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HARFORD COUNTY GOVERNMENT

DEPARTMENT OF PUBLIC WORKS
DIVISION OF WATER AND SEWER

March 21, 2008

NOTICE OF WORKGROUP SESSION
Water and Sewer Division
General Rules and Regulations
Parts 22 and 26



The Harford County Department of Public Works, Division of Water and Sewer is proposing changes to two sections of the Rules and Regulations. The change to Part 22 involves the timing of when an operational walkthrough may be scheduled for developer projects. Currently, for most developer projects, the operational walkthrough occurs prior to installation of the pavement base-course. We are proposing to require the operational walkthrough to occur after the pavement base-course has been installed. The purpose of this is to ensure all road construction debris is completely removed from the sanitary manholes and sewer mains prior to making our facilities operational. In the past, we have had problems with debris entering manholes and sewer mains causing sewage back-ups and blockages in the mains. In some cases the debris has entered downstream sewage pump stations which can potentially damage the pumping systems. A second purpose of this change is to ensure pavement construction activities have not damaged the water-tight integrity of sanitary sewer manholes.

The change to Part 26, Standard Specifications and Details, involves revisions to Section 02710, Sanitary Sewer Manholes. Harford County has been experiencing inflow and infiltration in its sanitary sewer collection system, some of which has been from new construction. Inflow is extraneous water originating from rainfall, entering the sewer system. Infiltration is extraneous water originating from groundwater, entering the sewer system. Often times, the groundwater table at a new construction site has not recovered to a final state until sometime after the operational walkthrough. If the groundwater has not recovered, leaky manhole joints will not be discovered until later, after the paving is complete. In an effort to try to minimize this from occurring the proposed changes include the installation of a synthetic wrap around all manhole joints and the performance of vacuum testing. Sometimes leaky joints occur due to gasket damage from mishandling the manhole sections. Additional language is included on quality control and the method of handling the manhole sections.

A public work session has been scheduled for:

**Wednesday, April 16, 2008, 1:30 pm
County Council Chambers
1st Floor, 212 South Bond Street**

Please find enclosed copies of the proposed changes. Do not hesitate to call if you have any questions. A public hearing will be scheduled after the workgroup session.

Sincerely,



Thomas C. Hilton, P.E.
Chief Engineer

Tch/rr2008

Cc: Robert B. Cooper, P.E., Director of Public Works
Joel V. Caudill, P.E., Deputy Director, Division of Water and Sewer
Jacqueline K. Ludwig, Chief of Administration and Engineering
Edward L. Kimmel, Chief of Facilities
Margaret Hartka, Senior Assistant County Attorney
Darryl W. Ivins, Civil Engineer III
Christine Flenner, New Connection Services
Tom Pistel, Bureau of Construction Inspections
Gary Smith, Bureau of Construction Inspections

PART 22 - DEVELOPER'S PROJECT PROCEDURES

A. Letter of Authorization

The Developer is responsible for submitting a completed Letter of Authorization form to the Department of Public Works concurrent with the initial submittal of any documents to the County for review. The Letter obligates the Developer to assume the financial responsibility of any charges for County staff time in the review and approval of said documents. These documents include, but are not limited to concept plans, preliminary plans, site plans, water and sewer construction drawings and administrative charges such as preparation of Public Works Utility Agreements, processing of bonds and/or letters of credit, project acceptances, etc.

B. Public Works Utility Agreement (PWUA)

1. It is the Developer's responsibility to notify Water and Sewer Administration, in writing, when the PWUA will be required.
2.
 - a. Prior to the execution of a Public Works Utility Agreement, the system shall be tested for adequate capacity. Said test shall be dependent upon the expected completion date of funded capital projects.
 - b. Tests for adequate capacity and subsequent preliminary plan or PWUA approval does not constitute a commitment of capacity. The County does not guarantee to provide any water and sewer pumping, transmission and treatment capacity that is beyond the capacity of the existing pumping, transmission and treatment facilities at the time actual connections are desired.
 - c. The issuance of building permits shall be dependent upon adequate capacity of the existing system at the time of issuance.
3. The PWUA may be prepared at the time of construction drawing approval. Note that final plats must be recorded prior to the issuance of any permits.
4. Documentation of ownership is required as an Exhibit to the PWUA in the form of a Title Certificate, Title Insurance Policy or Attorney Opinion Letter or a recorded deed.
5. The PWUA shall be written in accordance with approved water and sewer construction drawings which may contain one or more operational breaks.

6. Construction of a subsequent section or phase of a development will be initiated only after twenty-five percent (25%) of the lateral facilities in the current phase have been constructed, and after the PWUA has been executed for the subsequent phase.
7. The Developer shall have nine (9) months following the date of execution of the PWUA in which to commence construction of the lateral facilities for which the Agreement is written. In the event the Developer fails to commence construction of the lateral facilities or, if after having commenced construction of the lateral facilities, Developer stops construction of the facilities pursuant to the PWUA for a period in excess of six (6) months, then the Department of Public Works may declare this Agreement null and void and of no further force and effect.

C. Construction, Operational and Use and Occupancy

1. The Developer shall be responsible for obtaining State Health Department Construction Permits, when required. Water Resources Permits or other government permits as required by law, shall be obtained by the Developer and delivered to Harford County prior to start of construction.
2. The Developer is responsible for providing Harford County with certified as built drawings on original mylars using the following procedures:
 - a. Prior to the time of the pre-construction conference, the Division of Water and Sewer will receive the original mylar drawings from the engineer. Construction of the project will not begin until these drawings are in the County's possession.
 - b. Immediately after the construction of the section for which an operational will be requested is complete, the Developer or his agent shall request that the original mylars be transmitted from the Division of Water and Sewer engineering offices to the Developer's engineer. The engineer or surveyor shall field locate, using horizontal and vertical control, all valves, hydrants, curb stops, meter vaults, manholes, lampholes, cleanouts, and any other water and sewer appurtenances that were installed as part of the contract.
 - c. The engineer or surveyor must then incorporate the engineer's field located and certified as-built information onto the original mylar drawings as well as add the lot addresses and return them to the County for review and approval by the County. All work required to provide the as-built information onto the drawings shall be performed by the engineering company that designed the project or the engineer or surveyor that performed the construction stakeout and signed by the licensed professional

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responsible for the preparation of the as-built drawings. Completion of the as-built survey and subsequent drawing amendments must be in accordance with the as-built requirements in Part 25, Water and Sewer Design Guidelines, Section VII. A third party can perform this work only with the written approval of the Director of Public Works. This is the exception, not the rule. The as-built drawing submittal must be accompanied by a digital copy of the water and sewer features surveyed. The format shall be comma delimited digital ASCII files with the following information: Point Name, Northing, Easting, Elevation and Code. This information shall be submitted from all surveyors and engineers which utilize electronic survey equipment.

- d. The Operational ~~Certificate~~Inspection for the project will not be approved by the Division of Water and Sewer until all of the work mentioned above has been completed.
 - e. The County will make every effort to review, comment and/or accept the As-Built Certified drawings within five (5) working days after receipt from the Developer.
3. An Operational inspection will be granted when (1) all facilities are constructed in accordance with pre-determined Operational Breaks pursuant to approved construction drawings and the PWUA and (2) the base course of paving for roadways and parking lots which contain water and/or sewer facilities has been installed. No Operationals other than those noted on approved drawings will be given.
 4. Immediately prior to issuance of the Operational Certificate, (that is a pre-designated and pre-approved Operational Break) a Project Cost Affidavit shall be submitted by Owner/Developer to the County along with an actual quantities breakdown of all facilities actually installed. A performance security in an amount equal to fifteen percent (15%) of the one hundred fifteen percent (115%) of project cost will be submitted at this time to cover any punch list items in anticipation of project acceptance and for operation and maintenance problems that may occur while under the responsibility of the Owner/Developer. Total project cost at the time of Operational shall include all actual cost for all excavation, material, equipment, labor, soil stabilization, sub-surface rock removal, etc.
 5. Should the Developer fail to correct operation or maintenance problems during the Operational Acceptance period, or should the Developer fail to request Final Acceptance, the County may complete the work and bill any costs against the Developer. The County reserves the right to utilize any securities which have been posted on the project to recover any costs.

6. It is the responsibility of the Developer to request, in writing, the final inspection by the County to allow release of any securities held on the project.
7. The Developer is ultimately responsible for providing facilities which comply with County standards. This includes the mains and all service connections to the property, including cleanouts, curb stops, meter vaults, grinder pumps and hydro pneumatic booster tanks. Recognizing that the construction of buildings frequently results in modification or damage to the water and/or sewer service connections by the builder or building permittee, or their agents, an inspection of the water and sewer services is required prior to issuing any Use and Occupancy permits. The following requirements are applicable to the water and sewer Use and Occupancy inspection.
 - a. It is the permittee/builder's responsibility to call the Water and Sewer Division, Abingdon Maintenance Facility, to request a Use and Occupancy inspection. A forty-eight (48) hour notification is required. Permittee/builder is responsible to assure water and/or sewer service connections meet current standards prior to requesting a Use and Occupancy inspection appointment. For the sewer service cleanout at property line, the stack or wye branch connection shall be visible from the cleanout opening and all obvious visible problems corrected. If, upon the visual inspection, the pipe appears to be distorted or deflected, there are alternative inspections that the permittee/builder can perform. The alternative inspections must comply with the September 24, 1992 Memorandum from the Chief of Plumbing Services, which is incorporated herein by reference.
 - b. Information which must be provided with a Use and Occupancy inspection request includes, as a minimum: a permit number; a builders lot number; an address; a subdivision; a builders' name; a telephone number; and cross street reference.
 - c. When the inspection is performed, it is strongly recommended that the permittee/builder have a representative available to witness the inspection. The result of the inspection will be recorded by the water and sewer staff, to be left with the permittee/builder representative or attached to a window on the property.
 - d. Permittee/builder must call when reinspection is needed, and a forty-eight (48) hour notification is again required.
 - e. If a permittee/builder Type I Use and Occupancy has not been resolved within time limits specified by the County (one to thirty

days), no additional Use and Occupancy permits will be issued to that builder until outstanding Type I deficiencies are resolved. Exception to the time frame requirement may apply only to Type I approvals issued for winter seeding and grading. A Type I that is on hold due to winter seeding and/or grading must be resolved by May 1.

- f. Initial Use and Occupancy inspection is provided at no cost to permittee/builder. All re-inspections will be billed at the rate of \$60 per hour; the time billed shall include staff time, portal to portal, and a minimum of one-half hour per re-inspection will be billed.
- g. Water meter must be set before the issuance of a Use and Occupancy permit.

D. Procedures for Posting Water/Sewer Securities

Harford County Code authorizes the release of building permits prior to completion of construction of water and sewer facilities in a development provided that a security has been posted. The Developer is required to post security in the amount of one hundred and fifteen percent (115%) of the amount of the contract by and between the Developer and the contractor that will perform the work (said contract to describe a complete scope of work including all utility grading costs, installation, material, excavation, equipment, labor, soil stabilization, seeding and mulching, known sub-surface rock removal, etc), guaranteeing the completion of the construction of the water and/or sewer facilities required to provide services to the improvements to which the building permit applies and for the amount of hook-up charges, as determined by the County. Security shall be in the form of a Cash Performance Bond, a Performance Bond issued by an acceptable insurance company or an irrevocable letter of credit, as applicable and acceptable to the County. The Developer, along with the security, shall provide a written guarantee to Harford County by the contractor to complete the work, in the event the Developer defaults on it's obligations under the Public Works Utility Agreement, for the amount of the contract between the Developer and the contractor. The following procedure shall be used:

- 1. The Developer shall make a written request to the Division of Water and Sewer to post security. The request shall include a copy of the contract by and between the contractor and the Developer. The request shall also specifically detail the construction contract number, street names and lots involved and operational break(s), if applicable.
- 2. The Division of Water and Sewer shall review the request, and the required security amount shall be confirmed by the Division of Water and Sewer in writing.

3. The Developer shall submit the security and the guarantee to the Division of Water and Sewer for review and acceptance.
4. Request for reduction of the security for facilities installed and tested, including services, shall be made by the Developer, in writing to Water and Sewer Bureau of Construction Management with a copy to the Director of Public Works and a copy to Water and Sewer Administration. The request shall include a breakdown of quantities of work completed including footage and sizes of various pipes, manholes, valves, hydrants and pumping facilities, etc. and contingency items. The request shall also specifically detail the construction contract number, street names and lots that may be involved and operational break(s), if applicable.
5. The County may process one (1) reduction of the performance security during construction at fifty percent (50%) completion of the construction of facilities upon receiving verification from the Bureau of Construction Management.
6. Upon Operational Certificate for pre-designated and pre-approved Operational Breaks, the existing performance security may be reduced to fifteen percent (15%) of one hundred fifteen percent (115%) of the actual total cost. If there is no existing performance security, performance security shall be submitted, again in the amount of fifteen percent (15%) of one hundred fifteen percent (115%) of the actual total cost.
7. The County may process one (1) reduction of the security posted to guarantee the payment of hook-up charges when fifty percent (50%) of those charges have been paid. This request for reduction shall be made in writing by the Developer to the Division of Water and Sewer and shall include the addresses and lot numbers for which the hook-up charges have been paid.
8. For projects that had pre-construction conference before July 1, 1993 and did not provide pre-designated and pre-approved breaks and for projects that were under construction before July 1, 1993 and did not provide pre-designated and pre-approved operational breaks, maintenance security shall be submitted by Developer to County when applying for final acceptance in the amount of ten percent (10%) of the actual total cost of the project for a term of one (1) year from date of acceptance. Total project cost shall include all actual cost for all excavation, material, equipment, labor, soil stabilization, sub-surface rock removal, etc. If repairs are determined by County to be done by Developer prior to the end on one (1) year maintenance term and those repairs are not completed by the end of the one (1) year maintenance term, said maintenance bond or letter of credit can be renewed by County accordingly.

E. Final Acceptance

1. For all projects that had pre-construction conferences and/or for projects that began construction prior to July 1, 1993 and did not provide for pre-designated and pre-approved Operational Breaks, substantial completion shall be determined by the County and shall include: ninety-five percent (95%) completion of residential units within residential subdivisions; the completion of all but twelve (12) residential units within a residential subdivision, whichever is determined to be applicable by the County; completion of non-residential construction on ninety percent (90%) of the acreage of non-residential subdivision; and completion of non-residential construction on all but one (1) lot or five (5) acres in a non-residential subdivision. No building permits beyond the ninety-five percent (95%) build-out will be issued until project acceptance has been completed, signed and submitted, along with the maintenance security, to County by Developer.
2. For residential projects that had pre-construction conference after July 1, 1993 and projects that began construction after July 1, 1993 that provided pre-designated and pre-approved Operational Breaks, the following Project Acceptance Procedure applies:

A final acceptance shall be processed at the time of Operational Certificate for each Operational Break with the intent to have Project Acceptance completed within ninety (90) days of the date of Operational Certificate; however, operation and maintenance responsibility shall be borne by the Developer until:

- a. For residential projects, construction must be ninety-five percent (95%) complete within the Operational break and one (1) year has passed since the date of Operational Certificate, whichever is later, and (b) and (c) below have also been satisfied.

For non-residential projects, construction must be at ninety percent (90%) of the acreage or all but one (1) lot or five (5) acres, and (b) and (c) below have also been satisfied.

- b. Developer has requested final inspection in writing, and has completed all punch list items detailed during that inspection, and the County has verified, in writing, that the punch list is satisfactorily complete. A County punch list is valid for only ninety (90) days. The Developer must complete final punch list work within ninety (90) days of receipt. If Developer fails to complete the punch list work, the County may re-inspect and re-issue an

updated punch list.

- c. Roadways within the limits of the project being accepted have had the final surface applied.
- d. Pumping stations constructed by a Developer in accordance with a Public Works Utility Agreement shall be dedicated to the County through Project Acceptance within ninety (90) days of the date of Operational Certificate with no outstanding punch list items. The Developer shall have posted an operational bond, to be held for a minimum period of five years, from the time of project acceptance. The Developer shall be responsible for the cost of operation and maintenance of the facility for five (5) years from the date of Project Acceptance except when the station has been built for double or more than the capacity required for Developer's project. In this instance, Developer shall be responsible for the cost of operation and maintenance of the facility until Developer's project is one hundred percent (100%) built-out (at the time of the last Use and Occupancy Permit) or five (5) years from the date the Project Acceptance is fully executed, whichever is sooner.

**SECTION 02710
SANITARY SEWER MANHOLES**

1.0 GENERAL

A. Description

Sanitary sewer manhole installation shall include, but not necessarily be limited to, furnishing and installing sanitary sewer manholes and miscellaneous structures of concrete or brick masonry built to the shapes and dimensions shown and in accordance with the Contract Documents.

B. Related Work Included Elsewhere

1. Trench Excavation, Backfill, and Compaction: Section 02250
2. Sanitary Sewers: Section 02700
3. Cast-in-Place Concrete: Section 03300
4. **Precast Concrete Structures: Section 03400**
5. Mortar and Masonry Grout: Section 03600
6. Brick Masonry: Section 04200

C. Quality Assurance

~~The County will inspect all materials before, during and after installation to insure compliance with the Contract Documents.~~

The County will inspect all materials delivered to the job-site. Any pre-cast concrete sections which are not in compliance with the required dimensions; which are not true, square, plumb, symmetrical; which have honey-combing; cracks, chips; which do not have smooth surfaces; or otherwise have visible material defects shall be rejected and removed from the project site. Rejected materials may not be repaired but shall be replaced with new products.

2.0 MATERIALS

A. General

1. Materials shall be furnished in accordance with the Contract Documents and the current edition of the Approved List of Suppliers and Materials for Water and Sewer Main Construction.

B. Materials Furnished by the County

The County will not furnish any materials for sanitary manholes.

C. Contractor's Options

1. The Contractor may furnish polypropylene, or plastic-coated steel for manhole steps.

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2. Standard sanitary manholes shall be precast construction; however, the Contractor may furnish cast-in-place, or masonry construction for miscellaneous sanitary sewer structures with the approval of the County.

D. Detailed Material Requirements

1. Granular bedding beneath manhole bases shall meet the gradation requirements of AASHTO M43, Size Number 57, as specified in Section 02240.
2. Portland cement concrete for cast-in-place structures shall be as specified in Section 03300, mix number as indicated on the Standard Details or the Plans.
3. Precast manhole bases, risers, cone sections, grade rings, and precast utility structures shall be as specified in Section 03400.
4. Joints shall be "O" ring compression type meeting the requirements of ASTM C-443.
5. Non-shrink grout shall be as specified in Section 04100.
6. Mortar for brickwork and grade rings shall be as specified in Section 04100.
7. Brick for manhole inverts and miscellaneous structures shall be sewer brick as specified in Section 04200.
8. Frames and covers shall be as shown in the Standard Details and as specified in Section 05500.
9. Manhole steps shall be as per the Standard Details. The plastic coated type shall be manufactured using a minimum 3/8-inch diameter steel reinforcing rod meeting the requirements of ASTM A 615, as a core. The plastic coating shall meet the requirements of ASTM 2146, Type II, Grade 4375B.
10. Force main discharge manholes and above grade manholes shall be seal-coated to the limits noted on the Standard Details with 16 mils of a coal tar polyamide epoxy.
11. Manhole-to-Pipeline Connectors
 - a. Cast-in-place type connectors shall be:
 - 1) A Banded-boot type for sewer grades greater than 18% and less than 46.5%.
 - 2) A compression type for sewer grades less than 18%.
 - b. For doghouse type manhole applications a banded-boot type connector shall be used.
 - c. Mechanically wedge-in-place type connectors shall be used for cored openings.
12. Manholes shall have sealant between the manhole and the manhole frame. The sealant shall be mastic rope, type B, 3/4 inch minimum diameter, butyl based, meeting requirements of AASHTO M 198.

13. The stainless steel insert dish for manholes shall be manufactured of materials resistant to corrosion from atmospheres containing hydrogen sulfide and dilute sulfuric acid. The insert body shall be 18 GA, 304 stainless steel. The manufacturer must furnish a load test verification showing a load test failure in excess of 3,000 lbs. The insert shall contain gas relief valves designed to release a pressure of .5 to 2.0 psi and have a water leakdown rate no greater than 5 gallons per 24 hours. The handle shall be able to withstand a pull of 500 lbs. without breakage.

3.0 EXECUTION

A. General

1. Precast sections shall be transported and handled with proper equipment to protect the units from damage. Sections shall be handled by means of lifting inserts embedded in the concrete. All pre-cast concrete unit construction shall consist of new and un-used products, free from defects. Repairs to pre-cast concrete units shall be strictly prohibited, before, and after shipment. Pre-cast concrete units damaged as a result of installation shall be removed and disposed of by the Contractor at no cost to the County and not returned to the project site. Damaged pre-cast units shall be replaced with new un-used pre-cast units from the same manufacturer. Injection of grout sealant in the surrounding soils to correct joint leakage is prohibited.
4. 2. Excavation, foundation preparation, backfill, and compaction shall be as specified in Section 02250.
2. 3. Manholes and drop connections shall be installed in accordance with the Standard Details and as specified herein.
3. 4. Miscellaneous structures shall be constructed where shown and as indicated on the Plans or as directed by the County.
 - a. Cast-in-place concrete construction shall be as specified in Section 03300.
 - b. Brick construction shall be as specified in Section 04200.
4. 5. Pipelines connected to manholes and other structures shall have a pipe joint between 3 and 7 feet from the exterior wall of the structure.
5. 6. All new openings in existing manholes shall be core drilled in a manner acceptable to the manhole manufacturer and the County.
6. 7. A stainless steel insert dish shall be installed within all manholes where the edge of the cover is five (5) feet or less to the face of the curb. They shall also be installed in manholes that lie within the vertical sumps of roadways, swales, or ditches and as directed by the County.

B. Manhole Installation

1. Manholes, frames and covers shall be installed as pipeline installation progresses. The manhole vertical axis shall be plumb and directly over the centerline of the pipeline unless otherwise shown or directed.

2. **Manhole joints shall be watertight.** The exterior of all joints below grade on new manholes shall be fully wrapped with a wrapping product consisting of a butyl resin sealant laminated to a chemical resistant, cross-laminated polyolefin plastic material specifically made for pre-cast concrete structures, providing a permanent flexible watertight seal. In accordance with ASTM D-882, Tensile strength shall be no less than 6495 pounds. In accordance with FTMS 101C, Puncture force shall be no less than 15.3 pounds. Water vapor penetration, in accordance with ASTM E-96-80 shall be no more than 0.02. Hydrocarbon content percent by weight in accordance with ASTM D4 (modified) shall be 50 to 70. Inert mineral filler percent by weight in accordance with ASTM C990 shall be minimum 30 percent. Ductility at 77 degrees, in accordance with ASTM D113 shall be minimum 5.0.
3. **Grade rings shall be set on a full bed of mortar.** Exteriors shall be coated with waterproofing in accordance with the Standard Details.
4. Channels for receiving and passing water shall be formed in the bottom of manholes as shown or directed. All such channels shall be lined with sewer brick. Channels shall slope smoothly and evenly and a channel bench constructed to the height of the crown of the highest pipe. Channels and a watertight plug shall be installed in the manhole for future extensions where shown on the Plans or directed by the County.
5. Pipes shall be cut flush with the inside wall of the manhole.
6. The frame and cover shall be installed in accordance with the Standard Details.
7. Parging of the interior brick surfaces will not be permitted.

C. Curing

1. Manhole channels and benches shall receive a minimum twenty-four (24) hour cure time prior to being subjected to sewage flow. The County reserves the right to adjust this curing period if deemed necessary.

D. Tests

The construction of new manholes shall provide for a watertight interior, free of infiltration of groundwater and inflow of surface storm water runoff. After construction and during the one-year maintenance period there shall be no leakage or seepage of water into the manhole from defects related to materials and workmanship. Recovery of the groundwater table may take several months following construction and visible leakage may not be detected until after operational inspection. Therefore, to provide a greater assurance on manhole water-tightness, all new manholes shall be vacuum tested as follows:

1. **Vacuum Testing of New Manholes**

Vacuum testing procedures shall be performed in accordance with ASTM C1244 with the following clarifications and modifications.

- a. Vacuum testing shall be performed by a utility testing company approved by Harford County Water and Sewer Maintenance Department. The vacuum tests shall be performed after the finished grade is within plus or minus 0.2 feet. Harford County retains the right to require additional vacuum tests if it believes other construction activities have damaged the integrity of the manhole.
- b. During construction of the manhole, the Contractor shall note the presence and depth of groundwater.

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- c. The brick bench and channel does not have to be installed at the time of vacuum testing.
- d. The manhole shall be fully backfilled prior to performing the vacuum test.
- e. Prior to testing, all lift holes shall be plugged. All pipes entering the manhole shall be temporarily plugged, taking care to securely brace the pipes and plugs to prevent them from being drawn into the manhole.
- f. The test head shall be placed at the top of the manhole in accordance with the recommendation of the testing apparatus manufacturer. A vacuum of 10 inches of mercury shall be drawn on the manhole. Then the valve on the vacuum line of the test head shall be closed and the time measured to drop the vacuum to 9 inches of mercury. The manhole is acceptable if the time for the vacuum to drop from 10 to 9 inches of mercury is equal to or greater than that shown in the following table:

| Manhole Depth | Manhole Diameter (ft.) | | | | |
|---------------|------------------------|----|----|-----|-----|
| | 4 | 5 | 6 | 7 | 8 |
| | Time (Seconds) | | | | |
| <4 | 10 | 13 | 16 | 19 | 23 |
| 6 | 15 | 20 | 25 | 29 | 34 |
| 8 | 20 | 26 | 33 | 38 | 45 |
| 10 | 25 | 33 | 41 | 48 | 56 |
| 12 | 30 | 39 | 49 | 57 | 67 |
| 14 | 35 | 46 | 57 | 67 | 78 |
| 16 | 40 | 52 | 67 | 76 | 89 |
| 18 | 45 | 59 | 73 | 86 | 100 |
| 20 | 50 | 65 | 81 | 95 | 111 |
| 22 | 55 | 72 | 89 | 105 | 122 |
| 23 | 59 | 78 | 97 | 114 | 133 |

- g. If the vacuum test does not pass, the manhole shall be excavated and the joints examined for source(s) of the failure. The joints shall be properly cleared of foreign matter and gaskets checked. The manhole sections shall be re-set as necessary until the passing of the vacuum tests.

E. Protection During Pavement Operations

The Contractor shall provide whatever means necessary to prevent damage to manholes during paving operations and to prevent soil, gravel, asphalt and construction debris from entering sanitary manholes and sewer mains during paving operations.

The County reserves the right to require the Contractor to perform additional vacuum tests if it believes the manhole was damaged from paving or other construction activities. All damaged manhole sections shall be replaced and re-tested at the Contractor's expense. Any frames and covers and brick work damaged or pushed off-center from paving or other construction activities shall be re-set to the satisfaction of the County at no expense to the County.

The Contractor shall recognize that any debris entering sanitary manholes from sewer, road or other construction is strictly prohibited. Prior to the operational walkthrough, all soil, gravel, asphalt and other construction debris shall be completely removed from the manhole and sanitary sewer.

~~Manholes and other structures may be visually inspected by the County for leakage. Any visible leak shall be sealed or resealed until all leakage into the unit is eliminated. Infiltration testing shall be conducted only when the sewers attached to the manholes or other structures are tested in that manner. Testing shall be in accordance with Section 02700.~~

4.0 METHOD OF MEASUREMENT

A. Sanitary Sewer Manholes

Measurement for furnishing and installing sanitary sewer manholes will be made per vertical foot for the number of each type constructed, as shown on the Standard Details. Measurement will be made from the lowest point in the manhole invert to the highest external point on the top of the manhole frame and cover.

B. Drop Connections

Measurement for drop connections will be made for the number and type constructed. The manhole on which the drop structure is constructed will be measured and paid for separately as described above.

C. Miscellaneous Structures

Measurement for miscellaneous structures will be made for the number of each type of unit constructed in accordance with the Contract Documents or as directed.

5.0 BASIS OF PAYMENT

A. General

1. Payments will be made at the unit and/or lump sum prices bid. The prices bid shall include furnishing all labor, tools, equipment, and materials necessary to satisfactorily complete the work as shown, specified, and in strict accordance with the Contract Documents.
2. The price(s) bid for furnishing and installing sanitary sewer manholes shall include the following:
 - a. Trench excavation, backfill, compaction, and incidental items as specified in Section 02250.
 - b. Furnishing and installing granular bedding for manhole foundation as shown on the Standard Details and as required elsewhere in the Contract Documents.
3. Payment will be made for contingent items when approved by the County.

B. Sanitary Sewer Manholes

Payment for sanitary sewer manholes will be made per each type and size (diameter) of manhole installed. The price(s) bid shall include traffic control, furnishing and installing all precast, masonry, or cast-in-place concrete units, waterproofing, reinforcing bars, ladder rungs, metal frames and covers; all testing; providing an approved spoil site, and disposing of all spoil and excess materials; all environmental and erosion or sediment control work including off-site requirements at spoil storage or borrow sites; restoration of all disturbed areas, and incidental items to complete the manholes.

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C. Manhole Drop Connections

Payment for drop connections will be made per type and size constructed as shown, specified, and directed. The price(s) bid shall include furnishing and installing all pipe, fittings, precast concrete, concrete encasement, aggregate and incidental items to complete the drop connection.

D. Miscellaneous Structures

Payment for miscellaneous structures will be made for each structure constructed to limits shown on the Contract Documents and shall be full compensation for furnishing all items necessary to satisfactorily complete the work.

E. Waterproofing

No separate payment will be made for waterproofing, but will be considered incidental to unit prices bid.