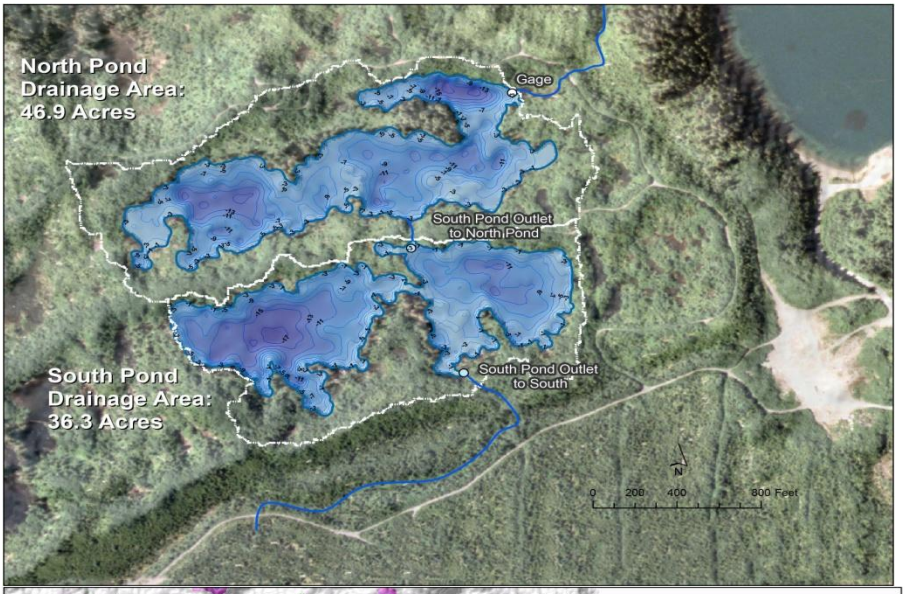
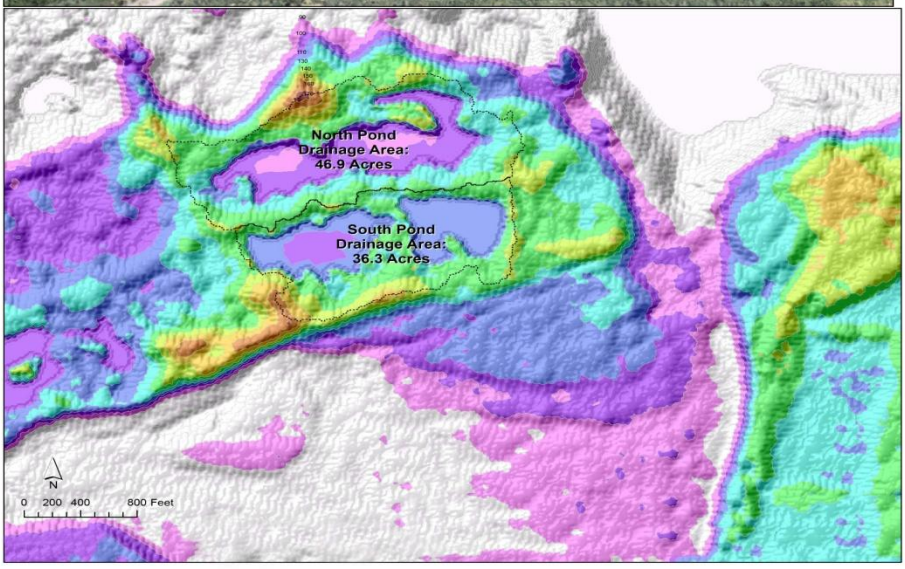
DISCHARGE MEASUREMENTS AND MAPS OF THE SAWMILL COVE SPRINGS NEAR YAKUTAT, ALASKA





PREPARED FOR THE

YAKUTAT REGIONAL AQUACULTURE ASSOCIATION

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DRAFT

This report is in draft format and portions of the report have not been adequately reviewed. Results have not be adequately checked or reviewed and the contents should not be cited.

INTRODUCTION

Alaska Hydroscience has been conducting hydrologic investigations for the Yakutat Regional Aquaculture Association (YRAA) since April 2014. These investigations were conducted to locate a suitable water source for a proposed fish hatchery. Thus far the most promising water source examined is an array of groundwater springs emerging along the beach at Sawmill Cove north east of Yakutat. Maps and detailed descriptions of these springs, as well as discharge measurements were delivered in a previous memo to the YRAA in October of 2015. The following memo provides bathymetric and drainage area maps of two large kettle ponds located upslope of the array of groundwater springs. The maps provided were generated from a digital elevation model combined with bathymetric surveys conducted in April of 2016. The maps further provide a survey of the drainage network associated with the kettle ponds.

PURPOSE

Despite abundant precipitation in the Yakutat region, non fish bearing sources of water for hatchery operations are not readily available. Thus far several sites have been investigated and estimates of continuous water availability have been inadequate for the desired project needs. The springs emerging along the beach at Sawmill Cove appear to be a potential candidate for project development, however, their distributed configuration combined with a short monitoring period present difficulties in accurately estimating water availability. The kettle ponds above Sawmill Cove were examined as a potential supplemental or backup water source for hatchery operations. The bathymetry and drainage surveys should provide reasonable estimates of annual discharge from the ponds as well as storage capacity should the water be needed as a secondary water supply.

SETTING AND SURVEY OBJECTIVES

The study site consists of two 20 acre kettle ponds located just above Sawmill Cove (figures 1-3). At the time of the survey the south pond was draining in two directions; north into the north pond and south west. The north pond was found discharging to tidewater after flowing a short distance. In addition to providing a bathymetric survey to determine the volume of the ponds, a temperature probe mooring was installed near the north pond outlet. Discharge measurements were conducted on April xx and May xx, and July xx, 2016 at the north pond outlet. An additional discharge measurement of the north pond outlet was conducted on May xx, 2016 to determine and additional flow contribrution from groundwater

discharge. On May xx a transducer was installed near the pond outlet to track changes in stage of the north pond.

Water chemistry field parameters including dissolved oxygen, pH, specific conductivity, and water temperature were collected during the site visits.

Bathymetric Survey

The bathymetric survey was conducted on site in April of 2016. 1,150 bathymetric soundings were collected for the North and South Sawmill Cove Ponds. Soundings were collected using a portable Lowrance Elite Series depth sounder and global positioning system (GPS). GPS waypoints and associated depth soundings were exported to a computer where they were processed using both Global Mapper and ESRI GIS software. Elevation and surface data were processing using Global Mapper. Depth soundings were interpolated to a continuous surface. Reports, maps and final data were stored in ESRI ArcGIS software version 10.4 in a file geodatabase. Horizontal accuracy of the soundings is approximatly 10 m. Vertical accuracy of the soundings was verified with a weighted fiberglass tape over a range of depths. The bathymetric maps of the ponds are shown in figure x.

Elevation Data and Drainage Area Determination

Lake surface elevation was extracted fro the 2014, IfSAR, Bare-earth DEM (DTM), 5M resolution (http://ifsar.gina.alaska.edu/). Depths were converted to elevations based on the elevation of the lake surface in IfSAR. A local vertical datum was established to monitor stage changes and estimate discharges of the north pond. The local datum is referenced to three reference marks, two of which are lag bolts in trees near the north pond outlet. The third reference mark is a steel pin driven into the bed of the pond.

Table 1. Showing surface area, elevation, maximum and average depths, volume, and drainage areas of the North and South Sawmill Cove Ponds.

	Surface Area (Acres)	**Surface Elevation** (ft)	**Depth** (ft)		**Volume** (ft^3)	**Drainage Area** (Acres)
			Max	**Average**		
North Pond	20.63	109	18.4	7.60	6,829,685	46.9
South Pond	20.04	119	18.9	8.02	7,000,998	36.3
Total	40.67				13,830,683	83.2

Vertical Datum Source: IFSAR DTM (5m) http://ifsar.gina.alaska.edu/

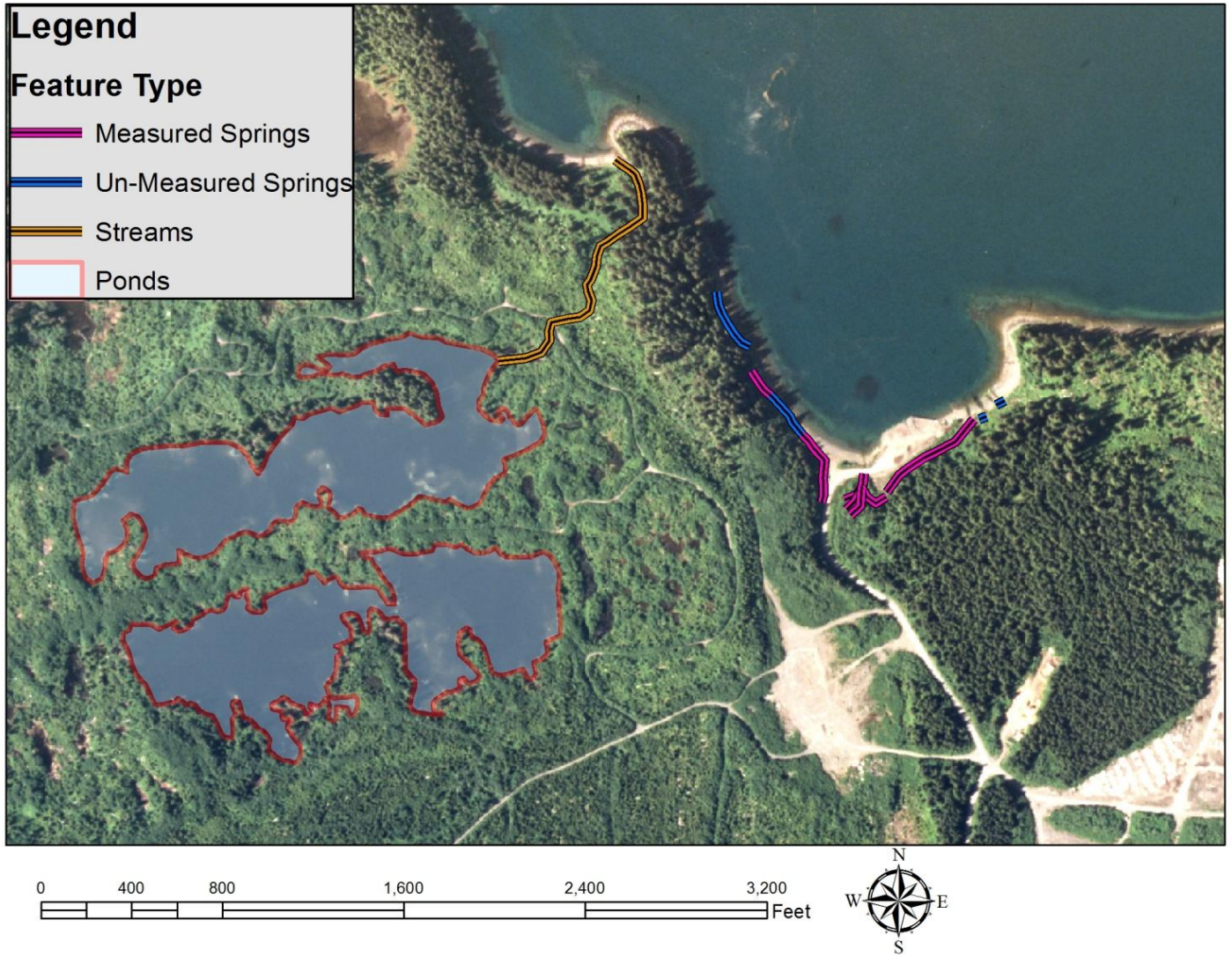

Figure 1. Map of the study area showing Sawmill Cove springs, kettle ponds, and outlet stream to the west.

Discharge Estimates

To obtain estimates of mean discharge from the ponds I compared runoff values from gaged streams in the Yakutat area (Table 1). I disregarded the elevated runoff values from the Ahrnklin River as this gage is furthest away from the study area and drains a more elevated region. Table 2 suggests annual runoff from the study area might range between 87 and 121 inches or 7.25 to 10.1 feet. The combined watershed area of both ponds is approximately 83.2 acres or 3,624,192 ft^2. When the drainage area is multiplied by the runoff (both 87 and 121 inches), estimates of annual mean discharge ranging from 0.83 to 1.16 ft^3/s or 370 to 520 gallons per minute.

Table 1. Showing station numbers, drainage area, periods of gage record, mean annual runoff, and location of stream gages near Yakutat, Alaska.

Stream	USGS Station Number	Drainage Area (mi^2)	Period of Record (MM/YY)	Runoff (inches)	Latitude	Longitude
Situk River	15129500	36	5/88-present	115	59.5861	-139.4947
Ophir Creek	15129600	2.5	10/91-9/12; 10/13-9/15	87	59.5239	-139.7436
Old Situk River	15129510	4.78	6/03-9/06	121	59.5705	-139.4383
Ahrnklin River	na	31.2	11/13-present	195[1]	59.4607	-139.1027
Lost River	na	10.9	10/06-9/11	105	59.4783	-139.5986
West Fork Situk River	na	9.5[2]	8/05-10/06	nd	59.5922	-139.4936

[1] Data are provisional; [2] Drainage area estimated for the West Fork Situk River.

Discussion

At the time of the bathymetric survey drainage from the ponds was in two directions. The South Pond had an outlet that drains to the south and west. During the May visit the water in this stream traveled a short distance, gradually losing all surface flow (figure 2). The other outlet of the south pond flows into the north pond over a short distance. Both outlets of the south pond are blocked by beaver dams. Removal of the beaver dam from the south outlet would likely result in most or all of the drainage being redirected to the north pond and ultimately discharging to tidewater.

The outlet of the North Pond is also blocked by a beaver dam. After flowing over the beaver dam it flows through an area of low relief for about 300 feet before flowing down a steep face. At the toe of the slope the stream gradient is low and it appears to provide a short Anadromous reach. During my visit in April 2016 I noticed several schools of what appeared to be juvenile pink salmon. This was an assumption and no fish were accurately identified to the species level. However, the presence of salmonid fry suggests that during some winters the flow may be continuous and of suitable water quality for fish propogation. Discharge measurements taken at the north pond outlet and just above tide water suggest little additional groundwater contribution to the stream discharge.

The DEM generated from the IfSAR data suggests another potential discharge location at the west end of the North Pond (figure 3). Although no stream was identified at this location at the time of the survey

it is possible that there was streamflow out of the North Pond at this location. The banks of both ponds are heavily vegetated and it was not practical to walk the entire perimeter at the time of the survey. It is also possible that surface flow discharges from the west end of the North Pond only during periods of elevated water levels.

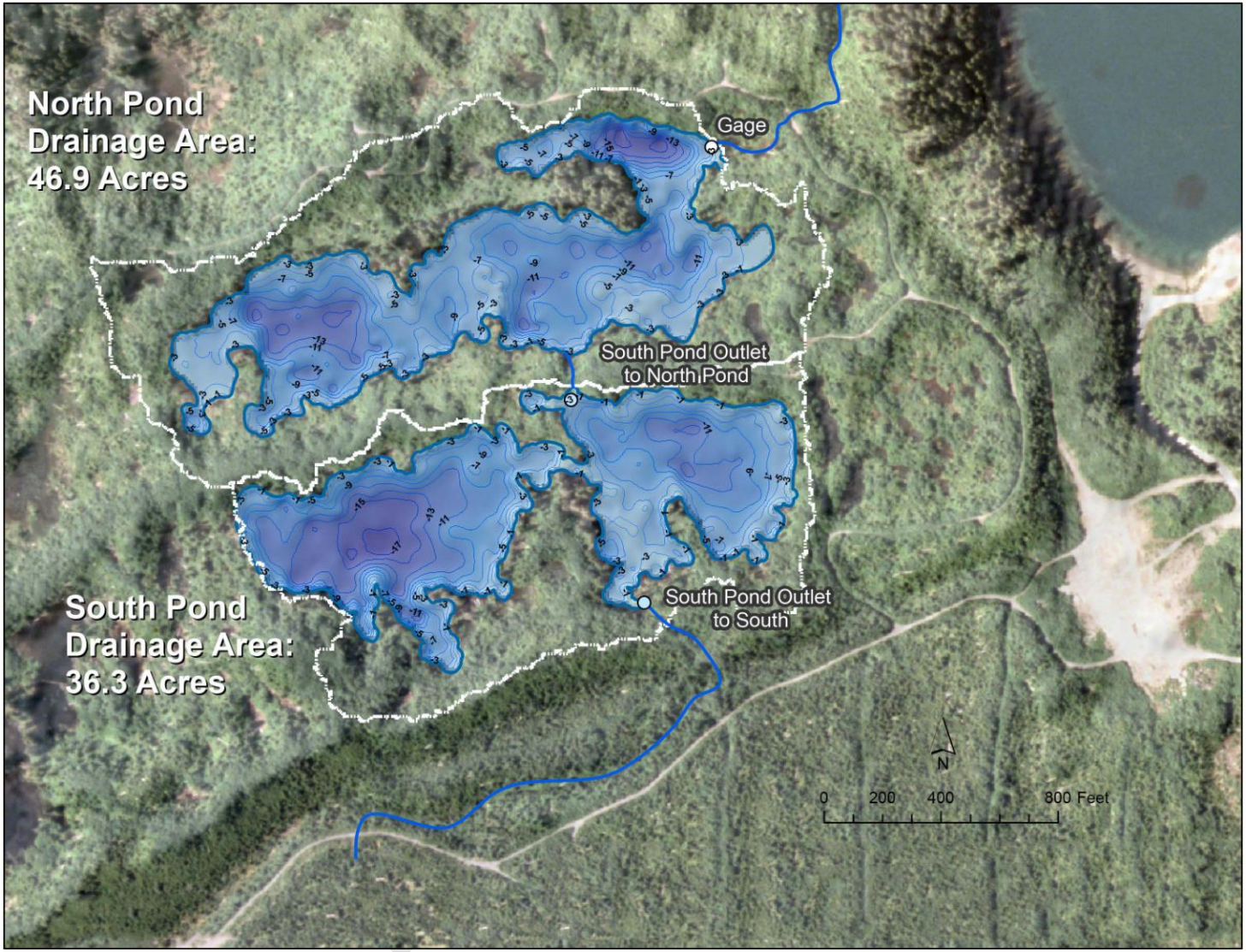

Figure 2. Map of the North and South Sawmill Cove Ponds including the drainage areas of both ponds and the drainage network.

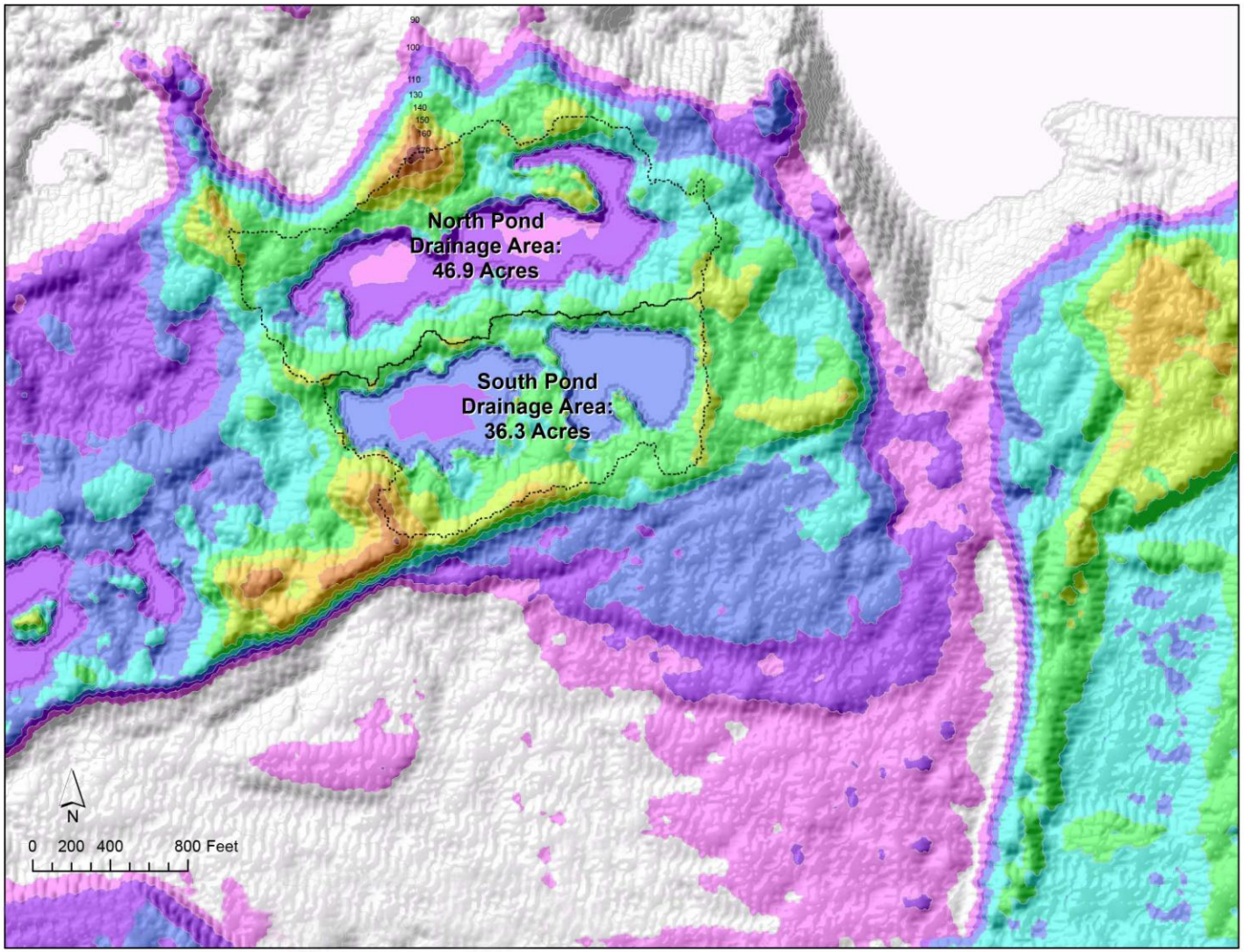

Figure 3. Map of the DEM generated using the IfSAR data and the drainage area estimates for both the North and South Sawmill Cove Ponds.