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STORMWATER DRAINAGE MANUAL

TOWN OF NEWINGTON

MAY 2000

Prepared for:

Town of Newington
Engineering Department

Prepared by:

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STORMWATER MANAGEMENT GUIDELINES
NEWINGTON, CONNECTICUT

Prepared for:

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Public Works Department
Engineering Division

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Introduction

The purpose of this drainage manual is to define stormwater management guidelines and specifications for all new drainage systems in the Town of Newington. This manual includes design criteria to be used, construction standards, and general details for detention and retention basins, underground storage and dry wells, environmental mitigation procedures, plus erosion, sediment, and environmental controls.

The manual is applicable to all land use and development projects regulated by the Town of Newington, plus public road construction and drainage discharges to public roads.

The guidelines do not supersede other existing State and Federal regulatory programs unless the Town Regulations are more restrictive.

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A. Stormwater Management Guidelines

I. Goals and Objectives

A. Applicability

These stormwater management guidelines apply to all land use and development projects regulated by the Town of Newington, including:

- Zoning Permits
- Subdivision Permits
- Inland Wetland Permits

The guidelines also apply to all public road construction and drainage discharges to public roads. The Town Engineer may waive submission requirements if all goals and objectives have been met. The waivers shall be in writing and shall state the reason for the waiver.

B. Objectives

Stormwater management plans achieve the following water and natural resource management objectives:

1. Reduce the rate of runoff from new land development to minimize increases in flooding, flood damage, and inconveniences caused by excess stormwater;

2. Reduce the soil erosion potential due to development or construction projects;

3. Assure the adequacy of existing and proposed culverts, detention basins, storm drainage systems, bridges, channels, and dams;

4. Increase water recharge into the ground;

5. Decrease nonpoint source pollution and water quality degradation;

6. Maintain stream channels for their biological, recreational, and aesthetic functions as well as for conveyance of runoff;

7. Increase opportunities for preserving open space through stream corridor and floodplain protection; and

8. Increase recreational opportunities through the multiple use of stormwater facilities.

C. Basic Components

The basic components of stormwater management include:

1. Off-Site Analysis: All proposed projects must identify the upstream tributary drainage area and perform a downstream impact analysis. The levels of analysis required depend on the size of the project and its potential drainage impact, as determined by the Town Engineer.

2. Peak Runoff Control: *Proposed projects should provide runoff controls to limit the future peak rates of runoff to the pre-development peak rates whenever there would be adverse conditions downstream as determined in the Stormwater Management Report or by the Town Engineer.*

3. Nonstructural Drainage Systems: Storm drainage systems should emphasize nonstructural approaches where possible to controlling runoff, encouraging the infiltration of rainfall into the soil and preservation of natural drainage patterns.

4. Riparian Buffers: Natural vegetated riparian buffers shall be preserved along watercourses and around wetlands wherever possible. The recommended minimum buffer width is 50 feet measured from the wetland boundary or the watercourse's ordinary high water mark. *The actual buffer width should reflect site conditions such as vegetation density, slope, and resource value.*

5. Erosion/Sedimentation Control Plan: All plans for proposed projects that propose to disturb a minimum of one-half acre of land or construct new, or modify existing drainage facilities, must include a plan to install measures to control soil erosion and sedimentation during construction.

6. Stormwater Runoff Quality: Storm drainage systems should minimize the discharge of pollutants into waterbodies through the use of measures that minimize sources of pollution and transport of pollutants. The goal is to remove 80 percent of the total suspended solids. Activities with over five acres of disturbed areas shall have a sediment basin with at least 134 cubic yards of capacity per acre drained to it (see Appendix C for other measures). *In addition to local regulations, stormwater runoff is also regulated by the*

Connecticut Department of Environmental Protection National Pollutant Discharge Elimination Systems (NPDES) program.

7. Conveyance System: All conveyance systems for proposed projects must be analyzed, designed, and constructed to accommodate existing upstream off-site runoff and developed on-site runoff.

8. Discharge Location: The runoff from proposed project sites should be located at natural watercourses or man-made drainage systems with adequate capacity, minimizing diversions.

9. Maintenance and Operation: Maintenance of all drainage facilities constructed or modified by a proposed project on private property is the responsibility of the property owner. Maintenance and operational plans and schedules are required.

10. Registered Professional Engineer: All stormwater management plans, reports, and computations shall be performed by, signed, and sealed by a licensed Professional Engineer registered in the State of Connecticut and who is experienced in the field of water resources.

11. Post Construction: Prior to the Town's issuance of a Certificate of occupancy, the drainage design engineer must certify in writing that the storm drainage system as-built conforms to the approved plans.

II. Stormwater Management Reports

Stormwater management reports are required for all subdivision applications, inland wetland applications, zoning applications, public road construction, and discharges to public roads except when waived by the Town Engineer if the applicant demonstrates that the stormwater goals and objectives have been met. Stormwater management reports should include:

1. Topographic Contour Map(s) showing drainage area(s). For small areas, MDC topography maps shall be used. For larger areas (greater than 200 acres), USGS maps may be used with the approval of the Town Engineer and in conjunction with the MDC topography maps.

2. Floodplain boundaries as defined on the Newington Flood Insurance Study, Flood Boundary and Floodway Map, and inland wetland boundaries.

3. An inventory (onsite and immediately downstream) of watercourses, including areas of limited flow capacity, bank or bed erosion, sediment deposition, DEP water quality classification, principal water uses and users, recreation areas, morphology classification, and channel stability. This inventory is to identify existing or potential problem areas and issues.

4. An inventory and evaluation of on-site and downstream hydraulic structures, including culverts, bridges, dams and dikes with information on their site flow capacity and physical condition. The downstream zone of influence extends to where the site's peak 100-year runoff is less than ten percent of the total watershed's peak runoff. For example, if a site's runoff is 25 CFS, then the zone of influence extends to where the watershed's peak flow is 250 CFS for the same storm frequency. This inventory is to identify the adequacy of downstream drainage facilities potentially impacted by the proposed project

5. An inventory map or list of significant on-site flood water storage areas, including impoundments, floodplains, and wetlands.

6. Identification of the peak rate of runoff at various key points in the watershed and the relative timing of the peak flow rates.

7. Identification of hydraulic structures or watercourses that are inadequate under existing or anticipated future conditions.

8. Recommendations on how runoff is to be managed to minimize any harmful downstream impacts.

9. Recommendations for drainage improvements for existing and future runoff conditions.

10. Written description and computations including the following information:

    a. Method used to calculate storm runoff.

    b. Runoff characteristics of the property before and after development.

    c. Drainage calculations.

    d. Maximum flow velocity and quantity at key points and points of discharge from the total system.

e. Design calculations for all drainage piping, structures, riprap and swales.

f. The evaluation of existing storm drain systems for the peak flow rates anticipated for future maximum development of their drainage areas and recommended method for solving deficiencies.

g. All ponding calculations at low points within pavement areas or grass areas.

h. Dry well computations along with perc test information.

11. A complete set of construction plans showing, in Plan and Profile, all storm drain piping, channels, and structures to be incorporated in the system, including top of frame and flowline elevation, along with details of any special or unusual structures. This will also include a complete Soil Erosion and Sediment Control Plan following the requirements outlined in the "Connecticut Guidelines for Soil Erosion and Sediment Control" as prepared by the Connecticut Council on Soil and Water Conservation latest edition.

12. All computer model input and output data shall be submitted with both paper and digital (disk) formats.

III. Hydrology

A. Methods

1. The stormwater management report for individual sites shall address any adverse increases in the peak flow rate, the timing of runoff and the volume of runoff. Hydrology studies shall be conducted at a level of detail commensurate with the probable impact of the project and should extend downstream to where the proposed project has less than a ten percent increase in the watershed's peak flow rates. Below this point, the proposed project has little hydrologic impact.

2. The peak rates of runoff from simple watersheds with less than 200 acres of land and with no significant surface impoundments shall be computed with the Rational Method, as described in ASCE Manual of Practice #37 and with runoff coefficients based upon both land use and soil types. The Rational Method shall be used for designing peak flow attenuation (detention) systems in

watersheds less than 30 acres in size (see Appendix A), or in watersheds with significant storage.

3. A complete runoff hydrograph evaluation is required for projects resulting in significant impacts, watersheds with significant surface water storage or impoundments, and other critical activities as determined by the Town Engineer. Hydrograph evaluations shall be conducted for existing and anticipated land use conditions for storms with average return frequencies of 1, 2, 10, 25 and 100 years.

4. On the larger streams, peak flow rates may be obtained from the Newington Flood Insurance Study and map, as amended from time to time.

5. The US Soil Conservation Services hydrology methods (TR-55, TR-20) or U.S. Army Corps of Engineers Methods (HEC-1) may be used to compute runoff hydrographs for watersheds of over 100 acres and when the volume of runoff if necessary (detention basins, etc.) for watersheds over 30 acres in size.

   Hydrograph evaluations shall be conducted for existing and anticipated land use conditions, based upon the approved Zoning Map. The hydrograph analysis shall include determination of runoff for each subwatershed and routing runoff through storage impoundments and floodplain storage areas. The timing sequence of the runoff must be fully developed. Subwatersheds shall be selected to determine flows at key structures as well as to determine runoff from areas prone to development. The analysis must isolate and identify that portion of the peak flow at critical downstream points which is due to the project site.

   The following 24-hour rainfall amounts shall be used:

Storm Frequency (Year Storm)	Inches of Rainfall
2	3.2
5	4.1
10	4.7
25	5.5
50	6.2
100	6.9

   The SCS Type III rainfall distribution pattern shall be used with Antecedent Moisture Condition II.

6. The time of concentration used for all hydrology methods should be based upon use of multiple segment flow paths as described in the Soil Conservation Service TR-55 manual and reflect field conditions. The computations must be submitted.

   The time of concentration shall be computed on the sum of travel times for overland flow, shallow concentrated flow, channels, and time in pipes. The minimum time of concentration shall be ten (10) minutes for storm sewer design, in Subdivision, and five (5) minutes for paved parking areas, retail/commercial centers, and central business area.

7. The design storm criteria varies for each site-specific project. There are both economic and practical considerations. Drainage systems or structures whose failure would cause loss of life and property damage or require long detours are designed to higher standards than routine systems. The following factors should be considered in establishing the design storm frequency:

   Design Storm Frequency Factors

   Replacement cost of the structure
   Risk of upstream damage
   Risk of downstream damage
   Potential loss of life
   Environmental impact
   Average daily traffic
   Detour length

Typical design storm frequencies are shown below:

Drainage Structure Type	Typical Design Storm Frequency, Years
Stormwater treatment systems	1" of runoff
Catch basins and gutters without sags	10
Catch basins and gutters with sags	25
Residential Zone storm drains without sags	10
Residential Zone storm drains with sags	25
Industrial and Commercial Zone storm drains laterals	10
Industrial and Commercial Zone storm drains interceptors	25
Local road storm drains	10
Local dry wells	25
Minor drainage swales and channels	25
Major channels (FEMA study)	100
Road culverts	25-100
Bridges	100
Detention basins	25-100
Low-hazard small dams	100*
High hazard large dams	1/2 PMF-PMF*
Flood control channels	100-500*

*Connecticut DEP Criteria apply to State regulated dams and channels.
PMF = Probable maximum flood

In selecting the design storm criteria, the local on-site conditions should be considered as well as the minimum regulatory requirements. The consequences of peak runoff rates exceeding the design flow must be considered with secondary overland flow provisions for reducing the chance of damage from excess flows.

Secondary overland flow relief systems:

	Frequency, Years
- Low density and residential	25
- Commercial, industrial, business, and minor streams	50
- Along major watercourses	100

B. Peak Flow Attenuation

1. The discharge of stormwater runoff from development sites must not cause adverse downstream conditions. When required by the Town Engineer, stormwater runoff must be controlled so that during and after development, the site will generate no greater peak flow than prior to development for a 2-, 10-, 25- or 50-year, and 100-year 24-hour storm considered individually.

   a. Attenuation of the 2-year storm is intended to achieve the stream channel erosion control objective.

   b. Attenuation of the 10, -25-, and/or 50-year storm is intended to assure the adequacy of existing and proposed culverts and storm drain systems.

   c. Attenuation of the 100-year storm is intended to reduce the rate of runoff from development to prevent expansion of the 100-year floodplain so as to alleviate flooding of improved properties and roadways.

2. The techniques available to attenuate changes in the peak flow rates include, but are not limited to, the following:

   - Limiting impervious coverage
   - Maintaining or increasing travel times
   - Groundwater recharge
   - Preserving wetlands and natural depressions
   - Stormwater detention facilities
   - Extending the time of concentration

C. Local Stormwater Management

The following measures shall be applied to individual lots or parcels of land where required by the Town Engineer:

1. Roof Runoff: Where feasible, such as pervious soils or large lots, roof runoff should either be directed into drywell or gallery infiltration systems sized to contain one inch of rooftop runoff or onto stable vegetated soils for at least 50 feet to encourage infiltration and groundwater recharge. Excess roof runoff may be directed overland or to watercourses or storm drains via grass swales or perforated drain pipes. It shall not cross sidewalks or parking areas. The area around the building perimeter shall be graded to drain away from the building.

2. Parking Lot Runoff: Parking lots constructed over pervious soils (excessively and well drained or well drained as defined by the Soil County Soil Survey) shall be designed to encourage groundwater recharge infiltration systems sized to contain one inch of parking lot runoff. Parking lots with heavy usage or near sensitive areas shall include measures to reduce the chance of groundwater contamination, including oil traps, sediment basins, vegetated filters, etc. prior to infiltration systems. The use of grass median strips and depressed islands is encouraged.

3. Sheet Flow: Runoff shall be dispersed into sheet flow across natural or artificially vegetated areas wherever possible.

D. Stormwater Detention Facilities

Stormwater detention facilities to temporarily store excess runoff may be used to control peak flow rate and duration of downstream flows when coordinated with the runoff characteristics of the watershed in which they are located and the local site conditions. Detention facilities are generally appropriate in the upstream two-thirds of a watershed or if downstream flood or erosion problems exist. Section V of this document addresses stormwater quality treatment measures.

Detention facilities may include, but are not limited to:

- Detention basins (less than 12 hours to drain)
- Extended duration retention basins (over 12 hours to drain)
- Landscaped depressions (also called bio-retention areas)
- Subsurface cisterns
- Ponds

1. Any detention facility whose failure could cause significant damage or loss of life may be regulated as a dam by DEP pursuant to Sections 22a-401 through 22a-409 of the General Statutes.

2. All detention facilities serving a watershed larger than 30 acres in size shall be analyzed with hydrograph and storage routing techniques such as TR-20 or HEC-1. For watersheds of less than 30 acres, detention systems should be sized to contain the development's increase in runoff volume as per Appendix B.

3. The release rate shall consider the existing and proposed flow rates at the site and downstream channels or structures and the timing of runoff from other subwatersheds within the basin for the design flood.

4. The waters released from a detention facility shall not increase the peak flow rate at off-site downstream points unless they have adequate flow capacity.

5. The discharge rate from extended duration (over 12 hours) detention facilities into alluvial or eroding channels shall not exceed the channel's bank-full capacity or the two-year flood frequency flow, whichever is less, unless it is determined said channel will be stable.

6. Section 8E of the "Connecticut Guidelines for Erosion and Sediment Control" as may be amended shall be used as a guide to construction details and materials. The minimum free board for the 100-year storm is one foot.

7. An operation and maintenance schedule shall be prepared for every detention facility identifying responsibilities and items of routine maintenance, after use and emergency operations in the event of a flood.

8. An emergency discharge outlet shall be provided with a capacity equal to the discharge from a 100-year frequency flood, with routing computations.

9. The detention facilities may be designed as a multipurpose sedimentation basin for use during and after construction.

10. The design of a detention basin facilities shall include the following data:

    a. Plan with a scale of not less than 1"=40' showing proposed contours with a 2-foot interval.

    b. Details of the outlet.

    c. Inflow hydrograph with outflow hydrograph superimposed on it.

    d. Cross sections of the embankment and spillway.

    e. Inflow mass curve.

    f. Elevation - storage curve or table.

    g. Elevation - discharge curve or table.

h. Flood-routing calculations.

i. Written comments on the subsurface conditions relative to water table, ledge, and soil permeability.

j. Time which is required for the facility to drain completely. For basins that are normally dry, the bottom of the basin will be pitched on a minimum slope of one percent to the outlet area.

k. Materials used in construction of the facility.

l. Methods employed to avoid clogging the discharge mechanism.

m. Fencing, if required for public safety.

n. Proposed landscaping and vegetative measures used to stabilize slopes and bottom surfaces.

o. A wildflower seed mixture in place of grass seed along all non-lawn areas is encouraged for aesthetic and non-maintenance purposes.

p. The designer will make note on the construction drawings that all detention areas are to be built and stabilized as soon as possible.

IV. Conveyance Systems

A. General Conditions

1. Priority should be given to maintaining natural drainage systems, including perennial and intermittent streams, swales and drainage ditches in an open condition.

2. The conveyance systems shall be designed to minimize changes in the runoff travel time via the use of overland flow, grass lined channels, surface depression storage, etc.

3. The conveyance system shall be planned to accommodate both frequent and infrequent storm events, using a combination of primary and secondary (auxiliary) facilities, and to minimize soil erosion. Secondary drainage systems convey flows that exceed the capacity of primary systems, usually via overland flow.

4. Closed storm drain systems (i.e., those involving a storm drain pipe or culvert) should be designed to:

   a. Have a minimum capacity of the 10-year frequency storm flow for laterals within the closed storm drain system in Residential Zones and in Commercial and Industrial Zones; and

   b. Consider secondary overland conveyance of excess flow for the primary storm (generally over the top of the closed storm drain system or roads) (see Section III-A-7).

5. Culverts and bridges should not impede the movement of fish and other aquatic species in stocked and perennial watercourses.

6. All storm drainage systems shall be designed and constructed to accommodate runoff from upstream land areas.

B. Storm Drainage Systems

Conventional stormwater drainage systems usually consist of catch basins with surface inlets connected to underground drain pipes. Drainage systems are used to collect surface runoff from roads, buildings, and parking lots and to convey the runoff to watercourses.

All subsurface storm drainage systems shall be designed in accordance with the Manning equation and the methods and procedures defined in the Connecticut Department of Transportation Drainage Manual prepared by the Division of Design, Bureau of Highway, as may be amended in the following requirements:

1. Roads, parking lots, and site developments should be graded so that runoff in excess of the primary storm drainage system capacity will flow overland to watercourses without obstruction.

2. The hydraulic design of local storm drainage systems usually begins at the upstream end of the system and proceeds downstream. The design follows the runoff from upland sources, including the analysis of overland sheet flow, gutter flow, channels, catch basins, and storm drains to discharge points into established waterbodies.

3. The hydraulic analysis of grass swales, gutters, catch basins, and storm drain pipes normally assumes that the flow is steady state (i.e., constant with respect to time) and uniform.

4. Storm drainage systems for small watersheds less than 200 acres will normally be designed with the use of the Rational Method to predict the peak flow rates. The storm drains shall accommodate all runoff from upstream areas, including adjacent lands outside the property to be developed.

5. The hydraulic design of storm drain pipes, swales, and gutters shall normally be based upon use of the Mannings Equation.

6. Drainage pipes will be designed to flow just full or below full during the peak flow of the design storm, with a minimum diameter of 12 inches and a minimum slope of 0.005 feet per foot.

7. Design computations shall be prepared on the appropriate forms contained in the Appendix.

8. Storm drains shall be designed to flow full. Inlet control will be analyzed as to determine if it will control the pipe size. Calculations will be submitted. When slopes are less than 1.0 percent, outlet control conditions shall be calculated.

10. Storm drains will be designed to maintain a velocity of 2.0 feet per second when the pipe is one-quarter full.

11. A minimum cover of two feet over the crown of the pipe shall be provided for all storm drains, except in streets which shall have a minimum cover of 2.5 feet in relation to the centerline grade of the streets.

12. Underdrains shall be provided as required by shallow groundwater. Underdrain outlets shall be connected to drainage structures whenever practical. When impractical, they shall be terminated at an approved watercourse.

13. Values for roughness coefficient "N" to be used in Manning Formula for pipes shall be based on the following:

Roughness Coefficient:

A. Reinforced concrete or ADS Pipe:

1.	15 inches through 30 inch	n = 0.015
2.	36 inch and larger	n = 0.013

B. Asphalt coated corrugated metal pipe

1.	Unpaved invert	n = 0.024
2.	Paved invert	n = 0.019
3.	Smooth flow	n = 0.013

14. Reinforced Concrete Pipe class shall be Class IV (minimum) with gasket joints and is to be indicated on the drawings.

15. Any deviation in the pipe materials or use of slopes over 10 percent shall be reviewed and approved by the Town Engineer before it is accepted and shown on the proposed plan.

16. Foundation drains of buildings connected into storm drainage systems shall be designed to prevent backflow into the building and shall be identified in an agreement filed in the land records.

17. Surface runoff shall be directed through vegetated filter strips or grass swales wherever possible prior to storm drain inlets or catch basins.

18. The design of the storm drainage system must be coordinated with the soil erosion and sediment control plan.

All permanent storm sewer pipe installed within the public street right-of-way shall be concrete pipe with a rubber gasket joint or ADS pipe with a rubber gasket joint, unless specifically waived by the Town Engineer. The general exception to this policy will be:

a. Where ground conditions require use of an underdrain system.
b. Where slope of pipe will be ten (10) percent or greater.
c. In rock cuts, only reinforced concrete pipe shall be used.
d. Where facility may be considered temporary in nature.
e. Where facility is on private property and remain private.
f. Where ADS pipe is used, the last section shall be concrete pipe.

C. Catch Basins

1. The first catch basin in a storm drain system shall be located within 300 feet of the roadway summit. Catch basin spacing and type shall be determined from the following guidelines or by the gutter flow analysis. A drainage structure shall be placed at each grade change, horizontal direction change, and at the junction of two or more drains.

2. A guide for installing catch basins shall consider the following as maximum spacing requirements:

   a. Where road grade is 5% or less – 400 feet
   b. Where road grade is 5% to 8% - 350 feet
   c. Where road grade is greater than 8% - 300 feet

   Field conditions may require the installation of modified or special catch basins, for example:

   a. Low point area of street or lot may require installation of a double grate structure.
   b. Street slope or quantity of water may require the use of a double grate structure perpendicular to the curbline to eliminate by-pass flow around structure.
   c. When required by gutter flow analysis.

3. All catch basins within intersectional areas are to be located five feet before all Point of Curvatures (P.C.'s) and Point of Tangents (P.T.'s) along the curb alignment.

4. A complete "Gutter Flow Analysis" will be performed when requested by the Town Engineer to determine catch basin spacing and need for double basins in roadway sags. Flooding shall not exceed one half of the lane width. The design procedures outlined in the State of Connecticut Department of Transportation "Drainage Manual" latest edition shall be followed.

5. All catch basins shall have a sump to trap sediment. The sump shall be a minimum 24-inches deep below the lowest pipe invert. Catch basin sumps must be watertight.

6. Catch basins subject to potentially high pollutant loads of floatable material shall be equipped with a hood or baffle to prevent discharge of floating material and have a sump at least 36 inches deep below the lowest pipe invert.

7. Catch basins subject to potentially high runoff pollution loads shall not receive storm drain pipe discharges into them, to minimize suspension of sediments and pollutants. Separate manholes are to be used for the storm drain pipe junctions.

D. Culverts and Bridges

The hydraulic analysis and design of culverts have to consider the orifice flow conditions at the inlet, the capacity of the pipe itself, and the effect of the depth of water at the outlet. All flow conditions have to be analyzed to see which is more restrictive.

Culverts and storm drains whose outlets are submerged or partially submerged often have their flow capacity limited by the tailwater depth at the outlet. This is of particular interest when discharging into rivers or tidal waters with variable water elevations.

Bridges are designed to have a clear free board between the bottom of their deck and the water surface. They are not designed to flow under pressure and do not have a solid structural base.

All culverts and bridges shall be designed in accordance to the methods and procedures defined in the DOT Drainage Manual and shall meet the following requirements:

1. Culverts and bridges will be designed for flood frequencies and under-clearances stipulated in the DOT Drainage Manual, except that on local (not State highways) roads and driveways with low traffic volumes and where alternate routes are available, lower design criteria is acceptable when:

   a. Water surface elevations shall not be increased by more than one foot, nor allowed to cause damage to upstream properties;

   b. Provisions are made to barricade the road when overtopped; and

   c. The road or driveway is posted as being subject to flooding.

2. Bridges and culverts along stocked watercourses and watercourses which may support fish shall be designed to allow passage of fish as recommended by the Department of Environmental Protection Fisheries Unit.

3. The location of new bridges and culverts shall minimize the relocation of watercourses.

4. Where applicable, rigid structure floors at bridges and culverts should be depressed below the normal streambed to allow an alluvial streambed to form over them and shall anticipate if the streambed is degrading.

5. The use of solid parapet walls at bridges and culverts located in the sag part of vertical curves is discouraged due to their blockage of flows overtopping the bridge.

6. Debris barriers shall be used upstream of structures prone to blockage by debris, rock slides, or vegetation.

7. The use of a single large culvert or bridge opening is preferred over use of multiple small openings.

8. The underclearances and maximum headwaters stipulated in the DOT Drainage Manual may be waived by the Town Engineer when decreasing the headwater depth at existing structures which could increase downstream peak flows.

9. All wingwalls and walls and culvert ends with vertical drops over four feet shall have barrier rails or fences. Object markers shall be used for vertical drops of less than four feet.

E. Open Channels

The analysis and design of open channels shall be consistent with the type of channel and its intended purpose. Channels shall be classified as local drainage channels or as watercourse channels, depending on use, and shall be classified as alluvial or non-alluvial based upon their geologic characteristics. Land clearing and land grading within a natural stream corridor should be avoided or minimized, except at stream crossings, so that streams remain in a natural state.

Care should be exercised to ensure that riparian vegetation, including grasses, shrubs and trees in the stream corridor or along the watercourse, remain undisturbed during land clearing, land grading, and land development. A 50-foot wide vegetated buffer area is desired on both sides of natural streams.

1. Type A open channels are local drainage channels with a primary purpose of conveying urban, parking lot and road runoff from small watersheds, frequently with intermittent flow and limited ecological value and are intended to convey their design flow within their banks.

They shall be designed in accordance with the DOT Drainage Manual and:

a. Freeboard allowances shall be provided in proportion of the potential damages that could occur in the event of overtopping;

b. The use of impervious linings is discouraged except for very high velocity flow and steep slopes; and

c. Channels shall be designed with a compact cross-section to concentrate low flows.

2. Type B open channels are natural perennial watercourses or man-made perennial channels planned to simulate a natural watercourse. They shall be designed in accordance with the DOT Drainage Manual and the Connecticut Diversion Permit policies (where applicable).

3. Channel restoration plans shall be prepared for all type B open channel projects. The plan shall help restore and/or create an aquatic habitats suitable for fisheries, while maintaining or improving water quality, recreation, aesthetics and flow capacity. Coordination with the Fisheries and Wildlife Units of DEP is recommended.

F. Storm Drainage Discharge Points

1. The discharge of all stormwater that has been collected or otherwise artificially channeled shall be into suitable natural streams or, with approval, into Town or State drainage systems with adequate capacity to carry the discharge. Otherwise, there shall be no discharge onto or over private property within or adjoining the street unless (a) proper easements and discharge rights have been secured by the applicant; (b) such easements and rights are transferable; and (c) there will be adequate safeguards against soil erosion and flood hazards.

2. No stormwater shall be diverted from one watershed to another without proper DEP Diversion permits and an evaluation of downstream impacts.

3. Storm drainage discharges shall be coordinated with the National Pollution Discharge Elimination System permit program administered by the Connecticut Department of Environmental Protection, which regulates certain types of discharges and diversions.

4. Storm drainage discharge points shall be selected to minimize their environmental impact.

5. All storm drain system outlets shall be terminated with an approved outlet structure to minimize soil erosion. Section 7.4.16 of the Newington Zoning Regulations require the use of a headwall or flared end section at storm drain sewer outlets to watercourses.

6. Stormwater drainage which discharges into rivers and lakes shall consider the hydraulic impact of having drainage outlets submerged (tailwater effect). The preferred method of determining tailwater levels on non-tidal rivers is based on the use of FEMA Flood Insurance Studies available from the Town Clerk and DEP. Published studies are available for most rivers with watersheds of over one square mile and they include flood water elevations for events with average return frequencies of 10, 50, 100, and 500 years.

   Historic flood levels and high water marks may be available in some areas and are helpful in estimating tailwater levels.

   Tailwater levels can be computed by determining the water profiles in rivers using the Mannings Equation for uniform flow and the standard step method for non-uniform flow.

V. Stormwater Quality

1. Stormwater drainage systems should include provisions for the treatment of surface runoff to minimize the sources and transport pollutants. Applicants should verify if their projects are subject to the DEP NPDES Phase I or pending Phase II requirements. The NPDES stormwater and construction site regulations are currently being revised.

2. The "Guidelines for Soil Erosion and Sediment Control," Connecticut DEP, January 1985, as amended time to time will be used as the minimum standard for the design of erosion and sediment control measures.

3. Small volumes of runoff from small areas can usually be controlled with on-site pollution control measures. The recommended techniques include use of sheet flow through vegetated areas, rooftop runoff infiltration, use of pervious surfaces, grass-vegetated swales, catch basins with sumps, catch basin-dry well combinations, and sediment basins or chambers.

The following activities are capable of generating significant levels of pollution and require formal stormwater management plans:

- All development and construction projects affecting over five acres of disturbed soil;
- All sites with over one acre of impervious cover;
- Residential development with three or more units;
- Industrial and commercial projects;
- When required by CT DEP;
- Primary aquifer recharge areas.

Infiltration Systems

Infiltration of on-site runoff by use of vegetated depressions and buffer areas, pervious surfaces, drywells, infiltration basins and trenches permits recharge of groundwater and provides water quality treatment through soil filtration.

Infiltration systems should be provided by a sediment control system to reduce soil clogging.

Long Duration Wet Pond Retention Systems

Long duration retention by use of wet ponds and wetlands constructed in upland areas provides for the storage of collected runoff in a holding area prior to release in a waterway allowing quality treatment by sedimentation, flocculation, and biological removal. Retention is used when post-development runoff volume is expected to exceed the capabilities of infiltration and where significant channel erosion occurs downstream. Wet ponds have permanent pools of water and require sufficient watershed area to maintain them.

Extended Duration Detention/Sediment Systems

Extended duration detention sediment systems provide for the temporary storage of collected runoff in a holding area prior to release into a waterway. Settling is the primary pollutant removal mechanism. The degree of removal is dependent on whether a given pollutant is in particulate or soluble form. Removal is likely to be quite high if a pollutant is a particulate, whereas very limited removal can be expected for soluble pollutants. The detention period is typically about 24 hours.

Extended detention can provide thermal benefits to a trout stream. By using a perforated, low-flow drain pipe encased in a gravel jacket having all adequate mass, extended detention may be used to dissipate heat and cool stormwater runoff prior to its discharge to a trout stream.

VI. Easements and Rights-of-Way

A. Maintenance roads and easements shall be provided for all permanent facilities. The road shall be 12 feet wide, having 12 inches of processed gravel subbase and surface treated. The gradient shall not exceed 15 percent.

The use of public streets or fill embankments of public streets as the dam and/or spillway for detention ponds will not be permitted.

B. A channel or brook right-of-way of sufficient minimum width to include a 10-foot access strip in addition to the width of the channel or brook from bank top to bank top shall be offered for dedication to the Town for drainage purposes and maintenance.

C. The following drainage right-of-way criteria apply to subsurface storm drains:

Drainage Right-of-Way for Pipe:

Pipe Size	Minimum Width	Location of Centerline of Pipe or Ditch
Under 24"	20 feet	5' from either edge of drainage ROW
30" to 48"	25 feet	10' from either edge of drainage ROW
54' to 72'	35 feet	15' from either edge of drainage ROW

D. Where proposed storm drains discharge into an existing natural watercourse, an unlimited "Right to Drain" agreement from the adjacent property owner is required.

E. Section 3.72, 3.73, and 3.74 of the Newington Subdivision Regulations, pertaining to drainage easements, is incorporated by reference for subdivision applications.

VII. Materials

All materials for pipes, structures, catch basins, manholes, riprap, silt fence, etc. shall conform with ConnDOT Standard Specifications as amended from time to time.

j18smg-jea.doc

APPENDIX A

SUMMARY – TOWN OF NEWINGTON DRAINAGE ANALYSIS AND DESIGN REQUIREMENTS INCLUDING ADDENDUM #1

TOWN OF NEWINGTON

DRAINAGE ANALYSIS AND DESIGN REQUIREMENTS

A complete storm drainage analysis prepared and certified by a Professional Engineer, registered in the State of Connecticut, shall be made in accordance with sound engineering practices and constructed to the requirements of the Town of Newington. The criteria noted below will be adequate for most conditions. However, the criteria may be altered if, in the opinion of the Town Engineer, an upgrading of these standards is required.

DESIGN FREQUENCY

Pipe Design (Surface Drainage):

A. Residential street drainage - lateral system - 10 year design, trunk line - 10 year design, except in sag areas where property damage is likely, due to flooding.

B. Commercial, Industrial, Central Business - lateral system - 10 year design, trunk system - 25 year design.

Major Ditches, Channels and Dry Weather Courses (defined as natural or man made water course which is tributary to an existing stream and defined on M.D.C. topography maps) - 25 year design.

Existing Major Streams and Their Improvements as Defined by HUD Insurance Program (which may include Abutting Flood Plain) - 100 Year Design. For streams not covered by HUD Insurance Program the frequency may be reduced to 50 year design.

Positive Overland Flood Relief Without Property Damage - 25 year design in residential and 50 year in Commercial, Industrial and Central Business District.

TIME OF CONCENTRATION

The time of concentration shall be computed on the sum of overland flow time, time in ditches, and time in pipes. The minimum time of concentration shall be ten (10) minutes for storm sewer design, in Subdivision, and five (5) minutes for paved parking areas, retail/commercial centers, and central business area.

RUNOFF FACTORS

The following runoff factors shall be used:

A. Paved or impervious areas - 0.9
B. Steep slopes (over 15%) - 0.5 to 0.7
C. Lawn residential and park areas (less than 15% slope)--0.25 to 0.45.
D. Undeveloped land 0.15 to 0.25 (depending on slope)

Weighted runoff factors are to be used in drainage computations. Runoff factors for adjacent undeveloped land are to be computed on the "complete upstream development of land based on existing zoning or land use as proposed by Master Plan whichever causes higher runoff". The Town Engineer may modify this requirement where the watershed storm water management program calls for storm water retention upstream of subject site.

DESIGN METHOD - PIPES

The rational formula (Q=CIA) will be used basically in computing flows. The Town Engineer may require the use of the Soil Conservation Service methodology under certain conditions or situations where existing condition may warrant the use of a more conservative design. The following manuals will be used for determining pipe size and channel configuration:

A. Design Charts for open-channel flow Hydraulic Design Series No. 3 by Bureau of Public Roads, August 1961.

B. Hydraulic Charts for the selection of Highway Culverts. Hydraulic Engineering Circular No. 5 by Bureau of Public Roads, December 1965

C. Technical Release No. 55 Urban Hydrology for small Water Sheds Engineering Division, Soil Conservation Service U.S. Department of Agriculture June 1986

Storm sewer systems shall be designed to flow full but not under pressure, using the Manning Formula to determine the pipe size.

Special attention shall be given to the effect of submergence or free flow outlet condition in the design of outfall pipe. Measures shall be taken to maintain a maximum velocity of 5 feet per second for design flow.

All outlet structures shall be tested for erosion control.

Where the slope of pipe is less than 1 percent or there is evidence of a tailwater condition, backwater computations shall be included as part of the drainage submission.

DESIGN METHODOLOGY - RETENTION BASINS

Small Sites and watershed area less than 200 acres - See Addendum "1" to this Appendix.

Watershed area greater than 200 acres - The Town Engineer will review existing field conditions and will establish design parameters on case by case basis. The minimum design criteria in any case will be the same as contained in Addendum "1" to this Appendix.

Watershed Greater than 200 Acres - The Town of Newington reserves the option to utilize the SCS methodology for estimating runoff for comparison with rational method.

STORM SEWER DESIGN

All permanent storm sewer pipes installed within the public street right of way shall be concrete pipes unless specifically waived by the Town Engineer. The general exception to this policy will be:

A. Where ground conditions require use of an under-drain system.

B. Where slope of pipe will be ten (10) percent or greater.

C. Where facility may be considered temporary in nature.

D. Where facility is on private property and will remain private

Minimum size pipe allowed is twelve (12) inches in diameter.

Minimum grade of pipe shall provide a velocity of two (2) feet per second, where flowing 1/4 full.

Roughness Coefficient:

A. Reinforced concrete or ADS Pipe--

1. 15 inch through 30 inch --n=0.015.
2. 36 inch and larger----------n=0.013.

A. Asphalt coated corrugated metal pipe--

1. Unpaved invert----------n=0.024
2. Paved invert----------n=0.019
3. Smooth flow----------n=0.13

CATCH BASIS SPACING

A guide for installing catch basins shall consider the following as maximum spacing requirements:

A. Where road grade is 5% or less - 400 feet
B. Where road grade is 5% to 8% - 350 feet
C. Where road grade is greater than 8% - 300 feet

Field conditions may require the installation of modified or special catch basins, for example:

A. Low point area of street may require installation of a double grate structure.

B. Street slope or quantity of water may require the use of a double grate structure perpendicular to the curb line to eliminate by pass flow around structure.

Town Engineer reserves the right to require submission of gutter flow analysis.

Spacing of manhole structures shall be a function of field conditions and approved by Town Engineer.

All materials shall conform to Connecticut Development of Transportation's specifications.

All structures shall be constructed in accordance with Connecticut Department of Transportation's requirements.

DITCHES and CHANNELS

All ditches and channels (bottom width two (2) feet or greater shall be analyzed as to type of treatment necessary based on flow, velocity, and grade, as follows:

1. Rip-Rap, 2. Paved, 3. Grass or natural ground.

DRAINAGE RIGHTS OF WAY FOR PIPE:

Pipe Size	Minimum Width	Location of Centerline of Pipe or Ditch
Under 24"	20 feet	5' from either edge of drainage R.O.W.
30" to 48"	25 feet	10' from either edge of drainage R.O.W.
54' TO 72'	35 feet	15' from either edge of drainage R.O.W.

NOTES:

A. A copy of the computations used in determining all pipe sizes shall be submitted to the Town Engineer on a form(s) supplied by the Town.

B. Engineer shall check capacity of existing down stream facilities as part of his/her analysis.

C. A drainage analysis map outlining drainage areas shall be submitted with the computations as follows:

   1. When only local street drainage is involved, the contour map of the subdivision section will be adequate. If the submitted section is part of an overall system, then calculations and area map shall be submitted for the upstream area.

   2. If a watercourse is involved, a contour map based on M.D.C. datum, scale 1" = 200', showing the tributary area and the effect on down stream properties shall be submitted.

D. Guidelines for soil erosion and sediment control prepared by the Council on Soil and Water Conservation and dated January 1985 shall be used in addressing designs and treatment of soil erosion and sediment related conditions.

Addendum

A. Design of Retention Systems for Small Work sheds

B. Storm Drainage Calculation and Design Form

C. Backwater Computation Form

ADDENDUM 1 TO: "APPENDIX B"
Town of Newington
Drainage Analysis and
Design Requirements

DESIGN OF RETENTION SYSTEMS - SMALL SITES AND WATER SHEDS

LESS THAN 30 ACRES

A. STORAGE CAPACITY

1. Surface - 25-year storm (difference between full development and existing conditions for routing calculation, and 100-year utilizing emergency spillway or overflow.

2. Subsurface – 25 year storm (difference between full development and existing conditions) unless waived by Town Engineer in writing.

B. MAXIMUM DISCHARGE THROUGH OUTLET

Capacity of existing downstream system up to a maximum for a 10-year storm based on existing conditions. (NOTE: On Major Water Courses or Brooks, the Town Engineer may approve a higher discharge.

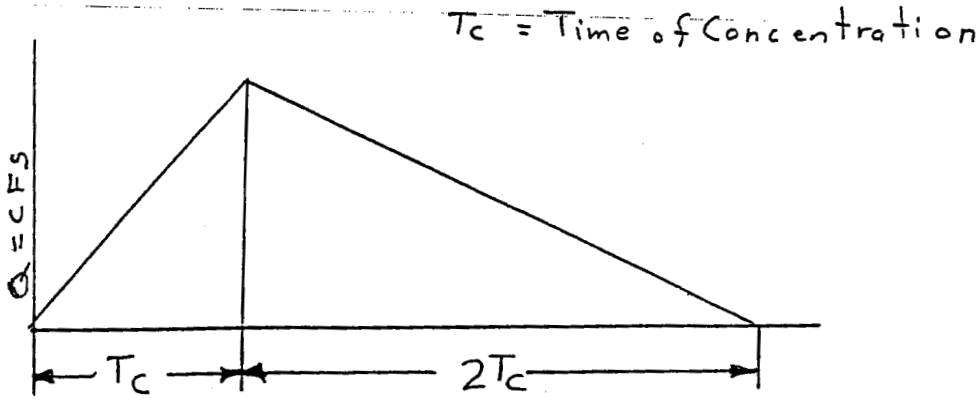
C. CONTROL STRUCTURE

Must be designed to monitor the discharge of lower frequency storms (NOTE: For example; 1-year, 2-year, 5-year, etc.)

D. Engineer must determine which storm (utilizing the rational formula within the parameters of design presents the controlling effect on downstream facilities and properties. (NOTE: For example: within a small watershed, a storm of longer duration may control over the peak discharge storm.)

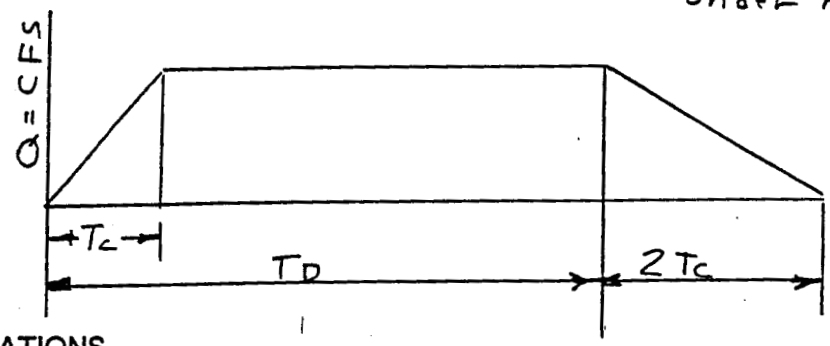
E. The triangular type hydrographs, shown below, shall be used in developing flows for the design storm:

1. PEAK STORM



T_c = Time of Concentration
T_D = Time Span of Storm Under Analysis.

2. DURATION TYPE STORM



F. ROUTING CALCULATIONS

Method and Format shall be submitted to Town Engineer for approval.

DESIGN OF DETENTION SYSTEMS FOR SMALL SITES On site storage and leaching utilizing the absorption qualities of existing ground-25 year where no outlet exists.

A. A design of lesser frequency (10 year) may be considered where access exists to a public street either by direct pipe connection to a street system or over land flow within the property to a public street.

B. Engineer must determine which storm utilizing the rational formula within the parameters of design presents the controlling condition. Storm Conditions may exist where volume of run-off may control over peak discharge. Therefore, storage capacity of the system can become a critical factor depending on the absorption quality of the ground.

C. Town Engineer shall approve method/procedure to be used for calculating underground storage capacity required for system.

D. Test pits shall be excavated to a depth where the proposed system is to be installed. Perculation tests shall be conducted by the Engineer in accordance with accepted procedures. Effective permeability of the soil shall be assessed as follows:

1. Two (2) test pits - lower of two results,

2. Four (4) or more pits - eliminate the high and low; use average of remaining results.

NOTE: Time of year is critical in determining the elevation of the water table. Tests should be done either in the spring or fall.

E. All catch basins discharging into the system shall have trapped outlets with three (3) foot sumps.

Design for the above Retention and Detention Systems shall incorporate provision(s) for emergency relief or by-pass to accommodate excess flows. This provision insures that no major or adverse impact will occur to property within the immediate area of the system.

APPENDIX B

COMPUTATION FORMS AND AIDS

TOWN OF NEWINGTON
STORM DRAINAGE COMPUTATIONS

LOCATION _____

PREPARED BY _____ DATE _____

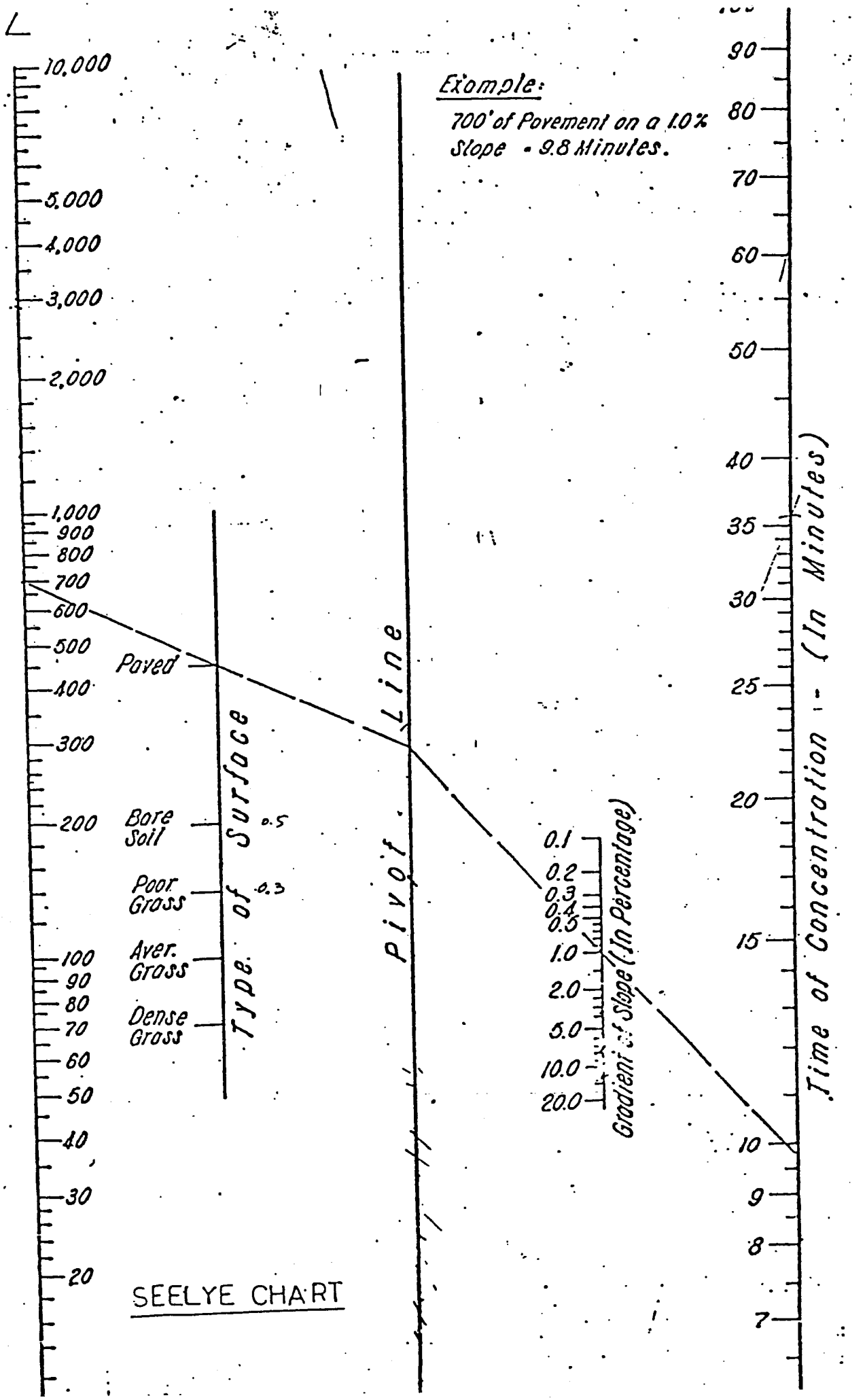
CHECKED BY _____ DATE _____

$Q = CIA$

DESIGN FREQUENCY _____ YRS.

SHEET _____ OF _____ SHEETS

REMARKS	LOCATION		AREA				TIME OF FLOW (MINUTES)			DESIGN						PROFILE			MISCELLANEOUS			
	FROM INLET	TO INLET	TRIBUTARY AREA (ACRES)	RUN-OFF COEFFICIENT	EQUIVALENT (100%) ACRES	CUMULATIVE (100%) ACRES	TO UPPER END	IN SECTION	ACCUMULATED TOTAL	RAINFALL INTENSITY (INCHES PER HOUR)	RUN-OFF (C.F.S.)	SLOPE (FT. PER 100 FT.)	DIAMETER OF PIPE (INCHES)	CAPACITY OF PIPE FULL (C.F.S.)	VELOCITY OF PIPE FULL (FT. PER SEC.)	INVERT ELEVATION UPPER END	INVERT ELEVATION LOWER END	SECTION LENGTH (FT.)				


Example:
700' of Pavement on a 1.0% Slope = 9.8 Minutes.
L
10,000
5,000
4,000
3,000
2,000
1,000
900
800
700
600
500
400
300
200
100
90
80
70
60
50
40
30
20
Paved
Bare Soil
Poor Gross
Aver. Gross
Dense Gross
0.5
0.3
Type of Surface
Pivot Line
0.1
0.2
0.3
0.4
0.5
1.0
2.0
5.0
10.0
20.0
Gradient of Slope (In Percentage)
90
80
70
60
50
40
35
30
25
20
15
10
9
8
7
Time of Concentration - (In Minutes)
SEELYE CHART

RAINFALL FREQUENCY VALUES FOR CT-RI
With 24-Hr. Storm Duration

Inches of Rainfall

FREQUENCY	1-YR.	2-YR.	5-YR.	10-YR.	25-YR.	50-YR.	100-YR.
Connecticut							
Fairfield	2.7	3.3	4.3	5.0	5.7	6.4	7.2
Hartford	2.6	3.2	4.1	4.7	5.5	6.2	6.9
Litchfield	2.6	3.2	4.1	4.7	5.5	6.2	7.0
Middlesex	2.7	3.3	4.2	5.0	5.0	6.3	7.1
New Haven	2.7	3.3	4.2	5.0	5.6	6.3	7.1
New London	2.7	3.4	4.3	5.0	5.7	6.3	7.1
Tolland	2.6	3.2	4.1	4.8	5.5	6.2	6.9
Windham	2.6	3.2	4.2	4.8	5.5	6.2	6.9
Rhode Island							
Northern	2.7	3.3	4.2	4.8	5.6	6.2	7.0
Eastern	2.7	3.4	4.3	4.9	5.7	6.3	7.1
Southern	2.7	3.4	4.4	5.0	5.8	6.4	7.2

Reference: U.S. Department of Commerce and Weather Bureau
T.P. 40, May 1961

EXHIBIT 2-3.1 CT-RI

April 1982

RAINFALL INTENSITY CHART IN INCHES PER HOUR
HARTFORD, CONN.

DURATION IN MINUTES

Return Period (Years)	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	3
10	6.2	5.6	5.4	5.3	5.0	4.7	4.5	4.4	4.3	4.1	4.0	3.9	3.8	3.7	3.5	3.4	3.3	3.2	3.2	3.2	3.1	3.0	2.9	2.9	2.8	2.7	2.6	2.
25	7.1	6.7	6.4	6.1	5.7	5.6	5.4	5.2	5.0	4.9	4.7	4.5	4.4	4.3	4.2	4.1	4.0	4.0	3.9	3.8	3.7	3.6	3.5	3.5	3.4	3.3	3.2	3.
50	7.7	7.4	7.0	6.7	6.5	6.1	6.0	5.8	5.6	5.4	5.2	5.1	5.0	4.9	4.7	4.6	4.5	4.4	4.3	4.3	4.2	4.1	4.0	3.9	3.8	3.7	3.6	3.

DURATION IN MINUTES

Return Period (Years)	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	6
10	2.6	2.5	2.5	2.5	2.4	2.4	2.3	2.3	2.3	2.2	2.2	2.1	2.1	2.1	2.0	2.0	2.0	2.0	1.9	1.9	1.9	1.9	1.8	1.8	1.8	1.8	1.8	1.
25	3.1	3.1	3.0	3.0	2.9	2.9	2.8	2.8	2.7	2.6	2.5	2.5	2.5	2.5	2.4	2.4	2.4	2.4	2.3	2.3	2.2	2.2	2.2	2.2	2.2	2.1	2.1	2.
50	3.5	3.4	3.3	3.3	3.2	3.2	3.1	3.1	3.0	3.0	2.9	2.9	2.8	2.8	2.8	2.7	2.7	2.7	2.6	2.6	2.5	2.5	2.4	2.4	2.4	2.4	2.4	2.

WATER SURFACE ANALYSIS

PROJECT _____ TOWN _____ ROUTE _____

DESIGNED BY _____ DATE _____ CHECKED BY _____ DATE _____ SH. NO. _____

STA. _____ OFFSET _____

OFFSET _____

STRUCTURE TYPE _____

TOP OF GRATE ELEV. _____

DESIGN W.S. ELEV. _____

OUTLET STA. _____

OUTLET T.W. EL. _____

OUTLET EL. _____

MATCH "A" MARK

Q = _____ EL. _____ EL. _____

LENGTH _____

SLOPE _____

Q = _____ EL. _____ EL. _____

LENGTH _____

SLOPE _____

SIZE		INLET CONTROL		OUTLET CONTROL $HW = H + h_o - LS_o$								Control HW
TYPE	n	$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS	HW	

SIZE		INLET CONTROL		OUTLET CONTROL $HW = H + h_o - LS_o$								Control HW
TYPE	n	$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS	HW	

STA. _____ OFFSET _____

OFFSET _____

STRUCTURE TYPE _____

TOP OF GRATE ELEV. _____

DESIGN W.S. ELEV. _____

MATCH "A" MARK

Q = _____ EL. _____ EL. _____

LENGTH _____

SLOPE _____

Q = _____ EL. _____ EL. _____

LENGTH _____

SLOPE _____

SIZE		INLET CONTROL		OUTLET CONTROL $HW = H + h_o - LS_o$								Control HW
TYPE	n	$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS	HW	

SIZE		INLET CONTROL		OUTLET CONTROL $HW = H + h_o - LS_o$								Control HW
TYPE	n	$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	LS	HW	

PROJECT: _____
TOWN: _____
ROUTE: _____

CULVERT COMPUTATIONS

PREPARED BY: _____
CHECKED BY: _____
DATE: _____

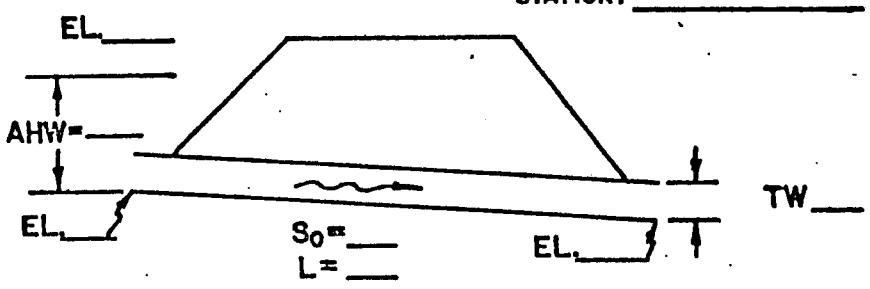
HYDROLOGIC AND CHANNEL INFORMATION

Q_1 = _____ TW_1 = _____
Q_2 = _____ TW_2 = _____

Q_1 = DESIGN DISCHARGE, FREQ. = _____ YR.
Q_2 = CHECK DISCHARGE, FREQ. = _____ YR.

SKETCH

STATION: _____



MEAN STREAM VELOCITY = _____
MAX. STREAM VELOCITY = _____

CULVERT DESCRIPTION (ENTRANCE TYPE)	Q	SIZE	HEADWATER COMPUTATION									CONTROLLING HW	OUTLET VELOCITY	COST	COMMENTS
			INLET CONT.		OUTLET CONTROL $HW = H + h_o - LS_o$										
			$\frac{HW}{D}$	HW	K_e	H	d_c	$\frac{d_c+D}{2}$	TW	h_o	HW				

SUMMARY & RECOMMENDATIONS:

Inlet Number	Time to Inlet	Area in Acres	Runoff Coefficient	AI	Sum of AI	Total AI	Rainfall Intensity	Q to Inlet	Grade of Gutter	Cross Slope of Shoulder	Depth of Flow at Gutter	Width of Flow	Q Bypassing Inlet	AI Bypassing Inlet	AI Entering Catch Basin
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Town ______________

Project ______________

Route ______________

Checked by ______________

Designed by ______________

Sheet No.

APPENDIX C

TYPICAL BEST MANAGEMENT MEASURES

The management measures used to minimize runoff volumes and to control peak rates of runoff should be appropriate for the size and type of watershed involved. The overall goals are to minimize runoff volume (limit impervious cover, encourage infiltration, disperse runoff, etc.) and to control peak flow rates (preserve natural watercourses, delay runoff, store excess runoff, etc.). The table below outlines some of the specific measures available.

RUNOFF FLOW RATE CONTROLS

On-Site	Small Watersheds	Large Watersheds
Minimize Impervious Cover	Save Wetlands	
Disperse Roof Runoff	Preserve Watercourses	Floodplain Storage
Disconnect Impervious Areas from Storm Drains	Protect Riparian Buffers	Channel Encroachment Limits
Minimize Curbs	Delay Runoff	Flood Control Dams
Use Dry Wells for Rooftop Runoff	Detention Basins	Minimize Channelization
Use Grass Channels	Retention Basins	Use Floodway Systems
Preserve Depressions	Wet Ponds	Control Velocities
Preserve Wetlands	Infiltration Systems	Restore Degraded Channels
Encourage Sheet Flow	Minimize Pipes, Conduits	Floodwater Diversions
Utilize Vegetative Filters	Wetland Storage	
Level Spreaders	Swale Check Dams	
Save Existing Trees	Increase Flow Path Lengths	
Use Pervious Pavements	Increase Roughness "N"	

Stormwater runoff should be managed to avoid sources of pollution and treat it to remove excess pollutants. The first steps are to minimize the volume of runoff (see Appendix C), and to control pollutants at their source. The secondary and tertiary type of measures treat the runoff after it has been exposed to pollutants. Typical management measures are listed below.

RUNOFF QUALITY CONTROLS

Source Controls	Primary Measures	Secondary Measures	Tertiary Measures
Litter Control	Grass Filter Strips	Grass Swales	Outlet Protection
Minimize Disturbance	Silt Fence	Sediment Chambers	Aeration
Avoid Steep Slopes	Haybales	Recharge Basins	Sand Filters
Apply Mulch	Catch Basin Sumps	Sediment Basins	Peat Filters
Hydro Seed or Sod	Hooded Outlets	Retention Basins	Chemical Treatment
Cover Stockpiles	Bag Filters	Check Dams	Artificial Wetlands
Save Existing Trees	Sheet Flow	Bio Filters	Cartridge Filters
Street Sweeping	Vegetated Shoulders	Vegetated Buffers	Vegetative Filters
Limit Fertilizer	Oil & Grease Traps	Swirl Concentrators	
Spill Cleanup	Minimize Curbs	Wet Ponds	

APPENDIX D

TYPICAL DETAILS

TYPICAL SECTION
ADS PIPE, CONCRETE OR METAL PIPE

TOWN OF NEWINGTON

TYPICAL

STORM DRAIN TRENCH

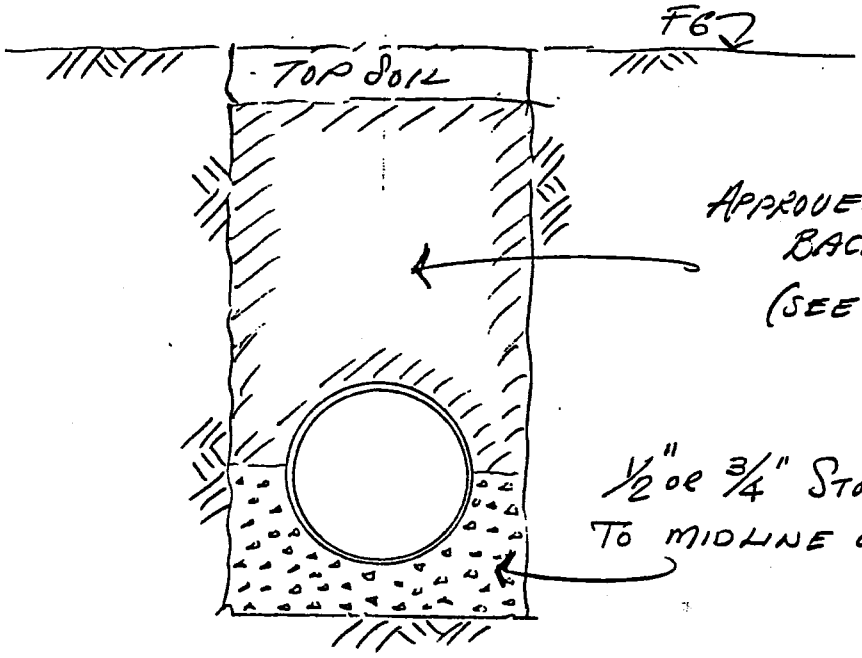
ADS PIPE UNDERDRAIN

Not to Scale

REVISIONS			
No.	Description	Date	Approved

Drawn By: H.J.R. | Checked By: P.M.A.

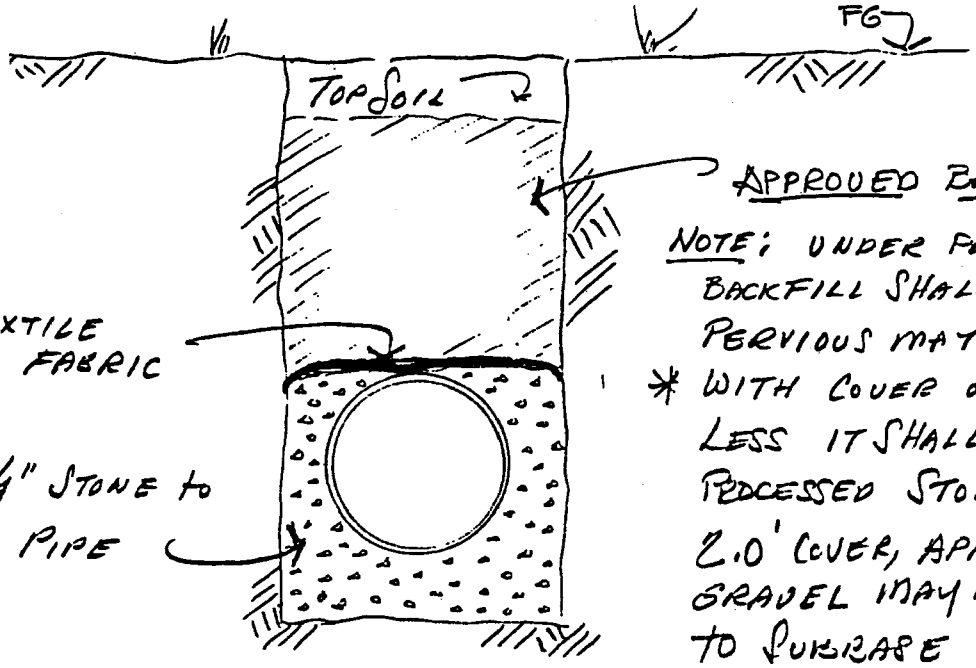
Date: | File:



REG ADS SMOOTHFLOW N-12

"O"RING RCP

ALUMINUM OR ASPHALT COATED CORREGATED METAL P



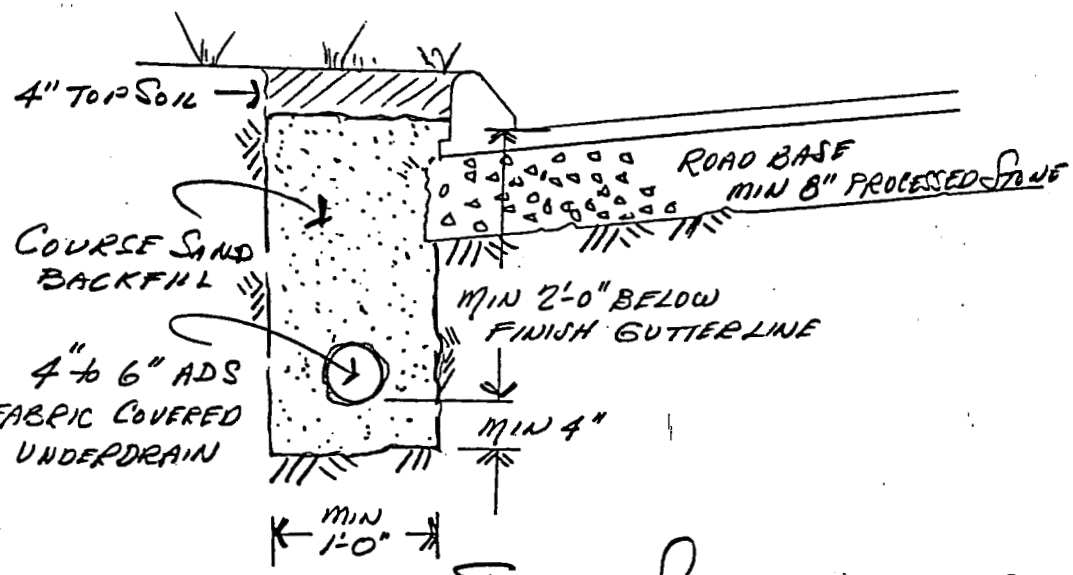
NOTE: UNDER PAVEMENT BACKFILL SHALL BE PERVIOUS MATERIAL,

* WITH COVER of 2.0' OR LESS IT SHALL BE PROCESSED STONE, OVE 2.0' COVER, APPROVED GRAVEL MAY BE USE TO SUBBASE of PAVEM

UNDERDRAIN

PERFERATED ADS SMOOTHFLOW N-12

TOWN of NEWINGTON



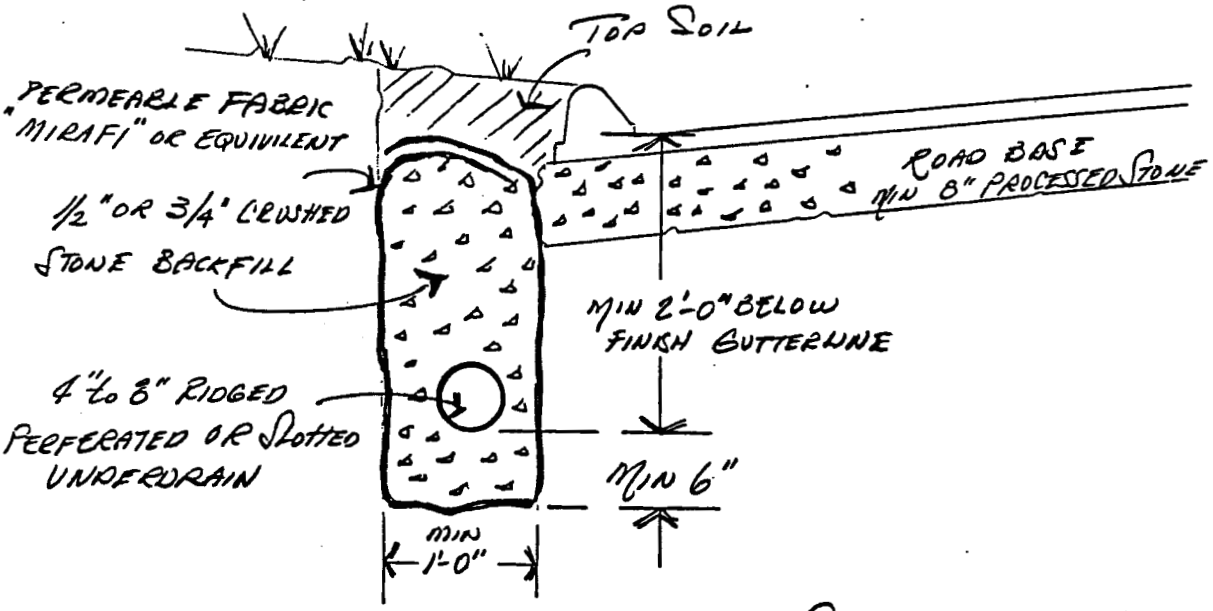
TYPICAL SECTION *NOT TO SCALE

FLEXABLE FABRIC COVERED UNDERDRAIN (SAND BACKFILL)

TOWN OF NEWINGTON

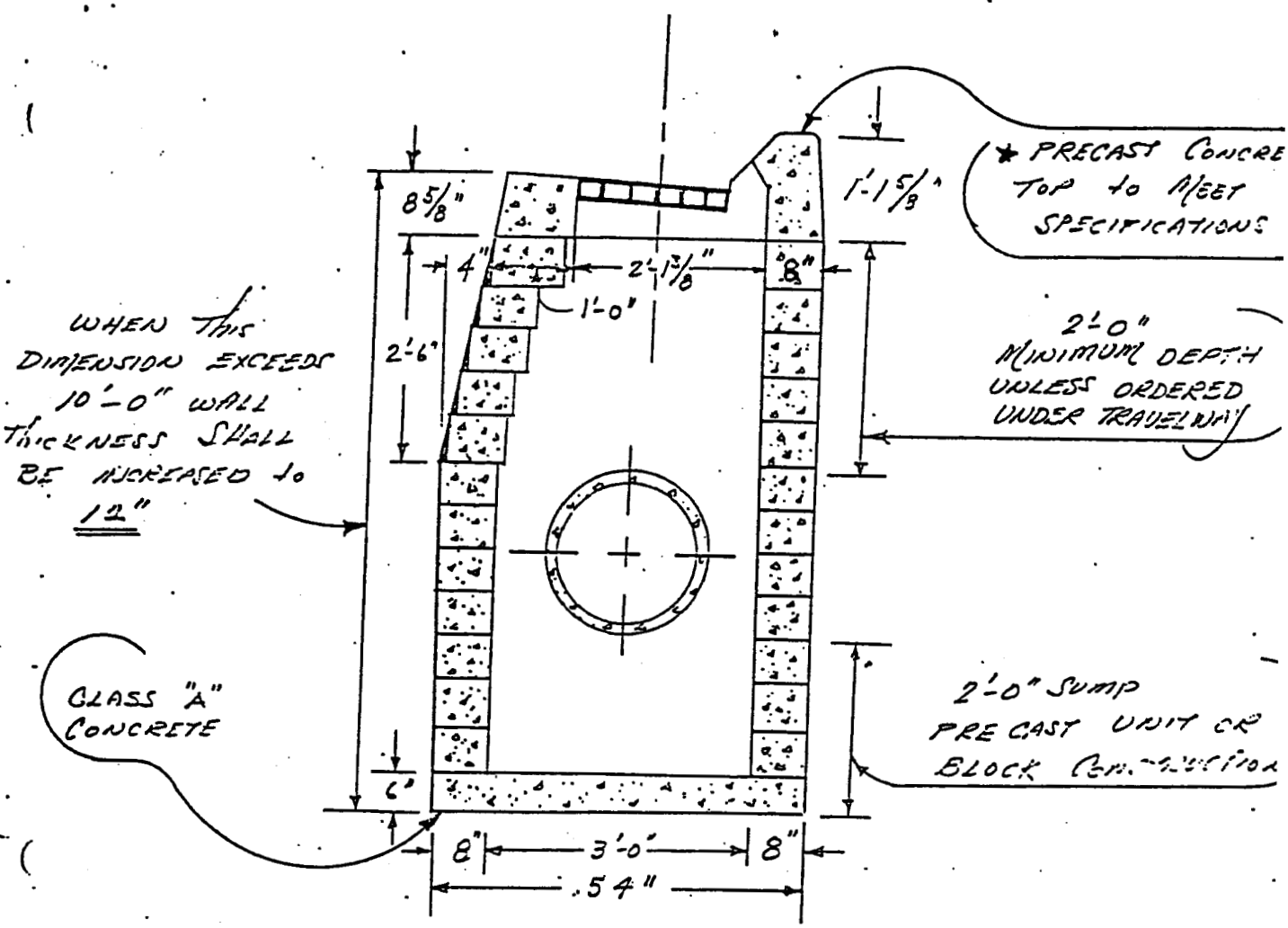
TYPICAL UNDERDRAIN DETAILS

REVISIONS			
No.	Description	Date	Approved



TYPICAL SECTION *NOT TO SCALE

RIDGED PERFERATED OR SLOTTED UNDERDRAIN (STONE BACKFILL)



NOTE: ALL INTERIOR WALLS of CATCH BASIN WILL BE FACED, POINTED, AND GROUTED WITH MORTAR.

* TOWN OF WINDSOR TYPE WITH 3/8 INCH PER FOOT CROSS SLOPE

REVISIONS			
No.	Description	Date	Approved
Drawn By: H.J.P.		Checked By: P.M.A	
Date:		File: plate	

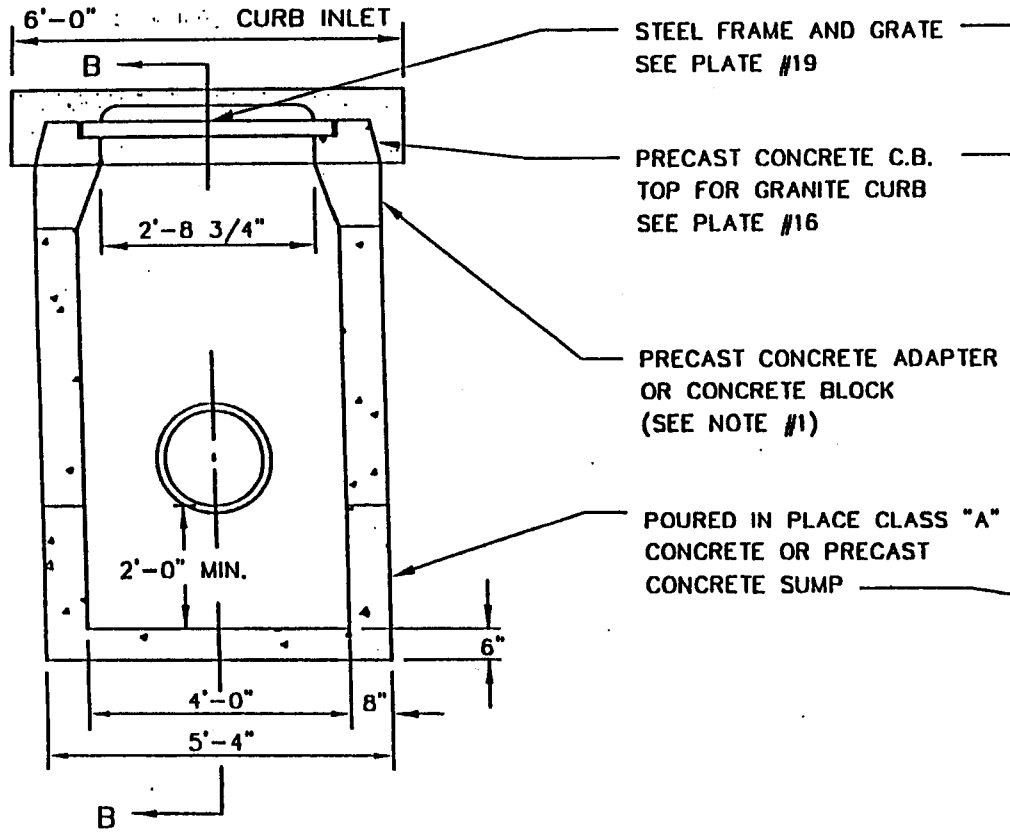
TOWN OF NEWINGTON

TYPICAL

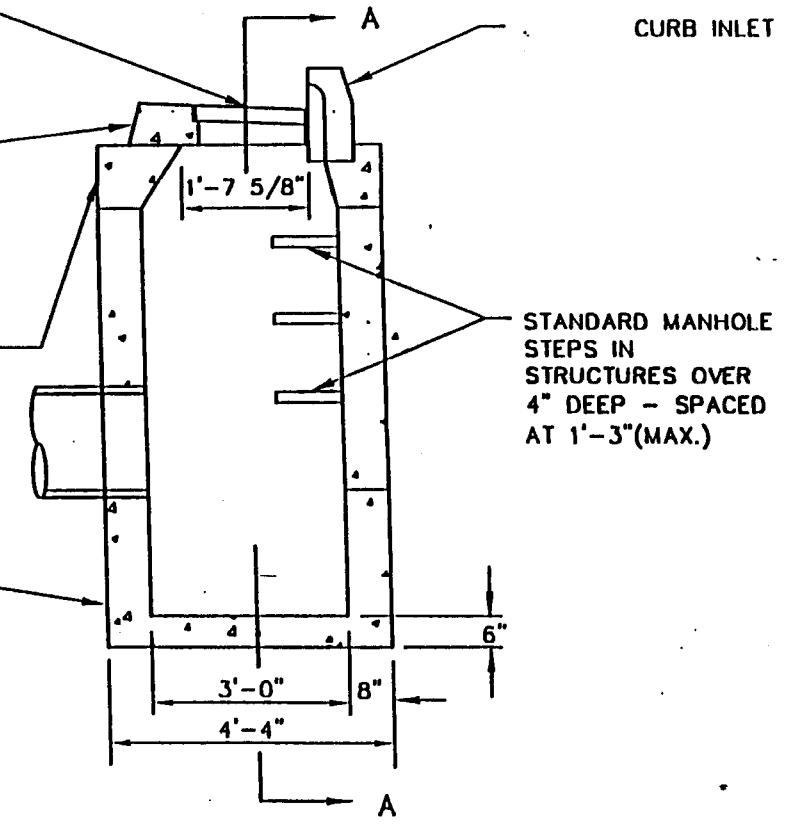
TYPE "C" CATCH BASIN BLOCK CONSTRUCTION

Not to Scale

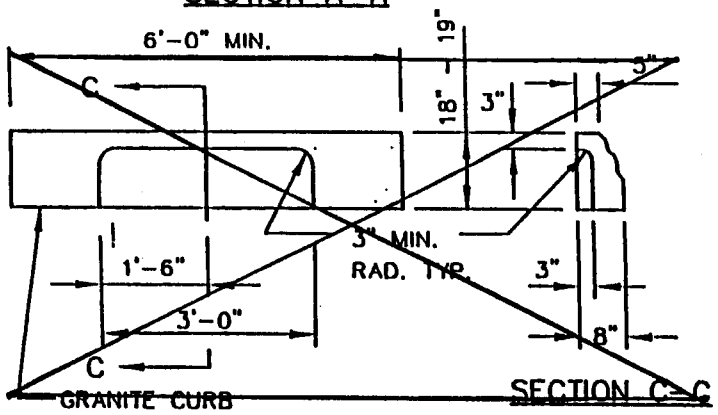
PLATE



SECTION A–A



SECTION B–B



GRANITE CURB INLET

NOTES:

1. WHEN CONC. BLOCKS USED, MAX. CORBEL OF 2" PER COURSE OF BLOCK.
2. WALLS – CONC. BLOCK OR PRECAST SECTIONS.
3. WALL THICKNESS TO BE 12" WHEN TOTAL HEIGHT OF STRUCTURE EXCEEDS 10' FROM T.F. TO BOTTOM OF BASE.

REVISIONS			
No.	Description	Date	Approved

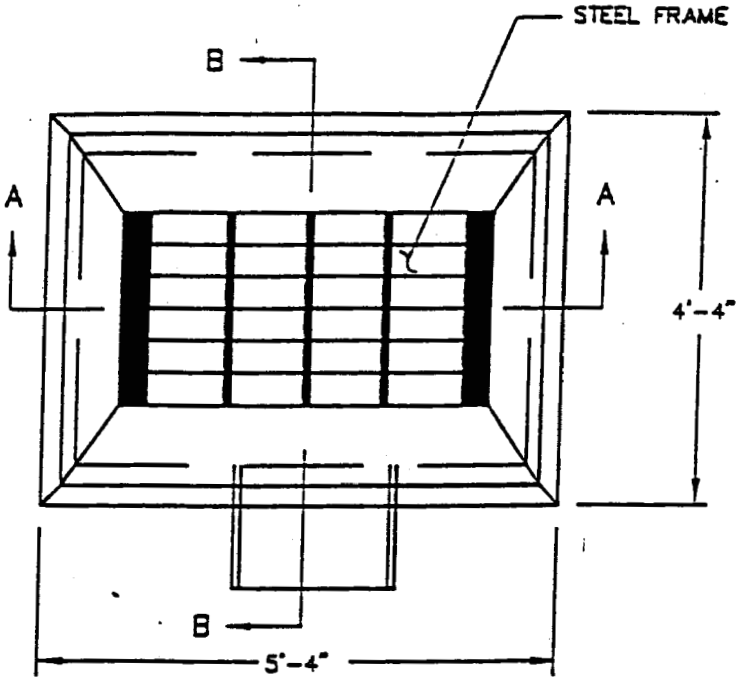
Drawn By: Checked By:

TOWN OF NEWINGTON

TYPICAL

TYPE "C" CATCH BASIN

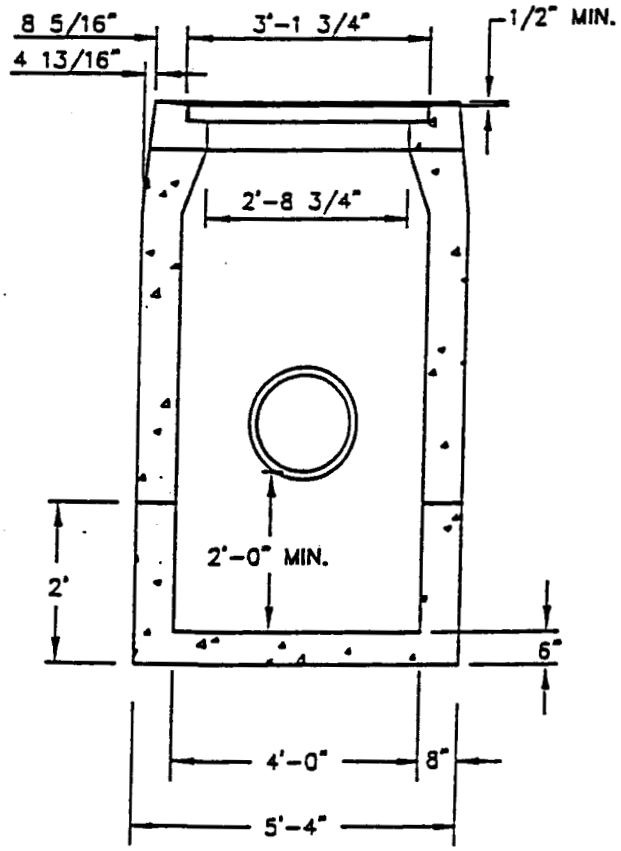
PLATE



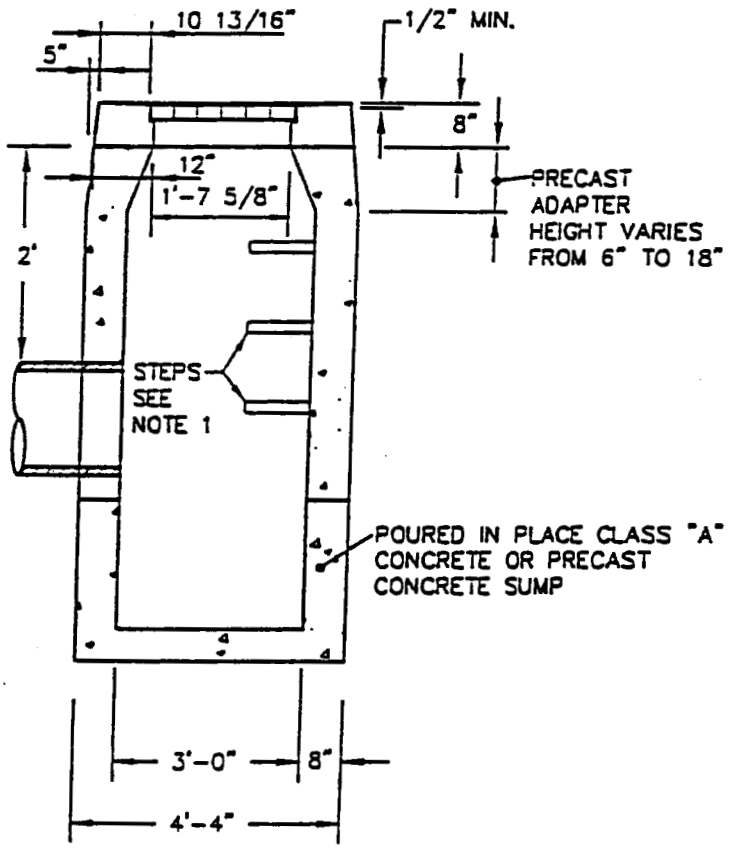
PLAN

NOTES:

1. STANDARD MANHOLE STEPS IN STRUCTURES OVER 4'–0" DEEP SPACED AT 1'–3".
2. WALLS CONC. BLOCK OR PRECAST CONC. SECTIONS.
3. WALL THICKNESS TO BE 12" WHEN TOTAL HEIGHT OF STRUCTURE EXCEEDS 10'–0" FROM T.F. TO BOTTOM OF BASE. INSIDE DIMENSIONS TO REMAIN THE SAME.



SECTION A–A



SECTION B–B

REVISIONS			
No.	Description	Date	Approved
Drawn By:		Checked By:	
Date:		File: plate:	

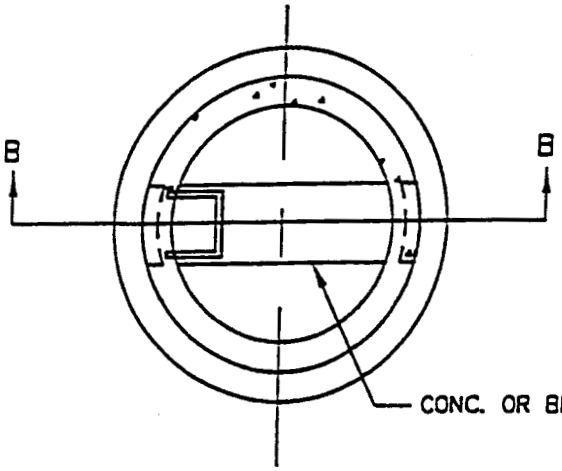
TOWN OF *NEWINGTON*

TYPICAL

TYPE "C–L" CATCH BASIN

Not to Scale

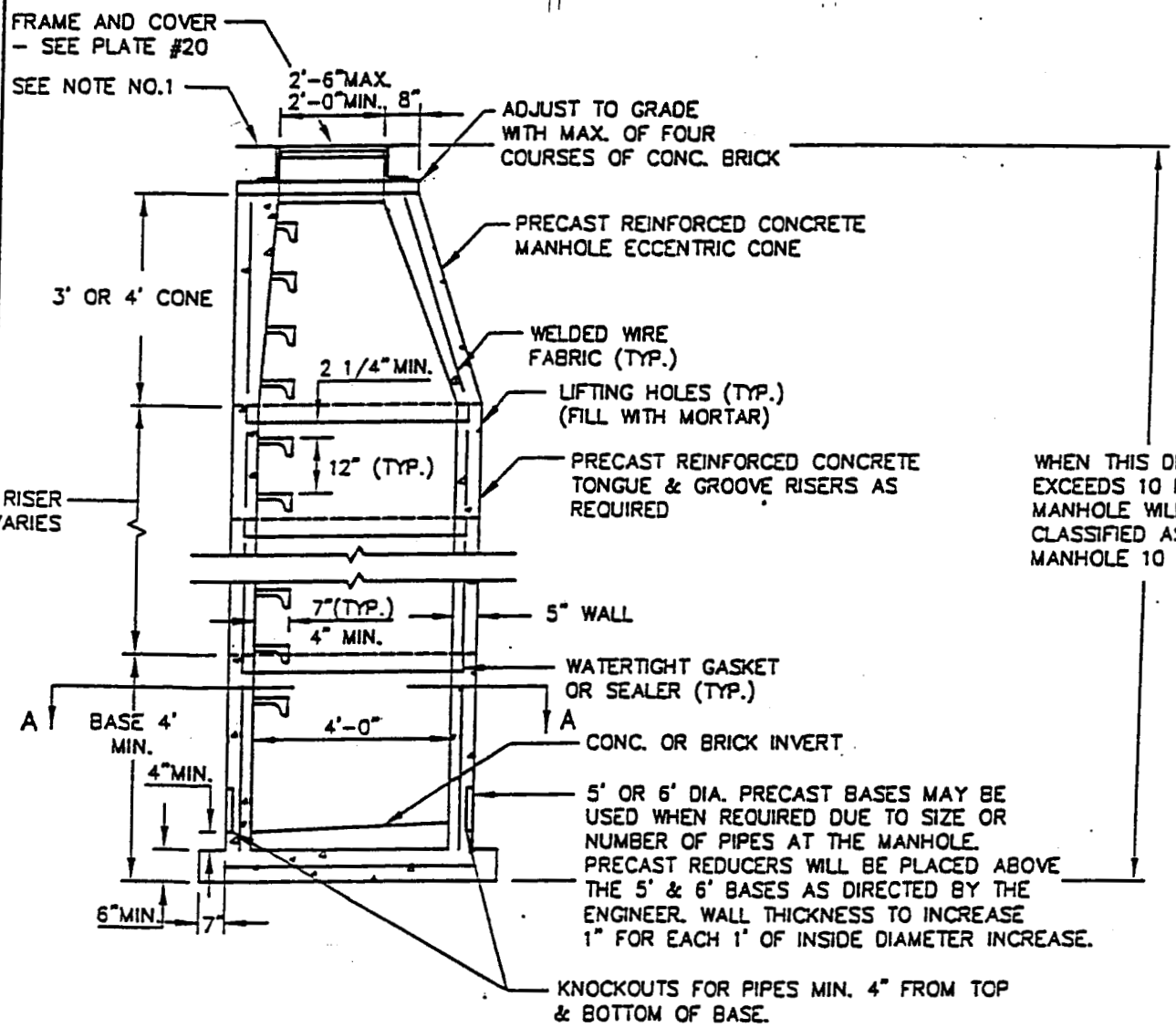
PLATE



CROSS SECTION "A–A"

NOTES:

1. ALL MANHOLE FRAMES COVERS TO BE SET FLUSH WITH BINDER COURSE. A MANHOLE RISER RING (PLATE #20) SHALL BE USED TO BRING MANHOLE COVER TO FINISHED GRADE PRIOR TO THE COMPLETION OF THE FINAL SURFACE COURSE.



MANHOLE VERTICAL SECTION "B–B"

TOWN OF NEWINGTON

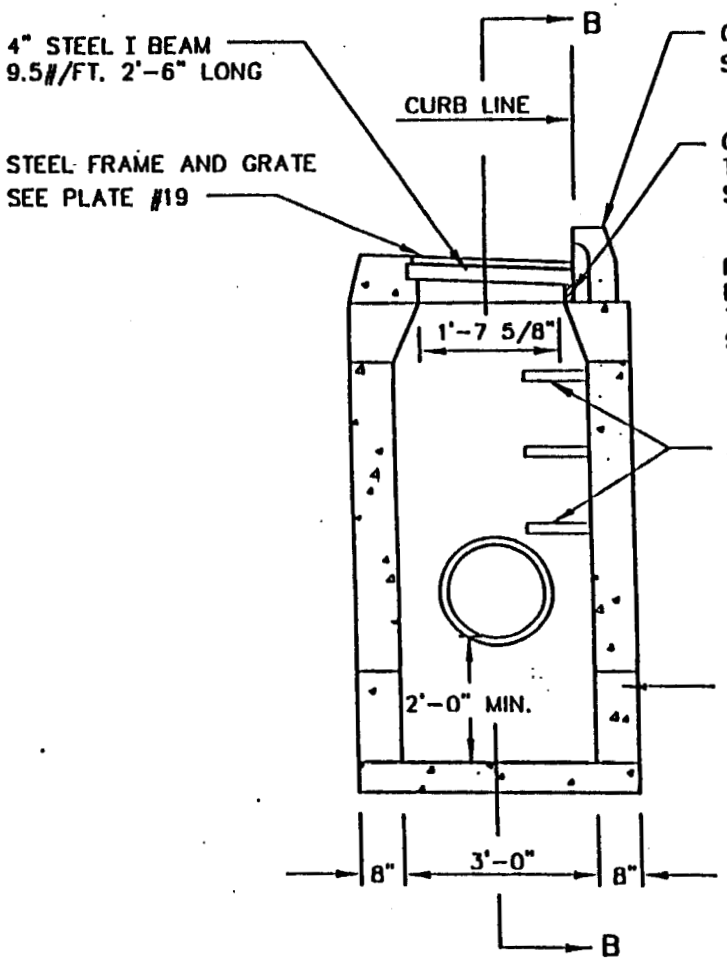
TYPICAL

STORM DRAIN MANHOLE – PRECAST CONCRETE UNITS

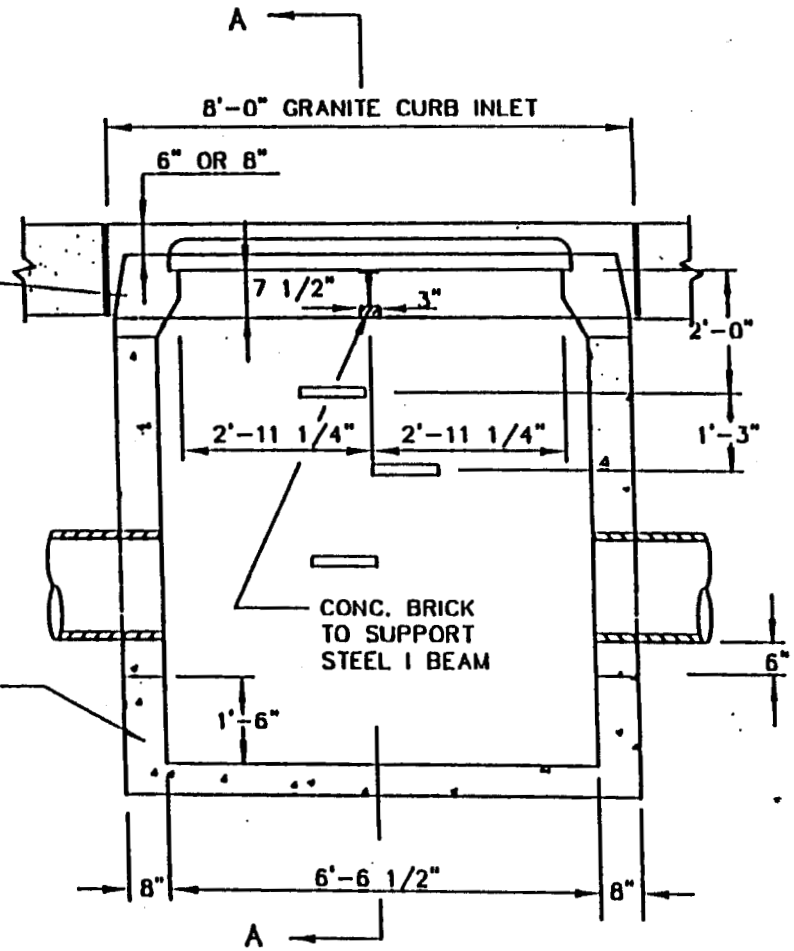
REVISIONS			
No.	Description	Date	Approved
Drawn By:		Checked By:	
Date:		File: plate	

Not to Scale

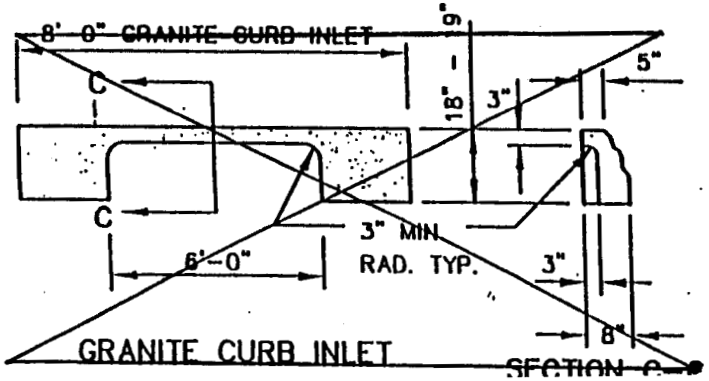
PLATE



SECTION A-A



SECTION B-B



NOTES:

1. WALLS – CONC. BLOCK OR PRECAST SECTIONS.
2. SET GRANITE CURB IN CEMENT MORTAR.
3. WALL THICKNESS TO BE 12" WHEN TOTAL HEIGHT OF STRUCTURE EXCEEDS 10' FROM T.F. TO BOTTOM OF BASE.

REVISIONS			
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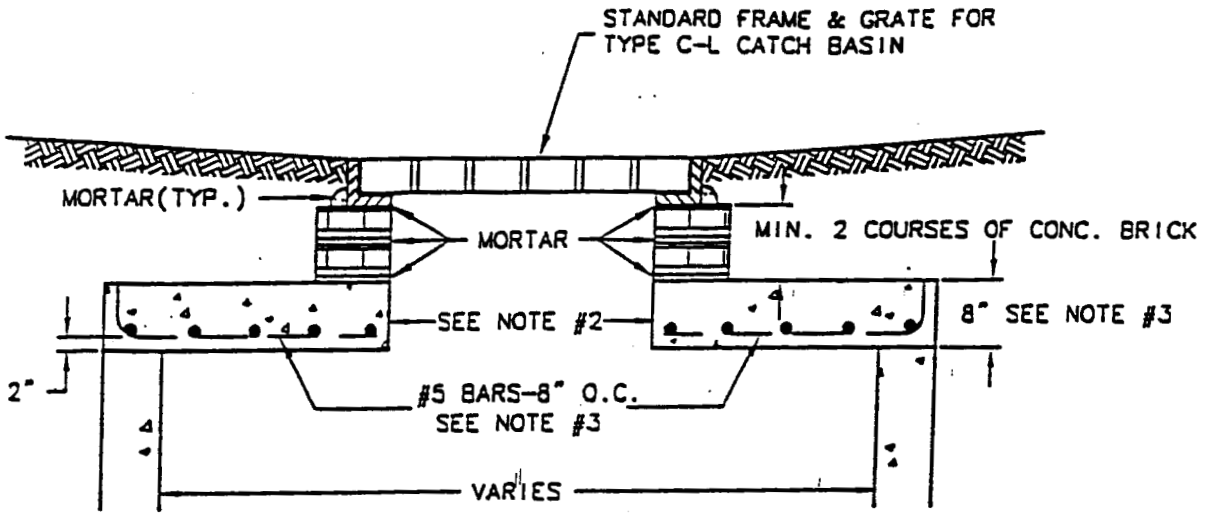
TOWN OF NEWINGTON

TYPICAL
TYPE "C" CATCH BASIN –
DOUBLE GRATE TYPE II

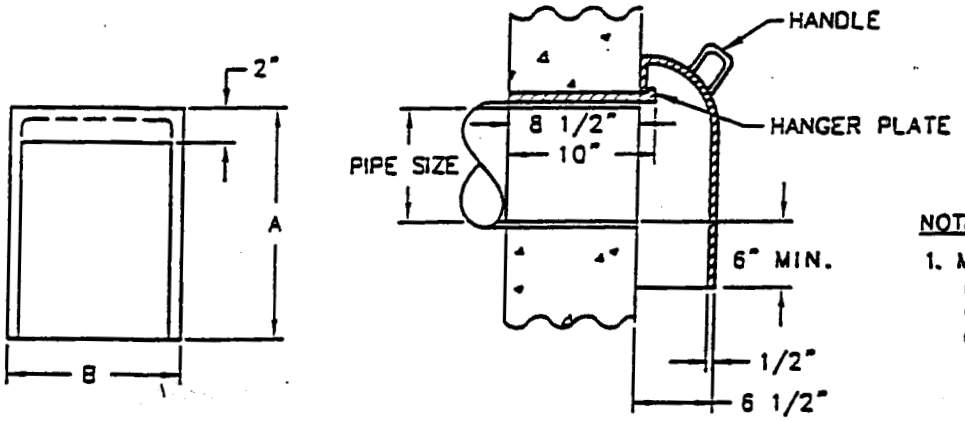
PLATE



TRANSITION C.B. SLAB – SECTION

NOTES:

1. TRANSITION SLAB FOR CATCH BASINS AND DRAIN INLETS CAN BE USED IN PLACE OF CORBELLING AS DIRECTED BY THE ENGINEER.
2. LOCATION AND SIZE OF OPENING VARIES.
3. THICKNESS OF SLAB AND REINFORCING WILL VARY ACCORDING TO DIMENSIONS. DESIGN OF SLAB SHALL MEET ALL THE REQUIREMENTS FOR A H20 LOADING.



NOTE:

1. MANUFACTURER CATALOG NUMBER TO BE INDICATED ON DETAIL DRAWINGS FOR CAST IRON TRAPS.

CATCH BASIN DEBRIS TRAP

(OPTIONAL – AT THE DIRECTION OF THE TOWN ENGINEER)

A	B	PIPE SIZE	WT. LBS.	SETTING METHOD
16"	12"	TO 6"	70	2 HOOKS
18"	12"	8"	75	2 HOOKS
20"	12"	10"	85	2 HOOKS
22"	16"	12"	100	2 HOOKS
25"	17"	15"	135	2 HOOKS
28"	20"	18"	155	2 HOOKS

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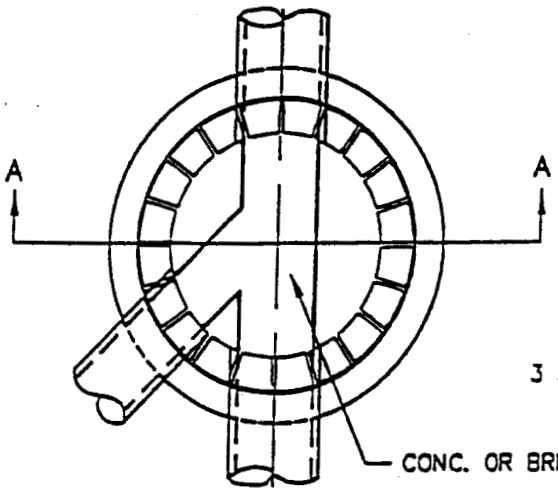
Date:		File: plate	

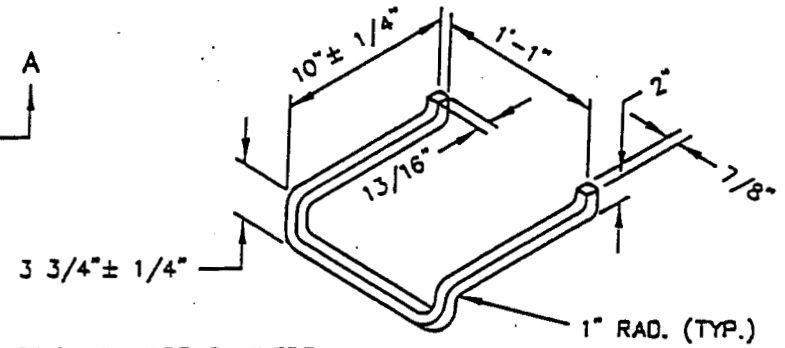
TOWN OF NEWINGTON

TYPICAL
TRANSITION CATCH BASIN SLAB
AND
CATCH BASIN DEBRIS TRAP

Not to Scale

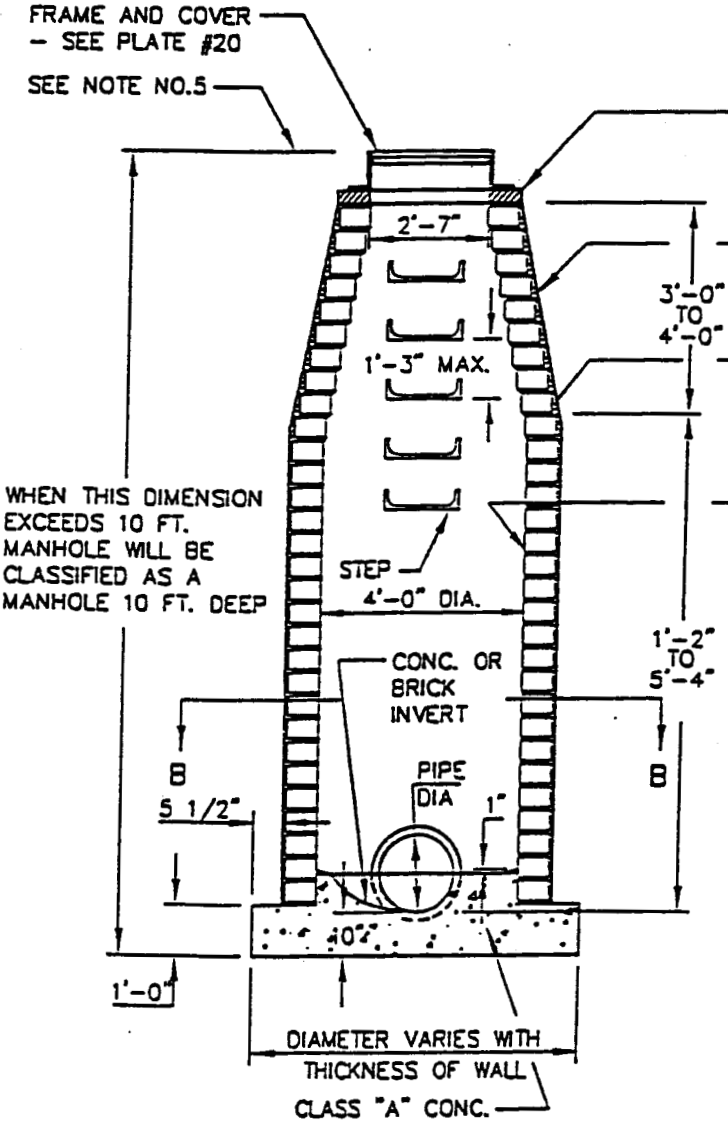
PLATE





SECTION B–B

STANDARD STEPS



NOTES:

1. INVERTS TO BE FORMED IN CONC. OR BRICK.
2. WALL SHALL BE 12" THICK WHEN DEPTH OF MANHOLE IS GREATER THAN 10' DEEP.
3. WALLS SHALL BE BUILT OF MASONRY CONC. UNITS OR CLASS "A" CONC. AT THE OPTION OF THE CONTRACTOR.
4. MASONRY CONC. UNITS TO BE LAID IN CEMENT SAND MORTAR 1:2 MIX. JOINTS NOT TO BE OVER 1/2" THICK ON INSIDE FACE OF WALL.
5. FRAME AND COVER TO BE SET FLUSH WITH BINDER COURSE. A MANHOLE RISER RING (PLATE 20) SHALL BE USED TO BRING MANHOLE COVER TO FINISHED GRADE PRIOR TO THE COMPLETION OF THE FINAL SURFACE COURSE.

SECTION A–A

TOWN OF NEWINGTON

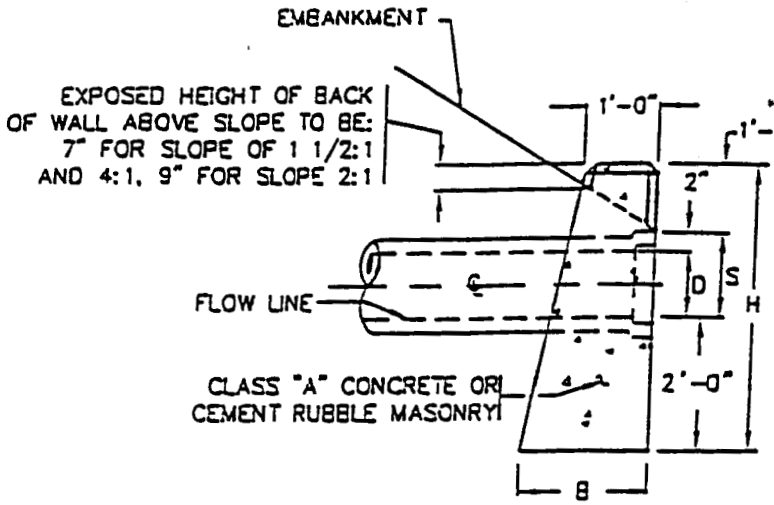
TYPICAL

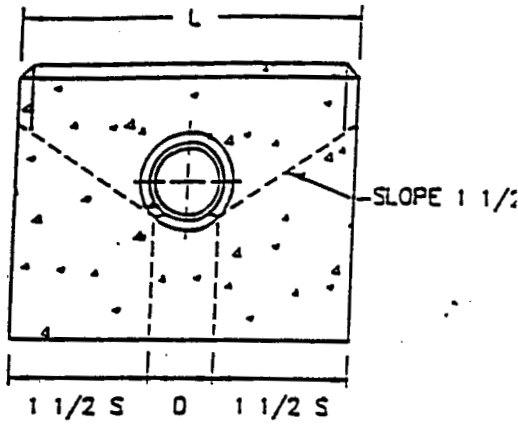
STORM DRAIN MANHOLE – MASONRY CONCRETE UNITS

REVISIONS			
No.	Description	Date	Approved
Drawn By:		Checked By:	
Date:		File: plate	

Not to Scale

PLATE





WALL AT FOOT OF SLOPE

FRONT ELEVATION

DIMENSIONS AND QUANTITIES FOR ONE ENDWALL BASED ON S=D+2"						
D	S	H	L	BATTER	B	VOL.
INS.	FT.& INS.	FT.& INS.	FT.& INS.	INS./FT.	FT.& INS.	CU.YD.
12"	1'-2"	4'-6"	4'-6"	2 1/2"	1'-11 1/4"	1.10
15"	1'-5"	4'-9"	5'-6"	2 1/2"	1'-11 7/8"	1.45
18"	1'-8"	5'-0"	6'-6"	2 1/2"	2'-0 1/2"	1.83
24"	2'-2"	5'-6"	8'-6"	2 1/2"	2'-1 3/4"	2.72
30"	2'-8"	6'-0"	10'-6"	2 1/2"	2'-3"	3.79
36"	3'-2"	6'-6"	12'-6"	3"	2'-7 1/2"	5.45
42"	3'-8"	7'-0"	14'-6"	3"	2'-9"	6.40*
48"	4'-2"	7'-6"	16'-6"	3"	2'-10 1/2"	8.00*

* VOLUME BASED ON "D" AND WALL THICKNESS AT CENTER LINE OF PIPE HAS BEEN DEDUCTED

NOTES:

ALL CONSTRUCTION DIMENSIONS ARE NOMINAL.

WHEN ONE ENDWALL IS TO BE USED FOR TWO PIPES, THE DIMENSIONS OF THAT ENDWALL SHALL CONFORM TO THAT REQUIRED FOR THE LARGER PIPE, EXCEPT THE DIMENSION "L" SHALL BE INCREASED BY THE OUTSIDE DIAMETER OF THE SMALLER PIPE PLUS ONE FOOT.

THESE ENDWALLS WILL BE USED ONLY AT LOCATIONS WHERE THEY WILL NOT BE A HAZARD TO VEHICLES THAT RUN OFF THE ROAD. IN NO CASE WILL THE LOCATION OF THESE ENDWALLS BE LESS THAN 30' FROM THE EDGE OF THE TRAVELED WAY.

COST REINFORCING BARS TO BE INCLUDED IN THE CONTRACT UNIT PRICE FOR CLASS "A" CONCRETE.

ALL EDGES OF EXPOSED SURFACES TO BE CHAMFERED APPROXIMATELY ONE INCH.

H = TOTAL HEIGHT OF ENDWALL
B = BASE
D = INSIDE DIAMETER OF PIPE
S = HEIGHT OF SLOPE ABOVE FLOW LINE AT FACE OF WALL-MINIMUM=D+2
L = LENGTH OF WALL=3S=D

REVISIONS			
No.	Description	Date	Approved
Drawn By:		Checked By:	
Date:		File:	

TOWN OF NEWINGTON

TYPICAL

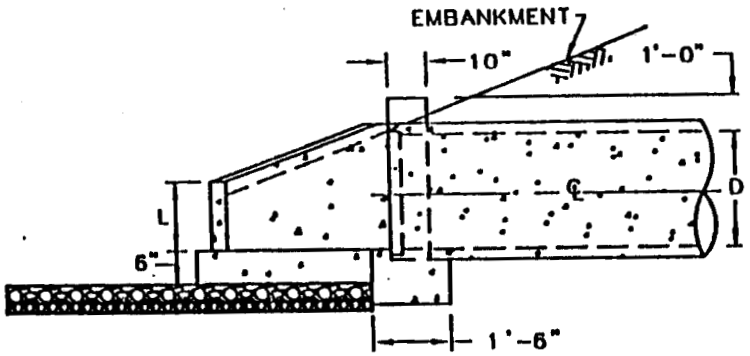
STANDARD ENDWALL

Not to Scale

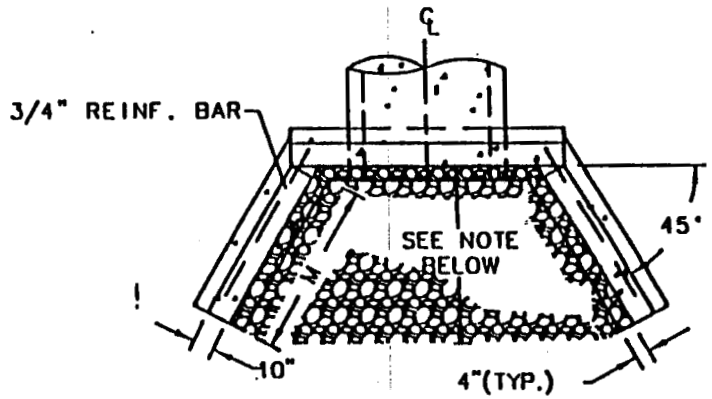
DIMENSIONS						
OPENING		WALL				FOOTING
DIA.	B	H	G	L	M	F
15"•	1.2	2'-3"	3'-7"	1'-0"	1'-3"	1'-6"
18"•	1.8	2'-6"	3'-10"	1'-2"	1'-7"	1'-6"
24"•	3.1	3'-0"	4'-4"	1'-5"	2'-1"	2'-0"
30"••	4.9	3'-6"	4'-10"	1'-9"	2'-5"	2'-0"

NOTES:

• FOR SLOPES 4:1 OR LESS PRECAST FLARED END SECTION CAN BE USED IN PLACE OF CONC. END WALLS FOR ALL PIPES 24" IN DIA. OR LESS.

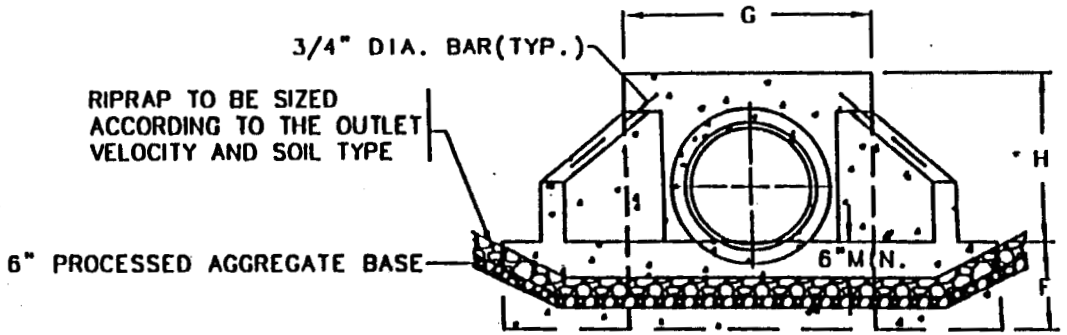


SIDE ELEVATION



PLAN

NOTE:
LENGTH OF RIPRAP DEPENDENT ON THE OUTLET DISCHARGE AND OUTLET PIPE SIZE



FRONT ELEVATION

REVISIONS			
No.	Description	Date	Approved
Drawn By:		Checked By:	
Date:		File: plate	

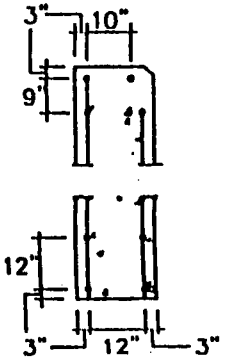
TOWN OF NEWINGTON

TYPICAL

WING TYPE ENDWALL FOR PIPES 30" DIAMETER AND SMALLER

Not to Scale

PLATE



DETAIL OF BAR SPACING

DIMENSIONS AND QUANTITIES FOR ONE WING TYPE ENDWALL											
D	B	C	G	H	K	L	P	R	Q	W	VOL.
INS.	FT.& IN.	FT.& IN.	FT.& IN.	FT.& IN.	FT.& IN.	FT.& IN.	FT.& IN.	FT.& IN.	FT.& IN.	FT.& IN.	CU.YD.
36"	1'-6"	2'-0"	3'-3"	6'-8"	9'-1 1/2"	7'-3 3/4"	1'-4 7/8"	0'-9 3/4"	3'-4 7/8"	5'-5 3/4"	5.87
42"	1'-6"	2'-0"	3'-3"	7'-2"	9'-10 1/2"	7'-9 3/4"	1'-6 3/8"	0'-9 3/4"	3'-10 1/2"	6'-7 3/4"	6.67
48"	1'-7"	2'-6"	3'-9"	8'-2"	10'-10"	8'-3 3/4"	1'-9 3/8"	0'-11 1/4"	4'-9"	7'-9 1/2"	9.11
60"	1'-7"	2'-6"	3'-9"	9'-2"	12'-4 1/2"	9'-3 3/4"	2'-0 3/8"	0'-11 1/4"	5'-9"	10'-1 1/4"	12.43
72"	1'-7"	2'-6"	3'-9"	10'-2"	13'-10 3/4"	10'-3 3/4"	2'-3 3/8"	0'-11 1/4"	6'-9"	12'-5"	16.30

NOTES:

ALL CONSTRUCTION DIMENSIONS ARE NOMINAL.

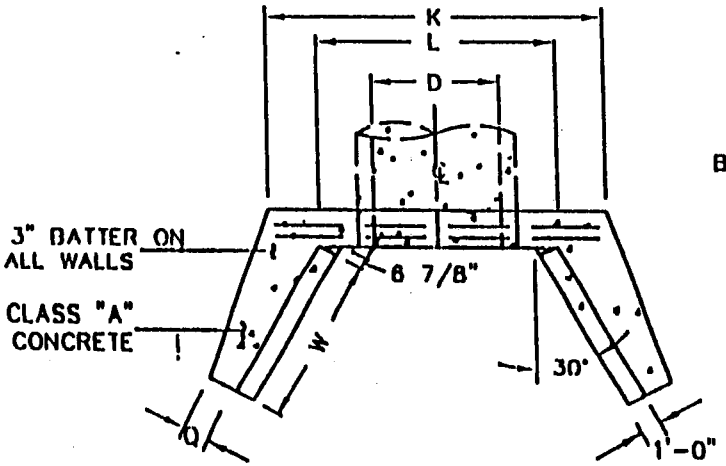
WHEN ONE ENDWALL IS TO BE USED FOR TWO PIPES, THE DIMENSIONS OF THAT ENDWALL SHALL CONFORM TO THAT REQUIRED FOR THE LARGER PIPE, EXCEPT THE DIMENSION "L" SHALL BE INCREASED BY THE OUTSIDE DIAMETER OF THE SMALLER PIPE PLUS ONE FOOT.

THESE ENDWALLS WILL BE USED ONLY AT LOCATIONS WHERE THEY WILL NOT BE A HAZARD TO VEHICLES THAT RUN OFF THE ROAD IN NO CASE WILL THE LOCATION OF THESE ENDWALLS BE LESS THAN 30' FROM THE EDGE OF THE TRAVELED WAY.

NOTES:

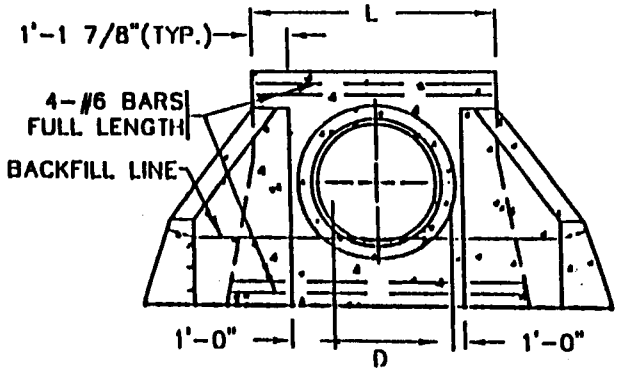
REINFORCEMENT TO BE PLACED FOR 48" PIPE AND LARGER

COST REINFORCING BARS TO BE INCLUDED IN THE CONTRACT UNIT PRICE FOR CLASS "A" CONCRETE.

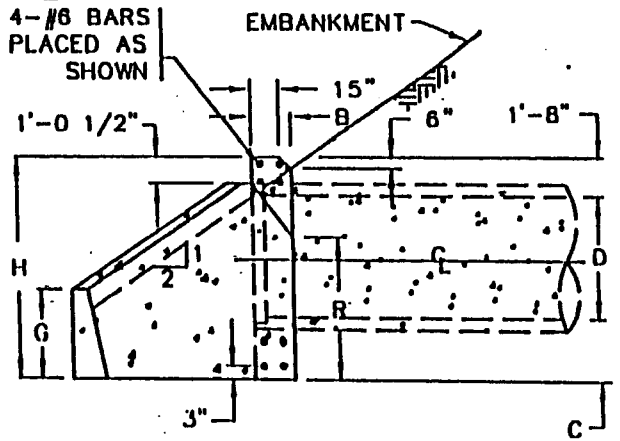


NOTE: ENDWALL SYMMETRICAL ABOVE CENTER LINE OF PIPE

PLAN



FRONT ELEVATION



SIDE ELEVATION

REVISIONS			
No.	Description	Date	Approved

TOWN OF *NEWINGTON*

TYPICAL

WING TYPE ENDWALL FOR PIPES 36" DIAMETER AND LARGER

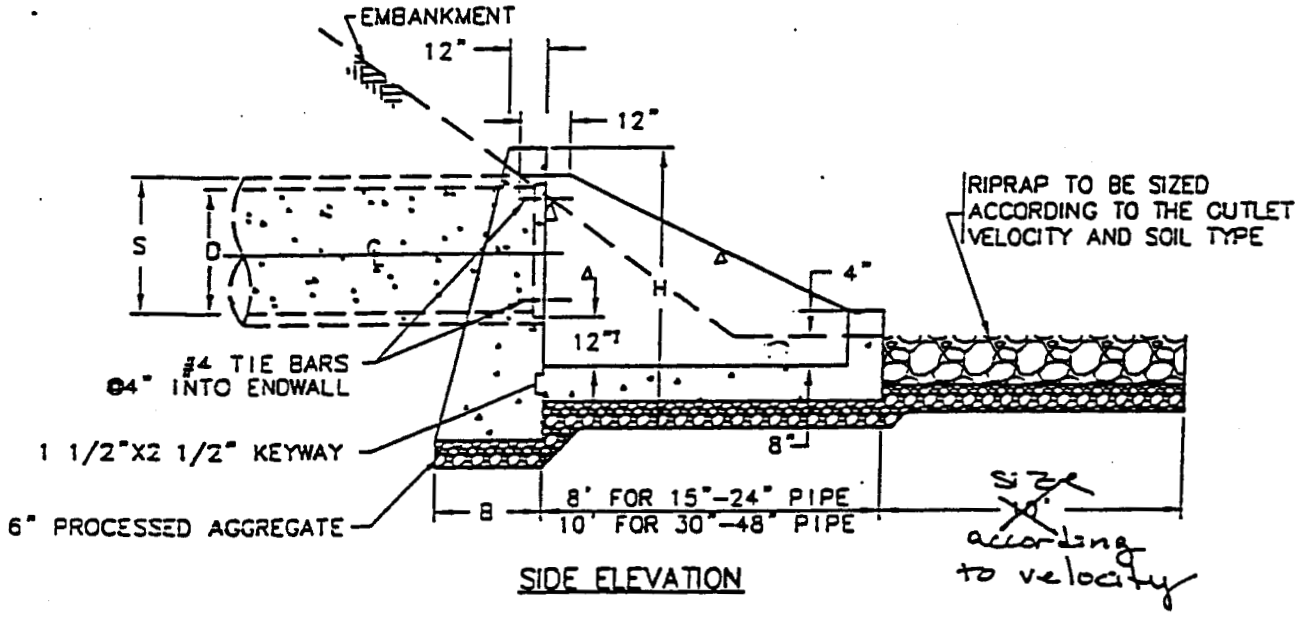
PLATE

* Plunge Pool is Optional
Outlet Velocity is Control

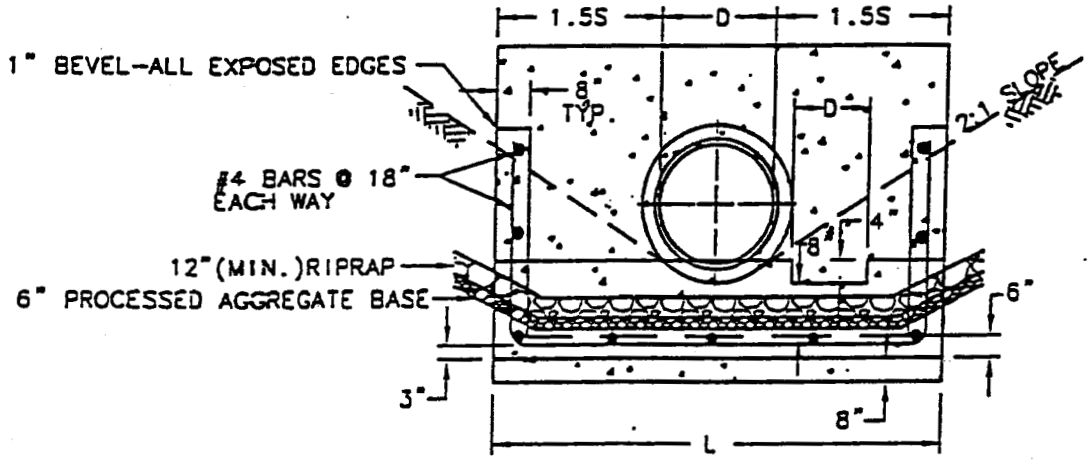
DIMENSIONS FOR ONE ENDWALL BASED ON S = D + 2					
D	S	H	L	BATTER	B
15" *	1'-5"	4'-9"	5'-6"	2 1/2"	1'-11 7/8"
18" *	1'-8"	5'-0"	6'-6"	2 1/2"	2'-0 1/2"
24" *	2'-2"	5'-6"	8'-6"	2 1/2"	2'-1 3/4"
30"	2'-8"	6'-0"	10'-6"	2 1/2"	2'-3"
36"	3'-2"	6'-6"	12'-6"	3"	2'-7 1/2"
42"	3'-6"	7'-0"	14'-6"	3"	2'-9"
48"	4'-2"	7'-6"	16'-6"	3"	2'-10 1/2"

H – TOTAL HEIGHT OF END WALL
B – BASE
D – INSIDE DIA. OF PIPE
S – HEIGHT OF SLOPE ABOVE FLOW LINE AT FACE OF WALL MIN.= D+2
L – LENGTH OF WALL= 3S+D

STANDARD ENDWALL



SIDE ELEVATION



FRONT ELEVATION

TOWN OF NEWINGTON

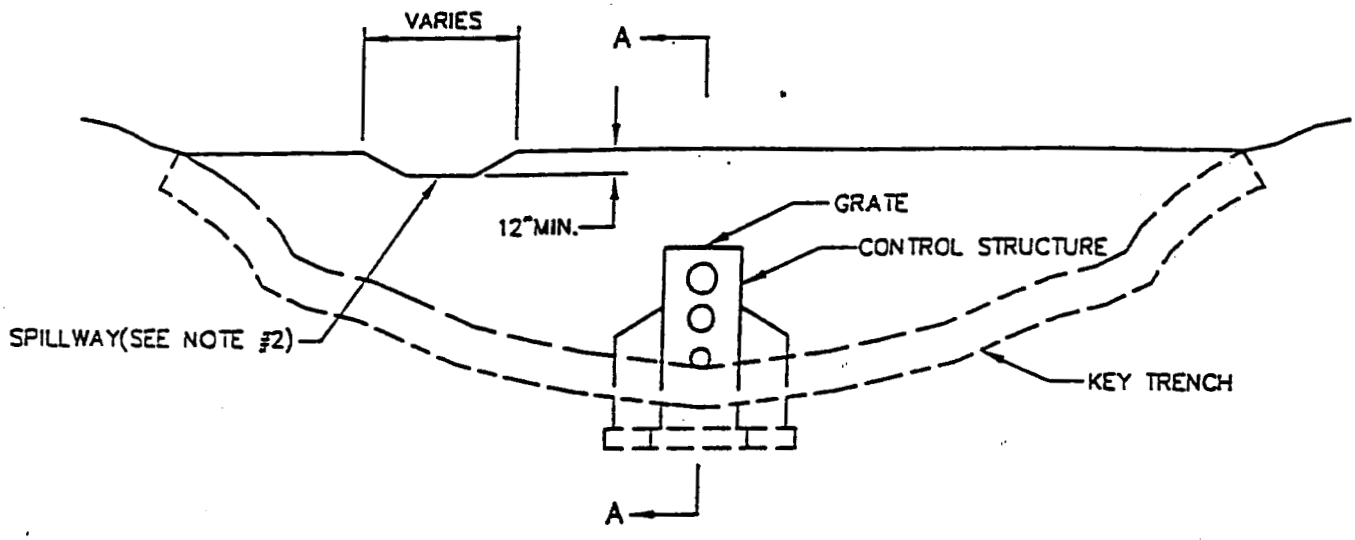
TYPICAL

IMPACT BASIN

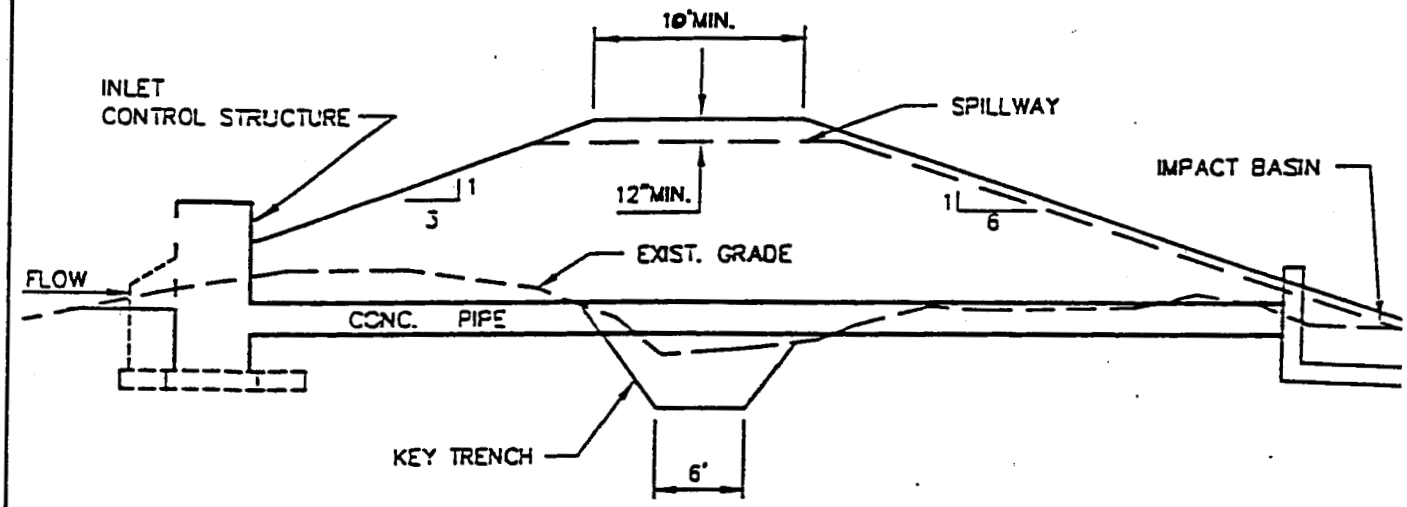
REVISIONS			
No.	Description	Date	Approved
Drawn By:		Checked By:	
Date:		File: plate	

Not to Scale

PLATE



FRONT ELEVATION



SECTION A – A

NOTES:

1. TO FACILITATE COMPLETE DRAINAGE AND TO AVOID SILTATION, THE BOTTOM OF ALL DETENTION BASINS SHALL HAVE A 2' WIDE BOTTOM DITCH WITH A SLOPE NOT LESS THAN ONE PERCENT. ALL SIDES OF THE BASIN SHALL BE PITCHED TOWARD THE DITCH.
2. THE SPILLWAY SHALL BE STABILIZED WITH CONCRETE, CONCRETE BLOCK PAVERS, BIT. CONCRETE, OR RIP-RAP TO PREVENT SLOPE EROSION.
3. CONCRETE ANTI-SEEP COLLARS SHALL BE INSTALLED ALONG THE PIPE. SPACING TO BE DETERMINED BY THE DESIGN ENGINEER(DESIGN OF WHICH IS TO BE INCLUDED WITH THE TYPICAL CROSS SECTION.)
4. SLOPES TO BE COMPLETED WITH A MIXTURE OF WILD FLOWER SEEDS AND ANNUAL RYE GRASS WHERE REQUESTED BY THE TOWN, OR AS DESIGNATED BY THE ENGINEER.

REVISIONS			
No.	Description	Date	Approved
Drawn By:		Checked By:	
Date:		File: plate	

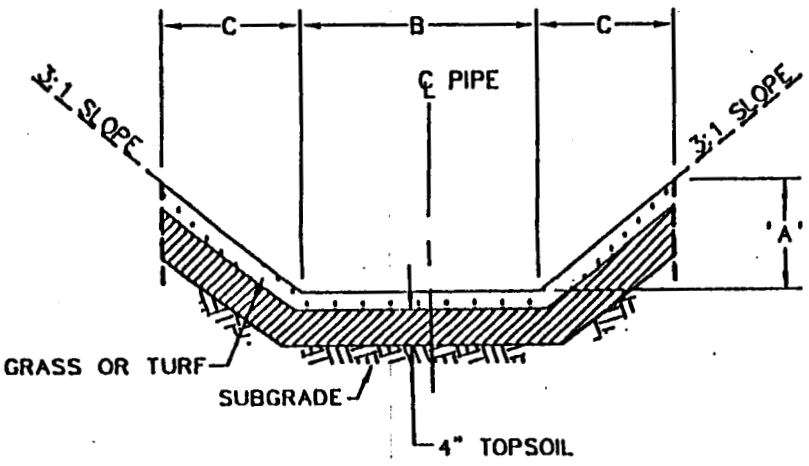
TOWN OF *NEWINGTON*

TYPICAL

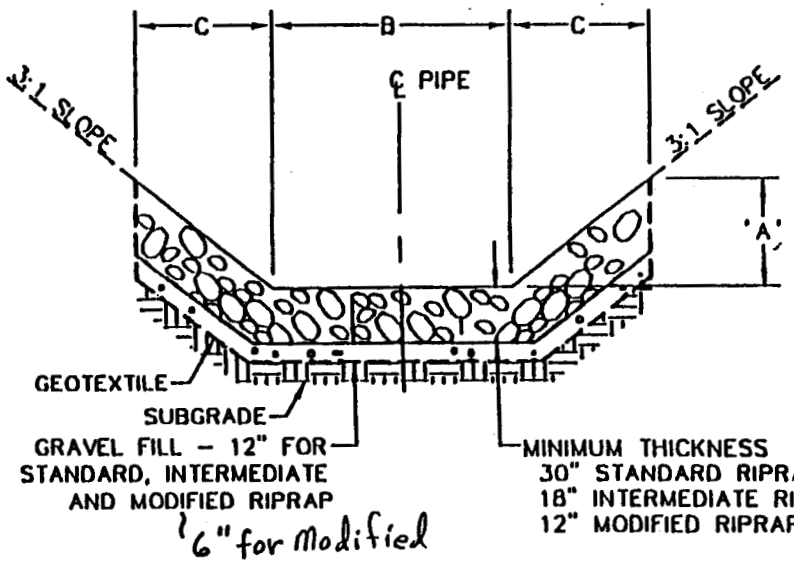
DETENTION POND DAM DETAIL

Not to Scale

PLATE



GRASS OR TURF SECTION



RIPRAP SECTION

NOTE:
FOR GRADATION OF STANDARD, INTERMEDIATE, AND MODIFIED RIPRAP, SEE SECTION 3.12 OF THE PUBLIC IMPROVEMENT STANDARDS

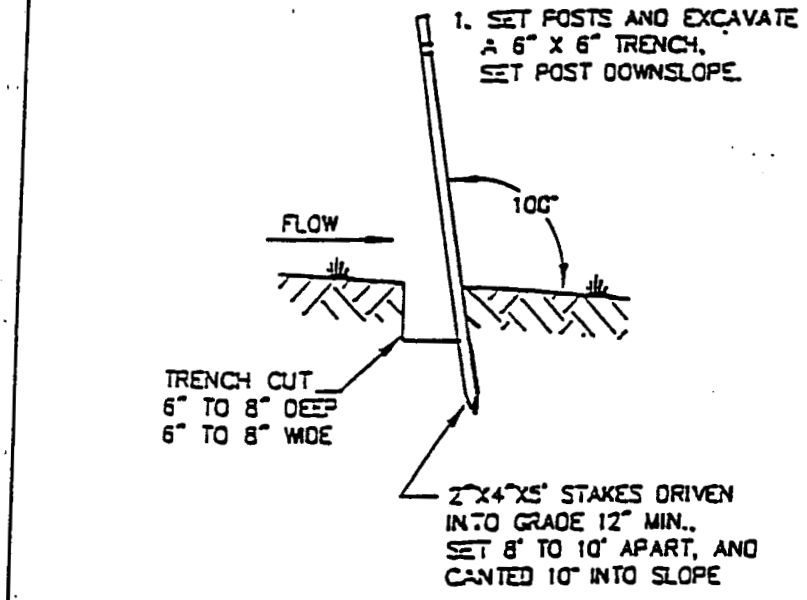
DIMENSIONS FOR GRASS OR RIPRAP DITCHES/CHANNELS												
SECTION TO CONFORM WITH PIPE OUTLET SIZE												
PIPE SIZES	15"	18"	21"	24"	27"	30"	36"	42"	48"	54"	60"	72"
A	8"	9"	11"	12"	14"	15"	18"	21"	24"	27"	30"	36"
B	27"	30"	33"	36"	39"	42"	48"	54"	60"	66"	72"	84"
C	24"	27"	33"	36"	42"	45"	54"	63"	72"	81"	90"	108"
	DITCHES					CHANNELS						

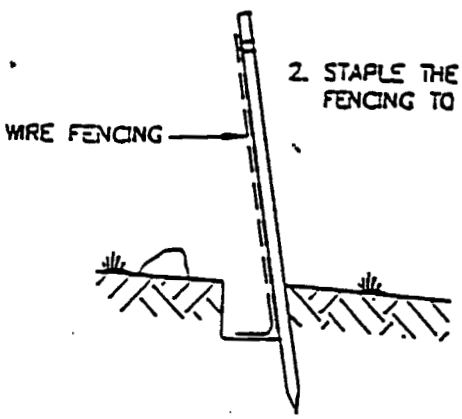
REVISIONS			
No.	Description	Date	Approved
Drawn By:		Checked By:	

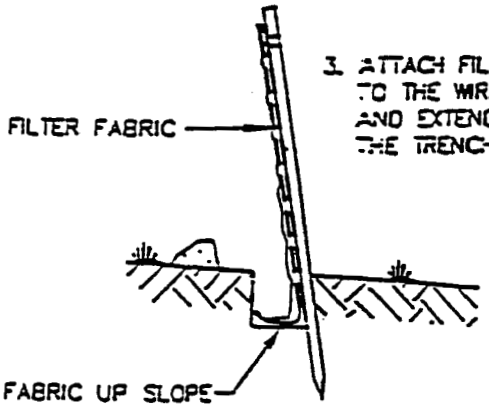
TOWN OF NEWINGTON

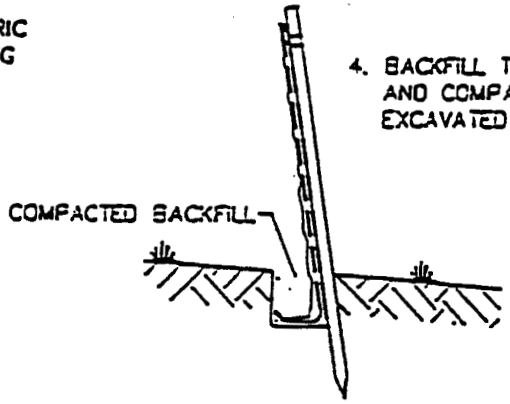
TYPICAL
DRAINAGE DITCH
AND
CHANNEL SECTIONS

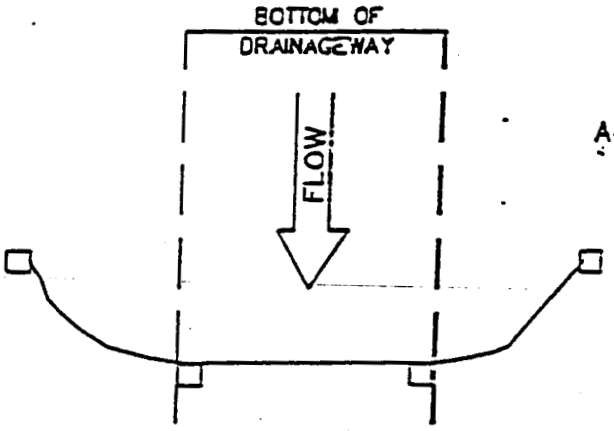
PLATE 27



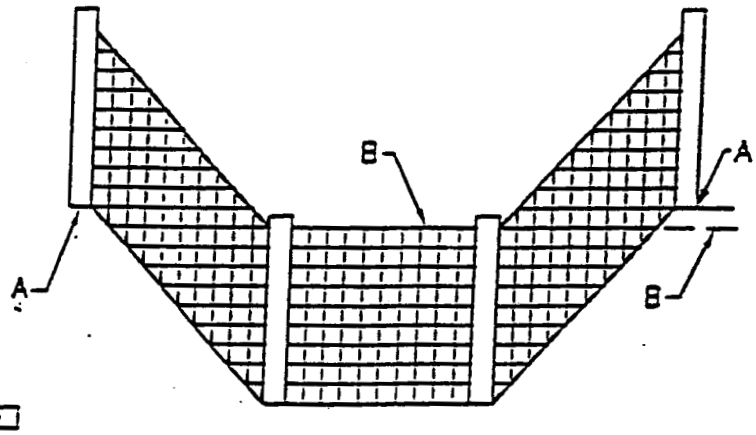








PLAN



ELEVATION

POINTS 'A' SHOULD BE HIGHER THAN POINT 'B'

REVISIONS			
No.	Description	Date	Approved
Drawn By:		Checked By:	
Date: Oct.		File: plate.	

TOWN OF NEWINGTON

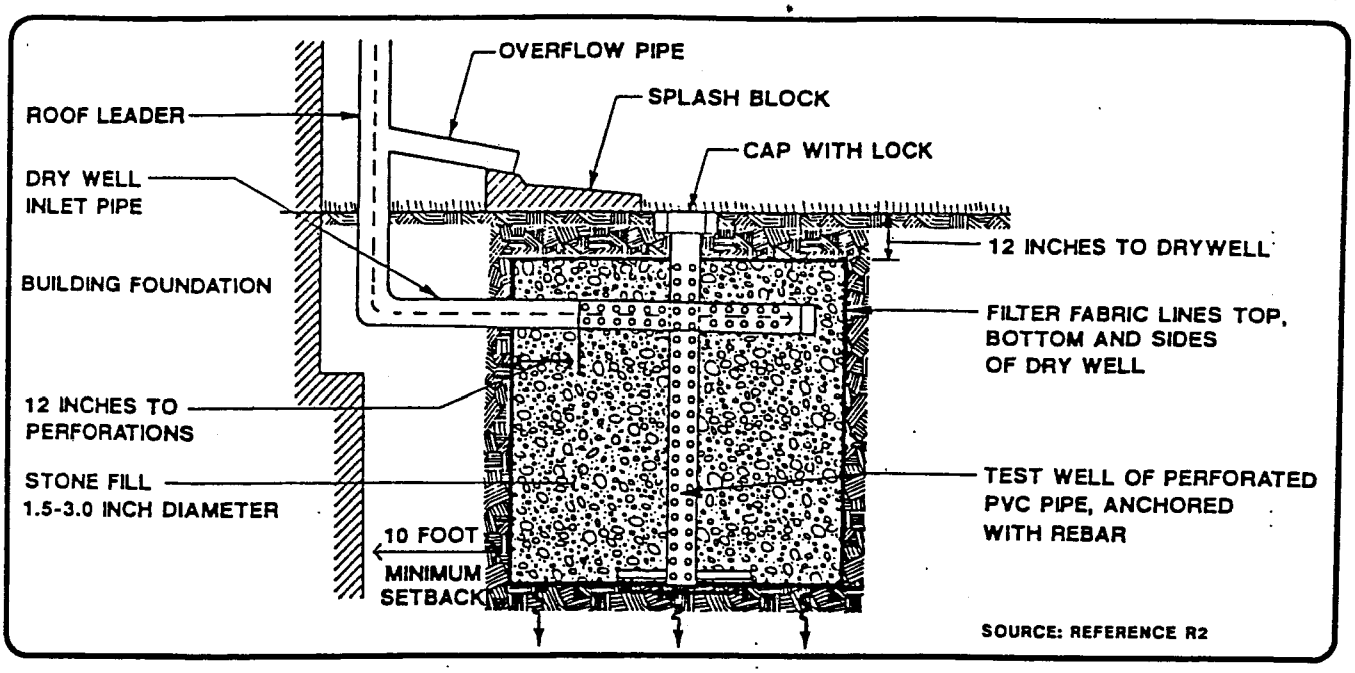
TYPICAL

FILTER FABRIC FENCE FOR EROSION CONTROL

Not to Scale

PLATE

ROOFTOP INFILTRATION VIA DRYWELL



DESIGN CRITERIA

Hydrologic Soil Groups A & B only
Size with a volume to capture frequent storms up to 1/2" rainfall
Provide gutter screens to protect from clogging with leaves
Provide overflow pipe

APPLICATIONS

To accept rooftop runoff from residential and commercial buildings
Should not be placed near building underdrains otherwise infiltration will be short-circuited

ADVANTAGES

Reduces runoff volume
Provides clean water infiltration to enhance groundwater supply
Reduces size of storm drains required downstream
Helps maintain base flow

DISADVANTAGES

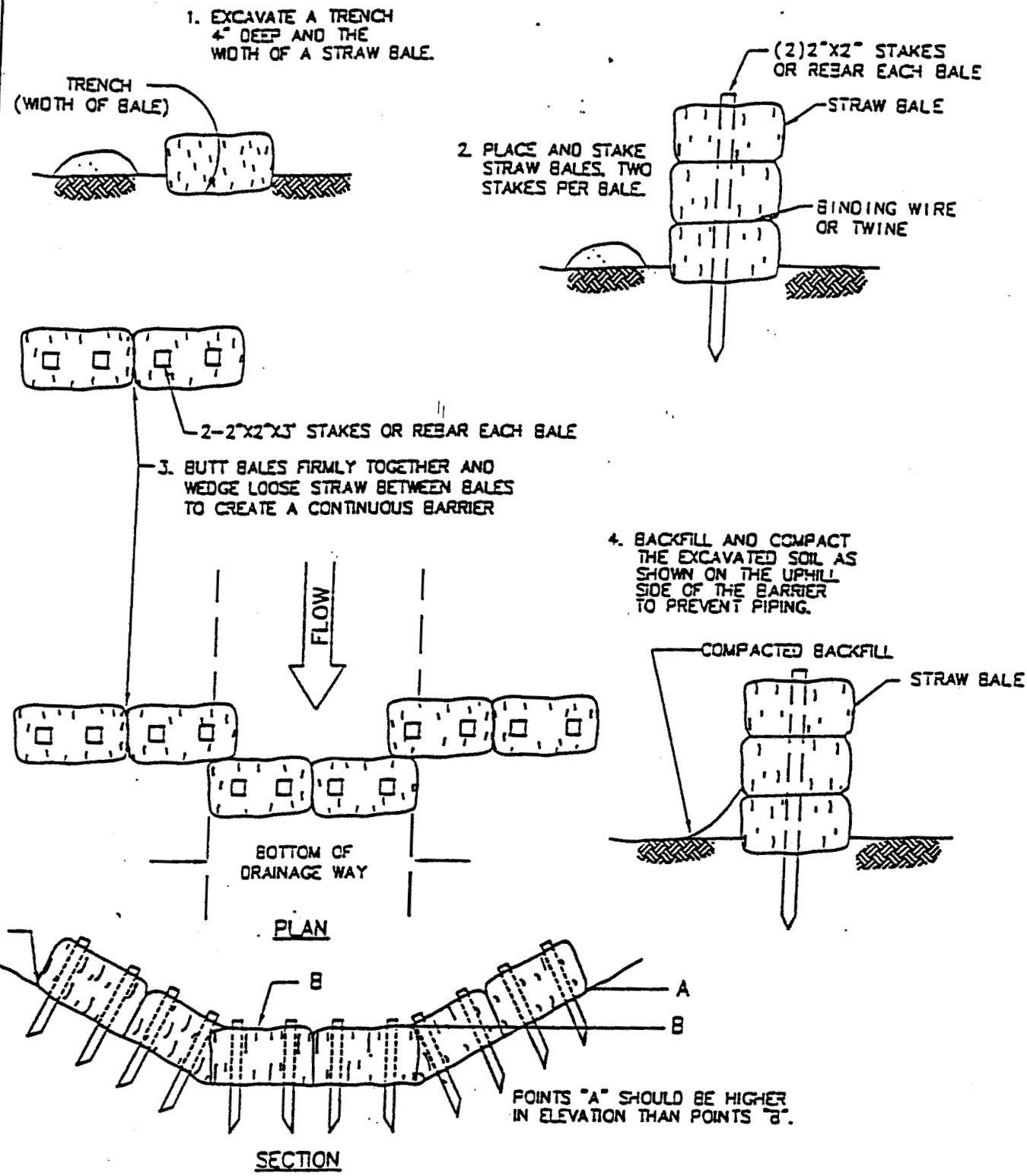
Clogging possible
Periodic rejuvenation may be required

TOWN OF *NEWINGTON*

TYPICAL

Not to Scale

PLATE



NOTES:

1. HAY BALES SHALL BE MAINTAINED AND/OR REPLACED AS REQUIRED OR AS DIRECTED BY THE ENGINEER.
2. PLACE HAY BALES SUCH THAT TWINE OR BINDING WIRE IS PARALLEL TO THE EXISTING GROUND.

REVISIONS			
No.	Description	Date	Approved
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Date:		File: plate	

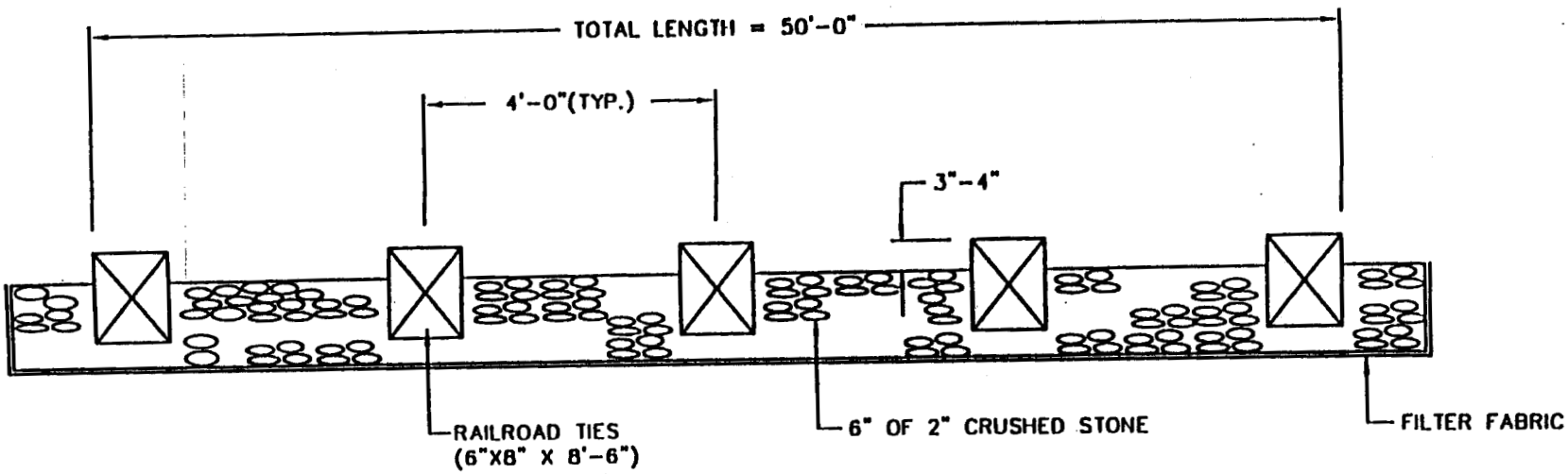
TOWN OF NEWINGTON

TYPICAL

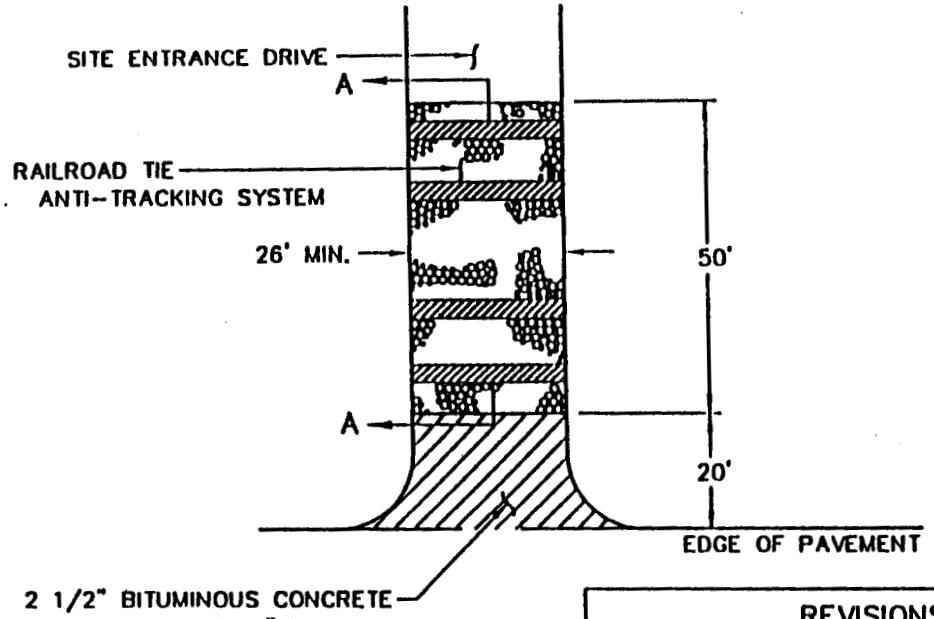
BALED HAY/STRAW FOR EROSION CONTROL

Not to Scale

PLATE



SECTION A – A



PLAN

NOTES:

1. MAINTAIN ANTI-TRACKING PAVEMENT IN GOOD CONDITION THROUGH OUT CONSTRUCTION PERIOD.
2. ROADWAY SHALL BE SWEPT DAILY TO REMOVE ANY MATERIAL THAT MAY BE TRACKED ONTO THE PAVEMENT.

REVISIONS			
No.	Description	Date	Approved
Drawn By: N.F.		Checked By: M.F.C.	

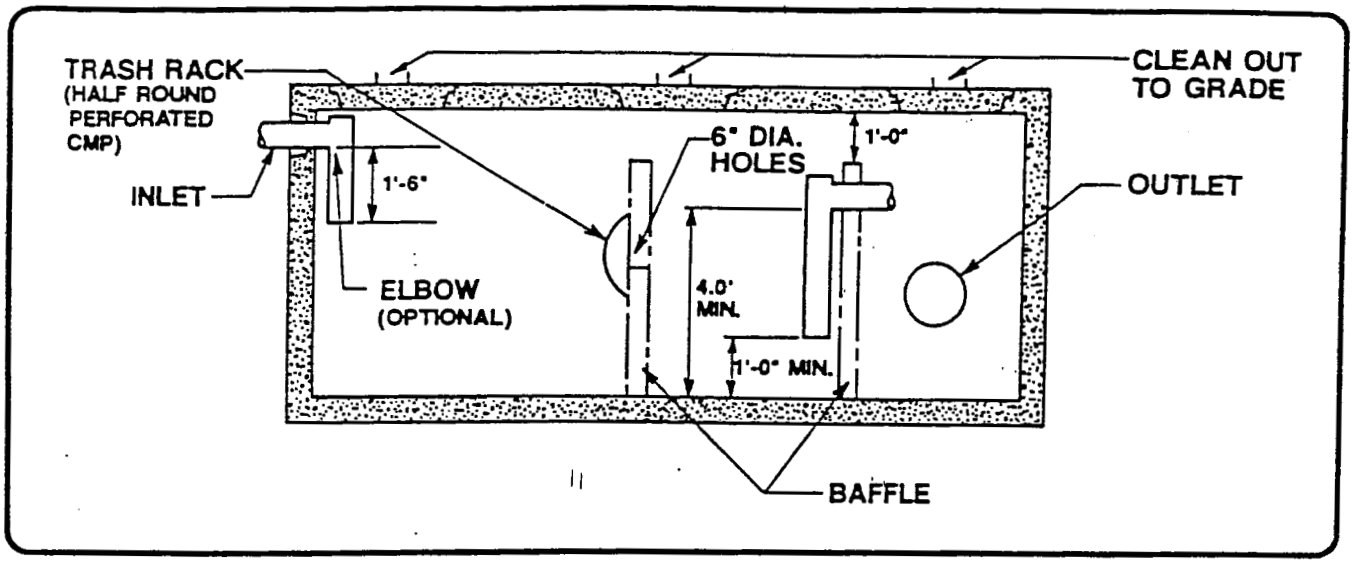
TOWN OF NEWINGTON

TYPICAL

ANTI-TRACKING APRON

PLATE

SEDIMENT CHAMBER



DESIGN CRITERIA

Provide 400 cubic feet of storage per impervious acre contributing to the drain
Minimize contributing area to 1 acre or less per unit
Provide a high flow bypass where possible

APPLICATIONS

Small and large parking areas with large hydrocarbon and sediment loads and vehicular traffic
Use as a pretreatment prior to infiltrative systems to prevent clogging

ADVANTAGES

Removes coarse sediments
Removes floatables
Removes various hydrocarbon films

DISADVANTAGES

Must inspect 4 times yearly
Limited pollutant removal capacity
Possible re-suspension of fine settled pollutants

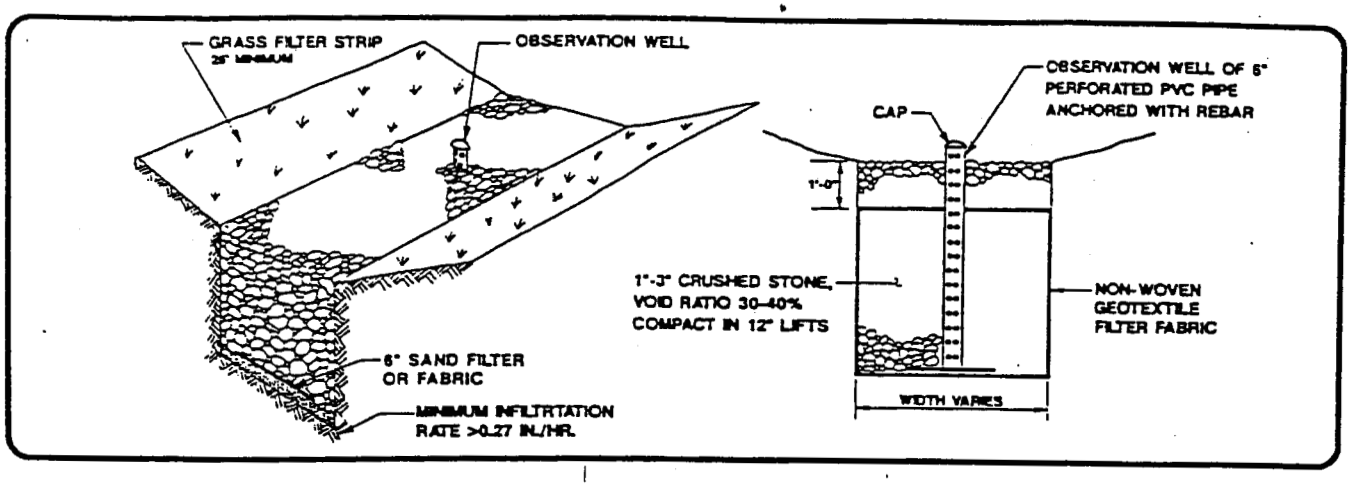
TOWN OF *NEWINGTON*

TYPICAL

Not to Scale

PLATE

INFILTRATION TRENCH



DESIGN CRITERIA

Cannot be located in fill
Locate a minimum 100 feet from a water supply well
Provide 4 ft minimum clearance from trench bottom to bedrock
Provide 2 ft to 4 ft minimum clearance from trench bottom to seasonally high water table
Locate 10 ft down gradient and 100 ft upgradient of foundations
Design for 3 day maximum draining time, 6 hours minimum
Design to serve 5 acres or less
Design to hold 1/2 inch of runoff from impervious acreage at a minimum
All runoff should be pre-treated via sediment chambers or vegetative filter strips
Drip line of trees should not extend over trench
Trench bottom should be level
Hydrologic Soil Groups A & B

VARIATIONS

May be used with stone reservoir only
May be located at base of vegetated swales behind check dams
May be used in combination with a high level overflow pipe for partial exfiltration
May be used with overflow berm or level spreader

APPLICATIONS

Residential lots and small commercial areas
Rooftop runoff
Adjacent to parking areas with grass filter strips receiving sheet flow
Highway medians
Below swales

ADVANTAGES

Easy to fit into site
Reduces runoff
Encourages infiltration
Filters pollutants, metals proven to bind in soils
Can nearly reproduce natural hydrological conditions
Maintains baseflow

DISADVANTAGES

Periodic inspection required to monitor function
Can clog with sediment
Possible risk of groundwater contamination from spills
Regular maintenance required
Rarely achieves peak runoff control

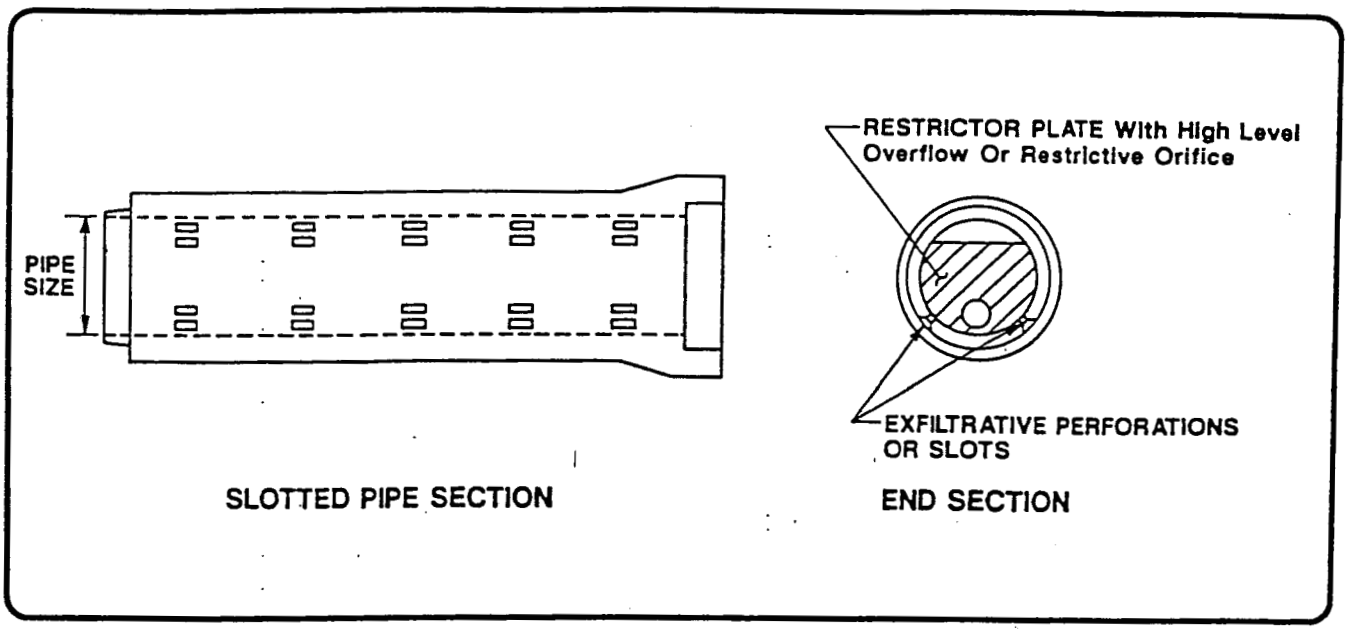
TOWN OF *NEWINGTON*

TYPICAL

Not to Scale

PLATE

UNDERGROUND EXFILTRATION STORAGE



DESIGN CRITERIA

Two to four feet to groundwater
Four feet to bedrock
Pre-treat runoff to remove sediment
Use in moderate and well drained soils
Place pipes flat with no slope
Size for 1/2" runoff maximum before outflow
In combination with stone bed can store more runoff

APPLICATIONS

Under parking lots due to space considerations
Applicable where basins may be unsightly
Can oversize to control peak discharges by storing runoff

ADVANTAGES

Commercially available
Takes little area
Out of sight
Groundwater recharge
Pollutant filtering
Reduce peak flows

DISADVANTAGES

Cost
Difficult to restore infiltrative capacity if it fails
Difficult to monitor
Frequent cleaning of sediment traps required
Requires pretreatment

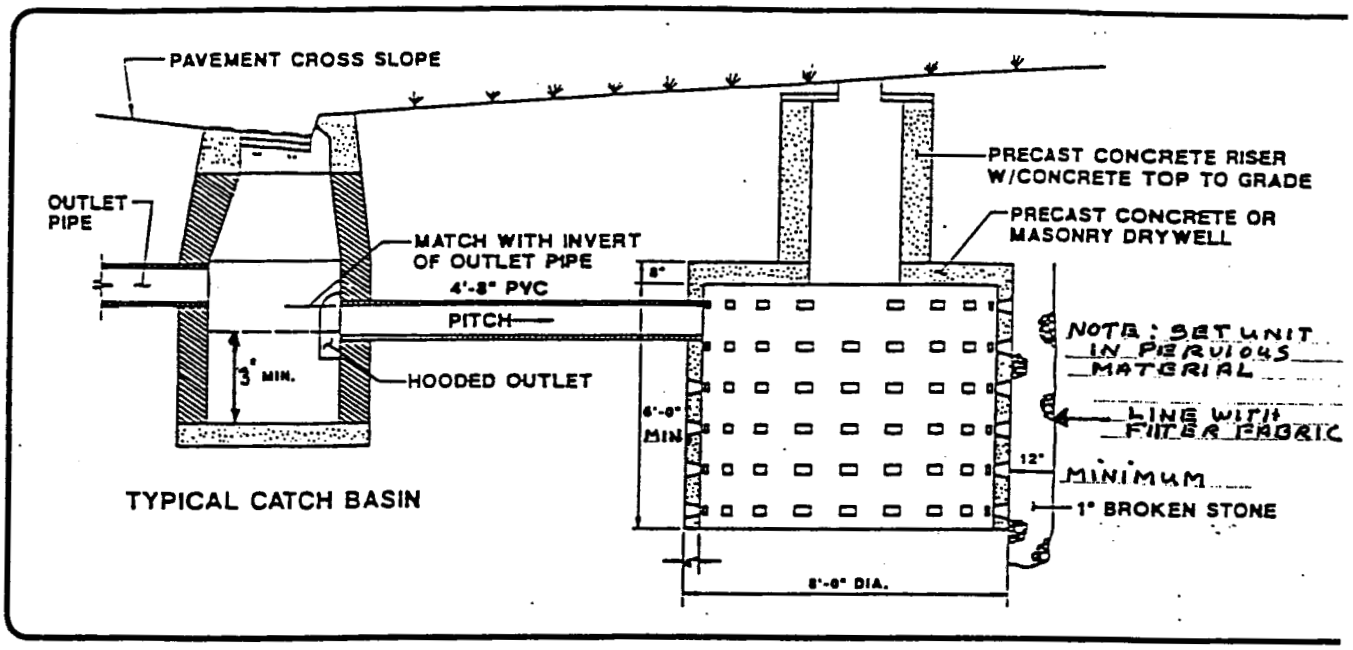
TOWN OF *NEWINGTON*

TYPICAL

Not to Scale

PLATE

CATCH BASIN - DRYWELL COMBINATION



DESIGN CRITERIA

Drywell must be located in soils with suitable infiltration capacity, hydrologic Groups A & B
Distance of 2 to 4 feet from drywell bottom to seasonally high groundwater required
Must pretreat runoff w/catch basin sump and hooded outlet to minimize clogging

APPLICATIONS

Areas with moderate pollutant and hydrocarbon loads
Should be used in areas with well-draining soils to take advantage of infiltration
Suitable for minor residential roads and small parking lots

ADVANTAGES

Maintains groundwater table and base flows
Renovates pollutants in first flush and frequent small storms
Reduces peak flows

DISADVANTAGES

Inspect yearly
Cannot clean infiltration surface

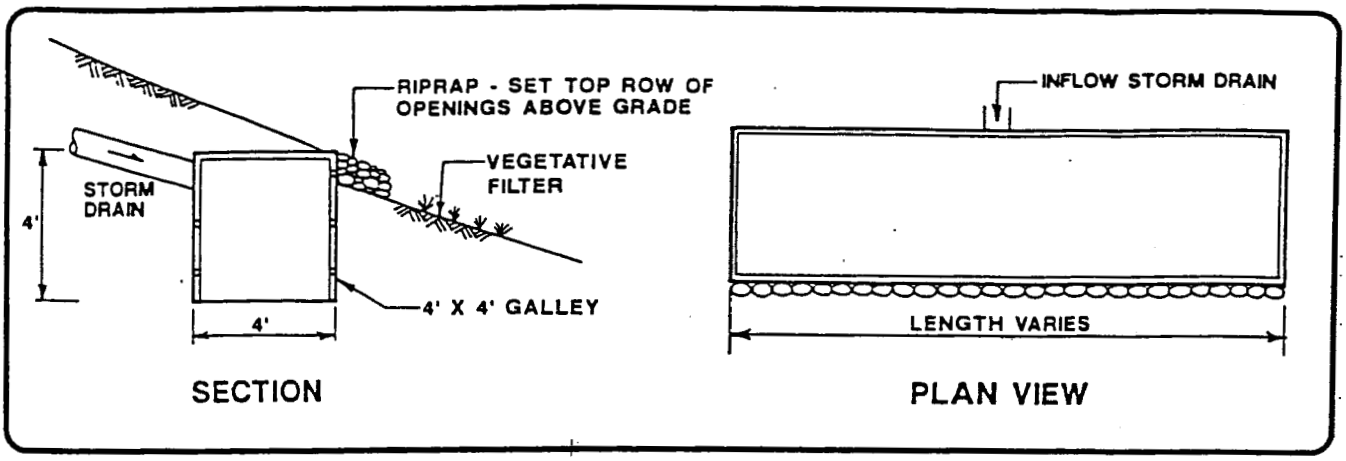
TOWN OF *NEWINGTON*

TYPICAL

Not to Scale

PLATE

INFILTRATION GALLEY W/ LEVEL SIDE OVERFLOW



DESIGN CRITERIA

Must be located in soils with suitable infiltrative capacity, hydrologic soil groups A and B
Distance of 2 to 4 feet from galley invert to seasonally high groundwater required
Pre-treat runoff through hooded catch basin with sump or sediment chamber

APPLICATIONS

Serves as an outlet for small drainage systems
May be used for rooftop drainage
Parking lots, driveways, recreation areas

ADVANTAGES

Infiltrates runoff from small storms
Excess overflows similar to level spreader and vegetative filter

DISADVANTAGES

Runoff must be pre-treated to prevent clogging of soil

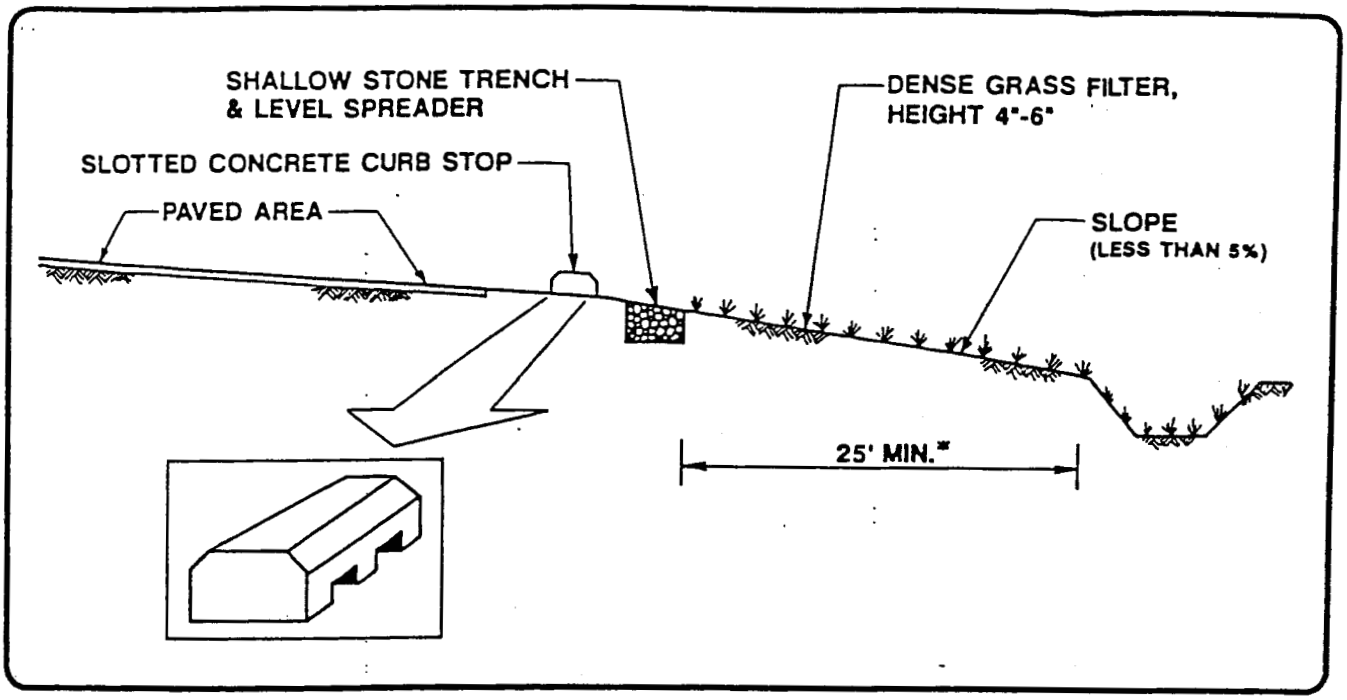
TOWN OF *NEWINGTON*

TYPICAL

Not to Scale

PLATE

VEGETATIVE FILTER



DESIGN CRITERIA

Depth of water should not exceed grass height
Select vegetation via use of CT Guidelines for Sediment and Erosion Control and Appendix B
Serve a contributing area of 5 acres or less
Uniformly grade to avoid depressions or swales
Grass height should be 4" to 6"
Performance best on slopes less than 5%
Filters should receive only sheet flow
Minimum length of 25', 50' to 75' optimal plus 4 ' for each additional percent slope
Recommended in topsoils of loamy sand to silt loam
Combine with forested strips where possible
A longer strip length provides more filtration

APPLICATIONS

Immediately abutting impervious surfaces
Downstream of level spreaders
Place in areas with high particulate loads, organics and metals
Pre-treatment for infiltrative systems

ADVANTAGES

Reduces pollutant loads
Increases time of concentration
Protects soil from erosion
May double for aesthetic/recreational use
Can provide wildlife habitat

DISADVANTAGES

Mowing maintenance
Channels formed from non-sheet flow may short-circuit filter
Periodic sediment accumulation at top of strip

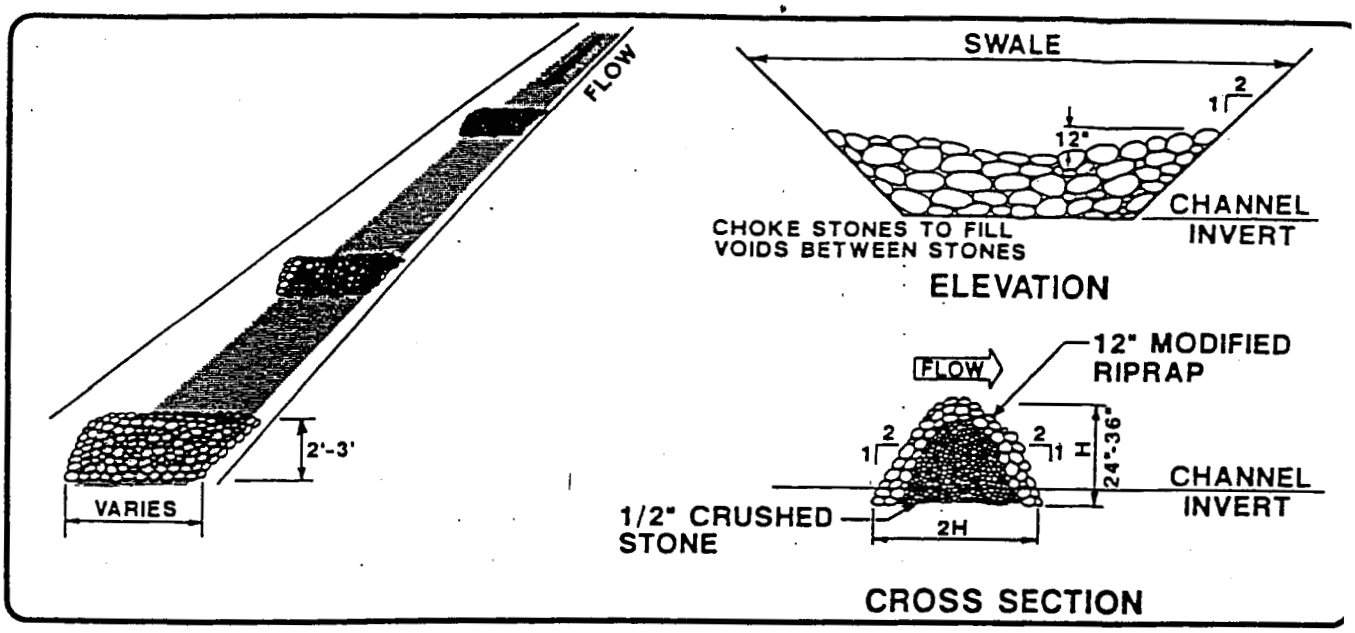
TOWN OF *NEWINGTON*

TYPICAL

Not to Scale

PLATE

RIPRAP CHECK DAM



DESIGN CRITERIA

Size to fit swale or channel dimensions
Size swale and dams to avoid overbank flows

APPLICATIONS

Temporary or permanent measure for existing channels
Useful in new temporary or permanent drainage swales
Used to reduce velocity in grass swales

ADVANTAGES

Acts to settle out coarse material
Delays runoff timing for small storms
Reduces velocity
Distributes water over channel
Increases infiltration in swales

DISADVANTAGES

Maintenance/stone replacement
Must periodically remove accumulated sediments from behind dam

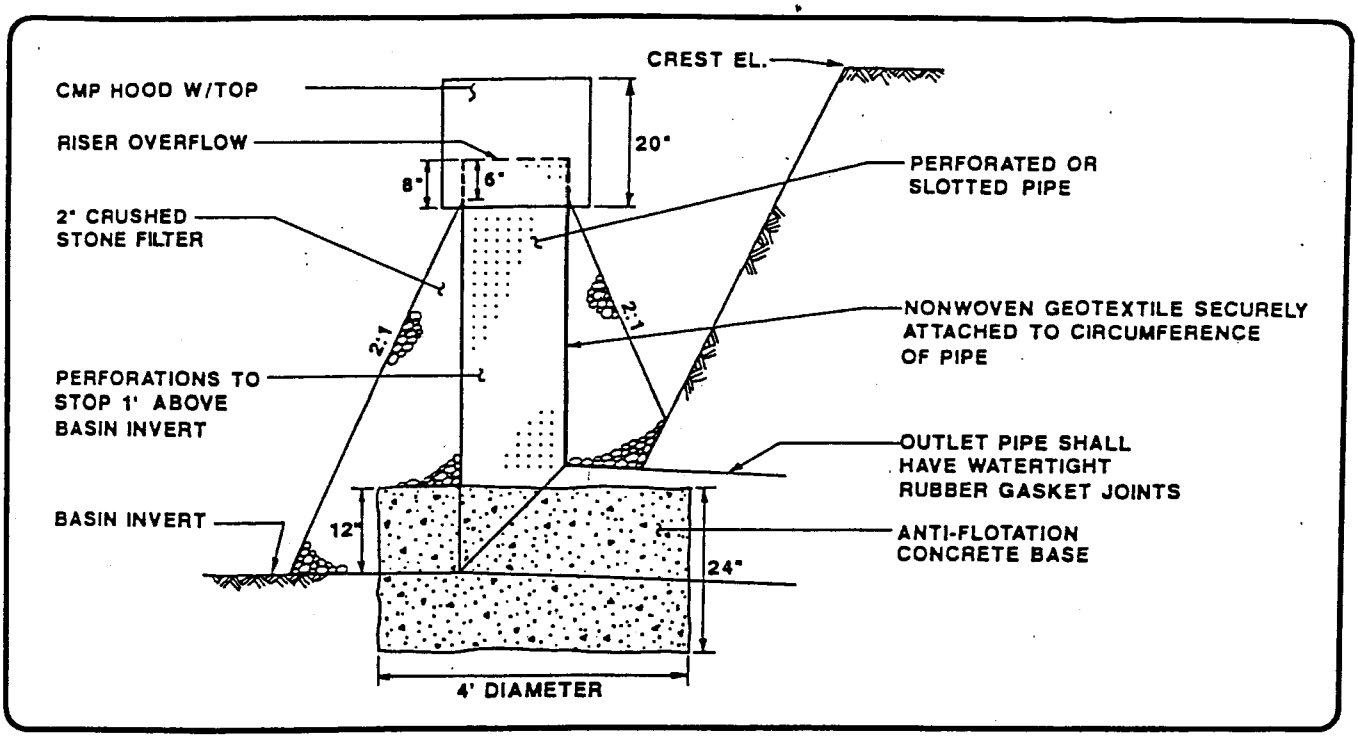
TOWN OF *NEWINGTON*

TYPICAL

Not to Scale

PLATE

SEDIMENT BASIN OUTLET



DESIGN CRITERIA

Auxiliary spillway should be provided for high flows
May be used for settling basins or infiltration basins due to metered outlet
Provide hood to trap floatables

APPLICATIONS

Sediment basins (temporary and permanent)
Infiltration basins
Ideal for off-line systems that capture small frequent storms

ADVANTAGES

Hood traps floatables
Slow metered discharge encourages settling

DISADVANTAGES

Does not accommodate high flows
Periodically clean stone filter

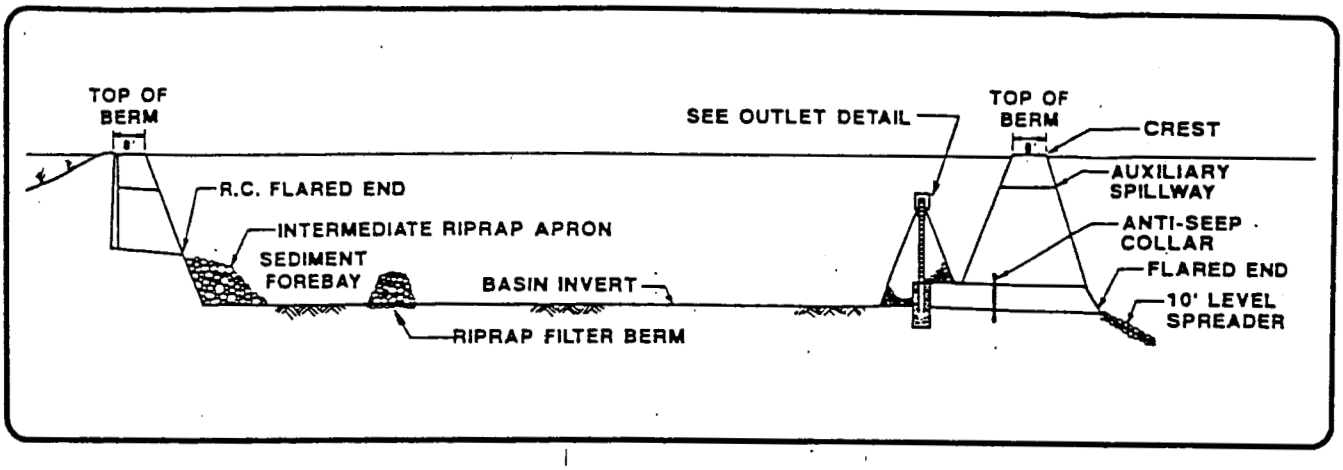
TOWN OF *NEWINGTON*

TYPICAL

Not to Scale

PLATE

SEDIMENT BASIN



DESIGN CRITERIA

Provide 2 to 4 feet to groundwater
Provide 4 feet to bedrock
Provide maintenance access
Provide auxiliary spillway outlet
Maximize length of basin and length from inlet to outlet
Utilize sediment forebay
Provide landscaped buffer at perimeter
Size to capture frequent storms (1/2")
Plant with dense growth of water-tolerant grass
Till bottom periodically and after maintenance
Pre-treat runoff
Functions best as an off-line system with large flows bypassing
3:1 maximum side slopes
Design basin floor with slope near zero

APPLICATIONS

Parking lot systems
Temporary measure during construction
Permanent measure on large developments

ADVANTAGES

Traps floatables
Traps coarse sediment
Groundwater recharge
Pollutant filtering

DISADVANTAGES

Sediment removal required
Periodic inspection and mainteance required

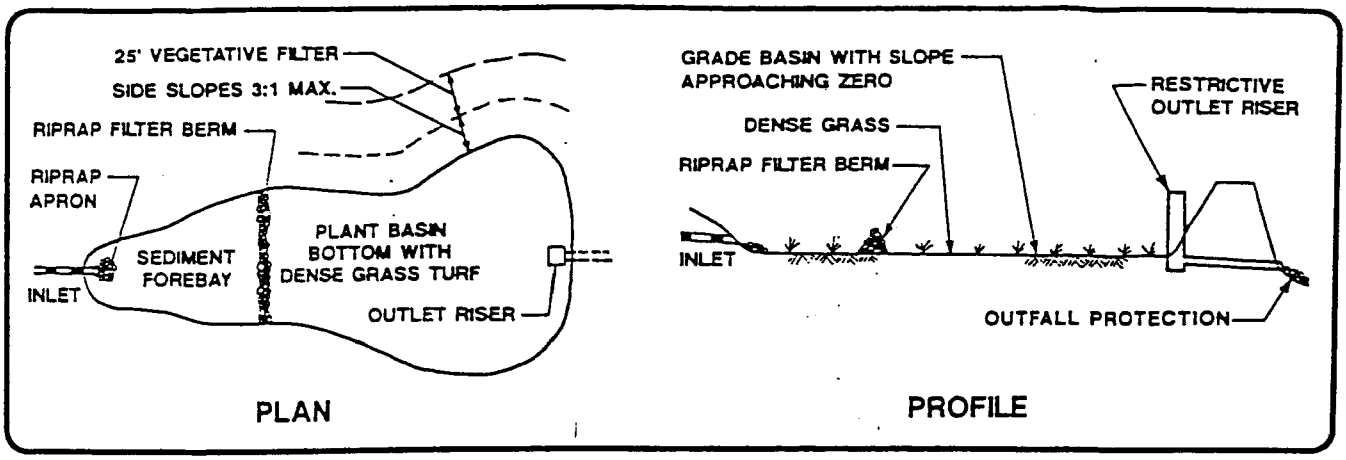
TOWN OF *NEWINGTON*

TYPICAL

Not to Scale

PLATE

INFILTRATION BASIN



DESIGN CRITERIA

Maximize surface area of basin floor
Pre-treat runoff to remove excess sediment load, floatables, and hydrocarbons
Route flow through entire length of basin
Prevent concentrated flow through basin, utilize sheet flow over entire width
Provide for flow control should basins infiltration fail
Utilize riprap apron at inlets
Utilize sediment forebay
Flat basin floor to promote uniform ponding
Side slopes should not exceed 3:1
Establish dense turf of water tolerant grass to maintain infiltration, trap pollutants, and uptake solubles
Basin should be tilled after final grading and periodically thereafter
Design for 3 day maximum draining time, 6 hour min.
Do not locate in fill soils
Perform test borings and permeability tests
Provide 4 feet minimum clearance to bedrock
Provide 2 to 4 ft clearance to seasonally high groundwater table
Locate a minimum 100 feet from drinking water wells
Locate a minimum 10 ft downgradient and 100 ft upgradient of foundations
Minimum infiltrative rate of 0.5 in/hr desired
Provide maintenance access
Provide a 25 ft vegetated buffer around the basin perimeter
Area should be protected during site construction to avoid soil compaction and raw sediment input
Basin should be mowed regularly , clippings removed

VARIATIONS

1. A first flush basin where the first 1/2 inch of runoff is directed to the basin. All larger flows bypass. This provides more efficient pollutant removal.
2. Combination detention/infiltration basin whereby more frequent flows are detained to infiltrate with no outflow. Larger storms utilize the basin's volume to attenuate peak flows in conjunction with a controlled outlet.
3. Full infiltration basin whereby all design storms are fully detained and infiltrated. An emergency overflow system should be provided in case infiltration fails.

APPLICATIONS

Commercial and large residential developments
Drainage areas of 5 to 50 acres
During construction, bottom should be left at 2 ft above final grade and used as a temporary sediment basin
Any site with well drained soils (hydrologic Groups A & B)
Should not be used in areas where contaminant spills are likely (industrial areas)

ADVANTAGES

Removes soluble and particulate pollutants
Can control peak discharges
Can serve large drainage areas
Groundwater recharge
Preserves natural water balance
May be used as recreational space

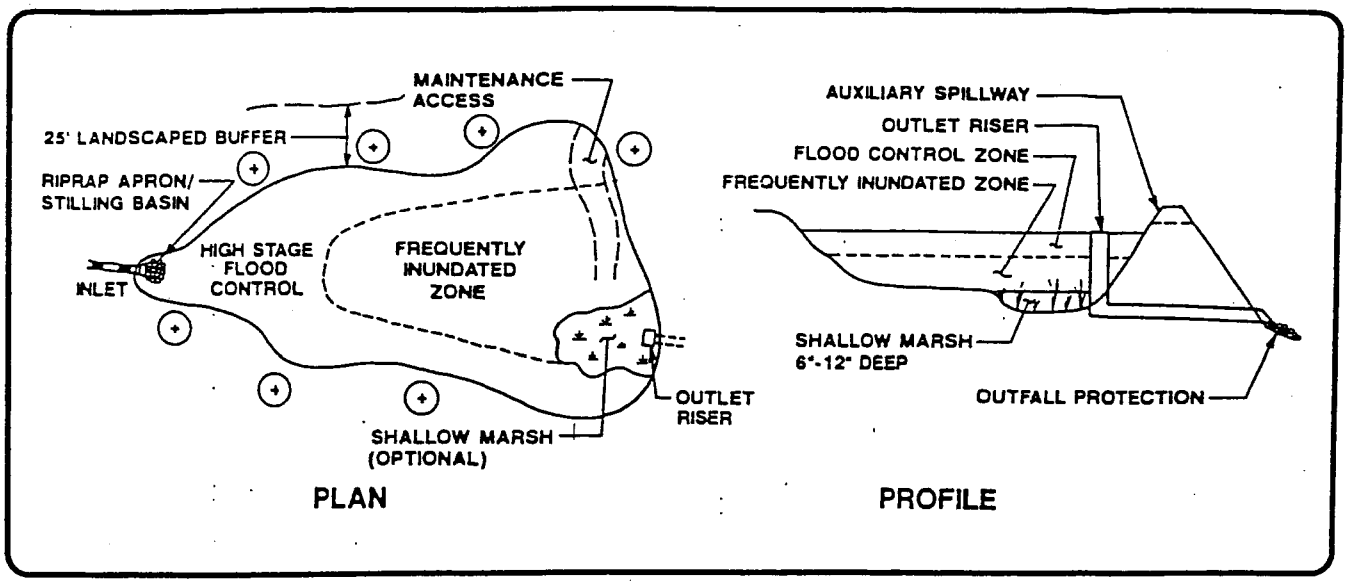
DISADVANTAGES

Fairly frequent maintenance
High failure rate due to poor soils and poor design
Infiltration rate may ultimately be determined by accumulated sediments

TOWN OF *NEWINGTON*

TYPICAL

EXTENDED DURATION DETENTION BASIN



DESIGN CRITERIA

Create optional small 6"-12" deep wet pool or marsh at riser outlet to treat soluble pollutants.
Utilize two-stage design to pass excessive flows and detain smaller, more frequent flows.
Design to control a range of storms.
Side slopes should not exceed 3:1
Capture first flush (1/2") volume minimum and release over 24 hours or longer.
Minimize distance between inlet and outlet.
Maximize length to emulate plug flow particulate settling
Install stilling basin or riprap apron to slow inlet velocities

The lower stage should be sized to accept the runoff from the mean storm event and structured to accept regular inundation.
The upper stage should be graded to drain quickly and only be inundated infrequently.
Locate preferably in B or C soils
Provide maintenance access
Provide 25' landscaped buffer/filter
Provide emergency low level outlet to drain wet pool
Basin should not intercept seasonally high watertable
For dry detention basins, provide perforated under-drain auxiliary outlet

APPLICATIONS

Retrofit for existing dry basins
Large residential developments, commercial and industrial complexes
Regional control measure

ADVANTAGES

Flood control
Particulate pollutant removal
Soluble pollutants removed with wet pool
Possible recreational use and habitat
Easy to retrofit old installations

DISADVANTAGES

Ocassional nuisance in wet portion
Moderate maintenance
Sediment removal
Unattractive

TOWN OF *NEWINGTON*

TYPICAL