



Devils Lake Water Improvement District

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Bacteria Sampling & Analysis Plan

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Group A: Project Management

A1. Title and Approval Sheet

Paul Robertson, Lake Manager
Devils Lake Water Improvement District

Date

Steve Hanson / DEQ Volunteer Monitoring Specialist

Date

Chris Redman / DEQ Quality Assurance Officer (QAO)

Date



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A3. Distribution List

A digital copy of The Devils Lake Water Improvement District Bacteria Sampling and Analysis Plan (SAP) shall be available on the District’s website (www.DLWID.org) with a signed paper copy kept on file at the District’s office. Small changes which may occur to the document shall be identified by a systematic increase in the decimal of the version number (e.g. 1.1., 1.2, 1.3). Substantial changes are denoted by an increase to the next whole integer (e.g. 1.3, 2.1). This newest version shall replace all previous versions. Users will be able to find the updated version at the District’s website, which shall be updated by the DLWID’s Lake Manager. Users and signatories of this document shall be notified electronically of all changes. Users of the document are responsible for insuring they are using the most current version.

A4. Project/Task Organization

Table 1. DLWID Water Quality Monitoring Staff

Name	Title	Affiliation	Responsibility	Telephone	Email
Paul Robertson	Lake Manager & Senior Scientist	Devils Lake Water Improvement District	Project Manager & Quality Assurance Officer	541-994-5330	paul@dlwid.org
Seth Lenaerts	Water Quality Specialist	Devils Lake Water Improvement District	Sampling, Analysis and Database Management	541-994-5330	seth@dlwid.org
Gale Ousele	Water Quality Technician	Neskowin Creek Water Testing 8105 Slab Creek Road Neskowin, OR 97149	<i>E. coli</i> testing	(503) 392-3927	galeq@oregoncoast.com

A5. Purpose Statement and Background

Devils Lake is a regionally significant, moderate sized coastal lake, strongly impacted by cultural eutrophication. A highly urbanized lake, Devils Lake suffers from Harmful Algal Blooms at many of the peak recreational periods in the year. Concerns have been identified by researchers and are shared by the general public. Devils Lake Water Improvement District Water Quality Bacterial Monitoring Program has been designed to provide accurate, informative data to stakeholders in the watershed about the quality of water in Devils Lake as it relates to Oregon’s Recreational Water Use Standards for *E. coli*.

Stakeholders include the District itself who publish and post the data online, through electronic mail, and at specific kiosks around the watershed. Additional stakeholders include the media who provide water quality updates through print, radio, and the



internet. Other stakeholders include local, tribal and state governments including the City of Lincoln City, Lincoln County, the Confederated Tribes of Siletz Indians, and the State of Oregon. Data are posted and used in such manners as deemed suitable by these entities. For example, data collected by the Devils Lake Water Improvement District which meet the quality controls and quality assurances required by DEQ are available for entry into the statewide database called Laboratory Analytical Storage And Retrieval (LASAR). Lastly, the larger stakeholders represented collectively as the public have access to the monitoring data through the District’s website and other postings for individual use in assessing water quality as it may relate to their own lake activities.

A6. Project Task and Description

DLWID staff conducts fieldwork in the Devils Lake Watershed located in Lincoln County, Oregon. Sampling occurs in the littoral zone of Devils Lake and in major tributaries. Staff collects instantaneous grab samples for chemical, physical and biological water quality parameters. Parameters include pH, conductivity, dissolved oxygen, Secchi Depth, turbidity and temperature. Biological samples are collected for analysis of *E. coli*. The results of this program are used primarily for comparison to state recreational water quality standards. Additionally, long-term data management is also a fundamental tool for effectiveness monitoring and for identifying water quality trends.

Table 2. Primary water quality monitoring tasks completed in each year.

Major Tasks	J	F	M	A	M	J	J	A	S	O	N	D
Staff Training				X			X					
Seasonal WQ sampling					X	X	X	X	X			
Seasonal <i>E. coli</i> monitoring					X	X	X	X	X			
Lab analysis					X	X	X	X	X	X		
Data processing and reporting					X	X	X	X	X	X		
Ordering of Lab Consumables				X		X				X		

A7. Measurement Quality Objectives

For water quality data to inform decision making it is critical that the quality of the results themselves be assessed in order to understand the sampling error and the error of the measurements themselves. Sampling error will be determined by the natural variability of the environmental parameter, the distribution and type of samples in space and time, and the total number of samples.

Measurement error is influenced by imperfections in the measurement and analysis system. Random and systematic measurement errors are introduced in the measurement



process during physical sample collection, sample handling, sample preparation, sample analysis, and data processing.

Specific Quality Assurance Objectives for the DLWID Water Quality Monitoring Program are:

- Collect a sufficient number of samples, sample duplicates, and field blanks to evaluate the sampling and measurement error.
- Analyze a sufficient number of Quality Control (QC) standards, blanks and duplicates during analysis to effectively evaluate results against numerical Quality Assurance (QA) goals established for precision and accuracy.
- Implement sampling techniques in such a manner that the analytical results are representative of the media and conditions being sampled.

Precision and Accuracy: Table 3 lists the precision and accuracy targets for the bacterial monitoring program.

Table 3. Accuracy and Precision Target

Matrix	Parameter	Precision	Accuracy	Measurement Range
Water	<i>E. coli</i>	± 0.6 log	NA	≤ 1 to >2419

¹Lower Limit of Detection (LLD) is provided. Measurement range can be extended through dilution of samples, but the Lower limit of Quantification (LLQ) is then increased by the dilution factor.

Representativeness: Samples are collected to most accurately represent the sample areas from a recreational water use perspective. For *E. coli*, samples are taken from the nearshore where the greatest at risk population, namely small children, frequent.

Comparability: This monitoring program will seek to ensure comparability between previous studies for all parameters where practical. The nature of having legacy data is that often it has not been collected and analyzed with the same methods as are used currently. Similarly sampling objectives change from researcher to researcher, and thus comparability may not be inherently possible. For example event sampling for bacteria create a whole different set of data then a routine monitoring approach. Event sampling tends to capture peak concentrations, while routine monitoring might often miss these high level events, yet provide useful trend data.

Completeness: DLWID staff strives to collect all the data described within the SAP. In order to accomplish this, preprinted waterproof sampling sheets are used detailing the sampling data to be collected. However, environmental and technical limits can and do prevent such a complete record to be collected over the course of the year. Where data are not collected, an entry describing why is recorded. If insufficient data are collected that would prevent the practical use of the data, then a partial dataset may be recorded with the limitations identified.



Sensitivity: Sensitivity relates to the ability of an analytical method to quantify concentrations relevant to a study and the ability of the study design to successfully answer the monitoring question. Analytical equipment purchased is designed to meet the level of sensitivity sought. Typically analytical sensitivity is one order of magnitude greater than a reporting level might prescribe. This is the case for the pH, conductivity, turbidity, temperature, and dissolved oxygen meters the District utilizes. Bacterial samples while inherently highly variable are rigorously analyzed then calculated using the Most Probable Number (MPN). The method employed is EPA approved for reporting whole numbers less than 2419. This range is well suited for recreational water use standards.

A8. Training Requirements and Certification

The Devils Lake Water Improvement District Lake Manager is in charge on insuring proper training is conveyed to all parties. The current manager is Paul L. Robertson. Paul possesses a Masters of Science in Environmental Diagnosis from Imperial College London and a Bachelor of Science in Environmental Chemistry from the University of Vermont. Paul has 14 years of sampling and analytical testing experience.

Currently the District is also served by the skills of Seth Lenaerts, a Resource Assistance for Rural Environments (RARE) participant through the University of Oregon. Seth has a Bachelors of Science from University of Wisconsin, Steven Point, majoring in Land Use Planning with a minor in Soil Science.

Additionally, the Devils Lake Water Improvement District generally employs an intern each summer for water quality work. This intern’s qualification range year to year, but selection criteria are high and include laboratory and field experience. Like all staff, the intern is formally trained on the protocols of the District by the Lake Manager, prior to sampling or analysis. Training includes review of the QAPP and all applicable SAPs. Additionally training videos and presentations are reviewed annually by all persons ahead of the conducting any formal analysis.

A9. Documentation and Records

Table 4. Document and Data Retention Policy.

Document or Record Name and Description	Storage Location	Storage Time
Quality Assurance Project Plan (QAPP) - project description and assurance procedures.	DLWID Lab & Website	5 years
Sampling Analysis Plans (SAPs) - specific sampling information for each sampling program.	DLWID Lab & Website	5 years
OWEB Water Quality Monitoring Guidebook - Methods manual	DLWID Lab & OWEB Website	5 years
Equipment Notebooks - records of quality control checks,	DLWID Lab	5 years



DLWID Bacteria SAP
Group A: Project Management

calibrations and maintenance.		
Field Data Sheets - Field forms containing sampling meta data and raw field data, including sample drop off time for bacterial analysis.	DLWID Lab	5 years
Laboratory Data Sheets - Lab worksheets containing analysis meta data. Worksheets contain time checkpoints during analysis, dilutions, and final data.	DLWID Lab, NCWT, & Water Environmental Services, Inc.	5 years
Chain of Custody Sheets – Sheets documenting what samples were collected, where they were collected, at what time and by whom. Forms also include who shipped the samples, when, and who received the samples.	Receiving Lab	5 years
Analytical Results – Data are archived digitally in MS Access and/or Excel	DLWID Lab	Indefinite
ODEQ Original Record - Data submitted to DEQ by DLWID for review, reformatting and upload into LIMS, usually a Microsoft Excel workbook.	DLWID Lab	5 years
Final LIMS Report - Approved result values for each volunteer dataset submitted for upload to LASAR	DEQ Laboratory: Final LIMS Report	5 years



Group B: Data Generation and Acquisition

B1. Sampling Process Design

In an effort to provide useful data to the public concerning recreational water use of Devils Lake, a bacteria sampling and analysis protocol has been developed for *Escherichia coli*. *E. coli* bacteria are indicator organisms of pathogenic bacteria and organisms. The sampling and analysis of *E. coli* is a standardized and recognized practice for monitoring the likely presence of pathogenic species associated with warm blooded mammals. *E. coli* sources include sewers, failed septic systems, and animals such as dogs and birds.

General Information:

E. coli are sampled weekly in the late spring, summer, and early fall months. Sampling is done during the peak use season of the lake. The sample sites include Devils Lake State Park Campground, Regatta Grounds, Holmes Road Park, Sand Point Park, Thompson Creek, Brown Bear State Park, and the lake outlet at the D River. Samples are taken on Mondays for same day analysis at the Neskowin Creek Water Testing Center (NCWTC), 10005 Slab Creek Road Neskowin, Oregon 97149. Contact is Gale Ousele: Office Phone (503) 392-6134 Messages at (503) 392-3927. Samples are taken no earlier than 9 am and delivered no later than 2 pm. Sample must be analyzed within 6 hours of sampling.

Sample IDs and Descriptions:

UNIVERSAL IDs

A comprehensive renaming of the sample sites was done in September 2007. This was done to accommodate combining data from past studies and current sampling programs which required the large scale restructuring and renaming. Samples were reclassified with a prefix based on the sample location and/or the sample depth.

Samples taken from the littoral zone have been labeled with the prefix LZ. Likewise pelagic zone and benthic zone samples have been labeled PZ and BZ respectively. Stream samples are labeled with an abbreviation of the stream name, TC for Thompson Creek, RC for Rock Creek, SLC for Spring Lake Creek, NC for Neotsu Creek, and GC for the stream system running out of the golf course. The D River is similarly abbreviated DR. Samples taken at the confluence of the stream and the lake have been given the number 0 (e.g., NC-0). Sample sites upstream of the mouth are numbered with the increasing integer, x+1 (NC-1, NC-2, etc). As a pre-existing system labeled the outlet of the lake as 0 (zero), this sample site continues to be labeled as such. With the prefix for the D River the site is thus identified as DR-0. Sites further downstream or moving away from the lake take on increasing integers, thus DR-1, and DR-2 are sites further downstream towards the Pacific Ocean. Watershed samples not fitting other



classifications are labeled with the prefix WS and generally retain historical sample ID integers such as WS-9 replacing the previous sample site 9.

Universal ID	DEQ LASER ID	Historical ID	Latitude (N)	Longitude (W)	Short Description
DR - 0	10526	DLW - 0	44.967500	124.015817	D River
LZ - 1		DLW - 1	44.969817	124.008200	Campground
LZ - 2		DLW - 2	44.973800	123.999083	Regatta Grounds
LZ - 3		DLW - 3	44.990100	123.995383	Holmes Road Park
LZ - 4		DLW - 4	44.987083	123.986333	Sand Point Park
TC-1		DLW-5			Thompson Creek
LZ - 6	13912	DLW - 6	44.967783	123.997600	Brown Bear
RC-1		DLW-7			Rock Creek

D River (DR-0): Note: ***Sample Location Change (2007 - 04 - 15)***

The sample site is at the outlet of Devils Lake, the D River. A small 0.6 meter high dam is at the outlet maintained by the Devils Lake Water Improvement District for recreational water storage. Samples were formerly taken just upstream of the dam at a point where commonly the water flows through a notched section of the dam that provides for continual water flow exiting the lake and provides for fish migration. Samples are currently taken on the north side of the lake approximately 10 meters upstream from the dam. Sample is taken in the nearshore waters where access is available to the general public. A change in the landscape on the north shore during 2007 has warranted this change. A public park, The D River Park, has been created which includes parking, picnicking, and a graveled trail.

Devils Lake Campground (LZ-1): The campground is located off of NE 6th Avenue in Lincoln City, Oregon. The samples are collected off the moorage dock that is accessible by the paved trail to the water's shore. The samples including the Secchi Disk measurement are taken at the end of the dock perpendicular to the general outward flow of the lake. The campground is utilized year round, but predominately in the summer months. The sample site is used by boaters and is posted no swimming.

Regatta Grounds (LZ-2): This city park is located off of West Devils Lake Road. The park is heavily visited site in the summer months and houses a boat launch, fishing dock, and a swimming area. The park has a full service bathroom and drinking faucets. The park is frequented by picnickers and children as it has a large playground, grass area, and a swimming area. There was a resident population of geese that inhabited the general area, but were relocated to a private farm outside the watershed (2006 - 08 - 18). This relocation greatly reduced the bacterial concentrations in the area. Some non-native birds remain and may frequent the area to this date. Samples are retrieved inside of the enclosed swimming area at the midpoint of the beach. Two Secchi Disk measurements are taken from the center of the U-shaped dock that surrounds the swimming area. One



measurement is taken inside the swimming area, the other on the outside of the swimming area.

Holmes Road Park (LZ-3): This city park is located at the foot of Holmes Road after it intersects West Devils Lake Road. The park is complete with a boat launch, a boat dock, and a separate fishing dock. The park has sewer flush toilets and a drinking fountain. A sewer pump station exists on the property just uphill from the boat launch. The sample site is at the foot of the boat launch approximately 1 meter north of the boat dock. Secchi measurements are taken at the end of the boat dock.

Sand Point Park (LZ-4): This city park is at the end of Sand Point, a small peninsula in the lake. The property is in the county, but the park is owned and maintained by the Lincoln City Parks and Recreation Department. The park is small with room for only 6 vehicles. No boat launch is provided, however just before the park on the loop road, a small unimproved boat launch is available. The park has picnic tables, and a small beach. A popular swimming area is provided. The waters at the park are largely intermixed with the broad lake as the park is at the point of the peninsula. The sample is taken 1 meter off of the shore at the medial mark on the beach, in what is commonly 10-30 cm of water. This spot is chosen as it is likely where the greatest at risk population would swim or wade.

Thompson Creek (TC-1): This creek is the second largest input into Devils Lake and is a 303d listed stream for bacteria. The KBCH Radio tower is the nearest landmark. The creek drains forested land uphill, but passes through a built up rural landscape at its terminal end. Septic systems serve the homeowners and houses are built right to the creek bed. The creek also passes by a horse farm, followed by the KOA Campground, before passing under East Devils Lake Road and into a dredged inlet that follows the peninsula that is Sand Point. Sample points are upstream from the East Devils Lake Road Culvert, at a private road crossing above the horse farm, at the upstream of the Park Lane Culvert, and at a second private road crossing above that. A forested sample site further upstream is being investigated. There are no physical public postings of these data, but they are available online.

East Devils Lake State Park aka Brown Bear (LZ-6): This state park sits off of East Devils Lake Road near mile marker 3.3. It is known as East Devils Lake State Park or locally as Brown Bear, and is managed by the Oregon Parks & Recreation Department stationed at the campground. The park is heavily forested with a large grassy area with picnic tables scattered throughout the grounds. Pit toilets are provided upland in the park. A fire pit and refuse bin exist near the sample site. The park has two docks. The north dock is for boat launching, while the southern one is designated as the fishing dock. Inside on the south side of the offset T-shaped Fishing Dock is a small unmarked swimming area and at times of low lake level a sandy beach. The park and beach sit along a wide sweeping edge of the lake. Conditions are often choppy in and around the park as there are long fetches in either the southerly or northerly direction, aiding the formation of waves on windy days. The closest houses are to the north about 150 meters. Those homes are on septic systems. The sample site is inside the T- shaped fishing dock, on the south side, just off the shore in the small swimming area. The Secchi Depth is recorded from the end of the Fish Dock, furthest from shore.



Rock Creek (RC-1): This creek is the largest tributary of Devils Lake. It runs under East Devils Lake Road near mile marker 3.7. The creek drains from private forest land, US Forest Land, and some agricultural land in the lowlands. A cow pasture, a horse farm and llama farm are located upstream from the sample site. Human habitation is limited on or near the creek. The sample was formerly taken by the Salmon Drift Creek Watershed Council up until 2007 April 15, but is now sampled in house. The sample site is just above the east bridge on East Devils Lake Road.

B2. Sampling Methods Requirements

Each sample is taken into a sterile, labeled 100 ml sample bottle purchased from IDEXX. Sodium thiosulfate has been added by the manufacturer to the prepackaged, sealed bottles to reduce the presence of chlorine which acts as a disinfectant. Disinfected samples could lead to a false negative result. The labels and lids clearly state the station ID written in indelible ink.

A record of the sample ID and corresponding sample site station is maintained. Forms preprinted on Rite in the Rain paper are used to record the supplemental data during the sampling routine. The forms are entitled “Devils Lake Water Improvement District Bacterial Sampling Sheets”. For each sampling day, the date, sampler initials, weather, air temperature and wind speed are recorded. For each sample, the sample time is also specified. At each sample site, a record of the type(s) of samples made (e.g. Grab, Replicate, and/or Split) is kept. Other data recorded include the Dissolved Oxygen in mg/l; Temperature in degrees Celsius; pH; Conductivity in microSeimens; Turbidity in Nephelometric Turbidity Units; Secchi Depth in meters where appropriate, and wind data including average, maximum and direction. These samples and readings are taken in accordance with the Devils Lake Water Improvement District Physical Monitoring Protocols. Also on the Rite in Rain preprinted forms the drop off time to the lab is recorded as are any comments from the sampling day.

Samples are taken just below the surface of the water, by plunging the bottle upside down into the water ensuring that the sodium thiosulfate is not spilt. Lake samples are generally taken 1 meter off shore in approximately 10 - 30 cm of water. Nearshore water is sampled as it is generally of the highest concentrations of bacterial contamination, and is accessible by the most at risk populations, children. Creek samples are taken in the thalweg (mid stream & highest flow). The sample bottle is quickly covered with the clean lid, insuring that no cross contamination takes place. The rim of the bottles and the insides of the lids and bottles are never touched, and are kept free from possible contamination including wind borne bacteria. One sample split is taken each week. Split samples are labeled with a ”s” or “Split”. This sample is collected into a larger bottle for separation at the lab. Two samples are run using the IDEXX methodology. Additionally one sample replicate is taken each week from a random location. Replicates are collected simultaneously into two distinct sample bottles. Replicate samples are labeled with “Rep”.



The samples are placed in an iced cooler immediately following sampling and are kept cool during transit. All samples are collected and transported to the lab within 4 hours preferably and no longer than 5 hours after the first sample was acquired.

Table 5. Sample Containers, Preservation and Holding Times.

Parameter	Sample Container	Preservation Method	Holding time (Max)	Equipment
<i>E. coli</i>	Sterile, 100 ml screw, top plastic sample cups	Sodium thiosulfate & Iced Cooler	6 hours	Sample Grabber

Sample Types:

REGULAR SAMPLES: Collected and labeled using the Universal ID from Table 1 below (e.g., TC-1).

REPLICATE SAMPLES: Taken from the same site at the exact same time are marked with an additional “Rep” on the label (e.g., TC – 1 Rep).

SPLIT SAMPLES: Taken in large bottle and denoted with the letters ‘Split’ or ‘s’ (e.g., TC-1 Split or TC-1s).

FIELD BLANKS: New clean bottles opened in the field and filled with distilled water. A field blank is labeled FB.

B3. Sample Handling and Custody Procedures

Escherichia coli samples will be collected into sterile, labeled 100 ml sample bottles. Both the sample bottles and lids are clearly labeled as a matter of quality assurance for the lab. The samples will be transported on ice, in a cooler, and analyzed within the designated holding time (six hours).

B4. Analytical Methods Requirements

Sample analysis is done by Neskowin Creek Water Testing. The water quality technician is Gale Ousele. The samples are run using the EPA approved Method developed by IDEXX called Colilert®-18. A sample preparation video is available at the following web address: <http://www.idexx.com/water/colilert18/index.jsp>

General protocol is demonstrated by the following 4 steps:

Step 1.

Add reagent to sample.

Step 2.



Pour into Quanti-Tray® (counts from 1-200) or Quanti-Tray®/2000 (counts from 1-2,419).

Step 3.

Seal in Quanti-Tray® Sealer and place in 35 °C incubator for 18 hours.

Step 4.

Quanti-Tray-Read results:

- Yellow wells = total coliforms
- Yellow/fluorescent wells = E. coli

Quanti-Tray/2000-Read results:

- Yellow wells = total coliforms
- Yellow/fluorescent wells = E. coli

Table 6. Analytical Methods and Equipment.

Parameter	Method	Units	Equipment
<i>E. coli</i>	IDEXX, Colilert®-18	MPN	Sealer, UV light

B5. Quality Control Requirements

Table 7. Required Quality Control Measurements

PARAMETER	ACCURACY	PRECISION
<i>E. coli</i>	<ul style="list-style-type: none"> • Daily blanks run with each sampling batch • Split samples ran from each sampling batch. 	<ul style="list-style-type: none"> • Replicates made every day or at 10% of sampling sites, whichever is greater • Replicate sampling done simultaneously • A level is a difference between the logs of the values ≤ 0.6.

B6. Instrument/Equipment Testing, Inspection & Maintenance Requirements

An instrument log accompanies each piece of analytical equipment. All service checks and inspections are recorded into the log. All reagents and supplies are checked at the start and end of the sampling day for expiration dates, damage, contamination, or degradation. Problems with any supplies (quality or quantity) and/or equipment are communicated to the Lake Manager and recorded on the dry-ease board in the lab and in maintenance logs as appropriate. Supplies are ordered on an as needed basis.

Table 8. Equipment Testing, Inspection and Maintenance Requirements

Equipment Type	Inspection Frequency	Type of Inspection
IDEXX QuantiTray Sealer	<ul style="list-style-type: none"> • Yearly or as needed 	<ul style="list-style-type: none"> • Take apart and clean
Incubator	<ul style="list-style-type: none"> • Prior to and at end of sample incubation 	<ul style="list-style-type: none"> • Check thermometer reading



B7. Instrument Calibration and Frequency

No instruments used in this protocol have calibration requirements.

B8. Inspection/Acceptance Requirements

All equipment, supplies, reagents, and instrumentation are securely stored in the Devils Lake Water Improvement District laboratory or the Neskowin Creek Water Testing Center. These are climate controlled facilities. Time sensitive reagents are clearly labeled with a chemical inventory sticker. Each sticker contains the date received, the date the item was opened, and the date the item expires.

B9. Data Acquisition Requirements

The Devils Lake Water Improvement District utilizes a Geographic Information System (GIS) for determining location of sampling sites, property ownership, land-use, and many other attributes about the watershed. These database files or GIS layers are obtained from reputable sources, specifically Lincoln County Planning and Development, Oregon Department of Geology and Minerals, the US Environmental Protection Agency, The US Department of Agriculture, and Oregon State University. Similarly, Streamflow and weather data may be retrieved by the District online or by contacting directly the USGS, Oregon Water Resources Department, and Oregon Climate Center for analysis and presentation purposes. Unless noted otherwise in the retrieved data, the quality of these results will be assumed to be of sufficient quality to use when analyzing DLWID's data. The limitations of all data collected will be referenced in any reports or presentations. Data acquired from non-governmental, third parties will not be uploaded into LASAR.

B10. Data Management

Field data are collected straight onto pre-printed, water proof paper. Each data parameter of interest is given a specific box for the researcher to fill in. For samples collected, boxes indicating if the sample is a grab, a replicate or a split are provided. Additional comment lines are provided for observations otherwise not collected. Data are transferred to a digital record for permanent storage and data manipulation. To increase the long-term digital integrity of the data, the Devils Lake Water Improvement District recently purchased a new computer with dual hard drives. Data are automatically stored on two separate hard drives in case of failure. Additionally, data are routinely backed up to external drives, and to web-based data storage systems.

Currently multiple spreadsheets (MS Excel) house the data, but efforts are currently underway to develop a database for data management. Data are entered into the spreadsheets by staff and by outside labs. For instance, cyanobacteria enumeration reports are prepared by Water Environmental Services, Inc. These spreadsheets are then



directly archived as a permanent record. Data are also entered by Neskowin Creek Water Testing (NCWT), for the bacteria analysis. This is done to facilitate the speed of data transmission (electronic mail verse only a hard copy) as well as to reduce data entry error. Data sent by NCWT are simply copied and pasted into a spreadsheet housed by DLWID. These data are in turn used to generate data reports including graphical representation of the data which are created for publication, website dissemination and media releases.

Data are also currently being prepared for submission into DEQ’s LASAR database. This is an online database managed by DEQ for data integrity. As a result data are presented to DEQ using specific submission criteria detailed in Table 10. All data in the DEQ’s database must be associated with a physical location defined by a latitude and longitude. Where existing LASAR sites do not match DLWID’s sites, new LASAR IDs will need to be created. For new sites, DLWID will provide DEQ with specific coordinates in latitude and longitude from the District’s GIS. The associated datum of the coordinates along with a map image of where new stations are will also be submitted.

Submitting Data: Example formats for submitting grab and continuous water quality data can be found on the DEQ’s Volunteer Monitoring web page. If DLWID is submitting data for a parameter not currently on the upload template’s “Raw Data” worksheet, then DLWID must specify what fields will be submitted for the new parameter. Generally these fields will include analytical organization, method, units, result value, data quality level, and comments. It may also be necessary to include laboratory batch numbers to link result values to appropriate QC results. DLWID should verify data submittal fields with their analytical laboratory and the DEQ volunteer monitoring specialist and include the fields in their approved SAP.

Table 9. DEQ Volunteer Monitoring Program Data Monitoring Procedures

Input	Action	Responsible Party	Output
Instantaneous Grab Water Quality Data			
Raw Field Data and Quality Control Results	Internal data management including review for reasonableness, completeness, data quality, existing DEQ LASAR stations, entry into electronic data storage, and formatting of data, including duplicate data, and assigned data quality level into an approved electronic format.	DLWID	Completed electronic data submittal file for DEQ.
Submitted Raw Field Data (DEQ’s “original record”)	Review for formatting and completeness; create new LASAR stations for new locations, assign appropriate DEQ parameter codes, sampling organization codes, and analytical organization codes.	ODEQ Volunteer Monitoring Specialist	Completed Request For Analysis (RFA) (LIMS field sheet) Needed codes for electronic upload to LIMS
Submitted Raw Field Data	Quality assurance review and reformatting data. Review and analyze all reported quality control information including splits, accuracy reports, duplicates and other results. Review/assign data quality levels to each reported result. Reformat	ODEQ Volunteer Monitoring Specialist	QA memo LIMS electronic upload comma separated file



	submitted data to LIMS electronic upload comma separated values format and assign all associated LIMS codes. Email electronic upload file and RFA to ODEQ Sample Coordinator.		
LIMS Electronic Upload File and RFA	Create LIMS Sampling event number and upload into LIMS	ODEQ Sample Coordinator	DAR
DAR	Review for successful upload and approve DAR.	ODEQ Volunteer Monitoring Specialist, ODEQ Managers	Approved DAR
Approved DARs	Print and sign Final Report.	ODEQ Sample Coordinator	Official Printed Final Report signed.
Release Data	Transfer electronic data to LASAR	ODEQ Technical Services staff	Data accessible on the DEQ webpage
Data in LASAR	Check on sampling event loading into LASAR, review 10% of sampling events for correct data transfer.	ODEQ Volunteer Monitoring Specialist	Verified LASAR data



Group C: Assessment and Oversight

C1. Assessment and Response Actions

Refer to Quality Assurance Project Plan

C2. Reports to Management

Quality controls are reported to Quality Assurance Officer by laboratory staff. With each sampling dataset, a hardcopy of the analysis is sent from the lab. In this analytical reporting sheet are the quality control values of reagent blanks, split samples and replicate sampling.



Group D: Data Validation and Usability

D1. Reports

The Devils Lake Water Improvement District creates weekly reports of its bacterial analysis during the monitoring season. These data summaries are map based depictions of water quality and serve to guide the recreational users of Devils Lake. These reports are posted on the District' website, posted at public recreational water access sites and are provided to the media and agencies such as the Department of Health and Human Services. Sampling generally occurs on Mondays and the reports are available by Tuesday Morning. A wider stakeholder group is also sent the weekly data through an email listserv, but generally this is not until Thursday such that additional Cyanobacterial data can be included in the weekly water quality announcements.

Bacteria results are generally available within 24 hours from sample delivery. The data are emailed to the Devils Lake Water Improvement District by the Neskowin Creek Water Testing Center. The data are copied into the current year's data spreadsheet entitled "Bacteria Sample Data.xls". The values are entered in for each site for the respected sample day. These data are copied and pasted into the column entitled "Current Week". Edits are made as to the color of the values in the "Current Week" column to correlate with the risk value associated with the value. The color Green is used for values 0-125 bacteria/100 ml, Yellow for counts 126-405, and Red for values above the single sample threshold of 406 bacteria/100 ml. The spreadsheet automatically updates the graphs associated with bacterial sample sites. Each graph contains all of the values to date in the current year for the sample site. Thresholds of 126 and 406 are clearly labeled on the graphs indicating the level of risk associated with the value. The worksheet is saved and closed.

Weekly postings are created by opening "Bacteria Posting.PPT" This PowerPoint Presentation is linked to the Excel sheet, and thus data are updated automatically. A Bacteria Posting.GIF is created from the presentation, and saved on to the hard disk and to the web through an FTP server. These files are used to create the kiosk, website, media and listserv postings described below.

WATERSHED POSTINGS: Postings for kiosks at public recreational sites are created by opening the document "Bacteria Summary – You are Here.doc" . Data is automatically updated from the Excel sheet and the PowerPoint presentation. The postings incorporate all of the weekly data on a map of the area. A color coded indicator is printed on each sheet with the breakdown of associated risks: Green 0-125, Yellow 126-405, and Red 406 or greater. Postings specific to a sample site list the name of the sample site with have the current datum circled. The data sheets are printed on Rite in the Rain Paper using a laser printer. The postings are displayed at the respected sample sites inside Plexiglas holders affixed prominently near the sample sites. This is



completed generally by the close of business following the sampling day. A sample of one of these posting is presented in the appendix.

WEB: The Devils Lake Water Improvement District maintains a website at www.DLWID.org. A page in the website is dedicated to and entitled, Monitoring. Bacteria monitoring results are posted weekly to this site. Postings are creating using MS PowerPoint file name "Bacteria Posting.ppt". Current sample data and publication dates are automatically updated into the file. An image file (Bacteria Posting.gif) is created and saved from the slide, which is used for web publication. The image is copied to the DLWID server into the Monitoring Folder, replacing the existing file

MEDIA POSTING: A copy of the Bacteria Posting.gif file is sent to all local media outlets. The News Guard prints the colored map each week. Sampling times and result distribution accommodate the weekly publication deadline of Tuesday at 10 am.

LISTSERV: A stakeholder and interested parties email list or listserv is maintained by the District. Individuals or entities can sign up for this service through the District website. Stakeholders signed up to receive the Water Quality Updates receive the bacteria data generally every Thursday through the summer. Stakeholders include the City of Lincoln City, Oregon Parks and Recreation Department, Oregon Health and Human Services, and the Lincoln County Health Department. Water quality updates may include result from other sampling, and thus the reports are sent out following that additional sample collection and analysis.

DEQ: Data submitted to Oregon Department of Environmental Quality is done on an annual basis.

D2. Data Review, Validation, and Verification

Refer to Quality Assurance Project Plan

D3. Validation and Verification Methods

Refer to Quality Assurance Project Plan

D4. Reconciliation with Data Quality Objectives

Refer to Quality Assurance Project Plan



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Bacteria Sampling and Analysis Plan

Appendix



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Appendix B: Sample *E. coli* Watershed Posting

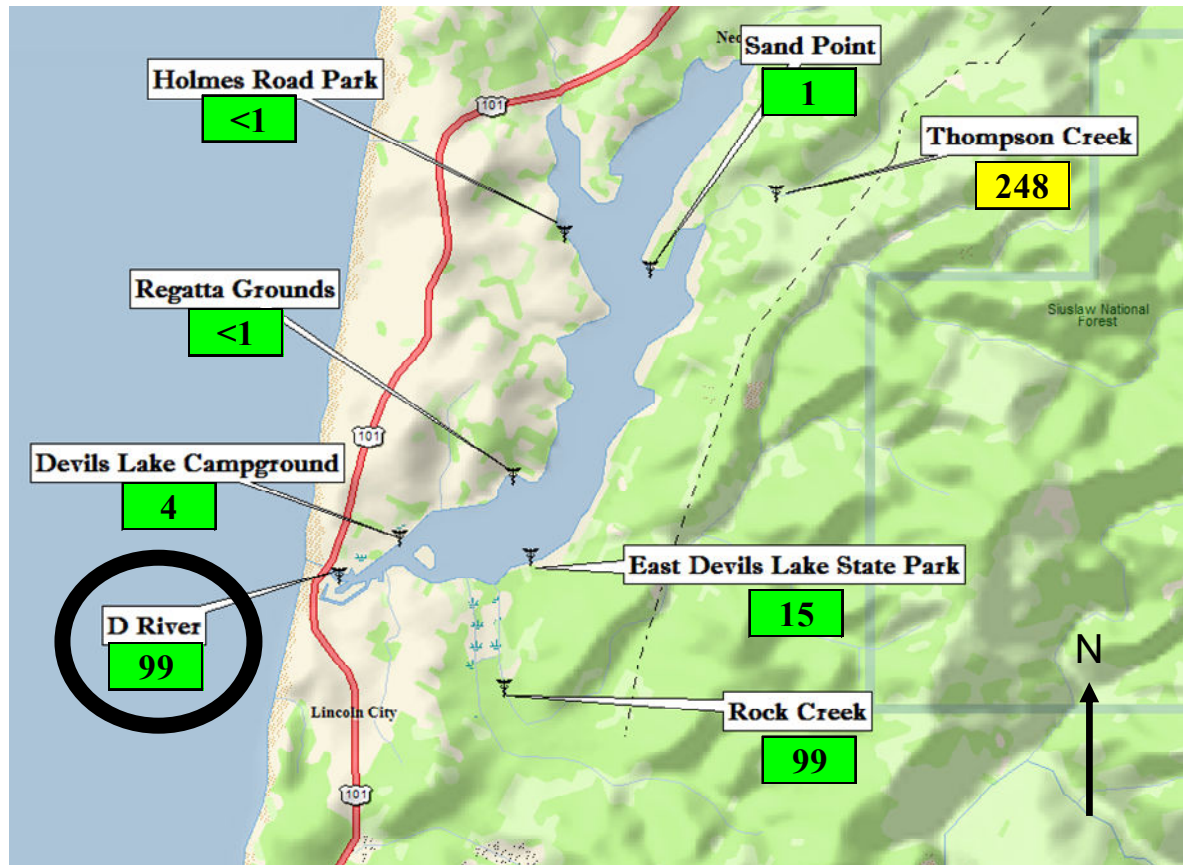


E. coli Summary

As of Tuesday, September 15, 2009

D River had met the state *E. coli* standard for recreational water quality

14 of 18 weeks sampled.



Devils Lake Water Improvement District
www.DLWID.org

You are at the D River

- The Devils Lake Water Improvement District conducts weekly *E. coli* tests of the freshwater beaches and major tributaries of Devils Lake.
- The data are for your information only, and do not indicate a closure or an actual advisory, but are posted here to serve as a guide to water quality in and around Devils Lake and the D River.
- The current value for each sample site is listed and color coded Red, Yellow or Green. These colors are associated with health risks based on state and federal guidelines for freshwater swimming waters.



For your convenience, you can also find this information online at www.DLWID.org
Questions? Please contact the Devils Lake Water Improvement District
Call (541) 994-5330 or Email: paul@DLWID.org