

HILLSBOROUGH CODE -- MUNICIPAL SEWER SYSTEM

Hillsborough Code -- Sewer System Specifications

Code of the Town of Hillsborough -- Chapter 181

THE TOWN OF HILLSBOROUGH
BOARD OF WATER AND SEWER COMMISSIONERS

APPENDIX A

Specifications for Hillsborough Municipal Sewer System

ARTICLE I -- Design of Sewers

Section 1. Type of Systems: All new systems or extensions shall be designed as separated sanitary and storm systems.

A. Requirements: Rain water from roofs, streets and other areas, and groundwater from foundation drains shall be excluded from the sanitary sewer.

Section 2. Design Period: Sewer systems or extensions shall be designed for the estimated ultimate tributary population, usually a period of 50 years hence, except in considering parts of the systems that can be readily increased in capacity. Similarly, consideration should be given to the maximum anticipated capacity of institutions, industrial parks, or commercial shopping centers.

A. Sewer extensions shall be allowed only if the receiving pumping station, and or sewage treatment plant is either:

1. Capable of adequately processing the added hydraulic and organic load; or,

2. Provision of adequate treatment facilities on a time schedule acceptable to the Board of Water and Sewer Commissioners is assured.

Section 3. Design Factors: In determining the required capacities of sanitary sewers the following factors shall be considered:

A. Maximum hourly sewage flow;

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- B. Additional maximum sewage or waste flow from industrial plants;
- C. Groundwater infiltration;
- D. Topography of area;
- E. Pumping requirements.

Section 4. Design Basis:

A. Collectors; Laterals:

1. New sewer systems shall be designed on the basis of an average daily per capita flow of sewage of not less than one hundred (100) gallons per day.

2. Sewers shall be designed to carry this sanitary waste flow multiplied by a peak flow factor, plus an infiltration allowance, when running full.

3. Sanitary waste from commercially or industrially zoned areas shall be measured, if existing, or shall be estimated on the basis of the following:

a. Industrial Parks - no less than three thousand (3,000) gallons per day per gross acre.

b. Shopping Center - no less than three thousand (3,000) gallons per day per gross acre.

c. Supermarkets - no less than four thousand five hundred (4,500) gallons per day per market.

B. Main and Trunk sewers: Design of trunk sewers shall be based on total contributory flow from the collection system served, but in no case shall the flow be based on less than 2:1/2 times the average flow of the contributory system.

C. Infiltration allowance:

1. For areas to be sewered in the future, an infiltration allowance of one hundred fifty (150) gallons per day per acre shall be used.

2. For sewers under design, an allowance of five hundred (500) gallons per inch diameter per mile per day shall be made.

Section 5. Details of Design:

A. Minimum size: No sewer shall be less than eight (8) inches in diameter.

B. Depth: Sewer shall be sufficiently deep so as to receive sewage from basements and to prevent freezing. A minimum depth of cover for street installation shall be eight (8) feet and for cross-country installation shall be six (6) feet.

C. Slope: All sewers shall be designed and constructed at such slopes as to prevent deposition of organic solids when flowing full based on Mannings's formula and an "n" value off .013 as set forth below. This shall mean a minimum velocity for design purposes of two (2) feet per second (fps) when flowing full.

Minimum slope to achieve minimum velocity shall be:

Sewer Size	Minimum Slope, Feet Per Foot
1. 8 inch	.004
2. 10 inch	.0028
3. 12 inch	.0022
4. 14 inch	.0017

Sewers shall be designed and laid with a uniform slope between manholes. A drop of at least 0.1 feet shall be provided between incoming and outgoing sewers on all manholes.

D. Alignments: Sewers shall be designed and constructed to follow the approximate center line of right of way, road and/or easement, with straight alignment between manholes.

E. Change in pipe size: When a smaller sewer joins a larger one, the invert of the larger sewer shall be lowered sufficiently to maintain the same hydraulic gradient. An approximate method which may be used for securing these results is to place the 0.8 depth point of both sewers at the same elevation.

F. High velocity protection: Where velocities greater than ten (10) feet per second may be attained, special provision shall be made to protect against displacement by erosion and shock.

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G. Sewers crossing streams: Sewers crossing streams or to be located within fifteen (15) feet of a stream embankment or otherwise where unusual strength is indicated, shall be of steel reinforced concrete, cast iron or other suitable material and shall be properly protected.

H. Manholes (Locations): Manholes shall be installed at the end of each sewer line, at all intersections, and at all changes in grade, size, or alignment. To follow the approximate center line of right of way, road, and/or easement, with straight alignment between manholes. In no case shall the distance between manholes be greater than three hundred (300) feet. Lampholes shall not be substituted for manholes nor installed at the end of laterals.

I. Invert Siphons: Inverted siphons shall be avoided whenever possible. However if used, inverted siphons shall have not less than two (2) barrels, with a minimum pipe size of six (6) inches and shall be provided with necessary appurtenances for convenient flushing and maintenance. The manholes shall have adequate clearances for rodding and in general, sufficient head shall be provided and pipe sizes selected to secure velocities of at least 3.0 feet per second for average flows. The inlet and outlet details shall be arranged so that the normal flow is diverted to one barrel, and so that either barrel may be cut out of service for cleaning.

J. Protection of Water Supplies: While no general statement can be made to cover all conditions, it is generally recognized that sewers shall be kept remote from public water supply wells or other water supply sources and structures. Should a proposed sewer be located within four hundred (400) feet of a public water supply or reservoir or within seventy five (75) feet of private wells, the Board of Water and Sewer Commissioners may require any special construction materials or techniques which it deems necessary in the interest of public health and safety.

1. There shall be no physical connection between a public or private potable water supply system and a sewer, or appurtenance thereto which would permit the passage of any sewage or polluted water into the potable water supply.

2. Sewer shall be located, during design, at least ten (10) feet, horizontally, from any existing or proposed water main. If, for absolutely essential reasons, it is not possible to achieve such separation, the sewer may be located not less than three (3) feet from a water main - horizontally, provided there is at least eighteen (18) inches

vertical separation between the bottom of the water main and the top of the sewer with the sewer below the water main.

3. Whenever sewers unavoidably must cross under water mains, the sewer shall be located at such an elevation that the top of the sewer is at least eighteen (18) inches below the bottom of the water main. Should the grade be such that lowering the sewer is not possible, the water main shall be raised to achieve the required separation.

IN NO CASE SHALL THE WATER MAIN PASS UNDER THE SEWER.

ARTICLE III -- Specifications for Materials

Section 1. Reinforced Concrete Pipe:

A. Pipe and Fittings shall conform to ASTM C-76 OR C-361. Cement shall be Type II.

B. Joints shall be made with oil resistant compression rings of an elastomeric material conforming to ASTM C-443.

Section 2. Cast-Iron Pipe;

A. Pipe and fittings shall conform to the following standards of the United States of America Standards Institute: A21.1, A21.4, A21.6, A21.8, and A21.10.

B. Joints shall be of the following Types: Mechanical Type, Push-on Type or Ball and Socket Type.

C. Joints and Gaskets shall be oil resistant and shall conform to the following standards of the United States of America Standards Institute: A21.11. Manufacturer's instructions for installation shall be followed.

Section 3. Ductile Iron Pipe;

A. Pipe and fittings shall conform to the following standards of the United States of America Standards Institute: A21.50, A21.50

B. Joints shall be as specified in section for Cast-Iron Pipe.

Section 4. Plastic Pipe:

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A. PVC Sewer pipe and fittings shall conform to ASTM D-3034 or ASTM F 679 (SDR 35 Minimum). Polymer compounding and classification shall be in accordance with ASTM D-1784, (Class 12454-B).

B. Pipe stiffness measured in accordance with ASTM D-2412 shall be a minimum of 46 psi at 5% deflection.

C. Joints for PVC pipe shall be oil resistant compression rings of an elastomeric material conforming to ASTM D-3212. Type shall be push-on, bell and spigot. Manufacturer's instructions for installation shall be followed.

D. PVC pipe used for force mains shall conform to ASTM D-2241 and D-1784 (Class 12454-B). A safety factor of 2.5 shall be used for pressure rating determination. Standard dimension ratio (SDR) shall be higher than 26.

E. ABS truss pipe and fittings shall conform to ASTM D-2680. Polymer compounding shall be in accordance with ASTM D-1788, (Class 3-2-2). pipe stiffness measured in accordance with ASTM D-2680 shall be a minimum of 200 psi at 5% deflection.

F. Joints for ABS truss pipe shall be chemical welded couplings Type SC in accordance with ASTM D-2680, forming a chemical welded joint. Manufacturer's instructions for installation shall be followed.

Section 5. Manholes: Basic requirements; All component parts shall have strength, leakproofness, and space necessary for the intended service.

A. Pre-cast concrete barrel sections, cones, and bases shall conform to ASTM C-478 except as may be otherwise shown on the Standard Manhole drawings and approved by the Board of Water and Sewer Commissioners.

B. Pre-cast manhole section assemblies (with or without reinforcement) shall withstand H-20 loading for the life of the structure. A period in excess of 25 years shall be the life of the structure.

C. Base sections shall be monolithic to a point six (6) inches above the crown of the incoming pipe, and shall be pre-cast reinforced concrete.

D. Manhole steps shall be permitted only by approval of the Board of Water and Sewer Commissioners; these steps shall be secondary entry means to a portable ladder.

E. All pre-cast sections and bases shall have the date of manufacture and the name or trademark of the

manufacturer impressed or indelibly marked on the inside wall.

F. Manhole frame and cover shall provide a 30 inch diameter clear opening. The cover shall have the letter "S" or the word "SEWER" in 3 inch letters cast into the top surface.

G. Castings shall be at least Class 30 conforming to the ASTM Standard Specification for Gray Iron Castings, Designation A48.

H. The castings shall be of good quality, strong, tough, even-grained cast-iron, smooth, free from scale, lumps, blisters, sandholes, and defects of every nature which would render them unfit for the service for which they are intended. Contact surfaces of covers and frame seats shall be machined at the foundry, before shipment, to prevent rocking of covers in any orientation.

I. Before being shipped from the foundry, casting shall be sandblasted and given two coats of coal-tar pitch varnish, applied in a satisfactory manner so as to make a smooth coating, tough, tenacious, and not brittle or with any tendency to scale off.

Section 6. Brick and Masonry: Brick shall be sound, hard and uniformly burned, regular and uniform in shape and size, of compact texture, and satisfactory to the Board of Water and Sewer Commissioners .

A. Brick shall comply with the ASTM Standard Specifications for Sewer Brick (made from clay or shale), Designation C32, for Grade SS, hard brick.

Rejected brick shall be immediately removed from the work.

B. Mortar shall be composed of portland cement, hydrated lime, and sand, in the proportions of 1 part cement to 1/2 part lime to 4:1/2 parts sand, (by volume). The proportion of cement to lime may vary from 1:1/4 for hard brick to 1:3/4 for softer brick, but in no case shall the volume of sand exceed three times the sum of the volume of cement and lime.

C. Cement shall be Type II portland cement conforming to ASTM C-150, Standard Specifications for Portland Cement.

D. Hydrated lime shall be Type S conforming to the ASTM Standard Specification for Hydrated Lime for Masonry Purposes, Designation C-207.

E. Sand shall consist of inert natural sand conforming to the ASTM Stand Specifications for Concrete (Fine)

Aggregates, Designation C33.

Section 7. Alternate Items: The Board of water and sewer commissioners and/or Inspector, reserve the right to require a sample for evaluation of any item supplied. Alternate items must receive approval prior to installation by the Board of Water and Sewer the Commissioners or Inspector.

ARTICLE IV -- Construction Standards

Section 1. Requirements: Construction of sewers will be in accordance with the specifications and requirements stated here in.

Section 2. Reference Drawings: Owner/Developer will submit a print to show the layout of work. The print will show the location of lines (including water lines, hydrants, service lines and curb valve locations), manholes, laterals and other utilities that are present.

Section 3. As Built Drawings: Owner/Developer shall, at the completion of work, provide the Board of Water and Sewer Commissioners, with as built drawings indicating the location of the sewer main and all appurtenances. The as built drawings shall be to an accuracy shall be to an accuracy of plus or minus of one (1.0) foot in plan view.

Section 4. Sewer Main - General: Owner/Developer shall furnish all materials, labor, tools and equipment, and perform all work and incidentals necessary for the installation of the sewer main and appurtenances (pipe, tees ("T's"), wye ("Y's"), Manholes, laterals). The quality, process of manufacture of all materials shall be subject to inspection and approval of the Inspector or commissioners. The above mentioned material shall be subject to rejection at anytime.

A. All materials shall be carefully inspected before being installed. All pieces found to be defective, as determined by the Commissioners or inspector, shall be pulled out in such manner not to damage it and shall be removed from the job site by Owner/Developer by the end of the first working day there after.

Section 5. Materials, Pipe Storage and Handling: The Owner/Developer shall arrange for the delivery of the pipe sections and fittings at approved locations in the vicinity of that portion of the sewer line in which the materials are to be

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used. To this end, he shall do such work as is necessary for access and for delivery of the the materials. Materials shall be stored in an approved, orderly manner so that there will be a minimum of re-handling from the storage area to the final position in the trench and so that there is a minimum of obstruction and inconvenience to any kind of traffic. Deliveries shall be scheduled so that quantities of pipe and fittings shall not be stored for excessive lengths of time in crowded locations. Storage of pipe and fittings will be restricted to approved or permitted areas.

A. Storage of Pipe: All sewer pipe stacked on the job site must have 4"x 4" timbers below the stack to prevent dirt and debris from entering the pipe. Chocks shall be nailed at each end to prevent movement of the pipe. For safety and convenience, each size pipe should be stacked separate. Pipe on tiers shall be alternated -bell-plain end; bell -plain end, etc.

B. The interior of the pipe and fittings shall be kept clean and free of debris at all times during storage and installation or the materials may be rejected by the Inspector or commissioners.

C. The pipe and fittings shall not be dropped from trucks or into the trench. Each pipe section and fitting shall be handled into its position in the trench in such manner and by such means as to assure the safety of the workmen and such as to cause no injury to the pipe, fittings or to any property.

D. Pipe laying crews shall have on the job site all the proper tools to handle and cut pipe. The use of hammer and chisel, or any other method which results in rough edges, chips and damages pipe, shall be prohibited.

E. Damaged pipe coating and/or lining shall be restored before installation as approved by the Board of Water and Sewer Commissioners

Section 6. Control of Alignment and Grade: The Owner/Developer shall establish the location of the pipe, manholes and other appurtenances, and shall establish bench marks along the route of the pipeline at conveniently intervals for the use of the Contractor, Inspector and for his own reference in checking the pipe manhole invert and other elevations throughout the project.

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A. The Contractor shall use a laser beam to assist in setting the pipe and manholes, provided he can demonstrate satisfactory skill in its use.

B. The use of string levels, hand levels, carpenters levels or other relatively crude devices for transferring grade or setting pipe and manholes will not be permitted.

C. During construction, the Contractor shall provide the Inspector and/or Board of Water and Sewer Commissioners, at their request, all reasonable and necessary materials, opportunities and assistance for setting stakes and making measurements, including the furnishing of one or two rodmen, as needed at intermittent times. The Contractor shall not proceed until he has made timely demand upon the Inspector and/or the Board of Water and Sewer Commissioners for, and has received from them, such controls and instructions as may be necessary as the work progresses. The work shall be done in strict conformance with such controls and instructions.

D. The Contractor shall carefully preserve bench marks, reference points and stakes, and in case of willfull or careless destruction, by his own men, he will be responsible for any mistakes or delay that may be caused by their unnecessary loss or disturbance.

Section 7. Depth of Bury and Location: The sewer mains and lateral lines will be located a minimum of eight feet (8') from the top of the pipe to finish grade. In the event of conflicts with existing water mains or water service lines. The water main and/or service lines will be offset above sewer lines by a minimum of eighteen inches (18") and the water main is to be insulated where conflicts exist with storm drains, culverts. State regulations requires water mains and sewer mains which run parallel, to have a ten foot (10') horizontal separation.

Section 8. Installation: Sewer pipe, manholes, laterals and appurtenances shall be laid on a six inch (6") layer of bedding material of crushed stone (1/2" to 3/4") and shall extend above the crown of the outside surface of the pipe and all appurtenances. It shall completely surround both sides of manhole to a horizontal plane above the crown of the outside surface of the highest incoming pipe.

A. Bedding material and fill material for

excavation below grade shall be screened gravel or crushed stone.

B. The interior of the pipe and fittings be kept clean and free of debris at all times during storage and installation or the materials may be rejected by the Inspector or Commissioners.

C. At all times the open ends of pipe shall be closed by temporary water tight plugs or by other approved means. If water is in trench, at time of installation, the plug shall not be removed until all danger of water entering the pipe has been eliminated.

D. Manholes: Pre-cast bases shall be placed on a 6 inch layer of compacted bedding material. Bedding material shall consist of crushed stone. The excavation shall be properly dewatered while placing bedding material and setting the base.

1. Inlet and outlet stubs shall be connected and sealed in accordance with manufacturer's recommended procedure.

2. Barrel sections and cones of the appropriate combination of heights shall then be placed. Horizontal joints between sections shall be of a type approved by the Board of water and sewer commissioners, which type shall, in general, depend for water-tightness upon an elastomeric or mystic-like sealant.

3. A leakage test shall than be made as described in Article V, -- "Testing".

4. Following satisfactory completion of the leakage test, the frame and cover shall be placed on the top or some other means of preventing accidental entry by unauthorized persons, children, animals, etc., until ready to make final adjustment to grade.

E. Dewatering: Owner/Developer shall provide for dewatering, if necessary, to provide a stable and dry trench during periods of construction. **At no time shall water in the trench be permitted to flow into the sewer.**

Section 9. Backfill: Back-filling of all piping, manholes and appurtenances shall be in accordance with the following:

A. A sand blanket shall cover the pipe, fittings, and all laterals a minimum of 12 inches above the crown of the outside surface.

B. Sand blanket material shall be graded sand

free from organic materials, so graded that 100% passes a 1/2 inch sieve; 15% (maximum) passes a #200 sieve.

C. Back-fill material for in road, travelled ways, shoulders, easements and/or cross-country shall be natural material excavated from trench during construction excluding debris, pieces of pavement, organic matter, top soil, all wet or soft muck, peat or clay, all excavated ledge material, or rocks over six (6) inches in the largest dimension or any material not approved by the Inspector and/or Commissioners. Completed construction will be entirely stable and provide for easy access to the sewer for maintenance and possibly reconstruction, when necessary. Backfill shall be mounded six (6) inches above original ground in easements and cross-country sections.

Section 10. Pavement: Repair and/or replacement of all pavement shall be made at the end of each day and meet the requirements of the latest edition of the standard specifications for road and bridge construction of the State of New Hampshire department of public works and highways.

Section 11. Inverts and Shelves: Manholes shall have a brick paved shelf and invert, constructed to conform to the size of pipe and flow. At changes in direction, the inverts shall be laid out in curves of the longest radius possible tangent to the center line of the sewer pipes. Shelves shall be constructed to the elevation of the highest pipe crown and slop to drain toward the flowing through channel underlayment of invert and shelf shall consist of brick masonry.

ARTICLE V -- Testing

Section 1. Required testing: All portions of the sewer system including piping and manholes shall be tested by the use of low-pressure air. Leakage tests shall be made and recorded (by those conducting test) on each manhole. Each test shall be observed by Inspector and/or by a member of the Board of Water and Sewer Commissioners. A validated and signed report to be delivered to the Board of Water and Sewer Commissioners, by the Owner/Developer.

Section 2. Pipe Testing: The procedure for conduction of acceptance test is as follows;

- A. Clean test section
- B. Plug all pipe outlets with suitable test

plugs. Bracing plug securely.

SAFETY PROVISIONS: Plugs used to close the sewer pipe for the air test must be securely braced to prevent the unintentional release of a plug. Gages, air piping manifolds and valves shall be located at the top of the ground. No one shall enter a manhole when a plugged pipe is under pressure.

Air testing apparatus shall be equipped with pressure release devices such as a rupture disc or a pressure relief valve designed to release pressure at a maximum of 6 psi.

C. Add air slowly to the portion of the pipe installation under test until the internal pressure is raised to 4.0 psig.

D. After an internal pressure of 4.0 psig is obtained, allow at least two minutes for air temperature to stabilize, adding only the amount of air required to maintain pressure.

E. After the two minute period disconnect the air supply.

F. When pressure decreases to 3.5 psig, start the stopwatch. Determine the time in seconds that is required for the internal air pressure to reach 2.5 psig.

G. If the stopwatch time is less than the time specified by the Board of Water and Sewer Commissioners Time Holding Chart, the pipe tested has failed.

H. After all sources of air leakage have been corrected the above test will be conducted again.

Section 3. Manhole Testing: Testing shall be done whenever possible prior to backfilling to assist in locating leaks. Vacuum testing draws together the joints and applies high pressure to the elastomeric joint material used to avoid leakage or to enable sections to be separated if necessary to effect a repair. The procedure for conducting acceptance test is as follows:

A. After the manhole has been assembled in place, all lifting holes shall be filled and pointed with an approved non-shrinking mortar. The test shall be made prior to placing the shelf and invert and before filling and pointing the horizontal joints. All pipes and other openings into the manhole shall be suitably plugged and the plugs braced to prevent release.

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SAFETY PROVISIONS: Plugs used to close the sewer pipe for the air test must be securely braced to prevent the unintentional release of a plug. Gauges, air piping manifolds and valves shall be located at the top of the ground.

B. Initial test pressure - 10" Hg (i.e. 20" Hg absolute)

C. Test time - 1" Hg drop to 9" Hg in 2 minutes minimum allowable, for 0-10' deep manholes; 2:1/2 minutes minimum allowable for 10'-15' deep manholes; 3 minutes minimum allowable for 15'-25' deep manholes.

D. The test requires a sealed manhole to hold a vacuum drop of 1" Hg over a given number of minutes for acceptance.

E. If the pressure drop exceeds the above limitations the unit shall be repaired and retested.

F. Joint repairs are to be done on both outside and inside of the joint to ensure a permanent seal.

ARTICLE VI -- Inspection

Section 1. Inspector a duly authorized employee of the Board of water and sewer commissioners shall be permitted to enter all properties for the purpose of inspection, observation, measurement and verification pertinent to design, construction and testing.

Section 2. The Inspector and/or Board of Water and Sewer Commissioners shall order any other means of testing or inspection necessary to ensure compliance.

ARTICLE VII -- Responsibilities

Section 1 It shall be the responsibility of the Owner/Developer for material or debris which has washed or flowed into or been placed in water-courses, ditches, gutters, drains, catchbasins, or elsewhere as a result of the construction operations. Such material or debris shall be entirely removed and satisfactorily disposed of during progress of the work, and the ditches, channels, drains, etc., kept in a neat, clean and functioning condition.

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Section 2. The Owner/Developer shall be responsible for the satisfactory operation of the entire sanitary system and shall make good and repair, without expense to the Municipal Sewer System, any part of this work which is imperfect or which may become clogged or inoperative due to lack of protection during construction, defective material, or poor workmanship for a period of two (2) years from the acceptance of the work as being complete by the Board of Water and Sewer Commissioners.

ARTICLE VIII -- Other

Section 1. Expenses: All expenses incurred by the department, relative to the design, construction and inspection shall be born by the Owner/Developer.

Section 1. Written Notice: Notice intent to start construction must be delivered, in writing to the Commissioners, two working days prior to date of start.

ARTICLE IV -- Enforcement

Section 1. Penalties for Violations: Any person, firm, partnership, or corporation found to be violating or in violation of the specifications of this appendix and/or code shall be fined in the amount not exceeding five hundred dollars (\$500.00) for each violation. Each day in which any such violation shall continue shall be deemed a separate offense.

Section 2. Liability for expenses, loss or damage: Any person violating any of the provisions of this chapter shall become liable to the town for any expense, including reasonable legal expenses or loss or damage occasioned by the town by reason of such violation.

ARTICLE V -- Enactment

This code becomes effective upon adoption by the Board of water and sewer commissioners, this 20 day of June, 1989, after recording and publication as provided by law by, the Board of Water and Sewer Commissioners of the Town of Hillsborough, Hillsborough County, State of New Hampshire at a duly held session of the Board of Water and Sewer Commissioners, of the Town of Hillsborough.

Voted and adopted this date:

Eugene Edwards
Eugene Edwards, Chairman

Walter Crane
Walter Crane

Donald Mellen
Donald Mellen
Sewer and Sewer Commissioners
Town of Hillsborough

Recorded this 29 day of June 1989

Shirley Hare
Shirley Hare, Town Clerk, Town of Hillsborough