1062.56
Rise (in)	=	78.0
Shape	=	Box
Span (in)	=	234.0
No. Barrels	=	1
n-Value	=	0.035
Culvert Type	=	Flared Wingwalls, Top Edge Bevel
Culvert Entrance	=	18D to 33.7D wingwall flare, d=0.083D
Coeff. K,M,c,Y,k	=	0.486, 0.667, 0.0249, 0.83, 0.2

Embankment

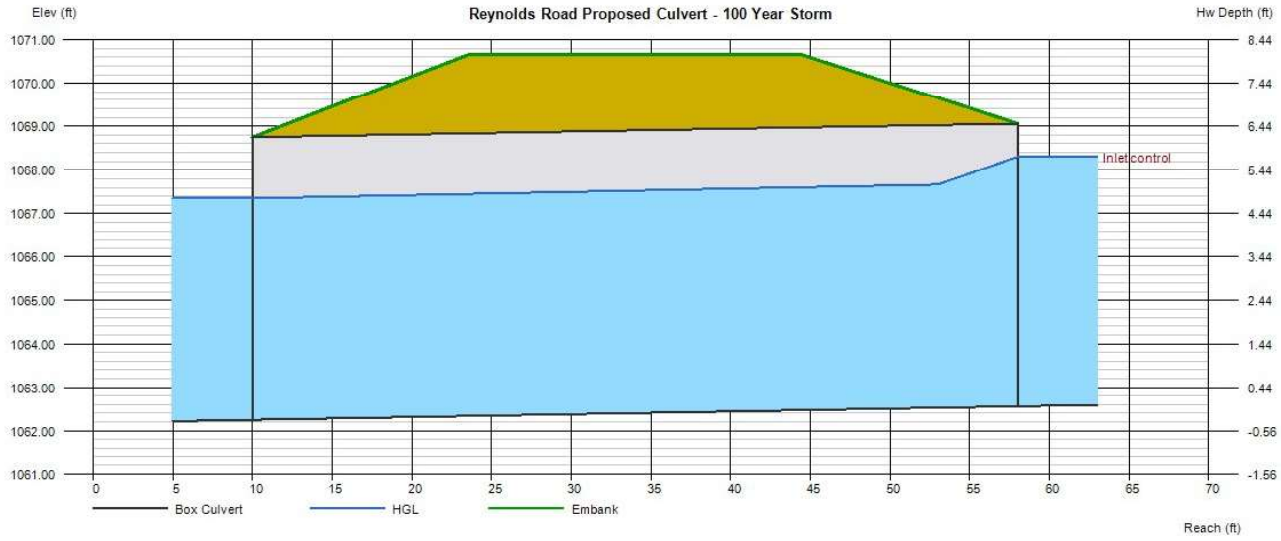
Top Elevation (ft)	=	1070.65
Top Width (ft)	=	21.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	792.00
Qmax (cfs)	=	792.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	792.00
Qpipe (cfs)	=	792.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	7.96
Veloc Up (ft/s)	=	7.89
HGL Dn (ft)	=	1067.36
HGL Up (ft)	=	1067.71
Hw Elev (ft)	=	1068.30
Hw/D (ft)	=	0.88
Flow Regime	=	Inlet Control



Iradell Road Culvert StreamStats Report

Region ID: NY
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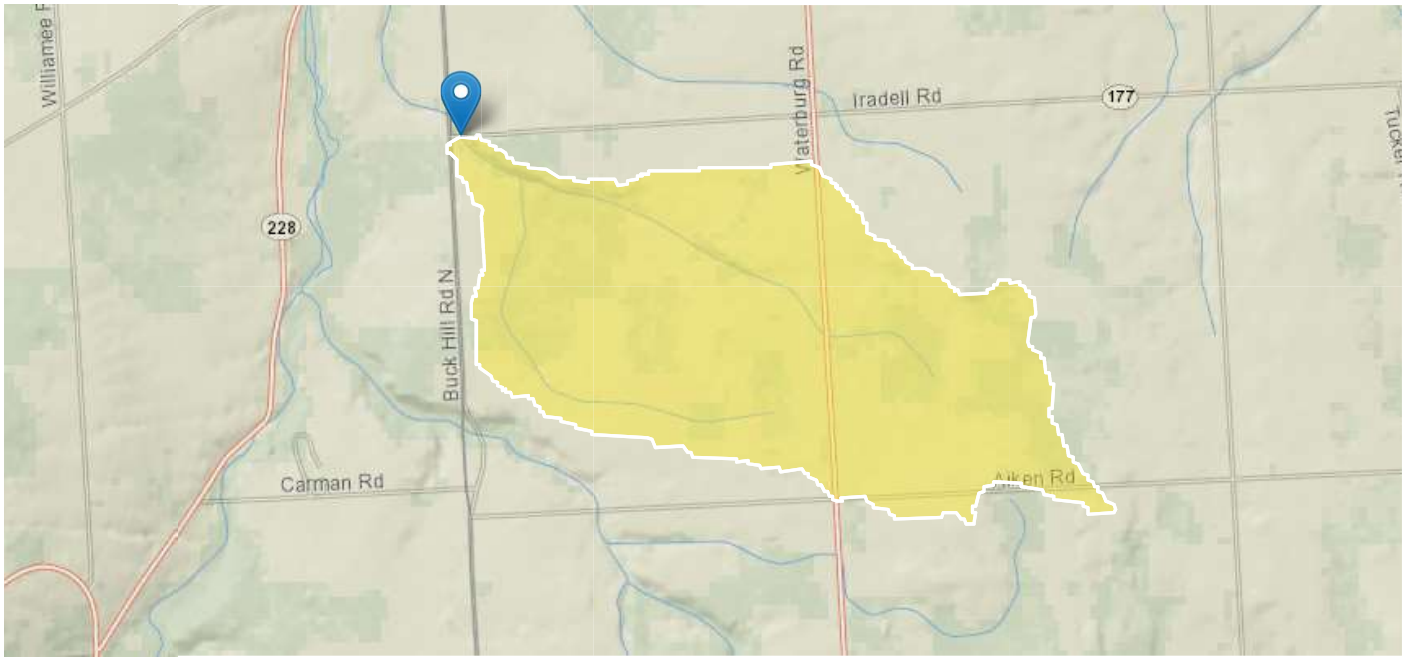


Collapse All

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
BSLOPCM	Mean basin slope determined by summing lengths of all contours in basin mulitplying by contour interval and dividing product by drainage area	155	feet per mi
CENTROIDX	Basin centroid horizontal (x) location in state plane coordinates	362241.4	meters
CENTROIDY	Basin centroid vertical (y) location in state plane units	4703350.4	meters
CONTOUR	Total length of all elevation contours in drainage area in miles	1.69	miles
CSL1085LO	10-85 slope of lower half of main channel in feet per mile.	156	feet per mi
CSL1085UP	10-85 slope of upper half of main channel in feet per mile.	73.4	feet per mi
CSL10_85	Change in elevation divided by length between points 10 and 85 percent of distance along main channel to basin divide - main channel method not known	117	feet per mi
DRNAREA	Area that drains to a point on a stream	1.09	square miles
EL1200	Percentage of basin at or above 1200 ft elevation	77.3	percent
FOREST	Percentage of area covered by forest	33.1	percent
JULAVPRE	Mean July Precipitation	3.55	inches

Parameter Code	Parameter Description	Value	Unit
JUNAVPRE	Mean June Precipitation	4.13	inches
JUNMAXTMP	Maximum June Temperature, in degrees F	75	degrees F
LAGFACTOR	Lag Factor as defined in SIR 2006-5112	0.0216	dimensionless
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	1.7	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	0.12	percent
LENGTH	Length along the main channel from the measuring location extended to the basin divide	2.33	miles
MAR	Mean annual runoff for the period of record in inches	13.7	inches
MAYAVPRE	Mean May Precipitation	3.36	inches
MXSNO	50th percentile of seasonal maximum snow depth from Northeast Regional Climate Center atlas by Cember and Wilks, 1993	11.7	inches
OUTLETX	Basin outlet horizontal (x) location in state plane coordinates	360955	feet
OUTLETY	Basin outlet vertical (y) location in state plane coordinates	4704225	feet
PRECIP	Mean Annual Precipitation	33	inches
PRJUNAUG00	Basin average mean precip for June to August from PRISM 1971-2000	11.1	inches
SLOPERATIO	Ratio of main channel slope to basin slope as defined in SIR 2006-5112	0.75	dimensionless
SSURGOA	Percentage of area of Hydrologic Soil Type A from SSURGO	0	percent
SSURGOB	Percentage of area of Hydrologic Soil Type B from SSURGO	62.1	percent
STORAGE	Percentage of area of storage (lakes ponds reservoirs wetlands)	0	percent

Peak-Flow Statistics

Peak-Flow Statistics Parameters [2006 Full Region 6]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	1.09	square miles	0.58	2467
SLOPERATIO	Slope Ratio NY	0.75	dimensionless	0.019	0.698
EL1200	Percentage of Basin Above 1200 ft	77.3	percent	0	100
STORAGE	Percent Storage	0	percent	0	5.98
MAR	Mean Annual Runoff in inches	13.7	inches	9.49	22.77

Peak-Flow Statistics Disclaimers [2006 Full Region 6]

One or more of the parameters is outside the suggested range. Estimates were extrapolated with unknown errors.

Peak-Flow Statistics Flow Report [2006 Full Region 6]

Statistic	Value	Unit
80-percent AEP flood	66.6	ft^3/s
66.7-percent AEP flood	86.6	ft^3/s
50-percent AEP flood	113	ft^3/s
20-percent AEP flood	184	ft^3/s
10-percent AEP flood	232	ft^3/s
4-percent AEP flood	297	ft^3/s
2-percent AEP flood	345	ft^3/s
1-percent AEP flood	394	ft^3/s
0.5-percent AEP flood	444	ft^3/s
0.2-percent AEP flood	511	ft^3/s

Peak-Flow Statistics Citations

Lumia, Richard, Freehafer, D.A., and Smith, M.J.,2006, Magnitude and Frequency of Floods in New York: U.S. Geological Survey Scientific Investigations Report 2006–5112, 152 p. (http://pubs.usgs.gov/sir/2006/5112/)

Application Version: 4.19.4
StreamStats Services Version: 1.2.22
NSS Services Version: 2.2.1

Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Mar 1 2024

Iradell Road Existing Culvert - 50 Year Storm

Invert Elev Dn (ft)	=	1105.34
Pipe Length (ft)	=	72.00
Slope (%)	=	2.40
Invert Elev Up (ft)	=	1107.07
Rise (in)	=	71.0
Shape	=	Elliptical
Span (in)	=	78.5
No. Barrels	=	1
n-Value	=	0.011
Culvert Type	=	Elliptical Inlet Face (E)
Culvert Entrance	=	Tapered inlet-thin edge, prejecting (E)
Coeff. K,M,c,Y,k	=	0.547, 0.8, 0.0598, 0.75, 0.7

Embankment

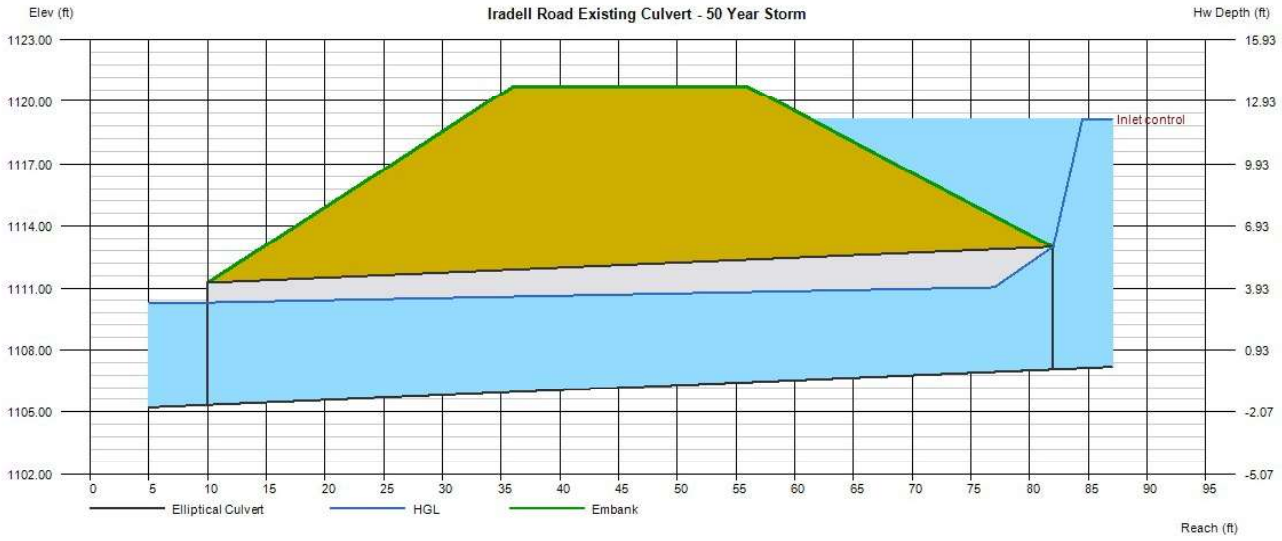
Top Elevation (ft)	=	1120.73
Top Width (ft)	=	20.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	345.00
Qmax (cfs)	=	345.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	345.00
Qpipe (cfs)	=	345.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	12.54
Veloc Up (ft/s)	=	15.13
HGL Dn (ft)	=	1110.31
HGL Up (ft)	=	1111.09
Hw Elev (ft)	=	1119.14
Hw/D (ft)	=	2.04
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Friday, Mar 1 2024

Iradell Road Existing Culvert - 100 Year Storm

Invert Elev Dn (ft)	=	1105.34
Pipe Length (ft)	=	72.00
Slope (%)	=	2.40
Invert Elev Up (ft)	=	1107.07
Rise (in)	=	71.0
Shape	=	Elliptical
Span (in)	=	78.5
No. Barrels	=	1
n-Value	=	0.011
Culvert Type	=	Elliptical Inlet Face (E)
Culvert Entrance	=	Tapered inlet-thin edge, prejecting (E)
Coeff. K,M,c,Y,k	=	0.547, 0.8, 0.0598, 0.75, 0.7

Embankment

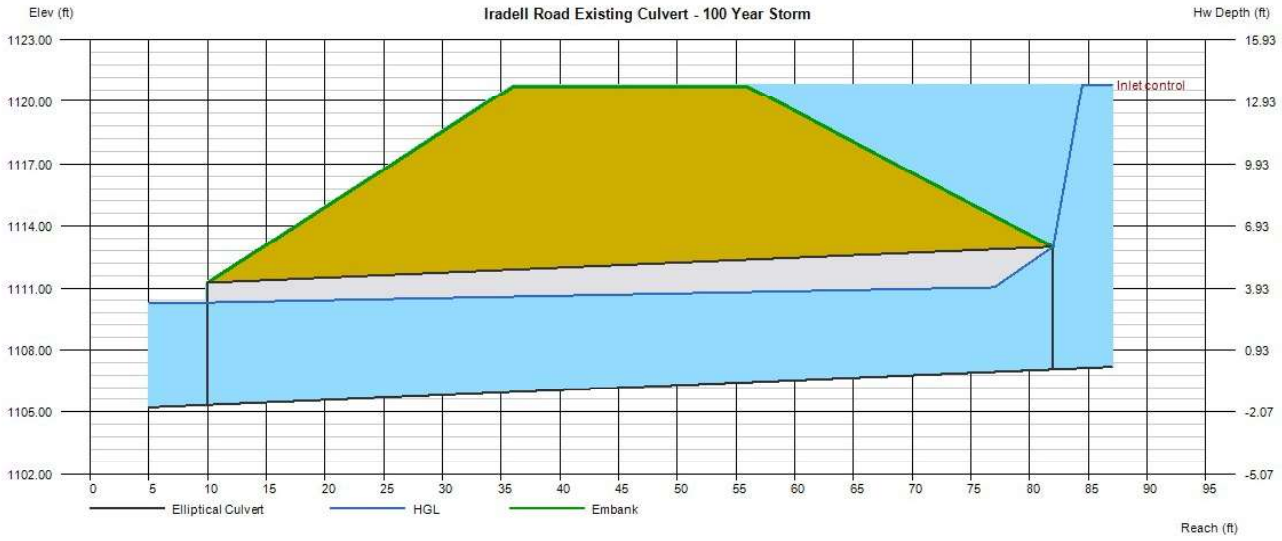
Top Elevation (ft)	=	1120.73
Top Width (ft)	=	20.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	394.00
Qmax (cfs)	=	394.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	394.00
Qpipe (cfs)	=	381.47
Qovertop (cfs)	=	12.53
Veloc Dn (ft/s)	=	13.87
Veloc Up (ft/s)	=	16.73
HGL Dn (ft)	=	1110.31
HGL Up (ft)	=	1111.09
Hw Elev (ft)	=	1120.85
Hw/D (ft)	=	2.33
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Mar 18 2024

Iradell Road Proposed Culvert - 50 Year Storm

Invert Elev Dn (ft)	=	1103.70
Pipe Length (ft)	=	72.00
Slope (%)	=	4.68
Invert Elev Up (ft)	=	1107.07
Rise (in)	=	73.5
Shape	=	Elliptical
Span (in)	=	180.0
No. Barrels	=	1
n-Value	=	0.035
Culvert Type	=	Elliptical Inlet Face (E)
Culvert Entrance	=	Tapered inlet-thin edge, prejecting (E)
Coeff. K,M,c,Y,k	=	0.547, 0.8, 0.0598, 0.75, 0.7

Embankment

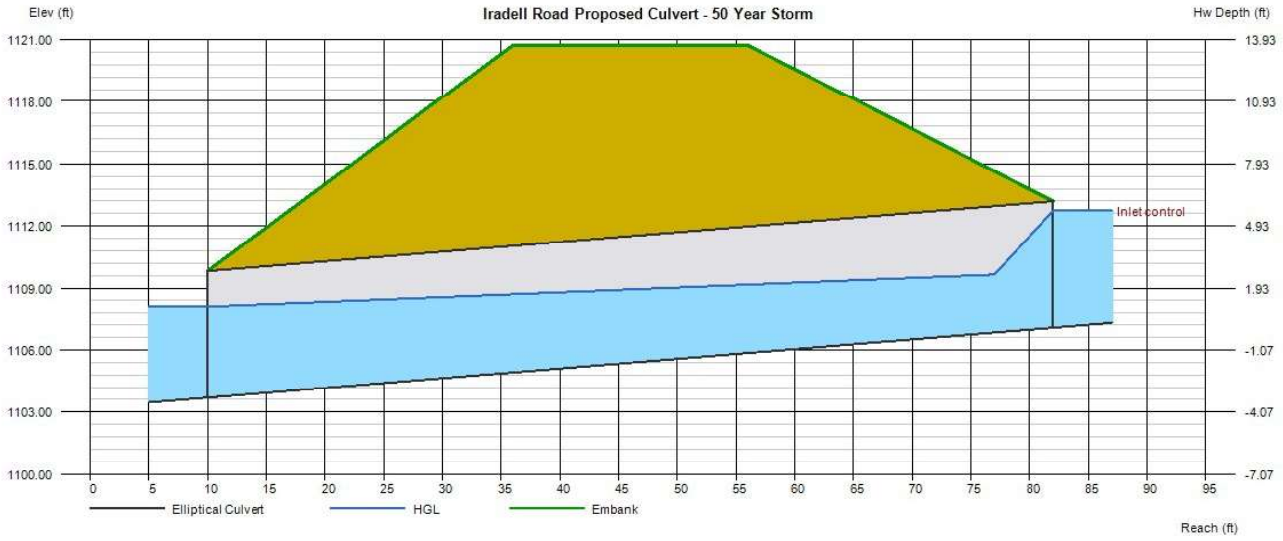
Top Elevation (ft)	=	1120.73
Top Width (ft)	=	20.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	345.00
Qmax (cfs)	=	345.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	345.00
Qpipe (cfs)	=	345.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	5.73
Veloc Up (ft/s)	=	11.52
HGL Dn (ft)	=	1108.11
HGL Up (ft)	=	1109.77
Hw Elev (ft)	=	1112.74
Hw/D (ft)	=	0.93
Flow Regime	=	Inlet Control



Culvert Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Mar 18 2024

Iradell Road Proposed Culvert - 100 Year Storm

Invert Elev Dn (ft)	=	1103.70
Pipe Length (ft)	=	72.00
Slope (%)	=	4.68
Invert Elev Up (ft)	=	1107.07
Rise (in)	=	73.5
Shape	=	Elliptical
Span (in)	=	180.0
No. Barrels	=	1
n-Value	=	0.035
Culvert Type	=	Elliptical Inlet Face (E)
Culvert Entrance	=	Tapered inlet-thin edge, prejecting (E)
Coeff. K,M,c,Y,k	=	0.547, 0.8, 0.0598, 0.75, 0.7

Embankment

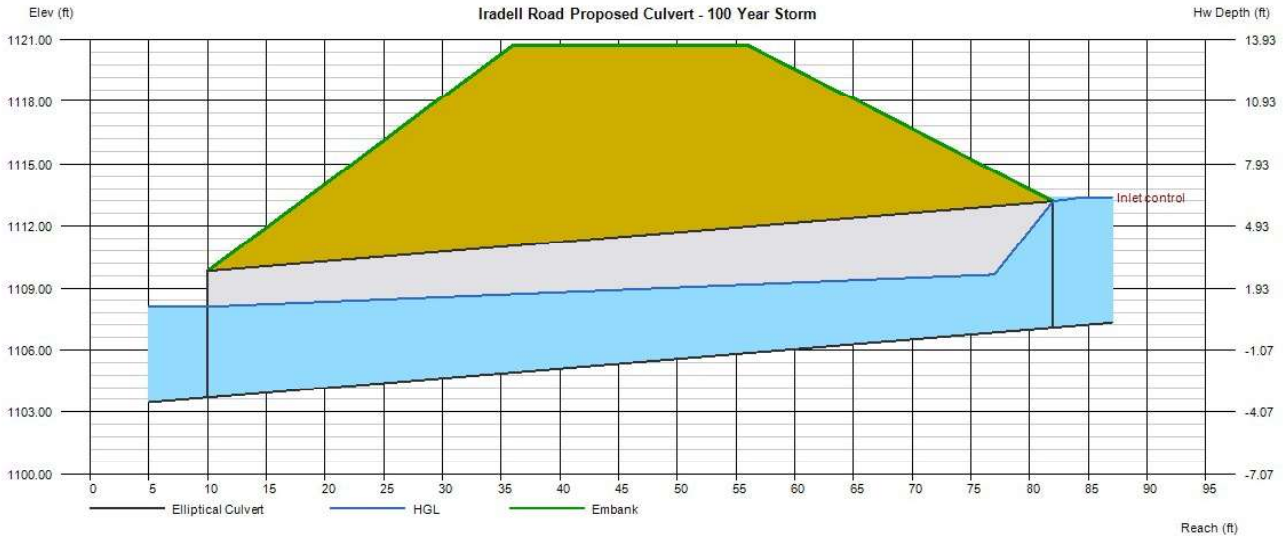
Top Elevation (ft)	=	1120.73
Top Width (ft)	=	20.00
Crest Width (ft)	=	100.00

Calculations

Qmin (cfs)	=	394.00
Qmax (cfs)	=	394.00
Tailwater Elev (ft)	=	(dc+D)/2

Highlighted

Qtotal (cfs)	=	394.00
Qpipe (cfs)	=	394.00
Qovertop (cfs)	=	0.00
Veloc Dn (ft/s)	=	6.54
Veloc Up (ft/s)	=	13.16
HGL Dn (ft)	=	1108.11
HGL Up (ft)	=	1109.77
Hw Elev (ft)	=	1113.38
Hw/D (ft)	=	1.03
Flow Regime	=	Inlet Control



APPENDIX E

EXISTING CULVERT PHOTOGRAPHS

Figure 1. Maplewood Road culvert looking east. No embedment throughout the culvert.

Figure 2. Maplewood Road culvert looking east.

Figure 3. Maplewood Road culvert looking west. Spalling concrete with steel reinforcement exposed and corroding.

Figure 4. Maplewood Road culvert looking west.

Figure 5. Maplewood Road culvert looking east.

Figure 6. Garrett Road culvert looking west. No embedment throughout the culvert.

Figure 7. Garrett Road culvert looking west. Large vertical separation between the outlet invert and the streambed below.

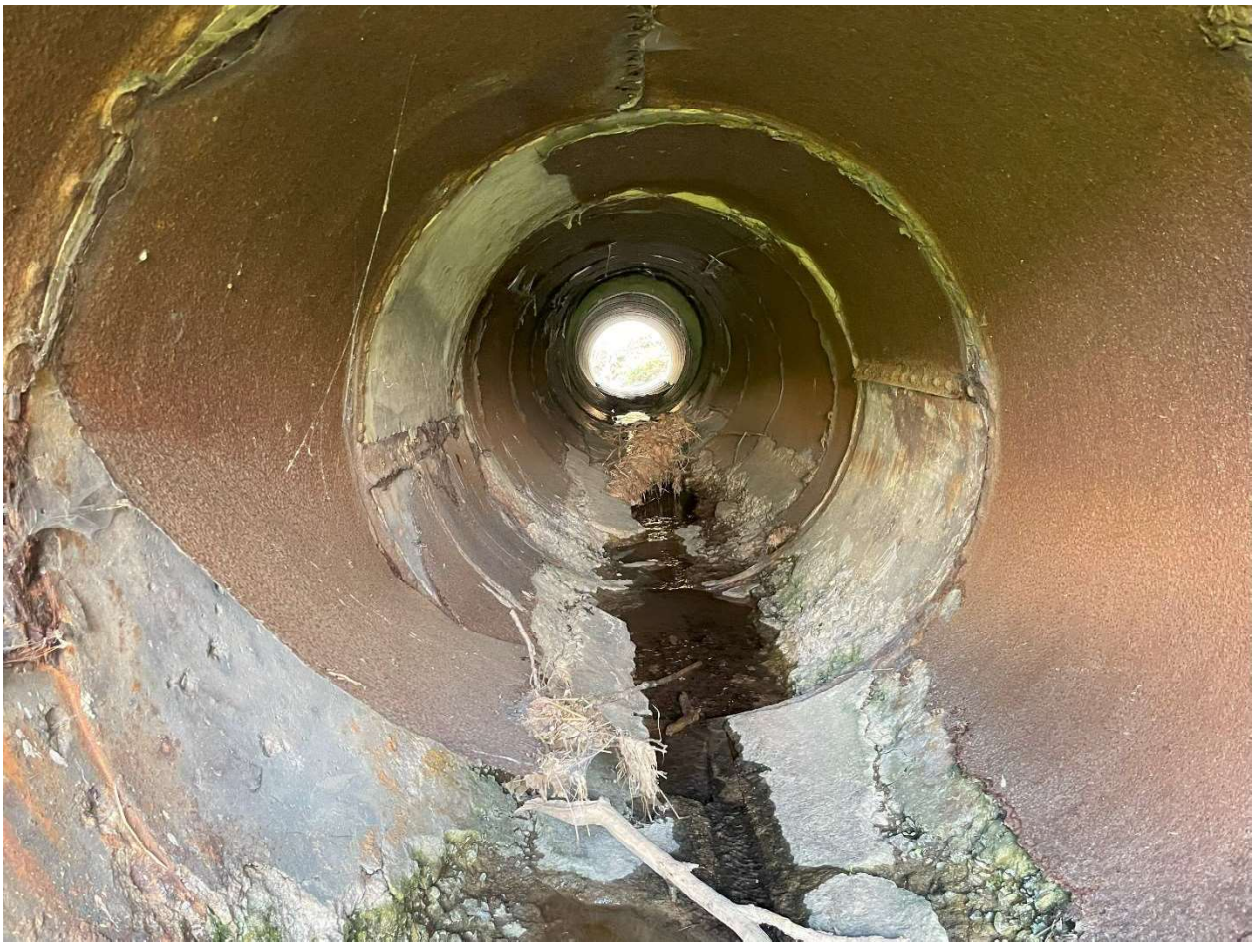


Figure 8. Garrett Road culvert looking east. The metal liner on the inside of the culvert is heavily corroded.

Figure 9. Garrett Road culvert looking west. The concrete on the bottom of the culvert is spalling.

Figure 10. Garrett Road culvert looking east.

Figure 11. Agard Road culvert looking north.

Figure 12. Agard Road culvert looking north.

Figure 13. Curry Road west culvert looking north. No embedment throughout the culvert.

Figure 14. Curry Road culverts looking south. Large vertical separation between the outlet inverts and the streambed below.

Figure 15. Curry Road east culvert looking south. Dead trout in the stream in the foreground.

Figure 16. Curry Road culverts looking north.

Figure 17. Reynolds Road culverts looking north.

Figure 18. Reynolds Road culverts looking north.

Figure 19. Reynolds Road culverts looking north.

Figure 20. Corrosion on the inside of one of the Reynolds Road culverts.

Figure 21. Corrosion on the inside of one of the Reynolds Road culverts.

Figure 22. Iradell Road culvert looking south.

Figure 23. Iradell Road culvert looking north.

Figure 24. Iradell Road culvert looking north. Limited embedment throughout the culvert.

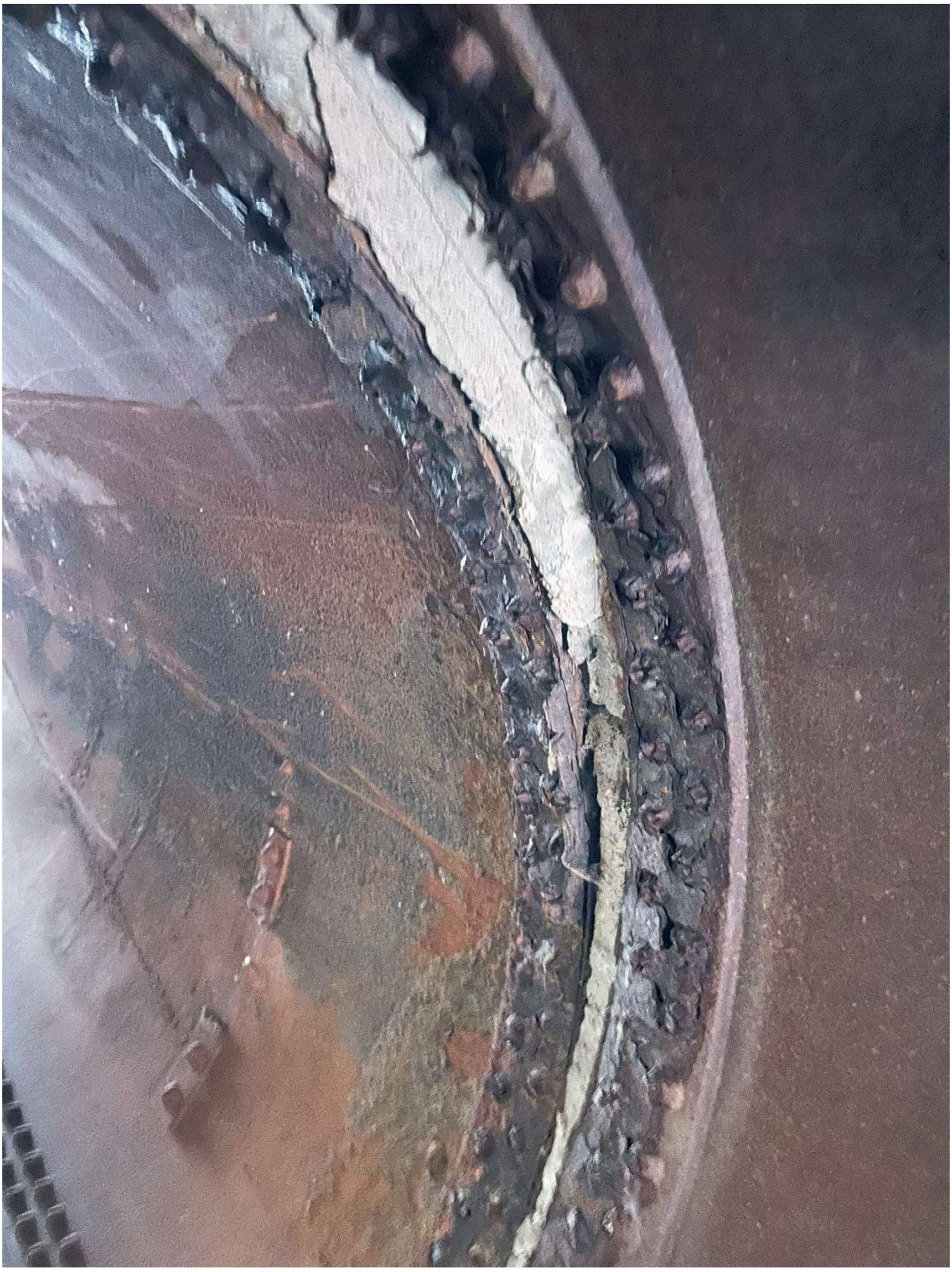


Figure 25. Iradell Road culvert. The rivets on the inside of the culvert are corroded and falling apart.

Figure 26. Iradell Road culvert looking southwest. Large vertical separation between the outlet invert and the streambed below.

Figure 27. Iradell Road culvert looking at the outside of the culvert on the north end. The culvert appears to be made from an old freight car petroleum containment vessel.

Figure 28. Iradell Road culvert looking south. There is a large pool forming at the outlet side of the culvert.

Figure 29. Iradell Road culvert looking north.

APPENDIX F

NORTH ATLANTIC AQUATIC CONNECTIVITY COLLABORATIVE DATA (NAACC DATA)

NAACC Data Center

Search Crossings LogIn

Data Set: NAACC (after 6/1/2015)

Survey Id: 26576 Crossing Code: xy4250281576544479

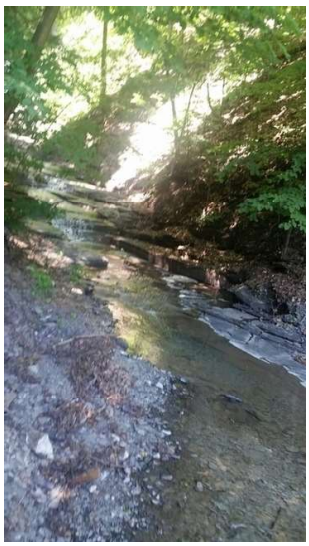
AOP Coarse Screen: Reduced AOP NAACC Aquatic Passability Score: 0.79

Data checked and accurate by Mariah Mahaney on 11-18-2015

xy4250281576544479(downstream)07-23-2015.jpg

xy4250281576544479(inlet)07-23-2015.jpg

xy4250281576544479(outlet)07-23-2015.jpg



xy4250281576544479(upstream)07-23-2015.jpg

Non-tidal Aquatic Connectivity Crossing Data

Database Entry By: No data

Entry Date: 11-18-2015

Coordinator: Mariah Mahaney

Last Updated: 11-18-2015

GPS to Crossing Distance (meters): 10.8

NHD-HUC8 Watershed: Seneca

Crossing Code: xy4250281576544479

Local ID: No data

Date Observed: 07-23-2015

Lead Observer: Mariah Mahaney

Town/County: Ulysses, NY

Stream/River: unknown

Road: Maplewood

Type: Paved

GPS: Lat: 42.50288, Long: -76.54458

Location Description: At the curve in the road by Maplewood Pt

Crossing Type: Culvert

Number of Culverts/Bridge Cells: 1

Flow Condition: Typical low-flow

Crossing Condition: OK

Tidal Site: No

Alignment: Flow-Aligned

Road Fill Height (feet) : 3

Bankfull Width (feet): No data

Bankfull Width Confidence: No data

Constriction: Moderate

Tailwater Scour Pool: None

Crossing Comments: No data

Evaluation of this stream crossing is estimated as: MINOR BARRIER

Non-tidal Aquatic Connectivity Structure Data

Total Number of Culverts: 1

This is culvert number 1 for this crossing:

Outlet Openness Ratio: 2.440

Outlet Shape: Box Culvert

Outlet Grade: At Stream Grade

Outlet drop to water surface (feet): 0.0

Structure Length: L = 35.6 Feet

Structure Material: Concrete

Outlet Armoring: Extensive

Outlet dimensions (feet): **A** = 9.0; **B** = 9.7; **C**= 9.0; **D** = 0.05 ; **E**= No data

Outlet drop to stream bottom (feet): 0.0

Inlet Openness Ratio: 1.925

Inlet Type: Headwall and Wingwalls

Inlet dimensions (feet): **A** = 8.9; **B** = 7.8; **C** = 8.9; **D** = 0.10

Inlet Shape: Box Culvert

Inlet Grade: At Stream Grade

Slope Percent: 0.7%

Internal Structures: None

Structure Substrate Matches Stream: None

Structure Substrate Coverage: None

Severity: None

Water velocity matches that of the stream? Yes

Height above dry passage: No data

Slope Confidence: Low

Internal Structures Comment: No data

Structure Substrate Type: None

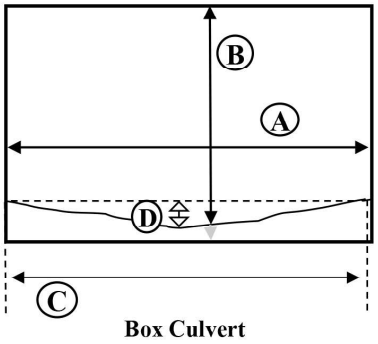
Physical Barriers: None

Water depth matches that of the stream? Yes

Dry passage through structure? No

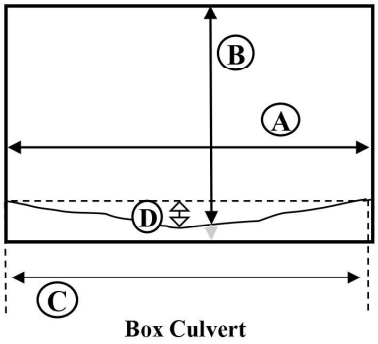
Structure Comments: No data

Inlet Shape:



Box Culvert

Outlet Shape:



Box Culvert

Search Crossings

NAACC Data Center

Search Crossings LogIn

Data Set: NAACC (after 6/1/2015)

Survey Id: 26514 Crossing Code: xy4251229776554537
AOP Coarse Screen: No AOP NAACC Aquatic Passability Score: 0.00
Data checked and accurate by Mariah Mahaney on 11-17-2015

xy4251229776554537(downstream)07-30-2015.jpg

xy4251229776554537(inlet)07-30-2015.jpg

xy4251229776554537(other1)07-30-2015.jpg

xy4251229776554537(outlet)07-30-2015.jpg

xy4251229776554537(upstream)07-30-2015.jpg

Non-tidal Aquatic Connectivity Crossing Data

Database Entry By: No data

Entry Date: 11-17-2015

Coordinator: Mariah Mahaney

Last Updated: 11-17-2015

GPS to Crossing Distance (meters): 0.5

NHD-HUC8 Watershed: Seneca

Crossing Code: xy4251229776554537

Local ID: No data

Date Observed: 07-30-2015

Lead Observer: Mariah Mahaney

Town/County: Ulysses, NY

Stream/River: unknown

Road: Garrett

Type: Paved

GPS: Lat: 42.51230, Long: -76.55453

Location Description: 100 ft south of Houghton intersection

Crossing Type: Culvert

Number of Culverts/Bridge Cells: 1

Flow Condition: Typical low-flow

Crossing Condition: Poor

Tidal Site: No

Alignment: Skewed (>45°)

Road Fill Height (feet) : 5.4

Bankfull Width (feet): No data

Bankfull Width Confidence: No data

Constriction: Moderate

Tailwater Scour Pool: Large

Crossing Comments: No data

Evaluation of this stream crossing is estimated as: SEVERE BARRIER

Non-tidal Aquatic Connectivity Structure Data

Total Number of Culverts: 1

This is culvert number 1 for this crossing:

Outlet Openness Ratio: 0.236

Structure Material: Metal

Outlet Shape: Round Culvert

Outlet Armoring: None

Outlet dimensions (feet): **A** = 4.0; **B** = 4.0; **C**= 1.1; **D** = 0.03 ; **E**= No data

Outlet Grade: Free Fall

Outlet drop to water surface (feet): 3.4

Outlet drop to stream bottom (feet): 3.5

Structure Length: L = 53.0 Feet

Inlet Openness Ratio: 0.280

Inlet Shape: Round Culvert

Inlet Type: Headwall and Wingwalls

Inlet Grade: At Stream Grade

Inlet dimensions (feet): **A** = 4.4; **B** = 4.4; **C** = 3.0; **D** = 0.02

Slope Percent: 4.1%

Slope Confidence: Low

Internal Structures: None

Internal Structures Comment: No data

Structure Substrate Matches Stream: None

Structure Substrate Type: None

Structure Substrate Coverage: None

Physical Barriers: None,Deformation

Severity: Minor

Water depth matches that of the stream? Yes

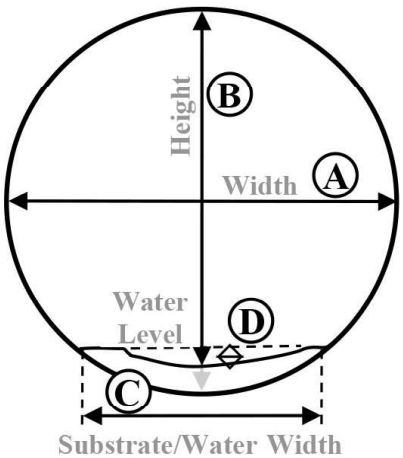
Water velocity matches that of the stream? Yes

Dry passage through structure? No

Height above dry passage: No data

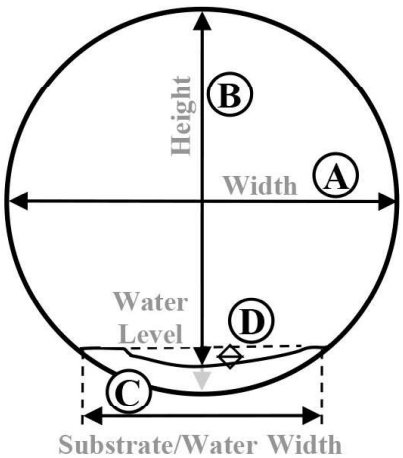
Structure Comments: 2/3 way through becomes corrugated metal. Rusting out through the bottom of the entire structure, the inlet portion of structure has sheets of metal peeling off.

Inlet Shape:



Round Culvert

Outlet Shape:



Round Culvert

Search Crossings

NAACC Data Center

Search Crossings LogIn

Data Set: NAACC (after 6/1/2015)

Survey Id: 20857 Crossing Code: xy4252442076615091
AOP Coarse Screen: Full AOP NAACC Aquatic Passability Score: 0.77
Data checked and accurate by Andrew Meyer on 11-17-2015


xy4252442076615091(downstream)07-27-2015.jpg


xy4252442076615091(inlet)07-27-2015.jpg


xy4252442076615091(outlet)07-27-2015.jpg


xy4252442076615091(upstream)07-27-2015.jpg

Non-tidal Aquatic Connectivity Crossing Data

Database Entry By: No data
Entry Date: 08-17-2015
Coordinator: Andrew Meyer
Last Updated: 08-17-2015
GPS to Crossing Distance (meters): 26.4
NHD-HUC8 Watershed: Seneca
Crossing Code: xy4252442076615091
Local ID: No data
Date Observed: 07-27-2015
Lead Observer: Mariah Mahaney
Town/County: Ulysses, NY
Stream/River: unknown
Road: Agard Rd
Type: Paved
GPS: Lat: 42.52439, Long: -76.61477
Location Description: 80 ft east of intersection with Jacksonville Rd & 50 ft west of 2706

Crossing Type: Culvert

Number of Culverts/Bridge Cells: 1

Flow Condition: Typical low-flow

Crossing Condition: OK

Tidal Site: No

Alignment: Flow-Aligned

Road Fill Height (feet) : 1.3

Bankfull Width (feet): No data

Bankfull Width Confidence: No data

Constriction: Spans Only Bankfull/Active Channel

Tailwater Scour Pool: None

Crossing Comments: saw crawfish

Evaluation of this stream crossing is estimated as: MINOR BARRIER

Non-tidal Aquatic Connectivity Structure Data

Total Number of Culverts: 1

This is culvert number 1 for this crossing:

Outlet Openness Ratio: 0.173

Structure Material: Metal

Outlet Shape: Pipe Arch/Elliptical Culvert

Outlet Armoring: None

Outlet dimensions (feet): A = 6.2; **B** = 3.8; **C**= 5.8; **D** = 0.80 ; **E**= No data

Outlet Grade: At Stream Grade

Outlet drop to water surface (feet): 0.0

Outlet drop to stream bottom (feet): 0.0

Structure Length: L = 71.0 Feet

Inlet Openness Ratio: 0.165

Inlet Shape: Pipe Arch/Elliptical Culvert

Inlet Type: Projecting

Inlet Grade: At Stream Grade

Inlet dimensions (feet): A = 6.3; **B** = 3.8; **C** = 5.8; **D** = 0.50

Slope Percent: 1.8%

Slope Confidence: Low

Internal Structures: None

Internal Structures Comment: No data

Structure Substrate Matches Stream: Comparable

Structure Substrate Type: Silt

Structure Substrate Coverage: 100%

Physical Barriers: None

Water depth matches that of the stream? No-Shallower

Severity: None

Water velocity matches that of the stream? No-

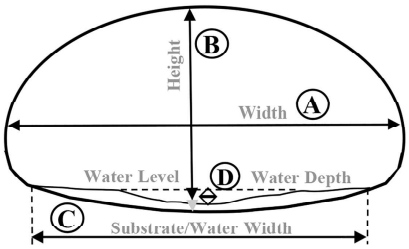
Faster

Dry passage through structure? No

Height above dry passage: No data

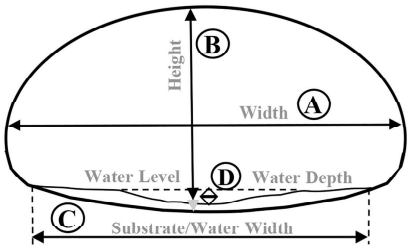
Structure Comments: No data

Inlet Shape:



Pipe Arch / Elliptical Culvert

Outlet Shape:



Pipe Arch / Elliptical Culvert

Search Crossings

NAACC Data Center

Search Crossings LogIn

Data Set: NAACC (after 6/1/2015)

Survey Id: 23584 Crossing Code: xy4252282176668151
AOP Coarse Screen: No AOP NAACC Aquatic Passability Score: 0.19
Data checked and accurate by Mariah Mahaney on 10-08-2015

xy4252282176668151(downstream)08-04-2015.jpg

xy4252282176668151(inlet)08-04-2015.jpg

xy4252282176668151(other1)08-04-2015.jpg

xy4252282176668151(other2)08-04-2015.jpg

xy4252282176668151(outlet)08-04-2015.jpg

xy4252282176668151(upstream)08-04-2015.jpg

Non-tidal Aquatic Connectivity Crossing Data

Database Entry By: No data

Entry Date: 10-08-2015

Coordinator: Mariah Mahaney

Last Updated: 10-08-2015

GPS to Crossing Distance (meters): 8.1

NHD-HUC8 Watershed: Seneca

Crossing Code: xy4252282176668151

Local ID: No data

Date Observed: 08-04-2015

Lead Observer: Kyle Rogers

Town/County: Ulysses, NY

Stream/River: unknown

Road: Curry

Type: Paved

GPS: Lat: 42.52279, Long: -76.66824

Location Description: near house 5071

Crossing Type: Culvert

Number of Culverts/Bridge Cells: 2

Flow Condition: Moderate

Crossing Condition: OK

Tidal Site: No

Alignment: Flow-Aligned

Road Fill Height (feet) : 1

Bankfull Width (feet): No data

Bankfull Width Confidence: No data

Constriction: Spans Only Bankfull/Active Channel

Tailwater Scour Pool: Large

Crossing Comments: No data

Evaluation of this stream crossing is estimated as: SEVERE BARRIER

Non-tidal Aquatic Connectivity Structure Data

Total Number of Culverts: 2

This is culvert number 1 for this crossing:

Outlet Openness Ratio: 1.228

Outlet Shape: Pipe Arch/Elliptical Culvert

Outlet Grade: Free Fall Onto Cascade

Outlet drop to water surface (feet): 1.0

Structure Length: L = 40.0 Feet

Structure Material: Metal

Outlet Armoring: Not Extensive

Outlet dimensions (feet): A = 16.8; **B** = 10.5; **C**= 9.3; **D** = 0.40 ; **E**= No data

Outlet drop to stream bottom (feet): 1.3

Inlet Openness Ratio: 1.378

Inlet Type: Mitered to Slope

Inlet dimensions (feet): A = 16.8; **B** = 10.5; **C** = 10.4; **D** = 0.50

Inlet Shape: Pipe Arch/Elliptical Culvert

Inlet Grade: At Stream Grade

Slope Percent: 4.8%

Internal Structures: None

Structure Substrate Matches Stream: None

Structure Substrate Coverage: None

Severity: None

Water velocity matches that of the stream? No-Faster

Height above dry passage: No data

Slope Confidence: Low

Internal Structures Comment: No data

Structure Substrate Type: None

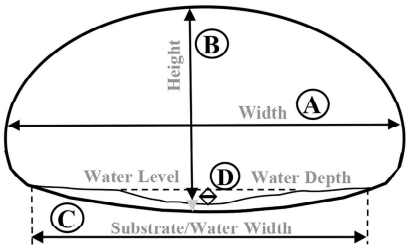
Physical Barriers: None

Water depth matches that of the stream? No-Shallower

Dry passage through structure? No

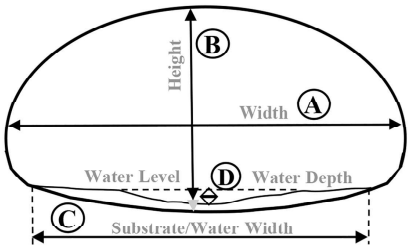
Structure Comments: No data

Inlet Shape:



Pipe Arch / Elliptical Culvert

Outlet Shape:



Pipe Arch / Elliptical Culvert

Non-tidal Aquatic Connectivity Structure Data

Total Number of Culverts: 2

This is culvert number 2 for this crossing:

Outlet Openness Ratio: 1.200

Outlet Shape: Pipe Arch/Elliptical Culvert

Outlet Grade: Free Fall Onto Cascade

Outlet drop to water surface (feet): 1.6

Structure Length: L = 40.5 Feet

Structure Material: Metal

Outlet Armoring: Not Extensive

Outlet dimensions (feet): A = 16.9; **B** = 10.2; **C**= 9.5; **D** = 0.20 ; **E**= No data

Outlet drop to stream bottom (feet): 1.9

Inlet Openness Ratio: 1.050

Inlet Type: Mitered to Slope

Inlet dimensions (feet): A = 16.9; **B** = 10.2; **C** = 8.3; **D** = 0.33

Inlet Shape: Pipe Arch/Elliptical Culvert

Inlet Grade: Perched

Slope Percent: 3.7%

Internal Structures: None

Structure Substrate Matches Stream: None

Structure Substrate Coverage: None

Severity: None

Slope Confidence: Low

Internal Structures Comment: No data

Structure Substrate Type: None

Physical Barriers: None

Water depth matches that of the stream? No-Shallower

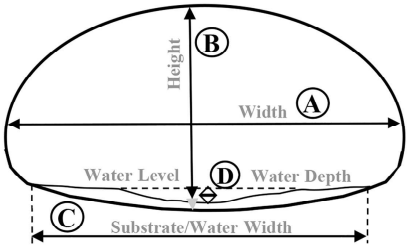
Water velocity matches that of the stream? No-

Faster **Dry passage through structure?** No

Height above dry passage: No data

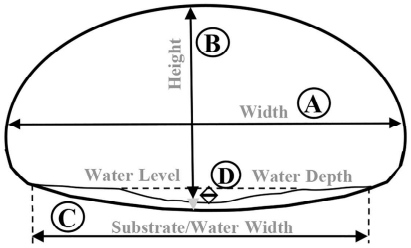
Structure Comments: structure 2's bottom is less flush with the bottom of the creek as compared to the bottom of structure 1

Inlet Shape:



Pipe Arch / Elliptical Culvert

Outlet Shape:



Pipe Arch / Elliptical Culvert

Search Crossings

NAACC Data Center

Search Crossings LogIn

Data Set: NAACC (after 6/1/2015)

Survey Id: 20568 Crossing Code: xy4249802276652552

AOP Coarse Screen: Reduced AOP NAACC Aquatic Passability Score: 0.67

Data checked and accurate by Andrew Meyer on 10-19-2015

xy4249802276652552(downstream)8-10-2015.jpg

xy4249802276652552(inlet)8-10-2015.jpg

xy4249802276652552(outlet)8-10-2015.jpg

xy4249802276652552(upstream)8-10-2015.jpg

Non-tidal Aquatic Connectivity Crossing Data

Database Entry By: No data

Entry Date: 08-11-2015

Coordinator: Mariah Mahaney

Last Updated: 10-16-2015

GPS to Crossing Distance (meters): 5.2

NHD-HUC8 Watershed: Seneca

Crossing Code: xy4249802276652552

Local ID: No data

Date Observed: 08-10-2015

Lead Observer: Kyle Rogers

Town/County: Ulysses, NY

Stream/River: Unknown

Road: Reynolds Road

Type: Paved

GPS: Lat: 42.49804, Long: -76.65261

Location Description: 100 feet east of intersection w/Perry City

Crossing Type: Culvert

Number of Culverts/Bridge Cells: 2

Flow Condition: Typical low-flow

Crossing Condition: OK

Tidal Site: No

Alignment: Flow-Aligned

Road Fill Height (feet) : 3

Bankfull Width (feet): No data

Bankfull Width Confidence: No data

Constriction: Moderate

Tailwater Scour Pool: Small

Crossing Comments: Many fish present

Evaluation of this stream crossing is estimated as: MINOR BARRIER

Non-tidal Aquatic Connectivity Structure Data

Total Number of Culverts: 2

This is culvert number 1 for this crossing:

Outlet Openness Ratio: 0.565

Structure Material: Metal

Outlet Shape: Round Culvert

Outlet Armoring: None

Outlet dimensions (feet): **A** = 6.0; **B** = 5.4; **C**= 3.5; **D** = 0.50 ; **E**= No data

Outlet Grade: At Stream Grade

Outlet drop to water surface (feet): 0.0

Outlet drop to stream bottom (feet): 0.0

Structure Length: L = 46.0 Feet

Inlet Openness Ratio: 0.523

Inlet Shape: Round Culvert

Inlet Type: Projecting

Inlet Grade: Perched

Inlet dimensions (feet): **A** = 5.6; **B** = 5.6; **C** = 2.7; **D** = 0.30

Slope Percent: 0.6%

Slope Confidence: Low

Internal Structures: None

Internal Structures Comment: No data

Structure Substrate Matches Stream: None

Structure Substrate Type: None

Structure Substrate Coverage: None

Physical Barriers: None

Severity: None

Water depth matches that of the stream? Yes

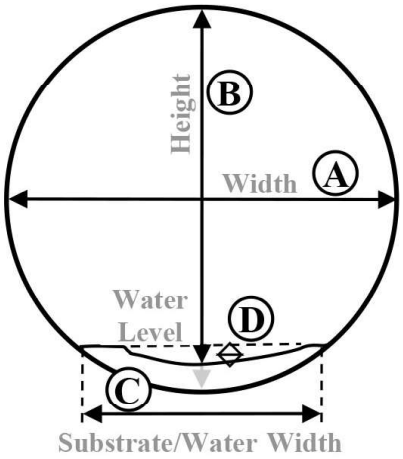
Water velocity matches that of the stream? No-Slower

Dry passage through structure? No

Height above dry passage: No data

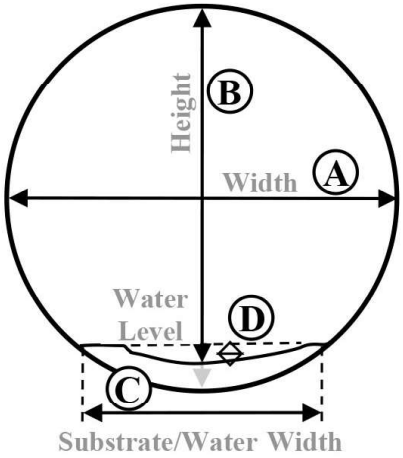
Structure Comments: No data

Inlet Shape:



Round Culvert

Outlet Shape:



Round Culvert

Non-tidal Aquatic Connectivity Structure Data

Total Number of Culverts: 2

This is culvert number 2 for this crossing:

Outlet Openness Ratio: 0.491

Structure Material: Metal

Outlet Shape: Round Culvert

Outlet Armoring: None

Outlet dimensions (feet): **A** = 5.8; **B** = 4.9; **C**= 4.2; **D** = 0.10 ; **E**= No data

Outlet Grade: At Stream Grade

Outlet drop to water surface (feet): 0.0

Outlet drop to stream bottom (feet): 0.0

Structure Length: L = 48.0 Feet

Inlet Openness Ratio: 0.591

Inlet Shape: Round Culvert

Inlet Type: Projecting

Inlet Grade: At Stream Grade

Inlet dimensions (feet): **A** = 6.1; **B** = 5.3; **C** = 1.8; **D** = 0.10

Slope Percent: 1.6%

Slope Confidence: Low

Internal Structures: None

Internal Structures Comment: No data

Structure Substrate Matches Stream: Comparable

Structure Substrate Type: Gravel

Structure Substrate Coverage: 75%

Physical Barriers: Debris/Sediment/Rock

Water depth matches that of the stream? No-Shallower

Severity: Severe

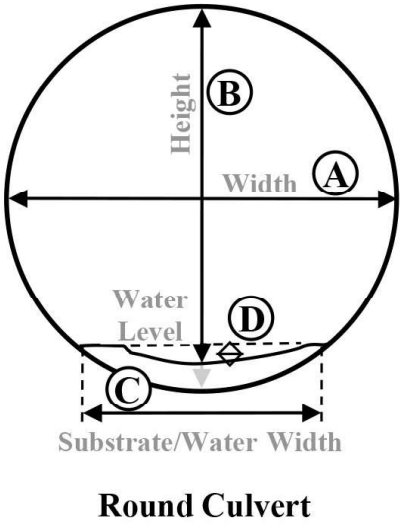
Water velocity matches that of the stream? Unknown

Dry passage through structure? No

Height above dry passage: No data

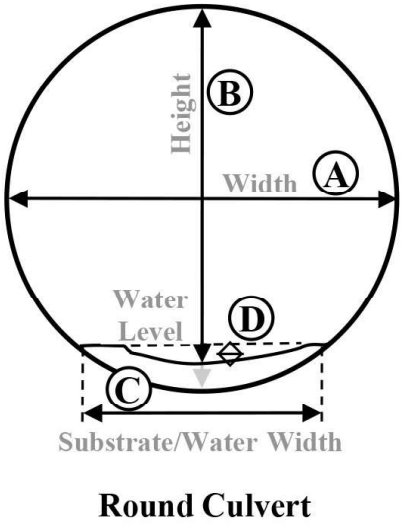
Structure Comments: Water does not flow through pipe, though it does pool at inlet -- deposited rocks block flow at typical flow

Inlet Shape:



Round Culvert

Outlet Shape:



Round Culvert

Search Crossings

NAACC Data Center

Search Crossings LogIn

Data Set: NAACC (after 6/1/2015)

Survey Id: 20572 Crossing Code: xy4247881976671566
AOP Coarse Screen: No AOP NAACC Aquatic Passability Score: 0.59
Data checked and accurate by Andrew Meyer on 11-18-2015

xy4247881976671566(downstream)8-10-2015.jpg

xy4247881976671566(inlet)8-10-2015.jpg

xy4247881976671566(upstream)8-10-2015.jpg

xy4247881976671566(outlet)8-10-2015.jpg

Non-tidal Aquatic Connectivity Crossing Data

Database Entry By: No data

Entry Date: 08-11-2015

Coordinator: Andrew Meyer

Last Updated: 08-11-2015

GPS to Crossing Distance (meters): 2.7

NHD-HUC8 Watershed: Seneca

Crossing Code: xy4247881976671566

Local ID: No data

Date Observed: 08-10-2015

Lead Observer: Kyle Rogers

Town/County: Ulysses, NY

Stream/River: unknown

Road: Iradell Road

Type: Paved

GPS: Lat: 42.47881, Long: -76.67154

Location Description: 200 ft East of Waterburg Intersection

Crossing Type: Culvert

Number of Culverts/Bridge Cells: 1

Flow Condition: Typical low-flow

Crossing Condition: OK

Tidal Site: No

Alignment: Flow-Aligned

Road Fill Height (feet) : 1.9

Bankfull Width (feet): 15

Bankfull Width Confidence: Low/Estimated

Constriction: Moderate

Tailwater Scour Pool: None

Crossing Comments: 200 ft East of Waterburg intersection

Evaluation of this stream crossing is estimated as: MODERATE BARRIER

Non-tidal Aquatic Connectivity Structure Data

Total Number of Culverts: 1

This is culvert number 1 for this crossing:

Outlet Openness Ratio: 0.118

Structure Material: Metal

Outlet Shape: Round Culvert

Outlet Armoring: None

Outlet dimensions (feet): A = 2.5; **B** = 2.4; **C**= 1.1; **D** = 0.20 ; **E**= No data

Outlet Grade: Free Fall

Outlet drop to water surface (feet): 0.1

Outlet drop to stream bottom (feet): 0.3

Structure Length: L = 40.0 Feet

Inlet Openness Ratio: 0.117

Inlet Shape: Round Culvert

Inlet Type: Projecting

Inlet Grade: At Stream Grade

Inlet dimensions (feet): **A** = 2.5; **B** = 2.4; **C** = 1.3; **D** = 0.20

Slope Percent: 0.2%

Slope Confidence: Low

Internal Structures: None

Internal Structures Comment: No data

Structure Substrate Matches Stream: None

Structure Substrate Type: None

Structure Substrate Coverage: None

Physical Barriers: None

Water depth matches that of the stream? No-Shallower

Severity: None

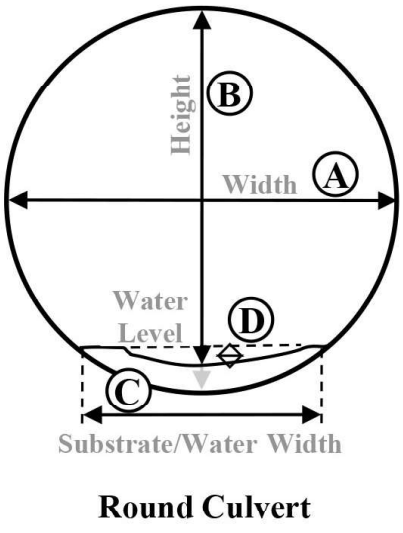
Water velocity matches that of the stream? No-Faster

Dry passage through structure? No

Height above dry passage: No data

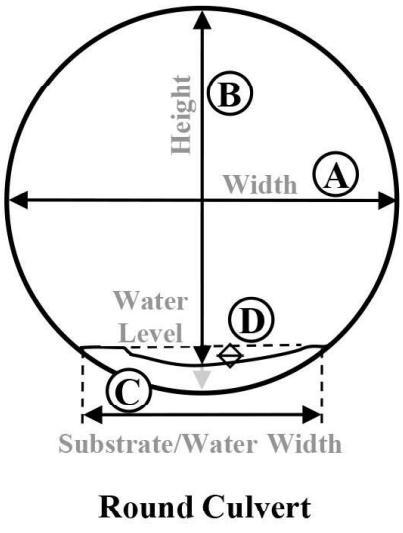
Structure Comments: No data

Inlet Shape:



Round Culvert

Outlet Shape:



Round Culvert

Search Crossings

APPENDIX G

NYSDEC'S BEST MANAGEMENT PRACTICES FOR STREAM CROSSINGS

Stream Crossings

Important Links

NYSDEC developed the stream crossings guidelines to promote natural stream conditions and to allow animals to move unrestricted while balancing transportation demands. Special considerations for the life requirements of invertebrates, fish, amphibians, reptiles, mammals, and birds have been considered while developing these guidelines. Depending on the project, additional engineering design may be necessary to ensure structural integrity and appropriate hydraulic capacity.

Draft 2024 Bridge and Culvert Guidance

- DEC has announced new draft Guidance for the Review of Bridge and Culvert Projects in Nontidal Waters Requiring a Protection of Waters Permit and a Water Quality Certificate </sites/default/files/2024-01/brdgclvrtguidance.pdf> (PDF) which is now available for public review and comment.
  NOTE: The period for public review and comment has been extended until February 23, 2024.
- This guidance describes minimum design requirements and other considerations of the New York State Department of Environmental Conservation (NYSDEC), Division of Fish and Wildlife during review of bridge and culvert projects requiring Protection of Waters permits. This new guidance has been developed to:
  - Clarify DEC's stream crossing guidelines described on this webpage and clarify permit issuance standards used by staff;
  - Incorporate climate change considerations into issuance of DEC permits as required by CRRA and CP-49; and
  - Promote and encourage statewide consistency and efficiency with both DEC staff and the regulated community.
- Written comments on the draft Guidance will now accepted by email until February 23, 2024. The comments shall be submitted to the contact below. Please include "Comments on the 2024 Draft Bridge and Culvert Guidance" in the subject line.
  - **Contact Information:**
    Corbin Gosier
    518-402-8872
    Corbin.gosier@dec.ny.gov

Continuity for Healthy Stream Ecosystems

Streams are long, linear ecosystems that are uniquely vulnerable to fragmentation through the development of stream crossings, like bridges and culverts. Designing effective crossings to keep *stream continuity* is imperative to protect the core functions of these diverse ecosystems and the animals they support. Poorly designed stream crossings act as barriers to natural communities and they can affect the overall health of the stream and its connection to riparian and upland areas that comprise the greater stream ecosystem.

A species biological fitness - the ability to survive and produce viable offspring - can be negatively impacted by the design of a stream crossing. Throughout a species life, their success can be determined by certain factors, such as:

1. NATURAL DISPERSAL - ACCESS TO BREEDING, SPAWNING, AND NURSERY AREAS

Natural dispersal -- the movement of a species from their native area -- is critical to a ensure a healthy, productive environment. Dispersal is an important step to help restore a stream after it has been damaged by a major event, like flooding, severe drought, or pollution. Barriers and restrictions, like stream crossings, can prevent adult fish from traveling to spawning areas and offspring from dispersing into

juvenile and adult habitat. Additionally, when animals are prevented from traveling in and along stream corridors, they may be subject to increased predation and mortalities. This reduces the overall chance to repopulate an area, which in turn can have impact on ecosystem health and services.

2. OPTIMAL TEMPERATURES AND OXYGEN LEVELS - ACCESS TO COLDWATER HABITATS

During the summer, species such as brook trout travel to and congregate in cold water sections of streams and tributaries. If fish are prevented from reaching these areas, they can become susceptible to heat stress and mortality. Limited travel may also cause overcrowding, which can make fish vulnerable to disease and predators.

3. GOOD COVER AND ACCESS TO FEEDING AREAS

Different habitats provide various feeding opportunities throughout a day or season and species regularly travel to take advantage of these resources. Restricting access to prime feeding areas can affect a variety of species.

4. NATURAL SUBSTRATES

Poor crossing design and installation can result in degradation of natural substrates, which can adversely affect native plants and animals. In undersized crossings, high water velocities may scour natural substrates in and downstream of the crossing, resulting in habitat degradation for fish and other wildlife. The substrate in or under a crossing should match the natural substrate of the surrounding stream in order to maintain natural conditions.

5. OPTIMAL HYDROLOGICAL CONDITIONS - WATER DEPTH AND FLOW

Inefficient stream crossings can alter the natural flow of a stream, which may have a serious impact on a species' fitness; fish and other aquatic organisms need sufficient water depth to move through a stream crossing.

- Low flow can impede passage and may also lead to stagnant conditions within the crossing.
- High flow caused by a constricted crossing can degrade wildlife habitat and weakens the structural integrity of a crossing overtime.
- High water velocities and related flow alterations may also erode stream banks.

Recognizing Problems

Stream crossings should be properly sized, placed, and installed. They should be large enough to allow easy passage of fish, wildlife, and floods while preserving natural flows and velocities. Approved designs should contain an open bottom or be embedded into the stream bed so that substrate and water depth are similar to the surrounding stream.

Identifying poor crossing structures and installations is an important step in evaluating whether they should be fixed or replaced. The following types of crossings demonstrate common design flaws that can create barriers for fish and wildlife.

Undersized Crossings: Restrict natural flow, scouring and erosion, high flow velocities, clogging and ponding. Can cause water to backup - *pond* - in areas upstream of the crossing when clogged by woody debris, leaves, and other material or during seasonal high water and flood events. Clogging can occur year-round or may intensify the effect of floods and make a crossing impassable to wildlife. Ponding can also lead to property damage, road and bank erosion, and severe changes in upstream habitat. As a result, undersized crossings typically require frequent and costly maintenance.

Shallow Crossings: Water depths are too low for many organisms to move through and the bottom may lack appropriate stream bed material.

Perched Crossings: Low flow, unnatural bed material, scouring and erosion, ponding. In perched culverts, scour pools often develop downstream of the culvert and eventually undercut the culvert and impede upstream passage.

Double Culverts: Restriction of natural flow, clogging with debris, ponding and flooding.

Stream Crossings: Guidelines and Best Management Practices

The following recommendations are to assist in designing, installing, and replacing stream crossings to protect stream continuity and to maintain healthy habitat for fish and wildlife. Structures should consider the pre-installation stream conditions and be thoughtfully designed and installed to retain the natural flow and substrate of the stream. Additional engineering may be necessary to ensure structural integrity and hydraulic capacity.

Types of Crossings, in descending order of preference:

1. **Bridges and open bottom box culverts**
2. **Open bottom arch culverts**
3. **Box culverts***
4. **Arch or elliptical/squash culverts***
5. **Circular culverts***

* **Box and pipe culverts (#3-5),** if used, must be installed level only in flat streambeds, where the slope is not steeper than 3% and be embedded to at least 20% of the culvert height at the downstream invert.

Design and Installation Recommendations:

- **Width** of the crossing should be 1.25x the normal width of the streambed, measured bank to bank at ordinary high water level *or* to the edges of terrestrial, rooted vegetation. An average of three measurements is recommended to determine natural channel bed width: 1.) at project site, 2.) and 3.) straight sections upstream *and* downstream from the crossing. Additionally, the overall **capacity** needs to accommodate expected high flows to ensure stream continuity.
- **Side slopes** should be as steep as possible without compromising stability to minimize the length of the culvert. Note: A side slope grade of 2:1 is typically the steepest that can be vegetated.
- **Installation** should take place *in the dry* to facilitate construction and reduce effects of turbidity and sedimentation downstream. This may require piping or pumping the stream flow around the work area and the use of cofferdams. The duration of dewatering should be kept to a minimum and the flow downstream should be equal to that upstream from the work site.
- **Erosion and sediment control,** such as rip rap, silt fencing and/or straw bales, and revegetation is important to limit disturbance to the streambed and banks.
  - Rip rap should be used as head wall protection to prevent scouring and erosion from high flows around the inlet and outlet of the culvert.
  - Silt fencing and/or straw bales, should be installed parallel to the stream to prevent downstream impacts and should be depicted on project plans.
  - Affected bank and bed areas should be restored to pre-project conditions following installation and banks should be revegetated with native plants and covered with mulch to accelerate plant growth.
- **Natural substrate** used in the crossing should match those found up and downstream and resist displacement from natural flows and during levels of high water or floods. Metal and concrete are not appropriate materials for species that travel along the streambed.
- **Timing restrictions** may be imposed to protect fish spawning. In general, instream work should occur during low flow conditions, typically between June and September, to minimize impacts to fish and water quality.
- **Maintenance** of structures is recommended to be completed at least once annually, preferably before high spring flows.

Required DEC Permits for projects involving:

- All streams with a classification of AA, A or B, or with a classification of C with a standard (T) or (TS). The Environmental Resource Mapper <https://www.dec.ny.gov/animals/38801.html> can be used to identify protected streams based on their classification and create simple maps needed as part of the permit application process.
- All navigable waters.
- NYSDEC regulated freshwater wetlands outside of the Adirondack Park.

Other Potential Permits

Adirondack Park Agency <https://www.apa.ny.gov/forms/index.cfm> regulates wetlands within the park and may have jurisdiction on stream crossings within the park.
U.S. Army Corps of Engineers <https://permits.ops.usace.army.mil/orm-public#> regulates activities involving dredging, excavation, placement of fill, or construction of certain structures in Waters of the United States.

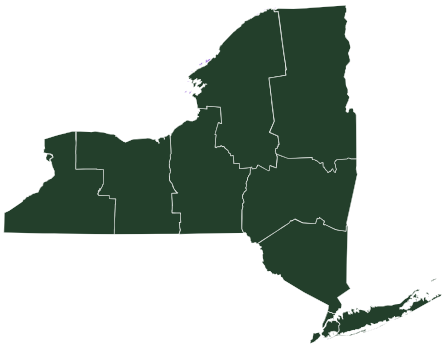
Contact for this Page

Division of Environmental Permits
625 Broadway
Albany, NY 12233

Phone: 518-402-9167
deppermitting@dec.ny.gov

This Page Covers

New York State



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APPENDIX H

EXISTING CULVERTS – NYSDOT FLOOD RISK MANAGEMENT PRACTICES FOR CULVERTS - CHECKS

MRB group

Project Title: Town of Ulysses Culvert Planning Project
Project No.: 2104.23002
Date: 4/8/2024
Engineer: C. Hurley

Objective: Evaluation of each proposed culvert hydraulically based on NYSDOT Guidelines for Culverts.

References:

1) NYSDOT Highway Design Manual - Chapter 8 - Section 6 - Culverts
2) Exhibit 8-12 - Flood Risk Management Guidelines for Culverts

Culvert Location	Culvert Rise (D) (ft)	Invert Upstream (ft)	Low Shoulder Elevation (ft)	Critical or Non-Critical Roadway?	50-Year Headwater (HW) Elevation (ft)	50-Year Headwater (HW) Depth (ft)	Allowable Headwater/Depth Ratio Required (AHW/D)	Headwater/Depth Ratio (HW/D)	Pass/Fail	100-Year Headwater Elevation (HW) (ft)	Allowable Headwater (AHW) Elevation (ft)	Pass/Fail
Maplewood Road	7.75	408.46	419.83	Non-Critical	412.69	4.23	≤ 1	0.55	Pass	413.05	417.83	Pass
Garrett Road	3.82	623.24	630.45	Non-Critical	626.83	3.59	≤ 1.5	0.94	Pass	627.07	628.45	Pass
Agard Road	3.88	860.11	865.05	Non-Critical	866.65	6.54	≤ 1.5	1.69	Fail	866.77	863.05	Fail
Curry Road	10.00	937.69	948.27	Non-Critical	948.3	10.61	≤ 1	1.06	Fail	949.23	946.27	Fail
Reynolds Road	5.29	1062.56	1070.34	Non-Critical	1071.51	8.95	≤ 1	1.69	Fail	1071.71	1068.34	Fail
Iradell Road	5.92	1107.07	1120.01	Non-Critical	1119.14	12.07	≤ 1	2.04	Fail	1120.85	1118.01	Fail

APPENDIX I

PROPOSED CULVERTS – NYSDOT FLOOD RISK MANAGEMENT PRACTICES FOR CULVERTS - CHECKS

MRB group

Project Title: Town of Ulysses Culvert Planning Project
Project No.: 2104.23002
Date: 4/8/2024
Engineer: C. Hurley

Objective: Evaluation of each proposed culvert hydraulically based on NYSDOT Guidelines for Culverts.

References:

1) NYSDOT Highway Design Manual - Chapter 8 - Section 6 - Culverts
2) Exhibit 8-12 - Flood Risk Management Guidelines for Culverts

Culvert Location	Culvert Rise (D) (ft)	Invert Upstream (ft)	Low Shoulder Elevation (ft)	Critical or Non-Critical Roadway?	50-Year Headwater (HW) Elevation (ft)	50-Year Headwater (HW) Depth (ft)	Allowable Headwater/Depth Ratio Required (AHW/D)	Headwater/Depth Ratio (HW/D)	Pass/Fail	100-Year Headwater Elevation (HW) (ft)	Allowable Headwater (AHW) Elevation (ft)	Pass/Fail
Maplewood Road	8.67	408.46	419.83	Non-Critical	412.63	4.17	≤ 1	0.48	Pass	412.98	417.83	Pass
Garrett Road	2.38	623.24	630.45	Non-Critical	626.46	3.22	≤ 1.5	1.36	Pass	626.69	628.45	Pass
Agard Road	3.75	860.11	865.05	Non-Critical	863.92	3.81	≤ 1.5	1.02	Pass	864.13	863.05	Fail
Curry Road	10.00	937.50	948.27	Non-Critical	945.49	7.99	≤ 1	0.80	Pass	946.22	946.27	Pass
Reynolds Road	6.50	1062.56	1070.34	Non-Critical	1067.84	5.28	≤ 1	0.81	Pass	1068.30	1068.34	Pass
Iradell Road	6.13	1107.07	1120.01	Non-Critical	1112.74	5.67	≤ 1	0.93	Pass	113.38	1118.01	Pass

APPENDIX J

COST ESTIMATES