

PERFORMANCE STANDARDS FOR

Stormwater Management

*

Grading and Steep Slope Protection

*

Road Standards

*

Sanitary Sewer

*

Water Supply

*

Soil Erosion and Sediment Control

A. STORMWATER MANAGEMENT

The stormwater management system shall be designed in accordance with the current requirements of the NYSDEC Stormwater Management Design Manual. NYSDEC requirements shall govern over any local or county requirements.

Design shall meet the NYSDEC sizing requirements for water quality volume, channel protection volume, overbank flood control and extreme flood control. Requirements for channel protection overbank and extreme flood control may be waived in certain instances where the conditions specified in the NYSDEC Manual are met (e.g. direct discharge to fourth order streams).

Where required, stormwater management systems shall be designed to provide for a zero net increase in the peak rate of stormwater runoff from the developed project to Offsite areas. In addition to the water quantity structural controls to be provided, grassed swales, water quality basins or other means will be developed to provide for water quality control measures. These water quality control best management practices will be provided in accordance with current NYSDEC requirements. Appropriate hydrologic and hydraulic calculations will be provided to demonstrate project impact to receiving channels or drainage systems immediately downstream.

1. Storm Drain System

a. Drainage Collection System

- 1) The storm sewer system will be designed with the pipes flowing full for a 25-year storm event.
- 2) The Rational Method $Q=CIA$ shall be used to size storm water conveyance pipes where the drainage area is less than half a square mile or 320 acres:

Q = The peak runoff rate in cubic feet per second (CFS)

C = The composite runoff coefficient based on the surface conditions:

<u>Condition</u>	<u>C</u>
Grass/ Landscape areas	0.65
Wooded areas	0.59
Paved/ Impervious area	0.99

I = The average rainfall intensity in inches per hour, taken from the intensity-duration- frequency curve for Orange County, NY.

T_c = The time of concentration in minutes, and the minimum T_c shall be 6 minutes.

A = The size of the drainage area in acres.

- 3) Storm drainage pipes will be sized based on Manning's Equation (with $n= 0.012$ for RCP and HDPE sewer pipes). Minimum pipe slope shall be 0.50%.
 - a) Minimum storm sewer pipe shall be 18" diameter
 - b) Maximum distance between inlet and manhole structures on roads will be 300'.
 - c) Each catch basin shall be designed in accordance with acceptable flow rates to the specific basin, but not to exceed 6 cfs in any case.

b. Storm Drain Culvert

- 1) The Soil Conservation Service Method TR20 shall be used for designing storm drain culverts.

- 2) Storm drainage culverts for roadways and pavements are to be designed for a 50 year storm.
- 3) The type of culvert structure material shall be selected based on size, structural strength, constructability, preservation of natural stream channel, aesthetics and cost.
- 4) In vehicular areas, provide a minimum cover of 18 inches or Class V RCP where cover is less than 18 inches.

2. Stormwater Detention Basins

- a. Hydrology for stormwater detention basins shall be based on USDA Soil Conservation Service Technical Release TR-20 methodology.
- b. Where detention facilities are required, the release of stormwater runoff to offsite areas shall not exceed the pre-development peak rate of runoff. To accomplish this, the rate of stormwater runoff shall be controlled through the use of detention basins or underground detention facilities, so that the post-development discharge rate is equal to or less than the existing discharge rate.
- c. The runoff generated from a 2 year, 10 year, and a 100 year storm shall be based on the 24 hour SCS Type III cumulative rainfall distribution for both existing and proposed conditions.
- d. Unless a site-specific soils evaluation is provided, the Rockland and Orange County soils maps shall be used to determine soil types to calculate CN factors.
- e. The water quantity basin design shall conform to the current design requirements contained in the NYSDEC Stormwater Management Design Manual.

3. Water Quality Basin Design

- a. The water quality basin design shall conform to the current design requirements contained in the NYSDEC Stormwater Management Design Manual. The NYSDEC water quality design requirements shall govern over any local or county requirements.
- b. The design approach shall utilize a "kit of parts" philosophy that encourages a variety of stormwater management practice (SMP) types. The selection of a specific SMP shall be based upon guidance from Chapter 7 of the Design Manual, and shall be depend on topography, soil and groundwater conditions, habitat, watershed characteristics, aesthetics, and other pertinent factors. Examples of SMP types to be considered from Chapter 6 of the Design Manual include:
 - ponds
 - wetlands
 - infiltration practices (infiltration trenches, basins, dry wells)
 - filtering systems (sand filters, organic filters, bioretention facilities)
 - open channels (wet swales, dry swales).

Where practicable, alternative approaches from Chapter 9 of the Design Manual shall also be considered to mitigate potential adverse impacts. These measures include:

- rain gardens
- green roofs
- stormwater planters

- permeable paving
 - cisterns.
- c. Where appropriate, water quality basins may be designed and incorporated as part of stormwater detention basin systems.
- d. Underground water quality treatment units may be used to satisfy the NYSDEC "pretreatment" criteria.
- e. Water quality treatment practices may include small decentralized facilities to serve localized drainage areas.

4. Open Channels

- a. Side slopes should not be greater than 2H:1V.
- b. Channels shall have a capacity to convey the runoff from a 25-year storm event with 0.5 foot of free board.
- c. The top width of parabolic waterway shall not exceed 30'; and the bottom width of trapezoidal waterway shall not exceed 15 feet.
- d. Channel stabilization measures shall be provided as required to prevent erosion.
- e. Rock Catchment areas may also be used to convey storm water runoff.

B. GRADING & EARTHWORK AND STEEP SLOPE PROTECTION

1. Grading & Earthwork

To minimize impacts to the natural resources, grading activities will be kept to the absolute minimum. Development activities will be generally limited to within those areas where the ground surface slope is no greater than 33%. The design of the roads and building areas will be completed to maintain less than a 20 foot cut or fill where ever possible. There will be those areas within the project site with existing topographic conditions which will require cuts and/or fills to be greater than 20 feet.

- a. Maximum slope for embankments and all landscaping areas shall be 2 horizontal to 1 vertical. Rock cut slopes and rock catchment areas will be based on the analysis and recommendations of the project geotechnical engineer.
- b. Grading plans to be designed to produce a minimum disturbance to natural resources. Balance earthwork where possible. Reuse excess rock for general fill and, if possible, for slope stabilization (i.e.; gabion walls) or for channel stabilization.
- c. Erosion control will be in compliance with New York State Guidelines. An erosion control plan will accompany all grading, utility and paving plans for both on-site and off-site improvements.
- d. Border areas shall be provided along Major, Collector, Local, Country and private roads. Guide rail should be considered where minimum border area cannot be provided.

(1) Major and Collector Road Border Area = min 9 ft wide measured from the edge of cartway. Maximum slope 3H:1V.

(2) Local, Country and Private Road Border Area = min 6 ft wide measured from the edge of cartway. Maximum slope 3H:1V.

- e. Retaining walls, rock catchments and slopes shall be permitted within the road R.O.W. provided these elements are located outside of the road border area or coordinated with guide rail protection.

2. Blasting

See Rock Blasting and Stabilization Protocol document for Tuxedo Reserve

C. ROAD STANDARDS

1. Streets

Street hierarchy and guidelines for gradients, sight distances, intersections, horizontal and vertical alignment, driveways, curbs and sidewalk have been addressed in Table 4C of the SMART CODE

2. Paving

Pavement sections will be based on Geotechnical Engineers recommendations and after completing a paving design analysis. The following are typical bituminous pavement sections to be used.

Major:	1½" Asphalt Concrete Top Course, NYSDOT Type 6 1½" Asphalt Concrete Binder 4" Asphalt Concrete Base Course, NYSDOT Type 2 8" Subbase, NYSDOT Type 1
Collector:	1½" Asphalt Concrete Top Course, NYSDOT Type 6 4" Asphalt Concrete Base Course, NYSDOT Type 2 8" Subbase, NYSDOT Type 1
Residential, Local, Private: Country Lane	1½" Asphalt Concrete, NYSDOT Type 6 Top Course 3" Asphalt Concrete Base Course, NYSDOT Type 2 8" Subbase, NYSDOT Type 1
Parking Lots:	1" Asphalt Concrete, NYSDOT Type 6 2" Asphalt Concrete Base Course, NYSDOT Type 2 6" Subbase, NYSDOT Type 1

3. Off-Site Roadway Improvements

Development build-out would be limited to the roadway capacity forecasted within the Tuxedo Reserve traffic analysis. At certain milestones within the development there will be the need to construct off-site roadway improvements to accommodate the increase in traffic. Tuxedo Reserve will monitor traffic patterns throughout the development program as they relate to the anticipated growth outlined within the traffic studies. Adjustments to the start and completion dates of off-site roadway improvements will be coordinated to best serve the interest of the Town, residents and the commuting public.

D. SANITARY SEWER

Sanitary sewers are designed based on the standards and regulation of Orange County Health Departments and the NYS DEC Design Standards for Wastewater Treatment Works.

1. Wastewater Design Flow

The flow rate is based on the NYS DEC Design Standards for Wastewater Treatment Works 1988, Table 3. Expected Hydraulic Loading Rate, and incorporates a 20% reduction for the use of water-saving plumbing fixtures:

Homes	Standard Flow Rate (gpd)	Reduced Flow Rate (gpd)
1 Bedroom	150	120
2 Bedrooms	300	240
3 Bedrooms	400	320
4 Bedrooms	475	380

Assumed bank, postal office, food, sport/health, day care, retail, office & business center all based on the flow rate of 0.10 gpd/sf in Southern Tract; and 0.08 gpd/sf for office, light industrial and warehouse in Northern Tract.

Wastewater peak wet weather design flows will be based on the following:

- Domestic sanitary flows (based on above standard flow rates)
- Infiltration flow (additional 15% of domestic sanitary flow)

2. Gravity Sewer

a. Pipe

- 1) Gravity system shall be designed for peak wet weather flow and without surcharging the system. Gravity sewers shall be designed when possible to provide a minimum velocity of not less than 2 fps when flowing half full. During initial years of development frequent sewer line flushing or cleaning may be required to flush and sediments that may be deposited during the low flows.
- 2) Minimum diameter of sewer lateral shall be 6" for commercial connection, 4" for residential connection, and 8" for public sewer extension.
- 3) Cleanout shall be provided at each lateral connection.
- 4) Sanitary pipes will be designed with following minimum hydraulic slope for all pipe types using $n=0.013$ for ductile iron and $n=0.010$ for PVC to provide a minimum velocity of 2 fps.
- 5) The maximum velocity shall be 15 fps, where 10 fps is preferred where possible.
- 6) When a smaller sewer joins a larger one, the invert of the larger sewer should be lowered to place the 0.8 depth point of both sewers at the same elevation.
- 7) Minimum cover above sanitary sewer pipe shall be 4'.
- 8) Minimum 3' of cover from the bottom of stream at stream crossing.

- 9) Minimum 10' of lateral separation and 18" of vertical separation shall be provided between sanitary sewers and water main.
- 10) Where appropriate separation from a water main is not possible, the sewer shall be encased in concrete or constructed of ductile iron pipe using mechanical or slip-on joints for a distance of at least 10' on either side of the crossing.
- 11) No sewer main shall be constructed within:
 - 50' from a water supply well or a below-grade reservoir;
 - 25' from surface water or open drainage/ culvert;
 - 10' from a storm or water pipe;
 - 25' from top of embankment or steep slope.
- 12) Sanitary sewers crossing streams or wetlands, or located within 25' of the stream embankment shall be constructed of steel, reinforced concrete or ductile iron pipes.
- 13) Maximum distance between manholes shall not exceed 400 feet.
- 14) Sewers on 20% slopes or greater shall be anchored securely with concrete or equal, anchors spaced as below:
 - Not over 36' center to center on grades 20% and up to 35%;
 - Not over 24' center to center on grades 35% and up to 50%;
 - Not over 16' center to center on grades 50% and over.
- 15) Except where otherwise approved by municipality or utility authority, the centerline of sanitary sewer manholes, when located within the municipal right-of-way, shall be located where possible 5ft from the center line of the paved cartway. If conditions prevent location near the centerline, the manhole shall be located within the cartway a minimum of five-feet from the gutterline.

b. Sanitary Sewer Manholes

- 1) Minimum inside manhole diameter shall be 48".
- 2) Provide minimum 0.1' drop across the sanitary sewer manhole.
- 3) Provide a drop connection when the difference between inverts is more than 2 feet. Inside or outside drop shall be used. Inside drop connections shall require a larger inside diameter manhole
- 4) No manholes are permitted within 100' of a public water supply well or a below grade reservoir.
- 5) Watertight manhole cover shall be provided within the 100-year flood level or 50' from the wetlands limit.

3. Force Main

- a. The minimum building service connections from individual grinder pumps to the collectors shall be 1-1/4" PVC pipe.
- b. The minimum force main diameter shall be 4".
- c. The minimum velocity shall be 2 fps.

- d. Force main shall enter the gravity sewer system at a point not more than 2 feet above the flow line of the receiving manhole.
- e. Cleanout shall be provided every 400' to 500', at major change in direction, and at where one collector main joins another main.

4. Pump Station

- a. Pump station shall be located outside of the 100-year floodplain and be accessible during the 25 year flood.
- b. Pump suction and discharge openings shall be at least 4" in diameter, unless otherwise approved in writing by the Town.

5. Sewage Disposal System

- a. All design and construction of sewage disposal systems shall be in accordance with the standards and regulations of Orange County Department of Health, and New York Department of Environmental Conservation, as outlined in the with Appendix 75-A of Part 75 of the Administrative Rules and Regulations contained in Chapter 11 of Title 10 (Health) of the Official Compilation of Codes, rules and Regulations of the State of New York.
- b. Mounded septic system is not permitted in Orange County

E. WATER

Water mains, pumping facilities and distribution storage design shall be designed in accordance with the latest edition of Recommended Standards for Water Work (also know as the Ten State Standards) and Part 5 of the New York State Sanitary Sewer Code.

1. Water Demand

Water demand is the sum of the residential and non-residential water demand. Fire flow volume is provided in dedicated storage and is, therefore, not a demand. The residential and non-residential water demand will be based on the following:

Parameter	Water per Unit Basis	2008, No PIPC	Water Demand	2008, PIPC	Water Demand
Residential					
1BR Dwellings	150 gal/unit/day @80%	20 units	2,400 gpd	20 units	2,400 gpd
2BR Dwellings	300 gal/unit/day @80%	409 units	98,160 gpd	409 units	98,160 gpd
3BR Dwellings	400 gal/unit/day @80%	638 units	204,160 gpd	607 units	194,240 gpd
4BR Dwellings	475 gal/unit/day @80%	128 units	48,640 gpd	159 units	60,420 gpd
Commercial	0.1 gal/sf/day	103,000 sq. feet	10,300 gpd	103,000 sq. feet	10,300 gpd
Future School	20 gallons per student per day	500 students	10,000 gpd	500 students	10,000 gpd

Parameter	Water per Unit Basis	2008, No PIPC	Water Demand	2008, PIPC	Water Demand
Total Average Daily Demand			373,660 gpd		375,520 gpd
Maximum Month to Average Day Peaking Factor			1.3		1.3
Maximum Day to Average Day Weighted Average Peaking Factor (1)			2.139		2.139
Total Max Month Demand			485,758 gpd		488,176 gpd
Total Maximum Day Demand			799,259 gpd		803,237 gpd
Total Max Day Supply (24 hrs per day)			835,200 gpd		835,200 gpd
	Note: Up to 2,860 bedrooms for non-age restricted residential units and no bedroom limitation for age restricted residential units will be allowed.				

(1) Weighted Average Peaking Factor is calculated as follows: $[(SFD \times 2.5) + (MFD \times 1.5)] / \text{Total Units}$

(SFD) Single Family Dwellings: 764 units
(MFD) Multi Family Dwellings: 431 units
Total: 1,195 units
Peaking Factor: $[(764 \times 2.5) + (431 \times 1.5)] / 1,195 = 2.139$

The water supply system should be designed to carry and deliver the peak-hour flow demand and the fire flow requirement whichever is greater. The storage facility shall contain average day demand plus the fire flow requirement.

2. Fire Flow

The fire protection need will be based on Insurance Services Office (ISO), *Fire Suppression Rating Schedule* and the ISO formula for estimated Needed Fire Flow (NFF) and the American Water Works Association's (AWWA). Manual of Practice 31, *Distribution System Requirements for Fire Protection (M31)*.

The following fire flow values will be provided:

- 2000 gpm for 2 hours for the multi-family dwellings
- 1060 gpm for 2 hours will be provided to the school

- 1000 gpm for 2 hours will be provided for the single family homes.

The minimum fire flow requirement is based on 2000 gpm for two hours.

3. Fire Hydrant

- a. Fire hydrants shall be spaced 350 ' to maximum 500' apart.
- b. Fire hydrants shall be generally located in the vicinity of low and high points of the streets and in the vicinity of street dead ends.

4. Water Main

- a. All water mains shall be sized to maintain a minimum pressure of 20 psi at ground level at all points in the distribution system under all conditions of flow, including fire.
- b. The normal working pressure in the distribution system should be approximately 60 psi and not less than 35 psi.
- c. Water main shall be separated both horizontally by 10' minimum and vertically by 18" minimum with any pipe lines carrying non-potable water such as sanitary and storm sewer.
- d. Water mains will be installed with minimum 4 feet of cover.
- e. Minimum water main size shall be 6" diameter cement-lined ductile iron pipe.
- f. Maximum valve spacing shall be 500' for commercial and 800' for residential development.
- g. Water mains shall be installed with minimum 2 feet of cover when crossing water course 15 feet wide. The pipe shall be of special construction having flexible watertight joint, and valves and permanent taps shall be provided on both sides of major stream crossings.

5. Water Storage Tank

- a. Water Storage tank shall be tucked below the ridge lines where possible.
- b. The minimum capacity of a water storage facility shall contain average day demand and fire flow for a total of 615,520 gallons (assuming an average flow of 375,520 gpd).

6. Wells

Public water supply wells shall be located to meet State regulatory requirements.

F. SOIL EROSION AND SEDIMENT CONTROL

Soil Erosion and sediment control devices and application shall be in accordance with NY State Guidelines for Urban Erosion and Sediment Control standards and regulations.