**Sample Engineering Report**

**Wastewater Land Application and Operation Permit Application**

X Location

Date

Prepared by:

Company ABC

Address

(111) 123-4567

**ENGINEER CERTIFICATION**

Engineering Report

Wastewater Land Application and Operation Permit Application

{Location}

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## Introduction and Background

Company ABC owns and operates an XYZ facility at X location, IA. Wastewater is treated in ABC and stored in a structure. Wastewater is land applied to ABC land using XYC mechanism.

The facility is operated under Iowa State Operation Permit No. 123. A permit renewal application was submitted to the Iowa DNR on X date.

This Engineering Report is a request for permit amendment to add an additional land application site. This Engineering Report includes the following:

* + Site information
  + Soils information
  + Groundwater monitoring well details
  + Initial groundwater quality data
  + Wastewater quality data

This report includes references to Iowa Wastewater Facilities Design Standards -Chapter 21 Land Application of Wastewater. The number in parenthesis at each report section title refers to the applicable Chapter 21 section.

## General Design Considerations

### Site Considerations (21.1.1)

Site # is located at X location. The proposed site location is defined in Figure #.

#### Site Identification (21.1.1.1)

##### Legal Description (21.1.1.1.a)

Following is the legal description for the site:

(1) Site Number -

(2) Owned by -

The landowner agreement for the site is attached as Appendix xx.

##### Features within One - Half Mile (21.1.1.1.b)

Residences located within one -half mile of the site are summarized in Table # and shown on Figure #.

Table xx Owners of Residential Property Within 0.5 Mile of Site

|  |  |  |  |
| --- | --- | --- | --- |
| Name | Address | Distance from Site (feet) | Direction from Site |
|  |  |  |  |
|  |  |  |  |

The site is adjacent to the following roads: {list roads adjacent}

The Iowa Geological Survey data base information on wells located in the vicinities of the sites is attached as Appendix xx and well locations indicated on Figure #.

There are X number public wells located within one-half mile of the site, with some being inactive or standby.

The following private wells are located within one-half mile of the site, but are assumed well locations that did not appear in the IGS database.

**Assumed/Unknown**

{List private wells}

There are no surface water supplies within one-half mile of the sites.

##### Land Areas (21.1.1.1.c)

The gross and net land areas for land application are summarized in Table # and Figure #.

Table xx Land Application Site Areas

|  |  |  |
| --- | --- | --- |
| Site No. | Gross Area (Acres) | Net Usable Area (Acres) |
|  |  |  |

##### Distance to Storage Facilities (21.1.1.d)

The application sites are located in relatively close proximity to the wastewater storage structure. Wastewater will normally be pumped from {describe} to the sites. The distance from the pump house to the XYZ side of Site {number} is approximately {distance}.

The application sites are variable elevations within {height} of the pump house elevation of {elevation}.

##### Proximity to Developments and Other Features (21.1.1.1.e)

The following are approximate distances from the land application sites to developments and other features located closest to the site:

{List}

##### Land Uses (21.1.1.1.f)

The land uses adjacent to the sites are summarized below:

{Land use}

It is anticipated that the adjacent properties will {describe any known future usage plans}. There are no known plans for ground water uses other than private water supply wells.

##### Field Tile (21.1.1.1.g)

All known field tile inlets are identified (see Figure #)

##### Vegetation (21.1.1.1.h)

The land application site is currently used for production of {crop rotation- e.g. corn, soybeans, alfalfa, etc}.

##### Areas for Expansion (21.1.1.1.i)

Site {number} may be expanded to the the following locations. Other potential additional application sites are being evaluated.

#### Site Criteria (21.1.1.2) (21.2.2)

The applicable setbacks and usable areas for land application are illustrated on Figure #. The areas of the site that will be used for land application comply with the following criteria:

* Sites are not flood prone (no flooding at a frequency greater than once every ten years).
* Land application will not be practiced within 300 feet of existing dwellings or public use areas.
* Land application will not be practiced within 50 feet of the property line.
* Land application will not be practiced within 400 feet of any existing potable water supply wells.
* Land application will not be practiced within 300 feet from a continuous flowing stream.
* Disposal area signs will be placed no further than 500 feet between signs along the site perimeter.
* Land application will not be practiced within 1000 feet from any shallow public water supply
* Land application will not be practiced within 500 feet from any public lake or impoundment
* Land application will not be practiced within 1/2 mile from any public lake or impoundment used as a source of raw water by a potable water supply

Signs installed at 500 feet maximum intervals along the site perimeter will indicate the following in letters no less than 2 inches high:

NO TRESPASSING

WASTEWATER APPLICATION SITE

{Company Name}

### Groundwater (21.1.2)

A groundwater and soils investigation was performed by XYZ. The complete soil boring and monitoring well installation report is attached as Appendix xx. The following groundwater monitoring wells were installed and their locations are indicated on Figure # and in Appendix xx. Table # is a summary of the groundwater monitoring well locations, depths, and depths to groundwater. Monitoring well construction details are included in Appendix xx.

Table xx Groundwater Monitoring Well Summary

|  |  |  |
| --- | --- | --- |
| Parameter | MW-x | MW-y |
| Site No. |  |  |
| Upgradient |  |  |
| Downgradient |  |  |
| Drilling Depth, ft. |  |  |
| Depth Bedrock, ft. |  |  |
| Depth to Groundwater, ft. |  |  |
| Depth, ft. |  |  |

#### Field Work Determination (21.1.2.1) (21.2.2.1)

The depths to groundwater were determined in {month/date}. See Appendix xx for details. The depths to groundwater are summarized in Table #.

The general direction of groundwater flow is from {direction} of the site.

#### Initial Groundwater Quality (21.1.2.2)

Samples were collected from the two groundwater monitoring wells on {date}, shortly after monitoring well construction. Sampling methods are included in Appendix xx.

The laboratory data on groundwater samples are summarized on Table #.

Table xx Initial Groundwater Quality Data Summary

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter1 | |  |  |
| Site Location | |  |  |
| Upgradient | |  |  |
| Downgradient | |  |  |
| Date sample taken | |  |  |
| TOC | |  |  |
| Total Dissolved Solids | |  |  |
| Conductivity, µSiem | |  |  |
| Total Nitrogen | |  |  |
| Ammonia -Nitrogen | |  |  |
| Organic Nitrogen | |  |  |
| TKN | |  |  |
| Nitrate + Nitrite - N | |  |  |
| Total P | |  |  |
| Chloride | |  |  |
| pH | |  |  |
| Alkalinity, as CaC03 | |  |  |
| Total Hardness as CaC03 | |  |  |
| Nitrogen, Nitrate | |  |  |
| Trace Elements: | |  |  |
| Aluminum | |  |  |
| Arsenic | |  |  |
| Beryllium | |  |  |
| Boron | |  |  |
| Cadmium | |  |  |
| Cobalt | |  |  |
| Chromium | |  |  |
| Copper | |  |  |
| Fluoride | |  |  |
| Iron | |  |  |
| Lithium | |  |  |
| Manganese | |  |  |
| Molybdenum | |  |  |
| Nickel | |  |  |
| Lead | |  |  |
| Selenium | |  |  |
| Zinc |  | |  |
| Coliforms, MPN/100 mL |  | |  |
| E. Coli |  | |  |
| 1Note: All concentrations mg/L unless otherwise noted. | | | |

### Geological Information (21.1.3) (21.2.3)

{Engineering Company} performed soil borings on {date}. The soil borings were performed to a depth of {depth}. The soil boring locations are indicated on Figure # and in Appendix xx. Soil samples were collected for laboratory chemical analyses. Textural classifications of soils were performed in the field. Soil samples were collected and analyzed in the laboratory for grain size. Details of the soil boring and laboratory methods, field notes, and laboratory reports are included in Appendix xx.

#### Soil Profile (21.1.3.1)

The detailed information on soil profiles at each soil boring are included in Appendix xx. Stratigraphic section information is included with each of the # of monitoring well boring logs and two soil boring logs in Appendix xx.

The project site is located within a geomorphic region known {name of region}. {Describe region}

In general, the test borings drilled at the site encountered {describe test borings}.

The physical and hydraulic characteristics of the soil for each soil boring and monitoring well boring are detailed in Appendix xx. The chemical characteristics are summarized in Table #.

Table xx Soil Chemical Characteristics Summary

|  |  |  |
| --- | --- | --- |
| Parameter |  |  |
| Area |  |  |
| pH |  |  |
| CEC, meq/1 00 |  |  |
| P, ppm |  |  |
| K, ppm |  |  |
| Zn, ppm |  |  |
| S, ppm S04-S |  |  |
| Cation Base Saturation |  |  |
| Ca % |  |  |
| Mg % |  |  |
| K % |  |  |
| Na% |  |  |
| H % |  |  |
| Organic Matter (percent) |  |  |
| Ca, ppm |  |  |
| Mg, ppm |  |  |
| Solids, percent |  |  |
| Metals1 |  |  |
| Silver |  |  |
| Arsenic |  |  |
| Barium |  |  |
| Cadmium |  |  |
| Chromium |  |  |
| Mercury |  |  |
| Lead |  |  |
| Selenium |  |  |
| 1Metals concentrations are expressed in units of mg/kg dry weight | | |

{Describe soil further}

#### Soil Requirements (21.1.3.2) (21.2.4)

The land application sites have greater than {depth} of topsoil overlying any sand or gravel strata.

Land application rates will be limited to avoid erosion and run off. USGS Soil Survey slopes are categorized and shown on Figure #.

### Initial Wastewater Analysis (21.1.4) (21.2.5)

A sample from the storage strucure was collected by {company} staff on {date}. The analytical laboratory reports of analysis are attached in Appendix xx.

Table # is a summary of the storage (lagoon) water analyses.

Table xx Initial Wastewater Analysis Summary

|  |  |
| --- | --- |
| Parameter1 | Storage (Lagoon) Concentration |
| Date sample taken |  |
| CBOD |  |
| TSS |  |
| TDS |  |
| Conductivity, mmho/cm |  |
| Selenium |  |
| TKN |  |
| Ammonia - Nitrogen |  |
| Organic Nitrogen |  |
| Nitrate + Nitrite - N |  |
| Total Nitrogen |  |
| Total P |  |
| Magnesium |  |
| Lithium |  |
| Sodium |  |
| Chloride |  |
| pH |  |
| Sulfate |  |
| Alkalinity as CaC03 |  |
| Total Hardness as CaC03 |  |
| Parameter1 | Storage Lagoon |
| Phosphorus |  |
| Total Organic Carbon |  |
| Sodium Absorption Ration |  |
| Fluoride |  |
| Total coliforms |  |
| E. Coli |  |
| Trace Elements: |  |
| Aluminum |  |
| Arsenic |  |
| Beryllium |  |
| Boron |  |
| Calcium |  |
| Cadmium |  |
| Cobalt |  |
| Chromium |  |
| Copper |  |
| Iron |  |
| Manganese |  |
| Molybdenum |  |
| Nickel |  |
| Lead |  |
| Zinc |  |

{Insert maps of site location here}

### Preapplication Treatment (21.1.5)

Treatment prior to application shall provide treatment equivalent to that obtained from a primary lagoon cell constructed and designed in accordance to Chapter 18C of Iowa Wastewater Facilities Design Standards. Treatment is done using {describe treatment mechanisms and process.}

The maximum organic loading on the primary cells is expected to be {amount} pounds BOD5/acre/day, which does not exceed the prescribed maximum of 25 pounds BOD5/acre/day. The minimum drawoff level of the primary cell shall be at a level of {amount} feet. {Describe any additional treatment information}

### Land Application Facility (21.1.6)

#### Hydraulic Loading Rate (21.1.6.1)

For slow rate application systems the percolating water is not to exceed a maximum of 10 inches per month. {If using overland flow application method please describe water balance equation used to calculate the hydraulic loading rate.}

#### Nitrogen Loading (21.1.6.2)

##### Nitrogen Balance (21.1.6.2.a)

The total nitrogen from wastewater, fertilizers, and other sources shall be balanced against the expected nitrogen demand of the crop. The total poundage of nitrogen loading was calculated from the total wastewater applied per year and the concentration of nitrogen, see Appendix xx for calculations. The allowed annual application rate based on nitrogen addition was found to be x.

##### Percolate (21.1.6.2.b)

The total nitrogen in the percolate shall not exceed 10 mg/l.

#### Phosphorus Loading (21.1.6.3)

The concentration of applied phosphorus is x mg/l. The soil pH was determined to be x. Due to these factors, soil plugging and site longevity is not anticipated to be of concern at the site.

#### Trace Element Loading (21.1.6.4)

A sample from the storage strucure was collected by {company} staff on {date}. The analytical laboratory reports of analysis are attached in Appendix xx.

Table # is a summary of the calculated land applied pounds per acre of trace elements with a minimum site-life of 30 years.

Table xx Trace Element Site-Life Application

|  |  |  |
| --- | --- | --- |
| Element | DNR Limit | Maximum Applied Amount (lb/acre) |
| Lead |  |  |
| Zinc |  |  |
| Copper |  |  |
| Nickel |  |  |
| Cadmium |  |  |

#### Salinity Restrictions (21.1.6.5)

The maximum application rate based on sodium addition is x, which is less than the calculated rate based on nitrogen demands and therefore not considered a limiting factor.

#### Disinfection (21.1.6.6)

Disinfection is provided by {mechanism} which maintains a contact time of x minutes with equipment to achieve a residual chlorine level of x mg/l.

#### Crops and Vegetation (21.1.6.7)

##### Crop Information (21.1.6.7.a)

Crops grown at the site include {list crop types.}

1. {Crop type} is compatible with the site characteristics and the design hydraulic loading rate of x.
2. The anticipated maximum allow nitrogen application rate is x pounds per acre for {crop type.}
3. {Describe cultivation and harvesting requirements.}
4. {Describe crop management.}

##### Crop Removal (21.1.6.7.b)

Aerial or leafy shoot portions of the crop are harvested {time frame- e.g. annually, biannually, etc.}.

### Storage Facility (21.1.7)

#### Storage Time (21.1.7.1)

The minimum days of storage for the site was determined to be x.

#### Construction (21.1.7.2)

The storage lagoon on site was constructed in accordance with design standards outlined in Chapter 18C of Iowa Wastewater Facilities Design Standards. The maximum total water depth is x feet with a minimum drawoff level at y feet.

#### Reliability (21.1.7.3)

There are x number of storage cells with the capability of series and parallel operation at the site.

#### Storage Option (21.1.7.4)

X days of storage is provided onsite in a facility in accordance with design standards outlined in Chapter 18C of Iowa Wastewater Facilities Design Standards. No discharge to a receiving waterway is anticipated at this time. In the event that maximum land application has occurred and discharge becomes necessary an Iowa NPDES Operating Permit will be obtained and a schedule of discharge and volume will be supplied.

### Reliability (21.1.8)

#### General (21.1.8.1)

{Describe alternate wastewater treatment plan if and when the largest application area is out of service due to system breakdown.}

#### Equipment (21.1.8.2)

* 1. Any spray application equipment specified shall minimize the formation of aerosols.
  2. A parts inventory for the application equipment shall be specified to expedite repair.
  3. The system shall be designed to assure uniform distribution of wastewater over the application area.
  4. Provisions should be made for draining the pipes to prevent freezing if pipes are located above the frost line.

#### Manpower (21.1.8.3)

Manpower necessary for operation, maintenance, and monitoring will be supplied by {describe source of maintanence and operation.}

### Monitoring Systems (21.1.9)

#### Frequency (21.1.9.1)

Water sampling and monitoring results shall be reported every {period of time- e.g. every three months, every two months, etc.}.

#### Parameters (21.1.9.2)

The parameters listed in section 1.2.2 of this report shall be monitored.

#### Location (21.1.9.3)

Monitoring well locations are outlined in Appendix xx {Soil Borings and Monitoring Wells}.

#### Operational (21.1.9.4)

Records of operational activities listed below shall be kept in accordance with Chapter 21.1.9.4 standards.

1. Date of application.
2. Location of area and acreage used for the week.
3. Precipitation, snow cover, and temperature on the day of application.
4. Volume of wastewater applied from pretreatment facility.
5. Volume of wastewater applied from storage facility.
6. Total volume of wastewater applied.
7. Duration of application for each cycle.
8. Type of crop grown.
9. Harvesting of crop (if used).
10. Ultimate use of the crop (if used).

### Effluent and Groundwater Limitations (21.1.10)

#### Effluent (21.1.10.1)

If discharge to a stream occurs, monitoring of the recovered water from pumped withdrawal, underdrains, or collected runoff shall be in accordance with the requirements listed in the Iowa NPDES Operation Permit.

#### Groundwater Limitations (21.1.10.2)

1. The groundwater resulting from land application of wastewater after dilution shall meet the standard for drinking water supplies as defined in 400-22 of the Iowa Administrative Code Section 22.3 (455B). {If an exisiting concentration of a parameter in the native groundwater exceeds this standard please describe actions that will be taken to maintain adherence to the above standard.}
2. In the event that any significant detrimental change to the groundwater at or near the site additional pretreatment or abandonment of the site shall be necessary.
3. In the event that contaminant levels of ground water exceed the maximum allowable concentration {describe a feasible alternate plan of wastewater treatment.}

## Type of Application (21.2) e.g. (Slow Rate Land Application)

Treated wastewater from the storage strucure will be land applied at rates equal to or less than the agronomic application rates to corn, soybeans, alfalfa, or pasture land using specific irrigation equipment and as per permit limitations.

### Site Criteria (21.2.1)

The site criteria are reviewed in section 2.1.2 of this report.

### Site Groundwater (21.2.2)

The ground water elevation is anticipated to be at least {depth} below the surface. There are {amount} existing field tiles crossing the property.

There is no anticipated impact of the very low rate land application on the groundwater flow.

### Geology (21.2.3)

The site geology is described in section # of this report. The permeability or infiltration rates are in the range of A to B inches per hour as per the USDA SCS Soil Survey information. Land application rates will be limited to prevent surface runoff.

The depth to bedrock is {specific number} feet as per USGS Bedrock Topography Maps for this area.

### 2.4 Topography (21.2.4)

As indicated on the USDA soil survey map, Site has slopes ranging from A% up to B%.

### Trace Element Limitations (21.2.5)

Table # is a comparison of trace element and heavy metals concentrations in storage lagoon water samples collected in {the specic time} with the DNR design standards Chapter 21 maximum allowable concentrations.

Table xx Trace Element Concentrations and Allowable Concentrations

|  |  |  |
| --- | --- | --- |
| Element | DNR Limit | Storage Lagoon Conc. {date} |
| Aluminum |  |  |
| Arsenic |  |  |
| Berylium |  |  |
| Boron |  |  |
| Cadmium |  |  |
| Chromium |  |  |
| Cobalt |  |  |
| Copper |  |  |
| Fluoride |  |  |
| Iron |  |  |
| Lead |  |  |
| Sodium |  |  |
| Manganese |  |  |
| Molybdenum |  |  |
| Nickel |  |  |
| Selenium |  |  |
| Vanadium |  |  |
| Zinc |  |  |

### 2.6 Storage Requirements (21.2.6)

The minimum amount of storage is determined to be {storage amount.} {Describe any further storage requirements.}

### Application Restrictions (21.2.7)

#### Application Based on permeability (21.2.7.1)

The application rate will be limited to prevent runoff. The rate will be {rate}.

#### Application Based on Limiting Factors (21.2.7.2)

Annual application rates will be limited by the agronomic application rate for {limiting factor- hydraulic, organic, nutrients}. The application of all sources of nitrogen including commercial fertilizer, manure, and stormwater will be limited to the agronomic crop uptake rate for each crop year. The amount of nitrogen applied after fall crop harvest, if any, will be applied to the agronomic rate limitations of the next crop year.

#### Application During Frost and Runoff (21.2.7.3)

Wastewater will not be land applied during frozen soil conditions or during rainfalls.

#### Application to Public Use Areas (21.2.7.4)

Wastewater will not be land applied to public use areas.

### Resting or Drying Period (21.2.8)

Water from the storage facility will be applied periodically as required to ensure adequate storage capacity for winter operations management.

### Land Owner Agreements (21.2.9)

The land owner agreements for the proposed sites are attached Appendix xx to this report.

### Water Rights (21.2.10)

This facility does not have a permitted discharge to surface waters. Therefore, DNR approval for diversion of the discharge from surface water discharge to irrigation is not required.

## Appendices

### Appendix xx Soil Borings and Monitoring Well Installation Report

Wastewater Land Application Site:

{Location}

Performed for:

{Company}

**Example Letter:**

RE: Soil Borings and Monitoring Well Installation Wastewater Land Application Site {location}

As authorized by {Company}, {Engineer} has completed the soil borings, groundwater monitoring well installation, and soil and groundwater testing for the above-referenced project. The work was performed in accordance with Chapter 21 of the Iowa Wastewater Facilities Design Standards. Chapter 21 standards apply to the Land Application of Wastewater. Two soil borings (SB-# and SB-#) were drilled to a depth of # feet on {date}. The soil borings were used to determine physical and chemical characteristics of near surface soils located within the proposed wastewater irrigation site. The physical characteristics included grain size analysis and permeability of the most restrictive layer.

Two test borings were drilled to a depth of # feet at the site on {date} and groundwater monitoring wells MW-x and MW-y were installed. The monitoring wells were used to determine groundwater quality in selected areas located upgradient and downgradient of the proposed wastewater land application site. Monitoring well and soil boring locations are shown on the enclosed Site Map.

**Site Description**

The XYZ Company Wastewater Land Application Site is identified as Parcel X on the enclosed Site Map. The site consists of {approximately how many acres} of farm land located XXXXXX County, Iowa. The site is bound by {describe site boundaries- e.g. county roads, ditches, etc} in the {Section, Township and Range} of X Township. Surface elevations on the property range from approximately xy to ab feet ASL. The site has historically been used for growing {type of crops}.

The project site is shown on the enclosed Site Map which was prepared by {Engineer}. This map shows the {Company} Wastewater Land Application Site superimposed on an aerial photograph.

**Test Boring Drilling and Soil Sampling**

The test borings were drilled at the site by {Engineer} on {date}. {Describe boring and sample collection process}.

Additional soil samples were collected from the two #-ft. soil borings for laboratory chemical analysis. {Describe soil sample process for chemical analysis}.

**Site Geology and Soil Profile**

The project site is located within a geomorphic region known as xxx. Deposits typically encountered in the upper portion of the soil sequence in this region are {list sediment type- e.g. glacial till, loess, alluvium}. The {sediment type} typically consists of {describe typical soil classification group names of the soil – e.g. sandy lean clay with deposits of organic silt, etc.}.

In general, the test borings drilled at the site encountered # to # feet of topsoil consisting of {describe boring composition and soil classification}. Detailed descriptions of the soils encountered during this investigation are provided on the Boring Logs enclosed in the Appendix. No bedrock was encountered in the test borings drilled at this site. USGS Bedrock Topography Maps list anticipated depth of bedrock in the range of # to # feet beneath the surface for this area. No sinkholes or bedrock outcrops were observed at the site or noted on available soil surveys and topographic maps. {Describe any other relevant site specific observations.}

**Monitoring Well Installation**

Two permanent groundwater monitoring wells were installed at the project site for groundwater quality determination and water level measurements. Monitioring well #xx was installed at an upgradient location at x, and downgradient monitoring well #yy was installed at location y.

Each groundwater monitoring well consisted of {briefly describe installation method and materials of upgradient and downgradient monitoring wells at the site.}

**Groundwater Sampling and Water Level Measurements**

The monitoring wells were developed by bailing five gallons of water from each well after they were installed on {date}. Groundwater samples were collected from the wells on {date} after the wells were allowed to recover. Groundwater samples were collected by {describe collection method.} The samples were placed in laboratory-provided containers, packed in a cooler with ice and delivered to the laboratory for chemical analysis.

Groundwater levels were measured in each of the monitoring wells after they were completed on {date}. Water levels were measured with an electronic water level sensor and referenced to the ground surface. Depth to water measurements was recorded to the nearest # feet below ground surface (BGS) on the enclosed Boring Logs. Static water levels measured in the monitoring wells on {date} were approximately # feet BGS in MW-xx and # feet BOS in MW-yy. In addition, groundwater observations were made in the #-ft. soil borings. Soil boring SB-# had a water level of # after drilling and SB-# had a water level of # feet.

Seasonal high water level is within # feet of the ground surface and is generally a subdued reflection of the existing surface topography. Based on surface topography, the direction of groundwater flow in the unconfined aquifer beneath the site would generally be from x direction to z direction.

**Laboratory Chemical Analysis**

Chemical analysis of the soil and groundwater samples was performed by Testing Laboratories. The soil samples were analyzed for the parameters described in Chapter 21.1.3 .1 and the groundwater samples were analyzed for the parameters described in Chapter 21.1.2.2. The results of the soil and groundwater analyses are provided on the enclosed Analytical Reports. On these Analytical Reports, composite soil samples

SB-# and SB-# on the {laboratory} lab reports and ESS-# and ESS-# on the {laboratory} lab reports were collected from soil borings SB-# and SB-#, respectively, Groundwater samples MW-xx and MW-yy on the lab report were collected from monitoring wells xyz respectively.

**Soil Permeability, Grain Size Distribution and Infiltration Rates**

Grain size distribution analyses and falling head permeability tests were performed on the two samples of topsoil and {type} soils obtained from borings SB-# and SB-#. The grain size distribution analyses are shown on Figure Nos. # and # enclosed in the Appendix. The following table provides the results of the falling head permeability tests conducted on representative soil samples 6 inches in length under a water head of # to # feet.

**Results of Falling Head Permeability Tests**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Soil Boring | Sample Depth | Moisture Content (percent) | Dry Density (pcf) | Coefficient of Permeability (ft/day) |
| SB-# |  |  |  |  |
| SB-# |  |  |  |  |

The laboratory testing indicates the upper # feet of the soil profile at the proposed wastewater land application site consists of {describe soil characteristic}. These soils are a mix of silt (percent), sand (percent), and clay (percent). The USDA Soil Textural Classification would be {soil classification}. According to Rawls and others, the minimum infiltration rate for {soil classification} would be # inches per hour. Based on the County Soil Survey, infiltration rates of the predominant soil types at the project site {soil Map Unit Names- e.g. Nicollet, Webster, Clarion, Canisteo} are expected to range from # to # inches per hour.

**General**

The analyses and recommendations in this report are based in part upon the data obtained from the soil borings and monitoring wells performed at the indicated locations and from any other information discussed in this report. This report does not reflect any variations which may occur between test borings or monitoring wells across the site. This report has been prepared for the exclusive use of our client for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. In the event that any changes in the nature, design or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions of this report modified or verified in writing by the geotechnical engineer.

We appreciate the opportunity to provide our geotechnical engineering services for this project. If you have any questions concerning this project, please contact our office.

Respectfully Submitted,

{Insert Map, Soil Boring Logs, and Analytical Reports here}

### Appendix xx Operation Permit- If available

### Appendix xx Wastewater Analyses

### Appendix xx USDA Soil Survey Information

### Appendix xx Landowner Agreement

### Appendix xx

### Appendix xx Site Survey Certification/Approval

### Additional Appendices Attach as needed