E Tunnel Wastewater Disposal System
and Monitoring Well ER 12-1
Operations and Maintenance Plan
Nevada National Security Site,
Nevada
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<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA3</td>
<td>Alluvial aquifer</td>
</tr>
<tr>
<td>amsl</td>
<td>Above mean sea level</td>
</tr>
<tr>
<td>BWQP</td>
<td>Bureau of Water Quality Planning</td>
</tr>
<tr>
<td>CFR</td>
<td>Code of Federal Regulations</td>
</tr>
<tr>
<td>COC</td>
<td>Chain of custody</td>
</tr>
<tr>
<td>CS</td>
<td>Carbon steel</td>
</tr>
<tr>
<td>DER</td>
<td>Normalized absolute difference</td>
</tr>
<tr>
<td>DOE</td>
<td>U.S. Department of Energy</td>
</tr>
<tr>
<td>DQI</td>
<td>Data quality indicator</td>
</tr>
<tr>
<td>DQO</td>
<td>Data quality objective</td>
</tr>
<tr>
<td>ELS</td>
<td>Environmental Laboratory Services</td>
</tr>
<tr>
<td>EPA</td>
<td>U.S. Environmental Protection Agency</td>
</tr>
<tr>
<td>ETDS</td>
<td>E Tunnel Wastewater Disposal System</td>
</tr>
<tr>
<td>FAWP</td>
<td>Field activity work package</td>
</tr>
<tr>
<td>FD</td>
<td>Field duplicate</td>
</tr>
<tr>
<td>FMP</td>
<td>Fluid Management Plan</td>
</tr>
<tr>
<td>FMR</td>
<td>Field Monitoring Report</td>
</tr>
<tr>
<td>ft</td>
<td>Foot</td>
</tr>
<tr>
<td>gal</td>
<td>Gallon</td>
</tr>
<tr>
<td>HSU</td>
<td>Hydrostratigraphic unit</td>
</tr>
<tr>
<td>in.</td>
<td>Inch</td>
</tr>
<tr>
<td>L</td>
<td>Liter</td>
</tr>
<tr>
<td>L/min</td>
<td>Liters per minute</td>
</tr>
<tr>
<td>LCA</td>
<td>Lower carbonate aquifer</td>
</tr>
<tr>
<td>LCA3</td>
<td>Lower carbonate aquifer 3 - thrust plate</td>
</tr>
<tr>
<td>LCS</td>
<td>Laboratory control sample</td>
</tr>
<tr>
<td>LCSD</td>
<td>Laboratory control sample duplicate</td>
</tr>
<tr>
<td>m</td>
<td>Meter</td>
</tr>
<tr>
<td>Mc</td>
<td>Chainman shale</td>
</tr>
<tr>
<td>mg/L</td>
<td>Milligrams per liter</td>
</tr>
<tr>
<td>mL</td>
<td>Milliliter</td>
</tr>
<tr>
<td>M&amp;O</td>
<td>Management and operating</td>
</tr>
</tbody>
</table>
E Tunnel and ER 12-1 Operations and Maintenance Plan

MS Matrix spike
MSD Matrix spike duplicate
NAD North American Datum
NDEP Nevada Division of Environmental Protection
NNSA/NFO U.S. Department of Energy, National Nuclear Security Administration
  Nevada Field Office
NNSS Nevada National Security Site
NSPC Nevada State Plane Coordinates
O&M Operations and Maintenance
pCi/L Picocuries per liter
PPE Personal protective equipment
Pz Paleozoic rocks
QA Quality assurance
QC Quality control
QMR Quarterly Monitoring Report
QTa Quaternary-Tertiary alluvium
REECo Reynolds Electrical & Engineering Co., Inc.
RPD Relative percent difference
SAP Sampling and Analysis Plan
SCL Sample collection log
SU Standard Unit
TCLP Toxicity Characteristic Leaching Procedure
UCCU Upper clastic confining unit
UGTA Underground Test Area
USGS U.S. Geological Survey
UTM Universal Transverse Mercator
%R Percent recovery
µS/cm Microsiemens per centimeter
Definitions

**Adverse Impact** – Intensive or chronic harm to the public health and welfare, or to the natural resources of the state.

**Grab Sample** – Any discrete, single, or individual sample collected in less than 15 minutes.

**Permissible Limit** – A value that is in excess of a standard and that operates only within the context of the specific permit for which it was developed. Standards and regulatory limits are enforceable within and without a permit; permissible limit is enforceable only within the context of the permit. The primary function of a permit is to authorize the release of constituents at concentrations greater than the natural burden in the receiving water.

**Pond** – A body of water within an impoundment.

**Ponding** – The persistence of a pond that is open to view or that is available as a source of water for mammalian, avian, or piscine wildlife.

**Threshold** – A limit (action level) which, when exceeded, warns that a permissible limit or compliance limit or a water quality standard is at risk of violation. A threshold is not an enforceable limit or standard, except as expressed in the text of the permit (i.e., for failure to take a prescribed, timely action).

**Upset** – An unplanned, unexpected, or unintentional divergence from compliance with the terms and conditions for a brief period, due to circumstances that the permittee could not expect and could not prevent. It does not include non-compliance that results from inadequate preventative maintenance; inattentive management; inadequate or defective design; operator error; neglect; careless or improper operation; or other preventable causes of non-compliance.

**Watershed** – The topography on which rainfall or snowmelt flows by gravity to coalesce into a single channel.
1.0 Introduction

The E Tunnel Wastewater Disposal System (ETDS) and Well ER 12-1 are regulated by the Nevada Division of Environmental Protection (NDEP) under Water Pollution Control Permit NEV 96021 (Murphy, 2013), herein referred to as the Permit. The Permit was issued to the U.S. Department of Energy (DOE), National Nuclear Security Administration Nevada Field Office (NNSA/NFO) with an effective date of October 1, 2013. This Operations and Maintenance (O&M) Plan is written to ensure compliance with the Permit. This plan is a stand-alone document providing specific implementation requirements to personnel responsible for Permit compliance. A project-specific Sampling and Analysis Plan (SAP) incorporating associated quality assurance (QA) and quality control (QC) requirements is included.

1.1 Purpose

This O&M Plan serves as a reference for all personnel involved in the operation, maintenance, and monitoring of the ETDS and ER 12-1. It describes the responsibilities, requirements, procedures, and tasks necessary to comply with the Permit. This document also constitutes the data quality objectives (DQOs) and sampling procedures for the ETDS and ER 12-1. If there are any conflicts between this O&M Plan and the Permit, the requirements of the Permit will prevail.

If this document must be revised due to a change in practices or procedures related to the operation, maintenance, or monitoring of the ETDS and/or ER 12-1, a revised O&M Plan will be submitted to NDEP for review.

1.2 Scope and Applicability

This document identifies responsibilities and protocols for making observations, monitoring effluent parameters, collecting grab samples, and maintaining the ETDS and ER 12-1 in compliance with the Permit. Implementation of this plan ensures compliance with the Permit. This O&M Plan is applicable to all operations and monitoring necessary for compliant management of the ETDS.
1.3 Roles and Responsibilities

NNSA/NFO has assigned Navarro with certain tasks to support compliance with the Permit. NNSA/NFO manages this contractor resource to ensure requirements of the Permit are met. General roles and responsibilities of Navarro personnel include the following:

- Managing and maintaining the ETDS, ER 12-1, and the Permit; conducting monthly monitoring and inspections; collecting ETDS samples; conducting groundwater sampling activities at ER 12-1; managing subcontract laboratory support for sampling activities; performing data evaluation; preparing Quarterly Monitoring Reports (QMRs) and Summary Reports; and ensuring that all Permit requirements are met.

The NNSS Management and Operating (M&O) contractor is also involved with Permit compliance activities as follows:

- Responsible for holding the primary ETDS and ER 12-1 Real Estate/Operations Permits, maintaining the ponds, maintaining ER 12-1, and assisting with groundwater well sampling.

1.4 Site Description and History

1.4.1 E Tunnel

Underground nuclear weapons-effects, weapons related, and safety experiment tests were conducted in tunnels located in Rainier Mesa on the Nevada National Security Site (NNSS) from 1957 to 1992. Chemical and high-explosives tests were also conducted in the tunnels. E Tunnel (U12e Tunnel), located at the south end of Rainier Mesa, was used for testing. E Tunnel is inactive and is “closed”.

The E Tunnel discharge water has been sampled and analyzed for pollutants since 1991. The ETDS consists of a series of ponds and a pipeline that conveys effluent from E Tunnel through the ETDS discharge point to the ponds for disposal. With the exception of the last pond, each pond contains an overflow pipe placed approximately 18 inches (in.) below the maximum height of the earthen dam. These overflow pipes allow automatic overfill protection for the earthen dams, and are used to control flow from one pond to the next in the system. The site layout is depicted in Figure 1-1.
ER 12-1 is located near the base of the eastern slope of Rainier Mesa, alongside the U12e Tunnel access road, where it passes the base of Dolomite Hill. The well is downgradient and approximately 1.6 kilometers (1 mile) east–southeast of underground nuclear tests conducted in Rainier Mesa. ER 12-1 was drilled in 1991 to determine the hydrogeology of Paleozoic carbonate rocks and of the Eleana Formation, a regional aquitard. Since 1997, ER 12-1 has been used as a monitoring wells for the E Tunnel evaporation ponds regulated by NDEP through the Permit. The well is a multi-level completion using sliding sleeves and external casing packers in five discrete zones. Table 1-1 provides a summary of relevant information for ER 12-1, and Figure 1-2 is a well completion diagram for ER 12-1.
Table 1-1
ER 12-1 Summary

<table>
<thead>
<tr>
<th>Hole Designation</th>
<th>ER 12-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nevada State Plane Coordinates (North American Datum 27)</td>
<td>N 886,640.40, E 640,539.59 ft</td>
</tr>
<tr>
<td>Surface Elevation</td>
<td>1,773.06 m (5,817.12 ft)</td>
</tr>
<tr>
<td>Upper Zone Screened Interval</td>
<td>516.0 to 555.0 m (1,693 to 1,821 ft)</td>
</tr>
<tr>
<td>Completion Bottom Depth</td>
<td>1,093.6 m (3,588 ft)</td>
</tr>
<tr>
<td>Static Water Level Depth</td>
<td>463.06 m (1,519.24 ft)</td>
</tr>
<tr>
<td>Static Water Level Elevation</td>
<td>1,309.99 m (4,297.88 ft)</td>
</tr>
<tr>
<td>Geology at Completion Intervals</td>
<td>Paleozoic Carbonate</td>
</tr>
<tr>
<td>Expected Contaminants</td>
<td>None</td>
</tr>
</tbody>
</table>

m = Meter
ft = Foot
2.0 Permit NEV 96021 Implementation

E Tunnel groundwater discharge and ER 12-1 water quality are regulated under the Permit. The Permit, in compliance with the Federal Water Pollution Control Act, as amended by the Nevada Revised Statutes (NRS, 2013), authorizes NNSA/NFO to manage and operate a system for the treatment and disposal of wastewater that discharges from E Tunnel.

This section outlines Permit requirements and describes the actions that must be performed to ensure compliance with the Permit. The Permit specifies requirements for compliant ETDS and ER 12-1 management. Permit requirements include the following:

- Monitoring and inspections (types, frequency, tolerances)
- Solid waste management
- ETDS and ER 12-1 operations
- Responses to and reporting of releases
- Recordkeeping and reporting
- Overall Permit management requirements

2.1 System Requirements and Operation

2.1.1 ETDS

The ETDS discharge point is a flume in the pipeline where the flow rate, indicator parametric data, and grab samples are collected in accordance with Permit requirements. Navarro is responsible for the operations outlined below and for reporting any potentially dangerous and/or unstable berm conditions to NNSA/NFO immediately upon discovery. These conditions include, but are not limited to, threatened or unplanned release of water outside the ETDS boundary, imminent or actual failure of a berm, or a break in the pipeline.

Operations entail allocating funding, scheduling, and oversight for the following activities:

- Ensuring that pond capacities are not exceeded, and preventing discharges to the surrounding watershed by using pond level data to manage flow and pond levels. Pond level management may include, but is not limited to, directing some or all of the water flow into alternate ponds within the pond system. Parameters considered in pond level management include seasonal precipitation rates, evaporation/infiltration rates, and storm events.

- Controlling vegetation to allow access for maintenance and/or repair of the pipeline, ETDS discharge point, and earthen berms.
• Performing maintenance tasks to ensure E Tunnel effluent is conveyed, without loss, from the tunnel portal through the ETDS for disposal by evaporation and infiltration in the ponds.

• Modifying the ETDS to ensure compliant system performance. Modification includes changing the size and/or shape of the berms; extending, rerouting, or replacing the pipeline; or performing other actions that would alter the ETDS. NNSA/NFO must obtain approval from NDEP before starting any activities that would result in such modifications.

2.1.2 ER 12-1

ER 12-1 is used as a monitoring well for the E Tunnel ponds to assess and monitor the groundwater near E Tunnel. Continued operation and sampling of ER 12-1 is required under the Permit. Navarro is responsible for biennial sampling of ER 12-1, while the M&O contractor is responsible for operations and maintenance of ER 12-1.

2.2 Monitoring

The Permit requires monitoring, sampling, and inspections at specified frequencies. Required responses to out-of-tolerance conditions and associated reporting are also included in the Permit.

2.2.1 Monthly Requirements at the EDTS

Monthly inspections and monitoring of the ETDS are required by the Permit. Monthly monitoring requirements are summarized below with detailed measurement procedures described in Section 2.3.

Monthly Inspections at the EDTS

Monthly inspections are performed to ensure the ETDS is in Permit-compliant operational condition. Inspection of the ETDS includes the following activities:

• Observing ponding (pond levels relative to the overflow pipes).

• Observing the presence of any deep-rooting botanicals (vegetation) on the berms.

• Observing any tunneling or burrowing into the berms by mammals, insects, or reptiles.

• Observing soil conditions on and around the berms, including erosion or sloughing of the interior or exterior slopes of the berms.

• Observing any seeps at the toe of the berms.

• Observing the physical condition of fencing.
• Observing the structural integrity of the ETDS.

• Recording total monthly precipitation, measured to the nearest 0.1-in. (data obtained from a National Oceanic and Atmospheric Administration meteorological station at the ETDS). This measurement is not reported on the Field Monitoring Report (FMR) form, but is reported in the QMR or Summary Report.

Navarro must conduct inspections in accordance with these procedures. Results of the inspections are recorded on the FMR form and reported in the QMR or Summary Report. An example FMR form is included as Appendix A of this document. The information documented on the FMR form meets the recording requirements set forth in the Permit. The forms are retained for no less than three years as required by the Permit.

**Monthly Monitoring at the EDTS**

Monthly monitoring is performed to ensure the ETDS discharge limits specified in Permit Table 1-A are not exceeded. The following discharge monitoring measurements are collected monthly:

• The average instantaneous discharge flow rate (of three measurements) is recorded on the FMR form. The calculated rate (instantaneous rate multiplied by minutes per day) and total monthly volume (calculated rate multiplied by number of days in the month) are reported in the QMR or Summary Report.

• Hydrogen ion activity (pH), reliable to 0.1 Standard Unit (SU) (Tolerance: 6.0–9.0 SU)

• Specific conductance as microsiemens per centimeter (µS/cm), reliable to three significant digits (Tolerance: Less than 1,500 µS/cm)

Measurements are collected in compliance with Section 2.3.

**2.2.2 Annual Sampling Requirements at the ETDS**

Grab samples of effluent water are collected annually and analyzed for Permit Table 1-B parameters; results are reported in the Summary Report. Samples are collected, managed, and analyzed according to approved procedures and Section 2.3.

**2.2.3 Biennial Sampling Requirements at ER 12-1**

Groundwater samples are collected every 24 months from ER 12-1 and analyzed for Permit Table 1-B parameters, and the results are reported in the Summary Report, as applicable. Samples are collected, managed, and analyzed according to approved procedures to Section 2.3.
2.2.4 Out-of-Tolerance Conditions and Responses

The Permit specifies conditions under which notification and/or additional monitoring or sampling is required. The actions taken for out-of-tolerance conditions are described below.

Inspection at the EDTS

Inspection observations requiring immediate notifications include the following:

- Threatened or unplanned release of water outside the ETDS boundary
- Imminent or actual failure of a pond berm
- A break in the pipeline

If such conditions are observed during any inspection, they must be reported to NNSA/NFO immediately upon discovery. These conditions will be evaluated and repaired, as directed by NNSA/NFO.

Any 24-hour, 25-year storm event or greater, which is above the ETDS operating capacity, must be reported immediately to NNSA/NFO. In the event of such a storm, all reasonable and prudent efforts to contain excess storm water must be employed.

Monthly Monitoring at the EDTS

Monthly monitoring results for pH and/or specific conductance outside their tolerance ranges trigger additional monitoring. These measurements must be collected again before the end of the next business day if initial results are outside the ranges specified in Permit Table 1-A. If the resample data are outside the tolerance range(s), Navarro will notify NNSA/NFO immediately, and a grab effluent sample will be collected on the next business day and analyzed for Permit Table 1-B parameters.

The sample will be shipped overnight and designated a priority in order to obtain the results within 14 days. Immediately upon receipt, the laboratory data will be reviewed and verified that they meet the QA/QC parameters for analysis. If a parameter result exceeds Permit Table 1-B limits, monthly sampling for Permit Table 1-B parameters will be implemented in the next month for a minimum of four consecutive months.

When the average parametric concentration(s) for three consecutive months are less than the threshold and the permissible limit(s) in Permit Table 1-B, monitoring will return to routine conditions. If monthly
monitoring data indicate that the parameter(s) of concern may not return to concentrations (either averages or individual measurements) within Table 1-B limits, Navarro will notify NNSA/NFO, and negotiations between NNSA/NFO and NDEP will proceed on possible causal factors, corrective actions, and path forward.

**Annual or Biennial Sampling**

Annual or biennial sampling results that exceed Permit Table 1-B limits must be reported immediately to NNSA/NFO by Navarro. Monthly sampling for Permit Table 1-B parameters will be implemented in the next month until the cause of the variance is determined (minimally four consecutive months).

When the average parametric concentration(s) for three consecutive months are less than the threshold and permissible limit(s) in Permit Table 1-B, monitoring will return to routine conditions. If one or more of the sample results used to obtain the average equal or exceed Table 1-B limits, the data and other relevant information will be evaluated and the findings reported to NNSA/NFO to allow sufficient time for NNSA/NFO to report the findings to NDEP (within 145 calendar days after the initial sampling that exceeded the limits).

**2.3 Sampling and Analysis Plan**

This section provides the SAP under which the monitoring required by the Permit is conducted. The SAP ensures that DQOs are defined, consistent sample collection procedures are used, contract laboratories implement required U.S. Environmental Protection Agency (EPA) analysis protocols, and standard QA/QC practices are followed for all Permit-required monitoring. The SAP provides the procedures necessary to establish the integrity and reliability of data used to demonstrate compliance with the terms and conditions of the Permit.

This SAP and the requirements within it are mandated by the Permit. This SAP describes the monitoring, sampling, and analysis activities required to fulfill the Permit conditions. The SAP also provides procedures for field personnel involved in the monitoring and sampling at the ETDS and the purging and collection of groundwater samples at ER 12-1. All activities associated with monthly and annual monitoring of the ETDS, biennial monitoring of ER 12-1, and other monitoring for Permit compliance must be performed in accordance with this section, which will be revised as necessary, in accordance with the Permit.

The scope of the monitoring effort includes the following elements:
• Developing, completing, and maintaining required documentation to demonstrate compliance with the Permit.

• Conducting and recording observations at the ETDS.

• Collecting flow data and water-quality parameters (pH and specific conductance) from the E Tunnel discharge flume.

• Collecting E Tunnel effluent water samples from the ETDS discharge point and analyzing for Permit Table 1-B parameters.

• Collecting groundwater samples from ER 12-1 and analyzing for Permit Table 1-B parameters.

• Submitting ETDS and ER 12-1 water samples to the laboratory for analysis.

• Reviewing and evaluating the laboratory data.

2.3.1 Objectives

Limitations on the ETDS discharge water are specified in Tables 1-A and 1-B of the Permit, while the limitations on ER 12-1 groundwater are specific in Table 1-B. The objective of the sampling and monitoring conducted under this SAP is to demonstrate ETDS discharge water and ER 12-1 groundwater results are within these limits. Table 2-1 presents a summary of sample location and frequency, parameters, resampling requirements, and recording and reporting requirements.

This SAP incorporates the development of DQOs, a strategic planning approach based on the scientific method that is designed to ensure that the data collected will provide sufficient and reliable information to verify sampled waters are within Permit limits. The seven steps of the DQO process as they pertain to sampling required in this SAP are presented below:

Step 1: Define the Reason for Sampling

A determination must be made regarding whether the limits specified in the Permit are being exceeded.

Step 2: Identify the Decisions the Sampling Will Resolve

Results of sampling will determine Permit compliance status and determine whether additional sampling may be required.
Step 3: Identify the Information Inputs Needed

Results of the monthly measurements and analytical data for annual and biennial sampling are needed to make comparisons to Permit Tables 1-A and 1-B.

Step 4: Define the Boundaries

The target populations (ETDS discharge water and ER 12-1 groundwater) are specified in the Permit. The Permit also defines temporal requirements through specification of measurement and sampling frequency.

Step 5: Define the Analytical Approach

The analytical approach includes collecting monthly measurements, taking annual grab samples from the ETDS discharge water and biennial grab samples from ER 12-1, and submitting them for laboratory analysis. This approach will produce data that are sufficiently sensitive to evaluate the results against the Permit limits, establish compliance status, and determine whether additional sampling is required.

If the monthly measurement results are within the ranges specified in Permit Table 1-A, then no additional monitoring is required, and compliance with these Permit requirements is achieved. If the measurements are outside the Permit Table 1-A ranges, then additional monitoring and sampling is required.

Annual and biennial analytical results demonstrate compliance with the Permit limits if those results are within the values specified in Permit Table 1-B. If the results are outside these limits, additional sampling is required.
### Table 2-1

**E Tunnel Water Pollution Control Permit NEV 96021 Sampling and Reporting Requirements**

<table>
<thead>
<tr>
<th>Sample Location and Frequency</th>
<th>Measurement Parameter</th>
<th>Comments</th>
<th>Resampling Requirements</th>
<th>Recording and Reporting Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETDS – monthly</td>
<td>Instantaneous Flow Rate</td>
<td>Measure the time it takes (in seconds) to fill the designated 5-gal bucket (gravimetrically measured at 20.1 L), and calculate the flow rate (in L/min) by dividing 20.1 L by the number of seconds and multiplying by 60 seconds per minute. Perform this measurement three times in succession, and determine the average. Note that the discharge water is emptied back into the discharge flume. Calculate the total volume for each month by multiplying the instantaneous rate (L/min) by 1,440 minutes per day and multiplying by the number of days in the month. Report instantaneous rate, calculated rate, and total volume for each month in the QMR.</td>
<td>Not applicable</td>
<td>Exact place, date, and time of sample collection, measurement, or observation; name of sample collection personnel; sample analysis date(s); analytical techniques or methods; and sample analysis, measurement, or observation results. Report all observations, measurements, and results in the QMR.</td>
</tr>
<tr>
<td></td>
<td>pH</td>
<td>Collect measurements reliable to 0.1 SU.</td>
<td>If pH is outside the 6.0 to 9.0 SU range, and/or if specific conductance is above the 1,500 µS/cm limit, collect a confirmatory sample on the next business day and analyze for pH and specific conductance. If confirmatory sample results for both parameters are again outside the ranges, collect a sample on the next business day and analyze for Table 1-B parameters.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Specific Conductance</td>
<td>Collect measurements in µS/cm, reliable to three significant digits. Field instruments will be calibrated following approved procedures.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Permit Table 1-B parameters</td>
<td>Sample monthly (minimum of four months) if Permit Table 1-A parameters (pH and specific conductance) exceed the permissible limits on two consecutive business days and/or if the annual ETDS sample or the biennial ER 12-1 sample exceeds the specified limits for one or more parameters.</td>
<td>Sample for at least four consecutive months after receipt of initial sample results; continue until the cause of the variance is determined or until the average parametric concentration for three consecutive months is less than the threshold and the permissible limits. Return to routine conditions.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Visual Inspection</td>
<td>Inspect for ponding; deep-rooting botanicals in earthen embankments; tunneling or burrowing by mammals, insects, or reptiles into earthen embankments; physical condition of fencing; and structural integrity of the ponds.</td>
<td>Not applicable</td>
<td></td>
</tr>
</tbody>
</table>
### Table 2-1
E Tunnel Water Pollution Control Permit NEV 96021 Sampling and Reporting Requirements

<table>
<thead>
<tr>
<th>Sample Location and Frequency</th>
<th>Measurement Parameter</th>
<th>Comments</th>
<th>Resampling Requirements</th>
<th>Recording and Reporting Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>ETDS – annually in October</td>
<td>Parameters (^a) listed in Permit Table 1-B parameters unless the sampling is being conducted as required by Permit Part I.B.12.</td>
<td></td>
<td>Permit Parts I.B.9, I.B.11, and I.B.12</td>
<td>Exact place, date, and time of sample collection, measurement, or observation; name of sample collection personnel; sample analysis date(s); analytical techniques or methods; and sample analysis, measurement, or observation results. Report all observations, measurements, and results in the QMR.</td>
</tr>
<tr>
<td>ER 12-1 – biennially in April</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>TCLP analyses for 40 CFR 261.24 Table 1 constituents (^b)</td>
<td>Upon removal of any sludge or residue from any impoundment, collect a representative sample, and perform TCLP analyses.</td>
<td></td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

\(^a\) Gross alpha, gross beta, tritium, cadmium, chromium, copper, iron, lead, magnesium, manganese, mercury, selenium, zinc, chloride, fluoride, sulfate, nitrate as nitrogen, specific conductance, and pH. Note that specific conductance and pH are field measurements only.

\(^b\) CFR, 2016b

CFR = Code of Federal Regulations
gal = Gallon
L = Liter
L/min = Liters per minute
TCLP = Toxicity Characteristic Leaching Procedure
Step 6: Specify the Performance Criteria

Performance criteria are defined by the data quality indicators (DQIs) discussed in Section 2.3.3.5. If the sample results are within these performance criteria, then the data are of sufficient quality to determine compliance status.

Step 7: Optimize the Plan for Obtaining the Data

The detailed SAP presented in the sections below provides the sampling protocol and QA/QC requirements that will ensure decision-quality data are obtained.

The DQOs seek to ascertain whether the sample results demonstrate compliance with the Permit limitations and that the data are of sufficient quality to make this determination. The sampling protocol and QA/QC requirements outlined in this SAP are designed to collect representative samples under consistent methods with prescribed DQIs. DQIs are quantitative and qualitative descriptors established to determine the degree of acceptability or usability of data and include precision, accuracy, representativeness, comparability, completeness, and sensitivity. Data collected under this SAP are evaluated against these DQIs as part of the QA/QC procedures. This evaluation is discussed in more detail in Section 2.3.3.5.

The populations of interest are natural water sources, continuously flowing discharge, and aquifer. The primary contaminant of concern is tritium. Due to the matrix (water) and the fact that the total concentrations of the Permit parameters are being determined (as opposed to dissolved or suspended), uniform distribution of the parameters in the water is expected, thus providing representative samples with little variation. The primary sources for sampling variation are naturally occurring and, apart from potential seismic activities and infiltration or runoff from significant storm events, are not subject to significant change within a short period of time (relative to monitoring schedules).

The sampling process focuses on controlling variability. For the ETDS, because the discharge is continuously flowing, control is limited to the design of the piping system conveying the effluent to the ETDS discharge flume. For ER 12-1, controls are established by ensuring the pumping and purging process is consistent. Impacts of the sample collection process are also controlled by the routine use of procedures based on standard sampling practices and by using clean sample containers to avoid potential contamination. Container certifications are maintained in project files.
2.3.2 Field Activities and Sampling Procedures

The following subsections outline field activities, associated requirements, and details regarding sampling procedures and management. These requirements and procedures ensure data resulting from the sample collection process will be of sufficient quality to demonstrate compliance with the Permit. The sections below serve as the procedures for sample collection and management. Both Navarro and the M&O contractor are responsible for developing work packages to cover work conducted by their organizations at ETDS and ER 12-1.

2.3.2.1 General Sampling Guidelines

Monitoring and sampling procedures are developed from national guidelines and standards, including the mandatory analytical methods that establish the sample preservation and holding time conditions. These procedures and other related field operations documents (see Section 2.3.2.2) are compiled in a field activity work package (FAWP) that is taken to the field and used by qualified personnel to document execution and demonstrate completion of the work. The work process and field records are routinely reviewed after sampling events to identify lessons learned, which are then incorporated into the FAWP for subsequent sampling events.

Monthly monitoring at the ETDS includes field observations and collection of pH, specific conductance, and instantaneous flow rate. The flow rate is taken by measuring the time required to fill a 5-gal container (gravimetrically determined to contain 20.1 L); Table 2-1 describes the procedure used to measure the flow rate. Annual grab samples are collected directly from the ETDS, and are analyzed for Permit Table 1-B constituents.

ER 12-1 samples are collected from the uppermost zone because it is most likely to intercept water that has infiltrated from E Tunnel. The purge volume is based on three effective well volumes approximately 8,820 L [2,330 gal]). During sampling activities, approximately 18,900 to 45,500 L (5,000 to 12,000 gal) are purged at a flow rate determined by Underground Test Area (UGTA) personnel. The well is sampled once water-quality parameters have stabilized or three effective well volumes have been purged. Past sampling efforts indicate that water-quality stabilization has occurred after purging approximately 15,150 L (4,000 gal) of groundwater. After well purging is complete and before the pump is turned off, a sample is collected. The pump specifications and depth of the pump intake are documented in the field log.
Water-quality parameters (i.e., pH, temperature, conductivity, and turbidity) are monitored and documented while the well is purged to determine when sampling may proceed. Operational checks of water-quality equipment is performed before, during, and at the end of purging according to manufacturer requirements. The sampling team ensures that only equipment with current calibration is used, and that calibration is documented and included in the project files.

ER 12-1 groundwater samples are collected from the wellhead manifold sampling port. Sample containers are filled directly from the sampling port. Sample containers are filled slowly, with minimal turbulence, up to the shoulder of the container. The samples are analyzed for Permit Table 1-B constituents. Navarro field personnel are responsible for implementing and documenting deviations from the requirements of this SAP.

2.3.2.2 Field Documentation

Field activities are documented in field logs and/or logbooks to verify quality of work. Field records are collected and maintained by the M&O UGTA personnel for ER 12-1 M&O activities, and by Navarro personnel for ETDS and ER 12-1 sample collection activities until completion of field operations. During the field effort, a copy of all field documents is maintained on site in a knowledge box. Records include pre-field documentation, safety briefings, calibration forms, sample collection logs (SCLs), photograph logs, and chain-of-custody (COC) forms. Handwritten records are made in dark, indelible ink. QA review of field documentation is conducted according to the requirements in this SAP. Pre-field activities—such as pre-field briefings, readiness review checklists, and training records—are documented accordingly.

The field logs or logbooks record activities in sufficient detail to allow future reconstruction of events. They may include information to allow traceability to more detailed information in associated forms/records (e.g., SCLs or COCs). If changes to methodology are required, field personnel obtain prior authorization; changes are documented in the field logs or logbooks. Corrections or deletions to field documentation entries are made by drawing a single line through the entry, and initialing and dating the entry.

2.3.2.3 Field Measurements

Field measurements at the ETDS include pH and specific conductance; field measurements at ER 12-1 include pH, specific conductance, temperature, and turbidity. Equipment is calibrated based on approved procedures and is calibrated before use. A calibration check consists of measuring a reference standard
and confirming the response is within an accepted range. Field instrument adjustments and calibration checks are documented in the field log.

All equipment is uniquely identified by the serial number, and records reference the unique identification. Copies of these calibration instructions, and calibration and reference standard records are kept in the project files.

Onsite calibrations of field measurement instruments are documented by field personnel performing the calibration on forms or logs. Qualified field personnel ensure that all field monitoring equipment is calibrated before and after use. Personnel conducting the calibration are knowledgeable in the operation of the instrument. The form or log is completed and updated for each calibration. A separate form or log is maintained for each instrument. At a minimum, the following information is recorded on the calibration log:

- Make, model, and serial number of the instrument
- Calibration standard lot numbers and expiration date
- Date and time of calibration, recalibrations if needed, and post-calibration
- Calibration measurements
- Any problems encountered during calibration
- Name and signature of the person conducting the calibration

### 2.3.2.4 Field Equipment

The following equipment/material may be used for ETDS and ER 12-1 sample collection, sample handling and packaging, documentation, and decontamination. Items may be added or deleted, as necessary, to satisfy field requirements:

- Ice and coolers for samples
- Sample containers (see Table 2-2)
- Sampling paperwork, including COCs, SCLs, bottle labels
- 2-in. wellhead manifold with sampling port
- Discharge hoses
- Geopump peristaltic pump, if filtering samples
- 0.45-micron disposable filters
- Appropriately sized tubing for use with the Geopump
- Buckets
- Nitrile gloves
- Deionized water
- pH paper
- Custody tape
- Duct tape, plastic tape, with holders
- Bubble wrap
• Paper towels or Kimwipes
• Indelible black markers and/or ink pens
• Plastic resealable bags
• Alconox, or equivalent, detergent
• Scrub brushes and containers (tubs/buckets)
• Sponges
• Tap water
• 10-percent nitric acid solution (spray bottle)
• 1-percent hydrochloric acid solution (spray bottle)

2.3.2.5 Sample Containers and Labeling

Samples are collected in new pre-cleaned containers, pre-preserved as specified in Table 2-2. Sample labels include project number, COC number, sample number, date and time collected, preservation, filtered or nonfiltered, parameter(s) to be analyzed, and sample team members. Labels are affixed to the container before or during sample collection. Samples are identified in accordance with company protocol.

SCLs are prepared for each sample, including QC samples, by field personnel to accurately and thoroughly document the sampling activity. Each space on a sample collection form is completed; “NA” is marked if a space is not applicable. At a minimum, the following information is recorded on SCLs:

• Project name
• Unique sample identification number
• Location to identify where the sample was collected or depth of pump intake
• Type of sample collected (e.g., characterization, QC)
• Sample medium (groundwater)
• Date and time of sample collection
• Sampling equipment and collection method used
• Amount of sample collected, container type, preservative, filtered or non-filtered
• Physical description of the sample (e.g., color, odor)
• Name of sample team members
• COC number
• Analytical laboratory where samples are being shipped
## Table 2-2
### Sampling Containers, Preservatives, and Holding Times

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Analytical Method *</th>
<th>Sample Medium</th>
<th>Container</th>
<th>Preservation</th>
<th>Minimum Sample Volume</th>
<th>Maximum Holding Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metals (arsenic, cadmium, chromium, copper, iron, lead, magnesium, manganese, mercury, selenium, zinc)</td>
<td>EPA 200.7</td>
<td>Water</td>
<td>Polyethylene</td>
<td>Nitric acid to pH&lt;2 at least 24 hours before analysis</td>
<td>500 mL</td>
<td>180 days, except mercury Mercury – 28 days</td>
</tr>
<tr>
<td>Chloride</td>
<td>EPA 300.0</td>
<td>Water</td>
<td>Polyethylene</td>
<td>None</td>
<td>50 mL</td>
<td>28 days</td>
</tr>
<tr>
<td>Fluoride</td>
<td>EPA 300.0</td>
<td>Water</td>
<td>Polyethylene</td>
<td>None</td>
<td>50 mL</td>
<td>28 days</td>
</tr>
<tr>
<td>Sulfate</td>
<td>EPA 300.0</td>
<td>Water</td>
<td>Polyethylene</td>
<td>Cool ≤ 6°C</td>
<td>50 mL</td>
<td>28 days</td>
</tr>
<tr>
<td>Nitrate as Nitrogen</td>
<td>EPA 300.0</td>
<td>Water</td>
<td>Polyethylene or glass</td>
<td>Cool ≤ 6°C</td>
<td>50 mL</td>
<td>48 hours</td>
</tr>
<tr>
<td>Gross alpha</td>
<td>EPA 900.0</td>
<td>Water</td>
<td>Polyethylene</td>
<td>Nitric acid, pH&lt;2</td>
<td>1 L</td>
<td>6 months</td>
</tr>
<tr>
<td>Gross beta</td>
<td>EPA 900.0</td>
<td>Water</td>
<td>Polyethylene</td>
<td>Nitric acid, pH&lt;2</td>
<td>1 L</td>
<td>6 months</td>
</tr>
<tr>
<td>Tritium</td>
<td>EPA 906.0</td>
<td>Water</td>
<td>Glass</td>
<td>None</td>
<td>250 mL</td>
<td>6 months</td>
</tr>
<tr>
<td>pH</td>
<td>Field measurement</td>
<td>Water</td>
<td>Polyethylene or glass</td>
<td>None</td>
<td>Per manufacturer specification</td>
<td>Analyze immediately</td>
</tr>
<tr>
<td>Specific Conductance</td>
<td>Field measurement</td>
<td>Water</td>
<td>Polyethylene or glass</td>
<td>None</td>
<td>Per manufacturer specification</td>
<td>Analyze immediately</td>
</tr>
</tbody>
</table>

* Analytical methods (not including field measurements) are those for which the NDEP BWQP ELS has provided the laboratory a certification or approval. Unless excepted by the ELS, allowed methods are provided in 40 CFR 136 (CFR, 2016a).

BWQP = Bureau of Water Quality Planning
ELS = Environmental Laboratory Services
mL = Milliliter
2.3.2.6 Chain of Custody

Data validity depends on demonstrating that samples have been obtained from locations stated and have reached the laboratory without alteration. The COC refers to the sample history from point of collection to analysis and through disposal. The COC records custody transfers (e.g., to secure storage if necessary, packaging and shipment, and laboratory receipt); identifies requested analyses, preservatives, and whether the samples may contain hazardous constituents; and establishes samples as legally defensible entities. The COC is required, without exception. The COC containing original signatures accompanies samples to the laboratory, and a copy is retained in project files. Documentation used in sample custody and tracking includes the following:

- Sample bottle labels
- SCLs
- Custody seal tape, initialed and dated
- COC forms

Physical custody of samples is maintained by one of the following:

- The sample is in a sample team member’s physical possession or physical field of view.
- The sample is transferred to a designated secure storage limited to authorized personnel.
- The sample is sealed and maintained under lock and key.

Laboratory disposal records demonstrate disposal in accordance with applicable regulations. Review of disposal records is performed by the DOE Consolidated Audit Program.

2.3.2.7 Custody Seals

Custody seals indicate whether samples and/or shipping containers have been tampered with before laboratory receipt. Custody seals are placed on sample containers after collection of sample and before shipment to the laboratory. In addition, two or more seals are placed across the opening of shipping containers (i.e., coolers), in a manner that indicates if the container was opened during transit. Samples in interim storage before shipment are maintained in a secure location with limited access. If the laboratory notes that custody seals are broken, the organization that shipped the sample is notified, and they decide whether to proceed.
2.3.2.8 **Decontamination**

Decontamination will not be required because all sample containers will be new, and equipment will not be reused. If decontamination is required, the procedure will be called out in the work plan.

2.3.2.9 **Demobilization**

Equipment (except for the pump) used for sampling of ETDS or ER 12-1 is removed upon completion of sampling, and the site (ETDS, ER 12-1 pad, access road, and surrounding areas) is returned to its pre-sampling condition.

2.3.2.10 **Waste Management**

Based on previous data and under the condition the sites will operate under a far-field scenario (i.e., tritium concentrations are less than 400,000 picocuries per liter [pCi/L], as defined in the UGTA Fluid Management Plan [FMP]) (NNSA/NSO, 2009). Waste may include sanitary trash (e.g., office waste), disposable sampling equipment, personal protective equipment (PPE), lab waste (e.g., Kimwipes), and decontamination fluids. Sanitary waste will be disposed of into an appropriate receptacle (dumpster). Lab waste and PPE will be disposed of into the roll-off bin at Building 23-310. If tritium concentrations are greater than 400,000 pCi/L, waste will be placed in plastic bags, stored in drums or other appropriate containers, and managed as potential radioactive waste pending waste characterization. ETDS discharge effluent not containerized for analysis will be discharged back into the discharge flume.

Fluid-producing operations at ER 12-1 are governed by the most current version of the UGTA FMP (NNSA/NSO, 2009). Based on previous samples, ER 12-1 is operated under a far-field scenario. Water resulting from ER 12-1 sampling events, field monitoring, and decontamination activities is disposed into the existing sump at the site. Fluids may be pumped, via pump or gravity, to the ground surface as long as tritium-monitoring results verify far-field conditions.

2.3.2.11 **Offsite Shipping and Notification**

Samples are packaged according to Navarro procedures and DOE and U.S. Department of Transportation regulations. Before shipment, the laboratory is notified of the number of samples, requested analyses, turn-around time, and potential hazards. Radiological surveys are performed by the Navarro Radiological Control Technicians before release from the NNSS. Analysis is contingent upon radiation levels being low enough to allow offsite shipment and laboratory receipt. Based on previous
data, ETDS samples contain approximately 351,000 pCi/L tritium, while ER 12-1 samples contain approximately 18 pCi/L tritium. If samples have significantly higher activity, sampling will not proceed until the sampling program and work package are reviewed by the Navarro Radiation Services Group to determine whether modifications to the work processes or controls are necessary.

2.3.3 Quality Assurance and Quality Control

The overall objective of the sampling and monitoring activities described in this SAP is to collect accurate and defensible data to demonstrate the limits set forth in Permit Tables A-1 and B-1 have not been exceeded. QA/QC elements include the following:

- Field QC sampling
- Requirements for subcontract analytical laboratory support
- Laboratory QC checks
- Laboratory QC samples
- DQIs
- Data quality reviews

2.3.3.1 Field QC Samples

Field QC samples help determine the validity of sample results and are analyzed by the same procedures as associated samples. Results are evaluated against DQIs. The collection of field QC samples depends on the number and type of investigation samples collected. Additional QC samples may be submitted based on site conditions. The following QC samples will be collected during sampling at the ETDS and ER 12-1:

- One field duplicate (FD). The FD is collected from the same location at approximately the same time as the original sample and labeled so that the laboratory cannot determine which samples are duplicate pairs (“blind duplicates”).

- One extra volume sample for full lab QC (laboratory control sample [LCS], method blank, matrix spike [MS]).

Handling and labeling of field QC samples will follow Navarro-approved procedures.

2.3.3.2 Analytical Laboratory Requirements

All laboratory contracts are established through the procurement process to ensure DOE, EPA, and NDEP requirements are met. The laboratories supporting this project have received approval and/or
certification from the NDEP BWQP ELS to perform analyses in support of Nevada Clean Water Act compliance monitoring (NRS, 2013).

The laboratories use the methods in Table 2-2 to analyze samples. Table 2-3 lists the analytes, detection limits, and Permit Table 1-B limits. The detection limits are not required by the Permit; however, they demonstrate that the DQI for sensitivity is met.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Detection Limit</th>
<th>Table 1-B Threshold/Permissible Limit</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>ETDS</td>
<td>ER 12-1</td>
</tr>
<tr>
<td>Gross Alpha</td>
<td>2</td>
<td>35.1</td>
<td>15</td>
</tr>
<tr>
<td>Gross Beta</td>
<td>4</td>
<td>101</td>
<td>50</td>
</tr>
<tr>
<td>Tritium</td>
<td>400</td>
<td>1,000,000</td>
<td>20,000</td>
</tr>
<tr>
<td>Cadmium</td>
<td>0.0003</td>
<td>0.045</td>
<td>0.005</td>
</tr>
<tr>
<td>Chloride</td>
<td>0.3</td>
<td>360</td>
<td>250</td>
</tr>
<tr>
<td>Chromium</td>
<td>0.001</td>
<td>0.09</td>
<td>0.09</td>
</tr>
<tr>
<td>Copper</td>
<td>0.001</td>
<td>1.2</td>
<td>1.2</td>
</tr>
<tr>
<td>Fluoride</td>
<td>0.25</td>
<td>3.6</td>
<td>3.6</td>
</tr>
<tr>
<td>Iron</td>
<td>0.02</td>
<td>5.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Lead</td>
<td>0.002</td>
<td>0.014</td>
<td>0.014</td>
</tr>
<tr>
<td>Magnesium</td>
<td>0.013</td>
<td>135</td>
<td>135</td>
</tr>
<tr>
<td>Manganese</td>
<td>0.002</td>
<td>0.25</td>
<td>0.25</td>
</tr>
<tr>
<td>Mercury</td>
<td>0.0001</td>
<td>0.0018</td>
<td>0.0018</td>
</tr>
<tr>
<td>Nitrate as Nitrogen</td>
<td>0.25</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Selenium</td>
<td>0.003</td>
<td>0.045</td>
<td>0.045</td>
</tr>
<tr>
<td>Zinc</td>
<td>0.003</td>
<td>4.5</td>
<td>4.5</td>
</tr>
</tbody>
</table>

mg/L = Milligrams per liter

2.3.3.3 Analytical Laboratory QA/QC Checks

Subcontracted analytical laboratories conduct the following QA/QC checks, at a minimum:

- Sample collection and preservation (chemical and temperature)
- Preparation and analysis within established holding times
- Laboratory batch QA/QC samples (e.g., blanks, spikes, replicates)
- Calibrations and initial and continuing instrument performance checks
- Compound identification and quantitation
2.3.3.4 Laboratory QC Samples

Laboratories use the following QC data to determine precision and accuracy performance:

- **LCSs** – One LCS (a spiked, blank matrix carried through sample preparation and analysis) is analyzed for each sample batch. Data quality is determined by control limits for LCS recovery established by internal control charts.

- **Method blanks** – A method blank is a volume of deionized, distilled water (for liquid samples) subjected to the entire analytical procedure. The volume or weight of the blank is approximately equal to the sample. This determines the interference of solvents and reagents used in the analysis. A method blank is analyzed with each batch of samples.

- **MSs** – To evaluate the effect of sample matrix on accuracy, a sample aliquot is spiked with the analyte and analyzed with each batch. Percent recovery (%R) of 20 percent is generally acceptable, although exceeding this does not necessarily qualify data.

2.3.3.5 Data Quality Indicators

DQIs are quantitative and qualitative descriptors to determine the degree of acceptability or usability of data and include precision, accuracy, representativeness, comparability, completeness, and sensitivity. DQIs evaluate the entire measurement system, including laboratory measurement processes (i.e., analytical method performance) and individual analytical results (i.e., parameter performance). Table 2-4 identifies each DQI, provides the system performance criteria, and describes the potential impacts to the decision if the criteria are not met.

Precision, accuracy, and sensitivity are quantitative measures that assess the analytical method, sampling performance, and the need to qualify individual results when QC sample results are not within established limits. Representativeness and comparability are qualitative measures, and completeness is a quantitative measure. Representativeness, comparability, and completeness assess the measurement system performance. Performance metrics are established for analytical methods and individual sample results. Based on an assessment of quality, data qualified as estimated for precision or accuracy may be considered to meet the parameter performance criteria.

All incidents and conditions that adversely affect data quality will be documented. Corrective actions to mitigate adverse field conditions are tracked to verify their successful implementation. All DQI performance criteria deficiencies will be evaluated for data usability and impacts to the project. The following sections discuss each DQI that will be used to assess the quality of laboratory data.
Table 2-4
Analytical Laboratory Performance Criteria for ETDS and ER 12-1 DQIs

<table>
<thead>
<tr>
<th>DQI</th>
<th>Performance Criterion</th>
<th>Potential Impact on Decision if Performance Criterion Not Met</th>
</tr>
</thead>
<tbody>
<tr>
<td>Precision</td>
<td>Uncertainty associated with each measurement system is sufficiently controlled to have confidence in comparison of analytical results to action levels. This is monitored through analysis and evaluation of FDs, LCSDs, and MSDs.</td>
<td>Data that do not meet the performance criteria will be evaluated for purposes of evaluating completeness. Decisions may not be valid if field or analytical method performance criteria for precision are not met and the analytical result approaches the Permit Table 1-B threshold or permissible limit.</td>
</tr>
<tr>
<td>Accuracy</td>
<td>LCS results and MS results should be within analytical method-specific criteria.</td>
<td>Data that do not meet the performance criteria will be evaluated for purposes of evaluating completeness. Decisions may not be valid if analytical method performance criteria for accuracy are not met and the analytical result approaches the Permit Table 1-B threshold or permissible limit.</td>
</tr>
<tr>
<td>Representativeness</td>
<td>Sampling system and process is designed to account for variability in the population of interest. Correct analytical method performed for appropriate parameters; valid data reflect appropriate target population.</td>
<td>Cannot identify Permit Table 1-B parameters or estimate their concentration; therefore, cannot make decision(s) on target population.</td>
</tr>
<tr>
<td>Comparability</td>
<td>Consistent sampling, handling, preparation, analysis, reporting, and data quality review criteria will be used. Approved standard methods and procedures will be used to analyze and report the data.</td>
<td>Inability to combine data with data obtained from other sources in an effort to contribute to common interpretation and analysis.</td>
</tr>
<tr>
<td>Completeness</td>
<td>Measurements are sufficient to satisfy data needs for critical decisions.</td>
<td>Content and water characterization incomplete.</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>Detection limits of laboratory instruments must be less than or equal to respective Permit Table 1-B thresholds or permissible limits.</td>
<td>Cannot determine whether parameters are present at Permit Table 1-B thresholds or permissible limits; therefore, the affected data will be assessed for usability and potential impacts on meeting the Permit objectives.</td>
</tr>
</tbody>
</table>

LCSD = Laboratory control sample duplicate
MSD = Matrix spike duplicate

**Precision**

Precision is the degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves. Precision is expressed as standard deviation, variance, or range—in either absolute or relative terms (EPA, 2003)—and assesses the variability of the sampled population, sampling design, and sample handling, preservation, and storage along with variability of the analysis process.

Precision is determined for FDs, if collected, and for laboratory duplicate samples. The laboratory duplicate relative percent difference (RPD) and normalized absolute difference (DER) criteria are
provided in Table 2-5, but may be established as well by the laboratory for a specific analytical method and matrix. FDs, if collected, will also be evaluated against Table 2-5 criteria. If laboratory duplicates fail the RPD or DER criteria, sample data will be qualified accordingly based in part on the degree of failure. FDs that fail Table 2-5 criteria will not result in qualifying sample data, but they may drive further evaluation of the sampling design and process.

### Table 2-5

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Analytical Method a</th>
<th>Sample Medium</th>
<th>Target Precision RPD</th>
<th>Target Accuracy %R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metals (arsenic, cadmium, chromium, copper, lead, mercury, selenium, iron, magnesium, manganese, and zinc)</td>
<td>200.7 &lt;br&gt; Mercury by 245.1</td>
<td>Water</td>
<td>20</td>
<td>80–120 &lt;br&gt; 77–120 (mercury)</td>
</tr>
<tr>
<td>Inorganics (chloride, fluoride, and sulfate)</td>
<td>300.0</td>
<td>Water</td>
<td>20</td>
<td>75–125</td>
</tr>
<tr>
<td>Nitrate as nitrogen</td>
<td>300.0</td>
<td>Water</td>
<td>20</td>
<td>75–125</td>
</tr>
<tr>
<td>Gross alpha</td>
<td>900.0</td>
<td>Water</td>
<td>20 (DER ≤ 3)</td>
<td>75–125</td>
</tr>
<tr>
<td>Gross beta</td>
<td>900.0</td>
<td>Water</td>
<td>20 (DER ≤ 3)</td>
<td>75–125</td>
</tr>
<tr>
<td>Tritium</td>
<td>906.0</td>
<td>Water</td>
<td>20 (DER ≤ 3)</td>
<td>75–125</td>
</tr>
<tr>
<td>pH</td>
<td>Field measurement</td>
<td>Water</td>
<td>± 0.1 pH unit</td>
<td>± 0.1 pH unit</td>
</tr>
<tr>
<td>Specific conductance</td>
<td>Field measurement</td>
<td>Water</td>
<td>25</td>
<td>75–125</td>
</tr>
</tbody>
</table>

---

a Analytical methods (not including field measurements) are those for which the NDEP BWQP ELS has provided the laboratory a certification or approval. Unless excepted by the ELS, allowed methods are provided in 40 CFR 136 (CFR, 2016a).

### Accuracy

Accuracy is the degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) that are due to sampling and analytical operations (DOE, 2013). Accuracy assesses performance of laboratory measurement processes and evaluates individual groups of analyses.

Accuracy is determined by analyzing a reference material of known parameter concentration or by reanalyzing a sample to which a known concentration or amount of the parameter has been added.
Accuracy is expressed as %R, and is calculated by dividing the measured sample concentration by the true concentration and multiplying by 100. The accuracy criteria are provided in Table 2-5 and will be evaluated by reviewing several laboratory QA samples, primarily the LCS and LCSD.

Values that are outside the %R criteria do not necessarily result in the qualification of data. It is only one factor in making an overall judgment about data quality and usability. Factors beyond the laboratory’s control, such as sample matrix effects, can cause the measured values to be outside the established criteria. Therefore, the entire sampling and analytical process will be evaluated when determining data quality.

The criterion to evaluate analytical method performance for accuracy (Table 2-5) is based on analytical method-specific MS, LCS, and surrogate accuracy measurements. Each measurement is assessed for potential impacts on project objectives.

**Representativeness**

Representativeness is the degree to which data accurately and precisely represent a population, variation at a sampling point, or environmental condition (MARSSIM, 2000); and is assured by developing a sampling strategy, collecting a specified number of samples from proper locations, analyzing samples by approved analytical methods, reviewing field documentation, operating in accordance with approved procedures and plans, conducting field surveillances, and collecting field blanks. Biased samples are designed to represent the target population as opposed to the entire population. Therefore, target populations are identified as locations most likely to contain contaminants.

**Comparability**

Comparability is a qualitative parameter expressing the confidence with which one dataset can be compared to another (MARSSIM, 2000). To ensure comparability, all samples will be subjected to the same or equivalent sampling, handling, preparation, analysis, data review, and qualification criteria in accordance with approved procedures and standard methods.

**Completeness**

Completeness is a quantitative evaluation of overall measurement system performance. The criterion for meeting completeness is generating sufficient data of appropriate quality to satisfy data needs. The quantitative measurement to evaluate completeness is presented in Table 2-5 and is based on the
percentage of sample locations planned versus sampled, percentage of samples collected versus analyzed, and measurements made that are judged to be valid.

Sensitivity

Sensitivity is a quantitative parameter that evaluates the capability of a method or instrument to measure parameter concentrations at or near decision levels. The criterion for this parameter is measurement sensitivity (detection or reporting limits) lower than corresponding thresholds or permissible limits (Table 2-3). If this criterion is not achieved, the affected data will be assessed for usability and potential impacts on meeting project objectives.

2.3.3.6 Data Quality Review

Data of known quality are required for making decisions. Rigorous QA/QC includes data verification, validation, and quality assessment; and ensures samples are appropriately collected and analyzed and that results meet data quality criteria. Data are assessed to determine whether the performance criteria of the DQIs are met. If the DQIs are not met, impact to the project is evaluated, and the appropriate corrective action is implemented to fill data gaps.

Data quality is assessed in two phases:

1. Before final reporting by the laboratory performing the analyses for compliance with procedures, analytical standard methods, and subcontract terms and conditions

2. Upon receipt of data based on subcontract terms and conditions (i.e., schedule and deliverable), analytical standard method requirements, DOE Quality Systems for Analytical Services, and EPA Contract Laboratory Program National Functional Guidelines (EPA, 2001 and 2004)

Data are reviewed under the following degrees of rigor (in order of increasing rigor):

- Verification
- Validation
- Quality assessment

Data Verification

Data verification includes Tier I and Tier II reviews, as described below.
**Tier I – Data Completeness Review:** Tier I is a completeness review to ensure all data and documentation are present and complete. The review is expeditiously conducted upon receipt of data. Problems are identified, documented, and transferred with the data for Tier II review. At a minimum, the Tier I review covers the following:

- Complete and legible COC documents
- Problems identified in laboratory-generated cover letters (evidenced by case narrative)
- Requested sample analyses and hold times
- Cooler temperature at time of sample receipt
- Proper preservation and pH for each matrix and parameter
- Receipt of laboratory log-in report
- Complete field sampling forms
- Inclusion of all laboratory report forms

**Tier II – Data Review and Summary:** Tier II is conducted by personnel with training in and technical understanding of laboratory methods and data quality. Calculations of results from raw data are not verified, and data validation qualifiers are not assigned at this level. Deficiencies of analytical services (e.g., method performance, submittals) are documented in the project file. Completion of the following items is verified in a Tier II review:

- Laboratory sample identification corresponds to client sample identification.
- There is a one-to-one correlation of laboratory sample numbers to client sample numbers.
- Each QC sample is assigned a unique laboratory sample number.
- The correct sample matrix is identified for all sample results.
- Critical Tier I items, if defined, meet SAP objectives.
- Preparation and analysis dates and analytical batch numbers are assigned to each batch.
- Preparation dates and QC batch numbers are assigned to each QC batch.
- Each QC batch corresponds to the appropriate analytical batches.
- Appropriate units are reported for all sample results.
- Sample dilutions are properly noted.
- Sample detection limits are adjusted for dilutions.
- Detection limits meet SAP requirements.
- Laboratory data qualifiers are correct and explained.
- Blanks are clean or flagged by the laboratory.
- QC samples are analyzed for appropriate analytes, and results are within limits.
- LCSs and MSs are analyzed for appropriate analytes.
- Correct analytical methods are used.

**Data Validation**

Data validation involving recalculation of laboratory data will not be performed.
2.3.4 Data Quality Review Summary

The overall purpose of the requirements, assessments, and reviews included in Section 2.3.3 provide the information needed to assess whether or not the data meet the requirements set forth in the DQOs. A written summary will be prepared that documents the reviews conducted under these sections and, record of the review and conclusions will be retained for not less than three years as required by the Permit.

2.3.5 Data Management

Data are managed in accordance with the Permit, NNSA/NFO, and Navarro requirements.

Navarro is responsible for the following:

- Monthly monitoring (observations and measurements) of the ETDS
- Sampling of the ETDS and ER 12-1
- Maintaining the data in the project files, compilation, trend analysis, and reports
- Offsite release and shipment of samples to laboratories
- Analytical services discrepancies
- Receipt and review of analytical packages from laboratories
- Reporting of data

The M&O contractor manages ER 12-1 maintenance and pumping data, including VSC settings.

Records and documentation that result from implementation of the SAP exceed the requirements set forth in the Permit. These records and documentation will be retained for no less than three years.

2.3.6 Data Reduction and Reporting

Monthly observations and measurements are recorded using the FMR form (see Appendix A). Data are entered into a computer spreadsheet program to create charts of individual parameter concentrations versus time. All data entered into spreadsheets, figures, graphs, and tables are subjected to a check-printing process to ensure accurate data transcription, reduction, manipulation, and interpretation. Graphs are routinely evaluated to determine whether trends are observed. Reports required by the Permit are developed by Navarro and provided to NNSA/NFO for review and comment. Once all comments are resolved, reports are finalized for NNSA/NFO signature and submittal to NDEP.

The QMR and Summary Report summarize the monitoring data, measurements, sample analyses, and observations for each completed calendar quarter or calendar year, as applicable. The Summary Report
includes quarterly and annual summaries as well as charted trend analysis. Any additional data, measurements, sample analyses, or observations that are collected more frequently than required by the Permit will also be reported in the next QMR or Summary Report.

QMRs and Summary Reports are submitted to NDEP by the 28th day of the month following each completed calendar quarter or calendar year, as applicable.

2.4 Solid Waste

Permit requirements governing solid waste are specifically applicable to removal and disposal of any sludge or residue from the ETDS ponds. Before removal and disposal of any sludge or residue, a representative sample must be collected and analyzed using the TCLP for the constituents list in 40 CFR 261.24, Table 1 (CFR, 2016b). Any samples collected in support of compliance with these requirements will be collected under a separate, sampling-specific DQO process.

2.5 Releases

Any potentially dangerous and/or unstable berm conditions will be reported immediately upon discovery by Navarro personnel to NNSA/NFO. These conditions include, but are not limited to, threatened or unplanned release of water outside the ETDS boundary, imminent or actual failure of a pond berm, or a break in the pipeline. NNSA/NFO will report any upset, spill, overflow, or release of treated or untreated wastewater to NDEP as outlined in Section 3.0.

2.6 Recording and Reporting

The Permit requires that measurements, observations, and sampling conducted to demonstrate Permit compliance be recorded. These documentation requirements are specified in applicable portions of this O&M Plan. The records generated through implementation of this plan meet the Permit requirements. These records will be retained for no less than three years. Requirements governing the development and delivery schedule for the QMR and Summary Report are specified in Section 2.3.6.
3.0 Permit Management Requirements

NNSA/NFO has direct responsibility for the management of the Permit. Those responsibilities include the following:

- Notifying NDEP in advance of any anticipated facility expansions or modifications that may result in changes in the discharges

- In the event of any change in control of, or responsibility for, the facilities authorized by the Permit, NNSA/NFO must notify the succeeding person of the existence of the Permit by letter, a copy of which will be forwarded to NDEP.

- NNSA/NFO must ensure the ETDS collection, treatment, and disposal facility is configured and maintained in conformance with sound engineering judgment and sound engineering principles. NNSA/NFO ensures these requirements are met through oversight of the compliance tasks assigned to Navarro and the M&O contractor.

- NNSA/NFO must submit Permit renewal application upon expiration of Permit NEV 96021.

- NNSA/NFO must allow authorized agents of NDEP to perform the following tasks:
  - Enter the NNSS for inspection of the ETDS.
  - Access records kept under requirements of the Permit.
  - Inspect monitoring equipment or monitoring methods required in the Permit.
  - Perform monitoring to determine compliance with the Permit.
  - Sample any source within the watershed where the ETDS is located.

NNSA/NFO is also responsible for reporting certain conditions to NDEP. Navarro has reporting responsibilities to NNSA/NFO, and in turn, NNSA/NFO reports to NDEP. Reporting responsibilities include any upset, spill, overflow, or release of treated or untreated wastewater. This report will be made immediately upon discovery by telephone (702-486-2850) before the end of the next business day. In the event of such an occurrence, NNSA/NFO must submit a written report to NDEP within 10 working days after the telephoned report. The written report will include the details of the event, including the following:

- Time, date, and location of the event
- Estimated or actual quantity released
- A map or diagram of the flow path and affected channels, tributaries, or other bodies of water
- Specific cause or causes of the event
- Actions to protect public health or to mitigate damage to the resources of the impacted area
- Corrective actions
NNSA/NFO must notify NDEP if the conditions regarding response to out-of-tolerance conditions outlined in Section 2.2.4 are met.
4.0 References

CFR, see Code of Federal Regulations.


DOE, see U.S. Department of Energy.

EPA, see U.S. Environmental Protection Agency.


Murphy, T.H., Nevada Division of Environmental Protection, Bureau of Federal Facilities. 2013. *Water Pollution Control Permit NEV 96021*, Rev. 1. 1 October. Las Vegas, NV.

Navarro GIS, see Navarro Geographic Information Systems.

NNSA/NSO, see U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office.

NRS, see Nevada Revised Statutes.


Appendix A

Example E Tunnel Wastewater Disposal System
Field Monitoring Report Form

(2 Pages)
## SECTION 1: MONITORING PERSONNEL

Personnel conducting the monitoring:

Print: ________________________ Sign: ________________________

Print: ________________________ Sign: ________________________

## SECTION 2: INSPECTION TYPE

Monthly ☐ Annual ☐ Other - Specify: ________________________

## SECTION 3: OBSERVATIONS

(If the answer is "yes", discuss observations in SECTION 5)

1. Signs of recent flooding or soil erosion within the ETDS boundary? No ☐ Yes ☐
2. Erosion or sloughing of interior or exterior slopes of embankments? ☐ ☐
3. Any problems noted in the condition of the pipeline, valves, or TDMS? ☐ ☐
4. Seepage along the base of any pond embankment? ☐ ☐
5. Other - Specify: ________________________

## SECTION 4: FIELD MEASUREMENTS & OBSERVATIONS

### 1. Discharge Monitoring

**A. Flow Rate - using a stopwatch, determine the seconds taken to fill the 5 gallon bucket (measured at 5.3 gallons, 20.1 liters)**

<table>
<thead>
<tr>
<th>Reading 1</th>
<th>Reading 2</th>
<th>Reading 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liters</td>
<td>20.1</td>
<td>20.1</td>
</tr>
<tr>
<td>Seconds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liters/Minute</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Flow Rate Calculation (embedded on spreadsheet): Liters/Minute = \((20.1 \text{ liters/A seconds}) \times (60 \text{ seconds/1 minute})\) where A = the number of seconds elapsed to fill the fixed volume

### B. Temperature & Hydrogen Ion Activity (6 - 9 is within tolerance)

<table>
<thead>
<tr>
<th>Calibration</th>
<th>Post Sampling</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH 4 Buffer Reading</td>
<td>Standard Units</td>
</tr>
<tr>
<td>pH 7 Buffer Reading</td>
<td>Standard Units</td>
</tr>
<tr>
<td>pH 10 Buffer Reading</td>
<td>Standard Units</td>
</tr>
<tr>
<td>Certified Sample Reading</td>
<td>N/A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Discharge pH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degrees Celsius (not a permit parameter)</td>
<td>Standard Units</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Within Tolerance?</th>
</tr>
</thead>
</table>

### C. Specific Conductance: (≤ 1500 μS/cm is within tolerance)

<table>
<thead>
<tr>
<th>Meter Serial Number</th>
<th>As Found</th>
<th>Adjusted to</th>
<th>As Left</th>
</tr>
</thead>
<tbody>
<tr>
<td>Daily calibration and check using 1000 μS/cm standard:</td>
<td>Discharge Conductance:</td>
<td>μS/cm</td>
<td></td>
</tr>
</tbody>
</table>

Within Tolerance? | ☐ ☐

NOTE: IF OUT OF TOLERANCE, CONTACT TASK LEAD (5-1986), TASK MANAGER (5-1816), OR ER PROGRAM MANAGER (5-2505)

8/9/2017
2. Deep rooting botanicals into earthen embankments?  
Yes

3. Signs of mammal, insect, or reptile tunneling or burrowing in the earthen embankments?  
No

4. Physical condition of any perimeter fencing:  
Marginal

5. Structural integrity of the ETDS  
Good

NOTE: IF A POTENTIAL BREACH OF CONTAINMENT CONDITION IS OBSERVED, CONTACT TASK LEAD (5-1886), TASK MANAGER (5-1816), OR ER PROGRAM MANAGER (5-2505)

6. Ponds containing water:  
- Pond 4
- Pond 5
- Pond 6a
- Pond 6b
- Pond 6c

7. Ponding - Describe ponding volume and designed overflow. Photographs may be taken to illustrate water levels and overflow pipe.
- Pond 4
- Pond 5
- Pond 6a
- Pond 6b
- Pond 6c

SECTION 5: COMMENTS
Comments/Observations:

SECTION 6: CONCLUSIONS
The monitoring, observations, and inspections documented here satisfy the associated data quality objectives as described in the OM Plan and related implementing documents.

Signature: __________________________ Date: __________________________