Household Sewage Treatment System Installation Manual

Brown County Health Department

Table of Contents

1 Section 1.0 Introduction

1.1 General Information

The Household Sewage Treatment System (HSTS) is a vital part of a total wastewater infrastructure that supports the quality of life in communities. This infrastructure protects human health and the environment and maintains property values. The preservation of public health and the environment requires that every home in the county be provided with a system for treating wastewater produced by its occupants. Many residences are connected to public sanitary sewers. The balances of the residences are served by individual HSTS.

Building this infrastructure needs to be the work of professionally minded people that are committed to quality work. The investment being made by the property owners in these systems requires that installers and vendors of equipment be committed to successful installations and trouble-free, long-term operation with routine service.

A HSTS is only as good as its installation. This is true where very good soil conditions allow the use of totally passive treatment systems. It is also true where advanced treatment systems must compensate for marginal soil and site conditions. Assuring that installations result in competitively priced, trouble-free systems that are maintainable at reasonable costs is one of the greatest challenges that the onsite wastewater treatment industry faces. The industry cannot afford to leave the satisfaction of customers to chance.

It is important to realize that this document will continue to be supplemented and revised on an annual basis or until it is replaced by a standard manual of installation practice for the onsite industry. Any alternative means or methods offered to achieve the objectives of this manual are subject to review by the Brown County Health Department.

1.2 Purpose of Manual

This manual has evolved out of the need to fill the gap that has existed between state of the art design practices and equipment, and the state of readiness of the practitioners in the field. This manual is designed to continue to bridge this gap to promote solidly grounded standards of good installation practices, to meet the need of uniform standards, and provide the mechanisms to assure and document quality work.

The Health Department has developed this manual to:

- Promote sound construction practices for conventional and advanced HSTS in general.

- Provide construction guidance for conventional and advanced HSTS designed specifically for local soils.
- Build consensus and cooperation among those persons involved in: design, sale, installation, and inspection of onsite systems.
- Development and sale of property with onsite systems.
- Operation and maintenance of onsite systems.

This manual is **not intended** to substitute for, or replace:

- Training and experience that qualifies a person in the procedures of HSTS installation.
- Training that certifies a person to install specific systems, or products.
- Professional qualifications and sound professional judgment of HSTS practitioners.

The manual is formatted to promote the use of checklists and documentation by persons responsible for:

- Design, sale, installation and inspection of HSTS.
- Development and sale of property with HSTS.
- Operation and maintenance of HSTS.

This manual is a revision of the sewage manual provided by the Clermont County Health District. The manual has been modified to fit the needs of Brown County and does have changes that are different from that of Clermont County. It is the sole responsibility of the installer or designer to know the differences of the manual and to apply those changes to system designed or installed in Brown County.

1.3 Layout of Manual

The layout of the manual is to give a simple reference and checklist type format, giving direct and short guidance on the requirements and suggestions regarding HSTS's within the County. This manual has consolidated information that was previously contained in a variety of other sources of information. It also provides combined guidance and requirements for HSTS that are classified as conventional technology and advanced technology. This document is broken down into sections. A listing and sequence of these sections is found in the table of contents. The sections are as follows:

1.0 Introduction
2.0 HSTS Installation Planning
3.0 Tanks
4.0 Aggregates and Cover
5.0 Piping
6.0 Finished Appearance
7.0 Drainage Enhancements
8.0 Electrical Systems
9.0 Disinfection and Monitoring Devices
10.0 Mounds/Modified Mounds/Other At-Grade Structures
11.0 Leach Trenches

12.0 Aerobic Treatment Unit
13.0 Peat Biofilters
14.0 Recirculating Media Filters
15.0 Septic Tank Effluent Drip Distribution
16.0 System Start Up and Checkout Procedures
17.0 Mounds and Modified Mounds
18.0 As-built Drawings
19.0 References
20.0 Dose Sheets
21.0 Addendum

Section 2.0, HSTS Installation Planning thru Section 16.0, System Checkout Procedures, contain the requirements and specifications for HSTS. Within each section, most items are presented in a manner that provides a simple, easy to follow format. The format allows one to use applicable sections of this document for planning and installation considerations.

It must be understood that not all sections of this document are applicable for every given system. For example, piping has been assigned its own section, but the section does not include pipe specific to leach lines.

1.4 HSTS Types Included

As stated previously, this manual was written as an inclusive document to provide a single source of information for the planning and installation of HSTS. Conventional and advanced technologies now appear within the same document. These two technologies, although classified and handled differently, do share similar requirements. For example, all have the same requirements for the building sewer. A simple rule of thumb for the distinction between conventional and advanced technology is the following: *If a HSTS is time dosed, that is, it has a timer controlling dosing or other mechanism based on time, then it is advanced technology (This does not apply to demand dose applications).*

An effort was made to incorporate more information and guidance on HSTS's that are considered proprietary. Most are considered to be advanced technology, too. As time passes, these types of systems are becoming more prevalent throughout the onsite wastewater industry as it continues to grow. The following is a listing of different technologies covered in this document. They are listed based upon their typical consideration as conventional or advanced technology.

It must be understood that the following listing is for systems as typically applied. It may be that there are instances when the above may be classified differently due to specific requirements for a given site.

Conventional	Advanced Technology
Gravity Leach Trenches	Timed Dosed Mounds
Wisconsin Mounds	Peat Filters
	Recirculating Media Filters
Demand Dosed Leach Trenches	Drip Distribution
	Timed Dosed Aerobic Systems

Table 1-1 Conventional and Advanced Technology Classification (Clermont County)

1.5 HSTS Component Application(s)

A variety of components are offered by the onsite industry for use in HSTS. For any of these components, the component must be approved by the component manufacturer for installation and operation in the situation which they will be used. Additionally, these components must be pre-approved by the Health Department for use in the county, and be installed following Health Department approved manufacturer specifications.

1.6 Inspections

The Brown County Health Department requires that the installer gives the sanitarian one day notice before requesting an inspection. The sanitarian will make every effort to schedule the appointment as soon as possible. However, due to budget constraints and a low number of staff the inspection may take several days to set up. The Brown County Health Department reserves the right to cancel/reschedule an inspection up to and including the day of the inspection.

2 Section 2.0 HSTS Installation Planning

2.1 General

Planning the construction of a HSTS is a critical part of the overall HSTS installation process. Proper planning works to the benefit of all the involved parties. It reduces the potential for errors that require changes that cost time and money. It also provides a means by which special considerations for a particular installation may be thought out before fieldwork.

2.2 Critical Elements of Job Planning and Execution

The following items are critical for a successful installation:

- Positive mental attitude.
- Commitment to quality work.
- Safe job site and safe construction practices.
- OSHA guidelines for trenching and shoring followed.
- Communication among involved parties.
- Understanding the plan.
- Knowledge of job specifications.
- Layout survey and notes.

- Maintaining horizontal and vertical job control.
- Stability of components.
- Watertight tanks and components.
- Usage of specified components & aggregates.
- Good solvent welds on every glued connection.
- Protecting components from surface and groundwater inflows.
- Freeze protection of pipes.
- Mechanical protection of pipes.
- Components installed per product specifications.
- Components are accessible and serviceable.
- Electrical system wired to specifications.
- Electrical system protected from moisture.
- Controls set properly.
- As-built documentation.
- System check-out & start-up documentation.
- Homeowner maintenance contracts.
- *Walk-thru inspection within 60 to 90 days after the system is put into service.*
- Good vegetative cover.
- Attractive finished appearance.
- Regular service and maintenance.

2.3 Job Planning

Job planning is the process by which the installer assesses the requirements for completion of a job for a designed HSTS. It includes all the activities considered before beginning site activities. These activities may include, but are not limited to, construction equipment scheduling, personnel scheduling (e.g. - electrician), material procurement/staging (e.g. - pump(s), aggregates, pipe, tanks, etc.), system construction layout, site activities necessary to achieve completion and documentation.

2.3.1 Site and Plan Review

A site plan and review consists of studying the proposed HSTS layout with respect to the actual site conditions.

- Conferring with homeowner and/or person(s) responsible for overall site protection.
- Accuracy of site plan with respect to structures and features confirmed.
- Sources of water from the house, such as down spouts, foundation drain outlets, etc., reviewed and verification of discharge away from the HSTS confirmed.
- HSTS components, including control panel (if applicable), location(s) reviewed.
- Confirmation that all wastewater is connected to the building sewer.

2.3.2 Wet Weather Planning

During the initial planning of a HSTS installation, thought must be given to the potential of wet weather and the impacts wet weather may have on the performance of the finished product and installation schedule. Certain aspects of HSTS installation, especially basal area preparation and leach line installation are extremely sensitive to wet weather installation. The sensitivity is based on the soil moisture content and the resulting response of the soil due to activities such as plowing, excavating, or equipment traffic.

Construction activities, such as plowing and excavation, in wet weather can result in conditions that restrict the infiltration of wastewater into the soil. To say another way, the HSTS has little or no chance of working if installed when the soil is plastic. In fact, the soil conditions may be unacceptable and require a new location on the site, so that natural and uncompromised soil conditions can be relied upon for infiltration. In addition, leach trenches are susceptible to siltation from unmanaged run-off during extended rain events.

It is therefore, very important that an installer considers the potential effects that a wet weather episode may have on a particular installation. The overall planning for the project should contain provisions and/or contingencies for such weather. Some activities that can aid an installer with wet weather are covering a soil absorption area with plastic/tarps or ensuring an adequate quantity of sand for placement on the basal area after approval is given for plowing activities, prior to the rain event.

<u>The following must be done</u>:

- Guidance given in Section 2.4 is used.
- Weather forecast checked for time period of planned weather sensitive activities.
- For mounded HSTS, aggregate available at the site for immediate placement upon Health Department approval.

<u>The following are recommended</u>:

- Provisions taken to reduce impacts of rain event on weather sensitive activities; for example, covering soil absorption areas.
- Wet soils allowed to dry before stockpiling. If wet soil is stockpiled, it will not dry in a stockpile.
- Stockpiles graded to shed water.
- Any soil stockpiles covered to maintain them at workable moisture contents.
- Systems are covered immediately after approval is given.

2.3.3 Planning the Work

The following are some items to consider before any work begins.

- *Ohio Underground Utility Protection Service (OUPS) has marked utilities prior to any excavation.*

- *Utilities not marked by OUPS contacted, to mark their utilities.*
- *Owner (homeowner or builder) contacted to identify locations of any underground utilities that were not marked by OUPS or other entity.*
- Site constraints, such as utility locations, construction corridors and isolation distances, are identified.
- Work site is maintained in a "rain ready" condition.
- Controlling elevations of the work site identified.
- Any unanticipated site conditions or "surprises" found during planning brought to the attention of the system designer and Health Department, as soon as possible.
- Material procurement.
- Staging of materials at site in manner and location that minimizes double handling.
- Material transport paths avoiding wet and soft areas.

2.3.4 HSTS Protections

HSTS protections are measures taken to ensure that any other group or person does not harm the proposed site system, any of the system components and/or the HSTS set aside area.

- Owner (homeowner and/or builder) contacted with regard to system location so that they are aware and cautioned to not disturb these areas by any of their activities.
- Planned soil absorption area *and* reserve area barricaded to prevent unauthorized access to this area and avoid possible damage.
- HSTS areas are protected from damage from waste from new home construction, homes under repair, or homes being remodeled.
- HSTS excavations protected from damage due to surface water flooding.
- Installed HSTS components are protected (or restrained) from floating. Special care is taken with pipes, tanks, treatment units and other components that are susceptible to floatation.
- Sufficient water in tanks and basins to prevent floatation maintained in these vessels, until typical HSTS usage begins.

2.3.5 Planning to Prevent Future Damage by Others

Steps must be taken to give assurance that others do not damage a system. This will prevent unnecessary callbacks after installation.

- Homeowner, general contractor, or person with overall project responsibility given an as-built of the HSTS.
- As-built package includes language stating responsibility for damage after system completion is not the installer's, after as-built has been submitted to the proper project authorities (Consult an attorney in this matter).
- Receipt of the as-built package by the homeowner, general contractor, or responsible person of the project is documented.

2.4 Soil Moisture Condition Planning

A primary cause of ponding in mounds is construction of the system when the soil is too wet or too dry. For soil absorption systems, compaction of soils when soil is too wet contributes to failure of these system types. Before beginning chisel plowing operations or leach line excavation, it must be determined if the soil is plastic near the infiltration surface. The following applies to the mound type system basal area preparation.

This procedure will direct chisel-plowing efforts. Three (3) cases are given for plasticity (an indication of soil wetness) with respect to depth. Each case provides allowable chisel plowing methodologies (See Figure 1 Chisel Plowing Activity with Respect to Depth to Plastic Soils). Field activities that do not follow the actions listed in the figure may be subject to disapproval and other associated consequences.
The following apply to soil absorption systems.

- Soil moisture is below the plastic limit. ***The simple field technique is attempting to roll a small amount of soil into a thread or wire. If it rolls into a thread or wire, soil is plastic - soil is not to be worked.***
- Infiltrative surface is protected from silt and rain.
- For mounded systems, sand placement on basal areas can alleviate this item. Sand placement will require preapproval from the Health Department. HSTS constructed during “wet” conditions will result in disapproval of the work by the Health Department.
- For mounded systems, if soil is too dry, recommend adding moisture and allowing sufficient time to soak in before working the basal area. For example, if water was added in the p.m., check the soil moisture in the a.m. ***or*** sand four (4) inches to six (6) inches (or reasonable depth to create a good soil to sand interface depending on soil conditions) is placed on the basal area before chiselng. Once again any sand placed prior to chisel plowing will require Brown County Health Department approval.

	Case I	Case II	Case III
Field Condition	Ground Surface Plastic	Ground Surface Min. 8 in. Friable/ Non-plastic Plastic	Ground Surface Min. 12 in. Friable/ Non-plastic Plastic
Flat Site*			
Action	Do Not Plow	Plow From Side Only	Plow From Side or Within Basal
Sloping Site**			
Action	Do Not Plow	Do Not Plow	Plow Parallel to Contour

Figure 1 Chisel Plowing/Excavation Activities with respect to depth to plastic soils. *A flat site has a slope less than 4%. **A sloping site has a slope equal to or exceeding 4%.

2.5 Clearing

Clearing shall consist of vegetation removal from the proposed soil absorption site. All of the above cautions apply.

2.5.1 Areas without Trees or Brush

- See Section 2.5.3 for equipment requirements.
- If a mounded structure, basal area vegetation cut as close as possible to the ground without compaction, rutting, or smearing.
- For other soil absorption units, mowing of the area may be needed; this activity did not cause compaction, rutting, or smearing.
- No heavy equipment used.
- For any mounded structures, clipped (loose) vegetation removed by raking or blowing off basal area; removal method(s) did not cause compaction or smearing.

2.5.2 Areas with Trees or Brush

- Trees or bush with a trunk diameter three (3) inches or larger are cut as close to the ground as possible, leaving the stump.
- Trees or bush with a trunk diameter of less than three (3) inches have had stumps removed by pulling it out or cut as close to the ground as possible, leaving the stump.
- Organic debris has been removed.
- Areas with excessive litter (e.g. – branches/leaves) have had vegetative matter removed in an acceptable manner. (Raked/blown off).

2.5.3 Mechanical Clearing

Use of mechanical means for clearing is subject to the same limitations that apply in sections 2.4, 2.5.1 and 2.5.2

- Machines with very low ground pressure of less than or equal to 4 psi can be used; for example, skid steers with rubber tracks, and/or small rubber tracked excavators.
- No rubber tire equipment is used, except walk behinds (maximum ground pressure of four (4) pounds per square inch).
- Care is taken to ensure soil compaction and smearing is avoided.

2.6 Layout Plan, Excavation Planning and As-built (Survey Notes)

This three-step approach is given to provide a systematic process for HSTS installation. The process starts with the layout plan. Information from the layout plan is used to develop the excavation plan. During the excavation planning, materials are ordered, excavation sequence (installation sequence) is determined, and job control procedures are developed to ensure that target grades are met. The as-built is your record of the completed installation.

2.6.1. Layout Plan (Step 1 – Required)

A layout plan consists of laying out, in the field, the location of all the components of the HSTS. This layout will assist the installer in planning the execution of the installation of the HSTS. See the guidance in the appendix for further information.

- Minimum of two (2) benchmarks are located, marked, and recorded; these are either permanent features (e.g., top of concrete walk) or they may be temporary; if temporary, benchmark is durable enough to maintain its integrity over the duration of the system installation.
- Various dimensions, such as length and width were physically measured in the field, confirming feasibility of proposed system location in accordance with the installation plan.
- All activities with the layout were consistent, easy to crosscheck, and repeatable, by others, such as inspectors and/or designers.
- **Completed layout plan is required PRIOR TO a scheduled preconstruction conference, or issue of an installer permit.**
- Component installation areas are marked in the field with elevations recorded within the installer's layout plan paperwork. **A copy of this information is given to the Health Department at the preconstruction conference**.

2.6.2 Excavation Plan (Step 2 – Required)

The excavation plan is the step during planning in which the system installation is planned based upon information from the layout plan. The field data is used to estimate the needs to complete the installation, such as material requirements. See the guidance in the appendix for further information.

- Grades projected during the layout plan are those used as target grades.
- Material staging area and haul routes identified, avoiding HSTS components.

2.6.3 As-built (Step 3 – Required)

The as-built is the documentation that records the findings from the layout plan and survey of installed components. It is the as-built drawing ***that is required***. See the guidance in the appendix for further information.

- As-built notes are a continuation of the layout survey.
- As-built notes are recorded in the format given in the appendix; if format used deviates from this, notation is provided showing methodology used.
- **As-built notes are required for all HSTS's**.
- As-built notes record elevations and distances, as required.
- As-built notes record any and all buried electric for the HSTS.
- As-builts drawn neat and properly scaled.

2.7 Homeowner Education

Homeowner education is teaching the end user how to provide the proper care and maintenance for the type of system installed. Also, the end user is given available documentation for the installed system, such as installed product information and warranties, copy of as-built, and installer contact information. The end user is the one that provided the dollars to install it. They have the greatest vested interest in the proper functioning of any HSTS. That is not to say that other involved parties have any less interest, but since they "pay the bill," their's takes priority over other's. It is, therefore, important that the following be accomplished to promote better understanding by the end user. It should emphasize the importance of end user's responsibility to maintain a HSTS to maximize the system performance potential.

- Operation and function of the HSTS control panel and alarm (if applicable) have been reviewed by house occupants.
- General operation of the system is understood by the owner, general contractor, or other responsible party.
- Operation manuals and any warranty information, if applicable, have been given to the owner, general contractor, and/or responsible party.
- Basic system maintenance and monitoring requirements have been explained to the homeowner, general contractor, or other responsible party.
- Septic tank maintenance and care has been explained to the homeowner, general contractor, or responsible party.
- Homeowner, general contractor, or responsible party has information on emergency contact information for that system.
- Installer has ensured that the complete HSTS is functioning as intended prior to normal usage of the HSTS.

2.8 Considerations for HSTS Replacement

The following items are those that require verification prior to beginning field activities.

- Adequate electric circuits to power the HSTS are available.
- "Added costs" due to electrical service panel replacement are included, as applicable.
- Required isolation distances from various features can be maintained.
- Available HSTS area is identified during planning, so that sensitive areas may be protected.
- Presence of leaking pipes below a floor slab, or leaking sumps/crocks allowing groundwater infiltration into the house drain is investigated and eliminated.
- Verification and corrective action, if necessary (applicable permits obtained, for example plumbing permit), ensuring all piping tied into the HSTS is from household wastewater sources. All sources of wastewater are routed to the HSTS.
- Verification and corrective action, if necessary, to ensure no downspout, foundation drain, and/or other non-wastewater sources are routed to the HSTS.
- Discharges of downspouts, foundation drains and/or other non-wastewater sources are directed away from the absorption area.
- Any leaking fixtures properly identified and fixed by the installer/homeowner before final approval.

- Inspection of plumbing and repair, as needed to ensure proper and adequate venting.

During installation:

- Building sewer is replaced, back to the exit of the house.
- House drain is checked for the presence of built-up solids, and cleared, as needed.

3 Section 3.0 Tanks

3.1 Definitions

A tank is a **watertight** vessel, chamber, or vault that is designed to contain a liquid. Several classes of tanks are defined based upon the purpose of the tank. The classes are septic tanks, dosing tank/basins, dosing septic tanks, filtrate sumps and other tanks. Other tanks include, but are not limited to, chlorine contact chambers, upflow filters, sample wells, etc.

Septic tanks are used to provide passive solids and fat/oil/grease removal through sedimentation and floatation. A dosing septic tank is a single unit tank that serves as both the septic tank and a dosing basin. Dosing tank(s)/basin(s) and filtrate sump(s) perform the same task. The difference in terms originates from the type of effluent each receives. A filtrate sump receives liquid from a pretreatment unit while a dosing tank typically receives effluent from a septic tank.

3.2 Scope and Applicability

This section will cover the requirements for the sizing and installation of septic tanks and dosing tanks. It will also provide the requirements regarding the filters, riser lids, etc. It is most important that the manufacturer's installation guidance is followed. This manual reflects that guidance, but the manufacturer (or tank vendor) must be consulted to obtain Health Department approved guidance directly from them.

3.3 General

The following are general requirements for all tanks that are part of an HSTS. These will apply to all tanks regardless of location or function within the HSTS.

- Septic tank approved by the Ohio Department of Health (ODH) for use in the state of Ohio.
- ***Tanks are watertight.***
- ***Riser-tank connections are watertight.***
- ***Inlet and outlet seals are watertight and meet fabrication specifications of ASTM C-923. No tear seal gaskets are permitted.***
- ***All tanks must be bedded (set) on gravel or manufacturer's recommended approved granular material (see 3.6.1.9) to a depth of 4 inches.***

- ***Tank is installed such that end to end elevation difference is one (1) inch or less.***
- Any rubber boot type fitting is secured with clamps fabricated from high-grade stainless steel.
- Tank is installed per Health Department approved manufacturer's recommendations, for all tanks.
- In-field watertight tank test per Health Department's requirements is performed and meets performance specifications.
- Tank was ballasted against floatation once set.
- Tanks must be approved by the manufacturer for installation and operation in the situation that they will be used.
- For Aerobic Treatment Systems, the guidance provided within Section 3.6 applies.
- For proprietary treatment systems requiring special consideration due to the possibility that the system may be incorrectly loaded, the Minimum Operating Capacity (MOC) can be sized to the manufacturer's specifications when preauthorized by the Health Department. All other capacities must be met.

3.4 Primary Tank Sizing

The following subsections are the requirements for the size or capacity of the septic tank and tank combinations for all HSTS's. These subsections are broken down by the type of HSTS's. The types are Advanced Technology, Dosed Conventional Systems and Gravity Conventional Systems. Advanced Technology HSTS's are ones that utilize a timer or other means to control the frequency of dosing, not including demand dosed HSTS's. Dosed Conventional Systems are HSTS's that are dosed by demand (i.e. – dosing controlled solely by liquid levels in the dose tank). Gravity Conventional Systems are HSTS that deliver water to treatment components by gravity due to inflows into the septic tank (e.g. – conventional Leach line).

The total volume of the septic tank was derived from the individual volume requirements for various capacities. The following definitions are given to assist in using the following table:

- Daily Design Flow (DDF): Peak flow capacity of the system, based upon 120 gallons per bedroom per day. Minimum of 360 gallons per day (gpd).
- Emergency Reserve Capacity (RC): Tank capacity located above the level at which the high water alarm is activated.
- Minimum Operating Capacity (MOC): Tank capacity located between tank bottom and lowest operating liquid level for primary treatment in the tank (tank portion that provides settling and floatation of solids).
- Surge Capacity (SC): Tank capacity located between minimum operating capacity and emergency storage capacity; that is, between the lowest operating liquid levels maintained in the tank for primary treatment and the level of the high water alarm activation. *Applicable to time dosed HSTS.*

- Dose Capacity (DC): Tank capacity located between the dosing pumps "ON" float position and "OFF" float position. *Applicable to demand controlled/demand dosed HSTS.*
- Functional Capacity: Usable capacity to meet design objectives. Includes RC, MOC, SC and DC.

- Non-Functional Capacity: The volume required to satisfy conditions imposed by various factors. For example, the volume of water required to submerge a pump in a dosing basin or dosing septic tank is non-functional capacity. Also, demand-dosing systems are required to maintain two (2) inches between the high water alarm and the "ON" elevation of a float; this is non-functional capacity.

3.4.1 Advanced Technology Systems

Two approaches to operating a timed dosed system exist within the county. Differences in these approaches affect the volume of required surge and reserve capacities in a tank. The overall minimum tank(s) size does not change. One approach is the 80/80 Surge/Reserve. The other is the 65/100 Surge/Reserve. The approach used is dependent upon the type of advanced technology system installed. The following is guidance defines which approach is used for various systems.

80/80 Surge/Reserve	65/100 Surge/Reserve
Type "G" – Millennium Mound	Type "A" – Modified Mounds
	Type "B" – Modified Mounds
	Type "E" – Modified Mounds

Table 3-1 System Type and Surge/Reserve Protocol Applied

3.4.1.1 80/80 Surge/Reserve

The following items are the tank volume requirements for HSTS defined in Section 3.4.1 under the 80/80 Surge/Reserve category. Tank or tank combinations have functional capacities for the sum of all of the following (Table 3-2 summarizes the volume requirements based upon the number of bedrooms);

1. 80% DDF = *Emergency Reserve Capacity (RC)*
2. 80% DDF (based upon actual float settings in the tank) = *Surge Capacity(SC)*
3. Minimum of 250% of DDF = *Minimum Operating Capacity*
4. Volume to submerge a pump (for dosing basins and dosing septic tanks), if applicable
5. Tank or tank combinations must always meet ODH minimums. If the sum of 1., 2., 3., and 4., above, is greater than the ODH minimum, then that capacity shall be used.

The 80/80 surge/reserve criteria uses a different dosing regimen than the 65/100 surge/reserve criteria. The 80/80 surge/reserve requires that a HSTS be dosed based upon an average flow rate and, if necessary, upon a peak flow rate. 60% of the daily design flow is the average daily design flow rate, while the peak design daily flow rate is 100%. Equations for computing the average and peak flows follow. Note that this design regimen is set up to evenly distribute the *average* DDF over the course of a day. If water use exceeds average flow rate conditions, then the system will dose the HSTS based upon the peak flow rate. This results in variations in the "OFF" time of the dosing.

Number of Bedrooms	Daily Design Flow, "DDF" (gal/day/bdrm)	Minimum Operating Capacity, "MOC" (gal)	Surge Capacity, "SC" (gal)	Reserve Capacity "RC" (gal)	Sum "MOC", "SC" & "RC" (gal)	ODH Minimum Tank Size (gal)	Minimum Required Tank Size (gal)
1-3	360	900	288	288	1,476	1,500	1,500
4	480	1,200	384	384	1,968	2,000	2,000
5	600	1,500	480	480	2,460	2,000	2,000
6	720	1,800	576	576	2,952	2,500	2,500
7	840	2,100	672	672	3,444	2,500	2,500

Table 3-2 80/80 Surge/Reserve Capacity Breakdown of Volume Requirements

The equation for the ***average DDF*** is:

$$DDF_{average} = (0.6) \times DDF_{dailydesignflow}$$

Equation 3-1 Computing Average DDF

The equation for the ***peak DDF***

$$DDF_{peak} = (1.0) \times DDF_{dailydesignflow}$$

Equation 3-2 Computing Peak DDF

The following table, Table 3.1b, provides values of average & peak DDF for two (2) thru six (6) bedroom HSTS's.

Number of Bedrooms	Peak DDF (gal/day)	Average DDF (gal/day)
1- 3	360	216
4	480	288
5	600	360
6	720	432

Table 3-3 Peak and Average Daily Design Flows

3.4.1.2 65/100 Surge/Reserve

The following items are the tank volume requirements for HSTS defined in Section 3.4.1 under the 65/100 Surge/Reserve category. Tank or tank combinations have functional capacities for the sum of all of the following (Table 3-4 summarizes the volume requirements based upon the number of bedrooms);

1. 100% DDF = *Emergency Reserve Capacity (RC)*
2. 65% DDF (based upon actual float settings in the tank) = *Surge Capacity(SC)*
3. Minimum of 250% of DDF = *Minimum Operating Capacity*
4. Volume to submerge a pump (for dosing basins and dosing septic tanks), if applicable
5. Tank or tank combinations must always meet ODH minimums. If the sum of 1., 2., 3., and 4., above, is greater than the ODH minimum, then that capacity shall be used. (See the last column in Table 3.2 for guidance).

The 65/100 surge/reserve criteria uses a different dosing regimen than the 80/80 surge/reserve criteria. The 65/100 surge/reserve requires that a HSTS be dosed based upon the number of doses desired over the course of one day. For both normal and peak modes the 100% of the DDF is used.

Number of Bedrooms	**Daily Design Flow, "DDF"** (gal/day/brm)	**Minimum Operatin g Capacity, "MOC"** (gal)	**Surge Capacity, "SC"** (gal)	**Reserve Capacity "RC" (gal)**	**Sum "MOC", "SC" & "RC"** (gal)	**ODH Minimum Tank Size** (gal)	**Minimum Required Tank Size** (gal)
1-3	360	900	360	234	1,494	1,500	1,500
4	480	1,200	480	312	1,992	2,000	2,000
5	600	1,500	600	390	2,490	2,000	2,000
6	720	1,800	720	468	2,988	2,500	2,500
7	840	2,100	840	546	3,486	2,500	2,500

Table 3-4 65/100 Surge/Reserve Capacity Breakdown of Volume Requirements

3.4.2 Demand Dosed Conventional System

Demand dosed conventional systems include only: dosed leach lines. In Brown County, these HSTS's are not required to have a Service Provider Agreement for the life of the HSTS.

The following is the general tank sizing criteria for this type of HSTS. For specific information on the tankage requirement of this system, see Section 3.4.2.1 Dosed Leach Lines.

- Tank or tank combinations have functional capacities for the ***sum*** of all of the following:
  1. Minimum of 100% of DDF = *Emergency Reserve Capacity*
  2. Minimum of 100% of System Specific Dose Volume = *Dose Volume Capacity*
  3. Minimum of 250% of DDF = *Minimum Operating Capacity*
  4. Volume to submerge a pump and other non-functional capacities (for dosing basins and dosing septic tanks), if applicable.

5. Tank or tank combinations must always meet ODH minimums. If the sum of 1, 2, 3, and 4, above, is greater than the ODH minimum, then that capacity shall be used. (See the last column in Table 3.4 for guidance).
6. For proprietary systems, tank capacities must *also* meet the manufacturer's minimum specifications, if different than what is stated above.

The following general formula is used to guide the sizing of tank(s) for a d*emand dosed conventional system*:

$$TankageVolume = \left[2.5 \times DDF\right] + \left[DoseVolume\right] + \left[1.0 \times DDF\right] + \left[Non - FunctionalCapcity\right]$$

Equation 3-3 Computing Demand Dose System Tank Volume Requirements

The tankage volume calculated by the above equation is used for general guidance or consideration of proposing changes to the required tankage. The result of the above equation is to be checked against the minimum tankage volumes dictated by ODH. The larger of ODH minimum tank volumes and Tank volume calculated based on minimum functional capacities is selected for a given number of bedrooms.

3.4.2.1 Dosed Leach Lines

The following are allowable tank/tank combinations that are available for this type of HSTS. Please note that the listed tank volumes are minimum volumes. ***Note: Any deviations or changes to the following tankage guidance must be pre-approved by the Health Department.***

HSTS Size Criteria	Allowable Tank/Tank Combinations
1-3 Bedroom	1,500 gal Septic Tank & 1,000 gal Dosing Tank 2,000 gal Dosing Septic Tank (Style #2, only)
4 Bedroom	2,000 gal Septic Tank & 1,000 gal Dosing Tank

Table 3-5 Dosed Leach Lines Tank Sizing Guidance

3.4.3 Gravity Conventional System

Table 3-6 gives the minimum tank or tank combination volumes that are required for gravity conventional HSTS's. (Note that for a one (1) or two (2) bedroom HSTS the minimum total volume is fifteen hundred (1,500) gallons).

Number of Bedrooms	Minimum Required Tank Capacity (gal)
1-3	1,500
4	2,000
5	2,000
6	2,500
7	2,500

Table 3-6 Gravity Conventional System Tank Sizing (Brown County)

3.4.4 Primary Tank Volume Reductions

The volumes within the primary tank may be reduced based on the following:

3.4.4.1 Non-Proprietary Treatment Systems

These types must provide the following:

- The HSTS is based upon flows equivalent to a four bedroom or larger home, **AND**
- The HSTS control panel is equipped with telemetry which alerts a contracted registered service provider and the Brown County Health Department by phone **or** internet, twenty four (24) hours a day/seven (7) days a week, when there is an alarm condition in the HSTS. A maximum of twenty four (24) hours is permitted between the time of the alarm and response by the service provider.
- The homeowner must sign off to acknowledge the reduction.
- The reductions must be pre-approved by the Health Department, prior to installation.

Therefore:

- Sixty (60) percent of Daily Design Flow = *Emergency Reserve Capacity*
- Sixty (60) percent of Daily Design Flow (based on actual float settings in the tank) = *Surge Capacity*
- The reductions must be pre-approved by the Health Department, prior to installation.

3.4.4.2 Proprietary Treatment Systems

These types must provide the following:

- The system has the current NSF Standard 40 rating or equivalent , **AND**
- The HSTS control panel is equipped with telemetry which alerts a contracted registered service provider and the Brown County Health Department by phone **or** internet, twenty four (24) hours a day/seven (7) days a week, when there is an alarm condition in the HSTS. A maximum of twenty four (24) hours is permitted between the time of the alarm and response by the service provider.
- The reductions must be pre-approved by the Health Department, prior to installation.

Therefore:

- Sixty (60) percent of Daily Design Flow = *Emergency Reserve Capacity*
- Sixty (60) percent of Daily Design Flow (based on actual float settings in the tank) = *Surge Capacity*
- The reductions must be pre-approved by the Health Department, prior to installation.

3.5 Location and Depth of Placement

The location and depth of the tank must be planned. The following items are to be considered during this planning;

- Tank location complies with Health Department isolation distances. Some of these isolation distances are as follows:
  - **10 ft from structures and property lines.**
  - **50 ft from a Private Water System.**
- Tank depth does not exceed the manufacturer's recommendation or the following maximum burial depths(whichever is less):
  - For **<u>Gravity Systems</u>, maximum burial depth = two (2) feet**.
  - For **<u>Pumped Systems,</u> maximum burial depth = two (2) feet**.
- Tank depth does not exceed the Health Department's maximum for allowable riser height(s) for conventional and advanced technology. The exception may be some repair/replacement scenarios with pre-approval by the Health Department.
- Depth and location verified to meet the conditions of this section on the installation/excavation plan, prior to commencement of field activities.
- Tank location allows for ease of service.
- ***Design constraints of tanks override all other considerations, but will need Health Department approval.***

3.6 Tank Installation

Today's market offers varying tank choices based upon material and construction. Pre-cast concrete (PCC) tanks, plastic tanks and fiberglass tanks are available for use in HSTS. Any of these choices provides a viable means to achieve the goals. Each type of tank, however, does require specific installation practices that are specified by a manufacturer, or manufacturer's association to ensure a good tank installation. Guidance in this manual will be provided on the tank's material of construction. ***Installers should <u>always</u> consult with the tank vendor/manufacturer to obtain the Health Department approved guidance on the installation of that specific tank.***

3.6.1 Precast Concrete (PCC) Tanks

"Proper installation of the tank is absolutely necessary for maintaining the watertightness produced in the plant. Many of the problems experienced with leakage can be attributed to incorrect procedures during installation." (Stated in the National Precast Association Septic Tank Manufacturing Best Practices Manual)

3.6.1.1 Tank Excavation

- Follows Health Department approved manufacturer's specifications.
- Firm and uniform base of virgin soil; any soft or organic soils were removed.
- OSHA trenching and shoring guidelines followed.

3.6.1.2 Tank Bedding

- Provides a level bearing surface, free of rocks, boulders and deleterious material. Deleterious material is any material that may have a harmful effect. Some examples are organic debris and materials not meeting specifications.

- **Minimum of four (4) inches of clean gravel is provided**, or greater if required by the tank manufacturer. **(*<u>Do Not Use ODOT Item 304 or other "crusher run" stone</u>*)**
- When rock is encountered in the excavation, a minimum of six (6) inches of clean gravel is provided, or greater if required by the tank manufacturer.
- **Tank delivery driver will need to sign off on the sale ticket that tank was bedded properly. If installer cannot provide this signature then he or she will need to prove to the Brown County Health Department that the tank was bedded (no photographs are allowed).**

3.6.1.3 Tank Joint Seals

(The following applies to two (2) piece PCC Tanks)

- Joint preparation and sealing performed in accordance with the most recent National Precast Concrete Association Tank Manufacturing Best Practices Manual and in accordance with the Health Department approved manufacturer's specifications.
- Joint/sealant allowed to fully compress before the tank was backfilled (Check with tank manufacturer for joint sealant settling time versus ambient temperature requirements to allow full compression).

3.6.1.4 Tank Backfilling

- Backfill material is a Health Department approved gravel or sand listed in Section 4.0 Aggregates. (***<u>Do not use ODOT Item #304 or other "crusher run" stone.</u> No soil backfill is to be placed below the pipe inverts***.
- Aggregate (gravel, sand or combination thereof) placed to elevation of the inverts of the inlet and outlet, providing uniform support. Health Department approved manufacturer's backfilling procedure followed if more stringent than specified in this section. ***No soil backfill is to be placed below the inverts.***

3.6.1.5 Tank Riser(s)/Riser(s) Connection(s)

- See Section 3.9 Risers/Lids for general requirements.
- Riser or riser adapters are cast into the tank top for securing the riser, **or** risers are monolithically cast into the top of the tank.
- Tank-to-riser connections utilizing a non-mechanical, "grooved" or "flat" connection are not permitted. "grooved" or "flat" connections typically rely upon an adhesive strip for securing the riser to the tank body. Tar strip is **NOT** permissible to achieve the primary seal for this connection.

3.6.1.6 Tank Inlet/Outlet Pipe Connectors

- Connectors are ***watertight.***
- Connectors provided are cast as part of the tank.

- Boot style connectors or compression seals, meeting or exceeding ASTM C-923, for materials and performance, provided. Tear seal type gaskets are **NOT** permitted.
- Rubber boot type fitting secured with clamps fabricated from high-grade stainless steel, which cannot be magnetized.
- Mortar, pipe-to-pipe couplings, mastics or sand collars grouted in cored holes are not used to seal a pipe to a tank.
- Hydraulic cement, silicone sealant, latex caulks, mortar, mastics or tar strips **ARE PROHIBITED** for use of achieving a watertight seal.

3.6.1.7 Final Grade

- Final grade gives a minimum uniform slope away from the tank/risers of 16H:1V (six (6) inches of fall in eight (8) feet).
- Tank backfill adequately compacted to reduce the potential forming of depressions around the tank, due to settlement.
- Final grade does not cause minimum or maximum burial depths to be exceeded. (Check with tank manufacturers for minimums).
- Maximum burial depth for PCC tank is two (2) feet or less depending on structural strength. Any septic tank depth greater than 2 feet will need Health Department approval. (Ease of access, servicing and inspection). *See Section 3.5 for required burial depths based upon pumped or gravity system.*

3.6.1.8 Protection

- ***"If the water level in the hole is allowed to rise to a high level, concrete tanks can float. To prevent floatation during backfilling, fill the tank with water, place soil on top of the tank or keep water pumped out of the hole until backfilling is completed."*** (Stated in the National Best Practices Precast Concrete Association Septic Tank Manufacturing Best Practices Manual).
- Protection is provided to prevent vehicle damage to risers, lids and tanks during and after installation from construction equipment or vehicles.
- Note: Any dirt placed on top of the septic tank will still need to allow the tank to be checked for proper backfill.

3.6.1.9 Reference

<u>Best Practices Manual</u>
National Precast Association
10333 North Meridian Street
Suite 272
Indianapolis, IN 46290
(Voice) 800.366.7731 or 317.571.9500

(Fax) 317.571.0041
www.precast.org

3.6.2 Fiberglass Tanks

The following guidance applies to tanks that are fabricated from fiberglass materials. This guidance is NOT intended to replace Health Department-approved vendor and/or manufacturer's specifications for the installation of these types of tanks.

3.6.2.1 Tank Excavation

- Dimensions as required by the manufacturer.
- Firm and uniform base of virgin soil. If bedrock is encountered, contact tank manufacturer for further guidance.
- Any soft or organic soils removed.

3.6.2.2 Tank Bedding

- Provides a level bearing surface, free of large rocks, boulders and deleterious material.
- Bedding type and thickness provided per Health Department-approved manufacturer's requirements.

3.6.2.3 Tank Seam

- Tank seam tested at time of assembly to ensure a watertight joint.

3.6.2.4 Tank Backfilling

- Backfill material was granular material per Health Department-approved manufacturer's specifications. ODOT Item #304 or other "crusher run" material was not used to backfill tank.
- Backfill type flows easily under haunches of tank body and into ribs of tank. Rodding of backfill may be necessary to ensure intimate contact of backfill with tank body below the springline (mid-seam) of the tank.
- Backfill was free of deleterious material.
- Level of water inside the tank did not exceed the level of fill outside the tank.
- Tank backfill provides uniform support of piping entering and exiting the tank.

3.6.2.5 Tank Riser(s)/Riser Connection(s)

- See Section 3.9 Risers/Lids for general requirements.

3.6.2.6 Tank Inlet/Outlet Pipe Connectors

- Connections are watertight.
- Connectors are provided as part of the tank.
- Connectors meet or exceed material/fabrication specifications of ASTM C-923. Tear seal type gaskets are **NOT** permitted.
- Connectors bonded to the tank per manufacturer's specifications.

- Hydraulic cement, silicone sealant, latex caulks, mortar, mastics or tar strips **ARE PROHIBITED** for use in achieving a watertight seal.
- If a rubber boot connector is used, high-grade stainless steel clamp used for securing boot to pipe.

3.6.2.7 Final Grade

- Final grade gave a minimum uniform slope away from the tank/risers of 16H:1V (six (6) inches per eight (8) feet).
- Tank backfill adequately compacted to reduce the potential for formation of depressions around the tank.
- Did not cause the maximum or minimum burial depth to be exceeded.

3.6.2.8 Protection

- Fiberglass tanks must be protected against floatation. Measures must be taken to provide ballast against this action (e.g. – water in tank).
- Unless certified by the manufacturer, vehicle traffic is not permitted on top of installed tank.
- Protection is provided to prevent damage from vehicle traffic to risers, lids or tanks.

3.6.3 Plastic Tanks

The following guidance applies to tanks that are fabricated from plastics. This guidance is not intended to replace vendor and/or manufacturer specifications for the installation of these types of tanks. It is extremely important that the Health Department approved manufacturer's specifications for these tanks are followed.

3.6.3.1 Tank Excavation

- Dimensions as required by the tank manufacturer.
- Firm and uniform base of virgin soil provided. If bedrock is encountered, contact tank manufacturer for further guidance.
- Any soft or organic soils were removed.

3.6.3.2 Tank Bedding

- Provided a level bearing surface, free of rocks, boulders and deleterious material.
- Bedding type and thickness provided per Health Department approved manufacturer's requirements.

3.6.3.3 Tank Backfilling

- Backfill material was granular material per Health Department- approved manufacturer's specifications. ODOT Item #304 or other "crusher run" material was not used to backfill tank.
- Backfill flows easily under haunches of tank body and into ribs of tank. Rodding of backfill may be necessary to ensure intimate contact of backfill with tank body below the springline of the tank.

- Backfill was free of deleterious material.
- Level of water inside the tank did not exceed the level of fill outside the tank.
- Tank backfill provides uniform support of piping entering and exiting the tank

3.6.3.4 Tank Riser(s)/Riser Connection(s)

- See Section 3.9 Risers/Lids for general requirements.
- Riser seal is in accordance with Health Department-approved manufacturer's specifications.

3.6.3.5 Tank Inlet/Outlet Pipe Connectors

- Connectors are watertight.
- Connectors are provided as part of the tank.
- Connectors meet or exceed material/fabrication specifications of ASTM C-923. Tear seal type gaskets are **NOT** permitted.
- Connectors bonded to the tank per manufacturer's specifications.
- Hydraulic cement, silicone sealant, latex caulks, mortar, mastics or tar strips **ARE PROHIBITED** to achieve the primary watertight seal.
- If a rubber boot connector is used, high-grade stainless steel clamp used for securing boot to pipe.

3.6.3.6 Final Grade

- Final grade gave a minimum uniform slope away from the tank/risers of 16H:1V (six (6) inches per eight (8) feet).
- Tank backfill adequately compacted to reduce the potential for settlement forming depressions around the tank.
- Did not cause the maximum or minimum burial depth to be exceeded.

3.6.3.7 Protection

- Plastic tanks **MUST** be protected against floatation. Measures must be taken to provide ballast against this action (e.g. – maintain water in the tank).
- Unless certified by the manufacturer, vehicle traffic is not permitted on top of the tank.
- Protection is provided to prevent vehicle damage to risers, lids and tanks.

3.7 Dosing Basins/Filtrate Sump

The following section will apply to basins or sumps used to collect/store effluent from a pre-treatment component such as a textile packed bed filter, peat packed bed filter or intermittent sandfilter for the purpose of pumping to the next component within a treatment train. Typically, these are used for the purpose of dosing the mound component of the treatment train. The following apply to all dosing basins/filtrate sumps.

- The minimum size of the basin based upon the sum of the following:
  - Volume of water needed to keep the pump submerged (if required by the manufacturer).

    - Dose volume for the next component in the treatment train.
    - Drainback volume for freeze protection.
- It must also be sized so that:
    - Effluent quality is not degraded significantly.
    - Inlet invert and any weep hole must be allowed to drain freely at the maximum, typical, water level.
- Dosing basins/ filtrate sumps are ***watertight***. Compliance with this watertight requirement is demonstrated by a field test of watertightness.
- Pipe connectors are watertight.
- Pipe connectors meet or exceed material/fabrication specifications of ASTM C-923. Tear seal type gaskets are **NOT** permitted.
- Connectors bonded to the tank/basin per manufacturer's specifications.
- Hydraulic cement, silicone sealant, latex caulks, mortar, mastics or tar strips **ARE PROHIBITED** to achieve the primary watertight seal.
- If a rubber boot connector is used, high-grade stainless steel clamp used for securing boot to pipe.

The following items apply to dosing basins that are fabricated from larger diameter pipe sections or other materials to serve as a dosing basin. These do not apply to dosing basins/filtrate sumps that are furnished as a tank. These types of dosing basins are subject to the conditions of Section(s) 3.6.1, 3.6.2 and 3.6.3, according to the material of fabrication.

- Minimum dimensions;
    - Circular: Eighteen (18) inches
    - Square: Eighteen (18) inches, along the shortest length
- Constructed of rigid, watertight construction. Interior wall is smooth. Compliance with this watertight requirement is demonstrated by a field test of watertightness.
- Corrugated pipe that is not smooth on the interior is **NOT** acceptable.
- Extends a minimum of four (4) inches above grade.
- Fitted with an appropriate childproof lid. (See Section 3.9)

3.8 Effluent Filter

An effluent filter is a device that is used to separate solids from liquids. These are primarily used to filter the effluent from a septic tank. Aerobic HSTS, which are designed to digest solids, do not have to meet these specifications. The following are the requirements for all effluent filters installed in the county. All effluent filters must meet the conditions of Section 3.8.1 and also Section 3.8.2.

3.8.1 General

- Effluent filters are installed on any treatment system(s), dosed with primary effluent, including time dosed and demand dosed systems.
- Effluent filter installed to allow easy removal for inspection and maintenance. Effluent filter installed in such a manner that piping and pump(s) do not have to be removed for inspection and maintenance.

- Effluent filter used meets the conditions of Section(s) 3.8.1.1, 3.8.1.2 or 3.8.1.3.
- It is required that an effluent filter be installed on **ALL** systems.

3.8.1.1 Residential Grade

- Meet the requirements of Section 3.8.1 General.
- Filter is rated for residential use.
- Filter handle is installed within ten (10) inches of the top of the riser.
- A commercial filter may be substituted for a residential filter.

3.8.1.2 Commercial Grade

- Meet the requirements of Section 3.8.1 General.
- Filter is rated for commercial use.
- Filter offers a minimum usable surface area that does not require inspection/service at an interval less than normal maintenance intervals for the total system when the filter is installed as part of a system.
- Filter has a minimum open area equal to or greater than one hundred (100) square inches.
- Filter handle is installed within ten (10) inches of the top of the riser.

3.8.1.3 Dosing Septic Tank Effluent Filters

3.8.1.3.1 Screen Vault Filter (Style 1 Tank)

Filters used within a Style 1 dosing septic tank meet the following:

- Filter meets the requirements of Section 3.8.1 General.
- Screen vault filter capable of retaining any solid that is larger than one eighth (1/8) inch as liquid passes through the filter.
- Installed pump does not exceed the filter's maximum flow rate.
- Filter inlet holes are within the clear zone of the tank.
- Screen vault filter has a minimum open area equal to or greater than five hundred (500) square inches.

3.8.1.3.2 Special Effluent Filters (Style 2 Tank)

The following effluent filter specifications apply to applications of non-shared liquid level dosing septic tanks (Style 2) utilized in HSTS that are not currently required to have a maintenance contract.

- Meet the requirements of Section 3.8.1 General.
- Filter is rated for commercial use.
- Filter is capable of filtering solids that are 1/32 inch and larger.
- Filter has a minimum surface area of 2,850 square inches.
- Filter has an open area of 770 square inches.
- Filter handle is installed within ten (10) inches of the top of the riser.

3.8.2 Application of Commercial Grade, Residential Grade and Special Effluent Filters

The following table defines which effluent filter is to be installed for a given set of conditions. For Type "G" Structures, see Section 3.8.1.3.1

HSTS Type & Tanks	Residential Grade	Commercial Grade	Special Effluent Filter Types
Separate Septic & Separate Dosing Tank	**XXX**	---------	---------
Style #2 – Dosing Septic Tank	---------	---------	**XXX**
Septic Tank into Leach Line (Gravity)	**XXX**	---------	**---------**

Table 3-7 Commercial and Residential Grade Effluent Filter Use

3.9 Risers/Lids

The following guidance applies to all risers used on any tank/basin (See Section 3.6.1.5, 3.6.2.5, and 3.6.3.4).

Risers

- Riser-to-tank seal is **watertight**.
- Riser-to-tank seal is in accordance with riser manufacturer's specifications.
- Riser seals are not affected by backfilling activities.
- Riser-to-tank seal is **NOT ATTAINED** with silicone sealant, latex caulks, hydraulic cement, mortar, mastics or tar strips.
- Riser seal is sealed with product meeting manufacturer's specifications.
- If plastic risers are used, all contact surfaces are roughened prior to the application of adhesive.
- Allowable limit of riser-riser and riser-tank connections below grade.
    - One (1) watertight riser-riser connections permitted below grade per riser.
    - One (1) watertight riser-tank connection permitted below grade per riser.
- Minimum riser size:
    - Circular
        - Twenty-four (24) inches in diameter for risers containing pumps or other components requiring routine service.
        - Eighteen (18) inches in diameter for tank access for other risers.
    - Square
        - Twenty-four (24) inches, along the shortest side, for risers containing pumps or other components requiring routine service.

        - Eighteen (18) inches, along the shortest side, for tank access for other risers.
- Riser constructed of rigid, watertight sidewall construction.
- Riser extends four (4) inches above grade.
- Risers capable of resisting forces from frost heave without movement.
- Number of riser extensions is minimized. (e.g. – If 12 inches of extension is needed, use a single 12 inch section, not two 6 inch sections).
- Final grade was to lid of the riser and gave a minimum uniform slope away for 16H:1V (or six (6) inches of fall per eight (8) feet).

Lids

- Child proof lid of the following types provided for each riser and/or pump basin:
- Lid capable of supporting three hundred (300) pounds with minimal deflection.
- Securing lids of different types:
    - Concrete:
        - Minimum weight – sixty (60) pounds
        - Maximum weight – eighty (80) pounds
    - Other:
        - Bolted with three (3) stainless steel, $^{3}/_{16}$ inch, hex heads or other approved fastener may be used.

3.10 Watertight Tank Field Test

All tanks used for advanced technology and dosed systems must be tested in the field for watertightness. ***The Health Department must witness this test.*** It is necessary that the installer perform this test before the certifying test. Tanks used for gravity conventional systems are not subject to the watertight test. However, these tanks must be fabricated and installed to the specifications in Section 3.0.

Two procedures are given for the watertight field test. One is for PCC tanks; the other is for fiberglass/plastic tanks. The difference in the tests is to accommodate the different requirements between PCC tanks and fiberglass/plastic tanks.

3.10.1 PCC Tanks (includes filtrate sumps) – Watertight Field Test Procedure

This procedure is presented in a step-by-step fashion (if there are any questions please contact Brown County Health Department):

1. Check surface of tank for any cracks, honeycomb, or other possible points of concern. Mark those areas, so that they can be spotted easily.
1. Install tank, risers, inlet and outlet pipes per Health Department-approved manufacturer’s specifications and Health Department’s requirements.
2. Place back-fill to a reasonable depth outside of the tank that: 1) allows detection of any leakage at the points of concern (cracks, honeycomb and / or seam), and 2) provides adequate support of the tank walls.

3. Fill tank to water level above the lowest point of concern to demonstrate water tightness, or a leak.
    a. If leakage is observed:
        i. Contact tank vendor to have leak repaired or tank replaced.
        ii. Repeat above steps, as required
4. As tank proves water tightness, increase backfill depth and the water depth for the next higher point of concern, as in steps 3 and 4.
5. Repeat, as in step 5, for each pipe penetration.
6. Continue to fill tank to two inches above the riser-to-tank seal. Allow tank to sit for twenty-four (24) hours to absorb water.
7. Add water to two inches above the riser-to-tank seal. Caution: Adding too much water in the riser risks causing pressure to possibly damage the tank. ***<u>NOTE</u>***: If a second riser is added to the tank then installer will need to have guidance from the tank manufacture that is approved by the Health Department, as to how the secondriser can be tested fro watertightness.
8. ***Water adjacent to the exterior of the tank is removed so that ponding is below the lowest point of concern.*** ***<u>NOTE</u>***: Water ponded within the tank excavation above this point is cause for failure of Health Department witnessed test.
9. ***<u>STOP.</u>*** Health Department must witness watertight test. The following steps are performed by the Health Department:
    a. Water level within the riser is marked and time noted.
    b. After one (1) hour, water level is checked against mark.
    c. If water level has not changed: tank passes. If water level changes: Tank is not watertight. Installer must take corrective action to find and repair leakage. After corrective action taken, steps a) thru c) are repeated.
    d. Test failure and repairs will be documented in the inspection record.

3.10.2 Plastic/Fiberglass (including filtrate sumps) – Watertight Tank Field Test Procedure

This procedure is presented in a step-by-step fashion (if there are any questions please contact Brown County Health Department):

1. Install tank, risers, inlet and outlet pipes per Health Department approved manufacturer’s specifications and Health Department’s requirements.
2. Backfill tank per Health Department-approved manufacturer’s specifications. Water must be added to the tank per the Health Department-approved manufacturer’s specifications.
3. Add water to test each pipe penetration.
4. Add water two (2) inches above the tank/riser joint. ***<u>NOTE</u>***: If a second riser is added to the tank then installer will need to have guidance from the tank manufacture, that is approved by the Health Department, as to how the second riser can be tested for watertightness.
5. ***Water adjacent to the exterior of the tank is removed so that ponding is below the tank lowest point of concern***. ***<u>NOTE</u>***: Water ponded within the tank

excavation above this point is cause for failure of Health Department witnessed test.

6. ***STOP.*** Health Department must witness watertight test. The following steps are performed by the Health Department:
    a. Water level within riser is marked and time is noted.
    b. After one (1) hour, water level is checked against mark.
    c. If water level has not changed: Tank passes. Water level changes: Tank is not watertight. (The installer must take corrective action to find and repair the leakage). ***NOTE****: Tank repairs must be made in accordance with the manufacturer's specifications that are acceptable to the Health Department.* After corrective action was taken, above Steps a. thru c. is repeated.
    e. Test failures and repairs will be documented in the inspection record.

NOTE: Piping used in the watertight field test penetrating the tank must become part of the permanent system. Pipe segments cannot be removed after successful completion of this test.

3.11 Pump Installation

This section applies to HSTS's relying upon a pump to dose a HSTS component, such as a proprietary pretreatment unit(s) or mound.

- Pump capable of supplying the required flow rate and Total Dynamic Head (TDH) to provide distribution, as required by the design.
- Pump discharge piping has a solvent welded, horizontal quick disconnect within ten (10) inches of the top of the riser.
- Lift rope supplied and secured to pump and pipe, as required.
- Electric installed per Section 8.0 Electric.
- Centrifugal pump is on a minimum of six (6) inch block, off the bottom.
- Turbine type pumps must be within an adequate flow inducer design approved by the pump manufacturer.
- Check valve is installed, if applicable (will require Brown County Health Department approval).
- Gate valve installed in line with the pump discharge assembly, downstream of the horizontal quick disconnect.
- Removal of a filter or screen from a pump vault can be done without removing the pump and without lifting the vault.
- Flow rate of pump verified by measuring flow rate in field, by either the timed draw down test, or other pre-approved method.

3.11.1 Flow Rate Testing of Installed Components

For Advanced Technology HSTS's, it is important that the flow rate of the installed, adjusted system be measured. This is particularly true for component pumps that are controlled by a timer. In order to measure the flow rate of any HSTS, the following items must be completed before the flow rate test.

- All fittings and pipe segments are solvent welded.

- Distribution network was properly flushed (See Section 5.14).
- Weep hole properly drilled.
- Operating head was properly set (See Section 5.9.1).
- Distribution network cleanouts are closed or open cleanouts have a distal tube in place.

Section 3.11.1.1 is the only Health Department approved method for determining the flow rate of a system.

3.11.1.1 Timed Draw Down Test

This test measures the amount of liquid pumped for a given period of time (typically two (2) minutes). The amount of liquid pumped is calculated using tank geometry and water level measurements. Accuracy of timed draw down tests should improve if measurements are done while a system runs at a steady operating head. Testing at a steady head condition eliminates the error introduced when a draw down is timed while the distribution network is filling with water.
The following is the procedure for the Timed Draw Down Test:

1. No flows coming into the tank (inlet sealed, if necessary).
2. Liquid level in the tank is within the ***expected normal operating range*** for the system design.
3. Allow pump to run until water is in the correct operating head on all distal tubes.
4. Measure to the nearest eighth ($^1/_8$) inch the distance from a straight edge across the riser opening to water surface. Record this measurement and start timing for two (2) minutes.
5. Run the pump for two (2) minutes (or other specified time period) at a steady operating head.
6. Repeat Step 3 immediately, measuring from the straight edge to the water surface again.
7. Compute gallons pumped, based on tank volume tables.
8. Divide gallons pumped by the time measure at a steady operating head to compute flow rate in gallons per minute.

3.12 Floats/Transducers Settings

This section provides general guidance on the set-up of float switches for time-dosed systems and demand-dosed systems.

3.12.1 General

The following items apply to any and all floats within an HSTS, regardless of location or application.

- Narrow angle, signal- rated float controls, or a transducer are used. Motor contactors, or solid state control relays are used in the control panel to operate pumps.
- Floats are able to move freely, without interference from flowing water, adjacent floats, piping, wires, pump or other feature that may conflict with the float.
- Float cord ends are protected from moisture (ask vendors to recommend protection method) to prevent wicking of moisture into the cord.
- Floats are placed on their own float tree, for ease of service**. Pump discharge pipe mounted floats are prohibited.**
- Float trees must lock into one exact position.
- Float tree and support mechanisms must be non-corrosive (cannot use zip ties).
- Adequate cord length is provided to allow float tree removal from tank during times of service and inspection.
- Float set-up to achieve the minimum requirements in 3.4.1, 3.4.2, 3.4.4, or 3.7, depending on the application. Surge and reserve volumes are to be maximized.
- Excess float cords are gathered up neatly and zip tied (or other approved method) out of the way of other components.
- *It is recommended that either all floats are narrow angle (mercury type) or wide angle (mechanical type) floats for a particular pumping system. These two differing float types should not be combined to regulate a pumping system.*

3.12.1.1 Floats – Time Dosing Applications

- Meet the condition of Section 3.12.1
- Tether lengths of floats were set-up per the manufacturer's recommended length.
- Timed dosed HSTS operate with a three or four control float, or transducer system. The controls must include (unless otherwise approved by the Health Department): See Addendum
    - Low Level/Redundant Off Control – Must cut the power to the pump which it controls when the liquid level drops below the sensor and activates a low level alarm.
    - Timer Enable Control – Must activate the programmable timer for controlling the pump and allow the pump to dose at the Average Design Flow.
    - Timer Override/Peak Enable Control – Must activate the programmable timer override function for controlling the pump and allow pump to dose at the Peak Design Flow.
    - High Level Control – Must activate the High Level Alarm. This control may be combined with the Timer Override/Peak Enable Control.

3.12.1.2 Floats – Demand Dosing Applications

- High water alarm float is set to activate when the water level is two (2) inches above the “ON” position (This provides the homeowner timely warning of a problem).
- Tether lengths are set at the manufacturer’s minimums for float set-up that have separate “ON” and “OFF” floats, whether motor-rated or signal-rated.
- Tether lengths for dual function floats (e.g. – One (1) float provides “ON” and “OFF” capabilities) are installed per the manufacturer’s specifications to achieve the required distance between the float activation points.
- For separate “ON” and “OFF” floats, both floats must have equal tether lengths.
- Manufacturer’s specifications, with respect to tether cord lengths for float activation points, must be submitted to the Health Department.

4 Section 4.0 Aggregates and Cover

4.1 Definition

Aggregates are a broad class of granular materials (or non-cohesive soils). Examples of aggregates are sand and gravel. They are used for a variety of purposes such as media for the treatment of HSTS liquids, pipe support, and backfill material.

4.2 Scope and Applicability

This section provides specifications for aggregates that are placed within the treatment train. It will also provide guidance for other uses of aggregates in a HSTS, for example, aggregate for pipe support. This section does provide guidance on gravel backfill acceptable for many tanks. However, the vendor or manufacturer is to be consulted regarding the exact gravel material and methodologies. The aggregates for which specifications will be given are sand, #57 stone, and #8 stone.

4.3 Stockpiling Requirements

The following are general requirements that will apply to all aggregates.

- Aggregates stockpiles are located so that any equipment traffic will not damage the soil absorption area.
- Aggregates are maintained in separate, distinct stockpiles, to avoid mixing.
- Material is stockpiled in an area not subject to water ponding.

4.4 Miscellaneous Aggregates

Miscellaneous aggregates are those that have general uses such as pipe support. These do not include any aggregates that are used within a treatment system of any HSTS or aggregates used to backfill a tank.

- Mason's sand is **NOT** acceptable for use as an aggregate.
- **Aggregate material is compacted**.
- Aggregate material is not commingled with any organic material, soil or other deleterious material.
- Maximum particle size of aggregate is two (2) inches in diameter.
- For thickness greater than twenty-four (24) inches of miscellaneous aggregate, material is placed in lifts and settled in place for uniform density.
- Aggregate contains a minimal quantity of fines (i.e. - clay size particles).
- ODOT #403 or other, non-sorted, "Crusher Run" material is **NOT** permissible.

4.5 ODOT #57 Stone (Rounded)

#57 stone is a graded aggregate of varying sizes that is used in HSTS's. The following is a list of HSTS's for which this aggregate may be used in:

- **Gravel Leach Line Trenches**
- **Gradient Drain**
- **Mound/ /Modified Mounds**

The following are the specifications for usage in HSTS applications within the County.

- ***#57 stone is rounded, not angular*** (i.e. - graded crushed limestone is ***NOT*** permissible).
- #57 stone meets gradation requirements of ODOT 703.01 (AASHTO M 43).
- #57 stone does not exceed 1.0% by weight passing the No. 200 (75 μm) sieve when tested in accordance with AASHTO T11or ODOT Supplement 1004. *Note*: 1.5% by weight passing the No. 200 sieve is permissible if the material is essentially free of clay and shale materials.
- #57 stone meets the quality requirements of ODOT 703.02(B) (2). .
- Material has been approved for use as #57 stone by ODOT or by the Health Department.

4.6 ODOT #8 Stone (Rounded)

#8 stone is a graded aggregate of varying size that is used in HSTS. The following is a list of HSTS's for which this aggregate may be used:

- **Mound/ /Modified Mounds**
- **Gradient Drain**

The following are the specifications for usage in HSTS applications within the County.

- ***#8 stone is rounded, not angular*** (i.e. - graded crushed limestone is ***NOT*** permissible).
- #8 stone meets gradation requirements of ODOT 703.01 (AASHTO M 43).
- #8 stone does not exceed 1.0% by weight passing the No. 200 (75 μm) sieve when tested in accordance with AASHTO T11or ODOT Supplement 1004. *Note*: 1.5% by weight passing the No. 200 sieve is permissible if the material is essentially free of clay and shale materials.
- #8 Stone meets the quality requirements of ODOT 703.02(B) (2). .
- Material has been approved for use as #8 stone by ODOT or by the Health Department.

4.7 ODOT #57 or #8 Stone (Angular)

#57 stone is a graded aggregate of varying size that is used in HSTS's. The following is a list of HSTS's for which this aggregate may be used.

- **Pretreated - /Modified Mounds**
- **Gradient Drain**

The following are the specifications for usage in HSTS applications within the County.

- ***#57 stone may be angular*** (i.e. - graded crushed limestone is permissible).
- See Section 4.5 ODOT #57 Stone (Rounded) for the gradation and quality requirements of this aggregate type.
  - It is recommended that this #57 stone is NOT used as pipe bedding or pipe cover, especially for smaller diameter pressurized piping.
- ***#8 stone may be angular*** (i.e. - graded crushed limestone is permissible).
- See Section 4.6 ODOT #8 Stone (Rounded) for the gradation and quality requirements of this aggregate type.

Gravel Type	Gravel Leach Trenches	Modified At-Grade/Modified Mounds (Type "A," "B," "E"	Type "G" (Millennium Mound)
ODOT #57 Rounded	Approved	Approved	Approved
ODOT #57 Angular	Not approved	Not approved	Not approved
ODOT #8 Rounded	Not approved	Approved	Approved
ODOT #8 Angular	Not approved	Not approved	Not approved

Table 4-1 Gravel usage by system type. Note that these gravels may be used for pipe support and other backfill materials, as required. Mounds that receive septic tank effluent (e.g. - Type "G" and Type "H") must use rounded stone, crushed limestone is not permitted.

4.8 Sand for Treatment

Sand for treatment is used to treat and disperse effluent within HSTS's. The sand is one of the most important components of these types of systems. The various HSTS's are listed with the sand that is to be used in construction. The following table (Table 4.2) is a summary of Sections 4.8.1, 4.8.2 and 4.8.3.

Sand Type	Modified Mounds (Type “A,” “B,” “E”	Type “G” (Millennium Mound)
ODOT Natural Sand	Approved	Not approved
ASTM C-33 Concrete	Approved	Not approved
Filter Sand (1.25 gpd/ft^2)	Approved	Approved
Filter Sand (2.5gpd/ft^2)	Not approved	Approved

Table 4-2 Sand usage by system type. Note that these sands may be used for pipe backfill and other backfill materials, as required.

4.8.1 Filter Sand (1.25 gpd/ft^2)

For these structures (any structure that receives septic tank effluent), sand meeting the following specifications is to be used:

- Sand meets the following gradation:

Sieve Size	% Passing
3/8	100
#4	95/100
#8	80/100
#16	45/85
#30	15/60
#50	3/10
#100	0/2
#200	0/1

Table 4-3 Filter Sand (1.25gpd/ft^2) gradation parameters.

- For this sand, D_{10} (effective size) is 0.3 to 0.5 mm.
- For this sand, C_u (coefficient of uniformity) is 1 to 4.
- Gradation analysis must meet ASTM wet sieve analysis protocols for fines.
- Sand meets the criteria of the Aggregate Jar Test (See Section 4.12).

4.8.2 Filter Sand (2.5gpd/ft^2)

For these structures (any structure that receives septic tank effluent), sand meeting the following specifications is to be used:

- Sand meets the following gradation:

Sieve Size	% Passing
3/8	100
#4	77/100
#8	53/100
#16	15/80
#30	3/50
#50	0/1
#100	0/1
#200	0/1

Table 4-4 Filter Sand (2.5 $^{gallon}/_{day}$) gradation parameters.

- For this sand, D_{10} (effective size) is 0.4 to 0.9 mm.
- For this sand, C_u (coefficient of uniformity) is 1 to 4.
- Gradation analysis must meet ASTM wet sieve analysis protocols for fines.
- Sand meets the criteria of the Aggregate Jar Test (See Section 4.12).

4.8.3 Natural Sand & Concrete Sand

For those structures receiving filtrate sand meeting the following specifications is to be used:

- Sand that meets the specifications of ASTM C-33, (C-33 concrete sand); **or,**
- Sand is ODOT Natural Sand which is not manufactured and meets:
  - The gradation requirements of ODOT 703.02(A) (2).
  - The requirements of ODOT 703.02(A) (3).

4.9 Gradient Drain/Interceptor Drain Aggregate

Gradient drain/interceptor drain aggregate must adhere to the following:

- #57 or #8 stone defined in Section 4.5 or 4.6 is acceptable. This aggregate may be **clean** crushed limestone meeting Section 4.7, provided that grade stakes delineating the trench bottom are placed with the gradient drain trench. Stakes located at the corners and every twenty (20) feet of drain or per approved plans. See Section 7.0 Drainage Enhancement for further information.

4.10 Cover Soil Specifications

The cover specifications include the requirements for covering a treatment system with the appropriate materials. Three types of cover materials are available. They are sandy loam topsoil, site generated topsoil, and other site soils. Some general requirements for all cover soils are:

- Geotextile fabric per Section 4.11 or other approved barrier material was placed over gravel prior to final cover installation.
- Cover soil was free of any rocks (larger than three (3) inches), large roots and other large organic debris.
- All soil clods, larger than two (2) inches in diameter, were broken apart.
- Cover grading allows for easy, trouble-free lawn care maintenance in the future.

- Cover soils will allow grass to germinate and grow unimpeded.

4.10.1 Best Available Site Topsoil

When moistened, this soil will feel gritty and will not form a ribbon when rubbed between the thumb and forefinger.

- No added “filler” materials were present in the soil such as mulch, sawdust, or other organic debris.
- Used on advanced treatment systems that receives septic tank effluent.
- Placed overtop of treatment system gravel areas and to within one (1) foot of all sides of these gravel areas, unless otherwise specified.
- Remaining areas on or around treatment system may be covered with other site soils.

4.10.2 Other Site Soils

These soils are still soft when moistened and are not resistant to pressure between the thumb and forefinger. Additionally they are not sticky when wet.

- Commonly found at the site within the top twenty-four (24) inches of the ground surface or can be trucked in from another location.
- No added “filler” materials were present in the soil such as mulch, sawdust, or other organic debris.
- Used on advanced treatment systems that receives pretreated effluent.
- Remaining areas on or around treatment system may be covered with other site soils.
- Can be placed outside of treatment gravel areas unless otherwise specified.
- Used to berm up areas and backfill trenches.

4.11 Geotextile Fabric

Geotextile fabric used in an HSTS to prevent backfill material from entering a treatment or soil absorption system shall meet the requirements listed in Table 4.5.

Geotextile Property	Test Method	Average Role Value
Thickness (mil)	ASTM D1777	Minimum – 4 mil Maximum – 20 mil
Air Permeability (cfm/ft)	ASTM D737	Minimum - 500 cfm
Grab Tensile (lbs)	ASTM D4632 or D1682	Minimum – 18 lbs
Grab Elongation (%)	ASTM D4632 or D1682	Minimum – 50%
Puncture (lbs)	ASTM D4833	Minimum – 10 lbs
Trapezoidal Tear (lbs)	ASTM D4533 or D1117	Minimum – 10 lbs
AOS (Sieve Size)	ASTM D4751	Minimum - #20 Sieve Size Opening Maximum - #70 Sieve Size Opening

Table 4-5 Geotextile Fabric Specification (Partly adopted from the Wisconsin Department of Commerce Code. Comm. 84.40).

4.12 Aggregate Jar Test

Once the proper aggregate arrives at the job site, it may not appear to be clean. An in-field Jar Test is to be utilized to qualitatively assess the materials cleanliness for use within the treatment system. The following steps should be performed:

Fill a quart glass jar half full with the aggregate.
Fill the jar with clean tap water.
Shake the jar vigorously and allow settling for 30 minutes.
If a sixteenth (1/16) inch or greater amount of fines has accumulated on top of sand or at the bottom of the gravel, then the aggregate shall be rejected and not used in the system. It may be used for pipe support, tank bedding, or backfill, **but not in the treatment system**.

5 Section 5.0 Piping

5.1 General

This specification includes conveyance-piping systems associated with a HSTS. It includes specifications for gravity systems and pressure distribution systems.

- Any piping, which is marked on plans or stated in this manual, as Schedule 40 PVC shall meet ASTM D-1785/D-2665
- See Section 5.16 Solvent Welding for glued PVC connections

5.2 Gravity Piping

A piping system that is non-pressurized which conveys liquids and solids by gravity. Gravity piping types included in the following are building sewer and other gravity piping downstream of the septic tank. It does not include gravity piping within leach trenches, gradient drains or gravity piping that is part of a proprietary treatment system.

5.3 Building Sewer

The building sewer is pipe that conveys raw wastewater from the house to the septic tank or primary treatment unit.

5.3.1 Pipe Type (Building Sewer)

- Schedule 40 PVC pipe; meets/exceeds ASTM D-1785/D-2665.
- Four (4) inch diameter used.
- **Pipe markings face upwards.**
- No cell core or other lightweight pipe used.

5.3.2 Pipe Installation (Building Sewer)

- Minimum slope was one-eighth inch per foot ($^1/_8$" per 1' or 1 %).

- Slope was uniform between horizontal and vertical alignment changes.
- Pipes installed on existing land slopes greater than 14% must not travel directly downhill. Pipe and pipe trench must “zigzag” down the slope or anchored at connectors or as specified.
- Connections were solvent welded with color primer used.
- For bell and spigot pipe, the bell(s) point upstream.
- No sudden or extreme slope changes or vertical pipe segments installed in the building sewer that may cause separation of solids from liquids in the pipe, resulting in pipe blockage.
- Uniform support under the entire length of pipe provided by virgin soil or bedding in gravel **(No sand).** Aggregates meet the specifications in Section 4.0.
- No dirt clods, rocks or similar objects used to support pipe.
- Backfill was free of rocks larger than two (2) inches, along the longest dimension.
- Backfill was free of deleterious material.
- Backfill was placed in a manner such that depressions are not formed after settlement.
- Pipe cased when crossing a driveway or other vehicle path (See Section 5.5), or another approved method of pipe protection is used.
- Any rubber boot type fitting was secured with clamps fabricated from non-magnetic stainless steel.
- Pipes installed are completely covered under final grade with at least 2” of cover.
- All attempts should be made to prevent the building sewer from becoming an easy outlet for footer water.
- Eccentric reducers are used on any existing building sewer to transition the size of existing pipes to four (4) inches. Cleanout installed within three (3) feet, upstream of this transition.

5.3.3 Cleanouts for Building Sewer

Cleanouts will be designated by C/O.

- Schedule 40 PVC pipe meeting/exceeding ASTM D-1785/D-2665 used.
- Four (4) inch diameter pipe used.
- Four (4) inch threaded cap provided.
- C/O tied into building sewer with sanitary tee pointing towards the tank.
- Extends a minimum of ten (10) inches above final grade.
- C/O installed either within three (3) feet of the exterior or one (1) foot of the interior wall. An outside C/O is recommended for ease of service.
- C/O installed upstream from any horizontal alignment change greater than forty-five (45) degrees.
- C/O installed every seventy-five (75) feet of building sewer (excluding required C/O adjacent to the foundation). If more than seventy-five (75) feet but less than one hundred fifty (150) feet exists, install C/O at the midpoint.

- C/O installed before an eccentric reducer, when required, to reduce pipe size.

5.4 Other Gravity Piping

Other gravity piping includes gravity pipes associated with a HSTS. It does not include gravity piping within leach trenches, gradient drains, building sewer pipe(s) or gravity piping that is part of a proprietary treatment system. An example of an installation location is between a septic tank and dose basin, headline piping or discharge piping.

5.4.1 Pipe Type

- Schedule 40 PVC pipe; meets/exceeds ASTM D-1785/D-2665.
- Four (4) inch diameter used.
- Pipe markings face upwards.
- No cell core or other lightweight pipe used.

5.4.2 Pipe Installation

- Minimum slope was one-eighth inch per foot ($^{1}/_{8}$" per 1') or 1%.
- No vertical pipe segments, except at a pumped gradient drain discharge.
- Pipes installed on existing land slopes greater than 20% must not travel directly downhill. Pipe and pipe trench must "Zig Zag" down the slope or as specified.
- Connections were solvent welded with color primer used.
- Uniform support under the entire length of pipe provided by virgin soil or bedding in compacted gravel. Aggregates meet the specifications in Section 4.0.
- No dirt clods, rocks or similar objects used to support pipe.
- Backfill was free of rocks larger than two (2) inches, along the longest dimension.
- Backfill was free of deleterious material.
- Backfill was placed in a manner such that depressions are not formed after settlement.
- Pipe cased when crossing a driveway or other vehicle path (See Section 5.5), or other approved method of pipe protection is used.
- Any rubber boot type fitting was secured with clamps fabricated from non-magnetic stainless steel.
- Pipes installed are completely covered under final grade with at least 2" of cover.

5.4.3 Cleanouts for Other Gravity Piping

Clean outs will be designated as C/O.

- Schedule 40 PVC pipe meeting/exceeding ASTM D-1785/D-2665 used.
- Four (4) inch diameter pipe used.

- Four (4) inch threaded cap provided.
- C/O tied into pipe with sanitary tee pointing towards the tank.
- Extends a minimum of ten (10) inches above final grade.
- C/O installed upstream from any horizontal alignment change greater than forty-five (45) degrees.
- Recommend C/O installed every one hundred (100) feet of other gravity Piping. If more than one hundred (100) feet but less than two hundred (200) feet exists, install C/O at the midpoint.

5.4.4 Discharge Pipe

The discharge line is part of other gravity piping, serving to convey effluent collected as part of treatment to the final point of discharge to receiving waters, via gravity. The discharge pipe is to meet the following specifications:

- Sections 5.4.1, 5.4.2 and 5.4.3 apply.
- For proprietary HSTS that discharge using piping smaller than four (4) inches in diameter, then this pipe is to transition to four (4) inch pipe meeting 5.4.1 and 5.4.2 within one pipe length of final treatment unit.
- **Discharge line terminates at the specified drainage way**.
- Minimum of six (6) inches of freeboard is required between the invert of the discharge pipe and the water surface of the receiving waterway. For waterways subject to flash flooding, the invert of the discharge pipe is recommended to be placed above the high water mark to prevent damage to the pipe during these events.
- Commercial “swing gate“ animal guard; *or* two (2) one quarter ($^1/_4$) inch stainless steel bolts placed horizontally provided (like an equal sign (=)). Drain baskets are not permitted.

5.5 Casing Pipe (Pipe Casing), and Pipe Protection

Casing pipe is used to protect buried piping from “heavy” surface loads, such as under vehicles paths.

- Case all pipe(s) that lie under driveways or other vehicle paths.
- Schedule 40 PVC pipe (or better) meeting/exceeding ASTM D-1785/D-2665 used.
- Casing bedded in #57 or #8 stone (See Section 4.0).
- Casing extends beyond driveway or vehicle path by at least five (5) feet on either side.
- Case pipes that run over or under a water line for ten (10) feet to either side of the water line.
- If the top of the pipe is five (5) feet or greater below the surface, then the pipe may be encased in gravel and backfilled with compacted site soils without being cased.
- Pipe casing is to be installed such that this casing pipe does not exert ANY downward pressure on the carrier pipe (inner pipe), particularly at the entrance and exit of the casing pipe.

5.6 Pressure Piping

Pressure piping is any pipe that conveys water under pressure supplied by a pump, or siphon action. Pressure piping is installed in locations in which the water must be pushed to reach its destination. Typically, pressure piping is used in mound soil absorption systems, dosed systems, and proprietary treatments systems. This specification shall not include pressure discharge piping associated with a gradient drain (See Section 7.0 Drainage Enhancements for specifications).

5.6.1 Pipe Type

- Schedule 40 or Schedule 80 PVC pipe meeting/exceeding ASTM D-1785/D-2665.
- Pipe markings face upwards.
- ***Fittings are pressure rated*** for Schedule 40, meeting/exceeding ASTM D-2466-06; or Schedule 80 PVC.
- Diameter is as specified, or as determined by hydraulic analysis of overall pressure distribution network that has been reviewed and approved by the Health Department, prior to installation.
- Minimum velocity in any pipe is two feet per second ($2\ ^{feet}/_{second}$). (Allowances will be made for HSTS's with a siphon, with prior approval.)

5.6.2 Pipe Installation

- All connections were solvent welded; small applicator used to minimize potential for excess cement causing joint roughness, increasing friction losses.
- Colored primer was used in the welding process.
- Pipes installed on existing land slopes greater than twenty percent (20%) must not travel directly downhill. Pipe and pipe trench must "Zig Zag" down the slope or as specified.
- Pipes installed are completely under final grade.
- Pipes lay upon firm, virgin soils or bedded in compacted gravel (See Section 4.0 for specifications). No pipe deflection permitted under applied pressure.
- No dirt clods, rocks or similar objects used to support pipe.
- No vertical pipe, place pipe on an angle with stable support.
- No pipe-to-pipe or pipe-to-conduit contact installed. Move the pipes, case both pipes, or encase both pipes in gravel in the region of possible contact. Maximum particle size of the gravel is 1/3 of the pipe diameter.
- Pipe protected in areas where crossed by a driveway (See Section 5.5).
- Pressure distribution piping does not share a common trench with any portion of the gradient drain or interceptor drain. These separate trenches have a minimum separation of three (3) feet from wall-to wall.
- Direct flame contact was not used to achieve a permanent bend in PVC pipe. ("Conduit bending boxes" designed for bending PVC is acceptable, provided the cross-sectional dimensions of the pipe have not changed).

- Pressure main or sub-main run from the subsurface to the top of a mound or other above-ground structure uses a combination of elbows for elevation change or pipe “bent” per requirements and supported per this section.
- If pipe was bent:
  - Bent section has circular cross-section.
  - No creasing of the pipe.
  - Pipe wall thickness, within bend, not significantly decreased.
- Rubber type boot fittings were not used in joining pipe segments, except where connecting new PVC pipe to a building sewer or other material.

5.7 Pipe Protection

Includes both mechanical and freeze protection.

5.7.1 Freeze Protection

Pressure pipes shall be protected from freezing by one of the following methods:

- At least twenty four (24) inches of soil cover or per approved plan or;
- Drain back of areas with less than twenty four (24) inches cover **or;**
- Combination of both twenty-four (24) inches soil cover and drain back.
- Lines that are laid to drain back have a minimum slope of one eighth (1/8) inch per foot towards the pump and are bedded firmly on that grade. **Pipe must remain stable under pressure.**
- For drain back, weep hole size does not cause distal pressure to fall below design pressures.
- Weep hole installed at correct elevation to ensure liquid does not rest in pipe segments with less than twenty four (24") inches of soil cover or per approved plans, if more stringent.
- *Weep hole elevation is such that NORMAL tank water elevations do not submerge the weep hole. Normal tank water elevations are any water elevation below the elevation of the high water alarm and the elevation of an override.*

5.7.2 Mechanical Protection

Pipes shall be protected from mechanical damage.

- Pipe under driveways cased (Section 5.5).
- No direct pipe-to-pipe or pipe-to-conduit contacts. The pipes can be moved, both pipes cased, or both pipes bedded in gravel in the region of contact. Maximum particle size of the gravel is one-third ($^{1}/_{3}$) of the pipe diameter.
- No vertical pipe segments are allowed. Angle pipes to change elevation with stable support (except within a tank/basin or in or under a valve box).
- Pipe with less than eight (8) inches cover outside of the mound, are cased (Section 5.5).
- For the force main “ramp” to the mound, if pipe cover is less than eight (8) inches, then pipe must be cased, pipe on mound sand fill beneath the soil cover is considered to be protected.

5.8 *Pressure Pipe Network*

The pressure pipe network for any pressurized treatment system includes all piping from the dose chamber to and including the discharge network. It includes dosing pump, force main pressure piping, sub-main pressure piping, pressurized laterals and all associated fittings.

For the pressure distribution system, it is the installer's responsibility to assure that the distribution system operates as designed. Care must be taken during the assembly to prevent entry of dirt and debris from entering the pipes. Some dirt and debris will be present in pipes after field assembly is completed, so flushing the pressure pipe network is a necessary step before start-up.

The following are practices for preparing pipe in the shop:

1. Inspect laterals for missing, blocked or irregular orifices
2. Clear lateral pipes of any burrs and/or tailings.
3. Solvent weld couplings in place on one side of a connection.
4. Pre-assemble manifolds and distribution laterals.
5. Mark and bundle distribution laterals in the shop for fast re-assembly in the field.
6. Tape over open ends of the distribution lateral pipes.

5.8.1 Pressure Piping – Force Main

The force main is a segment of a pressure piping system that conveys effluent from a point of energy input (i.e. - pump or siphon) to another point within the HSTS.

- All requirements of Section 5.0 met.
- ***Diameter justified by hydraulic calculations based on actual site conditions.***
- Minimum scouring velocity of two feet per second (2 $^{feet}/_{second}$) is maintained in all segments at the design flow rate.
- Pump discharge piping has a solvent welded horizontal pressure rated quick disconnect (union) installed within ten (10) inches of the top of the riser.
- Schedule 40 PVC gate valve supplied, will need prior approval.
- Check valve is installed, if applicable. Will require prior approval.
- Pump discharge piping installed so that a screened pump filter can be removed for inspection and maintenance by disconnecting the union.
- Excavation for the force main is **NOT** within any chisel-plowed area. *If this occurs, a redesign may be required with applicable re-design fees and/or re-inspection fees.*
- Transitions to laterals with pressure rated crosses of the same diameter as the force main. ***Tees are not permitted in this location.*** Threaded cap on one (1) branch of cross provides a cleanout.
- For force mains entering a distribution box or drop box, the force main transitions to four (4) inch diameter Schedule 40 PVC pipe ten (10) feet before entering distribution/drop box. Transition to four (4) inch pipe uses prefabricated PVC fittings designed for this purpose. This pipe is to be on a

minimum slope toward the box.

- Minimum of three (3) feet of separation to any drain or leaching trench from wall to wall.
- Minimum slope for drainback is $^1/_8$" per foot (1 %).

5.8.2 Pressure Piping – Sub-Main

The sub-main is that portion of a pressure distribution network that is used to convey liquid from the force main to the manifold or laterals of the distribution network.

- All requirements of Section 5.0 are met, as appropriate.
- Sub-main diameters as specified ***or*** diameter justified by hydraulic calculations based on actual site conditions and design flow rate.
- Minimum scouring velocity of two feet per second (2 $^{feet}/_{second}$) is maintained in all segments at the design flow rate.
- Schedule 40 PVC gate valve supplied, will need prior approval required.
- Excavation for the sub-main is **NOT** within any chisel plowed area. *If this occurs, a redesign may be required with applicable re-design fees and/or re-inspection fees.*
- Sub-main transitions to laterals with pressure rated crosses of the same diameter as the sub-main. *Tees are **NOT** permitted in this location.* Threaded cap on one (1) branch of cross provides a cleanout.
- Crosses are installed level for H pattern lateral set.
- Appropriate use of fittings, such as forty-five (45) degree elbows, or approved pipe bending techniques were used to "ramp" the sub-main onto the mound from the subsurface.
- Lateral and sub-mains are of equal lengths and symmetrical unless otherwise stated in an approved plan. Recommend sub-mains are installed at the same elevations with other sub-mains within the same pressure network. Recommend, unless otherwise specified in an approved plan, sub-mains are laid so that equal amounts of drain back occur compared with other sub mains in the same system.
- Minimum of three (3) feet separation to any drain or leaching trench.
- Minimum slope for drainback is $^1/_8$" per foot (1 %).

5.8.3 Pressure Piping – Manifold

The manifold is that portion of a pressure distribution network that is used to convey liquid from the force main or sub-main to the laterals of the distribution network.

- All requirements of Section 5.0 are met.
- Manifold diameters as specified ***or*** diameter justified by hydraulic calculations based on actual site conditions and design flow rate.
- Minimum scouring velocity of two feet per second (2 $^{feet}/_{second}$) is maintained during flushing at the design flow rate.
- Manifold transitions to laterals with pressure rated crosses of the same diameter as the manifold. *Tees are **NOT** permitted in this location.* Threaded cap on one (1) branch of cross provides a cleanout.
- Crosses are installed level for H pattern laterals.

- Manifolds are of equal length for symmetrical lateral layouts.
- Manifold is laid so that equal amounts of drain back occur compared with other manifolds in the same system, unless otherwise specified in an approved plan.
- Minimum slope for drainback is $^{1}/_{8}$" per foot (1 %).

5.8.4 Pressure Piping – Laterals

The distribution lateral is the portion of the pressure distribution network used to distribute pumped liquids, via orifices, over the surface of the treatment media of a treatment system. In mound systems, the length of a lateral network along the contour is designed to match the soil's linear loading rate requirements and the peak flow of the system.

- Laterals fabricated from Schedule 40 or Schedule 80 PVC pipe, meeting/exceeding ASTM D-1785/D-2665.
- Lateral diameters are typically three-quarter ($^{3}/_{4}$) inches, unless otherwise specified or design requirements can be met otherwise.
- The difference between the flow rates of the proximal orifice and distal orifice (first and last orifice) is less than 10%.
- Laterals lengths, orifice spacing, and layouts are installed as specified in the approved plan.
- **All** couplers and fittings used are **pressure rated**, meeting/exceeding ASTM D-2466-06. W*yes at the end of laterals on Type "H" Structures are excluded; these may be DWV type fittings.*
- Laterals are uniformly supported over their entire length.
- Laterals installed flat or sloped back toward the manifold:
- Orifices, except for the proximal and distal at twelve (12) o'clock, are at six (6) o'clock position and the laterals are installed flat (0%). The clean out is raised slightly to drain to the next to last orifice.
- Orifice shields required for all orifices.
- For multiple laterals set side by side, laterals are installed so that orifices are staggered for maximum uniform spacing between orifices.

5.8.5 Maximum Operating Head (Squirt Height) Variation

No operating head in a distribution lateral network shall be less than the required minimum operating head. No operating head on any network lateral shall exceed the required minimum operating head by more than ten (10) percent.

5.8.6 Pressure Piping – Lateral Cleanouts (C/O)

Lateral cleanouts (C/O) allow for the flushing of the laterals, after construction and as part of maintenance.

5.8.6.1 Lateral Cleanouts – General requirements

- C/O installed at the end of each lateral.
- C/O placed within an access well/valve box.
- C/O elevated minimum of one-half (1/2) inch above lateral's distal orifice to drain back for freeze protection.
- C/O adequately bedded in gravel for support.
- Access well/valve box lid allows for clearance to the C/O assembly.
- Access well/valve boxes are set on a stable base.

5.8.6.2 Three quarter (3/4) Inch Diameter or Smaller Laterals Requirements

- C/O is the same size as the lateral.
- C/O can be easily opened/closed with one hand.
- **C/O extends a maximum of six and one-half (6 ½) inches above the lateral top**.
- Uses a "sweeping 90" to make this turn. This elbow must meet the pipe type requirements for laterals. Includes an equally sized quarter-turn (slip fit by threaded, threaded end up) PVC ball valve equal in size to the lateral. *"Sweeping 90" may require cutting to meet maximum of six and one-half (6 ½) inches above the lateral.*
- ***No forty-five (45) degree fittings used for this application.***

5.8.6.3 Laterals One (1) inch or Larger in Diameter C/O Requirements

- C/O's installed are same size as laterals.
- C/O used wyes with female adapters and cleanout pipe plugs (Note: C/O fittings may be DWV fittings) with wyes facing upwards.
- C/O accessible for testing and service; a closed fist "fits" between the C/O and the well or box wall.
- Both upper and lower C/O's are accessible for routine maintenance.
- ***No forty-five (45) degree fittings used for this application.***

5.9 Operating Head (Squirt Height) Adjustment

The following gives options that are acceptable methods to control the operating head of a HSTS. All lateral clean outs must be made accessible within a valve box, access well or tank/sump.

- High pressure Schedule 40 or 80 PVC gate valve used; **or,** orifice type flow restrictor used located within an accessible union**; or,** other flow control devices or methods of adjustment are subject to review and approval by the Health Department.
- Device used to adjust the operating head (squirt height) is to allow setting the operating head of the pressure distribution network at design parameters and is to be located only in the pump tank or septic tank.

5.9.1 Operating Head

For the specified operating heads for various types of mound systems, see the Appendix.

5.10 Orifice and Orifice Shields

The following sections present the requirements of orifices and orifice shields. Each will be presented in its own subsection.

5.10.1 Orifice(s)

An orifice is an opening in a pipe that is sized to allow discharge of liquid at a specific flow rate that is dependent upon the pressure of the system at the orifice.

- Orifices were drilled on a drill press. *Field drilling of orifices is **NOT** permitted.*
- Orifices are drilled at low speed to avoid burring and/or softening of PVC due to generated heat. Burred or improperly sized orifices will result in failure for that inspection.
- All orifices are perpendicular to the center-line of the lateral, sharp edged, and without burrs. If burrs were created, the orifice was cleaned of burrs. A reamer the same size as the drill bit was used. *It is recommended that a "dreamer "* be *used. A "dreamer" is a special drill bit that functions as both a pilot bit and reamer, providing good results, if properly used.* Sharp drill bits also produce satisfactory results. Replace drill bits before they become dull.
- Orifice spacing is based upon the pressure distribution network detail drawings, corresponding to the system capacity (See pressure distribution network drawings).

5.10.2 Orifice Shield(s)

An orifice shield is a device that functions to protect the orifice from becoming blocked.

- Installed on all pressure distribution laterals at corresponding orifices.
- Installed on the weep hole on a pressure dosed HSTS to minimize splashing.
- Commercially manufactured shields installed, unless pre-approved non-commercial shields are installed (See the following for requirements):
- Non-commercial orifice shields installed meeting the following specifications:
    - Clearance between orifice and shield was a minimum of one-half (1/2) inch.
    - Length or diameter was a minimum of three (3) inches.
    - Open area for drainage out of the shield was a minimum of one (1) square inch.
    - Have been reviewed and approved by the Health Department using a sample and a photograph or scale drawing provided by the fabricator (The photo or drawing will be kept on file).
    - Have written approval to use non-commercial shield.
    - Are available for inspection on site before installation.

5.11 Air Release Valves

An air release valve is a device used to allow the release of trapped gases from within a pipe. Trapped gases within pressure piping do not allow the pressure distribution system to operate as designed.

- Air release valve installed per design requirements.
- Air release valve designed for use with wastewater.
- Air release valve installed at relative high points (based on elevation) in the pipe.
- Air release valve contained in an access well/valve box that is open to the atmosphere.
- Access well/valve box lid allows for a minimum of two (2) inches clearance to the air release valve or valve does not extend by design.

5.12 Flow Direction Control Valves

These devices are used to control the direction of the flow. They may either allow flow in a specified direction or allow flow distribution in specified ratios for flow control. Some examples of these devices are flow splitters, K-rain valves, flow separators and solenoids.

- Device installed per Health Department-approved manufacturer/distributor specifications.
- Device provides type of service required by design.
- Device used was specified as part of the HSTS design.
- Device accessible for adjustment and/or maintenance.
- Device functions properly at start-up.

5.12.1 K-Rain Valves

A hydraulically activated valve switches zones automatically every time the pump starts. These valves work solely on the pressure of the pump to change zones. These valves must:

- Contain a one and one-half ($1^1/_2$) inches or longer piece of clear (SCH 40 equivalent) pipe on every valve outlet equal in size to the device outlet diameter.
- Be contained in a structurally sound enclosure which allows for easy valve servicing. The enclosure must have a secure insulated lid (capable of holding 300 pounds with minimal deflection). Lid either heavy concrete (minimum weight sixty (60) pounds/maximum weight eighty (80) pounds) or bolted with three (3) stainless steel, $^3/_{16}$ inch hex heads.

5.13 Pressure Pipe Network Dose Pump

The pressure pipe network dose pump is the device used to push water through the distribution network.

- Pump rated for effluent service by the manufacturer and also is UL or CSA listed product.
- Pump size to be capable of delivering the required flow rate and total dynamic head to provide distribution as required by the design. Total dynamic head is calculated from elevation differences, pipe size/type, fittings used, lateral/orifice

configuration, velocity, and minimum distal operating head (squirt height) with respect to design flow rate.

- Pump discharge piping includes a solvent welded quick disconnect (union) that is horizontal and within ten (10) inches of the top of riser, for easy service.
- Plastic or Nylon lift rope is attached to the pump and secured within ten (10) inches of the top of the lid.
- Dose pump either:
    - Rests within a screened pump vault; **or**,
    - Rests on a six (6) inch block; **or**,
    - Rest within a flow inducer (turbine pumps **ONLY**) designed to satisfy the flow rate of the pump and prevent cavitations; **or**,
    - Rest as specified by a proprietary design and with prior approval.
- Schedule 40 PVC gate valve, of the same diameter of the pressure pipe, supplied if required by the system design. The gate valve is to be installed in-line with the pump discharge assembly and within eighteen (18) inches of the riser lid.
- Check valve supplied, if required by the system design. Ball valve installed on the downstream side of union.
- Removal of a filter or screen pump vault can be done without removing the pump and without lifting the vault.
- Pump cords are to be provided with adequate length to allow easy removal of the pump for service.
- Pump manufacturer, model, horsepower, rated flow rate/total dynamic head, voltage requirements and amperage drawn at time of startup documented.
- Float switch settings/ water level settings documented on dose sheet.
- **Floats are not connected to the discharge pipe assembly.**

5.14 Flushing Procedure

The following is the procedure that is to be used to clean the pressure network. Flushing is done before the operating head adjustments are made and the flow rate measured. The following is a step-by-step guide to perform the flushing procedure:

1. Have adequate water volume in tank.
2. Open gate valve in the pressure network to full flow.
3. Open sub-main cleanouts for full flow.
4. Keep lateral cleanout valves closed.
5. Run pump until all dirt and debris is no longer evident in the discharge, a minimum of twice (2x) the total pipe volume is required.
6. *Time of Flushing* = $^{\text{Total Pipe Volume}}/_{\text{Set Flow Rate}}$ where;

Total Pipe Volume = Total Pipe Length x $[^{\text{gallons}}/_{\text{foot of pipe}}]$

7. Shut off pump, close sub-main cleanouts. (Treat

threads with pipe dope/Teflon tape).

8. Flush laterals one-at-a-time. Allow each cleanout to be flushed for a minimum of fifteen (15) seconds **or** until water flows free of dirt and debris.
9. Shut off pump. Ensure all cleanouts are closed.

***Note**: Evidence of orifice tailings, pipe shavings, or other debris during startup pressure test inspection will result in failure of that inspection.*

5.15 Required Design (Net) Dose Volume

The required net dose volume is the volume of liquid that is to be applied to a treatment media by a distribution system or proprietary device by each dose for treatment.

- Proprietary pretreatment devices - refer to product guidelines for recommended net dose volumes.
- Net dose volume is five (5) times the total lateral volume, or unless otherwise specified.
- Net dose for distribution networks with 1/8th orifices provide at least 0.25 $^{gallons}/_{orifice}$, but not more than 0.42 $^{gallons}/_{orifice}$ per dose, or as specified. (This does not apply to the Type "H" Structure (Wisconsin Mound)).

5.16 *Solvent Welding*

5.16.1 General

The following information is provided on correct methods and procedures for joining PVC pipe. The following are general rules for solvent welding PVC:

- Joining surfaces must be softened and made semi-fluid with primer.
- Sufficient (but not excess) cement must be applied to fill any gaps between the pipe and the fitting.
- Assembly of pipe and fittings is to be made while the surfaces are wet and fluid.
- Joint strength develops as the cement dries. In the tight part of the joint the surfaces will tend to fuse together, in the loose part the cements will bond to both surfaces.

5.16.2 Primers and Cements

- Colored primer is to always be used.
- Cements found to be jelly-like or not free flowing, should not be used.
- Cements are to be stored between 40^{o} and 110^{o} F.
- Cements are not to be exposed to open flames or heat.
- *Primers and cements are extremely flammable.*
- *Adequate ventilation is to be provided during solvent welding activities.*
- *Avoid cementing in enclosed areas, if possible. If not possible, ensure proper ventilation exists.*
- Avoid frequent contact with the skin.

5.16.3 Applicators

To properly apply primer and cement, the correct size and type of applicator must be used. There are three basic types of applicators daubers, brushes and rollers. Rollers are used on large diameter pipe and are typically not required for HSTS.

- **Daubers** - Use only on pipes 2 in diameter and smaller. Width of dauber is equal to one/half the diameter of the pipe.
- **Brushes** – Can be used on any diameter of pipe. Brush constructed with natural bristles. Width of the brush equal to be at least ½ of pipe diameter.

The following table is given as easy guide to applicator usage.

Pipe Diameter	Dauber Applicator	Brush Applicator Width (in)
½	A	½
¾	A	1
1	A	1
1 ¼	A	1
1 ½	A	1 – 1 ½
2	A	1 – 1 ½
2 ½	NR	1 ½ - 2
3	NR	1 ½ - 2 ½
4	NR	2 -3
6	NR	3 - 5

Table 5-1 - PVC Cement Applicator Use Guide, A = Acceptable, NR = Not Recommended.

5.16.4 Pipe Joining

The following is the recommended procedure for joining PVC pipe. Following this procedure is critical when constructing PVC pipe systems that are pressurized (e.g. – mound distribution pipe network). The procedure is presented in a step-by-step fashion.

- **Preparation**
  - Inspect pipe before cutting or joining for any damage and/or defects.
  - Pipe and fittings are to be at the same temperature, when joining. If not, allow one (1) hour for temperatures to equalize.

- **Cutting**
  - It is important to note that some HSTS designs require the use of plastic pipe cutters. This is overall good practice. These devices eliminate the creation of shavings and other small plastic debris that can plug orifices and may cause other flow restrictions.
  - Pipe is to be cut square. Use a miter box, if necessary.
  - Shavings are not to enter the pipe.
  - Use a plastic pipe cutting tool which DOES NOT flare up diameter at end of pipe.

- **Deburring and Chamfering**
  - Remove all burrs from end of pipe with a knife, file or plastic deburring tool.
  - Chamfer (bevel) the end of the pipe 10^{o} – 15^{o}.

- **Cleaning**
  - Remove any dirt, moisture, or grease from pipe and fitting sockets with a clean dry rag. Use a chemical cleaner if wiping fails to clean a surface.

- **Dry Fitting**
  - Check dry fit of pipe and fitting by inserting pipe into fitting. With light pressure, pipe should easily go at least 1/3 of the way in. If it bottoms out, it should be snug.

- **Priming**
  - Use correct applicator type, as indicated in table 5.1.
  - Apply primer freely to fitting socket, keeping surface and applicator wet until surface has been softened (approximately 5 – 15 seconds, more time is required for cold temperatures).
  - After priming, remove any puddles of primer fluid.
  - Apply primer to the end of the pipe equal to the depth of the fitting socket, applying in the same manner as was done on the fitting socket.

- **Cementing**
  - Apply cement to pipe and fitting surfaces to be glued.
  - *Do not allow cement to puddle in pipe or fitting.* This could cause a restriction in the flow path within the piping system and increase friction head loss.

- **Joining**

  - Assemble pipe/fittings quickly while cement is fluid.
  - Insert pipe into fitting until it contacts socket bottom; turn pipe ¼ turn.
  - Hold pipe until pipe does not back out.
  - Allow joint to cure (See Section 5.16.3 Solvent Welding Curing).
  - Remove excess cement from exterior. Properly made joint will show a continuous bead of cement around joint perimeter.

5.16.5 Solvent Welding Curing

In order to form a good solvent welded joint, minimum cure times are recommended. The following is information on the recommended initial set times for a given joint:

Temperature Range	Pipe Sizes ½” to 1 ¼”	Pipe Sizes 1 ½” to 3”	Pipe Sizes 4” to 8”
60° to 100° F	15 minutes	30 minutes	1 hour
40° to 60° F	1 hour	2 hour	4 hour
0° to 40° F	3 hour	6 hour	12 hour

Table 5-2 Initial Set Time for Solvent Welded Joints in PVC Piping.

Relative Humidity 60 % or Less*	**Cure Time ½” to 1 ¼”**	**Cure Time 1 ½” to 3”**	**Cure Time 4” to 8”**
Temperature Range During Assembly and Cure Periods	Up to 180 psi	Up to 180 psi	Up to 180 psi
60^o to 100^o F	1 hour	2 hour	6 hour
40^o to 60^o F	2 hour	4 hour	12 hour
0^o to 40^o F	8 hour	16 hour	48 hour

For relative humidity above 60 %, allow 50 % more cure time.

Table 5-3 Recommended curing time before pressure testing of pipe system.

6 Section 6.0 Finished Appearance

6.1 General

The finished appearance of a HSTS is an important part of the system installation. It is the portion of the system that may not directly affect the operation of the system or system components, but yet it is the portion of the system that is visible long after system completion. ***The finished appearance may be the one thing that makes an impression on a past or future customer.*** It will frequently be the single item by which the quality of work by an installer is judged by the end user (owner). This may be a "make or break" situation when others are considering bids or proposals. Care and attention to these items may result in good referrals. Items included in this section are: 1) grading; 2) care of surface water; 3) seeding and mulching; 4) erosion control; and 5) diversion swales.

6.2 Grading

Grading is the act of cutting and/or filling to achieve desired final elevations. The requirements for grading will apply to any disturbances caused by activities associated with the installation of a HSTS.

- All grade transitions were smooth and reasonably gradual, such that lawn care activities do not result in scalping of vegetation.
- **Any exposed system components, such as valve boxes, distribution boxes, drop boxes, etc. backfilled and cover material firmly tamped in place so that soil around these components will not compact further under foot pressure. Lids flush with final settled grade.**
- Any and all rutting eliminated.
- Cover over treatment system is as specified in Section 4.10 and other applicable sections.
- All clods of soil larger than two (2) inches broken down so that no irregularities are present on surface; large rocks and roots removed.
- All aggregate stockpile locations were treated so that vegetation can be established.
- ***Areas of potential settlement mounded to offset settlement, such as pipe trenches***.
- Minimum final grade was 3H:1V, or less, unless otherwise specified.

The following procedure for calculating the slopes of any elevated structures is provided. This procedure is adopted from Converse, J. C. and Tyler, E. J., 2000. Wisconsin Mound Soil Adsorption System: Siting, Design and Construction Manual. Publication #15.24 (Available on the Internet at www.wisc.edu/sswmp/pub_15_24.pdf).

Slope %	Down Slope Correction Factor	Up Slope Correction Factor
0	1.00	1.00
1	1.03	0.97
2	1.06	0.94
3	1.10	0.92
4	1.14	0.89
5	1.18	0.88
6	1.22	0.85
7	1.27	0.83
8	1.32	0.80
9	1.38	0.79
10	1.44	0.77
11	1.51	0.75
12	1.57	0.73
13	1.64	0.72
14	1.72	0.71
15	1.82	0.69
16	1.92	0.68
17	2.04	0.66
18	2.17	0.65
19	2.33	0.64
20	2.50	0.62
21	2.70	0.61
22	2.94	0.60
23	3.23	0.59
24	3.57	0.58
25	4.00	0.57

Table 6.1 - Down-Slope and Up-Slope Correction Factors. (Adopted from Converse and Tyler, 2000).

For “up-slope,” the following equation is used to determine the horizontal “run” distance:

$D_{\text{"up-slope"}}$ = 3 x [Height of structure above original ground surface] x (Up-Slope Correction Factor from Table 9.1)

Where the Height and resulting $D_{\text{"up-slope"}}$ is in feet, **NOT feet and inches**.

For “down-slope” the following equation is used to determine the horizontal “run” distance:

$D_{\text{"down-slope"}}$ = 3 x [Height of structure above original ground surface] x (Down-Slope Correction Factor from Table 9.1)

Where the Height and resulting $D_{\text{"down-slope"}}$ is in feet, **NOT feet and inches**.

6.3 Care of Surface Water

With soil being used as the final component within the treatment train, it is not desirable to have outside surface water infiltration into this component. This will result in additional hydraulic loading which may affect its capabilities of performing properly.

- Areas contributing to surface water run-on to a HSTS have been diverted away from this component (see Section 6.6, for diversion swale or Section 7.6 for interceptor drain).
- Diverted water will not create erosion problems within the diversion or at its outlet.
- Recommended to protect basal area or proposed leaching trench field from surface water run-on, prior to and during construction of the system.
- Surface water will not be trapped behind component on a slope.

6.4 Seeding and Mulching

Seeding and mulching is used to establish vegetation on disturbed areas.

- Seedbed has been hand raked prior to seeding, removing rocks, sticks, and roots; large clods have been broken up so that final seedbed is smooth.
- Seedbed has sufficient organic content to facilitate vegetative growth
- For heavy or acidic soils, pelletized high calcium limestone or agricultural high calcium lime was added to neutralize and promote structure development in the soil. This material can be applied at a rate of 0.15 to 0.25 pounds per square foot.
- Paper mulching, used in hydro seeding processes, must be applied at a rate such that soil of the seeded area is **NOT** visible.
- For warm weather seeding:
    - Seed mix used:

        - ODOT's specified seed mix for areas urban in character, see ODOT Item 659.09:
            - 30% Kentucky Bluegrass.
            - 30% Creeping Red Fescue.
            - 20% Annual Ryegrass.
            - 20% Perennial Ryegrass.

              OR,
        - Turf Type Fescue Mix.
    - Seed was applied at a rate of 0.015 pounds per square yard.
    - Straw mulch applied by mechanical straw blowers was applied at a rate of one half ($^1/_2$) pounds per square yard. For hand spreading of straw, straw was applied until soil was not visible.
- For cold weather seeding:
    - Either of the aforementioned seed mixes used.
    - Cold weather seed rate = warm weather rate doubled. Recommend adding winter wheat or cereal rye.
    - Cold weather mulch rate = warm weather rate doubled, for mechanical application of straw

6.5 Erosion Control

Erosion control is any provision taken that will prevent the migration of soil particles due to the action of moving water.

- Methods to control water movement through work area applied to prevent soil migration (See 6.6, Diversion Swale for example).
- Recommend following applicable erosion control practices given in *Rainwater and Land Development* available through the Ohio Department of Natural Resources.

6.6 Diversion Swale

A channel constructed with a supporting ridge on the lower side lying across the slope to intercept and redirect surface water.

- Diversion swale installed as located on plan.
- Diversion is ten (10) feet or more from the HSTS.
- Diversion swale outlets ten (10) feet or more from the property line or as specified by other local codes or ordinances.
- Outlet does not/will not create erosion of receiving channel.
- For drainage area less than six (6) acres:
    - Swale bottom width was one (1) foot minimum.
    - Depth was fourteen (14) inches from flow line to top of ridge.
    - Overall top width was eight and one half (8.5) feet minimum.
    - Ridge/berm width was one (1) foot or greater.
    - Maximum side slope was 3H:1V or flatter.
    - Channel shape: parabolic, V-shaped, or trapezoidal.
    - Swale slope was greater than 0.4% but less than 1%.
    - Swale extends minimum ten (10) feet beyond HSTS before discharge.

7 Section 7.0 Drainage Enhancement

7.1 Description

Drainage enhancements are measures taken to assist in removing subsurface water and proper management of surface water. For example, a gradient drain is a subsurface drain installed beneath the ground surface to collect and convey groundwater. The primary purpose of the gradient drain is to collect groundwater and to remove it from the adsorption area. A drain is composed of a collector segment, discharging segment and, possibly, a pump basin. The collector segment is the portion of the drain that actively collects water from the surrounding areas, via gravity. The discharging segment is the portion utilized to convey water away from the soil absorption area. A drain may have a gravity discharge or may require a pumped discharge.

The type of discharge for the drain is dictated by site conditions. Adequate elevation change is required to achieve a gravity discharging drain. In areas with insufficient elevation change, a pressurized discharge will be required. If a pressurized discharge is required, then the drain must incorporate a sump in which collected water is stored for pumping in discrete pumping cycles.

Interceptor drain or diversion swales are other drainage enhancements. See Section 7.6 Interceptor Drain, Section 6.6 Diversion Swale, Section 6.3 Care of Surface Water, and 6.5 Erosion Control for other drainage enhancements.

7.2 Gradient Drain Collector Segment

The requirements for the collector portion of the gradient drain are:

- Drain installed as located on approved plan.
- Drainage tubing diameter is four (4) inches.
- Minimum trench width based upon type of backfill:
  - #57 stone fill; minimum trench width was twelve (12) inches.
  - #8 stone fill; minimum trench width was eight (8) inches.
    (*Note that either rounded or angular (graded crushed limestone) may be used in this component. However, if angular #57 stone fill is used, markers must be provided so that the fall of the gradient collector segment may be determined)*
- Minimum pipe and trench bottom slope is one-sixteenth ($^{1}/_{16}$) inch per foot ($^{1}/_{2}$%).
- Corrugated slotted tubing used meeting/exceeding ASTM F-405.
- Minimum depth of pipe invert/trench bottom was twenty-four (24) inches below ground surface on mounded or other above grade structures, or six (6) inches below nearest leaching trench bottom, unless otherwise specified on plan.
- Aggregate is placed to within two (2) inches of top grade.
- Separation layer placed: Geotextile fabric or two (2) inches straw.

- Gradient drain collector did not share trench with any other liquid transport piping.
- Minimum of three (3) feet separation to any force/sub-mains, for non-crossing pipe alignments.
- Minimum of one (1) foot outside of basal area or mounded structure sand area for modified mounds.

7.3 Gradient Drain Gravity Discharge Segment

- Pipe diameter is four (4) inches.
- Pipe type with associated pipe slope:
  - For slope equal to or greater than one sixteenth ($^1/_{16}$") inch per foot:
    - Corrugated or smooth interior solid walled pipe used meeting ASTM F-405, and bedded in gravel; **or**,
    - Solid SDR 35 or SCH 40 smooth wall pipe used, and properly bedded and backfilled.
  - For slope less than one sixteenth ($^1/_{16}$) inch per foot:
    - Solid SDR 35 or SCH 40 smooth wall pipe used, and properly bedded and backfilled.
- For areas with less than twelve (12) inches of cover, Schedule 40 pipe used, regardless of slope.
- Last ten (10) feet must be SCH 40 PVC with animal guard.
- No flat (0%) or rising pipe segments present.
- Connections solvent welded, using color primer, if PVC pipe is used.
- Appropriate mechanical couplers used for corrugated or smooth interior pipe.
- Dissimilar pipe material connections made with mechanical coupling designed for this purpose.
- Trench backfilled with soils free of large rocks. Tamped and/or mounded to offset settlement effects after final approval.
- Pipe terminated at defined, pre-existing drainage way as specified on approved plan.
- Minimum six (6) inches freeboard from pipe invert to noted high water mark (or drainage way invert).
- Animal guard provided. Either commercial “flapper-type” device or two (2) one quarter (1/4") inch diameter bolts, galvanized, stainless steel or zinc coated, installed horizontally (like an equal sign (=)). No basket type devices used.
- Pipe discharge does not create any adverse erosion conditions (May require splash block, larger rocks, or rip rap for protection).
- Gradient drain discharge does not share a trench with any portion of a pressure pipe network.
- Any clamps used to secure rubber boot type pipe connections fabricated from non-magnetic stainless steel.
- Minimum of three (3) feet separation to any force/sub-main trench, and eight (8) feet from any lateral or leaching trench.

7.4 Gradient Drain Pressurized Discharge

- Gradient Drain sump required.
- Pressure pipe is Schedule 40 PVC, meeting/exceeding ASTM D-1785/D-2665.
- Minimum pipe diameter is one (1) inch; maximum pipe diameter is one and one half (1 $^{1}/_{2}$) inches, unless otherwise specified. Note: Pump must operate in the middle third of the corresponding pump performance curve. For short discharges, a flow restriction device, such as a cap with a large (1 inch diameter) hole or other, may be required to provide needed flow resistance to get pump operation within the middle third of the performance curve.
- Discharge pipe freeze protected by:
  - Twenty-four (24) inches soil cover.
  - Drain back of areas with less than twenty four (24) inches soil cover (Volume of drain back added to net dose of twenty (20) gallons); weep hole installed at proper elevation.
- Discharge pipe mechanically protected following Section 5.7.2
- Pipe properly bedded on virgin soil or aggregate.
- Trench backfilled with soils free of large rocks. Tamped and/or mounded to offset settlement effects after final approval.
- Minimum six (6) inches of freeboard provided at point of discharge to noted high water mark, maximum height above grade not to exceed ten (10) inches.
- Adequate protection provided at discharge to prevent erosion requires; splash block, large rocks, or rip rap for protection.
- Gradient drain discharge does not share a trench with any portion of the pressure distribution pipe network.
- Minimum of three (3) feet separation to any force/sub-main trench, and eight (8) feet from any lateral or leaching trench.

7.5 Gradient Drain Sump

See Appendix for drawing of Gradient Drain Basin for a typical detail of sump installation.

- Circular: Minimum sump diameter is eighteen (18) inches.
- Rectangular: Minimum shortest side length is eighteen (18) inches.
- Sump basin of rigid, watertight sidewall construction, extending minimum four (4) inches above original grade. Interior wall is smooth.
- Final grade was to lid of sump and gave a minimum uniform slope away of 16H: 1V (or six (6) inches of fall in eight (8) feet).
- Secure (capable of holding 300 pounds with minimal deflection), child-proof, lid provided; either heavy concrete (minimum weight sixty (60) pounds/maximum weight of eighty (80) pounds) or bolted (three (3) stainless steel, $^{3}/_{16}$ inch hex heads used.
- Sump based on compacted granular fill, mortar, or concrete.
- Sump depth allows twenty (20) gallon **net** dose (must be increased to include drain back volume, if applicable).
- Pump sized to handle anticipated flows.

- Minimum six (6) inches freeboard between sump inlet invert of pipe and sump pump "ON" water level.
- Horizontal solvent welded quick disconnect (union) within ten (10) inches of basin lid.
- Nylon or polyethylene lift rope supplied on pump.
- Pipe penetrations sealed.
- Electric installed per Section 8.0.
  - Gradient drain pump does NOT share an electrical circuit with another pump.
- Pump is a minimum of six (6) inches off the bottom, either on block or resting inside a properly designed flow inducer if turbine type pump is used.
- Inlet piping into sump basin is solid wall Schedule 40 PVC pipe (ASTM D-1785 or D-2665). PVC pipe is continuous to the collector segment and protrudes into the basin a minimum of three (3) inches (maximum of 6 inches) and extends over excavation into the collector trench a minimum of three (3) feet.
- *Only* ***one (1)*** *pipe penetration* from the gradient drain into gradient drain sump, unless prior approval.
- Need a high level alarm and float. Float "On" position will be two (2) inches below inlet pipe.

7.6 Interceptor Drain

An interceptor drain is a *gravity* drain that is used to collect laterally moving groundwater (up gradient) and surface water that is flowing toward a soil absorption field. These are used on sloping sites and placed on up-slope side of the absorption field and receive no flows resulting from the HSTS.

- Interceptor drain discharge installed per Sections 7.3 thru 7.5.
- Interceptor drain collector portion meets the following requirements:
  - Drainage tubing diameter is four (4) inches.
  - Minimum trench width based upon type of backfill:
  - #57 stone fill; minimum trench width is twelve (12) inches.
  - #8 stone fill; minimum trench width is eight (8) inches.
    (*Note that either rounded or angular (graded crushed limestone) may be used in this component. However, if angular #57 stone fill is used, markers must be provided so that the fall of the gradient collector segment may be determined.)*
- Minimum slope is one-sixteenth ($^1/_{16}$) inch per foot ($^1/_2$ %) of pipe and trench bottom.
- Corrugated, meeting/exceeding ASTM F-405, or smooth interior slotted pipe.
- Minimum depth of pipe invert/trench bottom was twenty-four (24) inches below ground surface on mounded or other above grade structures, or six (6) inches below nearest leaching trench bottom, unless otherwise specified on an approved plan.
- Interceptor drain installed within two (2) inches of final grade.
- Covered with two (2) inches straw to prevent siltation, during vegetation establishment.

- Interceptor drain collector does not share trench with any other piping.
- Minimum of three (3) feet separation to any force/sub-main trench, and eight (8) feet from any lateral or leaching trench.

8 Section 8.0 Electrical System(s)

8.1 General

Electrical system(s) includes all items for a HSTS that require the use of electric power to drive or control part of the system. Items include but are not limited to: electric cables, electric wires, electrical conduit, junction boxes, “dry” location installation, float switch(es)/control(s), safety disconnects, service panel requirements and control panel(s). For an explanation of the applicability of the above items, see the following individual sections for the definition and specifications of each. The following items are the general requirements, as they apply to a HSTS, for electrical systems.

- Electrical installations complied with conditions and/or regulations provided by the National Electric Code (NEC), local electrical inspection department, and these rules.
- Electrical connections installed for easy access, maintenance, and/or component replacement.
- Electrical installations approved by the local electrical inspection before final approval of the HSTS is given.
- Recommend that a surge suppressor is installed that allows protection of the HSTS electrical components.

8.2 Electrical Cable

Electrical cable is defined as a conductor with multiple wires contained in a protective sheath that enables the transmission of electrical current.

- Electrical cables sized to meet the amperage and voltage requirements of electrical components being served and minimize voltage drop due to length of cable required to provide service to the component.
- Directly buried electrical cable is rated for this application or housed within conduit.
- Electric cable crossing an excavation, tank (regardless of tank materials (e.g. - concrete, plastic, fiberglass)), or entering an electric enclosure, tank riser, pump basin, or building, encased in conduit and protected from settlement; **or** cable is surrounded by gravel, protected from settlement, with Danger Tape six (6) inches directly above the cable. Cable must be in conduit when entering an electric enclosure, tank riser, pump basin, or building; **or** other Health Department approved specifications are provided by vendor/manufacturer.
- Directly buried electrical cable placed upon virgin soils or bedded within compacted sand or gravel (see Section 4.0).
- Depth of burial twenty-four (24) inches or greater for electrical cable not encased in conduit. If less than twenty-four (24) inches of cover soil, electrical cable encased in conduit.
- All electrical cable conduits sealed with approved sealant, or device (such as a properly sized cord grip), prohibiting transmission of gases and vapors originating from within the HSTS (e.g. - tanks), or from ground moisture.
- Conductor is continuous between terminals or splice boxes. No underground

splices or splices inside conduit.

- Low voltage cable does not share conduit with high voltage cable.
- *For pumped gradient drain or interceptor drain, the cable providing electric service to the pump as it enters the basin is not required to be within conduit if it meets the following conditions for this cable:*
    - Sufficient cover is provided to satisfy local electric code, prior to entering the basin.
    - Cable penetration through the wall does not allow soil to enter into the basin. Penetration is sealed, as necessary to prevent soil infiltration.
    - Cable must enter J-box utilizing a non-corrosive cord grip.
    - Location of the point of penetration has 24 inches of cover and is directly below the J-Box.

8.3 Electric Wire

Electrical wire is defined as a conductor with a single wire that enables the transmission of electrical current.

- Electrical wire sized to meet the amperage and voltage requirements of electrical components being served and minimize voltage drop due to the length of wire required to provide service to the component.
- All electrical wires encased in conduit regardless of the burial depth or path of intended wire run.
- Electrical wire(s) encased in conduit placed upon virgin soils or bedded within compacted sand or gravel. Electrical wire installed in a manner that differential soil settlement will not impart forces on electrical conduit.
- All electrical wire conduits sealed with approved sealant prohibiting transmission of gases and vapors originating from within the HSTS (e.g. - tanks), or from ground moisture.
- Conductor is continuous between terminals or splice boxes. No underground splices or splices in conduit.
- Low voltage wires do not share a conduit with high voltage wires.

8.4 Electrical Conduit

Electrical conduit is defined as a pipe used to encase electrical conductors for protection.

- Approved Schedule 40 PVC electrical conduit installed or other pre-approved equivalent.
- All connections solvent welded or mechanical watertight joint.
- Under ground electrical conduits supported by natural, undisturbed, virgin soils or compacted fine to coarse sand or gravel fill.
- Electrical conduit sealed with approved sealant or device, prohibiting entry of gases and vapors into the conduit at all conduit entrances.
- No LB type connectors installed below grade on the exterior of any HSTS component. An LB may be installed within a tank or pump basin “below grade,” as long as the LB is not being utilized as a junction box. The LB must be used as a “pulling elbow.”

- Electrical conduit used to contain electric conductors when soil cover is less than twenty-four (24) inches, regardless of cable/wire type.
- Electrical conduit installed at locations where an electrical run crosses a trench excavation. Conduit support meets pipe support requirements.
- Electrical conduit used for any penetration into all risers, tanks or other enclosures sealed with sealant compatible with both materials, excludes gradient drain.
- Conduit sealed to be watertight before entering any J-Box (es).
- Electrical conduit placed below final grade when entering tank riser or pump basin.
- Conduit (including LB type connectors) contains a metal shield six (6) inches above and below final grade in areas where it is leaving the protection of ground (ex. at ground surface where conduit is extended vertically to enter a control panel).

8.5 Electrical J (Splice) Box(es)

An enclosure specifically designed for electrical system application to allow joining (splicing) of wires or cables.

- All electrical J Box(es) NEMA 4X rated. **Metal J boxes are not acceptable**.
- J Box(es) used at tanks/basins are located within the riser and mounted at a flood proof elevation, above original grade or located according to a specific design.
- J Box(es) located within tanks and/or risers securely mounted to tank or riser. Any penetration created while mounting J box sealed for watertightness, regardless of location. Sealant is compatible with both material types.
- Cord grips provided for any cable entering J Box. Cord grips fit cable snugly.
- No metal cord grips used, unless brass or stainless steel.
- “Round” or “square” cord grips used on the correct type of wire.
- J Box(es) sealed to inhibit gases, vapors and water from entering the J Box. Any open J box penetration sealed.
- J Box(es) opened (cover open) for inspection of the connections within J Box.
- J Box(es) sealed immediately after an approved inspection.
- No “plugged” connections used within J Box. **Connections are hard wired.**
- Conduit into J Box(es) sealed to prevent vapor/gas/water transmission through the conduit.
- Any splice box(es) mounted within any riser of any type or within a gradient drain pump basin is **NOT** to be used to house an electrical switch or any other type of electrical disconnect (See Section 8.10).
- J Box(es) mounted within a riser/basin in such a manner that the lid of the box is “UP.” Boxes are not to be mounted such that the lid/cover is on a side.

8.6 Electrical Splices

An electrical splice is the joining of any electrical conductors:

- Electrical splices are waterproof. ***(Non-waterproof electrical splice(s) will not be accepted).***

- Waterproof splicing techniques used:
  - Either butt-splice connectors covered in heat shrink tubing**; or**,
  - Manufactured waterproof wire nuts
- All splices located in an accessible electrical J Box or control panel.
- No “plugged” connections used within J Box. **Connections are hard wired.**
- Adequate wire present in J Box to allow easy connection and replacement of the component (pump, float switches, etc.).

8.7 Dry Locations

- Dry locations are only acceptable if they meet any of the following criteria:
  - Specified as part of a design that is stamped by a professional engineer (PE)**; or**,
  - Accepted as a dry location by the local electrical inspector**; or**,
  - Wired using components specified by the design.

8.8 Float Switch/Control & Pressure Transducers

A float switch/control is a device that will activate or deactivate an electrical circuit based upon its relative position. Typically, these are used in the controlling of pump activity, timed dosing activity, and alarms. A float switch is a float that transmits motor amps, directly controlling a pump motor. A float control is a float that transmits signal amps to various pump motor control circuitry.

- Float(s) are protected from moisture contacting bare wires or the paper insulation wrap between wires.
- Float(s) are not disturbed by any water stream (e.g. - weephole spray) within chamber.
- Float(s) installed so that they are free to move up and down without interference from other float(s), discharge piping, pump, or other items within tank or basin.
- Float(s) installed in a manner that any service time can be minimized.
- **<u>Float(s) setting(s) (elevation/height within the tank or basin) are documented on the dose sheet as required</u>.**
- Float(s) spliced per 8.5 and 8.6 of this section.
- **Floats are placed on their own float tree for ease of servicing.**
- Float trees must lock into an exact position.
- Float trees and support mechanisms must be non-corrosive.
- Float cords are left long enough to easily remove or adjust floats on a float tree. Excess cords are wound and zip tied or contained by another approved method.
- ***Float trees are to hold either narrow angle (mercury) floats or mechanical (ball) floats, as required by the control panel or pump. These float types are not to be intermixed on a particular float tree.***
- ***Zip ties or cable lock ties are NOT to be used to secure a float to a float mast (tree).***
- ***Floats are to be secured to the float mast/tree with a device that is constructed for such an application. This device must lock onto the float mast/tree while providing a secure attachment for the float cord.***

Pressure transducers utilize the change in pressure versus liquid depth to sense the depth of water within the vessel. The following are applicable to these devices:

- Transducers are to be mounted on a non-corrosive mount allowing for ease of service.
- Transducer capable of being locked into only one (1) position on its mount.
- Transducer umbilical tubing is of sufficient length to allow easy removal for servicing.

8.9 Service Panel

A service panel is an electrical panel that is used to distribute electricity to various circuits via breakers.

- Service panel breakers serving the control panel circuits or other HSTS circuits shall be clearly and permanently labeled as follows:
    - HSTS Controls/Alarms.
    - HSTS Pump #1 (*Pump #1 is always the first pump in the treatment train)*.
    - HSTS Pump #2.
    - HSTS Pump #3.
    - HSTS Blower.
    - Aerobic Treatment Unit (ATU) Motor.
- Ground fault circuit interrupts (GFCI's) type breakers are not used to provide service to the HSTS. **Exception:** Components that call for GFCI protection in an approved design.

8.10 Safety Disconnect(s)

A safety disconnect is a device that maintains a circuit open, so that any component (e.g. - pump) cannot be activated during times of service.

- Each electrical motor has a safety disconnect that is approved by the local electrical inspector.
- Safety disconnect(s) located outdoors in an accessible location that is compliant with local building codes and the National Electric Code (NEC).
- Any safety disconnect(s) or shutoff switch is **NOT** located within a riser of any tank or within the gradient drain sump.
- Are labeled properly for the device that it services.
- If the disconnect is located on a wall or pole, it must be a minimum of three (3) feet above and a maximum of five (5) feet above final grade.

8.11 Control Panel(s)

A control panel is an electrical component designed for HSTS applications to allow control of the HSTS or to house certain features of a HSTS. Section 8.11.1 will apply to any and all control panels, whether programmable (i.e. – capable of performing time dosing) or non-programmable (i.e. – control panel used in conjunction with a Type "H" Structure (Wisconsin Mound)).

8.11.1 General

The following items apply to all control panels. These apply to control panels employed in demand dosed HSTS and time dosed HSTS.

Design features

- All control panels must be UL listed and be NEMA 4X rated.
- Have an event counter and elapsed time meter for each pump, excluding a gradient drain pump.
- Have a high water level audio and visual alarm.
- Some means to control condensation inside the panel.
- Panels must contain a switch to silence an audible alarm.
- A disconnect for each circuit built into the panel, or a requirement for a disconnect for each circuit to be installed outside of the panel.
- All control panels must have ability to be operated in auto mode or manual mode.

Installation guidance

- Control panel(s) is (are) installed within view of the treatment tank (septic/dosing tank).
- All control panels located outdoors for convenient inspection and service.
- Control panel located for convenient viewing and access by the homeowner.
- Control panel is mounted four (4) feet to five (5) feet above final grade.
- Control panel is located on or within five (5) feet of an exterior house wall or *a letter shall be provided to the Health Department before final approval, signed by the homeowner, to justify the location of the panel.*
- It is **<u>NOT</u>** recommended that control panels be located on exterior walls of frequently used living quarters (e.g. - bedrooms). *Occasional control panel noise (specifically motor contactor engagement) may disturb occupants.*
- Control panel(s) and conduit installed so that any conduit or cable settling will not distort or crack the enclosure.
- Electrical conduit shall be sealed with a product recommended by the control panel manufacturer to prohibit entry of gases and vapors originating from other portions of the HSTS.

8.11.2 Programmable Control Panels

See Addendum for panel requirements for system type

9 Section 9.0 Disinfection and Monitoring Devices

9.1 General

Disinfection and monitoring devices are an important part of many HSTS installations which allow the end user to properly operate, manage, and maintain the onsite system. These components are often essential to easily identify and fix problems, meet regulatory requirements, or adjust settings to prevent system failure and health hazards.

9.2 Disinfection Devices

A Health Department reviewed and approved commercially manufactured vessel which is designed to allow effluent to pass by and be exposed to an agent which kills or inactivates disease causing organisms.

9.3 Scope and Applicability

These devices are used in an HSTS to meet water quality discharge standards or to gain depth credits in soil absorption systems. The use of disinfection devices must be pre-approved by the Health Department.

9.4 Types of Disinfection

Currently only two types are available for use in the County. They are UV radiation and tablet chlorination. The following apply to both units.

- The unit is sized for the expected flow from the treatment device.
- They are installed according to the Health Department's approved manufacturer's recommendations.
- Installed upstream of sample well/point.
- The units are watertight.
- They are housed in an easily accessible container for convenient servicing.
- They are monitored by the control panel and alert the operator when maintenance is needed.
- When maintenance is needed, the control panel inactivates any primary pumps in the system until serviced is properly performed.

9.4.1 UV Disinfection

UV radiation is generated by an electrical discharge through mercury vapor, which penetrates the genetic material of microorganisms and retards their ability to reproduce.

- Installed immediately after the treatment component.
- When called for as part of an approved design, UV installed before any soil absorption component.
- If UV light goes out then system is not allowed to pump or an alarm is sounded.

9.4.2 Chlorinators

Chlorine is a powerful oxidizing agent, kills or inactivates microorganisms by oxidation of cellular wall material.

- Designed not to allow tablets to be immersed in effluent.

- Installed with a free flowing outlet.
- When called for as part of an approved design, installed before discharging to an approved location.
- Never installed before a soil absorption system or other approved treatment device.
- Uses sodium hypochlorite tablets.
- Is stocked with two (2) tablets in each feeder tube before final approval.
- Additional tablets are left with homeowner in their original container.
- Tablets are formulated for residential flows to prevent wicking.
- Used in conjunction with a dechlorinator.

9.4.2.1 Chlorine Contact Chamber

For chlorine to properly disinfect, the chemical must be in contact with the wastewater for a given length of time. For this reason contact chambers must be designed and installed behind chlorinators so that the wastewater flows turbulently, in a plug flow fashion, throughout the device, ensuring complete mixing. This mixing allows the chlorine to have maximum contact with the wastewater and ensures that there are no dead areas (unused portions) of the chamber.

- Chamber(s) have a minimum volume of seventy (70) gallons.
- Sized to allow for a minimum of twenty (20) minute contact time.
- Effluent flows in a plugged flow fashion through a labyrinth with a minimum of a 20:1 length/width ratio, unless otherwise approved.
- Constructed of rigid watertight material, extending minimum four (4) inches above original grade.
- Final grade was to the lid of chamber and gave a minimum uniform slope away of 16H: 1V (or six (6) inches of fall in eight (8) feet).
- Secure (capable of holding three hundred (300) pounds with minimal deflection), child-proof, lid provided; either heavy concrete (minimum weight sixty (60) pounds/maximum weight eighty (80) pounds) or bolted down with (three (3) stainless steel, $^{3}/_{16}$ inch hex head screws. Subject to Section 3.0 watertight test requirements.
- Designed and installed so that water does not back up to the chlorinator.

9.4.2.2 Dechlorinators

Because chlorine is a powerful oxidizer which is harmful to humans, animals, and the environment, removal of chlorine from the waste stream is necessary. Dechlorination tablet feeders require the same specifications to be followed as chlorinators.

- Dechlorination tablets are formulated with Sodium Sulfite.
- Installed downstream of chlorine contact chamber.
- Installed so that water does not back up to the chlorinator.

9.5 Effluent Sampling Wells

This effluent sampling well allows for the monitoring of treatment system effluent quality to insure compliance with regulations.

- Vessel is subject to requirements found in Section 3.0.
- Minimum diameter of fifteen (15) inches, or shortest sidewall length of fifteen (15) inches used.
- Designed and installed so that effluent has a free flowing inlet.
- Designed with six (6) inches of freeboard under inlet pipe.
- Inlet pipe extends into the basin three (3) inches.
- Outlet must be six (6) inches above the bottom of the basin.
- Outlet pipe extends into the basin three (3) inches.
- Installed after any disinfection device, unless otherwise stated.
- Constructed of rigid watertight material, extending minimum four (4) inches above original grade.
- Final grade was to the lid of chamber and gave a minimum uniform slope away of 16H:1V (or six (6) inches of fall in eight (8) feet).
- Secure (capable of holding three hundred (300) pounds with minimal deflection), child-proof lid provided; either heavy concrete (minimum weight sixty (60) pounds/maximum weight eighty (80) pounds) or bolted down with three (3) stainless steel, $^{3}/_{16}$ inch hex head screws. ***S3 recessed square heads are prohibited.***

9.6 Access Wells/Valve Boxes

An access well/valve box is a container designed for installation below grade to maintain an open volume at this location. They have lids to grade, which provide access to observation ports, lateral cleanouts, valves, and other system components.

9.6.1 Specifications

The following apply to access wells/valve boxes:

- Easy access to internal components provided.
- Set upon a stable, compacted gravel base; so that lids or covers will not settle onto internal components.
- Installed so that lids and covers are flush with ***settled*** finished grade. (Backfill soil around access well/valve box was firmly compacted and will compact no further under foot pressure).
- For manufactured access wells/valve boxes, lids lock into place.
- For access wells/valve boxes covered with patio stones, the diameter of the patio stone must be at least 2 inches larger than the diameter of the access well/valve box.
- Wells/boxes are protected from lawnmower damage.

9.7 Observation Ports

An observation port is a device that allows viewing of various infiltrative surfaces within a structure. See the Observation Port drawing in the Appendix.

9.7.1 Specifications

The following apply to observation ports (See Observation Port drawing in the Appendix).

- Installed as indicated on the drawings in the Appendix or as otherwise specified.
- Ports constructed from three (3) inch or four (4) inch Schedule 40 PVC pipe solvent welded to a PVC toilet flange base of the same diameter.
- Toilet flange bottom was removed.
- Port base contains four (4) slots, four (4) inches long, one-eighth ($^1/_8$) to one-quarter ($^1/_4$) inch wide, placed ninety (90) degrees to one another.
- Observation ports on sand/soil interface have slots wrapped in geotextile fabric to prevent siltation of viewing surface.
- Top of the observation port terminated at a point that is three (3) inches below final grade/access well lid.
- Observation port fitted with **non-threaded** cap/plug that was easily removable (thin test caps/plug).
- Port is made accessible in an approved access well.
- Observation port(s) that go to the plowed soil/ground level cannot be placed in the gravel of a mound system. They should be placed on the slope of the sand.

10 Section 10.0 Mounds/Modified Mounds/Other At-grade Structures

10.1 Definition

A mound/modified mound/other above grade structures will be referred to as structures throughout this section. These provide secondary or tertiary treatment for domestic wastewater. Domestic wastewater effluent is distributed over the infiltrative surface of the structure for treatment and/or dispersal into site soils. These structures are used to compensate for inadequate soil conditions, site topography, and other limitations.

10.2 Scope and Applicability

Structures are applicable to soils and lots with slow permeability soils, seasonally shallow water tables, and other restrictive conditions. They are used to receive soil depth credits.

10.3 Purpose and Function

Structures provide a device to overcome certain site limitations. Two general classes of these structures exist. The first class is those structures that receive septic tank effluent. In these, the structure provides secondary treatment of the effluent, while providing a sufficient structure-soil interface to allow infiltration at a rate that can be accommodated by the native soils. Two examples of these are mounds and drip micro mounds. The second class is those structures that receive filtrate. Filtrate is septic tank effluent that has been sufficiently “cleaned” by a pretreatment device. This pretreatment device is a Health Department approved device that aerobically treats effluent to Health Department approved limits on various parameters such as BOD_5, TSS and Fecal Coliforms. These structures provide an effective method of spreading filtrate over adequate soil surface area so that the infiltration rate of the soil is not exceeded. Modified mounds (designed like a mound with less sand) provide additional treatment as the filtrate passes through the structure, and serve primarily to take advantage of the upper soil horizons.

10.3.1 Specifications

The following shall apply to the design, location, and installation of all structures.

10.3.2 General

- Structure is not located in a low or swampy area, unless no options exist.
- Unless otherwise specified within an approved plan, structures are either time dosed, or follow a pretreatment device which is time dosed.

10.4 Basal Area Preparation

Basal area preparation includes activities necessary to allow the construction of a structure. These activities are clearing, basal area chisel plowing, and protection of this area. Clearing involves the removal of vegetation to allow the plowing of the footprint of the proposed soil absorption system. Chisel plowing opens the surface of the soil absorption area to create an interface with sand to allow infiltration of waters into the soil profile.

10.4.1 Protection

Protection of the basal area and replacement area is extremely important through all phases of the construction process. Extreme care must be taken to avoid compaction of the basal area from HSTS construction activities or other site activities. Even with the use of low ground pressure equipment during the basal preparation, care must be used as to not smear or rut this area. The reserve (backup) area shall be held to the same protection standards as the primary area.

- Basal and replacement area protected from unauthorized access by barricades or other features that limit site access.
- Material staging for any activity located in an area that will not impact basal area.
- Sources of surface water run-on have been identified and measures taken to protect basal area from these flows.
- It is understood that **no excavation may occur in the basal area**.
- It is understood that damage to the basal area may require relocation of the structure, relocation of the entire system, and possibly re-design. Re-design fees may be charged.

10.4.2 Clearing

Clearing shall consist of vegetation removal from the footprint or basal area of the structure. All conditions in Section 2.4 apply.

10.4.2.1 Areas without Trees or Brush

- See Section 10.4.2.3 for equipment requirements.
- Basal area vegetation cut as close as possible to ground surface without compaction, rutting, or smearing.
- No heavy equipment used.
- Clipped (loose) vegetation removed from basal area; removal methods do not cause compaction, rutting, or smearing.

10.4.2.2 Areas with Trees or Brush

- Trees or bushes with a trunk diameter three (3) inches or larger cut as close to the ground as possible, leaving the stump.
- Trees or bushes with a trunk diameter of less than three (3) inches removed by pulling them out (including stump) or cut as close to the ground as possible, leaving the stump.
- Organic debris removed.
- Areas with excessive litter (e.g. – leaves/sticks/branches) and vegetative matter

removed in an acceptable manner (Raked/blown off).

10.4.2.3 Mechanical Clearing

- Use of mechanical means for clearing is subject to the same limitations that apply in Sections 10.4.2, 10.4.2.1, and 10.4.2.2.
- Machines with very low ground pressure of less than or equal to four (4) psi can be used; for example, skid steers with rubber tracks and/or small rubber tracked excavators. No backhoe or heavy equipment on basal area.
- No rubber tire equipment is used, except walk behinds.
- Care is taken to ensure soil compaction and smearing is avoided.

10.4.3 Chisel Plowing

Chisel plowing of the basal area (infiltrative surface) creates an interface between the sand of the structure and the soil. The characteristics of the interface zone will determine the performance of the structure. The key element is to expose enough of the existing soil structure so that all of the effluent can enter the soil and begin the final phase of treatment.

Water moves through any soil by two methods: 1) flowing through pore spaces within the soil structural unit (peds) 2) flowing through void spaces created by ped arrangement (between peds). Water movement through soil pores depends on pore size and continuity. The finer (smaller) the pore size is, the slower the water movement (and vice versa). In very small pore spaces, the attractive forces between the water molecules and the individual clay particles that are part of the composition of the soil are strong and dominant. Water molecules move from the moist particles to the dry particles very slowly. The soil's structure cannot be improved by mechanical means, so damage to the structure must be minimized during chisel plowing operations.

The moisture state of the basal area must be carefully considered prior to chisel plowing. It is possible for the soil to be too wet or too dry. If the soil is too wet, compaction and smearing of the soil is possible, thus greatly reducing the quantity of infiltration across the sand/soil interface. If the soil is too dry, it is possible to pulverize the soil into dust. The dust layer results in a soil stratum that has very small pore spaces and no soil structure, greatly inhibiting infiltration into the soil basal area.

10.4.3.1 Chisel Implement Guideline

- Before plowing basal area, implement tested on soil in similar condition to the basal area to ensure it meets performance criteria.
- Tractor tire or tracks did not lose traction and spin (Note: power requirement is approximately ten (10) horsepower per shank).
- Bucket teeth **NOT** used as chisel implement.
- Rototiller **NOT** used.
- Unless otherwise specified, the following apply:
    - Width:
        - Individual chisel shanks are one (1) inch to two (2) inches wide.

- <u>Spacing</u>:
  - Spacing of shanks is fifteen (15) inches or less, center-center. (Ideal spacing is to have shanks staggered nine (9) inches apart).
  - Soil conditions may require closer spacing or additional passes with implement (Note: Tractor propelled implements limited to one pass.)
  - Spacing allows fractured soil to flow between shanks, soil not dragged.
- <u>Length</u>:
  - Shanks are long enough to penetrate soil four (4) inches to six (6) inches.
  - Shanks are long enough to prevent fractured soil and sod from being dragged by implement.
- <u>Width of Implement</u>:
  - Tractor hitch-mounted implements have an effective width equal to, or exceeding the width of tires or tracks.
  - Tractor hitch-mounted implements make one pass to chisel plow the effective width of the implement.
  - Backhoe and excavator arm-mounted implements have no minimum width requirement, *but care must be taken to not overwork the soil*.
  - Allows operator full view to monitor chiseling operation.

10.4.3.2 Chisel Plow Requirements

- Only infiltrative surface (basal area) was plowed.
- Buffer area between the basal area and gradient drain was not disturbed.
- For sites with side-to-side elevation difference of more than six (6) inches:
  - Chisel plowing was parallel to land contour.
- For sites with side-to-side elevation difference less than six (6) inches:
  - Chisel plowing direction is not specified, but the operator must not overwork a particular area due to overlap.
- Chisel plow was around any remaining stumps.
- Effective depth of chisel plowing was four (4) inches to six (6) inches (unless written authorization was obtained to do otherwise).
- Irregular surface resulted from chisel plowing.
- Plowed infiltrative surface has 60% to 75% of the soil surface broken up.
- Bottom and sidewall of plowed grooves are rough and open.
- Immediately after completion ***and*** acceptance by the Health Department, plowed area is covered with a layer of sand.
- Chisel plowing not attempted when basal soils are frozen. Guidance for saturated or extremely dry soils is given in Section 2.4 Soil Moisture Condition Planning.
- Chisel plowing is stopped if smearing of plowed soils or vertical groove wall is noted.
- Bucket teeth **NOT** used as chisel implement.

- Rototiller **NOT** used.
- All sand for the system has to be on the job site with appropriate documentation (sand tickets) prior to chisel plowing.

10.5 Layout of Structures

This section gives specifications applying to the layout of structures for the following site conditions. They are; “flat” sites - regular shape; “flat” sites - irregular shape; sloped sites; and split/divided structures. A regular shape is a typical rectangular shaped structure, while irregular shape is a structure that deviates from a typical linear type structure. In some instances, site conditions (available area/topography) require that a structure be divided or split so that the structure meets design requirements.

10.5.1 Flat Site – Regular Shape

A regular shape reflects a straight-line type structure, while a flat site is a site in which the slope of the site is less than 4%.

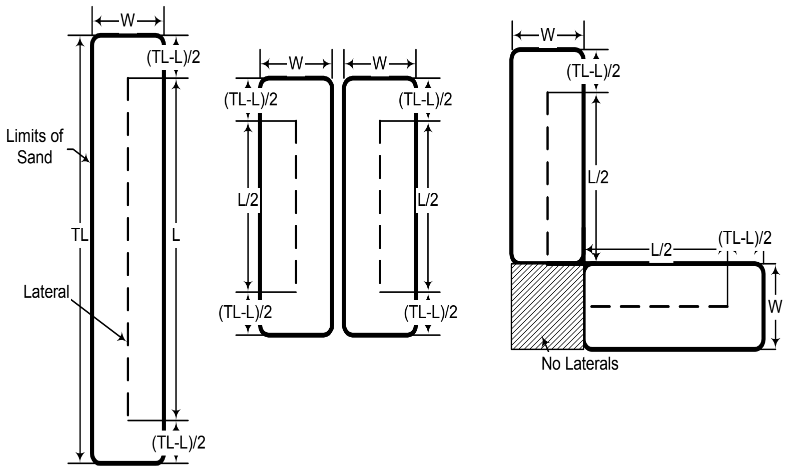
- Orientation is not greatly dictated by the contour of the land. Therefore, the orientation of the structure can be based on maintaining minimum isolation distance from various site features, overall parcel utilization characteristics, and owner preferences.
- Structure avoided crossing any type of surface water drainage course. If crossed as part of an approved plan, potential flows are redirected away from or around the structure.
- Maximum deviation of basal elevation directly under lateral(s) was six (6) inches per one hundred (100) feet of the structure ($^1/_2$%), unless otherwise specified.

10.5.2 Flat Site – Irregular Shape

An irregular shape is one in which an L-shaped type structure or other is to be installed. Special consideration must be given to these sites such that design assumptions are not violated (particularly linear loading rate, LLR). A flat site is a site in which the slope of the site is less than 4%.

- Orientation is not greatly dictated by the contour of the land. Therefore, the orientation of the structure can be based on maintaining minimum isolation distance from various site features, overall parcel utilization characteristics, and owner preferences.
- The pressure piping distribution laterals are placed so that sideways moving water that flows perpendicularly from the lateral will “see” the “$^L/_2$” structure side dimension as shown in Figure 10.1
- Structure avoided crossing any type of surface water drainage course. If one must be crossed as part of an approved plan, potential flows are redirected away from or around the structure.

- Maximum deviation of basal elevation directly under lateral(s) was six (6) inches per one hundred (100) feet of the structure, unless otherwise specified.



<u>Figure 10.1</u> – Irregular shape structure. Structure at left is a typical single structure mound. Dimension L/2 must be the same for both structures, at right. *(See the Reference Section for a table that gives half-structure dimensions for CCGHD mounds.)*

10.5.3 Sloped Site

A sloping site is one in which the overall slope of the area on which the structure is to be placed is equal to or exceeds 4%.

- Long axis of the structure absorption bed followed the contour of the slope.
    - Maximum deviation of basal elevation directly under lateral(s) (centerline along the length of the mound) was six (6) inches per one hundred (100) feet of the structure
- All isolation distance requirements were met.
- Structure avoided crossing any type of surface water drainage course. If one must be crossed as part of an approved plan, potential flows are redirected away from or around the structure.
- Surface water redirected around the structure prior to contacting the structure's toe.

10.5.4 Split/Divided Structures

A split/divided structure is one in which the structure is divided into completely separate structures. These are typically installed due to special site conditions. These types of structures result in increased aggregate requirements for structure completion.

- Structure lay out satisfies the required linear loading rate.
- Individual structures installed per Section 10.5.1 or 10.5.3 as they apply due to the site conditions.
- Installation of this type of structure only as part of an approved plan.

10.6 Construction Specifications

These specifications are given as a general approach to the steps necessary to construct structures. It contains items that are specific to these types of systems, but the overall approach is applicable to many types of HSTS installations.

10.6.1 Structure Layout Procedure

The following is a recommended procedure to layout these types of structures. The structure must be laid out so that the basal area can be located and checked for compliance with applicable rules. The layout also serves as the starting point of the as-built plan. It serves as a critical tool for planning the overall HSTS. It allows the installer to assess what the site conditions are and what will be required to install a particular HSTS on the site. The following is a summary of activities for the layout of these types of systems.

- Structure location marked by the designer and installer has verified that layout requirements are met.
- Other items, such as proprietary pretreatment technologies, septic tank, and dosing tank, located and marked. Distances and elevation changes noted with respect to the other components to provide input for hydraulic calculations (or to give to pump vendors for proper pump sizing).
- Gradient drain sump, discharge line route, and discharge location located. Elevation changes and distances recorded to verify ability for gravity outlet, **or** provide input for hydraulic calculations (or to give to pump vendors for proper pump sizing).
- Verified that all minimum required isolation distances are met.
- Any questions noted so that these may be addressed at the time of the Preconstruction Conference.
- **Completed before the Preconstruction Conference.**

10.6.2 Layout of Structures Requiring a Level Upper Sand Surface

- Includes all mounds that receive septic tank effluent; **and**
- Modified mounds with two or more laterals placed side by side.

__Steps:__

This describes a procedure to lay out the center portion of a mound structure, where the level infiltrative surface and the sand depth required for treatment are located. **The edges of the level upper sand surface** are the boundaries of this portion of the structure. Review the cross section of the structure for the location of the edges, relative to other features. This procedure may be used to locate the up-slope and the down-slope edges of the level sand, the side-slopes of the sand fill, and the locations of the sand fill toes. On a sloping site, the up-slope edge and toe are closer together, and the down-slope edge and toe are farther apart.

Lay out the up-slope edge of the **level sand**

1. Lay out the mound according to specifications found in Section 10.5 and according to site plan location with paint/flags.
2. Place lathe, as needed, to mark the up-slope edge of the level sand along its full length.
3. With the laser/level/transit, locate the highest elevation along the up-slope edge. Place a lathe at this point.
4. Mark the specified depth of sand on that lathe. This marks the "top of sand" elevation along the up-slope edge of the bed.
5. Mark the other lathe with the "top of sand" elevation.

Lay out of down-slope edge of the **level sand**

1. Place a grade rod against the base of the up-slope lathe. Hold the rod level and measure the width of the level sand.
2. Place lathe, as needed, to mark the down-slope edge of the level sand.
3. Mark the "top of sand" elevation on the lathe.

Lay out of the lower sand fill side-slope toe

1. Measure the sand depth at a lathe. Multiply the sand depth by three (3xd).
2. Place a grade rod against the base of the lathe, extending it down slope.
3. Hold the rod level and measure the (3xd) distance out from the base of the lathe.
4. Drive a lathe into the ground at the (3xd) distance. Mark the lathe where it crosses the level rod.
5. String a line, from the "top of sand" mark on the lower edge lathe to the mark on the lathe at (3xd). Extend the straight line beyond the lathe to meet the ground and pin the line in place
6. The string line is the side-slope location for the structure. The pin is the toe at that point. The side-slope remains constant, but the toe may move up the slope or down the slope, depending on the ground elevation.

Lay out the upper sand fill side-slope and toe

1. Build the upper slope to the same line as the lower side-slope, turned 180 degrees.

10.6.3 Layout of Structures Allowing for a Uniform Sloping Sand Surface

- Includes drip distribution micro mounds

Steps:

This describes a procedure to lay out the center portion of structure, where the infiltrative surface and the sand depth required for treatment are located. The infiltrative surface of the structure slopes uniformly. The edges of the upper sand surface are the boundaries where the side-slopes begin. Review the cross-section of the structure for the location of the edges, relative to other features. This procedure may be used to locate the up-slope and down-slope edges of the upper sand surface, the side-slopes of the sand fill, and the locations of the sand fill toes. On a sloping site, the up-slope edge and toe are closer together, and the down-slope edge and toe is farther apart.

Lay out of the up-slope edge of the sand

1. Lay out the mound according to the specifications found in section 10.5.
2. Place lathe, as needed, to mark the up-slope edge of the sand along its full length.
3. Locate the highest ground elevation along the up-slope edge. Place a lathe at this point.
4. Mark the specified depth of sand on that lathe. This marks the "top of sand" elevation along the up-slope edge of the bed.
5. Mark the other lathe with the "top of sand" elevation.

Lay out of down-slope edge of the sand

1. Place a grade rod against the base of the up-slope lathe. Measure the width of the sand, from edge to edge.
2. Place lathe, as needed, to mark the down-slope edge of the sand.
3. Locate the highest ground elevation along the down-slope edge. Place a lathe at this point
4. Mark the specified depth of sand on that lathe. This marks the "top of sand" elevation along the down-slope edge of the bed.
5. Mark the "top of sand" elevation on the lathe.

Lay out of the lower sand fill side-slope and toe

1. Measure the sand depth at a lathe. Multiply the sand depth by three (3xd).
2. Place a grade rod against the base of the lathe, extending it down slope.
3. Hold the rod level and measure the (3xd) distance out from the base of the lathe.
4. Drive a lathe into the ground at the (3xd) distance. Mark the lathe where it crosses the level rod.
5. String a line, from the "top of sand" mark on the lower edge lathe to the mark on the lathe at (3xd). Extend the straight line beyond the lathe to meet the ground and pin the line in place.
6. The string line is the side-slope location for the structure. The pin is the toe at that point. The side-slope remains constant, but the toe may move up the slope or down the slope, depending on the ground elevation.

Lay out of the upper sand fill side-slope and toe

1. Build the upper slope to the same line as the lower side-slope, turned 180 degrees.

10.6.4 Layout of Structures Allowing for Sand to be Placed Everywhere at a Minimum Thickness

- Includes modified mound systems.

Steps:

1. Lay out structure to the specifications found in Section 10.5.
2. Locate the gravel area (length & width) within this outer perimeter as specified in the approved plans.
3. Verify that the maximum deviation of basal elevation directly under lateral(s) will be less than six (6) inches per one hundred (100) feet ($^1/_2$%).
4. Remember that laterals must be installed level (with slight elevation at the end). Any variations in contour under the lateral must be filled with sand to establish a level sand-to-gravel interface. Maintain the minimum 3:1 side slope.

10.7 Construction of Structures

Careful site protection and basal area protection are required for these HSTS's. The basal area is to be protected during all phases of site development, preparation, and construction. No rubber tire equipment is permitted for use within the limits of the basal area during construction, except when the basal area is being chisel plowed. **NO TRENCHING IN THE BASAL AREA!** If damage to the site and/or basal area results, the site may require:

- Relocation of the structure.
- Relocation of the entire system.
- A redesign of the structure or re-design of the system.
- Re-inspection fees and re-design fees may be charged to the permit holder.

For structures that have drains along both sides of the structure:

- No construction traffic permitted on the area enclosed by the drains.

10.8 Aggregates

Aggregates within a structure consist of specified sand and specified gravel found in Section 4.0. The sand is the media in which biological activities occurs, thus allowing treatment of the wastewater. The gravel serves as a more permeable layer above the sand, spreading the liquids to be treated over the sand area and provides pipe support. The following are general guidelines for the installation and storage of these aggregates.

- Aggregates stockpiles were away from basal area, allowing sufficient space for equipment operation.
- Sand stockpile usage:
    - Top of pile to six (6) inches from pile bottom: This aggregate placed along

centerline, in the "center" of the structure (structure core) and directly over the basal area (plowed surface).
    - Six (6) inches from pile bottom: This aggregate can be placed to build the side slopes of the structure.
- *Copies of the sand and gravel tickets are available to be given to the inspector at the time of inspection.*
- All sand must be on sight before chisel plow can begin.

10.8.1 Aggregate Placement

- For structures that are "narrow" (i.e. - structure base area reachable by installer's equipment from a side), the following is the only option available for placement of structure aggregates and cover soils.
    - All material was placed from outside the basal area or from outside the drains.
- For structures that are "wide," two options are available for the placement of structure aggregates and cover soils.

Option #1:

- All material was placed from the outside of the basal area or from the outside of the drains.

Option #2: This method only applies to soil conditions described in Section 2.4

- Two thirds ($^2/_3$) of the width of the basal area was chisel plowed.
- Material was placed on the chisel plowed area from outside of the nearest drain.
- Material was transported across the non-chisel plowed area according to the following:
    - Traffic was perpendicular to the centerline of the structure.
    - Equipment was backed off of the basal area, not turned or spun.
    - Two thirds ($^2/_3$) of the sand was placed before the remaining basal area is chisel plowed.
- The remaining one third ($^1/_3$) of basal area was then chisel plowed.
- The remaining material was placed from the outside of the basal area and from the outside of the drain.
- This option will require Brown County Health Department approval.

Option #3: This method requires the use of **rubber-tracked equipment** to move aggregate to the center of a mound structure, and does not apply to **rubber-tire equipment with steel tracks**.

- Place twelve inches of sand, starting from the drain, onto the prepared basal area.
- Keep at least six inches of sand under the tracks as the sand is placed.
- Keep traffic perpendicular to the centerline of the structure. Back

out; don’t turn or spin.

- Place sand in six inch lifts.
- Unloaded equipment may be run parallel to the centerline to settle sand after placement.
- Take care to keep the sand clean in the center third of the structure.

10.8.2 Sand

The sand is the treatment media on which aerobic bacteria grow to break down wastewater constituents.

- The sand complies with media specifications found in Section 4.0.
- Minimum final settled sand depth is as specified in an approved plan.
- The sand was placed in maximum six (6) inch lifts and settled, if applicable. Care must be taken with the initial lift. The goal is to settle the sand, not the basal soils. Do not stratify the sand particles.
- After sand placement, the structure was hand graded providing the specified smooth slope transitions.
- Sand is settled for stable support of the gravel and distribution network.
- Sand is free of any dirt clods or other undesirable materials.
- All sand areas meet the minimum dimensions found on the approved plan unless system layout steps determined areas needed to be larger to accomplish 3H:1V slopes.

10.8.3 Gravel

This **clean and washed gravel** is placed to properly support distribution laterals, evenly distribute applied wastewater, and prevent erosion of sand.

- Gravel complies with media specifications found in Section 4.0.
- **Gravel must be visually CLEAN or it will have to be removed**.
- Gravel thickness should be minimized. Extra gravel is not acceptable, if laterals need to be made level it should be done with sand only. The primary purpose of the gravel is to securely support the pipes.
- Laterals are as specified in the approved set of plans.
- Laterals comply with the specifications found in Section 5.0.
- Laterals are completely supported and surrounded by gravel at the time of inspection.
- Gravel is placed so that it completely supports the distribution laterals.
- All gravel areas meet the minimum dimensions found on the approved plan (drawings).
- Cleanouts installed on laterals per Section 5.8.6.1 (slightly elevated and well supported to drain back).
- Access wells installed over all cleanouts per Section 9.6.
- Gravel thickness (depth) is provided on the drawings in the appendices.

10.8.4 Laterals

The laterals described in this manual are PVC pipes designed for controlled and predictable distribution and application of effluent.

- When the laterals are specified to be installed level (flat), the first and last orifice on any given lateral is to be installed in the 12 O'clock (Up) position. All other orifices on a given lateral will be installed in the 6 O'clock position (Down).
- Laterals are as specified in the approved set of plans.
- Laterals comply with the specifications found in Section 5.0.
- Laterals are completely supported and surrounded by gravel at the time of inspection.
- Cleanouts installed on laterals per Section 5.8.6.1 (slightly elevated and well supported with drainage toward laterals).
- Access wells installed over all cleanouts per Section 9.6.
- Gravel thickness (depth) is provided on the drawings in the appendices.

10.9 Geotextile (Filter) Fabric

Material placed over system to provide separation and filtration to prevent migration of cover materials into the filter bed.

- Placed after flushing procedure completed, prior to final cover soil installation.
- Gravel or drip tubing area covered completely with geotextile fabric consistent with specs found in Section 4.11.
- Overlap of fabric six (6) inches minimum.
- No tears in the fabric are allowed.
- If torn, the area is treated with an overlapping piece of fabric at least six (6) inches larger in all directions of the tear.
- Has to be in place for system to be finaled.

10.10 Cover Soil

Provides protection of the structure components and prevents contact with sewage.

- For structures receiving filtrate, site soils used (See Section 4.10).
- For structures receiving septic tank effluent, the area over the gravel or drip tubing area complies with Section 4.10.1 **No Exceptions**; the remaining portion of the cover can be good topsoil from the site (Section 4.10.2).
- Cover soil was free of any rocks (larger than three (3) inches) and large roots.
- All soil clods, larger than two (2) inches in diameter, were broken apart.
- Cover grading allows for easy, trouble-free lawn care maintenance in the future.
- Cover graded to drain surface water off and away from the structure.
- Cover was placed so that a minimum of six (6) inches of cover exists after settlement. (Maximum settled thickness was eight (8) inches).
- A minimum of 3H:1V, or flatter, slope was established on the sand fill prior to soil placement.
- Any exposed components (e.g. - valve boxes) have soil tamped into place so that no further settling will occur. Finished grade around such components shall be

flush with their tops.
- Grass seed and geotextile fabric the area per Section 6.4.

10.11 Observation Ports

Subsurface access stand pipe which allows viewing of the sand/gravel and sand/basal area surfaces for monitoring of potential plugging.

- See the drawings in the appendix for the number and placement of the observation ports.
- Due to a change in the location of the observation ports, they **CANNOT** share a common access well with a lateral cleanout.
- All observation ports that go to the basal area **CANNOT** be located in the gravel.

10.12 Drain Installations

- It is recommended that when the design uses an interceptor drain, it is installed after final soil cover is placed at the up-slope toe of the soil cover to prevent water from being trapped behind drain.

11 Section 11.0 Leach Trenches (LT)

11.1 Definition

A soil absorption sewage system consisting of excavated trenches and perforated four (4) inch diameter pipe with gravel, eight (8) inch diameter perforated pipe with manufacturer recommended backfill, or other approved distribution devices. These are used for the dispersal and treatment of wastewater in the surrounding native soils.

11.2 Scope and Applicability

The LT sewage system applies to soils and lots within the county with adequate topsoil and soil depth, sufficient lot area to accommodate the primary leach trench system and an equivalent area of replacement, and proper topography.

11.3 Purpose and Function

Effluent from the septic tank, or approved pretreatment device, is delivered by gravity or pump to the leach trenches (LT) for final treatment and disposal into the soil. Thus, the purpose of leach trenches is to convey effluent into the soil until total soil absorption of the effluent occurs.

11.4 Specifications

The following shall apply to the installation of leach trenches.

- See the drawings in the Appendix.

11.4.1 Sizing and Location

- Total length of leach trenches (size) required is based on number of bedrooms.
- Replacement area is protected and able to accommodate total length of replacement leach trenches (LT).
- LT are **NOT** located on:
  - Slopes in excess of 15% (approximately 7H:1V) unless otherwise approved.
- LT are not located on the following topography unless otherwise approved:
  - Slope crests.
  - Convex areas.
  - “Mounded” landscapes.
- For simplicity sake, 300 feet of leach line will be used for each bedroom. There will be a three bedroom minimum for the county.
- ***LT are installed along contour***.
- LT are laid out, along contour, and marked to control excavation.

- Maximum length of any LT is in accordance with ODH rules (150 feet).
- Minimum LT to LT spacing is six (6) feet (center-to-center), unless otherwise pre-approved.
- Maximum filling after installation of trench to achieve constant contour elevation is three (3) inches unless design requires more.
- Gradient drain or interceptor drain is installed as specified and indicated on plans, see Section 7.0 Drainage Enhancement.
- Diversion swale is installed as indicated on plans per Section 6.6.
- Piping for a pumped system enters from upslope of the LT. **NO** pipe ditches down slope of LT.
- No earth dams for LT.

11.4.2 Traditional Leach Trenches (LT)

Three types of traditional trenches exist: gravel trenches, gravel-less trenches, and chambered trenches.

- Soil in area of LT excavation was not saturated during excavation procedures.
- During excavation, care was taken to ensure adjacent soils were not disturbed and compacted.
- The trench bottom is level. LT excavation depth was eighteen (18) inches below the down slope edge of the trench.
- For minor variations of original grade +/- 3 inches from contour is permitted.
- Filling up to three (3) inches is permitted upon final grade to ensure LT depth was eighteen (18) inches.
- Beginning and end of LT at the same elevation, **NO EXCEPTIONS**.

11.4.2.1 Gravel LT

A leach line utilizes a pipe backfilled with gravel to disperse the effluent into the surrounding soils.

- Width of gravel LT minimum of twelve (12) inches.
- #57 stone complying with Section 4.5 installed.
- Top of gravel elevation is at six (6) inches below the grade, unless the system design says otherwise.
- Bottom of gravel/leaching trench (invert elevation) is eighteen (18) inches below the grade unless the system design says otherwise.
- LT cannot be excavated deeper than eighteen (18) inches, unless prior approval is given by Brown County Health Department.
- A separation layer of geotextile fabric (Section 4.11) or a minimum of two (2) inches of straw is placed, after gravel filling is completed.
- Pipe diameter is four (4) inches.
- Any of following pipe types is permitted for gravel LT. Note holes are down for all of the following pipe types.
  - Three (3) hole perforated corrugated polyethylene (PE) tubing meeting/exceeding ASTM F-405.

  - Three (3) hole perforated PE pipe (2,500 lb crush) meeting/exceeding ASTM F-810.
  - Three (3) hole perforated PVC pipe meeting/exceeding ASTM F-2729.
  - Three (3) hole perforated corrugated PE pipe (smooth interior wall) meeting/exceeding ASTM F-405/AASHTO M-252.
  - LT will need to be split into two fields with the use of a distribution box.
  - Installer will need to educate the homeowner on switching the fields once a year.
- Ends of each pipe are capped.
- All couplers were compatible with both materials joined.
- Trenches backfilled in manner so that depressions are not created after settlement.

11.4.2.2 Gravel-less LT

A leach line constructed of a gravel-less product by a specified material, which is backfilled with native soils or non-cohesive fill (e.g. - coarse sand).

- Gravel-less LT trench excavation width is specified in accordance with ODH guidelines.
- Product is placed in center of LT on trench bottom, uniformly supported.
- Backfill for pipe is placed per ODH guidelines.
- Cover for gravel-less LT is native site soils.
- Trenches are backfilled in manner so that depressions are not created after settlement.
- Manufacturer’s coupling devices are used to join product segments.
- Each pipe has an end cap.
- Installation of gravel-less LT is pre-approved by Health Department.
- Gravel-less LT needs to be placed between 6 -18 inches of grade, unless the system design says otherwise.
- No reduction will be given, in the LT, for use of a gravel-less product.

11.4.2.3 Chambered LT

A chambered LT is a trench that utilizes a proprietary chamber product to disperse effluent throughout a LT.

- Chamber installation complies ODH guidelines.
- Installation of chambered LT is pre-approved by the Health Department.
- Drop box to be set so that the outlet invert is at the same elevation or below the top of the chamber. **Note:** Drop Boxes will need to meet requirements set by 11.5.
- No reduction will be given, in the LT, for use of a chamber product.

11.4.3 AT Grade Trenches

AT Grade trench is used in areas where indicated on the Permit-to-Install, application and/or design.

- This is sized according to the same capacities as traditional LT.

- Soil in area of the trench excavation was not plastic during excavation procedures.
- During excavation, care was taken to ensure adjacent soils are not disturbed and/or compacted.
- Trench excavation depth was twelve (12) inches below the down slope contour elevation. Trench bottom is level.
- Down slope edge of the trench is installed on contour.

11.4.3.1 AT Grade Trenching

A shallow leach line constructed of a pipe backfilled with gravel to disperse the effluent into the surrounding soils.

- Width of shallow gravel LT is a minimum of twelve (12) inches.
- #57 stone complying with Section 4.5 installed or as specified in approved plan.
- Maximum gravel fill thickness is twelve (12) inches total or as specified in approved plan.
- Separation layer of geotextile fabric (Section 4.11) or, a minimum of two (2) inches of straw placed after gravel fill is completed.
- Pipe diameter four (4) inches.
- Any of following pipe types is permitted for gravel LT. Holes are placed down:
    - Three (3) hole perforated corrugated polyethylene (PE) tubing meeting/exceeding ASTM F-405, designed for leach trenches.
    - Three (3) hole perforated PE pipe (2,500 lb crush) meeting/exceeding ASTM F-810.
    - Three (3) hole perforated PVC pipe meeting/exceeding ASTM F-2729.
    - Three (3) hole perforated corrugated PE pipe (smooth interior wall) meeting/exceeding ASTM F-405/AASHTO M-252.
- Ends of each pipe are capped.
- All couplers were compatible with both materials joined.
- Trenches backfilled so that depressions are not created after settlement.
- Final cover over trench is six (6) inches or as specified in approved plan.

11.5 Drop Boxes

A drop box is used in an area that has a slope where a traditional leach line system can not be utilized. The drop box allows equal flow to all LT in a split field.

- When effluent is pumped to the distribution box, the last ten (10) feet of pipe is four (4) inch SCH 40 PVC laid at a minimum slope before entering the distribution box.
- Lids of polyethylene and PVC drop boxes may be secured with sealant or fasteners.
- Drop box installed at each inlet of any and all gravity LT.
- Drop box installed level, regardless of topography.
- Drop box installed on firm, natural, virgin soil.
- Drop box backfilled with native site soils; Native soils **solidly** compacted around

box, eighteen (18) inches in all directions, except for the lowest drop box in a system.
- No cover is placed over drop box lids to allow for easy future maintenance/inspection.
- All pipe penetrations are watertight.
- All pipe terminations within drop box are cut squarely; allowances are made for future cap or plug installation within drop box.

11.6 Drop Boxes on Traditional LT & AT – Grade Trenching

- Drop box installed so that top of box is at the elevation of the contour (down slope edge of lid).
- Drop box allows for equal flow to existing LT and next drop box.
- Drop box inlet pipe is higher the LT outlet and outlet to next drop box.
- Compacted earth dam around drop box, for eighteen (18) inches in all directions, does not contain porous media such as sand or gravel.
- Outlet pipe for LT and outlet pipe for next drop box is same elevation.

11.7 Headline Pipe (Septic Tank/Pretreatment Unit to Drop Box)

The headline pipe is a solid walled pipe serving to convey effluent from the septic tank to a distribution box by gravity. (Section 5.0 applies)

- Four (4) inch diameter, Schedule 40 PVC, meeting/exceeding ASTM D-1785/D-2665 is installed.
- Headline pipe installed with pipe lettering up.
- All joints are solvent welded, and color primer is used.
- Headline pipe is uniformly supported over length of pipe.
- Minimum slope is one eighth ($^1/_8$) inch per foot (1%).
- Pipe extended into distribution box one (1) inch to one and a half ($1^1/_2$) inches.
- When effluent is pumped to the distribution box, the last ten (10) feet of pipe is four (4) inch SCH 40 PVC laid on a minimum slope before entering the drop box. This pipe segment is to have positive slope toward the drop box.

11.8 Headline Pipe (Drop Box to Drop Box)

The following apply to this portion of the headline pipe:

- **Virgin earth dams are kept in place**. Pipe over uncompacted fill is not acceptable.
- Four (4) inch diameter, Schedule 40 PVC, meeting/exceeding ASTM D-1785/D-2665 installed.
- All joints solvent welded and color primer is used.
- Headline pipe uniformly supported with virgin soil over length of pipe.
- Pipe backfilled and well compacted with friable soils.
- Pipe extended into drop box one (1) inch to one and a half ($1^1/_2$) inches.
- Slope dependant upon site topography.
- Headline pipe installed with pipe lettering up.

11.9 Header Pipe

The header pipe is a solid walled pipe that serves to convey effluent from a drop box to a LT.

- Four (4) inch diameter, Schedule 40 PVC, meeting/exceeding ASTM D-1785/D-2665 is installed, unless otherwise specified.
- Header pipe to LT pipe (or chamber) transition is completed with a coupler that is compatible with both pipe materials.
- Length of header pipe not less than: eighteen (18) inches for traditional LT, after drop box penetration.
- Header pipe uniformly supported with virgin soil.
- Pipe backfilled and rigorously compacted with friable clayey soils.
- Pipe extended into drop box one (1) inch to one and a half ($1^1/_2$) inches.
- Pipe installed so that lettering is up.

11.10 Dosed Leach Line Trenches (DLT)

Dosed leach line trenches are LT's utilizing a septic tank or a pre-treatment unit in combination with a dosing tank to provide lift of the effluent to the distribution box. These systems are to conform to the following:

- Dose volume is to be set such that the dosing pump runs for at least one (1) minute, or a specified time in an approved plan. The dose volume to be used is the total dose volume (i.e. Total Dose Volume = Net Dose Volume + Drainback).
- Tanks and tank combinations meet the requirements of Section 3.0 Tanks.
- Last ten (10) feet of the force main is Sch 40 PVC, four (4) inches in diameter laid on a minimum slope.
- Velocity within the force main is a minimum of two (2) feet per second.

12 Section 12.0 Aerobic Treatment Unit

12.1 Definition

Aerobic Treatment Unit (ATU) means any system that utilizes the principle of oxidation in the decomposition of sewage by introduction of air (oxygen) into the wastewater for a sufficient period of time to result in adequate treatment.

12.2 Scope and Applicability

These standards and specifications apply to the design, construction, and installation of ATUs. ATUs provide primary and secondary wastewater treatment. When used as a pretreatment device prior to soil absorption, ATUs receive depth credit. Discharging ATUs must have coverage under EPA's NPDES (National Pollutant Discharge Elimination System) permit.

12.3 Purpose and Function

An ATUs is used to pre-treat wastewater to meet the soil absorption system standards for a particular site, or to properly treat sewage to meet discharge effluent quality standards, both of which help protect human health and the environment.

12.4 Design Criteria

All ATUs installations must comply with the following:

- **The ATUs must be a pre-approved with Ohio Department of Health (ODH).**
- All ATUs access points for maintenance and tank pumping have risers and lids extending a minimum of four (4) inches above final grade.
- Riser minimum diameter is eighteen (18) inches (twenty-four (24) inch if a pump is contained within the tank).
- Installed to Health Department approved manufacturer's specifications.

12.5 Installation and Location

ATUs are installed as follows:

- ATUs installed in location shown on site plan.
- Discharge lines installed to the area identified on the site plan.

12.6 Materials and Specifications

Generally, ATU systems are a proprietary design. It is imperative that the manufacturer's installation guidance be used with the following conditions.

- ATU is approved by ODH for installation in Ohio. (Contact the Health Department for a list of ATUs approved by ODH).
- All upflow filters must be the manufacturer's recommended type, unless otherwise specified by the Health Department.

- Aeration disinfection device is the manufacturer's recommended type and also meets the Health Department's disinfection standards and specifications.

13 Section 13.0 Peat Biofilters

13.1 Definition

A Peat Biofilter (PBF) is a proprietary secondary treatment device installed at or above the ground surface. A PBF's provides wastewater treatment by pumping effluent over a natural peat media that has large pore spaces, high surface area, and a long retention time. This process requires unsaturated downward flow of the effluent through the peat filter media. Proper function calls for influent to the filter to be distributed over the media in controlled, uniform doses. In order to achieve uniform dosing, these systems require a timer controlled pump with associated pump chambers and electrical components. The treated effluent is collected from the bottom of the module(s) and is passed either by gravity or a pump to a suitable soil absorption system. **Refer to vendor's installation guidance.**

14 Section 14.0 Recirculating Media Filters

14.1 Definition

Any approved device where septic tank effluent is pumped over a media for treatment. The resulting filtered effluent stream is split, part of which returns to the septic tank, and the remaining portion is transferred either by gravity or is pumped to a suitable soil absorption system.

14.2 Scope and Applicability

These standards and specifications apply to the design, construction, and installation of Recirculating Media Filters (RMF).

14.3 Purpose and Function

A RMF is used to pretreat household wastewater to meet the soil absorption system standards for a particular site to help protect human health and the environment.

14.4 Design Criteria

Meets the specifications of the Ohio Department of Health approval.

14.5 Installation and Location

Meets the specifications of the Ohio Department of Health approval.

15 Section 15.0 Septic Tank Effluent Drip Distribution

15.1 Definition

A pre-engineered drip distribution packaged unit which includes but is not limited to the control panel, pump, floats, float tree, discharge assembly, hydraulic unit with heater, drip tubing with fittings, flexible PVC pipe, air release and check valves. **Refer to vendor's installation guidance.** This will need to be on ODH approved list.

16 Section 16.0 System Start-Up and Checkout Procedure

16.1 Start-Ups (installers)

- Are to be completed by a responsible party.
- Are to be done before the final inspection.
- Are to confirm and document that a system and all components are operating as designed and specified.

16.2 Start-Up Documentation (installers)

- Is to be done in a Health Department-approved format provided by the system or product vendor, or the Health Department, as applicable.
- Is to be completed first by the installer, dated and signed.

16.3 Checkout Documentation (service provider or third party if applicable)

- Is to be repeated and verified by the service provider, or other responsible person, as applicable, dated and signed.
- Is to verify that the system is ready to be turned over to the care of the service provider.
- Is to identify any deficiencies in the operation of the system.
- Is to identify any deficiencies in the installation that will have a negative impact on maintenance and service.
- Is complete and acceptable to the Health Department when the service provider, or other responsible person, has documented that all deficiencies have been corrected and the system is acceptable.
- Is to be dated and signed by the service provider, or other responsible person, and sent to the Health Department.
- Is to give notice to the Health Department that the system is either: a) ready for final inspection, or b) that deficiencies need to be corrected and another checkout is needed.

Note that any vendor system startup or checkout information must be received by the Health Department prior to the Health Department Final Approval. It is necessary that the installer is aware of <u>any</u> vendor specified items that are not specifically identified in this Installation Manual. The Health Department will require deficiencies identified during a vendor inspection to be addressed prior to final approval of the system. If this requires another inspection by the Health Department beyond normal allotments, then a Reinspection fee will be charged.

16.4 Measuring and adjusting Operating Head of Low Pressure Pipe Systems

Operating head was:

- Measured at the ends of the distribution laterals.
- Set per Section 5.9.1 or design specifications.
- Adjusted using a PVC high pressure gate valve (located in septic or pump tank).
- Read directly in a clear pipe or tubing supplied by the installer. The clear pipe is threaded into every cleanout at the end of all laterals, or measured similarly with a calibrated pressure gauge.
- For pipe tube measurements:
    - Operating head measured from the top of the distribution lateral.
    - Measured to the nearest inch.
    - Measured with clear tubes on every lateral cleanout.
- Measured after the system was flushed (See Section 5.14 Flushing Procedure).
- Measured with the liquid level within the tank’s normal operating range. This is below the high water alarm.
- Measurement with full pressurization was recorded before adjustment with gate valve.
- Recorded in the control panel for both the flow rate and squirt height.

16.5 Flow Rate

The flow rate was:

- Within the acceptable range of flow rates based on the operating head.
- Recorded in the control panel.

Flow rate was determined by one of the following methods:

- A flow meter as part of the system.
- “Timed Draw Down” methods.
- Other approved methods.

16.6 Required Design Dose Volume

The required design dose volume is the volume of liquid that is to be applied to the distribution laterals or proprietary device to maximize treatment.

- Proprietary pretreatment devices – refer to product guidelines for recommended design dose volumes. Settings must maximize treatment.
- Design dose volume is five (5) times the total lateral volume, unless otherwise specified; and,
- Design dose provides one quarter (0.25) gallon per dose per orifice to (0.42) gallon per dose per orifice and was based upon an approved design.

16.7 Dose Volume

Dose volumes were set as specified by the design and controlled by either:

- A timer controlled pump run time, at a known flow rate; or
- Float switches set to pump a known volume of liquid.

16.8 Programmable Timers

- Set up to meet design specifications.
- Settings recorded in the control panel service record.
- Provide baseline information for monitoring the system.

16.9 Event Counters and Elapsed Time Meters

Counter and elapsed time meter totals:

- Are recorded in the control panel service record.
- Provide baseline information for monitoring system operations.

16.10 Control Panels with Analog Timers

These have:

- Timers set to the smallest unit of time possible for highest accuracy.
- Controls NOT set to respond to high water alarm events by pumping on demand.
- Timers set to limit the flow through the system to the daily design flow.

16.11 Control Panels with Digital Timers

These have:

- Controls NOT set to respond to high water alarm events by pumping on demand.
- Timers set to limit the flow through the system to the daily design flow.

16.12 As-Built Documentation

As-built documentation is:

- Signed and dated by the responsible party.
- Neat and legible.
- Completed using symbols and methods given in this manual.
- Reasonably scaled.
- A record that the homeowner and/or maintenance service provider is able to use effectively.

17 Section 17.0 Mounds & Modified Mounds

17.1 Use of Section A.0

This appendix section contains specifications and recommendations that are specific to Brown County. **This section is to be used in conjunction with Sections 1.0 thru 19.0 of this manual.**

17.2 Inspection Protocol for Advanced Systems

The following is the inspection protocol used by the Health Department, for all mounds and modified mound systems. The following items listed for each inspection point are to be completed by that inspection point. Failure to complete an item for that inspection may result in a red tag (and associated re-inspection fee). Up to three (3) inspections are required for these types of HSTS.

Inspection #1 – Basal Area/Watertightness Test

- Basal area has been prepared to the Health Department's specifications.
- *Option "A"* – The Watertight Field Test Procedure was started previously to allow final watertight test.

Inspection #2 – System Components Installed /Watertightness Test

- All system components installed, open for inspection and ready for cover.
- Flushing procedure completed.
- *Option "B"* – The Watertightness Field Test Certification Procedure was started previously to allow final watertight test (Preferred inspection for the watertight tank test).

Inspection #3 – System Checkout

- All mechanical and electrical work on the system is completed.
- Final grading of the system completed.
- System seeded and strawed to specifications.
- The distribution network has been flushed and all foreign material has been cleared out.
- Liquid levels in the dosing tank are set with float switches or transducer to the specifications.
- Operating head is set to the specifications.
- System flow rate has been checked and is within the design limits.
- Dosing work sheet has been completed.
- All control, alarm, mechanical and electrical components have been checked and are operating within the design specifications.

- All required installation and start-up documentation completed, signed, and dated, by the installer.
- Service record form (within the control panel) dated, counter and meter totals entered, and initialed; service record left in the control panel.
- All system warranty information, homeowner manual(s), as-built copy, installation and maintenance information, videos, etc. are packaged, clearly labeled, and in a secure location within the home.
- The service provider has duplicated the installer's start-up procedures, confirming that the system operates as specified by the following and verifying the installer's documentation.
- The service provider has certified that the system components related to maintenance and service has been installed in an acceptable manner.

A blackwater holding tank at a particular site will change the inspection protocol. Upon approval of the blackwater holding tank by the Board of Health, an additional inspection will be added to the inspection protocol for all HSTS types. The following condition must be adhered to, in order to receive an inspection for a blackwater holding tank:

- ***Will require a preconstruction conference, this must be completed prior to the inspection of the blackwater holding tank. This is effective for ALL HSTS types, conventional (e.g. – leach lines and Wisconsin Mounds) systems as well as alternative technology.***

17.3 Mound Designations

For Brown County, several mound/modified mounds are defined. The Micro-Sandfilter (Type C and D) will not be covered in this Section. These mound types are specific to drip distribution systems. Specifications and guidance will be provided upon request and after approval from Health Department.

17.4 Basal Area Preparation

For basal area preparation and protection guidance, see Section 10.4, 2.3 and 2.4.

17.5 Clearing

For guidance on clearing and mechanical clearing, see Sections 2.5 thru 2.5.3 and 10.4.2 thru 10.4.3.

17.6 Chisel Plowing

For guidance on chisel plowing, Sections 2.3.2 Wet Weather Planning and Section 2.4 Soil Moisture Condition Planning ***must be followed.*** Section 10.4.3

Chisel Plowing thru 10.4.3.2 Chisel Plow Requirements provides requirements for this activity.

For Section 10.4.3 Chisel Plowing, the following are applicable to the buffer distance between the gradient drain/interceptor drain and basal area:

- Buffer distance is one (1) foot for Type A, B, E, F & G.

17.7 Layout of Mound/Modified Mound

For guidance on mound layout, see Section 10.5 Layout of Structures thru 10.5.4 Split/Divided Structures. Also see the Appendix B for reference materials for splitting a mound in half.

17.8 Mound Layout Procedure on a Site with a Slope less than Four Percent

- Installers may submit layout plans for specific types of sites.
- Review the Addendums in the last section of this manual for more information on layout plans.
- See Figure A.2 for a general mound layout diagram.
- See Table A.2 for the layout dimensions of specific structures.
- Contact a Health Department Sanitarian if you have any questions.

17.9 Construction of Mound/Modified Mound

- Tables A.3 through A.9 provide estimated volumes of sand, gravel and cover soil for commonly used mound structures. These estimates have proven to be fairly reliable for structures on relatively flat sites with regular and uniform surfaces. Actual requirements for sand and cover may be greater due to variations from those site conditions described above or by condition unforeseen by the Health Department.
- Designers: It is your responsibility to take those variable site factors into consideration and to provide site-specific estimates for the volume of sand and cover soil on your designs.
- Installers bidding design plans by others: It is your responsibility to check that the estimated volumes of material presented on a plan are consistent with the minimum requirements for building the system on a site.
- Installers submitting layout plans: It is your responsibility to take into consideration variable factors which increase the volumes of sand and cover soil required on sites when determining the cost of construction.

Note: Requirements for minimum side-slopes on sloping and irregular ground will result in additional sand and cover soil being needed to meet the specifications. Depression and irregularities within the toes of the sand fill will require additional volumes of sand.

Type "A" – Modified Mound

Capacity (# Bdrms)	"A"	"B"	"C"	"D"	"E"	"F"	"G"	"H"	"I"	Total Length	Length Between Drains	Width of Sand	Width of Gravel	Width Between Gradient Drain Edges
3	4'-9"	125'-0"	1'-3"	5'-0"	6'-0"	4'-8"	3'-5"	3'-9"	1'-0"	132'-6"	134'-6"	10'-0"	2'-6"	12'-0"
4	4'-9"	168'-0"	1'-3"	5'-0"	6'-0"	4'-8"	3'-5"	3'-9"	1'-0"	175'-6"	177'-6"	10'-0"	2'-6"	12'-0"

Type "B" – Modified Mound

Capacity (# Bdrms)	"A"	"B"	"C"	"D"	"E"	"F"	"G"	"H"	"I"	Total Length	Length Between Drains	Width of Sand	Width of Gravel	Width Between Gradient Drain Edges
3	6'-6"	125'-0"	1'-11"	7'-6"	8'-6"	7'-2"	5'-3"	5'-6"	1'-0"	136'-0"	138'-0"	15'-0"	3'-10"	17'-0"
4	6'-6"	168'-0"	1'-11"	7'-6"	8'-6"	7'-2"	5'-3"	5'-6"	1'-0"	180'-0"	182'-0"	15'-0"	3'-10"	17'-0"

Type "E" – Modified Mound

Capacity (# Bdrms)	"A"	"B"	"C"	"D"	"E"	"F"	"G"	"H"	"I"	Total Length	Length Between Drains	Width of Sand	Width of Gravel	Width Between Gradient Drain Edges
3	6'-0"	125'-0"	2'-6"	2'-6"	8'-6"	3'-0"	0'-6"	4'-0"	1'-0"	133'-0"	135'-0"	15'-0"	5'-0"	17'-0"
4	6'-0"	168'-0"	2'-6"	2'-6"	8'-6"	3'-0"	0'-6"	4'-0"	1'-0"	180'-0"	182'-0"	15'-0"	5'-0"	17'-0"

Table A.1 – Mound Layout Dimensions. See Figure A.2 for definition of layout dimensions.

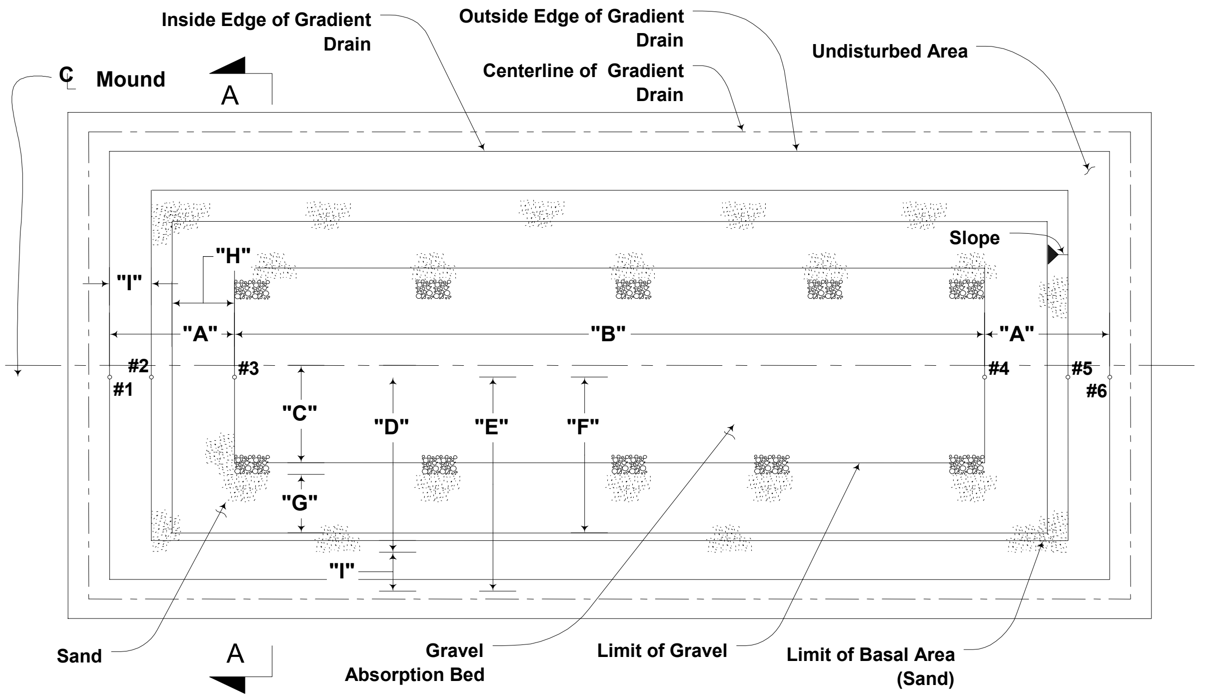
Type "F" – Modified Mound

Capacity (# Bdrms)	"A"	"B"	"C"	"D"	"E"	"F"	"G"	"H"	"I"	Total Length	Length Between Drains	Width of Sand	Width of Gravel	Width Between Gradient Drain Edges
3	9'-9"	125'-0"	2'-6"	11'-3"	12'-3"	3'-0"	0'-6"	8'-9"	1'-0"	142'-6"	144'-6"	22'-6"	5'-0"	24'-6"
4	9'-9"	168'-0"	2'-6"	11'-3"	12'-3"	3'-0"	0'-6"	8'-9"	1'-0"	185'-6"	187'-6"	22'-6"	5'-0"	24'-6"

Type "G" – Modified Mound

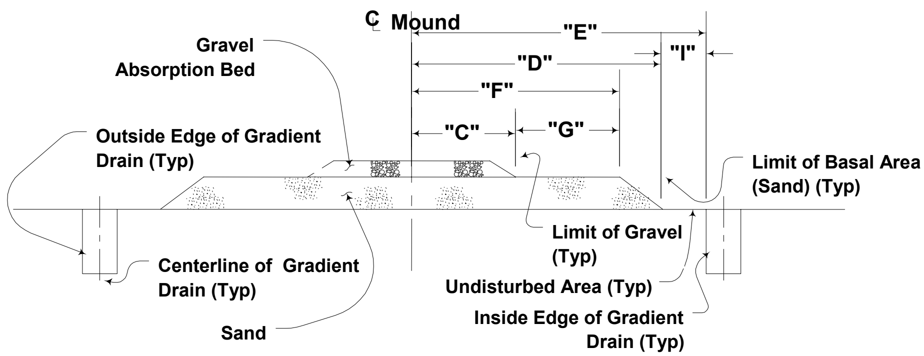
Capacity (# Bdrms)	"A"	"B"	"C"	"D"	"E"	"F"	"G"	"H"	"I"	Total Length	Length Between Drains	Width of Sand	Width of Gravel	Width Between Gradient Drain Edges
3	7'-0"	125'-0"	2'-6"	9'-0"	10'-0"	3'-0"	0'-6"	6'-0"	1'-0"	137'-0"	139'-0"	18'-0"	5'-0"	20'-0"
4	7'-0"	170'-0"	2'-6"	9'-0"	10'-0"	3'-0"	0'-6"	6'-0"	1'-0"	182'-0"	184'-0"	18'-0"	5'-0"	20'-0"

Table A.2 – Mound Layout Dimensions. See Figure A.2 for definition of layout dimensions.



Generic Mound Plan for Layout

(No Scale)



Cross Section A-A (Type "A," "B," "E," "F," & "G" Mounds)

(No Scale)

Figure A.2 - Mound Layout Dimension Diagram.

Type A – Modified Mound Note

Capacity (# of Bedrooms)	Sand Volume (yd^3)	Gravel Volume (yd^3)	Top Soil (Cover Soil) (yd^3)
3	16.3	4.8	41.2
4	21.3	6.5	54.2

Table A.3 – Estimated "Air Space" Volumes for Type A Structures.

Type B – Modified Mound

Capacity (# of Bedrooms)	Sand Volume (yd^3)	Gravel Volume (yd^3)	Top Soil (Cover Soil) (yd^3)
3	25.0	7.3	60.0
4	32.4	9.8	81.0

Table A.4 – Estimated "Air Space" Volumes for Type B Structures.

Type E – Modified Mound

Capacity (# of Bedrooms)	Sand Volume (yd^3)	Gravel Volume (yd^3)	Top Soil (Cover Soil) (yd^3)
3	51.0	11.5	52.0
4	68.0	15.5	68.0

Table A.5 – Estimated "Air Space" Volumes for Type E Structures.

Type F – Modified Mound

Capacity (# of Bedrooms)	Sand Volume (yd^3)	Gravel Volume (yd^3)	Top Soil (Cover Soil) (yd^3)
3	66.0	11.5	74.0
4	86.0	15.5	96.0

Table A.6 – Estimated "Air Space" Volumes for Type F Structures.

Type G – Millennium Mound

Capacity (# of Bedrooms)	Sand Volume (yd^3)	Gravel Volume (yd^3)	Top Soil (Cover Soil) (yd^3)
3	117.0	11.5	74.0
4	157.7	15.7	97.0

Table A.7 – Estimated "Air Space" Volumes for Type G Structures.

17.10 Pressure Pipe Network

For the specifications on the pressure pipe network for these systems, see Section 5.8 Pressure Pipe Network. Specific installation layout and details of the pressure piping are provided on the drawings for each mound type. For each mound drawing set, drawings are supplied for each mound size. Also, for some sizes of various mounds, alternate pressure distribution layouts have been designed.

17.11 Orifice and Orifice Shields

See Section A.19 Pressure Distribution Network Data Table on the Pressure Distribution drawings.

17.12 Flushing Procedure

The flushing procedure must be completed. See Section 5.14 Flushing Procedure for guidance.

17.13 Required Design Dose Volumes

Table A.11 thru A.14 is given as guidance for the design dose volumes of HSTS for Brown County. Deviations from these volumes must meet the requirements of Section 5.15 Required Design Dose Volumes, and have prior Health Department approval. The design flow rates are included in the tables for the design dose volume for convenience.

Note: Flow rates are based on minimum operating head

Type A – Modified Mound

Capacity (# of Bedrooms)	Minimum Design Dose Volume (Gallons, Net)	Maximum Net Dose Volume (Gallons, Net)	Design Flow Rate, Q_{Design} (Gal per Minute, gpm)
3	17.0	30.0	(1 ½”) 26.0 (1 ¼”) 19.0
4	23.0	34.0	34.8

Table A.11 - Design Dose Volume for Type A Structures.

Type B – Modified Mound

Capacity (# of Bedrooms)	Minimum Design Dose Volume (Gallons, Net)	Maximum Net Dose Volume (Gallons, Net)	Design Flow Rate, Q_{Design} (Gal per Minute, gpm)
3	17.0	30.0	(1 ½”) 26.0 (1 ¼”) 19.0
4	23.0	34.0	38.4

Table A.12 - Design Dose Volume for Type B Structures.

Type E – Modified Mound

Capacity (# of Bedrooms)	Design Dose Volume (Gallons, Net)		Design Flow Rate, Q_{Design} (Gal per Minute, gpm)
3	33.6		29.0
4 (2 H)	46.5		48.4
4 (3 H)	45.4		46.7

Table A.13 - Design Dose Volume for Type E Structures.

Type G – Millennium Mound

Capacity (# of Bedrooms)	Design Dose Volume (Gallons, Net)	Design Flow Rate, Q_{Design} (Gal per Minute, gpm)
3	34.0	53.0
4 (4 H Pattern)	45.0	69.6

Table A.14 - Design Dose Volume for Type G Structures (Millennium Mound).

17.14 Operating Head (Squirt Height) Requirements

The following tables list the required minimum and maximum operating heads for mounds structures. The operating heads produce velocities of two (2) feet per second or greater.

Type A – Modified Mound

Capacity (# of Bedrooms)	Minimum Operating Head (inches)	Maximum Operating Head (inches)
3	58 (1 ½”) 32 (1 ¼”)	66
4	60	66

Table A.16 – Operating Head Range for Type A Structures (Modified Mound). Note differing minimum heads for sub-main diameters in parenthesis.

Type B– Modified Mound

Capacity (# of Bedrooms)	Minimum Operating Head (inches)	Maximum Operating Head (inches)
3	58 (1 ½”) 32 (1 ¼”)	66
4	60	66

Table A.17 – Operating Head Range for Type B Structures (Modified Mound). Note differing minimum heads for sub-main diameters in parenthesis.

Type E– Modified Mound

Capacity (# of Bedrooms)	Minimum Operating Head (inches)	Maximum Operating Head (inches)
3	42	66
4 (2 H Pattern)	60	66
4 (3 H Pattern)	52	66

Table A.18 – Operating Head Range for Type E Structures (Modified Mound).

Type G – Millennium Mound

Capacity (# of Bedrooms)	Minimum Operating Head (inches)	Maximum Operating Head (inches)
3	60	66
4	60	66

Table A.19 – Operating Head Range for Type G Structures (Millennium Mound).

17.15 Cover Specification

For the requirements of the soil cover, see Section 4.10 Cover Specification.

17.16 Access Wells/Valve Boxes

For the requirements of these items, see Section 9.6 Access Wells/Valve Boxes.

17.17 Observation Ports

For the fabrication specification(s) of the observation ports, see Section 9.7 Specifications. Also, see Observation Port Detail in Section A.19.

17.17.1 Observation Port Locations

The plan drawing for each of the mound structures shows the location of the observation ports. The following is general guidance on the quantity and surface to be viewed based upon the mound structure type.

17.17.2 Mound(s) A, B, E, F, & G

- Four (4) observation ports provided.
- Two (2) of four (4) observation ports are set on top of sand.
- Two (2) of four (4) observation ports are set on top of the basal soil **and not to be located in the gravel, but placed on side slope.**
- See the plan drawings for the locations of these ports.

17.17.3 "Split"/"Segmented" Mound

A "split"/segmented mound is a structure in which the length of a mound designhas been divided between two or more separate mound structures. These types of structures result from special conditions presented by the site or, possibly, homeowner preference. Observation ports for these types of mounds will be handled on a case by case basis.

Information has been provided in Appendix B giving the dimensions of mounds that are split in *half*. The dimensions provided are for <u>one</u> of the split mound segments.

17.18 Certification of Completion Documentation

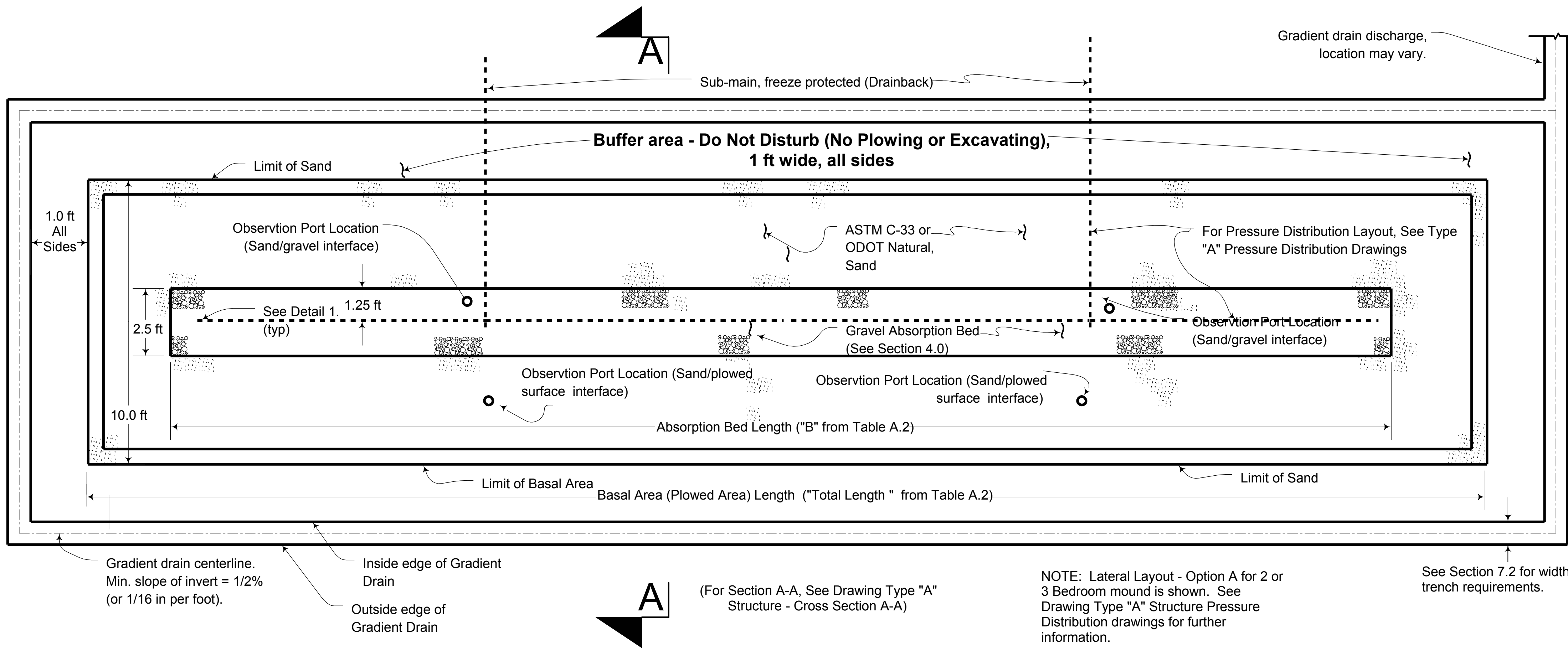
See Section 19.0 System checkout Procedures.

17.19 Drawing

The following is a summary of the drawings for the mound structures. These drawings follow in this Appendix.

- Type A Structure (Modified Mound)
  - General Plan
  - Cross Section A-A
  - Pressure Distribution – 3 Bedroom
  - Pressure Distribution – 4 Bedroom
- Type B Structure (Modified Mound)
  - General Plan
  - Cross Section A-A
  - Pressure Distribution – 3 Bedroom
  - Pressure Distribution – 4 Bedroom
- Type E Structure (Modified Mound)
  - General Plan
  - Cross Section A-A
  - Pressure Distribution – 3 Bedroom
  - Pressure Distribution – 4 Bedroom (2-H)
  - Pressure Distribution – 4 Bedroom (3-H)
- Type G Structure (Millennium Mound)
  - General Plan
  - Cross Section A-A
  - Pressure Distribution – 3 Bedroom
  - Pressure Distribution – 4 Bedroom

- Drainage Sump
- Traditional Leaching Trenches
- Observation Port Detail



Type "A" Structure - General Plan

(No Scale)

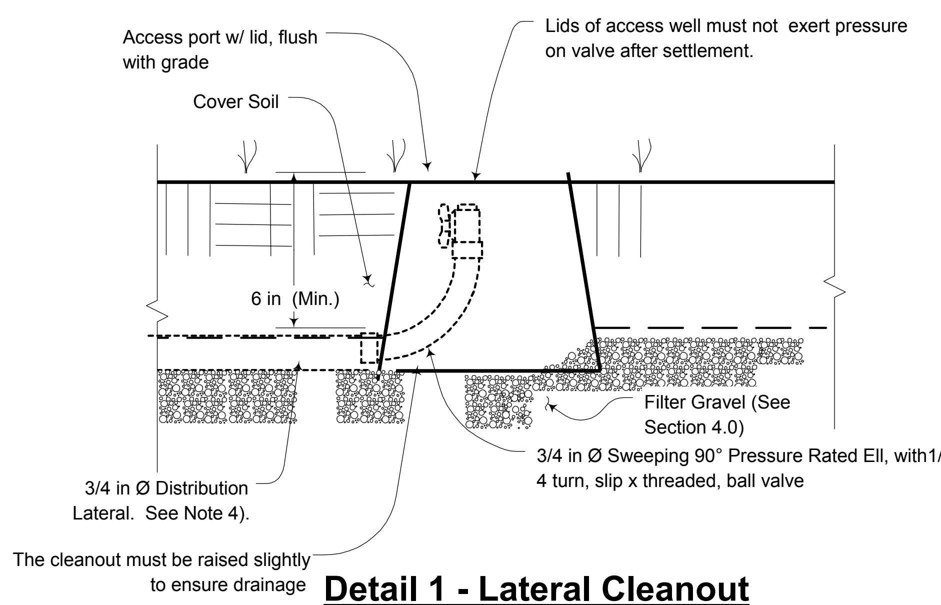
Notes:

1) Observation ports to be located as shown on this drawing. Each observation port must be within its own access well. A total of four (4) observation ports are required, as shown.

2) See Table A.2 and Figure A.2 for dimensions of various mound components.

3) Buffer area to be protected. Compaction, excavation, or plowing in this area is NOT permitted.

4) **All orifices are set at the 6 O'Clock position (down), EXCEPT for the first and last orifice of EACH lateral. These are at the 12 O'Clock position (UP)**. See Type "A" Structure - Pressure Distribution corrsponding to the appropriate number of bedrooms.



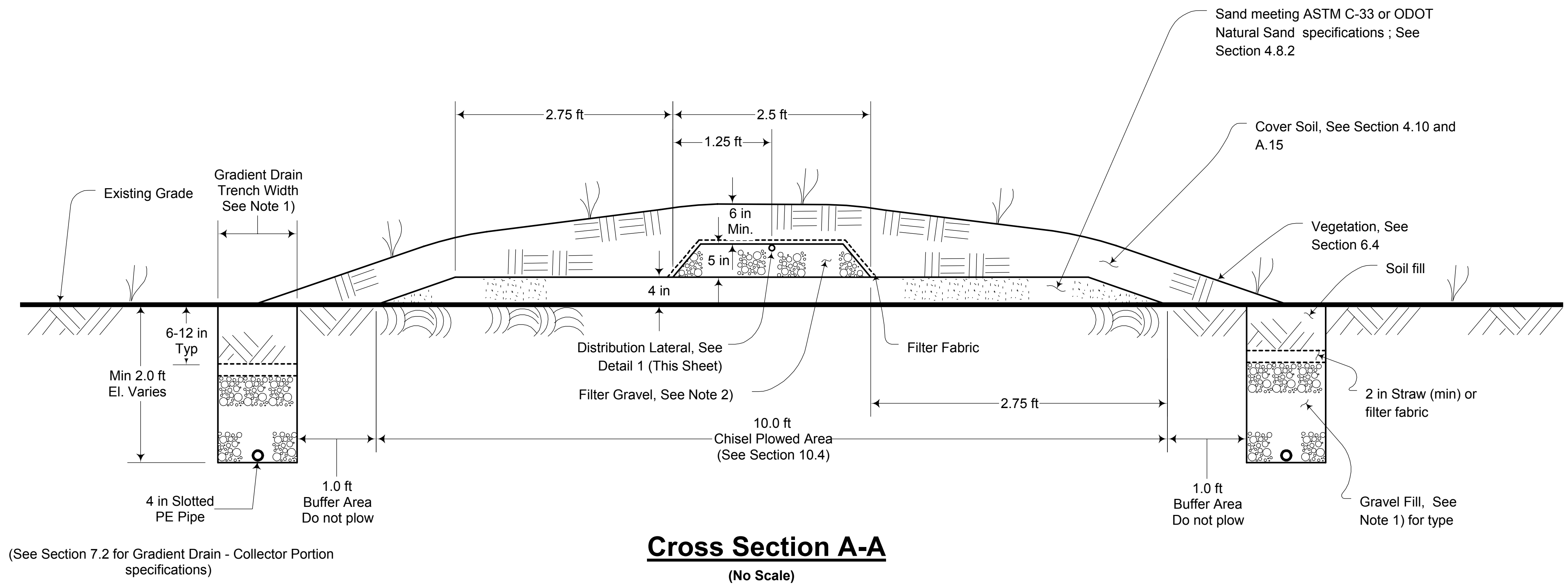
Detail 1 - Lateral Cleanout

(No Scale)

Ø = Pipe DIameter

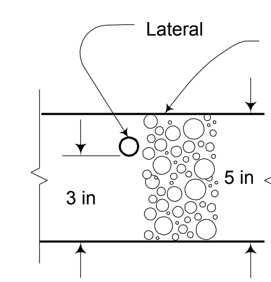
BROWN COUNTY HEALTH DEPARTMENT

Type "A" Structure (Modified Mound) - General Plan



Cross Section A-A

(No Scale)



Detail 1

(No Scale)

Notes:

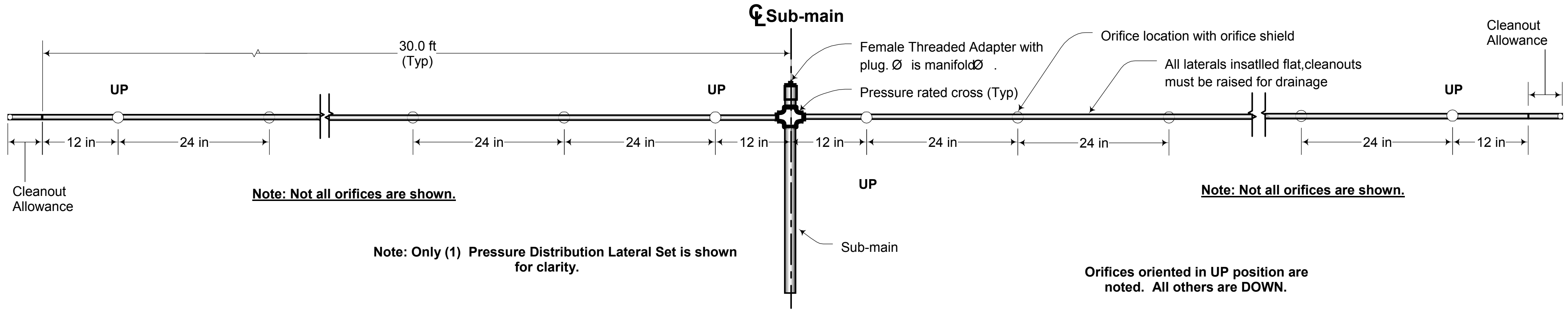
1) The required aggregate backfill varies with the width of the excavated trench, See Section 7.2 for requirements. For aggregate specifications, See Section(s) 4.5, 4.6 or 4.7. If aggregate specified in Section 4.7 is used, then the requirements of Section 4.9 apply. This section requires special marking to allow for confirmation of pipe invert slope.

2) The specified aggregate(s) in this component are summarized in Figure 4.1. See Sections 4.5, 4.6 or 4.7 for individual aggregate type specifications.

3) The Sub-main and force main must be sloped to allow drainback to the point where two (2) feet of cover over the force main is not maintained. The minimum slope for this drainback is 1% (1/8 in per ft). The force main must not penetrate the basal area.

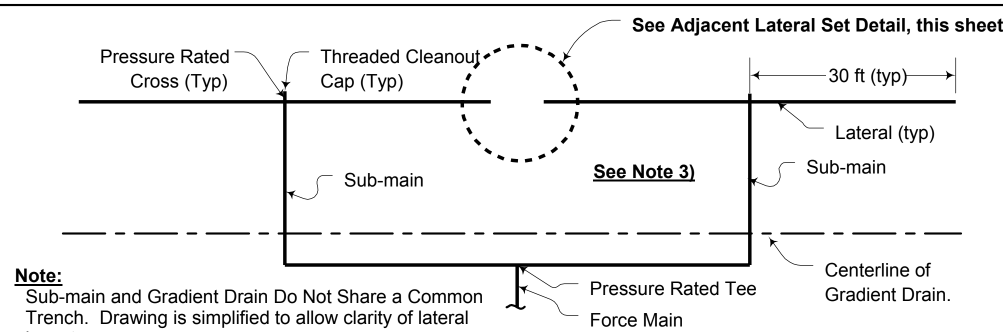
BROWN COUNTY HEALTH DEPARTMENT

Type "A" Structure (Modified Mound) Cross Section A-A

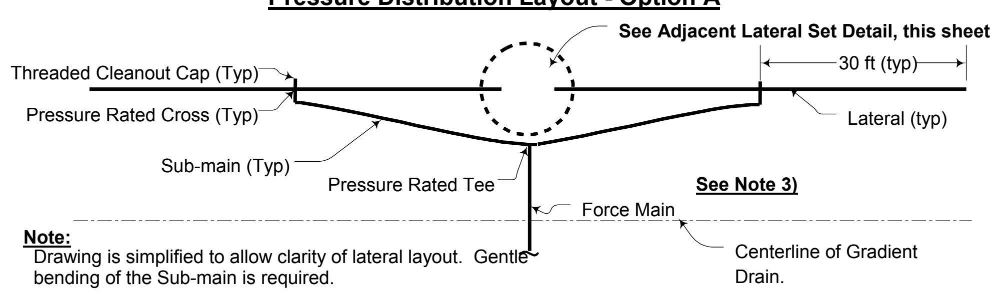


Typical Lateral Set Layout

(No Scale)



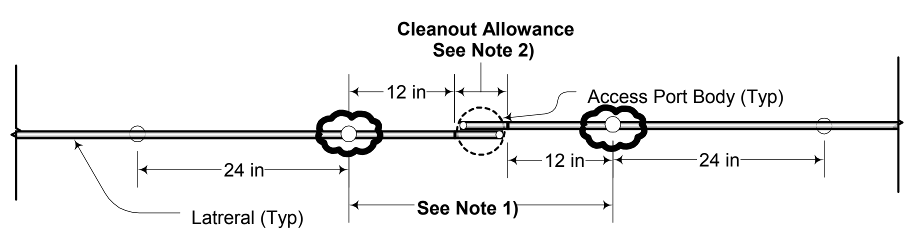
Pressure Distribution Layout - Option A



Pressure Distribution Layout - Option B

Lateral Layout Options

(No Scale)



Adjacent Lateral Set Layout

(No Scale)

Notes:

1) This dimension may vary, but can be no less than 24 in. (Same as orifice center to center spacing).

2) Laterals may overlap or abutt in this location. Ball valve on both laterals may be within a common access port. Conditions of Note 1 apply.

3) The sub-main and force main must be sloped to allow drainage of pipe sections with less than 2 feet of cover. The minimum slope for drainback is 1% (1/8 in per ft).

Pressure Distribution Network Data Table

Force Main (Supply Main):

Diameter (Ø) (To be determined from layout)

Sub-main:

Diameter (Ø)	= 1 1/4 in OR 1 1/2 in

Laterals:

Diameter (Ø)	= 3/4 in
Individual Lateral Length	= 30 ft
Laterals per set	= 2
Sets of laterals required	= 2

Orifices:

Diameter (Ø)	= 1/8 in
Typical Orifice Center-Center Spacing	= 24 in (2 ft)
Orifices per lateral	= 15
Total Number of Orifices	= 60

Orifice Orientation (See Typ. Lat. Set Layout (This Sheet)

System Data:

1 1/2 Ø Sub-main:

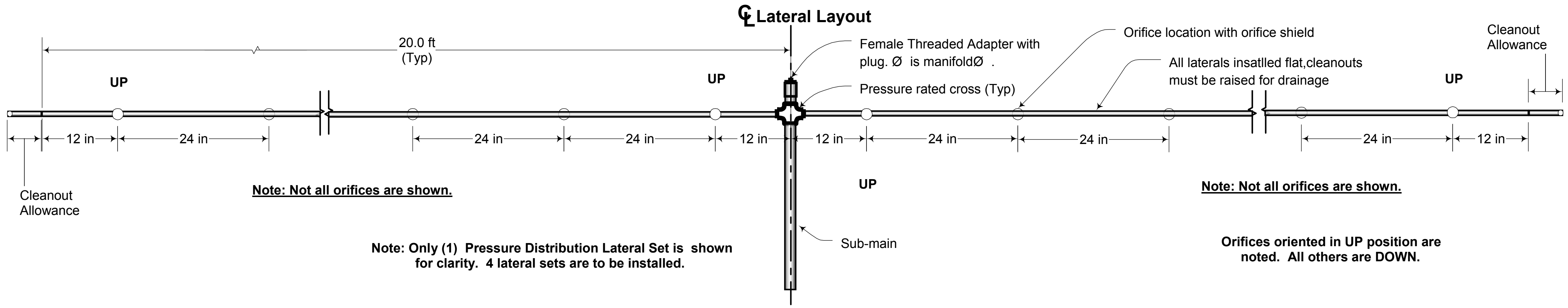
System Flow Rate (Q)	= 26.0 gpm
Squirt Height (Min)	= 58 in
Net Dose Volume	= 17-30 gal

1 1/4 Ø Sub-main:

System Flow Rate (Q)	= 19.0 gpm
Squirt Height (Min)	= 32 in
Net Dose Volume	= 17-30 gal

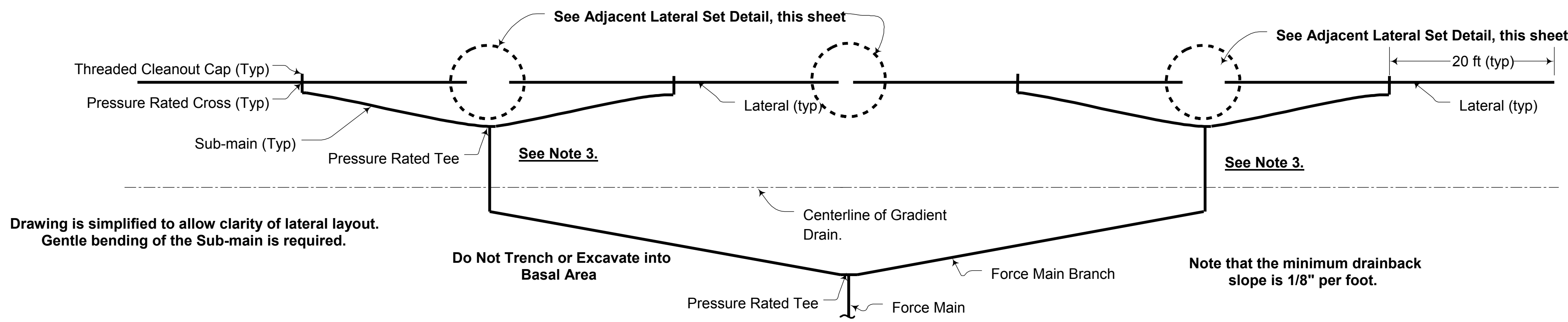
BROWN COUNTY HEALTH DEPARTMENT

Type "A" Structure - Pressure Distribution 3 Bedroom



Typical Lateral Set Layout

(No Scale)



Lateral Layout

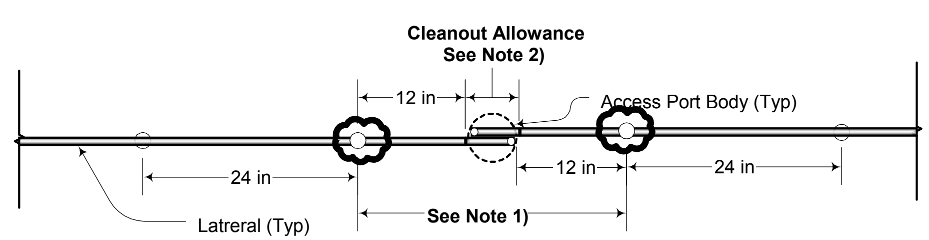
(No Scale)

Notes:

1) This dimension may vary, but can be no less than 24 in (Same as orifice center to center spacing).

2) Laterals may overlap or abutt in this location. Ball valves on both laterals may be within a common access port. Conditions of Note 1 apply.

3) The sub-main and force main must be sloped to allow drainage of pipe sections with less than 2 feet of cover. Minimum slope for drainback is 1% (1/8 in per ft).



Adjacent Lateral Set Layout

(No Scale)

Pressure Distribution Network Data Table

Force Main (Supply Main):
Diameter (Ø) (To be determined from layout)

Force Main Branch:
Diameter (Ø) = 1 1/2 in

Sub-main:
Diameter (Ø) = 1 in

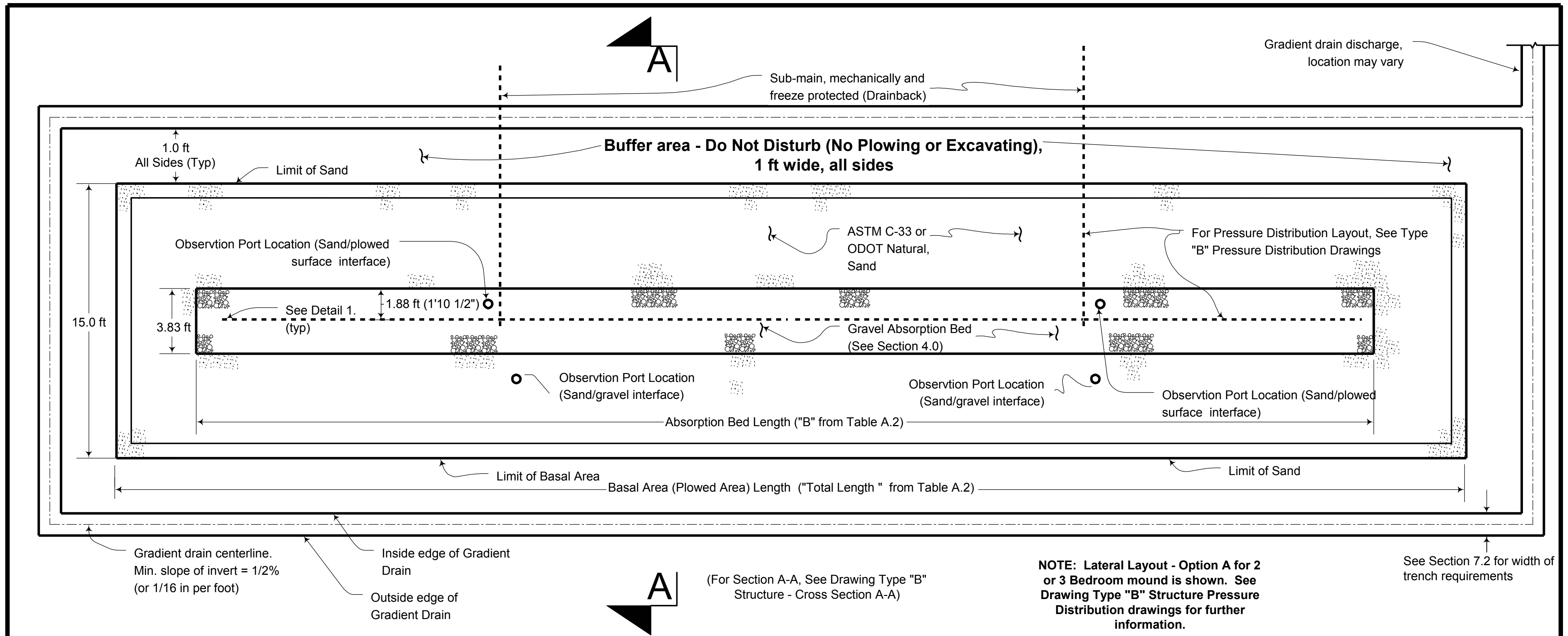
Laterals:
Diameter (Ø) = 3/4 in
Individual Lateral Length = 20 ft
Laterals per set = 2
Lateral sets required = 4

Orifices:
Diameter (Ø) = 1/8 in
Typical Orifice Center-Center Spacing = 24 in (2 ft)
Orifices per lateral = 10
Orifices per Set = 20
Total Number of Orifices = 80

System Data
System Flow Rate (Q) = 34.8 gpm
Squirt Height (min) = 60 in
Net Dose Volume = 23-34 gal

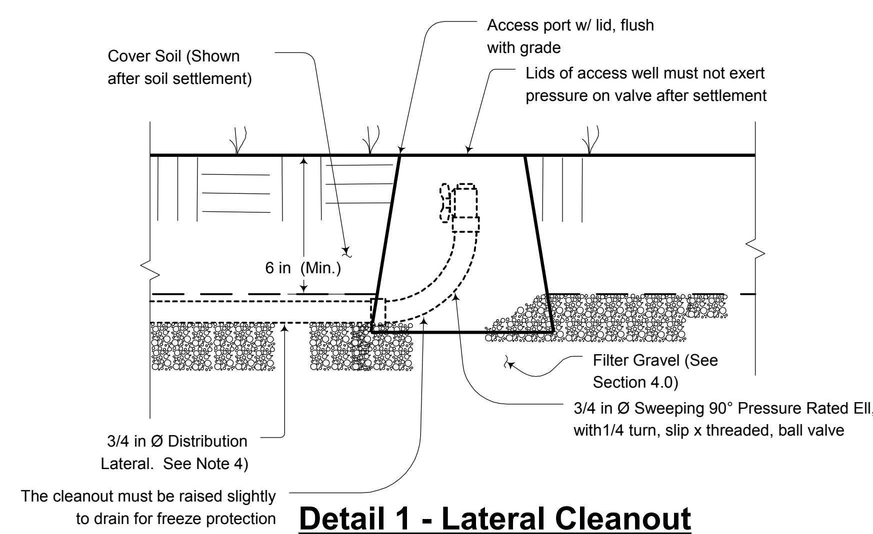
BROWN COUNTY HEALTH DEPARTMENT

Type "A" Structure - Pressure Distribution 4 Bedroom



Type "B" Structure - General Plan

(No Scale)



Detail 1 - Lateral Cleanout

(No Scale)

Notes:

1) Observation ports to be located as shown on this drawing. Each observation port must be within its own access well. A total of four (4) observation ports are required, as shown.

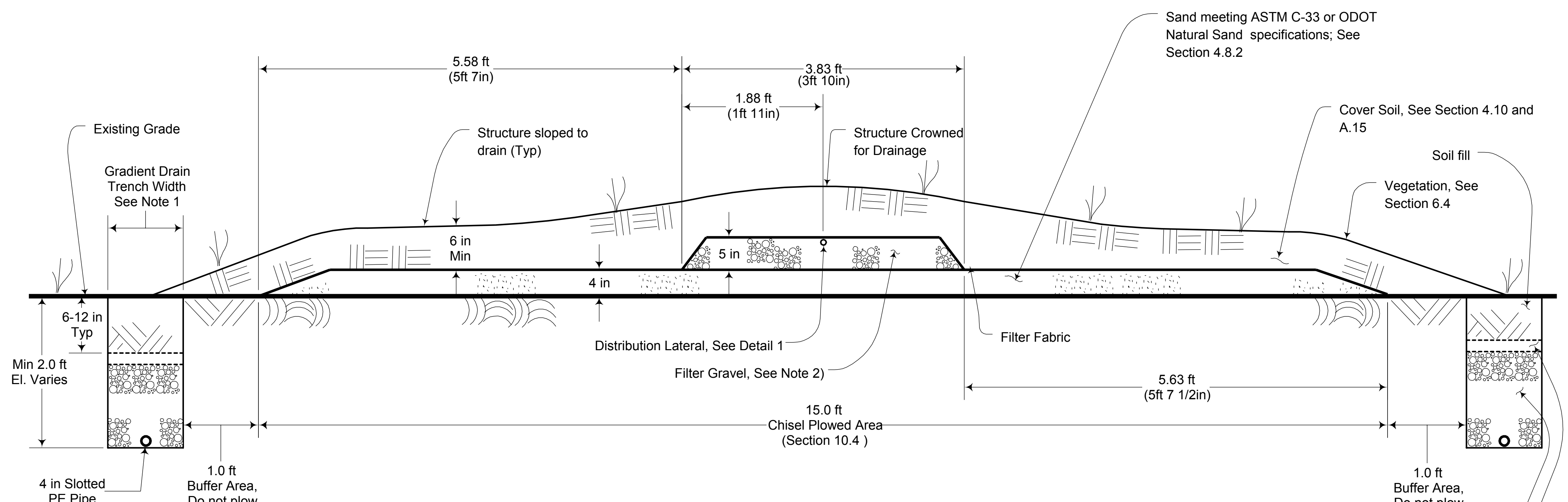
2) See Table A.2 and Figure A.2 for dimensions of various mound components.

3) Buffer area to be protected. Compaction, excavation, or plowing in this area is NOT permitted.

4) **All orifices and orifice shields are set at the 6 O'Clock position (down), EXCEPT for the first and last orifice of EACH lateral. These are at the 12 O'Clock (UP) position.** See Type "B" Structure - Pressure Distribution corresponding to the appropriate number of bedrooms.

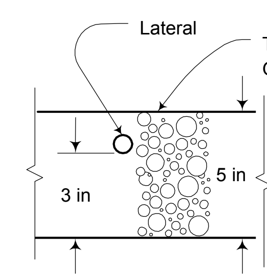
BROWN COUNTY HEALTH DEPARTMENT

Type "B" Structure (Modified Mound) - General Plan



Cross Section A-A

(No Scale)



Detail 1

(No Scale)

Notes:

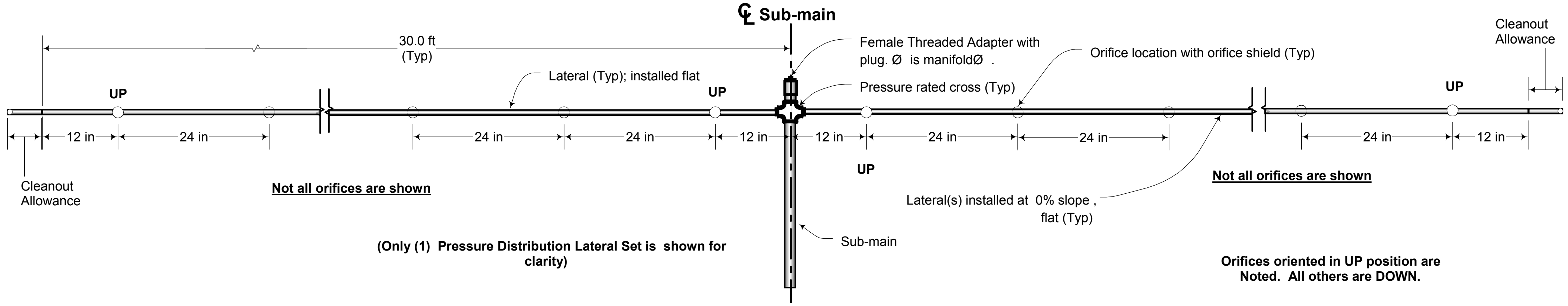
1) The required aggregate backfill varies with the width of the excavated trench. See Section 7.2 for requirements. For aggregate specifications, See Section(s) 4.5, 4.6 or 4.7. If aggregate specified in Section 4.7 is used, then the requirements of Section 4.9 apply. This section requires special marking to allow for confirmation of pipe slope.

2) The specified aggregate(s) in this componet are summarized in Table 4.1. See Sections 4.5, 4.6 or 4.7 for individual aggregate type specifications.

3) The Sub-main and force main must be sloped to allow drainback to the point where two (2) feet of cover over the force main is maintained. The minimum slope for drainback of these pipes is 1% (1/8 in per ft).

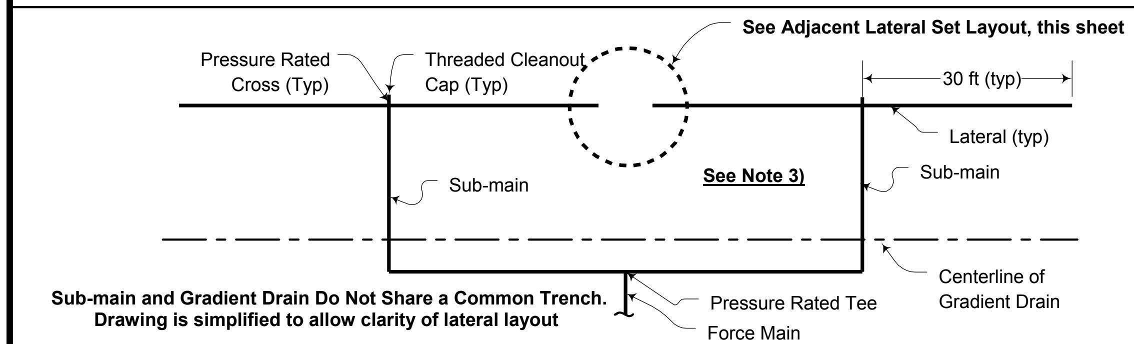
BROWN COUNTY HEALTH DEPARTMENT

Type "B" Structure (Modified Mound) Cross Section A-A

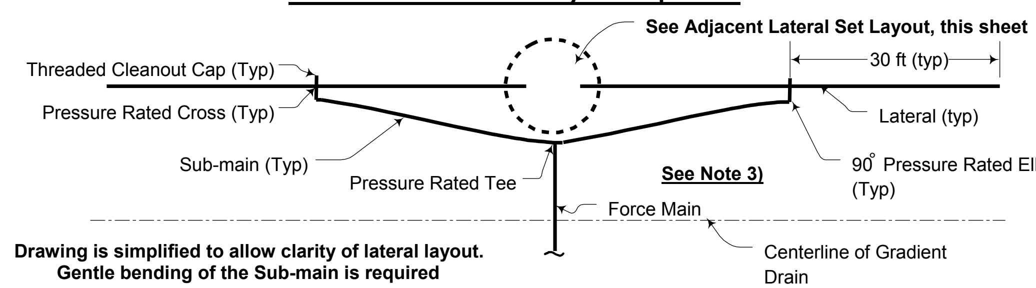


Typical Lateral Set Layout

(No Scale)



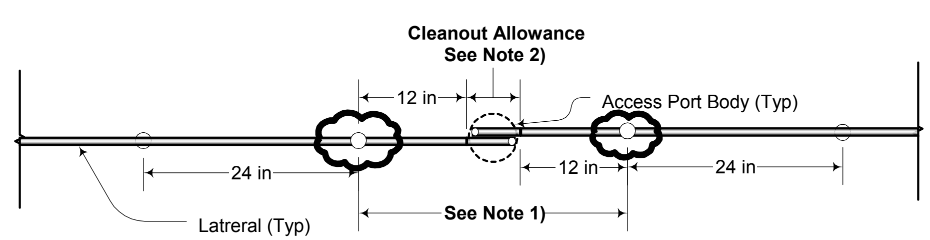
Pressure Distribution Layout - Option A



Pressure Distribution Layout - Option B

Lateral Layout Options

(No Scale)



Adjacent Lateral Set Layout

(No Scale)

Notes:

1) This dimension may vary, but can be no less than 24 in. (Same as orifice center to center spacing).

2) Laterals may overlap or abutt in this location. Ball valve on both laterals may be within a common access port. Conditions of Note 1) apply. Valve handles must be easily opened and closed.

3)The sub-main and force main must be sloped to allow drainage of pipe sections with less than 2 feet of cover. The minimum slope for drainback of these pipes is 1% (1/8 in per ft).

Pressure Distribution Network Data Table

Force Main (Supply Main):

Diameter (Ø)(To be determined from layout)

Sub-main:

Diameter (Ø)	= 1 1/4 in or 1 1/2 in

Laterals:

Diameter (Ø)	= 3/4 in
Individual Lateral Length	= 30 ft
Laterals per set	= 2
Sets of laterals required	= 2

Orifices:

Diameter (Ø)	= 1/8 in
Typical Orifice Center-Center Spacing	= 24 in (2 ft)
Orifices per lateral	= 15
Total Number of Orifices	= 60
Orifice orientation(See Typ. Lat. Set Layout (This Sheet))	

System Data:

1 1/2 Ø Sub-main:

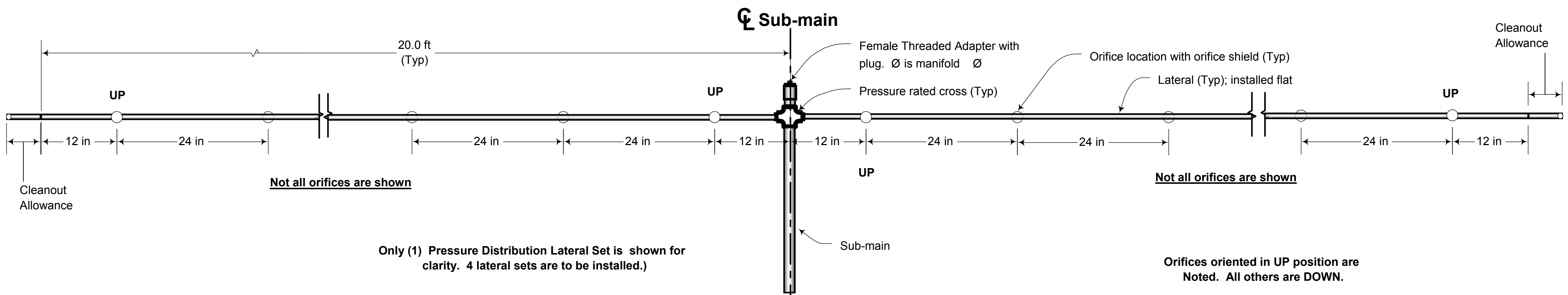
System Flow Rate (Q)	= 26.0 gpm
Squirt Height (Min)	= 58 in
Net Dose Volume	= 17-30 gal

1 1/4 Ø Sub-main:

System Flow Rate (Q)	= 19.0 gpm
Squirt Height (Min)	= 32 in
Net Dose Volume	= 17-30 gal

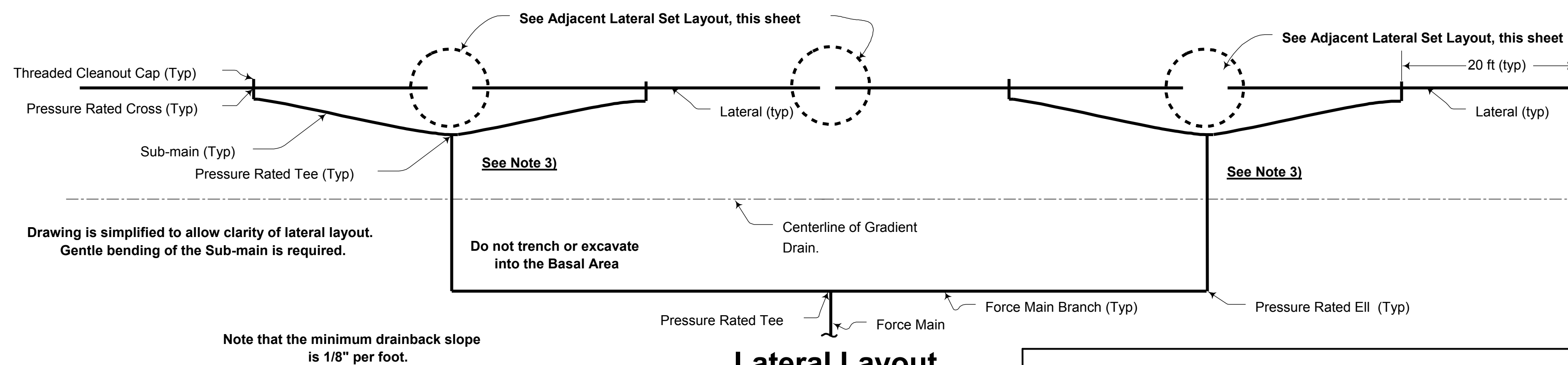
BROWN COUNTY HEALTH DEPARTMENT

Type "B" Structure - Pressure Distribution 3 Bedroom



Typical Lateral Set Layout

(No Scale)



Lateral Layout

(No Scale)

Notes:

1) This dimension may vary, but can be no less than 24 in. (Same as orifice center to center spacing).

2) Laterals may overlap or abutt in this location. Ball valves on both laterals may be within a common access port. Conditions of Note 1) apply. Valve handles must be easily opened and closed.

3) The sub-main and force main must be sloped to allow drainage of pipe sections with less than 2 feet of cover. Minimum slope of drainback is 1% (1/8 in per ft).

Pressure Distribution Network Data Table

Force Main (Supply Main):

Diameter (Ø)(To be determined from layout)

Force Main Branch:

Diameter (Ø) = 1 1/2 in

Sub-main:

Diameter (Ø) = 1 in

Laterals:

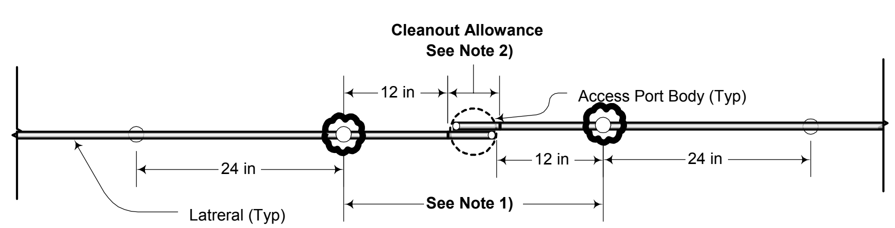
Diameter (Ø) = 3/4 in
Individual Lateral Length = 20 ft
Laterals per set = 2
Lateral sets required = 4

Orifices:

Diameter (Ø) = 1/8 in
Typical Orifice Center-Center Spacing = 24 in (2 ft)
Orifices per lateral = 10
Total Number of Orifices = 80
Orifice Orientation (See Typ. Lat. Set Layout (this Sheet))

System Data

System Flow Rate (Q) = 38.4 gpm
Squirt Height (Min) = 60 in
Net Dose Volume = 23-34 ga

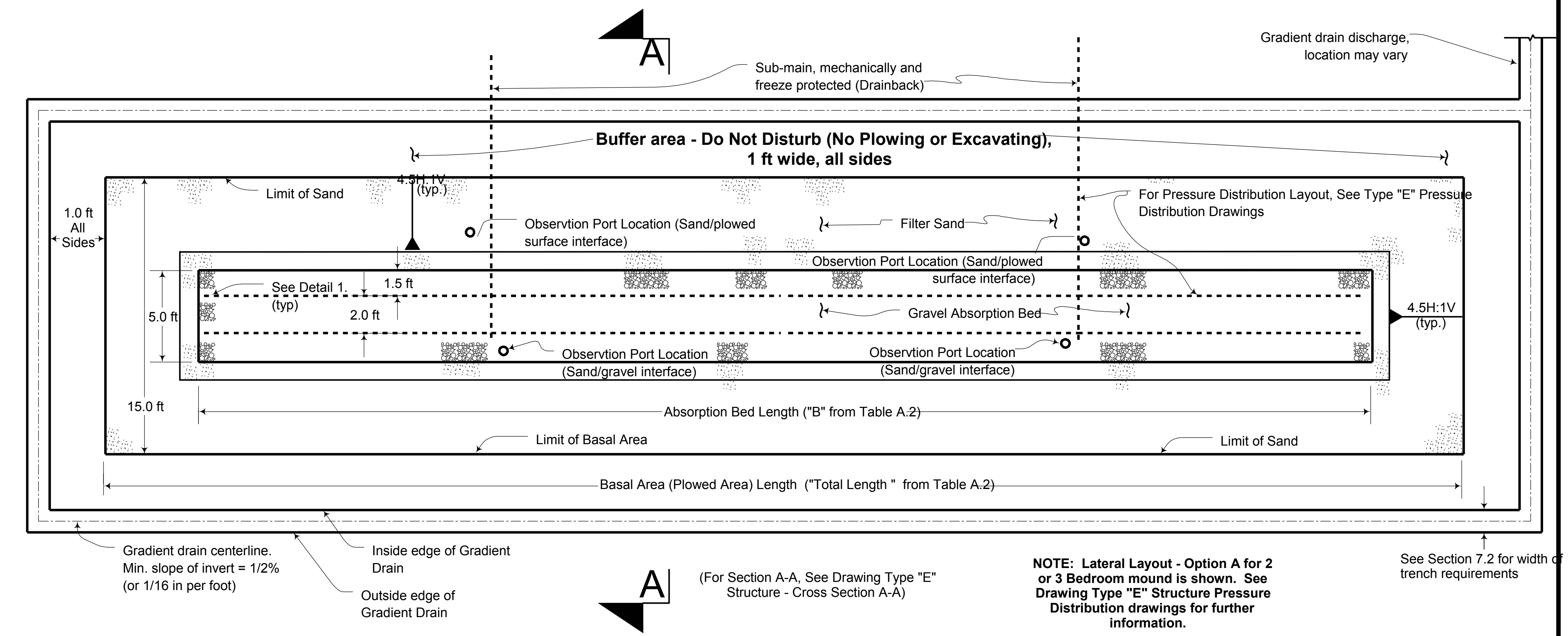


Adjacent Lateral Set Layout

(No Scale)

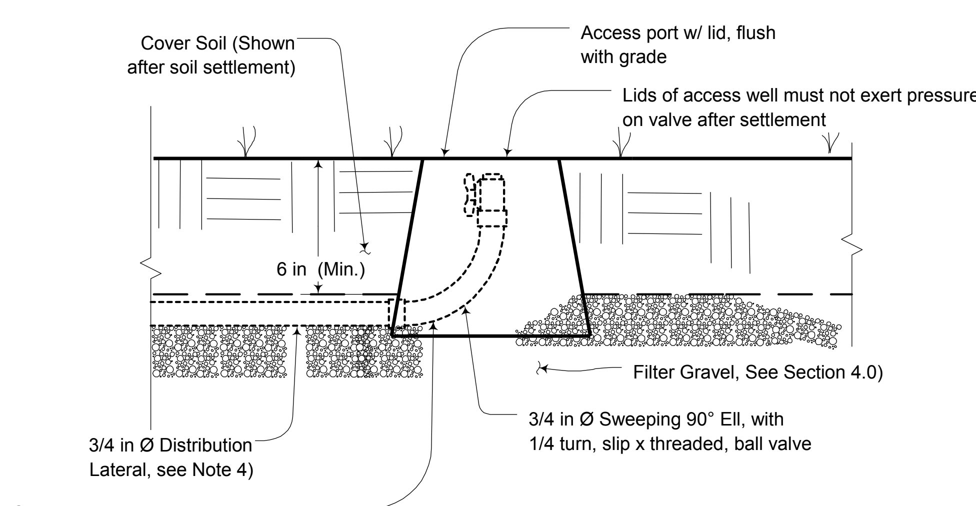
BROWN COUNTY HEALTH DEPARTMENT

Type "B" Structure - Pressure Distribution 4 Bedroom



Type "E" Structure - General Plan

(No Scale)



Detail 1 - Lateral Cleanout

(No Scale)

Notes:

1) Observation ports to be located as shown on this drawing. Each observation ports must be within its own access well. A total of four (4) nobservation ports are required.

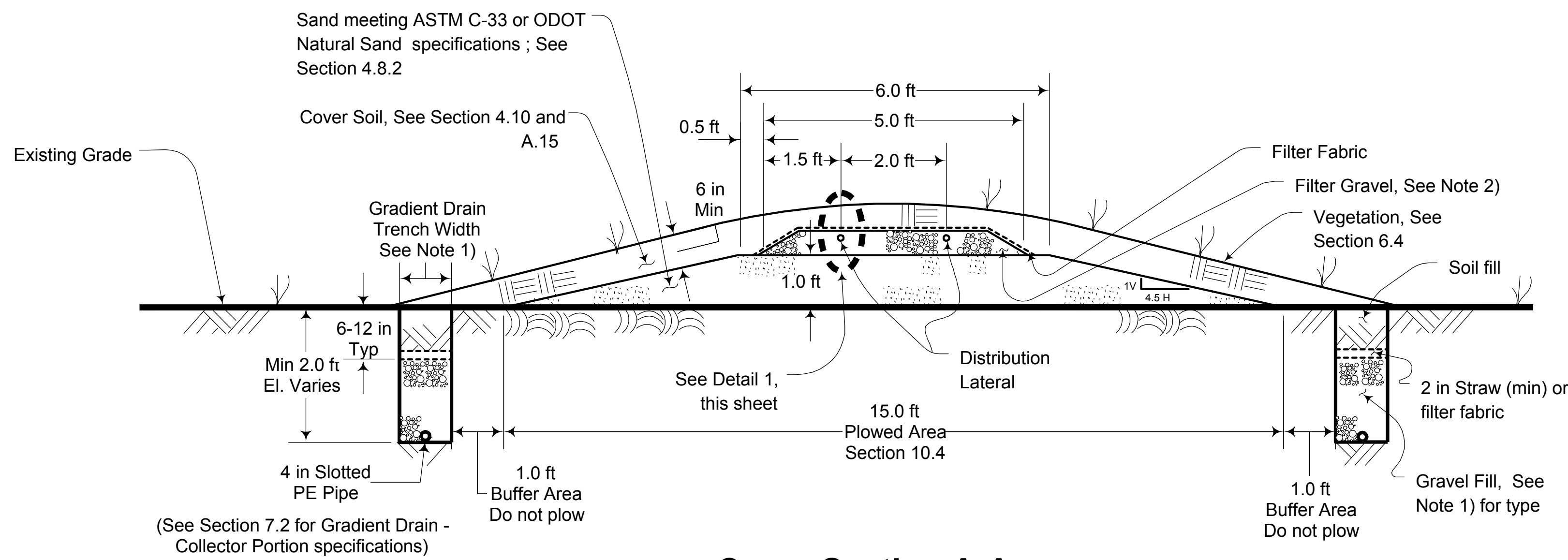
2) See Table A.2 and Figure A.2 for dimensions of various mound components.

3) Buffer area to be protected. Compaction, excavation, or plowing in this area is NOT permitted.

4) Orifices are set at the 6 O'Clock position (down). Orifice spacing varies based upon the number of Bedrooms. See Type "E" Structure - Pressure Distribution corresponding to the appropriate number of bedrooms.

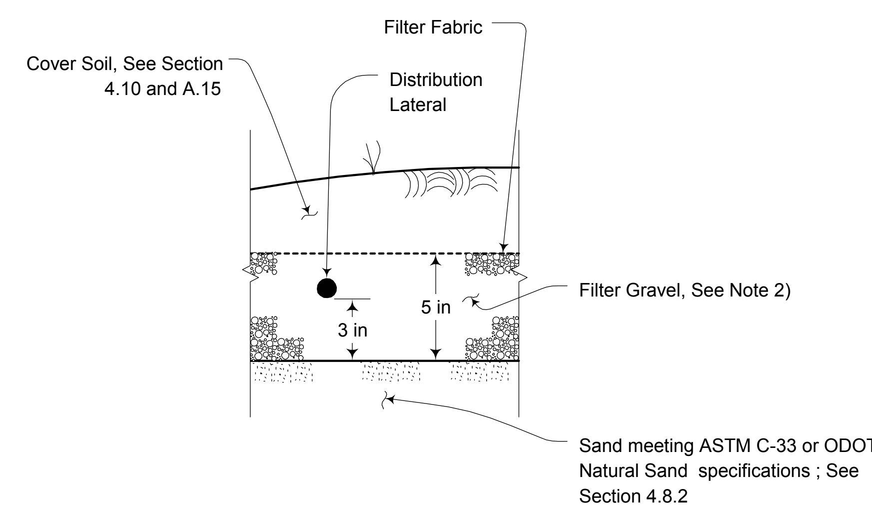
BROWN COUNTY HEALTH DEPARTMENT

Type "E" Structure (Modified Mound) General Plan



Cross Section A-A

(No Scale)



Detail 1

(No Scale)

Notes:

1) The required aggregate backfill varies with the width of the excavated trench. See Section 7.2 for requirements. For aggregate specifications, See Section(s) 4.5, 4.6 or 4.7. If aggregate specified in Section 4.7 is used, then the requirements of Section 4.9 apply. This section requires special marking to allow for confirmation of pipe slope.

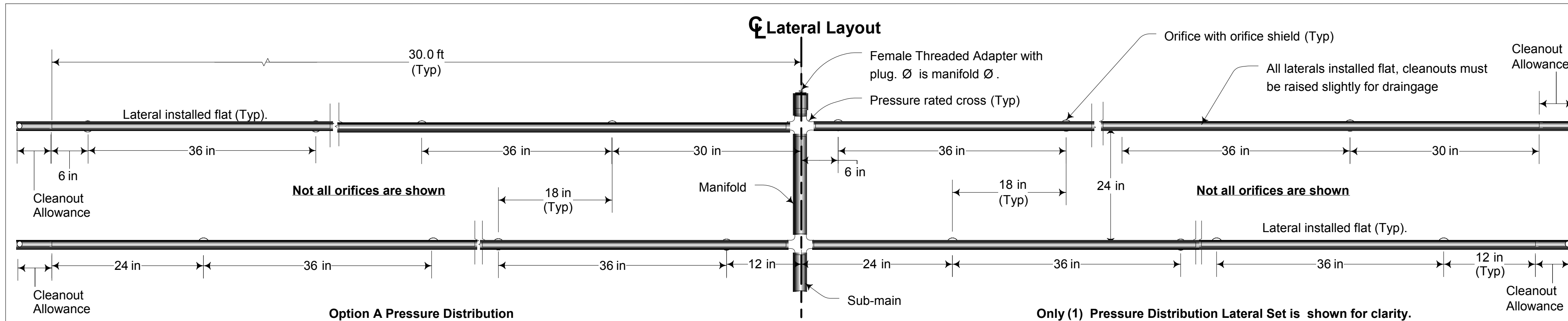
2) The specified aggregate(s) in this componet are summarized in Table 4.1. See Sections 4.5, 4.6 or 4.7 for individual aggregate type specifications.

3) The Sub-main and force main must be sloped to allow drainback to the point where two (2) feet of cover over the force main is maintained. The minimum slope for this drainback is 1% (1/8 in per ft).

4) **The force main does not penetrate the basal area.**

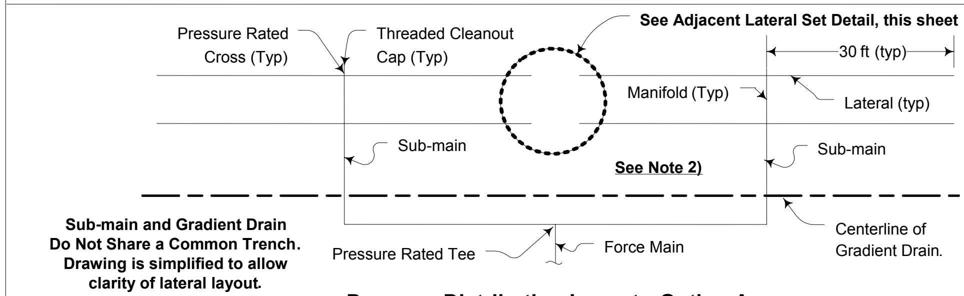
BROWN COUNTY HEALTH DEPARTMENT

Type "E" Structure (Modified Mound) Cross Section A-A

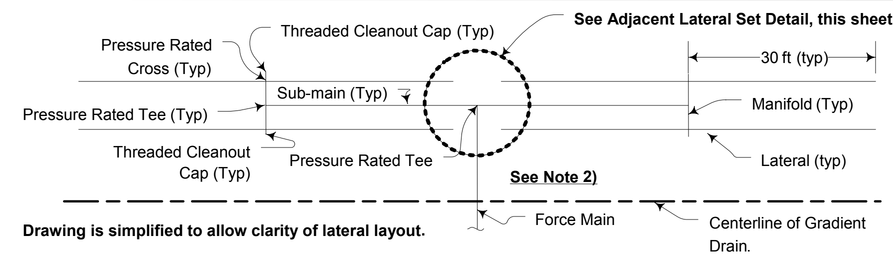


Typical Lateral Set Layout

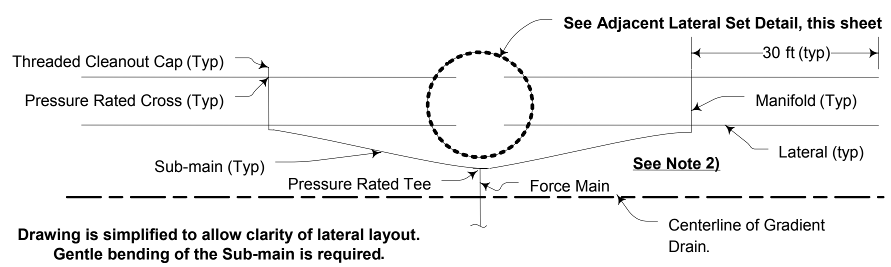
(No Scale)



Pressure Distribution Layout - Option A



Pressure Distribution Layout - Option B



Pressure Distribution Layout - Option C

Lateral Layout Options

(No Scale)

Notes:

1) This dimension may vary, but can be no less than 36 in.
2) The sub-main and force main must be sloped to allow drainage of pipe sections with less than 2 feet of cover. Minimum slope for drainback is 1% (1/8 in per foot).
3) A total of 8 Laterals required, configured as 2 sets.
4) System Data: Flow Rate (Q) = 29.0 gpm, Squirt Height = 42 in, Dose Volume = 28.0 to 35.0 gal.
5) Laterals may overlap or abut in this location. Ball valves on both laterals may be within a common access port. Conditions of Note 1) apply. Valves must be easily opened and closed.

Pressure Distribution Network Data Table

Force Main (Supply Main):

Diameter (Ø) = 1 1/2 in

Sub-main:

Diameter (Ø) = 1 1/2 in

Manifolds:

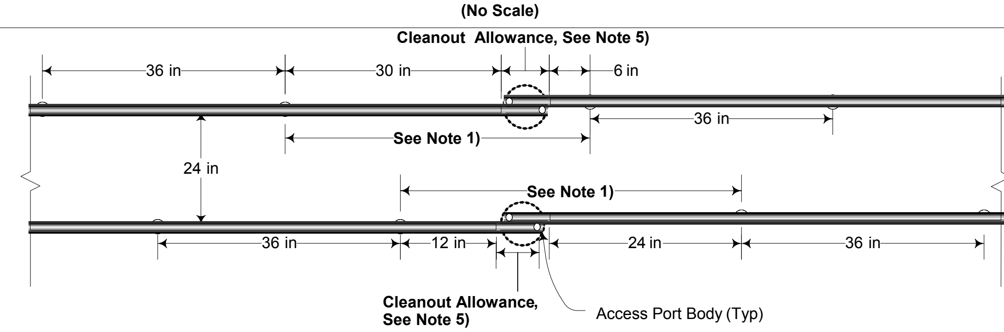
Diameter (Ø) = 1 1/2 in
Lateral Spacing = 2 ft
Number of Manifolds = 2

Laterals:

Diameter (Ø) = 3/4 in
Individual Lateral Length = 30 ft

Orifices:

Diameter (Ø) = 1/8 in
Typical Orifice Center-Center Spacing = 36 in (3 ft)
Orifices per lateral = 10
Total Number of Orifices = 80

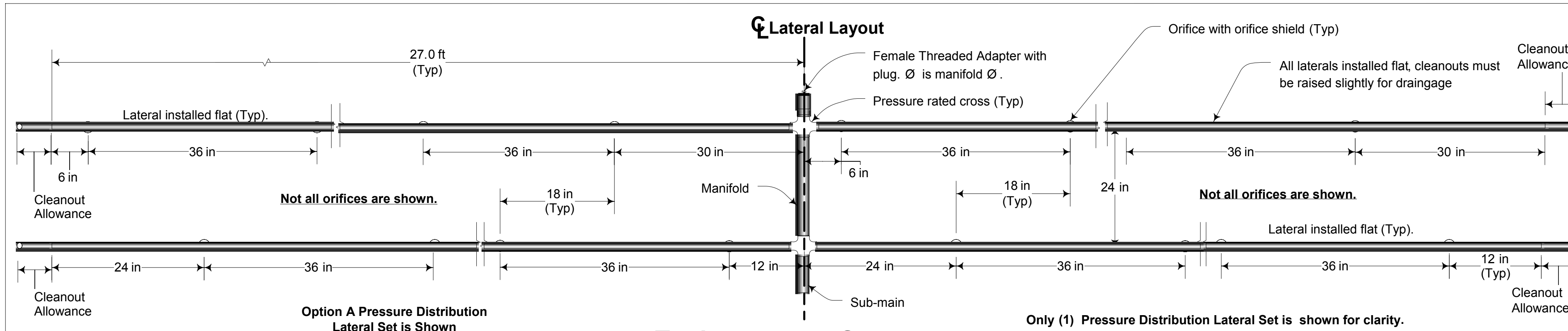


Adjacent Lateral Set Layout

(No Scale)

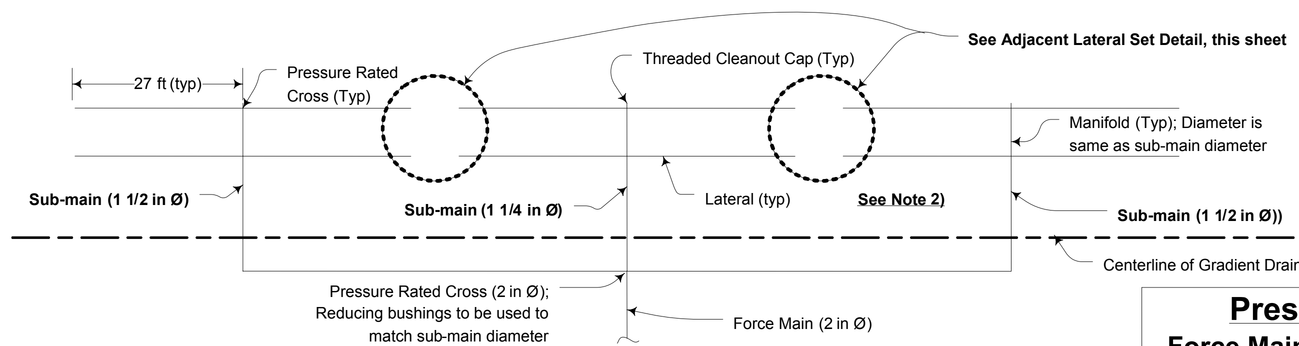
BROWN COUNTY HEALTH DEPARTMENT

Type "E" Structure - Pressure Distribution 3 Bedroom



Typical Lateral Set Layout

(No Scale)



Drawing is simplified to allow clarity of lateral layout. Gentle bending of the sub-main is required.

Pressure Distribution Layout

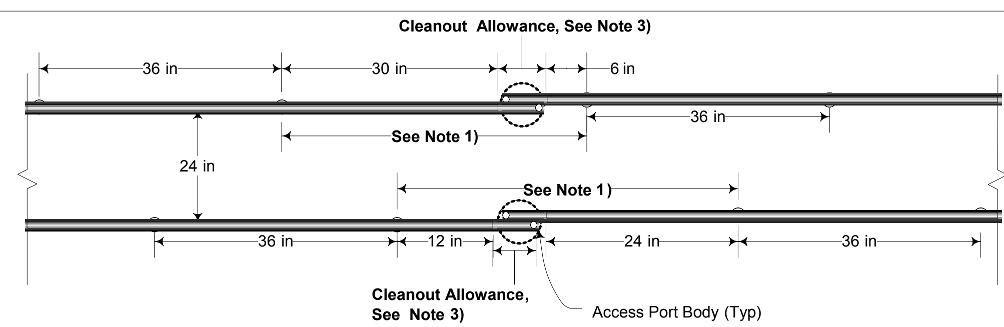
(No Scale)

Notes:

1) This dimension may vary, but can be no less than 36 in.

2) The sub-mains and force main must be sloped to allow drainage of pipe sections with less than 2 feet of cover. Minimum slope for drain back is 1% (1/8 in per foot).

3) Laterals may overlap or abutt in this location. Ball valves on both laterals may be within a common access port. Conditions of Note 1) apply. Valves must be easily opened and closed.



Adjacent Lateral Set Layout

(No Scale)

Pressure Distribution Network Data Table

Force Main (Supply Main):
Diameter (Ø) = 2 in

Sub-main(s):
Diameter (Ø) = 1 1/2 in or 1 in

Manifolds:
Diameter (Ø) = Same as Sub-main (1 1/2 in or 1 1/4 in)

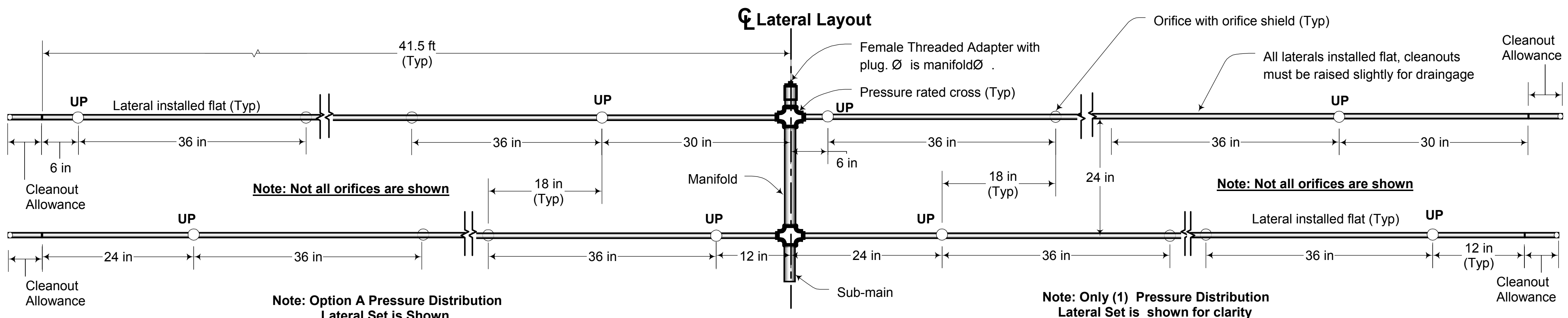
Laterals:
Number of Manifolds = 3
Diameter (Ø) = 3/4 in
Lateral Spacing = 2 ft
Individual Lateral Length = 30 ft
Laterals per Set = 4
Sets of Laterals Required = 3

Orifices:
Diameter (Ø) = 1/8 in
Typical Orifice Center-Center Spacing = 36 in (3 ft)
Orifices per lateral = 9
Orifices per Lateral Set = 36
Total Number of Orifices = 108

System Data:
System Flow Rate (Q) = 43.5 gpm
Squirt Height (Min) = 52 in
Net Dose Volume = 27.0 to 40.0 gal

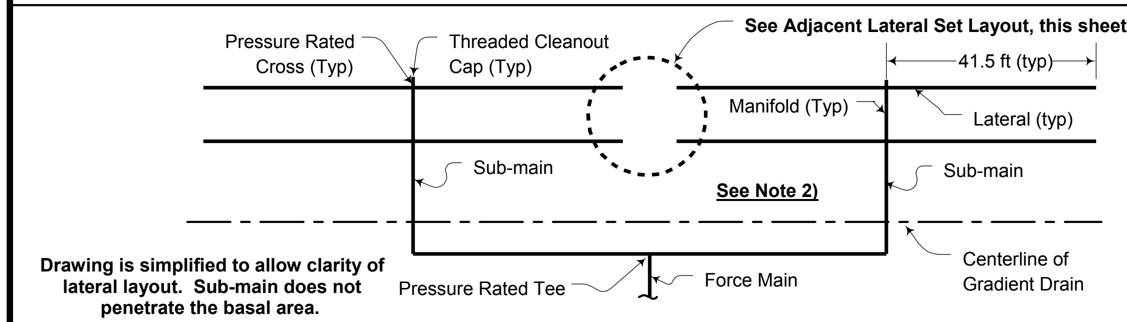
BROWN COUNTY HEALTH DEPARTMENT

Type "E" Structure - Pressure Distribution 4 Bedroom (3-H Lateral Layout)

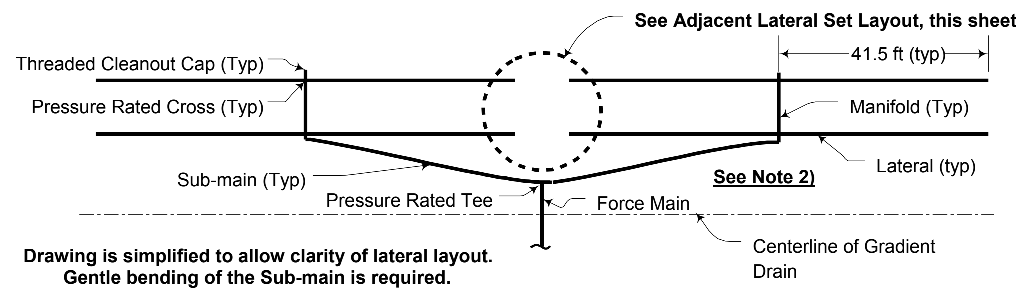


Typical Lateral Set Layout

(No Scale)



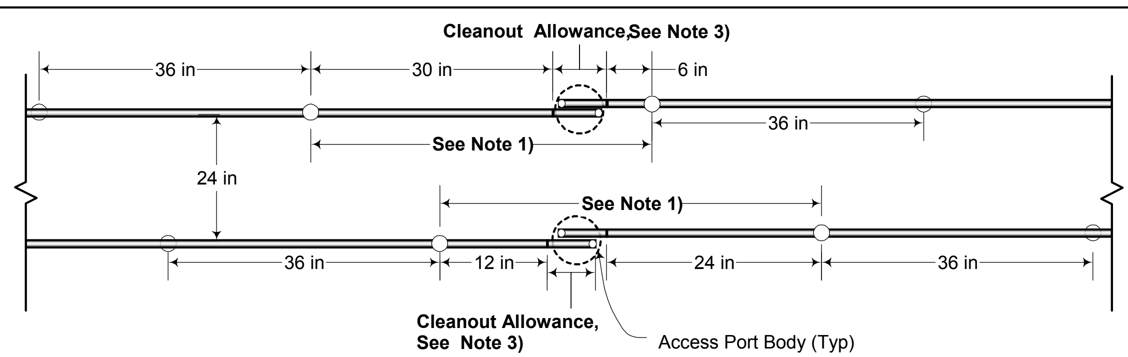
Pressure Distribution Layout - Option A



Pressure Distribution Layout - Option C

Lateral Layout Options

(No Scale)



Adjacent Lateral Set Layout

(No Scale)

Notes:

1) This dimension may vary, but can be no less than 36 in.

2) The sub-main and force main must be sloped to allow drainage of pipe sections with less than 2 feet of cover. Minimum slope for drainback is 1% (1/8 in per foot).

3) A total of 8 Laterals required, configured as 2 sets.

4) System Data: Flow Rate, (Q) = 49.7 gpm, Squirt Height = 60 in, Dose Volume = 29.0 to 42.0 gal.

5) Laterals may overlap or abutt in this location. Ball valves on both laterals may be within a common access port. Conditions of Note 1) apply. Valves must be easily opened and closed.

Pressure Distribution Network Data Table

Force Main (Supply Main):

Diameter (Ø)(To b determined by site layout)	

Sub-main:

Diameter (Ø)	= 1 1/2 in

Manifolds:

Diameter (Ø)	= 1 1/2 in
Lateral Spacing	= 2 ft
Number of Manifolds	= 2

Laterals:

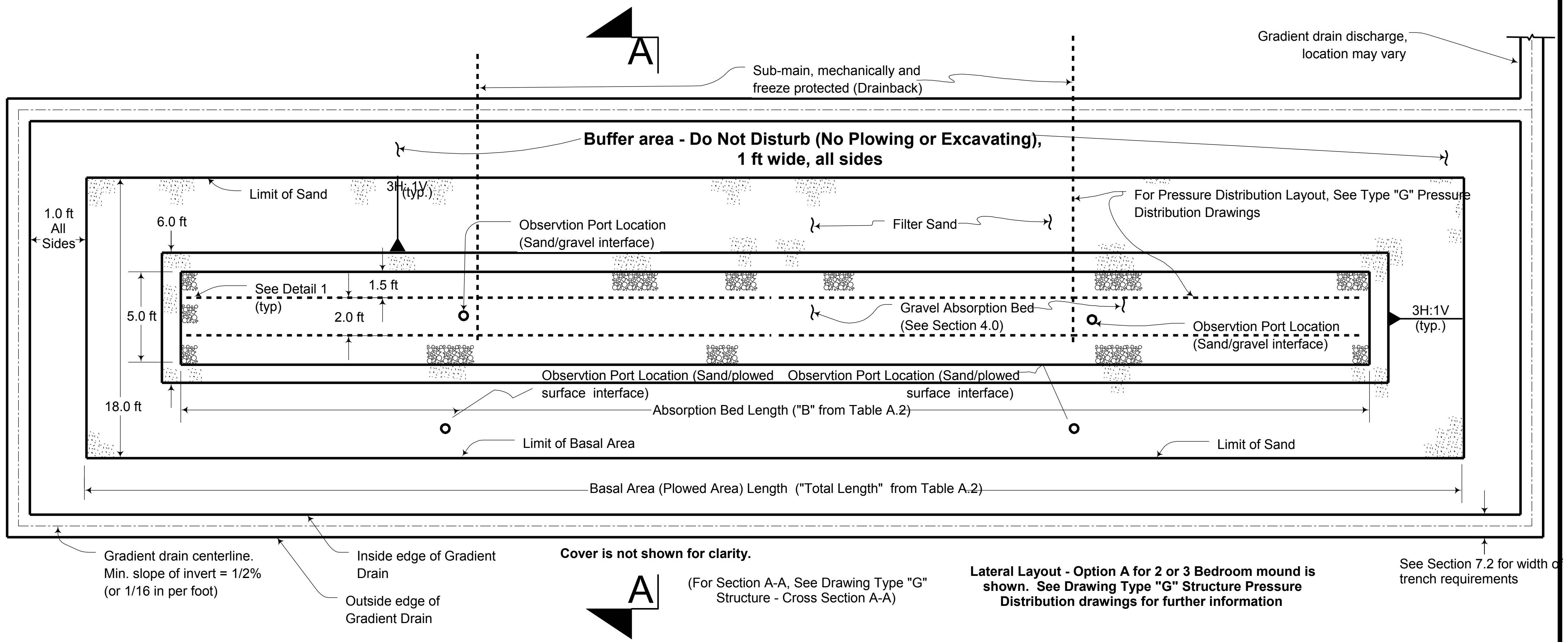
Diameter (Ø)	= 3/4 in
Individual Lateral Length	= 41 ft

Orifices:

Diameter (Ø)	= 1/8 in
Typical Orifice Center-Center Spacing	= 36 in (3 ft)
Orifices per lateral	= 14
Total Number of Orifices	= 112

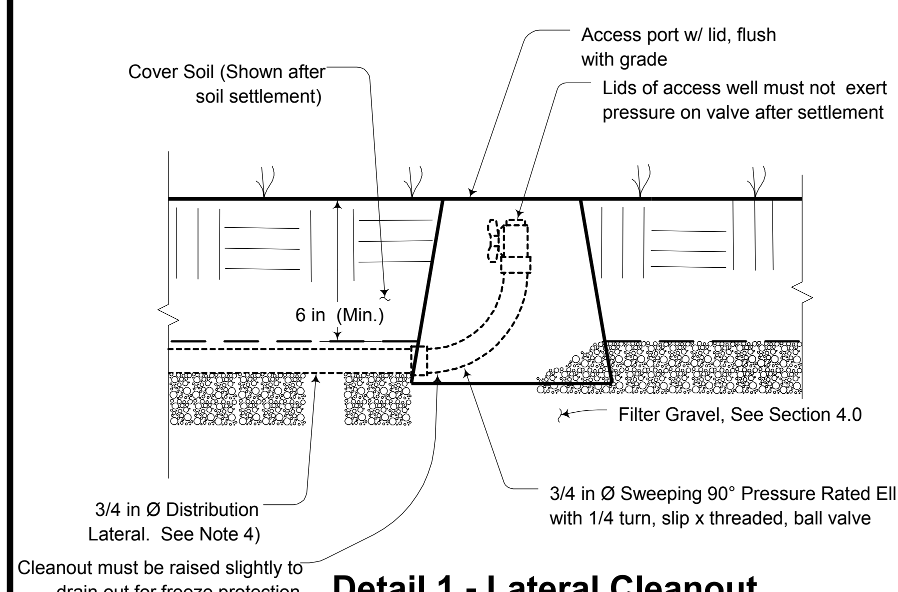
BROWN COUNTY HEALTH DEPARTMENT

Type "E" Structure - Pressure Distribution 4 Bedroom (2-H Lateral Layout)



Type "G" Structure - General Plan

(No Scale)



Detail 1 - Lateral Cleanout

(No Scale)

Notes:

1) Observation ports to be located as shown on this drawing.

2) See Table A.2 and Figure A.2 for dimensions of various mound components.

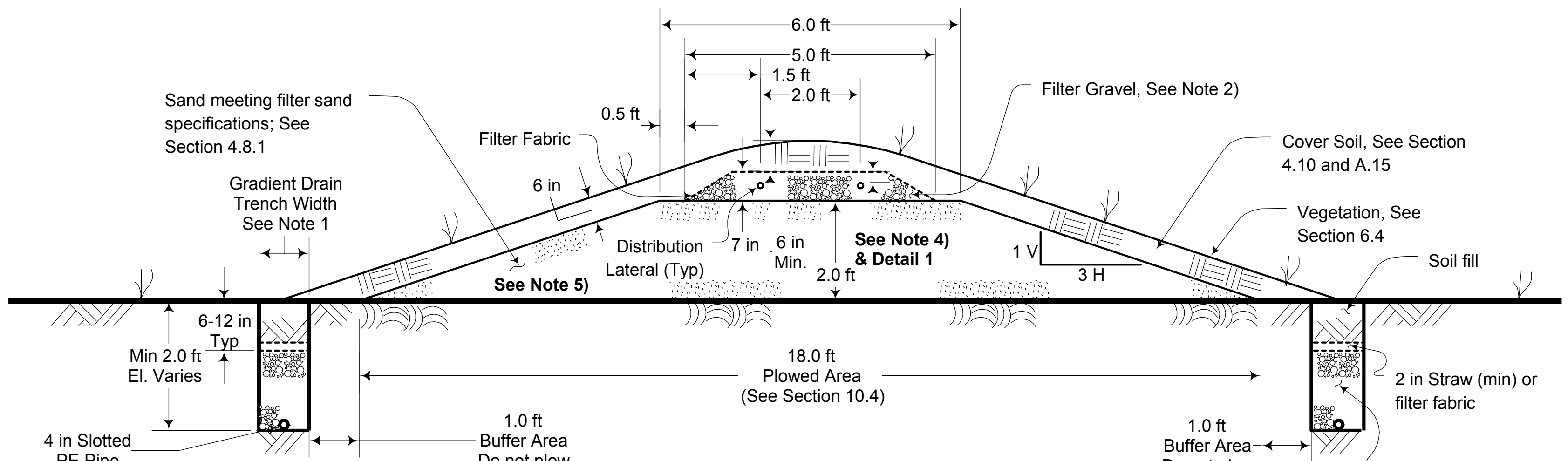
3) Buffer area to be protected. Compaction, excavation, or plowing in this area is NOT permitted.

4) Orifice spacing and orientation varies. See Pressure Distribution Drawings for further information.

5) **The orifices/orifice shields are at 6 O'Clock (down) position, EXCEPT for the first and last orifice which are DOWN.** Laterals are flat (level).

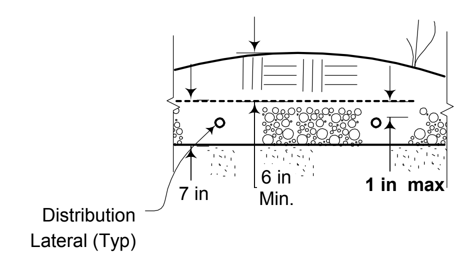
6) Sub-main(s) are to be sloped at a minimum of 1% (1/8 in per ft) to promote drainage back towards the force main after dosage completion.

BROWN COUNTY HEALTH DEPARTMENT
Type "G" Structure (Millennium Mound) General Plan



Cross Section A-A

(No Scale)



Detail 1

(No Scale)

Notes:

1) The required aggregate backfill varies with the width of the excavated trench, See Section 7.2 for requirements. For aggregate specifications, See Section(s) 4.5, 4.6 or 4.7. If aggregate specified in Section 4.7 is used, then the requirements of Section 4.9 apply. This section requires special marking to allow for confirmation of pipe slope.

2) The specified aggregate(s) in this component are summarized in Table 4.1. See Sections 4.5 and 4.6 for individual aggregate type specifications. Graded crushed limestone is not permitted.

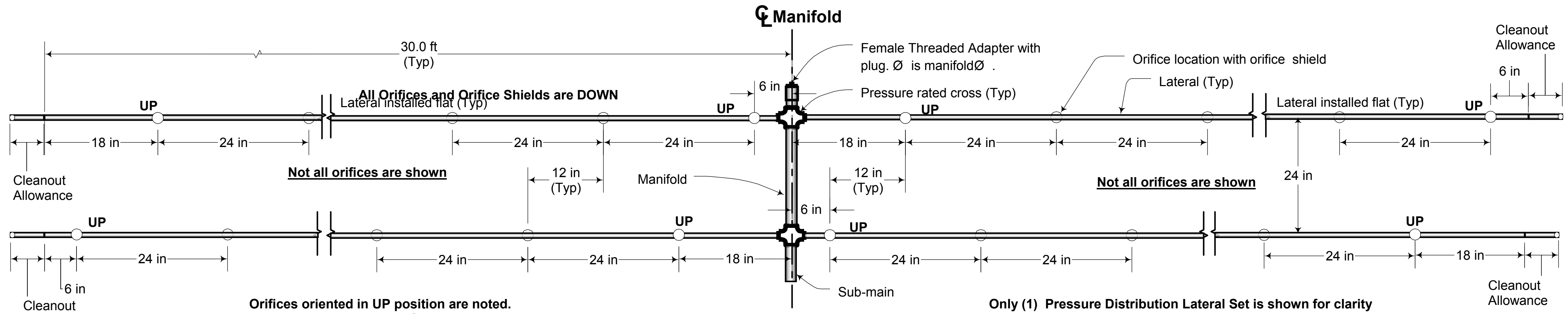
3) The Sub-main and force main must be sloped to allow drainback to the point where two (2) feet of cover over the force main is not maintained. The minium slope of the force main and sub-main for drainback is 1% (1/8 inch per foot). The force main must not penetrate the basal area.

4) The gravel thickness is to be such that the distribution lateral is covered, but no more than 1 inch below the surface of the gravel.

5) Filter sand is to be uniformly compacted to limit settlement.

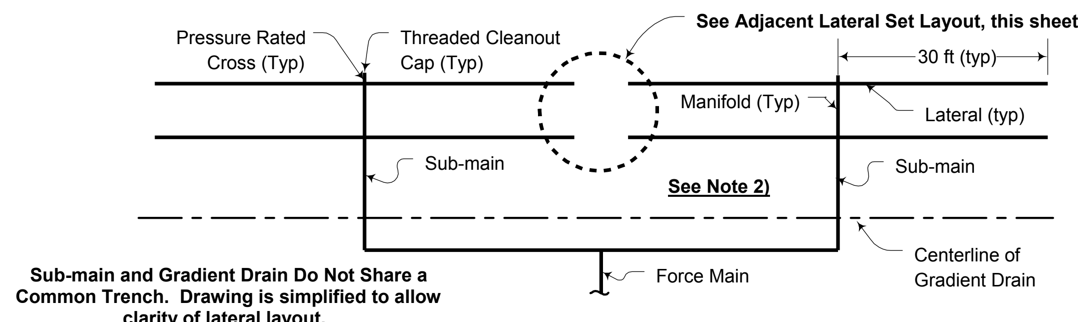
BROWN COUNTY HEALTH DEPARTMENT

Type "G" Structure (Millennium Mound) - Cross Section A-A

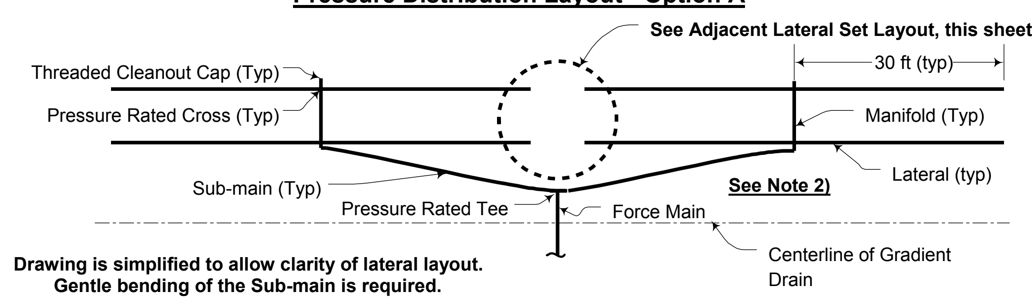


Typical Lateral Set Layout

(No Scale)



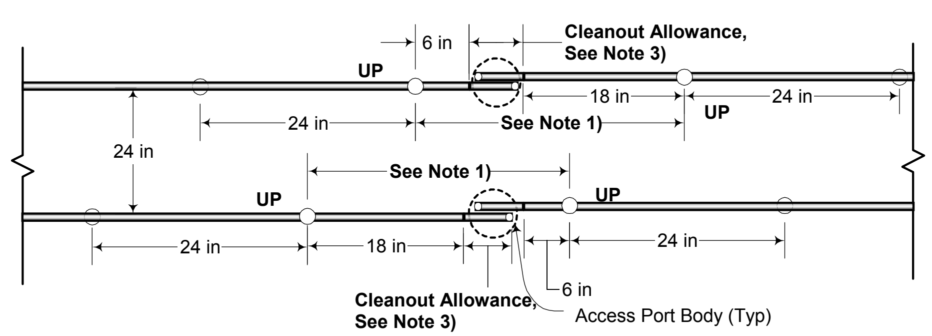
Pressure Distribution Layout - Option A



Pressure Distribution Layout - Option B

Lateral Layout Options

(No Scale)



Adjacent Lateral Set Layout

(No Scale)

Notes:

1) This dimension may vary, but can be no less than 24 in.

2) The sub-main and force main must be sloped to allow drainage of pipe sections with less than 2 feet of cover. Minimum slope for drainback of these pipes is 1% (1/8 in per ft).

3) Laterals may overlap or abut in this location. Ball valves on both laterals may be within a common access port. Conditions of Note 1) apply. Valves must be easily opened and closed.

4) System Flow Rate (Q) = 53.0 gpm; Squirt Height = 60 in; Design Dose Volume = 34.0 gallons.

Pressure Distribution Network Data Table

Force Main (Supply Main):

Diameter (Ø)(To be determined by site layout)

Sub-main:

Diameter (Ø) = 1 1/2 in

Manifolds:

Diameter (Ø) = 1 1/2 in
Lateral Spacing = 2 ft
Number of Manifolds = 2

Laterals:

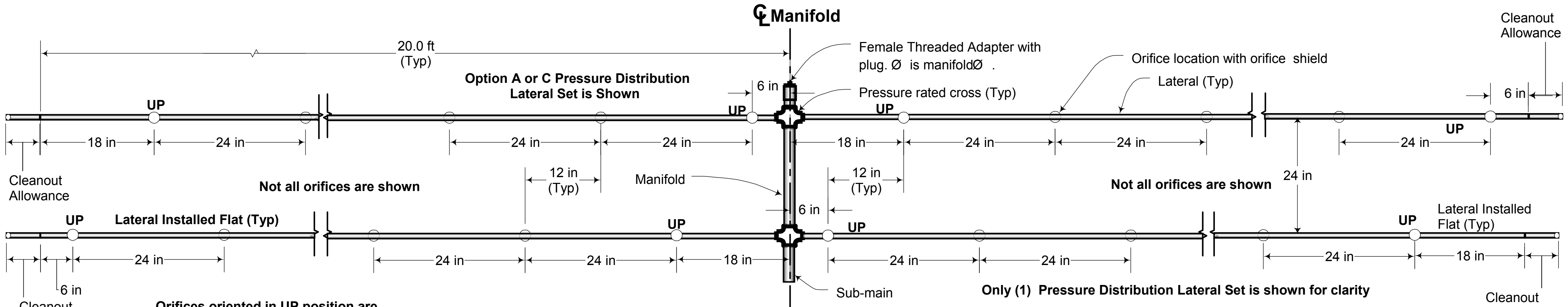
Diameter (Ø) = 3/4 in
Individual Lateral Length = 29 ft

Orifices:

Diameter (Ø) = 1/8 in
Typical Orifice Center-Center Spacing = 24 in (2 ft)
Orifices per lateral = 15
Total Number of Orifices = 120
Orifice Orientation = 6 O'clock (Down)

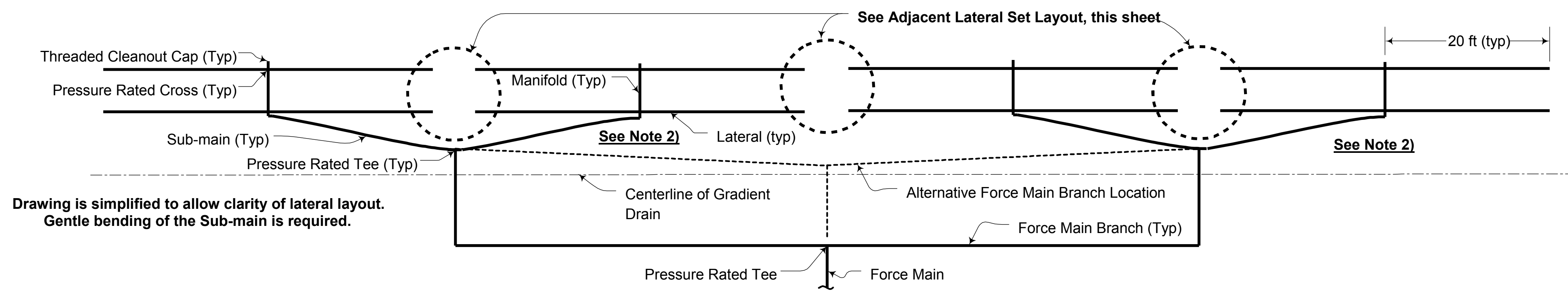
BROWN COUNTY HEALTH DEPARTMENT

Type "G" Structure - Pressure Distribution 3 Bedroom



Typical Lateral Set Layout

(No Scale)



Lateral Layout Option

(No Scale)

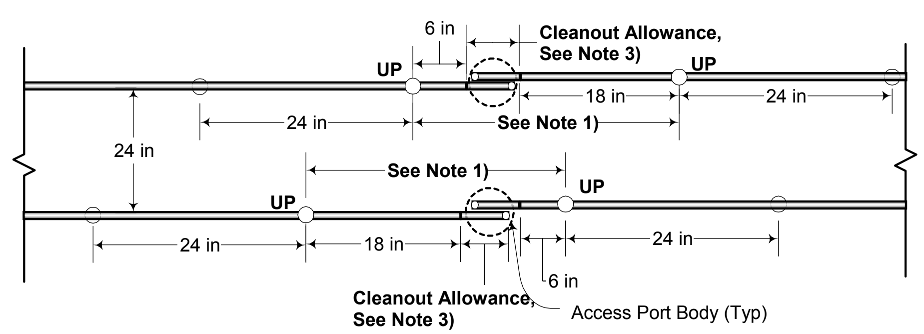
Notes:

1) This dimension may vary, but can be no less than 24 in.

2) The sub-main and force main must be sloped to allow drainage of pipe sections with less than 2 feet of cover. Minimum slope for drainback of these pipes is 1% (1/8 in per ft).

3) Laterals may overlap or abut in this location. Ball valves on both laterals may be within a common access port. Conditions of Note 1 apply. Valves must be easily opened and closed.

4) System Flow Rate (Q) = 69.6 gpm; Operating Head = 60 in; Net Dose Volume = 45.0 gallons.



Adjacent Lateral Set Layout

(No Scale)

Pressure Distribution Network Data Table

Force Main (Supply Main):

Diameter (Ø)(To be determined by site layout)	

Force Main Branch

Diameter (Ø)	= 1 1/2 in

Sub-main:

Diameter (Ø)	= 1 1/2 in

Manifolds:

Diameter (Ø)	= 1 1/2 in
Lateral Spacing	= 2 ft
Number of Manifolds	= 2

Laterals:

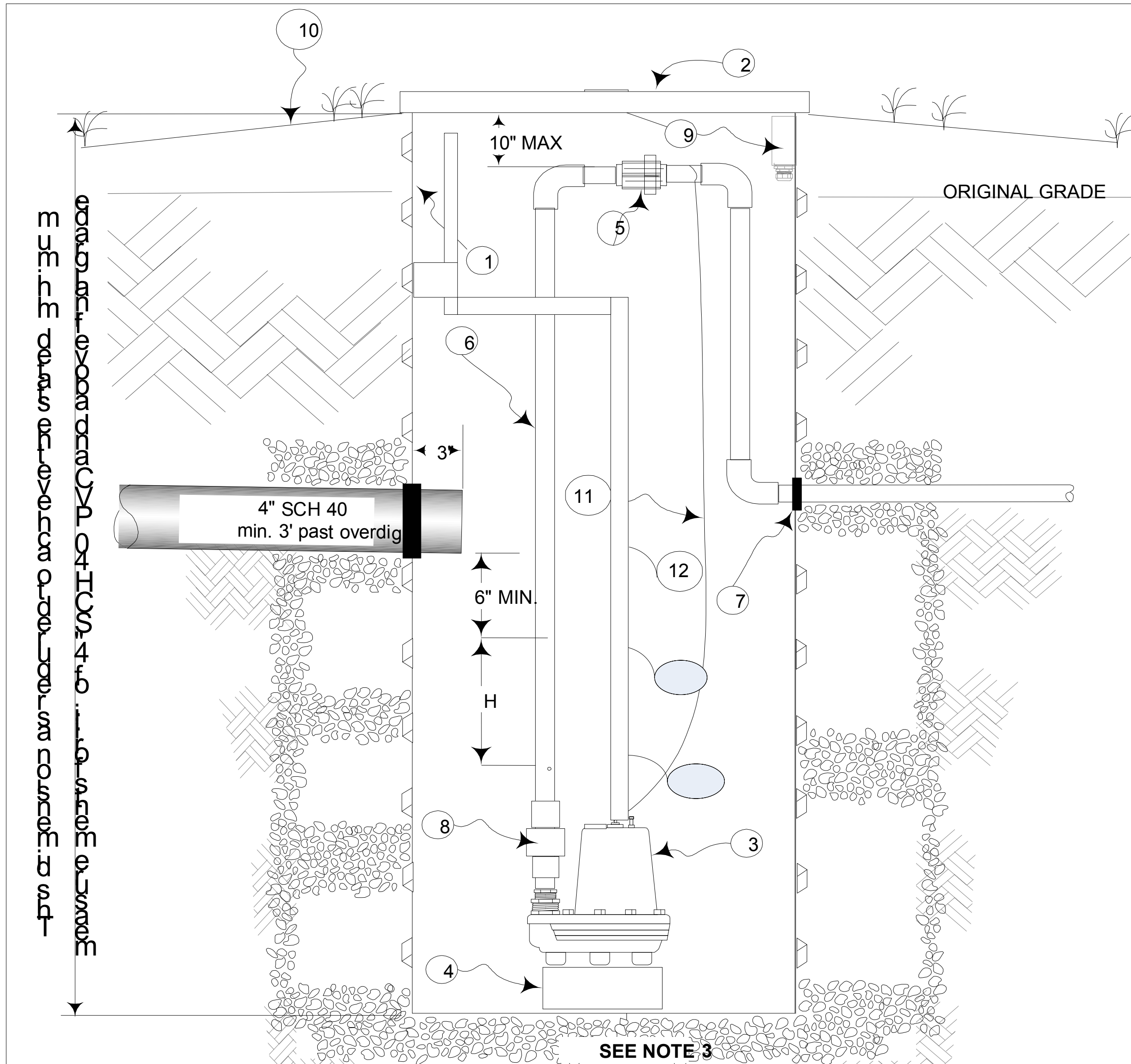
Diameter (Ø)	= 3/4 in
Individual Lateral Length	= 20 ft

Orifices:

Diameter (Ø)	= 1/8 in
Typical Orifice Center-Center Spacing	= 24 in (2 ft)
Orifices per lateral	= 10
Total Number of Orifices	= 160
Orifice Orientation	= 6 O'clock (Down)

BROWN COUNTY HEALTH DEPARTMENT

Type "G" Structure - Pressure Distribution 4 Bedroom (4H)



#	DESCRIPTION
1	Gradient Drain Pump Vault - 18" Min. Road Drain Tile Or One Piece Manufactured Concrete Or Sealed Seam Unit.
2	Child Proof Cover - Heavy Concrete Lid Or 3/16" Hex/#3S Bolt Down Fiberglass / Plastic Lid.
3	Drainage Pump - Sized To Meet Inflow Volumes And Ability To Overcome Head Requirements.
4	6"(min.) Concrete Block
5	Union Or Quick Disconnect
6	Min.1" - 1-1/2" SCH 40 PVC With Pressure Rated Fittings.
7	All Pipe Penetrations Are Sealed From Gravel And Dirt With Product Meant For This Intended Application.
8	Check Valve - Where Required By Pump Manufacturer or Installation Situation.
9	NEMA 4x Electrical Enclosure With Properly Fitted Cord Grips And Sealed Electrical Wire Inlet. Leave Enough Cord For Easy Removal Pump. Installed Above Original Grade.
10	Final Grade - Sloped Away From Sump Basin
11	Lifting Rope - Nylon Marine Grade
12	High level alarm

Notes:

1 The 'ON' Switch For The Pump Is To Be Min. Of 6" Below the Invert Of The Inlet Pipe.

2 Multiple Drain Tiles Are To Be Connected Together Outside Of The Sump. Only One Penetration Should Be Made Into The Basin.

3 If A Bottomless Sump Basin Is Used, Gravel Must Be Used To Line The Bottom Of The Vault.

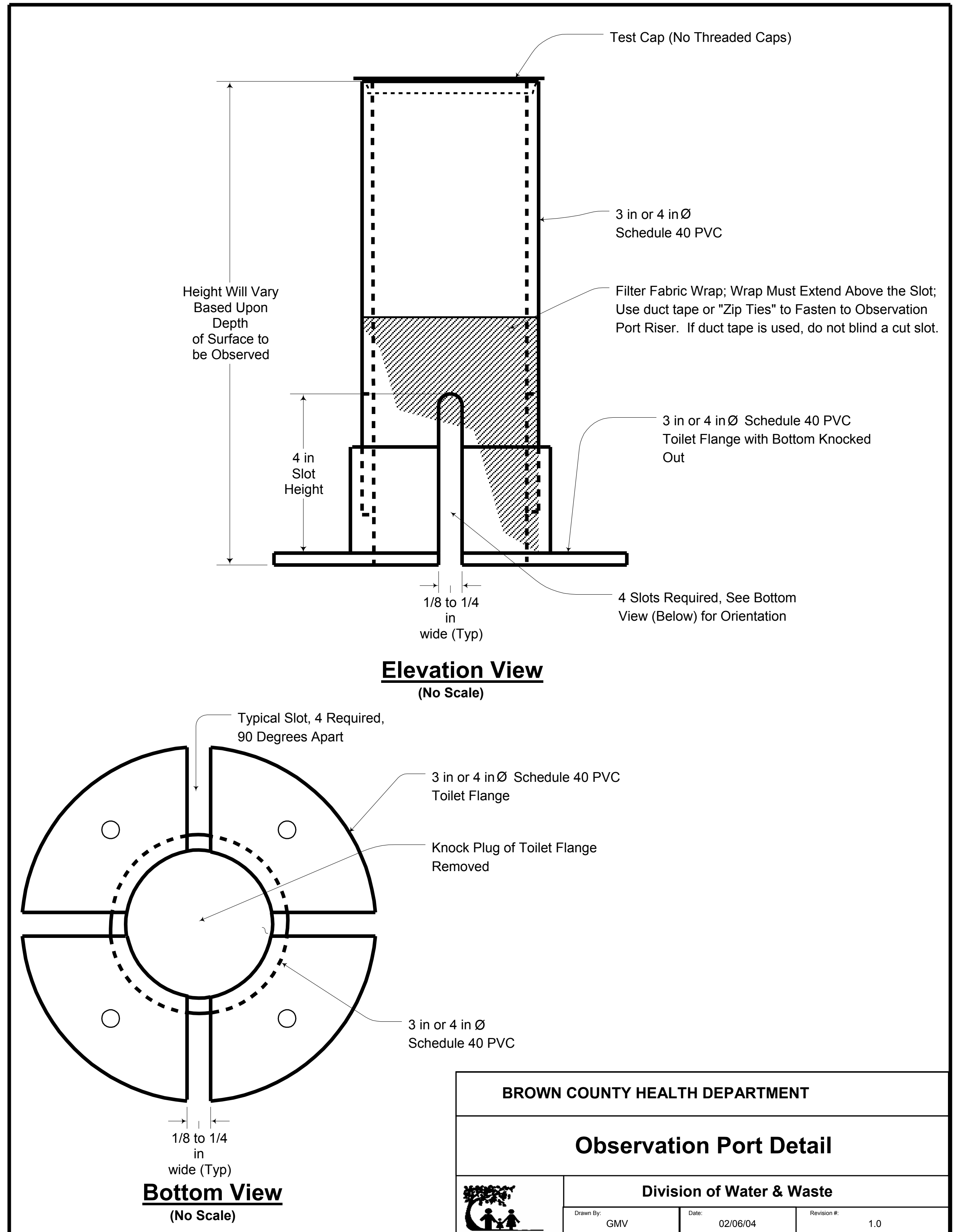
4 Electrical Wiring And Connections To Be Made Per Local and National Electric Codes.

5 High level alarm “on” position at “2” below inlet pipe.

20 gallon dose net	
Sump Diameter	Distance H
24 Inch	10"-11"
21 Inch	13"-14"
20 Inch	15"-16"
18 Inch	18"-19"

BROWN COUNTY HEALTH DEPARTMENT

Drainage Sump


Test Cap (No Threaded Caps)
3 in or 4 in Ø
Schedule 40 PVC
Filter Fabric Wrap; Wrap Must Extend Above the Slot; Use duct tape or "Zip Ties" to Fasten to Observation Port Riser. If duct tape is used, do not blind a cut slot.
Height Will Vary Based Upon Depth of Surface to be Observed
4 in Slot Height
3 in or 4 in Ø Schedule 40 PVC Toilet Flange with Bottom Knocked Out
1/8 to 1/4 in wide (Typ)
4 Slots Required, See Bottom View (Below) for Orientation
Elevation View
(No Scale)
Typical Slot, 4 Required, 90 Degrees Apart
3 in or 4 in Ø Schedule 40 PVC Toilet Flange
Knock Plug of Toilet Flange Removed
3 in or 4 in Ø
Schedule 40 PVC
1/8 to 1/4 in wide (Typ)
Bottom View
(No Scale)
BROWN COUNTY HEALTH DEPARTMENT
Observation Port Detail
Division of Water & Waste
Drawn By: GMV
Date: 02/06/04
Revision #: 1.0

18 As-Built

- Symbols for “Layout Plans” and “As-builts”
- Type “A” Structure
  - Planning/As-built General Plan
  - Planning/As-built Cross Section A-A
- Type “B” Structure
  - Planning/As-built General Plan
  - Planning/As-built Cross A-A
- Type “E” Structure
  - Planning/As-built General Plan
  - Planning/As-Built Cross Section A-A
- Type “G” Structure (Millennium Mound)
  - Planning/As-built General Plan
  - Planning/As-built Cross section A-A
- Leach Line Trenches (LLT) As-built Sheet

Symbol	Meaning
B M	Benchmark
B.S.	Backsight
F.S.	Foresight
H.I.	Height of Instrument
I P	Instrument Set-up Location
T P	Turning Point
(3 - 2)	Existing (Natural) Elevation
	Pressure/Gravity Pipe
3 -- 2	Top of Pipe
	Spot Grade Rod Reading*

*Spot grades are to be used with the following prefixes and suffixes to indicate item being surveyed.

Prefixes:
- EX - Existing
- PL - Planned
- AB - As-Built

Suffixes:
- D.B. - Ditch Bottom (Ditch Invert)
- T.G. - Top of Gravel
- T.S. - Top of Sand
- F.L. - Flow Line(Pipe Invert)
- T.T. - Top of Tank
- T.R. - Top of Riser
- T.P. - Top of Pipe

Example:

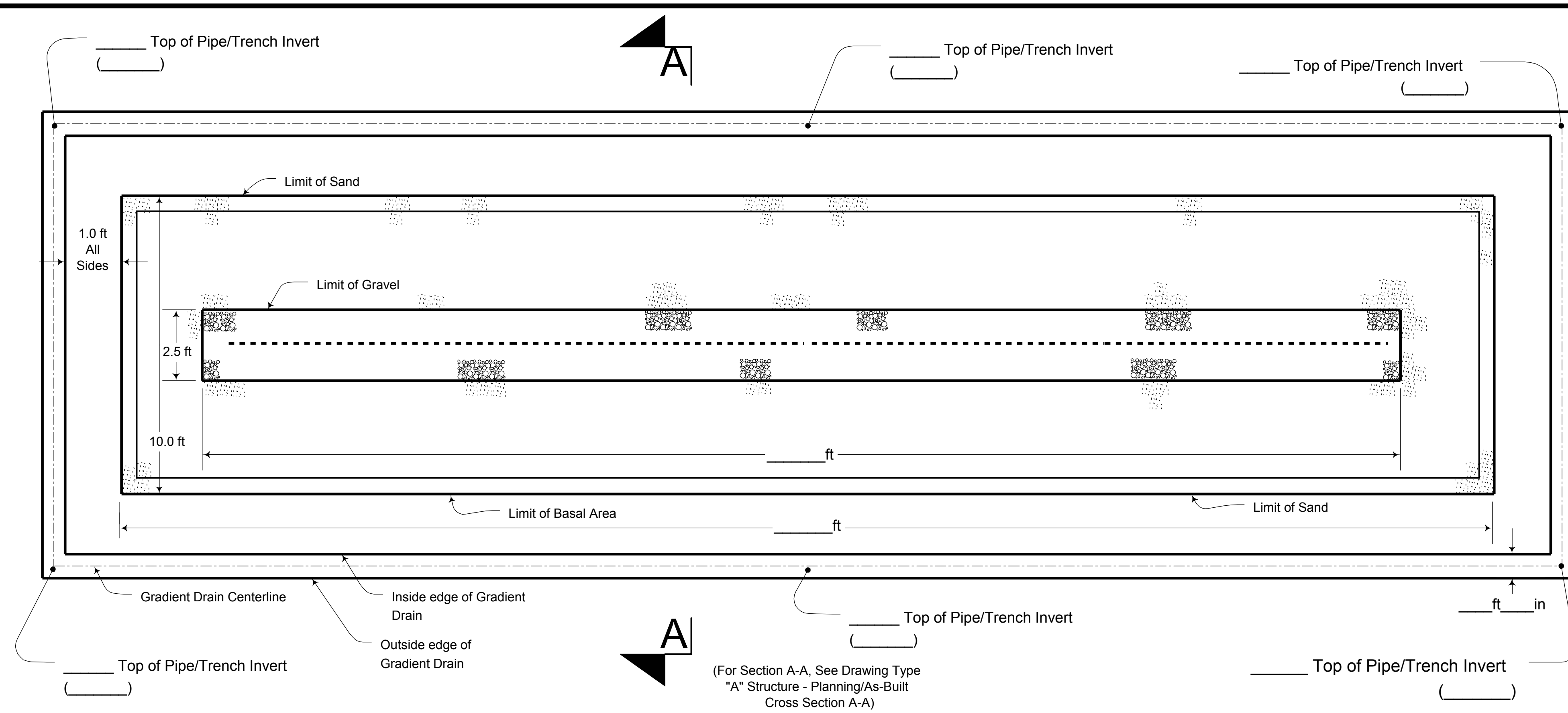
AB 3 - 2 TT

Interpretation: As-Built Spot Elevation Shot for Top of Tank ; Grade Rod Reading of 3 ft - 2 in.

Symbol	Meaning
	Gradient Drain
	Gradient Drain Sump Basin or Pump Basin
E E E E	Buried Electric Service
W W W W	Buried Water Service
	Structure (Building)
D D	Diversion Ditch
CP	Control Panel
	Electrical Disconnect
3 - 2	Top of Drop Box
	Cased Pipe
	Tank
(3 - 2) (3 - 2)	Contour

BROWN COUNTY HEALTH DEPARTMENT

Symbols for "Layout Surveys" and "As-Builts"



N
(Indicate North)

Pipe Segment for Drainback	Total Dainback Length (ft)	Pipe Diameter (in)	Gal/foot of pipe	Volume of Drainback (gal)
Sub-Mains				
Force Main				
			Total Drainback	

Use of This Drawing

1) Fill in the blanks in the above drawing with elevation readings obtained from either planning and/or as-built recording. This sheet can be used to plan a job, and then used to record constructed elevations.

2) Draw the actual configuration and indicate the elevations of the sub-main/force main. Remember to record the lengths of the sub-main/force main that are not freeze protected to use in drainback calculations.

3) Indicate the location of the outlet (lowest point) of gradient drain. If the gradient drain discharge is pumped, draw the location of the sump basin. On the back of this sheet, draw the discharge line showing slope for gravity or freeze protection for pressurized.

4) Draw the locations of the installed observation ports.

Benchmark B | M

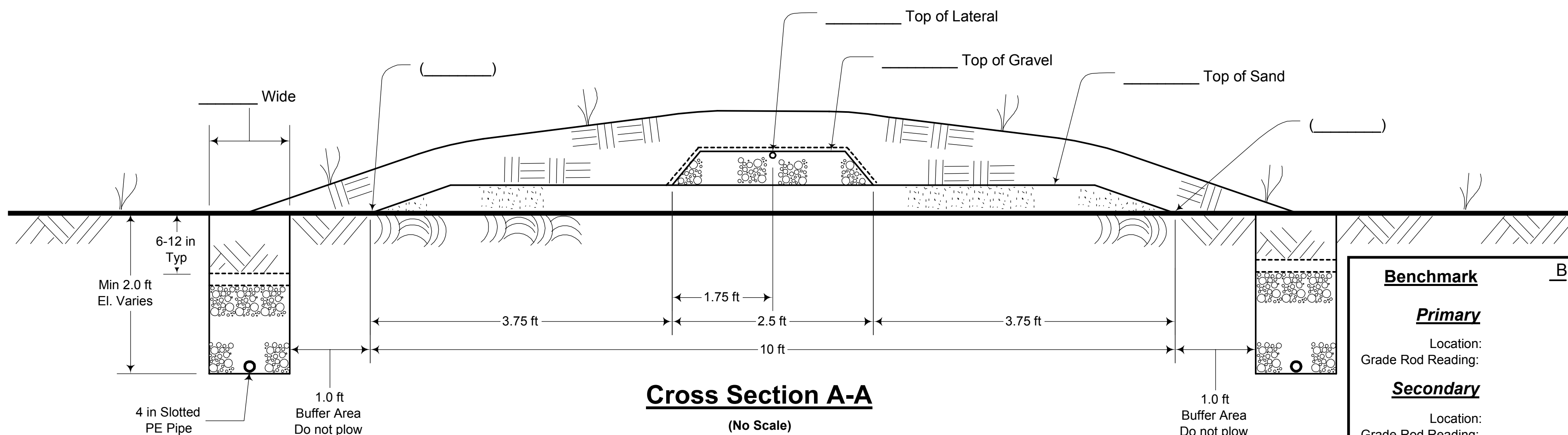
Primary
Location:
Grade Rod Reading:

Secondary
Location:
Grade Rod Reading:

Number of Bedrooms: ________

BROWN COUNTY HEALTH DEPARTMENT

Type "A" Structure - Planning and As-built General Plan



Cross Section A-A

(No Scale)

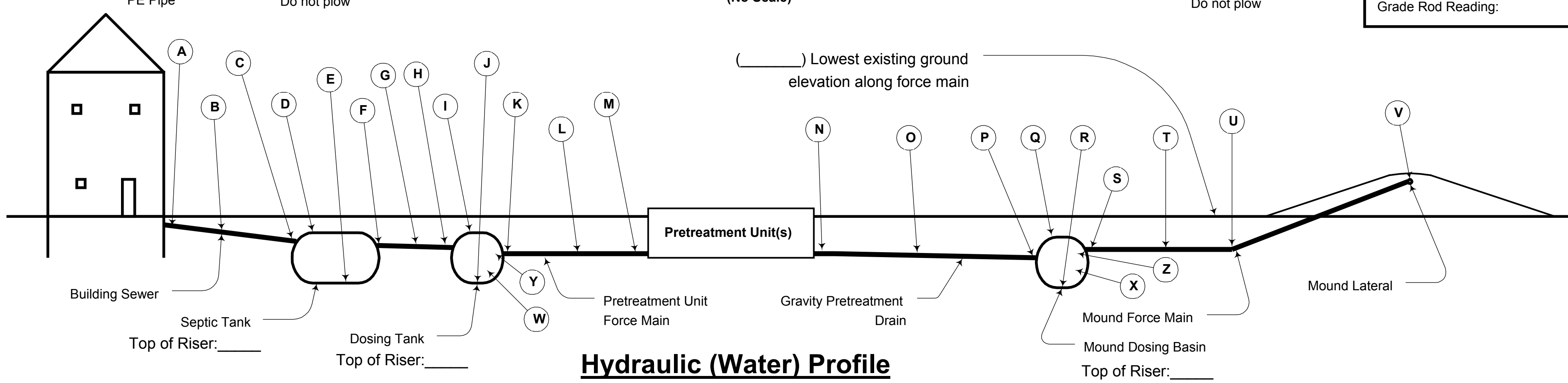
Benchmark B | M

Primary

Location:
Grade Rod Reading:

Secondary

Location:
Grade Rod Reading:



Hydraulic (Water) Profile

(No Scale)

Use the table below to record site data.

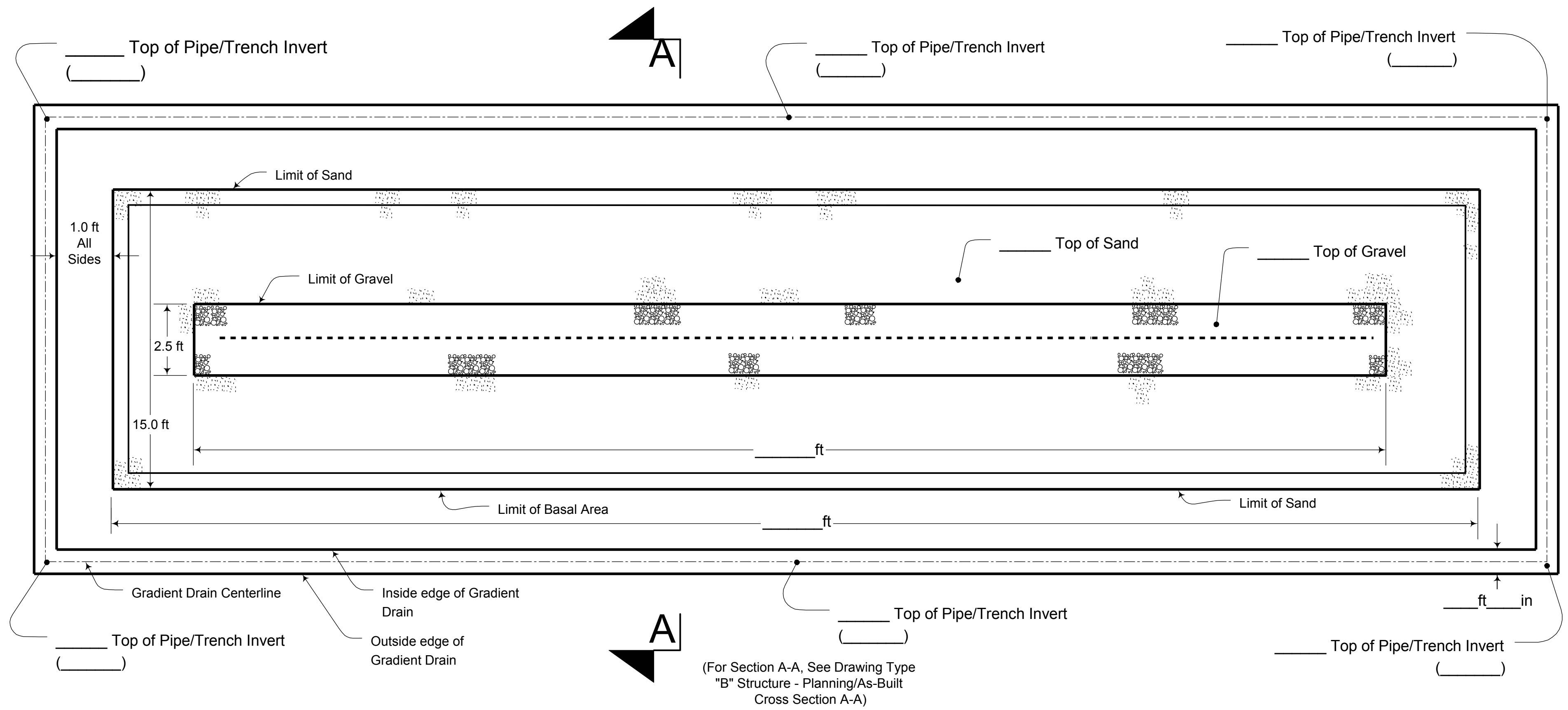
A	_______ Top of Pipe	**K**	_______ Top of Pipe (_______)	**U**	_______ Top of Pipe (_______)	**Y**	_______ Weep Hole Elevation
B	Length of Pipe_______ft (Ø =)	**L**	Length of Pipe_______ft (Ø =)	**V**	_______ Top of Lateral	**Z**	_______ Weep Hole Elevation
C	_______ Top of Pipe	**M**	_______ Top of Pipe (_______)	**W**	Pump Discharge _________		
D	_______ Top of Septic Tank (______)	**N**	_______ Top of Pipe (_______)	**X**	Pump Discharge _________		
E	_______ Base Septic Tank (______)	**O**	Length of Pipe_______ft (Ø =)				
F	_______ Top of Pipe (_______)	**P**	_______ Top of Pipe (_______)				
G	Length of Pipe_______ft (Ø =)	**Q**	_______ Top Pump Basin(_______)				
H	_______ Top of Pipe (_______)	**R**	_______Base Pump Basn(_______)				
I	_______ Top of Dosing Tank (______)	**S**	_______ Top of Pipe (_______)				
J	_______Base Dosng Tank (______)	**T**	Length of Pipe_______ft (> 2 ft Cover)				

Number of Bedrooms: _______

BROWN COUNTY HEALTH DEPARTMENT

Type "A" Structure - Planning/As-built Cross Section A-A

ip



N

(Indicate North)

Pipe Segment for Drainback	Total Drainback Length (ft)	Pipe Diameter (in)	Gal/foot of pipe	Volume of Drainback (gal)
Sub-Main				
Force Main				
			Total Drainback	

Benchmark B | M

Primary

Location:
Grade Rod Reading:

Secondary

Location:
Grade Rod Reading:

Use of This Drawing

1) Fill in the blanks in the above drawing with elevation readings obtained from either planning and/or as-built recording. This sheet can be used to plan a job, and then used to record constructed elevations.

2) Draw the actual configuration and indicate the elevations of the sub-main/force main. Remember to record the lengths of the sub-main/force main that are not freeze protected to use in drainback calculations.

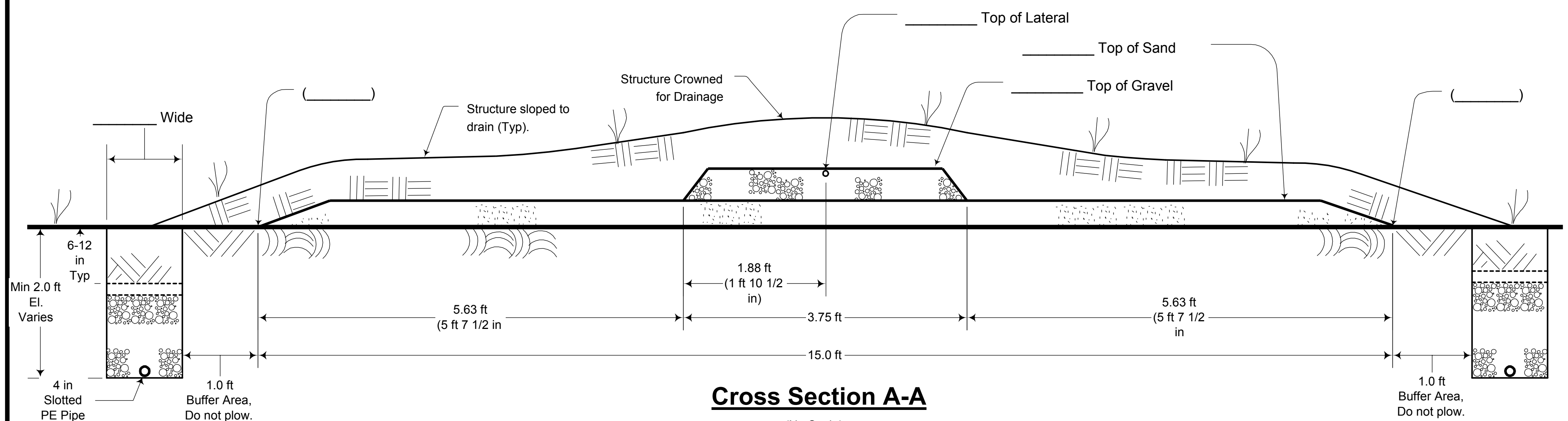
3) Indicate the location of the outlet (lowest point) of gradient drain. If the gradient drain discharge is pumped, draw the location of the sump basin. On the back of this sheet, draw the discharge line showing slope for gravity or freeze protection for for pressurized.

4) Draw the locations of the installed observation ports.

Number of Bedrooms:_______

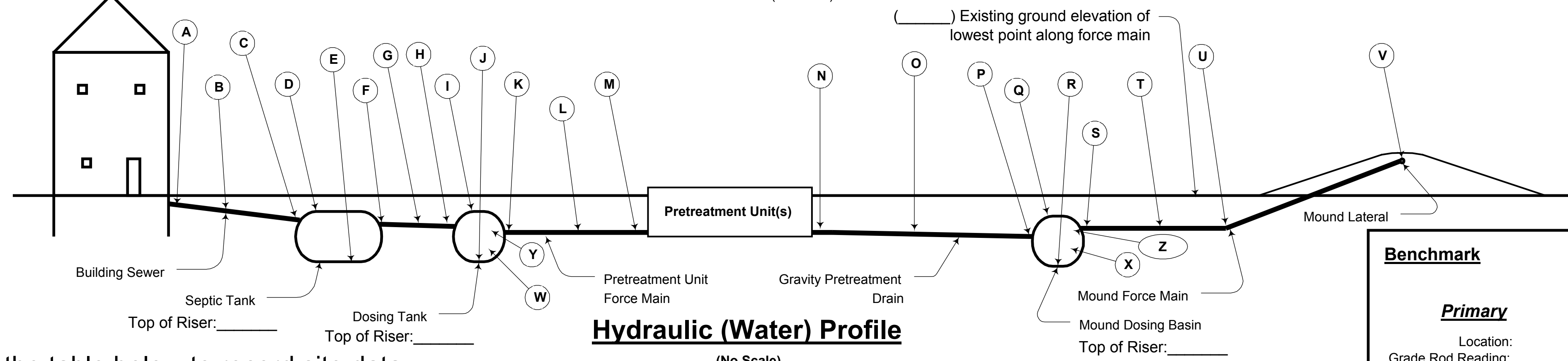
BROWN COUNTY HEALTH DEPARTMENT

Type "B" Structure - Planning and As-Built General Plan



Cross Section A-A

(No Scale)



Hydraulic (Water) Profile

(No Scale)

Benchmark B | M

Primary

Location:
Grade Rod Reading:

Secondary

Location:
Grade Rod Reading:

Use the table below to record site data.

A	_______ Top of Pipe
B	Length of Pipe_______ft (Ø =)
C	_______ Top of Pipe
D	_______ Top of Septic Tank (______)
E	_______ Base Septic Tank (______)
F	_______ Top of Pipe (_______)
G	Length of Pipe_______ft (Ø =)
H	_______ Top of Pipe (_______)
I	_______ Top of Dosing Tank (______)
J	_______Base Dosng Tank (______)

K	_______ Top of Pipe (_______)
L	Length of Pipe_______ft (Ø =)
M	_______ Top of Pipe (_______)
N	_______ Top of Pipe (_______)
O	Length of Pipe_______ft (Ø =)
P	_______ Top of Pipe (_______)
Q	_______ Top Pump Basin(_______)
R	_______Bttm of Pump Basn(_______)
S	_______ Top of Pipe (_______)
T	Length of Pipe_______ft (> 2 ft Cover)

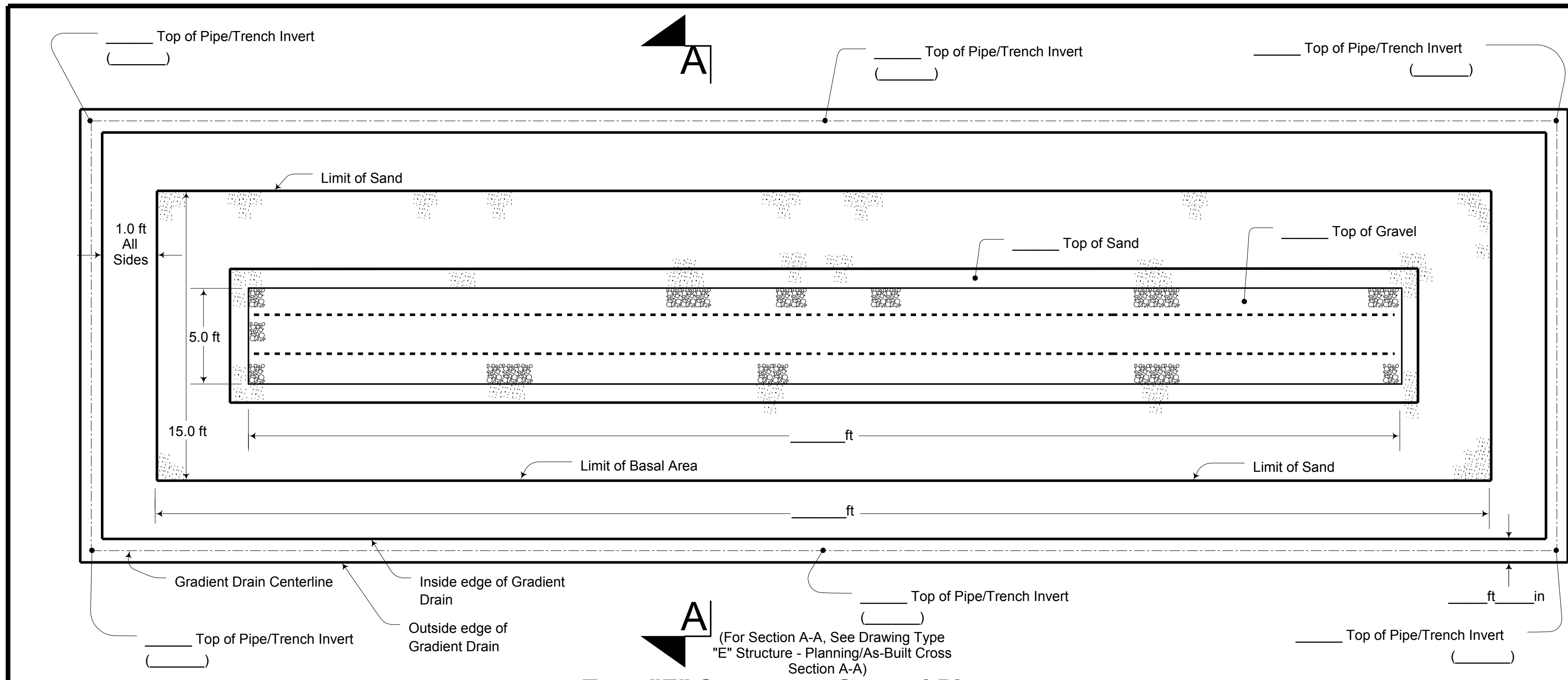
U	_______ Top of Pipe (_______)
V	_______ Top of Lateral
W	_______ Pump Discharge
X	_______ Pump Discharge
Y	_______ Weep Hole Elevation

Z	_______ Weep Hole Elevation

Number of Bedrooms: _______

BROWN COUNTY HEALTH DEPARTMENT

Type "B" Structure - Planning/As-Built Cross Section A-A



Type "E" Structure - General Plan

(No Scale)

N

(Indicate North)

Pipe Segment for Drainback	Total Drainback Length (ft)	Pipe Diameter (in)	Gal/foot of pipe	Volume of Drainback (gal)
Sub-main				
Force Main				
			Total Drainback	

Benchmark

Primary

Location:
Grade Rod Reading:

Secondary

Location:
Grade Rod Reading:

Use of This Drawing

1) Fill in the blanks in the above drawing with elevation readings obtained from either planning and/or as-built recording. This sheet can be used to plan a job, and then used to record constructed elevations.

2) Draw the actual configuration and indicate the elevations of the sub-main/force main. Remember to record the lengths of the sub-main/force main that are not freeze protected to use in drainback calculations.

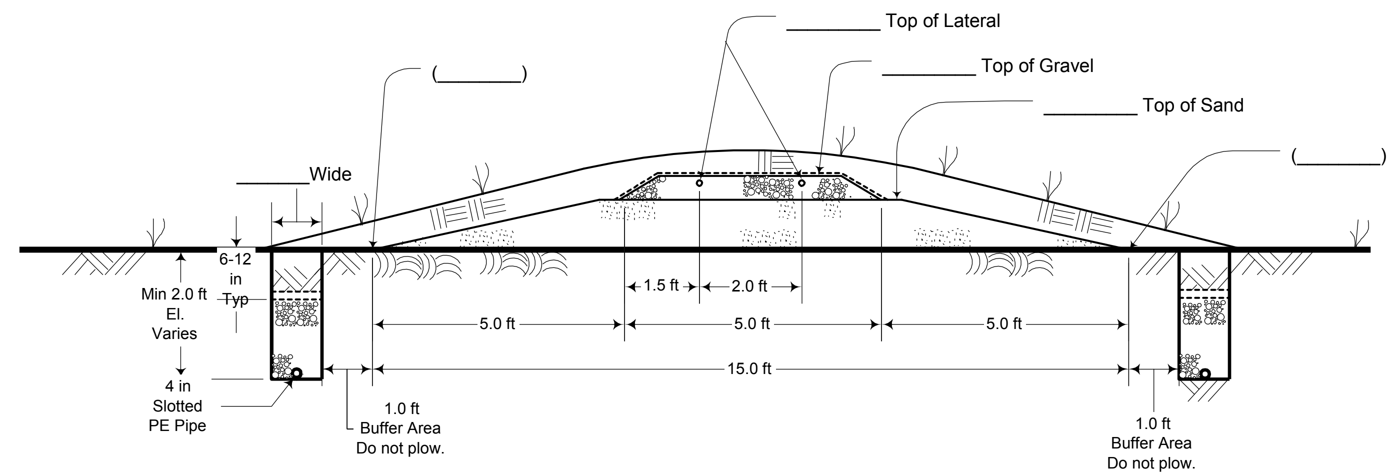
3) Indicate the location of the outlet (lowest point)of gradient drain. If the gradient drain is pumped, draw the location of the sump basin. On the back of this sheet, draw the discharge line showing slope for gravity or freeze protection for pressurized

4) Draw the locations of installed locations of the observation ports.

Number of Bedrooms:_______

BROWN COUNTY HEALTH DEPARTMENT

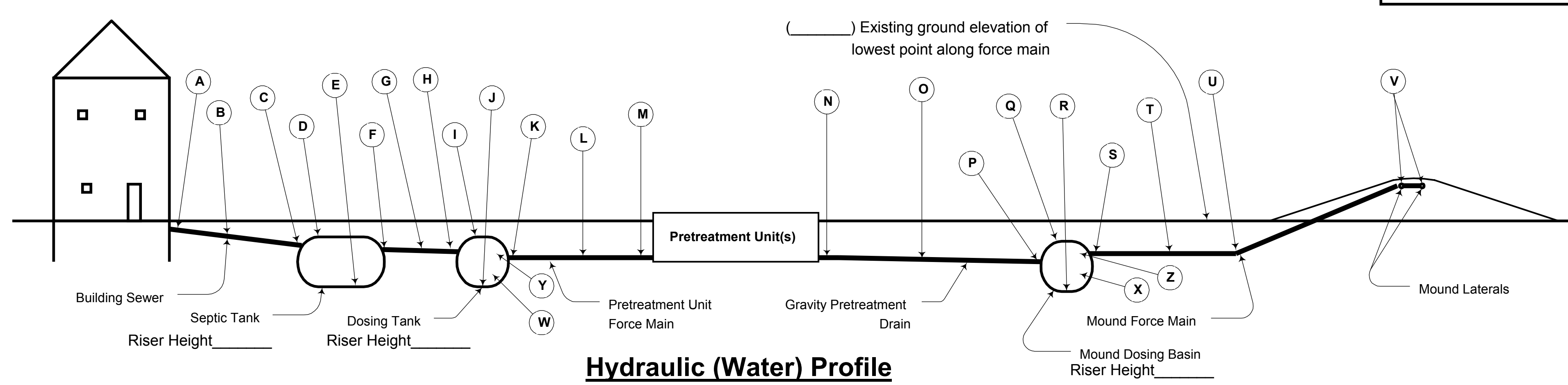
Type "E" Structure - Planning/As-Built General Plan



Cross Section A-A

(No Scale)

Benchmark	B M
Primary	
Location:	
Grade Rod Reading:	
Secondary	
Location:	
Grade Rod Reading:	



Hydraulic (Water) Profile

(No Scale)

Use the table below to record site data.

A	_______ Top of Pipe
B	Length of Pipe_______ft (Ø =)
C	_______ Top of Pipe
D	_______ Top of Septic Tank (______)
E	_______ Base Septic Tank (______)
F	_______ Top of Pipe (_______)
G	Length of Pipe_______ft (Ø =)
H	_______ Top of Pipe (_______)
I	_______ Top of Dosing Tank (______)
J	_______ Base Dose Tank (______)

K	_______ Top of Pipe (_______)
L	Length of Pipe_______ft (Ø =)
M	_______ Top of Pipe (_______)
N	_______ Top of Pipe (_______)
O	Length of Pipe_______ft (Ø =)
P	_______ Top of Pipe (_______)
Q	_______ Top Pump Basin(_______)
R	_______ Base Pump Basin (_______)
S	_______ Top of Pipe (_______)
T	Length of Pipe_______ft (> 2 ft Cover)

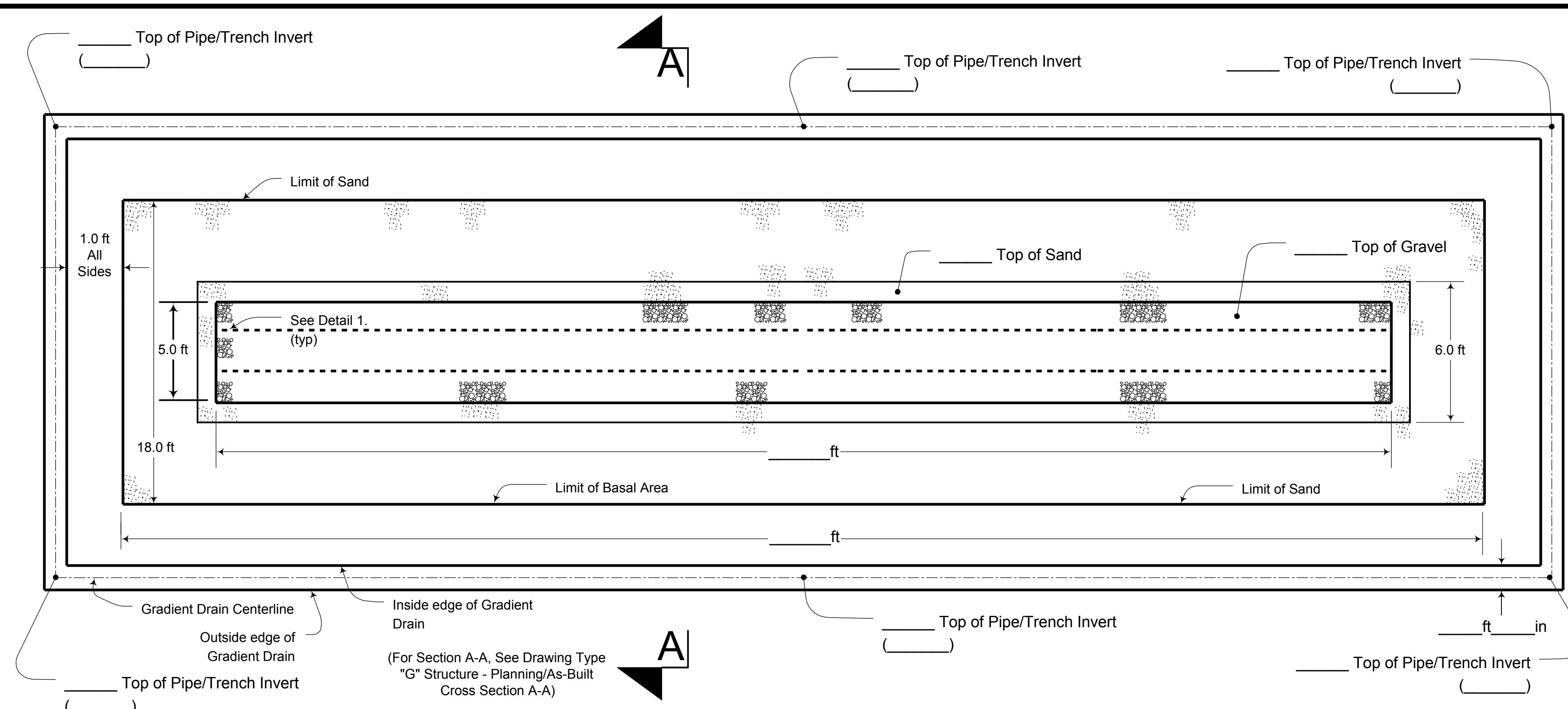
U	_______ Top of Pipe (_______)
V	_______ Top of Laterals
W	_______ Pump Discharge
X	_______ Pump Discharge

Y	_______ Weep Hole Elevation
Z	_______ Weep Hole Elevation

Number of Bedrooms:_______

BROWN COUNTY HEALTH DEPARTMENT

Type "E" Structure - Planning/As-Built Cross Section A-A



Type "G" Structure - General Plan

(No Scale)

N

(Indicate North)

Pipe Segment for Drainback	Total Dainback Length (ft)	Pipe Diameter (in)	Gal/foot of pipe	Volume of Drainback (gal)
Sub-Main				
Force Main				
			Total Drainback	

Benchmark B|M

Primary
Location:
Grade Rod Reading:

Secondary
Location:
Grade Rod Reading:

Use of This Drawing

1) Fill in the blanks in the above drawing with elevation readings obtained from either planning and/or as-built recording. This sheet can be used to plan a job, and then used to record constructed elevations.

2) Draw the actual configuration and indicate the elevations of the sub-main/force main. Remember to record the lengths of the sub-main/force main that are not freeze protected to use in drainback calculations.

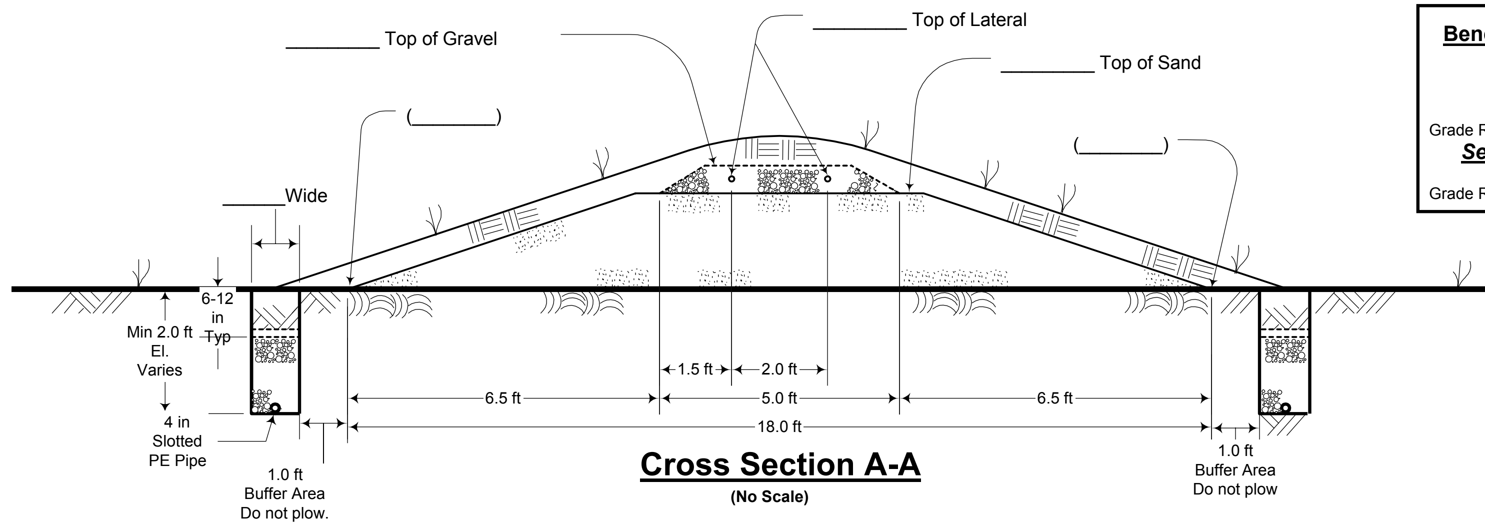
3) Indicate the location of the outlet (lowest point) of gradient drain. If the gradient drain discharge is pumped, draw the location of the sump basin. On the back of this sheet, draw the discharge line showing slope for gravity or freeze protection for pressurized

4) Draw the location of the installed locations of the observation ports.

Number of Bedrooms: ________

BROWN COUNTY HEALTH DEPARTMENT

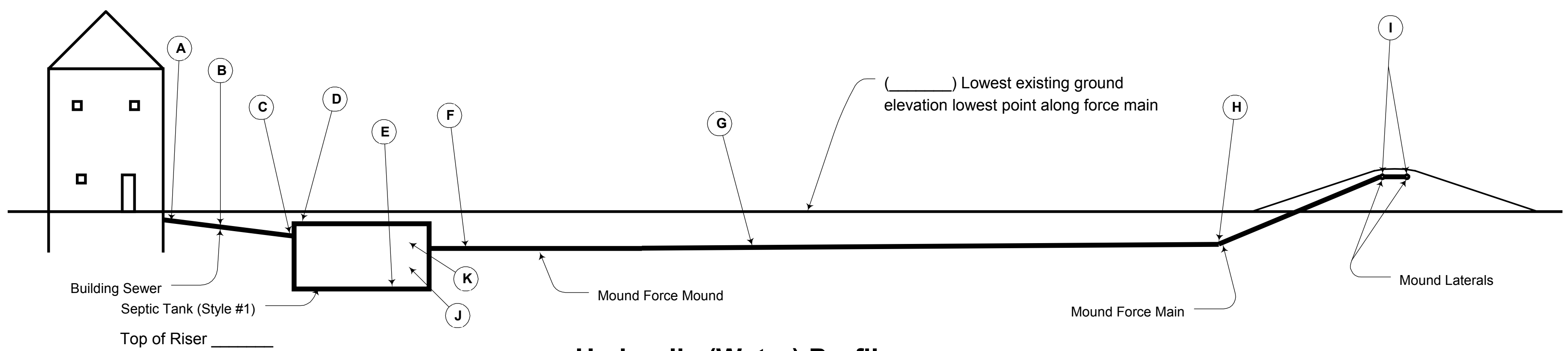
Type "G" Structure - Planning and As-Built General Plan



Cross Section A-A

(No Scale)

Benchmark	B / M
Primary	
Location:	
Grade Rod Reading:	
Secondary	
Location:	
Grade Rod Reading:	



Hydraulic (Water) Profile

(No Scale)

Use the table below to record site data.

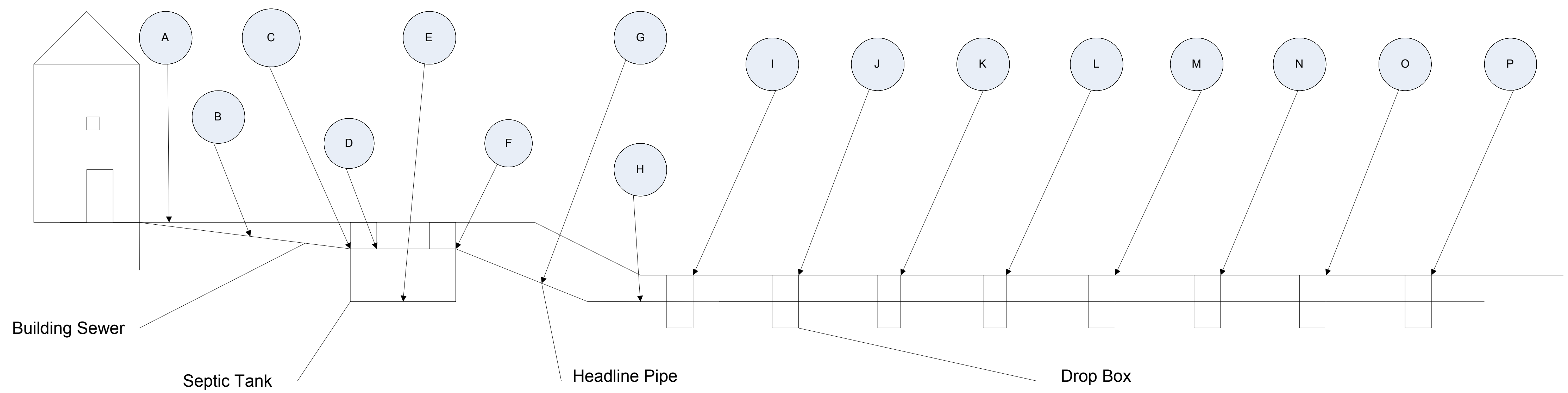
A	_______ Top of Pipe
B	Length of Pipe_______ft (Ø =)
C	_______ Top of Pipe
D	_______ Top of Septic Tank (______)
E	_______ Base Septic Tank (______)
F	_______ Top of Pipe (_______)
G	Length of Pipe_______ft (> 2 ft Cover)
H	_______ Top of Pipe (_______)

I	_______ Top of Manifold (_______)
J	Pump Intake _________
K	Weep Hole Elevation

Number of Bedrooms: ______

BROWN COUNTY HEALTH DEPARTMENT

Type "G" Structure - Planning /As-Built
Cross Section A-A



Use the table below to record site data

Hydraulic (water) Profile

A	_______ Top of Pipe
B	Length of Pipe _______ft
C	_______ Top of Pipe
D	_______ Top of Septic Tank (_____)
E	_______ Base of Septic Tank
F	_______ Top of Pipe (______)
G	Length of Pipe _______ft
H	_______ Top of Pipe (_______)
I	Grade (contour) Elevation _______ Top of Drop Box _______ Trench Bottom _______ Drop Box Outlet _______ Top of Gravel _______
J	Grade (contour) Elevation _______ Top of Drop Box _______ Trench Bottom _______ Drop Box Outlet _______ Top of Gravel _______
K	Grade (contour) Elevation _______ Top of Drop Box _______ Trench Bottom _______ Drop Box Outlet _______ Top of Gravel _______

L	Grade (contour) Elevation _______ Top of Drop Box _______ Trench Bottom _______ Drop Box Outlet _______ Top of Gravel _______
M	Grade (contour) Elevation _______ Top of Drop Box _______ Trench Bottom _______ Drop Box Outlet _______ Top of Gravel _______
N	Grade (contour) Elevation _______ Top of Drop Box _______ Trench Bottom _______ Drop Box Outlet _______ Top of Gravel _______
O	Grade (contour) Elevation _______ Top of Drop Box _______ Trench Bottom _______ Drop Box Outlet _______ Top of Gravel _______

P	Grade (contour) Elevation _______ Top of Drop Box _______ Trench Bottom _______ Drop Box Outlet _______ Top of Gravel _______

Benchmark B M

Primary

Location:
Grade Rod Reading:

Secondary

Location:
Grade Rod Reading:

Notes:

- On the back of this sheet, draw a plan of the approximate layout of leach lines in the field. Use this drawing to record LLT segments that are not on contour. Record the length of each lateral on this drawing.
- Gradient drain is to be drawn on the plan view of the LLT's. The elevations of the gradient drain are to be recorded on the plan.

Reference: Traditional Leaching Trenches, Appendix Section A.19

BROWN COUNTY HEALTH DEPARTMENT

Leach Line Trenches (LLT) As-Built Sheet

Environmental Department

19 References

- Velocity and Frictional Headloss by Flow Rate & Pipe Diameter
- Precast Concrete Tank Volume-depth Relations
- PVC Pipe Data
- Fittings Headloss by Type & Size
- Type “G” Structure (Millennium Mound) - Average & Peak “OFF” Timer Settings
- Half Mound Structure Table

Flow Rate	1/2 Inch Pipe		3/4 Inch Pipe		1 Inch Pipe		1 1/4 Inch Pipe		1 1/2 Inch Pipe		2 Inch Pipe		2 1/2 Inch Pipe		3 Inch Pipe		3 1/2 Inch Pipe		4 Inch Pipe	
(gal/min)	Velocity (ft/s)	Headloss per 100 ft of pipe (ft)	Velocity (ft/s)	Headloss per 100 ft of pipe (ft)	Velocity (ft/s)	Headloss per 100 ft of pipe (ft)	Velocity (ft/s)	Headloss per 100 ft of pipe (ft)	Velocity (ft/s)	Headloss per 100 ft of pipe (ft)	Velocity (ft/s)	Headloss per 100 ft of pipe (ft)	Velocity (ft/s)	Headloss per 100 ft of pipe (ft)	Velocity (ft/s)	Headloss per 100 ft of pipe (ft)	Velocity (ft/s)	Headloss per 100 ft of pipe (ft)	Velocity (ft/s)	Headloss per 100 ft of pipe (ft)
2	2.1	3.6	1.2	0.9	0.7	0.3	0.4	0.1	0.3	0.0	0.2	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.0
4	4.2	13.0	2.4	3.3	1.5	1.0	0.9	0.3	0.6	0.1	0.4	0.0	0.3	0.0	0.2	0.0	0.1	0.0	0.1	0.0
6	6.3	27.5	3.6	7.0	2.2	2.2	1.3	0.6	0.9	0.3	0.6	0.1	0.4	0.0	0.3	0.0	0.2	0.0	0.2	0.0
8	8.5	46.8	4.8	11.9	3.0	3.7	1.7	1.0	1.3	0.5	0.8	0.1	0.5	0.1	0.3	0.0	0.3	0.0	0.2	0.0
10	10.6	70.7	6.0	18.0	3.7	5.5	2.1	1.5	1.6	0.7	1.0	0.2	0.7	0.1	0.4	0.0	0.3	0.0	0.3	0.0
12	12.7	99.1	7.2	25.2	4.5	7.8	2.6	2.0	1.9	1.0	1.1	0.3	0.8	0.1	0.5	0.0	0.4	0.0	0.3	0.0
14	14.8	131.8	8.4	33.5	5.2	10.3	3.0	2.7	2.2	1.3	1.3	0.4	0.9	0.2	0.6	0.1	0.5	0.0	0.4	0.0
16	16.9	168.8	9.6	42.9	5.9	13.2	3.4	3.5	2.5	1.6	1.5	0.5	1.1	0.2	0.7	0.1	0.5	0.0	0.4	0.0
18	19.0	209.9	10.8	53.3	6.7	16.5	3.9	4.3	2.8	2.0	1.7	0.6	1.2	0.3	0.8	0.1	0.6	0.0	0.5	0.0
20	21.1	255.0	12.0	64.8	7.4	20.0	4.3	5.3	3.2	2.5	1.9	0.7	1.3	0.3	0.9	0.1	0.6	0.1	0.5	0.0
22			13.2	77.3	8.2	23.9	4.7	6.3	3.5	3.0	2.1	0.9	1.5	0.4	1.0	0.1	0.7	0.1	0.6	0.0
24			14.4	90.8	8.9	28.0	5.2	7.4	3.8	3.5	2.3	1.0	1.6	0.4	1.0	0.2	0.8	0.1	0.6	0.0
26			15.7	105.3	9.7	32.5	5.6	8.5	4.1	4.0	2.5	1.2	1.7	0.5	1.1	0.2	0.8	0.1	0.7	0.0
28			16.9	120.8	10.4	37.3	6.0	9.8	4.4	4.6	2.7	1.4	1.9	0.6	1.2	0.2	0.9	0.1	0.7	0.1
30			18.1	137.3	11.1	42.4	6.4	11.1	4.7	5.3	2.9	1.6	2.0	0.7	1.3	0.2	1.0	0.1	0.8	0.1
32					11.9	47.7	6.9	12.6	5.0	5.9	3.1	1.8	2.1	0.7	1.4	0.3	1.0	0.1	0.8	0.1
34					12.6	53.4	7.3	14.0	5.4	6.6	3.3	2.0	2.3	0.8	1.5	0.3	1.1	0.1	0.9	0.1
36					13.4	59.3	7.7	15.6	5.7	7.4	3.4	2.2	2.4	0.9	1.6	0.3	1.2	0.2	0.9	0.1
38					14.1	65.6	8.2	17.3	6.0	8.1	3.6	2.4	2.5	1.0	1.6	0.4	1.2	0.2	1.0	0.1
40					14.9	72.1	8.6	19.0	6.3	9.0	3.8	2.7	2.7	1.1	1.7	0.4	1.3	0.2	1.0	0.1
42							9.0	20.8	6.6	9.8	4.0	2.9	2.8	1.2	1.8	0.4	1.4	0.2	1.1	0.1
44							9.4	22.6	6.9	10.7	4.2	3.2	2.9	1.3	1.9	0.5	1.4	0.2	1.1	0.1
46							9.9	24.6	7.3	11.6	4.4	3.4	3.1	1.4	2.0	0.5	1.5	0.2	1.2	0.1
48							10.3	26.6	7.6	12.5	4.6	3.7	3.2	1.6	2.1	0.5	1.6	0.3	1.2	0.1
50							10.7	28.7	7.9	13.5	4.8	4.0	3.4	1.7	2.2	0.6	1.6	0.3	1.3	0.2
52									8.2	14.5	5.0	4.3	3.5	1.8	2.3	0.6	1.7	0.3	1.3	0.2
54									8.5	15.6	5.2	4.6	3.6	1.9	2.3	0.7	1.8	0.3	1.4	0.2
56									8.8	16.7	5.4	4.9	3.8	2.1	2.4	0.7	1.8	0.4	1.4	0.2
58									9.1	17.8	5.5	5.3	3.9	2.2	2.5	0.8	1.9	0.4	1.5	0.2
60									9.5	19.0	5.7	5.6	4.0	2.4	2.6	0.8	1.9	0.4	1.5	0.2
62									9.8	20.1	5.9	6.0	4.2	2.5	2.7	0.9	2.0	0.4	1.6	0.2
64									10.1	21.4	6.1	6.3	4.3	2.7	2.8	0.9	2.1	0.5	1.6	0.2
66									10.4	22.6	6.3	6.7	4.4	2.8	2.9	1.0	2.1	0.5	1.7	0.3
68									10.7	23.9	6.5	7.1	4.6	3.0	3.0	1.0	2.2	0.5	1.7	0.3
70									11.0	25.2	6.7	7.5	4.7	3.1	3.0	1.1	2.3	0.5	1.8	0.3
72									11.4	26.6	6.9	7.9	4.8	3.3	3.1	1.1	2.3	0.6	1.8	0.3
74									11.7	27.9	7.1	8.3	5.0	3.5	3.2	1.2	2.4	0.6	1.9	0.3
76									12.0	29.4	7.3	8.7	5.1	3.7	3.3	1.3	2.5	0.6	1.9	0.3
78									12.3	30.8	7.5	9.1	5.2	3.8	3.4	1.3	2.5	0.7	2.0	0.4
80									12.6	32.3	7.7	9.6	5.4	4.0	3.5	1.4	2.6	0.7	2.0	0.4

Velocity and Frictional Headloss by Flow Rate & Pipe Diameter

Tank Types Grouped by Manufacturer	Number of Compartments	Liquid Level (Shared or Independent)	1st Compartment or Tank (gallons per inch)	2nd Compartment (gallons per inch)
Coate				
800 Dosing Tank	1	N/A	16.76	N/A
1,000 Dosing Tank	1	N/A	21.21	N/A
1,500 Septic Tank	2	Shared	29.05	N/A
1,500 Dosing Septic Tank	2	Independent	29.05	8.33
2,000 Septic Tank	2	Shared	35.53	N/A
2,000 Dosing Septic Tank	2	Independent	33.33	11.53
J K Precast				
500 Dosing Tank	1	N/A	11.45	N/A
1,000 Dosing Tank	1	N/A	21.43	N/A
1,500 Septic Tank	2	Independent	21.29	10.58
2,000 Septic Tank	2	Independent	27.64	13.33
2,500 Septic Tank	2	Independent	27.64	13.33
Buckeye Precast				
1,000 Dosing Tank	1	N/A	24.00	N/A
1,500 Septic Tank	2	Shared		N/A
2,000 Septic Tank	2	Shared		N/A

Precast Concrete Tank Volume-Depth Relations

Nominal Size	(in)	Schedule 40			Schedule 80		
		Wall Thickness (in)	ID (in)	Volume (gal/ft)	Wall Thickness (in)	ID (in)	Volume (gal/ft)
1/2	0.840	0.109	0.622	0.016	0.147	0.546	0.012
3/4	1.050	0.113	0.824	0.028	0.154	0.742	0.022
1	1.315	0.133	1.049	0.045	0.179	0.957	0.037
1 1/4	1.660	0.140	1.380	0.078	0.191	1.278	0.067
1 1/2	1.900	0.145	1.610	0.106	0.200	1.500	0.092
2	2.375	0.154	2.067	0.174	0.218	1.939	0.153
2 1/2	2.875	0.203	2.469	0.249	0.276	2.323	0.220
3	3.500	0.216	3.068	0.384	0.300	2.900	0.343
3 1/2	4.000	0.226	3.548	0.514	0.318	3.364	0.462
4	4.500	0.237	4.026	0.661	0.337	3.826	0.297

PVC Pipe Data (Orenco Systems Inc (4/97))

	Fitting Size								
Fitting Type	1/2"	3/4"	1"	1 1/4	1 1/2	2"	2 1/2"	3"	4"
90 Ell	1.5	2.0	2.7	3.5	4.3	5.5	6.5	8.0	10.0
45 Ell	0.8	1.0	1.3	1.7	2.0	2.5	3.0	3.8	5.0
Long Sweep Ell	1.0	1.4	1.7	2.3	2.7	3.5	4.2	5.2	7.0
Close Return Bend	3.6	5.0	6.0	8.3	10.0	13.0	15.0	18.0	24.0
Tee-Straight Run	1.0	2.0	2.0	3.0	3.0	4.0	5.0	-----	-----
Tee-Side Inlet or Outlet or Pitless Adapter	3.3	4.5	5.7	7.6	9.0	12.0	14.0	17.0	22.0
Ball or Globe Valve	17.0	22.0	27.0	36.0	43.0	55.0	67.0	82.0	110.0
Angle Valve (Open)	8.4	15.0	15.0	18.0	22.0	28.0	33.0	42.0	58.0
Gate Valve (Fully Open)	0.4	0.5	0.6	0.8	1.0	1.2	1.4	1.7	2.3
Check Valve (Swing Gate)	4.0	5.0	7.0	9.0	11.0	13.0	16.0	20.0	26.0
In-line Check Valve (Spring) or Foot Valve	4.0	6.0	8.0	12.0	14.0	19.0	23.0	32.0	43.0

Fitting Headloss by Type & Size ***Equivalent Number of Feet of Straight Pipe***

See Section 10.5.4 & Section A.17.4

Type "G" Structure - Time Dosing Data for Average and Peak Flows

			Average			Peak		
Number of Bedrooms	**DDF (GPD)**	**Design Dose Volume (gal)**	**Number of "OFF" Periods**	**"OFF" Time (Hours)**	**""OFF" Time (Hours: Minutes)**	**Number of "OFF" Periods**	**"OFF" Time (Hours)**	**""OFF" Time (Hours: Minutes)**
3	360	34	6.4	3.75	3:45	10.6	2.26	2:16
4	480	45	6.4	3.75	3:45	10.7	2.24	2:14

Half Structure Dimensions (use with Figure A.2, in the Appendix Section A)

# Bedrooms	"A"	"B"	"C"	"D"	"E"	"F"	"G"	"H"	"I"	Total length	Between drains	Width of sand	Width of gravel	Width between gradient drain
Type "A" Modified Mound Half Structure														
3	4'-9"	62'	1'-3"	5'	6'	4'-8"	3'-5"	3'-9"	1'	69'-6"	71'-6"	10'	2'-6"	12'
4	4'-9"	83'	1'-3"	5'	6'	4'-8"	3'-5"	3'-9"	1'	89'-6"	91'-6"	10'	2'-6"	12'
Type "B" Modified Mound Half Structure														
3	5'-6"	62'	1'-11"	7'-6"	8'-6"	7'-2"	5'-3"	4'-6"	1'	69'	71'	15'	3'-10"	17'
4	5'-6"	83'	1'-11"	7'-6"	8'-6"	7'-2"	5'-3"	4'-6"	1'	92'	94'	15'	3'-10"	17'
Type "E" Modified Mound Half Structure														
3	6'	62'-6"	2'-6"	7'-6"	8'-6"	3'	6"	6"	1'	74'-6"	74'-6"	15'	5'	17'
4	6'	84'-6"	2'-6"	7'-6"	8'-6"	3'	6"	6"	1'	96'-6"	96'-6"	15'	5'	17'
Type "G" Millennium Mound Half Structure														
3	7'	62'-6"	2'-6"	9'	10'	3'	6"	6'	1'	74'-6"	76'-6"	18'	5'	20'
4	7'	85'	2'-6"	9'	10'	3'	6"	6'	1'	97'-6"	99'-6"	18'	5'	20'

Orifice & System Flow Rate Equations

1/8 inch orifice: $Q_{Single1/8orifice} = 0.1934^{(*)} \times \sqrt{h}$

5/32 inch orifice: $Q_{Single5/32orifice} = 0.3022^{(*)} \times \sqrt{h}$

3/16 inch orifice: $Q_{Single3/16orifice} = 0.4325^{(*)} \times \sqrt{h}$

Total System Flow Rate: $Q_{System} = \left[(TotalNumberOrifices) \times (Q_{Orifice})\right]$

Where;
h = Operating Head/Squirt Height (feet)
Q = Flow Rate for that diameter orifice (gallons per minute)

* This number, a constant, is derived from a combination of empirical (based upon measuring and testing) sources and unit conversions necessary to simplify the equation. The physical construction, shape, area of orifice opening and fluid properties are parameters that are included in the empirical portion. These parameters are included in the Coefficient of Discharge for that orifice. The units of equation inputs match those typically measured in the field for ease of calculation. These numbers have been mathematically combined to arrive at the numbers that you see starred above.

Continuity Equation (Relation between flow rate, area of flow and fluid velocity)

$Q = A_{Flow} v$

$v = \dfrac{Q}{A_{Flow}}$

Note: $A_{circle} = \dfrac{\pi \times D^2}{4}$

Where;
Q = Flow rate (cubic feet per second)
A = Area of flow (feet squared)
v = fluid velocity (feet per second)

The following are two examples of calculations for a Type G (Millennium) structure.

Type G (Millennium) Mound Example:

Have:

- 3 Bedroom Millennium Mound (Type G) Installed
- Measured a 62 inch Squirt Height (Operating Head)
- 1,500 gallon concrete tank with 24.5 gallons per inch of fluid depth in tank
- Timed draw down test gave 5 inches of draw down after setting gate valve

- 30 feet of 1 ½ inch sub-main drainback
- 10 feet of 2 inch force main drainback

Want:

- Measured flow rate of the pump after setting the gate valve
- Flow rate of an orifice and system flow rate based on measured squirt height. $Q_{orifice}$.
- Check of fluid velocity in the lateral, $v_{lateral}$
- Calculate drainback volume and total dose volume
- Check of fluid velocity in the lateral
- "ON" Setting for the timer

Solution:

Set Flow Rate Q_{set}

Consider the set flow rate, Q_{set}, of the system after flushing and setting of operating head (final gate valve adjustments). From the timed draw test, it is known that 5 inches of fluid were pumped and the tank gives 22.5 gallons per inch. Therefore;

Gallons Pumped = (22.5 $^{gallons}/_{inch}$) x (5 inches)
Gallons Pumped = 112.5 gallons pumped

The test was run for 2 minutes as prescribed for this procedure. To find the set flow rate, Q_{set}, divide the gallons pumped by 2 minutes.

Q_{set} = 112.5 gallons pumped
Q_{set} = (112.5 gallons pumped) ⁄ (2 minutes)
Q_{set} = 56.25 $^{gallons}/_{minute}$

Orifice Flow Rate

From Section A.13, Table A.14 and Section A.11 (also, the drawings), the orifice diameter is $^{1}/_{8}$ inch. The design operating head is given as 60 inches (See Section A.14, Table A.19). Using the orifice flow equation for $^{1}/_{8}$ inch orifices which is

$$Q_{Single1/8orifice} = 0.1934 \times \sqrt{h}$$

h is the operating head in feet. But h was measured in the field as 62 inches. Convert 62 inches to feet;

Operating head, h = (62 inches) / 12 $^{inches}/_{foot}$
= 5.1667 feet
Rounding gives:
Operating head, h = 5.17 feet

Now plug into the orifice equation:

$$Q_{Single1/8orifice} = 0.1934 \times \sqrt{5.17}$$

$$Q_{Single1/8orifice} = 0.4397 \frac{gallons}{\min ute}$$

System Flow Rate

From the drawings/installation, there are 120 orifices in the system plus the weep hole for a total of 121 orifices. From the previous step, it is known that the orifice flow rate is 0.4397 $^{gallons}/_{minute}$ which is $Q_{orifice}$.

Using the following equation and substituting values:

$$Q_{System} = \left[\left(TotalNumberOrifices\right) \times \left(Q_{Orifice}\right)\right]$$

$$Q_{System} = \left[(121) \times (0.4397)\right]$$

$$Q_{System} = 53.2 \frac{gallons}{\min ute}$$

Note that this calculated flow rate is less than the flow rate determined from the timed draw test, but they are reasonably close. The variation in these two differing flow rates arises from the possible measurement errors and rounding in the timed draw down test. Also, notice that the orifice equation uses constants (numbers) in them. These numbers are comprised of unit conversions and also the Coefficient of Discharge for an orifice in PVC pipe. The orifice flow equation in its "un-modified' form is given as

$$Q_{orifice} = 2.45 \times C \times D^2 \times \sqrt{2gh}$$

Where C is the Orifice Discharge Coefficient, typically a value of C = 0.63 is used. This C value is based upon the physical construction of the orifice. It is the minor variations in the construction of the orifices from drilling that may cause the "real" C value to not be 0.63. Designers rely heavily upon C being equal to 0.63. It is for this reason that such emphasis is placed upon the QA/QC in drilling orifices. In a perfect world, the two flow rates would be equal.

Lateral fluid Velocity

From the drawings/installation 8 laterals were installed. Assuming that sub-main lengths are equal and all laterals are at the same elevation, the design is symmetric (balanced). Symmetric systems are the most desirable because the use of a gate valve on a sub-main can be avoided. Because of the symmetry, the lateral fluid velocity can easily be found, as follows. For non-symmetric systems, this calculation procedure cannot be used. One must consider frictional losses and other head losses to calculate flow rates for the differing branches of the system.

Therefore, with 8 laterals the flow rate of a lateral is found by dividing Q_{set} by the number of laterals, given as 8.

$$Q_{lateral} = Q_{set} / 8$$
$$Q_{lateral} = (56.25\ ^{gallons}/_{minute}) / 8$$
$$Q_{lateral} = 7.03\ ^{gallons}/_{minute}$$

Convert minutes to seconds:

$$Q_{lateral} = (7.03\ ^{gallons}/_{minute}) / (60\ ^{seconds}/_{minute})$$
$$Q_{lateral} = 0.117\ ^{gallons}/_{seconds}$$

From the reference section, it is found that ¾ inch PVC (Sch 40) has 0.028 $^{gallons}/_{foot}$. Using this volume and the $Q_{lateral} = 0.117\ ^{gallons}/_{seconds}$, the lateral flow rate can easily be found by:

$$Q_{lateral} = (0.117\ ^{gallons}/_{seconds}) / (0.028\ ^{gallons}/_{foot})$$
$$Q_{lateral} = 4.18\ ^{feet}/_{second} > 2\ ^{feet}/_{second}\text{ ; therefore OK}$$

An alternative method of finding the lateral velocity is using the continuity equation is as follows. Note unit consistency is extremely important and tedious in this method, highlighting the ease with which lateral velocity was calculated above.

It is known from above that:

$$Q_{lateral} = 7.03\ ^{gallons}/_{minute}$$

Now divide $Q_{lateral}$ by 7.48 to get cubic feet per minute

$$Q_{lateral} = (7.03\ ^{gallons}/_{minute}) / (7.48\text{ gallons/cubic foot})$$
$$Q_{lateral} = 0.95\ ^{cubic\ feet}/_{minute}$$

Now divide $Q_{lateral}$ by 60 to get cubic feet per second

$$Q_{lateral} = (0.95\ ^{cubic\ feet}/_{minute}) / 60$$
$$Q_{lateral} = 0.0158\ ^{cubic\ feet}/_{second}$$

The continuity equation will be used to find velocity. To use this equation, the area of the flow must be found in **square feet.** From the reference section, it is known that the inside diameter of ¾ inch diameter PVC pipe (Sch 40) is 0.824 inches. Divide this by 12 to get feet.

$$ID = 0.824 / 12$$
$$ID = 0.069\text{ feet}$$

To find the flow area

$$A_{circle} = \frac{\pi \times D^2}{4}$$

$$where \pi = 3.14$$

$$A_{circle} = \frac{3.14 \times (0.069)^2}{4}$$

$$A_{circle} = \frac{3.14 \times (0.069)^2}{4}$$

$$A_{circle} = 0.0037 squarefeet$$

Substituting into the following form of the continuity equation:

$$v = \frac{Q}{A_{Flow}}$$

$$v = \frac{0.0158}{.0037}$$

$$v = 4.27 \frac{feet}{\sec ond} \geq 2 \frac{feet}{\sec ond} thereforeOK$$

Lateral Velocity = 4.27 $^{feet}/_{second}$

Drainback Volume & Total Dose Volume

To find the drainback volume, the length of pipe and diameters of the segments that are draining back need to be known. These were given. Consulting the reference section, it is found that 2 inch pipe has 0.174 $^{gallon}/_{foot}$ & 1 ½ inch pipe has 0.106 $^{gallon}/_{foot}$. To find volumes multiply the segment length by the gallons per pipe foot, as follows:

2”

Gallons = 10 feet x 0.174 $^{gallon}/_{foot}$

Gallons = 1.74

1 ½”

Gallons = 30 feet x 0.106 $^{gallon}/_{foot}$

Gallons = 3.18

Therefore, the total drainback volume is the sum of the drainback for both pipe diameters. It is computed as follows:

Gallons Drainback = 3.18 + 1.74

Gallons Drainback = 4.92 gallons

From the Section A.13, Table.14 or the drawing, the design dose volume is found to be 34.0 gallons. Therefore, the Total Dose Volume is:

Total Dose Volume = Design Dose Volume + Drainback Volume
Total Dose Volume = 34.0 gallons + 4.92 gallons
Total Dose Volume = 38.92 gallons

Say,

Total Dose Volume = 39.0 gallons

"ON" Setting for Timer

In order to find the "ON" setting or the pump run time. Q_{set} and the Total Dose Volume are needed. These were previously found in this example. To find the run time, divide the Total Dose Volume by Q_{set}.

Run Time = Total Dose Volume / Q_{set}
Run Time = 39.0 / 56.25
Run Time = 0.693 minutes

Multiply by 60 to get seconds

Run Time = 0.693 minutes x 60
Run Time = 41.6 seconds

Say,

Run Time = 42 seconds

Note that this would be 0 minutes and 42 seconds. This is the time that is to be entered into the control panel as the "ON" time.

Flow Rate Q via Timed Draw Down Test

From the timed draw test, it is known that 4.5 inches of fluid was pumped and the tank gives 20.0 gallons per inch. Therefore;

Gallons Pumped = $(20.0^{gallons}/_{inch})$ x (4.5 inches)
Gallons Pumped = 90.0 gallons pumped

The test was run for 2 minutes as prescribed for this procedure. To find the flow rate, Q, divide the gallons pumped by 2 minutes.

Q = 90.0 gallons pumped
Q = (90.0 gallons pumped) ⁄ (2 minutes)
Q = 45.0 $^{gallons}/_{minute}$

Orifice Flow Rate

From Section A.13, Table A.15 and Section A.11 (also, the drawings), the orifice diameter is $^5/_{32}$ inch. The design operating head is given as 48 inches (See Section A.14, Table A.20). Using the orifice flow equation for $^3/_{16}$ inch orifices which is

$$Q_{Single5/32orifice} = 0.3022^{(*)} \times \sqrt{h}$$

h is the operating head in feet. But h was measured in the field as 55 inches. Convert 62 inches to feet;

Operating head, h = (55 inches) / 12 $^{inches}/_{foot}$
= 4.583333 feet

Rounding gives:

Operating head, h = 4.58 feet

Now plug into the orifice equation:

$$Q_{Single5/32orifice} = 0.3022^{(*)} \times \sqrt{4.58}$$

$$Q_{Single5/32orifice} = 0.647 \frac{gallons}{minute}$$

System Flow Rate based on Operating Head

From the drawings/installation, there are 76 orifices in the system plus the weep hole for a total of 77 orifices. From the previous step, it is known that the orifice flow rate is 0.647 $\frac{gallons}{minute}$ which is $Q_{orifice}$.

Using the following equation and substituting values:

$$Q_{System} = [(TotalNumberOrifices) \text{x} (Q_{Orifice})]$$
$$Q_{System} = [(77) \text{ x } (0.647)]$$
$$Q_{System} = 49.8 \frac{gallons}{minute}$$

Comparison of Flow Rate Q via Timed Draw Down Test & Flow Rate Q via Timed Draw Down Test

It is necessary to compare the flow rate determined from the Timed Draw Down Test and Q_{system}. The method by which this comparison is made is by the following equation:

$$FlowRateRatio = \frac{QTimedDrawDown}{QSystem}$$

$$FlowRateRatio = \frac{\frac{45gallons}{minute}}{\frac{49.8gallons}{minute}}$$

$$FlowRateRatio = .903$$

The Flow Rate Ratio must meet the following conditions:

$$0.85 \le \text{Flow Rate Ratio} \le 1.15$$

Since the calculated ratio was found to be 0.903, it is greater than 0.85, but less than 1.15. Therefore, it is OK. If this ration were found to be outside of these limits, call the Health District.

Drainback Volume & Total Dose Volume
To find the drainback volume, the length of pipe and diameters of the segments that are draining back need to be known. These were given. Consulting the reference section, it is found that 1 ½ inch pipe has 0.106 $^{gallon}/_{foot}$. To find volumes multiply the segment length by the gallons per pipe foot, as follows:

1 ½"

$$\text{Gallons} = 30 \text{ feet} \times 0.106 \ ^{gallon}/_{foot}$$
$$\text{Gallons} = 3.18$$

From the Section A.13, Table.15 or the drawing, the design dose volume is found to be 79 gallons. This dose volume must be added to the drainback volume to arrive at the Total Dose Volume.

Total Dose Volume = Design Dose Volume + Drainback Volume
Total Dose Volume = 79.0 gallons + 3.18 gallons
Total Dose Volume = 82.18 gallons

Say,

Total Dose Volume = 82.18 gallons

Hazen Williams Pipe Friction Head Losses

$$h_f = \frac{10.5 \times (L) \times \left(\frac{Q}{C}\right)^{1.85}}{D^{4.87}}$$

Where;
L = Length of Pipe (feet)
Q = system Flow Rate (Gallons per Minute)
C = Constant = 150 (for PVC pipe)
D = Inside Pipe Diameter (***inches)***
h_f = headloss due to pipe friction (***feet***)

General Form of the Energy equation (Bernoulli's Theorem)
In words:
(Energy of Section 1) + (Energy Added) – (Energy Lost) – (Energy Extracted) = (Energy of Section 2)

Mathematically:

$$\left(\frac{p_1}{\gamma} + \frac{v_1^{\,2}}{2g} + z_1\right) + H_A - H_L - H_E = \left(\frac{p_2}{\gamma} + \frac{v_2^{\,2}}{2g} + z_2\right)$$

20 Dose Sheets

- Type “A” and “B” Structure (Modified Mound)
- Type “E” Structure (Modified Mound)
- Type “G” Structure (Millennium Mound)
- Dosed Leach Line Trenches

Type "A" & "B" Structure (Modified Mound) and Treatment Unit - Dose Sheet

Submitted by: ______________________ **Date:** ____________ **Permit #:** ________

Step 1 *Complete the following table*

A	**Number of Bedrooms**		**Bedrooms**
B	**Estimated Flow per Bedroom**	**120**	**Gpd per Bedroom**
C	**Daily design Flow (DDF)** ***Line A x Line B = DDF***		**Gallons per Day**
D	**Minimum Required Reserve Volume (100% DDF)** ***Enter Number from Line C***		**Gallons**
E	**Minimum Surge Volume (65% DDF)** ***Multiply Line C by 0.65***		**Gallons**
F	**Treatment Unit Design Flow Rate ($Q_{DsgnTreat}$)** ***Obtain from the Vendor***		**Gallons per Minute**
G	**Treatment Unit Minimum Operating Head (Squirt Height)** ***Obtain from the Vendor***		**Inches**
H	**Treatment Unit Design Dose Volume** ***Obtain from the Vendor***		**Gallons per ________**
I	**Total Treatment Unit Design Dose Volume** ***Line H x Line A***		**Gallons**

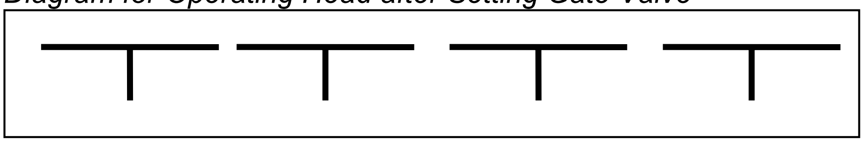
Step 2 Pressure Distribution Flushing Procedure - *Complete the following items after pressure distribution system is installed. See Section 5.13 for details.*

1. Flush the pressure distribution system
    a. Verify that the gate valve is completely open.
    b. Remove plugs on crosses. Close lateral c/o valves.
    c. Start pump. *Note: protect mound structure from erosion from flushing.*
    d. Observe water flow from crosses. This discharge should:
        i. Have uniform streams exiting cleanout.
        ii. Be clear with no debris.
    e. Replace plugs on crosses.
    f. Open lateral cleanout on a lateral.
    g. Start pump
    h. Observe water flow from cleanout. This discharge should:
        i. Have uniform streams exiting cleanout.
        ii. Be clear with no debris.
    i. Close cleanout ball valves.
    j. Repeat for each lateral c/o.

<u>Step 3</u> Mound Operating Head Setting - *Install clear tubes on **EACH** lateral cleanout. Begin with the gate valve in the 100% open position. Start pump. Allow operating head to stabilize. Measure the fluid height fluid in each clear tube from the top of the lateral. Record height measurement, may require an extra length of tube. Adjust the gate valve to set the operating head, so that none are less than the minimum, but none are more than 66 inches. The water level in the clear tube is to be relatively stable before measuring the height. The difference from lowest to highest can't exceed 10%. Record the set operating head on the following simple lateral layout diagram. Cross out those not used.*

Operating Head – Gate Valve 100% Open		**Inches**

Diagram for Operating Head after Setting Gate Valve



Note: The minimum height required is found in Table A.16 and A.17 in Section.

<u>Step 4</u> Verification of the System Flow Rate - *Use the Timed Draw Down Test, Standard Volume Test or Flow Meter Test to measure the flow rate of the dosing pump to the treatment unit(s) and the mound.*

	Pretreatment Dosing Pump		
J	**<u>Measured Flow Rate</u>**		**Gallons per Minute**
K	**<u>Design Flow Rate</u>** ***Enter Number from Line F***		**Gallons per Minute**
L	**<u>Flow Rate Check</u>** ***Divide Line J by Line K***		**---------**
	Mound Dosing Pump		
M	**<u>Measured Flow Rate</u>**		**Gallons per Minute**
N	**<u>Design Flow Rate</u>** ***Enter Number from Line F***		**Gallons per Minute**
O	**<u>Flow Rate Check</u>** ***Divide Line M by Line N***		**---------**

If Line L or O is 0.85 or greater, but less than 1.15, then OK
If Line L or O is less than 0.85 or greater than 1.15, Call the Health District

<u>Step 5</u> Timer Settings - *Complete the following table to develop necessary control panel settings.*

Dosing to Pretreatment (Timer Controlled)

P	**<u>Treatment Unit Design Dose Volume</u>** ***Insert number from Line I***		**Gallons**
Q	**<u>Volume of Drainback</u>** ***Insert water volume draining back from the pretreatment***		**Gallons**

R	**Total Treatment Unit Dose Volume** ***Add Line P and Line Q***		**Gallons**
S	**Timer "ON" Setting** ***Divide Line R by Line J***		**Minutes per Dose**
T	**Timer "ON" Setting in Seconds** ***Line S x 60***		**Seconds**
U	**Average (Normal) "OFF" Setting**	_____:_____	**Hours: Minutes**
V	**Peak/Over-ride "OFF" Setting**	_____:_____	**Hours: Minutes**

Dosing to Mound (Demand Dosed)

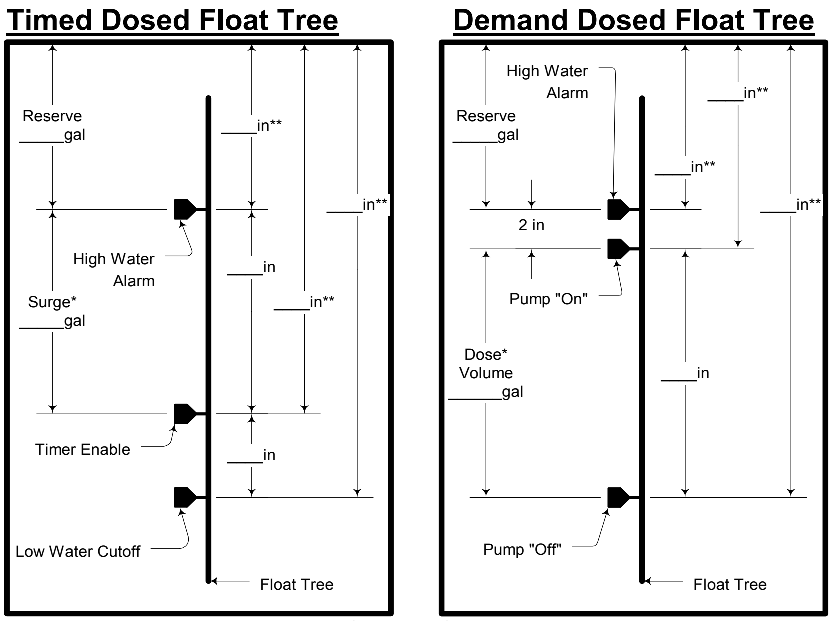
W	**Mound Design Dose Volume** ***See Section A.13***		**Gallons**
X	**Volume of Drainback** ***Volume of water draining back (Obtain from Type "A" – General Planning sheet)***		**Gallons**
Y	**Total Mound Dose Volume** ***Add Line W and Line X***		**Gallons**

Set the floats in the mound dosing basin to provide the volume of water between the "ON" and "OFF" positions in this basin.

Step 6 Setting Floats - *Complete the following diagrams to document total dose volume, reserve capacity and other stipulated minimums. Use the following table to enter basic tank and pump information requested.*

Septic Tank Manufacturer/Size & Model	
Pretreatment Tank Manufacturer/Size & Model	
Pretreatment Dosing Pump Manufacturer/Model & GPM	
Mound Dosing Basin/Size & Model	
Mound Dosing Pump Manufacturer/Model & GPM	

Float Tree Diagram



***Floats set to provide volume of water found in Line M.**
****These measurements are from the "Top of the Tank Lid" or Top of the Tank Lip." If another reference point is used, it must be noted.**
*****Low water cutoff may not be required for certain applications see guidance on control panels for dosing tanks.**

Type "E" Structure (Modified Mound) - Dose Sheet

Submitted by: ____________ **Date:** ____________ **Permit #:** ____________

Step 1 *Complete the following table*

A	**Number of Bedrooms**		**Bedrooms**
B	**Estimated Flow per Bedroom**	**120**	**Gpd per Bedroom**
C	**Daily design Flow (DDF)** ***Line A x Line B = DDF***		**Gallons per Day**
D	**Minimum Required Reserve Volume (80% DDF)*** ***Multiply Line C by 0.80***		**Gallons**
E	**Minimum Surge Volume (80% DDF)*** ***Multiply Line C by 0.80***		**Gallons**
F	**Mound Design Flow Rate (Q_{Design})** ***See Section A.13, Table A.13***		**Gallons per Minute**
G	**Mound Design Minimum Operating Head (Squirt Height)** ***See Section A.14,Table A.18*** ***Maximum is 66 inches***		**Inches**
H	**Pretreatment Design Dose Volume** ***Obtain from Vendor***		**Gallons**

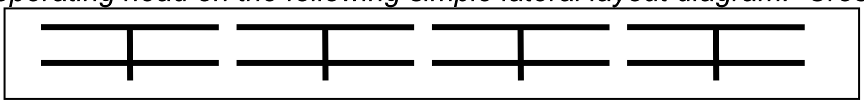
For approved primary tank reductions, write in actual capacities provided

Step 2 Pressure Distribution Flushing Procedure - *Complete the following items after pressure distribution system is installed. See Section 5.13 for details.*

2. Flush the pressure distribution system
   a. Verify that the gate valve is completely open.
   b. Remove plug on crosses. Close lateral c/o valves.
   c. Start pump. *Note: protect mound structure from un-intended erosion from flushing.*
   d. Observe water flow from crosses. This discharge should:
      i. Have uniform streams exiting cleanout.
      ii. Be clear with no debris.
   e. Replace plugs on crosses.
   f. Open cleanouts on a pair of laterals.
   g. Start pump
   h. Observe water flow from cleanouts, this discharge should:
      i. Have uniform streams exiting cleanout.
      ii. Be clear with no debris.
   i. Close cleanout ball valves.
   j. Repeat for each lateral pair.

Step 3 Mound Operating Head Setting - *Install clear tubes on **EACH** lateral cleanout. Begin with the gate valve in the 100% open position. Start pump. Allow operating head to stabilize. Measure the fluid height in each clear tube from the top of the lateral.*

Record height measurement, may require an extra length of tube. Adjust the gate valve to set the operating head, so that none is less than the minimum, but is no more than 66 inches. The water level in the clear tube is to be relatively stable before measuring the height. The difference from the lowest to highest can't exceed 10% of the lowest. Record the set operating head on the following simple lateral layout diagram. Cross out those not used.



Note: The minimum height required is 60 inches.

<u>Step 4</u> Verification of the System Flow Rate - *Use the Timed Draw Down Test, Standard Volume Test or Flow Meter Test to measure the flow rate of the dosing pump to the pretreatment and the structure(s).*

	Pretreatment Dosing Pump		
I	**<u>Measured Flow Rate</u>**		**Gallons per Minute**
J	**<u>Design Flow Rate</u>** ***Obtain from Vendor***		**Gallons per Minute**
K	**<u>Flow Rate Check</u>** ***Divide Line I by Line J***		---------
	Mound Dosing Pump		
L	**<u>Measured Flow Rate</u>**		**Gallons per Minute**
M	**<u>Design Flow Rate</u>** ***Enter Number from Line F***		**Gallons per Minute**
N	**<u>Flow Rate Check</u>** ***Divide Line L by Line M***		---------

If Line K or N is 0.85 or greater, but less than 1.15, then OK
If Line K or N is less than 0.85 or greater than 1.15, Call the Health District

<u>Step 5</u> Timer Settings - *Complete the following table for control panel settings.*

Dosing to Pretreatment (Timer Controlled)

O	**<u>Design Dose Volume</u>** ***Insert number from Line H***		**Gallons**
P	**<u>Volume of Drainback</u>** ***Insert water volume draining back from the pretreatment***		**Gallons**
Q	**<u>Total Dose Volume to Pretreatment</u>** ***Add Line O and Line P***		**Gallons**
R	**<u>Timer "ON" Setting</u>** ***Divide Line Q by Line I***		**Minutes per Dose**
S	**<u>Timer "ON" Setting</u> in Seconds** ***Line R x 60*** $^{sec}/_{min}$		**Seconds per Dose**
T	**<u>Convert Line S to Minutes and Seconds</u>**	_____:______	**Minutes: Seconds**

U	**Average (Normal) "OFF" Setting**	_____:______	**Hours: Minutes**
V	**Peak/Over-ride "OFF" Setting**	_____:______	**Hours: Minutes**

Dosing to Mound (Demand Dosed)

W	**Mound Design Dose Volume** ***See Section A.14***		**Gallons**
X	**Volume of Drainback** ***Volume of water draining back*** ***(Obtain from Type "E" – General Planning sheet)***		**Gallons**
Y	**Total Mound Dose Volume** ***Add Line W and Line X***		**Gallons**

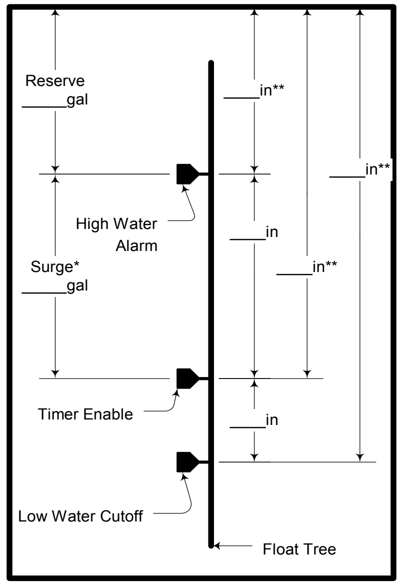
Set the "ON" and "OFF" float(s) in the mound dosing basin to provide the total dose volume of water.

Step 6 Setting Floats - *Complete the following diagrams to document total dose volume, reserve capacity and other stipulated minimums. Use the following table to enter basic tank and pump information requested.*

Septic Tank Manufacturer/Size & Model	
Pretreatment Dosing Pump Manufacturer/Model & GPM	
Mound Dosing Basin/Size & Model	
Mound Dosing Pump Manufacturer/Model & GPM	

Float Tree Diagram

Timed Dosed Float Tree



***Floats set to provide volume of water found in Line Q.**
****These measurements are from the "Top of the Tank Lid" or Top of the Tank Lip." If another reference point is used, it must be noted.**
*****Low water cutoff may not be required for certain applications see guidance on control panels for dosing tanks.**

"Constant" Capacity Tanks

"Constant" Capacity		**Gallons/Inch**
Surge Volume Provided		**Gallons**
Surge Volume		**Inches**
Reserve Volume Provided		**Gallons**
Reserve Volume		**Inches**

"Varying" Capacity Tanks

Surge Volume		**Gallons**
Standard Volume Location in Tank		**Gallons**
Reserve Volume		**Gallons**
Standard Volume Location in Tank		**Gallons**

Location of the Standard Volume was verified____________
(Installer's Initials)

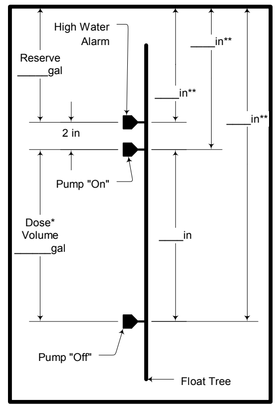
Demand Dosed Float Tree

Distance Between "ON" & "OFF"
"Constant" Capacity in galons per inch

Total Dose Volume ________ gallons
Gallons per Inch ________

Divide Total Dose Volume by Gallons per Inch

Distance Bewteen "ON" & "OFF" _______ inches



Distance Between "ON" & "OFF"
"Varying" Capacity in gallons per inch

Total Dose Volume ________ gallons

Standard Volume locate in the tank ________ gallons

Location of Standard Volume verified _______
(Insatller's Initials)

Floats set to provide volume of water found in Line Y.
****These measurements are from the "Top of the Tank Lid" or Top of the Tank Lip." If another reference point is used, it must be noted.***

Type "G" Structure (Millennium Mound) - Dose Sheet

Submitted by: **Date:** **Permit #:**

Step 1 *Complete the following table.*

A	**Number of Bedrooms**		**Bedrooms**
B	**Estimated Flow per Bedroom**	**120**	**GPD per Bedroom**
C	**Daily Design Flow (DDF)** ***Line A x Line B = DDF***		**Gallons per Day**
D	**Minimum Required Reserve Volume (80% DDF)** ***Multiply Line C by 0.8*** ***See Table 3.1a***		**Gallons**
E	**Minimum Surge Volume (80% DDF)** ***Multiply Line C by 0.8*** ***See Table 3.1a***		**Gallons**
F	**Design Flow Rate (Q_{Design})** ***See Section A.13, Table A.14***		**Gallons per Minute**
G	**Design Minimum Operating Head (Squirt Height)** ***See Section A.14, Table A.19, Maximum is 66 inches***	**60**	**Inches**
H	**Design Dose Volume** ***See Table in Appendix Reference Section or See Section A.13, Table A.14***		**Gallons (net)**

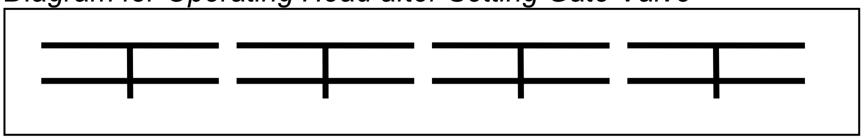
Step 2 Pressure Distribution Flushing Procedure - *Complete the following items after the pressure distribution system is installed. See Section 5.13 for details.*

3. Flush the pressure distribution system
   a. Verify that the gate valve is completely open.
   b. Remove plugs on crosses. Close lateral c/o valves.
   c. Start pump. *Note: protect mound structure from erosion from flushing.*
   d. Observe water flow from crosses. This discharge should:
      i. Have uniform streams exiting cleanout.
      ii. Be clear with no debris.
   e. Replace plugs on crosses.
   f. Open cleanouts on a pair of laterals.
   g. Start pump
   h. Observe water flow from cleanout. This discharge should:
      i. Have uniform stream exiting cleanouts.
      ii. Be clear with no debris.
   i. Close cleanout valve(s).
   j. Repeat for each lateral pair.

Step 3 Mound Operating Head Setting - *Install clear tubes on **EACH** lateral cleanout. Begin with the gate valve in the 100% open position. Start pump. Allow* *operating head to stabilize. Measure the fluid height in each clear tube from the top of the lateral. Record height measurement, may require an extra length of tube. Adjust the gate valve to set the operating head, so that none is less than the minimum, but is no more than 66 inches. The water level in the clear tube is to be relatively stable before measuring the height. Record the set operating head on the following simple lateral layout diagram. Cross out those not used.*

Operating Head – Gate Valve 100% Open		**Inches**

Diagram for Operating Head after Setting Gate Valve



Note: The minimum height required is 60 inches.

Step 4 Verification of the System Flow Rate - *Use the Timed Draw Down Test, Standard Volume Test or Flow Meter Test to measure the flow rate of the dosing pump to the structure.*

I	**Measured Flow Rate**		**Gallons per Minute**
J	**Design Flow Rate** ***Enter Number from Line F***		**Gallons per Minute**
K	**Flow Rate Check** ***Divide Line I by Line J***		---------

If Line K is 0.85 or greater, but less than 1.15, then OK
If Line K is less than 0.85 or greater than 1.15, call the Health District

Step 5 Timer Settings - *Complete the following table to develop necessary control panel settings.*

Dosing to Structure (Timer Controlled)

L	**Design Dose Volume** ***Insert number from Line H***		**Gallons**
M	**Volume of Drainback** ***Insert water volume draining back from the mound***		**Gallons**
N	**Total Dose Volume** ***Add Line L and Line M***		**Gallons**
O	**Timer "ON" Setting** ***Divide Line N by Line I***		**Minutes per Dose**
P	**Timer "ON" Setting in Seconds** ***Line O x 60*** $^{sec}/_{min}$		**Seconds**
Q	**Convert Line P to Minutes**	_____:_____	**Minutes:**

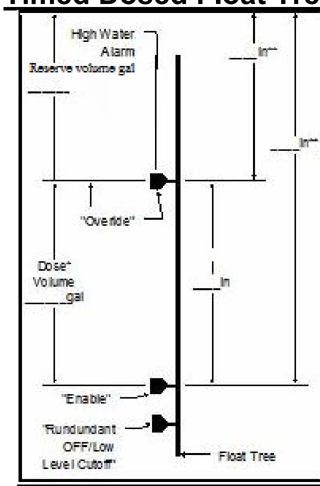
	and Seconds		**Seconds**
R	**Compute 60% DDF (Average Daily Design Flow)** ***0.6 x Line C, See Table 3.3 in Sec. 3.4.1.1***		**Gallons per Day**
S	**Number of "OFF" Periods for Average (Normal) Mode** ***Line R divided by Line L, See Table in Appendix Reference Section***		**Periods**
T	**Average (Normal) "OFF" Setting** ***24 divided by Line S***		**Hours**

U	**Average (Normal) "OFF" Setting** ***Convert to Hours and Minutes, See Table in Appendix Reference Section***	_____:_____	**Hours: Minutes**
V	**Number of "OFF" Periods for Peak (Override) Mode** ***Line C divided by Line L, See Table in Appendix Reference Section***		**Periods**
W	**Number of "OFF" Periods for Peak (Override) Mode** ***24 divided by Line V, See Table in Appendix Reference Section***		**Hours**
X	**Number of "OFF" Periods for Peak (Override) Mode** ***Convert to Hours and Minutes, See Table in Appendix Reference Section***	_____:_____	**Hours: Minutes**

Step 6 Setting Floats - *Complete the following diagrams to document total dose volume, reserve capacity and other stipulated minimums. Use the following table to enter basic tank and pump information requested.*

Septic Tank Manufacturer/Size & Model	
Mound Dosing Pump Manufacturer/Model & GPM	

Timed Dosed Float Tree



***Floats set to provide volume of water found in Line E.**
****These measurements are from the "Top of the Tank Lid" or Top of the Tank Lip." If another reference point is used, it must be noted.**
*****Low water cutoff may not be required for certain applications see guidance on control panels for dosing tanks.**

"Constant" Capacity Tanks

"Constant" Capacity		**Gallons/Inch**
Surge Volume Provided		**Gallons**
Surge Volume		**Inches**
Reserve Volume Provided		**Gallons**
Reserve Volume		**Inches**

"Varying" Capacity Tanks

Surge Volume		**Gallons**
Standard Volume Location in Tank		**Gallons**
Reserve Volume		**Gallons**
Standard Volume Location in Tank		**Gallons**

Location of the Standard Volume was verified____________
(Installer's Initials)

Dosed Leach Line Trenches - Dose Sheet

Submitted by: ______________ **Date:** ______________ **Permit #:** ______________

Step 1 *Complete the following table.*

A	**Number of Bedrooms**		**Bedrooms**
B	**Estimated Flow per Bedroom**	**120**	**Gpd per Bedroom**
C	**Daily design Flow (DDF)** ***Line A x Line B = DDF***		**Gallons per Day**
D	**Minimum Required Reserve Volume (100% DDF)** ***Enter Number from Line C***		**Gallons**
E	**Design Dose Volume** ***See This Sheet***		**Gallons**
F	**Drainback Volume** ***Obtain from As-built Information***		**Gallons**
G	**Total Dose Volume** ***Line E + Line F = Total Dose Volume***		**Gallons**

Step 2 Verification of the System Flow Rate - *Use the Timed Draw Down Test, Standard Volume Test, or Flow Meter Test to measure the flow rate of the system.*

H	**Measured Flow Rate**		**Gallons per Minute**
I	**Pump Run Time Check** ***Divide Line G by Line H***		**Minutes**

If Line I is 1.0 or greater, then OK

If Line I is less than 1.0, flow rate to be decreased to allow minimum pump run time of 1 minute.

Step 3 Setting Float Elevations and Documentation - *Complete the following diagram to document total dose volume, reserve capacity, and other stipulated minimums. Use the following table to enter basic tank and pump information requested.*

Tank Manufacturer/Size & Model	
Pump Manufacturer/Model & GPM	

Drainback Calculations:

Use the Following table to calculate the drainback for the pressure distribution system:

Pressure Distribution Pipe Segment Draining Back	Pipe Diameter (in)	Number of Linear Feet of Pipe Draining Back (ft)	Volume per Foot of Pipe (gal/ft)	Water Volume (gal)
Force Main				
Force Main Branch(es)				
Sub Mains				
Manifolds				
Other				
			Total Drainback	

Reference Table of Water Volume in Gallons per Foot of Pipe by Diameter, Schedule 40 PVC Pipe

Nominal Size	Volume (gal/ft)
1/2	0.016
3/4	0.028
1	0.045
1 1/4	0.078
1 1/2	0.106
2	0.174
2 1/2	0.249
3	0.384
3 1/2	0.514
4	0.661
PVC Pipe Data (Orenco Systems Inc) (4/97)	

21.0 Addendum

1. Guidelines for Field Layouts
2. Installer Layout Plan Checklist
3. Pre-Construction Conference
4. Type A & B Structures Modified
5. Type G Structures Modified
6. Modifying for a Certain Slope
7. Bedroom Definitions
8. Flow Inducer
9. Panel Requirements for System Type

Guidelines for:
Field Lay Outs for Plan Applications
Using Planning / As-Built Forms
Construction Tolerances and Inspection Tolerances

- Installers and designers must flag or mark system designs for a field-check by a sanitarian.
- Sanitarians will approve a plan/design or field-check system designs for tolerances before approving an installer permit.
- It is the responsibility of the installer and/or designer to make sure the plan/design meets all Brown County Health Department tolerants. The septic system may be disapproved during or after construction if the sanitarian finds that the system does not meet the plan/design tolerances. Plans/designs for the mound/alternative system may be checked on the first inspection.
- A plan must have at least one benchmark. One permanent benchmark is acceptable. If benchmarks are temporary (subject to being disturbed), a primary benchmark and a secondary benchmark are strongly recommended.
- Benchmark(s) must be adequately described on the plan and well-marked.
- Failure to flag or mark a plan design is likely to result in a re-inspection and may require a re-inspection fee.
- Design plans from designers must be in elevations.
- Installer layout plans may be in elevations or grade rod readings.
- Grade rod readings on layout plans must be taken at the same instrument height.
- Layout plans must have a grade rod reading recorded on all benchmarks (back-sights).
- “Canned” Planning / As-built forms, or other plans, must record:
    1. any controlling site elevations
    2. as many existing and planned elevations as needed to confirm that the layout meets the guidelines and can be installed as designed.
- Keep Planning/As-Built forms as clean and simple as possible:
    1. plan and construct the system within the tolerances
    2. Place existing elevations in the spaces marked with (   ).
    3. Place planned elevations in the spaces marked _____.

Taking Readings (Feet and tenths preferred. Feet and inches only.)

Readings taken <u>on existing ground</u>, <u>in an excavation</u>, or <u>on top of fill</u> are written <u>in rounded</u> <u>inches</u>; never in fractions.

Readings taken at other points, such as bench marks, top of pipes, laterals, tanks, etc, are written to the nearest 1/8 of an inch. Readings on these features, given in round inches or, will be assumed to be exact readings.

Tolerances for taking readings for system planning and layout
Mounds:
+/- 1 inch on the line laid out along the centerline of the distribution bed
The centerline may vary from the true contour (level) by 0.5 % or six inches in 100 feet

Guidance for Planning, Constructing and Checking Leaching Trenches

Lay out a contour for a leaching trench by visualizing the trench full of water seeking its own level. The water in the trench will be six inches lower than the contour elevation. The true contour follows the line where the water touches the down-slope trench wall. Don't exceed the tolerances for layout and construction, as follows:

The difference from the contour elevation may be no more than:
+/- 1 inch at the drop box location and at the ends of the contour line;
+/- 3 inches between a drop box and the ends of the contour line

Existing ground readings match at the start (at the drop box) and at the end of the contour.

The top of the drop box, properly set, is at the contour elevation for normal leaching systems and six (6) inches above contour for AT Grade Trench.

The trench bottom is 18 inches below the top of the drop box.

For normal gravel trenches, this "line" can't be more than 3 in /0.25 ft lower than the contour.

Inspectors will check at any point along this "line."

Tolerances will be tighter for systems with shallower trenches.

The top of the gravel must be level with or slightly above the flow line of the drop box outlet.

Avoid over-fill (waste) of gravel and avoid a depth-of-cover problem.

Minimum soil cover is 6 inches over the gravel to the top of the drop box or existing ground if drop boxes are not used.

Guidance for Installing and Checking Laterals on Pressurized Distribution Systems

Reference Elevations

- A lateral's reference elevation is the top of the lateral next to its manifold or its tee.

Tolerances

- +/- ½ in from its reference elevation to "top of pipe" readings along the lateral
- The end of a lateral must be slightly above its reference elevation.

Guidance for Installing and Checking Laterals on Pressurized Distribution Systems, Continued

A lateral on an as-built requires two readings:

1. its reference elevation
2. end of the lateral
3. **all other points on the lateral must be +/- ½ in of its reference elevation**

Gravel must cover laterals, except at the ends.
Inspectors will check anywhere along a lateral for elevations and cover.

Guidance for Installing and Inspecting Fills and Cover on Mound Structures

- Depth and width minimums are critical.
- Top of fills may vary, but must meet the minimums.
- Minimum depth of soil cover will be checked.

Guidance for Installing and Inspecting Pipelines

- No pipes covered without an inspector's permission.
- All pipe connections are exposed for inspection under any circumstances.
- Inspector will check anywhere along the length of a pipe for slope and support.

Guidance for Freeze-Protection

Important: Gravel and sand do not count as cover for freeze protection.

<u>**Freeze protection** by cover depth:</u>
- Pipe elevations may be uneven.
- Pipe cover must meet minimum requirements.
- Pipe support must prevent stress on joints after backfilling.

<u>**Freeze protection** by drain back:</u>
- Pipe slope must produce drainage.
- Pipe support must prevent bellies or air locks after backfilling.

<u>**Weep-hole elevations**</u>:
- Plan weep-hole carefully and set tank(s) and pipe depths accordingly.
- Weep-hole elevation matches point(s) on top of the main or sub-mains where soil cover is 24 inches.
- Record the sizes and lengths of pipe that drain back to the pump tank

Installer Layout Plan Checklist

This applies only to an installer's layout plan application for a system that is a standard design in the current BCHD Household Sewage Treatment System Installation Manual at the time of application. Applications for other systems must follow the two Design Plan Review Checklists provided by the Health Department.

☐ Use ODH Site and Soils Evaluation forms
☐ For sites with less than 12" of soil to a seasonal water table (ABC soils), write "NO SOIL" on the soil information sheet. These will be recognized as needing two feet of separation distance made up of sand, or sand plus a soil credit from pretreatment or from a method of application.
☐ Site and soil information for all other sites will be submitted using the forms and following the format provided by the Ohio Department of Health.
☐ The site plan is drawn to scale on 8½ by 11 inch or larger paper. Shows north arrow.
☐ The site plan shows an outline of the system location and of the replacement.
☐ The existing elevations and planned elevations information are on the planning and as-built form, or forms, as provided for the system in the Health Department's Installation Manual.
☐ The Health Department's Installation Manual is referenced as the source of design information for the system, and as the source for installation guidance.
☐ The system is flagged or staked.
☐ The site is protected with caution tape, construction fencing or other barrier.
☐ Existing field elevations correspond to the information on the planning form(s)
☐ Site plan shows existing and proposed structures, driveways and other hardscapes
☐ Isolation offsets are maintained for system: 10 ft from property lines, right-of-ways, buildings; 50 ft from water supply source and surface water (pond, waterway, etc.).

- ☐ Application includes a floor plan of the residence to determine system size.
- ☐ The Health Department’s criteria for a bedroom, located in this manual, will be applied.
- ☐ Large volume water fixtures will be considered when sizing a system.
- ☐ As a registered and bonded installer, I understand the following:
    - If I encounter any undisclosed or hidden condition on the site that may bear upon the approvability of the system, it is my responsibility to discontinue that part of the installation effected and report the situation to the Health Department immediately.
    - This system will be installed and inspected according to the current Health Department’s Installation Manual at the time of application.
    - A copy of the as-built drawing, equipment and/ or product installation manuals, schematic drawings, operation and maintenance literature, and warranty forms are to be given to the job customer when payment is received.

Installer Signature: ________________________ Date: ______________

Pre-Construction Conferences

This guidance applies to all applications submitted for and permits-to-install purchased for onsite wastewater treatment systems in the Brown County Health Department. It is intended to clarify under which circumstances pre-construction conferences are required, not required, and when they are optional. If a pre-construction conference is required then a fee will be accessed.

<u>Installation Manual</u> refers to the current Brown County Health Department Household Sewage Treatment System Installation Manual.

<u>Installer</u> refers to the person holding the permit-to-install

<u>Layout plan</u> refers to a plan prepared by a registered installer using the Planning/As-Built sheets in the Installation Manual, and/or under the guidance provided by Installation Manual Addendums.

Designer refers to a person submitting a plan other than the specific designs which are described and specified with accompanying drawings in the Installation Manual.

Circumstance	Pre-Construction Conference
Installer submitted the layout plan application	Not required
Installer did not submit layout plan application	Required
Installer is the designer of the design plan application	Not required
Designer of the design plan requests PCC	Upon request
Installer is not the designer of the design plan application	Required
Installer did not install in county in previous year	Required for first install

The Health Department reserves the right to require a pre-construction conference for any job, regardless of the circumstances, if the staff is convinced that one is necessary.

An installer is ready for a pre-construction conference, or to start an installation, when that person has confidence, based on an assessment of the site and the plan, that the system can be installed as designed and approved. Ways of assessing a site and plan include, but are not limited to:

- flagging or painting of contours
- verification that the site has been protected and not been disturbed
- verification that house and accessory structure locations are consistent with the plan
- field-checking controlling elevations of the plan

An inspector participates in a pre-construction meeting based on an understanding that the installer has prepared adequately, so that the installation can be completed to the plan specifications.

The responsibility to install the system to the specifications, as is noted on the permit-to-install, is the sole responsibility of the installer.

If an installer has questions about the installation, that installer has the responsibility to use the resources made available by the Health Department, the vendors who supply the equipment, and to consult with their inspector. Brown County Health Department reserves the right to cancel/reschedule an inspection up to and including the day of the inspection.

Bedroom Definition and Exceptions

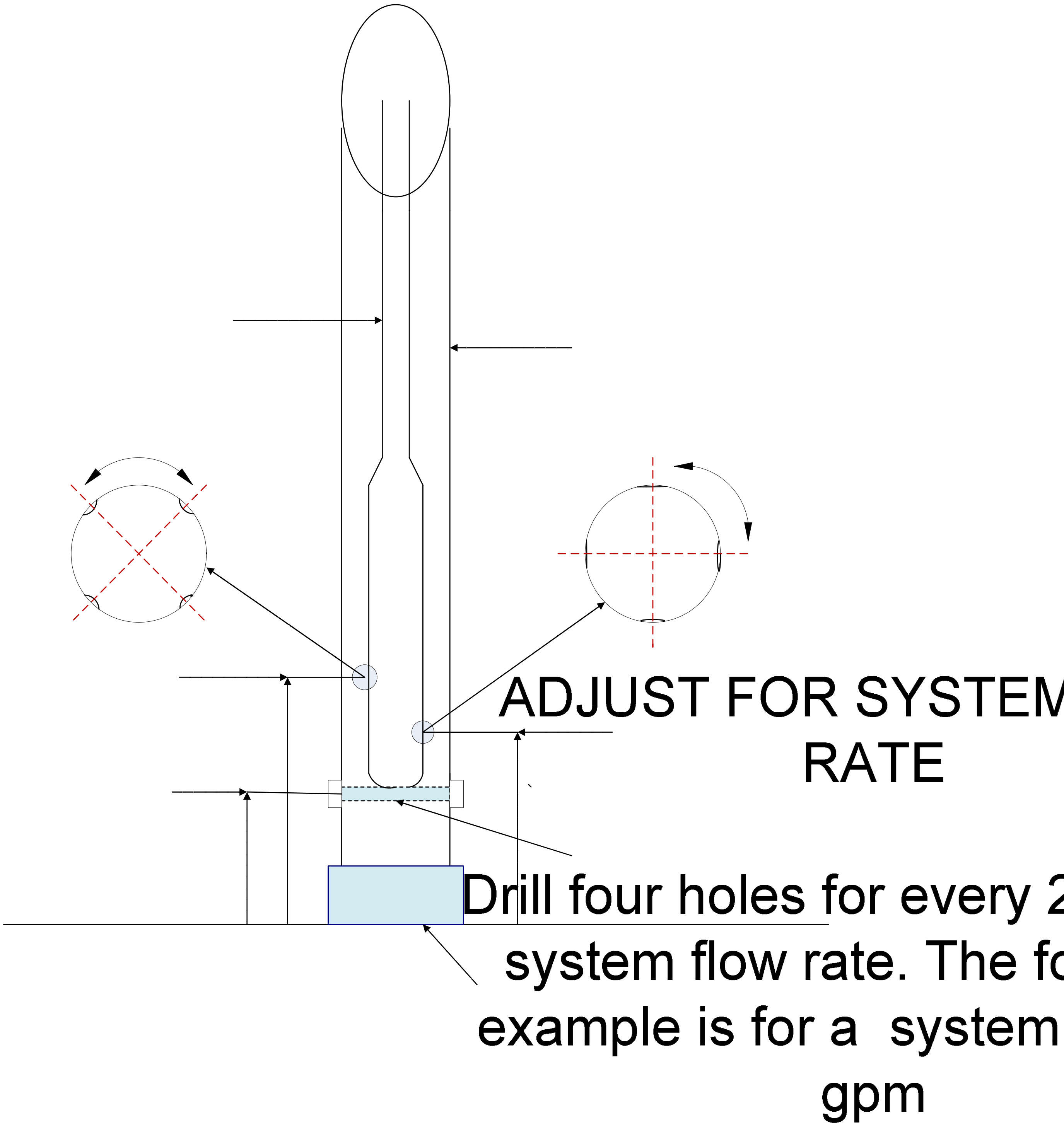
- Brown County Board of Health defines a bedroom as any room that might reasonably be used as a sleeping room including but not limited to rooms designated as a den, computer room, office, study, etc. These rooms are to be considered bedrooms when designing a household sewage treatment system for a home.

- Any room with no door and no closet that is adjacent to a full bath will still be considered a bedroom.

- When two rooms are in a suite with a common full bathroom both will be considered to be bedrooms.

- If a homeowner wants to change their plans so that fewer rooms will be considered to be bedrooms, the revised plans must also be submitted to the Building Department before they will be accepted as changed by the Health Department.

This is a guidance document. Any other room situations will be evaluated on a case by case basis and this document will be updated as needed.


ADJUST FOR SYSTEM
RATE
Drill four holes for every 2
system flow rate. The fo
example is for a system
gpm

PANEL REQUIREMENTS FOR SYSTEM TYPE

Tank Types
Style One Dosing Septic Tank
Style Two Dosing Septic Tank
Septic Tank plus Dosing Tank
(for the addendum)
System Classifications
Millennium Mound (Type G structure or Modified Type G structure)
Dosed leaching trenches
Activated sludge aerobic treatment unit to soil absorption
Curtain drain without gravity flow

Panel Type and System Classifications
Type A-1: Millennium Mound (Type G structure or Modified Type G structure)
Type A-2: Millennium Mound (Type G structure or Modified Type G structure)
Type B: Dosed leaching trenches
Type B: Aerobic treatment unit to soil absorption.
Type B: Curtain drain without gravity flow.

Note: Pump One refers to the first pump in a treatment train; Pump Two refers to the second pump in a treatment train.
Panel functions for systems beyond the general requirements for all control panels
All panels have a visual and audible alarm.
Type A-1:

- The timer is programmable to operate Pump One on one schedule in a normal enabled mode and on a separate schedule in a high water alarm enabled mode. The Off cycles can be programmed in the required hours-and-minutes time range, or the equivalent. The On cycle can be programmed in the required minutes-and-seconds time range, or the equivalent.
- The panel records high water alarm events for Pump One.
- The panel always allows a pump that starts a dosing cycle to complete the cycle for a full dose.
- A low water level activates audio and visual alarms and cuts power to Pump One.

Type A-2:

- The timer is programmable to operate Pump One on one schedule in a normal enabled mode and on a separate schedule in a high water alarm enabled mode. The Off cycles can be programmed in the required hours-and-minutes time range, or the equivalent. The On cycle can be programmed in the required minutes-and-seconds time range, or the equivalent.

- The panel records high water alarm events for Pump One
- The panel always allows a pump that starts a dosing cycle to complete the cycle for a full dose.

Type B:

- Pump One operates on demand in response to water level sensors.
- The panel records high water alarm events for Pump One.
- The panel always allows a pump that starts a dosing cycle to complete the cycle for a full dose.

INDEX

G

H

I

J

K

L

M