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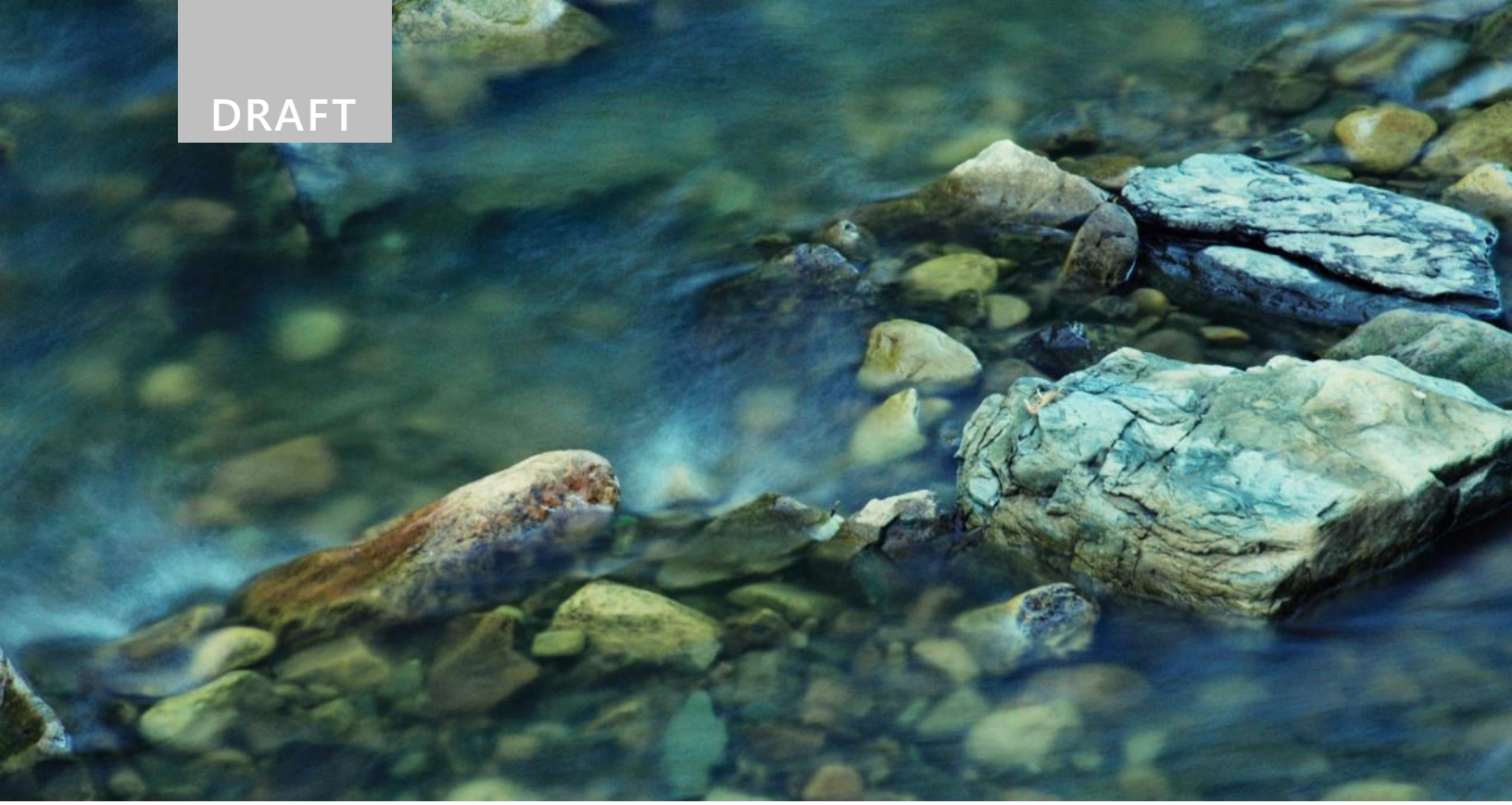

October 2018
SDWA-10-2013-0080/Yakima Valley Dairies

ANCHOR QEA

Nitrification/Denitrification Quality Assurance Project Plan

Prepared for
George DeRuyter & Son Dairy, LLC/D&A Dairy, LLC/George & Margaret, LLC

DRAFT

October 2018
SDWA-10-2013-0080/Yakima Valley Dairies

Nitrification/Denitrification Quality Assurance Project Plan

Prepared for
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Project Number: 180996-02.01
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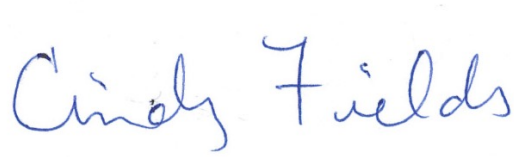
SIGNATURE PAGE

EPA Docket No. SDWA-10-2013-0080

Nitrification/Denitrification Quality Assurance Project Plan

Date: October 26, 2018

Mark Larsen
Project Coordinator, Anchor QEA, LLC



Date: October 26, 2018

Cindy Fields
Project Chemist/Quality Assurance Manager, Anchor QEA, LLC

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APPENDICES

ABBREVIATIONS

AOC	Administrative Order on Consent
DAF	dissolved air flotation
Dairy	George DeRuyter & Son/D&A Dairies
DQO	data quality objective
EPA	U.S. Environmental Protection Agency
FSDS	Field Sampling Data Sheet
HASP	Health and Safety Plan
NDN	nitrification/denitrification
PC	project coordinator
QAM	quality assurance manager
QAPP	Quality Assurance Project Plan
QC	quality control
SOP	standard operating procedure
SOW	Statement of Work
TO	treatment operator
WCC	Western Coordinating Committee

1 Project Management

1.1 Project/Task Organization

This section presents the necessary organizational structure and lines of communication to implement sampling and monitoring activities presented in this *Nitrification/Denitrification* (NDN) *Quality Assurance Project Plan* (QAPP).

This NDN QAPP was developed in accordance with requirements identified in Section III.A of the Statement of Work (SOW; Appendix B of Administrative Order on Consent [AOC] SDWA-10-2013-0080 [EPA 2013]). This NDN QAPP was prepared in accordance with *Guidance for Quality Assurance Project Plans (EPA QA/G-5)* (EPA 2002) and *EPA [U.S. Environmental Protection Agency] Requirements for Quality Assurance Project Plans (EPA QA/R-5)* (EPA 2001). In addition to this guidance, data quality objectives (DQOs) were developed using the requirements included in the AOC SOW and in accordance with *Guidance on Systematic Planning Using the Data Quality Objectives Process (EPA QA/G-4)* (EPA 2006).

The project organization and lines of authority and communication are illustrated schematically in Figure 1.

The project coordinator (PC) will be responsible for implementing the activities identified in this NDN QAPP and maintaining communication with the EPA PC to report progress and resolve issues that may arise while implementing this NDN QAPP, if necessary. The PC has overall authority over the project team and NDN QAPP implementation.

The project chemist/quality assurance manager (QAM) will help develop and review project planning documents, evaluate data, and prepare deliverables.

A certified analytical laboratory will analyze the manure samples.

The treatment operator (TO)/site safety coordinator will be responsible for sample collection and implementation of this NDN QAPP and the Health and Safety Plan (HASP).

The PC and project chemist/QAM will develop appropriate corrective actions to address any potential quality assurance issues or deficiencies that may occur. Corrective actions will be communicated to the EPA PC and implemented and documented by the TO or laboratory as required.

1.2 Problem Definition/Background

1.2.1 Purpose

This NDN QAPP defines and describes the processes and methods to perform NDN influent and effluent monitoring. This NDN QAPP was developed to document the type, quantity, and quality of data needed to meet project objectives and support key decisions. This NDN QAPP also describes the methods for collecting and assessing data collected to implement the NDN QAPP.

1.2.2 Primary Objective

The objective of this NDN QAPP is to evaluate nutrients in the influent and effluent of the NDN digestor system operated to remove nitrogen from the manure lagoon liquids.

1.2.3 Study Design

George DeRuyter & Son/D&A Dairies (herein referred to as the Dairy) are implementing an NDN treatment system to reduce nitrogen concentrations in manure pre-treated by the Dairy's dissolved air floatation (DAF) unit. EPA has established a goal of 40% removal efficiency to be met by July 2019 (EPA Letter 178). If that removal efficiency cannot be met, then the schedule for lagoon retrofits will be modified (expedited). Representative data are required to document achieved removal efficiencies.

The quantity of manure treated by the NDN treatment system will be measured using a flow totalizer located at downstream of the DAF unit. Sampling locations will be established downstream of the DAF unit (NDN influent sample) and downstream of the NDN treatment system (NDN effluent sample).

The NDN treatment system operator will collect analytical samples and archives on a monthly basis, at a minimum. The samples will be submitted to the SoilTest Farm Consultants, Inc., laboratory for analysis of nitrate/nitrite, ammonia, organophosphate, total Kjeldahl nitrogen, and total suspended solids.

1.3 Project/Task Description and Schedule

1.3.1 Project/Task Description

The scope of this NDN QAPP encompasses NDN treatment system installation, monthly sampling once the unit is operational, and laboratory analysis of NDN influent and effluent samples. Information collected in accordance with this NDN QAPP will be reported in monthly NDN System Monitoring Reports.

The NDN treatment system is being constructed within D&A Dairy Lagoon No. 1, located directly downstream of the digester and DAF unit. The manure flows to the NDN treatment system are being monitored for flow by the digester operator (Regenis). That information will document the quantity and rates of manure treated by the NDN system.

Samples of NDN influent and NDN effluent will be measured at least once per month during the study period. The testing program will include collection of archive samples that can be analyzed in the event that laboratory data are rejected during data validation or if additional data points are desired.

1.3.2 Project Schedule

Task	Start Date	Completion Date
Submit NDN QAPP	August 17, 2018	October 26, 2019
Perform monthly sampling events	January 2019	December 2019
Submit analytical results and figures showing nitrogen levels in NDN influent and effluent	In parallel with Monthly Progress Report submittal	In parallel with Monthly Progress Report submittal
Submit Quarterly NDN Monitoring Data Report containing a cumulative presentation of all data collected to date, validation, and laboratory reports	February 2019	February 2020

1.4 Quality Objectives and Criteria

1.4.1 Project Quality Objectives

Project-specific DQOs were identified through the DQO process (EPA 2006) to meet the data user's needs for each activity. The specific data needs for the NDN monitoring primarily focus on total nitrogen concentrations in NDN influent and effluent. The DQO decision-making process for the NDN performance monitoring is described in Appendix A.

The data needs for the NDN monitoring are summarized in Table 1. This table lists the specific analytes, regulatory limits and measurement criteria, and data uses. The different criteria evaluated to develop the data needs are described in the DQO decision-making process (Appendix A).

1.4.2 Measurement Performance Criteria

Measurement performance criteria are often expressed in terms of data quality indicators. The principal indicators of data quality are precision, accuracy, representativeness, comparability, and

completeness. The following are definitions to assess data quality indicators summarized from *Guidance for Quality Assurance Project Plans (EPA QA/G-5)* (EPA 2002):

1. **Precision** is the measure of agreement among repeated measurements of the same property under identical or substantially similar conditions.
2. **Accuracy** is a measure of the overall agreement of a measurement to a known value. It includes a combination of random-error (precision) and systematic-error (bias) components of both sampling and analytical operations.
3. **Representativeness** is a qualitative term that expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Representativeness will be addressed by using appropriate sample preservation and handling techniques; analyzing samples within holding times; analyzing duplicate samples, matrix spike samples, and blanks; and selecting representative sampling locations.
4. **Comparability** is a qualitative term that expresses the measure of confidence that one dataset can be compared to another and can be combined for a decision to be made. Comparability of data is established through the use of standard analytical methodologies, with practical quantitation limits low enough to provide detected concentrations of analytical parameters, standard reporting formats, and common traceable calibration and reference materials.
5. **Completeness** is a measure of the amount of valid data needed to be obtained from a measurement system.

Precision, accuracy, and completeness criteria are shown in Table 2.

1.5 Special Training/Certification

All personnel working on the project site will be trained in health and safety in accordance with the HASP. All personnel will comply with the requirements included in the HASP regarding site-specific hazards and conditions. Training requirements, documentation, and tracking are included in the HASP.

Section III.A.3.a of the AOC SOW requires laboratories analyzing drinking and non-drinking water samples to be accredited by the State of Washington, the National Environmental Laboratory Accreditation Program, or an equivalent as determined by EPA. As per Section VII.13.a of the AOC, the analytical laboratory's certification will be provided to EPA prior to use of the lab for analytical testing. The analytical laboratory will comply with the requirements for analytical laboratories described in Section III.A.3.a of the AOC SOW. Laboratory certification is included in Appendix B.

1.6 Documents and Records

All field activities will be documented in the appropriate field form included in Appendix C. Field documentation may include, but is not limited to, the following:

- Flow Measurement Survey
- Chain-of-Custody Form

All field team-generated documentation will be compiled and submitted to the TO and PC for distribution, inclusion in the project records, and use in subsequent reporting.

Laboratory documentation will be provided in accordance with the methods and protocols discussed in Section 4 of this NDN QAPP. Laboratory analytical data will be distributed to the PC. The PC will distribute the data to EPA, project team members, and others as required.

2 Data Generation and Acquisition

Considering the primary objective of the project (as detailed in Section 1.2.2), a field activity and sampling strategy has been designed to ensure that all information, sample collection, analytical data, and resulting decisions are technically sound, scientifically valid, and properly administered.

2.1 Sampling Design

The objectives of the project will be accomplished by collecting flow data and influent/effluent samples from the NDN system to monitor nutrient concentrations and percent nitrogen removal.

2.1.1 Nitrification/Denitrification System Sampling

Influent and effluent samples will be collected from the NDN system. Samples will be analyzed for nitrate/nitrite, ammonia, orthophosphate, total Kjeldahl nitrogen, and total suspended solids. Section 2.2 presents a description of the sampling methodology employed to collect samples.

Laboratory analytical results will be used to investigate percent nitrogen removal from the NDN treatment system at the Dairy. Monthly results from will be used to evaluate percent nitrogen removal over time to evaluate the effectiveness of the digester and NDN treatment system.

2.1.2 Flow Measurements

Flow measurements will be recorded by a flow totalizer and documented in the field forms. Flow meters will be located at the inlet to the NDN system.

2.2 Sample Collection

This section presents the sampling methodology for collecting laboratory analytical samples from NDN treatment system.

Samples will be collected from the NDN treatment system by collection of one influent and one effluent sample. Archive samples will be collected to allow for additional analysis in the event that problems are identified during analysis or data validation for the original sample.

Duplicate samples will be collected each quarter beginning in January 2019 to assess precision of the sampling results (Section 2.5.1).

Sample container types, number of containers, holding times, and preservation for required analytes are specified in Table 2.

Grab sample collection will begin upon completion of installation. Samples will be collected at the inlet and outlet monthly, beginning in January 2019 and continuing through July 2019.

The influent sampling location will be the tailpipe of the fine solids separator that flows to the NDN lagoon. The effluent sampling location will be the overflow pipe leaving the NDN lagoon to the secondary storage lagoon.

Sampling protocol involves inserting clean, empty 1-liter polyethylene bottles into a flowing stream at an inlet/outlet and filling the bottle approximately two-thirds full. One additional bottle will be collected for archival purposes.

Figure 2 shows the NDN system inlet and outlet locations at Lagoon No. 1.

2.3 Sample Handling and Custody

This section describes sample management and documentation to ensure that samples maintain their original condition during collection, transportation, storage, and analysis. All sample control and chain-of-custody procedures will follow the standard operating procedure (SOP) entitled "Chain of Custody, Handling, Packing, and Shipping" (Appendix D), except where noted.

2.3.1 Sample Identification

Each sample collected in the field will be labeled for future identification. Sample labels will be filled out as completely as possible by a member of the sampling team prior to the start of the day's field sampling activities. The date, time, and sample identification number should not be completed until the sample is actually collected. All sample labels will be filled out using waterproof ink. Each label will contain the following information at a minimum:

- Sampler's initials
- Sampler's company affiliation
- Project name
- Sample identifier
- Date and time of sample collection
- Analyses required

The sample nomenclature should include the following identifiers:

- Project identifier (NDN for nitrification/denitrification)
- Media code (influent or effluent)
- Sample number
- Date of collection (YYMMDD format)
- Indication of field duplicate if applicable (i.e., add 100 to station number)

Following is an example sample identifier for a sample collected from the influent inlet at Station 1 on January 15, 2019:

NDN-INFLUENT-01-190115

Following is an example sample identifier for a field duplicate of that same sample:

NDN-INFLUENT-101-190115

Field duplicate collection frequency is addressed in Section 2.5.1.

2.3.2 Sample Chain of Custody

Sample designation, sampling time and date, sampling personnel, and analyses will also be recorded on the field records, sample labels, and chain-of-custody records. The purpose of the chain of custody is to ensure the possession of samples is traceable from the time the samples are collected until they are analyzed. A sample is considered to be in custody when the following occurs:

- It is in the possession of the sampler, transporter, or laboratory.
- It is in view of the sampler, transporter, or laboratory after being in their possession.
- It was in the possession of the sampler, transporter, or laboratory and was then secured by them.
- It is in a designated secure area that has restricted access.

To ensure proper sample control in the field, it is important that as few people as possible handle the samples. The field sampler is the primary person responsible for the care and custody of samples until they are transferred or shipped. The PC and TO will determine if proper custody procedures have been followed during field activities and, if deficiencies are found, will determine if additional sample collection is warranted.

All samples will be accompanied by a chain-of-custody record. When sample custody is transferred, the individuals relinquishing and receiving the samples will sign and date the chain-of-custody record. The chain-of-custody record documents custody transfer from the sampler, often through another agent (shipping/transport company), to the laboratory sample custodian.

Samples will be packaged properly prior to shipping, and a chain-of-custody record will accompany each shipping container. All shipping containers will be sealed with custody seals for shipment/transport to the laboratory, unless the sample coolers are hand-delivered to the laboratory. Hand-delivered coolers will be transported without custody seals only if they remain in the controlled possession of the sampler at all times; if a cooler is outside of the sampler's possession, then a custody seal will be affixed.

Custody seals will be placed in a manner that will indicate if the container had been opened during shipment. Courier names and other pertinent information will be documented on the chain-of-custody record. All shipments will be accompanied by the chain-of-custody record that identifies the contents of the shipment. The original will be included in the shipment; an additional copy will be retained by the sampler and provided to the PC. All shipping documentation (e.g., freight bills) will be retained as part of the chain-of-custody documentation by the PC.

Once at the laboratory, the sample custodian will accept custody of the samples and enter information about the shipment into a sample receipt log that will include the initials of the person receiving the package, the cooler temperature, and the status of custody seals on the containers. The sample custodian will log in the samples following the laboratory's SOP. The unused portions of all samples after analysis will be disposed of by the laboratory in accordance with their SOP.

2.3.3 Field Sampling Data Sheets

In addition to the chain-of-custody documentation described in Section 2.3.2., Field Sampling Data Sheets (FSDSs) will be completed to document daily activities and observations. FSDSs will be completed for each groundwater and quality assurance sample collected and will include sample identification, sample collection time, sample bottles used, analysis requested, flowmeter readings, and other pertinent information, including significant events and observations that occur during sampling activities.

Sufficient information will be noted on the FSDSs to enable participants to reconstruct events that occurred and to refresh the memory of field personnel, if needed. Original copies of field forms and chain-of-custody documents will be retained by the PC in the project files.

2.4 Analytical Methods

Groundwater samples will be analyzed for the following analytes and methods:

- Nitrate+nitrite (as nitrogen) by Western Coordinating Committee (WCC) Method S-3.10
- Ammonia (as nitrogen) by WCC Method S-3.50
- Orthophosphate by WCC Method S-4.10
- Total Kjeldahl nitrogen by WCC Method B-2.20
- Total suspended solids by Standard Method 2540 CD

Table 2 presents the analytes, method, container, preservation method, and holding times for the groundwater samples collected during groundwater monitoring.

2.5 Quality Control

This section presents the field and laboratory quality control (QC) requirements for NDN monitoring.

2.5.1 Field Quality Control Samples

NDN monitoring includes collecting field QC samples including field duplicates and field blanks. The field duplicate sample will be collected concurrently with the normal sample using the same collection procedures. Duplicate and field blank samples will be collected at a minimum of once per quarter beginning in January 2019 and again in March and June 2019. The date and time the field duplicate is sampled will be recorded on the FSDS and chain-of-custody record correctly. No attempts at a "blind" sample (e.g., marking all field duplicates as being collected as 12:00 p.m.) will be made. The field blank is a sample of analyte-free water collected by pouring directly into the sample bottle and provides information on field conditions during sampling. Equipment blanks will not be required because samples are collected directly into the sample container.

2.5.2 Laboratory Quality Control Procedures

Laboratory QC procedures include the following:

- Instrument calibration and standards as defined in the specified analytical methods
- Laboratory blank measurements at a minimum of 5% or a one-per-batch frequency
- Accuracy and precision measurements at a minimum of one per set
- Data reduction and reporting according to the specified analytical methods
- Laboratory documentation according to the specified analytical methods and laboratory SOP requirements

2.6 Instrument/Equipment Testing, Inspection, and Maintenance

Instrument maintenance logbooks will be maintained in the laboratory at all times and will include a schedule of maintenance and a complete history of past maintenance for equipment used to analyze NDN monitoring samples.

2.7 Laboratory Instrument/Equipment Calibration and Frequency

The analytical laboratory will follow all calibration procedures and frequencies specified in the analytical methods listed in Section 2.4. The calibration requirements for each method and respective corrective actions will be accessible, either in the laboratory SOPs or in the laboratory's Quality Assurance Manual for each instrument or analytical method in use. All calibrations will be preserved on electronic media.

2.8 Inspection/Acceptance of Supplies and Consumables

Supplies and consumables will be inspected upon receipt. All sample bottles used for collecting laboratory analysis samples will be new, certified clean, and provided by the laboratory. Field sampling team members will make note of the information on the certificate of analysis that accompanies sample containers to ensure that they meet the specifications and guidance for

contaminant-free sample containers. Any discrepancies will be brought to the attention of the TO immediately.

2.9 Non-Direct Measurements

No pre-existing data will be used to make decisions to support the NDN monitoring. All data used to support decision-making will be collected during monitoring after the system is fully operational.

2.10 Data Management

All field data collected during the groundwater monitoring will be recorded on field forms. Pertinent information will be transferred to a Microsoft Excel spreadsheet or similar electronic data management tool. The analytical data obtained from the laboratory will be maintained in an electronic database. All data will undergo review and validation as described in Section 4.

3 Assessment and Oversight

3.1 Assessments and Response Actions

The PC and project chemist/QAM will monitor the performance of the quality assurance procedures presented in this NDN QAPP. The PC has the ultimate responsibility for implementing this NDN QAPP. If problems arise, or if directed by the PC, the project chemist/QAM will conduct a field audit to evaluate compliance with the guidance presented in this NDN QAPP.

The laboratory will comply with the methods listed in Section 2.3 and laboratory SOPs for sample analyses; QC; and instrument testing, inspection, maintenance, and calibration. If deficiencies are noted, the laboratory will notify the project chemist/QAM. If such cases occur, the PC will notify the EPA PC, and corrective action procedures will be implemented.

3.2 Reports to Management

3.3 Nitrification/Denitrification System Monitoring Data Reports

Monthly NDN Monitoring Data Reports will be prepared starting in 2019 after the NDN treatment system is fully operational. The Monthly NDN Monitoring Data Reports will present the findings of the NDN monitoring work. Reports will include, but are not limited to, the following components:

- Each Monthly NDN Monitoring Data Report will present, in tabular format, the validated data with qualifiers, as applied. Each monthly report will include figures that depict, at a minimum, cumulative influent and effluent constituent concentrations (including total nitrogen) plotted against time.
- Each Quarterly NDN Monitoring Data Report will include the same information contained in the Monthly NDN Monitoring Data Reports as well as Data Validation Summary Reports and the analytical data packages from the laboratory.

3.3.1 Analytical Data Reporting

The analytical laboratory will submit sufficient laboratory documentation such that sample results are traceable to the field samples and the analytical data can be verified and validated by an independent third-party review. Preliminary and validated data reports will be provided by the laboratory to the PC. The PC and project chemist/QAM will review the data reports from the laboratory and evaluate the data validation and usability as described in Section 4. Validated data, the Data Validation Summary Report, and associated raw data will be submitted to EPA as part of data reporting.

The following information will either be supplied by the laboratory as a hard copy deliverable to support project activities, data validation, and the documentation of data quality or maintained at the laboratory and available on request:

Data Deliverables or Information Supplied by or Maintained at the Laboratory
Case narrative, including a discussion of nonconformance and corrective actions
Sample data and QC data summary forms
Chain-of-custody records, sample receipt forms, logbook pages, shipping manifests
Verification of sample temperature on receipt
Copies of temperature logs for storage coolers used to store samples
Certificate of cleanliness for all laboratory-supplied sample bottles
Internal chain of custody
Copies of SOPs
Sample and standard preparation logs
Instrument operating conditions
Copies of sample analysis logbooks and analyst's notes
Instrument run log including copies of autosampler loading and verification of autosampler loading
Raw data for instrument—hardcopy or electronic for field, calibration, and QC samples
Data review sheets
Example calculations
Control charts for method blanks, replicates, matrix spikes, matrix spike duplicates, laboratory control samples, and surrogates
Pertinent method detection limit studies and supporting information
Standards, standards reference materials, balance weights, and thermometer certificates
Verification of autopipettes and volumetric glassware
Balance calibration logs
Equipment maintenance records
Consumables acceptance and tracking records
Analyst's demonstration of precision and accuracy

The validated data will be submitted monthly to EPA. The Data Validation Summary Report and the associated laboratory data packages will be submitted to EPA quarterly.

4 Data Validation and Usability

4.1 Data Review, Verification, and Validation

Data verification will be conducted by the laboratory prior to submitting to the PC. Data review, validation, and verification performed by the laboratory will comply with EPA requirements and laboratory SOPs for the methods specified in Section 2.4 of this NDN QAPP.

4.2 Verification and Validation

Prior to submitting the analytical samples to the laboratory, the sampling team leader or a designate will review the field notes and chain of custody for accuracy and completeness. The notes will be reviewed for appropriate documentation of the field work-pertinent activities. The chain of custody will be reviewed for appropriate sample nomenclature and selected analysis.

The analytical data generated shall be reduced, verified, and reported by the laboratory according to the methods listed in Section 2.4. Data verification will be performed by the laboratory for all analyses prior to releasing the data. The laboratory will archive the analytical data in their own laboratory data management system. The project chemist will also validate laboratory data upon receipt.

4.2.1 Validation

The project chemist will validate laboratory data upon receipt. The project chemist will perform an EPA Stage 2A (EPA 2009) validation consistent with the most current National Functional Guidelines (EPA 2017). A validation checklist will be included with each monthly report, and a Data Validation Summary Report (including a table containing qualifiers applied to data) will be included with each Quarterly NDN Monitoring Data Report.

4.3 Reconciliation with User Requirements

Analytical data results obtained during the NDN treatment system monitoring will be reconciled with precision, accuracy, and completeness criteria shown in Table 2.

5 References

EPA (U.S. Environmental Protection Agency), 2001. *EPA Requirements for Quality Assurance Project Plans (EPA QA/R-5)*. EPA-240-B-01-1003. Office of Environmental Information, Washington, D.C. March 2001 (reissued May 2006).

EPA, 2002. *Guidance for Quality Assurance Project Plans (EPA QA/G-5)*. EPA-240-R-02-009. Office of Environmental Information, Washington, D.C. December 2002.

EPA, 2006. *Guidance on Systematic Planning Using Data Quality Objectives Processes (EPA QA/G-4)*. EPA 240-B-06-001. Office of Environmental Information, Washington D.C. February 2006.

EPA, 2009. *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use*. EPA-540-R-08-005. Office of Solid Waste and Emergency Response. January 2009.

EPA, 2013. *Administrative Order on Consent (AOC) Docket No. SDWA-10-2013-0080*. March 19, 2013.

EPA, 2017. *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Methods Data Review*. EPA-540-R-2017-001. Office of Superfund Remediation and Technology Innovation. January 2017.

Tables

Table 1
Data Needs

Analyte	Units	Lowest Potential Regulatory Level/ Measurement Criteria[a]	Data Use
Laboratory Measurements			
Nitrate/nitrite	mg/L	10/1	Document total nitrogen content in manure before and after treatment
Ammonia	mg/L	--	
Total Kjeldahl nitrogen	mg/L	--	
Available phosphorus	mg/L	--	Understand impact on available phosphorous concentrations
Total suspended solids	mg/L	--	Understand solids loading of manure
Field Measurements			
Flow	total gallons or cubic feet	--	Document quantify of manure treated

Notes:

a. National Primary Drinking Water Regulations MCLs are not applicable to manure directly but rather apply in drinking water. The 10 mg/L MCL is for nitrate, the 1 mg/L MCL is for nitrite.

-- : not applicable

MCL: Maximum Contaminant Level

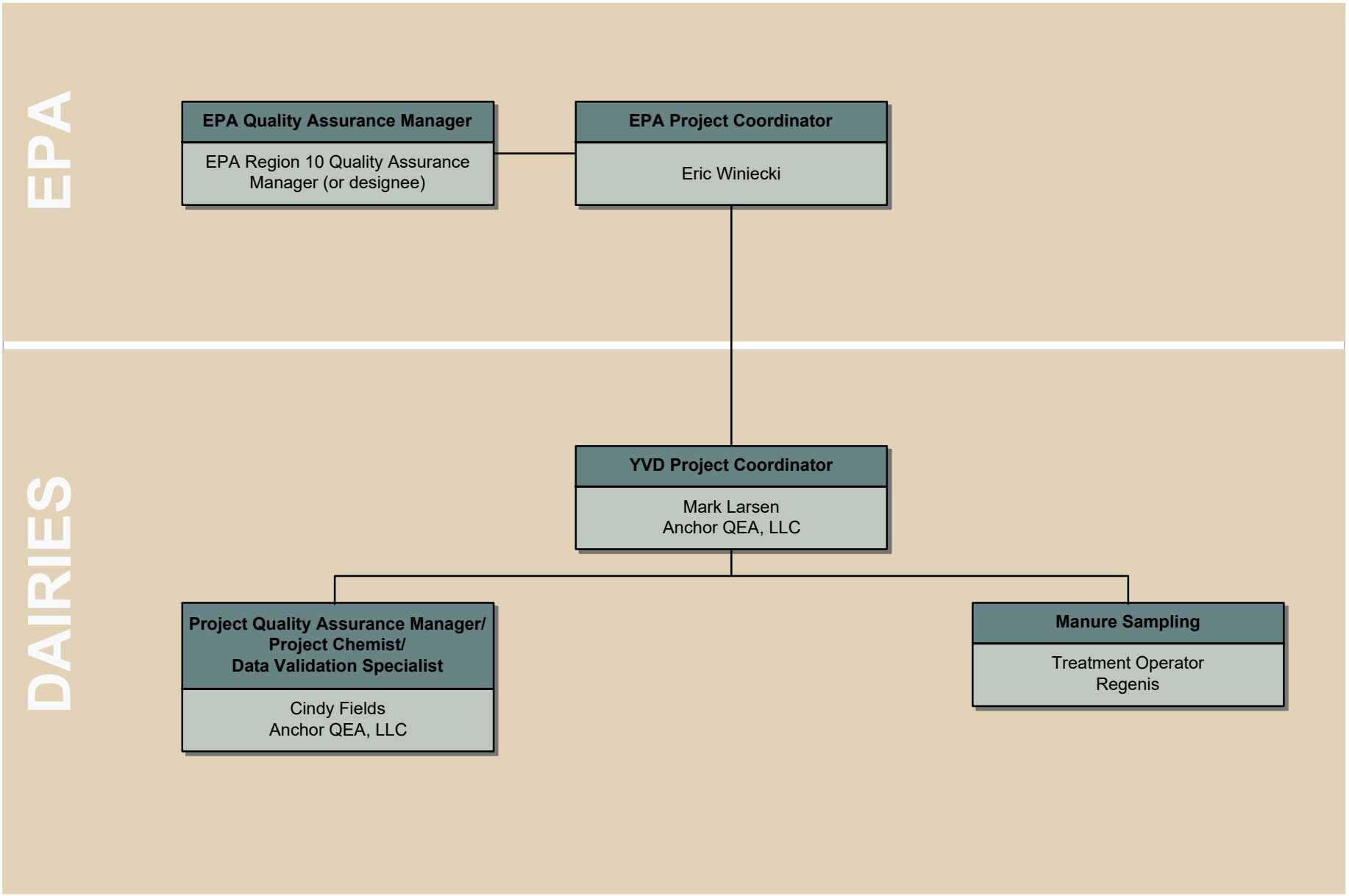
mg/L: milligrams per liter

Table 2
Analytes, Methods, Holding Times, and Preservation

Analyte	Method	Laboratory Reporting Limit (mg/kg)	Container[1]	No. of Containers	Shared Container Designation	Hold Time	Preservation	Accuracy	Precision	Completeness
Nitrate+nitrite	WCC S-3.10	0.8	1-L HDPE	1	Bottle No. 1	48 hours at ≤6°C; Indefinitely at ≤15°C	Liquid: closed container at ≤6°C	80% to 120%	+/-20%	90%
Ammonia	WCC S-3.50	3.2				48 hours at ≤6°C; Indefinitely at ≤15°C	Liquid: closed container at ≤6°C	80% to 120%	+/-20%	90%
Orthophosphate	WCC S-4.10	5.2	1-L HDPE	1	Bottle No. 2	28 days	Liquid: closed container at ≤6°C	80% to 120%	+/-20%	90%
Total Kjeldahl nitrogen	WCC B-2.20	520				28 days	Liquid: closed container at ≤6°C	80% to 120%	+/-20%	90%
Total suspended solids	SM 2540 CD	3				7 days	≤6°C	80% to 120%	+/-20%	90%
Archive	--	--	1-L HDPE	1	Bottle No. 3	--	Liquid: closed container at ≤15°C	--	--	--

Notes:
1. If samples cannot be submitted to the laboratory within 48 hours, fill the bottle two-thirds full and freeze upon collection.
--: not applicable
HDPE: high-density polyethylene
L: liter
mg/kg: milligrams per kilogram
SM: Standard Method
WCC: Western Coordinating Committee

Figures



Publish Date: 2018/10/26 6:38 PM | User: rpetrie
Filepath: K:\Projects\0996-Perkins Coie\Yakima Dairies Project\Lagoons - 2018\QAPP\0996-RP-007 (Org Chart - NDN).dwg Figure 1

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Figure 1
Project Organization

Nitrification/Denitrification Quality Assurance Project Plan
Yakima Valley Dairies

SOURCE: Aerial from Google Earth Pro 10/16/2018
HORIZONTAL DATUM: Washington State Plane South, North American Datum of 1983, U.S. feet

NOTES:
DAF: dissolved air flotation
NDN: nitrification\denitrification

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Feet

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Filepath: K:\Projects\0996-Perkins Coie\Yakima Dairies Project\Lagoons - 2018\QAPP\0996-RP-001 (2018 QAPP D&A Lagoon 1).dwg Figure 2

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Figure 2
Nitrification/Denitrification System Inlet and Outlet Locations at Lagoon No. 1

Nitrification/Denitrification Quality Assurance Project Plan
Yakima Valley Dairies

Appendix A
Data Quality Objectives

Table A-1
Data Quality Objectives for Sampling

Data Quality Objective Step	Description
Step 1: State the Problem	George DeRuyter & Son/D&A Dairies are implementing a nitrification/denitrification (NDN) treatment system to reduce total nitrogen concentrations in the manure pre-treated by the dissolved air floatation (DAF) unit. The U.S. Environmental Protection Agency (EPA) has established a goal of 40% total nitrogen removal efficiency to be met by July 2019 (EPA Letter 178). If that removal efficiency cannot be met, then the schedule for lagoon retrofits will be modified (expedited). Representative data are required to document achieved removal efficiencies. EPA's minimum expectations for those data were outlined in EPA Letter 178.
Step 2: Identify the Goals of the Study	Primary Questions: • What reduction in total nitrogen levels is achieved through the NDN treatment process when comparing influent and effluent nitrogen concentrations? • Can the NDN treatment system achieve and maintain a 40% removal efficiency by July 2019? • How does the NDN treatment system affect the distribution of the different forms of nitrogen (i.e., organic nitrogen, ammonia nitrogen, nitrate/nitrite nitrogen) in the manure?
Step 3: Identify the Information Inputs	• The NDN treatment system is being constructed within D&A Dairy Lagoon No. 1, located directly downstream of the digester and DAF unit. • The manure flows to the NDN treatment system are being monitored for flow by the digester operator (Regenis). That information will document the quantity and rates of manure treated by the NDN treatment system.
Step 4: Define the Boundaries of the Study	• Spatial Boundary: The study will compare the manure influent entering the NDN treatment system (downstream of the DAF) and the manure effluent from the NDN treatment system. • Temporal Boundary: The study will document influent and effluent concentrations on a monthly basis between December 2018 and December 2019. • Media of Interest: This study is specific to the manure treated by the NDN system.
Step 5: Develop a Decision Rule	Primary Decision Rule: As described in EPA Letter 178, the NDN treatment system will be considered successful if it results in NDN effluent manure nitrogen levels that are, on average, 40% lower than NDN influent levels. Nitrogen levels will represent the sum of organic nitrogen (the difference between total Kjeldahl nitrogen and ammonia nitrogen), ammonia nitrogen, and nitrate/nitrite nitrogen.

Table A-1
Data Quality Objectives for Sampling

Data Quality Objective Step	Description
Step 6: Specify Performance or Acceptance Criteria	Samples of NDN influent and NDN effluent will be measured at least once per month during the study period. The testing program will include the collection of archive samples that can be analyzed in the event that laboratory data are rejected during data validation or if additional data points are desired. • Precision, accuracy, and completeness criteria for analytical samples are shown in Table 3 of the *NDN Quality Assurance Project Plan* (QAPP). • Data verification will be conducted by the laboratory prior to submission to the project coordinator. • Data review, validation, and verification will comply with EPA National Functional Guidelines and laboratory standard operating procedures for the analytical methods specified in Section 2.5.2 of the QAPP.
Step 7: Develop a Detailed Plan for Obtaining Data	1. The quantity of manure treated by the NDN treatment system will be measured using a flow totalizer located downstream of the DAF unit. 2. Sampling locations will be established downstream of the DAF unit (NDN influent sample location) and downstream of the NDN treatment system (NDN effluent sample). 3. The NDN treatment operator will collect analytical samples and archives on a monthly basis, at a minimum. The samples will be submitted to the State of Washington-certified SoilTest Farm Consultants, Inc., laboratory for chemical analysis. 4. Manure samples will analyzed for nitrate/nitrite, ammonia, organophosphate, total Kjeldahl nitrogen, and total suspended solids. 5. Analytical data will be compiled, validated, and reported to EPA. Summary information on the amount of manure treated and the nitrogen levels in the influent and effluent from the treatment process will be presented to EPA monthly. Data reporting will comply with the expectations in EPA Letter 178. 6. Laboratory data packages and complete Data Validation Summary Reports will be submitted quarterly to EPA. 7. Following the June 2019 data collection period, the removal of total nitrogen by the NDN treatment system will be compared against the EPA's 40% performance target. Trends in system performance will also be noted at that time.

Appendix B
Lab Certifications

WASHINGTON STATE DEPARTMENT OF ECOLOGY

ENVIRONMENTAL LABORATORY ACCREDITATION PROGRAM

SCOPE OF ACCREDITATION

Soiltest Farm Consultants, Inc. Laboratory

Moses Lake, WA

is accredited for the analytes listed below using the methods indicated. Full accreditation is granted unless stated otherwise in a note. EPA is the U.S. Environmental Protection Agency. SM is "Standard Methods for the Examination of Water and Wastewater." ASTM is the American Society for Testing and Materials. USGS is the U.S. Geological Survey. AOAC is the Association of Official Analytical Chemists. Other references are described in notes.

Matrix/Analyte	Method	Notes
Drinking Water		
Turbidity	SM 2130 B-01	
Fluoride	SM 4500-F^- C-97	
Nitrate	SM 4500-$NO3^-$ F-00	
Nitrite	SM 4500-$NO3^-$ F-00	
Non-Potable Water		
n-Hexane Extractable Material (O&G)	EPA 1664A_1_1999	
Turbidity	SM 2130 B-01	
Alkalinity	SM 2320 B-97	
Hardness (calc.)	SM 2340 B-97	
Specific Conductance	SM 2510 B-97	
Solids, Total	SM 2540 B-97	2
Solids, Total Dissolved	SM 2540 C-97	2
Solids, Total Suspended	SM 2540 D-97	
Chloride	SM 4500-Cl^- E-97	
Fluoride	SM 4500-F^- C-97	
Ammonia	SM 4500-NH3 G-97	
Nitrate	SM 4500-$NO3^-$ F-00	
Nitrite	SM 4500-$NO3^-$ F-00	
Nitrogen, Total Kjeldahl	SM 4500-Norg B-97	
Orthophosphate	SM 4500-P E-99	1
Sulfate	SM 4500-$SO4^-$ E-97	
Biochemical Oxygen Demand (BOD), Carbonaceous BOD (CBOD)	SM 5210 B-01	1

Matrix/Analyte	Method	Notes
Chemical Oxygen Demand (COD)	SM 5220 D-97	
Aluminum	EPA 200.5_4.2_2003	
Antimony	EPA 200.5_4.2_2003	
Arsenic	EPA 200.5_4.2_2003	
Barium	EPA 200.5_4.2_2003	
Beryllium	EPA 200.5_4.2_2003	2
Cadmium	EPA 200.5_4.2_2003	
Chromium	EPA 200.5_4.2_2003	
Cobalt	EPA 200.5_4.2_2003	
Copper	EPA 200.5_4.2_2003	
Iron	EPA 200.5_4.2_2003	
Lead	EPA 200.5_4.2_2003	
Lithium	EPA 200.5_4.2_2003	1
Manganese	EPA 200.5_4.2_2003	
Molybdenum	EPA 200.5_4.2_2003	
Nickel	EPA 200.5_4.2_2003	
Selenium	EPA 200.5_4.2_2003	
Silver	EPA 200.5_4.2_2003	
Strontium	EPA 200.5_4.2_2003	
Vanadium	EPA 200.5_4.2_2003	
Zinc	EPA 200.5_4.2_2003	
Calcium	EPA 200.7_4.4_1994	
Magnesium	EPA 200.7_4.4_1994	
Phosphorus	EPA 200.7_4.4_1994	1
Potassium	EPA 200.7_4.4_1994	
Sodium	EPA 200.7_4.4_1994	
Solid and Chemical Materials		
Total carbon	AOAC 972.43	1
Nitrogen, Total	AOAC 990.3	1
Nitrogen, Total Kjeldahl	AOAC 990.3	1
Solids, Total, Fixed and Volatile	SM 2540 G-97	
Ammonia	SM 4500-NH3 H-97	1
Nitrate	SM 4500-$NO3^-$ F-00	1,3
Aluminum	EPA 6010D_(7/14)	
Antimony	EPA 6010D_(7/14)	

Matrix/Analyte	Method	Notes
Arsenic	EPA 6010D_(7/14)	
Barium	EPA 6010D_(7/14)	
Beryllium	EPA 6010D_(7/14)	
Cadmium	EPA 6010D_(7/14)	
Calcium	EPA 6010D_(7/14)	
Chromium	EPA 6010D_(7/14)	
Cobalt	EPA 6010D_(7/14)	
Copper	EPA 6010D_(7/14)	
Iron	EPA 6010D_(7/14)	
Lead	EPA 6010D_(7/14)	
Magnesium	EPA 6010D_(7/14)	
Manganese	EPA 6010D_(7/14)	
Molybdenum	EPA 6010D_(7/14)	
Nickel	EPA 6010D_(7/14)	
Phosphorus, total	EPA 6010D_(7/14)	
Potassium	EPA 6010D_(7/14)	
Selenium	EPA 6010D_(7/14)	
Sodium	EPA 6010D_(7/14)	
Strontium	EPA 6010D_(7/14)	
Vanadium	EPA 6010D_(7/14)	
Zinc	EPA 6010D_(7/14)	
Mercury	EPA 7473_(2/07)	

Accredited Parameter Note Detail

(1) Interim accreditation pending the successful completion of an on-site audit to verify method capabilities (WAC 173-50-100). (2)Provisional accreditation pending submittal of acceptable Proficiency Testing (PT) results (WAC 173-50-110).(3) Reported result is technically nitrate-nitrite, however nitrite values are negligible due to oxidizing conditions.

Rebecca Wood

Authentication Signature
Rebecca Wood, Acting Lab Accreditation Unit Supervisor

09/05/2017

Date

Appendix C
Field Form

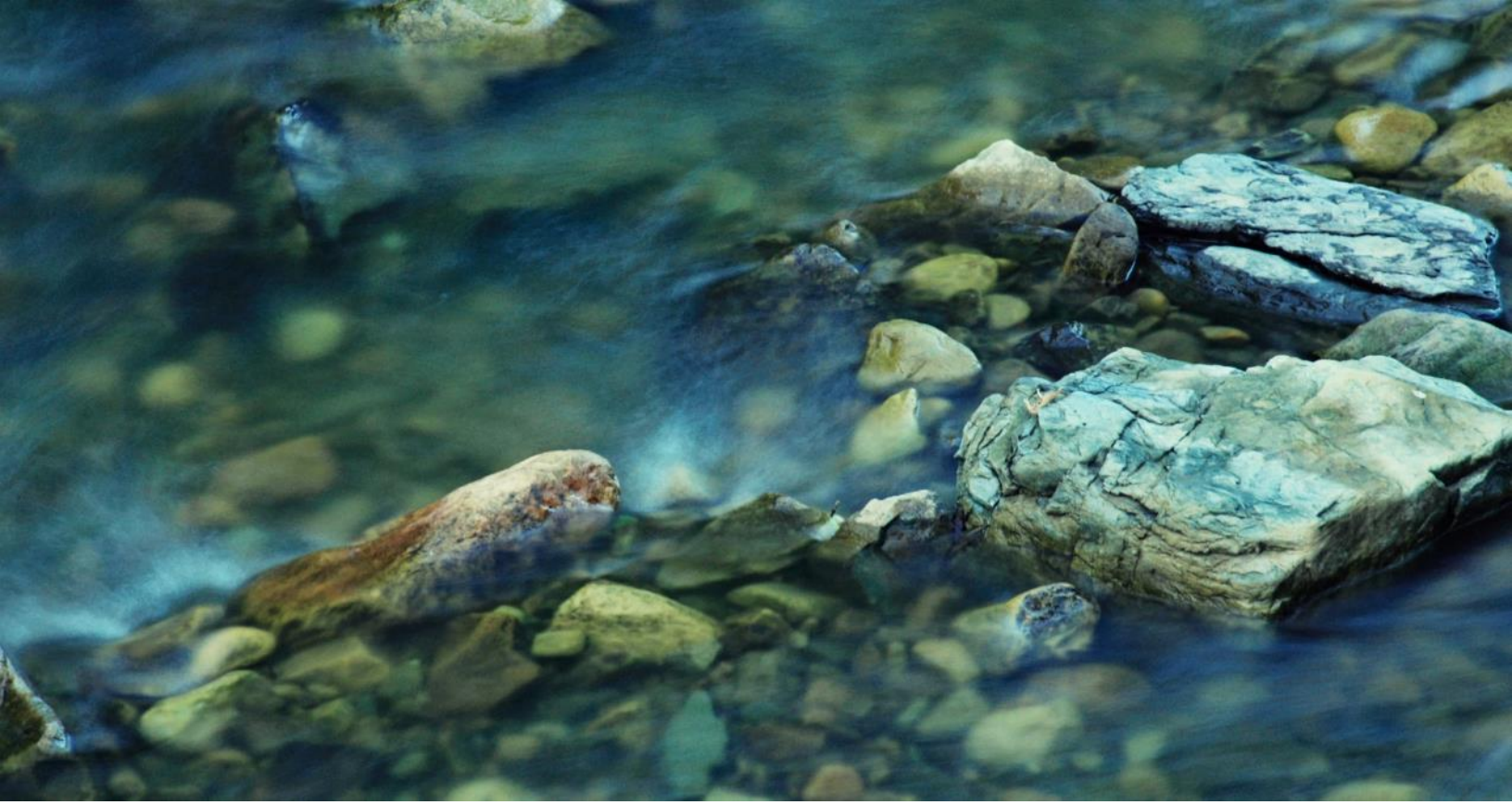
720 Olive Way, Suite 1900
Seattle, Washington 98101
206.287.9130

ANCHOR QEA

Nitrification/Denitrification (NDN) Flow Monitoring Data

Station ID: NDN Influent (Record minimum once weekly)		**Project Name: Yakima Valley Dairies – George DeRuyter & Son/D&A Dairies NDN Monitoring** **Project Number: 180996-01.01**	
Date and Time:		Totalizer Reading:	
Notes:			
Date and Time:		Totalizer Reading:	
Notes:			
Date and Time:		Totalizer Reading:	
Notes:			
Date and Time:		Totalizer Reading:	
Notes:			
Date and Time:		Totalizer Reading:	
Notes:			
Recorded by:			

Appendix D
Chain of Custody, Handling, Packing, and Shipping Standard Operating Procedure



August 2018
Yakima Valley Dairies

ANCHOR QEA

Chain of Custody, Handling, Packing, and Shipping Standard Operating Procedure

Project Number: 180996-02.01
\\fuji\anchor\Projects\Yakima Dairies\SDWA AOC\Engineering\Lagoon Lining Design\2018 Lagoon Design\2018 Final Documents\QAPP for NDN\Appendix D - Shipping Handling SOP_AQ.docx

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ATTACHMENT

ABBREVIATIONS

DOT	U.S. Department of Transportation
HAZWOPER	Hazardous Waste Operations and Emergency Response
IATA	International Air Transport Association
NAPL	nonaqueous phase liquid
NDN	nitrification/denitrification
QAPP	Quality Assurance Project Plan
SOP	standard operating procedure

1 Scope and Application

This Standard Operating Procedure (SOP) describes the chain-of-custody, handling, packing, and shipping procedures for the management of samples to decrease the potential for cross-contamination, tampering, misidentification, and breakage, as well as to ensure that samples are maintained in a controlled environment from the time of collection until receipt by the analytical laboratory.

2 Personnel Qualifications

Anchor QEA field sampling personnel will have current health and safety training, including 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training and site-specific training as needed. In addition, Anchor QEA, LLC, field sampling personnel will be versed in the relevant SOPs and will possess the skills and experience necessary to successfully complete the desired field work.

3 Equipment List

The following list provides materials that may be required for each project. The following project documents and sample collection requirements should be reviewed prior to initiating field operations:

- Indelible ink pens (black or blue)
- Polyethylene bags (resealable-type)
- Clear packing tape, strapping tape, and duct tape
- Chain-of-custody forms
- U.S. Department of Transportation (DOT) shipping forms, as applicable
- Custody seals or tape
- Appropriate sample containers and labels
- Insulated coolers of adequate size for samples and sufficient ice to maintain a temperature of 4°C during collection and transfer of samples
- Wet ice
- Temperature blank
- Sample return shipping papers and addresses

4 Cautions

Review project requirements and select appropriate supplies prior to field mobilization.

Ensure that appropriate sample containers with applicable preservatives, coolers, and packing material have been supplied by the laboratory.

Understand the off-site transfer requirements for the facility at which samples are collected.

If overnight courier service is required, schedule pick-up or know where the drop-off service center is located and its hours of operation. Prior to using air transportation, confirm air shipment is acceptable under DOT and International Air Transport Association (IATA) regulation.

Schedule a pick-up time for the laboratory courier or know the location of the laboratory/service center and its hours of operation.

Understand DOT and IATA shipping requirements and evaluate dangerous goods shipping regulations relative to the samples being collected. Potential samples requiring compliance with this DOT regulation include the following:

- Methanol preservation for volatile organic compounds in soil samples
- Non-aqueous phase liquid (NAPL)

5 Health and Safety Considerations

Follow health and safety procedures outlined in the project/site Health and Safety Plan.

Use caution and appropriate cut-resistant gloves when tightening lids to 40-milliliter vials. These vials can break while tightening and can lacerate the hands. Amber vials (with thinner glass) are more prone to breakage.

Some sample containers contain preservatives. The preservatives must be retained in the sample container and should in no instance be rinsed out. Preservatives may be corrosive, and standard care should be exercised to reduce potential contact to personnel skin or clothing. Follow project safety procedures if spillage is observed. If sample container caps are broken, discard the bottle. Do not use for sample collection.

6 Procedure

1. Prior to collecting samples, complete the chain-of-custody record header information by filling in the project number, project name, and the name(s) of the sampling technician(s) and other relevant project information. Attachment D-1 provides an example chain-of-custody form.
2. Chain-of-custody information **must** be printed legibly using indelible ink (black or blue).
3. After sample collection, enter the individual sample information on the chain-of-custody form as follows:
    a. The sample nomenclature is dictated by the project database and requires unique identification for each sample collected for the project. Consult the *Nitrification/Denitrification* (NDN) *Quality Assurance Project Plan* (QAPP) for additional information regarding sample identification.

b. List the sample matrix (e.g., "W" for water).
c. List the date of sample collection. The date format to be followed should be YYMMDD (e.g., January 15, 2019, should be entered as 190115).
d. List the time that the sample was collected. The time value should be presented using 24-hour format (e.g., 3:15 p.m. should be entered as 15:15).
e. The analytical parameters that the samples are being analyzed for should be written legibly. As much detail as possible should be presented to allow the analytical laboratory to properly analyze the samples. Analytes and methods are found in Table 2 of the NDN QAPP.
f. List the number of containers for each sample.
g. Note in the comments which samples should be used for site-specific matrix spikes.
h. Indicate any special project requirements or expedited turnaround time in the notes section.
i. Provide a contact name and phone number in the event that problems are encountered when samples are received at the laboratory.
j. The "Relinquished By" field should contain the signature of the sampling technician who relinquished custody of the samples to the shipping courier or the analytical laboratory.
k. The "Date" field following the signature block indicates the date the samples were relinquished. The date format should be MM/DD/YYYY (e.g., 01/15/2019).
l. The "Time" field following the signature block indicates the time that the samples were relinquished. The time value should be presented using 24-hour format.
m. The "Received By" section is signed by sample courier or laboratory representative who received the samples from the sampling technician, or it is signed upon laboratory receipt from the overnight courier service.

4. Complete as many chain-of-custody forms as necessary to properly document the collection and transfer of the samples to the analytical laboratory.

6.1 Handling Procedures

1. Complete the sample label with the following information in indelible ink:
   a. Sample identification code and other sample identification information, if applicable
   b. Analysis required
   c. Date
   d. Time sampled
   e. Initials of sampling personnel
   f. Preservative added, if applicable
2. Confirm that all caps on the sample containers are secure and tightly closed.
3. In some instances, it may be necessary to wrap the sample container cap with clear packing tape to prevent it from becoming loose.

4. For some projects, individual custody seals may be required. Custody seal evidence tape may be placed on the shipping container, or they may be placed on each sample container such that the cooler or cap cannot be opened without breaking the custody seal. The custody seal should be initialed and dated prior to relinquishing the samples.

6.2 Packing Procedures

Following collection, samples must be placed on wet ice to initiate cooling to 4°C immediately. Retain samples on ice until ready to pack for shipment to the laboratory. Procedures for this are as follows:

1. Secure the outside and inside of the drain plug at the bottom of the cooler being used for sample transport with duct tape.
2. Place each individual sample bottle set in a sealable plastic bag.
3. Place the sealed sample containers upright in the cooler.
4. Package ice in large resealable plastic bags. Ice should be double-bagged in two plastic bags to prevent leakage. Samples placed on ice will be cooled to and maintained at a temperature of approximately 4°C.
5. Fill the remaining space in the cooler with cushioning material such as bubble wrap. The cooler must be securely packed and cushioned in an upright position.
6. Place the completed chain-of-custody form(s) in a large resealable bag and tape the bag to the inside of the cooler lid.
7. Close the lid of the cooler and fasten with packing tape.
8. Wrap strapping tape around both ends of the cooler.
9. Place custody seal evidence tape over the front right and back left of the cooler lid, initial and date, then cover with clear plastic tape.

Note that Procedure Nos. 2, 3, 5, and 6 may be modified in cases where laboratories provide customized shipping coolers. These cooler types are designed so the sample bottles and ice packs fit snugly within preformed styrofoam cushioning and insulating packing material.

6.3 Shipping Procedures

1. All samples will be delivered by an express carrier within 48 hours of sample collection. Alternatively, samples may be delivered directly to the laboratory or laboratory service center, or a laboratory courier may be used for sample pickup.
2. If parameters with short holding times are required (e.g., volatile organic compounds [EnCore™ Sampler], nitrate, orthophosphate, and biochemical oxygen demand), sampling personnel will take precautions to ship or deliver samples to the laboratory so that the holding times will not be exceeded.
3. Samples must be maintained at 4°C ± 2°C until shipment and through receipt at the laboratory.

4. When the samples are received by the laboratory, laboratory personnel will complete the chain-of-custody form(s) by recording the date and time of receipt of samples, measuring and recording the internal temperature of the shipping container, and checking the sample identification numbers on the containers to ensure they correspond with the chain-of-custody form(s).

Any deviations between the chain-of-custody form(s) and the sample containers, broken containers, or temperature excursions will be communicated to Anchor QEA immediately by the laboratory.

7 Waste Management

Not applicable.

8 Data Recording and Management

The sampling team leader will retain copies of the chain-of-custody forms for filing in the project file. Record retention shall be in accordance with project requirements.

9 Quality Assurance

Chain-of-custody forms will be legibly completed in accordance with applicable project documents, such as a Sampling and Analysis Plan, QAPP, Work Plan, or other project guidance documents. A copy of the completed chain-of-custody form will be sent to the Anchor QEA field team leader or designee for review.

Attachment D-1
Chain-of-Custody Form

Chain-of-Custody Record and Laboratory Analysis Request

Laboratory Number:

Date:

Project Name: Yakima Valley Dairies – Nitrification/Denitrification Monitoring

Project Number: 180996-02.01

Project Manager: Mark Larsen or Cindy Fields

Phone Number: 206-903-3394

Shipment Method:

Line	Field Sample ID	Collection Date/Time	Matrix	No. of Containers	Test Parameters: Nitrate + nitrite (SM 4500 NO3 F)	Ammonia (SM 4500 NH3 F)	Orthophosphate (SM 4500 P E)	TKN (SM 4500 Norg)	TSS (SM 2540 CD)	Refigerated Archive								Comments/Preservation
1	NDN-INFLUENT-01-		W	4	X	X	X	X	X	X								
2	NDN-EFFLUENT-01-		W	4	X	X	X	X	X	X								
3																		
4																		
5																		
6																		
7																		
8																		
9																		
10																		
11																		
12																		
13																		
14																		
15																		

Notes:

Relinquished By:	Company: Anchor QEA, LLC	Received By:	Company:
Signature/Printed Name	Date/Time	Signature/Printed Name	Date/Time
Relinquished By:	Company:	Received By:	Company:
Signature/Printed Name	Date/Time	Signature/Printed Name	Date/Time

Distribution: A copy will be made for the laboratory and client. The Project file will retain the original.