

Connecticut Guidance for the Design of Subsurface Treatment and Disposal Systems

Prepared for:

Design Engineers & Treatment Operators

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Underground Injection Control Program

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Section 1 Purpose of this Guidance

The Connecticut Department of Energy and Environmental Protection (“CT DEEP”, “DEEP” “the Department”) has developed this Engineering User Guide to support the Engineering Report submissions required for subsurface disposal systems to provide assistance with the preparation of a complete application. The guidance complements the “*Guidance for Design of Large Scale On-Site Wastewater Renovation Systems*” (“*2006 Design Standards*”) as amended and outlines the design elements and criteria used to permit discharges of treated domestic sewage. Use of this guidance will help ensure that your application and treatment system appropriately addresses all required elements ensuring a timely review of the project and complies with Conn. Gen. Stat. Section 22a-430, Section 22a-430 Regs. Conn. State Agencies, and Section 1421 of the Federal Safe Drinking Water Act 42 USC 300h et. seq. Failure to include the required elements will result in delayed processing times and ultimately permit issuance.

The elements in this document apply primarily to land treatment systems for domestic sewage. Land treatment systems for commercial or industrial wastewater will be evaluated on an individual basis, since those waste streams can be highly variable. Many if not all of the requirements associated with domestic sewage are applicable to commercial and industrial wastewater, however there may be additional design requirements or limiting design factors that must be considered. This document does not apply to systems utilizing overland flow.

This document is not intended to serve as a prescriptive design manual or be a substitute of the *2006 Design Standards* as land treatment systems are highly site-specific and hydrogeologic conditions vary across the state, regions and sites within the same region. This document is intended to provide applicants and design engineers with guidance on what is required for DEEP to consider an application complete. Unlike prescriptive design standards that specify allowable technologies or fixed equipment configurations, this guidance establishes a performance-based framework that allows engineers to select appropriate treatment processes provided they demonstrate, through accepted engineering principles, that groundwater quality and public health will be protected.

Applications determined to be incomplete during the technical review process may be rejected or placed on hold until all required project information and supporting documentation have been submitted. Failure to provide the required information will result in project and permitting delays, and in certain scenarios may result in the rejection of an application. DEEP encourages applicants to visit the UIC Program website, review the *2006 Design Standards*, and this guidance document prior to submitting an application to avoid project delays.

Section 2 Regulatory Jurisdiction

2.1 Federal Regulatory Standards

- **Safe Drinking Water Act (SDWA), Part C – Underground Injection Control**, Section 1421, 42 U.S.C. § 300h et seq. — establishes the federal UIC program and minimum requirements. EPA identifies Sections 1421 and 1422 as the principal statutory UIC provisions.
- **40 CFR Part 144 – Underground Injection Control Program** — establishes federal minimum requirements for UIC programs, including requirements applicable to injection wells.
- **40 CFR Part 145 – State UIC Program Requirements** — establishes requirements and procedures for EPA approval, revision, and withdrawal of state UIC programs.
- **40 CFR Part 146 – Underground Injection Control Program: Criteria and Standards** — establishes technical criteria and standards for injection wells, including Class V wells.
- **40 CFR Part 147 – State, Tribal, and EPA-Administered Underground Injection Control Programs** — identifies the approved UIC programs applicable in each state, including Connecticut

Drinking Water MCLs: U.S. EPA National Primary Drinking Water Regulations (40 CFR Part 141). This confirms the enforceable 10 mg/L Nitrate-N and 1 mg/L Nitrite-N limits, as well as the zero-tolerance (0 CFU/100 mL) standard for total coliforms/*E. coli*.

Surface Water & Ambient Criteria: U.S. EPA Clean Water Act (CWA) Section 304(a) Water Quality Criteria.

- **Nutrients:** EPA's Numeric Nutrient Water Quality Criteria guides regional total nitrogen (0.5 to 3.0 mg/L) and total phosphorus (0.01 to 0.1 mg/L) limits to prevent cultural eutrophication.
- **Pathogens:** EPA's Recreational Water Quality Criteria (RWQC, reviewed/updated through the EPA Water Quality Standards Academy) dictates the ≤ 126 CFU/100 mL *E. coli* and ≤ 35 CFU/100 mL *Enterococci* targets for primary contact recreation.

2.2 State Regulatory Standards

In Connecticut, subsurface sewage disposal systems are regulated by both the Department of Public Health (DPH) and the Department of Energy and Environmental Protection (DEEP).

- Connecticut General Statutes § 22a-430 – Permit for discharge of water or substance into waters of the state
- Regulations of Connecticut State Agencies, Chapter 446k, § 22a-430 – Water Pollution Control — includes Connecticut's water discharge permitting regulations. The UIC-specific regulation is § 22a-430-8, Underground Injection Control.

- Regulations of Connecticut State Agencies § 19-13-B102 – Standards for Quality of Public Drinking Water — relevant to the UIC prohibition against injection that may cause a violation of Connecticut drinking water standards.

2.2.1 When DEEP Has Regulatory Authority for a Subsurface System

Your project falls under DEEP's regulatory authority if it meets any of the following three criteria:

1. **Discharge Volume:** The site has cumulative discharge flows exceeding 10,000 gallons per day (GPD).
2. **Community Sewerage Systems:** The site discharges through a "community sewerage system," regardless of the design flow. This includes systems serving two or more residences in separate structures that are not connected to a municipal system (excluding a principal dwelling with a single accessory apartment on the same lot).
3. **Alternative Sewage Treatment Systems:** The site utilizes an "alternative sewage treatment system" or "alternative treatment system" prior to discharge, regardless of the flow rate. This refers to any system serving one or more buildings on a single property that uses a treatment method other than a conventional subsurface system before discharging to the waters of the state.

Who Regulates Your Septic System?

*In Connecticut, jurisdiction is determined by the type of system you have and how much water it processes daily (measured in **Gallons Per Day, or GPD**).*

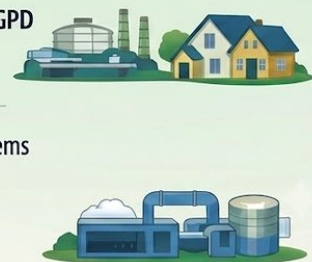
1. Local Health Department Jurisdiction

- Small Standard Systems < 2,000 GPD
▶ Local Director of Health
- Mid-Sized Systems 2,000 – 10,000 GPD
▶ Local Health Dept. & DPH Approval



2. CT DEEP Jurisdiction

- Large Systems $\geq 10,000$ GPD
▶ CT DEEP
- Advanced Technology Systems
▶ CT DEEP



Application Recommendations

If your project involves a conventional subsurface disposal system, it is recommended that you review the eligibility criteria for coverage under the *General Permit to Discharge from Subsurface Disposal Systems* before submitting your application. This ensures your system meets all necessary regulatory requirements for streamlined processing.

Additional Resources and Support

For more detailed information regarding the Underground Injection Control (UIC) program, please visit the DEEP Subsurface Sewage Treatment and Disposal Systems webpage. This resource provides technical guidance, regulatory updates, and additional forms necessary for compliance.

- **Webpage:** [Subsurface Sewage Treatment and Disposal Systems](#)
- **Direct Inquiries:** If you have specific questions about UIC Permits or the application process, you may contact the program directly via email at deep.uicpermitting@ct.gov

Schedule a DEEP Site Investigation

Before submitting an application and preparing plans, applicants must schedule a site investigation with UIC Program Supervisor.

Email us: DEEP.UICPermitting@ct.gov

Subject line: "Site Testing"



Section 3 Overall Treatment System Design Considerations & Document Navigation

3.1 Foundational Principles

Sound scientific, site specific, and engineering judgment, not prescriptive formula, is the foundation of on-site wastewater treatment system designs. Minimum design standards remain necessary to protect public health and the environment.

Wastewater is part of the water cycle. Pretreated effluent still carries pollutants of concern such as pathogenic microorganisms, nitrogen, phosphorus, and synthetic organics that must be further renovated as the wastewater migrates through subsurface soils before commingling with groundwater. Soils possess substantial but finite renovative capacity; adequate detention time, soil contact, and separation from any 'point of concern' make that renovation possible.

The adequacy of any wastewater treatment system is ultimately judged against two (2) cornerstone questions that have been posed for decades:

- 1. Will the discharge cause pollution?**
- 2. Will the system work reliably over its intended lifespan under site-specific conditions?**

Although the biological and geochemical principles underlying subsurface sewage treatment have remained fundamentally unchanged, substantial advances have occurred since publication of the *2006 Design Standards*. These advances include improved characterization of domestic sewage strength, refined understanding of constituent fate and transport, enhanced field monitoring of onsite treatment systems, better quantification of soil treatment processes, and expanded knowledge of the influence of climate, groundwater fluctuations, and watershed-scale nutrient loading. Contemporary engineering practice increasingly relies on performance-based evaluation, site-specific characterization, and process modeling to supplement traditional prescriptive design approaches. The design guidance incorporates these advances while remaining consistent with the established engineering principles governing subsurface sewage disposal systems.

3.2 Performance-Based Design Philosophy

The primary objective of every subsurface wastewater disposal system is protection of groundwater resources and public health.

Performance-based design recognizes that equivalent environmental protection may be achieved through different combinations of engineered treatment and natural attenuation within the subsurface environment.

Accordingly, treatment may be provided by:

- engineered biological treatment.
- engineered physical or chemical treatment.
- unsaturated soil treatment;
- groundwater transport;
- or combinations thereof.

The engineering report shall identify which treatment barriers are relied upon and demonstrate that each barrier is capable of providing the treatment credit assigned to it.

Treatment credit shall not be assumed without supporting engineering analysis.

3.3 Multiple Barrier Concept

Groundwater protection is achieved through multiple independent treatment barriers.

Typical barriers include:

Barrier	Primary Function
Biological reactor	Carbon oxidation, nitrification, denitrification
Clarification	Solids removal
Filtration	Particle removal
Disinfection	Pathogen reduction
Unsaturated soil	Filtration, adsorption, nitrification, pathogen attenuation
Groundwater travel	Dispersion and additional attenuation

The failure of any single barrier should not result in unacceptable groundwater quality at the point of compliance.

3.4 Performance Objectives

The design of every subsurface sewage disposal system shall be based on the following fundamental objectives.

<i>Design Objective</i>	<i>Primary Considerations</i>
<i>Protect Water Quality</i>	• Groundwater • Surface waters • Nutrient loading
<i>Protect Public Health</i>	• Pathogen reduction • Human exposure
<i>Maintain Hydraulic Performance</i>	• Long-term infiltration capacity • Groundwater mounding • Hydraulic connectivity • Surface breakout
<i>Ensure Long-Term Reliability</i>	• System durability • Operation and maintenance (O&M) • Climate resilience • Variable hydraulic and constituent loading

These four objectives form the foundation of these Design Standards. Every subsurface sewage disposal system, whether conventional or incorporating alternative treatment technologies, shall be designed to protect water quality and public health, maintain long-term hydraulic function, and provide reliable performance throughout its anticipated service life. The design criteria presented in the chapters that follow establish the engineering requirements necessary to achieve these objectives.

3.5 Engineering Design Basis

Every engineering report shall include a documented design basis.

The design basis shall include, at a minimum:

- Design wastewater flow
- Peak hydraulic loading
- Organic loading (BOD₅) & total suspended solids loading
- Total nitrogen loading
- Ammonia loading
- Alkalinity
- Design temperature(s)
- Influent variability
- Safety factors

The design engineer shall demonstrate that the proposed treatment system has sufficient hydraulic and biological capacity under most limiting site and loading conditions.

3.5.1 Biological Treatment Principles

The engineering report shall identify the biological processes relied upon for treatment.

These may include:

- Carbon oxidation
- Removal of biodegradable organic matter.
- Performance generally evaluated using BOD₅.

3.5.2 Nitrification

Conversion of ammonia to nitrate by autotrophic bacteria.

The report should evaluate:

- dissolved oxygen
- solids retention time
- temperature
- alkalinity
- pH
- hydraulic retention time

Temperature corrections should use accepted engineering relationships.

3.5.3 Denitrification

Reduction of nitrate to nitrogen gas.

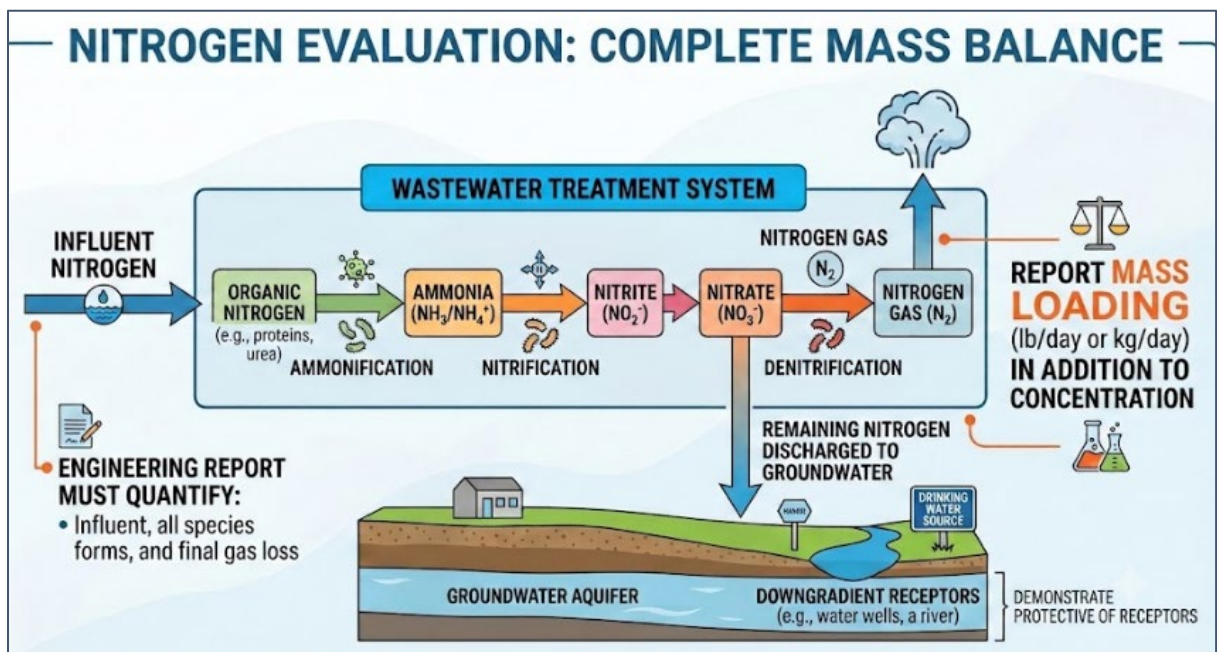
The report shall evaluate:

- carbon availability
- anoxic detention time
- recycle ratios
- temperature
- mixing

Nitrogen removal shall be supported by mass balance calculations.

3.5.4 Nitrogen Mass Balance

A Nitrogen Mass Balance is used to evaluate nitrogen loading, treatment performance, and the fate of nitrogen through an Alternative Treatment System (“ATS” or “AT”) and subsurface dispersal system. The mass balance provides a quantitative evaluation of nitrogen entering the system, nitrogen removed through treatment processes, and nitrogen remaining in the treated effluent available for discharge to the environment.



The Nitrogen Mass Balance shall be used to support system design, evaluate nutrient reduction objectives, and demonstrate that the proposed ATS and dispersal system are appropriate for protecting groundwater and surface water resources. The evaluation should consider influent nitrogen loading, treatment system removal efficiency, effluent nitrogen concentrations, hydraulic loading, and site-specific conditions affecting nitrogen transport and attenuation.

The Nitrogen Mass Balance is particularly important for systems designed to achieve nitrogen removal within the treatment process or for sites where reliance on natural

soil attenuation is limited due to groundwater sensitivity, receiving water concerns, or regulatory requirements.

The Nitrogen Mass Balance should be prepared in accordance with the Department's approved methodology and shall include sufficient information to demonstrate:

- The estimated nitrogen load entering the ATS;
- The anticipated nitrogen removal achieved through treatment;
- The nitrogen concentration and mass discharged from the ATS;
- The nitrogen loading applied to the dispersal system; and
- The anticipated nitrogen fate following discharge, including any credited attenuation mechanisms.

The Nitrogen Mass Balance is intended to complement, but not replace, groundwater monitoring, treatment performance monitoring, or other evaluations required by the permit. Mass loading (lb/day or kg/day) should be reported in addition to concentration.

3.5.5 Soil Treatment Processes

Where treatment credit is assigned to the soil, the report shall demonstrate that the soil possesses adequate treatment capacity.

Relevant mechanisms include:

- filtration
- adsorption
- aerobic biodegradation
- nitrification
- pathogen die-off
- dispersion
- dilution

The degree of treatment credit assigned shall be proportional to the available engineering evidence.

Treatment credit should not be assumed solely because wastewater enters a leaching system.

3.5.6 Groundwater Transport

Groundwater quality shall be evaluated at the applicable point of compliance.

The engineering report should evaluate:

- groundwater flow direction
- hydraulic gradient
- hydraulic conductivity

- effective porosity
- groundwater velocity
- travel time
- dispersion
- dilution
- seasonal groundwater fluctuations

Where appropriate, analytical calculations or numerical groundwater models should be used.

3.5.7 Treatment Pathway Selection

The treatment pathways provide a structured framework for assigning treatment responsibilities between engineered processes and natural subsurface attenuation.

Selection of a pathway shall be based upon:

- site hydrogeology.
- available unsaturated treatment depth.
- groundwater travel characteristics.
- proximity to sensitive receptors.
- nitrogen sensitivity.
- pathogen risk.
- reuse objectives.

The engineering report shall clearly document the rationale supporting the selected pathway.

3.5.8 Demonstration of Performance

Rather than relying solely upon equipment certification, the engineering report shall demonstrate expected treatment performance through engineering analysis.

Documentation should include:

- process design calculations
- reactor sizing
- detention time calculations
- oxygen demand calculations
- nitrogen mass balances
- hydraulic loading calculations
- expected effluent quality
- groundwater impact evaluation

Where published treatment performance data are used, the applicability of those data to the proposed design shall be demonstrated.

3.6 Convention Treatment Systems – Design Basis and Submission Requirements

Conventional treatment systems are subsurface sewage disposal systems consisting of a septic tank followed by a subsurface leaching system that relies on naturally occurring physical, chemical, and biological processes within the unsaturated soil to renovate domestic sewage before it reaches groundwater. Unlike Alternative Treatment systems, conventional systems do not incorporate engineered mechanical or advanced biological treatment processes designed to achieve a specified effluent quality prior to discharge to the leaching system. Instead, treatment performance is achieved through proper siting, hydraulic loading, septic tank pretreatment, and adequate unsaturated soil beneath the infiltrative surface.

Because conventional systems rely on the treatment capacity of the receiving soil, the design basis shall demonstrate that the proposed system is compatible with the site conditions and will provide sufficient treatment to protect public health, groundwater quality, and the environment. The design shall be based on the approved design flow, wastewater characteristics, site investigation, and the requirements of these Design Standards.

At a minimum, the engineering report shall address the following:

- **Influent characterization.** Identification of the anticipated wastewater source, design flow, and expected wastewater strength. Unless otherwise justified, domestic sewage characteristics consistent with the design assumptions contained in these Design Standards may be used.
- **Site characterization.** Documentation of soil conditions, limiting layers, seasonal high groundwater, bedrock, topography, groundwater flow conditions, include sensitive receptors/ areas (wetlands, wells), property boundaries, and other site characteristics affecting system performance. Soil evaluations shall establish the suitability of the proposed receiving soils and the available treatment zone beneath the infiltrative surface.
- **Hydraulic design basis.** Documentation of the selected design loading rate, required leaching area, distribution method, septic tank capacity, and reserve area, together with the calculations used to size each system component in accordance with these Design Standards.
- **Treatment basis.** A description of how the proposed septic tank and subsurface leaching system will provide treatment through sedimentation, flotation, filtration, adsorption, microbial degradation, and other natural attenuation processes occurring within the unsaturated soil profile. Where site-specific conditions warrant, the engineering report shall discuss the expected fate and transport of constituents of concern, including nitrogen, phosphorus, and pathogens.
- **Basis of design assumptions.** Identification of all assumptions used in the design, including wastewater source, occupancy, design flow methodology, site limitations, groundwater conditions, soil classification, and any site-specific factors that influence long-term performance or system reliability.

The engineering report shall demonstrate that the proposed conventional treatment system conforms to the requirements of these Design Standards and that adequate treatment will

achieve the anticipated operating conditions. Applications that do not include sufficient documentation to establish the basis of design or demonstrate compliance with the applicable siting, hydraulic, and treatment requirements will be considered incomplete and may be returned to the applicant for resubmission.

3.7 Alternative Treatment Systems — Design Basis and Submission Requirements

Alternative Treatment systems are subsurface sewage disposal systems that incorporate a mechanical, biological, physical, or chemical treatment process upstream of the leaching system to improve wastewater quality beyond that typically achieved through conventional septic tank pretreatment. AT systems may be used in situations where conventional treatment systems are not suitable due to site limitations, increased design flows, sensitive receiving waters, groundwater protection objectives, nitrogen reduction requirements, or other environmental considerations.

Unlike conventional treatment systems, which rely primarily on the treatment capacity of the septic tank and the receiving soil profile, AT systems incorporate engineered treatment processes intended to achieve a predictable level of effluent quality prior to discharge to the leaching system. Because the treatment performance of an AT system depends on the specific biological, chemical, and physical mechanisms employed, the design engineer must demonstrate that the proposed treatment train is appropriate for the intended application and will reliably achieve the assumed effluent characteristics under the anticipated operating conditions.

The design of an AT system shall establish a clear relationship between the wastewater characteristics entering the treatment system, the treatment processes provided, and the expected effluent quality delivered to the subsurface sewage disposal system. The design basis shall account for normal operating conditions as well as factors that may influence treatment performance, including variable wastewater strength, hydraulic loading fluctuations, seasonal operation, temperature effects, maintenance requirements, and potential upset conditions.

For all AT system designs, the design engineer shall establish the predicted effluent quality using an engineering analysis appropriate for the treatment technology employed. This analysis may include kinetic design calculations, process modeling, mass balance evaluations, manufacturer performance data, third-party certification testing, published scientific literature, or other technically defensible methods demonstrating that the proposed treatment system will achieve the intended treatment objectives.

At a minimum, this analysis shall address the following:

- **Influent characterization.** The anticipated influent wastewater strength and loading conditions, including constituents relevant to the treatment objective (e.g., BOD₅, TSS, total nitrogen, ammonia, phosphorus, pathogens, or other parameters), based on the approved design flow and the nature of the wastewater source (residential, commercial, or industrial).

- **Treatment process train.** A complete description of each treatment unit process and its function within the overall treatment system, including process sequencing, hydraulic and organic loading rates, retention times, recirculation rates, design criteria, control systems, and manufacturer performance information or third-party certification data, where applicable.
- **Predicted effluent quality.** The expected effluent concentrations for each constituent of concern following treatment, including the basis for the predicted values and the calculations, testing data, or supporting information used to demonstrate that the proposed treatment system will meet the design objectives.
- **Basis of design assumptions.** Identification of all assumptions incorporated into the design, including wastewater strength, design temperatures, safety factors, seasonal occupancy, high-strength wastewater sources, maintenance assumptions, and any site-specific conditions affecting treatment performance.
- **Site constraints.** Vulnerable areas limiting capacity. Treated wastewater must remain in the ground.
- **Reliability and long-term performance considerations.** Documentation of system features and design considerations that support reliable operation, including treatment process stability, monitoring requirements, alarms, maintenance requirements, and provisions for addressing variable loading conditions or temporary reductions in treatment performance.

The engineering report accompanying an application for approval to construct shall include sufficient documentation to demonstrate that the proposed AT system is capable of achieving the assumed effluent quality and that the resulting discharge is compatible with the proposed subsurface sewage disposal system and site conditions. Applications that do not include a documented design basis, supporting performance information, and sufficient technical justification for the predicted effluent quality will be considered incomplete and may be returned to the applicant for resubmission.

3.8 Climate Change Considerations in Subsurface Sewage Disposal System Design

Subsurface sewage disposal systems are typically designed for a service life of several decades and are sited based on subsurface and hydrologic conditions observed at a discrete point in time. Because climate conditions are changing over the relevant design life of these systems, engineers shall evaluate the following factors, as applicable to the site, and incorporate appropriate design allowances rather than relying solely on historical climate data and observed conditions.

3.8.1 Seasonal High Groundwater Table (SHGWT) and Groundwater Elevation Trends

- Determination of the SHGWT shall not rely exclusively on a single season of monitoring or on historical soil mottling data where more recent or projected groundwater trends indicate the potential for elevated groundwater conditions.
- In areas subject to rising regional groundwater tables, coastal groundwater influence, or documented long-term upward trends, the design engineer shall

evaluate whether an additional factor of safety to the SHGWT elevation is warranted, and shall document the basis for the elevation used in design.

- For sites within the zone of tidal or coastal groundwater influence, the potential for groundwater elevation increases associated with relative sea level rise shall be evaluated using the most up to date published state or federal projection data for the applicable planning horizon.

3.8.2 Precipitation Intensity and Hydraulic Loading

- Design storm and infiltration/percolation testing conditions shall reflect current precipitation intensity-duration-frequency (IDF) data. Where updated regional IDF data (e.g., NOAA Atlas 14 or successor datasets) indicate an increase in short-duration, high-intensity rainfall relative to the data historically used in design, the engineer shall evaluate the effect on system hydraulic performance, including surface ponding, hydraulic surge, and reduced effective infiltrative capacity following storm events.
- Percolation and hydraulic conductivity testing conducted during unusually dry or unusually wet antecedent conditions shall be evaluated for representativeness, and additional testing or conservative adjustment factors shall be applied where seasonal variability could affect long-term system performance.

3.8.3 Flooding and Coastal Inundation

- Siting and design shall account for the most current effective flood hazard mapping and, where available, projected future-conditions floodplain mapping, rather than mapping based solely on historical flood elevations.
- Systems proposed in or near mapped flood hazard areas, or areas subject to projected expansion of flood hazard boundaries within the design life of the system, shall incorporate additional freeboard, elevation of electrical and mechanical components, and/or flood-resistant construction consistent with applicable state and local floodplain management requirements.

3.8.4 Drought, Extended Dry Periods, and Water Use Patterns

Where design flow estimates rely on assumed water use patterns, the engineer shall consider the potential for altered seasonal use patterns (e.g., extended dry-weather demand periods) and their effect on biomat development, hydraulic loading variability, and system dosing frequency.

3.8.5 Temperature and Biological Treatment Performance

For AT systems (“AT” or “ATS”) that rely on biological treatment processes (e.g., nitrification, denitrification), the design shall account for the range of wastewater and ambient temperatures reasonably anticipated over the system's design life, including the effect of elevated seasonal temperatures on treatment kinetics and the effect of prolonged cold periods on cold-weather startup and performance.

The engineering report shall include a narrative addressing which of the above climate-related factors are applicable to the site, the data sources relied upon (including reference to any state or federal climate projection resources used), and

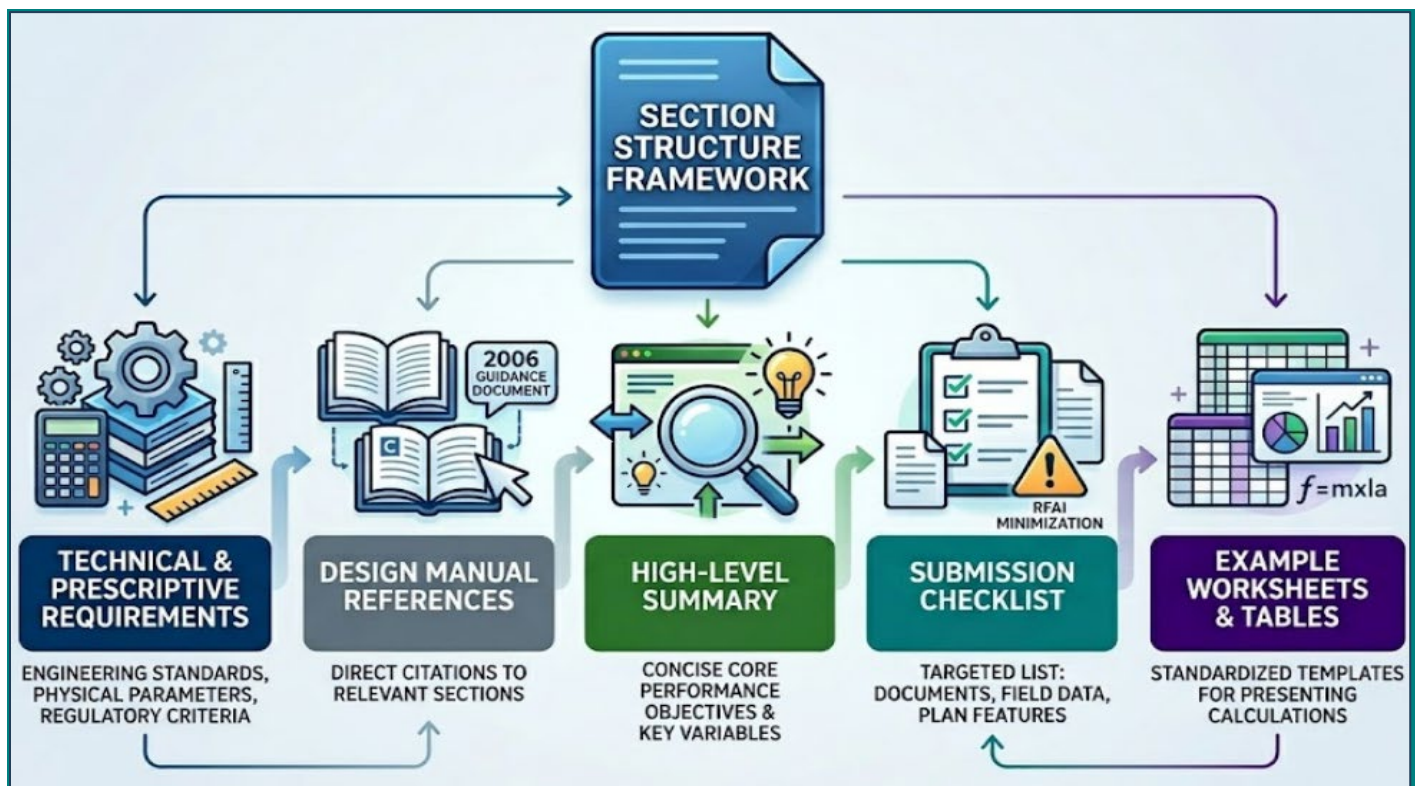
the specific design adjustments, if any, made in response. Where the engineer determines that no adjustment is warranted, the basis for that determination shall be documented.

3.9 Document Navigation & Terminology

This guide is structured to mirror the logical flow required for a standard Engineering Report for a Large-Scale On-Site Wastewater Renovation System (OSWRS). To ensure a streamlined review process and maintain high data integrity, each section follows a standardized five-part framework. This layout allows the applicant to move from foundational site data to complex hydraulic modeling and final certification.

Each section follows a consistent five-element format intended to guide applicants through the information and documentation necessary to prepare a complete Engineering Report.

- 1. Technical & Prescriptive Requirements:** The specific engineering standards, physical parameters, and regulatory criteria that must be met to demonstrate pollutant removal and adequate effluent dispersal.
- 2. Design Manual References:** Direct citations to relevant sections of the *2006 Guidance Standards* for exhaustive technical details.
- 3. High-Level Summary:** A concise overview of the core performance objectives and key variables for that section.
- 4. Submission Checklist:** A targeted list of documents, field data, and plan features required for a complete application to minimize "Requests for Additional Information" (RFAI).
- 5. Example Worksheets & Tables:** Standardized templates for presenting calculations and technical findings.



Note: While engineers may use their own formats, these templates illustrate the exact level of detail, specific variables, and calculations (such as the 1.5 safety factor for metered flows) required for a thorough technical evaluation.

Each project has unique characteristics and site-specific variables that may affect the level of engineering analysis and documentation required. The design engineer is responsible for determining the appropriate components and level of detail necessary to support the proposed design. DEEP staff will make the final determination as to whether the Engineering Report contains sufficient information to be considered complete for review. Applicants are encouraged to engage with DEEP early in the project development process to discuss site-specific considerations, anticipated requirements, and any factors that may affect the scope of the Engineering Report.

Overview of Document Sections

The following table outlines the progression of the Engineering Report as detailed in this guide:

Section	Focus Area	Core Objective
Section 3.0	Document Outline and Navigation	To ensure a streamlined review process and maintain high data integrity, each section follows a standardized five-part framework
Section 4.0	Project Overview and Administrative Status	A comprehensive description of the development, facility type, and uniform design flows
Section 5.0	Existing and Proposed Site Conditions	A description and spatial overview of the project location, including property history and proposed future use
Section 6.0	Considerations For Design	Establishing standards for hydraulic capacity, nitrogen dilution, and phosphorus sorption
Section 7.0	Flow & Characteristics	Quantifying wastewater volumes and wastewater strength for all sources
Section 8.0	Site Investigation, Site Selection and Proposed Development	Interdisciplinary field testing to characterize subsurface and groundwater conditions
Section 9.0	System Hydraulics	Calculating leaching area requirements based on Long-Term Acceptance Rates (LTAR)
Section 10.0	Site Hydraulics	Modeling groundwater mounding and verifying vertical separation compliance
Section 11.0	Wastewater Treatment System Components	Engineering specifications for all collection, treatment, and distribution hardware
Section 12.0	Required Plans and Diagrams	Providing technical proof through site plans, profiles, and process schematics
Section 13.0	Designing for Target Endpoints	Defining treatment performance, monitoring requirements, and effluent limits needed to achieve applicable design and water quality objectives
Section 14.0	Conclusion and Compliance Summary	Verification of design integrity and professional certifications
Section 15.0	Checklist	Identifying key design elements and required documentation to meet regulatory requirements

This guidance document uses the following symbol  to identify common project deficiencies that frequently result in application review delays.

3.9.1 Terminology

The 2006 *Design Standards* adopted the term "**wastewater renovation**" in place of the statutory and regulatory terminology then in use to emphasize that the principal design objective is the renovation of wastewater, rather than its disposal. That engineering objective has not changed.

For consistency with the governing legal framework, however, this guidance primarily uses the terminology found in the applicable statutes and regulations, including Conn. Gen. Stat. § 22a-430, the Department's Water Quality Standards, Water Discharge Regulations, Rules of Practice, and Environmental Permit Application Package. Using the same terminology as these authorities promotes consistency between this guidance, the governing legal requirements, and the language used throughout the permitting process.

Accordingly, this guidance uses the terms "*Sewage*," "*Domestic Sewage*," "*Sewage Disposal*," "*Subsurface Sewage Disposal System*," and "*Leaching System*" as they are defined in the governing statutes and regulations. It's important to note that since the time this document was being drafted were legislative updates that may impact the terms and definitions used. Section 27 of Public Act 23-207 amended Connecticut General Statutes (CGS) Section 22a-430(g) and delegated authority to the Department of Public Health (DPH) for household and small commercial subsurface sewage disposal systems with a design flow of 10,000 gallons per day or less and authorized the same threshold for small community sewerage systems. This change in law results in a change in jurisdictional oversight of your permitted system from DEEP to DPH. The following is an excerpt of published information from August 2026:

“The Department of Public Health (DPH) and the Department of Energy and Environmental Protection (DEEP) are implementing the transfer of jurisdiction over certain categories of on-site wastewater disposal systems as required by Section 22a-430(g) of the Connecticut General Statutes, as amended by section 27 of Public Act 23-207 delegating authority from DEEP to DPH.

The following categories of wastewater disposal systems are delegated to DPH authority, effective July 1, 2026: Newly proposed on-site wastewater disposal systems (“OWDS”) with a cumulative design flow of 10,000 gallons per day (“GPD”) or less, of the following categories:

- Small community sewerage systems.
- Household subsurface sewage disposal systems.
- Small commercial subsurface sewerage disposal systems.

The applicable DPH regulations for OWDS are available online in the Connecticut eRegulations system as ‘Policies and Procedures,’ which are effective until final regulations are adopted. Policies and Procedures are a regulatory mechanism that have the effect of regulation. Please visit the eRegulations online system to obtain a copy of the Policies and Procedures.”

Earlier guidance documents may use different terminology to describe the same concepts. The following terms are equivalent:

Statutory/Regulatory Term	2006 <i>Design Standards</i> Term
Sewage	Wastewater
Domestic Sewage	Domestic Wastewater
Sewage Disposal	Wastewater Renovation
Subsurface Sewage Disposal System or Leaching System	Subsurface Wastewater Absorption System (SWAS)
Land Treatment System; Subsurface Sewage Disposal System	On-site Wastewater Renovation System (OWRS)

Because this guidance was developed through the collaborative efforts of numerous contributors over an extended period, readers may occasionally encounter the statutory/regulatory terminology and the terminology from the *2006 Design Standards* used interchangeably. Unless the context requires otherwise, these terms are intended to have the same meaning as shown in the table above and should not be interpreted as reflecting different technical or regulatory concepts.

Regardless of the terminology used, the underlying engineering principle remains the same. The purpose of a Subsurface Sewage Disposal System is not simply to dispose of sewage, but to renovate it through physical, chemical, and biological treatment in the subsurface so that it reaches a quality protective of public health and the environment before it enters groundwater or any other ‘point of concern’.

Section 4 Project Overview and Administrative Status

4.1 Overall Project Description

In this section, provide a comprehensive description of the project. Ensure the narrative is clear, addressing each of the following components:

- 4.1.1 Project Name:** The formal title of the development or facility.
- 4.1.2 Site Address:** The physical location of the project, including the street address, town, and zip code.
- 4.1.3 Project Narrative:** A detailed description of the proposed work, including the scope of construction and the intended use of the land. DEEP encourages applicants to provide comprehensive project descriptions including the history and future use of the site, especially as it relates to modifications of existing sites and permits.



Failure to provide sufficient project details is a common cause of project and permitting delays.

- 4.1.4 Facility Type:** Specify the use of the facility (e.g., residential development, commercial retail, industrial site, or mixed-use).
- 4.1.5 Ownership Type:** Indicate if the entity is municipal, private, or institutional.
- 4.1.6 Design Flows:** State the proposed maximum and average design flows in gallons per day (GPD). Design flow shall be determined in accordance with the Connecticut Department of Public Health (CT DPH) Technical Standards for Subsurface Sewage Disposal Systems based on the proposed facility use, occupancy, and anticipated wastewater generation. The design flow shall account for all wastewater sources tributary to the treatment system and represent the maximum anticipated daily hydraulic loading for which the system is designed. Where standard design criteria are not applicable, or where appropriate to support the proposed design, documented water meter records from comparable facilities or site-specific flow data may be used to establish or validate the design flow, subject to sound engineering judgment.

 ***To ensure a streamlined technical review and avoid common administrative roadblocks, it is critical that the design flow figures remain consistent across all application documents. Discrepancies between the project narrative, site plans, and technical specifications can lead to significant processing delays.***

4.2 Key Requirements

4.2.1 Uniformity: Use the exact same maximum and average design flow values (in gallons per day) throughout the entire application package.

4.2.2 Documentation Check: Verify that the figures provided in the overall project description match those cited in the:

- Engineering reports
- Hydrogeologic studies (e.g., nitrogen dilution or phosphorus sorption analyses)
- Site plan notations
- Supporting NetDMR attachments

4.2.3 Direct Impact: Maintaining data integrity across your submission reduces the need for "Requests for Additional Information" (RFAI) from the Department and keeps the project on track for its construction review.

Example Table: Project Design Basis

Data Category	Unit/Type	Application Value	Consistent in All Sections?
Facility Use Type	(e.g., Residential)		[]
Total Acreage	Acres		[]
Design Flow	GPD		[]
Average Daily Flow	GPD		[]

Section 5 Existing and Proposed Site Conditions

5.1 Site Description

This section acts as the project's "biography". It bridges the gap between the property's history (industrial/agricultural) and its future use. By clearly documenting existing infrastructure and environmental constraints (like 100-year floodplains, wetland boundaries, drinking water well locations (if existing). Aquifer protection areas (if applicable), the engineer establishes the baseline from which all renovation and hydraulic calculations are derived. Provide a description and spatial overview of the project location. This section must include:

- 5.1.1 Site location:** Define the site using parcel boundaries, nearest crossroads, and precise latitude and longitude coordinates.
- 5.1.2 Property Size:** State the total acreage of the entire property.
- 5.1.3 Visual Aids:** Include high-quality location and vicinity maps to orient the reviewer.
- 5.1.4 Operational Overview:** Describe both the existing land uses and the specific proposed activities that will generate wastewater discharge.

Include any additional information necessary to describe prior uses of the site (e.g., former industrial or agricultural utility).

5.2 Current Site Conditions

Provide a detailed inventory of the site's current status that includes the following:

- 5.2.1 Community Demographics:** Describe the population served (e.g., age-restricted housing) and the physical scale, including the number of buildings, units and bedrooms.
- 5.2.2 Infrastructure History:** Identify all existing and historical water and wastewater infrastructure on the property.
- 5.2.3 Wastewater Profile:** List all current wastewater sources and their corresponding flow rates.
- 5.2.4 Maintenance Records:** For existing systems, provide a summary of current system maintenance practices and schedules.
- 5.2.5 Regulatory Status:** Provide a comprehensive list of required state and local permits:
 - **Currently Issued:** List permit numbers and expiration dates.
 - **Pending:** List applications currently under review and their current status.
 - **Compliance History:** For renewal or modification applications, include a summary of the site's compliance and enforcement history.

5.3 Site Assessment Data Requirements

Submit the results of all field investigations and environmental assessments, including:

5.3.1 Property Interests: Identification of areas of common and limited common interest.

5.3.2 Geotechnical Data: A detailed and comprehensive description of known soil conditions, seasonal high-water tables, neighboring subsurface systems that may be impacted, known challenges, and bedrock conditions. Sources of the information must be provided.



Failure to provide sufficient geotechnical data with supporting sources will result in project and permitting delays.

5.3.3 Hydrogeology: Confirmation of groundwater depth and the established flow direction(s) and gradient(s) with the submission of a groundwater contour map. Provide a comprehensive description of how groundwater depth(s) and flow direction(s) were established and the seasonal variations. DEEP recommends that applicants have a hydrogeologist on their project team with experience in groundwater modeling.



Failure to provide sufficient hydrology information with supporting sources will result in project and permitting delays.

5.3.4 Environmental Constraints: Identification of floodplain elevations, coastal boundaries, protected or endangered species, aquifer protection areas, unique geologic conditions, and relevant climate considerations (e.g., storm surge or heavy precipitation risks). DEEP encourages applicants to consider climate change and how that will impact the design factors, specifically if the site has existing limiting design factors, such as seasonal high-water tables, bedrock, or are near surface waters, that will impact the current and future use of the site.

5.4 Site Plan and Mapping Standards

All applications must include detailed mapping to depict existing conditions. Ensure your site plans clearly label the following:

5.4.1 Boundaries & Structures: Property lines, buildings, and roads.

5.4.2 Natural Features: Topography (contours), wetlands, and watercourses.

5.4.3 System Components: Current subsurface system locations, septic tanks, and leaching systems.

5.4.4 Testing Locations: Placement of test pits, piezometers, boring and monitoring wells, and sample locations to determine background conditions. All projects at a minimum, one (1) upgradient monitoring well. Based on the site conditions and hydrology of the groundwater, additional wells may be required to ensure there is a complete understanding of the existing site conditions.

5.4.5 Utilities & Drainage: Existing utility lines, nearby water supply wells, and all surface/subsurface drainage features.

5.4.6 Map Legend & Submission Checklist

📌 To ensure your application moves through the review process without administrative delays, please verify that your site plans and mapping include the following standardized symbols and labels. Clear, professional mapping reduces the need for "Requests for Additional Information" (RFI) and helps streamline the technical evaluation.

- **Property & Natural Features**

- **Property Boundaries:** Clearly defined with bearings and distances.
- **Topography:** Existing and proposed contours (i.e. 2-foot intervals), steep slopes and bedrock outcroppings. Include vertical datum used in preparing mapping.
- **Water Resources:** Delineated wetlands, watercourses, and applicable setback lines.
- **Floodplain:** 100-year flood elevation lines (if applicable).

- **Existing & Proposed Infrastructure**

- **Structures:** All buildings (labeled by use) and permanent site features like roads or retaining walls.
- **Subsurface Components:** Septic tanks, pretreatment units (where applicable), pump chambers, dosing tanks, grease interceptors/traps, distribution boxes or pressure distribution manifolds, force mains and associated piping, leaching systems, underdrains (where applicable), inspection ports, observation wells, and monitoring wells (where required).
- **Utilities:** Water lines, gas lines, electric/telecom conduits, and storm drainage.
- **Water Supply:** Locations of any nearby public or private water supply wells within the required separation distances.

- **Investigation & Monitoring Points**

- **Test Pits:** Locations of all deep hole observations used for soil evaluation.

- **Hydraulic Conductivity Tests:** Location and depth of where soil permeability was measured. Provide a comprehensive and detailed description of methodology used.
- **Monitoring Wells:** Locations of existing or proposed groundwater monitoring stations. Provide elevations for the top of monitoring well points based on datum.
- **Borings:** Location and description of soil profiles observed during soil evaluation. Provide elevations at grade of borings or top of well point based on datum.
- **Standard Map Elements**
 - **North Arrow:** Clearly oriented.
 - **Scale Bar:** Professional engineering scale (e.g., 1" = 40'). This may vary based on the size of project.
 - **Title Block:** Including project name, site address, and date of last revision.
 - **Professional Seal:** Signed and sealed by a licensed Professional Engineer or licensed Land Surveyor, as required.

Design Manual Reference: Refer to Section II Wastewater Renovation in Subsurface Soils and Section V: Basic Groundwater Hydrology of the *2006 Guidance Standards* for protocols on documenting environmental constraints and soil/bedrock characterization.

5.4.7 Submission Checklist: Site & Mapping

Category	Requirement	Verified
Site Identity	Latitude/longitude, total acreage, and vicinity maps included.	[]
Land Use	Description of current use and proposed wastewater-generating activities.	[]
History	Summary of prior industrial/agricultural utility and infrastructure history.	[]
Demographics	Population served, number of buildings, and unit counts.	[]
Regulatory	List of all issued/pending state and local permits with expiration dates.	[]
Field Data	Geotechnical, hydrogeological, and environmental assessment results.	[]
Boundaries	Property lines clearly defined with bearings and distances on maps.	[]
Natural Features	2-foot contours, delineated wetlands, and 100-year flood elevations.	[]
Testing Points	All test pits, borings, hydraulic conductivity tests, and monitoring wells accurately labeled.	[]
Standard Items	Professional seal, north arrow, and scale bar on all sheets.	[]

5.4.8 Example Table: Existing Infrastructure & Compliance Inventory

Use this table to summarize the current status of the property to streamline the technical evaluation.

Infrastructure Component	Description/Source	Flow (GPD)	Maintenance Status
Existing Septic Tanks	e.g. Two 2,000-gal concrete		Last pumped: [Date]
Leaching Fields	e.g. Stone & pipe trenches		Age: [Years]
Water Supply	e.g. On-site well / Public	N/A	[Type/Status]
Compliance History	e.g. Past NOV or Consent Order	N/A	Status: [Open/Closed]

Section 6 Considerations For Design

6.1 Proposed Design Flow

All wastewater treatment and disposal systems must be sized using conservative design flows and specific wastewater characteristics approved by DEEP.

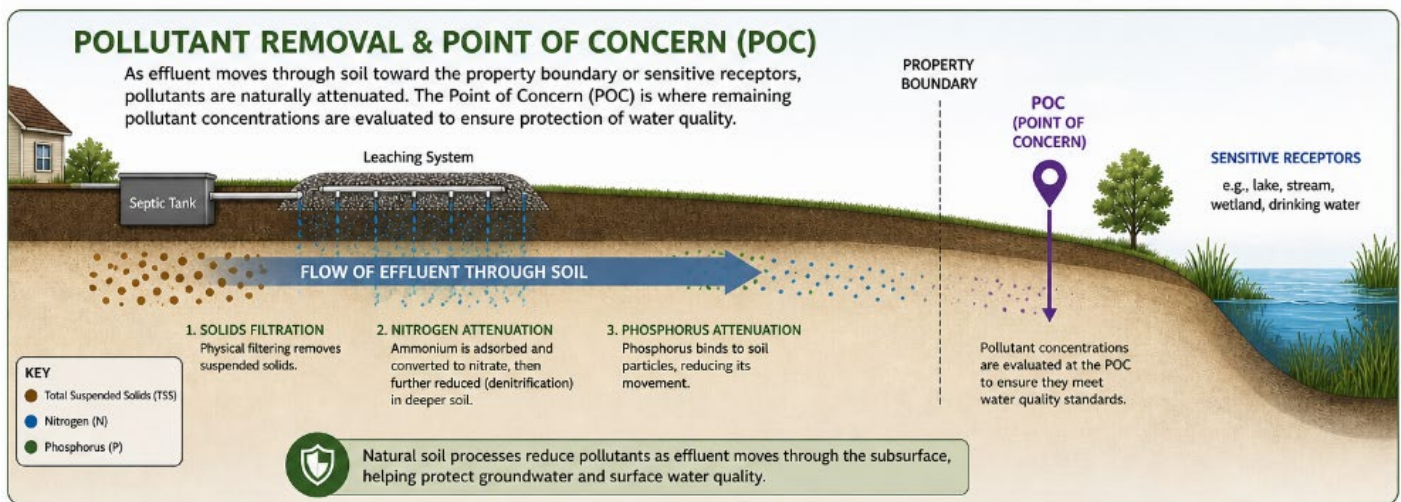
Note: Ensure these figures are used consistently throughout all application modules to avoid technical discrepancies.

6.2 Hydraulic Capacity in the Soils

The soil's ability to transport and renovate effluent is a critical health safety and environmental factor.

6.2.1 Transport and Renovation: Soils must have sufficient hydraulic capacity (including a DEEP-established reserve capacity) to transmit pretreated wastewater over a necessary distance. This distance must be adequate to renovate the wastewater to drinking water quality before it reaches the “point of concern”, ensuring the attenuation of organic/inorganic pollutants and pathogens.

6.2.2 Unsaturated Soil Depth: The system must maintain a minimum of three (3) feet of unsaturated soil beneath the bottom of the leaching structures for the design flow, even during periods of mounded seasonal high groundwater.



6.3 Pathogen Removal (21-Day or 56-Day Travel Time)

Public health protection relies on the natural removal of pathogens (via filtration, die-off, or inactivation). A minimum groundwater travel time of 21 days is required to provide adequate pathogen reduction under typical conditions.

- 6.3.1 Renovation Requirement:** Any pathogens not removed in the unsaturated zone must be neutralized within the saturated soils downgradient of the leaching field.
- 6.3.2 Point of Concern:** This renovation must be complete before the commingled effluent and groundwater reaches a 'point of concern'.
- 6.3.3 Application Rates:** Application rates of pretreated wastewater must not exceed the soil's natural capacity for pathogen attenuation.
- 6.3.4 Sensitive Receptors:** For sensitive receptors such as potable water supply wells, reservoirs, and susceptible wetlands, **a more conservative minimum travel time of 56 days shall be maintained** to ensure an enhanced level of protection and to minimize the risk of pathogen migration to vulnerable resources.

6.4 Nitrogen Attenuation & Dilution Analysis

The primary objective of nitrogen management is to ensure that the concentration of total nitrogen in the renovated wastewater does not exceed Connecticut Water Quality Standards at the points of concern (i.e. property boundary(ies), wetlands, surface waterbody, lake, pond, estuary, aquifer protection areas, or public or private water supplies).

6.4.1 Technical Requirements

- **Mass Balance Analysis:** Applicants must provide a detailed Nitrogen Dilution Analysis. Your analysis must utilize a DEEP-approved mass balance equation. This calculates the dilution of the nitrogen plume as it mixes with natural groundwater recharge from precipitation.
- **Renovation Factors:** The analysis should consider the nitrogen concentration of the pretreated effluent (N_{ww}), the volume of the discharge (Q), and the available "dilution water" from the contributing watershed (Q_{ip}).
- **Point of Concern:** You must clearly identify the 'point of concern' in your mapping. This is the location where the plume must meet the drinking water standard (typically 10 mg/L for nitrate-nitrogen).
- **Recharge Assumptions:** Clearly state the recharge rate used or precipitation infiltration (e.g., 21 inches/year). Any deviations from standard regional averages must be justified with site-specific data.
- **Plume Dynamics:** Provide a narrative describing the projected horizontal and vertical extent of the nitrogen plume.

6.4.2 Technical Data Summary: Nutrient Attenuation

To facilitate an efficient technical review, please include the following summary table in your Engineering Report. This provides the reviewer with a snapshot of your findings for both nitrogen and phosphorus at the defined POC.

Parameter	Value	Units	Notes/Assumptions
Effluent total nitrogen (N_{ww})		mg/L	Average concentration after pretreatment
Average daily flow (Q_{ww})		GPD	Must match Sections 4.1, 6.1, and 7.1
Precipitation		in/yr	Based on site-specific precipitation data
Precipitation infiltration		%	Based on soil coverage and type (CN numbers)
Effective infiltration area (A_e)		sq. ft.	Area contributing to dilution
Daily volume of infiltrated precipitation, where $Q_{ip} = (\%I \times A_e) / 100$		Gallons, L ³	
Background nitrogen (N_{bg})		mg/L	Ambient groundwater concentration
Calculated nitrate-nitrogen at POC		mg/L	Target: < 10 mg/L
Effluent P concentration		mg/L	
Projected system life		Years	Typically 20 to 30 year design life
Total linear feet of leaching units (L)		ft	
Effective bottom width (inc. stone) (W)		ft	
Depth of unsaturated soil (D)		ft	

Parameter	Value	Units	Notes/Assumptions
P sorption value (from soil testing and literature)		mg/100g	
Average dry unit weight of soil		lb/cu.ft	
Calculated months of sorption		Months	The unsaturated soil beneath the system has the capacity to sorb at least 6 months of the P in the percolate from the system
Distance to phosphorus POC		Feet	Distance to nearest downgradient POC

Notes:

- Effluent nitrogen (N) and phosphorus (P) concentrations is dependent on wastewater characteristics, level of treatment provided prior to discharge into the soil.
- Wastewater strength is use-dependent. Typical total nitrogen concentrations range approximately 60 – 80 mg/L for residential sources and 80 – 120 mg/L for commercial and school facilities.
- In conventional systems, approximately 60% of total nitrogen is assumed to reach the subsurface, and compliance is demonstrated using a dilution/attenuation model to achieve a target concentration of 10 mg/L at the 'point of concern'.
- For systems incorporating advanced biological treatment, effluent nitrogen discharged to soil is typically assumed to be 10 mg/L, with site-specific calculations used to confirm compliance at the 'point of concern'.
- Typical total phosphorus concentrations range from 16 – 20 mg/L, with approximately 30 – 40% removal achieved through standard treatment, resulting in effluent concentrations of about 10 – 15 mg/L.
- For systems incorporating advanced biological treatment typical total phosphorus concentrations of the effluent range from 6 – 12 mg/L
- Where the capacity of native soils to attenuate phosphorus has not been demonstrated, additional phosphorus removal through treatment (enhanced biological or chemical addition) may be required.

6.5 Phosphorus Sorption & Soil Capacity

Because phosphorus is often the "limiting nutrient" for freshwater ecosystems, preventing its migration into Connecticut's lakes and streams is a regulatory priority. Unlike nitrogen, which is primarily managed through dilution, phosphorus is managed through sorption (the physical and chemical binding of phosphorus to soil particles). The goal is to ensure that phosphorus is fully removed by the soil before the renovated wastewater reaches a 'point of concern'.

- 6.5.1 Sorption Analysis:** You must prove that the soil has the chemical capacity to "lock" phosphorus in place.
- 6.5.2 Loading Calculations:** Approximately 30% of the phosphorus in the influent is removed through pre-treatment, at the biomat/soil interface or through treatment system. The remaining phosphorus load must be attenuated within the minimum three (3) feet of unsaturated soil beneath the leaching system. The unsaturated soil must demonstrate the capacity to sorb a minimum of six (6) months of the applied phosphorus load, based on the inherent sorption characteristics of the existing soils.
- 6.5.3 Breakthrough Prevention:** The design must ensure that the "front" of the phosphorus plume does not reach a surface water body at concentrations higher than the existing background levels for the duration of the permit.
- 6.5.4 Sorption Capacity Calculations:** Applicants must demonstrate that the soil in the receiving area has sufficient phosphorus sorption capacity to sorb a minimum of six (6) months of the applied phosphorus load.
- 6.5.5 Soil Testing:** The soil investigation, including detailed description and classification, can be used to support an estimation of phosphorus sorption capacity based on published literature values representative of the native soil types present at the site. This approach is appropriate where soil conditions are well characterized through field classification and conservative sorption values are selected to avoid overestimation of capacity. Where such representative data are not available, or where site conditions cannot be confidently characterized, laboratory testing of site-specific soil samples to determine the Phosphorus Sorption Index (PSI) or similar metrics.
- 6.5.6 Impact on Surface Waters:** Because phosphorus is often the limiting nutrient in freshwater systems, this analysis is especially critical if the discharge is up-gradient of a lake, pond, or phosphorus-impaired watercourse. The design must demonstrate that effluent application rates are controlled to maintain the unsaturated flow under the system (3 feet) to avoid phosphorus migration with groundwater, particularly in sensitive areas. The design shall ensure that phosphorus concentrations at the POC does not exceed existing background levels for the duration of the permit.
- 6.5.7 Loading Rates:** The application must prove that the phosphorus loading rate does not exceed the soil's ability to sequester the nutrient, preventing "breakthrough" where phosphorus begins to move toward surface waters at concentrations above background levels.

6.6 Summary of Supporting Documentation

When submitting these analyses, ensure your engineering report includes:

- All assumptions used in the dilution models (e.g., recharge rates, occupancy rates).
- Supporting documentation for soil chemistry to demonstrate that conservative phosphorus sorption values were selected.
- Calculations for the projected plume trajectory and nutrient concentrations at the POC.

Design Manual Reference: Refer to Section X: Subsurface Wastewater Absorption System Design of the *2006 Guidance Standards* for protocols on documenting environmental constraints and soil/bedrock characterization.

Section 7 Wastewater Flow and Characteristics

The Engineering Report must accurately identify and quantify all existing and proposed wastewater flows, including projected increases from facility expansions or changes in use. Ensuring that flow estimates are supported by site-specific data is critical to protecting Connecticut's water resources and preventing system failure. The Engineering Report must accurately identify and quantify all existing and proposed wastewater flows. This includes any projected increases resulting from facility expansions, changes in use, or system modifications. All flow estimates must be supported by applicable design standards and site-specific data to ensure the system is protective of Connecticut's water resources.

This section establishes the hydraulic baseline for the entire application. Accuracy here is vital, as these figures dictate the sizing of every downstream component, from septic tank capacity to the footprint of the leaching field. By requiring a 1.5 safety factor for metered data, the DEEP ensures the system remains resilient during unforeseen high-usage events.

The report shall quantify flows from all contributing sources, such as retail spaces, restaurants, and residential units, accounting for the cumulative flow and specific wastewater characteristics of the development.

7.1 Calculation Standards by Development Type

In determining proposed design flows, applicants must evaluate the following sources based on the criteria below:

7.1.a. Residential Developments:

- **Basis:** Flow rates are calculated based on the number of bedrooms. A breakdown of unit counts and bedroom counts per unit shall be provided.
- **Regulatory Standard:** Refer to the Connecticut Department of Public Health (CT DPH) Technical Standards for specific per-bedroom flow allocations.

7.1.b. Commercial Developments

- **Basis:** Flows are determined by the number of employees, restaurant seats, meals served, and the nature of specific business activities.
- **Calculation Methods:**
 - **Standard:** Use the *DPH Technical Standards*.
 - **Alternative:** Submit three (3) years of water meter data from a facility that is similar in location, size, hours, and usage. Copies of actual utility bills or certified meter readings for the 3-year period, along with a narrative justifying why the reference site is "similar in size, hours, and usage" shall be provided.

- **Safety Factor:** When using meter data, a 1.5 factor of safety must be applied to the peak average flow to determine the maximum design flow.
- **Variable Usage:** You must account for fluctuating flow patterns and peak usage periods (e.g., weekend surges or seasonal shifts).

7.1.c Institutional Developments

- **Basis:** Flows from schools, healthcare facilities, and government buildings are based on the population served, hours of operation, and facility type.
- **Regulatory Standard:** Refer to the *DPH Technical Standards*.

7.1.d. Mixed-Use Developments

- **Basis:** Calculations must reflect the combined flows generated by the residential, commercial, and institutional components of the site.

7.1.1 Submission Checklist for Section 7.1

Ensure your Engineering Report explicitly defines the following three metrics:

Metric Category	Requirement & Description	Verified
Average Daily Flow	The typical volume expected under normal operating conditions.	[]
Peak Flow	The maximum volume expected during high-usage periods. A description of how the system will manage surges (e.g., a "Saturday night rush" at a restaurant or "shift changes" at an industrial facility) must be included.	[]
Design Flow	The final calculated capacity used to size the treatment and disposal system (including all required safety factors).	[]

7.1.2 Submission Checklist: Flow Calculations

Category	Requirement	Verified
Definition of Terms	Average Daily Flow, Peak Flow, and final Design Flow clearly defined.	[]
Standard Source	<i>DPH Technical Standards</i> cited for all residential and institutional flows.	[]
Meter Data (if used)	3 years of data provided from a comparable facility.	[]
Safety Factor	1.5 multiplier applied to peak annual flows metered flows.	[]
Mixed-Use Logic	Combined flow breakdown provided for residential/commercial/institutional blends.	[]
Peak Analysis	Documentation of how seasonal or weekend surges were calculated.	[]

7.1.3 Example Worksheet: Design Flow Summary Table

Engineers must provide a breakdown similar to the table below to demonstrate how the final Design Flow was derived.

Source Description	Unit Basis (e.g., Bedrooms/Seats)	DPH Standard Rate (GPD/Unit)	Sub-Total Flow (GPD)
Residential Units			
Retail/Office			
Restaurant/Café			
Total Calculated Base Flow	--	--	A =
Measured Peak (if using meter data)	--	--	B =
Safety Factor (B x 1.5)	--	--	C =
FINAL DESIGN FLOW	--	--	(A or C)

Design Manual Reference: Refer to Section III: Estimating Wastewater Flows of the *2006 Design Standards*.

7.2 Design Characteristics

The Engineering Report must include a comprehensive technical discussion of both influent (untreated) and effluent (treated) wastewater characteristics. This section defines the "chemistry" of the wastewater. By identifying exactly what is in the influent, DEEP can verify if the proposed treatment technology and the site's natural soil properties are capable of renovating the wastewater to meet drinking water standards. Accurate characterization prevents "technical roadblocks" such as premature system clogging or groundwater contamination. This data is essential for evaluating whether the proposed treatment and disposal system can achieve the performance standards required to protect groundwater quality.

7.2.1 Required Technical Parameters

For each of the following parameters, the report must provide expected concentrations or values based on the specific nature of the project:

- **Flow Metrics:** Clearly state the 'average daily flow' and the 'maximum design flow' (as calculated in Section 4.1).
- **Biochemical Oxygen Demand (BOD₅):** Provide the 5-day BOD concentration to indicate the organic strength of the wastewater.
- **Total Suspended Solids (TSS):** Identify the concentration of particulate matter that requires removal.
- **Nitrogen Species:** Provide a breakdown of nitrogen forms, including total Kjeldahl nitrogen (TKN), ammonia (NH₃), and nitrate (NO₃). This is critical for the Nitrogen Dilution Analysis required in Section 6.4.
- **Phosphorus:** Detail the phosphorus concentration, which informs the phosphorus sorption analysis.'
- **pH:** Indicate the acidity or alkalinity of the wastewater, as extreme pH levels can interfere with biological treatment processes and soil renovation.

7.2.2 Technical Basis for Characteristics

The characteristics provided must be supported by one of the following:

- **Standard Values:** Referencing Section IV: Estimating Wastewater Characteristics of the *2006 Design Standards*.
- **Site-Specific Sampling:** For existing systems undergoing modification, provide actual laboratory analytical data from recent composite sampling.
- **Similar Facility Data:** Data from a comparable facility, provided the applicant includes a justification for the comparison.

7.2.3 Alternative Treatment: Enhanced Pretreatment

Alternative treatment (AT) systems are subsurface sewage disposal systems that incorporate a mechanical or enhanced biological treatment process upstream of the leaching system, in lieu of, or in addition to, conventional septic tank pretreatment. Because AT systems are engineered to achieve a specific level of effluent quality — typically to address site limitations, elevated design flows, or nitrogen removal requirements — their design must be supported by a defensible technical basis demonstrating that the proposed treatment train will reliably achieve the predicted effluent characteristics.

For all AT system designs, the design engineer shall establish the predicted effluent quality using a kinetic design analysis (i.e., a process design based on the kinetic rates governing the biological and/or physicochemical treatment mechanisms employed). At a minimum, this analysis shall address the following:

- **Influent characterization.** The anticipated influent wastewater strength (e.g., BOD₅, TSS, total nitrogen, and other constituents relevant to the treatment objective), based on the design flow and the nature of the source (residential, commercial, or institutional).
- **Process treatment train.** A complete description of each treatment unit process in sequence, including design criteria, hydraulic and organic loading rates, retention times, and the manufacturer's performance data or third-party certification (e.g., NSF/ANSI Standard 40 or 245, as applicable) supporting the proposed configuration.
- **Predicted effluent quality.** The estimated effluent concentrations for each constituent of concern following treatment, with supporting calculations showing how the kinetic design analysis was applied to derive these values from the influent characterization and treatment train parameters.
- **Basis of design assumptions.** Identification of design temperatures, safety factors, and any site-specific conditions (e.g., seasonal occupancy, high-strength waste sources) incorporated into the kinetic modeling.

This information shall be submitted as part of the engineering report accompanying the application for approval to construct. Applications lacking a documented kinetic design analysis and supporting predicted effluent data will be considered incomplete and returned to the applicant for resubmission.

Regulatory Reminder: Ensuring these characteristics are accurate at the outset prevents technical "roadblocks" during the DEEP review process and ensures the long-term viability of the subsurface system.

Design Manual Reference: Refer to Section IV: Estimating Wastewater Characteristics and Section XI: Enhanced Pretreatment of the *2006 Design Standards* for standard concentrations associated with various facility types and residential uses.

7.3 Wastewater Characteristics Summary Table

This table should be used to summarize the design assumptions for the treatment train.

Parameter	Influent Concentration	Effluent Limit	Expected Percent Removal (%)
BOD ₅ mg/L			
TSS mg/L			
Total Nitrogen mg/L or calculated			
Ammonia mg/L			
Nitrate mg/L			
Nitrate mg/L			
TKN mg/L			
Total Phosphorus mg/L			
Orthophosphate mg/L			
pH, S.U.		(Range)	N/A
Total Coliform col/100mL			

Applicants are encouraged to use the following checklist to ensure that all necessary information is provided in support of the design characteristics presented in the Engineering Report.

Submission Checklist: Wastewater Data

Category	Requirement	Verified
Parameter List	BOD ₅ , TSS, TKN, NH ₃ , NO ₃ , phosphorus, pH, and total coliform included.	[]
Technical Basis	Cited <i>2006 Design Standards</i> , site-specific sampling, or similar facility data.	[]
Justification	If using a "similar facility," a written justification of the comparison is provided.	[]
Lab Reports	For modifications to existing systems, recent certified lab results are attached.	[]
Consistency	Concentrations match the values used in the Section 5.4/5.5 nutrient models.	[]

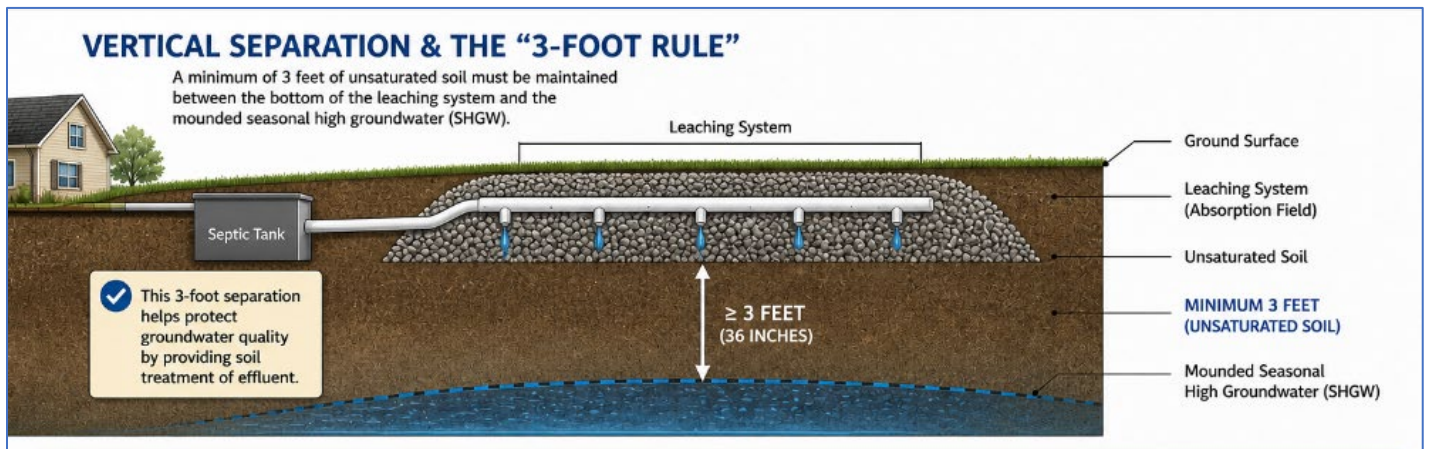
Section 8 Site Investigation, Site Selection and Proposed Development

This section provides the empirical data needed to prove the site can physically handle the discharge. By identifying "restrictive layers" (like tight till or shallow bedrock) and the true SHGW, the engineer can ensure the system is placed in the most renovated portion of the soil profile. This prevents the most common causes of system failure: surface breakout and groundwater contamination. Site evaluation is a mandatory, interdisciplinary process. All investigations may be conducted by qualified professionals in engineering, soil science, and hydrogeology; however, the final design and supporting documentation shall be certified by a Professional Engineer (P.E.) licensed in Connecticut.

8.1 The goal

To apply rigorous scientific and engineering principles to ensure the proposed system functions safely, the following four (4) pillars are foundational:

- 8.1.1 Renovative Capacity:** Soils must effectively treat wastewater to meet Connecticut Water Quality Standards before it reaches a 'point of concern' (e.g., property lines, wetlands, or drinking water wells).
- 8.1.2 Hydraulic Capacity:** The site must be physically capable of dispersing and transporting the wastewater volume without causing surface breakouts.
- 8.1.3 Vertical Separation:** To ensure aerobic renovation, a minimum of three (3) feet depth of unsaturated soil at the design flow must be maintained beneath the leaching structures and mounded seasonal high groundwater table.
- 8.1.4 Pathogen Removal:** The system design must facilitate natural filtration and die-off in both the unsaturated and saturated zones.



8.2 Site Investigation Requirements

A comprehensive soil testing program is required to validate the design. The evaluation must address the following technical elements:

8.2.1 Assessment of Site Suitability: Applicants must develop site plans that clearly depict:

- **Topography:** Detailed contour intervals.
- **Hydrogeology:** Depth to groundwater, flow direction, gradient and seasonal high levels.
- **Sensitive Features:** Identification of areas where groundwater intersects the surface, as well as all wetlands and watercourses.
- **Geology:** Evaluation of bedrock depth and characteristics.

8.2.2 Field Testing Requirements: Subsurface conditions must be characterized through a recorded field log. Testing must include:

- **Test Pits & Borings:** A minimum of one boring or test pit per 2,500 square feet of proposed leaching area may serve as a general guideline for site characterization. The actual number and placement of borings or test pits should be determined based on site-specific conditions such as soil variability, groundwater depth and overall system size.
- **Soil Logs and Descriptions:** NRCS Web Soil Survey standards to describe soil horizons may be utilized, but site-specific information must be provided.
- **Physical Indicators:** Documentation of ledge outcroppings, moisture content, and redoximorphic features (soil staining that indicates seasonal saturation).

8.2.3 Hydraulic Conductivity (K) Testing

- **Documentation:** Measurements of K values must be taken across different soil horizons.
- **Analysis:** Use appropriate analytical methods, such as the geometric mean, to determine representative conductivity for the site. A conservative design utilizes the lower range of hydraulic conductivity values when calculating the hydraulic mound and the higher range of hydraulic conductivity to calculate the time of travel through the soil profile.

8.2.4 Monitoring Wells & Seasonal High Groundwater

Monitoring wells are required to establish the baseline hydraulic gradient and seasonal high groundwater conditions.

- **Monitoring Period:** Actual groundwater levels should be observed during the seasonal high period, typically between February and May to observe actual groundwater levels.
- **Estimation Methods:** Seasonal highs may be estimated using records from a nearby USGS well with comparable geology and topography, land use, and hydrology. By analyzing seasonal trends and assuming similar responses to

precipitation, the site's seasonal high groundwater level can be estimated through interpolation or adjustment. Some on-site readings are still needed to establish the correlation.



Critical: While USGS data can provide a correlation, on-site readings are still required to establish the specific site-to-well relationship.

Design Manual Reference: Refer to Section II: Wastewater Renovation in Soils, Section V: Basic Groundwater Hydrology, Section VI: Hydraulic Capacity Analysis, Section VII: Hydrogeologic Study and Report, and Section VIII: Elevation of Seasonal High Groundwater Table of the *2006 Design Standards* for operating procedures regarding deep-hole observations, percolation testing, and groundwater monitoring protocols.

Seasonal Groundwater Monitoring Log

Applicants must use a log similar to the template below to document groundwater depth, flow direction, and hydraulic gradient. This data is essential for establishing the Seasonal High Groundwater (SHGW) level required for Section 5.1.4. If the site has unidirectional flow, ensure the location of the wells sufficiently captures the entire site to avoid additional sampling later prolonging the technical evaluation.

Date	Well ID ¹	Reference Elevation (TOC) ²	Depth to Water (ft)	Groundwater Elevation	Notes (Precipitation/Weather)

1. Groundwater monitoring wells shall be identified alpha-numerically, where upgradient wells shall be U001, U002, etc.; mid-gradient wells shall be M001, M002, etc.; and downgradient wells shall be D001, D002, etc.
2. TOC means "Top of Casing"

Design Manual Reference: Refer to Section II: Wastewater Renovation in Soils, Section V: Basic Groundwater Hydrology, Section VI: Hydraulic Capacity Analysis, Section VII: Hydrogeologic Study and Report, and Section VIII: Elevation of Seasonal High Groundwater Table of the *2006 Design Standards* for standard operating procedures regarding deep-hole observations, percolation testing, and groundwater monitoring protocols.

8.2.1 Summary of Site Investigation Deliverables

Before moving to the design phase, ensure your application package includes the following items to verify the empirical data used for site characterization:

Category	Requirement	Verified
Field Logs	Signed and dated logs for all test pits and borings (A minimum of one boring or test pit per 2,500 square feet of proposed leaching area may serve as a general guideline for site characterization. The actual number and placement of borings or test pits should be determined based on site-specific conditions such as soil variability, groundwater depth and overall system size.).	☐
NRCS Mapping	A copy of the Web Soil Survey for the project area.	☐
Well Construction Diagrams	Detailed diagrams for all monitoring wells, specifically including screen depth and sand pack specifications.	☐
SHGW Justification	A narrative explaining the methodology used to determine the Seasonal High Groundwater (SHGW) level, such as direct monitoring or correlation with nearby USGS well data.	☐

8.2.2 Submission Checklist: Field Investigation

Category	Requirement	Verified
Field Logs	Signed and dated logs for all test pits and borings included.	[]
Soil Texture	USDA classifications provided for every distinct soil horizon.	[]
Water Table	Method of determining SHGW (Monitoring vs. Correlation) documented.	[]
Hydraulic Conductivity	Raw data and calculations for K values (ft/day) attached.	[]
Restrictive Layers	Depth to bedrock, mottled soil, or impervious clay clearly identified.	[]
Map Correlation	All testing locations (TP-1, MW-1, etc.) match the Site Plan (Section 11.2).	[]

8.2.3 Example Worksheet: Soil and Groundwater Data Summary

This table serves as a summary of the field investigation results to assist the technical reviewer.

Point ID (e.g., TP-1)	Elevation (MSL)	Depth to Bedrock (in)	Depth to SHGW (in)	Most Restrictive Layer K (ft/day)
Up-gradient				
Primary Area				
Reserve Area				
Down-gradient				
Average Values	--	Min:	Min:	Geo-Mean:

Section 9 System Hydraulics

System hydraulics involves evaluating the volume of wastewater a site can safely absorb and treat based on the capacity of a mature biological mat or leaching field. Proper hydraulic design ensures that treatment and dispersal components operate efficiently without overloading the soil interface.

9.1 Key Variables

The hydraulic performance of a subsurface system is influenced by several critical factors:

- 9.1.1 Wastewater Strength:** Higher organic loading can impact the development of the biological mat (biomat).
- 9.1.2 Soil Permeability:** The native soil's ability to transmit liquid (K value).
- 9.1.3 Leaching Structure Configuration:** The geometry and orientation of the units (e.g., trenches, galleries, or plastic units).
- 9.1.4 Application Method:** Whether effluent is distributed via gravity or pressure distribution.

9.2 Hydraulic Design Calculations

When calculating system hydraulics, the Engineering Report must address the following technical components:

- 9.2.1 Maximum Design Flow:** All hydraulic sizing must be based on the Maximum Design Flow established in Section 4.1.6.
- 9.2.2 Effective Leaching Area & Long-Term Acceptance Rate (LTAR):** The design must account for the LTAR, which represents the equilibrium rate at which a mature biomat can accept effluent over the life of the system.
- 9.2.3 Required Effective Area:** Calculate the total surface area required for infiltration based on the LTAR and soil characteristics.
- 9.2.4 Structure Calculation:** Provide a specific calculation of the effective leaching area provided by the proposed leaching structures (e.g., side-wall and bottom-area credits). For pressure distribution of a high-quality effluent the effective leaching area will be considered just the bottom area of the leaching system.
- 9.2.5 Application Methods**
 - **Gravity Distribution:** Standard flow where effluent moves via sloping pipes.
 - **Pressure Distribution:** Recommended for larger systems and systems employing advanced treatment to ensure *even distribution* across the entire leaching field, preventing localized hydraulic overloading.

9.3 Hydraulic Reserve Capacity

In accordance with DEEP criteria, the reserve area requirements can be met through hydraulic reserve capacity within the system design rather than necessitating a physically separate "reserve area" on the property.

Design Manual Reference: For detailed methodologies on calculating LTAR and effective area credits, please see Section X: Subsurface Wastewater Absorption System Design of the *2006 Design Standards*.

Hydraulic Summary Table

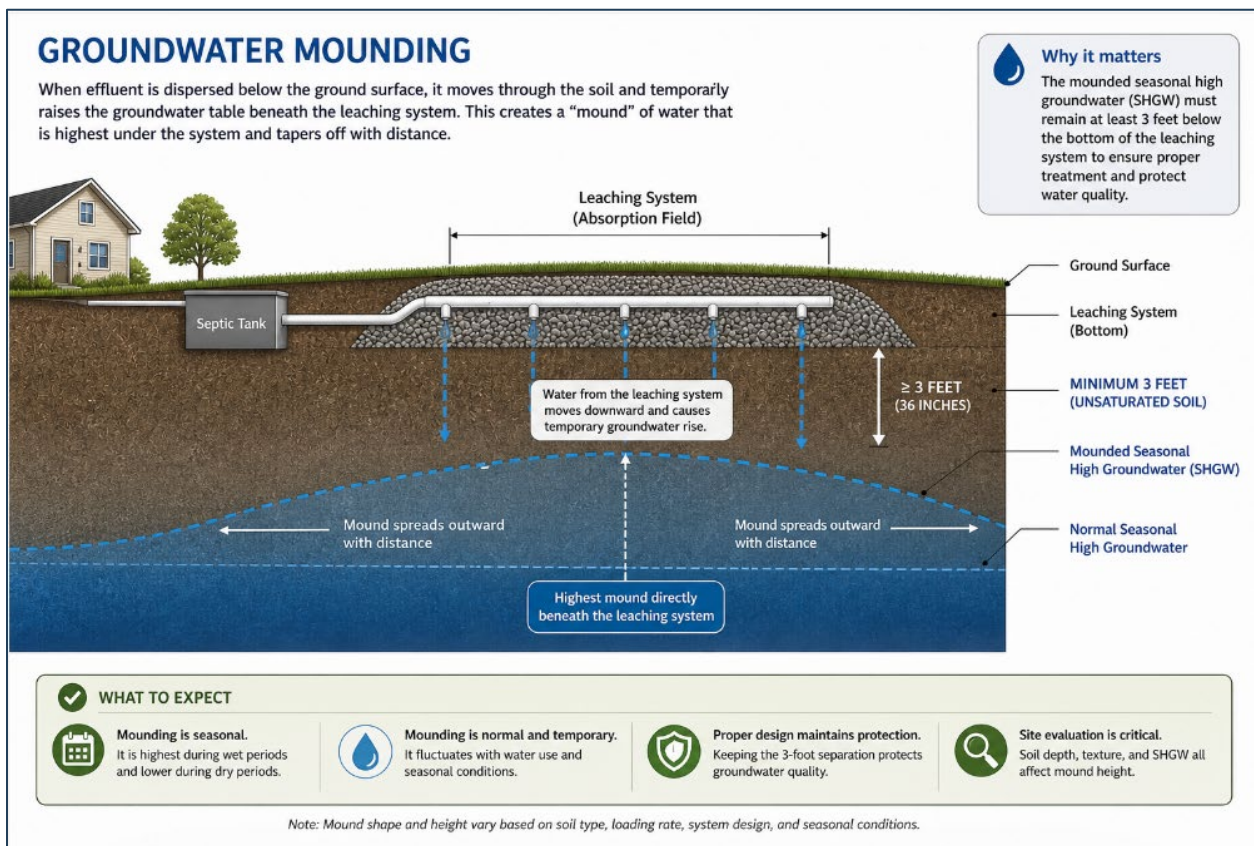
Component	Design Value	Units
Applied Hydraulic Load		GPD/sq. ft.
Calculated LTAR		GPD/sq. ft.
Total Required Area		sq. ft.
Total Provided Area		sq. ft.
Hydraulic Reserve %		%

While System Hydraulics (Section 6.0) focuses on the leaching field's ability to absorb effluent, Site Hydraulics evaluates the property's overall capacity to transmit effluent during seasonal high groundwater conditions. The goal is to ensure the wastewater travels a sufficient distance for renovation without breaking out at the surface or compromising vertical separation.

10.1 Key Hydraulic Variables

The site's hydraulic capacity is dictated by the interaction of several environmental factors:

- 10.1.1 Soil Permeability (K):** The rate at which water moves through the specific soil horizons.
- 10.1.2 Groundwater Gradient:** The slope of the water table, which drives the direction and speed of flow.
- 10.1.3 Site Constraints:** Physical "bottlenecks" such as shallow bedrock, dense glacial till, or nearby surface water bodies that may restrict flow.



10.2 Groundwater Mounding Analysis

The central technical question in site hydraulics is: "How high will the groundwater mound beneath the leaching system?" As effluent is added to the water table, it creates a localized vertical and horizontal "mound." If this mound rises too high, it can eliminate the required unsaturated zone needed for aerobic treatment. Projects must incorporate the impacts of climate change when performing the mounding analysis.

Applicants must use one of the following methodologies to predict mounding behavior:

10.2.1 Two-Dimensional Analysis (Darcy's Law)

- **Approach:** A more simplistic calculation used for sites with a consistent slope and uniform soil.
- **Application:** Ideal for determining the horizontal flow capacity of the "soil reservoir" downgradient of the system.

10.2.2 Three-Dimensional Analysis (Well Recharge Equations)

- **Approach:** Uses complex equations (such as the Hantush or Glover methods) to model the radial spread of the mound.
- **Application:** Most suitable for areas with flat topography where effluent spreads in multiple directions rather than following a steep linear gradient.

10.2.3 Computer Modeling

- **Approach:** Utilizing software (e.g., MODFLOW) to simulate complex site conditions.
- **Application:** Necessary for large-scale systems or sites with highly variable geology, complex boundary conditions, or multiple discharge points.

10.3 Engineering Documentation

All site hydraulic analyses must be documented as part of the engineering basis of design. The report should explicitly state:

10.3.1 The specific model or equation used for the mounding analysis.

10.3.2 The "safety factor" applied to the K values used in the model.

10.3.3 The calculated minimum vertical separation remaining between the top of the mounded seasonal high groundwater table and the bottom of the leaching structure.



Critical: Ensuring the vertical and horizontal mound stays below the leaching system is critical for preventing common roadblocks in the permitting process. A failure to provide a robust mounding analysis will result in project and permitting delays.

Design Manual Reference: Refer to Section X: Subsurface Wastewater Absorption System Design of the *2006 Design Standards* for standard operating procedures regarding deep-hole observations, percolation testing, and groundwater monitoring protocols.

10.4 Mounding Analysis Summary Sheet

To ensure your hydraulic modeling aligns with DEEP's technical expectations, please include the following data summary in your Engineering Report.



Providing these specific inputs are required to enable technical review of your groundwater mounding calculations. Failure to provide a comprehensive evaluation will result in project and permitting delays.

10.4.1 Critical Design Checks

Your analysis must demonstrate that the system maintains regulatory compliance even at the peak of the predicted mound:

- **Vertical Separation Verification**
 - **Formula:** $\text{Elevation}\{\text{Leaching Bottom}\} - (\text{Elevation}\{\text{SHGW}\} + \text{height of mound}) = \text{Remaining Separation}$
 - **Requirement:** The remaining separation must meet the minimum unsaturated zone depth required by the DEEP design criteria to ensure aerobic treatment.
- **Boundary Conditions**
 - **Impact of Constraints:** If the site has shallow bedrock or is near a surface water body, the model must account for *boundary effects* where the mound may rise more sharply due to restricted lateral flow.
 - **Sensitivity Analysis:** *It is highly recommended to provide the most conservative worst-case scenario to demonstrate that the system will not surface or break out under less-than-ideal field conditions. A conservative design utilizes the lower range of hydraulic conductivity values when calculating the hydraulic mound and the highest range of hydraulic conductivity values to calculate the time of travel through the soil profile.*
- **Downgradient Capacity**
 - **Darcy's Law Check:** Use a 2D analysis to verify that the soil cross-section downgradient of the system can actually *convey* the total volume of added effluent plus the natural background groundwater flow without the water table intersecting the ground surface.

Model Component	Value	Units	Source/Method
Hydraulic Conductivity (K)		ft/day	Geometric mean
Aquifer Thickness (D)		feet	Depth to bedrock or restrictive layer
Specific Yield (Sy)		decimal	Estimated based on soil
Transmissivity (T)		sq. ft./day	Calculated
Infiltration Rate (w)		ft/day	Based on Maximum
Duration of Loading (t)		days	Typically modeled for 90+ days
Calculated Mound Height (hm)		feet	Peak height above

10.4.2 Engineering Basis Checklist

Before finalizing Section 10.0, ensure the following are attached:

Category	Requirement & Description	Verified
Calculated Hydrographs	Provide a visual representation showing the predicted growth and stabilization of the groundwater mound over time.	[]
Flow Nets	Include mapping that illustrates the projected changes in groundwater contours once the treatment system reaches full operational capacity.	[]
Software Validation	For designs using computer modeling (e.g., MODFLOW), provide a summary of all input parameters and details of any calibration performed against on-site monitoring well data.	[]

Summary of Design Compliance

To conclude the *pollutant renovation analysis*, please provide a summary table of your final calculations:

Pollutant	Requirement	Calculated Result	Compliance Status
Pathogens	Total coliform = zero, 21-Day / 56-Day Travel		☐ Pass ☐ Fail
Nitrate	< 10 mg/L at POCs		☐ Pass ☐ Fail
Phosphorus	6-Month Min. Capacity		☐ Pass ☐ Fail
Vertical Sep.	3' Min. to Mound		☐ Pass ☐ Fail

Design Manual Reference: Refer to Section II: Wastewater Renovation in Soils, and Section X: Subsurface Wastewater Absorption System Design of the *2006 Design Standards* for standard operating procedures regarding deep-hole observations, percolation testing, and groundwater monitoring protocols.

The Engineering Report must detail all components of the proposed system. At a minimum, the following categories must be addressed to demonstrate that the system is properly engineered to achieve pollutant removal and ensure the adequate dispersal of effluent.

11.1 Wastewater Collection and Conveyance

This stage involves the safe transport of raw wastewater from the source to the treatment units.

11.1.1 Infrastructure: Building sanitary sewers, lateral connections, manholes, and cleanouts.

11.1.2 Flow Management: Septic influent piping and flow equalization tanks (if required to manage surge volumes).

11.1.3 Pumping: Grinder pumps (for non-gravity flow), lift stations, and force mains.

11.2 Primary Treatment (Solids Removal)

Primary treatment focuses on the physical separation of solids and the initial breakdown of organic matter.

11.2.1 Separation: Septic or primary settling tanks designed for the separation of settleable solids and floatable materials (scum).

11.2.2 Digestion: Anaerobic digestion of organic solids within the sludge storage zone.

11.2.3 Components: Influent/effluent screens, baffles or tees, access risers, inspection ports, and flow control devices.

11.3 Secondary Treatment (Biological Treatment)

This stage utilizes biological processes to reduce BOD₅ and Total Suspended Solids (TSS).

11.3.1 Advanced Pretreatment Units: Aerobic Treatment Units (ATUs), fixed-film systems, or suspended-growth (extended aeration) systems.

11.3.2 Aeration Infrastructure: Blowers, compressors, and diffusers or aeration chambers.

11.3.3 Clarification: Secondary clarifiers, media filtration, and recirculation pumps as required to meet permit limits.

11.4 Tertiary and Advanced Treatment

Required when high-level nutrient reduction or disinfection is necessary to meet Water Quality Standards.

- 11.4.1 Nutrient Reduction:** Specific processes for nitrogen removal (nitrification/denitrification) and phosphorus reduction (flocculation/sedimentation).
- 11.4.2 Polishing Filtration:** Sand, peat, textile, or membrane filtration systems.
- 11.4.3 Disinfection:** Ultraviolet (UV) or ozone disinfection units (common for high-sensitivity sites).
- 11.4.4 Compliance:** Dedicated effluent monitoring ports and sampling points.

11.5 Treated Effluent Storage and Pumping

- 11.5.1 Dosing:** Final effluent pump tanks or dosing chambers using timed or demand-based controls.
- 11.5.2 Safety & Redundancy:** High-water alarms, redundant effluent pumps, and flow measurement devices to control dosing volumes.

11.6 Distribution System to Leaching Area

- 11.6.1 Pressure Distribution:** Pressure piping, distribution manifolds, and pressure laterals with orifice shields to ensure even distribution.
- 11.6.2 Control:** Valves, cleanouts, and alternating/resting-zone controls to prevent hydraulic overloading of the soil.

11.7 Subsurface Leaching (Soil Absorption) System

The final stage where treated effluent is dispersed into the environment.

- 11.7.1 Structures:** Leaching fields, beds, chambers, or proprietary stone-free systems.
- 11.7.2 Compliance Checks:** Verification of separation distances to seasonal high groundwater and bedrock.
- 11.7.3 Long-term Planning:** Identification of the reserve (expansion) leaching area.

11.8 Operation, Monitoring, and Maintenance (O&M) Features

Features that ensure the system remains compliant throughout its life cycle.

- 11.8.1 Automation:** Control panels, telemetry for remote monitoring, and emergency power provisions.
- 11.8.2 Maintenance:** Routine access points for inspections and sludge management/pumping provisions.

11.9 System Component Checklist

In your Engineering Report, please provide a comprehensive list of all specified equipment, including manufacturer names and model numbers for any proprietary treatment units.

To ensure a comprehensive regulatory review, the Engineering Report must include the following professional plans and diagrams. These documents serve as the technical documentation that the system is designed to achieve mandated pollutant removal and hydraulic dispersal goals. The following is a comprehensive list, however items with a superscript (1) must be provided on the construction plans and specifications.

12.1 Site Plan

The site plan provides the spatial context for the project. It must include:

- 12.1.1 Property Geometry:** Boundaries, lot dimensions, and setbacks.
- 12.1.2 Built Environment:** All existing and proposed buildings and site features.
- 12.1.3 Natural Features:** Topography (contours), surface drainage patterns, wetlands, watercourses, and floodplains.
- 12.1.4 Resource Protection:** Existing and proposed water supply wells (on-site and off-site) within the prescribed review radius.
- 12.1.5 Compliance Distances:** Explicit labels for required separation distances to wells, property lines, and structures.

12.2 Wastewater Treatment System Layout Plan

This plan tracks the flow of wastewater through the treatment train:

- 12.2.1 Infrastructure:** Locations of building sewers, service laterals, septic tanks, and any secondary/tertiary treatment units.
- 12.2.2 Mechanicals:** Pump chambers, dosing tanks, lift stations, emergency generator control panels, and alarms.
- 12.2.3 Conveyance:** Configuration of gravity and pressure piping, including flow direction arrows, cleanouts, and inspection ports.

12.3 Subsurface Disposal (Leaching Field) System Plan

A detailed view of the final dispersal area:

- 12.3.1 Configuration:** Layout and dimensions of leaching trenches, beds, or chamber systems.
- 12.3.2 Geometry:** Orientation and spacing of all leaching structures.
- 12.3.3 Distribution:** Piping manifolds, dosing zones, and observation ports.

12.4 Cross Sections Through the Subsurface Disposal System



Critical for verifying vertical separation compliance (3 ft):

- 12.4.1 Profiles:** Existing and proposed ground surfaces.
- 12.4.2 Components:** Cross sections of leaching structures and the infiltrative surface elevation.
- 12.4.3 Hydrology:** Seasonal high groundwater (SHGW) elevation and predicted groundwater mounding.
- 12.4.4 Geology:** Depth to bedrock or other restrictive layers.

12.5 Soil Evaluation and Groundwater Investigation Map & Plan

- 12.5.1 Groundwater Contour Map:** The contour map is foundational in determining the location of monitoring wells, depth to groundwater, and water flow.
- 12.5.2 Data Points:** Locations of all test pits, soil borings, and monitoring wells.
- 12.5.3 Technical Summary:** Identification of SHGW and depth to restrictive layers.
- 12.5.4 Integration:** Direct correlation of soil data with the specific disposal system footprint.

12.6 Hydraulic Profile and Process Schematic

This section ensures the system can physically move the required volume:

- 12.6.1 Elevations:** Precise invert elevations for all components (sewers, tanks, pumps, and leaching structures).
- 12.6.2 Engineering Data:** Hydraulic grade lines and pump head requirements.
- 12.6.3 Process Flow:** A schematic showing influent sources, treatment stages (primary, secondary, tertiary), and any recirculation or bypass flows.

12.7 Grading, Stabilization, and Erosion Control Plan

- 12.7.1 Landform:** Existing and proposed grades within and adjacent to the disposal areas, including cut/fill limits.
- 12.7.2 Protection:** Temporary and permanent erosion and sedimentation controls.
- 12.7.3 Construction Management:** Designated access routes and equipment limitations to prevent soil compaction in leaching areas.



Critical: Ensure all plans are signed and sealed by a Licensed Professional Engineer. Discrepancies between the invert elevations in Section 10 and the cross sections in Section 10 are a common cause of project and permitting delays. Please perform a final "plan-to-profile" consistency check before submission.

For more detailed explanations related to design considerations, applicants are encouraged to consult the 2006 Design Standards available on the CT DEEP- UIC Program website.

If you have questions about UIC Permits in general, you can contact the UIC Program via e-mail at deep.uicpermitting@ct.gov.

13.1 Pollutants of Concern

The monitoring and effluent limits established in a permit are site-specific and are designed to evaluate treatment system performance, verify that treated water meets applicable water quality standards and MCLs, and provide early indication of potential treatment issues. Different parameters provide information about different aspects of the treatment process, including removal of solids and organic matter, nutrient treatment, disinfection performance, and overall system operation.

Parameter	Recommended Sample Type	Treatment Goal	Why It Is Monitored
Biochemical Oxygen Demand (BOD₅)	24-hour composite	Remove organic matter	Measures the amount of oxygen consumed by microorganisms as they break down organic material. BOD monitoring evaluates how effectively the treatment system removes organic pollutants.
Total Suspended Solids (TSS)	24-hour composite	Remove solids	Measures the amount of suspended material remaining in the treated water. TSS monitoring verifies solids removal performance and helps ensure the treatment system is operating properly.
Total Nitrogen (TN)	24-hour composite	Remove/ Reduce nutrients	Measures the total amount of nitrogen in the treated water, including ammonia, nitrate, nitrite, and organic nitrogen. TN is used to evaluate overall nitrogen removal performance and nutrient loading.
Ammonia	24-hour composite	Convert and remove nitrogen	Measures the ammonia fraction of nitrogen. Elevated ammonia levels may indicate incomplete biological treatment or reduced nitrification performance.
Nitrate Nitrogen	24-hour composite	Evaluate nitrification / denitrification	Measures the oxidized form of nitrogen produced during nitrification. Monitoring nitrate helps evaluate nitrogen treatment performance.
Nitrite Nitrogen	24-hour composite	Verify complete nitrification	Measures an intermediate product of nitrification. Elevated nitrite concentrations may indicate an incomplete or stressed biological treatment process.
Total Kjeldahl Nitrogen (TKN)	24-hour composite	Evaluate nitrogen removal	Measures organic nitrogen and ammonia nitrogen. TKN is combined with nitrate and nitrite results to calculate Total Nitrogen.

Parameter	Recommended Sample Type	Treatment Goal	Why It Is Monitored
Total Phosphorus (TP)	24-hour composite	Control phosphorus nutrients	Measures all forms of phosphorus in the treated water, including dissolved and particulate phosphorus. TP monitoring evaluates phosphorus removal and potential nutrient loading.
Orthophosphate (as P)	Grab	Evaluate available phosphorus	Measures the dissolved inorganic phosphorus fraction that is readily available for biological uptake. Comparing orthophosphate to total phosphorus provides information about the form of phosphorus remaining after treatment.
pH (Daily Minimum and Daily Maximum)	Continuous online monitoring	Maintain proper chemical conditions	Measures whether the treated water is acidic or basic. Continuous monitoring helps identify changes in treatment conditions that could affect process performance or reuse suitability.
Alkalinity	Grab	Maintain treatment stability	Measures the water's ability to resist changes in pH. Alkalinity is important for maintaining stable biological treatment processes, particularly nitrification.
Turbidity	Continuous online monitoring	Verify treatment performance	Measures water clarity by detecting suspended particles. Continuous turbidity monitoring provides real-time confirmation that treatment is functioning properly and supports effective disinfection.
Total Coliform	Grab	Verify microbial quality	Measures indicator bacteria used to evaluate the effectiveness of disinfection and the overall microbial quality of reclaimed water.
UV Dose	Continuous online calculation	Verify disinfection	Measures the amount of ultraviolet energy applied to the treated water. Continuous UV dose verification confirms that the disinfection system is operating at the required level.

A grab sample is a single sample collected at a specific time and location and represents conditions at that point in time. A 24-hour composite sample combines multiple samples collected over a 24-hour period to provide a more representative measure of the treated water quality over time. Continuous monitoring uses an online instrument or system to continuously measure or calculate a parameter and allows operators to identify changes in treatment performance in real time.

 **Disclaimer:** The treatment and effluent limit tables provided below are examples of monitoring requirements that may be included in an issued permit. They are intended to illustrate potential treatment targets and assist applicants in developing appropriate operation and maintenance plans to achieve permit compliance. Actual monitoring requirements and effluent limits will be established in the final permit based on the specific project and applicable requirements.

13.2 Influent Monitoring – Untreated Wastewater

This table identifies the minimum monitoring requirements for raw untreated wastewater entering an Alternative Treatment System.

Influent monitoring is used to characterize the strength and variability of the wastewater, establish baseline operating conditions, evaluate treatment performance, and assess pollutant removal efficiency.

The monitoring data collected at the influent monitoring location are intended for process evaluation and performance assessment and are not used to demonstrate compliance with effluent limitations.

Discharge Serial No.: Example					Monitoring Location: Influent		
Wastewater Description: Influent to the Treatment System							
Monitoring Location Description: Example							
Parameter	NetDMR Code	Units	Minimum Daily Limit	Average Daily Limit	Maximum Daily Limit	Sample Type	Sample Frequency
Flow	00056	GPD	N/A	10,000	15,000	Totalizer	Continuous
Parameter	NetDMR Code	Units	Minimum Daily Limit	Average Monthly Limit	Maximum Daily Limit	Sample Type	Sample Frequency
Biochemical Oxygen Demand _{5-day}	00310	mg/L	N/A	Report	Report	24-hr composite	weekly
Total Suspended Solids	00530	mg/L	N/A	Report	Report	24-hr composite	weekly

Discharge Serial No.: Example					Monitoring Location: Influent		
Wastewater Description: Influent to the Treatment System							
Monitoring Location Description: Example							
Parameter	NetDMR Code	Units	Minimum Daily Limit	Average Daily Limit	Maximum Daily Limit	Sample Type	Sample Frequency
Flow	00056	GPD	N/A	10,000	15,000	Totalizer	Continuous
Parameter	NetDMR Code	Units	Minimum Daily Limit	Average Monthly Limit	Maximum Daily Limit	Sample Type	Sample Frequency
Total Nitrogen	00600	mg/L	N/A	Report	Report	24-hr composite	monthly
Ammonia	00610	mg/L	N/A	Report	Report	24-hr composite	monthly
Nitrate Nitrogen	00620	mg/L	N/A	Report	Report	24-hr composite	monthly
Nitrite Nitrogen	00615	mg/L	N/A	Report	Report	24-hr composite	monthly
Total Kjeldahl Nitrogen	00625	mg/L	N/A	Report	Report	24-hr composite	monthly
Total Phosphorus, as P	00665	mg/L	N/A	Report	Report	24-hr composite	monthly
Orthophosphate, as P	00667	mg/L	N/A	Report	Report	24-hr composite	monthly
pH	61942	S.U.	6.0	NA	9.0	Grab	monthly
Alkalinity	00410	mg/l	N/A	Report	Report	Grab	weekly

13.2.1 Design Considerations – Influent Monitoring for Untreated Wastewater

Alternative Treatment systems shall be designed based on the characteristics and expected variability of the wastewater entering the treatment system. Influent monitoring is used to characterize raw untreated wastewater, establish design loading conditions, evaluate treatment performance, and support evaluation of whether the proposed treatment system is capable of achieving the required effluent quality.

The following design considerations should be evaluated:

13.2.1.1 Wastewater Characterization and Design Loading

- The influent monitoring location should be established at a representative point prior to treatment and should characterize the raw untreated wastewater entering the AT system.
- Influent monitoring should evaluate wastewater characteristics necessary to support system design, including flow, organic loading, solids loading, nutrient loading, and other parameters that may affect treatment performance.
- Design assumptions should consider expected wastewater strength and loading conditions to ensure the AT system is appropriately designed to meet applicable effluent requirements.

13.2.1.2 Influent Variability

- The design should account for expected variations in wastewater flow and strength that may affect treatment performance. Variability may result from changes in wastewater generation, seasonal conditions, facility operations, or other factors specific to the project.
- Where appropriate, design loading conditions should consider anticipated peak or other representative loading conditions rather than relying solely on average influent concentrations or flows.

13.2.1.3 Representative Sampling

- Influent samples should be collected at a location and frequency sufficient to characterize the wastewater entering the AT system and support evaluation of design assumptions.
- Where 24-hour composite samples are required, samples should be representative of the wastewater entering the AT system during the monitoring period. Flow-proportional composite sampling is preferred where feasible. Time-weighted composite sampling may be used when flow-proportional sampling is not practicable.
- Sampling methods should be consistent with applicable sampling requirements and quality assurance/quality control procedures.

13.2.1.4 Treatment Performance and Pollutant Removal

- Influent and effluent monitoring data should be evaluated together to assess treatment performance and pollutant removal efficiency. This evaluation is particularly important for systems designed to achieve enhanced nutrient removal or other specified treatment performance.
- Total nitrogen (TN) removal performance should be evaluated using influent and effluent concentrations. Total nitrogen shall be calculated as the sum of total Kjeldahl nitrogen (TKN), nitrate nitrogen, and nitrite nitrogen.
- Influent monitoring results should also be used to evaluate whether the treatment system is operating under the loading conditions for which it was designed and whether adjustments to operation or maintenance may be necessary to maintain required treatment performance.

13.3 Effluent Monitoring – Pathogen Removal and Subsurface Drip

This table identifies the minimum effluent monitoring requirements and applicable water quality limits for Alternative Treatment systems used for (1) subsurface drip irrigation and (2) other applications where the treatment system does not rely on soil treatment for pathogen removal.

For these applications, the AT system shall produce treated effluent that meets the applicable water quality standards and effluent limitations established in the permit prior to discharge or reuse. For subsurface drip irrigation systems, the design and operation of the dispersal system, including applicable seasonal or site-specific limitations, shall be evaluated based on site conditions and the intended use of the reclaimed water. The soil and subsurface system may provide additional attenuation of treated effluent but shall not be relied upon to achieve compliance with applicable effluent limitations or required treatment performance unless specifically authorized by the applicable requirements.

Discharge Serial No.: Example					Monitoring Location: Example		
Wastewater Description: Pretreated Domestic Sewage Effluent							
Monitoring Location Description: Example							
Parameter	NetDMR Code	Units	Minimum Daily Limit	Average <u>Daily</u> Limit	Maximum Daily Limit	Sample Type	Sample Frequency
Flow	00056	GPD	N/A	10,000	15,000	Totalizer	Continuous
Parameter	NetDMR Code	Units	Minimum Daily Limit	Average <u>Monthly</u> Limit	Maximum Daily Limit	Sample Type	Sample Frequency
Biochemical Oxygen Demand _{5-day}	00310	mg/L	N/A	10 - 20	15 - 30	24-hr composite	weekly
Total Suspended Solids	00530	mg/L	N/A	10 - 20	15 - 30	24-hr composite	weekly
Total Nitrogen	00600	mg/L	N/A	10	Report	24-hr composite	monthly
Ammonia	00610	mg/L	N/A	Report	Report	24-hr composite	monthly
Nitrate Nitrogen	00620	mg/L	N/A	Report	Report	24-hr	monthly

Discharge Serial No.: Example					Monitoring Location: Example		
Wastewater Description: Pretreated Domestic Sewage Effluent							
Monitoring Location Description: Example							
Parameter	NetDMR Code	Units	Minimum Daily Limit	Average Daily Limit	Maximum Daily Limit	Sample Type	Sample Frequency
Flow	00056	GPD	N/A	10,000	15,000	Totalizer	Continuous
Parameter	NetDMR Code	Units	Minimum Daily Limit	Average Monthly Limit	Maximum Daily Limit	Sample Type	Sample Frequency
						composite	
Nitrite Nitrogen	00615	mg/L	N/A	Report	Report	24-hr composite	monthly
Total Kjeldahl Nitrogen	00625	mg/L	N/A	Report	Report	24-hr composite	monthly
Total Phosphorus, as P	00665	mg/L	N/A	Report	Report	24-hr composite	monthly
Orthophosphate, as P	00667	mg/L	N/A	Report	Report	24-hr composite	monthly
pH	61942	S.U.	6.0	NA	9.0	Grab	monthly
Alkalinity	00410	mg/l	N/A	Report	Report	Grab	weekly
Turbidity	82079	NTU	N/A	Report	Report	Continuous	Continuous
Escherichia coli (E. coli)	31616	CFU/100 mL	N/A	126	410	Grab	weekly
Total Coliform	74056	CFU/100 mL	N/A	2.2	14	Grab	weekly
UV Disinfection Dose	N/A	mJ/cm²	>100	NA	NA	Continuous	Calculated

13.3.1 Design Considerations – Reclaimed Water Systems Not Relying on Soil Treatment for Pathogen Removal

Alternative Treatment systems designed for subsurface drip irrigation or other reuse applications where pathogen removal is not credited to the soil or subsurface dispersal system should be designed to achieve the required reclaimed water quality prior to reuse or discharge. The design should consider the following:

13.3.1.1 Treatment Performance and Reliability

- The AT system should be designed to consistently achieve applicable effluent quality requirements under expected operating conditions, including anticipated variations in influent flow, wastewater strength, and seasonal conditions.
- Treatment processes used to achieve pathogen reduction should be incorporated into the AT system and should not rely on pathogen attenuation, filtration, or biological treatment provided by the soil or subsurface dispersal system.
- The design should demonstrate that required treatment performance can be maintained during normal operating conditions and reasonably anticipated variations in system operation.

13.3.1.2 Disinfection System Design

- Disinfection should be designed to achieve the applicable microbial water quality requirements prior to reuse or discharge.
- The disinfection process should include operational controls to verify treatment performance, such as UV intensity, UV transmittance, flow, contact time, or other applicable process parameters.
- For UV disinfection systems, the design should identify the required UV dose and provide continuous monitoring or other appropriate controls to verify that the required dose is achieved.
- The design should include appropriate alarms, automatic diversion, or other protective measures when disinfection performance does not meet established operating criteria.

13.3.1.3 Microbial Monitoring and Treatment Verification

- The treatment system should be designed to achieve applicable *E. coli* and/or coliform requirements without relying on the soil or subsurface dispersal system for additional pathogen reduction.
- Microbial performance should be verified through monitoring of treated effluent prior to reuse or discharge, consistent with applicable permit requirements.

- The designer should evaluate whether additional treatment barriers are appropriate where the reclaimed water use presents increased potential for public exposure.

13.4 Effluent Monitoring – Nutrient Removal

This table identifies the minimum effluent monitoring requirements and applicable water quality limits for Alternative Treatment system designed to achieve nutrient removal, primarily nitrogen, prior to discharge or infiltration. These systems are designed to achieve the required level of nutrient treatment within the treatment process and shall not rely on the soil or subsurface dispersal system for additional nutrient attenuation to meet applicable effluent limitations.

Effluent monitoring is used to evaluate treatment performance, demonstrate compliance with applicable nutrient limits, and verify that the treated effluent meets the required water quality standards prior to discharge or infiltration.

Discharge Serial No.: Example					Monitoring Location: Example		
Wastewater Description: Pretreated Domestic Sewage Effluent							
Monitoring Location Description: Example							
Parameter	NetDMR Code	Units	Minimum Daily Limit	Average Daily Limit	Maximum Daily Limit	Sample Type	Sample Frequency
Flow	00056	GPD	N/A	10,000	15,000	Totalizer	Continuous
Parameter	NetDMR Code	Units	Minimum Daily Limit	Average Monthly Limit	Maximum Daily Limit	Sample Type	Sample Frequency
Biochemical Oxygen Demand _{5-day}	00310	mg/L	N/A	10 - 20	15 - 30	24-hr composite	weekly
Total Suspended Solids	00530	mg/L	N/A	10 - 20	15 - 30	24-hr composite	weekly
Total Nitrogen	00600	mg/L	N/A	5 - 10	Report	24-hr composite	monthly
Ammonia	00610	mg/L	N/A	Report	Report	24-hr composite	monthly
Nitrate Nitrogen	00620	mg/L	N/A	10	Report	24-hr composite	monthly
Nitrite Nitrogen	00615	mg/L	N/A	1	Report	24-hr composite	monthly
Total Kjeldahl	00625	mg/L	N/A	Report	Report	24-hr	monthly

Discharge Serial No.: Example					Monitoring Location: Example		
Wastewater Description: Pretreated Domestic Sewage Effluent							
Monitoring Location Description: Example							
Parameter	NetDMR Code	Units	Minimum Daily Limit	Average Daily Limit	Maximum Daily Limit	Sample Type	Sample Frequency
Flow	00056	GPD	N/A	10,000	15,000	Totalizer	Continuous
Parameter	NetDMR Code	Units	Minimum Daily Limit	Average Monthly Limit	Maximum Daily Limit	Sample Type	Sample Frequency
Nitrogen						composite	
Total Phosphorus, as P	00665	mg/L	N/A	0.5 – 1.0	Report	24-hr composite	monthly
Orthophosphate, as P	00667	mg/L	N/A	Report	Report	24-hr composite	monthly
pH	61942	S.U.	6.0	NA	9.0	Grab	monthly
Alkalinity	00410	mg/l	N/A	Report	Report	Grab	weekly

13.4.1 Design Considerations – Nutrient Removal Requirements

Alternative Treatment systems designed to achieve nutrient removal within the treatment process should be designed based on the level of nutrient treatment required for the specific project. The design should consider site-specific conditions, influent characteristics, the receiving environment, and applicable water quality objectives.

The AT system design should demonstrate the ability to achieve the applicable nutrient treatment performance goals. The following treatment categories should be considered:

Treatment Category	Total Nitrogen (TN) Performance Goal	Total Phosphorus (TP) Performance Goal
Standard AT	Report nutrient performance; nutrient removal is not specifically incorporated into the treatment design	Report nutrient performance; phosphorus removal is not specifically incorporated into the treatment design
Enhanced Nutrient Removal AT	≤10 mg/L TN monthly average	≤1.0 mg/L TP monthly average
High-Level Nutrient Removal AT	≤5 mg/L TN monthly average	≤0.5 mg/L TP monthly average

Where nutrient removal is incorporated into the treatment design, nutrient removal efficiency should also be evaluated. A TN removal efficiency of 50 to 70 percent or greater should be considered when evaluating nitrogen treatment performance, particularly where influent nitrogen concentrations may vary significantly. Evaluation of both effluent concentration and percent removal provides a more complete assessment of treatment system performance.

13.4.1.1 Site-Specific Nutrient Considerations

Enhanced or high-level nutrient removal should be evaluated for environmentally sensitive areas, including, but not limited to:

- Areas overlying or contributing to drinking water aquifers.
- Nitrogen-impaired watersheds.
- Areas within nitrogen management areas associated with Long Island Sound protection efforts.
- Phosphorus-impaired watersheds.
- Nutrient-sensitive surface waters.
- Other locations where nutrient loading has the potential to adversely affect groundwater or surface water quality.

For environmentally sensitive areas, the Department may require higher levels of nutrient treatment based on site-specific conditions. As a design consideration, systems located in these areas should evaluate achieving:

- ≤ 5 mg/L TN as a monthly average.
- ≤ 0.5 mg/L TP as a monthly average.
- Demonstrated nutrient removal within the treatment system rather than reliance on soil attenuation.

13.4.1.2 Treatment System Design

Where nutrient removal is required, the AT system should be designed so that the treatment process achieves the applicable nutrient treatment objectives prior to discharge or infiltration.

The soil or subsurface dispersal system may provide additional nutrient attenuation; however, it should not be relied upon to achieve compliance with applicable nutrient treatment requirements unless specifically authorized by the applicable requirements.

The design should consider the expected influent nutrient concentrations and variability, treatment process capabilities, anticipated nutrient loading, and operating conditions necessary to consistently achieve the required treatment performance.

13.5 Effluent Monitoring – Indoor Non-Potable Reuse

This table identifies the minimum effluent monitoring requirements and applicable water quality limits for Alternative Treatment system that produce reclaimed water for indoor non-potable toilet and urinal flushing. These monitoring requirements are intended to evaluate treatment performance, demonstrate compliance with permit conditions, and verify that the reclaimed water consistently meets the applicable water quality requirements for the approved reuse application.

Reclaimed water that does not meet applicable permit conditions or effluent limitations shall not be used for indoor reuse. The water shall be managed through an approved alternative disposal or discharge method, such as infiltration or discharge to a publicly owned treatment works (POTW), as authorized by the applicable permit and requirements.

Discharge Serial No.: Example					Monitoring Location: Example		
Wastewater Description: Pretreated Domestic Sewage Effluent							
Monitoring Location Description: Example							
Parameter	NetDMR Code	Units	Minimum Daily Limit	Average <u>Daily</u> Limit	Maximum Daily Limit	Sample Type	Sample Frequency
Flow	00056	GPD	N/A	10,000	15,000	Totalizer	Continuous
Parameter	NetDMR Code	Units	Minimum Daily Limit	Average <u>Monthly</u> Limit	Maximum Daily Limit	Sample Type	Sample Frequency
Biochemical Oxygen Demand _{5-day}	00310	mg/L	N/A	5 - 10	10 - 15	24-hr composite	weekly
Total Suspended Solids	00530	mg/L	N/A	5 – 10	10 - 15	24-hr composite	weekly
Total Nitrogen	00600	mg/L	N/A	10	Report	24-hr composite	monthly
Ammonia	00610	mg/L	N/A	Report	Report	24-hr composite	monthly
Nitrate Nitrogen	00620	mg/L	N/A	Report	Report	24-hr composite	monthly
Nitrite Nitrogen	00615	mg/L	N/A	Report	Report	24-hr	monthly

Discharge Serial No.: Example					Monitoring Location: Example		
Wastewater Description: Pretreated Domestic Sewage Effluent							
Monitoring Location Description: Example							
Parameter	NetDMR Code	Units	Minimum Daily Limit	Average Daily Limit	Maximum Daily Limit	Sample Type	Sample Frequency
Flow	00056	GPD	N/A	10,000	15,000	Totalizer	Continuous
Parameter	NetDMR Code	Units	Minimum Daily Limit	Average Monthly Limit	Maximum Daily Limit	Sample Type	Sample Frequency
						composite	
Total Kjeldahl Nitrogen	00625	mg/L	N/A	Report	Report	24-hr composite	monthly
Total Phosphorus, as P	00665	mg/L	N/A	Report	Report	24-hr composite	monthly
Orthophosphate, as P	00667	mg/L	N/A	Report	Report	24-hr composite	monthly
pH	61942	S.U.	6.0	NA	9.0	Grab	monthly
Alkalinity	00410	mg/l	N/A	Report	Report	Grab	weekly
Turbidity	82079	NTU	N/A	Report	2	Continuous	Continuous
Escherichia coli (E. coli)	31616	CFU/100 mL	N/A	2.2	14	Grab	weekly
Total Coliform	74056	CFU/100 mL	N/A	2.2	14	Grab	weekly
UV Disinfection Dose	N/A	mJ/cm²	>100	NA	NA	Continuous	Calculated

13.5.1 Design Considerations – Reclaimed Water Systems for Indoor Non-Potable Toilet and Urinal Flushing

Alternative Treatment systems designed to produce reclaimed water for indoor non-potable toilet and urinal flushing shall be designed to consistently achieve the required reclaimed water quality prior to distribution for reuse.

Designers shall review and incorporate the applicable provisions of the *Connecticut DEEP Reuse Guidance Manual, as amended* when developing the treatment and reclaimed water distribution system. The design should address treatment performance, disinfection, monitoring, distribution, cross-connection protection, storage, and management of non-compliant reclaimed water.

Because reclaimed water used within a building creates a potential pathway for human contact, the treatment system should incorporate appropriate treatment processes, monitoring, and operational controls to maintain the required water quality throughout the approved reuse application.

The following design considerations should be evaluated:

13.5.1.1 Treatment Performance and Reliability

- The AT system shall be designed to reliably achieve the applicable effluent limits under expected operating conditions, including variations in influent flow, wastewater strength, and seasonal conditions.
- Treatment processes necessary to achieve the required reclaimed water quality shall be incorporated into the AT system and shall not rely on downstream processes, plumbing systems, or other means to achieve compliance.
- The design should evaluate treatment reliability during normal operation, startup, shutdown, maintenance activities, and reasonably anticipated upset conditions.

13.5.1.2 Disinfection and Microbial Control

- The AT system shall include a disinfection process capable of achieving the applicable microbial water quality requirements prior to distribution for reuse.
- The design should include continuous monitoring or other operational controls necessary to verify disinfection performance.
- Where ultraviolet (UV) disinfection is used, the system should include validated UV dose requirements and continuous monitoring of critical operating parameters.
- The design should include alarms, automatic diversion, shutdown, or other protective measures to prevent distribution of reclaimed water that does not meet applicable permit requirements.

13.5.1.3 Reclaimed Water Distribution System

- The reclaimed water distribution system shall be designed in accordance with applicable requirements to prevent cross-connections with potable water systems and shall include appropriate safeguards, identification, and maintenance provisions.
- The design should consider storage capacity, stagnation, residual water quality impacts, and operational controls necessary to maintain reclaimed water quality after treatment.
- Reclaimed water shall not be distributed for indoor reuse unless the treatment system demonstrates compliance with the applicable effluent limits and reuse requirements.

13.5.1.4 Non-Compliant Water Management

- The system shall include provisions for managing reclaimed water that does not meet applicable permit conditions or effluent limits.
- Non-compliant treated wastewater shall not be used for toilet or urinal flushing and shall be diverted to an approved alternative disposal or discharge method, such as infiltration or discharge to a publicly owned treatment works (POTW), as authorized by the applicable permit and requirements.
- The design should include appropriate controls, notifications, and operational procedures to prevent non-compliant water from entering the reclaimed water distribution system.

13.5.1.5 Monitoring and Verification

- Effluent monitoring shall be conducted at the compliance monitoring location following completion of all treatment processes and prior to distribution for reuse.
- Monitoring data shall be used to evaluate treatment performance, demonstrate compliance with permit conditions, and verify that the reclaimed water meets the applicable water quality requirements for the approved reuse application.

13.6 Intermediate Monitoring – Treatment Performance

This table identifies monitoring that may be required at designated locations within an Alternative Treatment system prior to infiltration or final discharge. Intermediate monitoring is used to verify design assumptions, evaluate treatment process performance, confirm that individual treatment components are operating as intended, and identify potential operational issues before treated wastewater reaches the dispersal system.

Intermediate monitoring requirements should be established based on the treatment processes, design assumptions, and performance objectives of the specific AT system. Monitoring may include parameters that provide information about the performance of individual treatment processes or identify conditions that could affect the ability of the system to achieve the required final effluent quality.

Monitoring conducted under this table is intended to support system operation, maintenance, and performance evaluation and is not used to demonstrate compliance with final effluent limitations unless otherwise specified in the permit.

Discharge Serial No.: Example					Monitoring Location: Intermediate		
Wastewater Description: Intermediate Monitoring Requirements for Alternative Treatment Systems							
Monitoring Location Description: Example							
Parameter	NetDMR Code	Units	Minimum Daily Limit	Average Daily Limit	Maximum Daily Limit	Sample Type	Sample Frequency
Flow	00056	GPD	N/A	10,000	15,000	Totalizer	Continuous
Parameter	NetDMR Code	Units	Minimum Daily Limit	Average Monthly Limit	Maximum Daily Limit	Sample Type	Sample Frequency
Biochemical Oxygen Demand _{5-day}	00310	mg/L	N/A	Report	Report	24-hr composite	weekly
Total Suspended Solids	00530	mg/L	N/A	Report	Report	24-hr composite	weekly
Total Nitrogen	00600	mg/L	N/A	Report	Report	24-hr composite	monthly
Ammonia	00610	mg/L	N/A	Report	Report	24-hr composite	monthly

Discharge Serial No.: Example					Monitoring Location: Intermediate		
Wastewater Description: Intermediate Monitoring Requirements for Alternative Treatment Systems							
Monitoring Location Description: Example							
Parameter	NetDMR Code	Units	Minimum Daily Limit	Average Daily Limit	Maximum Daily Limit	Sample Type	Sample Frequency
Flow	00056	GPD	N/A	10,000	15,000	Totalizer	Continuous
Parameter	NetDMR Code	Units	Minimum Daily Limit	Average Monthly Limit	Maximum Daily Limit	Sample Type	Sample Frequency
Nitrate Nitrogen	00620	mg/L	N/A	Report	Report	24-hr composite	monthly
Nitrite Nitrogen	00615	mg/L	N/A	Report	Report	24-hr composite	monthly
Total Kjeldahl Nitrogen	00625	mg/L	N/A	Report	Report	24-hr composite	monthly
Total Phosphorus, as P	00665	mg/L	N/A	Report	Report	24-hr composite	monthly
Orthophosphate, as P	00667	mg/L	N/A	Report	Report	24-hr composite	monthly
pH	61942	S.U.	6.0	NA	9.0	Grab	monthly
Alkalinity	00410	mg/l	N/A	Report	Report	Grab	weekly

13.6.1 Design Considerations – Intermediate Monitoring Requirements for Alternative Treatment Systems

Intermediate monitoring locations should be incorporated into the design of Alternative Treatment system where monitoring is necessary to verify treatment performance, evaluate individual treatment components, or confirm key design assumptions. Intermediate monitoring provides information about treatment processes within the AT system and allows potential operational issues to be identified and addressed before treated wastewater reaches the final discharge or dispersal location.

The following design considerations should be evaluated:

13.6.1.1 Monitoring Location Selection

- Intermediate monitoring locations should be established at points within the treatment train that provide meaningful information about the performance of individual treatment processes or critical treatment components.
- Monitoring locations should be selected based on the treatment objectives, system configuration, expected pollutant removal mechanisms, and operational controls needed to evaluate system performance.
- Sampling locations should be accessible, representative of the treatment process being evaluated, and designed to allow for routine sampling and maintenance.

13.6.1.2 Verification of Design Assumptions

- Intermediate monitoring should be used to evaluate key assumptions incorporated into the ATS design, including anticipated treatment efficiencies, loading conditions, hydraulic retention, and treatment process performance.
- Where treatment performance assumptions are critical to achieving the required effluent quality, intermediate monitoring should provide information demonstrating that individual treatment components are operating within the expected performance range.
- Design documentation should identify the purpose of each intermediate monitoring location and the specific performance criteria or operational parameters being evaluated.

13.6.1.3 Treatment Process Performance Evaluation

- Intermediate monitoring parameters should be selected based on the treatment processes incorporated into the AT system and the expected pollutant removal mechanisms.
- Parameters may include, but are not limited to, organic loading, solids removal, nitrogen transformation, phosphorus removal, dissolved oxygen, alkalinity, pH, turbidity, or other process indicators appropriate to the treatment system.

- Monitoring results should be evaluated together with influent and effluent monitoring data, as appropriate, to assess overall system performance and identify trends or changes in treatment efficiency.

13.6.1.4 Operational Reliability and Troubleshooting

- Intermediate monitoring should provide information necessary to identify process changes, operational issues, or treatment upsets before they affect final effluent quality.
- The AT system design should include provisions for responding to monitoring results that indicate reduced treatment performance, including operational adjustments, maintenance activities, or other corrective actions.
- Critical treatment components should include appropriate access points, monitoring capability, and operational controls necessary to maintain reliable performance.

13.6.1.5 Relationship to Compliance Monitoring

- Intermediate monitoring is intended to support system operation, maintenance, and performance evaluation and does not replace required final effluent compliance monitoring.
- The ATS must meet applicable effluent limitations at the designated compliance monitoring location prior to discharge, reuse, or infiltration.
- Treatment performance demonstrated through intermediate monitoring should not be used to reduce or eliminate required effluent monitoring unless specifically authorized by the Department.

13.7 Groundwater Monitoring – Protection and Compliance

This table identifies groundwater monitoring requirements that may be established for Alternative Treatment system where groundwater monitoring is required by the permit. Groundwater monitoring is used to evaluate groundwater quality downgradient of the treatment and dispersal system, assess the effectiveness of the overall treatment and disposal system in protecting groundwater resources, and identify potential impacts to groundwater quality.

Monitoring results are used to evaluate changes in groundwater quality over time and demonstrate compliance with applicable groundwater protection standards and permit requirements. Groundwater monitoring requirements, including monitoring locations, parameters, frequency, and applicable limits, should be established based on site-specific conditions, the characteristics of the discharge, groundwater flow and use, and applicable regulatory requirements.

Discharge Serial Nos. Example				Monitoring Location: Example	
Groundwater Monitoring Location No.: Up, Mid, Down Gradient Monitoring Wells				Description: Monitoring wells	
Parameter	NetDMR Code	Maximum Daily Limit ¹	Units	Frequency of Sampling	Sample Type
Total Coliform	74055	0 (zero)	Col/100 ml	Quarterly	Grab
Groundwater Depth (Standard depth below grade)	72019	Report	Ft	Quarterly	Instantaneous
Ammonia Nitrogen	00610	Report	mg/L	Quarterly	Grab
Nitrate Nitrogen	00620	10	mg/L	Quarterly	Grab
Nitrite Nitrogen	00615	1	mg/L	Quarterly	Grab
Total Kjeldahl Nitrogen	00625	Report	mg/L	Quarterly	Grab
Total Nitrogen	00600	Report	mg/L	Quarterly	Grab
pH	00400	6.0 – 9.0	S.U.	Quarterly	Grab
Total Phosphorous	00666	Report	mg/L	Quarterly	Grab
Orthophosphate, as P	00667	mg/L	Report	Report	Grab

13.7.1 Design Considerations – Groundwater Monitoring

Groundwater monitoring may be required for Alternative Treatment Systems (ATS) where evaluation of groundwater quality is necessary to verify protection of groundwater resources, evaluate the effects of the treatment and dispersal system, or demonstrate compliance with applicable permit conditions. Groundwater monitoring should be designed to evaluate changes in groundwater quality associated with operation of the treatment and dispersal system and provide early identification of potential impacts.

The following design considerations should be evaluated:

13.7.1.1 Monitoring Well Network Design

- The groundwater monitoring network should be designed based on site-specific conditions, including hydrogeology, groundwater flow direction, depth to groundwater, soil characteristics, loading rates, and the location of sensitive receptors.
- Monitoring wells should be located to evaluate groundwater conditions upgradient and downgradient of the dispersal area, as appropriate, and should provide representative information regarding groundwater quality before and after discharge.
- The number, location, and construction of monitoring wells should be sufficient to evaluate the anticipated zone of influence of the discharge and potential changes in groundwater quality.

13.7.1.2 Groundwater Quality Evaluation

- Groundwater monitoring parameters should be selected based on wastewater characteristics, treatment objectives, site conditions, and potential contaminants of concern.
- Monitoring should include parameters necessary to evaluate groundwater protection, including, as applicable, nitrogen species, phosphorus, chloride, indicator parameters, and other water quality parameters identified by the Department.
- Groundwater monitoring results should be evaluated in conjunction with influent, intermediate, and effluent monitoring data to provide a comprehensive evaluation of the treatment and dispersal system.

13.7.1.3 Nutrient and Nitrogen Considerations

- For systems designed to address nitrogen loading, groundwater monitoring should be used to evaluate whether nitrogen concentrations in groundwater remain protective of applicable groundwater quality standards.
- The evaluation should consider nitrogen loading rates, treatment system performance, groundwater flow conditions, dilution, and other site-specific factors affecting nitrogen transport and attenuation.

- Where groundwater transport or natural attenuation is considered in evaluating potential groundwater impacts, the design documentation should clearly identify the assumptions and methods used to support that evaluation. Such evaluation shall not be used to substitute for required treatment or compliance with applicable effluent limitations.

13.7.1.4 Sampling and Data Evaluation

- Groundwater samples should be collected from representative monitoring locations using appropriate sampling procedures and analytical methods.
- Sampling frequency should be sufficient to evaluate seasonal variability, system startup conditions, and long-term changes in groundwater quality, as appropriate.
- Groundwater monitoring data should be evaluated over time to identify trends and determine whether additional evaluation, operational adjustments, or corrective actions may be necessary.

13.7.1.5 Compliance Considerations

- Groundwater monitoring is intended to evaluate protection of groundwater resources and the effects of the treatment and dispersal system. It does not replace required effluent monitoring or authorize reliance on groundwater attenuation to meet effluent quality requirements unless specifically authorized by the Department.
- The AT system and dispersal system shall be designed and operated to protect groundwater quality and meet applicable permit requirements.

Section 14 Conclusion and Compliance Summary

The technical data and engineering analyses presented in this guide demonstrate a comprehensive approach to protecting Connecticut's water resources. By adhering to the interdisciplinary site evaluation and rigorous hydraulic modeling standards set forth by DEEP, applicants can ensure that their proposed systems function as highly effective renovation facilities.

14.1 Final Design Integrity

This guide serves as the framework for a design that is fundamentally protective of public health and the environment. Key outcomes of a successful application following these protocols include:

- 14.1.1 Hydraulic Stability:** A verified mounding analysis confirming that the 3-foot vertical separation is maintained under peak loading and seasonal high groundwater conditions.
- 14.1.2 Nutrient Neutralization:** Demonstrated nitrogen dilution and phosphorus sorption that meet or exceed Connecticut Water Quality Standards at all points of concern.

14.1.3 Pathogen Inactivation: Proven vertical and horizontal travel times (21-day or 56-day) to ensure natural die-off before effluent reaches sensitive receptors.

14.1.4 Operational Longevity: A complete treatment train—from primary solids removal to advanced tertiary processes—engineered for a 20 to 40 year design life.

14.2 Professional Engineering Certification

Every Engineering Report submitted through this process must conclude with a formal certification. This statement confirms that the system has been designed in accordance with sound engineering practices and the *2006 Guidance Document for Design of Large-Scale On-Site Wastewater Renovation Systems*.

"I certify that the design of the wastewater treatment and disposal system described in this report has been prepared in accordance with professional engineering standards. It is my professional opinion that the system, as designed, is capable of achieving the required level of treatment and renovation to protect the waters of the State of Connecticut."

Section 15 Appendix A: Checklist

This comprehensive checklist is designed to help a Professional Engineer (P.E.) navigate the technical and regulatory requirements of a Large-Scale On-Site Wastewater Renovation System (OSWRS) application.

By following these points, you can minimize "Requests for Additional Information" (RAI) and avoid common historical roadblocks in the permitting process.

Phase 1: Site Investigation & Evaluation

Item	Requirement & Technical Tip	Verified
Interdisciplinary Verification	Ensure the site report is signed and sealed by a Licensed Professional Engineer (P.E.).	[]
SHGW Correlation	If using USGS data to estimate Seasonal High Groundwater, provide at <i>least three</i> concurrent on-site readings to establish a correlation.  <i>Critical: Document redoximorphic features in every test pit; they are the "biological record" of high water and often carry more weight than a single dry-season reading.</i>	[]
Hydraulic Conductivity (K)	Use the geometric mean for K values within the same soil horizon.  <i>Critical: Avoid "best-case" K values; regulators require representative conservative averages.</i>	[]
Minimum Test Pits	Verify there is at least one boring or test pit per 2,500 square feet located directly within the footprint of the proposed leaching area.	[]

Phase 2: Flow & Characteristics

Item	Requirement & Technical Tip	Verified
Design Flow Consistency	Ensure the Design Flow in Section 4.1 matches the values used in Nitrogen Dilution and Mounding analyses.	[]
Factor of Safety	For commercial sites using 3 years of meter data, verify the mandatory 1.5 safety factor was applied to the peak flow.	[]
Influent/Effluent Table	Provide expected concentrations for BOD₅, TSS, total nitrogen, and phosphorus.  <i>Critical: For mixed-use, provide a weighted average based on the percentage of flow from each source (e.g., 20% restaurant, 80% residential).</i>	[]

Phase 3: Pollutant Renovation & Hydraulics

Item	Requirement & Technical Tip	Verified
The 3-Foot Rule	Cross-sections must prove a 3-foot vertical separation between the leaching system bottom and the mounded SHGW.  <i>Critical: The separation is measured from the top of the mound, not just the static SHGW.</i>	[]
Nitrogen POC	Clearly identify the 'point of concern' (typically the property boundary)	[]

Item	Requirement & Technical Tip	Verified
Phosphorus Sorption	Demonstrate a minimum of six (6) months of absorption capacity within the analysis.	[]
Pathogen Travel Time	Document the required 21-day or 56-day travel time using site-specific gradient and porosity data.	[]

Phase 4: Plans, Profiles & Schematics

Item	Requirement & Technical Tip	Verified
Plan-to-Profile Check	Invert elevations on the Hydraulic Profile (Section 10.6) must match those shown on the Cross Sections (10.4).	[]
Erosion Control	Identify a clear construction access route that prohibits heavy machinery from driving over primary or reserve leaching areas.  <i>Critical: Soil compaction during construction is a leading cause of premature system failure. Mark these "No-Go" zones clearly on the grading plan to extend the life of your system</i>	[]
Reserve Area	Clearly label and protect the hydraulic reserve (or physical expansion area) from future development.	[]
O&M Access	Verify all tanks, pump chambers, and treatment units have risers to grade for maintenance access.	[]

Phase 5: Final Engineering Basis

Item	Requirement	Verified
Regulatory Language	Use professional, regulatory terminology throughout; avoid colloquial phrasing.	[]
Referenced Guidance	Explicitly cite the <i>2006 Guidance Standards</i> for all methodologies.	[]

Final Submission Checklist

❗ Perform one last check before submission ensure all critical regulatory and technical requirements have been met:

Category	Requirement	Verified
Professional Certification	All plans are signed and sealed by a CT-Licensed P.E.	[]
Data Consistency	Invert elevations are consistent across all plans, profiles, and schematics.	[]
Safety Margin	The 1.5 safety factor has been applied to all metered commercial flows.	[]
Nutrient Modeling	Nitrogen, phosphorus, and pathogen calculations are based on site-specific soil data.	[]
Resource Protection	A clear construction sequence is included to prevent soil compaction in leaching areas.	[]

Section 16 List of Abbreviations and Acronyms

This section provides a standardized reference for the technical and regulatory terminology used throughout this manual. Consistent use of these terms ensures clarity in engineering reports, permit applications, and daily operational logs.

Abbreviation	Full Term
AT or ATS	Alternative Treatment System
AWWA	American Water Works Association
BOD	Biochemical Oxygen Demand
CFR	Code of Federal Regulations
CGS	Connecticut General Statutes (Alt: <i>Conn. Gen. Stat.</i>)
CWA	Clean Water Act
CT DEEP	Connecticut Department of Energy and Environmental Protection
CT DPH	Connecticut Department of Public Health
DO	Dissolved Oxygen
EPA	U.S. Environmental Protection Agency
GIS	Geographic Information System
LTAR	Long-Term Acceptance Rate
MBBR	Moving Bed Biofilm Reactor
MCLs	Maximum Contaminant Level
mg/L	Milligrams per Liter
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Turbidity Units

Abbreviation	Full Term
ONWS	Onsite Non-potable Water System
POTW	Publicly Owned Treatment Works
RCSA	Regulations of Connecticut State Agencies (Alt: <i>Regs. Conn. State Agencies</i>)
SBR	Sequencing Batch Reactor
SCADA	Supervisory Control and Data Acquisition
SDWA	Safe Drinking Water Act
TDS	Total Dissolved Solids
TKN	Total Kjeldahl Nitrogen
TN	Total Nitrogen
TP	Total Phosphorus
TSS	Total Suspended Solids
UCONN	University of Connecticut
UIC	Underground Injection Control Program
UV	Ultraviolet (Disinfection)
WPCF	Water Pollution Control Facility
WWTP	Wastewater Treatment Plant