

# AGENDA

2017 January 12

Regular Meeting: 6 pm

Lincoln City, Council Chambers

801 SW Hwy 101, 3<sup>rd</sup> Floor



## Quick Look:

- Financial Report
- Committee Briefings
- Lake Projects Update

## Devils Lake Water Improvement District

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[www.DLWID.org](http://www.DLWID.org)

### I. Roll Call

### II. Consent Agenda

- a) Minutes of the Previous Meetings
- b) Financial Report

**III. Comments from Citizens Present on Agenda/Non-Agenda Items:** *This is an opportunity for members of the audience to bring to the District's attention any item not listed on the agenda for public hearing. Comments are limited to five (5) minutes per citizen and the Board of Directors may use the light system. Speakers may not yield their times to others, and as a general rule this is not a time for exchange of questions. At the conclusion of this agenda item, a board member may discuss or raise questions regarding an item presented by a citizen. The Chair has the authority to reduce the time allowed for comment in accordance with the number of persons present and signed up to speak.*

### IV. Unfinished Business.

(Agenda Support Item A)

- a) **Committee Briefings:**
  - i. Sewer Committee
  - ii. Special Projects/Events and Communication
  - iii. Septic Inspection
  - iv. Save our Shoreline & Water Monitoring

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**b) Projects:**

- i. Hostetler Park Sediment Removal
- ii. Devils Lake Aeration Project

**c) Student Intern Coordination Progress**

**V. New Business**

- a) Motion to approve DLWID credit card from TLC
- b) The DLWID insurance policies have been issued with no changes, the annual premium has decreased slightly for 2017.

**VI. Non-agenda Item**

**VII. Additional Comments from Citizens Present on Non-Agenda Items:** *This is an opportunity for members of the audience to bring to the District's attention any item not listed on the agenda for board discussion. Comments are limited to five (5) minutes per citizen, and the Board of Directors may use the light system. Speakers may not yield their times to others, and as a general rule this is not a time for exchange of questions. At the conclusion of this agenda item, a board member may discuss or raise questions regarding an item presented by a citizen. The Chair has the authority to reduce the time allowed for comment in accordance with the number of persons present and signed up to speak.*

**VIII. Board Comments & Announcement**

**IX. Adjournment**

## Staff Report 2016-1-12

### VI. Unfinished Business

### Agenda Support Item A

#### a) **Committee Briefings.**

i. **Sewer Committee.** The committee meeting was held on Friday, December 9, 2016. Meeting highlights are listed below:

a. The letter to homeowners is currently in progress and the committee members expect it to be finalized during the month of January.

b. There was some discussion regarding delivering the project plan to property owners because it was a good overview of the project, but it was also suggested that committee members should, before dissemination of any project plan, review and refine it to make it more specific.

c. The next regularly scheduled meeting of the sewer committee will be Friday, January 13, 2017, Room 108, Oregon Coast Community College, Lincoln City.

ii. **Special Project/Events and Communications.** The Special Projects and Events and Communications committee have been merged into one committee to increase efficiency. The current committee information is listed below:

a. Storm notice events communication discussion is ongoing. The committee members feel this is a very important service to our community project.

b. Increased interest is shown and emphasis will be placed on working with the Salmon Drift Creek Watershed Council regarding E coli bacteria impacting Devils Lake via Thompson Creek.

c. The Devils Lake Fishing Derby, April 2018. Grant application has been submitted to VCB. Miles is working diligently with Lincoln City to get full approval for the event.

d. The Devils Lake Revival, expected to be held in September 2017. Details to be developed after the new year.

e. Devils Lake Dash. May 19-21, 2017. In contact with Bill and Tina Cox, more details will be available once I meet with them this month.

f. Miles has a possible opportunity for us to erect an informational sign for Devil's Lake near W Devil's Lake Rd.

g. Next meeting is scheduled for 10 AM, February 11, 2017 at OCCC.

iii. **Septic Inspection.** No change. The committee will be working on an updated message of the importance of septic inspections particularly for those living on the east side of the lake

iv. **Save our Shoreline and Water Monitoring.** Next committee meeting will be January 12, 2017. Future committee meetings will include work on plant material selection for next spring homeowner project planting recommendations. **As a reminder, funds are available to assist homeowners with the shoreline planting projects. Please contact a committee member for specific project details.**

### **Projects**

i. **Devils Lake Dredging Project:** No change, review with aeration project.

ii. **Devils lake Aeration Project:** Update from Dr. Horne is below:

**Re: PROGRESS REPORT ON DEVILS LAKE "DESIGN AN AERATION-MIXING SYSTEM TO REDUCE BLUE-GREEN ALGAL (CYANOBACTERIA) BLOOMS."**

**Date:** 4 January 2017

#### **SUMMARY**

In my last report, I concluded that the anoxic bottom water in the deep water of Devils Lake could only exist if it was stabilized by salinity since the temperature difference from top to bottom was far too small to produce temperature-density stratification, given the open nature of the lake and the strong winds that blow frequently. Anoxic bottom water releases nutrients which stimulate nuisance algae growth, deter fish and can produce nasty odors that deter lakeshore activities. The removal of the anoxic deep water is the purpose of the proposed aeration-oxygenation-mixing systems. Further examination of the DLWID data base over the last two months indicates that surface water salinity (as conductivity or chloride) shows large variations that may be due to ocean surges in winter-spring. Even if only a small and diluted fraction the dense sea water reaches a deep-water site in the old river channels like Sand Point, it could remain undisturbed for a long time since the much less dense freshwater inflows will slide over it.

However, the surface-only samples do not prove that salinity stabilizes the unwanted bottom water anoxia. Only a direct measurement will do that so some are recommended in summer-fall 2017. In addition, a direct measurement of the nutrients released during anoxia would further assist in selecting the final aeration-mixing-oxygenation system design. It is recommended that a basic water quality

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monitoring probe and 25-foot cable along with a Kemmer-type deep water sampling bottle be purchased for use as soon as possible for the 2017 campaign.

Sub-consultants Laguna Science and Flow-through are completing the “nuts and bolts” of the various proposed scenarios this month. Consultants HBH will use this data and modify as needed for local Oregon suppliers as needed and bring the plans closer to that which can be given to a local contractor for construction. The Board will be given a choice of three basic plans which can be installed in sequence or all at once depending on the outcome of the 2017 sampling season.

## **Introduction**

This memo updates the previous regular phone calls between myself and the current and recent past Lake Manager of the DLWID and those with the others involved in this contract (HBH Consulting Engineers), Dr. Ken O’Hara (Flow-through) and Richard Steel of Laguna Science.

The initial plans and drawings for various forms of aeration are progressing. The main options so far proposed for Devils Lake are:

- **Conventional aeration** (a few bubblers in the deepest point)
- **Vigorous Epilimnion Mixing (VEM)** which uses many bubblers spread over the deeper and shallower water sites
- **Oxygenation with pure oxygen** (Oxygenation with pure oxygen, like the oxygen used in their homes, in hospitals or when travelling by people with breathing problems, is five times more efficient than using air but must be supplied indirectly by concentrating oxygen in the air or purchasing as liquid oxygen (LOX). Air is free but must be compressed and pumped before use).

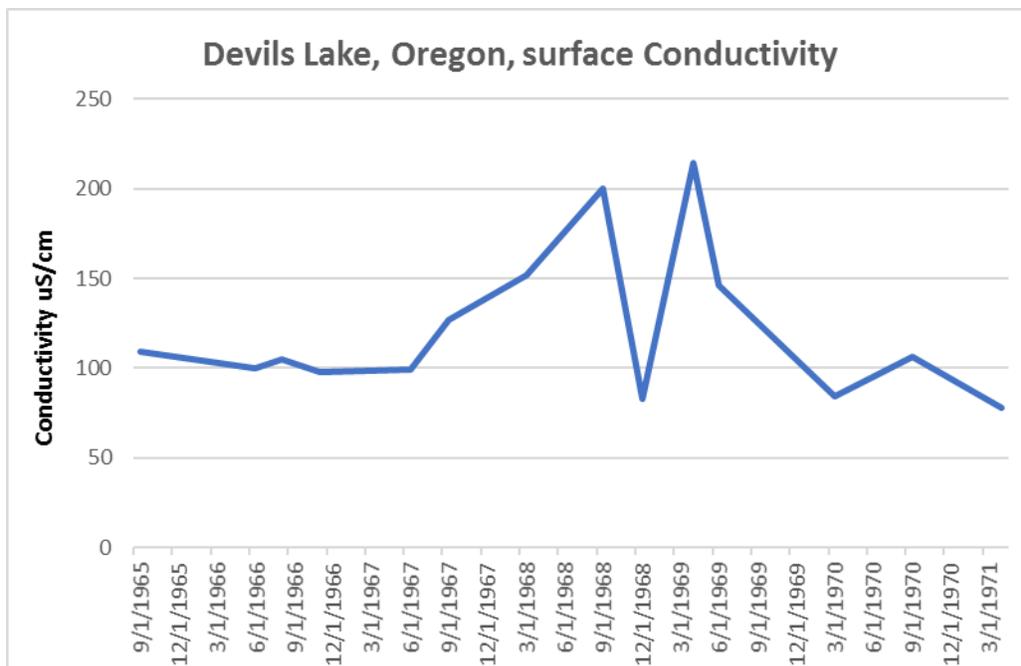
The specific application of any of the three options to Devils Lake depends on the lake bathymetry. An ideal lake for aeration-mixing-oxygenation is one with mostly steep sides and deep water (> 15 m; 50 feet) with few shallow areas. Devils Lake is almost the opposite though there are a few deep spots (15-20 feet) in the old river channels. Thus, a range of options stated above (bullet points) and based on the three main choices was proposed (see charts).

## **NEW OPTION**

With the knowledge from the fall 2017 field data loggers (see discussion at end) a modified first option (basic aeration) using a less intensive deep array can be considered. This is important since it will be cheaper and can be a first step carried out with other options to be added as needed later.

Examination of the Devils Lake data base over the last two months shows numerous measurements of salinity over the last 50 years. Unfortunately, there are no depth-temperature profiles for salinity. Most data has been surface or near-surface (0.5 m), with the exception of some consultant studies in the 1990s and a little temperature-DO measurements in shallow water near the Regatta landing. An idea of what might be happening in the bottom was can be gained from looking at the various surface water chemicals that are related to salinity. These are salinity (measured as conductivity since the chloride ions that dominate sea water anions conduct electricity), chloride (direct measure of sea chlorine) and possibly some other.

The salinity data used in this memo is for surface water in Devils Lake in the 1965-1971 using a few wide-spread collections each year and some in the early 1990s. The data (Fig. 1 and Appendix Table 1) shows considerable variations over time with some high values in winter 1969 and spring 1977. The latter values are probably due to the severe drought the previous winter which would have drastically reduced freshwater inflow to the lake.

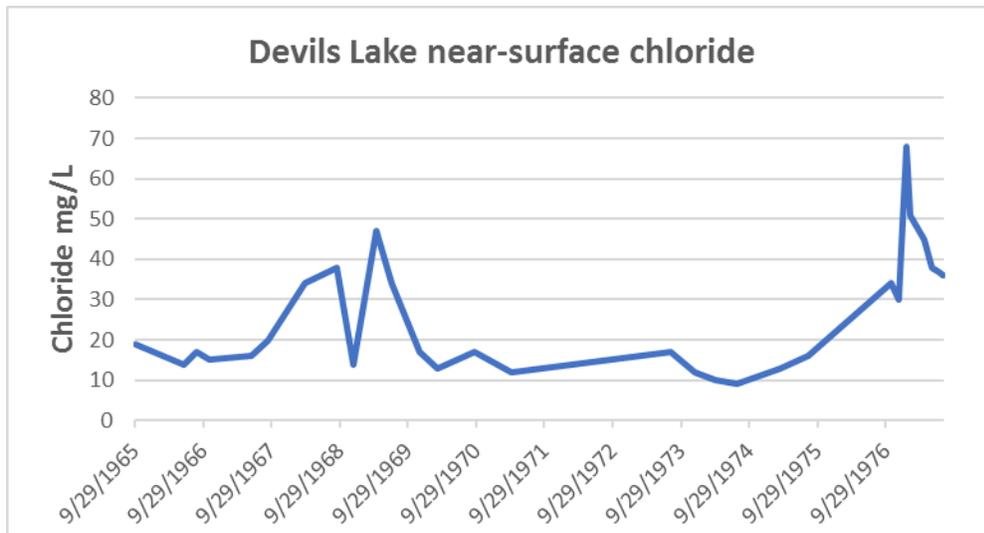


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**Fig. 1. Salinity (measured as conductivity) in the surface waters of Devils Lake, Oregon between 1965 and 1971 where samples were taken a few times in each year. Peaks may be due to ocean tidal surges flowing up the short D-River which would stabilize a bottom water layer.**

An alternative approach is to use chloride as the surface indicator for deeper salt buildup. This data is shown in Fig. 2. Here a longer data set was used and again shows some peaks which, where applicable, match the salinity (conductivity) pattern.



**Fig. 2. Pattern of chloride in the surface waters of Devils Lake, Oregon showing patterns of higher concentrations that may be due to ocean winter storm surges reaching the lake.**

There is some confusion in the data base regarding conductivity since sometimes the values are recorded in uS/cm and sometimes in umhos. Since conductance is measured in uS/cm that is the unit of interest and umhos is a unit of electrical resistance, the reciprocal of conductance. However, it is unlikely that a commercially available probe would make this conversion and since these units are essentially the same on probe readouts, I have used uS/cm for the figures and tables.

**CONCLUSION**

The field data I have examined so far (surface only), supports the possibility of **summer** anoxic bottom waters in Devils Lake being supported by salinity density from the remains **winter-spring** ocean storm

surges. This may not happen every year and salty bottom water may or may not carry over from year to year. If salinity is confirmed as being responsible for the density stability, a less expensive aeration project can be considered. The removal of similar salty pockets that become anoxic is a specialty of sub-consultants Flow-through and Laguna Science who have successfully eliminated this problem in water bodies of the same size as Devils Lake. For this reason, a more direct measurement in summer 2017 is suggested.

#### **RECOMMENDATIONS FOR FIELD WORK IN 2017**

Two new purchases are suggested:

1. Basic water quality probe and short 25 ft cable
2. Basic Kemmer-type sampler bottle for deep water samples

Devils Lake WID already monitors water quality in the open waters of the lake using a boat. The regular sampling has primarily been for water quality concerns of people such as microbial pathogens but has included other limnological data such as chlorophyll (algae) and nutrients. Sampling was normally restricted to surface or near-surface samples are collected. This data has been very useful in determining how to fix any water quality problems. However, it does not help determine the salinity and dissolved oxygen in deep water which is now needed to choose what kind of aeration-mixing system is best. This data will assist in the current concern about nuisance blue-green algae (Cyanobacteria) blooms because an EPA standard has been promulgated for microcystin toxins released by some species of blue-green algae on some occasions.

It is suggested that, when out on the lake at the deep-water station off Sand Point, additional sampling of dissolved oxygen, temperature and conductivity be taken a 1 m depth intervals to about 1 foot off the bottom. The cost of probes is not insignificant but if one is purchased without all the “bells and whistles” the cost should be appropriate for the benefits expected on savings with the aeration system. In addition, a major factor in probe costs is the length of the cable but since Devils Lake has a maximum depth of less than 25 feet, cable cost is reduced.

It is also suggested that a Kemmer-type probe be purchased to collect discrete samples from just above the bottom which can be analyzed for phosphate (SRP) and ammonia (NH<sub>3</sub>) to determine if the bottom water anoxia is releasing nutrients that will cause algae blooms in summer and fall (internal nutrient loading), regardless of any inflows from the watershed (external nutrient loading).

These additional samples would increase lake time by about 30 minutes per occasion (probably every two weeks) and chemical analysis costs by 2 samples per occasion (SR phosphate & ammonia).

### **Decisions to be made based on the fall 2016 data logger information**

The main concern is to determine how the data collected over this project can be used for the most economical method to treat nuisance and potentially toxic blue-green algae in Devils Lake. The data loggers deployed for a month in fall 2016, indicated that the water column in the deepest water was anoxic (contained no oxygen) while the upper water had abundant oxygen. This occurred despite the fact that the temperature of top and bottom waters was very similar and cool at about 20°C. Under such conditions the surface and bottom waters should be mixed by the winds, which are common over Devils Lake. The only explanation is that the bottom water contained some salty water which provided the density required to stabilize the water column. Thus situation is common in shallow lakes or estuaries with direct connections to the ocean or an estuary. Examples are Lake Merritt in Oakland California, and the barrages of Cardiff and Swansea Bays in Wales.

The connection of Devils Lake to the Pacific Ocean is short enough that tidal surges could carry sea water into the lake. The sea water would sink to the bottom and stay there. Freshwater flowing in from streams, even in floods with muddy dense water, would slide over the salty bottom water. However, we have no direct proof of higher salinity in the bottom water. This could easily be determined in the summer of 2017 using a temp-DO-conductivity probe.

The significance of the salinity-density stability layer in Devils Lake is that if it is present then some form of aeration could be favored over oxygenation. A salt-stabilized anoxic bottom layer could be oxygenated directly but would not be desirable for most migratory or resident fish relative to a mixed oxygenated water column.

In addition, if the only thing needed was to disrupt the salinity layer was aeration-mixing, a simpler and thus less costly system may be all that was needed. However, without a direct confirmation of the salinity profile this reduction cannot be proposed at this time. Indirect indications of salinity and observations of storm surges by Tom Wood suggest some potential stratification but the measurements were made decades ago and only near the surface.

### **PROGRESS BY OTHER CONSULTANTS**

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To reduce overall costs, the original proposal was divided into two sections; The HBH consultants to carry out the bulk of the work of design, Horne to carry out an initial 17 methods analysis to be sure aeration-mixing-oxygenation was a good option and provide other potential options, and Laguna Science and Dr. Ken O’Hara to carry out the initial design which could then be forwarded to HBH. Costs were to be reduced by having the DLWID manager attend some meetings with local agencies and others rather than have HBH do this section.

Sub-consultants Laguna Science (Richard Steel) and Flow-through (Ken O’Hara) are completing the “nuts and bolts” of the various proposed scenarios this month (January 2017). Consultants HBH will use this data and modify as needed for local Oregon suppliers as needed and bring the plans closer to that which can be given to a local contractor for construction. The Board will be given a choice of three basic plans which can be installed in sequence or all at once depending on the outcome of the 2017 sampling season.

Direct consultants HBH report to the manager directly but also frequently discuss matters with Horne. The work by HBH will, as discussed with the Lake Manager of DLWID, be terminated somewhere between 50 and 75% of the final product to allow for the results of 2016 (no algae blooms per the manager and an increase in submerged aquatic vegetation (SAV) to be assessed in 2017. Increases in SAV may reduce nuisance algae by various means including bottom mud stabilization, increase denitrification, and direct competition for nutrients between nuisance free-floating phytoplankton and the more efficient algae that grow on the SAV (periphyton).

**APPENDIX**

**Appendix 1.** Table of surface water conductivity in Devils Lake 1965081 showing peak values in the winters of 1969 and 1977 (could be drought-related)

	<b>Surface</b>
	Conductivity
date	<b>uS/cm</b>
9/29/1965	109
6/20/1966	100
8/23/1966	105
11/1/1966	98

6/13/1967	99
9/11/1967	127
3/25/1968	152
9/10/1968	200
12/9/1968	83
4/14/1969	214
6/30/1969	146
3/3/1970	84
9/21/1970	106
4/5/1971	78
12/10/1973	107
4/1/1974	93
7/23/1974	110
3/10/1975	110
8/11/1975	115
10/26/1976	177
12/8/1976	173
1/18/1977	335
2/8/1977	230
4/19/1977	231
5/31/1977	195
7/5/1977	183
8/2/1977	180
7/17/1981	105
<b>mean</b>	<b>144</b>

iii) **Student Intern Coordination Progress:** No change, the next meeting with OSU staff is scheduled to be held during January 2017.

**VII. New Business**

**Agenda Support Item B**

a) **Discussion of Budget Committee membership requirements.**

Three committee members' terms end on December 31, 2016; therefore, three new members are sought for appointment to this committee for positions number 1, 3, and 4.

b) **Motion for DLWID Credit Card**

Make a motion for obtaining a credit card for DLWID through TLC. TLC requires that the motion includes any and all signatories as well as the desired credit limit. After the motion is approved a copy of the official meeting minutes will be provided to TLC, as they have requested this for the final step in obtaining a card.