

# STONEFIELD

## STORMWATER OPERATIONS & MAINTENANCE PLAN

### ASHWORTH INVESTMENTS, LLC.

PROPOSED MULTI-FAMILY RESIDENTIAL PROJECT  
MAP: 32-4, LOT: 21  
2001 KINGSTOWN ROAD  
TOWN OF SOUTH KINGSTOWN  
WASHINGTON COUNTY, RHODE ISLAND

**PREPARED FOR:**

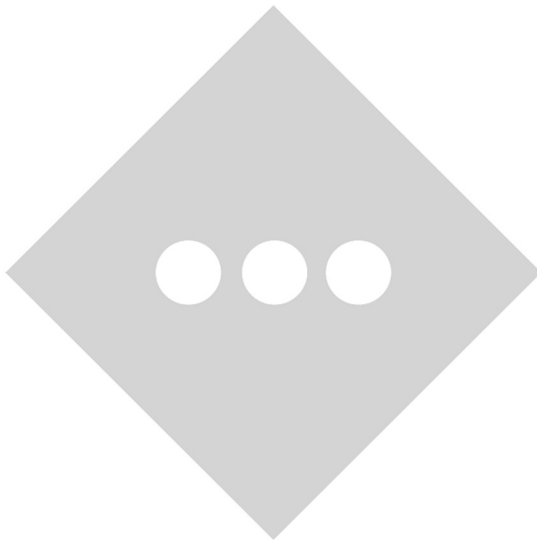
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**PREPARED BY:**

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**REPORT DATE:**

MARCH 27, 2026



A handwritten signature in black ink, appearing to read 'Josh Kline', written over a horizontal line.

JOSH KLINE, PE  
RI PE LICENSE # 13607

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## **I.0 INTRODUCTION**

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This Stormwater Operations & Maintenance Plan has been prepared to identify the operational and maintenance responsibilities for the proposed stormwater facilities for the development of the parcel located at 2001 Kingstown Road, South Kingstown, Washington County, Rhode Island. This Plan has been prepared in conjunction with the Preliminary & Final Land Development Plans and Stormwater Management Plan, prepared by Stonefield Engineering & Design LLC. and in accordance with the standards and regulations set forth by The Town of South Kingstown of Washington County and the Rhode Island Department of Environmental Management (RIDEM).

Operation and maintenance of the permanent stormwater control Best Management Practices (BMPs) shall be the responsibility of the operator of the project site at the time that the applicable maintenance is required. Stormwater management improvements associated with this development include the implementation of two (2) below ground infiltration basins, two (2) Contech CDS water quality unit with associated subsurface conveyance system. All guidelines, standards and requirements set forth in this Plan shall be implemented for all proposed stormwater infrastructure, as well as any existing features that will remain, including areas of preserved landscaping. These guidelines are not exclusive to the proposed improvements, and existing infrastructure that is to remain in post development conditions shall be maintained in accordance with this document as applicable.

A copy of this report shall be kept on-site at all times both during and after construction. Upon reviewing agency approval, the title and date of the maintenance plan as well as the contact information of the current agent responsible for maintaining the stormwater management measures for the project shall be recorded (as deemed required).

### **I.1 RESPONSIBILITY**

The purpose of the Stormwater Operations and Maintenance (O&M) Plan is to ensure adequate inspection of the systems, removal of accumulated sediments, oils and debris, and implementation of corrective action and record keeping activities. The enclosed O&M activities will be performed by a Contract Operator for the scope of maintenance. The Contract Operator will be a professional engineer or other professional with expertise and experience with stormwater management facilities operation and maintenance. The Owner, its successors, and/or assigns shall be responsible for the maintenance of the stormwater infrastructure associated with the proposed site improvements. Adequate maintenance is defined in this document as good working condition.

The current responsible agent shall evaluate the maintenance plan for effectiveness at least annually and revise the plan, as necessary. A detailed, written log of all preventative and corrective maintenance performed for each stormwater management measure must be kept, including a record of all inspections and copies of maintenance-

related work orders. Upon request from a public entity with jurisdiction over the project area the responsible agent shall make available the maintenance plan and associate logs and other records for review.

**Responsible Agent:**

**Name:** TBD  
**Address:** TBD  
**Contact:** TBD  
**Phone:** TBD  
**Email:** TBD

**I.2 DOCUMENTATION**

Quarterly Operation and Maintenance Record Log and Schedule will be kept by the Owner summarizing inspections, maintenance, repairs and any corrective actions taken. The log will include the date on which each inspection or maintenance task was performed, a description of the inspection findings or maintenance completed, and the name of the inspector or maintenance personnel performing the task. If a maintenance task requires the clean-out of any sediments or debris, the location where the sediment and debris was disposed after removal will be indicated. Sample Inspection and Maintenance Logs for each stormwater BMP are enclosed. Additionally, invoices and other documentation of performance of maintenance activities (e.g., sediment disposal) shall be kept by the Owner or the legally authorized representative. The documentation will be kept on file.

The site supervisor shall be responsible for ensuring that the scheduled tasks as described in this plan are appropriately completed and recorded in the Maintenance Log. Accurate records of all inspections, routine maintenance and repairs shall be documented and these records shall be available for inspection by members of the governing authority as designated by the Town of South Kingstown, or their designated agent, upon request.

**I.3 CHANGES TO OPERATIONS & MAINTENANCE PLAN**

The Owner(s) and/or Responsible Agent shall notify the designated Governing Authority of any changes to the Operations & Maintenance Plan. Amendments to the Plan include but are not limited to changes in ownership, changes in assignment of financial responsibility, change in responsible parties, and modifications to the procedures outlined herein. Changes to the Plan shall be recorded on the Amendment Log in **APPENDIX F** of this Plan.

## 2.0 INSPECTION & MAINTENANCE OF STORMWATER SYSTEMS

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The Owner, Property Manager and maintenance staff will conduct the Operation and Maintenance program set forth in this document. The Owner or Property Manager will ensure that inspections and record keeping are timely and accurate, and that cleaning and maintenance are performed in accordance with the recommended frequency for each stormwater component. Inspection & Maintenance Log Forms (provided herein) shall include the date and the amount of the last significant storm event in excess of 1" of rain in a 24-hour period, physical conditions of the structures, depth of sediment in structures, evidence of overtopping or debris blockage and maintenance required of each structure.

The following areas, facilities and measures will be inspected by the Owner or Property Manager and maintained as specified below. The following guidelines are applicable to all known stormwater structures and facilities on the parcel. Identified deficiencies will be corrected. Accumulated sediments and debris will be properly handled and disposed of off-site, in accordance with local, state, and federal guidelines and regulations.

### 2.1 CONTECH® CDS WATER QUALITY UNITS

**Structures:** Two (2) Contech® CDS Water Quality Unit

- **WQ-1**
  - Design Intent: Pretreat discharge prior to infiltration through Basin B-1.
  - Approximate Location: Immediately east of proposed basin B-1.
  - Composition: CDS 1515-3-C; Frame and Grate; Inline structure with internal bypass
- **WQ-2**
  - Design Intent: Pretreat discharge prior to infiltration through Basin B-2.
  - Approximate Location: Located in front of proposed five (5) guest parking spaces.
  - Composition: CDS 1515-3-C; Frame and Grate; Inline structure with internal bypass

**Description:** The CDS system must be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on-site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation. Inspection is the key to effective maintenance and is easily performed. At a minimum, inspections shall be performed twice per year (e.g. spring and fall), however, more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations shall also be inspected more frequently where excessive amounts of trash are expected. Each individual owner must ensure that any and all of their proprietary stormwater pretreatment devices are maintained in accordance with the requirements stated in *Stormwater Rule*

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250-RICR-150-10-8.31-C, which requires the sump to be inspected a minimum of 2 times per year. Additionally, the device must be cleaned out when either pollutant removal capacity is reduced by 50% or more, or when 50% or more of the device’s pollutant storage capacity is filled or displaced. The system must be cleaned and maintained in accordance with manufacturer specifications as identified in **APPENDIX D**.

**Maintenance Equipment:** Cleaning of CDS systems must be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Operator shall perform all maintenance in accordance with the manufacturer specifications.

**Maintenance Access:** Access to the CDS unit is typically achieved through two manhole or grate access covers. One allows inspection and cleaning out of separation chamber and isolated sump while the other allows for inspection and cleaning out of sediment captured and retained on the outside screen. Confined space entry procedures must be followed if physical access is required.

**Inspection & Maintenance Summary:** The table below provides a brief summary of inspection and maintenance actions for the CDS water quality units. Operator shall refer to manufacturer specifications enclosed herein for specific means and methods inspection and maintenance.

**TABLE I: CDS WATER QUALITY GENERAL MAINTENANCE SCHEDULE \***

Frequency	Operation & Maintenance Activity
<ul style="list-style-type: none"><li>• Minimum two times per year</li></ul>	<u>Inspection Actions</u> <ul style="list-style-type: none"><li>• Visual inspection shall ascertain that system components are in working order &amp; no visible blockages or obstructions.</li><li>• Quantify accumulation of hydrocarbons, trash and sediment in system.</li><li>• Inspect filter fabric for clogging, tearing, or other damage.</li><li>• Inspect chambers for sediment, debris and other obstructions.</li><li>• Evaluate structural integrity of overall system and inspect for cracks, settlement, leaking, or other indications of malfunction.</li></ul>
<ul style="list-style-type: none"><li>• Annually</li><li>• When at 50% sediment capacity</li></ul>	<u>Preventive Maintenance Actions</u> <ul style="list-style-type: none"><li>• Perform a clean-out when either pollutant removal capacity is reduced by 50% or more, or when 50% or more of the device’s pollutant storage capacity is filled or displaced or an appreciable level of hydrocarbons and trash has accumulated. Remove trash, debris, organic matter and other obstructions.</li><li>• Cleaning shall only be conducted during dry weather conditions when no flow is entering the system.</li><li>• In the event of a spill, units shall be cleaned immediately.</li><li>• Remove and replace degraded perimeter stone as required.</li><li>• Remove and replace damaged filter fabric as required.</li></ul>
<ul style="list-style-type: none"><li>• Promptly as Needed</li></ul>	<u>Corrective Maintenance Actions</u> <ul style="list-style-type: none"><li>• Notify Owner of any structural damage or other indication of malfunction and of all system repairs needed in a timely manner.</li></ul>

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	<ul style="list-style-type: none"><li>• Perform corrective maintenance activities as required on applicable system components in accordance with all applicable local and manufacturer recommendations. Responsible party shall thoroughly document all required and completed corrective actions including repair and replacement of system components.</li></ul>
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**\*This table is a brief summary of inspection and maintenance measures required for the Contech® CDS Separator and is not intended to replace or overrule the enclosed manufacturer specifications. Operator is responsible for reviewing and adhering to all manufacturer specifications for the Contech® CDS Separator.**

## **2.2 SUBSURFACE INFILTRATION BASIN**

**Structures:** R-Tank® SD/HD Modular Stormwater Storage System

- **Infiltration Basins B-1**
  - Design Intent: Capture, treat & infiltrate discharge from a the entirety of the private road and the roof runoff from the single family dwellings
  - Approximate Location: Within the open space running along the Northern property line
  - Composition: 285 R-Tank® HD Single Modules (12 rows of 18 chambers)
- **Infiltration Basin B-2**
  - Design Intent Capture, treat & infiltrate discharge rooftops and open space
  - Approximate Location: Within the open space at the northwest corner of the project site.
  - Composition: 180 R-Tank® HD Single Modules (12 rows of 14 chambers)

**Description:** As they are underground, subsurface infiltration systems are difficult to maintain and are prone to clogging and failure; therefore, aggressive and timely maintenance is required. Inspect the infiltration basin at least yearly, and after storms equal to or greater than the 1-year, 24-hour, Type III storm event. Ensure that the access points to components are not compromised, that inlet and outlet pipes are functioning as expected, standing water is not present within the infiltration BMP 72 hours after a rain event, there are no signs of illicit discharges or vandalism, there is no subsidence, erosion, or cracking of structures, there is no leakage through the structure, and evaluate the level of sedimentation and trash accumulation for acceptable levels. Prior to beginning any maintenance on the system, if applicable, the outlet pipe shall be plugged to prevent contamination of the downstream systems. The basin is equipped with a Treatment Row that shall be cleaned and maintained on the same schedule as the infiltration basin and in accordance with manufacturer specifications as identified in **APPENDIX D**.

**Maintenance Equipment:** Subsurface infiltration systems shall be cleared of accumulated and sediments through the use of a vacuum truck and hose. Precautions shall be taken to maintain the structural integrity of the system and associated internal equipment during cleaning.

**Maintenance Access:** Access to the subsurface infiltration basin shall be provided via the access risers installed on the system. The basin is also equipped with inspection ports at each end for more frequent inspections.

**Inspection & Maintenance Summary:** The table below provides a summary of inspection and maintenance actions and required frequency for Subsurface Infiltration Basins:

**TABLE 2: SUBSURFACE INFILTRATION BASIN GENERAL MAINTENANCE SCHEDULE\***

Frequency	Operation & Maintenance Activity
<ul style="list-style-type: none"> <li>• Annually</li> <li>• After storms equal to or exceeding the 1-year, 24-hour Type III Storm Event</li> </ul>	<p><u>Infiltration Basin Inspection</u></p> <ul style="list-style-type: none"> <li>• Inspect inflow pipes for leaking, cracks, clogging, or other forms of damage or malfunction.</li> <li>• Inspect basin for sediment, debris, trash, organic matter and other obstructions.</li> <li>• Inspect soil and infiltration functionality. Ensure no standing water remains within the basin after 72 hours.</li> <li>• Inspect overall structure for structural integrity, cracks, settlement, leaking, sediment accumulation.</li> <li>• Inspect internal components for signs of damage or loss of functionality.</li> <li>• Inspect Treatment Row in accordance with manufacturer specifications.</li> </ul>
<ul style="list-style-type: none"> <li>• Annually</li> </ul>	<p><u>Preventive Maintenance Actions</u></p> <ul style="list-style-type: none"> <li>• Remove trash, debris, organic matter and other obstructions.</li> <li>• Remove and replace degraded perimeter stone.</li> <li>• Repair damage to components as required.</li> <li>• Maintain Treatment Row in accordance with manufacturer specifications.</li> </ul>
<ul style="list-style-type: none"> <li>• Annually</li> </ul>	<p><u>Inspect &amp; Clean Pretreatment Devices</u></p> <ul style="list-style-type: none"> <li>• Treatment Row                             <ul style="list-style-type: none"> <li>○ Refer to manufacturer field manual for specific means and methods of operation and maintenance for treatment row.</li> </ul> </li> <li>• Deep Sump Catch Basins                             <ul style="list-style-type: none"> <li>○ Refer to Section 2.1 of this Plan for specific means and methods of operations &amp; maintenance of deep sump catch basins.</li> </ul> </li> <li>• Contech CDS Water Quality Unit                             <ul style="list-style-type: none"> <li>○ Refer to Section 2.2 of this Plan for specific means and methods of operations &amp; maintenance of the water quality treatment device.</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>• Promptly as Needed</li> </ul>	<p><u>Corrective Maintenance Actions</u></p> <ul style="list-style-type: none"> <li>• Notify Owner of any structural damage or other indication of malfunction and of all system repairs needed in a timely manner.</li> <li>• Perform corrective maintenance activities as required on applicable system components in accordance with all applicable local and manufacturer recommendations. Responsible party shall thoroughly document all required and completed corrective actions including repair and replacement of system components.</li> <li>• Prior to start of any maintenance actions, plug basin outlet pipe(s) to prevent contamination of downstream systems.</li> </ul>

**\*This table is a brief summary of inspection and maintenance measures required for the R-Tank® SD Module and is not intended to replace or overrule the enclosed manufacturer specifications. Operator is responsible for reviewing and adhering to all manufacturer specifications for the R-Tank® SD Module.**

### **3.0 GENERAL SITE OPERATIONS & MAINTENANCE**

#### **3.1 ONSITE CONVEYANCE SYSTEM**

##### **STORM DRAIN PIPING**

The proposed site storm drain system is comprised of a network of piping and structures discharging to two (2) subsurface infiltration systems.

- Sediments and hydrocarbons will be properly handled and disposed of off-site, in accordance with local, state and federal guidelines and regulations.
- If there is evidence of clogging, blockages, or other failure of the conveyance system, appropriate remediation measures shall be conducted in a timely manner. All corrective measures taken shall be appropriately logged in accordance with this Plan.

### **ROOF DRAIN LEADERS**

Roof runoff from the proposed multi-tenant building is directed to the proposed conveyance system via roof leaders and ultimately to Basins B-1 and B-2. The Property Owner shall be responsible for maintenance of all material associated with roof leaders.

- Perform routine roof drain inspections and cleanings multiple times per year as needed and at the end of the foliage and snow removal seasons.
- Keep roofs clean and free of debris.
- Keep roof drainage systems clear.
- Keep roof access limited to only those responsible for maintenance and cleaning.
- Keep gutters clear of leaves and debris.

### **3.2 VEGETATED AREAS**

The maintenance of vegetated areas is essential in maintaining the functionality of the stormwater management system. This includes the health/density of vegetative cover and activities such as the application and disposal of lawn and garden care products, disposal of leaves and yard trimmings and proper aeration of soils.

It is the responsibility of the Property Owner to coordinate Landscape Maintenance of the onsite open space areas. Post-construction conditions shall incorporate a mix of existing and proposed landscape features and open space. This Plan is inclusive of all vegetation, both existing and proposed. At a minimum, the following maintenance and operations requirements shall met be during and after construction period:

- Inspect slopes and embankments early in the growing season to identify active or potential erosion problems. Replant bare areas or areas with sparse growth. If erosion is evident, armor the area with an appropriate lining or riprap stone.
- Inspect planted areas on a semi-annual basis and remove any litter.
- Maintain planted areas adjacent to pavement to prevent soil washout.
- Immediately clean any soil deposited on pavement.

- Re-seed bare areas; install appropriate erosion control measures when native soil is exposed, or erosion channels are forming.
- Plant alternative mixture of grass species in the event of unsuccessful establishment.
- The grass vegetation should be cut to a height between three and four inches.
- Pesticide/Herbicide Usage – No pesticides are to be used unless a single spot treatment is required for a specific control application unless approved and applied by a licensed professional.
- No pesticides or herbicides are allowed within the 100' adjacent upland resource area property without prior approval of the Governing Authority unless approved and applied by a licensed professional.
- Fertilizer usage should be avoided. If deemed necessary, fertilizer may only be of the low nitrogen and phosphorous variety. Fertilizer may be used to begin the establishment of vegetation in bare or damaged areas but should not be applied on a regular basis unless necessary.
- Fertilizer applications shall be limited to the spring and early fall and applied per the manufacturers' specifications. Nitrogen content shall not exceed 25% with ratios for Nitrogen, Phosphorus, and Potassium at 3-1-2 or 3-1-1. It is also recommended that at least 30%-50% of total nitrogen be slow release.
- Annual application of compost amendments and aeration are recommended.

### **3.3 MAINTENANCE OF STREETS & PARKING AREAS**

Roadways with curbs and catch basins must be swept at a minimum of once per year. Roadways with curbs and catch basins that discharge to nitrogen or phosphorus impaired waters, or their tributaries are swept at a minimum of twice per year, once in the spring and once in the fall. Sweeping on central pedestrian pathway, used for emergency vehicles only, must be conducted on an as-needed basis. All street sweepings collected must be disposed of in accordance with RIDEM regulations. The responsible party may temporarily store street sweepings in labor yards, but street sweepings must be disposed of offsite in a reasonable timeframe. Street sweepings may not be disposed of on parking lots or lands.

The following minimum maintenance measures shall be implemented:

- Sweep or vacuum standard asphalt pavement areas with a rotary brush sweeper (or another method approved by licensed professional) and properly dispose of removed material.
- Minimum recommended sweeping schedule:
  - October / November
  - April / May
  - More frequent sweeping of paved surfaces will result in less accumulation in catch basins, less cleaning of subsurface structures, and less disposal costs.

- Check dumpster areas frequently for spillage and/or pavement staining and clean, as necessary.
- No coal-tar, petroleum-based, or other parking lot “sealants” are permitted to be used on-site unless approved by local authority. Normal maintenance activities intended to extend the life expectancy of the pavement surfaces including the use of bitumen asphalt to seal developing cracks, asphalt repair are not subject to this special condition.

The following street and parking lot sweeping procedures shall be performed to reduce the discharge of pollutants:

### **Sweeping**

- Street sweeping will be conducted in dry weather. Sweeping will not be conducted during or immediately after rainstorms.
- Dry cleaning methods will be used whenever possible with the exception of very fine water spray for dust control. Avoid wet cleaning or flushing of the pavement.
- When necessary, parking bans will be enacted to facilitate sweeping on busy streets.
- More frequent sweeping of paved surfaces will result in less accumulation in catch basins. Sweeping will be conducted in a manner that avoids depositing debris into storm drains. Deep sump catch basins shall be inspected and/or cleaned as needed after street sweeping concludes in accordance with the procedures set forth in *Section 2.1 Deep Sump Catch Basins* of this Plan.
- Sweeping shall generally be conducted with a vacuum sweeper, however alternative sweeping equipment (mechanical, regenerative air, vacuum filter, tandem sweeping) may be selected depending on the level of debris. Brush alignment, sweeper speed, rotation rate, and sweeping patterns will be set to optimize levels to manage debris.
- Sweeping equipment will be routinely inspected and maintained to reduce the potential for leaks.

### **Disposal**

- If street sweepings are reused, e.g., as anti-skid material or to fill in parking lots, they will be properly filtered to remove solid waste, such as paper or trash, in accordance with their intended reuse. All reuse and/or disposal of street sweeping will be managed in accordance with current RIDEM policies and regulations.
- Street sweepings can be stored for up to one year in approved temporary storage areas. Storage areas will be protected to prevent erosion and runoff and should be located away from wetland resource areas and buffer zones, surface water, or groundwater.
- Sweepings are classified as solid waste and are disposed of at solid waste disposal sites.

### **3.4 WINTER MAINTENANCE AND SNOW & ICE MANAGEMENT**

It is the responsibility of the Property Owner to contract with a professional snow removal/winter conditions management contractor to treat the paved parking and walking areas within the developed area for safe access during winter conditions. All snow and ice operators are required to be trained in the RIDEM practices. The contractor is responsible for minimizing de-icing applications while ensuring safe vehicle and pedestrian access to onsite facilities.

Snow storage and removal shall be conducted in accordance with the following minimum requirements:

- Snow will be stored in areas that do not block or hinder access to any structure or accessory facility.
- Snow storage areas will be managed to prevent blockage of storm drain catch basins, stormwater drainage channels, and on-street parking. Snow combined with sand and debris may block a storm drainage system, diminishing the drainage capacity of the system and causing localized flooding.
  - Storm drain catch basins and stormwater management systems shall be inspected and cleaned as needed at the end of the snow removal season in accordance with the procedures outlined in this Plan.
- Sand and debris deposited on vegetated or paved areas shall be cleared from the site and properly disposed of at the end of the snow season, no later than springtime.
- Snow shall not be dumped into any waterbody, pond, or wetland resource area.
- Snow shall not be dumped within a Wellhead Protection Area (WHPA) of a public water supply or within 200 feet of a private well, where road salt may contaminate water supplies.
- Snow shall not be dumped in sanitary landfills and gravel pits.

In addition to snow removal, potentially icy and unsafe paved surfaces are addressed as follows:

- The de-icing program consists of two treatment zones: The largest area, parking and vehicle circulation areas, and the smaller area, the sidewalks/front doors of the facility.
- The parking and vehicle circulation areas within the development will be treated with approved treatment product mixed with sand. Per deicing event up to 200 gallons per acre may be applied.
- The front door entrances and sidewalks of commercial units will have a non-sodium pelletized de-icing material that may contain calcium chloride or magnesium chloride as the active ice melting ingredient. The pellets are broadcast at a rate up to 1 lb. per 75-100 square feet.
- Only calcium or magnesium-based de-icing chemicals shall be used on surfaces where runoff/drainage will discharge into any wetland resources, or the 100' adjacent upland resource area.

The following winter maintenance procedures shall be performed to reduce the discharge of pollutants:

- Minimize the use and optimize the application of sodium chloride and other salt (while maintaining public safety) and consider opportunities for use of alternative methods.
- Optimize sand and/or chemical application rates through the use, where practicable, of automated application equipment (e.g., zero velocity spreaders), anti-icing and pre-wetting techniques. Implementation of pavement management systems, and alternate chemicals. Maintain records of the application of sand, anti-icing and/or de-icing chemicals to document the reduction of chemicals to meet established goals.
- Prevent exposure of de-icing product (salt, sand, or alternative products) storage piles to precipitation by enclosing or covering the storage piles. Implement good housekeeping, diversions, containment, or other measures to minimize exposure resulting from adding to or removing materials from the pile. Store piles in such a manner as not to impact surface water resources, groundwater resources, recharge areas, and wells.

**4.0 ESTIMATED ANNUAL BUDGET**

The Owner and/or the Responsible Agent should perform a cost analysis and establish the annual operation and maintenance budget for the site. Once the budget has been established the below breakdown can be utilized to help track yearly costs for various onsite features and can be updated within **Table 3**.

The below values are subject to modification upon establishment of party responsible for completing associated work and/or consultation from manufacturers or responsible local authorities. Certain factors are not considered in the below estimates that may have significant cost implications. For example, removal and disposal of catch basin cleanings and sediment must be completed in accordance with local regulations and taken to a facility permitted by RIDEM to accept solid waste; the cost, policy, requirements, proximity or other factors of the specific disposal facility is not able to be accurately accounted for at the time of this Plan. Significant corrective measures such as unforeseen structural repairs may not be considered in initial estimates.

**TABLE 3: OPERATION AND MAINTENANCE BUDGET**

<b>System / Feature</b>	<b>Approximate Cost / Year</b>
Infiltration Basin Inspection & Maintenance	--
Hood & Sump Inspection & Maintenance	--
Conveyance System Inspection & Maintenance	--
Sediment Debris and Trash Removal/Disposal	--
Landscape & Vegetation Inspection & Maintenance	--
Street Sweeping	--
Winter Maintenance / Snow & Ice Management	--

## **5.0 INSPECTION & LOGS OF PREVENTATIVE AND CORRECTIVE MEASURES**

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The person responsible for maintenance shall maintain a detailed log of all preventative and corrective maintenance for the structural stormwater management measures incorporated into the design of the development, including a record of all inspections and copies of all maintenance-related work orders.

A maintenance plan shall include a schedule of regular inspections and tasks, and detailed logs of all preventative and corrective maintenance performed on the stormwater management measure, including all maintenance-related work orders. The person with maintenance responsibility must retain and, upon request, make available the maintenance plan and associated logs and other records for review by a public entity with administrative, health, environmental, or safety authority over the site.

All inspection and maintenance activities shall be recorded to document frequency of inspection and maintenance, and implementation of corrective action. All regularly scheduled inspections, inspections following major storm events, maintenance activities, and repairs shall be recorded. General Inspection and Maintenance Logs for each Stormwater BMP can be found in **APPENDIX E** of this Plan. The enclosed general log forms shall be considered a minimum standard for recording purposes; the Operator and Inspection/Maintenance Personnel are strongly encouraged to supplement the Log with additional notes and photos.

## **6.0 ANNUAL EVALUATION OF THE EFFECTIVENESS OF THE PLAN**

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The person responsible for maintenance shall evaluate the effectiveness of the maintenance plan at least once per year and adjust the plan and the deed as needed. The responsible party should evaluate the effectiveness of the maintenance plan by comparing the maintenance plan with the actual performance of the maintenance. The items to evaluate may include, but not limited to:

- Whether the inspections have been performed as scheduled;
- Whether the preventive maintenance has been performed as scheduled;
- Whether the frequency of preventative maintenance needs to increase or decrease;
- Whether the planned resources were enough to perform the maintenance;
- Whether the repairs were completed on time;
- Whether the actual cost was consistent with the estimated cost;
- Whether the inspection, maintenance, and repair records have been kept.

If actual performance of those items has been deviated from the maintenance plan, the responsible party should find the causes and implement solutions in a revised maintenance plan. Should modifications to the Plan be deemed necessary to ensure longevity of the site systems, the changes should be noted within the enclosed Amendment Log in **APPENDIX F**.

# **APPENDIX A PROJECT FIGURES**

## **INVENTORY**

**FIGURE 1: RADIUS MAP**

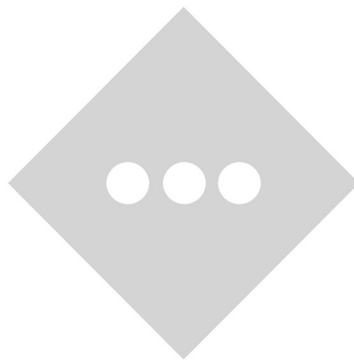
**FIGURE 2: USGS MAP**

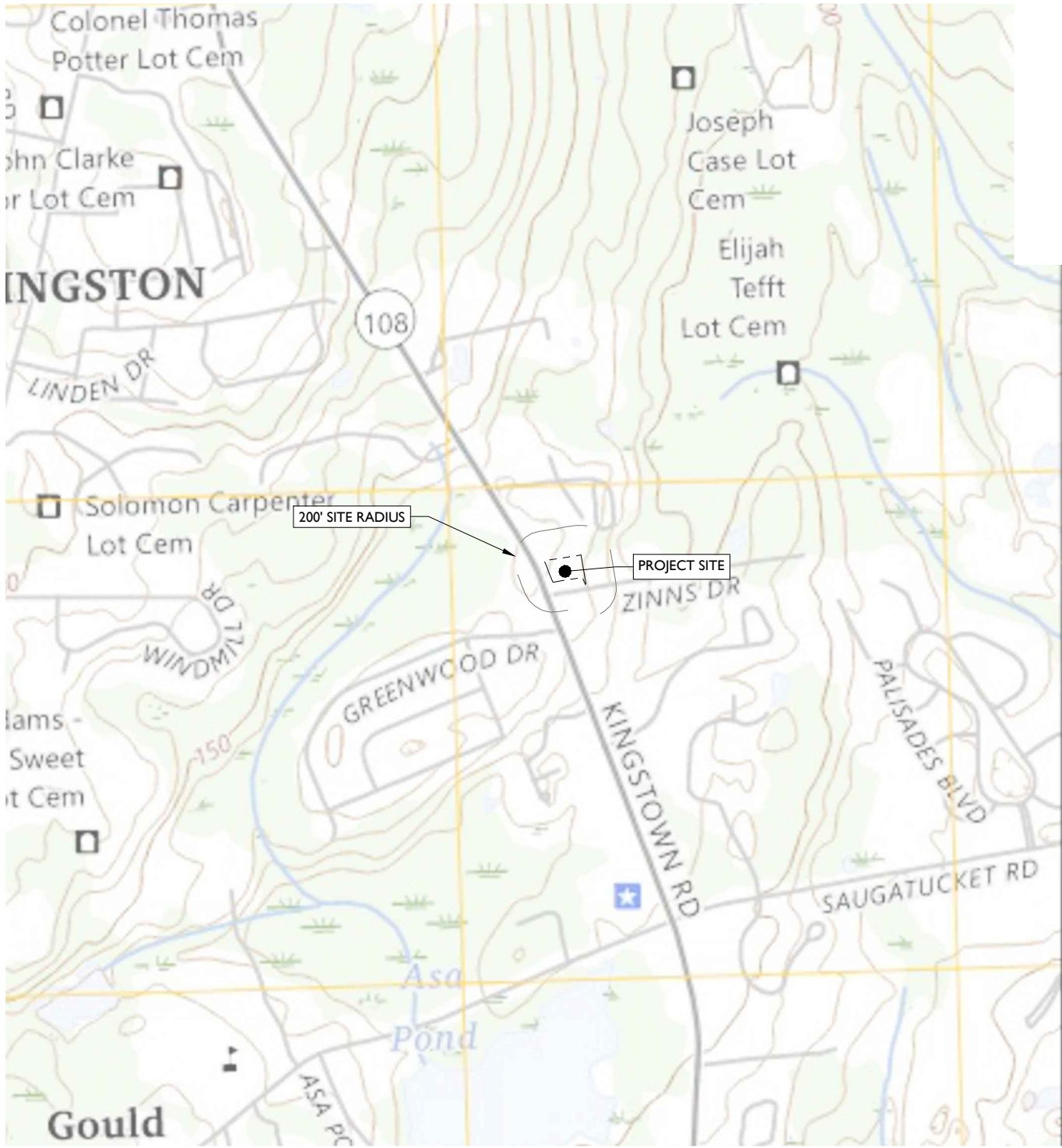
**FIGURE 3: AERIAL LOCATION MAP**

**FIGURE 4: FEMA MAP**

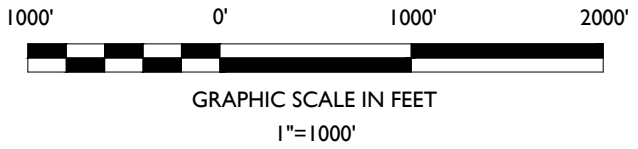
**FIGURE 5: SOIL SURVEY MAP**

**FIGURE 6: RIDEM GROUNDWATER CLASSIFICATION MAP**





# USGS QUAD MAP



SOURCE: USGS KINGSTOWN QUADRANGLE RHODE ISLAND WASHINGTON COUNTY 7.5-MINUTE SERIES

## 600 NJ STATE HIGHWAY ROUTE 36 PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT

MAP 32-4, LOT 21  
2001 KINGSTOWN ROAD  
TOWN OF SOUTH KINGSTOWN, WASHINGTON COUNTY, RHODE ISLAND

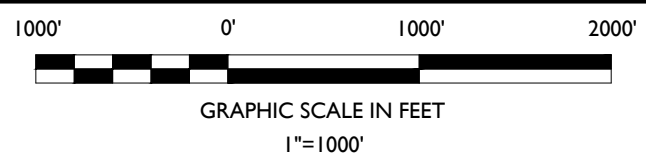
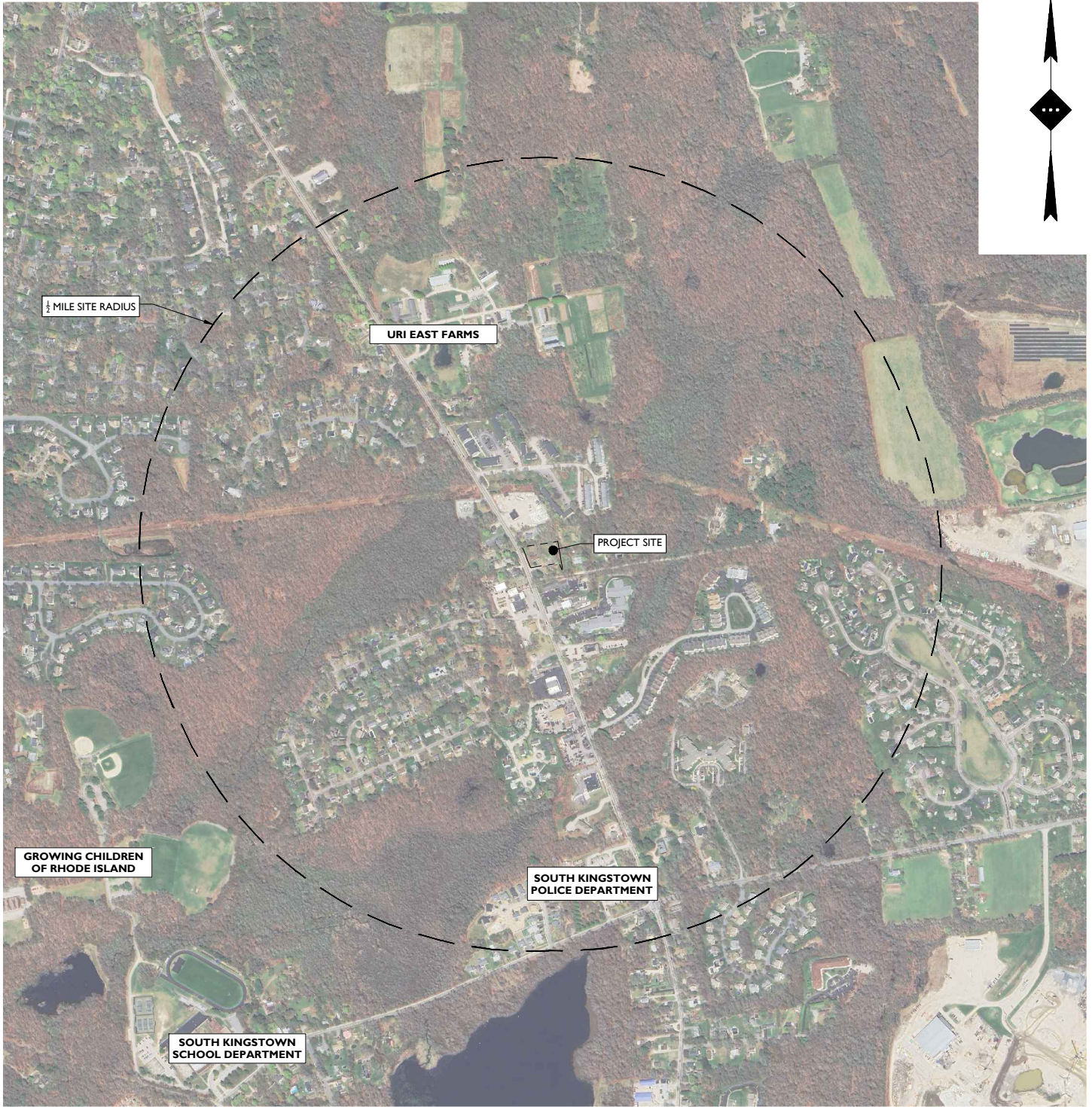
<b>DRAWN BY:</b>	NNS
<b>CHECKED BY:</b>	JHK
<b>DATE:</b>	11/20/2025
<b>SCALE:</b>	1" = 1000'
<b>PROJECT ID:</b>	BOS-250053



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# AERIAL MAP

SOURCE: GOOGLE EARTH DATED APRIL 23, 2025

## 2001 KINGSTOWN ROAD PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT

MAP 32-4, LOT 21  
2001 KINGSTOWN ROAD  
TOWN OF SOUTH KINGSTOWN, WASHINGTON COUNTY, RHODE ISLAND

<b>DRAWN BY:</b>	NNS
<b>CHECKED BY:</b>	JHK
<b>DATE:</b>	11/20/2025
<b>SCALE:</b>	1" = 1000'
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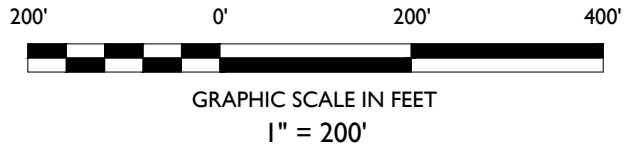
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**ZONING LEGEND:**

- (MU) - MIXED USE
- (CH) - COMMERCIAL HIGHWAY
- (R-10) - MEDIUM HIGH DENSITY RESIDENTIAL DISTRICT
- (RM) - RESIDENTIAL MULTI-HOUSEHOLD DISTRICT
- (R-20) - MEDIUM HIGH DENSITY RESIDENTIAL DISTRICT
- (R40) - MEDIUM DENSITY RESIDENTIAL DISTRICT
- (CN) - COMMERCIAL NEIGHBORHOOD

# TAX & ZONING MAP



SOURCE: SOUTH KINGSTOWN, RI ONLINE ZONING MAP

## 2001 KINGSTOWN ROAD PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT

MAP 32-4, LOT 21  
2001 KINGSTOWN ROAD  
TOWN OF SOUTH KINGSTOWN, WASHINGTON COUNTY, RHODE ISLAND

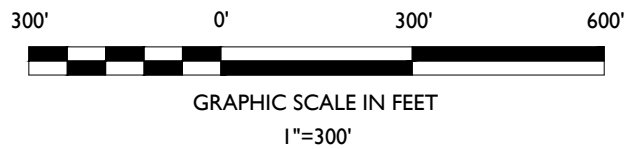
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<b>CHECKED BY:</b>	JHK
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# FEMA FLOOD MAP

SOURCE: FEMA FLOOD MAPS NUMBER 44009C0184K & 44009C0185J

## 2001 KINGSTOWN ROAD PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT

MAP 32-4, LOT 21  
2001 KINGSTOWN ROAD  
TOWN OF SOUTH KINGSTOWN, WASHINGTON COUNTY, RHODE ISLAND

<b>DRAWN BY:</b>	NNS
<b>CHECKED BY:</b>	JHK
<b>DATE:</b>	11/20/2025
<b>SCALE:</b>	1" = 300'
<b>PROJECT ID:</b>	BOS-250053

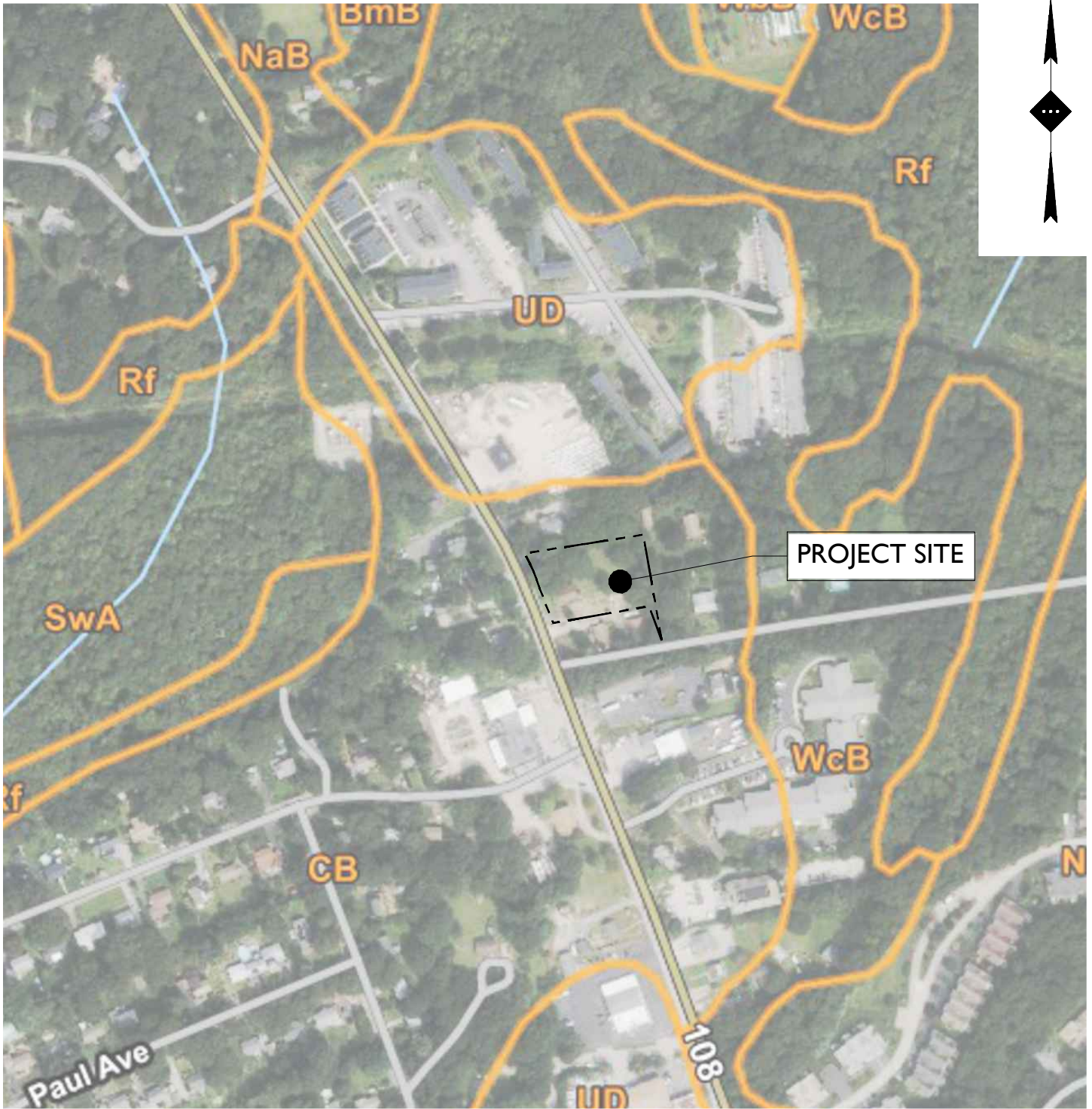


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# SOILS MAP



GRAPHIC SCALE IN FEET

1"=300'

SOURCE: USDA: NATURAL RESOURCE CONSERVATION SERVICE RETRIEVED JULY 7, 2025

## 2001 KINGSTOWN ROAD PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT

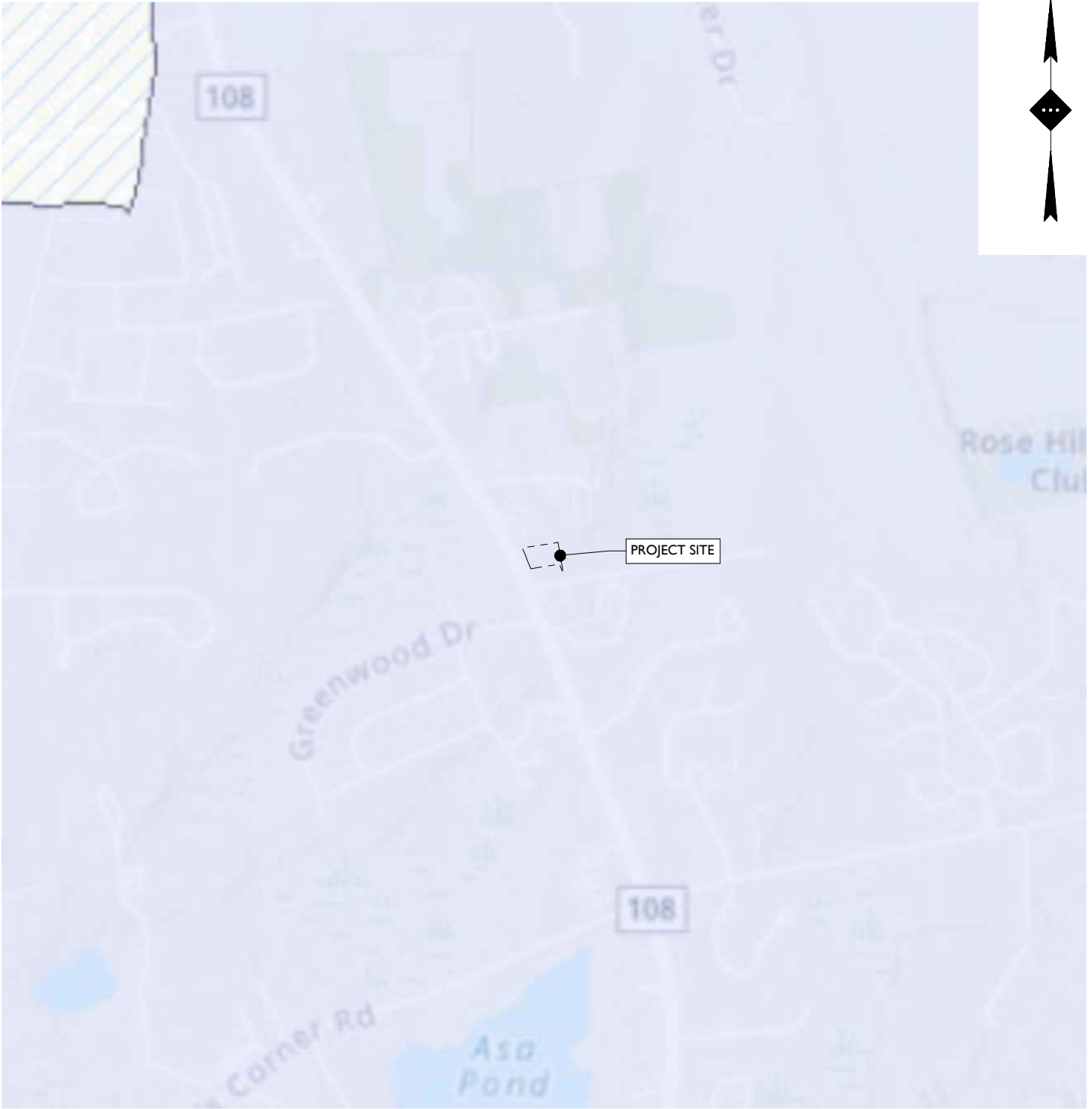
MAP 32-4, LOT 21  
2001 KINGSTOWN ROAD  
TOWN OF SOUTH KINGSTOWN, WASHINGTON COUNTY, RHODE ISLAND

<b>DRAWN BY:</b>	NNS
<b>CHECKED BY:</b>	JHK
<b>DATE:</b>	11/20/2025
<b>SCALE:</b>	1" = 300'
<b>PROJECT ID:</b>	BOS-250053

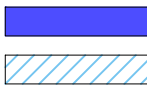


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# GROUNDWATER CLASSIFICATION MAP



GA - TO BE PROTECTED TO MAINTAIN DRINKING WATER QUALITY  
 GAA - TO BE PROTECTED TO MAINTAIN DRINKING WATER QUALITY



GRAPHIC SCALE IN FEET

1" = 1000'

SOURCE: RIDEM ENVIRONMENTAL RESOURCE MAP, RECEIVED OCTOBER 1, 2025

## 2001 KINGSTOWN ROAD PROPOSED MULTI-FAMILY RESIDENTIAL DEVELOPMENT

MAP 32-4, LOT 21  
 2001 KINGSTOWN ROAD  
 TOWN OF SOUTH KINGSTOWN, WASHINGTON COUNTY, RHODE ISLAND

<b>DRAWN BY:</b>	NNS
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<b>DATE:</b>	11/20/2025
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<b>PROJECT ID:</b>	BOS-250053



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# **APPENDIX B**

## **SITE PLANS**

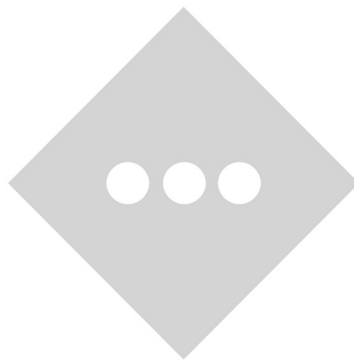
### **INVENTORY**

**B-1: SITE PLANS**

**B-2: STORMWATER MANAGEMENT PLAN**

**B-3: SOIL EROSION & SEDIMENT CONTROL PLANS**

**B-4: LANDSCAPING PLANS**

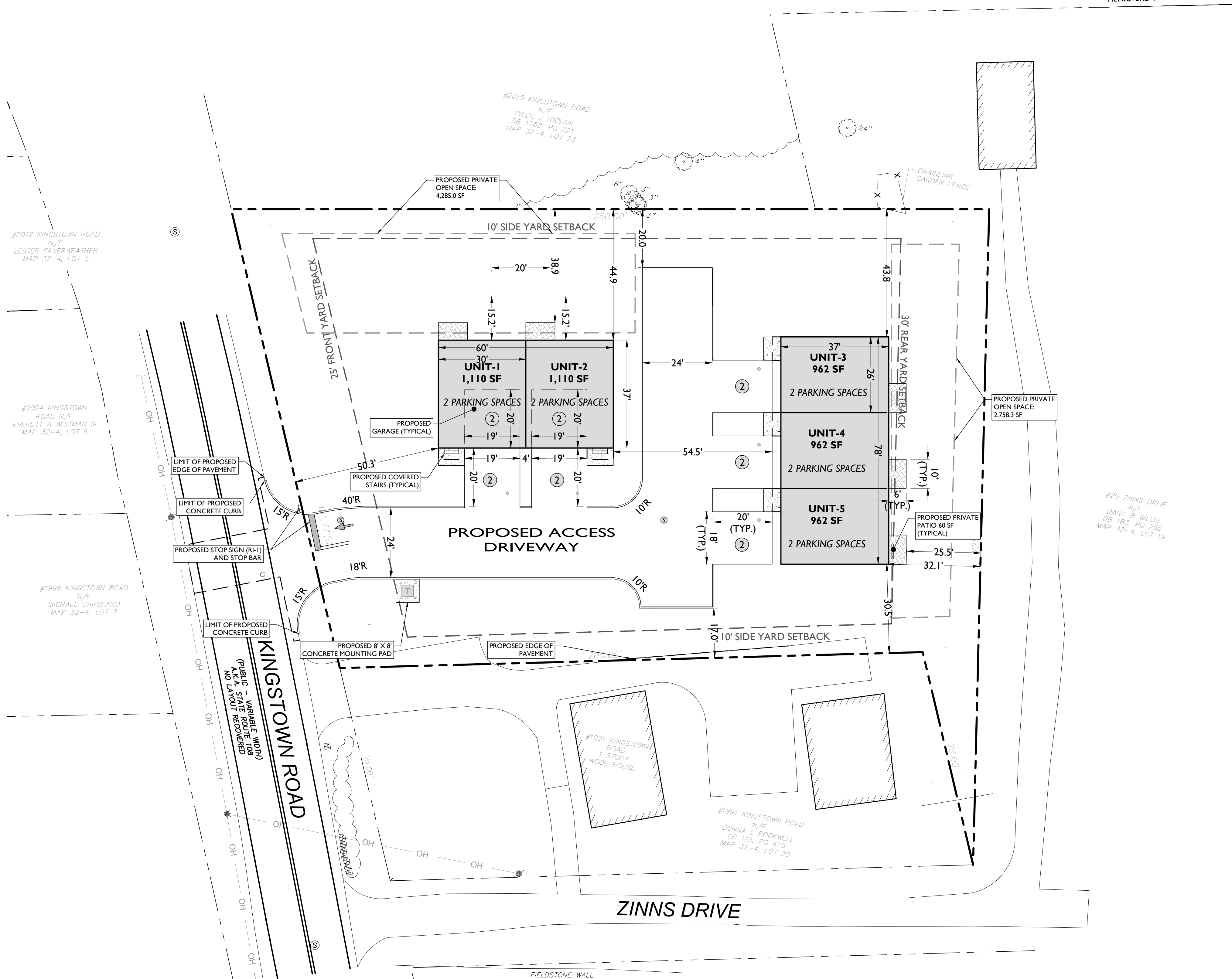


LAND USE AND ZONING			
MAP 32-4, LOT 21			
MIXED USE (MU)			
PROPOSED USE		PERMITTED USE	
MULTI-HOUSEHOLD LAND DEVELOPMENT PROJECTS (USE CODE I2.1)			
ZONING REQUIREMENT	REQUIRED	EXISTING	PROPOSED
MINIMUM LOT SIZE & MAXIMUM LOT DENSITY	30,000 SF *	37,736 SF	NO CHANGE
MINIMUM LOT WIDTH AND FRONTAGE	150 FT	159 FT	159 FT
MAXIMUM BUILDING COVERAGE	30%	6%	13.5%
MAXIMUM BUILDING HEIGHT	35 FT	35 FT	< 35 FT
MINIMUM FRONT YARD SETBACK	25 FT	13 FT	50.3 FT
MINIMUM SIDE YARD SETBACK	10 FT	56 FT	30.5 FT
MINIMUM REAR YARD SETBACK	30 FT	151 FT	32.1 FT
MINIMUM DEDICATED OPEN SPACE	10% (3,000 SF)	NOT SPECIFIED	18.7% (7,043.3 SF)

(\*) 15,000 SF FOR THE FIRST 2 D.U.S + 5,000 SF PER EACH ADD'L D.U. 15,000 SF + 3 UNITS (5,000 SF) = 30,000 SF

OFF-STREET PARKING REQUIREMENTS		
CODE SECTION	REQUIRED	PROPOSED
§ 711. A.	REQUIRED PARKING: 2 SPACES PER DWELLING UNIT (2 SPACES X 5 UNITS) = 10 SPACES	14 SPACES

MULTI-HOUSEHOLD LAND DEVELOPMENT PROJECT REQUIREMENTS		
SUBDIVISION AND LAND DEVELOPMENT REGULATIONS		
SECTION H		
ZONING REQUIREMENT	REQUIRED	PROPOSED
#9 BUILDING SEPARATION	50 FT	54.5 FT



SYMBOL	DESCRIPTION
---	PROPERTY LINE
- - - -	SETBACK LINE
---	PROPOSED OPEN SPACE
---	SAWCUT LINE
---	PROPOSED CURB
○	PROPOSED SIGNS / BOLLARDS
▒	PROPOSED BUILDING
▒	PROPOSED CONCRETE
▒	PROPOSED PATIO

- GENERAL NOTES**
- THE CONTRACTOR SHALL VERIFY AND FAMILIARIZE THEMSELVES WITH THE EXISTING SITE CONDITIONS AND THE PROPOSED SCOPE OF WORK (INCLUDING DIMENSIONS, LAYOUT, ETC.) PRIOR TO INITIATING THE IMPROVEMENTS IDENTIFIED WITHIN THESE DOCUMENTS. SHOULD ANY DISCREPANCY BE FOUND BETWEEN THE EXISTING SITE CONDITIONS AND THE PROPOSED WORK, THE CONTRACTOR SHALL NOTIFY STONEFIELD ENGINEERING & DESIGN, LLC PRIOR TO THE START OF CONSTRUCTION.
  - THE CONTRACTOR SHALL OBTAIN ALL NECESSARY PERMITS AND ENSURE THAT ALL REQUIRED APPROVALS HAVE BEEN OBTAINED PRIOR TO THE START OF CONSTRUCTION. COPIES OF ALL REQUIRED PERMITS AND APPROVALS SHALL BE KEPT ON SITE AT ALL TIMES DURING CONSTRUCTION.
  - ALL CONTRACTORS WILL TO THE FULLEST EXTENT PERMITTED BY LAW, INDEMNIFY AND HOLD HARMLESS STONEFIELD ENGINEERING & DESIGN, LLC AND ITS SUB-CONSULTANTS FROM AND AGAINST ANY DAMAGES AND LIABILITIES INCLUDING ATTORNEYS' FEES ARISING OUT OF CLAIMS BY EMPLOYEES OF THE CONTRACTOR IN ADDITION TO CLAIMS CONNECTED TO THE PROJECT AS A RESULT OF NOT CARRYING THE PROPER INSURANCE FOR WORKERS COMPENSATION, LIABILITY INSURANCE, AND LIMITS OF COMMERCIAL GENERAL LIABILITY INSURANCE.
  - THE CONTRACTOR SHALL NOT DEVIATE FROM THE PROPOSED IMPROVEMENTS IDENTIFIED WITHIN THIS PLAN SET UNLESS APPROVAL IS PROVIDED IN WRITING BY STONEFIELD ENGINEERING & DESIGN, LLC.
  - THE CONTRACTOR IS RESPONSIBLE TO DETERMINE THE MEANS AND METHODS OF CONSTRUCTION.
  - THE CONTRACTOR SHALL NOT PERFORM ANY WORK OR CAUSE DISTURBANCE ON A PRIVATE PROPERTY NOT CONTROLLED BY THE PERSON OR ENTITY WHO HAS AUTHORIZED THE WORK WITHOUT PRIOR WRITTEN CONSENT FROM THE OWNER OF THE PRIVATE PROPERTY.
  - THE CONTRACTOR IS RESPONSIBLE TO RESTORE ANY DAMAGED OR UNDERMINED STRUCTURE OR SITE FEATURE THAT IS IDENTIFIED TO REMAIN ON THE PLAN SET. ALL REPAIRS SHALL USE NEW MATERIALS TO RESTORE THE FEATURE TO ITS EXISTING CONDITION AT THE CONTRACTORS EXPENSE.
  - CONTRACTOR IS RESPONSIBLE TO PROVIDE THE APPROPRIATE SHOP DRAWINGS, PRODUCT DATA, AND OTHER REQUIRED SUBMITTALS FOR REVIEW. STONEFIELD ENGINEERING & DESIGN, LLC WILL REVIEW THE SUBMITTALS IN ACCORDANCE WITH THE DESIGN INTENT AS REFLECTED WITHIN THE PLAN SET.
  - THE CONTRACTOR IS RESPONSIBLE FOR TRAFFIC CONTROL IN ACCORDANCE WITH MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES, LATEST EDITION.
  - THE CONTRACTOR IS REQUIRED TO PERFORM ALL WORK IN THE PUBLIC RIGHT-OF-WAY IN ACCORDANCE WITH THE APPROPRIATE GOVERNING AUTHORITY AND SHALL BE RESPONSIBLE FOR THE PROCUREMENT OF STREET OPENING PERMITS.
  - THE CONTRACTOR IS REQUIRED TO RETAIN AN OSHA CERTIFIED SAFETY INSPECTOR TO BE PRESENT ON SITE AT ALL TIMES DURING CONSTRUCTION & DEMOLITION ACTIVITIES.
  - SHOULD AN EMPLOYEE OF STONEFIELD ENGINEERING & DESIGN, LLC BE PRESENT ON SITE AT ANY TIME DURING CONSTRUCTION, IT DOES NOT RELIEVE THE CONTRACTOR OF ANY OF THE RESPONSIBILITIES AND REQUIREMENTS LISTED IN THE NOTES WITHIN THIS PLAN SET.
  - NO ADDITIONAL SURVEY OR OPEN SPACE MONUMENTATION PROPOSED.

NO.	DATE	ISSUE	BY	DESCRIPTION
01	03/27/2024	ISSUE	NNS	FOR MUNICIPAL RESUBMISSION
00	12/05/2023	ISSUE	AJD	FOR MUNICIPAL SUBMISSION

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**APPLICANT & OWNER**  
ASHWORTH INVESTMENTS, LLC.  
40 MALBONE STREET  
WARWICK, RHODE ISLAND

**PROPOSED MULTI-HOUSEHOLD LAND DEVELOPMENT PROJECT**  
BLOCK 32-4, LOT 21  
ZONE MU - MIXED USE  
TOWN OF SOUTH KINGSTOWN  
WASHINGTON COUNTY, RHODE ISLAND

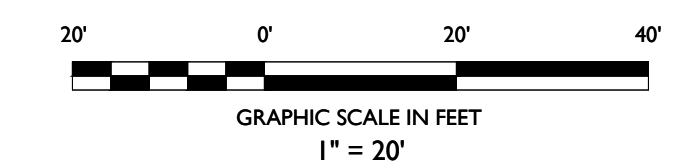
JOSHUA H. KLINE, P.E.  
RHODE ISLAND LICENSE No. 13607  
LICENSED PROFESSIONAL ENGINEER

**STONEFIELD**  
engineering & design

SCALE: 1" = 20' PROJECT ID: BOS-250053

TITLE:  
**SITE PLAN**

DRAWING:  
**C-5**



Z:\PROJECTS\2023\BOS250053\05-1003-HELLY MILLER - 2024 KINGSTOWN ROAD, SOUTH KINGSTOWN, RHODE ISLAND\DWG\SP-01.DWG

**EXCAVATION & UTILITY VERIFICATION NOTE:**  
 PRIOR TO THE START OF CONSTRUCTION (RECOMMENDED 30 DAYS PRIOR) THE CONTRACTOR SHALL PERFORM EXPLORATORY TEST PITS AT LOCATIONS OF UTILITY / DRAINAGE CROSSINGS OR CONNECTIONS WITH EXISTING UTILITY OR STORMWATER INFRASTRUCTURE. THE CONTRACTOR IS RESPONSIBLE TO OBTAIN ANY NECESSARY ROAD OPENING PERMITS TO PERFORM SAID EXPLORATORY WORK. SHOULD A CONFLICT BE DISCOVERED WITH THE INFORMATION CONTAINED WITHIN THESE PLANS THE CONTRACTOR SHALL IMMEDIATELY NOTIFY STONEFIELD ENGINEERING & DESIGN, LLC IN WRITING.

**SANITARY / STORMWATER CONSTRUCTION NOTE:**  
 THE CONTRACTOR SHALL START CONSTRUCTION OF ALL GRAVITY SANITARY AND STORMWATER INFRASTRUCTURE AT THE DOWNSTREAM CONNECTION POINT (E.G. LOWEST INVERT) AND WORK UP GRADIENT.

SYMBOL	DESCRIPTION
---	PROPERTY LINE
100	PROPOSED GRADING CONTOUR
---	PROPOSED GRADING RIDGELINE
☐	PROPOSED STORMWATER STRUCTURES
---	PROPOSED STORMWATER PIPING
○	PROPOSED UNDERGROUND OUTLET STRUCTURE

**DRAINAGE AND UTILITY NOTES**

- THE CONTRACTOR TO PERFORM A TEST PIT PRIOR TO CONSTRUCTION (RECOMMEND 30 DAYS PRIOR) AT LOCATIONS OF EXISTING UTILITY CROSSINGS FOR STORMWATER IMPROVEMENTS. SHOULD A CONFLICT EXIST, THE CONTRACTOR SHALL IMMEDIATELY NOTIFY STONEFIELD ENGINEERING & DESIGN, LLC IN WRITING. CONTRACTOR SHALL START CONSTRUCTION OF STORM LINES AT THE LOWEST INVERT AND WORK UP GRADIENT.
- THE CONTRACTOR IS REQUIRED TO CALL THE APPROPRIATE AUTHORITY FOR NOTICE OF CONSTRUCTION EXCAVATION AND UTILITY MARK OUT PRIOR TO THE START OF CONSTRUCTION IN ACCORDANCE WITH STATE LAW. CONTRACTOR IS REQUIRED TO CONFIRM THE HORIZONTAL AND VERTICAL LOCATION OF UTILITIES IN THE FIELD. SHOULD A DISCREPANCY EXIST BETWEEN THE FIELD LOCATION OF A UTILITY AND THE LOCATION SHOWN ON THE PLAN SET OR SURVEY, THE CONTRACTOR SHALL NOTIFY STONEFIELD ENGINEERING & DESIGN, LLC IMMEDIATELY IN WRITING.
- THE CONTRACTOR IS RESPONSIBLE TO MAINTAIN A RECORD OF THE AS-BUILT LOCATIONS OF ALL PROPOSED UNDERGROUND INFRASTRUCTURE. THE CONTRACTOR SHALL NOTE ANY DISCREPANCIES BETWEEN THE AS-BUILT LOCATIONS AND THE LOCATIONS DEPICTED WITHIN THE PLAN SET. THIS RECORD SHALL BE PROVIDED TO THE OWNER FOLLOWING COMPLETION OF WORK.

**EXCAVATION, SOIL PREPARATION, AND DEWATERING NOTES**

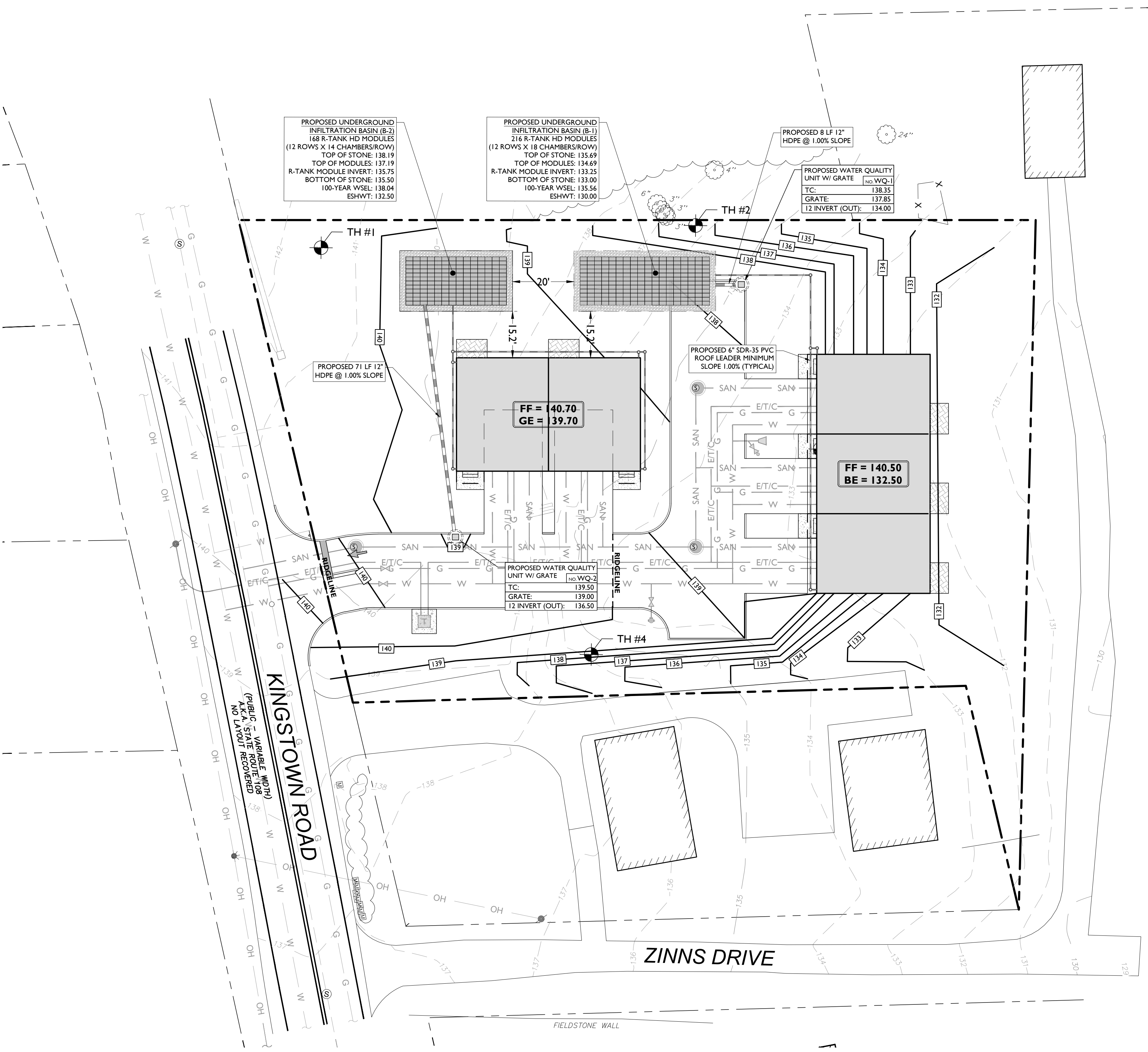
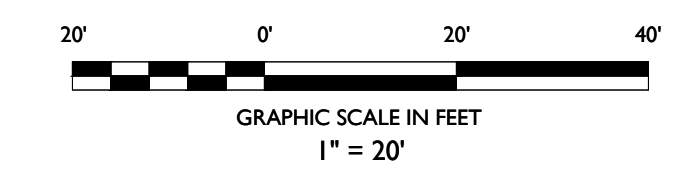
- THE CONTRACTOR IS REQUIRED TO REVIEW THE REFERENCED GEOTECHNICAL DOCUMENTS PRIOR TO CONSTRUCTION. THESE DOCUMENTS SHALL BE CONSIDERED A PART OF THE PLAN SET.
- THE CONTRACTOR IS REQUIRED TO PREPARE SUBGRADE SOILS BENEATH ALL PROPOSED IMPROVEMENTS AND BACKFILL ALL EXCAVATIONS IN ACCORDANCE WITH RECOMMENDATIONS BY THE GEOTECHNICAL ENGINEER OF RECORD.
- THE CONTRACTOR IS RESPONSIBLE FOR PROVIDING SHORING FOR ALL EXCAVATIONS AS REQUIRED. CONTRACTOR SHALL HAVE THE SHORING DESIGN PREPARED BY A QUALIFIED PROFESSIONAL SHORING DESIGNER. THE CONTRACTOR SHALL OBTAIN ANY REQUIRED PERMITS FOR DEWATERING OPERATIONS AND GROUNDWATER DISPOSAL.
- THE CONTRACTOR IS RESPONSIBLE FOR ENSURING THAT ALL OPEN EXCAVATIONS ARE PERFORMED AND PROTECTED IN ACCORDANCE WITH THE LATEST OSHA REGULATIONS.
- THE CONTRACTOR IS RESPONSIBLE FOR ANY DEWATERING DESIGN AND OPERATIONS, AS REQUIRED, TO CONSTRUCT THE PROPOSED IMPROVEMENTS. THE CONTRACTOR SHALL OBTAIN ANY REQUIRED PERMITS FOR DEWATERING OPERATIONS AND GROUNDWATER DISPOSAL.

**STORMWATER INFILTRATION BMP CONSTRUCTION NOTES**

- PRIOR TO THE START OF CONSTRUCTION, ANY AREA DESIGNATED TO BE USED FOR AN INFILTRATION BMP (BIOTENTION AREA, ETC.) SHALL BE FENCED OFF AND SHALL NOT BE UTILIZED AS STORAGE FOR CONSTRUCTION EQUIPMENT OR AS A STOCKPILE AREA FOR CONSTRUCTION MATERIALS. NO ACTIVITY SHALL BE PERMITTED WITHIN THE INFILTRATION BASIN AREA UNLESS RELATED TO THE CONSTRUCTION OF THE INFILTRATION BASIN. IT IS THE RESPONSIBILITY OF THE CONTRACTOR TO NOTIFY ALL SUBCONTRACTORS OF BASIN AREA RESTRICTIONS.
- THE CONTRACTOR SHALL MAKE EVERY EFFORT, WHERE PRACTICAL, TO AVOID SUBGRADE SOIL COMPACTION IN THE AREAS DESIGNATED TO BE USED FOR AN INFILTRATION BMP.
- ALL EXCAVATION WITHIN THE LIMITS OF ANY INFILTRATION BMP SHALL BE PERFORMED WITH THE LIGHTEST PRACTICAL EXCAVATION EQUIPMENT. ALL EXCAVATION EQUIPMENT SHALL BE PLACED OUTSIDE THE LIMITS OF THE BASIN WHERE FEASIBLE. THE USE OF LIGHT-WEIGHT, RUBBER-TIRED EQUIPMENT (LESS THAN 8 PSI APPLIED TO THE GROUND SURFACE) IS RECOMMENDED WITHIN THE BASIN LIMITS.
- THE SEQUENCE OF SITE CONSTRUCTION SHALL BE COORDINATED WITH BASIN CONSTRUCTION TO ADHERE TO SEQUENCING LIMITATIONS.
- DURING THE FINAL GRADING OF AN INFILTRATION BASIN, THE BOTTOM OF THE BASIN SHALL BE DEEPLY TILLED WITH A ROTARY TILLER OR DISC HARROW AND THEN SMOOTHED OUT WITH A LEVELING DRAW OR EQUIVALENT GRADING EQUIPMENT. ALL GRADING EQUIPMENT SHALL BE LOCATED OUTSIDE OF THE BASIN BOTTOM WHERE FEASIBLE.
- FOLLOWING CONSTRUCTION OF AN INFILTRATION BASIN, SOIL INFILTRATION TESTING BY A LICENSED GEOTECHNICAL ENGINEER IS REQUIRED TO CERTIFY COMPLIANCE WITH THE DESIGN INFILTRATION RATES. IF THE FIELD INFILTRATION RATES ARE LOWER THAN THE RATE USED DURING DESIGN, THE CONTRACTOR SHALL NOTIFY STONEFIELD ENGINEERING & DESIGN, LLC IN WRITING IMMEDIATELY TO DETERMINE THE APPROPRIATE COURSE OF ACTION.
- THE CONTRACTOR SHALL NOTIFY THE MUNICIPALITY TO DETERMINE IF WITNESS TESTING IS REQUIRED DURING INFILTRATION BASIN EXCAVATION AND/OR SOIL INFILTRATION TESTING.

**STORMWATER UNDERGROUND BMP CONSTRUCTION NOTES**

- THE CONTRACTOR SHALL INSTALL AND BACKFILL THE UNDERGROUND BMP IN ACCORDANCE WITH THE MANUFACTURER'S SPECIFICATIONS.
- UNDERGROUND BASINS SHALL UTILIZE A STONE BACKFILL WITH A MINIMUM VOID RATIO OF 40%.
- NO CONSTRUCTION LOADING OVER UNDERGROUND BASINS IS PERMITTED UNTIL BACKFILL IS COMPLETE PER THE MANUFACTURER'S SPECIFICATIONS. NO VEHICLES SHALL BE STAGED OR OPERATE FROM A FIXED POSITION OVER THE BASIN.



NO.	DATE	ISSUE	BY	DESCRIPTION
01	03/27/2024	FOR MUNICIPAL RESUBMISSION		
00	12/05/2023	FOR MUNICIPAL SUBMISSION		

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**APPLICANT & OWNER**  
 ASHWORTH INVESTMENTS, LLC.  
 40 MALBONE STREET  
 WARWICK, RHODE ISLAND

**PLAN SET CLASSIFICATION**  
 PROPOSED MULTI-HOUSEHOLD LAND DEVELOPMENT PROJECT

BLOCK 32-4, LOT 21  
 ZONE MU - MIXED USE  
 TOWN OF SOUTH KINGSTOWN  
 WASHINGTON COUNTY, RHODE ISLAND

JOSHUA H. KLINE, P.E.  
 RHODE ISLAND LICENSE No. 13607  
 LICENSED PROFESSIONAL ENGINEER

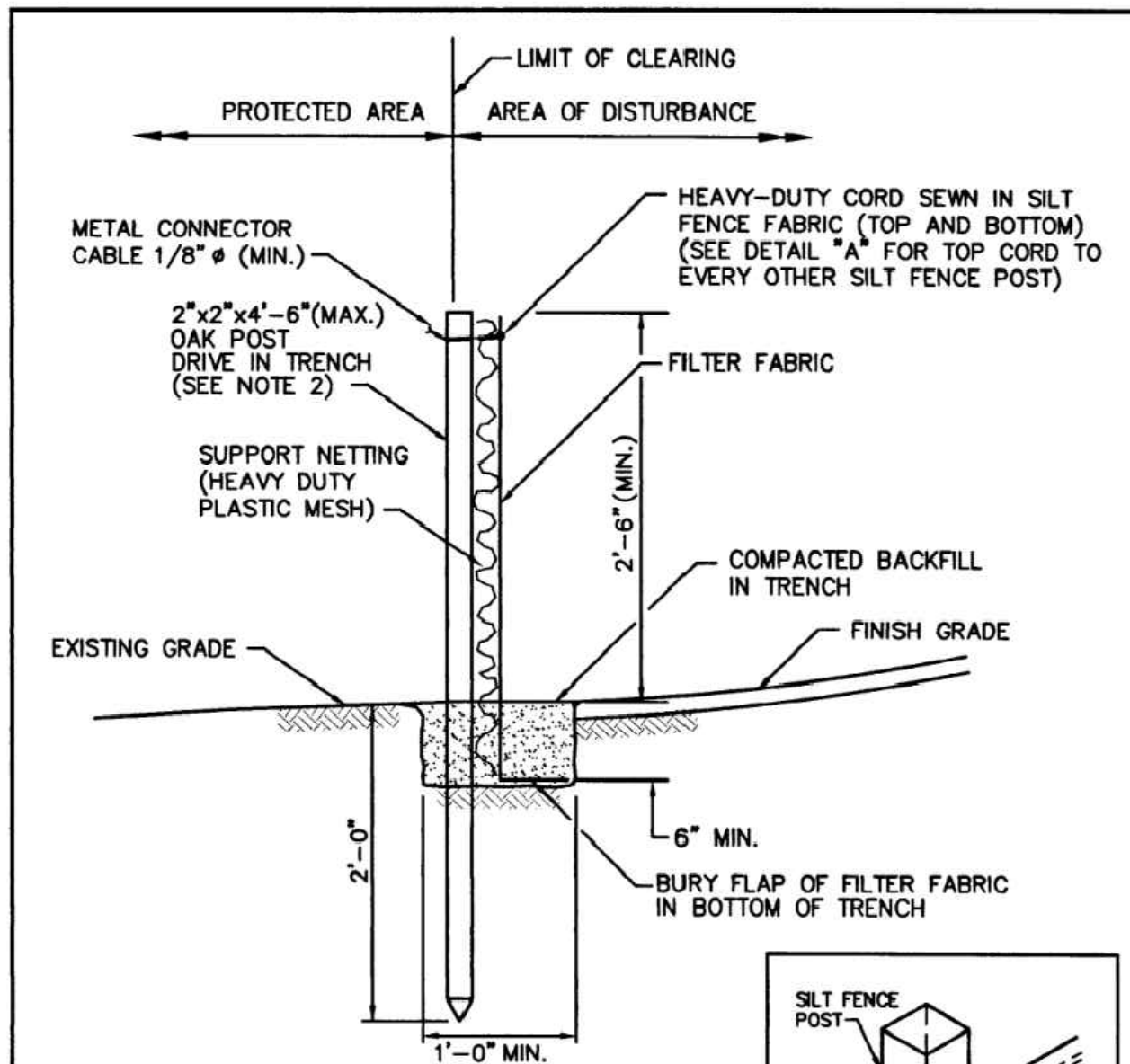
**STONEFIELD**  
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SCALE: 1" = 20' PROJECT ID: BOS-250053

TITLE:  
**STORMWATER MANAGEMENT PLAN**

DRAWING:  
**C-7**





**NOTES:**

- SHALL BE IN ACCORDANCE WITH SECTION 206 OF THE R.I. STANDARD SPECIFICATIONS.
- 2"x2"x4'-6" (MAX.) OAK POSTS FOR SILT FENCE SHALL BE LOCATED 8'-0" (MAX.) O.C. IN WETLAND AREAS AND 4'-0" (MAX.) O.C. IN WETLAND RAVINE, GULLY OR DROP-OFF AREAS AS SHOWN ON PLANS.
- 1"x1"x4'-6" (MIN.) POSTS PERMITTED FOR PRE-FABRICATED SILT FENCE.
- SILT FENCE SHALL BE INSTALLED BEFORE ANY GRUBBING OR EARTH EXCAVATION TAKES PLACE.

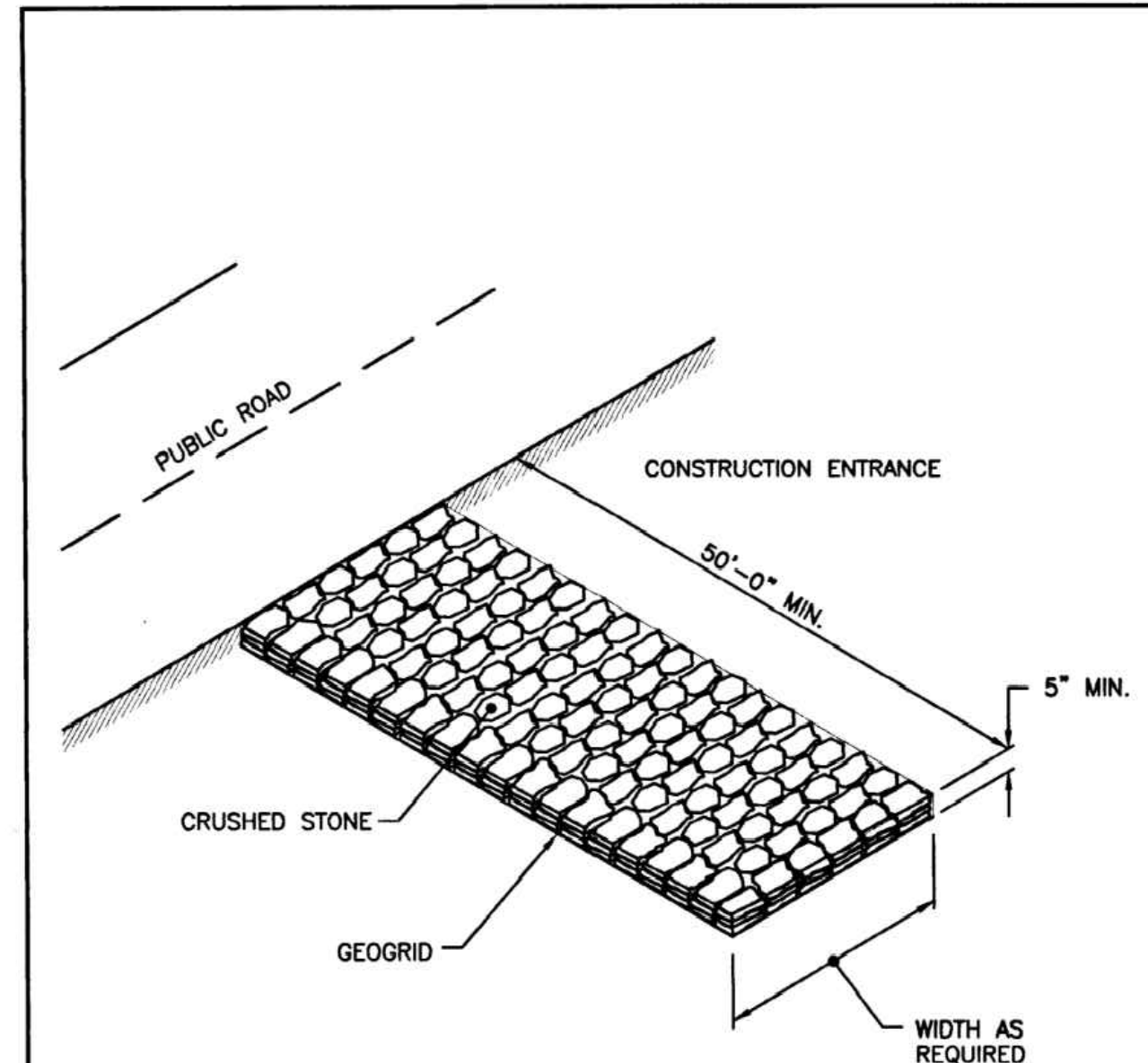
REVISIONS		
NO.	BY	DATE

**RHODE ISLAND DEPARTMENT OF TRANSPORTATION**

**SILT FENCE DETAIL**

R.I. STANDARD  
**9.2.0**

JUNE 15, 1998  
ISSUE DATE



**NOTE:** SHALL BE IN ACCORDANCE WITH SECTION 211 OF THE R.I. STANDARD SPECIFICATIONS.

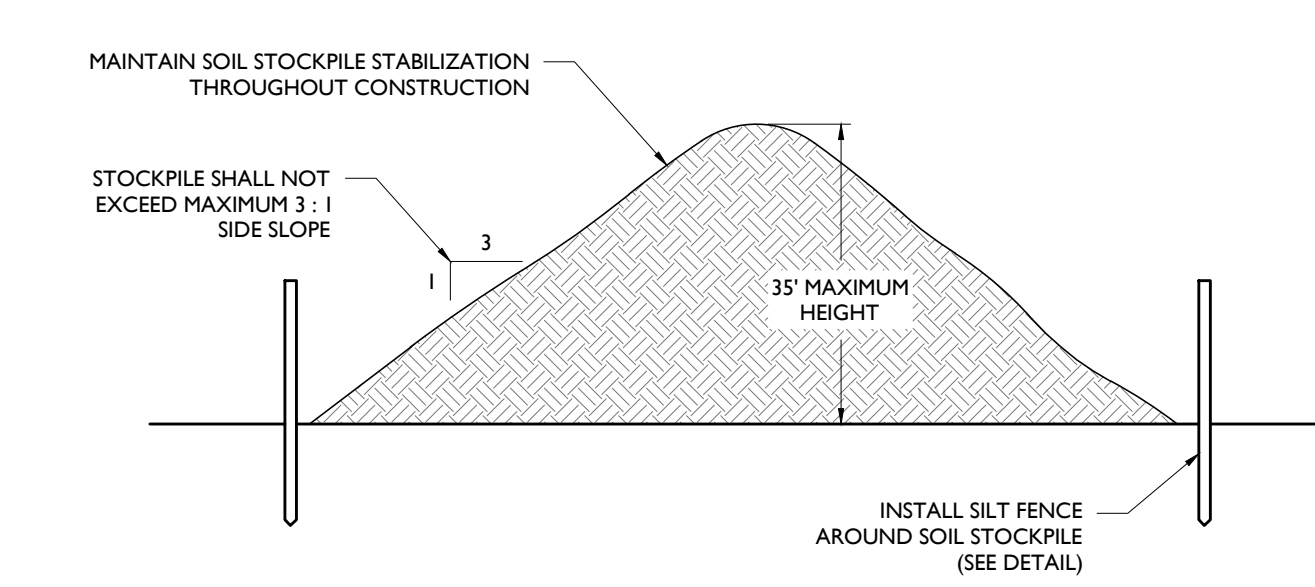
REVISIONS		
NO.	BY	DATE

**RHODE ISLAND DEPARTMENT OF TRANSPORTATION**

**CONSTRUCTION ACCESS**

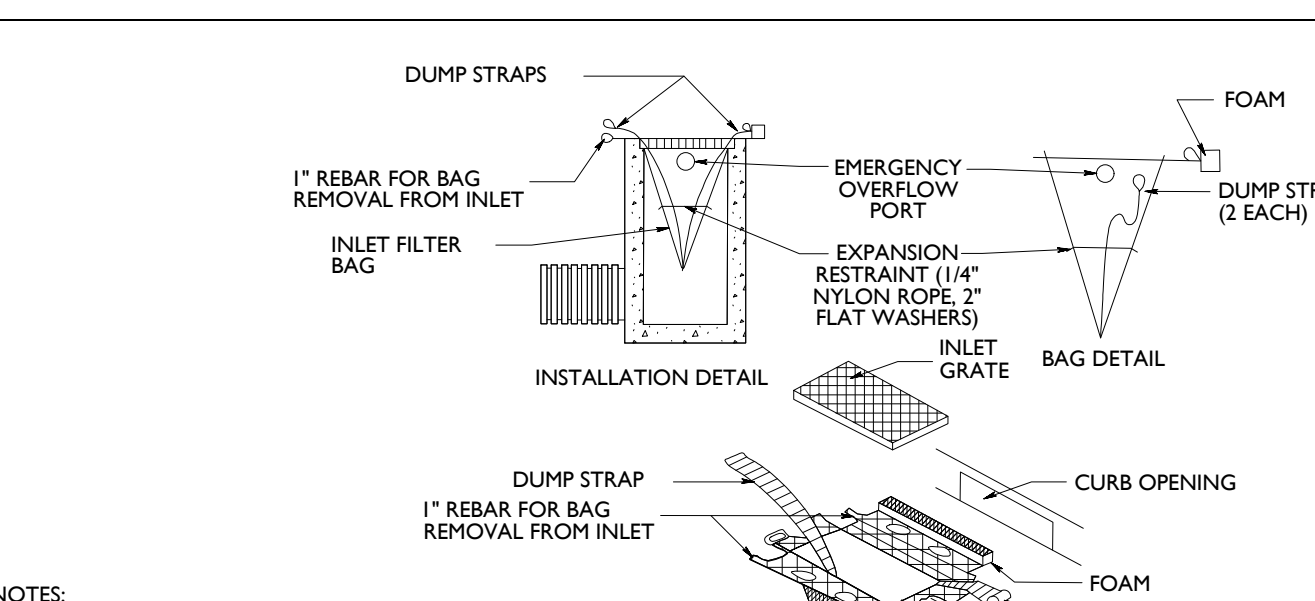
R.I. STANDARD  
**9.9.0**

JUNE 15, 1998  
ISSUE DATE



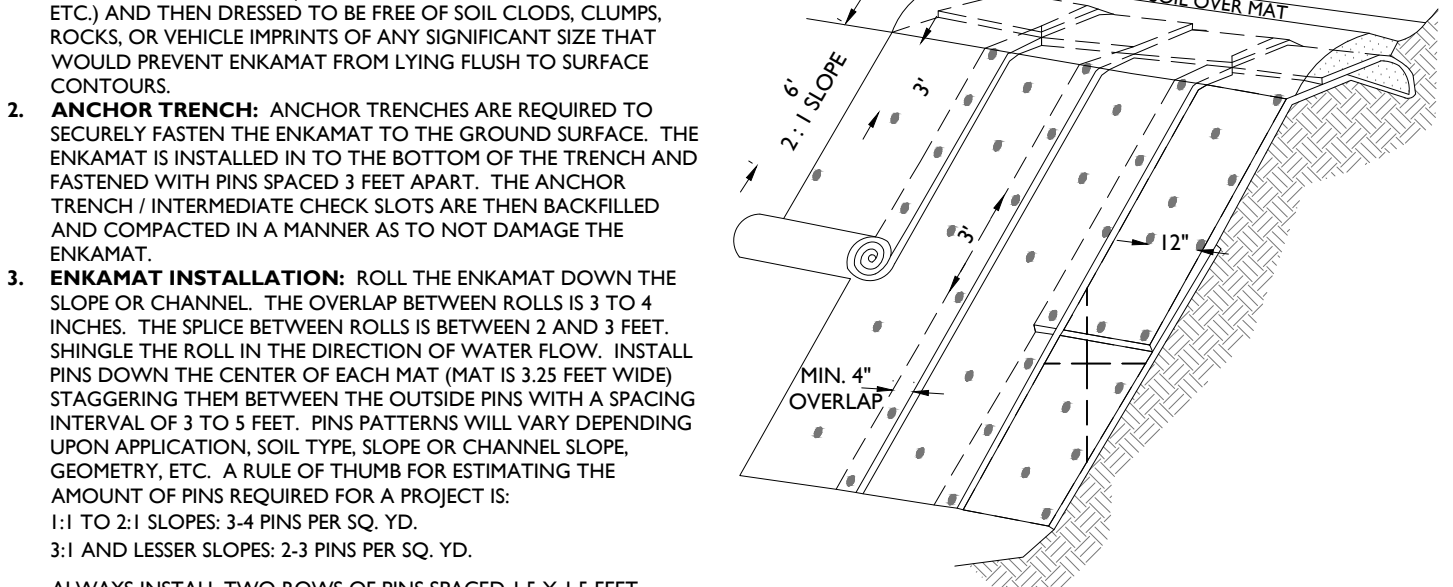
**NOTES:**

- STOCKPILES SHALL BE SITUATED SO AS NOT TO OBSTRUCT NATURAL DRAINAGE OR CAUSE OFF-SITE ENVIRONMENTAL DAMAGE.
- STOCKPILES SHALL BE STABILIZED IN ACCORDANCE WITH THE STANDARDS FOR PERMANENT OR TEMPORARY VEGETATIVE COVER FOR SOIL STABILIZATION, AS APPROPRIATE (SEE SOIL EROSION NOTES).



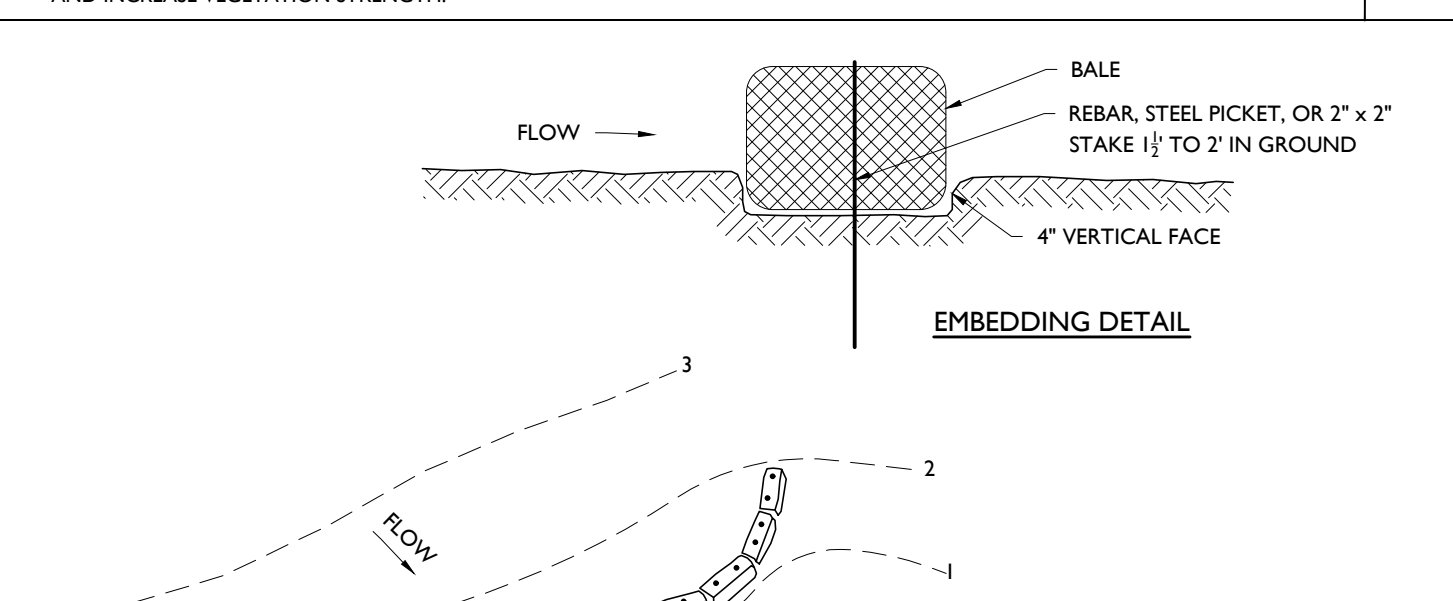
**NOTES:**

- THE FILTER BAG SHALL SAFELY PASS FLOWS GREATER THAN THE 1-YEAR 24-HOUR STORM EVENT.
- SEDIMENT REMOVAL AND MAINTENANCE SHALL BE PERFORMED FREQUENTLY AND AFTER EVERY STORM EVENT.



**NOTES:**

- SITE PREPARATION:** THE SITE MUST BE GRADED TO THE DESIGN SPECIFICATIONS (GRADE, GEOMETRY, DENSITY OF SOIL, ETC.) AND THEN DRESSED TO BE FREE OF SOIL CLODS, CLUMPS, ROCKS, OR VEHICLE IMPRINTS OF ANY SIGNIFICANT SIZE THAT WOULD PREVENT ENKAMAT FROM LYING FLUSH TO SURFACE CONTOURS.
- ANCHOR TRENCH:** ANCHOR TRENCHES ARE REQUIRED TO SECURELY FASTEN THE ENKAMAT TO THE GROUND SURFACE. THE ENKAMAT IS INSTALLED IN TO THE BOTTOM OF THE TRENCH AND FASTENED WITH PINS SPACED 3 FEET APART. THE ANCHOR TRENCH / INTERMEDIATE CHECK SLOTS ARE THEN BACKFILLED AND COMPACTED IN A MANNER AS TO NOT DAMAGE THE ENKAMAT.
- ENKAMAT INSTALLATION:** ROLL THE ENKAMAT DOWN THE SLOPE OR CHANNEL. THE OVERLAP BETWEEN ROLLS IS 3 TO 4 INCHES. THE SPICE BETWEEN ROLLS IS BETWEEN 2 AND 3 FEET. SHINGLE THE ROLL IN THE DIRECTION OF WATER FLOW. INSTALL PINS DOWN THE CENTER OF EACH MAT (MAT IS 3.5 FEET WIDE) STAGGERING THEM BETWEEN THE OUTSIDE PINS WITH A SPACING INTERVAL OF 3 TO 5 FEET. PINS PATTERNS WILL VARY DEPENDING UPON APPLICATION, SOIL TYPE, SLOPE OR CHANNEL SLOPE, GEOMETRY, ETC. A RULE OF THUMB FOR ESTIMATING THE AMOUNT OF PINS REQUIRED FOR A PROJECT IS:  
1:1 TO 2:1 SLOPES: 3-4 PINS PER SQ. YD.  
3:1 AND LESSER SLOPES: 2-3 PINS PER SQ. YD.  
ALWAYS INSTALL TWO ROWS OF PINS SPACED 1.5 X 1.5 FEET APART AT ALL ROLL SPICE LOCATIONS.
- ANCHORING DEVICES:** TYPICALLY 1/8 GAUGE OF A 6" X 1" X 6" METAL PINS ARE USED. WHEN SURFACE SOIL CONDITIONS ARE LOOSE, USE 1" X 1" X 8" OR 1 1/2" X 1 1/2" X 12" METAL PINS. 8" x 1/8" PINS WITH 1.5" DIAMETER WASHER, OR 12-30" J-SHAPE PINS (BENT REBAR) HAVING A 1/2" DIAMETER. DRIVE PINS OR PINS FLUSH WITH THE GROUND SURFACE.
- SEEDING:** FOR NON-SOIL FILLING APPLICATIONS, BROADCAST SEED OR HYDROSEED OVER THE INSTALLED ENKAMAT. MAKE SURE HYDROMULCH OCCURS AFTER SEEDING TO ENSURE THE SEED REACHES THE TOPSOIL. IF SOIL FILLING, SEED AFTER FILLING IS COMPLETED. YOU MAY ALSO SEED BEFORE AND AFTER SOIL FILLING TO CREATE A BETTER ESTABLISHED ROOT STRUCTURE AND INCREASE VEGETATION STRENGTH.



**NOTES:**

- THE HAY BALE SHALL BE SECURELY TIED BALES PLACED ON CONTOUR.
- 2 REBARS, STEEL PICKETS, OR 2" X 2" STAKES 1 1/2' TO 2' IN GROUND.
- ANGLE FIRST STAKE TOWARD PREVIOUSLY LAID BALE.

NO.	BY	DATE	ISSUE	DESCRIPTION
01	NNS	03/27/2026	FOR MUNICIPAL RESUBMISSION	
00	AJD	12/05/2025	FOR MUNICIPAL SUBMISSION	

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Phone 617.203.2076

**APPLICANT & OWNER**  
ASHWORTH INVESTMENTS, LLC.  
40 MALBONE STREET  
WARWICK, RHODE ISLAND

**PLAN SET CLASSIFICATION**  
**PROPOSED MULTI-HOUSEHOLD LAND DEVELOPMENT PROJECT**

BLOCK 32-4, LOT 21  
ZONE MU - MIXED USE  
TOWN OF SOUTH KINGSTOWN  
WASHINGTON COUNTY, RHODE ISLAND

JOSHUA H. KLINE, P.E.  
RHODE ISLAND LICENSE No. 13607  
LICENSED PROFESSIONAL ENGINEER

**STONEFIELD**  
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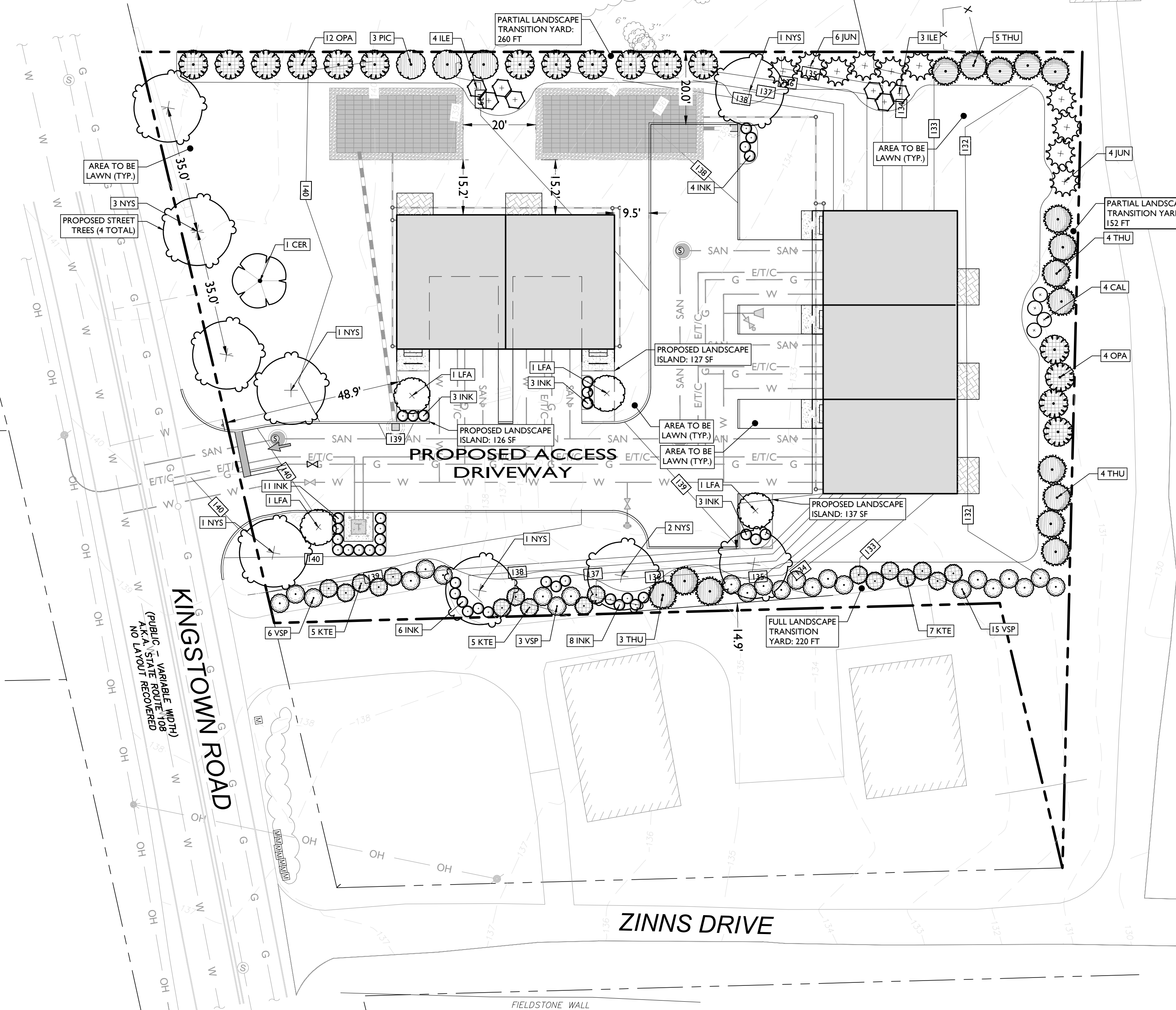
SCALE: 1" = 20' PROJECT ID: BOS-250053

TITLE:  
**SOIL EROSION AND SEDIMENT CONTROL DETAILS**

DRAWING:  
**C-10**

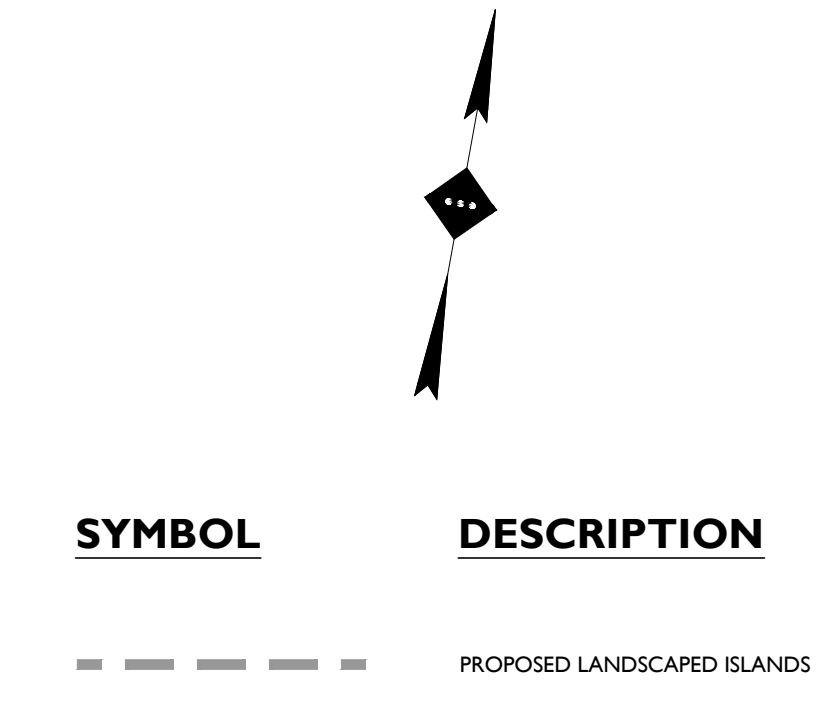
PLANT SCHEDULE						
SYMBOL	CODE	QTY	BOTANICAL NAME	COMMON NAME	SIZE	CONTAINER
DECIDUOUS TREES						
	LFA	4	LIRIODENDRON TULIPIFERA 'FASTIGIATA'	COLUMNAR TULIP POPLAR	1.5" - 2" CAL	B&B
	NYS	9	NYSSA SYLVATICA	SOUR GUM	1.5" - 2" CAL	B&B
EVERGREEN TREES						
	OPA	16	ILEX OPACA	AMERICAN HOLLY	6' - 8' HT	B&B
	JUN	10	JUNIPERUS VIRGINIANA	EASTERN REDCEDAR	6' - 8' HT	B&B
	VSP	24	JUNIPERUS VIRGINIANA 'SPARTAN'	SPARTAN EASTERN REDCEDAR	6' - 8' HT	B&B
	KTE	17	JUNIPERUS VIRGINIANA 'KETELEERI'	KETELEERI EASTERN REDCEDAR	6' - 8' HT	B&B
	PIC	3	PICEA ABIES	NORWAY SPRUCE	6' - 8' HT	B&B
	THU	16	THUJA X 'GREEN GIANT'	GREEN GIANT ARBORVITAE	6' - 8' HT	B&B
ORNAMENTAL TREES						
	CER	1	CERCIS CANADENSIS	EASTERN REDBUD MULTI-TRUNK	1.5" - 2" CAL	B&B
SHRUBS						
	CAL	4	CLETHRA ALNIFOLIA	SUMMERSWEET	18" - 24"	POT
	ILE	7	ILEX VERTICILLATA	WINTERBERRY	18" - 24"	POT
EVERGREEN SHRUBS						
	INK	38	ILEX GLABRA 'COMPACTA'	COMPACT INKBERRY	18" - 24"	POT

NOTE: IF ANY DISCREPANCIES OCCUR BETWEEN AMOUNTS SHOWN ON THE LANDSCAPE PLAN AND WITHIN THE PLANT LIST, THE PLAN SHALL DICTATE.



LANDSCAPING REQUIREMENTS (ZONING ORDINANCE)		
CODE SECTION	REQUIRED	PROPOSED
§ 402.1.2	TRANSITION YARD LANDSCAPING LANDSCAPING SHALL BE REQUIRED WHEN ANY COMMERCIAL ZONING DISTRICT ABUTS A RESIDENTIAL DISTRICT FULL LANDSCAPE SCREEN REQUIRED: MINIMUM WIDTH: 10 FT 8 EVERGREEN TREES AND 2 SHRUBS FOR EVERY 40 LF SOUTH PROPERTY LINE: 220 FT (220 FT) * (8 TREES / 40 FT FRONTAGE) = 44 EVERGREEN TREES (220 FT) * (2 SHRUBS / 40 FT FRONTAGE) = 11 SHRUBS PARTIAL LANDSCAPE SCREEN REQUIRED: MINIMUM WIDTH: 20 FT 4 EVERGREEN TREES AND 1 SHRUB FOR EVERY 40 LF NORTH PROPERTY LINE: 260 FT (260 FT) * (4 EVERGREEN TREES / 40 FT FRONTAGE) = 26 TREES (260 FT) * (1 SHRUB / 40 FT FRONTAGE) = 7 SHRUBS EAST PROPERTY LINE: 152 FT (152 FT) * (4 EVERGREEN TREES / 40 FT FRONTAGE) = 16 TREES (152 FT) * (1 SHRUB / 40 FT FRONTAGE) = 4 SHRUBS	14.9 FT 44 TREES 11 SHRUBS 20.0 FT 26 TREES 7 SHRUBS 16 TREES 4 SHRUBS
§ 505.7.A	PARKING LOT LANDSCAPING LANDSCAPING REQUIRED IN NEW DEVELOPMENT TO IMPROVE COMMUNITY APPEARANCE PARKING LOT LANDSCAPING REQUIRED FOR SCREENING, SHADE, AND DEFINING CIRCULATION	COMPLIES COMPLIES
§ 604E	SITE LANDSCAPING ANY PROPERTY HAVING DIRECT FRONTAGE OF KINGSTOWN ROAD SHALL PROVIDE LANDSCAPING BETWEEN THE STREET R.O.W. AND THE PRINCIPAL BUILDING	COMPLIES

LANDSCAPING REQUIREMENTS (SUBDIVISION & LAND DEVELOPMENT REGULATIONS)		
CODE SECTION	REQUIRED	PROPOSED
§IV.G.2 §IV.G.2.a FIGURE 7.	STREET LANDSCAPING LANDSCAPE STRIP REQUIRED WHERE PARKING ADJOINS A R.O.W. MINIMUM WIDTH: 10 FT PARTIAL LANDSCAPE SCREEN REQUIRED 2 SHADE TREES & 1 ORNAMENTAL TREE FOR EVERY 40 LF PARKING ALONG KINGSTOWN ROAD: 38 FT (38 FT) * (2 TREES / 40 FT FRONTAGE) = 2 SHADE TREES (38 FT) * (1 TREE / 40 FT FRONTAGE) = 1 ORNAMENTAL TREE	48.9 FT 2 TREES 1 TREE
§IV.G.3	PERIMETER PARKING LOT LANDSCAPING PARKING AREAS CONTAINING 5 OR MORE SPACES OR EXCEED 2,500 SF OF PAVED AREA: PERIMETER LANDSCAPE STRIP REQUIRED MINIMUM WIDTH: 10 FT 1 TREE AND 3 SHRUBS FOR EVERY 35 LF OF PERIMETER NORTH PROPERTY LINE: 45 FT (45 FT) * (1 TREE / 35 FT PERIMETER) = 1 TREE (45 FT) * (3 SHRUBS / 35 FT PERIMETER) = 4 SHRUBS SOUTH PROPERTY LINE: 112 FT (112 FT) * (1 TREE / 35 FT PERIMETER) = 3 TREES (112 FT) * (3 SHRUBS / 35 FT PERIMETER) = 10 SHRUBS	NORTH: 20.0 FT SOUTH: 14.9 FT 1 TREE 4 SHRUBS 3 TREES 10 SHRUBS
§IV.G.4 §IV.G.4.4	INTERIOR PARKING LOT LANDSCAPING MINIMUM 5% INTERIOR LANDSCAPING REQUIRED (7,455 SF) * (0.05) = 373 SF MINIMUM LANDSCAPE ISLAND WIDTH: 9 FT 1 TREE & 3 SHRUBS OR GROUND COVER FOR EVERY ISLAND (1 TREE * 3 ISLANDS) = 3 TREES (3 SHRUBS * 3 ISLANDS) = 9 SHRUBS	389 SF (5.2%) COMPLIES 3 TREES 9 SHRUBS
§IV.G.5	BUILDING LANDSCAPING LANDSCAPE STRIP BETWEEN BUILDING AND PARKING AREA REQUIRED MINIMUM LANDSCAPE STRIP WIDTH: 3 FT	COMPLIES
§IV.G.7	TRANSITION YARD LANDSCAPING TRANSITION YARD LANDSCAPING IS REQUIRED WHEN ADJACENT LAND USES ARE INCOMPATIBLE LANDSCAPING SHALL BE REQUIRED WHEN ANY COMMERCIAL ZONING DISTRICT ABUTS A RESIDENTIAL DISTRICT FULL LANDSCAPE SCREEN REQUIRED: MINIMUM WIDTH: 10 FT 8 EVERGREEN TREES AND 2 SHRUBS FOR EVERY 40 LF SOUTH PROPERTY LINE: 220 FT (220 FT) * (8 TREES / 40 FT FRONTAGE) = 44 EVERGREEN TREES (220 FT) * (2 SHRUBS / 40 FT FRONTAGE) = 11 SHRUBS PARTIAL LANDSCAPE SCREEN REQUIRED: MINIMUM WIDTH: 20 FT 4 EVERGREEN TREES AND 1 SHRUB FOR EVERY 40 LF NORTH PROPERTY LINE: 260 FT (260 FT) * (4 EVERGREEN TREES / 40 FT FRONTAGE) = 26 TREES (260 FT) * (1 SHRUB / 40 FT FRONTAGE) = 7 SHRUBS EAST PROPERTY LINE: 152 FT (152 FT) * (4 EVERGREEN TREES / 40 FT FRONTAGE) = 16 TREES (152 FT) * (1 SHRUB / 40 FT FRONTAGE) = 4 SHRUBS	14.9 FT 44 TREES 11 SHRUBS 20.0 FT 26 TREES 7 SHRUBS 16 TREES 4 SHRUBS
§IV.G.8	LANDSCAPED STREET YARDS ANY ZONING DISTRICT HAVING FRONTAGE ON KINGSTOWN ROAD SHALL HAVE A LANDSCAPED STREET YARD	COMPLIES
§XIII.B.13	STREET TREE REQUIREMENTS 1 TREE FOR EVERY 50 LF OF FRONTAGE KINGSTOWN ROAD: 162 FT (162 FT) * (1 TREE / 50 FT FRONTAGE) = 4 TREES	4 TREES



SYMBOL DESCRIPTION  
--- PROPOSED LANDSCAPED ISLANDS

DATE	ISSUE	BY	DESCRIPTION
01/00	00		
03/27/2024	NNS		FOR MUNICIPAL RESUBMISSION
12/05/2023	AJD		FOR MUNICIPAL SUBMISSION

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**APPLICANT & OWNER**  
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WARWICK, RHODE ISLAND

**PROPOSED MULTI-HOUSEHOLD LAND DEVELOPMENT PROJECT**  
BLOCK 32-4, LOT 21  
ZONE HU - MIXED USE  
TOWN OF SOUTH KINGSTOWN  
WASHINGTON COUNTY, RHODE ISLAND

**811**  
Know what's below  
Call before you dig.

- LANDSCAPING NOTES**
- THE CONTRACTOR SHALL RESTORE ALL DISTURBED GRASS AND LANDSCAPED AREAS TO MATCH EXISTING CONDITIONS UNLESS INDICATED OTHERWISE WITHIN THE PLAN SET.
  - THE CONTRACTOR SHALL RESTORE ALL DISTURBED LAWN AREAS WITH A MINIMUM 4 INCH LAYER OF TOPSOIL AND SEED.
  - THE CONTRACTOR SHALL RESTORE MULCH AREAS WITH A MINIMUM 3 INCH LAYER OF MULCH.
  - THE MAXIMUM SLOPE ALLOWABLE IN LANDSCAPE RESTORATION AREAS SHALL BE 3 FEET HORIZONTAL TO 1 FOOT VERTICAL (3:1 SLOPE) UNLESS INDICATED OTHERWISE WITHIN THE PLAN SET.
  - THE CONTRACTOR IS REQUIRED TO LOCATE ALL SPRINKLER HEADS IN AREA OF LANDSCAPING DISTURBANCE PRIOR TO CONSTRUCTION. THE CONTRACTOR SHALL RELOCATE SPRINKLER HEADS AND LINES IN ACCORDANCE WITH OWNER'S DIRECTION WITHIN AREAS OF DISTURBANCE.
  - THE CONTRACTOR SHALL ENSURE THAT ALL DISTURBED LANDSCAPED AREAS ARE GRADED TO MEET FLUSH AT THE ELEVATION OF WALKWAYS AND TOP OF CURB ELEVATIONS EXCEPT UNLESS INDICATED OTHERWISE WITHIN THE PLAN SET. NO ABRUPT CHANGES IN GRADE ARE PERMITTED IN DISTURBED LANDSCAPING AREAS.

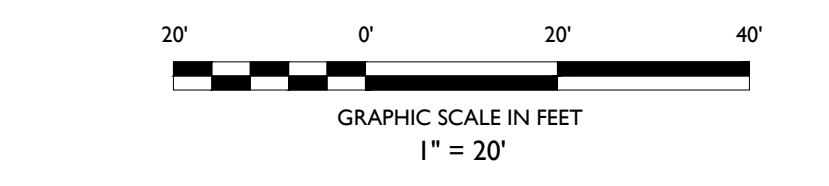
JOSHUA H. KLINE, P.E.  
RHODE ISLAND LICENSE No. 13607  
LICENSED PROFESSIONAL ENGINEER

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SCALE: 1" = 20' PROJECT ID: BOS-250053

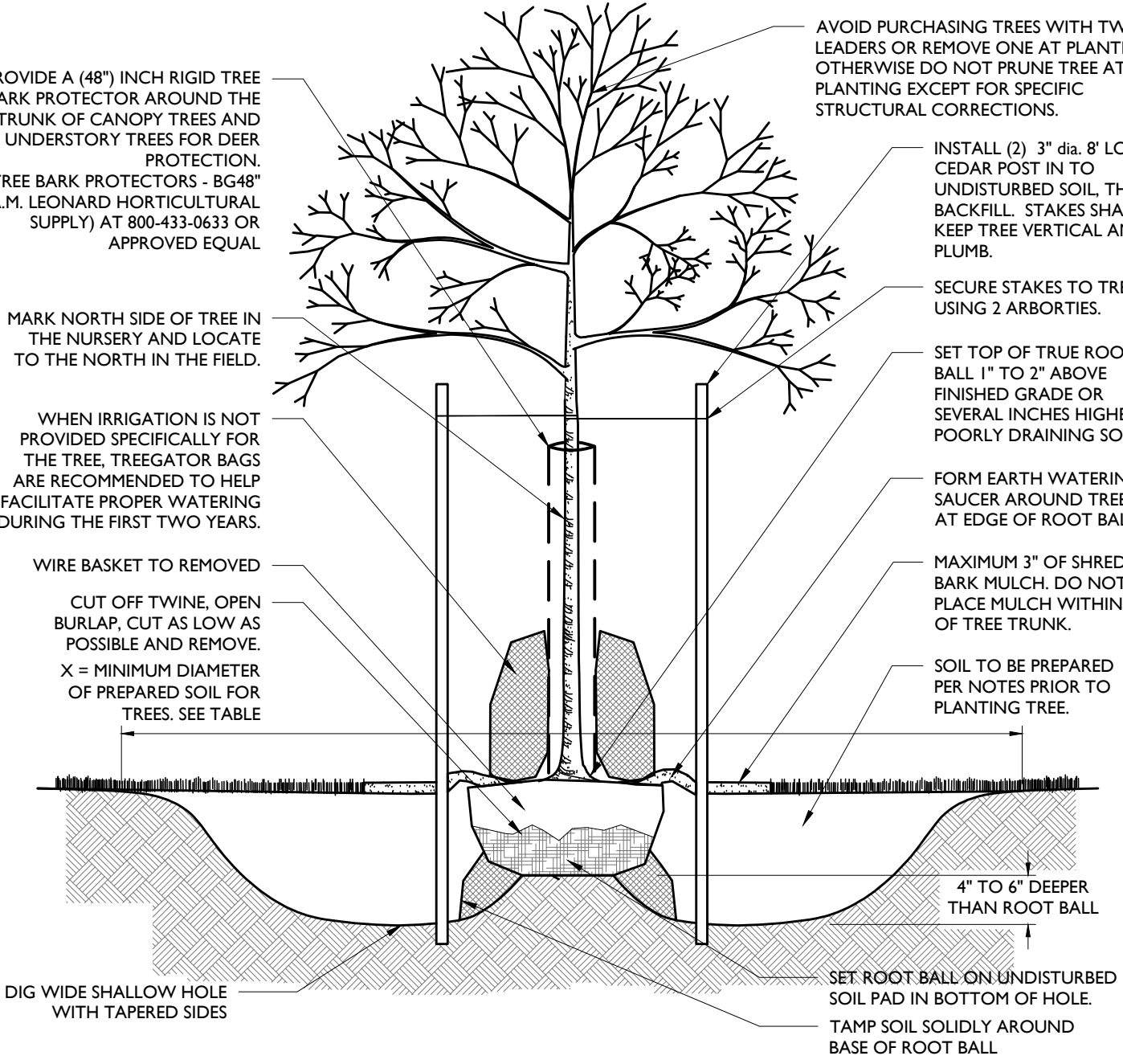
TITLE:  
**LANDSCAPING PLAN**

DRAWING:  
**C-11**



**NOTES:**

- FOR CONTAINER-GROWN TREES, USE FINGERS OR SMALL HAND TOOLS TO PULL THE ROOTS OUT OF THE OUTER LAYER OF POTTING SOIL THEN CUT OR PULL APART ANY ROOTS CIRCLING THE PERIMETER OF THE CONTAINER.
- THOROUGHLY SOAK THE TREE ROOT BALL AND ADJACENT PREPARED SOIL SEVERAL TIMES DURING THE FIRST MONTH AFTER PLANTING AND REGULARLY THROUGHOUT THE FOLLOWING TWO SUMMERS.
- SOIL AMENDMENTS:
  - MODIFY HEAVY CLAY OR SILT SOILS (MORE THAN 40% CLAY OR SILT) BY ADDING COMPOSTED PINE BARK (UP TO 30% BY VOLUME) OR GYPSUM
  - MODIFY EXTREMELY SANDY SOILS (MORE THAN 85% SAND) BY ADDING ORGANIC MATTER AND/OR DRY, SHREDDED CLAY LOAM UP TO 30% OF THE TOTAL MIX

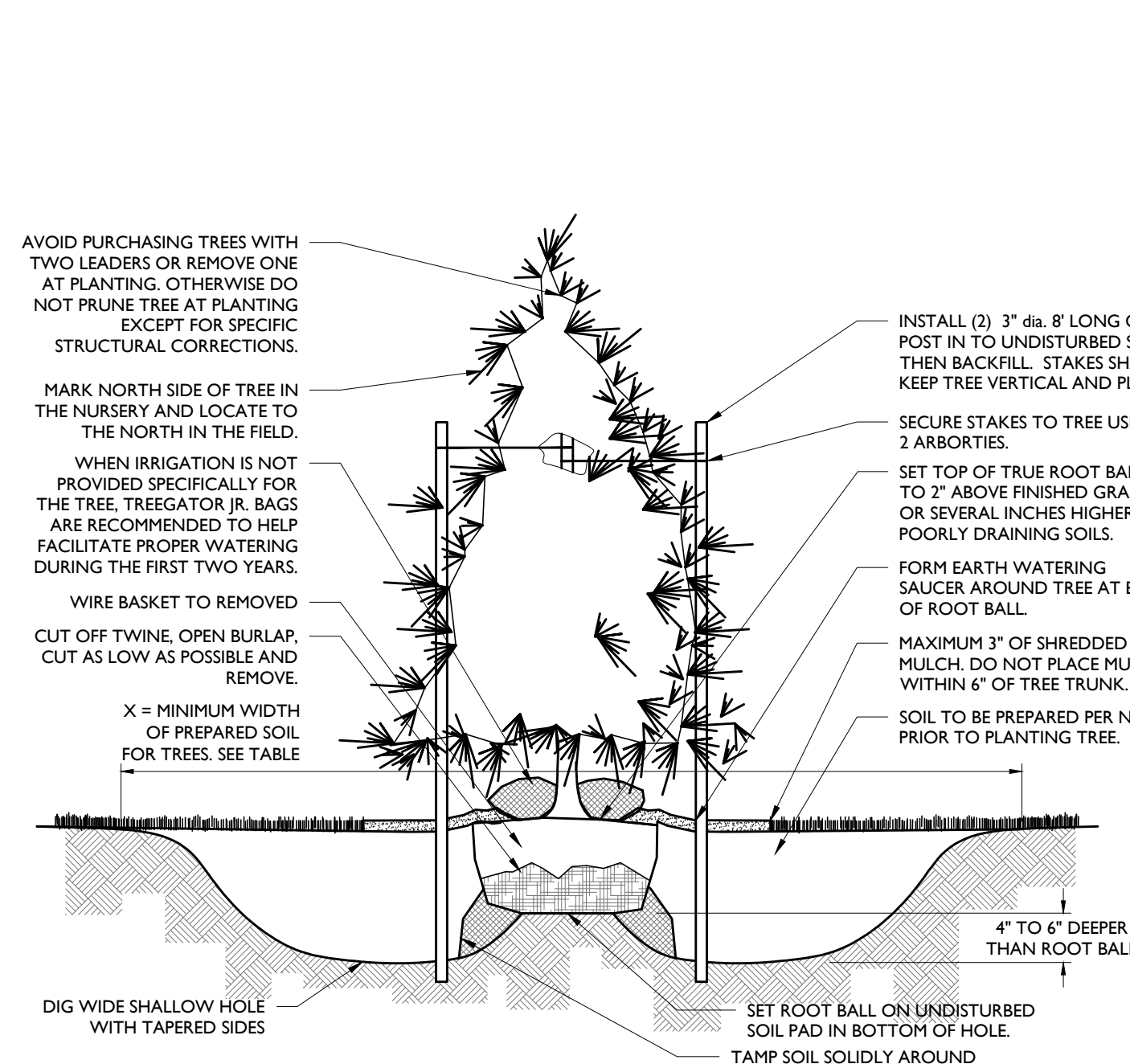


**DECIDUOUS TREE PLANTING DETAIL**

NOT TO SCALE

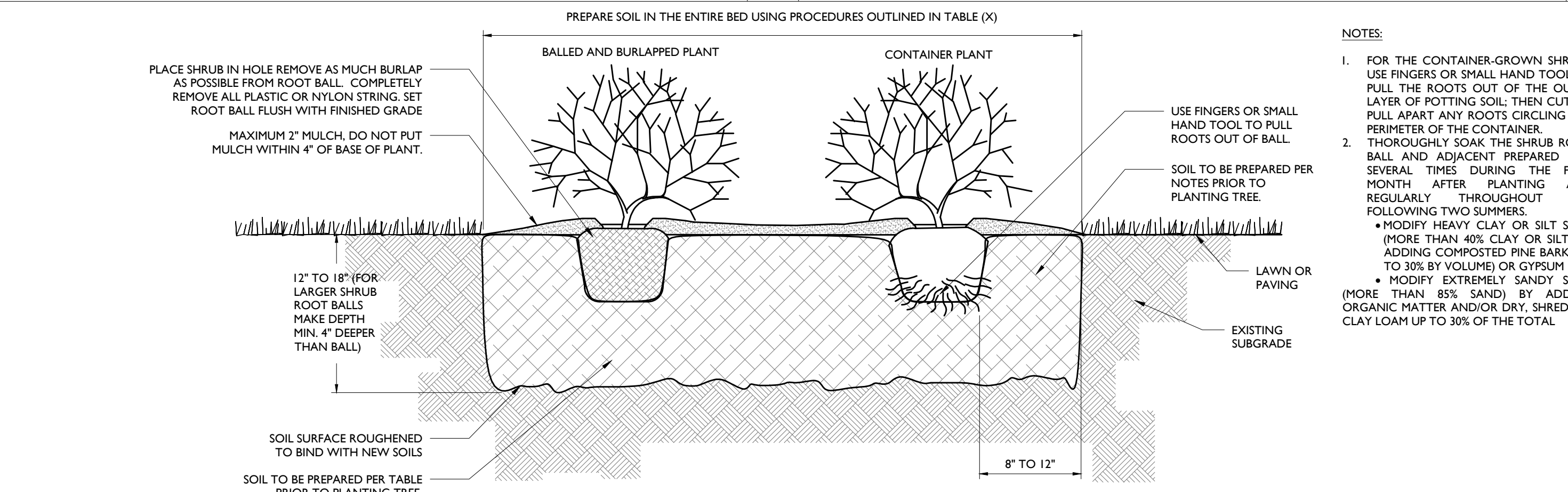
**NOTES:**

- FOR CONTAINER-GROWN TREES, USE FINGERS OR SMALL HAND TOOLS TO PULL THE ROOTS OUT OF THE OUTER LAYER OF POTTING SOIL THEN CUT OR PULL APART ANY ROOTS CIRCLING THE PERIMETER OF THE CONTAINER.
- THOROUGHLY SOAK THE TREE ROOT BALL AND ADJACENT PREPARED SOIL SEVERAL TIMES DURING THE FIRST MONTH AFTER PLANTING AND REGULARLY THROUGHOUT THE FOLLOWING TWO SUMMERS.
- SOIL AMENDMENTS:
  - MODIFY HEAVY CLAY OR SILT SOILS (MORE THAN 40% CLAY OR SILT) BY ADDING COMPOSTED PINE BARK (UP TO 30% BY VOLUME) OR GYPSUM
  - MODIFY EXTREMELY SANDY SOILS (MORE THAN 85% SAND) BY ADDING ORGANIC MATTER AND/OR DRY, SHREDDED CLAY LOAM UP TO 30% OF THE TOTAL MIX



**CONIFEROUS TREE PLANTING DETAIL**

NOT TO SCALE

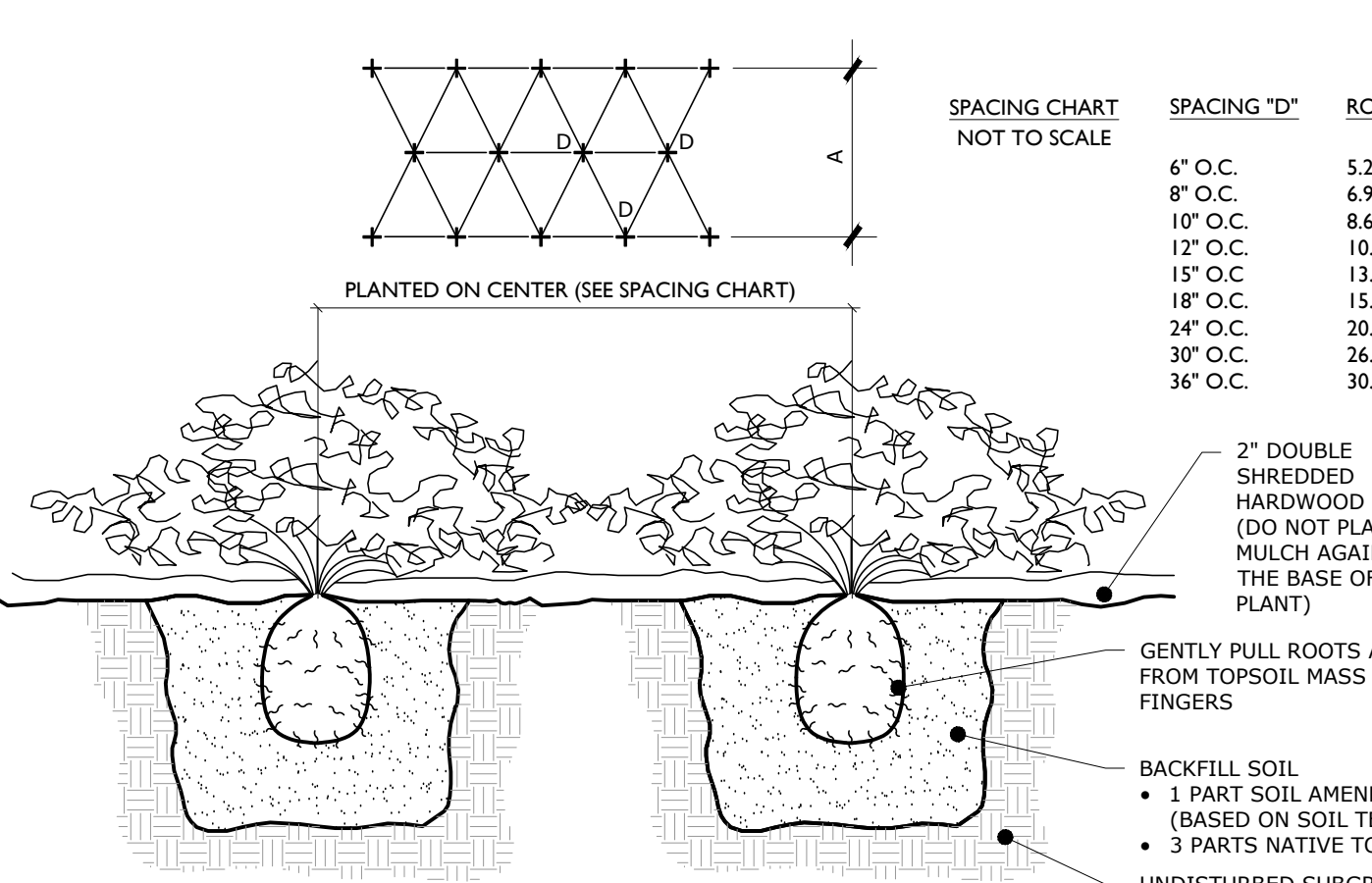


**DECIDUOUS AND EVERGREEN SHRUB PLANTING DETAIL**

NOT TO SCALE

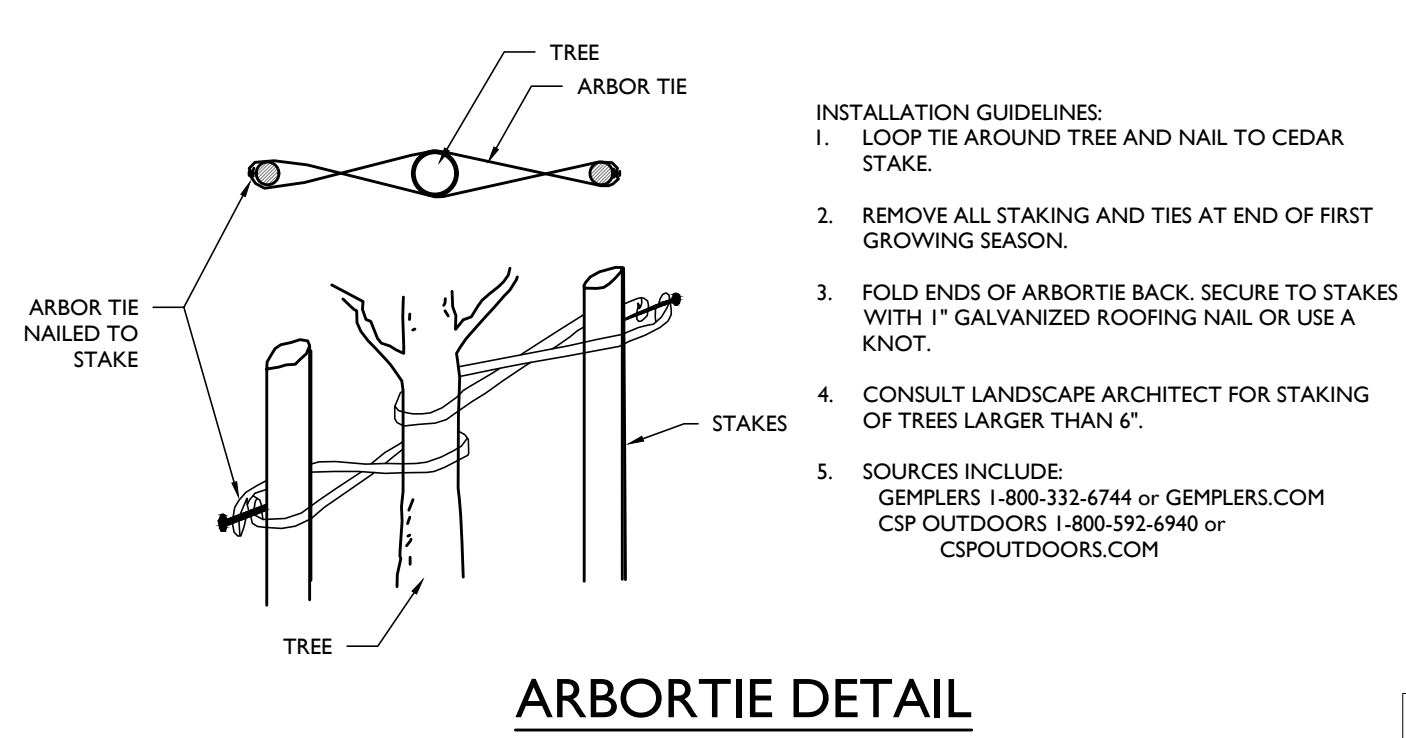
**NOTES:**

- THOROUGHLY SOAK THE GROUND COVER ROOT BALL AND ADJACENT PREPARED SOIL SEVERAL TIMES DURING THE FIRST MONTH AFTER PLANTING AND REGULARLY THROUGHOUT THE FOLLOWING TWO SUMMERS.
- SOIL AMENDMENTS:
  - MODIFY HEAVY CLAY OR SILT SOILS (MORE THAN 40% CLAY OR SILT) BY ADDING COMPOSTED PINE BARK (UP TO 30% BY VOLUME) OR GYPSUM
  - MODIFY EXTREMELY SANDY SOILS (MORE THAN 85% SAND) BY ADDING ORGANIC MATTER AND/OR DRY, SHREDDED CLAY LOAM UP TO 30% OF THE TOTAL MIX
- ALL GROUND COVER AREAS SHALL BE TREATED WITH A PRE-EMERGENT PER MANUFACTURER'S SPECIFICATIONS



**GROUND COVER/PERENNIAL/ANNUAL PLANTING DETAIL**

NOT TO SCALE



**ARBORTIE DETAIL**

NOT TO SCALE

**GENERAL LANDSCAPING NOTES:**

- THE LANDSCAPE CONTRACTOR SHALL FURNISH ALL MATERIALS AND PERFORM ALL WORK IN ACCORDANCE WITH THESE SPECIFICATIONS, APPROVED OR FINAL DRAWINGS, AND INSTRUCTIONS PROVIDED BY THE PROJECT LANDSCAPE DESIGNER, MUNICIPAL OFFICIALS, OR OWNER'S REPRESENTATIVE. ALL WORK COMPLETED AND MATERIALS FURNISHED AND INSTALLED SHALL BE IN ACCORDANCE WITH THE INTENTION OF THE SPECIFICATIONS, DRAWINGS, AND INSTRUCTIONS AND EXECUTED WITH THE STANDARD LEVEL OF CARE FOR THE LANDSCAPE INDUSTRY.
- WORK MUST BE CARRIED OUT ONLY DURING WEATHER CONDITIONS FAVORABLE TO LANDSCAPE CONSTRUCTION AND TO THE HEALTH AND WELFARE OF PLANTS. THE SUITABILITY OF SUCH WEATHER CONDITIONS SHALL BE DETERMINED BY THE PROJECT LANDSCAPE DESIGNER OR GOVERNING MUNICIPAL OFFICIAL.
- IT IS THE RESPONSIBILITY OF THE LANDSCAPE CONTRACTOR, BEFORE ORDERING OR PURCHASING MATERIALS, TO PROVIDE SAMPLES OF THOSE MATERIALS TO THE PROJECT LANDSCAPE DESIGNER OR GOVERNING MUNICIPAL OFFICIAL FOR APPROVAL, IF SO REQUESTED.
- IF SAMPLES ARE REQUESTED, THE LANDSCAPE CONTRACTOR IS TO SUBMIT CERTIFICATION TAGS FROM TREES, SHRUBS AND SEED VERIFYING TYPE AND PURITY.
- UNLESS OTHERWISE AUTHORIZED BY THE PROJECT LANDSCAPE DESIGNER OR GOVERNING MUNICIPAL OFFICIAL, THE LANDSCAPE CONTRACTOR SHALL PROVIDE NOTICE AT LEAST FORTY-EIGHT HOURS (48 HRS) IN ADVANCE OF THE ANTICIPATED DELIVERY DATE OF ANY PLANT MATERIALS TO THE PROJECT SITE. A LEGIBLE COPY OF THE INVOICE, SHOWING VARIETIES AND SIZES OF MATERIALS INCLUDED FOR EACH SPECIFICATION SHALL BE FURNISHED TO THE PROJECT LANDSCAPE DESIGNER, OR GOVERNING MUNICIPAL OFFICIAL.
- THE PROJECT LANDSCAPE DESIGNER OR GOVERNING MUNICIPAL OFFICIAL RESERVES THE RIGHT TO INSPECT AND REJECT PLANTS AT ANY TIME AND AT ANY PLACE.

**PROTECTION OF EXISTING VEGETATION NOTES:**

- BEFORE COMMENCING WORK, ALL EXISTING VEGETATION WHICH COULD BE IMPACTED AS A RESULT OF THE PROPOSED CONSTRUCTION ACTIVITIES MUST BE PROTECTED FROM DAMAGE BY THE INSTALLATION OF TREE PROTECTION FENCING. FENCING SHALL BE LOCATED AT THE DRAIN-LINE OR LIMIT OF DISTURBANCE AS DEPICTED WITHIN THE APPROVED OR FINAL PLAN SET, ESTABLISHING THE TREE PROTECTION ZONE. FENCE INSTALLATION SHALL BE IN ACCORDANCE WITH THE PROVIDED TREE PROTECTION PLAN. NO WORK MAY BEGIN UNTIL THE REQUIREMENT IS FULFILLED. THE FENCING SHALL BE INSPECTED REGULARLY BY THE LANDSCAPE CONTRACTOR AND MAINTAINED UNTIL ALL CONSTRUCTION ACTIVITIES HAVE BEEN COMPLETED.
- IN ORDER TO AVOID DAMAGE TO ROOTS, BARK OR LOWER BRANCHES, NO VEHICLE EQUIPMENT, DEBRIS, OR OTHER MATERIALS SHALL BE DRIVEN, PARKED OR PLACED WITHIN THE TREE PROTECTION ZONE. ALL ON-SITE CONTRACTORS SHALL USE ANY AND ALL PRECAUTIONARY MEASURES WHEN PERFORMING WORK AROUND TREES, WALKS, PAVEMENTS, UTILITIES, AND ANY OTHER FEATURES EITHER EXISTING OR PREVIOUSLY INSTALLED UNDER THIS CONTRACT.
- IN RARE INSTANCES WHERE EXCAVATING, FILL, OR GRADING IS REQUIRED WITHIN THE DRAIN-LINE OF TREES TO REMAIN, THE WORK SHALL BE PERFORMED AS FOLLOWS:
  - TRENCHING: WHEN TRENCHING OCCURS AROUND TREES TO REMAIN, THE TREE ROOTS SHALL NOT BE CUT, BUT THE TRENCH SHALL BE TUNNELED UNDER OR AROUND THE ROOTS BY CAREFUL HAND DIGGING AND WITHOUT INJURY TO THE ROOTS. NO ROOTS, LIMBS, OR WOODS ARE TO HAVE ANY PAINT OR MATERIAL APPLIED TO ANY SURFACE.
  - RAISING GRADES: WHEN THE GRADE AT AN EXISTING TREE IS BELOW THE NEW FINISHED GRADE, AND FILL NOT EXCEEDING 6 INCHES (6") IS REQUIRED, CLEAN, WASHED GRAVEL FROM ONE TO TWO INCHES (1" - 2") IN SIZE SHALL BE PLACED DIRECTLY AROUND THE TREE TRUNK. THE GRAVEL SHALL EXTEND OUT FROM THE TRUNK ON ALL SIDES A MINIMUM OF 18 INCHES (18") APPROXIMATELY AND BE COVERED WITH A FINISHED GRADE AT TREE. IF MORE GRAVEL IS REQUIRED BEFORE ANY EARTH FILL IS PLACED, NEW EARTH FILL SHALL NOT BE LEFT IN CONTACT WITH THE TRUNK OF ANY TREE REQUIRING FILL. WHERE FILL EXCEEDING 6 INCHES (6") IS REQUIRED, A DRY LAID TREE WALL SHALL BE CONSTRUCTED. IF APPLICABLE, TREE WELL INSTALLATION SHALL BE IN ACCORDANCE WITH THE PROVIDED "TREE WELL DETAIL."
  - LOWERING GRADES: EXISTING TREES LOCATED IN AREAS WHERE THE NEW FINISHED GRADE IS TO BE LOWERED, SHALL HAVE RE-GRADING WORK DONE BY HAND TO THE INDICATED ELEVATION, NO GREATER THAN SIX INCHES (6"). ROOTS SHALL BE CUT CLEANLY THREE INCHES (3") BELOW FINISHED GRADE UNDER THE DIRECTION OF A LICENSED ARBORIST. WHERE CUT EXCEEDING 6 INCHES (6") IS REQUIRED, A DRY LAID RETAINING WALL SHALL BE CONSTRUCTED. IF APPLICABLE, THE RETAINING WALL INSTALLATION SHALL BE IN ACCORDANCE WITH THE PROVIDED "TREE RETAINING WALL DETAIL."

**SOIL PREPARATION AND MULCH NOTES:**

- LANDSCAPE CONTRACTOR SHALL OBTAIN A SOIL TEST OF THE IN-SITU TOPSOIL BY A CERTIFIED SOIL LABORATORY PRIOR TO PLANTING. LANDSCAPE CONTRACTOR SHALL ALLOW FOR A TWO WEEK TURNAROUND TIME FROM SUBMITTAL OF SAMPLE TO NOTIFICATION OF RESULTS.
- BASED ON SOIL TEST RESULTS, ADJUST THE RATES OF LIME AND FERTILIZER THAT SHALL BE MIXED INTO THE TOP SIX INCHES (6") OF TOPSOIL. THE LIME AND FERTILIZER RATES PROVIDED WITHIN THE "SOIL SPECIFICATION" OR "SOIL SPECIFICATION" IS APPROXIMATE AND FOR BIDDING PURPOSES ONLY. IF ADDITIONAL AMENDMENTS ARE NECESSARY, ADJUST THE TOPSOIL AS FOLLOWS:
  - MODIFY HEAVY CLAY OR SILT SOILS (MORE THAN 40% CLAY OR SILT) BY ADDING COMPOSTED PINE BARK (UP TO 30% BY VOLUME) OR GYPSUM.
  - MODIFY EXTREMELY SANDY SOILS (MORE THAN 85% SAND) BY ADDING ORGANIC MATTER AND/OR DRY, SHREDDED CLAY LOAM UP TO 30% OF THE TOTAL MIX.
- TOPSOIL SHALL BE FERTILE, FRIABLE, NATURAL, TOPSOIL OF LOAMING CHARACTER, WITHOUT ADMIXTURE OF SUBSOIL MATERIAL OBTAINED FROM A WASHED OR DRAINABLE SITE, FREE FROM ALL CLAY, LUMPS, COARSE SANDS, STONES, PEBBLES, ROOTS, STICKS, AND OTHER FOREIGN MATERIAL GREATER THAN ONE INCH (1").
- TOPSOIL SHALL HAVE A PH RANGE OF 5.0-7.0 AND SHALL NOT CONTAIN LESS THAN 6% ORGANIC MATTER BY WEIGHT.
- OBTAIN TOPSOIL ONLY FROM LOCAL SOURCES OR FROM AREAS HAVING SIMILAR SOIL CHARACTERISTICS TO THAT FOUND AT THE PROJECT SITE.
- CONTRACTOR SHALL PROVIDE A SIX INCH (6") DEEP LAYER OF TOPSOIL IN ALL PLANTING AREAS. TOPSOIL SHALL BE SPREAD OVER A PREPARED SURFACE IN A UNIFORM LAYER TO ACHIEVE THE DESIRED COMPACTED THICKNESS. THE SPREADING OF TOPSOIL SHALL NOT BE CONDUCTED UNDER MUDDY OR FROZEN SOIL CONDITIONS.
- UNLESS OTHERWISE NOTED IN THE CONTRACT, THE LANDSCAPE CONTRACTOR SHALL BE RESPONSIBLE FOR THE INSTALLATION OF TOPSOIL AND THE ESTABLISHMENT OF FINE-GRADING WITHIN THE DISTURBED AREA OF THE SITE.
- LANDSCAPE CONTRACTOR SHALL VERIFY THAT THE SUB-GRADE ELEVATION MEETS THE FINISHED GRADE ELEVATION (LESS THE REQUIRED TOPSOIL), IN ACCORDANCE WITH THE APPROVED OR FINAL GRADING PLAN.
- ALL LAWN AND PLANTING AREAS SHALL BE GRADED TO A SMOOTH, EVEN AND UNIFORM PLANE WITH NO ABRUPT CHANGE OF SURFACE AS DEPICTED WITHIN THE APPROVED OR FINAL CONSTRUCTION SET UNLESS OTHERWISE DIRECTED BY THE PROJECT LANDSCAPE DESIGNER OR MUNICIPAL OFFICIAL.
- THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROPER SURFACE AND SUBSURFACE PLANT BED DRAINAGE PRIOR TO THE INSTALLATION OF PLANTINGS. IF POOR DRAINAGE CONDITIONS EXIST, CORRECTIVE ACTION SHALL BE TAKEN PRIOR TO INSTALLATION. ALL PLANTING AND LAWN AREAS SHALL BE GRADED AND MAINTAINED TO ALLOW A FREE FLOW OF SURFACE WATER.
- DOUBLE SHREDDED HARDWOOD MULCH OR APPROVED EQUAL SHALL BE USED AS A THREE INCH (3") TOP DRESSING IN ALL SHRUB PLANTING BEDS AND AROUND ALL TREES PLANTED BY LANDSCAPE CONTRACTOR. GROUND COVER, PERENNIAL, AND ANNUAL PLANTING BEDS SHALL BE MULCHED WITH A TWO INCH (2") TOP DRESSING. SINGLE TREES OR SHRUBS SHALL BE MULCHED TO AVOID CONTACT WITH TRUNK OR PLANT STEM. MULCH SHALL BE OF SUFFICIENT CHARACTER AS NOT TO BE EASILY DISPLACED BY WIND OR WATER RUNOFF.
- WHENEVER POSSIBLE, THE SOIL PREPARATION AREA SHALL BE CONNECTED FROM PLANTING TO PLANTING.
- SOIL SHALL BE LOOSENED WITH A BACKHOE OR OTHER LARGE COARSE-TILING EQUIPMENT UNLESS THE SOIL IS FROZEN OR EXCESSIVELY WET. TILING THAT PRODUCES LARGE COARSE CHUNKS OF SOIL IS PREFERABLE TO TILING THAT RESULTS IN FINE GRAINS UNIFORM IN TEXTURE. AFTER THE AREA IS LOOSENED IT SHALL NOT BE DRIVEN OVER BY ANY VEHICLE.
- APPLY PRE-EMERGENT WEED CONTROL TO ALL PLANT BEDS PRIOR TO MULCHING. ENSURE COMPATIBILITY BETWEEN PRODUCT AND PLANT MATERIAL.
- ALL PLANTING SOIL SHALL BE AMENDED WITH THE FOLLOWING:
  - MYCROB TREE SAVER - A DRY GRANULAR MYCORRHIZAL FUNGI INOCULANT THAT IS MIXED IN THE BACKFILL WHEN PLANTING TREES AND SHRUBS. IT CONTAINS SPORES OF BOTH ECTOMYCORRHIZAL AND VA MYCORRHIZAL FUNGI (VAM), BENEFICIAL RHIZOSPHERE BACTERIA, TERRA-SORB SUPERABSORBENT HYDROGEL TO REDUCE WATER LEACHING, AND SELECTED ORGANIC MICROBIAL NUTRIENTS.
  - DIRECTIONS FOR USE: USE ONE OZ PER EACH FOOT DIAMETER OF THE ROOT BALL OR 3-OZ PER INCH CALIPER. MIX INTO THE BACKFILL WHEN TRANSPLANTING TREES AND SHRUBS. MIX PRODUCT IN A RING-SHAPED VOLUME OF SOIL AROUND THE UPPER PORTION OF THE ROOT BALL, EXTENDING FROM THE SOIL SURFACE TO A DEPTH OF ABOUT 8 INCHES, AND EXTENDING OUT FROM THE ROOT BALL ABOUT 8 INCHES INTO THE BACKFILL. WATER TO SOIL SATURATION.
  - MYCROB TREE SAVER IS EFFECTIVE FOR ALL TREE AND SHRUB SPECIES EXCEPT RHODODENDRONS, AZALEAS, AND MOUNTAIN LAUREL, WHICH REQUIRE ERICOID MYCORRHIZA.
  - SOIL PH: THE FUNGI IN THIS PRODUCT WERE CHOSEN BASED ON THEIR ABILITY TO SURVIVE AND COLONIZE PLANT ROOTS IN A PH RANGE OF 3 TO 9.
  - FUNGICIDES: THE USE OF CERTAIN FUNGICIDES CAN HAVE A DETRIMENTAL EFFECT ON THE INOCULATION PROGRAM. SOIL APPLICATION OF ANY FUNGICIDE IS NOT RECOMMENDED FOR TWO WEEKS AFTER APPLICATION.
  - OTHER PESTICIDES: HERBICIDES AND INSECTICIDES DO NOT NORMALLY INTERFERE WITH MYCORRHIZAL FUNGAL DEVELOPMENT, BUT MAY INHIBIT THE GROWTH OF SOME TREE AND SHRUB SPECIES IF NOT USED PROPERLY.

**HEALTHY START MACRO TABS 12-8-8**

- FERTILIZER TABLETS ARE PLACED IN THE UPPER 4 INCHES OF BACKFILL SOIL WHEN PLANTING TREES AND SHRUBS.
- TABLETS ARE FORMULATED FOR SLOW RELEASE NUTRIENT DELIVERY AND LAST UP TO 2 YEARS AFTER PLANTING. TABLETS CONTAIN 12-8-8 NPK FERTILIZER, AS WELL AS A MINIMUM OF SEVEN PERCENT (7%) HUMIC ACID BY WEIGHT, MICROBIAL NUTRIENTS DERIVED FROM SEA KELP, PERINYL BYPRODUCTS, AND YUCCA SCHIDIGERA, AND A COMPLEMENT OF BENEFICIAL RHIZOSPHERE BACTERIA. THE STANDARD 21 GRAM TABLET IS SPECIFIED HERE. DIRECTIONS FOR USE: FOR PLANTING BALLED & BURLAPPED (B&B) TREES AND SHRUBS, MEASURE THE THICKNESS OF THE TRUNK, AND USE ABOUT 1 TABLET (21-G) PER HALF-INCH. PLACE THE TABLETS DIRECTLY NEXT TO THE ROOT BALL, EVENLY DISTRIBUTED AROUND ITS PERIMETER, AT A DEPTH OF ABOUT 4 INCHES.

SIZE AT PLANTING	IRRIGATION FOR VITALITY	IRRIGATION FOR SURVIVAL
< 2" CALIPER	DAILY FOR TWO WEEKS, EVERY OTHER DAY FOR TWO MONTHS, WEEKLY UNTIL ESTABLISHED.	TWO TO THREE TIMES WEEKLY FOR TWO TO THREE MONTHS
2"-4" CALIPER	DAILY FOR ONE MONTH, EVERY OTHER DAY FOR THREE MONTHS, WEEKLY UNTIL ESTABLISHED.	TWO TO THREE TIMES WEEKLY FOR THREE TO FOUR MONTHS
4"-6" CALIPER	DAILY FOR SIX WEEKS, EVERY OTHER DAY FOR FIVE MONTHS, WEEKLY UNTIL ESTABLISHED.	TWICE WEEKLY FOR FOUR TO FIVE MONTHS

- TABLE NOTES:**
- AT EACH IRRIGATION, APPLY TWO TO THREE GALLONS PER INCH TRUNK CALIPER TO THE ROOT BALL SURFACE. APPLY IT IN A MANNER SO ALL WATER SOAKS THE ENTIRE ROOT BALL DO NOT WATER IF ROOT BALL IS WET/SATURATED ON THE IRRIGATION DAY.
  - WHEN IRRIGATING FOR VITALITY, DELETE DAILY IRRIGATION WHEN PLANTING IN WINTER OR WHEN PLANTING IN COOL CLIMATES. ESTABLISHMENT TAKES THREE TO FOUR MONTHS PER INCH TRUNK CALIPER. NEVER APPLY IRRIGATION IF THE SOIL IS SATURATED.
  - WHEN IRRIGATING FOR SURVIVAL, TREES TAKE MUCH LONGER TO ESTABLISH THAN REGULARLY IRRIGATED TREES. IRRIGATION MAY BE REQUIRED IN THE NORMAL HOT, DRY PORTIONS OF THE FOLLOWING YEAR.

**PLANT MATERIAL AND HANDLING NOTES:**

- ALL PLANT MATERIAL SHALL CONFORM TO THE AMERICAN STANDARD FOR NURSERY STOCK (ANSI Z60.1-2004) OR LATEST REVISION AS PUBLISHED BY THE AMERICAN NURSERY AND LANDSCAPE ASSOCIATION.
- IN ALL CASES, BOTANICAL NAMES LISTED WITHIN THE APPROVED OR FINAL PLANT LIST SHALL TAKE PRECEDENCE OVER COMMON NAMES.
- ALL PLANTS SHALL BE OF SELECTED SPECIMEN QUALITY, EXCEPTIONALLY HEAVY, TIGHTLY KNIT, SO TRAINED OR FAVORED IN THEIR DEVELOPMENT AND APPEARANCE AS TO BE SUPERIOR IN FORM, NUMBER OF BRANCHES, COMPACTNESS AND SYMMETRY. ALL PLANTS SHALL HAVE A NORMAL HABIT OR SOUND, HEALTHY, VIGOROUS PLANTS WITH WELL DEVELOPED ROOT SYSTEM. PLANTS SHALL BE FREE OF DISEASE, INSECT PESTS, EGGS OR LARVAE.
- PLANTS SHALL NOT BE PRUNED BEFORE DELIVERY. TREES WITH ABRASION OF THE BARK, SUNSCALDS, DISFIGURING KNOTS OR FRESH CUTS OF LIMBS OVER ONE AND ONE-FOURTH INCHES (1-1/4") WHICH HAVE NOT COMPLETELY CALLOUSED SHALL BE REJECTED.
- ALL PLANTS SHALL BE TYPICAL OF THEIR SPECIES OR VARIETY AND SHALL HAVE A NORMAL HABIT OF GROWTH AND BE LEGIBLY TAGGED WITH THE PROPER NAME AND SIZE.
- THE ROOT SYSTEM OF EACH PLANT SHALL BE WELL PROVIDED WITH FIBROUS ROOTS. ALL PARTS SHALL BE SOUND, HEALTHY, VIGOROUS, WELL-BRANCHED AND DENSELY FOLIATED WHEN IN LEAF.
- ALL PLANTS DESIGNATED BALL AND BURLAP (B&B) MUST BE MOVED WITH THE ROOT SYSTEM AS SOLID UNITS WITH BALLS OF EARTH FIRMLY WRAPPED WITH BURLAP. THE DIAMETER AND DEPTH OF THE BALLS OF EARTH MUST BE SUFFICIENT TO ENCOMPASS THE FIBROUS ROOT FEEDING SYSTEMS NECESSARY FOR THE HEALTHY DEVELOPMENT OF THE PLANT. NO PLANT SHALL BE ACCEPTED WHEN THE BALL OF EARTH SURROUNDING ITS ROOTS HAS BEEN BADLY CRACKED OR BROKEN PREVIOUSLY TO OR DURING THE PROCESS OF PLANTING. THE BALLS SHALL REMAIN INTACT DURING ALL OPERATIONS. ALL PLANTS THAT CANNOT BE PLANTED AT ONCE MUST BE HEEL-IN BY SETTING IN THE GROUND AND COVERING THE BALLS WITH SOIL OR MULCH AND THEN WATERING. HEMP BURLAP AND TWINE IS PREFERABLE TO TREATED. IF TREATED BURLAP IS USED, ALL TWINE IS TO BE CUT FROM AROUND THE TRUNK AND ALL BURLAP IS TO BE REMOVED.
- ALL PLANTS TO BE PLANTED TO THE PROJECT IN OPEN VEHICLES SHALL BE COVERED WITH TARP OR OTHER SUITABLE COVERS SECURELY FASTENED TO THE BODY OF THE VEHICLE TO PREVENT INJURY TO THE PLANTS. CLOSED VEHICLES SHALL BE ADEQUATELY VENTILATED TO PREVENT OVERHEATING OF THE PLANTS. EVIDENCE OF INADEQUATE PROTECTION FOLLOWING DIGGING, CARELESSNESS WHILE IN TRANSIT, OR IMPROPER HANDLING OR STORAGE SHALL BE CAUSE FOR REJECTION OF PLANT MATERIAL. ALL PLANTS SHALL BE KEPT MOIST, FRESH, AND PROTECTED. SUCH PROTECTION SHALL ENCOMPASS THE ENTIRE PERIOD DURING WHICH THE PLANTS ARE IN TRANSIT, BEING HANDLED, OR ARE IN TEMPORARY STORAGE.
- ALL PLANT MATERIAL SHALL BE INSTALLED IN ACCORDANCE WITH THE CORRESPONDING LANDSCAPE PLAN AND PLANTING DETAILS.
- LANDSCAPE CONTRACTOR SHALL MAKE BEST EFFORT TO INSTALL PLANTINGS ON THE SAME DAY AS DELIVERY. IF PLANTS ARE NOT PLANTED IMMEDIATELY ON SITE, PROPER CARE SHALL BE TAKEN TO PLACE THE PLANTINGS IN PARTIAL SHADE WHEN POSSIBLE. THE ROOT BALL SHALL BE KEPT MOIST AT ALL TIME AND COVERED WITH MOISTENED MULCH OR AGED SHRUBS. PROPER IRRIGATION SHALL BE SUPPLIED SO AS TO NOT ALLOW THE ROOT BALL TO DRY OUT. PLANTINGS SHALL BE UNTIED AND PROPER SPACING SHALL BE ALLOTTED FOR AIR CIRCULATION AND TO PREVENT DISEASE, WILTING, AND LEAF LOSS. PLANTS THAT REMAIN UNPLANTED FOR A PERIOD OF TIME GREATER THAN THREE (3) DAYS SHALL BE HEALED IN WITH TOPSOIL OR MULCH AND WATERED AS REQUIRED TO PRESERVE ROOT MOISTURE.
- NO PLANT MATERIAL SHALL BE PLANTED IN MUDDY OR FROZEN SOIL.
- PLANTS WITH INJURED ROOTS OR BRANCHES SHALL BE PRUNED PRIOR TO PLANTING UTILIZING CLEAN, SHARP TOOLS. ONLY DISEASED OR INJURED PLANTS SHALL BE REMOVED.
- IF ROCKS OR OTHER UNDERGROUND OBSTRUCTION IS ENCOUNTERED, THE LANDSCAPE DESIGNER RESERVES THE RIGHT TO REMOVE OR ENLARGE THE OBSTRUCTION FROM THE PLANTING AREA.
- IF PLANTS ARE PROPOSED WITHIN SIGHT TRIANGLES, TREES SHALL BE LIMBED AND MAINTAINED TO A HEIGHT OF EIGHT FEET (8') ABOVE GRADE AND SHRUBS, GROUND COVER, PERENNIALS, AND ANNUALS SHALL BE MAINTAINED TO A HEIGHT NOT TO EXCEED TWO FEET (2') ABOVE GRADE UNLESS OTHERWISE NOTED OR SPECIFIED BY THE GOVERNING MUNICIPALITY OR AGENCY.
- INSTALLATION SHALL OCCUR DURING THE FOLLOWING SEASONS:
  - PLANTS (MARCH 15 - JUNE 15 OR SEPTEMBER 1 - DECEMBER 1)
  - LAWNS (MARCH 15 - JUNE 15 OR SEPTEMBER 1 - DECEMBER 1)
- THE FOLLOWING TREES ARE SUSCEPTIBLE TO TRANSPORT SHOCK AND SHALL NOT BE PLANTED DURING THE FALL SEASON (STARTING SEPTEMBER 15):
  - ABIES CONCOLOR
  - ACER BUEGERIANUM
  - ACER FRASERIANUM
  - ACER RUBRUM
  - ACER SACCHARINUM
  - BETULA VARIETIES
  - CARPINUS VARIETIES
  - CEDRUS DEODARA
  - CELTIS VARIETIES
  - CERCIDIPHYLLUM VARIETIES
  - CORNUS VARIETIES
  - CRATAEGUS VARIETIES
  - CORNUS VARIETIES
  - CRATAEGUS VARIETIES
  - NYSSA SYLVATICA
  - OSTRYA VIRGINIANA
  - PINUS NIGRA
  - PLATANUS VARIETIES
  - POPULUS VARIETIES
  - PRUNUS VARIETIES
  - PYRUS VARIETIES
  - QUERCUS VARIETIES (NOT Q. PALUSTRIS)
  - SALIX WEeping VARIETIES
  - SORBUS VARIETIES
  - TAXODIUM VARIETIES
  - TAXUS B. REPANDENS
  - TILIA TOMENTOSA VARIETIES
  - ULMUS PARVIFOLIA VARIETIES
  - ZELKOVA VARIETIES

- IF A PROPOSED PLANT IS UNATTAINABLE OR ON THE FALL DIGGING HAZARD LIST, AN EQUIVALENT SPECIES OF THE SAME SIZE MAY BE REQUESTED FOR SUBSTITUTION OF THE ORIGINAL PLANT. ALL SUBSTITUTIONS SHALL BE APPROVED BY THE PROJECT LANDSCAPE DESIGNER OR MUNICIPAL OFFICIAL PRIOR TO ORDERING AND INSTALLATION.
- DURING THE COURSE OF CONSTRUCTION/PLANT INSTALLATION, EXCESS AND WASTE MATERIALS SHALL BE CONTINUOUSLY AND PROMPTLY REMOVED AT THE END OF EACH WORK DAY. ALL DEBRIS, MATERIALS, AND TOOLS SHALL BE PROPERLY STORED, STOCKPILED OR DISPOSED OF AND ALL PAVED AREAS SHALL BE CLEANED.
- THE LANDSCAPE CONTRACTOR SHALL DISPOSE OF ALL RUBBISH AND EXCESS SOIL AT HIS EXPENSE TO AN OFF-SITE LOCATION AS APPROVED BY THE LOCAL MUNICIPALITY.
- A 90 DAY MAINTENANCE PERIOD SHALL BEGIN IMMEDIATELY AFTER ALL PLANTS HAVE BEEN SATISFACTORILY INSTALLED.
- MAINTENANCE SHALL INCLUDE BUT NOT BE LIMITED TO, REPLACING MULCH THAT HAS BEEN DISPLACED BY EROSION OR OTHER MEANS, REPAIRING AND RESHAPING WATER RINGS OR SAUCERS, MAINTAINING STAKES AND GUYNS IF ORIGINALLY REQUIRED, WATERING WHEN NEEDED OR DIRECTED, WEEDING, PRUNING, SPRAYING, FERTILIZING, MOWING THE LAWN, AND PERFORMING ANY OTHER WORK REQUIRED TO KEEP THE PLANTS IN A HEALTHY CONDITION.
- MOW ALL GRASS AREAS AT REGULAR INTERVALS TO KEEP THE GRASS HEIGHT FROM EXCEEDING THREE INCHES (3"). MOWING SHALL BE PERFORMED ONLY WHEN GRASS IS DRY. MOWER BLADE SHALL BE SET TO REMOVE NO MORE THAN ONE THIRD (1/3) OF THE GRASS LENGTH. WHEN THE AMOUNT OF GRASS IS HEAVY, IT SHALL BE REMOVED TO PREVENT DESTRUCTION OF THE UNDERLYING TURF. MOW GRASS AREAS IN SUCH A MANNER AS TO PREVENT CLIPPINGS FROM BLOWING ON PAVED AREAS, AND SIDEWALKS. CLEANUP AFTER MOWING SHALL INCLUDE SWEEPING OR BLOWING OF PAVED AREAS AND SIDEWALKS TO CLEAR THEM FROM MOWING DEBRIS.
- GRADED AREAS DAMAGED DURING THE PROCESS OF THE WORK SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR, WHO SHALL RESTORE THE DISTURBED AREAS TO A CONDITION SATISFACTORY TO THE PROJECT LANDSCAPE DESIGNER, MUNICIPAL OFFICIAL, OR OWNER/OWNER'S REPRESENTATIVE. THIS MAY INCLUDE FILLING TO GRADE, FERTILIZING, SEEDING, AND MULCHING.
- SHOULD THE OWNER REQUIRE MAINTENANCE BEYOND THE STANDARD 90-DAY MAINTENANCE PERIOD, A SEPARATE CONTRACT SHALL BE ESTABLISHED.
- LANDSCAPE CONTRACTOR SHALL WATER NEW PLANTINGS FROM TIME OF INSTALL AND THROUGHOUT REQUIRED 90-DAY MAINTENANCE PERIOD UNTIL PLANTS ARE ESTABLISHED. IF ON-SITE WATER IS NOT AVAILABLE AT THE PROJECT LOCATION, THE LANDSCAPE CONTRACTOR SHALL FURNISH BY MEANS OF A WATERING TRUCK OR OTHER ACCEPTABLE GANNER.
- THE QUANTITY OF WATER APPLIED AT ONE TIME SHALL BE SUFFICIENT TO PENETRATE THE SOIL TO A MINIMUM OF EIGHT INCHES (8") IN SHRUB BEDS AND SIX INCHES (6") IN TURF AREAS AT A RATE WHICH WILL PREVENT SATURATION OF THE SOIL.
- IF AN AUTOMATIC IRRIGATION SYSTEM HAS BEEN INSTALLED, IT CAN BE USED FOR WATERING PLANT MATERIAL. HOWEVER, FAILURE OF THE SYSTEM DOES NOT ELIMINATE THE LANDSCAPE CONTRACTOR'S RESPONSIBILITY OF PLANT HEALTH AND ESTABLISHMENT.

**PLANT MATERIAL GUARANTEE NOTES:**

- THE LANDSCAPE CONTRACTOR SHALL GUARANTEE ALL PLANT MATERIAL FOR A PERIOD OF ONE YEAR (1 YR) FROM APPROVAL OF LANDSCAPE INSTALLATION BY THE PROJECT LANDSCAPE DESIGNER, MUNICIPAL OFFICIAL, OR OWNER/OWNER'S REPRESENTATIVE.
- THE LANDSCAPE CONTRACTOR SHALL REMOVE AND REPLACE DYING, DEAD, OR DEFECTIVE PLANT MATERIAL AT HIS EXPENSE. THE LANDSCAPE CONTRACTOR SHALL ALSO BE RESPONSIBLE FOR ANY DAMAGES CAUSED BY HIS COMPANY'S OPERATIONS.
- ALL REPLACEMENT PLANTS SHALL BE OF THE SAME SPECIES AND SIZE AS SPECIFIED ON THE APPROVED OR FINAL PLANT LIST. REPLACEMENTS RESULTING FROM REMOVAL, LOSS, OR DAMAGE DUE TO OCCUPANCY OF THE PROJECT IN ANY PART, VANDALISM, PHYSICAL DAMAGE BY ANIMALS, VEHICLES, ETC., AND LOSSES DUE TO CURTAILMENT OF WATER BY LOCAL AUTHORITIES SHALL BE APPROVED AND PAID FOR BY THE OWNER.
- THE CONTRACTOR SHALL INSTRUCT THE OWNER AS TO THE PROPER CARE AND MAINTENANCE OF ALL PLANTINGS.

**LAWN (SEED OR SOD) NOTES:**

- SEED MIXTURE SHALL BE FRESH, CLEAN, NEW CROP SEED. SOD SHALL BE STRONGLY ROOTED, UNIFORM IN THICKNESS, AND FREE OF WEEDS, DISEASE, AND PESTS.
- SEED OR SOD SHALL BE PURCHASED FROM A RECOGNIZED DISTRIBUTOR AND SHALL BE COMPOSED OF THE MIX OR BLEND FOR USE FOR PLANTING BALLED & BURLAPPED (B&B) TREES AND SHRUBS. MEASURE THE THICKNESS OF THE TRUNK, AND USE ABOUT 1 TABLET (21-G) PER HALF-INCH. PLACE THE TABLETS DIRECTLY NEXT TO THE ROOT BALL, EVENLY DISTRIBUTED AROUND ITS PERIMETER, AT A DEPTH OF ABOUT 4 INCHES.
- REFERENCE LANDSCAPE PLAN FOR AREAS TO BE SEED OR LAID WITH SOD.
- SEEDING SHALL NOT BE PERFORMED IN WINDY WEATHER. IF THE SEASON OF THE PROJECT COMPLETION PROHIBITS PERMANENT STABILIZATION, TEMPORARY STABILIZATION SHALL BE PROVIDED IN ACCORDANCE WITH THE "TEMPORARY SEEDING SPECIFICATION".
- PROTECT NEW LAWN AREAS AGAINST TRESPASSING WHILE THE SEED IS GERMINATING. FURNISH AND INSTALL FENCES, SIGNS, BARRIERS OR ANY OTHER NECESSARY TEMPORARY PROTECTIVE DEVICES. DAMAGE RESULTING FROM TRESPASS, EROSION, WASHOUT, SETTLEMENT OR OTHER CAUSES SHALL BE REPAIRED BY THE LANDSCAPE CONTRACTOR AT HIS EXPENSE. REMOVE ALL FENCES, SIGNS, BARRIERS OR OTHER TEMPORARY PROTECTIVE DEVICES ONCE LAWN HAS BEEN ESTABLISHED.

ISSUE	DATE	BY
01	03/27/2026	NNS
00	12/05/2025	AJD

NOT APPROVED FOR CONSTRUCTION

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**APPLICANT & OWNER**  
ASHWORTH INVESTMENTS, LLC.  
40 MALBONE STREET  
WARWICK, RHODE ISLAND

**PROPOSED MULTI-HOUSEHOLD LAND DEVELOPMENT PROJECT**

**PLAN SET CLASSIFICATION**

BLOCK 32-4, LOT 21  
ZONE MU - MIXED USE  
TOWN OF SOUTH KINGSTOWN  
WASHINGTON COUNTY, RHODE ISLAND

JOSHUA H. KLINE, P.E.  
RHODE ISLAND LICENSE NO. 13607  
LICENSED PROFESSIONAL ENGINEER

**STONEFIELD**  
engineering & design

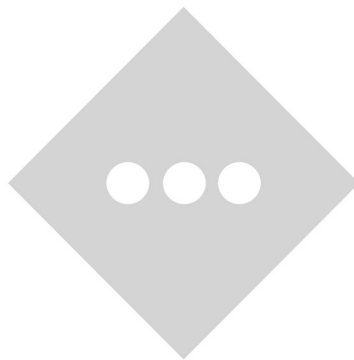
SCALE: AS SHOWN PROJECT ID: BOS-250053

TITLE: **LANDSCAPING DETAILS**

DRAWING: **C-12**

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**APPENDIX C**  
**STORMWATER BMP LOCATION EXHIBIT**





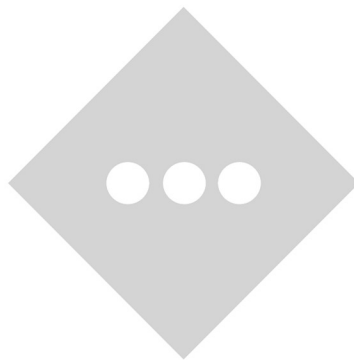
# **APPENDIX D**

## **PROPRIETARY STORMWATER DEVICE MANUFACTURER SPECIFICATIONS**

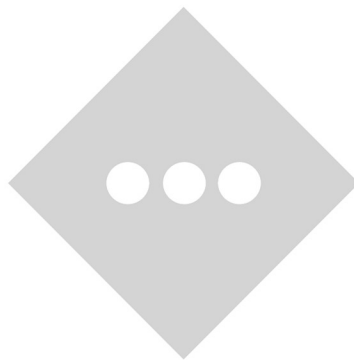
### **INVENTORY**

**D-1: CONTECH CDS OPERATIONS & MAINTENANCE  
GUIDE**

**D-2: R-TANK MODULE OPERATIONS AND  
MAINTENANCE MANUAL**



**APPENDIX D-I**  
**CONTECH CDS OPERATIONS &**  
**MAINTENANCE GUIDE**



# CDS Guide

## Operation, Design, Performance and Maintenance



## CDS®

Using patented continuous deflective separation technology, the CDS system screens, separates and traps debris, sediment, and oil and grease from stormwater runoff. The indirect screening capability of the system allows for 100% removal of floatables and neutrally buoyant material without blinding. Flow and screening controls physically separate captured solids, and minimize the re-suspension and release of previously trapped pollutants. Inline units can treat up to 6 cfs, and internally bypass flows in excess of 50 cfs (1416 L/s). Available precast or cast-in-place, offline units can treat flows from 1 to 300 cfs (28.3 to 8495 L/s). The pollutant removal capacity of the CDS system has been proven in lab and field testing.

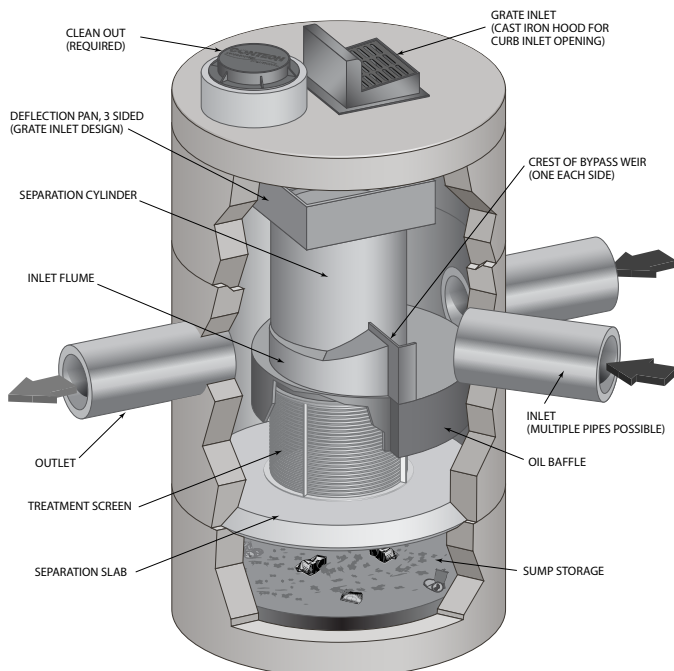
## Operation Overview

Stormwater enters the diversion chamber where the diversion weir guides the flow into the unit's separation chamber and pollutants are removed from the flow. All flows up to the system's treatment design capacity enter the separation chamber and are treated.

Swirl concentration and screen deflection force floatables and solids to the center of the separation chamber where 100% of floatables and neutrally buoyant debris larger than the screen apertures are trapped.

Stormwater then moves through the separation screen, under the oil baffle and exits the system. The separation screen remains clog free due to continuous deflection.

During the flow events exceeding the treatment design capacity, the diversion weir bypasses excessive flows around the separation chamber, so captured pollutants are retained in the separation cylinder.



## Design Basics

There are three primary methods of sizing a CDS system. The Water Quality Flow Rate Method determines which model size provides the desired removal efficiency at a given flow rate for a defined particle size. The Rational Rainfall Method™ or the Probabilistic Method is used when a specific removal efficiency of the net annual sediment load is required.

Typically in the United States, CDS systems are designed to achieve an 80% annual solids load reduction based on lab generated performance curves for a gradation with an average particle size (d50) of 125 microns ( $\mu\text{m}$ ). For some regulatory environments, CDS systems can also be designed to achieve an 80% annual solids load reduction based on an average particle size (d50) of 75 microns ( $\mu\text{m}$ ) or 50 microns ( $\mu\text{m}$ ).

### Water Quality Flow Rate Method

In some cases, regulations require that a specific treatment rate, often referred to as the water quality design flow (WQQ), be treated. This WQQ represents the peak flow rate from either an event with a specific recurrence interval, e.g. the six-month storm, or a water quality depth, e.g. 1/2-inch (13 mm) of rainfall.

The CDS is designed to treat all flows up to the WQQ. At influent rates higher than the WQQ, the diversion weir will direct most flow exceeding the WQQ around the separation chamber. This allows removal efficiency to remain relatively constant in the separation chamber and eliminates the risk of washout during bypass flows regardless of influent flow rates.

Treatment flow rates are defined as the rate at which the CDS will remove a specific gradation of sediment at a specific removal efficiency. Therefore the treatment flow rate is variable, based on the gradation and removal efficiency specified by the design engineer.

### Rational Rainfall Method™

Differences in local climate, topography and scale make every site hydraulically unique. It is important to take these factors into consideration when estimating the long-term performance of any stormwater treatment system. The Rational Rainfall Method combines site-specific information with laboratory generated performance data, and local historical precipitation records to estimate removal efficiencies as accurately as possible.

Short duration rain gauge records from across the United States and Canada were analyzed to determine the percent of the total annual rainfall that fell at a range of intensities. US stations' depths were totaled every 15 minutes, or hourly, and recorded in 0.01-inch increments. Depths were recorded hourly with 1-mm resolution at Canadian stations. One trend was consistent at all sites; the vast majority of precipitation fell at low intensities and high intensity storms contributed relatively little to the total annual depth.

These intensities, along with the total drainage area and runoff coefficient for each specific site, are translated into flow rates using the Rational Rainfall Method. Since most sites are relatively small and highly impervious, the Rational Rainfall Method is appropriate. Based on the runoff flow rates calculated for each intensity, operating rates within a proposed CDS system are

determined. Performance efficiency curve determined from full scale laboratory tests on defined sediment PSDs is applied to calculate solids removal efficiency. The relative removal efficiency at each operating rate is added to produce a net annual pollutant removal efficiency estimate.

### Probabilistic Rational Method

The Probabilistic Rational Method is a sizing program Contech developed to estimate a net annual sediment load reduction for a particular CDS model based on site size, site runoff coefficient, regional rainfall intensity distribution, and anticipated pollutant characteristics.

The Probabilistic Method is an extension of the Rational Method used to estimate peak discharge rates generated by storm events of varying statistical return frequencies (e.g. 2-year storm event). Under the Rational Method, an adjustment factor is used to adjust the runoff coefficient estimated for the 10-year event, correlating a known hydrologic parameter with the target storm event. The rainfall intensities vary depending on the return frequency of the storm event under consideration. In general, these two frequency dependent parameters (rainfall intensity and runoff coefficient) increase as the return frequency increases while the drainage area remains constant.

These intensities, along with the total drainage area and runoff coefficient for each specific site, are translated into flow rates using the Rational Method. Since most sites are relatively small and highly impervious, the Rational Method is appropriate. Based on the runoff flow rates calculated for each intensity, operating rates within a proposed CDS are determined. Performance efficiency curve on defined sediment PSDs is applied to calculate solids removal efficiency. The relative removal efficiency at each operating rate is added to produce a net annual pollutant removal efficiency estimate.

### Treatment Flow Rate

The inlet throat area is sized to ensure that the WQQ passes through the separation chamber at a water surface elevation equal to the crest of the diversion weir. The diversion weir bypasses excessive flows around the separation chamber, thus preventing re-suspension or re-entrainment of previously captured particles.

### Hydraulic Capacity

The hydraulic capacity of a CDS system is determined by the length and height of the diversion weir and by the maximum allowable head in the system. Typical configurations allow hydraulic capacities of up to ten times the treatment flow rate. The crest of the diversion weir may be lowered and the inlet throat may be widened to increase the capacity of the system at a given water surface elevation. The unit is designed to meet project specific hydraulic requirements.

## Performance

### Full-Scale Laboratory Test Results

A full-scale CDS system (Model CDS2020-5B) was tested at the facility of University of Florida, Gainesville, FL. This CDS unit was evaluated under controlled laboratory conditions of influent flow rate and addition of sediment.

Two different gradations of silica sand material (UF Sediment & OK-110) were used in the CDS performance evaluation. The particle size distributions (PSDs) of the test materials were analyzed using standard method "Gradation ASTM D-422 "Standard Test Method for Particle-Size Analysis of Soils" by a certified laboratory.

UF Sediment is a mixture of three different products produced by the U.S. Silica Company: "Sil-Co-Sil 106", "#1 DRY" and "20/40 Oil Frac". Particle size distribution analysis shows that the UF Sediment has a very fine gradation ( $d_{50} = 20$  to  $30 \mu\text{m}$ ) covering a wide size range (Coefficient of Uniformity, C averaged at 10.6). In comparison with the hypothetical TSS gradation specified in the NJDEP (New Jersey Department of Environmental Protection) and NJCAT (New Jersey Corporation for Advanced Technology) protocol for lab testing, the UF Sediment covers a similar range of particle size but with a finer  $d_{50}$  ( $d_{50}$  for NJDEP is approximately  $50 \mu\text{m}$ ) (NJDEP, 2003).

The OK-110 silica sand is a commercial product of U.S. Silica Sand. The particle size distribution analysis of this material, also included in Figure 1, shows that 99.9% of the OK-110 sand is finer than 250 microns, with a mean particle size ( $d_{50}$ ) of 106 microns. The PSDs for the test material are shown in Figure 1.

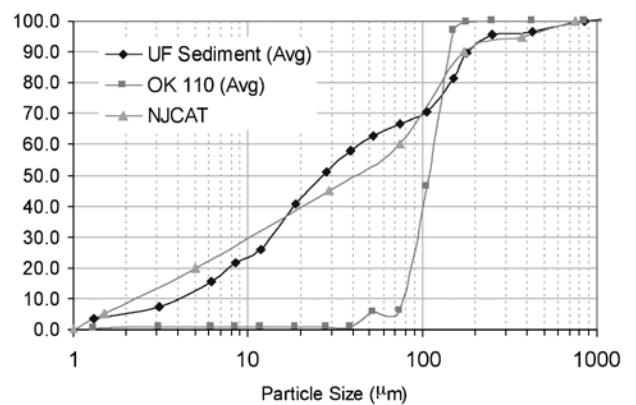


Figure 1. Particle size distributions

Tests were conducted to quantify the performance of a specific CDS unit (1.1 cfs (31.3-L/s) design capacity) at various flow rates, ranging from 1% up to 125% of the treatment design capacity of the unit, using the 2400 micron screen. All tests were conducted with controlled influent concentrations of approximately 200 mg/L. Effluent samples were taken at equal time intervals across the entire duration of each test run. These samples were then processed with a Dekaport Cone sample splitter to obtain representative sub-samples for Suspended Sediment Concentration (SSC) testing using ASTM D3977-97 "Standard Test Methods for Determining Sediment Concentration in Water Samples", and particle size distribution analysis.

## Results and Modeling

Based on the data from the University of Florida, a performance model was developed for the CDS system. A regression analysis was used to develop a fitting curve representative of the scattered data points at various design flow rates. This model, which demonstrated good agreement with the laboratory data, can then be used to predict CDS system performance with respect

to SSC removal for any particle size gradation, assuming the particles are inorganic sandy-silt. Figure 2 shows CDS predictive performance for two typical particle size gradations (NJCAT gradation and OK-110 sand) as a function of operating rate.

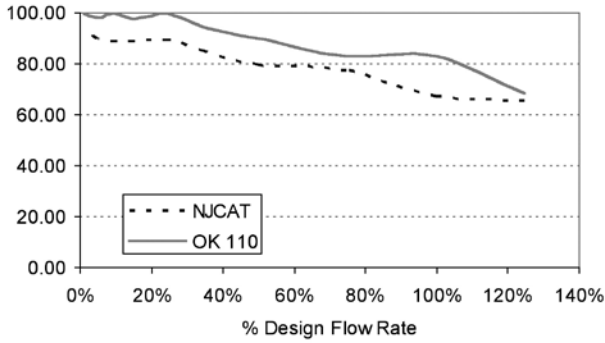


Figure 2. CDS stormwater treatment predictive performance for various particle gradations as a function of operating rate.

Many regulatory jurisdictions set a performance standard for hydrodynamic devices by stating that the devices shall be capable of achieving an 80% removal efficiency for particles having a mean particle size ( $d_{50}$ ) of 125 microns (e.g. Washington State Department of Ecology — WASDOE - 2008). The model can be used to calculate the expected performance of such a PSD (shown in Figure 3). The model indicates (Figure 4) that the CDS system with 2400 micron screen achieves approximately 80% removal at the design (100%) flow rate, for this particle size distribution ( $d_{50} = 125 \mu\text{m}$ ).

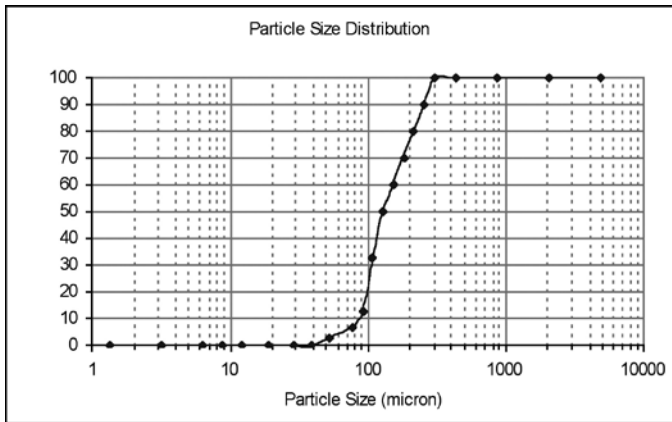


Figure 3. WASDOE PSD

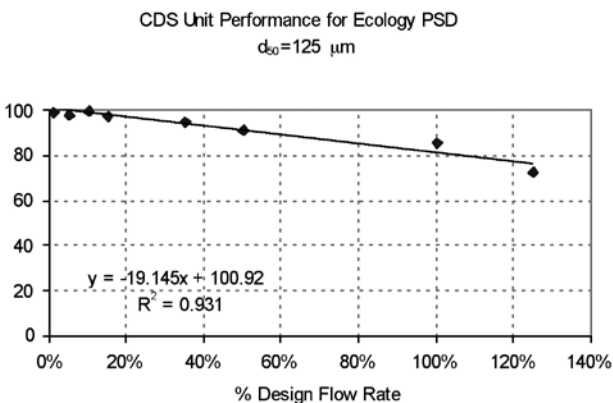


Figure 4. Modeled performance for WASDOE PSD.

## Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

## Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (e.g. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified



during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (cylinder and screen) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained outside the screen. For deep units, a single manhole access point would allow both sump cleanout and access outside the screen.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. If absorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine whether the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

## Cleaning

Cleaning of a CDS system should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. The screen should be cleaned to ensure it is free of trash and debris.

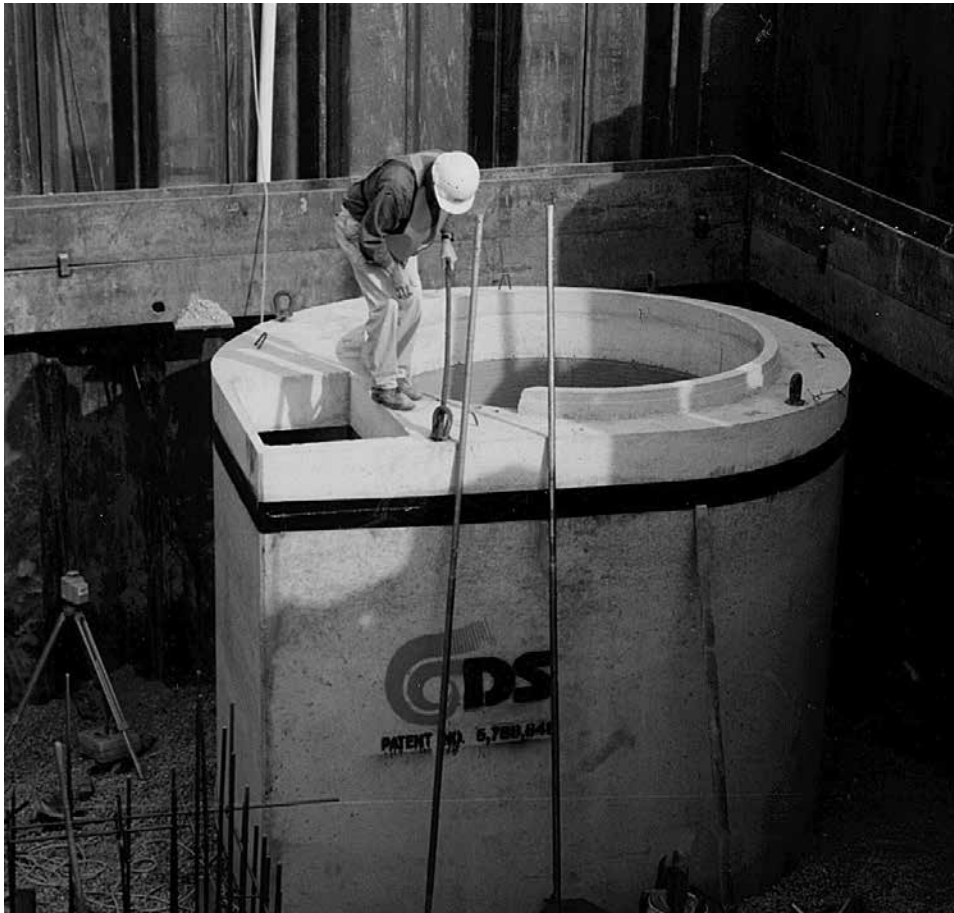
Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure that proper safety precautions have been followed. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the CDS system should be done in accordance with local regulations. In many jurisdictions, disposal of the sediments may be handled in the same manner as the disposal of sediments removed from catch basins or deep sump manholes. Check your local regulations for specific requirements on disposal.



CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	y <sup>3</sup>	m <sup>3</sup>
CDS1515	3	0.9	3.0	0.9	0.5	0.4
CDS2015	4	1.2	3.0	0.9	0.9	0.7
CDS2015	5	1.5	3.0	0.9	1.3	1.0
CDS2020	5	1.5	3.5	1.1	1.3	1.0
CDS2025	5	1.5	4.0	1.2	1.3	1.0
CDS3020	6	1.8	4.0	1.2	2.1	1.6
CDS3025	6	1.8	4.0	1.2	2.1	1.6
CDS3030	6	1.8	4.6	1.4	2.1	1.6
CDS3035	6	1.8	5.0	1.5	2.1	1.6
CDS4030	8	2.4	4.6	1.4	5.6	4.3
CDS4040	8	2.4	5.7	1.7	5.6	4.3
CDS4045	8	2.4	6.2	1.9	5.6	4.3
CDS5640	10	3.0	6.3	1.9	8.7	6.7
CDS5653	10	3.0	7.7	2.3	8.7	6.7
CDS5668	10	3.0	9.3	2.8	8.7	6.7
CDS5678	10	3.0	10.3	3.1	8.7	6.7

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities

Note: To avoid underestimating the volume of sediment in the chamber, carefully lower the measuring device to the top of the sediment pile. Finer silty particles at the top of the pile may be more difficult to feel with a measuring stick. These finer particles typically offer less resistance to the end of the rod than larger particles toward the bottom of the pile.





## SUPPORT

- Drawings and specifications are available at [www.ContechES.com](http://www.ContechES.com).
- Site-specific design support is available from our engineers.



800-338-1122

[www.ContechES.com](http://www.ContechES.com)

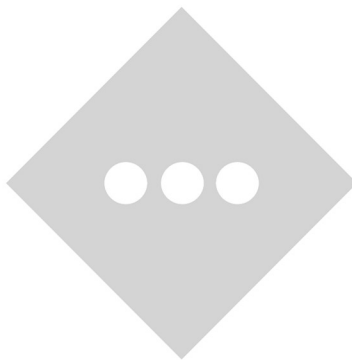
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**APPENDIX D-2**  
**R-TANK MODULE OPERATIONS &**  
**MAINTENANCE MANUAL**





# STORMWATER STORAGE SYSTEM

## OPERATIONS AND MAINTENANCE MANUAL

Green Stormwater Infrastructure Solutions



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## DISCLAIMER

**Read the following information before inspecting, cleaning, or performing maintenance on this Stormwater Treatment Device. This manual is intended to explain the specifics of the maintenance on R-Tank Stormwater Storage Systems.**

It is the responsibility of all personnel to familiarize themselves with, understand and comply with all applicable local, state, and federal laws. All information in this manual is current at the time of printing but are subject to change based on the development of new processes and procedures. Ferguson Enterprises assumes no responsibility and is not accountable for any injuries, fines, penalties, or losses that occur involving any procedure in this manual or other actions taken. The R-Tank Stormwater Storage System performance is based on the procedures being followed in this manual. Non-Compliance with the outlined measures will be the responsibility of the owner.

# GENERAL INFORMATION

Your R-Tank System has been designed to function in conjunction with the engineered drainage system on your site, the existing municipal infrastructure, and/or the existing soils and geography of the receiving watershed. Unless your site included certain unique and rare features, the operation of your R-Tank System will be driven by naturally occurring systems and will function autonomously. However, upholding a proper schedule of Inspection & Maintenance is critical to ensuring continued functionality and optimum performance of the system.

# INSPECTION INFORMATION

**During construction, the system shall be protected from sediment laden runoff and only activated once the site has been fully stabilized.**

Both the R-Tank and all stormwater pre-treatment features incorporated into your site must be inspected regularly. Inspections should be done every six months for the first year of operation, and at least yearly thereafter. Inspections may be required more frequently for pre-treatment systems. You should refer to the manufacturer requirements for the proper inspection schedule.

With the right equipment most inspections and measurements can be accomplished from the surface without physically entering any confined spaces. If your inspection does require confined space entry, you must follow all local, regional, and OSHA requirements.

All maintenance features of your system can be accessed through a covering at the surface. With the lid removed, you can visually inspect each component to identify sediment, trash, and other contaminants within the structure. Check your construction plans to identify the maintenance features engineered into your R-Tank system, which may include:

**Upstream Pipes, Inlets, and Manholes:** Working from the structures adjacent the R-Tank toward those farther away, check for debris and sediment in both the structures and the pipes. Be sure to include all structures that contain pre-treatment systems. Some structures may include a sump.

**Maintenance Ports / Inspection Ports:** Maintenance/inspection ports are located near the inlet and outlet connections, treatment rows, and throughout the system. These should be used to check for sediment and typically allow access for backflushing and cleaning.

**Treatment Row:** On installations in 2018 or later, inlet pipes may connect to a row of modules with 12” diameter access holes running horizontally through the module that can be jet vacuumed. Check these rows for accumulation of sediment and debris.

All observations and measurements should be recorded on an Inspection Log kept on file. We have included a form you can use at the end of this guide.



# INSPECTION CHECKLIST

Site Name:		Company:	
Location:		Contact:	
City and State:		Phone:	
System Owner:		Email:	

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Inspection Description	Frequency	Observations / Notes	Initials
Pretreatment Systems	Quarterly		
Connections	Bi-Annually		
Inspection Ports	Bi-Annually		
Accumulation of Sediment or Debris	Bi-Annually		
Upslope Erosion	Quarterly		
Accidental or Illicit Spillage	Quarterly		

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Maintenance Items	Required Maintenance Activities	Initials
Pretreatment Systems		
Connections		
Inspection Ports		
Accumulation of Sediment or Debris		
Upslope Erosion		
Accidental or Illicit Spillage		

# SYSTEM MAINTENANCE

For modules taller than 40" the R-Tank Stormwater Storage Systems should be back-flushed once sediment accumulation has reached 6". For modules less than 40" tall, perform maintenance when sediment depths are greater than 15% of the total system height. If your system includes a Treatment Row with linear access through the modules from the inlet pipe, backflush this area when sediment depths reach 6".

**BEFORE ANY MAINTENANCE IS PERFORMED ON YOUR SYSTEM - PLUG THE OUTLET PIPE TO PREVENT CONTAMINATION OF THE DOWNSTREAM SYSTEMS.**

## Maintenance During Construction

Installed R-Tank Stormwater Storage Systems should be properly protected post installation, but before the System is accepted by owners in the following manner:

- **Vehicular Traffic:** Protect system from heavy construction equipment loads by using smaller vehicles, low ground pressure tracked equipment when possible, or protective measures such as steel plates to spread the load experienced by the system.
- **Sediment and Debris:** Use proper erosion control Best Management Practices to prevent sediment and debris from reaching the system.
- **Remove Sediment and Debris, as Needed:** If upslope practices fail to prevent sediment laden runoff from entering the upstream inlets, pipes, and system, sediment removal should be performed using jet-vac equipment.

## Maintenance After Construction

Site specific conditions (land use, climate, tree cover, slopes, construction activities, etc.) along with data from regular inspections will determine how frequently the system must be cleaned. At a minimum, vacuum cleaning should occur every 1 to 2 years. Routine maintenance, such as pre-treatment inlet cleanout should occur every 3 to 6 months.

- Begin by cleaning all upstream structures, pipes, and pre-treatment systems containing sediment and/ or debris. If your system includes a Treatment Row, this portion of the system should be cleaned with traditional jet-vac equipment. Add a centralizer to the jet for easiest access through the modules.
- Complete initial debris removal by vacuuming debris up the inspection port locations, while using the jetting water to push debris to the hose. For finer debris, back-flush the R-Tank system. To perform this, water is pumped into the system through the inspection ports as rapidly as possible. The turbulent action of the water moving through the R-Tank will suspend sediments which may then be pumped out. If your system includes an outlet structure, this will be the ideal location to pump contaminated water out of the system. However, removal of back-flush water may be accomplished through the inspection ports, as well.
- For systems with large footprints that would require extensive volumes of water to properly flush the system, you should consider performing your maintenance within 24 hours of a rain event. Stormwater entering the system will aid in the suspension of sediments and reduce the volume of water required to properly flush the system.

# INSPECTION AND MAINTENANCE COST ESTIMATE WORKSHEET

Project Name:		Engineer:	
Location:		City / State:	
Owner:		Contact:	
Phone:		Email:	

<b>Life Expectancy (Yrs.) =</b>	
---------------------------------	--

Inspection Description	Frequency / Year	Total Services*	Cost per Service	Total Cost**
Pretreatment Systems	4		\$	\$
Connections	2		\$	\$
Inspection Ports	2		\$	\$
Accumulation of Sediment or Debris	2		\$	\$
Upslope Erosion	4		\$	\$
Accidental or Illicit Spillage	4		\$	\$

Maintenance Items	Frequency / Year	Total Services*	Cost per Service	Total Cost**
Pretreatment Systems			\$	\$
Connections			\$	\$
Inspection Ports			\$	\$
Accumulation of Sediment or Debris			\$	\$
Upslope Erosion			\$	\$
Accidental or Illicit Spillage			\$	\$
System Vacuuming			\$	\$

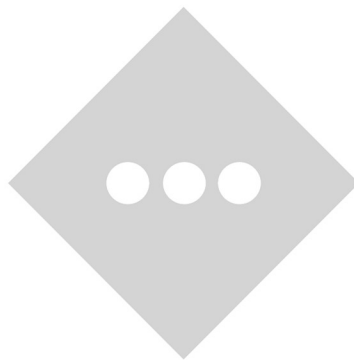
Total Costs = Inspection Costs + Maintenance Costs =	\$
--	----

Estimated Annual Operating Expenses = Total Costs / Years of Service =	\$
--	----

\* Total Services = Frequency of Services / Yr. multiplied by Life Expectancy  
 \*\* Total Cost = Total Services multiplied by Cost per Service

# **APPENDIX E**

## **INSPECTION CHECKLISTS**



### F.3 CONSTRUCTION STANDARDS/SPECIFICATIONS FOR INFILTRATION BMPs

#### F.3.1 Infiltration Trench/Chamber General Notes and Specifications

Infiltration trench or chamber systems may not receive run-off until the entire contributing drainage area to the infiltration system has received final stabilization.

1. Construction equipment and traffic shall be restricted from traveling over the infiltration trench or chamber areas to minimize compaction of the soil.
2. Excavate the infiltration trench/chamber to the design dimensions. Excavated materials shall be placed away from the trench/chamber sides to enhance trench wall stability. Large tree roots must be trimmed flush with the trench sides in order to prevent fabric puncturing or tearing of the filter fabric during subsequent installation procedures. The side walls of the trench/chamber shall be roughened where sheared and sealed by heavy equipment.
3. A Class "C" geotextile or better shall interface between the trench/chamber side walls and between the stone reservoir and gravel filter layers. A partial list of non-woven filter fabrics that meet the Class "C" criteria is contained below..

Mirafi 180-N  
Amoco 4552  
WEBTEC N70  
GEOLON N70  
Carthage FX-80S

The width of the geotextile must include sufficient material to conform to trench/chamber perimeter irregularities and for a 6-inch minimum top overlap. The filter fabric shall be tucked under the sand layer on the bottom of the infiltration trench/chamber for a distance of 6 to 12 inches. Stones or other anchoring objects should be placed on the fabric at the edge of the trench/chamber to keep the trench open during windy periods. When overlaps are required between rolls, the uphill roll should lap a minimum of 2 feet over the downhill roll in order to provide a shingled effect.

4. A 6-inch sand filter layer may be placed on the bottom of the infiltration trench/chamber in lieu of filter fabric, and shall be compacted using plate compactors. The sand for the infiltration trench shall be washed and meet AASHTO Std. M-43, Size No. 9 or No. 10.
5. The stone aggregate should be placed in lifts and compacted using plate compactors. A maximum loose lift thickness of 12 inches is recommended. The gravel (rounded "bank run" gravel is preferred) for the infiltration trench/chamber

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shall be washed and meet one of the following AASHTO Std. M-43; Size No. 2 or No. 3.

6. Infiltration chambers should consist of high molecular weight high density polyethylene (HDPE) and meet AASHTO H10 and H20 standards. Chambers should have repeating endwalls for internal support. Infiltration chambers must be constructed in accordance with manufacturer's specifications.
7. Following the stone aggregate placement, the filter fabric shall be folded over the stone aggregate to form a 6-in minimum longitudinal lap. The desired fill soil or stone aggregate shall be placed over the lap at sufficient intervals to maintain the lap during subsequent backfilling.
8. Care shall be exercised to prevent natural or fill soils from intermixing with the stone aggregate. All contaminated stone aggregate shall be removed and replaced with uncontaminated stone aggregate.
9. Voids can be created between the fabric and the excavation sides and shall be avoided. Removing boulders or other obstacles from the trench walls is one source of such voids; therefore, natural soils should be placed in these voids at the most convenient time during construction to ensure fabric conformity to the excavation sides.
10. Vertically excavated walls may be difficult to maintain in areas where soil moisture is high or where soft cohesive or cohesionless soils are predominate. These conditions may require laying back of the side slopes to maintain stability.
11. PVC should be in accordance with RIDOT specification section M.04 Drainage and the following provisions, as applicable. PVC distribution pipes shall be Schedule 40 and meet ASTM Std. D 1784. All fittings and perforations (1/2 inch in diameter) shall meet ASTM Std. D 2729. A perforated pipe shall be provided only within the infiltration trench/chamber and shall terminate 1 ft short of the infiltration trench wall. The end of the PVC pipe shall be capped.
12. Corrugated metal pipes should be in accordance with RIDOT specification section M.04 Drainage and the following provisions, as applicable. The corrugated metal distribution pipes shall conform to AASHTO Std. M-36 and shall be aluminized in accordance with AASHTO Std. M-274. Coat aluminized pipe in contact with concrete with an inert compound capable of effecting isolation of the deleterious effect of the aluminum on the concrete. Perforated distribution pipe shall be provided only within the infiltration trench/chamber and shall terminate 1 ft short of the infiltration trench wall. An aluminized metal plate shall be welded to the end of the pipe.
13. Corrugated High Density Polyethylene (HDPE) pipe should be in accordance with RIDOT specification no. 701.02.1 – Non-Metallic Pipe and the following provisions,

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as applicable. HDPE pipe, couplings and fittings shall conform to the following: 4-10-in pipe shall meet the requirements of AASHTO M252 Type S, and 12in through 24in shall meet the requirements of AASHTO M294 Type S. Perforated distribution pipe shall be provided only within the infiltration trench/chamber and shall terminate 1 ft short of the infiltration trench wall. The end of the pipe shall be capped.

14. The observation well is to consist of 4- to 6-inch diameter PVC Schedule 40 pipe (ASTM Std. D 1784) with a cap set 6 inches above ground level and is to be located near the longitudinal center of the infiltration trench or chamber. Preferably the observation well will not be located in vehicular traffic areas. The pipe shall have a plastic collar with ribs to prevent rotation when removing cap. The screw top lid shall be a "Panella" type cleanout or equivalent with a locking mechanism or special bolt to discourage vandalism.
15. Distribution structures should be in accordance with RIDOT specification section 700 – Drainage and Selected Utility Accessories and the following provisions, as applicable. If a distribution structure with a wet well is used, a 4-inch PVC drain pipe shall be provided at opposite ends of the infiltration trench/chamber distribution structure. Two (2) cubic feet of porous backfill meeting AASHTO Std. M-43 Size No. 57 shall be provided at each drain.
16. If a distribution structure is used, the manhole cover shall be bolted to the frame.

NOTE: PVC pipe with a wall thickness classification of SDR-35 meeting ASTM standard D3034 is an acceptable substitution for PVC Schedule 40 pipe.

**Table F-4 Infiltration Trench/Chamber Construction Inspection Checklist**

Project:

Location:

Site Status:

Date:

Time:

Inspector:

CONSTRUCTION SEQUENCE	SATISFACTORY/ UNSATISFACTORY	COMMENTS
1. Pre-Construction		
Pre-construction meeting		
Runoff diverted		
Soil permeability tested		
Groundwater / bedrock sufficient at depth		
2. Excavation		
Size and location		
Side slopes stable		
Excavation does not compact subsoils		
3. Filter Fabric Placement		
Fabric specifications		
Placed on bottom, sides, and top		

CONSTRUCTION SEQUENCE	SATISFACTORY/ UNSATISFACTORY	COMMENTS
4. Aggregate Material		
Size as specified		
Clean / washed material		
Placed properly		
5. Observation Well		
Pipe size		
Removable cap / footplate		
Initial depth = _____ feet		
6. Final Inspection		
Pretreatment facility in place		
Contributing watershed stabilized prior to flow diversion		
Outlet		

Comments:

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Actions to be Taken:

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### F.3.2 Infiltration Basins Notes and Specifications

1. The sequence of various phases of basin construction shall be coordinated with the overall project construction schedule. A program should schedule rough excavation of the basin with the rough grading phase of the project to permit use of the material as fill in earthwork areas. The partially excavated basin, however, cannot serve as a sedimentation basin.

Specifications for basin construction should state: (1) the earliest point in progress when storm drainage may be directed to the basin, and (2) the means by which this delay in use is to be accomplished. Due to the wide variety of conditions encountered among projects, each should be separately evaluated in order to postpone use as long as is reasonably possible.

2. Initial basin excavation should be carried to within 1 foot of the final elevation of the basin floor. Final excavation to the finished grade should be deferred until all disturbed areas on the watershed have been stabilized or protected. The final phase excavation should remove all accumulated sediment. Relatively light-tracked equipment is recommended for this operation to avoid compaction of the basin floor. After the final grading is completed, the basin provides a well-aerated, highly porous surface texture.
3. Infiltration basins may be lined with a 6- to 12-inch layer of filter material such as coarse sand (AASHTO Std. M-43, Sizes 9 or 10) to help prevent the buildup of impervious deposits on the soil surface. The filter layer can be replaced or cleaned when it becomes clogged. When a 6-inch layer of coarse organic material is specified for discing (such as hulls, leaves, stems, etc.) or spading into the basin floor to increase the permeability of the soils, the basin floor should be soaked or inundated for a brief period, then allowed to dry subsequent to this operation. This induces the organic material to decay rapidly, loosening the upper soil layer.
4. Establishing dense vegetation on the basin side slopes and floor is recommended. A dense vegetative stand will not only prevent erosion and sloughing, but will also provide a natural means of maintaining relatively high infiltration rates. Erosion protection of inflow points to the basin shall also be provided.
5. Selection of suitable vegetative materials for the side slope and all other areas to be stabilized with vegetation and application of required lime, fertilizer, etc. shall be done in accordance with the RIDOT specification section L.01.
6. Grasses of the fescue family are recommended for seeding primarily due to their adaptability to dry sandy soils, drought resistance, hardiness, and ability to withstand brief inundations. The use of fescues will also permit long intervals between mowings. This is important due to the relatively steep slopes that make mowing difficult. Mowing 2 times a year, once in June and September, is generally satisfactory. Re-fertilization with 10-6-4 ratio fertilizer at a rate of 500 lb per acre (11 lb per 1000 sq ft) may be required the second year after seeding.

**Table F-5 Infiltration Basin Construction Inspection Checklist**

Project:

Location:

Site Status:

Date:

Time:

Inspector:

CONSTRUCTION SEQUENCE	SATISFACTORY/ UNSATISFACTORY	COMMENTS
1. Pre-Construction		
Runoff diverted		
Soil permeability tested		
Groundwater / bedrock depth		
2. Excavation		
Size and location		
Side slopes stable		
Excavation does not compact subsoils		
3. Embankment		
Barrel		
Anti-seep collar or Filter diaphragm		
Fill material		
4. Final Excavation		

CONSTRUCTION SEQUENCE	SATISFACTORY/ UNSATISFACTORY	COMMENTS
Drainage area stabilized		
Sediment removed from facility		
Basin floor tilled		
Facility stabilized		
5. Final Inspection		
Pretreatment facility in place		
Inlets / outlets		
Contributing watershed stabilized before flow is routed to the facility		

Comments:

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Actions to be Taken:

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### Infiltration System Operation, Maintenance, and Management Inspection Checklist

Project:

Location:

Site Status:

Date:

Time:

Inspector:

MAINTENANCE ITEM	SATISFACTORY / UNSATISFACTORY	COMMENTS
1. Debris Cleanout (Annual)		
Trench/chamber or basin surface clear of debris		
Inflow pipes clear of debris		
Overflow spillway clear of debris		
Inlet area clear of debris		
2. Sediment Traps or Forebays (Annual)		
Obviously trapping sediment		
Greater than 50% of storage volume remaining		
3. Dewatering (Annual)		
Trench/chamber or basin dewateres between storms		
4. Sediment Cleanout of Trench/Chamber or Basin (Annual)		

MAINTENANCE ITEM	SATISFACTORY / UNSATISFACTORY	COMMENTS
No evidence of sedimentation in trench/chamber or basin		
Sediment accumulation doesn't yet require cleanout		
5. Inlets (Annual)		
Good condition		
No evidence of erosion		
6. Outlet/Overflow Spillway (Annual)		
Good condition, no need for repair		
No evidence of erosion		
7. Aggregate Repairs (Annual)		
Surface of aggregate clean		
Top layer of stone does not need replacement		
Trench/Chamber or basin does not need rehabilitation		

Comments:

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Actions to be Taken:

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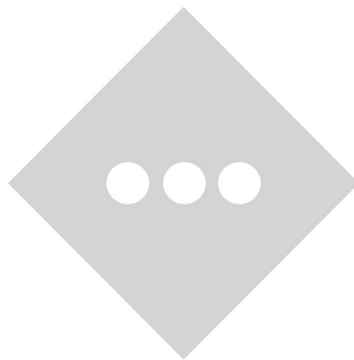
# **APPENDIX F**

## **ANNUAL EVALUATION FORMS**

### **INVENTORY**

**F-1: ANNUAL EVALUATION LOG**

**F-2: AMENDMENT LOG**



## ANNUAL EVALUATION RECORD

The person responsible for maintenance shall evaluate the effectiveness of the maintenance plan at least once per year and adjust the plan and the deed as needed.

The responsible party should evaluate the effectiveness of the maintenance plan by comparing the maintenance plan with the actual performance of the maintenance. The items to evaluate may include, but not limited to,

- Whether the inspections have been performed as scheduled;
- Whether the preventive maintenance has been performed as scheduled;
- Whether the frequency of preventative maintenance needs to increase or decrease;
- Whether the planned resources were enough to perform the maintenance;
- Whether the repairs were completed on time;
- Whether the actual cost was consistent with the estimated cost;
- Whether the inspection, maintenance, and repair records have been kept.

If actual performance of those items has been deviated from the maintenance plan, the responsible party should find the causes and implement solutions in a revised maintenance plan.

<b>Evaluator(s)</b>	<b>Date of Evaluation</b>	<b>Decision</b>
		<input type="checkbox"/> Maintain current version OR  <input type="checkbox"/> Revise current version Revision date _____ (also update the last revision date on the cover page)  <input type="checkbox"/> Requires a new deed recording (also update the last recording information on the cover page)
		<input type="checkbox"/> Maintain current version OR  <input type="checkbox"/> Revise current version Revision date _____ (also update the last revision date on the cover page)  <input type="checkbox"/> Requires a new deed recording (also update the last recording information on the cover page)
		<input type="checkbox"/> Maintain current version OR  <input type="checkbox"/> Revise current version Revision date _____ (also update the last revision date on the cover page)  <input type="checkbox"/> Requires a new deed recording (also update the last recording information on the cover page)

