# Appendix B

# Capitol Lake Designated Use Evaluation

# APPLICABLE DESIGNATED USE EVALUATION FOR CAPITOL LAKE

The Environmental Protection Agency weighed multiple factors in its determination of the applicable aquatic life designated use for Capitol Lake. This determination was necessary to ensure the Deschutes River is protective of downstream water quality standards in Capitol Lake for the development of the mainstem dissolved oxygen (DO) TMDLs. Capitol Lake does not have a site-specific aquatic life designated use and multiple designated uses exist for lakes and freshwaters. Thus, EPA conducted this separate analysis of the unique factors that exist for Capitol Lake in order to determine which aquatic life designated use was most appropriate.

First, EPA determined that it would be technically infeasible to apply the narrative standard found at WAC 173-201A-200 (1)(d)(ii):

> *For lakes, human actions considered cumulatively may not decrease the dissolved oxygen concentration more than 0.2 mg/L below natural conditions.*

This standard relies on the ability to establish a natural condition for the waterbody. However, as an artificial lake, Capitol Lake's natural condition cannot be evaluated without removing the dam, in which case it would be part of Budd Inlet rather than a lake.

EPA similarly determined that Washington's core summer salmonid habitat designated use does not apply to Capitol Lake. WAC 173-201A-600(1)(a)(ii) provides:

> *(a) Additionally, the following waters are also to be protected for the designated use of core summer salmonid habitat:*
>
> *…*
>
> *(ii) All lakes and all feeder streams to lakes (reservoirs with a mean detention time greater than fifteen days are to be treated as a lake for use designation);*

Where WAC 173-201A-020 defines "lakes" as:

> *"Lakes" shall be distinguished from riverine systems as being water bodies, including reservoirs, with a mean detention time of greater than fifteen days.*

And WAC 173-201A-020 defines "mean detention time" as:

> *"Mean detention time" means the time obtained by dividing a reservoir's mean annual minimum total storage by the thirty-day ten-year low-flow from the reservoir.*

EPA calculated the detention time of Capitol Lake based on the above definitions. In its Quality Assurance Project Plan (Roberts et al., 2004) for the *2015 Deschutes TMDLs*, Ecology calculated the detention time using the estimated lake volume for Capitol Lake of 1800 acre-feet (which translates to 7.84E+07 cubic feet), derived from a CH2MHill report (2001), along with the 30Q10 flow from 1991-2001 of 59.78 cfs.. The 30Q10 flow was obtained from daily discharge flows measured at the U.S. Geological Survey's Deschutes River at E Street gage (12080010) (the raw data can be obtained at this link).

EPA updated the volume of the lake based on bathymetry data collected in January 2020 by the Washington State Department of Enterprise Services (DES). EPA also updated the time period used to derive the 30Q10 flow to span from 2000 - 2019. EPA calculated the 30Q10 using USGS's SWToolbox, which had flow gage data through September 2019. The 30Q10 flow is 62.16 cfs, and the detention time is 14.25 days. A more detailed description of the methods EPA used to calculate the lake volume and detention time is included in the following paragraphs.

To calculate a new volume for the lake, EPA conducted a geospatial analysis using aerial imagery and the DES bathymetry data. DES provided the bathymetry data to EPA in an excel spreadsheet file with location coordinates (latitude and longitude) and associated depths. DES provided both 1 foot and 10 foot resolution data, and EPA used the 10 foot data in this analysis. EPA used ArcGIS 10.3 to conduct the analysis. Each of the lake segments (i.e., North, Middle, South and River, Percival Cove) were calculated separately. The following steps were used:

1. Aerial imagery was obtained by using the "Add Basemap" feature of ArcGIS. This was used to digitize the lake boundary at approximately a 1:2000 scale.
2. The lake boundary was verified against the bathymetry data to ensure that none of the measured bathymetry depth points were excluded by the boundary.
3. The lake boundary representing the shoreline was combined with the bathymetry data. All shoreline data points were set to a depth of zero.
4. ArcGIS was used to convert the combined bathymetry and shoreline data points to a raster grid representing the measured depths in the lake.
5. The Surface Volume tool was used to calculate the volume from the raster grid. Each of the different lake segment volumes were added together to obtain a total lake volume of 7.65E+07 cubic feet.

EPA used this equation to calculate the detention time:

$$\text{Detention time} = \left(\frac{7.65\text{E+07 cubic feet } [volume]}{62.16 \text{ cfs } [30Q10\ flow]}\right) * \left(\frac{1}{86400\ [conversion\ factor]}\right) = 14.25 \text{ days}$$

Because the detention time of Capitol Lake is less than 15 days, it does not meet the definition of a lake found at WAC 173-201A-020. Thus, EPA did not apply the core summer salmonid habitat designated use to the lake. EPA also did not apply the core summer salmonid habitat designated use to "feeder streams" to the lake (i.e., Percival Creek and Black Lake Ditch).

Finally, EPA considered the designated use that applies to Capitol Lake from Table 602 in WAC 173-201A-602. Table 602 defines the designated use for the Deschutes River as spawning, rearing, and migration. The location of this segment is defined as:

> *Upstream from the mouth (latitude 47.0436, longitude -122.9091) to, and including, the tributary to Offutt Lake at latitude 46.9236, longitude -122.8123.*

The first latitude and longitude provided is located at the mouth of Capitol Lake to Budd Inlet; thus, this definition also applies to Capitol Lake. Because spawning, rearing, and migration is the most stringent designated use remaining for aquatic life, EPA considers it to be the applicable aquatic life designated use for Capitol Lake. This also means salmonid spawning, rearing, and migration is the applicable aquatic life designated use for tributaries flowing into Capitol Lake, unless specified otherwise in Washington's water quality standards. For this reason, EPA applied the salmonid spawning, rearing, and migration designated use to Black Lake Ditch and Percival Creek.

# REFERENCES

CH2MHill. 2001. Technical Evaluation Report for the Discharge of Treated Wastewater from the Tumwater Brewery, prepared for Miller Brewing Company Tumwater Brewery.

Roberts, M., Zalewsky, B., Swanson, T., Sullivan, L., Sinclair, K., and LeMoine, M. 2004. Quality Assurance Project Plan, Deschutes River, Capitol Lake, and Budd Inlet Temperature, Fecal Coliform Bacteria, Dissolved Oxygen, pH, and Fine Sediment Total Maximum Daily Load Study. Washington State Department of Ecology Publication No. 04-03-103.