Topographic and Hydrologic Maps of the Devils Lake Watershed: 1955 to 2013

Reported for use in the Devil Lake Water Improvement District’s
2013 Grass Carp Application

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Background of Watershed Maps and Intended Use

The watershed of Devils Lake, Lincoln County, Oregon has been delineated in varying degrees by a myriad of researchers over the last sixty years. Topographic surveys have been generated for fishery purposes, forestry needs, flood control, and for watershed analyses. The level of detail and methods used range from hand drawn maps to LiDAR. This report is an assemblage of the topographic and hydrologic maps from this period and will serve to identify the surface waters that are tributary to Devils Lake and its one outfall, the D River. These systems are being documented as part of a requirement for a submission to the Oregon Department of Fish and Wildlife for grass carp.

While the identification of these surface waters is an important part of the grass carp application to identify potential fish screening needs, given the unique watershed characteristics and fish populations present in this coastal system it is unlikely that such screening would benefit the fish and wildlife resources such screening are typically aimed to protect. In the past Devils Lake has had previous plantings of grass carp and has had at its terminus a fish control structure to prevent grass carp from leaving the system. This structure was a requirement of the original stockings and was in place before the first grass carp were stocked in Devils Lake in 1986. No other fish control structures were required on any of the tributaries to the lake.

In the late 1990’s the Devils Lake water Improvement District petitioned the State of Oregon for a change to the requirement for a control structure at the outlet. Years of extensive and expensive to fix storm damage to the structure had taken its toll repeatedly on the structure. Approval of the request came based on the fact that should grass carp pass through the structure, down the D River, and into the Pacific Ocean, as a freshwater species the fish’s mortality was a certainty. Effectively there was no biological integrity value in maintaining the structure, and its permanent removal was deemed appropriate. Documenting that, the District received a letter from Oregon Department of Fish and Wildlife’s Mid Coast District Fish Biologist Robert C. Buckman dated June 1, 1999. This letter ultimately relieved the District of the maintenance of the fish structure (Appendix). Hence forth then there have been no fish control structures on Devils Lake or its tributaries for the purposes of limiting grass carp movement upstream or downstream of the lake. Should the District be able to plant additional grass carp, it is unlikely that such a need would change as described herein.

In an electronic communication dated May 23, 2013, the same Robert (Bob) C. Buckman, Mid Coast District Fish Biologist, responding to an inquiry by the District wrote that “In conclusion, for the particular circumstances in Devils Lake at Lincoln City, I do not support requiring fish screens as a condition of grass carp stocking since it provides no apparent benefit and likely would cause problems for native migratory fish” (Appendix). The reasons Buckman gave for his conclusion included that there is no evidence that he has seen since his beginning in the Mid Coast in 1993 that grass carp have moved any significant distance upstream of the lake. He further notes that the fish are sterile and that upstream waters do not present the habitat requirements for successful grass carp spawning. Moreover, given the lack of biological need for fish screening for grass carp, Buckman notes that any such fish control structures would negatively impact native fish migration, specifically the threatened Oregon Coast Coho that
spawn in Rock Creek upstream of Devils Lake. As a result, and as quoted above he does not support requiring fish screens for grass carp in this system.

However should fish screening be required in the future, the following series of figures serves to document the location of the surface waters within the basin. Figure 1 is the oldest map followed chronologically to the present with the most modern maps being constructed from digital data including LiDAR, hydrographic data, and watershed boundary shapefiles all useable in Geographic Information Systems (GIS) software. These most recent maps while displayed at approximately the same resolution as the other maps are generated from datasets that can be viewed with GIS software to a much higher scale. All such data are readily available for sharing with ODFW.

For the purposes of identifying the surface waters in the watershed, the maps individually and/or as a whole identify six permanent streams within the basin and a number of intermittent streams. Named streams include Rock Creek, Seid Creek, Thompson Creek, Neotsu Creek, and Spring Creek. A permanent unnamed stream at the northwest end of the lake also exists. Additionally, the outfall of Devils Lake is shown. The D River which at one time was known simply as “the Outlet” discharges directly into the Pacific Ocean, and at 120’ +/- 5’ it is known as the ”World’s Shortest” river. No other outfalls exist.

As to the lake height and its relationship to Mean Sea Level, Devils Lake was meandered at a level of 10.4’ MSL. The Federal Emergency Management Agency (FEMA) marks the 100 year flood level at 14.0’. As Devils Lake is in extremely close proximity to the Pacific Ocean, a special consideration of the potential for tsunamis exists. As such a Tsunami Inundation Map has also been provided in this report. Neither the 100 year flood, nor the worst case scenario of a near shore tsunami would be sufficient enough to change the discharge of the lake. As a result no additional risk to other watersheds exists from such events relative to the escapement of grass carp. Floodwaters and waters from a tsunami inundation both would be contained within the watershed boundary. Given the topography, the D River and ultimately the Pacific Ocean would remain the only discharge from the lake. As grass carp can not survive in saltwater, the biological integrity would be maintained even in the event of extreme climatic or geologic activity.
Figure 1. Rock Creek & Other Tribs. Willis & Nibler, 1955.
Figure 2. Devils Lake Area, Oregon. US Army Corps of Engineers, 1977
Figure 3. Devils Lake Watershed Analysis. Bierly and Associates, 1981.
Figure 4. 1982 Water Quality and Biomass Sampling and Analysis Program. City of Lincoln City and Oregon Department of Environmental Quality, 1982
Figure 5. Devils Lake Diagnostic & Feasibility Study. Kramer, Chin & Mayo, Inc. 1983.
Figure 6. Atlas of Oregon Lakes, 1985.
Figure 8. Paleolimnology of Devils Lake, Oregon. Eilers et al., 1993
Figure 9. Tsunami Inundation Map. DOGAMI, 1999.
MCWC Priority Subbasin

Fifth field name: Devils Lake
HUC (6 digit): 41011

Physical Attributes
- Area (acres): 7,676
- Stream Length @ 1:100k scale: 21324 meters
- Road Density (miles/sq mile): 6.89

Habitat
- Length surveyed: 1362 m
- Avg. large wood: 2.7 pieces/100 m (> 20 is desirable)
- Avg. shade: 33% (> 60-70% is desirable)
- Survey length index: 0.06
  Note: Survey length index is the ratio of surveyed length to stream length @ 1:100k scale and may exceed 1.0

RBA Averages (1998-1999)
- No 1998-1999 rapid bioassessment data existed for this subbasin.

Assessment Rank (1 is best)
- Summer Coho Rank: 111 of 154
- Winter Coho Rank: 34 of 154

* This subbasin contains 303(d) listed streams *

Figure 10. Sixth Field Subbasin Report: Lincoln City/Devil's Lake. MidCoast Watersheds Council, 2002.
Figure 11. Updated Bathymetry and Paleolimnology of Devils Lake, Lincoln County, Oregon. Eilers et al., 2005.
Figure 13. Devils Lake Watershed Aerial Imagery, 2005.
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Figure 16. Devils Lake 100 year floodplain. Devils Lake Shoreline Erosion Study, 2011.
Figure 17. Devils Lake Shoreline Erosion Study. Tetra Tech, Inc., 2012.
Figure 18. Online Atlas of Oregon Lakes, 2013.
Figure 19. USGS. The National Map. National Hydrography Dataset. 2013.
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Appendix

**ODFW Correspondence: 1999-06-01**

June 1, 1999

Lori Campbell  
Devils Lake Water Improvement District  
1845 SW Hwy 101  
Lincoln City, OR 97367

Dear Lori,

I am writing to let you know that the Oregon Department of Fish and Wildlife agrees that screens are not needed at the outlet structure on Devils Lake. These screens were originally required as a method to contain grass carp in the lake. Since then it has become evident that very few, if any, grass carp would migrate downstream below the structure. If they did, they would perish as soon as they hit the ocean. Unless an unforeseen problem develops from removing the screens, it seems they can be removed permanently.

Thanks again for operating the smolt trap at the outlet. This should provide valuable information to help with coho salmon and overall lake management.

Sincerely,

Robert C. Buckman  
Mid Coast District Fish Biologist
Oregon Department of Fish and Wildlife (ODFW) Correspondence 2013-05-23

From: Robert Buckman
To: Paul Robertson
Cc: Derek Wilson; Josie Thompson; Rick Klumph
Subject: RE: Topographic Survey, Grass Carp Screening and Coho
Date: Thursday, May 23, 2013 11:34:42 AM

Paul

I am responding to your request for comment on the need for fish screens to prevent grass carp from moving upstream into tributary streams feeding into Devils Lake. Rock Creek, the primary tributary flowing into Devils Lake has a reasonably healthy return of ESA listed coho salmon as well as other migratory fish including steelhead, cutthroat trout and lamprey.

When grass carp were originally stocked in Devils Lake in 1986 screens were required on the lake outlet, but not required to prevent grass carp from moving upstream into the tributary network. As identified below, in 1999 I commented that the requirement to screen the outlet was unnecessary from ODFW’s perspective since any grass carp that moved downstream from the lake perished as soon as they encountered ocean strength saltwater which was only about a hundred yards downstream. The screens to keep grass carp in the lake also created problems for anadromous fish migrating upstream, or downstream migrants including adult steelhead kelts.

Concerning screens to prevent upstream movement of grass carp into tributaries feeding Devils Lake, as ODFW District Fish Biologist for the area since 1993, I have not observed or become aware of any grass carp moving a significant distance upstream out of the lake. We survey Rock Creek, the largest tributary to the lake for adult coho salmon annually and periodically for juvenile fish resources. We have never observed grass carp moving into Devils Lake.

We would not expect grass carp to spawn successfully in tributaries to Devils Lake both because the streams do not meet habitat requirements for successful grass carp spawning, and because all grass carp are expected to be sterile. There is no evidence of grass carp successfully spawning in the Devils Lake system since the original introduction in 1986.

ODFW has concern with screens to prevent upstream movement of grass carp as a potential impact to coho salmon and other native fish attempting to migrate upstream out of Devils Lake. It is possible to install screens and associated infrastructure where native fish could be sorted and selectively allowed upstream while restricting grass carp passage, but it would still delay and potentially impact native migratory fish. In the particular circumstances that exist in Devils Lake, it would also not provide a benefit since extensive experience indicates that upstream movement of grass carp is not a problem.

In conclusion, for the particular circumstances in Devils Lake at Lincoln City, I do not support requiring fish screens as a condition of grass carp stocking since it provides no apparent benefit and likely would cause problems for native migratory fish.

Bob Buckman
ODFW
Mid Coast District Fish Biologist
Newport, Oregon

From: Paul Robertson [mailto:paul@dlwid.org]
Sent: Monday, April 08, 2013 11:56 AM
To: 'Robert Buckman'
Subject: Topographic Survey, Grass Carp Screening and Coho

Hi Bob,

The Devils Lake Water Improvement District is compiling data about the topography of the Devils Lake watershed for use in a potential grass carp application. I have unearthed a myriad of datasets documenting the watershed from hand drawn maps from ODFW fish biologists in the 1930’s to highly detail hydrographic data sets and LiDAR flown in the last couple of years. While I believe this report will ultimately be of high enough resolution and robustness to satisfy the needs of a topographic survey to detail where fish screening might be theoretically needed for a grass carp application, the reality is as we have discussed on the phone is that screening a watershed that is home to threatened Coho does not make good ecological sense, particularly if the grass carp are not entering the streams that would be screened anyway.

To the best of my knowledge grass carp are not known to inhabit tributaries of Devils Lake, specifically Thompson Creek, Rock Creek, Spring Creek, nor Neotsu Creek. The reasoning for this as I see it are for one grass carp prefer warmer water to be biologically active. These streams do not warm up like the still waters of Devils Lake, and are thus not favored by the grass carp. A preferred temperature of 25.3 °C has been reported by Collee et al. (1978), and Nico et al. report that feeding declined sharply below 14 °C (2005), similar to other Chinese carp species. Thus to forage, grass carp for our watershed are basically restricted to the warmer, lentic waters of the lake, and then only during warmer months as Devils Lake itself cools and grass carp become dormant for much of the year.

Additionally the natural spawning habitat for these fish are not shallow, fast moving cold coastal streams, but warmer (59-63F) very large, river systems such as the Amur River in China and Siberia (http://www.npwd.state.tx.us/huntwild/wild/species/gcarp/). While our coastal streams may warm up in late summer to these temperature, spring time when grass carp spawn they are much cooler. Further the grass carp eggs require a semi-pelagic environment provided in large volume and lengthy rivers, again something not afforded by the coastal stream hydrology in Oregon. Of course triploids are sterile, so spawning is restricted more directly through chromosomal incompatibility, and thus physical screening the fish from these areas is in a sense redundant should they seek to move to the streams which as the best of our knowledge and reasoning, they are not. As a result screening would only be harmful to native fish migration and not the grass carp.

Lastly as to screening for grass carp in Devils Lake Watershed, the outlet at the D River no longer is screened for similarly valid biological, physical and chemical principles. The District appreciated your letter in 1999 (attached) verifying the grass carp mortality guaranteed by salt water, should the fish venture out towards the Pacific. The salt water effectively closes off the watershed to escapees that might arise from straying fish or flooding and thus the screening that was previously required and maintained, is no longer. Given the data known about grass carp in the Devils Lake watershed, we would appreciate having a similar letter from you detailing that screening tributaries for grass carp would not be advised based on similarly defensible, scientific arguments laid out above, particularly in this coastal system with native, threatened Coho salmon in recovery.

Thank you for your consideration.

Sincerely,

Paul Robertson, Lake Manager
Devils Lake Water Improvement District
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Lincoln City, OR 97367