WIN:	24247.00			**Project Name:**		
Town:	T6 R8			**Stream Name:**	trib to Hay Lake	
Route No.	Grand Lake Rd			**Bridge Name:**		
Asset ID:	46554			**Analysis by:**	CSH	
Lat:	46.12699	**Long:**	68.72238	**Date:**	3/06/25 & 7/29/2019	

Peak Flow Calculations by USGS Regression Equations (Hodgkins, 1999 & Lombard/Hodgkins, 2015)

Enter data in blue cells only!

ver. 2018 Jul 09

	km^2	mi^2	ac		
A	1.30	0.50	320.0	Watershed Area *DRNAREA*	
W	0.06	0.0	14.5	Wetlands area (by NWI)	

Enter data in [mi^2]

Worksheet prepared by:
Charles S. Hebson, PE
Environmental Office
Maine Dept. Transportation
Augusta, ME 04333-0016
207-557-1052
Charles.Hebson@maine.gov

P$_c$	520921	5108084	watershed centroid (E, N; UTM 19N; meters)
County	Aroostook S		*choose county from drop-down menu*
pptA			mean annual precipitation (inches; by look-up)
A (km^2)	1.30	**Conf Lvl**	0.7
W (%)	4.53		NWI Wetlands % *STORNWI*

References:
Hodgkins, G.A., 1999.
Estimating the magnitude of peak flows for streams
 in Maine for selected recurrence intervals
WRIR 99-4008, USGS Augusta, ME

Watershed Characteristics for Monthly & Daily Flows

EAVG	758	mean basin elevation (ft)
SLOPE	3.29	mean basin slope (%)
EMAX	808	maximum basin elevation (ft)
WATER	0	percent of drainage basin land cover classified as open water
PRECIP	38.2	mean annual precipitation
SG	0.00	sand & gravel aquifer as decimal fraction of watershed A
HGA	0	mean basin percentage of hydrological soil group A
DIST	143.00	distance from the coast (mi)

Ret Pd	Peak Flow Estimate				Q$_T$ (ft^3/s)
T (yr)	Lower	Q$_T$ (m^3/s)	Upper		
1.1		0.43			15.1
2		0.89			31.4
5		1.40			49.6
10		1.78			62.8
25		2.32			81.9
50		2.72			96.2
100		3.18			112.4
500		4.31			152.2

Lombard, P.J. & G.A. Hodgkins, 2015.
Peak flow regression equations for small, ungaged streams in
 Maine - Comparing map-based to field-based variables
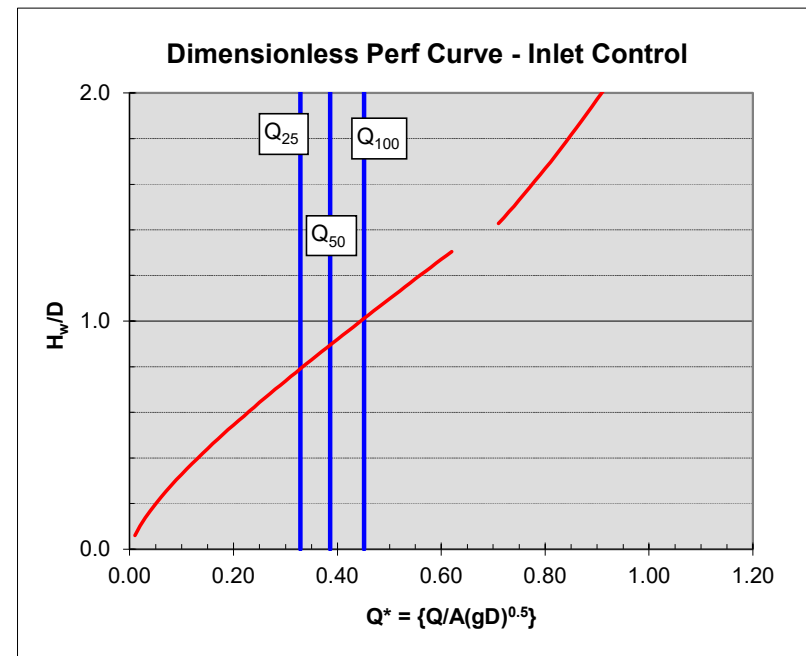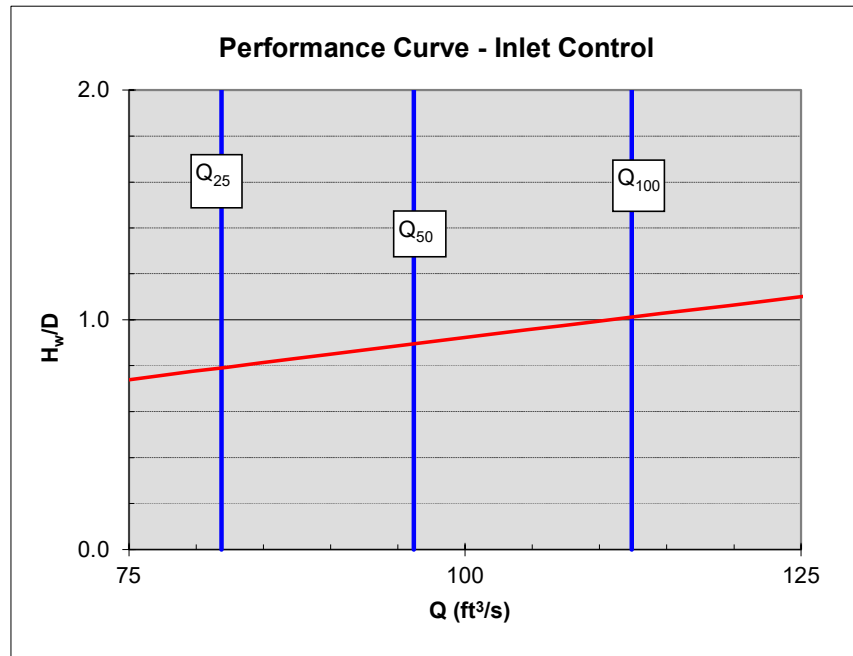*SIR 2015-4059,* USGS, Augusta, ME

$Q_T = b \times A^a \times 10^{-wW}$

NOTE: *This page is for preliminary sizing only.*
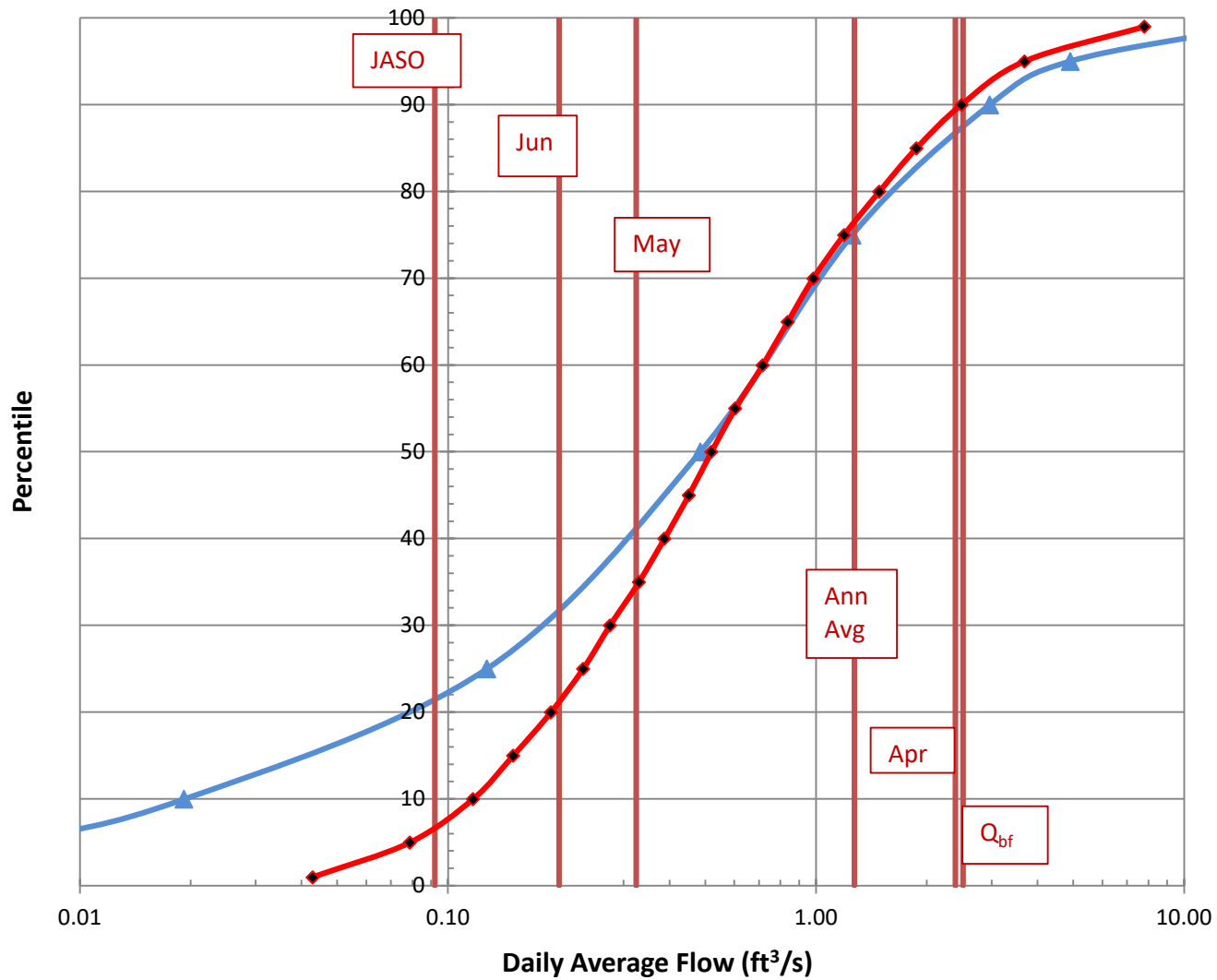*Final design should be done with HY8 or HDS-5*

Preliminary Culvert Sizing - Round & Box Culverts

Shape:	Round				
Type:	Circ CMP Proj	Q_{25}	81.9		
D or R (ft)	5	Q_{50}	96.2	trial D / R =	5.2
w (ft)	15 *box width*	Q_{100}	112.4	trial w: BFW =	7.9
Slope (ft/ft)	0.02				
A (ft^2)	19.63				
g (ft/s^2)	32.2				

Note:
culvert dimensions are for open flow area; adjust for lost capacity
due to embedding / backfilling (min {2' / 25% rise} embedment)

Performance Curve - Inlet Control

Dimensionless Perf Curve - Inlet Control

Daily Average Flow Distribution

Percentile (y-axis)

Daily Average Flow (ft³/s) (x-axis)

Chart labels: JASO, Jun, May, Ann Avg, Apr, Q_bf

Daily Avg Flow Dist

A_{ws} = (mi²) 0.5

Q (ft³/s)

Pctl	Median	84th pctl
1	0.04	0.08
5	0.08	0.13
10	0.12	0.18
15	0.15	0.22
20	0.19	0.27
25	0.23	0.31
30	0.28	0.36
35	0.33	0.41
40	0.39	0.47
45	0.45	0.53
50	0.52	0.62
55	0.60	0.73
60	0.72	0.85
65	0.84	0.99
70	0.98	1.16
75	1.19	1.39
80	1.49	1.66
85	1.88	2.13
90	2.48	2.86
95	3.69	4.45
99	7.80	10.26

Q_{bf}	2.5
$Q_{1.002}$	6.5
$Q_{1.1}$	15.1
Q_2	31.4

DO NOT ENTER ANY DATA ON THIS PAGE; EVERYTHING IS CALCULATED

**MAINE MONTHLY MEDIAN FLOWS and HYDRAULIC GEOMETRY BY USGS REGRESSION EQUATIONS (2004, 2013, 2015)**

	Value	Variable	Explanation
	0.50	A	Area (mi^2)
520921	5108084	P_c	Watershed centroid (E,N; UTM; Zone 19; meters)
	142.42	$DIST$	Distance from Coastal reference line (mi)
	38.2	$pptA$	Mean Annual Precipitation (inches)
	0.00	SG	Sand & Gravel Aquifer (decimal fraction of watershed area)

Month	Q_{median}	
	(ft3/s)	(m^3/s)
Jan	0.55	0.0156
Feb	0.14	0.0041
Mar	0.50	0.0142
Apr	2.39	0.0678
May	0.32	0.0092
Jun	0.20	0.0057
Jul	0.06	0.0018
Aug	0.02	0.0006
Sep	0.03	0.0008
Oct	0.26	0.0073
Nov	1.01	0.0286
Dec	1.00	0.0284

Median Monthly Flows

Q_{bf}	2.5	
ann avg	1.3	
ann med	0.5	
$Q_{1.002}$	6.5	
$Q_{1.01}$	8.8	
$Q_{1.05}$	12.6	
Q_{bf}	14.7	assume v = 4ft/s

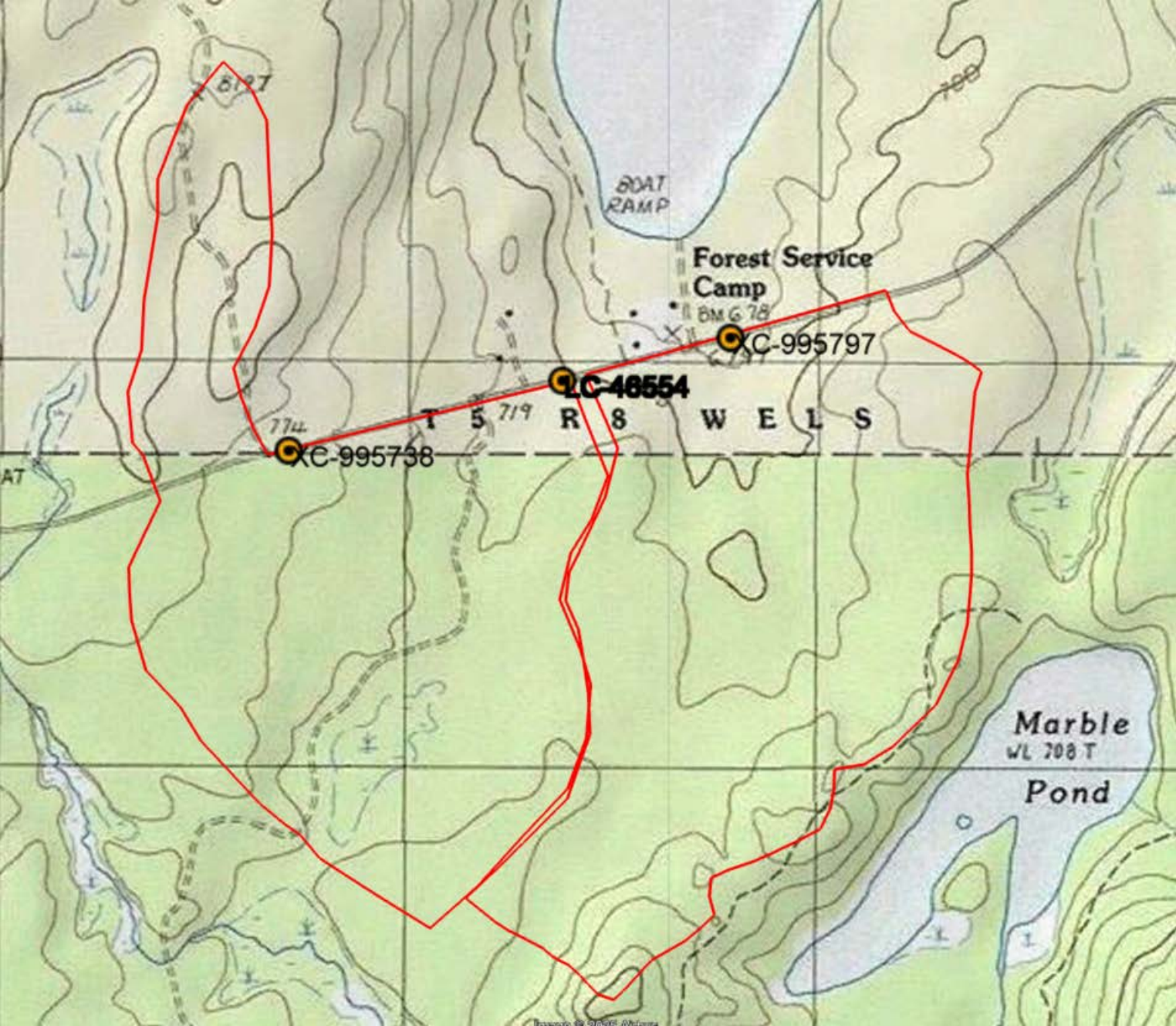| W_{bf}	7.9	estimated bankfull width (ft)
d_{bf}	0.5	estimated bankfull depth (ft)
A_{bf}	2.5	estimated bankfull flow area (ft^2)
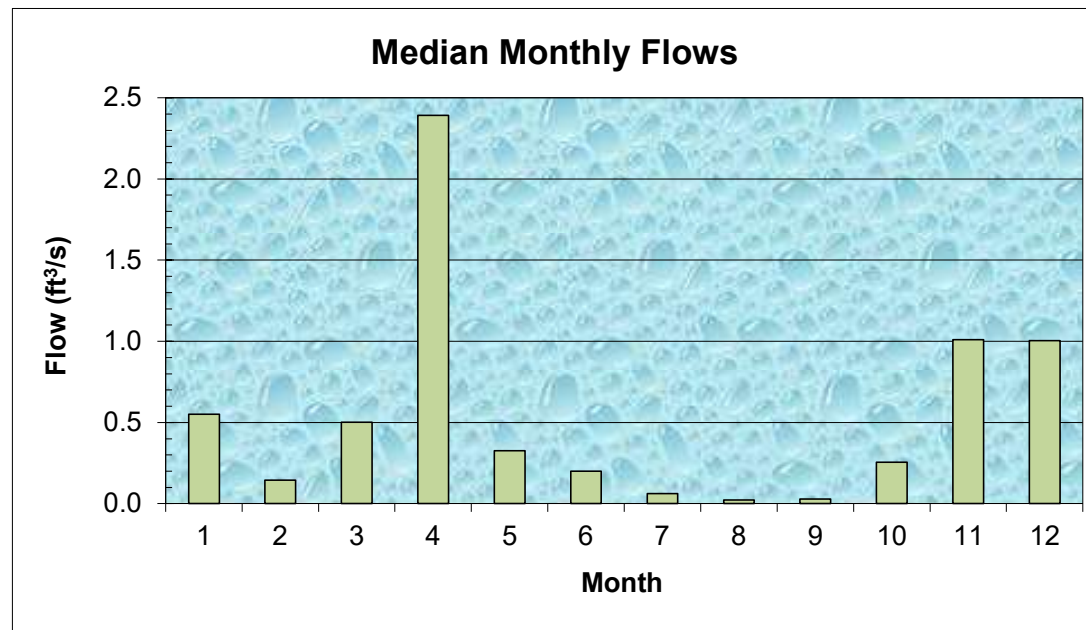
References

Dudley, R.W., 2013. FY2013 Progress Report - Phase 1 …, USFWS QRP Project

Dudley, R.W., 2004. Estimating Monthly Streamflows … , SIR 2004-5026

Dudley, R.W., 2015. Regression Equations for Monthly and Annual Mean..., USGS SIR 2015-5151

Log-Normal Probability Plot
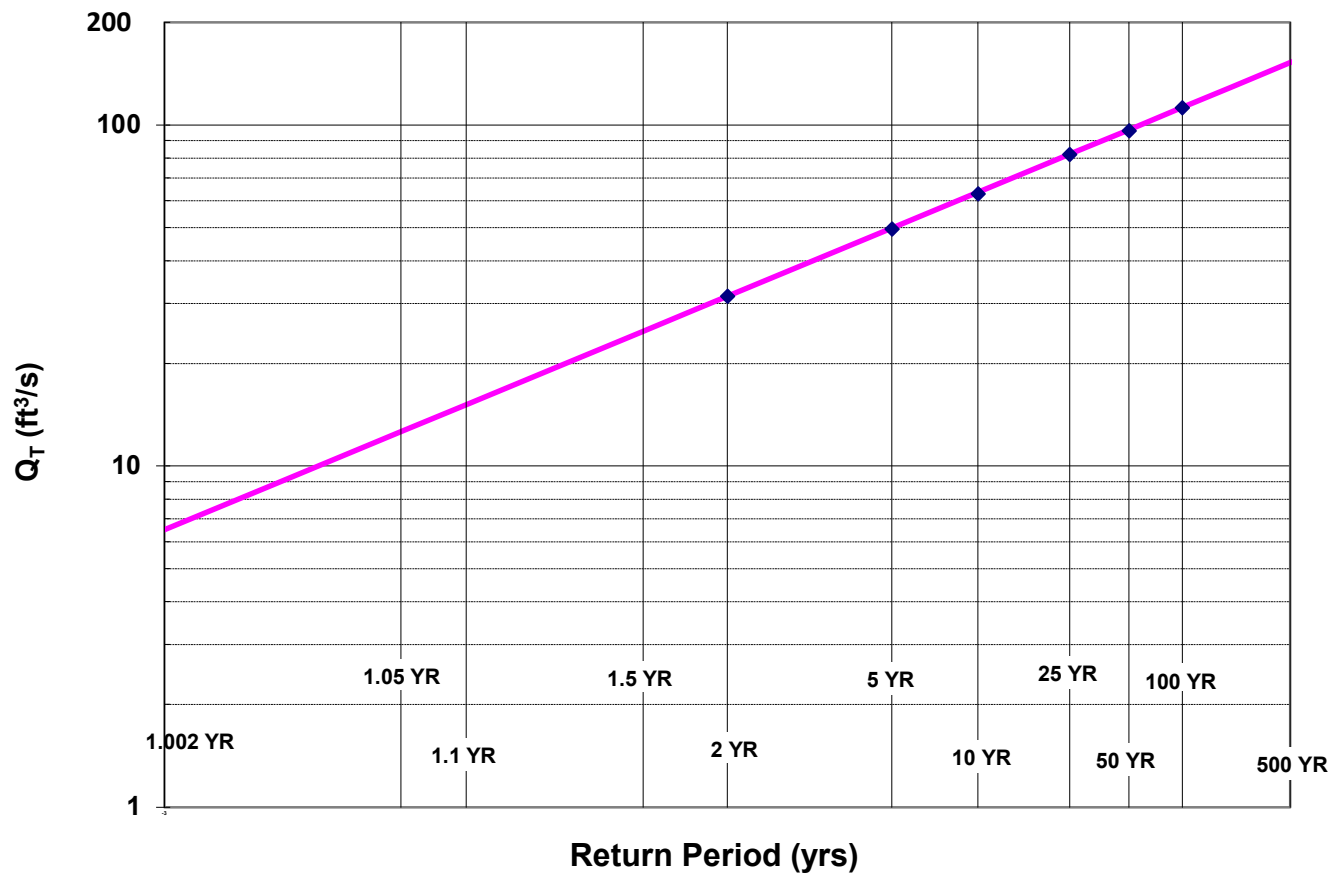
Q_T (ft³/s)

200

100

10

1

1.002 YR

1.05 YR

1.1 YR

1.5 YR

2 YR

5 YR

10 YR

25 YR

50 YR

100 YR

500 YR

Return Period (yrs)

Forest Service
Camp

BM G 78

XC-995797

LC-46554

T 5 R 8 WELS
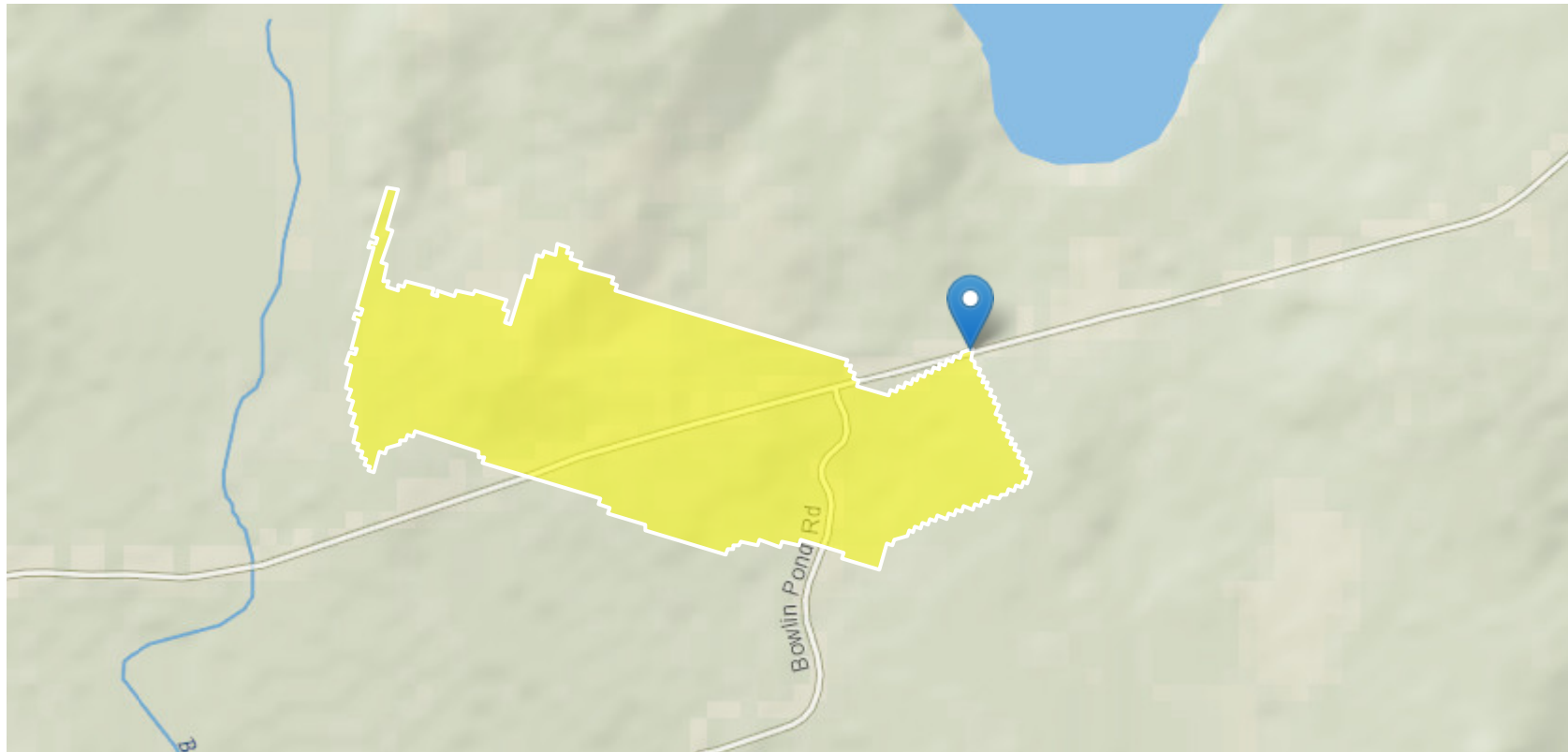
XC-995738

Marble
WL 708 T

Pond

BOAT
RAMP

T6 R8 24247 Grand Lake Rd 46554

Region ID: ME
Workspace ID: ME20190729231510379000
Clicked Point (Latitude, Longitude):   46.12699, -68.72238
Time: 2019-07-29 19:15:31 -0400

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	0.1	square miles
STORNWI	Percentage of storage (combined water bodies and wetlands) from the National Wetlands Inventory	4.53	percent
SANDGRAVAF	Fraction of land surface underlain by sand and gravel aquifers	0	dimensionless
ELEV	Mean Basin Elevation	758.3	feet
BSLDEM10M	Mean basin slope computed from 10 m DEM	3.29	percent
CENTROIDX	Basin centroid horizontal (x) location in state plane coordinates	520920.78	feet
CENTROIDY	Basin centroid vertical (y) location in state plane units	5108083.9	feet
COASTDIST	Shortest distance from the coastline to the basin centroid	143	miles
ELEVMAX	Maximum basin elevation	807.9	feet
LC06WATER	Percent of open water, class 11, from NLCD 2006	0	percent
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	7.47	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	0.2	percent
PRECIP	Mean Annual Precipitation	38.2	inches
SANDGRAVAP	Percentage of land surface underlain by sand and gravel aquifers	0	percent
STATSGOA	Percentage of area of Hydrologic Soil Type A from STATSGO	0	percent

Peak-Flow Statistics Parameters[Statewide Peak Flow DA LT 12sqmi 2015 5049]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.1	square miles	0.31	12

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
STORNWI	Percentage of Storage from NWI	4.53	percent	0	22.2

Peak-Flow Statistics Disclaimers[Statewide Peak Flow DA LT 12sqmi 2015 5049]

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

Peak-Flow Statistics Flow Report[Statewide Peak Flow DA LT 12sqmi 2015 5049]

Statistic	Value	Unit
1.01 Year Peak Flood	2.77	ft^3/s
2 Year Peak Flood	8.63	ft^3/s
5 Year Peak Flood	13.5	ft^3/s
10 Year Peak Flood	17	ft^3/s
25 Year Peak Flood	22.1	ft^3/s
50 Year Peak Flood	25.9	ft^3/s
100 Year Peak Flood	30.2	ft^3/s
250 Year Peak Flood	34.3	ft^3/s
500 Year Peak Flood	40.6	ft^3/s

Peak-Flow Statistics Citations

Lombard, P.J., and Hodgkins, G.A.,2015, Peak flow regression equations for small, ungaged streams in Maine— Comparing map-based to field-based variables: U.S. Geological Survey Scientific Investigations Report 2015–5049, 12 p. (http://dx.doi.org/10.3133/sir20155049)

Annual Flow Statistics Parameters[Statewide Annual SIR 2015 5151]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.1	square miles	14.9	1419
SANDGRAVAF	Fraction of Sand and Gravel Aquifers	0	dimensionless	0	0.212
ELEV	Mean Basin Elevation	758.3	feet	239	2120

Annual Flow Statistics Disclaimers[Statewide Annual SIR 2015 5151]

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

Annual Flow Statistics Flow Report[Statewide Annual SIR 2015 5151]

Statistic	Value	Unit
Mean Annual Flow	0.271	ft^3/s

Annual Flow Statistics Citations

Dudley, R.W.,2015, Regression equations for monthly and annual mean and selected percentile streamflows for ungaged rivers in Maine: U.S. Geological Survey Scientific Investigations Report 2015−5151, 35 p. (http://dx.doi.org/10.3133/sir20155151)

Flow-Duration Statistics Parameters[Statewide Annual SIR 2015 5151]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.1	square miles	14.9	1419
SANDGRAVAF	Fraction of Sand and Gravel Aquifers	0	dimensionless	0	0.212
ELEV	Mean Basin Elevation	758.3	feet	239	2120

Flow-Duration Statistics Disclaimers[Statewide Annual SIR 2015 5151]

Flow-Duration Statistics Flow Report[Statewide Annual SIR 2015 5151]

Statistic	Value	Unit
1 Percent Duration	0.0000561	ft^3/s
5 Percent Duration	0.000654	ft^3/s
10 Percent Duration	0.00261	ft^3/s
25 Percent Duration	0.0228	ft^3/s
50 Percent Duration	0.098	ft^3/s
75 Percent Duration	0.257	ft^3/s
90 Percent Duration	0.623	ft^3/s
95 Percent Duration	1.05	ft^3/s
99 Percent Duration	3.72	ft^3/s

Flow-Duration Statistics Citations

Dudley, R.W.,2015, Regression equations for monthly and annual mean and selected percentile streamflows for ungaged rivers in Maine: U.S. Geological Survey Scientific Investigations Report 2015−5151, 35 p. (http://dx.doi.org/10.3133/sir20155151)

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USGS Product Names Disclaimer: Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

Application Version: 4.3.8

	WIN:	24263.00			Project Name:	
	Town:	T6 R8			Stream Name:	trib to Hay Lake
	Route No.	Grand Lake Rd			Bridge Name:	
	Asset ID:	995797			Analysis by:	CSH
	Lat:	46.12788	Long:	68.71753	Date:	7/29/2019

Watershed area by manual delineation, other parameters from StreamStats

Peak Flow Calculations by USGS Regression Equations (Hodgkins, 1999 & Lombard/Hodgkins, 2015)

Enter data in blue cells only!

	km^2	mi^2	ac		
A	1.30	0.50	320.0	Watershed Area *DRNAREA*	Enter data in [mi^2]
W	0.06	0.0	16.0	Wetlands area (by NWI)	

ver. 2018 Jul 09

Worksheet prepared by:
Charles S. Hebson, PE
Environmental Office
Maine Dept. Transportation
Augusta, ME 04333-0016
207-557-1052
Charles.Hebson@maine.gov

P_c	521432 5107522	watershed centroid (E, N; UTM 19N; meters)
County	Aroostook S	*choose county from drop-down menu*
pptA		mean annual precipitation (inches; by look-up)
A (km^2)	1.30 Conf Lvl 0.7	
W (%)	5.00	NWI Wetlands % *STORNWI*

References:
Hodgkins, G.A., 1999.
Estimating the magnitude of peak flows for streams
  in Maine for selected recurrence intervals
WRIR 99-4008, USGS Augusta, ME

Watershed Characteristics for Monthly & Daily Flows

EAVG	737	mean basin elevation (ft)
SLOPE	2.42	mean basin slope (%)
EMAX	808	maximum basin elevation (ft)
WATER	0	percent of drainage basin land cover classified as open water
PRECIP	38.4	mean annual precipitation
SG	0.00	sand & gravel aquifer as decimal fraction of watershed A
HGA	0	mean basin percentage of hydrological soil group A
DIST	143.00	distance from the coast (mi)

Ret Pd	Peak Flow Estimate				
T (yr)	Lower	Q_T (m^3/s)	Upper		Q_T (ft^3/s)
1.1		0.42			14.9
2		0.88			30.9
5		1.38			48.7
10		1.75			61.7
25		2.28			80.4
50		2.67			94.3
100		3.12			110.2
500		4.22			149.1

Lombard, P.J. & G.A. Hodgkins, 2015.
Peak flow regression equations for small, ungaged streams in
  Maine - Comparing map-based to field-based variables
SIR 2015-4059, USGS, Augusta, ME

$Q_T = b \times A^a \times 10^{-wW}$

Log-Normal Probability Plot

DO NOT ENTER ANY DATA ON THIS PAGE; EVERYTHING IS CALCULATED

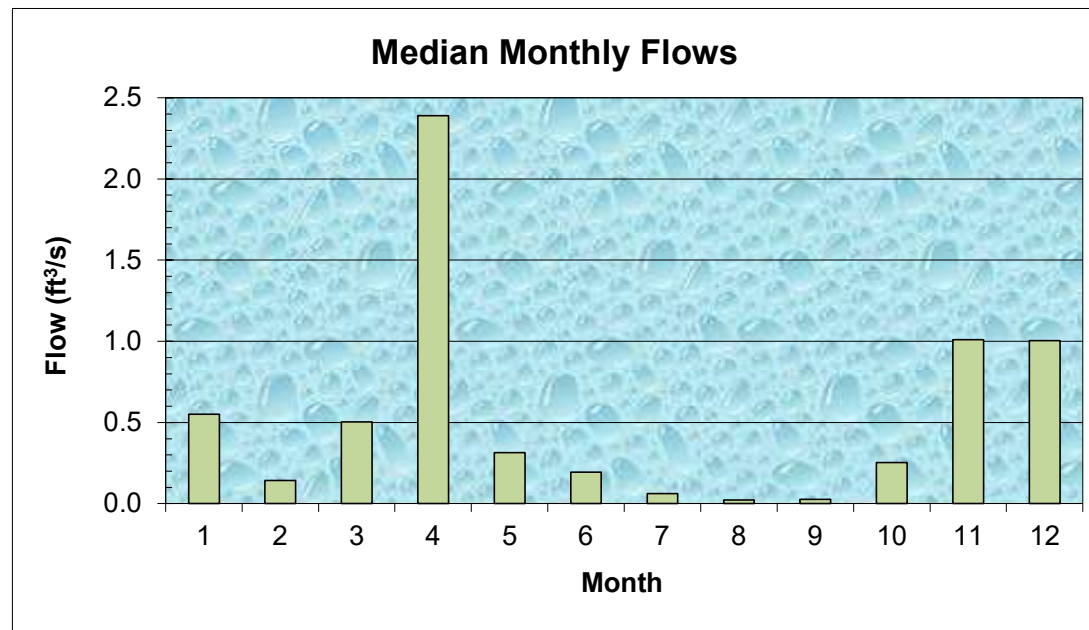**MAINE MONTHLY MEDIAN FLOWS and HYDRAULIC GEOMETRY BY USGS REGRESSION EQUATIONS (2004, 2013, 2015)**

Value		Variable	Explanation
	0.50	A	Area (mi^2)
521432	5107522	P_c	Watershed centroid (E,N; UTM; Zone 19; meters)
	141.96	$DIST$	Distance from Coastal reference line (mi)
	38.4	$pptA$	Mean Annual Precipitation (inches)
	0.00	SG	Sand & Gravel Aquifer (decimal fraction of watershed area)

Month	Q_{median}	
	(ft3/s)	(m^3/s)
Jan	0.55	0.0156
Feb	0.14	0.0040
Mar	0.50	0.0143
Apr	2.39	0.0677
May	0.31	0.0089
Jun	0.19	0.0055
Jul	0.06	0.0018
Aug	0.02	0.0006
Sep	0.03	0.0008
Oct	0.25	0.0072
Nov	1.01	0.0286
Dec	1.00	0.0284

Median Monthly Flows

Q_{bf}	2.5	
ann avg	1.3	
ann med	0.5	
$Q_{1.002}$	6.4	
$Q_{1.01}$	8.7	
$Q_{1.05}$	12.4	
Q_{bf}	14.7	assume v = 4ft/s

W_{bf}	7.9	estimated bankfull width (ft)
d_{bf}	0.5	estimated bankfull depth (ft)
A_{bf}	2.5	estimated bankfull flow area (ft^2)

References

Dudley, R.W., 2013. FY2013 Progress Report - Phase 1 …, USFWS QRP Project

Dudley, R.W., 2004. Estimating Monthly Streamflows … , SIR 2004-5026

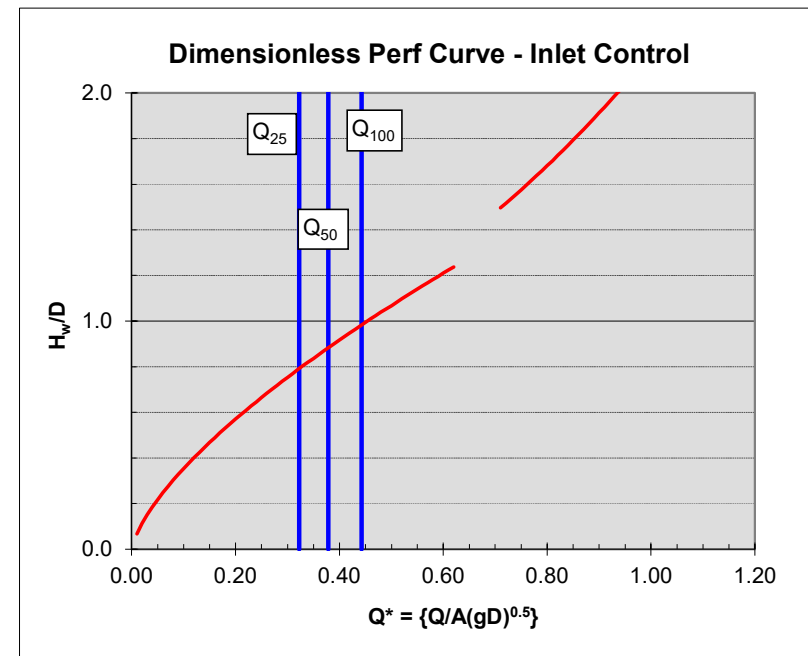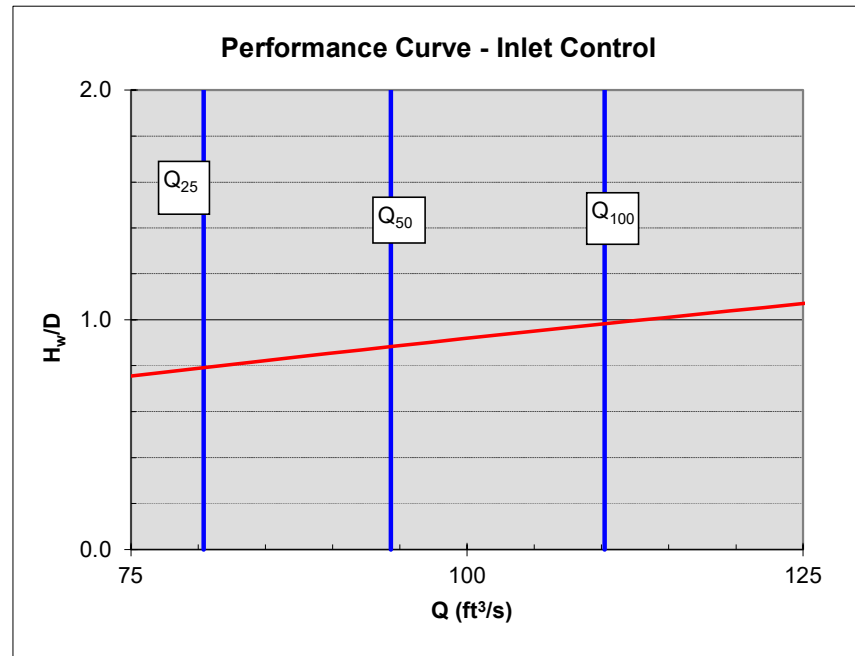Dudley, R.W., 2015. Regression Equations for Monthly and Annual Mean..., USGS SIR 2015-5151

Preliminary Culvert Sizing - Round & Box Culverts

Shape:	Round			
Type:	Box 0 ww	Q_{25}	80.4	
D or R (ft)	5	Q_{50}	94.3	trial D / R = 5.1
w (ft)	15 box width	Q_{100}	110.2	trial w: BFW = 7.9
Slope (ft/ft)	0.02			
A (ft^2)	19.63			
g (ft/s^2)	32.2			

Note:
culvert dimensions are for open flow area; adjust for lost capacity
due to embedding / backfilling (min {2' / 25% rise} embedment)

Performance Curve - Inlet Control

y-axis: H_w/D, x-axis: Q (ft^3/s)

Q25, Q50, Q100

Dimensionless Perf Curve - Inlet Control

y-axis: H_w/D, x-axis: $Q^* = \{Q/A(gD)^{0.5}\}$

Q25, Q50, Q100

Daily Average Flow Distribution

	Daily Avg Flow Dist	
A_{ws} = (mi^2)		0.5
	Q (ft^3/s)	
Pctl	Median	84th pctl
1	0.04	0.08
5	0.08	0.13
10	0.12	0.18
15	0.15	0.22
20	0.19	0.27
25	0.23	0.31
30	0.28	0.36
35	0.33	0.41
40	0.39	0.47
45	0.45	0.53
50	0.52	0.62
55	0.60	0.73
60	0.72	0.85
65	0.84	0.99
70	0.98	1.16
75	1.19	1.39
80	1.49	1.66
85	1.88	2.13
90	2.48	2.86
95	3.69	4.45
99	7.80	10.26

Q_{bf}	2.5
$Q_{1.002}$	6.4
$Q_{1.1}$	14.9
Q_2	30.9
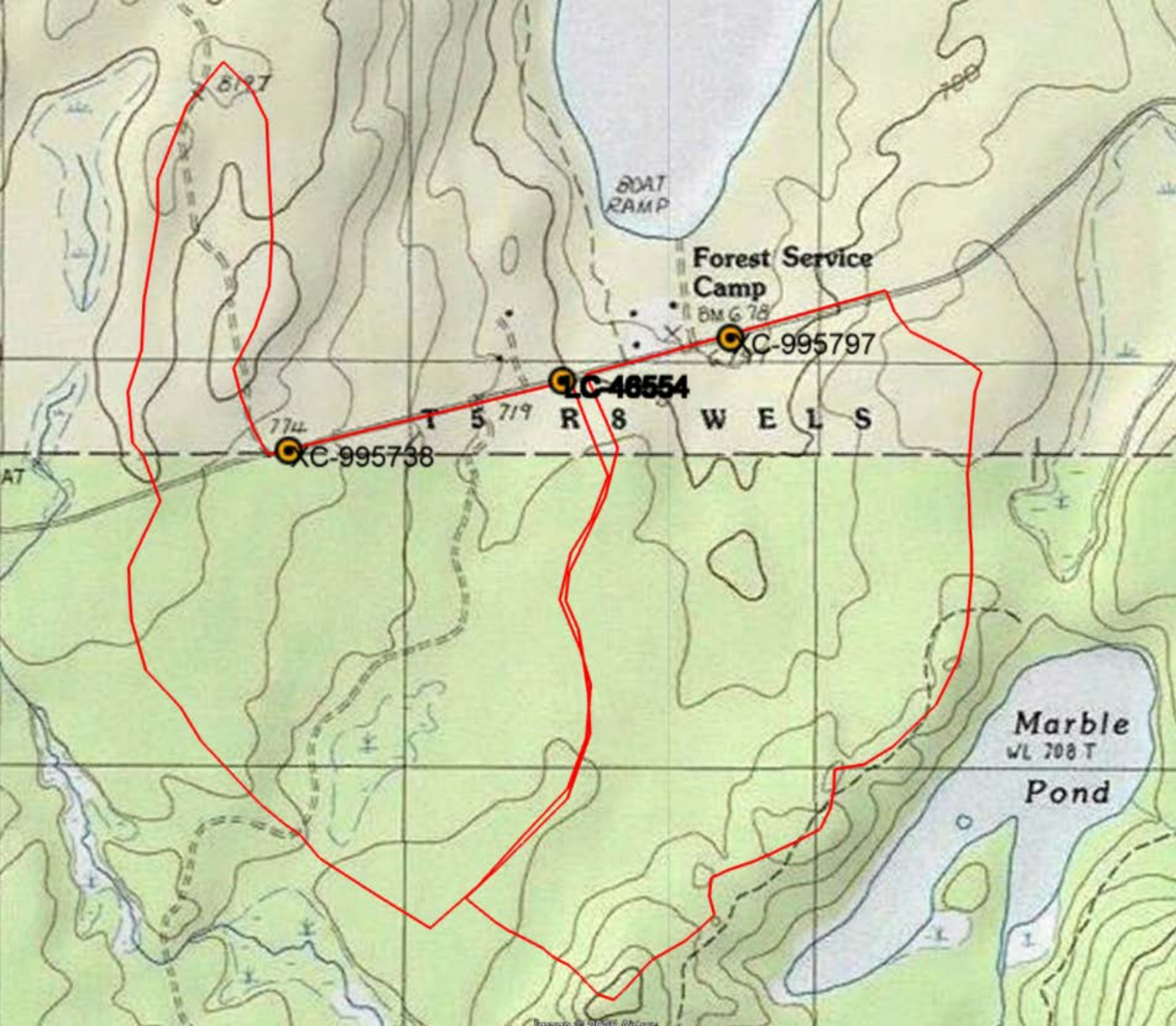
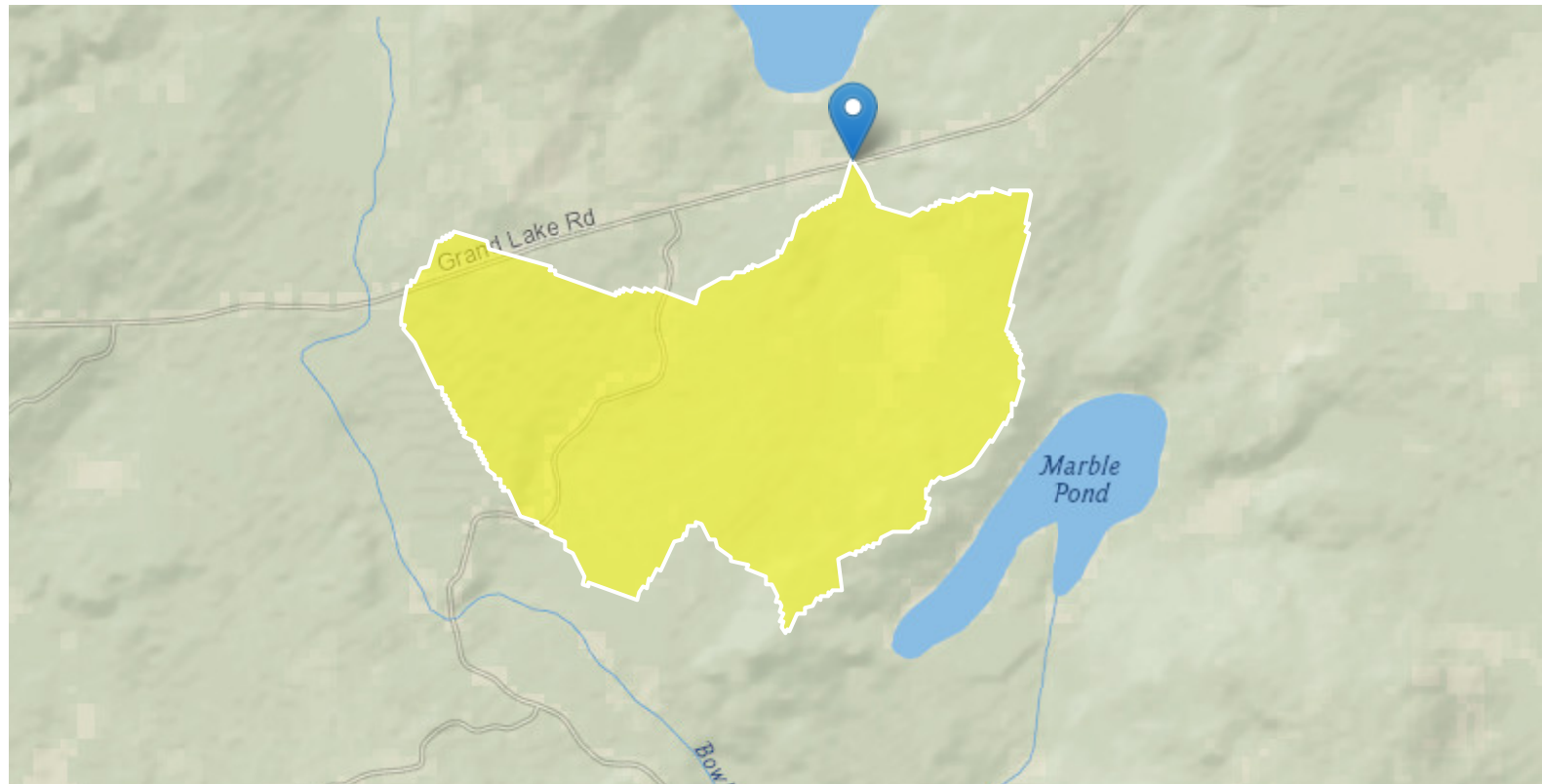# T6 R8 24263.00 Grand Lake Rd 995797

This watershed delineation superceded by manual delineation

Region ID: ME
Workspace ID: ME20190729232757984000
Clicked Point (Latitude, Longitude):   46.12788, -68.71753
Time: 2019-07-29 19:28:21 -0400

Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	0.8	square miles
STORNWI	Percentage of storage (combined water bodies and wetlands) from the National Wetlands Inventory	15.21	percent
SANDGRAVAF	Fraction of land surface underlain by sand and gravel aquifers	0	dimensionless
ELEV	Mean Basin Elevation	737	feet
BSLDEM10M	Mean basin slope computed from 10 m DEM	2.42	percent
CENTROIDX	Basin centroid horizontal (x) location in state plane coordinates	521432.29	feet
CENTROIDY	Basin centroid vertical (y) location in state plane units	5107521.5	feet
COASTDIST	Shortest distance from the coastline to the basin centroid	143	miles
ELEVMAX	Maximum basin elevation	804.2	feet
LC06WATER	Percent of open water, class 11, from NLCD 2006	0	percent
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	2.26	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	0.0432	percent
PRECIP	Mean Annual Precipitation	38.4	inches
SANDGRAVAP	Percentage of land surface underlain by sand and gravel aquifers	0	percent
STATSGOA	Percentage of area of Hydrologic Soil Type A from STATSGO	0	percent

Peak-Flow Statistics Parameters[Statewide Peak Flow DA LT 12sqmi 2015 5049]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.8	square miles	0.31	12

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
STORNWI	Percentage of Storage from NWI	15.21	percent	0	22.2

Peak-Flow Statistics Flow Report[Statewide Peak Flow DA LT 12sqmi 2015 5049]

PIl: Prediction Interval-Lower, PIu: Prediction Interval-Upper, SEp: Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	SEp
1.01 Year Peak Flood	10	ft^3/s	38
2 Year Peak Flood	31.7	ft^3/s	34
5 Year Peak Flood	48.9	ft^3/s	35
10 Year Peak Flood	60.5	ft^3/s	37
25 Year Peak Flood	79	ft^3/s	39
50 Year Peak Flood	90.6	ft^3/s	41
100 Year Peak Flood	106	ft^3/s	42
250 Year Peak Flood	118	ft^3/s	44
500 Year Peak Flood	140	ft^3/s	47

Peak-Flow Statistics Citations

Lombard, P.J., and Hodgkins, G.A.,2015, Peak flow regression equations for small, ungaged streams in Maine— Comparing map-based to field-based variables: U.S. Geological Survey Scientific Investigations Report 2015−5049, 12 p. (http://dx.doi.org/10.3133/sir20155049)

Flow-Duration Statistics Parameters[Statewide Annual SIR 2015 5151]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.8	square miles	14.9	1419

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
SANDGRAVAF	Fraction of Sand and Gravel Aquifers	0	dimensionless	0	0.212
ELEV	Mean Basin Elevation	737	feet	239	2120

Flow-Duration Statistics Disclaimers[Statewide Annual SIR 2015 5151]

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

Flow-Duration Statistics Flow Report[Statewide Annual SIR 2015 5151]

Statistic	Value	Unit
1 Percent Duration	0.00135	ft^3/s
5 Percent Duration	0.0107	ft^3/s
10 Percent Duration	0.0339	ft^3/s
25 Percent Duration	0.209	ft^3/s
50 Percent Duration	0.77	ft^3/s
75 Percent Duration	1.99	ft^3/s
90 Percent Duration	4.66	ft^3/s
95 Percent Duration	7.67	ft^3/s
99 Percent Duration	23	ft^3/s

Flow-Duration Statistics Citations

Dudley, R.W.,2015, Regression equations for monthly and annual mean and selected percentile streamflows for ungaged rivers in Maine: U.S. Geological Survey Scientific Investigations Report 2015–5151, 35 p. (http://dx.doi.org/10.3133/sir20155151)

Annual Flow Statistics Parameters[Statewide Annual SIR 2015 5151]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.8	square miles	14.9	1419
SANDGRAVAF	Fraction of Sand and Gravel Aquifers	0	dimensionless	0	0.212
ELEV	Mean Basin Elevation	737	feet	239	2120

Annual Flow Statistics Disclaimers[Statewide Annual SIR 2015 5151]

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

Annual Flow Statistics Flow Report[Statewide Annual SIR 2015 5151]

Statistic	Value	Unit
Mean Annual Flow	1.99	ft^3/s

Annual Flow Statistics Citations

Dudley, R.W.,2015, Regression equations for monthly and annual mean and selected percentile streamflows for ungaged rivers in Maine: U.S. Geological Survey Scientific Investigations Report 2015–5151, 35 p. (http://dx.doi.org/10.3133/sir20155151)

Low-Flow Statistics Parameters[Statewide LowFlow SIR 2004 5026]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.8	square miles	9.79	1418
SANDGRAVAF	Fraction of Sand and Gravel Aquifers	0	dimensionless	0	0.455

Low-Flow Statistics Disclaimers[Statewide LowFlow SIR 2004 5026]

Low-Flow Statistics Flow Report[Statewide LowFlow SIR 2004 5026]

Statistic	Value	Unit
7 Day 10 Year Low Flow	0.0177	ft^3/s

Low-Flow Statistics Citations

Dudley, R.W.,2004, Estimating Monthly, Annual, and Low 7-Day, 10-Year Streamflows for Ungaged Rivers in Maine: U.S. Geological Survey Scientific Investigations Report 2004-5026, 22 p. (http://water.usgs.gov/pubs/sir/2004/5026/pdf/sir2004-5026.pdf)

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