

## *Project Note:*

# *2007 Lake L9323 Monitoring and Analysis*

### *Introduction*

ConocoPhillips withdraws water from Lake L9323 for its Alpine operations. Water withdrawal is authorized by the Alaska Department of Natural Resources, Fish Habitat Permit FH03-111-0380. This study was done to satisfy corrective actions outlined in the February 21, 2007 letter from ADNR regarding over withdrawal of water from the Lake. The corrective actions required winter water quality monitoring and documentation of lake recharge during spring breakup. Results of the recharge monitoring are presented in this project note. The results of the winter monitoring were presented in a separate project note dated March 2007.

### *Methods*

Water surface elevations were collected at three different times, winter, pre-, and post-breakup. Water surface elevation surveys were conducted once in February and throughout spring breakup. A standard level loop survey was tied to local temporary benchmarks (TBMs) in order to determine water surface elevation. Each TBM was tied to the British Petroleum Mean Sea Level (BPMSL) datum. TBM locations are identified in Figure 1. Kuukpik/LCMF provided survey assistance and basis of elevations for the local benchmarks.

Water surface elevations were calculated by subtracting the measured freeboard (the distance from the top of ice to the water surface in the sample hole) from the elevation of the ice surface. An electric drill was used to auger a 2-inch (minimum) sample hole through the ice. Freeboard, was measured using a graduated pocket tape.

During open water conditions, water surface elevations were monitored using a graduated stream staff gage tied to local TBMs. The staff gage was located at the outlet of a shallow swale connecting a slough of the Nigliq channel to Lake L9323 (Figures 2 & 3). Support

steel used to set the gage was chalked to capture the peak water surface elevation. Additional gages located at each culvert battery on the CD4 access road were also observed to identify recharge at the eastern lake basin.

Aerial observations of lake water recharge via local melt and the spring floodwaters were conducted with the support of Maritime Helicopters. Ground observations were performed to identify recharge flows and hydraulic connectivity to local floodwaters.



Figure 1: Lake L9323 with stream staff gage and temporary bench marks (TBMs) used to identify water surface elevations. Aerial image provided by Aeromap US Inc., from photography flown in 2006.



Figure 2: Southward facing image of Lake L9323 and CD4 facility taken June 9, 2007.

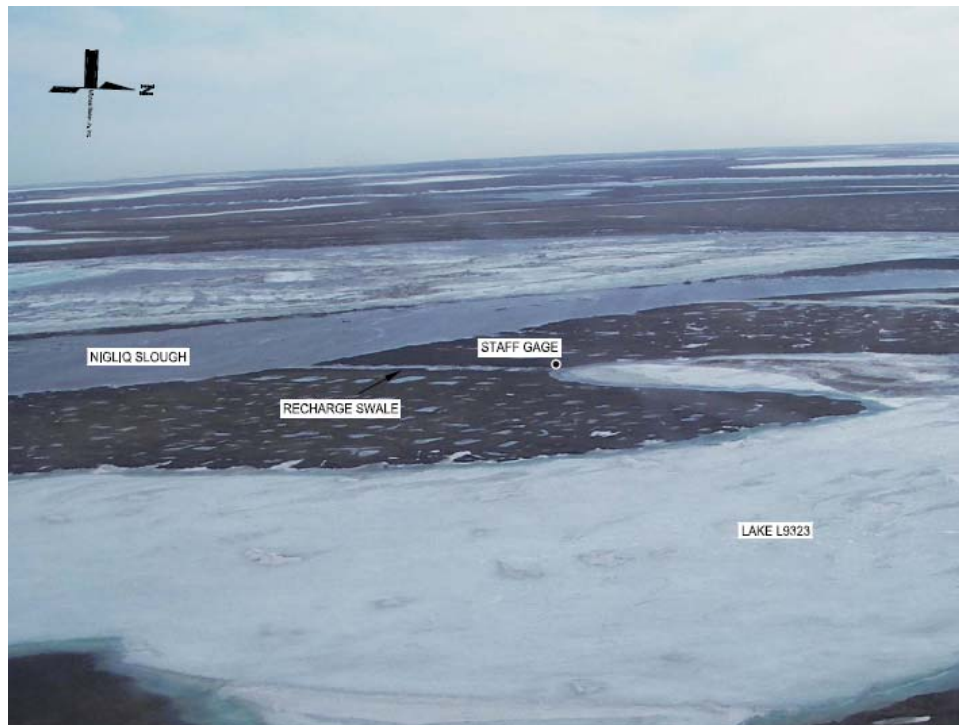


Figure 3: Western recharge swale of Lake L9323 taken June 4, 2007.

## Results

Water surface elevation data are presented in Table 1. An initial WSE of 7.82 feet was surveyed in February 2007. Local snow depth on lake ice was shallow and sporadic with portions of ice exposed. On May 12 a pre-breakup WSE was measured at 7.84 feet. The small rise in WSE could be attributed to significant snow deposition from an early May snow storm.

Date	Elevation (ft)	Notes
2/27/2007	7.82	Ice cover sporadically exposed due to limited snow cover
5/12/2007	7.84	Recent snow deposition on lake ice
6/4/2007	9.66	Peak recorded water surface elevation (approximate date)
6/5/2007	9.42	Recharge water draining back into Nigliq channel slough
6/10/2007	8.46	Recharge water draining into Lake M9525

Table 1 Lake L9323 observed water surface elevations (BPMSL)

Floodwater recharge of L9323 was first observed on June 4. A small ice jam on the Nigliq Channel increased local water surface elevations, directing water overbank into the west recharge swale and south CD4 culvert battery (Figure 4). Recharge via the Nigliq Channel floodwaters resulted in a peak lake water surface elevation of 9.66 feet. By the morning of June 5 water was draining back into the Nigliq Channel via the recharge swale. Additional drainage was observed through the north CD4 culvert battery from L9323 into Lake M9525 (Figure 5). By June 6 L9323 was hydraulically disconnected from the Nigliq Channel. Lake ice was intact throughout the monitoring event with recharge water surrounding the entire lake periphery. A water surface elevation was surveyed at 8.46 feet on June 10.

## Discussion

Lake L9323 was fully recharged via spring breakup floodwaters. This was determined based on an observed rise and fall in water surface elevation via swales connecting the eastern and western basins of L9323. Recharge of the lake occurred over a period of approximately 36 hours before the lake became disconnected (hydraulically) from the Nigliq Channel. An estimated bankfull water surface elevation of 8.46 feet (BPMSL) was measured on June 10. Water continued to drain from L9323 into M9525 as of June 20, suggesting a lower late-season bankfull water surface elevation



Figure 4: South culvert battery (out of picture) flow entering Lake L9323(June 4, 2007)



Figure 5: Lake L9323 from north Culvert battery (June 4, 2007)