

**MAINE DEPARTMENT OF TRANSPORTATION
BRIDGE PROGRAM**

**HYDROLOGY
&
HYDRAULICS**

For the Replacement of:

**Hunter Cove Bridge
Over
Hunter Cove
In
Rangeley, Maine**

Bridge #2384

WIN 018955.00

(Excerpted from the Preliminary Design Report)



MaineDOT



HYDROLOGY REPORT

Hunter Cove is approximately 1 mile long and 500' wide on the north side of Rangeley Lake. The cove is separated from the lake by a 500' manmade causeway and Hunter Cove Bridge. Two separate watershed basins enter Hunter Cove above the bridge. The first originates at Round Pond, 2 miles north from Hunter Cove and flows into Dodge Pond before entering the lake through Dodge Pond Stream. The second basin begins at Quimby Pond and runs through Quimby Brook for 1.2 miles before entering the cove. The total watershed area is 21.2 sq miles with 11% wetlands.

The Rangeley Lake is controlled by Oquossoc Dam before running into the Rangeley River. The Rangeley River runs 1.5 miles and empties into Mooselookmeguntic Lake. Average lake elevations obtained from Oquossoc Dam vary from a low of 1515' in March to a high of 1518' in June.

The Drainage Basin Characteristics for Mingo Loop Road over Hunter Cove in Rangeley were provided by the Maine Department of Transportation Office of the Environment-Hydrology Section. The flows were computed using the 1999 USGS full regression equation. No other flow data is available such as gage data or existing studies. Therefore the hydrology data was used as provided and as follows:

SUMMARY

Drainage Area	21.2	mi ²
Q1.1	282.4	ft ³ /s
Q10	1071.8	ft ³ /s
Q25	1361.8	ft ³ /s
Q50	1587.9	ft ³ /s
Q100	1829.8	ft ³ /s
Q500	2423.2	ft ³ /s

Reported by: Hjelm, Tyler J

Date: October 7, 2016

HYDRAULIC REPORT

The hydraulic analysis of this bridge location consisted of a qualitative study of information from a number of sources including FEMA, Oquossoc Dam, USGS and the existing plans. The conventional practice of developing a comprehensive quantitative model in HEC-RAS was not conducted because backwater condition from Rangeley Lake controls the hydraulics at the site.

The hydraulic investigation found that Hunter Cove is under backwater from Rangeley Lake for the following reasons:

In a FEMA Flood Insurance Study for the Town of Rangeley, flood profiles were provided for Dodge Pond Stream. The profiles show backwater from the lake approximately 300 feet upstream of the confluence with the lake at all flood frequencies including 10, 50, 100 and 500 year events. Since the confluence of Rangeley Lake and Dodge Pond Stream is in Hunter Cove, Hunter Cove Bridge must also be in the backwater. The historic Oquossoc Dam lake elevations are consistent with the FEMA base flood elevation of 1520' (NGVD); the highest lake recorded surface elevation was 1519.5' in 1984 (presumably NGVD).

The existing plans specifically note that the cove water surface elevation is the same as the lake elevation.

At the preliminary public meeting, several residents that lived on Hunter Cove confirmed that the headwater elevations in Hunter Cove are never noticeably different from the lake and that velocities are low through the bridge.

After reviewing the available hydraulic information, the Department is confident that the backwater condition creates predictable headwater elevation at the bridge, therefore no variation in hydraulic behavior between existing and proposed bridge configurations is considered in this report. The proposed bridge will have a low chord elevation of 1522.5' which results in approximately two and a half feet of freeboard from the FEMA base flood elevation and about four and half feet of freeboard from average annual high water elevations (in June).

The survey of the site revealed scour holes upstream and downstream of the bridge. The upstream hole is approximately 4 feet deep by 90 feet long. The channel elevation rises directly under the bridge before entering a second, more elongated scour hole. This hole is approximately 3 feet deep and 250 feet long. Velocities are not expected to be high at the site, due to the backwater from Rangeley Lake and relatively low flows. The scour has likely occurred at times when lake elevations are low, eliminating the backwater effects from the lake and increasing velocities through the bridge. In flood events, lake elevations will rise and re-create backwater condition.

The bridge abutments have remained well protected through its 77 year life, and little scour has taken place directly under the bridge. The longer proposed span length and increased bottom channel width will lower velocities through the bridge compared to existing conditions. Still, the proposed channel slopes will be 2:1 and armored with heavy rip rap to protect the pile supported abutments. If there were to be additional channel scour through the bridge, the riprap could be undermined and settle. In this case, the slopes may steepen and there may be some localized washouts around the abutments. It was felt that this was a low risk situation for a low volume, HCP 5 road.

SUMMARY

From FEMA Flood Insurance Study (NAVD 88)

		Existing Structure	Recommended Structure
		65' Span	78' Span
Total Area of Waterway Opening	ft ²		
Headwater elevation @ Q ₁₀	ft	1518.7	1518.7
Headwater elevation @ Q ₅₀	ft	1519.1	1519.1
Headwater elevation @ Q ₁₀₀	ft	1519.4	1519.4
Headwater elevation @ Q ₅₀₀	ft	1519.9	1519.9

*Note: the adjustment from the NGVD of 1929 to the NAVD of 1988 is -0.430 feet