MIAMI-DADE COUNTY
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Water and Sewer
PO Box 330316 • 3071 SW 38 Avenue
Miami, Florida 33233-0316
T 305-665-7471

VIA ELECTRONIC CORRESPONDENCE

March 31, 2017

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File No: 8.DC.52 & 77

Chief, Environmental Enforcement Section
Environment and Natural Resources Division
U.S. Department of Justice
P.O. Box 7611
Ben Franklin Station
Washington, D.C. 20044-7611
RE: DOJ No. 90-5-1-1-4022/1
Tom.Mariani@usdoj.gov

Chief, Clean Water Enforcement Branch
Water Protection Division
Attn: Brad Ammons
U.S. Environmental Protection Agency, Region 4
61 Forsyth Street, S.W.
Atlanta, Georgia 30303
Ammons.Brad@epa.gov

Rachael Amy Kamons
Environmental Enforcement Section
U.S. Department of Justice
P.O. Box 7611
Ben Franklin Station
Washington, D.C. 20044-7611
Rachael.Kamons@usdoj.gov

Florida Department of Environmental Protection
Southeast District – West Palm Beach
3301 Gun Club Road, MSC 7210-1
West Palm Beach, FL 33406
Attn: Compliance/Enforcement Section
Jason.Andreotta@dep.state.fl.us

RE: Consent Decree (Case: No. 1:12-cv-24400-FAM)
Reference DOJ Case No. 90-5-1-1-4022/1
Section VI – Gravity Sewer System Operations and Maintenance Program, Paragraphs 19(e)

Dear Sir/Madam:

On August 12, 2016, Miami-Dade County (County) submitted the Response to the EPA and FDEP on the Gravity Sewer System Operations and Maintenance Program (GSSOMP). In response to the second comment, the County has prepared a Gravity Sewer System Corrosion Control Options and Summary Report in accordance with the Consent Decree (CD) requirement Paragraph 19.(e).(ii). The report provided herein includes the summary of the existing corrosion control program and its overall effectiveness, with the recommendations for improvements.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering such information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are

significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Should you have any questions regarding this matter, please call me at (786) 552-8120.

Sincerely,

Bertha Goldenberg, P.E., ENV SP, LEED® Green Associate
Assistant Director, Regulatory Compliance and Planning

Attachments: GSSOMP Supplement - Evaluation of Corrosion Control Options Report

ec: Jonathan A. Glogau
Special Counsel
Chief, Complex Litigation
Office of the Attorney General
PL-01, The Capitol
Tallahassee, FL 32399-1050
850-414-3817
Jon.Glogau@myfloridalegal.com

Florida Department of Environmental Protection
Southeast District – West Palm Beach
3301 Gun Club Road, MSC 7210-1
West Palm Beach, FL 33406
Attn: Compliance/Enforcement Section
Lisa.M.Self@dep.state.fl.us
Sed.wastewater@dep.state.fl.us

Mayor Carlos A. Gimenez
Miami-Dade County
111 NW First Street 29th Floor
Miami, Florida 33128

Lester Sola, Director
Miami-Dade Water and Sewer Department
3071 SW 38th Avenue
Miami, Florida 33146

Jack Osterholt, Deputy Mayor/Director
Miami-Dade Regulatory and
Economic Resources
111 NW 1st Street. 29th Floor
Miami, FL 33128
Josterholt@miamidade.gov

Henry Gillman
Miami-Dade County Attorney
111 NW First Street Suite 2810
Miami, Florida 33128

William Bush
Associate Regional Counsel
U.S. EPA, Region 4
61 Forsyth Street, SW
Atlanta, Georgia 30303
Bush.William@epa.gov

William A. Weinischke
Senior Trial Attorney
Environmental Enforcement Section
Environment and Natural Resources Division
U.S. Department of Justice
P.O. Box 7611
Washington, D.C. 20044
Bill.Weinischke@usdoj.gov

ebc: Hardeep Anand
Antonio Cotarelo
Douglas L. Yoder
Bertha Goldenberg
Maricela Fuentes
Jose Cueto
Manuel Moncholi
Ureaka Wyche
Frances G. Morris
Sarah Davis
Sherry Negahban
Richard O'Rourke
Howard Fallon
Robert Fergen
Al Galambos
Dan Edwards
Rolando Roque
Juan Bedoya
Lee N. Hefty (RER-DERM)
Carlos Hernandez (RER-DERM)
Rashid Istambouli (RER-DERM)
David Wood (CD PMCM)
Andrea Suárez Abastida (CD PMCM)
Abby Diaz (CD PMCM)

CMOM Program

Gravity Sewer System Operations and Maintenance Program (GSSOMP) Supplement - Evaluation of Corrosion Control Options Report

March 31, 2017

Prepared by

The Miami-Dade County Water and Sewer Department and the Consent Decree CMOM Program Team

Prepared for

United States Environmental Protection Agency and
Florida Department of Environmental Protection

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Gravity Sewer System Operations and Maintenance Program (GSSOMP) Supplement –

EVALUATION OF CORROSION CONTROL OPTIONS REPORT

PREPARED FOR:

Miami-Dade Water and Sewer Department (MDWASD)

PREPARED BY:

THE CMOM PROGRAM TEAM
6100 BLUE LAGOON DRIVE, SUITE 440
MIAMI, FLORIDA 33126

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00.01 Acronyms/Abbreviations

Table 00-1
Abbreviations Used in the GSSOMP

Abbreviation	Description
APTTC	Adequate Pumping Transmission & Treatment Capacity Program
CCTV	Closed Circuit Television
CD	Consent Decree
CD PMCM Team	The Consent Decree Program Management and Construction Management Team
CIP	Cast iron pipe
CMOM	Capacity, Management, Operations, and Management
County	Miami Dade County
CWA	Clean Water Act
DIP	Ductile iron pipe
Division	MDWASD Wastewater Collection and Transmission Line Division
E&R	Evaluation and Review Section of the WWCTLD
EAMS	Enterprise Asset Management System
FDEP	Florida Department of Environmental Protection
FOG	Fats, Oils, and Grease
GIS	Geographic Information Systems
GPDIM	Gallon per day per inch diameter mile
GSS	Gravity sewer system
GSSOMP	Gravity Sewer System Operations and Maintenance Program
IMS	Information Management System or Inventory Management System
I/I	Inflow and Infiltration
IT	Information Technology
LF	Linear foot
LOS	Level of Service
KPI	Key Performance Indicator
M&R	Maintenance and Repair Section of the MDWASD WWCTLD
MDWASD	Miami Dade County Water and Sewer Department
MGD	Million gallons per day
MOM	Management, Operations, and Maintenance
NAPOT	Nominal Average Pump Operating Time
NPDES	National Pollutant Discharge Elimination System
O&M	Operations and Maintenance
OOL	Ocean Outfall Legislation
PE	Polyethylene
PCCP	Prestressed concrete cylinder pipe
PM	Performance Measure
PMCM	Program Management and Construction Management
Program	Consent Decree Program or Program Management and Construction Management Services Program
PSIP	Pump Station Improvement Program
PVC	Polyvinyl chloride

Table 00.1
Abbreviations Used in the GSSOMP (continued)

Abbreviation	Description
QA/QC	Quality Assurance/Quality Control
R&R	Rehabilitation and repair
RAP	Remedial Action Plan
RCP	Reinforced concrete pipe
RCCP	Reinforced concrete cylinder pipe
RDII	Rainfall Induced Infiltration and Inflow
RER-DERM	Miami-Dade County Department of Regulatory Economic Resources, Division of Environmental Resource Management
SCADA	Supervisory Control And Data Acquisition
SOP	Standard operating procedure
SORP	Sewer Overflow Response Plan
SPP	Spare Parts Program
SSES	Sanitary Sewer Evaluation Survey
SSO	Sanitary Sewer Overflow
WCTS	Wastewater Collection and Transmission System
WO	Work Order
WPA	Wellfield Protection Area
WPO	Wellfield Protection Ordinance
WWCTLD	MDWASD Wastewater Collection and Transmission Line Division
WWTP	Wastewater treatment plant
VCP	Vitrified clay pipe
VSC	Volume Sewer Customer
VSCO	Volume Sewer Customer Ordinance

00.02 Glossary

Building Backup: A wastewater release or backup into a building or private property that is caused by blockages, flow conditions, or other malfunctions in Miami-Dade's wastewater collection and transmission system (WCTS). A wastewater backup or release that is caused by blockages, flow conditions, or other malfunctions of a Private Lateral is not a Building Backup.

Capacity Management Operations and Maintenance (CMOM): A program of accepted industry practices to properly manage, operate and maintain sanitary wastewater collection, transmission, and treatment systems, investigate capacity constrained areas of these systems, and respond to sanitary sewer overflow (SSO) events.

Closed-circuit Television (CCTV): Technology by which MDWASD inspection crews and/or its outside contractors use a video camera to visually inspect the internal condition of pipes and subsurface structures.

Consent Decree (CD): The Consent Decree, Case: 1:12-cv-24400-FAM, negotiated between Miami-Dade County, Florida (Defendant), the Florida Department of Environmental Protection and the U.S. Environmental Protection Agency (Plaintiffs).

Environmental Protection Agency (EPA): United States Environmental Protection Agency and any of its successor departments or agencies.

Fats, Oils, and Grease (FOG) Control Program: "FOG" refers to fats, oils and grease, which are generated by residents and businesses processing or serving food and other products. A FOG Control program aims to prevent FOG accumulation in sewer systems.

Force Mains: Any pipe that receives and conveys, under pressure, wastewater from the discharge side of a pump. A force main is intended to convey wastewater under pressure.

Geographic Information System (GIS): A system consisting of hardware, software, and data that is designed to capture, store, and analyze geographically-referenced information.

Gravity Sewer Line or Gravity Sewer: Pipes that receive, contain, and convey wastewater not normally under pressure but are intended to flow unassisted under the influence of gravity.

Gravity Sewer System Operations and Maintenance Program (GSSOMP): The Consent Decree stipulated CMOM deliverable that sets forth the protocols and procedures associated with the operations and maintenance gravity sewer system.

Infiltration: As defined by 40 CFR § 35.2005(b)(20) shall mean water other than wastewater that enters the WCTS (including sewer service connections and foundation drains) from the ground through such means as defective pipe, pipe joints, connections, or manholes.

Inflow: As defined by 40 CFR § 35.2005(b)(21) shall mean water other than wastewater that enters the WCTS (including sewer service connections) from sources such as, but not limited to, roof leaders, cellar drains, yard drains, area drains, drains from springs and swampy areas, manhole covers, cross connections between storm sewers and sanitary sewers, catch basins, cooling towers, storm water, surface runoff, street wash waters, or drainage.

Inflow and Infiltration (I/I): The total quantity of water from inflow, infiltration, and rainfall-induced infiltration and inflow without distinguishing the source.

Lift Station: A facility in the WCTS (not at the wastewater treatment plants (WWTPs)) comprised of pumps which lift wastewater to a higher hydraulic elevation, including all related electrical, mechanical, and structural systems necessary to the operation of the lift station.

Manhole or Junction Box: Part of the gravity sewer system. A structure which provides a connection point for gravity lines, private service laterals, or force mains, as well as an access point for maintenance and repair activities.

Miami-Dade: Miami-Dade County, Florida, including all of its departments, agencies, instrumentalities such as the Water and Sewer Department and the Department of Regulatory and Economic Resources, and any success thereto.

NPDES: The National Pollutant Discharge Elimination System (NPDES) authorized under Section 403 of the Clean Water Act (CWA).

Private Lateral: The portion of a sanitary sewer conveyance pipe that extends from a single-family, multifamily, apartment or other dwelling unit, or commercial or industrial structure to which wastewater service is or has been provided up to the property line of such structure

Consent Decree Program Management and Construction Management Team (CD PMCM or PMCM): The professional services consulting team competitively selected by the County to support MDWASD in the implementation of the requirements of the CD.

Prohibited Bypass: The intentional diversion of waste streams from any portion of a treatment facility which is prohibited pursuant to the terms set forth at 40 CFR § 122.41(m).

Public Document Repository (PDR): The Miami-Dade Water and Sewer Department located at 3071 SW 38th Ave and the Miami-Dade Water and Sewer Department's website, http://www.miamidade.gov/water.

Sanitary Sewer Overflow (SSO): Any discharge of wastewater to waters of the United States or the State from Miami-Dade's WCTC through a point source not permitted in any NPDES permit, as well as any overflow, spill, or release of wastewater to public or private property from the WCTS that may or may not have reached waters of the United States or the State, including all building backups.

Sewer Overflow Response Plan (SORP): The SORP provides structured guidance, including a range of field activities to choose from, for a generalized uniform response to overflows.

Sewer System: The WCTS and the WWTPs.

Supervisory Control and Data Acquisition (SCADA) System: A system of automated sensory control equipment that monitors the operation of a portion of the lift stations within the collection system. The SCADA system is designed to convey alarms when predetermined conditions occur. Monitoring parameters may include, but are not limited to, power failures, high wet well levels,

pump failures that could potentially cause overflows, excessive pump runtimes, or other alarm set points as may be determined by system operators.

Wastewater Collection and Transmission System (WCTS): The municipal wastewater collection, and transmission system including all pipes, force mains, gravity sewer lines, pump stations, manholes, and appurtenances thereto, which are owned or operated by the Miami-Dade designed to collect and convey municipal sewage (domestic, commercial, and industrial to Miami-Dade's WWTPs.

Wastewater Treatment Plant (WWTP): Devices or systems used in the storage, treatment, recycling, and reclamation of municipal wastewater and include all facilities owned, managed, operated, and maintained by Miami-Dade, including but not limited to the North District WWTP, the Central District WWTP, and the South District WWTP, and all components of those plants.

Volume Sewer Customer (VSC): Any entity or municipality serviced on a bulk basis (at a wholesale rate) by Miami-Dade within the territorial limits of Miami-Dade County, and currently includes the municipalities of Bal Harbour, Bay Harbor Islands, Coral Gables, Florida City, Homestead, Hialeah, Hialeah Gardens, Medley, Miami Beach, North Miami, Opa Locka, North Bay Village, North Miami-Beach, Surfside, and West Miami.

Volume Sewer Customer Ordinance (VSCO): Section 24-42.2, "Sanitary Sewer System Collection and Transmission Systems" of the Miami-Dade County Municipal Code.

01. Introduction

As of December 7, 2015, MDWASD had submitted the following "New CMOM Programs", as prescribed by the Consent Decree, to the U.S. Environmental Protection Agency (EPA) and the Florida Department of Environmental Protection (FDEP) for comment and approval:

- Financial Analysis Program
- Sewer System Asset Management Program ("SSAMP")
- Sewer Overflow Response Plan ("SORP")
- **Gravity Sewer System Operations and Maintenance Program ("GSSOMP")**
- Pump Station Operations and Preventative Maintenance Program ("PSOPMP")
- Force Main Operations, Preventative Maintenance and Assessment/Rehabilitation Program (FMOPMARP")
- Force Main Rehabilitation/Replacement Program ("FM R/R")
- WWTP Operations and Maintenance Program ("WWTP OMP")
- Information Management System Program ("IMSP")

A consolidated CMOM implementation schedule was submitted to EPA/FDEP on March 31, 2016 for comment and approval, incorporating implementation activities from the above programs (with exception of the Financial Analysis Program). The GSSOMP submitted on February 6, 2015 did not include the evaluation of corrosion control options as stipulated by CD Paragraph 19(e)(ii). WASD. In response to EPA/FDEP's GSSOMP comments, MDWASD committed to submitting a summary of the existing program, its effectiveness, and any recommendations for improvements to EPA/FDEP by March 31 2017.

The purpose of the GSSOMP Supplement is to provide an evaluation of corrosion control options in compliance with Consent Decree (CD) requirements. This satisfies the above mentioned MDWASD commitment, and specifically enhances GSSOMP Section 10. Potential Sulfide and Corrosion Control Options.

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02. Consent Decree Requirements

Miami-Dade County is required to develop and implement the CMOM Programs described under CD paragraph 19, entitled New CMOM Programs, and continue to implement existing programs pursuant to paragraph 18. All CMOM Programs are to be developed in accordance with EPA Region 4 guidance, as set forth in Appendix C of the CD. Miami-Dade County must ensure that each CMOM program has a written, defined purpose; a written, defined goal; is documented in writing with specific detail; is implemented by trained personnel; has established performance measures; and has written procedures for periodic review.

Paragraph 19(e)(ii) of the CD requires that an "engineering evaluation of potential sulfide and corrosion control options and a summary report of findings, including a recommendation of the preferred sulfide and corrosion control method(s)…" be included in the Gravity Sewer System Operations and Maintenance Program (GSSOMP). The evaluation will utilize industry best practices for the evaluation of corrosion control options in gravity sewers and manholes. The criteria for the evaluation of each corrosion control option shall include applicable pipe and manhole materials, reference standards/specifications, interior/exterior protection, applicability, cost effectiveness, expected durability (to include how the option will extend the life of the pipe), and whether the option is currently used by MDWASD. If a corrosion control option is not currently used by MDWASD, this document will provide a recommendation whether the option is applicable and/or feasible for MDWASD to consider implementing in the future. The findings will include recommendations for the preferred sulfide and corrosion control methods.

This document presents existing MDWASD gravity sewer system internal and external corrosion control measures, including corrosion control options for sanitary sewer manholes, hydraulic transitions, and other attributes within the GSS that may be susceptible to hydrogen sulfide-related corrosion. Input of the Wastewater Collection and Transmission Line Division (WWCTLD) and Specifications Section was sought in the areas of existing corrosion control practices, guides, and specifications employed by MDWASD.

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03. Gravity Sewer System Corrosion Concerns

Corrosion in the wastewater collection and transmission system can result in structural defects leading to failure of components and pipe collapses with consequential SSOs, and infiltration into or exfiltration from the system. The response to these impacts can require significant resources and immediate action to repair. Therefore, it is important to identify where corrosion is more likely to occur in the system and preferred methods of corrosion control. Internal corrosion in sewer systems is primarily caused by corrosive gases, such as hydrogen sulfide (H_2S) and sulfur dioxide (SO_2) or bacterial oxidation of hydrogen sulfide to sulfuric acid (H_2SO_4). Another potential source of internal corrosion is discharge of corrosive liquids from industry; Miami-Dade County through RER-DERM requires industries to perform pretreatment prior to discharge to the gravity sewer system to reduce the potential of corrosion to the system and as such will not be the focus of this report. Aggressive soils, or soils which adversely react with the GSS construction materials, can cause corrosion externally.

The presence of hydrogen sulfide in the gravity sewer system can be detected at low concentrations via its characteristic “rotten-egg” smell. Hydrogen sulfide is typically the cause of odor complaints in and around the WCTS and WWTPs. Hydrogen sulfide gases have a de-sensitizing effect. After prolonged exposure, the olfactory nerve is desensitized, making the detection of hydrogen sulfide gas through sense of smell difficult. Higher concentrations of hydrogen sulfide gas are toxic, and its presence in accessible locations, particularly confined spaces or spaces with limited ventilation, can pose public and worker safety concerns.

Consideration of piping materials is an important component of a corrosion control plan. Vitrified clay pipe (VCP) and plastic pipes such as polyvinyl chloride (PVC), polyethylene (PE) and acrylonitrile-butadienestyrene (AS) are resistant to sulfide corrosion. All metal pipes (ductile iron, cast iron and steel), reinforced concrete pipe (RCP), and asbestos cement pipe (ACP) are susceptible to corrosion. These considerations are addressed in Section 04 of this report.

03.01 Hydrogen Sulfide Generation and Corrosion Potential

A number of factors impact the likelihood of conditions developing that allow for hydrogen sulfide generation and the potential for corrosion in WCTS:

- Low dissolved oxygen (DO) and high biochemical oxygen demand (BOD);
- Temperature and pH of wastewater;
- Anaerobic conditions;
- Long hydraulic residence times; and/or
- Turbulence.

The following locations increase gravity sewer system vulnerability to the adverse effects of hydrogen sulfide:

- Low velocity areas in gravity sewers (blockages or insufficient cleansing slope) and associated solids deposition;
- Intermittent sewer surcharging;
- Force main discharge points and drop manholes (hydraulic transitions); and
- Other areas of high turbulence.

03.02 Tools to Screen Hydrogen Sulfide and Corrosion Potential

Screening for hydrogen sulfide and corrosion potential occurs through these processes:

- Ongoing gravity sewer condition assessments and inspections:
    - During routine CCTV inspections, pipes and manholes are screened for material failure and for signs of hydrogen sulfide damage and corrosion and are recorded in compliance with MDWASD's CCTV inspection database coding system.
- Odor and atmospheric concentration testing:
    - Even at low concentrations in the air, you can smell the "rotten egg" odor of hydrogen sulfide gasses, however due to olfactory fatigue, the ability to detect gasses will lessen due to long term exposure.
        - Portable meters that can measure levels of hydrogen sulfide gasses are routinely used by MDWASD forces during daily routine maintenance activities.

Once identified, these areas may be scheduled for additional evaluation. Items to note include:

- Condition of pipe crowns;
- Evidence of intermittently surcharged pipe segments;
- Condition of ladder rungs, conduit and other metal;
- Exposed reinforcing steel through concrete; and
- Loss of concrete or aggregate exposure

03.03 Impacts of Hydrogen Sulfide and Corrosion

When undetected, cumulative impacts to the gravity sewer system resulting from hydrogen sulfide or other sources of corrosion, could be particularly damaging and difficult to repair especially should sudden catastrophic pipe failures occur. Even in areas where damage has been identified before a collapse has occurred, rehabilitating or replacing damaged WCTS assets is costly.

A number of methods are available to control hydrogen sulfide generation and corrosion potential, once identified. Most types of retroactive corrosion control methods reduce the levels of dissolved sulfide in the wastewater and prevent the generation of H_2S gas. Common techniques include aeration, oxidation, precipitation and pH elevation, which are typically incorporated in pump station wetwells. Because hydrogen sulfide generation in the collection system occur most anywhere in the system, chemical treatment at the pump stations does very little to decrease the hydrogen sulfide generation in the gravity sewer collection system. To be effective, chemical treatment for the collection system would need to be injected at the ends of gravity sewer segments, which is cost prohibitive even in known corrosion-subjected pipe reaches.

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04. Hydrogen Sulfide and Corrosion Control Options

MDWASD has aggressively taken a proactive approach to the repair and rehabilitation of the damage to their existing wastewater collection infrastructure and to implement standards and specifications which include the most current materials and technology available to protect new infrastructure being constructed. The WWCTLD relies on the Engineering Division and Specifications Section to review new products and technologies through their "New Products Committee". Communication between the various Departments, Divisions and Sections are an integral part of their corrosion control practices. Prevention is the Wastewater Collection and Transmission Line Division (WWCTLD) strategy to minimizing failure within the gravity sewer collection system.

04.01 WWCTLD/Specifications Section Meetings

Meetings between the WWCTLD and Specifications Section are held periodically and on an as-needed basis. Meetings between the WWCTLD and Specifications Section were held to compile and discuss existing corrosion control practices, guides, and specifications employed and accepted by MDWASD.

04.02 MDWASD Standard Specifications

MDWASD Standard Specifications include several sections that directly influence the corrosion control options discussed in this report. These specifications are reviewed periodically to update and introduce new technology from the wastewater industry. New products and technologies go through a comprehensive vetting process to assure that the product or technology meets the needs, performance measures and desired service life as determined by MDWASD. See Appendix A for the current applicable MDWASD Standard Specifications. MDWASD has also recently revised its "Basic Guide to Corrosion Protection" manual, providing additional guidelines for pipes, manholes and wetwells. This revised manual is provided in Appendix B of this report.

04.03 Current MDWASD Corrosion Control Practices

The WWCTLD employs prevention as the strategy to preclude or evade conditions favorable to pipe and structure failure due to internal and exterior corrosion.

Prevention begins with appropriate design and construction standards coupled with construction standards verification through inspections to ensure new and replaced sewers meet minimum design and construction standards intended to avoid hydrogen sulfide production and corrosion. MDWASD has established standards and the authority to enforce the standards in the design and construction of donated infrastructure. The current version of MDWASD's "Design and Construction Standard Specifications and Details" (appended to this report) promulgates these minimum design standards.

04.03.1 Gravity Sewer Interceptors

As a proactive approach to address failures on large diameter gravity interceptors, MDWASD has conducted condition assessments of these pipelines. Because these gravity sewer system large diameter interceptors are known to have lower velocities and have extended periods of low flow (exposing the pipe crowns to corrosive gasses), MDWASD continues to assess the condition of its gravity sewer interceptors on the accelerated CCTV inspection cycle (every five years) as discussed in the GSSOMP. As of the date of development of this report, a total of 11.1 miles of 36 inch diameter through 78 inch diameter gravity interceptors have been lined with fiberglass reinforced pipe (FRP) and manholes have received inert linings or coatings. See Appendix B – Gravity Sewer Interceptors for detailed maps of those interceptors that have been lined with FRP.

04.03.2 Pipe and Manhole Linings and Coatings – New Construction

The use of linings and coatings for concrete and ductile iron pipe and brick or concrete manholes for internal corrosion protection is common in the WCTS. Standard specifications are currently requiring special interior and exterior protective coatings for concrete and ductile iron gravity sewer piping. Ductile iron pipes require an exterior arc sprayed zinc basecoat prior to the asphaltic top coat. Ductile iron pipe is to be lined with a ceramic epoxy interior protective coating. Precast concrete manholes for new construction require Type II cement with an increased water cement ratio as well as the addition of an antimicrobial admixture, in locations as described below. In those areas known to have a higher potential for hydrogen sulfide gasses and/or industrial discharges, MDWASD may specify new manholes to have a polypropylene, random copolymer (PP-R) concrete protective liner system incorporated by the precast facility. MDWASD requires

the use of epoxy coating as an interior corrosion protection option for existing sewer manholes scheduled to be rehabilitated.

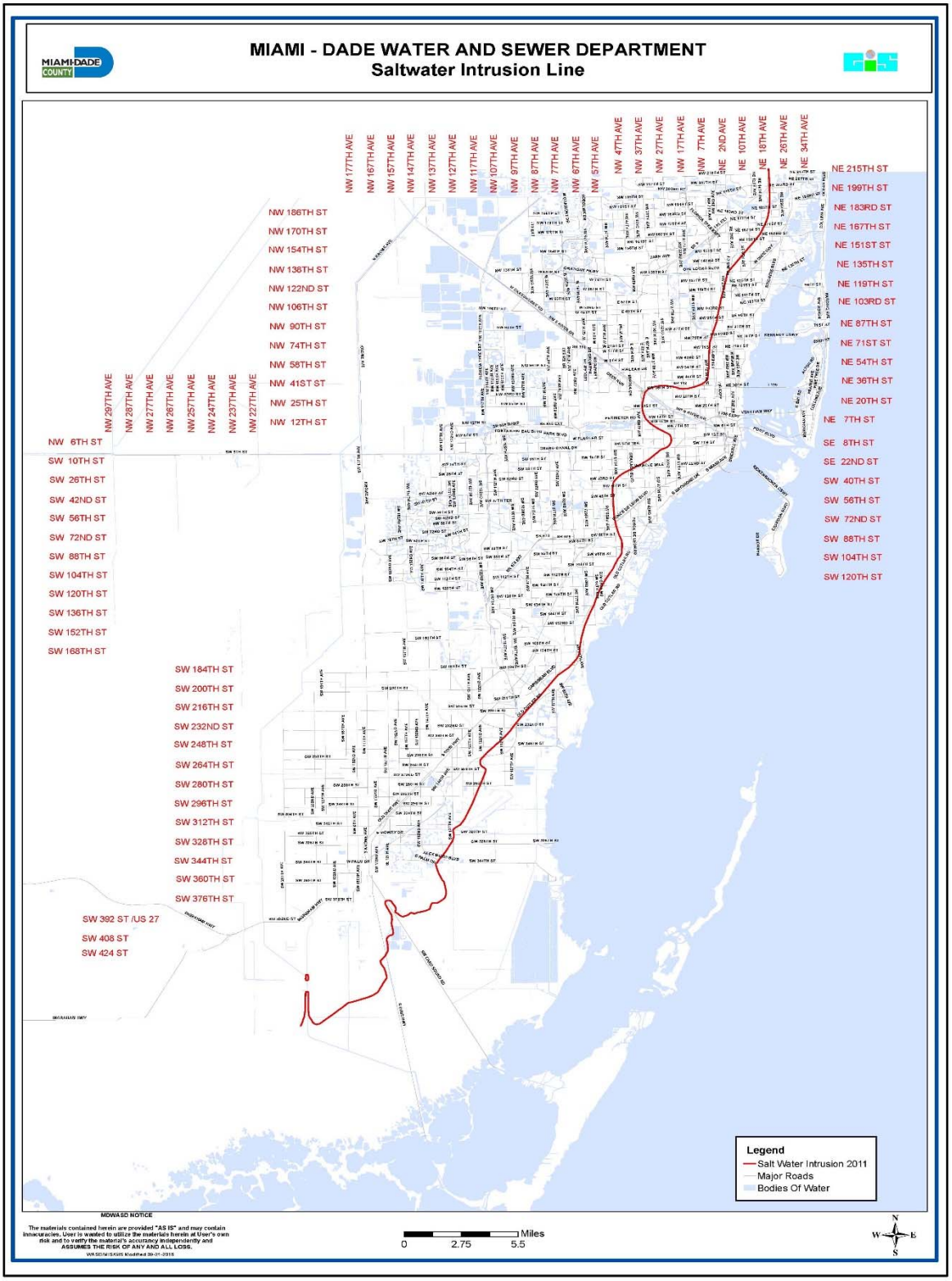
Locations that require a concrete protective coating or antimicrobial admixture include:

1. Manholes receiving the discharge of a force main (hydraulic transitions).
2. Manholes within a 350-foot radius of a pump station wet well.
3. Drop manholes.
4. Any manhole location determined by the Engineer to have a high probability of generating large quantities of sewer gas.

04.03.3 Inert Materials

MDWASD is in the process of reviewing its existing standards and specifications for pipe construction inside the saltwater intrusion areas. The current trend (best management practices) in many Florida municipalities is to specify inert pipe materials in areas of potential corrosion to both the interior and exterior of the pipe. MDWASD is looking to increase the use of inert materials because its current methodology for external corrosion control of polyethylene encasement on ductile iron pipes is not always effective. Currently, PVC, fiberglass, and high density polyethylene (HDPE) gravity sewer mains are being used in the WCTS, but has been predominantly limited to areas inside the saltwater intrusion area. Continued use of inert pipe materials within the saltwater intrusion areas of WCTS may also encourage regular use outside of the saltwater intrusion area, since corrosion issues can extend beyond the saltwater intrusion line. The approximate limits of the saltwater intrusion is shown in Figure 4.1 – Saltwater Intrusion Line.

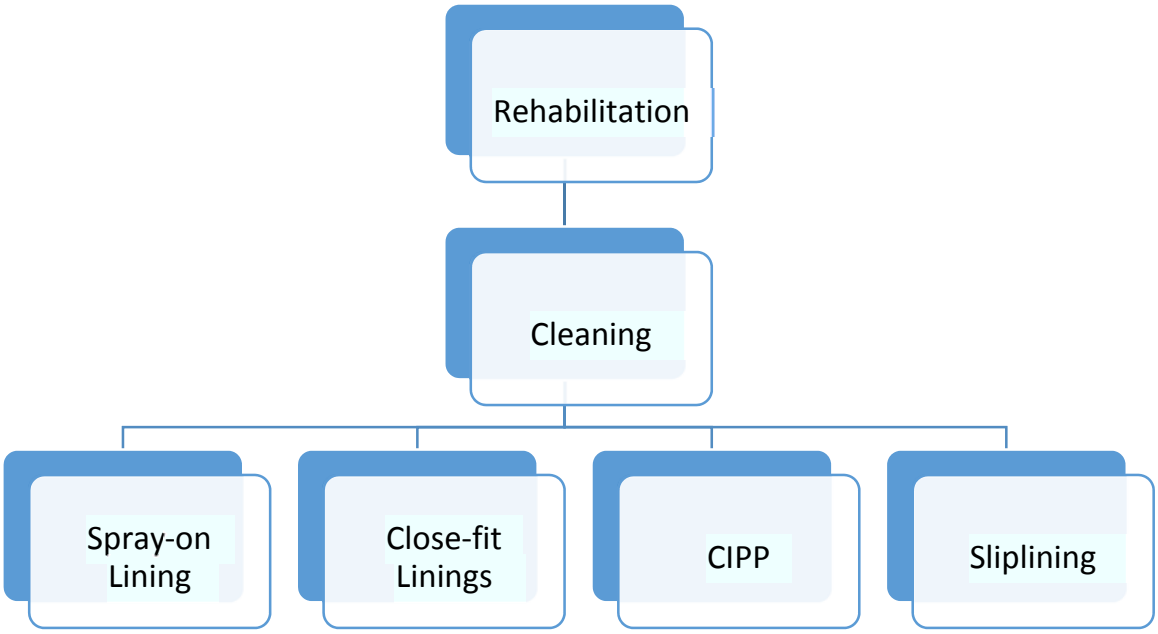
Figure 04-1
Saltwater Intrusion Line



04.03.4 Pipe Rehabilitation

The rehabilitation of existing gravity sewer mainline piping typically employs the application of an interior coating or lining system. The most common rehabilitation technologies currently used are shown in Figure 4.2 – Common Pipe Rehabilitation Technologies. Under each of these categories are variations which include installation methods, polymer formula variations and the types of lining material. Each of these methods are used as a mean of extending the useful life cycle of the existing pipe by halting the deterioration of the host pipe, sealing minor leaks and to providing varying degrees of structural stability depending on the rehabilitation method used.

Figure 04-2
Common Pipe Rehabilitation Technologies



Rehabilitation technologies such as spray-on linings, close-fit linings, cured in place pipe (CIPP), and sliplining are commonly referred to as “insitu” applications and have the advantage of requiring minimal excavation and a reduction in time and cost opposed to full pipe replacement construction which require extensive restoration.

Typical situations which drive consideration of these insitu rehabilitation methods are:

- Highly congested utility areas where open-cut is not an option due to limited space resulting from utility congestion, conflicts or manifold connection which would be difficult to reestablish at directional drill depths;
- Time constraints in which bypass of critical flows section need to be minimized;
- Areas which would require closure of critical travel routes or impede access to hospitals, schools, emergency evacuation routes or emergency facilities;
- Inaccessibility of the pipe due to easements, buildings, structures, fences, trees and other encumbrances; and
- Cost of restoration of pavement areas, curbs, driveways and landscape areas.

All rehabilitation processes result in a loss of cross sectional area and reduction in pipe capacity. Operational factors such as existing and future capacity needs, and external loading requirements are evaluated prior to consideration and selection of a renewal technology. Liner thickness for a fully structural liner typically ranges from 2/3 inch to 3 inches depending on pipe diameter and external loading requirements.

04.03.5 Manhole Rehabilitation

Existing sewer manholes with defects as identified in the GSSOMP inspection cycle, are scheduled for repair, rehabilitation or total replacement, depending on the type and degree of defects. MDWASD has the ability to repair some minor defects with “in-house” forces, but typically relies on local contractors, which specialize in the repair and rehabilitation of sanitary manholes. MDWASD maintains a Countywide “on call” or continuing contract for the rehabilitation of existing manholes. A copy of the specifications for such a contract is provided in Appendix C of this report. As a part of this on-going manhole rehabilitation, MDWASD has provided its “Work Order List” of manholes which have undergone, or are scheduled for repair and/or rehabilitation. This list is provided in Appendix D of this report.

Typical manhole repair and/or rehabilitation includes the following:

- Preparation of concrete surfaces (cleaning and removal of deteriorated concrete surfaces);
- Concrete repair (patching of reinforcement and concrete surfaces);
- Chemical sealing of active leaks (epoxy resin injection and epoxy mortar patching);

- Bench and chimney rehabilitation (as needed); and
- Application of an inert protective interior coating (epoxy based coating as per approved product list).

Where manholes are assessed to be structurally un-sound due to excessive deterioration, MDWASD will typically elect to totally replace the manhole, requiring the new manhole to meet all current standards. Under these circumstances, MDWASD may specify a combination of protective measures which could include increased water cement ratio, the addition of an antimicrobial admixture, and a polypropylene, random copolymer (PP-R) concrete protective liner system.

04.03.6 Force Main Discharge (Hydraulic Transitions)

There are 255 manholes within the MDWASD gravity sanitary sewer system, where force main discharge directly into the manhole structure. These are typically known as hydraulic transitions or hydraulic jumps, characteristic of a high velocity discharge into an area of lower velocity causing an abrupt rise in the wastewater surface. Because of the turbulence created, these manholes are by far the most susceptible locations in the gravity sewer system to hydrogen sulfide gas generation and corrosion. Because of the corrosion potential in these manholes, MDWASD inspects these transitions on an aggressive 2-year inspection cycle as a part of GSSOMP.

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05. Corrosion Control Options Summary

Gravity sewer system construction materials are an important component of a corrosion control plan. Vitrified clay pipe (VCP) and plastic pipes such as polyvinyl chloride (PVC), and polyethylene (PE) are resistant to sulfide corrosion. Ductile iron pipe (DIP), cast iron pipe (CIP), pre-stressed concrete cylinder pipe (PCCP), reinforced concrete cylinder pipe (RCCP), reinforced concrete pipe (RCP), concrete manholes, and brick and mortar manholes are present in the WCTS and are susceptible to corrosion. Under MDWASD's current corrosion control program, standards have been implemented to protect the infrastructure from potential deterioration both internally and externally. These corrosion control options include new construction and rehabilitation of existing gravity sewer pipes and structures.

The use of special linings and/or coatings provide a protective layer on the internal surfaces of pipes and manholes which form a barrier against destructive hydrogen sulfide gasses. Exterior coatings and poly wraps used to protect the exterior of non-inert materials from corrosive soils and aggressive environments provide a similar barrier against corrosion. MDWASD takes steps to control hydrogen sulfide damage in its installed large diameter/interceptor concrete pipe inventory. Over 11 miles of large diameter gravity sewer interceptor pipes and associated manholes which are made of materials susceptible to corrosion, have been rehabilitated with non-corrosive fiberglass sliplining systems (FRP) to avoid concrete deterioration.

MDWASD has also taken steps to reduce the production of hydrogen gasses in its collection system through design standards and standard specifications for construction, which are currently in place (See Appendix A for specifications). Minimizing excessive drop structures in manholes, reducing slopes on gravity sewer segments and lowering force main discharge locations are just a few examples of minimizing the turbulence within the system.

By employing these corrosion control options, MDWASD has taken a proactive approach to extend the useful life of the sanitary sewer collection system. Most of the interior lining systems used in the rehabilitation of pipes provide the durability and structural support equivalent to a new pipe. Coatings serve as protection to the new and/or existing sewer component which increase the durability and therefore increase the anticipated life of the system. Results are summarized in Table 05.1 Corrosion Control Options.

Table 05-1 Corrosion Control Options [1]

Pipe Material	Corrosion Control Option	Reference - MDWASD Standard Specifications	Interior/Exterior Corrosion Protection	Applicability	Current MDWASD Use
Concrete Pipe	T-Lock Liner	Basic Guide to Corrosion Protection	Interior	New Construction	x
Ductile Iron	Ceramic Epoxy	Section 01560 – 2.01E	Interior	New Construction	x
Ductile Iron	Metallic Zinc Coating	Section 01560 – 2.01E	Exterior	New Construction	x
Ductile Iron	Asphaltic Coating	Section 01560 – 2.01	Exterior	New Construction	x
Ductile Iron	Polyethylene Encasement	Section 01560 – 2.01E	Exterior	New Construction	x
Precast Manholes	Type II Cement	Section 02536-2.01B	Throughout	New Construction	x
Precast Manholes	Antimicrobial Agent	Section 02536-2.01B.1	Throughout	New Construction	x
Precast Manholes	Epoxy Coating	Section 02536-2.06A	Interior	New Construction	x
Precast Manholes	Polypropylene (PP-R) Liner	Section 02615-1.01A	Interior	New Construction	x
PVC/HDPE/ Fiberglass/ PCCP	Inert Pipe Material	N/A	Exterior	Corrosive Soils / Saltwater Intrusion Area	
All pipes	CIPP		Interior	Pipe Rehabilitation	x
Concrete Pipe	Sliplining (Fiberglass)		Interior	Pipe Rehabilitation	x
Concrete Pipe	Sliplining (HDPE)		Interior	Pipe Rehabilitation	x
Manholes	Epoxy Coating	UC-330 – 3.02A	Interior	Manhole Rehabilitation	X

[1] This table outlines general guidelines for corrosion protection of gravity sewer mains. Each project's protection solution shall be determined by an engineering evaluation of field conditions.

05.01 Hydrogen Sulfide and Corrosion Control Recommendations

MDWASD currently has a very proactive corrosion control program, and has implemented standards and standard specifications to utilize the most effective corrosion control options available. One primary recommendation would be to continue to review new products and technologies that will cost effectively lead to even more protection than the current products, procedures and technologies. MDWASD currently appoints individuals of various Departments, Divisions and Sections to participate as members of the "New Products Committee". The committee's purpose is to evaluate new products and technologies that can further protect the wastewater collection and transmission system components maintained by MDWASD. As well as providing the venue for improvements and modifications to the dynamic document, MDWASD has recently updated its corrosion control options in the review and revisions to the "Basic Guide for Corrosion Protection".

The Wastewater Collection and Transmission Line Division (WWCTLD) has determined that the uses of inert materials such as polyvinyl chloride (PVC) pipe, fiberglass reinforced pipe (FRP) and high density polyethylene (HDPE) pipe completely eliminate most of the corrosion problems both internally and externally. As a part of this corrosion control evaluation, MDWASD will require the use of inert materials within the saltwater intrusion area, and also encourage the use of those materials outside of the saltwater intrusion area. Although not considered an industry standard, many municipalities in Florida, such as Orange County, Collier County, Hillsborough County, Jacksonville Electric Authority, Toho Water Authority and others, require use of inert materials for all wastewater collection piping.

MDWASD will consider more frequent meetings among WWCTLD, Specifications Section and other interested parties, perhaps on a quarterly basis, to discuss effectiveness of the current corrosion control program, and development of additional corrosion control measures that would protect the sustainability of the gravity sewer system.

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06. References

Miami-Dade County Water and Sewer Department. *2011 CMOM Self Assessment,*
Miami-Dade County Water and Sewer Department. *2013 Sewer System Evaluation Survey and Night Flow Reports.*

MuniCode. *Municipal Code of Miami-Dade County.* Section 24-42.2.

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U.S. Environmental Protection Agency. 2009. *Condition Assessment of Wastewater Collection Systems (State of Technology Report).* EPA/600/R-09/049.

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Water Environment Federation. 2007. *Gravity Sanitary Sewer Design and Construction*. WEF Manual of Practice No. FD-5.

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APPENDICES

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Appendix A - MDWASD Standard Specifications

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WASD STANDARDS AND SPECIFICATIONS FOR CORROSION CONTROL OF GRAVITY SEWERS (PIPELINES AND MANHOLES)

STANDARDS	**REFERENCE**	**DESCRIPTION**
Section 02536	2.01 B1 2.06 2.08	Precast material for Gravity Sewer System Manholes Concrete protective coating Manhole accessories
Section 02615	ALL	Concrete protective liner system for precast structures
Section 09801	ALL	Concrete protective coating
Section UC-330	2.01 3.02 A	Chemical joint and crack sealing material for active leaks Modification of existing manholes
Section 02625	2.02 A,B,E	Materials for sanitary sewer manhole infiltration insert
Section UC-250	1.06 A3, A11 2.01 F 2.10	Gravity sewer system design requirements General products (Protection of steel bolts, nuts, washers) Ductile Iron sewer pipe
Section 15060	ALL	Piping and fittings
Appendix-B	ALL	Basic guide to corrosion protection

SECTION 02536

PRECAST MANHOLES & COVERS

PART 1 - GENERAL

1.01 SCOPE OF WORK:

This section includes minimum construction requirements for standard sewer manholes and precast concrete wet wells. It also includes precast concrete manhole sections with bell and spigot joints with masonry transition to covering, anchorage, coating/lining and accessories.

1.02 REFERENCES:

Unless otherwise indicated, all materials, workmanship and practices shall be in accordance with the current editions of the following standards:

A. Florida Building Code

B. ACI 318, Building Code Requirements for Reinforced Concrete; ACI 350 Code Requirement for Environmental Engineer Construction Structures.

C. PCI MNL 116, Manual for Quality Control for Plants and Production of Precast Concrete Products.

D. ASTM C62 - Specification for Building Brick (Solid masonry units made from Clay or shale).

E. ASTM C478 - Precast Reinforced Concrete Manhole Sections.

F. ASTM A123 - Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.

1.03 SUBMITTALS, INSPECTIONS:

Submit the following information for approval. Fabrication shall not begin until submission has been approved.

A. Satisfactory evidence that plant and production methods meet the requirements of PCI MNL 116 for the Quality Control of the Precast Plant, Concrete Batch Plant and Testing Lab.

B. Submit Design mix to the Engineer prior to fabrication.

C. Complete shop drawings of both concrete structure and castings and showing all dimensions, reinforcement data, concrete strengths, etc. If of a non-standard design or if required by the Engineer of Record submit design calculations and data. All computation shall bear the seal of a Professional Engineer registered in the State of Florida.

D. Manhole and Wet Wells: The WASD shall have the option of witnessing the manhole wet well pour, reinforcing or formwork prior to fabrication. Provide the Engineer a schedule of the manhole fabrication at the preconstruction meeting.

E. Provide a rebar cutting lists for Pump Station Wet Wells. The rebar cut list is not required for standard manholes.

F. Cylinder breaks shall be done for each lot in accordance with FDOT Standards (max of 50 structures per LOT). The manufacturer shall maintain records of the cylinder breaks for each design mix. The 28 day concrete cylinder break reports shall be submitted to the Department once the 28 day before the project closeout.

1.05 QUALIFICATIONS:

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five years documented experience. United Concrete Products, Landmark Precast, Concrete Products of the Palm Beaches, TJ Precast, US Concrete Products or Approved equal.

B. Quality Control Plan approved by the FDOT. The testing laboratory and batch plant shall be included in the FDOT Quality Control Plan.

C. The Precast Manufacturer shall have a stamp from the Quality Control Manager on each completed precast structure. The Quality Control Manager Stamp shall indicate that the manhole was constructed in accordance with ASTM C478 and Municipality Standards and the date that the structure was fabricated.

1.06 TRANPORTATION

A. The precast concrete structure shall cure for a minimum of 72 hours. Transport of the precast structure to the jobsite is not allowed during the 72 hour curing period.

B. Comply with all applicable requirements of FDOT Section 450-16 Handling, Storage, Shipping and Erection.

PART 2 - PRODUCTS

2.01 MATERIALS:

Precast manholes shall conform to the requirements of ASTM C478, latest edition, the Miami-Dade Water and Sewer Department Standard Details and the following:

A. Properties:

1. Reinforcement of Grade 60 bars. (Pump Station Wet Wells require rebars not wire mesh reinforcing).
2. Concrete 4,000 psi.
3. Water Cement Ratio: 0.40 to 0.34 Standard Manholes, 0.34 Pump Station Wet Wells.
4. Waterstops: Ribbed PVC Waterstop with centerbulb.

B. Cement shall be Type II with a **maximum aggregate size of #57**. Aggregate shall be **well graded** to produce a less porous and stronger concrete.

1. **Gravity Sewer System Manholes**: In sanitary sewage applications, all manholes receiving the discharge of a force main, connecting to a major sewer line or interceptor sewer terminal manhole within a 350 foot radius of the pump station, drop manholes, or where called for in the plans and/or specifications shall have a concrete protective coating or a antimicrobial admixture in the concrete mix.

   The antimicrobial admixture in the concrete mix is specified below:

   a. An antimicrobial agent, Con^{MIC}Shield®, or approved equal, shall be used to render the concrete uninhabitable for bacteria growth.
   b. Contractor shall mix the liquid antimicrobial additive with the total water content of the concrete mix design in a proportion of 1 gallon per cubic yard. In the case of repairs to damaged concrete a proportion of 2 gallons per cubic yard shall be utilized.
   c. In some instances all of the concrete in the structure will receive the additive and in other instances only a portion of the concrete will receive the additive. Hence, the Contractor shall apply the additive only as directed in the specific instance.
   d. Precast Plant shall submit a letter of certification to the Department, stating that the correct amount and correct mixing procedure was followed for all antimicrobial concrete.
   e. Con^{MIC}Shield® antimicrobial additive shall be as manufactured by Con^{MIC}Shield® Technologies, Inc.; 541 Tenth Street NW #233, Atlanta, GA 30318; Phone: (877)543-2094.

2. **Pump Station Wet Wells**

   a. Pump Station Wet Wells shall have Xypex/BASF Crystalline Waterproofing Admixture or approved equal, applied at 2 to 3% of the weight of portland cement in the wet well by volume. The Crystalline Waterproofing Admixture shall be used in lieu of painting the exterior of the structure with Bitumastic Coal-Tar Epoxy.

   b. Do not use Con-Shield with the Crystalline Waterproofing Admixture

   c. Concrete Protective Coating Preparation: The precast concrete structure with the Crystalline Waterproofing Admixture is required to cure for 28 days prior to application of the concrete protective coating. Prepare the interior wet well surface with an epoxy cement underlayment compatible with the concrete protective coatings approved for Pump Station Wet Wells, Epoxytec CPP, Tnemic 218 or approved equal.

C. Minimum shell thickness of manholes shall be eight (8) inches.

D. Lifting holes through the structure will not be permitted.

E. Three to five courses of brick shall be constructed atop the manhole corbel for height adjustment. Manhole adjustment grade rings may be utilized in lieu of clay bricks.

F. Precast Joints above Elevation +4.0. and Waterproofing

1. Standard Manhole: Ram-Nek preformed plastic joint filler, Swellseal Hydrophillic Waterstop by Deneef, or approved equal. Apply Non-Shrink Grout both inside and outside of the joint. Wrap the outside Corbel and Exterior joint with a heat activated high shrink membrane.

2. Pump Station Wet Wells: Ram-Nek preformed plastic joint filler, Swellseal Hydrophillic Waterstop by Deneef, or approved equal. Apply Xypex Concentrate Cementitous Slurry or approved equal to the exterior and interior of the joint between precast members for waterproofing.

G. Holes for pipe connections, with a diameter equal to the outside dimension of the connecting pipe plus an additional 4-inches, shall be formed in the manhole walls. No cutting or chipping of the pre-formed holes, or cutting additional holes in the precast concrete walls will be permitted.

H. The bottom slab shall be cast monolithically with the lower section and the longitudinal reinforcement extending into the slab. The free air drop of the mix shall not exceed five feet.

I. No construction joints will be allowed below an elevation of four feet above mean sea level. Construction joints will be allowed above elevation+4.0, if adequate keyways and waterstops, approved by the Department (Ribbed PVC waterstop with centerbulb), are provided. The Department may approve an alternate joint method in cases of excessively deeper and heavy structures.

J. Built-in ladders or climbing rungs will not be permitted in any sanitary sewer manhole and only in other structures where shown on the Plans and called for in the specifications.

K. Openings shall be sealed with hydraulic cement non-shrink grout on both the exterior and interior of the structure.

L. Furnish manholes with accessories listed under "Manhole Accessories", below.

M. Lid and Frame: See Section 05550, "Castings".

N. Waterproofing:
Xypex Crystalline Waterproofing Admixture C-1000R with red dye or approved equal, applied at 3% of the volume of Portland cement in the manhole by volume.
Rheomac 300D Admixture as manufactured by BASF with red dye applied at 2% of the volume of Portland cement in the manhole by volume.
The Crystalline Waterproofing Admixture may be used in lieu of painting the exterior of the structure with Bitumastic Coal-Tar Epoxy.
Note: The Engineer may accept certification from the precast fabricator in lieu of the red dye.

2.02 CLAY BRICK UNITS AND GRADE RINGS

A. Clay brick shall be used in manhole construction. Clay brick shall conform to ASTM Standard C32, "Building Brick (Solid Masonry Units Made from Clay or Shale)". Bricks shall have true edges and sharp corners and shall have been cured for at least 14 days before being placed in any wall. Under no circumstances shall brick with holes be utilized anywhere in construction of a manhole or other structure unless specifically called out on the Plans or in the Specifications.

B. Manhole adjustment grade rings may be utilized. Rings shall be made of 100% recycled HDPE and available in cone opening diameters of 24, 27, 30 and 36-inches. Slope adjustment shall be attained by rotation of “wedge” rings from 4.1% to 0% grade. Rings shall have been tested to withstand HS25 loading through at least 1,100,000 cycles without cracking or other damage. Rings shall not be damaged by hydrogen sulfide manhole conditions and shall be waterproof when assembled with approved butyl sealant. Ring shall weigh six pounds or less and be equipped with UV inhibitor. Rings shall have been in successful service in multiple locations within the US for at least ten years and shall be warranted for five years. Rings shall be LadTech, Inc. HDPE Recycled Adjusting Rings or approved equal.

C. Exterior Shrink Membrane not required on the HDPE Grade Rings.

2.03 MORTAR AND GROUT: As specified in Section 04060 and 03600, respectively. Only Type II cement shall be used.

2.04 REINFORCEMENT: As specified in Section 03300.

2.05 SUMP: Where required, formed integrally with the base slab.

2.06 CONCRETE PROTECTIVE COATINGS **(Gravity Sewer Manholes)**

A. For manholes standard manholes that do not have a concrete protective coating or an antimicrobial additive (ConShield)in the mix, coat the interior of the manhole with Bitumastic 300M or approved equal, 16 mils minimum thickness. The manholes with a concrete protective coating or ConShield anti-bacterial admixture shall not have Bitumastic on the interior of the manhole.

Locations that require a Concrete Protective Coating or the Con Shield Admixture:

1 Manholes receiving the discharge of a force main.
2 Manholes within a 350 foot radius of a pump station wet well.
3 Drop manholes (if a drop connection is added to an existing manhole the existing manhole shall be rehabilitated with a concrete protective coating).
4 Any manhole location determined by the Engineer to have the probability of generating large quantities of sewer gas.

B. All concrete protective coating systems shall be pre-approved by the Water and Sewer Department based on testing done within the WASD system. Only products that have had a successful test application within the Miami-Dade Water and Sewer Department system and approved by WASD forces shall be allowed.

PREAPROVED PRODUCTS LIST- concrete protective coatings (standard manholes)

1. **Available Manufacturers: The manhole coating products below have passed the WASD testing protocol and have been approved for use for rehabilitation of standard manholes. The manhole rehabilitation products shall be used as a complete system with no third party products used unless approved in writing by the coating manufacturer. A one year warranty on the complete coating system from the project completion is required.**

   a. Uroflex as manufactured by Epoxytec International
   b. PPC as Manufactured by Polymorphic Polymers Corporation
   c. SP15 Spray Mortar, Sewer Guard HBS 100 Epoxy Liner by BASF
   d. Permaform MS-10,000 Fortified with ConShield or Cor-Guard Epoxy
   e. SprayRoq, Spray Wall and SprayShield GT Coating
   f. GEOKRETE System as manufactured by Quadex
   g. Mainstay DS-5 High Build Epoxy, Mainstay ML-72 Restoration Mortar
   h. GML Coating System: Green Monster Epoxy, GML-30 and GML-60 Epoxy Cement
   i. Raven Lining System: Raven 405 Epoxy, Raven 755 Epoxy Mortar

2. The manhole chimney shall utilize a flexible concrete protective coating. The acceptable flexible interior coatings for the manhole Chimeny are Epoxytec Uroseal, Uroflex or Geokrete.

C. Due to the probability of sewer gas generation, all manholes receiving the discharge of a force main, connecting to a major sewer line or interceptor sewer, drop manholes, or within a 350-foot radius of the terminal manhole immediately upstream of the pump station shall be either constructed of concrete containing Con^{MIC}Shield® antimicrobial additive or lined on all interior concrete surfaces with a pre-approved concrete protective coating or approved equal. Concrete protective coating system shall fully protect openings, such as for pipes, to insure that corrosive attack cannot take place at these locations. Protective system design for these areas will be checked as shop drawings. Note that boot systems are not accepted by the Department.

   Since the proprietary grouts used to close the annular area between the manhole wall and pipe entering or leaving the manhole are not compatible to the addition of Con^{MIC}Shield® these areas require liner or coating (as acceptable to the Engineer) protection even in manholes constructed of concrete containing this material.

D. All manhole exterior surfaces, from finished grade to base, shall be coated with Carboline Bitumastic 300M, 2 coats 16 mils minimum thickness or have Xypex/BASF Crystalline Waterproofing Admixture, applied at 2 to 3% of the volume of portland cement in the manhole by volume. The Crystalline Waterproofing Admixture may be used in lieu of painting the exterior of the structure with Bitumastic Coal-Tar Epoxy.

E. If Con^{MIC}Shield® anti-microbial agent is used, interior coating and liners can be eliminated except as specified above.

2.07 CONCRETE ADDITIVE AND PROTECTIVE COATINGS **(Pump Station Wet Wells)**

A. Waterproofing Additive: Xypex Crystalline Waterproofing Admixture or approved equal, applied at 3% of the weight of Portland cement in the manhole by volume. The concrete protective coating shall be applied a minimum of 28 days after the casting of the reinforced concrete structure in order for new concrete to cure.

B. Epoxy Cement Underlayment to smooth and prepare concrete surface Epoxytec Ceramico, Tnemic 218 or approved equal.

C. Preapproved Concrete Protective Coating for Pump Station Wet Wells

1. Uroflex Coating System as manufactured by Epoxytec International
2. PPC as Manufactured by Polymorphic Polymers Corporation
3. or approved equal

2.08 MANHOLE ACCESSORIES:

All new sanitary sewer manholes shall be furnished with the following items. Where existing manholes will be modified or are scheduled to be refurbished, rehabilitation shall also include the following items unless otherwise approved by the Department.

A. Provide concrete protective coating system for manholes installed in locations identified to have high levels of sewer gas.

B. Provide high density polyethylene manhole infiltration inserts in accordance with Section 02625, unless the Department requires the installation of stainless steel insert.

C. Exterior Shrink Membrane on Corbel and Exterior Joint; <u>On all manholes</u> (excluding the HDPE grade rings)install a heat activated, high shrink membrane, on the manhole's exterior, at each section joint and from the cast iron frame to the corbel section. Membrane shall be Wrapid Seal, by Canusa Corrosion Protection and Sealing, or approved equal with the following properties:

PRODUCT COMPONENT	PROPERTY	TEST STANDARD	UNIT	RESULTS
ADHESIVE	Softening Point	ASTM E28	Deg. C (Deg. F)	100 (212)
	Lap Shear Strength	DIN 30 672	N/cm^2 (psi)	8 (12)
BACKING	Tensile Strength	ASTM D638	MPa (psi)	20 (2900)
	Elongation	ASTM D638	%	600
	Hardness	ASTM D2240	Shore D	46
	Abrasion Resistance	ASTM D1044	mg	45
SLEEVE	Peel Strength	ASTM D1000	N/cm^2 (psi)	15 (9)
	Water Absorption	ASTM D570	%	0.05

	Low Temp. Flexibility	ASTM D2671D	Deg. C (Deg. F)	-40 (-40)

PART 3 - EXECUTION

3.01 EXCAVATION:

A. Refer to Section 02314, "Excavation, Backfill and Fill for Structures" for specific procedures, requirements and testing methods appurtenant to the work under this Section.

B. Excavation shall extend to a level 12-inches below the level of the outside bottom of the base slab. If necessary, provide sheeting and shoring for the excavation.

C. Backfill resulting excavation with drainfield limerock or specified bedding material to a level to receive the structure at the proper elevation.

3.02 GENERAL INSTALLATION

A. The precast base shall be set level, with the walls plumb on the graded crushed rock bedding.

B. If any surfaces of structures are exposed to view and to a depth of 6 inches below grade, the Contractor shall fill all depressions and all air holes with mortar, dampen surfaces, and apply an approved bonding agent then spread slurry, consisting of one part cement and one and one-half parts sand, by damp loose volume, on the surface with clean burlap pads and sponge rubber floats. The Contractor shall remove any surplus by scraping and then rubbing with clean burlap. Finish surface shall be suitable to receive paint.

3.03 INSTALLATION OF MANHOLES

A. Place base slab and manhole sections plumb and level. Coat exterior of precast structure with Bitumastic 300M or approved equal. Install heat activated, high shrink membrane, on the manhole's exterior, at each section joint and from the cast iron frame to the corbel section.

B. During all backfilling operations, the backfill level shall be kept even on all sides of the structure. Exercise every precaution to prevent damage to, or unplanned loading of, the structures and its appurtenances.

C. Lay clay brick in running bond. A minimum of three and a maximum of five courses shall be constructed atop each manhole corbel. Lay masonry units in full bed of mortar, with full head joints, uniformly jointed with other work. Stucco inside and out with 3/4-inch of mortar.

D. Set cover frames and covers level without tipping, to correct elevations.

E. Exterior surfaces of all structures shall be painted prior to the installation as specified elsewhere herein.

F. Openings shall be sealed with non-shrink grout. No expanding grout shall be allowed.

G. After satisfactory installation and testing, all interior concrete surfaces of the new manhole shall be seal coated in accordance with Section 2.06-A.

H. The invert channels of the manhole shall be formed of brick or brick rubble thoroughly bedded and covered with sand-cement grout, accurately shaped to a semi-circular bottom conforming to the lower half of the connecting sewer pipe. Steep slopes outside the invert channels shall be avoided. Changes in size and grade shall be made gradually and evenly. Changes in the direction of the sewer or entering branch shall be a smooth curve with radius as long as practicable.

I. It shall be the Contractor's responsibility to assure that the frames and covers are set to match proposed finish paving grades at the manhole locations.

J. Gravity sewers shall connect to the manholes in accordance with Standard Details SS 7.0 and Section UC-250 "Gravity Sewer Systems".

3.04 ALTERNATE INSTALLATION

Installation methods given below in this Section shall only apply if permission is granted by the Engineer of Record to use the "Alternate Method of Construction" as specified elsewhere herein. All provisions of that Section shall be applied to the installation of the structures with the specific modifications as follows:

A. Excavation

Excavation shall be carried to a depth of two feet below the bottom of the base slab.

B. Special Bedding

1. Bedding shall be crushed stone or gravel meeting the requirements of ASTM Standard C33 "Concrete Aggregates", latest edition, gradation 67.
2. The bedding shall be placed in the excavation from cut bottom to the level of the bottom of the slab. Thereafter it shall be thoroughly rammed and tamped by use of a crane and weight or other means suitable to the Engineer of Record to provide a stable base for the structure. Tamping and, if necessary, additional filling shall be carried on until the Engineer of Record is satisfied that a suitably stable base has been created for the structure.

C. Backfill

1. After the structure is installed, special bedding material as specified immediately above shall be carefully hand or machine tamped around the structure up to a level of no more than eighteen inches above the water level. Thereafter the procedures and materials specified for backfill and compaction, shall be used to complete the installation.

2. During all backfilling operations the backfill level shall be kept even on all sides of the structure and the Contractor shall exercise every precaution to prevent damage to, or unplanned loading of, the structure or its appurtenances.

END OF SECTION

SECTION 02615

CONCRETE PROTECTIVE LINER SYSTEM FOR PRECAST STRUCTURES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish and install all labor, materials, equipment, and incidentals required to supply polypropylene, random copolymer (PP-R) concrete protective liner in the precast wet wells and manholes as required and as shown on the plans. The liner system shall be AGRU "Sure-Grip" PP-R Concrete Protective Liner, or approved equal polypropylene lining, as installed by U.S. Precast Corporation, Miami, Florida and Joelson-Taylor Concrete Products at Venice, FL, Deland, FL and other locations in this state.

B. PP-R concrete protective liner shall be designed and installed by the manufacturer of the precast structure to protect the structure's interior surfaces from chemical attack and microbial corrosion, and to facilitate the prevention of ground water infiltration. A watertight seal between the ring and cover, or access hatch, and the liner, must be incorporated into the design. Additionally, the liner must be sealed at the bottom of the concrete structure's wall with a waterstop assembly thermo-welded to the wall liner, or with continuous liner coverage over the top of the base slab. All construction joints must be sealed by extrusion welding the liner seams together to form a continuous and flexible seal between structure sections.

1.02 SUBMITALS

A. The contractor shall submit for review a detailed CAD shopdrawings for each type of structure to be used on the project. These drawings shall detail the precast structure, per the design specified for the project, and shall show the concrete protective liner's placement on the structure's interior wall surfaces, at the construction joints, at pipe and other conduit connections, and at the adjustment area between the precast structure and the ring and cover. A manhole frame sealing system, in accordance with Section 02620, may be used in lieu of liner at the adjustment area.

B. The contractor shall provide, upon request, detailed thermo-welding and weld testing procedures, and supply to the engineer, upon request, a copy of the liner manufacturer's certification of training for those personnel performing the welding.

PART 2 - PRODUCTS

2.01 PHYSICAL PROPERTIES

A. The PP-R liner shall be free of pores, pinholes, voids and foreign bodies. All anchoring studs shall be manufactured during the extrusion process in one piece with the sheet. No welding to attach the studs to the sheet or mechanical finishing work is permitted. All welding rod, profile strips, cap strips and polyester backed transition wrapping shall be manufactured from

the same resins by the same manufacturer. The liner manufacturer shall be ISO 9001 certified.

B. The characteristic values of the raw materials shall be as follows:

PROPERTY	TEST METHOD	UNIT	STD. VALUE
Density	ASTM D 792-86	G/cm^3	.898
Melt Flow Index	ASTM D 1238-88	G/10min	(190/5)
Heat Reversion	ASTM D 1637-83	%	< 2
Yield Stress	ASTM D 638-89	PSI	$\geq$ 2,900
Elongation of Yield	ASTM D 638-89	%	$\geq$ 10
Elongation at Break	ASTM D 638-89	%	$\geq$ 50
Fire Classification	UL 94		V2
Electric Conductivity			10^{13}
Resistance to Pull-Out	SKZ Test Directives	T/m^2 T/ft^2	30 3
Maximum Working Temperature		C. F.	90 degrees C. 194 degrees F.

2.02 CONFIGURATION

A. Studded PP-R liner sheets shall have a minimum design thickness of 2 mm (.079 inches) and have a minimum of 39 wedge shaped anchoring studs per square foot of liner. Minimum stud height shall be no less than 9 mm (.39 inches) with a minimum length of 14 mm (.55 inches). Anchoring studs must be capable of resisting continuous hydraulic backpressure, to a minimum of 40 feet of hydraulic backpressure, exerted between the interior wall of the concrete structure and the anchoring stud side of the protective liner.

B. Non-studded PP-R cap strips, used to bridge construction joints, shall have a minimum design thickness of 2 mm (.079 inches). Polyester backed non-studded PP-R transition sheets, used for the purpose of bonding PP-R to dissimilar materials, shall be attached to the PP-R sheet during the extrusion process.

C. The lining system shall be designed to be repaired, or modified, at any time during the design life of the system.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The installation of the PP-R concrete protective liner into precast wet wells and manholes shall be accomplished only by a precast concrete manufacturer certified by the liner manufacture, with a minimum of five years of manufacturing experience, and a minimum of five years experience in the installation of corrosion resistant thermoplastic sheet liners in concrete structures. Upon request, the liner installer shall provide written certification that the installation is in accordance with the liner manufacturer's installation specifications.

B. Placement of the liner on forms shall conform to the liner manufacturer's written instructions. All shop and field welding shall be performed only by thermoplastic extrusion welders certified by the liner manufacturer. All field thermo-welding shall additionally be performed only by confined space trained, and certified personnel.

- END OF SECTION -

SECTION 09801

CONCRETE PROTECTIVE COATING

PART 1 - GENERAL

1.01 SCOPE

The Contractor shall furnish all labor, material, equipment and appurtenances necessary for the installation of a concrete protective coating in the precast concrete structure, as shown on the approved plans, in accordance with these specifications.

1.02 RELATED SECTIONS

Section 09900 - Painting (Short)
Section UC-570 - Installation of Pump Station

PART 2 - PRODUCTS

2.01 PROTECTIVE COATING

All interior concrete surfaces of the wet well shall be coated with the PPC Coating System WW-200-1a/Damp Concrete, as manufactured by Polymorphic Polymers Corporation or approved equal. The manufacturer's application procedures shall be strictly followed and may only be applied by factory-trained application technicians.

PART 3 - EXECUTION

3.01 APPLICATION

Application procedure for PPC Coating System WW-200-1a/Damp Concrete shall be as follows:

A. Surface preparation

Surface preparation shall be to obtain a clean, sound concrete surface. All loose spalled concrete shall be removed. The exposed surface shall be free of dust, dirt, grease, oil, fats, concrete sealing or hardening chemicals, form release agents or other contaminants. Thoroughly wire brush to remove any loose rust on steel reinforcement.

B. Waterproofing Coat

1. With clean water, dampen concrete to a dull gray finish (no standing water). Maintain substrate dampness throughout the application of the first coat.

2. Apply with brush or spray one (1) coat PC-100-8 waterproofing mix. Allow to cure until dry to the touch (1-2 hrs). Apply second coat of waterproofing mix and allow to cure a minimum

of 24 hours.

3. Application thickness: 20 mils

C. Prime Coat

1. Before applying Prime Coat, check pH of concrete, it must be within the range of 5.5 to 8.0 before Prime Coat is applied.

2. All surfaces must be thoroughly coated with PC-Prime Coat having a totally "wetted" appearance after cure.

3. Application thickness: 7-10 mils.

D. Spalled Areas

After Prime Coat has set, all spalled areas must be filled with aggregate filled PPC Spall Grout, thereby returning the areas to a uniform contour. Exposed rebar (reinforcing steel) should be troweled to a minimum thickness of ½ inch.

E. Intermediate Coat

1. This coat shall consist of IC-Q Lining Coat an integral part of PPC Coatings. This filled, anti-pinholing material should be applied to a thickness of 20-30 mils.

2. Application thickness: 20-30 mils.

F. Final Coat

1. FC-Final Coat is applied after the Intermediate Coat has set. Final Coat has pigment and special additives to improve abrasion and chemical resistance.

2. Application thickness: 10-12 mils.

END OF SECTION

SECTION UC-330

REPAIRS TO DEPARTMENT SEWERS

PART 1 - GENERAL

1.01 SCOPE

The Contractor shall furnish all labor, material and equipment required to repair the Department's sewers due to damage caused by his operations or as required to perform necessary modifications to existing installations.

1.02 RELATED SECTIONS

Section 01016 - Safety Requirements and Protection of Property
Section 01100 - Special Project Procedures
Section 02315 - Trenching and Backfilling for Piping Systems
Section UC-250 - Gravity Sewer Systems

PART 2 - PRODUCTS

2.01 CHEMICAL JOINT AND CRACK SEALING MATERIALS FOR ACTIVE LEAKS

A. Chemical joint and crack sealing materials used on this Project shall have the following properties: react quickly to form a permanent watertight seal; resultant seal shall be flexible and immune to the effects of wet/dry cycles; non-biodegradable and immune to the effects of acids, alkalis, and organics in sewage; component packaging and mixing compatible with field conditions and worker safety; extraneous sealant left inside pipe shall be readily removable.

B. Chemical joint sealing material shall be acrylic resin type and shall be furnished with activators, initiators, inhibitors and any other materials recommended by the manufacturer for a complete grout system. Sealing grout shall be furnished in liquid form in standard manufacturer's containers. Sealing grout shall be AV-118 Duriflex manufactured by Avanti International, Houston, Texas (1-800-877-2570) or approved equal.

PART 3 - EXECUTION

3.01 REPAIRS DUE TO CONTRACTOR'S OPERATIONS

A. The Contractor shall exercise caution to insure that his operations do not damage the existing sewer. The Contractor shall be responsible for repairs to the sewers which are necessary due to damage caused by the Contractor's operations. Such repair shall be considered as part of the work.

B. Damaged pipe or manholes shall be replaced in kind or repaired by the Contractor to the satisfaction of the Department, with emphasis on providing a good, solid foundation for the new pipe. Temporary paving and permanent paving repairs shall also be made by the Contractor.

C. Contractor shall immediately repair any damage using methods satisfactory to the Engineer. Repairs shall proceed on a 24-hour/day, seven day/week basis if so directed by the Department. If the Contractor fails to immediately repair any such damage, the Department shall have the right to make the repair or have the repair made, and may charge to the Contractor all costs, including administrative costs and overhead, incurred by the Department in connection with the repair. The Department shall also charge to the Contractor any costs incurred or penalties imposed on the Department as a result of such damage.

D. The Contractor is strongly advised not to position equipment having greater than an AASHTO H-20 loading above the sewer line. Repair of any damage caused by such equipment loads shall be at the Contractor's expense.

E. Any repairs requiring excavation, except emergency work, shall have prior approval of the Engineer.

3.02 MODIFICATION OF EXISTING MANHOLES

Where modification of existing manholes are required to replace existing mains the following requirement shall be adhere to:

A. After satisfactory replacement and testing of mains all interior concrete surfaces of the modified manhole shall be high pressure washed and seal coated with 2 coats of a coal tar epoxy, Kop-Coat Company Bitumastic 300-M, or approved equal. Each coat shall have a dry film thickness of 8 mils, minimum. The requirements of this paragraph are not applicable to existing manholes to lined with a Department approved liner. (See Section 02536 for additional requirements.)

B. The modifications to the invert channels of the manhole shall be formed of brick or brick rubble thoroughly bedded and covered with sand-cement grout, accurately shaped to a semi-circular bottom conforming to the inside of the adjacent sewer section. Steep slopes outside the invert channel shall be in the direction of the sewer or entering branch shall be a smooth curve with radius as long as practical

C. Gravity sewer shall connect to the manholes in accordance with Miami Dade Water and Sewer Department's Standard Details and Section UC-250.

3.03 SEALING OF POST-REPLACEMENT LEAKS

In the event it becomes necessary to seal sewer pipe to stop leakage after sectional replacement, the following procedure shall be used:

A. Chemical joint or crack sealing material specified above or as approved by the Department shall be furnished and satisfactorily installed. The Contractor shall modify his equipment as necessary to seal the leaks, however both his equipment and sealing method shall meet the approval of the Department prior to use.

B. Extreme caution shall be utilized during leak sealing (pressure) operations in order to avoid damage of the sewer pipe. If any damage occurs, it shall be repaired as specified in Subsection 3.01, above, and to the satisfaction of the Department. Excessive pumping of grout which might plug a service lateral shall be avoided. Any service laterals blocked by the

grouting operation shall be cleared immediately by the Contractor.

END OF SECTION

SECTION 02625

SANITARY SEWER MANHOLE INFILTRATION INSERT

PART 1 - GENERAL

1.01 SCOPE

. This section specifies sanitary sewer manhole infiltration inserts. Manhole inserts shall be furnished and installed in all new sanitary sewer manholes and all manholes to be rehabilitated as part of the Project.

PART 2 - PRODUCTS

2.01 GENERAL

The manhole infiltration inserts furnished shall be the product of firms which have been regularly engaged in the manufacture of such items for a period of at least five (5) years.

2.02 MATERIAL

A. All materials used in the manufacture of the infiltration inserts shall be highly resistant to corrosion from sanitary sewer atmospheres containing hydrogen sulfide and dilute sulfuric acid.

B. Infiltration insert body shall be manufactured of High Density Polyethylene meeting the requirements of American Society for Testing and Materials Standard D1248-84 (Reapproved 1989), APolyethylene Plastics Molding and Extrusion Materials@, Type III, Class A, Category 5 or stainless steel, when required by the Department.

C. Insert body thickness shall be a minimum of .125 inches. Inflow dish shall be one piece molded with structural ribbing members in the bowl area for extra structural integrity. Inflow dish is to have smooth radius molded edges for additional strength and prevention of cracking. The insert shall have a straight-side design to allow penetration of the manhole lid dropping through the clear opening of the manhole frame. The depth of the infiltration insert shall be a minimum of 5 inches from the smooth radius molded edge to the center of the bowl area. The insert shall be designed to provide a sufficiently loose fit into the manhole frame to allow easy removal. Manufacturers name and the date manufactured shall be molded into the inflow dish.

D. The infiltration inserts shall be dimensioned to fit sanitary sewer manholes as shown on the Miami Dade Water and Sewer Departments Standard Detail #SS4.0, “Type “A” Manhole cover and Frame” pages 1 and 2 of 2.

E. The gasket shall be a minimum of .5 inches wide and shall be a minimum thickness of .125 inches installed by the manufacturer and shall be envelope type, providing a seal on the lower side of that portion of the insert, which sits in the manhole frame. The gasket shall be closed cell Neoprene rubber and shall provide a watertight seal when installed. The gasket

shall be permanently attached to the insert by means of chemical bonding, (or waterproof adhesive). The maximum amount of leakage through the infiltration insert shall be five (5) gallons in twenty-four (24) hours.

F. Ventilation is provided by a vent hole on the side of the bowl.

G. A handle made of nylon webbing no less than one (1) inch wide, shall be located so that it does not interfere with the installation of the manhole lid, yet still provide for easy removal of the infiltration insert. Corrosion resistant fasteners shall be used to fasten the nylon webbing to the inflow dish. The handle shall be able to withstand a pull of at least 500 pounds before failure or separation from the insert body.

H. Bidders may be required to submit a sample inflow dish along with a complete detailed specification and certifications referenced in this document for evaluation.

I. The County reserves the right to perform its own testing procedures or to send any and all samples to any laboratory for analysis. On the basis of this testing and analysis, the County shall be the sole judge of the acceptability of the sample in conformance with the specifications and its decision will be final. Any sample submitted shall create an express warranty that the whole of the goods to be provided by the contractor shall conform to the sample submitted.

J. Five (5) year warranty against defects.

K. Insert shall be an “Inflow Defender” by USSI, LLC; Venice, FL; (941) 926-2646 or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Inserts shall be installed in accordance with the manufacturer recommendations.

B. The Department reserves the right to require installation of stainless steel inserts, as required.

C. Manhole frame shall be set so that the tops of the covers are flush with the adjoining pavement or ground surface.

- END OF SECTION -

SECTION UC-250

GRAVITY SEWER SYSTEMS

PART 1 - GENERAL

1.01 SCOPE

A. These Specifications shall govern the design, materials and installation requirements of the Department for gravity sanitary sewer systems constructed in its service area when using Poly (Vinyl Chloride)(PVC) pipe and fittings, Vitrified Clay (V.C.) pipe and fittings or Ductile Iron pipe and fittings. "PVC" shall mean Poly (Vinyl Chloride) as it relates to pipe and fittings.

B. This Specification does not purport to cover all material or installation procedures which may be required, whether by the nature of the proposed work, or by the Department, or by other regulatory agencies.

C. It is intent of the Department to obtain a complete and working installation under this project, and any items of labor, equipment or materials which may reasonably be assumed as necessary to accomplish this end shall be supplied whether or not they are specifically shown on the Plans or stated herein.

1.02 QUALITY ASSURANCE

A. All material and installation shall be in accordance with the Department's Design and Construction Standard Specifications and Details.

B. The material and installation for this project shall be in full compliance with all applicable standards listed in Section 01090, " Reference Standards"

1.03 DEFINITIONS

See Section 01005, "Defined Terms"

1.04 PROJECT APPROVAL

The approval of the Department shall be secured, in accordance with Section 17005, prior to any construction related activity.

1.05 SPECIAL CONDITIONS

The work shall proceed in accordance with the following specification sections, bound herein:

A. Section 01011 - Site Conditions
B. Section 01016 - Safety Requirements and Protection of Property
C. Section 01031 - Grades, Lines and Levels
D. Section 01100 - Special Project Procedures
E. Section 01750 - Maintenance of Traffic and Public Streets

1.06 DESIGN REQUIREMENTS

A. GENERAL

1. Gravity sanitary sewer systems shall be designed in accordance with the State of Florida Department of Environmental Protection (DEP) Rules, Chapter 62-604 for Wastewater Facilities, with OSHA requirements and with the "Florida State Board Health Sewage Guide" and the recommendations of Chapter 12 of the ASCE Manual No. 37, "Sewer Design and Construction", except as otherwise provided herein. Wet wells and manholes shall be classified as hazardous areas, Class 1, Division 2, Group C.

2. In addition, systems shall be designed in accordance with the requirements of the Miami-Dade County Department of Environmental Resource Management (DERM), the requirements of the latest edition of the South Florida Building Code and the Miami-Dade Water and Sewer Department Standards and Specifications.

3. The use of PVC pipe or AWWA C900 PVC pipe within a public water supply wellfield cone of influence or in areas zoned industrial or commercial shall be as stated under "Tightness Standards" in Section UC-370.

4. Manhole to manhole runs shall be kept in the range of no more than 400 feet without permission.

5. Slope shall be such as to maintain two feet per second minimum velocity when running full or half full when calculated using the Manning Equation with a roughness coefficient of .013.

6. Minimum slope for terminal runs shall be 0.40 percent for eight inch pipe. This slope shall be maintained for a minimum of 300 feet and longer if loading is abnormally light.

7. Design shall be performed by experienced personnel who have previously designed sewerage collection systems in Miami-Dade County. Proof of experience shall be provided if required by the Department. All design work submitted for approval shall be signed, sealed and dated by a registered professional engineer licenced to practice in the State of Florida.

8. The Department reserves the right request complete design calculations, which shall be submitted and shall be in a format easily read.

9. Design shall be conservative with sufficient peaking and infiltration factors included. Absolute minimum slopes shall not be used since minor field construction variations will reduce slopes and give actual velocity of less than two feet per second.

10. The Department reserves the absolute right to require greater slopes, higher peaking or infiltration factors if this is considered necessary upon review of design. The design/build firm shall conform with any such requirements and supply said design and construct same at no extra cost to the County.

11. The use of PVC pipe and fittings will only be permitted for gravity sanitary sewers (and service laterals) 15-inches in diameter and smaller.

1.07 PERMITS, INSPECTIONS AND FEES

A. The Contractor shall obtain and pay for all permits, official inspections and all other fees in accordance with Section 01740, "Permits".

B. Inspection by Department personnel is required in addition to, not in lieu of, municipal and County department inspections (if any).

C. No installation will be accepted until it has passed all inspections, including pavement installation or replacement.

1.08 PRECONSTRUCTION CONFERENCE

Prior to commencement of the work, the Contractor shall attend a "Preconstruction Conference" in accordance with Section 01150, "Preconstruction Conference".

1.09 SUBMITTALS

A. The Contractor shall furnish "As-Builts" in accordance with Section 01725. Project Record Documents shall be submitted in accordance with Section 01720. The Contractor shall submit operating and maintenance instructions and all other submittals in accordance with Section 01730.

B. Where the Specifications require test certification or certification that certain products or material furnished are as specified, the Contractor shall deliver such certification to the Department. No material or equipment shall be approved for use in the work until individual certification has been received.

1.10 SAFETY REQUIREMENTS

A. The Contractor shall be in compliance with all applicable provisions of the Occupational Safety and Health Act of 1970, in general, and any subsequent amendments and revisions thereto and specifically to the provisions concerning confined space entry.

B. The Contractor's personnel will be in the vicinity of raw sewage. For his own protection, as well as for his employees, he shall check with Metropolitan Dade County Health Department, and based upon their recommendation, shall have his personnel properly immunized against disease.

C. Under this project, personnel may be required to enter the existing manholes/sewers to perform certain items of work. Before entering, the Contractor shall be in compliance with Dade County Manhole Ordinance No. 83-3 (which mandates, in part, that above-ground safety personnel shall be on duty at all times when someone enters or works in a manhole/sewer and the air within a manhole / sewer shall be tested with a combination oxygen deficiency meter-explosion meter to determine oxygen content and explosion potential). A test for the presence of hydrogen sulfide shall also be performed. The work area must be ventilated mechanically by the use of an air blower, before entry and during occupancy, to insure that an adequate quantity of oxygen is supplied to the work area.

D. The Contractor shall conduct his operations in such a manner, utilizing warning devices such as traffic cones, barricades and warning lights, and personnel such as flagmen and uniformed police officers, that the public is given adequate warning of hazards of the work site as may be deemed necessary by the authority having jurisdiction and/or the Department. See Section 01750, "Maintenance of Traffic and Public Streets."

E. In the instance of men working within the manholes, the Contractor shall provide safety provisions to cover any possible consequences of structural failure and/or flooding. Such provisions might take the form of, but not be limited to, ladders in position to permit rapid egress; safety harnesses ; stand-by pumping equipment; extra air supplies; and such other measures as the situation and good construction practices might indicate.

F. Certain products specified in these Specifications contain warnings by the manufacturers that under certain conditions, if instructions for use of the product are not followed, a hazardous condition may exist. It is the Contractor's responsibility to instruct his workmen in the safe use of the product, or any product substitution.

PART 2 - PRODUCTS

2.01 GENERAL

A. All material for use in the Project shall be new and of recent domestic manufacture and shall be the products of reliable manufacturers or suppliers who, unless otherwise specified, have been regularly engaged in the manufacture of such materials and equipment for at least five (5) years.

B. All fittings and components shall, wherever possible, be standard stock articles of well known manufacturers.

C. Where the Specifications designate the products of a particular manufacturer, the product specified has been found suitable for the intended use, but, unless otherwise provided, articles or products of similar characteristics may be offered for the approval of the Department, upon approval by the Engineer of Record.

D. Copies of complete descriptive data shall be furnished regarding all material, consisting of dimension drawings, catalog references and other information necessary to clearly identify each article.

E. When substitutions are permitted, the Contractor shall make all necessary changes in adjacent or connected structures and equipment, at his expense

F. Unless otherwise specified, all steel bolts, nuts, washers and all other miscellaneous ferrous metal items (except cast iron) furnished by the Contractor shall be hot-dip galvanized in accordance with ASTM A386, "Zinc Coating (Hot-Dip) on Assembled Steel Products" and ASTM A385, Providing High-Quality Zinc Coatings (Hot-Dip)". Where the word "galvanized" or its abbreviation is used on the Plans or in the Specifications, it shall mean hot-dip galvanized. Fabricated items shall be hot-dip galvanized after fabrication. Internal threads shall be tapped or re-tapped after galvanizing.

G. Where miscellaneous materials are required for a complete installation the Contractor shall provide such materials in conformance with Section 15065, "Miscellaneous Material".

H. See Section 01100 for water used in construction.

2.02 CASTINGS

A. GENERAL

1. Material used in the manufacture of the castings shall conform to ASTM A48, "Gray Iron Castings", for Class 30 iron. Manhole and valve box covers shall have a roadway or pedestrian type surface as required by location, and shall be non-rocking.

2. Castings shall be in compliance with Section 05550. Castings shall be as manufactured by U.S.F. Fabrication, Inc., Neenah Foundry, or approved equal.

3. Castings shall be delivered unpainted with a shotblasted finish.

B. MANHOLE FRAMES AND COVERS

Manhole covers and frames shall be Department Type "A" U.S.F.&F No. 310 as manufactured by U.S.F. Fabricating, Inc., Hialeah, Florida, or approved equal. The covers shall be cast labeled "SANITARY SEWER".

2.03 BRICK

A. Clay Brick: Bricks for manhole construction shall be dense, hard burned, common clay brick conforming to ASTM Standard C62, "Building Brick (Solid Masonry Units made from Clay or Shale)".

B. Concrete Brick: Concrete bricks shall conform to ASTM Standard C55, "Concrete Building Brick".

C. All bricks shall have true edges and sharp corners and shall have been cured for at least 14 days before being placed.

2.04 CONCRETE, MORTAR AND GROUT

See Section 17033, " Concrete, Mortar and Grout (Short)"

2.05 EMBEDMENT MATERIAL

Embedment material, for bedding, haunching and initial backfill, shall conform with the requirements of Section UC-300 “Gravity Sewer Pipe Foundation”.

2.06 MANHOLE

A. Shallow manholes shall be constructed of brick or precast concrete. All other manholes shall be constructed of precast concrete. See Section 02536, "Precast Manholes & Covers"

B. Castings for manhole frames, covers and other items shall conform to Subsection 2.02, above. Casting patterns shall conform to those designated in the Miami-Dade Water and Sewer Standard Details.

C. Concrete shall conform to Section 17033.

D. Brick for manhole construction shall be clay brick, in accordance with Subsection 2.03, above.

E. Cement mortar for manhole construction shall conform to Section 17033. It shall be mixed dry and then wetted to proper consistency for use. No mortars that have stood for more than one hour shall be used. Brick manholes shall be coated with 3/4-inch thickness of mortar both inside and outside.

F. The invert channels shall be formed of brick or brick rubble thoroughly bedded and covered with sand-cement grout, accurately shaped to a semicircular bottom conforming to the inside of the adjacent sewer section. Steep slopes outside the invert channels shall be avoided. Changes in size and grade shall be made gradually and evenly. Changes in the direction of the sewer or entering branch shall be a smooth curve with radius as long as practical.

G. Frames and covers shall be set accurately to grade with a minimum of 3 and a maximum of 5 courses of brick provided as a leveling course. It shall be the Contractor's responsibility to assure that the frames and covers are set to match existing and/or proposed finish paving grades at the manhole locations.

H. For PVC Sewers:

1. The first joint at both influent and effluent sewers at each manhole, including service laterals, shall consist of an approved manhole coupling grouted into the manhole wall, and providing a continuous watertight elastomeric gasket seal between the coupling and the pipe inserted therein. The coupling shall have an increasing tapered interior from the gasket groove to allow flexibility for the pipe in the event of future settlement of the manhole or pipeline.

2. The first length of PVC pipe into or out of the manhole shall be 2-feet long, maximum, and shall be either plain-end by plain-end, or plain-end by bell. In the first option, the next joint shall be a double bell PVC repair coupling (no stop) with a maximum 1-inch gap between the pipes inserted therein. In the latter option, the next joint shall be another 2-foot long section, maximum, of plain-end by bell PVC pipe.

I. For Ductile Iron and Vitrified Clay Sewers

The first length of pipe into or out of the manhole shall be a 2-foot length of plain end by plain end ductile iron pipe (i.e. 2' as measured from the outside wall) grouted directly into the opening in the manhole wall. This P.E. X P.E. short shall be joined to the spigot end of an adjacent ductile iron sewer main by use of a ductile iron solid sleeve. In the instance of a vitrified clay main, the ductile iron P.E. X P.E. short manhole stub out shall be joined to the V.C. spigot by use of a double hub connector for vitrified clay pipe. Note that C-900 PVC repair couplings shall not be used in ductile iron or vitrified clay mains.

J. Where shown on the drawings, the Contractor shall provide stub-outs for future extensions. Both ends of all such stubouts shall be closed with specified PVC plugs.

K. Precast manholes shall conform to Section 02536, "Precast Manholes & Covers". In precast concrete manholes, holes for sewer line connections, with a diameter equal to the outside diameter of the connecting sewer plus an additional four inches (4"), shall be formed in the manhole walls. No cutting or chipping at pre-formed holes, or cutting additional holes in precast concrete walls will be allowed.

L. A minimum of three to a maximum of five courses of brick shall be constructed atop each manhole corbel.

M. Prior to acceptance of manhole, the Contractor shall verify that he has installed required manhole accessories and coating/lining (See Section 02536)

2.07 POLY (VINYL CHLORIDE) PIPE

Pipe for use in gravity sewer systems shall be Vitrified Clay, Ductile Iron with polyethylene or ceramic epoxy (Protecto 401) lined , PVC SDR 35, or AWWA C900, C905 PVC as shown on the plans or called out elsewhere herein. For further information on these types of pipe, see Section 15060, “Piping and Fittings”.

2.08 REINFORCING STEEL

A. Bar reinforcement for concrete structures shall conform to the requirements of ASTM Standard A615 "Deformed and Plain Billet-Steel Bars for Concrete Reinforcement", Grade 60, Deformed, except that steel manufactured by the Bessemer Process will not be accepted. Wire mesh reinforcing for concrete paving or driveway repairs, if required, shall be welded wire fabric meeting the requirements of ASTM Standard A185, "Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement".

B. The Contractor shall furnish the Department with manufacturer's test certificates showing the steel to meet the above requirements, in addition to which the Department may take representative samples from the material on the job and have them tested by an independent testing laboratory. Completely detailed shop drawings and bending schedules shall be submitted by the Contractor for the approval of the Engineer of Record. Such approval shall be obtained before the bars are cut and bent.

2.09 DUCTILE IRON CASING PIPE

Ductile iron casing pipe shall be ANSI/AWWA Standard C151/A21.51, Class 50, no lining required. Casing pipe shall be one size larger than PVC pipe to be encased, unless otherwise approved.

2.10 DUCTILE IRON SEWER PIPE

A. Ductile iron sewer pipe shall be ANSI/AWWA Standard C151/A21.51, Class 53 for 6-inch, Class

52 for 8-inch, Class 50 for 10-inch through 15-inch. Ductile iron pipe shall conform to Section 15060.

B. All ductile iron pipe and fittings 8-inches and larger in diameter for use in force mains and gravity sewers, except riser pipes, shall be delivered with either heat fused virgin polyethylene lining or ceramic epoxy lining (See Section 15060). The only ceramic epoxy material approved by the Department at this time is a high-build multi-component Amine cured Novalac epoxy, Protecto 401, by Vulcan Painters, Inc. of Bessemer, AL 35021.

2.11 MISCELLANEOUS MATERIAL

A. The Contractor shall furnish and install all miscellaneous material and appurtenances required for a complete installation. Section 15065 specifies material necessary for a complete installation, not specified herein. These material, including the following, shall be installed when required, whether shown on the Plans or not.

1. Paint, Bituminous
2. Caulking Compound
3. Manhole Couplings
4. PVC double bell repair couplings, No-stop (sleeves)
5. PVC double bell transition couplings or adapters PSM SDR-35 PVC Sewer Pipe to ductile-iron or AWWA C900 CI-PVC Pressure pipe.
6. Stainless steel repair clamps, with stainless steel bolts

PART 3 - EXECUTION

3.01 PIPE INSTALLATION, GENERAL

A. Proper and suitable tools and appliances for the safe convenient handling and laying of pipe shall be used and, in general, conform with manufacturer's recommendations. At the time of laying, the pipe shall be examined carefully for defects, and should any pipe be discovered to be defective after being laid, it shall be removed and replaced with sound pipe by the Contractor at his expense.

B. Pipe and fittings shall, at all times, be handled with great care to avoid damage. In loading and unloading, they shall be lifted with cranes or hoists or slid or rolled on skidways in such manner as to avoid shock. Under no circumstances shall this material be dropped or allowed to roll or slide against obstructions. Pipe an other material shall be distributed along the right-of-way in advance of installation only to the extent approved by the Department. Such materials shall be so placed as to keep obstruction to traffic minimum.

C. Upon satisfactory completion of the pipe bedding, a continuous trough for the pipe barrel and recesses for the pipe bells, or couplings, shall be excavated by hand digging. When the pipe is laid in the prepared trench, true to line and grade, the pipe barrel shall receive continuous, uniform support with no pressure being exerted on the pipe joints from the trench bottom.

D. Pipe shall be installed in accordance with the manufacturer's recommendation. Before being lowered into the trench, the pipes and accessories shall be carefully examined and the interior of

the pipes shall be thoroughly cleaned of all foreign matter and other deleterious materials by methods acceptable to the Department. During suspension of work, for any reason, at any time, a suitable stopper shall be placed in the end of the pipe last laid to prevent mud, dirt, groundwater or other foreign material from entering the pipe. Any pipe which is disturbed or found defective shall be immediately removed and replaced with sound pipe.

E. Gaskets shall be thoroughly checked for breaks, cuts or other damage, and shall be free of oil, grease, dirt or other foreign matter. Pipe joints shall be assembled with care. Lubricant, if required shall be as recommended by the manufacturer of the pipe, and shall have no deteriorating effects on the gasket and pipe materials. If assembly is under water, lubricant recommended by the manufacturer for underwater use is required.

F. Good alignment of the pipe is required for assembly. Align the spigot to the bell of the previously laid pipe and insert the spigot into the bell until it uniformly contacts the gasket. Apply steady pressure until the spigot easily slips through the gasket. Do not push or swing the spigot into the bell. Smaller diameter pipe and fitting may be assembled manually. Mechanical means such as bars and blocks, ratchets or jacks shall be used for joining larger pipe and fittings. Power equipment such as a backhoe bucket, shall not be used to assemble pipe and fittings, since excessive force may damage the gasket or bell.

G. Cutting the pipe in the field shall be done by the Contractor in a neat and workmanlike manner using manual or power saws. The pipe shall be marked around its entire circumference before cutting to assure a square cut. After cutting, the end shall be beveled with a beveling tool, rasp, or other approved equipment, to the proper taper. Mark the proper insertion depth on the cut and beveled end before installing the cut pipe into the pipeline. Pipe laying shall proceed up-grade from the lowest point of the proposed system, with spigot ends pointing in the direction of flow.

H. All pipe shall be laid straight, true to the lines and grades shown on the Plans, or matching existing grade, in each section between manholes. The pipe shall be laid so that the identification markings are located on the top of the installed pipelines.

I. Each individual length of pipe shall be solidly and evenly bedded and haunched throughout its length on a prepared bed on the floor of the trench and not supported in position on blocks or wedges. Pipe shall only be laid when the two preceding lengths have been thoroughly embedded in place to prevent any movement or disturbance of the finished joint. Any pipe which is disturbed or found to be defective after laying shall be taken up and relaid or replaced.

J. Any work within the pipe and fittings shall be performed with care to prevent damage to the interior wall of the pipe. Damaged interior walls shall be repaired or the pipe section or fitting replaced as required by the Department. No cables, lifting arms, hooks or other devices shall be inserted into the pipe or fitting. All lifting, pulling or pushing mechanisms shall be applied to the exterior of the pipe or fitting.

K. After pipe has been laid, reviewed and found satisfactory, sufficient backfill shall be placed along the pipe barrel to hold the pipe securely in place during the conduction of the required tests.

3.02 INSTALLATION OF DUCTILE IRON AND VITRIFIED CLAY PIPE

A. Installation of gravity sewers shall conform to the applicable requirements of ANSI/AWWA Standard C600-93, "Installation of Ductile Iron Water Mains and Appurtenances".

B. Cutting of ductile iron pipe for fittings and other connections shall be done by the Contractor in a neat and workmanlike manner without damage to the pipe, the lining, or the coating. Pipe shall be cut with a mechanical pipe saw. After cutting the pipe, the plain ends shall be filed to remove all sharp edges and burrs.

C. Polyethylene encasement of valves, cast iron pipe and fittings, if required by the Department, shall be installed in accordance with ANSI/AWWA C105/A21.5, "Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids" Method A, B or C.

D. If any difficulty is experienced in assembling lengths of pipe together in the trench, the pipe sections shall be tried on the surface of the ground and each length of pipe plainly marked for position and sequence in which they are to be installed.

E. Ductile iron solid sleeves shall be used to connect D.I. pipe spigots to existing D.I. manhole stub spigots. Vitrified clay double hub connectors shall be used to connect D.I. manhole stub outs to V.C. pipe spigots.

F. All bolts, nuts, gaskets or other joint materials for use in the pipeline shall be properly protected.

G. Gaskets shall be properly stored, and care shall be exercised to keep them away from heat, light, oil, gasoline or other petroleum products. Gaskets shall be kept clean at all times and not handled with greasy or dirty hands.

3.03 INSTALLATION OF POLY VINYL CHLORIDE (PVC) PIPE

A. Each length of pipe, immediately prior to being placed in position in the trench, shall be inspected, cleaned and prepared for installation. Gaskets shall be thoroughly checked for breaks, cuts or other damage, and shall be free of oil, grease, dirt or other foreign matter. Pipe joints shall be assembled with care. Lubricant, if required, shall be as recommended by the manufacturer of the pipe, and shall have no deteriorating effects on the gasket and pipe materials. If assembly is underwater, lubricant recommended by the manufacturer for underwater use is required. Good alignment of the pipe is required for assembly. Align the spigot to the bell of the previously laid pipe and insert the spigot into the bell until it uniformly contacts the gasket. Apply steady pressure until the spigot easily slips through the gasket. Do not push or swing the spigot into the bell. Small diameter pipe and fittings may be assembled manually. mechanical means such as bars and blocks, ratchets or jacks shall be used for joining larger pipe and fittings. Power equipment, such as backhoe bucket, shall be not be used to assemble pipe and fittings, since excessive force may damage the gasket or bell.

B. Cutting the pipe in the field shall be done by the Contractor in a neat and workmanlike manner using manual or power saws. The pipe shall be marked around its entire circumference before cutting to assure a square cut. After cutting, the end shall be beveling tool, rasp, or other approved equipment, to the proper taper. Mark the proper insertion depth on the cut and beveled end before installing the cut pipe into the pipeline. Pipe laying shall proceed up-grade from the lowest point of the proposed system, with spigot ends pointing in the direction of flow. All pipe shall be laid straight, true to the lines and matching existing grade, in each section between manholes. The pipe shall be laid so that the identification markings are located on the top of the installed pipelines. At all times when work is not in progress, the exposed ends of all pipes shall be fully protected by an approved stopper to prevent groundwater, dirt, rocks or other substances from entering the pipe.

3.04 PIPE-TO-PIPE CONNECTIONS

Pipe-to-pipe connections shall be made by using solid sleeves for Ductile Iron, double hub

connectors for vitrified clay and double bell couplings for PVC.

3.05 PIPE-TO-PIPE MANHOLE CONNECTIONS

When a sound pipe stub-out exists at a manhole to which connection is to be made, a pipe-to-pipe connection shall be made as described above. If a stub-out is not present or is faulty, an opening shall be cut in the manhole wall and the connection made. The connection shall be constructed as specified above in paragraphs 2.06 H and I with the pipe material/method chosen to match that of the new line. The invert/shelf area inside the manhole shall be cut and reshaped as necessary to construct the new channels in compliance with WASD Standard Details

3.06 GRAVITY SEWER SERVICE LATERALS

See Section UC-310, "Gravity Sewer Service Laterals".

3.07 MODIFICATIONS OF EXISTING MANHOLES

See Section UC-330, "Repairs to Department Sewers"

3.08 EXCAVATION

See Section 02315, "Trenching and Backfilling for Piping Systems"

3.09 SEWER PIPE FOUNDATION

See Section UC-300, "Gravity Sewer Pipe Foundation"

3.10 CLEANING AND TESTING

See Section UC-370, "Cleaning and Testing Gravity Sewers"

3.11 SEWERAGE REMOVAL

See Section UC-290, "Removal of Sanitary Sewerage and Debris"

3.12 SEWAGE FLOW CONTROL

See Section UC-320, "Sewerage Bypass Pumping and Flow Control"

3.13 REPAIR OF DAMAGE TO DEPARTMENT MAINS & SEALING LEAKS

See Section UC-330, "Repairs to Department Sewers"

3.14 DEFLECTION TEST

See Section UC-350, "Sewer Deflection Test"

END OF SECTION

SECTION 15060

PIPING AND FITTINGS

PART 1 - GENERAL

1.01 SCOPE:

A. This section describes materials, testing, and installation of ductile-iron pipe and fittings for water and sewer mains, small diameter Poly Vinyl Chloride Pipe (PVC) with threaded, flanged and solvent cemented joints; Copper Pipe and Fittings, and High Density Polyethylene Pipe for water services. The work included in this section consists of furnishing all material, equipment, craft labor and performing all operations necessary for the supply, installation, and commissioning of all piping, fittings and accessories within the limits of work, as shown on the drawings and specified herein.

B. Where references are made to other standards or codes, unless specific date references are indicated the latest edition of said standard or code shall govern.

1.02 WORK NOT INCLUDED UNDER THIS SECTION:

Piping installation for various types of piping systems is specified other sections herein that constitute MDWASD's Design Standards and Construction Details. Installations specified in this section are supplementary to those sections and in the case of conflict the more stringent condition shall prevail. For type PSM SDR-35, 26 PVC and AWWA C900 PVC sewer pipe and fittings see Section UC-250, "Gravity Sewer Systems".

1.03 RELATED SECTIONS:

A. Section 15010 - Basic Mechanical Requirements

B. Section 15065 - Miscellaneous Materials

C. Section 15070 - Jacking and Boring

D. Section 15075 - Aerial Crossings

E. Section UC-250 - Gravity Sewer Systems

F. All sections specifying various types of valves.

1.04 PIPING LAYOUT AND DESIGN CRITERIA:

A. Field verify dimensions prior to preparation of layout and shop drawings. Obtain the following information from the drawings and specifications:

1. Elevation of the pipe centerline and of the completed ground.
2. Alignment of the pipeline.
3. Field test hydraulic gradient elevation (HGL).
4. Nominal internal diameter, ID.
5. Design internal pressure class or HGL
6. Joint types.

B. Obtain shop drawing approval prior to fabrication of piping. All items not specifically mentioned in the Specifications or noted on the approved Plans, but which are reasonably necessary to for a complete, functional, and satisfactory installation shall be included.

1.05 SUBMITTALS

A. Submit shop drawings in accordance with the General Provisions.

B. Provide an affidavit of compliance with standards referenced in this specification, e.g., AWWA C151, AWWA C153, etc.

C. Submit copy of report of pressure tests for qualifying the designs of all sizes and types of pipe and fittings that are being used in the project. The pressure test shall demonstrate that the minimum safety factor described in relevant standard is met.

D. Submit piping layout profile drawings showing location and dimensions of pipe and fittings; submit after equipment and valve submittals have been reviewed and marked **"Resubmittal not required."** Include laying lengths of valves, meters, in-line pumps, and other equipment determining piping dimensions. Label or number each fitting or piece of pipe. Piping having identical design pressure class, laying lengths, and bell-and-spigot dimensions that is to be placed in long straight reaches of alignment may have the same identifying label or number.

E. Provide the following information:

1. Mortar lining thickness.

2. Wall thickness.

3. Material test data for this project.

4. Show deflections at push-on and mechanical joints.

5. Submit joint and fitting details and manufacturer’s data sheets.

F. Fully detailed drawings of all fittings proposed shall be supplied by the manufacturer with his bid. The tabulated nominal weight of each size and type of fitting shall also be supplied by the manufacturer for all items proposed. This weight shall be that of the bare casting prior to application of any lining or coating.

G. Submit calculations and test data proving that the proposed restrained joint arrangement for restrained joint pipe can transmit the required forces with a minimum safety factor of 1.5.

H. Submit copy of manufacturer's quality control check of pipe material and production. Include hydrostatic test records and acceptance test records. For each acceptance test, submit a stress-strain diagram showing yield strength, yield point, tensile strength, elongation, and reduction in area. Provide specimen test section dimensions and speed and method used to determine speed of testing, method used for rounding of test results, and reasons for replacement specimens, if any. Submit ring-bending test of pipe of the same diameter and pressure class as the pipe required for this project to prove ring-bending stress at 48 ksi results in a factor of safety of 2.0.

I. For Ductile Iron Pipe and fittings, submit certificate that cement for mortar lining complies with ASTM C150, designating type.

J. Submit test report on physical properties of rubber compound used in the gaskets.

K. Submit test reports and certifications for ceramic epoxy lining as specified herein. Submit applicators qualifications. Submit manufacturer's written recommendations for application and repair of coating.

L. Submit drawing or manufacturer's data sheet showing flange facing, including design of facing serrations.

M. Submit weld procedure specification, procedure qualification record, and welder's qualifications prior to any welding to ductile-iron pipe or fittings.

1.06 DELIVERY, STORAGE, AND HANDLING

A. During shipping, delivery and installation of pipe and accessories, handle in a manner that is incompliance with the manufacturer's recommendations, and employ procedures that ensure delivery of an undamaged operable product

B. Exercise particular care not to damage coatings by limiting exposure or physical contact with other materials, objects, or the environment.

1.07 INSPECTION

The Owner's Representative will inspect materials, production, and testing of pipes, fittings, and special pieces at manufacturer's plant.

1.08 QUALITY ASSURANCE

All pipe, fittings and other materials supplied under this contract shall be subject to inspection while still on the delivery truck. It is the sole responsibility of the vendor and supplier to make prior contact with the Storekeeper or the Construction Management section and provide a minimum of 48-hours prior notice of delivery. When so notified, the Department will make arrangements for inspection of the material upon arrival or within a reasonable time thereafter. Material shall not be unloaded without inspections taking place either prior to or, if necessary for examination, during the unloading procedure. The Department will not be responsible for any delays or additional costs created by non-compliance with the requirement for prior notification or the requirement for thorough inspection.

Materials shall be delivered in complete compliance with the AWWA Standards as modified herein, without damage, and shall match or exceed the quality of any samples supplied. The Department absolutely reserves the right to require samples of any material supplied and to perform whatever tests considered by the Engineer, whose decision shall be final, to be in the Department's best interest on said samples. Where such tests are of a destructive nature, the sample, if it passes the test will be paid for (at cost as shown by invoice) by the Department. Samples failing will be immediately replaced with suitable material at the supplier's/contractor's expense. Samples required prior to order as a condition for purchase or as a materials submittal for approval will be at the supplier's/contractor's expense but, if approved and not used for destructive tests, may be used in the work with permission from the Engineer.

Materials found to be defective, not in strict compliance with the quality standards of samples

supplied or these specifications shall be immediately returned to the vendor at his expense. If defects are discovered at a later time, the vendor shall be required to remove said items and shall bare all costs for so doing together with any replacement costs. Rejection of items may subject the vendor to liquidated and/or actual damages as specified elsewhere herein.

Foundries supplying materials shall maintain their metallurgical records for a minimum period of two years after fabrication and firms not doing so may be found in default.

Flaws which provide cause for rejection include;

1. Incorrect metallurgy or metallurgy which cannot be verified to the complete satisfaction of the Engineer;

2. Foundry identification/location, size, pressure and material identification information lost, removed, non-existent, or not visible when assembled;

3. Not in complete compliance with all applicable AWWA Standards as modified herein and/or these specifications;

4. Not in compliance with NSF;

5. Not in compliance with approved shop drawings;

6. Out of roundness in excess of AWWA requirements;

7. Dimensional differences in excess of AWWA requirements;

8. Rough exterior coating;

9. Chipped, cracked, scratched or otherwise damaged interior or exterior coatings or linings;

10. Interior or exterior coatings which are too thin;

11. Coatings too thick to allow proper assembly; coatings too thick to allow proper grip by restraining gaskets or other restraining elements;

12. Pin holes or honey combing of pipe;

13. Weld spatter or excess metal in gasket grooves or the whole of the bell area;

14. Bell areas which are distorted or otherwise improperly cast;

15. Spigots which are out of round, not of proper dimension, or not beveled to an extent that will allow easy assembly of the pipe joint;

16. Gaskets which are defective or of the wrong material;

17. Lack of joint materials;

18. Improper or defective joint materials;

19. Bolting of the wrong material or size;

20. Electro galvanizing or other exterior plating when hot-dip galvanizing is required;

21. Incorrect, flawed or damaged interior coating or lining;

22. Lack or non-submittal of all required certifications;

23. Non-timely submission of certifications; incorrect/incomplete certifications or certifications lacking the signature, date and seal of a professional engineer when so required;

24. Flanges which are too thin, not a right angles to the pipe centerline, or otherwise distorted;

25. The above listed items together with all other flaws or defects which in the opinion of the Engineer, whose decision shall be final, adversely affect the assembly and/or function of the piping system as intended.

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS: DUCTILE IRON

A. GENERAL

As used herein, "ANSI" denotes the American National Standards Institute, "AWWA" denotes the American Water Works Association, and "ASTM" denotes the American Society for Testing and Materials.

All pipe and fittings to be furnished hereunder shall conform to the referenced ANSI and/or AWWA Standard as modified herein, as appearing in the following sections.

All markings required on pipe and fittings, shall be permanent and clearly legible and located such that they will not be hidden or destroyed when assembled into the intended system. Plainly mark each length of straight pipe and each fitting at the bell end to identify the design pressure class, the wall thickness, and the date of manufacture, and the proper location of the pipe item by reference to the layout schedule. Mark the spigot end of restrained joint pipe to show clearly the required depth of insertion into the bell.

B. DUCTILE IRON PIPE

All pipes shall be ductile iron pipe conforming to ANSI/AWWA Standard C151/A21.51-09, "Ductile-Iron Pipe, Centrifugally Cast, for Water". All pipe and fittings for water applications shall be in full compliance with ANSI/NSF 61, "Drinking Water System Components-Health Effects". Manufacturers shall maintain their NSF certification for the duration of the Contract and any extensions thereof.

The pipe thickness and outside diameter of pipe for sanitary sewer and water usage shall conform to Tables 1 and 2 (for push-on and mechanical joint pipe, respectively) of ANSI/AWWA Standard C151/A21.51-09 for the following sizes. The pressure class specified is the minimum permitted:

Size	Pressure Class
4-inch through 12-inch	350
14-inch through 20-inch	250
24-inch	200
30-inch through 54-inch	150

For restrained joint pipe, the thickness of the pipe barrel remaining after grooves are cut, if required in the design of restrained end joints, shall not be less than the nominal wall thickness of equal sized non-restrained joint pipe as shown above.

Minimum wall thickness for pipe having threaded flanges shall be Special Class 53 or Pressure Class 350.

Minimum pipe wall thickness required for corporation stops and tapped outlets shall be in accordance with Table A.1 of ANSI/AWWA C151/A21.51-09 for three full threads for design pressures up to 250 psi and four full threads for design pressures over 250 to 350 psi.

For flanged ductile-iron pipe with integrally cast flanges or threaded flanges, the nominal wall thickness of the pipe barrel shall be as specified in Section 3.3, "Joints and Accessories" under "Flanged Joints", herein below.

Minimum wall thicknesses for pipe having grooved-end joints shall be as shown in the following table:

DI Pipe and Fitting Sizes (inches)	**Grooved End Joint Wall Thickness***
16 and smaller	Special Class 53
18	Special Class 54
20	Special Class 55
24 to 36	Special Class 56
42 and larger	Special Class 53 or Pressure Class 350
*Special Class and Pressure Class per AWWA C151-09.	

Each piece of pipe shall be marked as required in Subsection 4.7 of AWWA C151-09. Letters and numerals on pipe sizes 12-inch and smaller shall be not less than 3/8-inch.

The Water and Sewer Department absolutely reserves the right to require the use of "thickness" class pipe or higher pressure class pipe in applications where in the opinion of the Engineer (i.e. the Chief, Engineering Division, M-D WASD or his representative) such use is in the best interest of the Department. The Engineer's decision in this regard shall be final.

A sufficient quantity of non-toxic vegetable soap lubricant shall be supplied with each shipment of pipe. The soap lubricant shall be suitable for use in subaqueous trench conditions.

Single gasket push-on pipe shall be shipped in standard 18-foot or 20-foot lengths, but not

both. Restrained single-gasket push-on joint pipe shall be shipped in standard 18 or 20-foot lengths as specified above or fabricated lengths as noted in each order. At least two lengths of each size of single gasket push-on pipe furnished under each order shall be tested with circumferential gauges to ensure that the pipe may be cut at any point along its length and have an outside diameter which will be within the manufacturer's standard design dimensions and tolerances for plain pipe. These lengths shall be identified with an easily distinguished, painted marking, longitudinally along the full length of the pipe.

C. GASKETS

Water Mains shall use SBR gaskets for typical applications and field conditions. Gaskets constructed of EPDM, Nitrile are used in areas where geotechnical information indicates the presence of moderate contamination is possible. All water mains shall use gaskets material with NSF 61 approval.

Sewer Mains shall use Neoprene or EPDM gaskets for typical applications and field conditions.

Areas with chemical or hydrocarbon contamination shall use the gasket material as recommended by the Ductile Iron Pipe Research Association (dipra.org) or the gasket manufacturer.

D. FITTINGS

Fittings Conforming to ANSI/AWWA C110/A21.11-12 (Water & Sewer Use)

Restrained push-on joint fittings shall be cast ductile iron for use with ductile-iron pipe as specified above. Standard mechanical joint, push-on joint and flanged joint fittings shall also be ductile iron for use with ductile-iron pipe as specified above. Cast ductile-iron fittings in the 3-inch through 24-inch size range shall be pressure rated at 350 psi, minimum; (except flange-joint fittings shall be rated at 250 psi, minimum); and in the 30-inch through 54-inch-inch size range shall be pressure rated at 250 psi, minimum. All fittings with mechanical joints, flange joints and push-on joints shall conform to ANSI/AWWA Standard C110/A21.10-12, "Ductile-Iron and Gray-Iron Fittings ". In addition, fittings with mechanical joints and push-on joints shall conform to ANSI/AWWA Standard C111/A21.11-12, "Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings".

The weight of fittings shall be as given in ANSI/AWWA C110/A21.11-12 for ductile-iron fittings. The weight of mechanical joint fittings shall be as established in Tables 4 through 13. The weight of flanged joint fittings shall as established in Tables 14 through 21.

Fittings Conforming to ANSI/AWWA C153/A21.53-11 (Water & Sewer Use)

All fittings shall be cast ductile-iron for use with ductile-iron pipe as specified above. Fittings in the 3-inch through 24-inch size range shall be pressure rated at 350 psi, minimum; 30-inch through 48-inch size range shall be pressure rated at 250 psi, minimum; and in the 54-inch through 64-inch size range shall be pressure rated at 150 psi, minimum (except for those fittings such as plugs, caps, and sleeves which are normally rated at a higher pressure). No flanged fittings or mixtures of flanged with other end type fittings will be allowed in the range of 3-inch through 48-inch. All fittings with mechanical joints, flange joints and push-on joints shall conform to ANSI/AWWA Standard C153/A21.53-11, "Ductile-Iron Compact Fittings ". In addition, fittings with mechanical joints and push-on joints shall conform to ANSI/AWWA

Standard C111/A21.11-12, “Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings" except as otherwise allowed in C153. Mechanical joint glands shall be ductile-iron only.

The weight of a fitting supplied under the contract shall not be less than ninety-five (95) percent of the tabulated nominal weight supplied by the manufacturer’s catalog literature for that fitting. Further, the weight of fittings supplied shall not be more than five (5) percent above the same tabulated nominal weight.

E. JOINTS AND ACCESSORIES

Joints in below-ground piping shall be flexible push-on or Mechanical joints, except where flanged joints are required to connect to valves, meters, and other equipment. Provide unrestrained buried joints except where restrained joints are specifically shown in the drawings. Joints in aboveground or submerged piping or piping located in vaults and structures shall be grooved end or flanged.

Restrained joints for piping 6 inches and larger shall be American Cast Iron Pipe "Lok-Ring" or "Flex-Ring," U.S. Pipe "TR-Flex," or equal. Weldments for restrained joints shall be tested by the liquid penetrant method per ASTM E165. Restrained joints for field closures shall be “Megalug” by EBAA Iron.

Push-On Type Joints (Single Gasket and Single Gasket with Gasket Restraint)

Push-on joints shall conform to ANSI/AWWA Standard C111/A21.11-12.

The required number of gaskets for each push-on joint pipe plus one extra for every 50 joints or fraction thereof, shall be furnished with each order. The gaskets shall be shipped in suitable protective containers. All single gasket pipe shall be as manufactured by United States Pipe and Foundry Company (Tyton), by the American Cast Iron Pipe Company (Amarillo Fastite), by McWane, Inc. (Mix of Tyton and Fastite), Tyler/Union (Tyton) or approved equal.

Push-on joints together with both their regular and gasket-restraint gaskets shall be of the design, dimensions and tolerances of either those provided by American Cast Iron Pipe Company (Amarillo Fastite/Fast-Grip) or those provided by United States Pipe and Foundry Company (Tyton/Field Lok). No other designs will be acceptable.

The pressure rating shall be stamped on the restrained gasket. The restrained gasket and joint restraining system shall conform to ANSI/AWWA Standard C111/A21.11-12 rated at the following:

Size	Pressure Rating (Min.)
4-inch through 12-inch	350
14-inch through 20-inch	250
24-inch	200
30-inch and above	150

The restrained gasket shall be manufactured a color other than black to allow for visual inspection of the pipeline. The restrained gasket color shall be consistent throughout the system and shall be inherent within the rubber, not painted.

Mechanical Joints

Mechanical joints for fittings shall conform to ANSI/AWWA Standard C111/A21.11-12. Bolt holes for mechanical joints shall be equally spaced, and shall straddle the vertical centerline. Tee head bolts and hexagonal nuts for all mechanical joints in fittings shall be of high strength low-alloy steel with composition, dimensions and threading as specified in ANSI/AWWA Standard C111/A21.11-12. Glands shall be of ductile-iron construction for ductile iron fittings, and cast gray iron or ductile iron for cast gray-iron fittings.

The proper number of gaskets, glands, bolts and nuts, all conforming to ANSI/AWWA Standard C111/A21.11-12, plus one extra gasket for every 10 joints or fraction thereof, shall be furnished with each order. The gaskets and joint accessories shall be shipped in suitable protective containers. Follower glands held in place with set screws will not be acceptable. Segmented glands will not be acceptable.

Mechanical Joint Megalug-Type Restraining Systems

In any mechanical joint or push on joint underground piping system restrained glands may be utilized for underground pipeline. The ASTM A536 ductile iron casting of the restrained gland shall be bonded powder coated. The wedge and wedge assembly shall have a bonded liquid polymer coating applied for corrosion protection. The gland shall utilize torque limiting twist off wedge actuation screws.

Foreign and domestic manufactured restrained glands are allowed for pipelines 24-inches and below unless otherwise required by the Department due to Federal or State funded projects which require domestic manufacture. In sizes 30, 36, 42 and 48-inch the prior written permission of the Engineer is required to use non-domestic manufactured restraining glands. The country of origin shall be clearly identified on the restraining gland and shop drawing.

The Department absolutely reserves the right to require other forms of restraint where in the opinion of the Engineer the use of this form of restraint is not in the best interest of the Department and his decision shall be final. Use of this type of restraint is restricted to underground mechanical joint or push-on joint applications and in general may not be used above grade or as a substitute for flanged joints.

The Megalug restraint systems manufactured by EBAA Iron Sales, Eastland Texas, will be considered the standard of quality for comparison purposes and if the Department has any doubts as to the durability, quality or ability to restrain of a proffered substitute, the entity offering the substitute shall bear the entire burden of proving this equality to the complete satisfaction of the Engineer. Other manufacturers producing this type of restraint system shall submit data with their shop drawings showing that their restraint system has been in the marketplace for a minimum of three years in this country.

Each thrust-resistant mechanical joint or push on joint made up with this type of restraint and the pipe and fitting of which it is a part, shall be designed to withstand an axial thrust from an internal pipeline pressure of at least 150 psi at bulkhead conditions without reduction because of its position in the pipeline nor for support from external thrust blocks.

This type of joint restraint shall not be used above grade except as previously specified nor shall it be used as a carrier pipe within a casing. This type of restraint shall not be used with tape wrapped pipe or with too great a coating thickness on the exterior of the pipe.

Restrained Push-on Joints (Single Gasket Non-Gasket Restrained)

Restrained joints in pipe and fittings shall be of the single gasket push-on type, and shall conform to all applicable provisions of ANSI/AWWA Standard C111/A21.11 and the following requirements:

Thickness of the pipe barrel remaining at grooves cut, if required in the design of restrained end joints, shall not be less than the nominal wall thickness of equal sized non-restrained pipe as specified in Section 3.1 above.

Restrained joints using field welding, set screws, or gaskets with expanding metal inserts are not acceptable.

The restraining components, when not cast integrally with the pipe and fittings, shall be ductile iron or a high strength non-corrosive alloy steel.

Tee head bolts and hexagonal nuts for all restrained joints in pipe and fittings shall be of high strength low-alloy steel with composition, dimensions and threading as specified in ANSI/AWWA Standard C111/A21.11, except that the length of the bolts shall meet the requirements for the restrained joint design.

The proper number of gaskets, bolts, nuts and all necessary joint material, plus one extra gasket for every 10 joints or fraction thereof, shall be furnished with each order. The gaskets and joint accessories shall be shipped in suitable protection containers.

Each thrust-resistant joint and the pipe and fitting of which it is a part, shall be designed to withstand the axial thrust from an internal pipeline pressure of at least 150 psi at bulkhead conditions without reduction because of its position in the pipeline nor for support from external thrust blocks.

Restrained push-on joint pipe and fittings shall be capable of being deflected after assembly. During deflection, all components in the restrained system shall be in contact to provide an equal force on all contact areas.

When restrained spigot ends are ordered for items of Group A, the corresponding bell ends of the pipe to be restrained (also within Group A), shall be furnished with the required matching restraining features at no additional cost other than the price bid per foot of pipe.

Flanged Joints

Connecting pieces with one end flanged and the other end either plain-end or mechanical joint, shall conform to ANSI/AWWA Standard C110/A21.10. Joint material for both the flanged end and the mechanical joint accessories for connecting pieces with a mechanical joint end shall be furnished as specified.

Other types of flanged fittings, and flanged pipe, shall conform to the following requirements unless otherwise stated in the order:

Flanged fittings shall conform to ANSI/AWWA Standard C110/A21.10, as specified hereinabove.

Flanged ductile-iron pipe with integrally cast flanges shall be manufactured in accordance with

ANSI/AWWA Standard C151/A21.51, and with provisions contained hereinabove for centrifugally cast ductile iron pipe, and shall be furnished with ANSI Standard Class 125 flanges, plain faced and drilled, conforming to ANSI Standard B16.1, "Cast Iron Pipe Flanges and Flanged Fittings", latest revision. Hollow back flanges are not acceptable.

Flanged ductile-iron pipe with threaded flanges shall be manufactured in accordance with ANSI/AWWA Standard C115/A21.15, "Flanged Ductile-Iron Pipe With Ductile-Iron or Grey-Iron Threaded Flanges", and shall be rated for a working pressure of 250 psi, minimum. The nominal thickness of flanged ductile-iron pipe, 6-inch and larger, shall not be less than those shown in Table 1 of ANSI/AWWA Standard C115/A21.15. The nominal thickness of 4-inch flanged ductile-iron pipe shall be Class 54 (min.) conforming to Tables 3 and 4 of ANSI/ Standard C151/A21.51. Flanges shall be solid-back.

The pipe shall be furnished with ANSI Standard Class 125 flanges, plain faced and drilled, conforming to ANSI Standard B16.1, latest revision. Hollow back flanges and grey-iron flanges shall not be acceptable for use as threaded flanges. Threaded flanges shall be individually fitted and machine tightened on the threaded pipe by the manufacturer, and shall not be interchangeable in the field.

Flanges shall be back-faced parallel to the face of flange. Prior to assembly of the flange onto the pipe, apply a thread compound to the threads to provide a leak-free connection. There shall be zero leakage through the threads at a hydrostatic test pressure of 250 psi without the use of the gasket. Pipe lengths shall be as ordered. Removal of flanges, cutting and re-threading the pipe, and re-installing the flanges will not be permitted in any case. Where a raised face flange connects to a flat-faced flange, remove the raised face of the flange.

All flanges on ductile-iron pipe and fittings shall be of ductile iron, class 70-50-5 in accordance with ANSI/AWWA C110/A21.10. All joint materials for flanged pipe and fittings, shall be supplied with all pipe or fittings ordered. Bolts and nuts shall comply with all requirements of Appendix Section A.1 of ANSI/AWWA Standard C115/A21.15-11 except that both shall be stainless steel. Bolts shall be of sufficient length to fully engage all threads in the nut. Unless ring gaskets are specified, gaskets shall be full-faced, and gaskets shall be of 1/8-inch thickness. Gaskets shall fully conform to the requirements of ANSI/AWWA Standard C115/A21.15-11 Appendix Section A.2 except that gaskets shall be SBR for water and neoprene for sewer usages.

Grooved-end Fittings and Couplings

Grooved-end fittings shall conform to ANSI/AWWA C110/A21.10-12 with grooved ends conforming to ANSI/AWWA C606-11, radius cut rigid joints. Fitting material shall conform to ASTM A48, Class 30; ASTM A126, Class B; or ASTM A536, Grade 65-42-10. Wall thickness of ductile-iron (ASTM A536) fittings shall conform to AWWA C110 or C153; wall thickness of cast-iron fittings shall conform to AWWA C110. Fittings and couplings shall be furnished by the same manufacturer.

Grooved-end pipe couplings shall be ductile iron, ASTM A536 (Grade 65-45-12). Gaskets shall be Buna-N and shall conform to ASTM D2000. Bolts in exposed service shall conform to ASTM A183, 110,000-psi tensile strength. Bolts in buried or submerged service shall be ASTM A193, Grade B8, and Class 2.

Couplings for pipe 24 inches and smaller shall conform to AWWA C606 for flexible radius ductile-iron pipe, except where rigid radius couplings are required to connect to fittings.

Couplings for pipe sizes 30 and 36 inches shall be in accordance with the coupling manufacturer's published literature for tolerances and dimensions for flexible and rigid radius cut joints. Couplings shall be Victaulic Style 31, Gustin-Bacon No. 500, or equal.

Couplings for pipe larger than 36 inches shall conform to AWWA C606 for shouldered end pipe. Couplings shall be Victaulic Style 44 or equal.

Grooved-end adapter flanges for piping 24 inches and smaller having an operating pressure of 150 psi and less shall be Victaulic Style 341 or 342 or equal. Flange dimensions shall conform to ASME B16.1, Class 125.

Grooved-end transition couplings for connecting ductile-iron pipe 12 inches and smaller to steel pipe shall be Victaulic Style 307 or equal.

Outlets and Nozzles

Provide outlets three quarters of an inch and smaller by direct tapping Ductile Iron Pipe in accordance with AWWA C600-10, Section 4.8. Provide outlets larger than three quarters of an inch up to 2 inches by tapping the pipe and attaching a service clamp. or use a threaded welded-on boss. Use stainless steel clamps for exposed piping. For outlets larger than 2 inches, use a tee with a flanged outlet. For outlets larger than 2 inches in buried piping, use a tee with a restrained joint outlet.

Ductile-Iron Pipe Weldments

All welding to ductile-iron pipe, such as for bosses, joint restraint, and joint bond cables, shall be done at the place of manufacture of the pipe. Perform welding by skilled welders experienced in the method and materials to be used. Welders shall be qualified under the standard qualification procedures of the ASME Boiler and Pressure Vessel Code, Section IX, Welding Qualifications.

Welds shall be of uniform composition, neat, smooth, full strength, and ductile. Completely grind out porosity and cracks, trapped welding flux, and other defects in the welds in such a manner that will permit proper and complete repair by welding.

Material for fittings with welded-on bosses shall have a Charpy notch impact value of minimum 10 ft-lbs under the conditions defined in ANSI/AWWA C151/A21.51-09. Test completed welds by the liquid penetrant method per ASTM E165.

Completed welds shall be inspected at the place of manufacture by the liquid penetrant method. Conform to the requirements specified in ASTM E165, Method A, Type I or Type II. The materials used shall be water washable and nonflammable.

E. LININGS AND COATINGS

Saltwater Intrusion and Corrosive Soils Requirements

In saltwater intrusion areas where the installation is subject to groundwater level variation (East of I-95 or saltwater intrusion line), the Department shall require the use of V-Bio Enhanced Polyethylene Encasement and ductile iron pipe with a zinc basecoat under the

asphaltic topcoat. All ductile iron pipe and fittings shall be wrapped with the V-Bio Polyethylene Enhanced Encasement and have the zinc protective coating factory applied.

For corrosive soils encountered outside of saltwater intrusion areas during construction V-Bio Polyethylene Encasement shall be installed to protect the ductile iron main, fittings and valves.

Zinc Basecoat: The exterior of ductile iron pipe shall be coated with a layer of arc-sprayed zinc per ISO 8179. The mass of the zinc applied shall be 200 g/m^2 of pipe surface area. A finishing layer topcoat shall be applied to the zinc. The mean dry film thickness of the finishing layer shall not be less than 3 mils with a local minimum not less than 2 mils. The coating system shall conform in every respect to ISO 8179-1 "Ductile iron pipes - External zinc-based coating - Part 1: Metallic zinc with finishing layer. Ductile iron fittings shall also have a zinc protective coating sprayed on at the factory at a minimum of 3 mils.

The V-Bio Polyethylene Enhanced Encasement shall be accordance with AWWA C600 and ANSI/AWWA C105/A21.5, “Polyethylene Encasement of Ductile-Iron Pipe Systems”. Color shall be blue for potable water, purple for recycled water, and green for sanitary sewage service. Polyethylene encasement for use with ductile iron pipe systems shall consist of three layers of co-extruded linear low density polyethylene (LLDPE), fused into a single thickness of not less than 8 mils. The inside layer of the polyethylene wrap to be in contact with the pipe exterior shall be infused with a corrosion inhibitor and antimicrobial biocide to to control galvanic corrosion. Product: V-Bio or approved equal.

Polyethylene encasement for ductile-iron pipe shall be supplied as a flat tube meeting the dimensions of Table 1 in AWWA C105 and shall be supplied by the ductile-iron pipe manufacturer.

Plastic adhesive tape shall consist of polyolefin backing and adhesive which bonds to common pipeline coatings including polyethylene. Products: Canusa Wrapid Tape; Tapecoat H35; Polyken 934; AA Thread Seal Tape, Inc.; or approved equal.

Install the polyethylene to completely encase the pipe and fittings to provide a watertight corrosion barrier. Continuously secure overlaps and ends of sheet and tube with polyethylene tape. Make circumferential seams with two or more complete wraps, with no exposed edges. Tape longitudinal seams and longitudinal overlaps, extending tape beyond and beneath circumferential seams. Wrap bell-spigot interfaces, restrained joint components, and other irregular surfaces with wax tape or moldable sealant prior to placing polyethylene encasement. Minimize voids beneath polyethylene.

Place circumferential or spiral wraps of polyethylene tape at 2-foot intervals along the barrel of the pipe to minimize the space between the pipe and the polyethylene. Overlap adjoining polyethylene tube coatings a minimum of 1 foot and wrap prior to placing concrete anchors, collars, supports, or thrust blocks. Hand-wrap the polyethylene sheet, apply two complete wraps with no exposed edges to provide a watertight corrosion barrier, and secure in place with 2-inch-wide plastic adhesive tape. Repair polyethylene material that is damaged during installation. Use polyethylene sheet, place over damaged or torn area, and secure in place with 2-inch-wide plastic adhesive tape.

Repair polyethylene encasement at all service connections in accordance with AWWA C600-10, Section 4.8.

Asphaltic Coating

All Ductile Iron pipe and fittings shall be outside-coated with an asphaltic material applied by means of the airless spray method. The exterior coating shall comply with ANSI/AWWA C151/A21.51 for this type of coating, shall be smooth without pinholes, thin, bare or overly thick areas. Smoothness shall be such that when hand rubbed, no “sand paper” feeling will be experienced and such that the spigot area will readily slide through the gasket without pulling, tearing, rolling or otherwise disturbing the sealing capabilities of the gasket. Spigot ends shall be beveled prior to coating to an extent that will permit ready insertion of the spigot through the gasket area.

Cement-Mortar Lining

Ductile Iron Pipe and fittings unless otherwise specified shall be double-thickness cement-lined and seal-coated in accordance with ANSI/AWWA Standard C104/A21.4-14, "Cement-Mortar Lining for Ductile-Iron Pipe and Fittings ".

Ceramic Epoxy Lining

Ductile Iron Pipe and fittings where so specified shall be lined with ceramic epoxy

Ceramic epoxy shall contain pigmentation to resist ultraviolet exposure under the same conditions.

All ductile iron pipe and fittings for which ceramic epoxy lining is to be applied shall be delivered to the application facility without asphalt, cement lining or other lining on the interior surface or the first 6 inches on the spigot end of the pipe exterior.
Ceramic epoxy material shall be a high-build multi-component Amine cured Novalac epoxy, Protecto 401, by Vulcan Painters, Inc. of Bessemer, AL 35021 or Department-approved equal. Permox CTF is also an acceptable sanitary sewer lining.

Ceramic epoxy material shall meet the following criteria and shall be accompanied by certification of the following test results:

A. A permeability rating of 0.00 when tested according to Method A of ASTM E96-00 "Test Method for Water Vapor Transmission of Materials", Procedure A with a test duration of 30 days.

B. The following test must be run on coupons from factory lined ductile iron pipe:

   1. ASTM B117 Salt Spray (scribed panel) - Results to equal no more than 0.5mm undercutting after one year.

   2. ASTM G95 Cathodic Disbondment 1.5 volts @ 77 degrees F. Results to equal no more than 0.5mm undercutting after 30 days.

   3. Immersion Testing rating using ASTM D714-87 (1994).
      a. 20% Sulfuric Acid - No effect after one year.
      b. 25% Sodium Hydroxide - No effect after one year.
      c. 160° F. Distilled Water - No effect after one year.
      d. 120° F. Tap Water (scribed panel) - 0.0 undercutting after one year with no effect.

C. A statement from the manufacturer attesting to the fact that at least 20% of the volume of the lining contains ceramic quartz pigment.

D. A statement concerning recoat ability and repair to the lining.

Ceramic Epoxy Application

a. The lining shall be applied by a competent firm with a successful history of applying linings to the interior of ductile iron pipe and fittings.

b. Surface Preparation
Prior to abrasive blasting, the entire area which will receive the protective compound shall be inspected for oil, grease, etc. Any areas where oil, grease or any substance is present which can be removed by solvent shall be solvent cleaned using the guidelines outlined in SSPC-1 Solvent Cleaning. After the surface has been made free of grease, oil or other substances, all areas to receive the protective compounds shall be abrasive blasted using compressed air nozzles with sand or grit abrasive media. The entire surface to be lined shall be struck with the blast media so that all rust, loose oxides, etc., are removed from the surface. Only slight stains and tightly adhering annealing oxide may be left on the surface. Any area where rust reappears before coating must be re-blasted to remove all rust.

c. Lining Application
After the surface preparation and within 8 hours of surface preparation, apply to the interior of pipe and fittings a minimum forty (40) mils dry film thickness of the protective lining. No lining shall take place when the substrate or ambient temperature is below 40 degrees Fahrenheit. The surface also shall be dry and dust free. If flange ends are included in the Project, the linings shall not be used on the face of the flange; however, full face gaskets must be used to protect the ends of the pipe. The 40-mil system shall not be applied in the gasket grooves.

d. Coating of Gasket and Spigot Ends
Coat the gasket area and exterior of the spigot end for 6 inches back from the end of the spigot with six (6) mils minimum, ten (10) mils maximum of Protecto Joint Compound. This coating shall be applied by brush to ensure complete coverage. Care shall be taken that the coating is smooth without excess buildup in the gasket groove or on the spigot end. All material for the gasket groove and spigot end shall be applied after the application of the lining as specified in the preceding paragraph.

e. Number of Coats
The number of coats of lining material applied shall be as recommended by the lining manufacturer. However, in no case shall this material be applied above the dry thickness per coat recommended by the lining manufacturer in printed literature. The time between coats shall never exceed that time recommended by the lining material manufacturer. No material shall be used for lining which is not indefinitely recoated able with itself without roughening the surface.

f. Touch-Up and Repair
Protecto Joint Compound shall be used for touch-up or repair. Procedures shall be in accordance with manufacturer's recommendations.

F. INSPECTION AND CERTIFICATION

a. Inspection
   1. All ceramic epoxy lined ductile iron pipe and fitting linings shall be checked for thickness using a magnetic film thickness gauge. The thickness testing shall be done using the method outlined in SSPC-PC-2 Film Thickness Rating. Re-line any pipe whose lining is below the specified minimum thickness.

   2. The interior lining of all pipe and fittings shall be tested for pinholes with a nondestructive 2,500 volt test. Re-line any pipe not passing the test.

   3. Each pipe joint and fitting shall be marked with the date of application of the lining system and with its numerical sequence of application on the date.

Procedures for Sealing Cut Ends and Repairing Field Damaged Areas

1. Remove burrs caused by field cutting of ends or handling damage and smooth out the edge of the lining if rough.

2. Remove all traces of oil, grease, asphalt, dust, dirt, etc.

3. Areas of loose or damaged lining associated with field cutting the pipe shall be repaired, if approved by the Engineer, as recommended by the pipe manufacturer. The damaged area shall be stripped back by chiseling or scraping about 1 to 2 inches into the well-adhered lining before patching.

   The exposed metal and the 1 to 2-inch lining overlap shall be roughened with a coarse grade of emery cloth (#40 grit), rasp or small chisel. Avoid wire brushing or similar buffing which would make the surface too smooth for good adhesion.

4. With the area to be sealed or repaired absolutely, clean and suitably roughened, apply a coat of Protecto Joint Compound by brush in accordance with the manufacturer's recommendations.

2.02 PIPE AND FITTINGS: POLY VINYL CHLORIDE (PVC)

A. Poly (vinyl chloride (PVC) pipe and fittings specified herein are small diameter PVC with threaded, flanged and solvent cemented joints.

B. All poly (vinyl chloride) (PVC) pipe and fittings shall be made from high impact, rigid poly (vinyl chloride) compounds. Pipe and fittings shall be marked indicating size, type and schedule, ASTM Designation, manufacturer or trade mark, and shall bear the NSF (National Sanitation Foundation) seal of approval. Wherever the abbreviation PVC is used in these Specifications in relation to pipe and fittings, it shall mean poly (vinyl chloride) plastic pipe and fittings as specified herein.

C. PVC pipe shall be Schedule 80 unless Schedule 120 pipe is called for on the Plans or by the Engineer, Type I, Grade I, or Class 12454B with socket ends, and shall comply with ASTM Standard D1785, "Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80 and 120".Products intended for contact with potable water shall be evaluated, tested, and certified for conformance with ANSI/NSF Standard No. 61 or the health effects portion of NSF Standard No. 14 by an acceptable certifying organization when required by the regulatory authority having jurisdiction.

D. Schedule 80 Socket-type fittings shall comply with ASTM Standard D2467, "Socket-Type Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80" and D2464 "Specification for Threaded Poly Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80, for threaded fittings.

E. Joining cement for PVC pipe and fittings shall comply with ASTM Standard D2564, "Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings". Cemented joints shall be made in accordance with ASTM Standard D-2855, "Recommended Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings".

F. Flanges: One piece molded hub type flat face flanges, 125 pound standard as specified under fittings hereinbefore.

G. Gaskets: Full faced, 1/8-inch thick, Neoprene/EPDM (for sewer) or SBR (for water).

H. AISI Type 316 stainless steel, ASTM A193, Grade B8M hex bolts and ASTM A 194 Grade E8 hex head nuts. Bolts shall be fabricated in accordance with ANSI B 1812 and provided with washers of the same materials as the bolts.

2.04 PIPE AND FITTINGS: COPPER

A. Pipe: Copper pipe shall be Type K for interior piping and Type K Soft Temper for exterior piping, both conforming to ASTM B88, seamless, round, drawn tubing.

B. Fittings: Solder joint fittings shall be wrought copper and bronze fittings conforming to ANSI B16.22 or cast brass fittings conforming to ANSI Standard B16.18. Fittings for use with copper tubing shall be one of the following:

1. Cast Bronze Solder-Joint Fittings: Solder joint fittings of this type shall be cast bronze fittings conforming to ANSI B16.18, "Cast Brass Solder-Joint Fittings", and ASTM Standard B62, "Composition Bronze or Ounce Metal Castings", as manufactured by Chase Brass and Copper Co., Stanley G. Flagg & Co., Inc., or Department-approved equal.

2. Wrought Copper Solder-Joint Fittings: Solder joint fittings of this type shall be wrought copper fittings in accordance with ASNI B16.22, "Wrought Copper and Bronze Solder-Joint Pressure Fittings".

C. Solder: Solder shall consist of 95 percent tin and 5 percent antimony. Soldering shall be in conformance with Section 3 of the Copper and Brass Research Association Copper Tube Handbook.

D. Connection of copper pipe or fittings with galvanized pipe or fittings shall be made with dielectric fittings. Connect copper pipe to direct-taps to Ductile Iron Pipe with an insulating union. Wrap the copper pipe with polyethylene tape at least two feet in length beyond the point of connection.

2.05 HIGH DENSITY POLYETHYLENE (HDPE) PIPE FOR USE IN POTABLE WATER SERVICES

A. Smooth wall high density polyethylene pipe for use in potable water services 3.5-inch nominal outside diameter and less shall meet ASTM D3350, and shall be PE 335434C. Pipe shall meet the standards of ASTM F714, as modified herein, including the "Government/Military Procure-

ment" sections. Minimum hydrostatic design basis shall be 1600 psi. In all cases, hydrostatic design basis and pressure rating shall be as determined using the methods of ASTM F714. Pipe of this type shall be butt-fusion welded at joints. All welding of joints shall be in strict conformity with the recommendations of the pipe manufacturer and by a firm or individual recommended to the Engineer of Record in writing by the manufacturer.

B. As a part of the shop drawing submittals, submit the following signed by a Florida Registered Engineer, all calculations to determine, the pipe thickness, SDR rating, allowable stresses, in accordance with ASME B31.8 -1992, Table A842.22 as required by the pipe manufacturer.

C. All mechanical fittings utilized with HDPE pipe and tubing services, shall conform with ANSI/AWWA C800-01 "Underground Service Line Valves and Fittings" as modified herein, shall utilize AWWA Standard (Mueller) threads on tapped pipe and tapping saddles; shall be; designed and manufactured to withstand a sustained working pressure of 150 psi and to restrain the pipe against pull out under loading beyond that causing tensile yield in the HDPE pipe or tubing connected. The manufacturer shall supply certification of these capabilities and fittings shall not be accepted or installed without said certification. If fittings are being supplied to the Department the certification shall ship with the fittings and payment will not be made without this certification. At the discretion of the Engineer, this certification may be required to be signed and sealed by a professional engineer licensed to practice in the state where the supplying firm is located or in the State of Florida. His decision in this regard shall be final.

D. In all cases, fittings shall be installed in strict accordance with the manufacturer's instructions.
1. HDPE PIPE FOR WATER SERVICES:

All 2-inch high density polyethylene pipe used for services shall be IPS-O.D. controlled with Standard Outside Dimension Ratio (SODR) of 9, pressure rating of 200 psi at a Factor of Safety of 2.5 or greater, nominal outside diameter of 2.375-inches, minimum wall thickness of 0.264-inches, PE 3408, all in conformance with ASTM D3035-95 "Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter". Pipe shall comply with ANSI/AWWA C901-96 "Polyethylene (PE) Pressure Pipe and Tubing, ½ In. (13 mm) Through 3 In. (76 mm), for Water Service" as modified herein. Pipe shall have a (natural) inner core with a blue colored outer shell.

Pipe shall have footage marks at a maximum interval of every two feet. Polyethylene material shall have a minimum cell classification in accordance with ASTM D3350-14 "Polyethylene Plastics Pipe and Fitting Materials" of 345444D for the core, which shall be 100% virgin material, and 345444E for the outer shell. Note that both of these materials are UV stabilized as signified by the "D" for natural colored and "E" for the colored shell. Pipe shall comply with NSF 61 or 14.

Submit manufacturer’s certification of compliance with all of the above requirements. Certification shall ship with the pipe on material sold to the Department and shall always be submitted with shop drawings and catalogue cuts. Certification shall be signed and sealed by a professional engineer licensed to practice in the State of Florida.

2. HDPE TUBING FOR WATER SERVICES:

All 1-inch high density polyethylene tubing used for services shall be CTS-O.D. Controlled with Standard Outside Dimension Ratio (SODR) of 9, pressure rating of 200 psi, nominal outside diameter of 1.125-inches, minimum wall thickness of 0.125-inches, PE 3608, all in conformance with ASTM D2737-12 "Polyethylene (PE) Plastic Tubing". Tubing shall com-

ply with ANSI/AWWA C901-08 "Polyethylene (PE) Pressure Pipe and Tubing, ½ In. (13 mm) Through 3 In. (76 mm), for Water Service" as modified herein. Tubing shall have a (natural) inner core with a blue colored outer shell.

Tubing shall have footage marks at a maximum interval of every two feet. Polyethylene material shall have a minimum cell classification in accordance with ASTM D3350-14 "Polyethylene Plastics Pipe and Fitting Materials" of 345444D for the core, which shall be 100% virgin material, and 345444E for the outer shell. Note that both of these materials are UV stabilized as signified by the "D" for natural colored and "E" for the colored shell.

Tubing shall comply with NSF 61 or 14. Submit Manufacturer' shall supply certification of compliance with all of the above requirements. Certification shall ship with the tubing on material sold to the Department and shall always be submitted with shop drawings and catalogue cuts. When required by the Chief, Engineering Division, Miami-Dade Water and Sewer Department or his designee, certification shall be signed and sealed by a professional engineer licensed to practice in the State of Florida.

2.06 WALL SLEEVES, PIPES AND CASTINGS

A. Wall Sleeves: Wall sleeves shall be of cast iron, ductile iron or carbon steel with steel galvanized after fabrication as specified in Section 15065, Miscellaneous Materials, under wall pipe. Sleeves shall be provided with seals and shall be oversized as required for the installation of seals. Sleeves shall terminate flush with finished surfaces of walls and ceilings, and shall extend 2-inches above the finished floor. Escutcheons shall be provided at walls and floor to completely conceal the sleeves smaller than 3-inches. Escutcheons shall be brass or cast iron, nickel plated split-type.

B. Interior: Wall sleeves shall be installed for all piping passing through interior walls and floors, except where noted on the Drawings. Sleeves shall be of sufficient size to pass the pipe without binding.

C. Wall Sleeve Seals: Wall sleeve seals shall be modular mechanical type consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall sleeve. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut. After the seal assembly is positioned in the sleeve, tightening of the bolts shall cause the rubber sealing elements to expand and provide an absolutely water-tight seal between the pipe and wall sleeve. The synthetic rubber shall be suitable for exposure to treated sewage effluent and groundwater. Bolts, nuts and hardware shall be 18-8 stainless steel. The seals shall be Link Seal as manufactured by Thunderline Corporation or Department-approved equal, and the wall sleeve and seal shall be sized as recommended by the seal manufacturer.

D. All piping passing through exterior walls and base slabs shall be provided with wall pipes. All wall pipes shall be of ductile iron and shall have an intermediate flange or waterstop located in the center of the wall. Each wall pipe shall be of the same grade, thickness and interior coating as the piping to which it is joined. Those portions of the wall pipes that are buried shall have a coal tar outside coating.

2.07 STEEL CASING (JACKING AND BORING)

See Section 15070, "Jacking and Boring"

2.08 STEEL PIPE (AERIAL CROSSING)

See Section 15075, "Aerial Crossings"

PART 3 - EXECUTION

3.01 General:

A. Furnish and maintain all barricades and flashing warning lights necessary to warn of the construction throughout the Project.

B. Pipe and fittings shall at all times be handled with great care to avoid damage. Exercise particular care not to injure pipe coatings. In loading and unloading, they shall be lifted with cranes or hoists or slid or rolled on skidways in such manner as to avoid shock. Under no circumstances shall this material be dropped or allowed to roll or slide against obstructions.

C All work shall be performed by skilled workmen experienced in pipeline construction.

D. All pipe and fittings shall be adequately supported by clamps, brackets, straps, concrete supports, rollers or other devices as shown and/or specified. Supports or hangers shall be spaced so that maximum deflection between supports or hangers shall not exceed 0.050 inch for pipe filled with liquid, but shall not be further than 6 feet apart, whichever is closer, unless otherwise shown. All pipe supports shall be secured to structures by approved inserts or expansion shields and bolts.

E. All pipe shall be thoroughly cleaned internally before being installed. All pipes, except oxygen service, air and gas, shall be flushed with water and swabbed to assure removal of all foreign matter before installation. Air and gas piping shall be tapped with a hammer to loosen scale or other foreign matter that might be within the pipe, and then thoroughly blown with a high pressure air hose. Furnish and maintain suitable air compressor.

F. Whenever possible, the pipe shall be installed with minimum 48-inches of cover. Deviations shall not be installed without written approval by the Owner.

G. Joints may only be opened to adjust alignment by half of the AWWA or manufacturer's recommended opening (which is smaller).

H. Pipe Sleeves and Wall Casings: Pipe sleeves and wall casings shall be provided at the locations called for on the Drawings and specified herein. These units shall be as detailed and of the material as noted on the Drawings and specified herein. They shall be accurately set in the concrete or masonry to the elevations shown. All wall sleeves and castings required in the walls shall be in place when the walls are poured. Ends of all wall casings and wall sleeves shall be of a type consistent with the piping to be connected to them.

I. Tie Rods: Unless otherwise indicated on the Drawings, the size and number of tie rods for a joint or installation shall be as recommended by the manufacturer's design chart for a working pressure of 150 psi. Tie rods shall be installed as recommended by the manufacturer.

3.02 EXCAVATION FOR PIPING

A. Make all excavation necessary for the construction of the pipelines, connections, valves and appurtenances, to the lines and grades shown on the Plans.

B. Excavate the trench at least 6 inches below pipe laying grade as shown on the Plans. Install sheeting and shoring for the protection of workers in trenches, and where it is necessary for pipe installation and property protection or required by the Trench Safety Act. The cost of de-watering any excavation shall be at the Contractor's expense. The disposal of water removed from an excavation shall be in a manner which will not create a hazard, or be detrimental to the public health or to public or private property.

C. Obtain all necessary permits approving the location and proposed method of disposal before discharging water from any excavation into any portion of the public right-of-way or into any existing drainage structure or facility. Furnish and maintain all construction signs required.

3.03 INSTALLATION OF PIPE, FITTINGS AND VALVES

A. General:

1. The design Drawings are in some cases diagrammatic. They may not show every bend, off-set, elbow or other fitting which may be required in the piping for installation in the space allotted. . Install gravity lines at uniform grade to low point after field verification of low point invert.

2. The centerline of the pipe shall not vary by more than 2 inches from the location shown on the Plans and the top of the pipe shall not vary by more than 2 inches from the established grade, except at points where this tolerance must be changed to clear obstructions, or make connections.

3. Limit onsite pipe storage to a maximum of one week. Use unloading and installation procedures that avoid cracking of the lining. If necessary, use plastic sheet bulkheads to close pipe ends and keep cement-mortar lining moist. Deliver the pipe alongside the pipe laying access road over which the pipe trailer-tractors can travel under their own power. Place the pipe in the order in which it is to be installed and secure it from rolling. Sandbags may be used to support the pipe in the ditch but no pipe shall be laid on blocks, except by the written permission of the Engineer of Record. Do not move pipe by inserting any devices or pieces of equipment into the pipe barrel. Field repair linings damaged by unloading or installation procedures. Flanged joints, mechanical joints and push-on joints in cast iron pipe and fittings may be made under water.

B. Installation of Ductile Iron Pipe

1. Install Ductile Iron Pipe in accordance with ANSI/AWWA C600-10 “Installation of Ductile-iron Mains and Their Appurtenances”, and the following. For potable water pipelines, comply with NSF/ANSI 61 “Drinking Water System Components – Health Effects. All bends, tees, and plugs, unless otherwise specified, shall be backed with concrete to undisturbed ground. Provision shall be made to prevent concrete from adhering to plugs or bolts by wrapping in polyethylene sheet complying with ANSI/AWWA C105/A21.5-05.

2. Bolts, nuts and rubber gaskets for use in flanged and mechanical joints shall be stored under cover. During laying operations, do not place tools, clothing, or other materials in the pipe Gaskets shall not be exposed to heat, light or any petroleum products, shall be kept clean and shall not be handled with greasy or dirty hands. When pipe laying is not in progress, close the ends of the installed pipe by a child- and vermin-proof plug.

3. Assemble Flanged joints in accordance with the written recommendations of the pipe manufacturer. Before making up flanged joints in cast iron pipe and fittings, the back of each flange under the bolt heads, and the face of each flange shall have all lumps, blisters and excess bituminous coating removed and shall be wire brushed and wiped clean and dry. Cut the bore of the gaskets such that the gaskets do not protrude into the pipe when the flange bolts are tightened.

4. Before laying the ductile iron pipe, all lumps, blisters and excess asphaltic coating shall be removed from the bell and spigot ends of each pipe and the outside of the spigot and the inside of the bell wire brushed and wiped clean and dry. The entire gasket groove area shall be free of bumps or any foreign matter which might displace the gasket. The cleaned spigot and gasket shall not be allowed to touch the trench walls or trench bottom at any time. Vegetable soap lubricant shall be applied in accordance with the pipe manufacturer's recommendations, to aid in making the joint. Exercise caution to prevent damage to the gasket or the adherence of grease or particles of sand or dirt. Deflections shall be made only after the joint has been assembled.

5. Cutting of ductile iron pipe for inserting valves, fittings, etc., shall be done with a mechanical pipe saw in a neat and workmanlike manner without damage to the pipe, the lining, or the coating.

6. Unless otherwise directed, ductile iron pipe shall be laid with the bell ends facing in the direction of laying; and for lines on an appreciable slope, the bells shall, at the discretion of the Engineer, face upgrade. Small angular changes (less than 2.5 degrees) in horizontal alignment defined in the drawings by a point of inflection (PI) with no accompanying curve data shall be approximated as a curve by deflecting an equal amount of equal length pipe segments to create a curve equally distributed on both sides of the given PI. Accomplish a larger (greater than or equal to 2.5 degrees) change in horizontal alignment where a curve is not called for in the drawings through the use of an elbow placed at the station of the PI shown in the drawings. Small angular changes (less than 2.5 degrees) in vertical alignment may be accomplished by the use of pulled joints. For larger vertical deflections, place an elbow at the station and elevation of the vertical PI shown in the drawings.

7. Push-on and mechanical joints in ductile iron pipe and fittings shall be made in accordance with the manufacturer's written recommendations except as otherwise specified herein. Joints between push-on and mechanical joint pipe and/or fittings shall be made in accordance with AWWA Standard Specifications, "Installation of Ductile Iron Water Mains and Appurtenances," C600-10, except that deflection at joints shall not exceed one-half of the manufacturer's recommended allowable deflection, or one-half of the allowable deflection specified in AWWA C600-10, whichever is the lesser amount.

8. Flanged joints shall be used only where indicated on the Plans. Before making up flanged joints in the pipeline, the back of each flange under the bolt heads and the face of each flange shall have all lumps, blisters and excess bituminous coating removed and shall be wire brushed and wiped clean and dry. Flange faces shall be kept clean and dry when making up the joint, and the workmen shall exercise caution to prevent damage to the gasket or the adherence of grease or particles of sand or dirt. Bolts and nuts shall be tightened by opposites in order to keep flange faces square with each other, and to insure that bolt stresses are evenly distributed.

9. Bolts and nuts in flanged and mechanical joints shall be tightened in accordance with the written recommendations of the pipe manufacturer for a leak-free joint. Exercise caution to

prevent overstress. Torque wrenches shall be used until, in the opinion of the Engineer, the workmen have become accustomed to the proper amount of pressure to apply on standard wrenches.

C. Installation of PVC Pipe:

1. In the installation of glue joint PVC pipe, the pipe shall first be cut square and smooth. Wipe all surfaces to be connected with a cloth moistened with an appropriate solvent and remove any foreign matter from socket of fitting. Using an ordinary paint brush of width about equal to the nominal pipe size, apply a generous coat of cement to inside and shoulder of socket, flowing on but not brushing out. A similar coat shall then be applied to the end of the pipe for at least the same distance on the pipe as the depth of socket, and to the cut end. Pipe and fittings shall then be pressed firmly together and the pipe turned a quarter to a half turn to evenly distribute the cement. The cementing and joining operation must not exceed one minute. Allow 24 hours set-up time before applying pressure. Sand shall be used as backfill material around pipe installed underground.

2. Thread Sealant: Teflon tape.

3. All rigid PVC pipe shall be cut, made up, and installed in accordance with the pipe manufacturer's recommendations. Plastic pipe shall be laid by snaking the pipe from one side of the trench to the other. Offset shall be as recommended by the manufacturer for the maximum temperature variation between time of solvent welding and during operation.

4. Schedule 80 pipe shall not be threaded. Use Schedule 80 threaded nipple where necessary to connect to threaded valve or fitting.

5. Only strap wrenches shall be used for tightening threaded plastic joints, and care shall be taken not to over tighten these fittings.

6. Provide adequate ventilation when working with pipe joint solvent cement.

7. Testing: All lines shall be hydrostatically tested at the pressures specified elsewhere herein or at the design pressures.

8. Supports And Hangers: In accordance with the manufacturer's recommendations.

D. Installation of Copper Pipe:

1. Tubing above ground shall, whenever possible, be run in full lengths between fittings, valves and connections and joints shall be kept to a minimum. All connections shall be made without sharp bends or kinks in the tubing. Above ground tubing shall be supported at short intervals to prevent sagging and vibration.

2. All copper pipe shall be reamed to full diameter before joining. The ends of pipe and the inside of fittings shall be cleaned and flux applied to the entire area of pipe to be soldered.

E. Joint Pipe:

1. Threaded Pipe: Ream all pipe after cutting and before threading. Use non-hardening pipe compound "Tite-Seal" or approved equal, on male threads only.

2. Provide nipples of same material and weight as pipe used. Provide extra strong nipples

when length of unthreaded part of nipple is less than 1-1/2".

3. Provide reducing fittings rather than bushings where changes in pipe sizes occur.

4. Provide dielectric unions or flanges between copper and steel piping and between brassware and steel. Do not use steel and copper piping in the same system without such isolation.

F. Unions: Provide unions or flanges in all domestic water service lines at each piece of equipment, specialty valves or at other locations required for ready disconnect.

G. Pipe Protection:

1. Paint all un-insulated metal (ductile iron or steel) piping underground with two coats of asphaltic paint.

2. Wrap soil pipe that touches metal or is exposed to masonry with a layer of 6 mil polyethylene.

3. Spirally wrap all pipe lines embedded in concrete with two layers of 30 lb. felt prior to placing the concrete.

4. Coat all exposed threads on galvanized steel pipe after assembly with two coats of zinc chromate.

H. Cleaning and Testing: All of the piping installed under this project shall be tested as follows and as directed by the Engineer.

1. With exceptions as noted below, all ductile iron piping installed under this Contract shall be cleaned and tested according to Paragraph I hereinbelow in this Section:
   a) Only potable water piping shall be disinfected.
   b) No leakage shall be permitted for flanged piping.
   c) No leakage shall be permitted for any type of above ground piping.

2. Unless otherwise specified elsewhere herein, all PVC pressure system bushings and galvanized steel piping shall be tested at 100 psig. No leakage will be permitted.

I. Installation of Aboveground and Exposed Piping

1. Aboveground and exposed pipe fittings, valves and accessories shall be installed as shown or indicated on the Drawings.

2. Piping shall be cut accurately to measurements established at the job site and shall be worked into place without springing or forcing, properly clearing all equipment access areas and openings. Changes in sizes shall be made with appropriate reducing fittings rather than bushings. Pipe connections shall be made in accordance with the details shown and manufacturer's recommendations. Open ends of pipe lines shall be properly capped or plugged during installation to keep dirt and other foreign material out of the system. Pipe supports and hangers shall be provided where indicated and as required to insure adequate support of the piping.

3. Welded connections shall be made in conformity with the requirements of AWWA Standard C 206 and shall be done only by qualified welders. The Engineer may, at his option, require certificates that welders employed on the work are qualified in conformity with the requirements of this standard and/or sample welds to verify the qualifications of the welders. Before testing, field welded joints shall be coated with the same material as used for coating its pipe in accordance with the requirements of AWWA.

4. Flanged joints shall be made up by installing the gasket between the flanges. The threads of the bolts and the faces of the gaskets shall be coated with a suitable lubricant immediately before installation.

5. Joints using Dresser couplings shall be made up as recommended by the manufacturer.

6. Use of perforated band iron (plumber's strap), wire or chain as pipe hangers will not be acceptable. Supports for pipe less than 1-1/2 inches nominal size shall not be more than 8-feet on centers and pipe 2-inches nominal size and larger shall be supported at not more than 10-feet on centers, unless otherwise indicated. Supports for PVC pipe shall be spaced one-half the distance specified above unless otherwise indicated. Any noticeable sagging shall be corrected by the addition of extra supports at the Contractor's expense.

J. INSTALLATION OF HDPE SERVICES

Furnish and install a 10 gauge stranded copper blue tracer wire above all HDPE services.

3.04 FIELD QUALITY CONTROL

A. All water mains shall be flushed to remove all sand, debris, rock and other foreign matter. Dispose of the flushing water without causing a nuisance or property damage.

B. Pressure and Leakage Testing: Hydrostatically test all pressure pipe. The test pressure for potable water mains shall be 150 psi. The test pressure for sewage force mains shall be 100 psi. Test Ductile Iron Pipe mains in accordance with ANSI/AWWA C600 latest edition once all backfill is in place and fully compacted, and after all thrust blocks have cured to their design strength. Do not test against closed valves. All pumps, piping and gauges shall be furnished, installed and operated by the Contractor and all such equipment and devices and their installation shall be approved by the Engineer. Pump shall be of a non-pulsating type suitable for this application and gauge accuracy certification may be required at the Engineer of Record's discretion. All pressure and leakage testing shall be done in the presence of a representative of the Department as a condition precedent to the approval and acceptance of the system.

C Disinfection:

Disinfect in accordance with ANSI/AWWA C651-14 – Disinfecting Water Mains. During the period that the chlorine solution or slug is in the section of pipeline, open and close valves to obtain a chlorine residual at hydrants and other pipeline appurtenances. Swab exposed faces of valves and blind flanges prior to bolting flanges in place with a 1% sodium hypochlorite solution. Disinfect isolation valves, pipe, and appurtenances per AWWA C651, Section 4.7.

Flush with potable water until discolored water, mud, and debris are eliminated. Swab interior of pipe and fittings with a 1% sodium hypochlorite solution. After disinfection, flush with potable water again until water is free of chlorine odor. After confirming the chlorine residual, flush the

excess chlorine solution from the pipeline until the chlorine concentration in the water leaving the pipe is either within 0.5 mg/L of the replacement water or no higher than that generally prevailing in the distribution system.

Discharge of chlorinated water into watercourses or surface waters is regulated by the National Pollutant Discharge Elimination System (NPDES). Disposal of the chlorinated disinfection water and the flushing water is the Contractor's responsibility. Schedule the rate of flow and locations of discharges in advance to permit review and coordination with Owner and cognizant regulatory authorities. For measuring chlorine concentration, supply and use a medium range, drop count, DPD drop dilution method kit per AWWA C651, Appendix A.1. Maintain kits in good working order available for immediate test of residuals at point of sampling.

D. Tests for Drain and Gravity Sewer Lines:

1. Drain and gravity sewer lines shall be tested for infiltration and exfiltration.

2. The allowable limits of infiltration or exfiltration or leakage for the drain or sewer lines, or any portion thereof shall not exceed a rate of 100 gallons per inch of internal pipe diameter per mile of pipe per 24 hours with no allowance for laterals or manholes. Duration of test shall be a minimum of two hours.

3. Any part or all of the system may be tested for infiltration or exfiltration, as directed by the Engineer. Prior to testing for infiltration, the system shall be pumped out so that normal infiltration conditions exist at the time of testing. The amounts of infiltration or exfiltration shall be determined by pumping into or out of calibrated drums, or by other approved methods.

4. The exfiltration test will be conducted by filling the portion of the system being tested with water to a level which will provide a minimum head of 2-feet in a lateral connected to the test portion, or, in the event there are no laterals in the test portion, a minimum difference in elevation of 5-feet between the crown of the highest portion of the drain or sewer and the test level.

5. Where infiltration or exfiltration exceeds the allowable limits specified herein, the defective pipe, joints, or other faulty construction shall be located and repaired by the Contractor.

6. Furnish all labor, equipment and materials and shall conduct all testing required, under the direction of the Engineer of Record. No separate payment will be made for this work and the cost for this work shall be included in the prices quoted in the Proposal.

7. Locate and repair all leaks until the leakage is reduced to the limits specified. Any observed leaks or obviously defective joints or pipes shall be repaired or replaced as directed by the Engineer of Record, even though the total leakage is below that specified above.

END OF SECTION

Appendix B - Basic Guide to Corrosion Protection

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BASIC GUIDE TO CORROSION

PROTECTION FOR

MIAMI-DADE WATER AND SEWER DEPARTMENT PROJECTS

March 2016

INTRODUCTION:

Purpose:

The information contained herein is presented for use as a basic guide to corrosion protection for Miami-Dade Water and Sewer Department projects. Most of the guidelines presented here are specific to this department and have been developed over the years in response to situations occurring in our own system of sewers. Corrosion is normally localized and is dependent on conditions such as soil conditions, site conditions, sewer gas exposure, saltwater exposure and other factors. Thus, the materials and practices specified may well vary from those used in other areas of the country.

The Miami-Dade Water and Sewer Department makes every effort to utilize the best possible material that can provide the longest useful life. This is done deliberately with the view to savings in the future cost of system failures, labor, maintenance, repairs and replacement. The Department exceeds the minimum industry standard in many cases for materials, equipment and construction methods.

The Department has always tried, where and when possible, to utilize materials, methods and systems that are well proven. This is done with the recognition that when we open the door to a material or process, there could be a failure that will not show up for several years. Thus, the Department can be confronted with a situation where a large amount of material is already installed in many places when a problem becomes apparent. Such a situation is very costly and creates great public inconvenience. For new products that are to perform a critical function or cannot be regularly observed, the Department will require a test application (normally for a one year period) to be done at the vendors cost as a condition for having it approved into the system upon a successful completion of the test.

UNDERGROUND PIPELINE

Ductile Iron

All pipes shall be ductile iron pipe conforming to ANSI/AWWA Standard C151/A21.51-09, "Ductile-Iron Pipe, Centrifugally Cast, for Water". The pressure class specified is the minimum permitted:

Size	Pressure Class
4-inch through 12-inch	350
14-inch through 20-inch	250
24-inch	200
30-inch through 54-inch	150

All Ductile Iron pipe and fittings shall be outside-coated with an asphaltic material applied by means of the airless spray method. The exterior coating shall comply with ANSI/AWWA C151/A21.51 for this type of coating, shall be smooth without pinholes, thin, bare or overly thick areas. Smoothness shall be such that when hand rubbed, no “sand paper” feeling will be experienced and such that the spigot area will readily slide

through the gasket without pulling, tearing, rolling or otherwise disturbing the sealing capabilities of the gasket. Spigot ends shall be beveled prior to coating to an extent that will permit ready insertion of the spigot through the gasket area.

Ductile iron pipe within the saltwater intrusion areas where the installation is subject to groundwater level variation (East of I-95 or saltwater intrusion line), the Department shall require the use of V-Bio Enhanced Polyethylene Encasement and ductile iron pipe with a zinc basecoat under the asphaltic topcoat. All ductile iron pipe and fittings shall be wrapped with the V-Bio Polyethylene Enhanced Encasement and have the zinc protective coating factory applied.

For corrosive soils encountered outside of saltwater intrusion areas during construction V-Bio Polyethylene Encasement shall be installed to protect the ductile iron main, fittings and valves.

Zinc Basecoat: The exterior of ductile iron pipe shall be coated with a layer of arc-sprayed zinc per ISO 8179. The mass of the zinc applied shall be 200 g/m^2 of pipe surface area. A finishing layer topcoat shall be applied to the zinc. The mean dry film thickness of the finishing layer shall not be less than 3 mils with a local minimum not less than 2 mils. The coating system shall conform in every respect to ISO 8179-1 "Ductile iron pipes - External zinc-based coating - Part 1: Metallic zinc with finishing layer. Ductile iron fittings shall also have a zinc protective coating sprayed on at the factory at a minimum of 3 mils.

The V-Bio Polyethylene Enhanced Encasement shall be accordance with AWWA C600 and ANSI/AWWA C105/A21.5, “Polyethylene Encasement of Ductile-Iron Pipe Systems”. Color shall be blue for potable water, purple for recycled water, and green for sanitary sewage service. Polyethylene encasement for use with ductile iron pipe systems shall consist of three layers of co-extruded linear low density polyethylene (LLDPE), fused into a single thickness of not less than 8 mils. The inside layer of the polyethylene wrap to be in contact with the pipe exterior shall be infused with a corrosion inhibitor and antimicrobial biocide to control galvanic corrosion. Product: V-Bio or approved equal.

Underground DIP Summary:

- Asphalt coating required for all underground pipe
- Saltwater intrusion areas require zinc coating and V-bio encasement
- AWWA C153 fittings are standard with C110 fittings used at the option of the Engineer in areas of heavy corrosion
- Ceramic epoxy lining required for sewage force mains
- Cement mortar lining required for potable water mains
- In corrosive soils outside of the saltwater intrusion area V-bio encasement is required. Zinc coated pipe and fittings may be used if identified by the Engineer in the Plans
- Automatic Air Release valves required at the high points of all sewer force mains.
- Aboveground pipe shall have a factory applied zinc primer and two coats of field applied two part epoxy coating acceptable to the Department.
- Field cuts shall have the interior ceramic epoxy liner coated at the ends
- Drilled openings for ARV’s shall have the damaged ceramic epoxy liner repaired

PVC C900 Sewage Force Main

PVC C900 is the recommended pipe material for force mains up to 12-inches. Sewer Force Mains in saltwater intrusion areas are required to use PVC C900. The fittings shall be ductile iron with the uses of C110 fitting being at the option of the Engineer.

Pipe 4-inches through 12 inches shall conform to AWWA C900, rubber-ring gasket bell end or plain end with elastomeric gasket coupling, DR 18 or as shown in the drawings, cast iron equivalent outside diameter, material cell classification 12454 per ASTM D1784, latest revision.

HDPE Pipe

1-inch high density polyethylene tubing used for services shall be CTS-O.D. Controlled with Standard Outside Dimension Ratio (SODR) of 9, pressure rating of 200 psi, nominal outside diameter of 1.125-inches, minimum wall thickness of 0.125-inches, PE 3608, all in conformance with ASTM D2737-12 "Polyethylene (PE) Plastic Tubing".

High density polyethylene, HDPE, shall be used for directional drill and slip-line pipeline repairs. This work requires signed and sealed plans and calculations from Florida Registered Professional Engineer submitted by the Contractor. The minimum DR of the pipe rating is provided by the Department in the project requirements.

PVC Gravity Sewer

PVC C900 is required in well field protection areas. PVC SR 26 heavy walled sewer pipe will be the minimum dimension allowed after Sept 2017.

Prestressed Concrete Lined Cylinder Pipe

Pipe and fittings for 48-inch and smaller shall be prestressed concrete lined cylinder type and for 54-inch and larger shall be prestressed concrete embedded cylinder type. All the pipe and fittings shall conform to AWWA Standard C301, "Prestressed Concrete Pressure Pipe, Steel-Cylinder Type", except as otherwise modified herein. PCCP shall be custom designed and constructed for the particular application.

Summary:

- Minimum steel cylinder thickness – 12 Gauge unless otherwise required by the Engineer
- Design Pressure based on operating pressure of the transmission main
- Potable Water shall use a cement mortar epoxy
- Sewage Force Mains shall use a 360 degree Liner unless otherwise ordered by the Engineer
- Saltwater intrusion areas shall have a bitumastic exterior coating
- Exposed metal shall have a zinc coating
- Joints shall be snap ring or harness clamp
- Closures shall be encased in concrete
- Joints shall be sealed with grout
- ARV’s required at the high points for sewage force mains

Bar Wrap Concrete Pipe

Bar Wrap concrete pipe may is used for potable water transmission mains. The design materials and workmanship for pipe shall conform to the requirements of AWWA C303. Lining and coating thickness for pipe shall be as specified in AWWA C303.

Summary:

- The cylinder shall comprise a minimum of 60% of the total steel area required for internal pressure by design
- The cylinder shall be a minimum 12 gauge steel
- Design Pressure based on operating pressure of the transmission main
- Potable Water shall use a cement mortar epoxy
- Exposed metal shall have a zinc coating
- Closures shall be encased in concrete
- Joints shall be sealed with grout
- Exterior mortar coating per AWWA C303

MANHOLES AND WET WELLS

Precast manholes shall conform to the requirements of ASTM C478, latest edition, the Miami-Dade Water and Sewer Department Standard Details.

Standard Manholes require coatings in the following applications:

1. Manholes receiving the discharge of a force main.
2. Manholes within a 350 foot radius of a pump station wet well.
3. Drop manholes (if a drop connection is added to an existing manhole the existing manhole shall be rehabilitated with a concrete protective coating).
4. Any manhole location determined by the Engineer to have the probability of generating large quantities of sewer gas.

Approved Coating for Standard manholes:

a. Uroflex Coating System as manufactured by Epoxytec International
b. PPC as Manufactured by Polymorphic Polymers Corporation
c. SP15 Spray Mortar, Sewer Guard HBS 1000 Epoxy Liner by BASF
d. M-301 Epoxy as manufactured by Warren Environmental
e. Permaform MS-10,000 Fortified with ConShield, Cor+Gard
f. SprayRoq, Spray Wall and SprayShield GT Coating
g. Agru Sure Grip Liner with Cretex on the Chimney
h. ConShield in the precast mix
i. Raven 405 FS, as manufactured by Raven Lining System

Approved Coatings for Pump Station Wet Wells:

a. Uroflex Coating System as manufactured by Epoxytec International
b. PPC as Manufactured by Polymorphic Polymers Corporation
c. or approved equal

Summary for Corrosion Protection:

- Water Cement Ratio: 0.40 to 0.34 Standard Manholes, 0.34 Pump Station Wet Wells
- Reinforcement of Grade 60 bars. (Pump Station Wet Wells require rebars not wire mesh reinforcing)
- Only products that have had a successful test application within the Miami-Dade Water and Sewer Department system and approved by WASD forces shall be allowed
- Pump Station Wet Wells are required to have a Xypex/BASF Crystalline Waterproofing Admixture or approved equal, applied at 2 to 3% of the weight of portland cement in the wet well by volume
- Standard Manholes shall have the exterior of the manhole coated with a 16 mil bitumastic coat or use a Crystalline Waterproofing Admixture
- Openings shall be sealed with hydraulic cement non-shrink grout on both the exterior and interior of the structure

<u>Concrete and Metal Structure Restoration</u>

The success of any rehabilitation is dependent on how well the surface preparation is performed. See Section 03721 Preparation for Resurfacing Concrete and Section 03732 Concrete Repair for guidelines, testing and standards.

The concrete protective coating system used shall have a cement underlayment approved by the coating manufacturer for application with the product. The Contractor shall not use any underlayment that may void the manufacturer's warranty. The epoxy cement used shall have written approval from the coating manufacturer.

Contractor's performing rehabilitation work should have a NACE Certified Coating Inspector be available upon request. The Contractor's NACE Certified Coating Inspector shall be available upon request to provide the WASD Engineer information on surface preparation, rehabilitation methods, patching, coating application and testing.

Summary for Corrosion Protection:

- Concrete cast with a lower Water Cement Ratio. 0.34, will be denser and more resistant to corrosion
- Concrete surface preparation shall produce a surface that is thoroughly cleaned to produce a clean interior surface free of all coatings, sand, rock, sludge or other damaging materials
- Metals shall be cleaned of rust to near white metal
- Metals shall use a zinc based primer
- Coatings at Treatment Plants or Pump Stations shall be selected by the Engineer or Plant Superintendents based on previous on pervious successful applications
- Coating applicators shall have certification from the industrial coating manufacturers supplying the product

APPENDIX C - Gravity Sewer Interceptors

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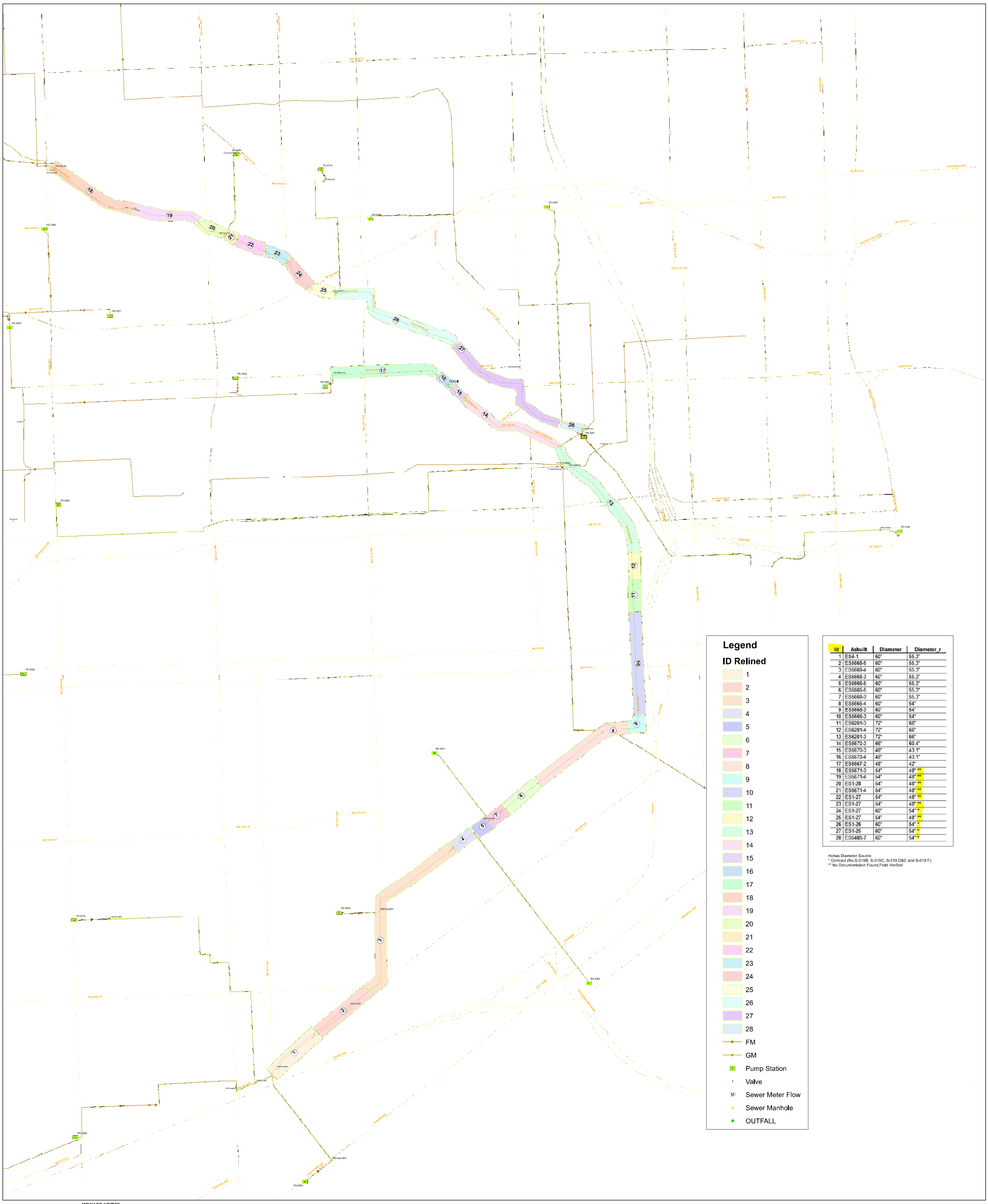

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2	ES5668-5	60"	55.3"
3	ES5668-4	60"	55.3"
4	ES5668-3	60"	55.3"
5	ES5666-5	60"	55.3"
6	ES5666-5	60"	55.3"
7	ES5668-3	60"	55.3"
8	ES5666-4	60"	54"
9	ES5666-3	60"	54"
10	ES5666-3	60"	54"
11	ES6201-3	72"	66"
12	ES6201-4	72"	66"
13	ES6201-3	72"	66"
14	ES5670-3	66"	60.4"
15	ES5670-3	48"	43.1"
16	ES5670-4	48"	43.1"
17	ES5667-2	48"	42"
18	ES5671-3	54"	48" **
19	ES5671-4	54"	48" **
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25	ES1-27	54"	48" **
26	ES1-26	60"	54" *
27	ES1-25	60"	54" *
28	ES5486-7	60"	54" *

Hobas Diameter Source:
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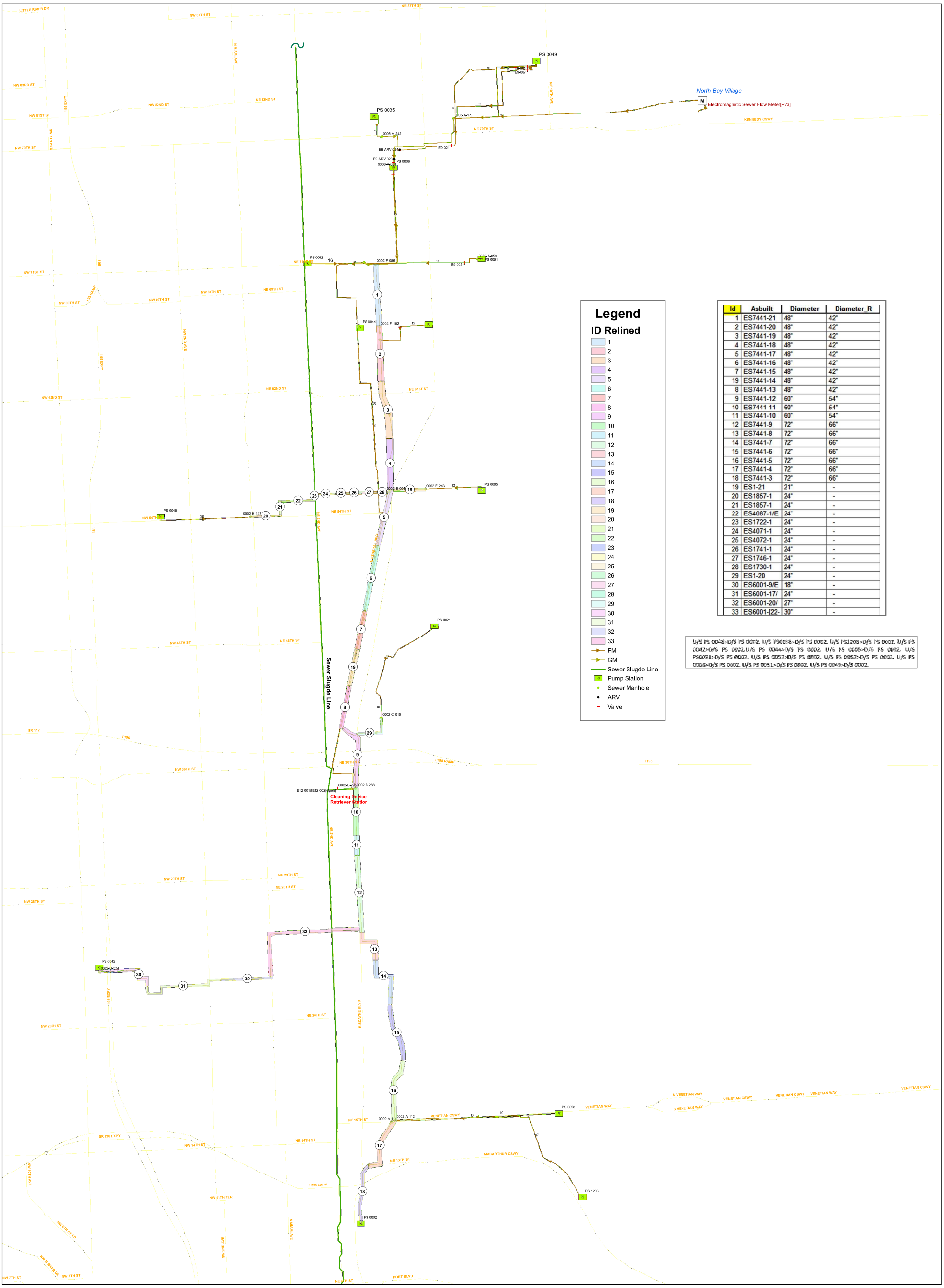

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- 33
- FM
- GM
- Sewer Slugde Line
- Pump Station
- Sewer Manhole
- ARV
- Valve

Id	Asbuilt	Diameter	Diameter_R
1	ES7441-21	48"	42"
2	ES7441-20	48"	42"
3	ES7441-19	48"	42"
4	ES7441-18	48"	42"
5	ES7441-17	48"	42"
6	ES7441-16	48"	42"
7	ES7441-15	48"	42"
19	ES7441-14	48"	42"
8	ES7441-13	48"	42"
9	ES7441-12	60"	54"
10	ES7441-11	60"	54"
11	ES7441-10	60"	54"
12	ES7441-9	72"	66"
13	ES7441-8	72"	66"
14	ES7441-7	72"	66"
15	ES7441-6	72"	66"
16	ES7441-5	72"	66"
17	ES7441-4	72"	66"
18	ES7441-3	72"	66"
19	ES1-21	21"	-
20	ES1857-1	24"	-
21	ES1857-1	24"	-
22	ES4087-1/E	24"	-
23	ES1722-1	24"	-
24	ES4071-1	24"	-
25	ES4072-1	24"	-
26	ES1741-1	24"	-
27	ES1746-1	24"	-
28	ES1730-1	24"	-
29	ES1-20	24"	-
30	ES6001-9/E	18"	-
31	ES6001-17/	24"	-
32	ES6001-20/	27"	-
33	ES6001-[22-	30"	-

U/S PS 0048>D/S PS 0002. U/S PS0038>D/S PS 0002. U/S PS1209>D/S PS 0002. U/S PS 0042>D/S PS 0002.U/S PS 0044>D/S PS 0002. U/S PS 0005>D/S PS 0002. U/S PS0021>D/S PS 0002. U/S PS 0052>D/S PS 0002. U/S PS 0052>D/S PS 0002. U/S PS 0006>D/S PS 0002. U/S PS 0051>D/S PS 0002. U/S PS 0049>D/S 0002.

0 0.375 0.75 Miles

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APPENDIX D - Specifications for One-Year Countywide Contract for Rehabilitation of Manholes, Inflow and Infiltration Repair

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SPECIFICATIONS FOR:

ONE-YEAR COUNTYWIDE CONTRACT FOR REHABILITATION OF MANHOLES, INFLOW AND INFILTRATION REPAIR

1.00 SCOPE

The Project consists of furnishing all labor, material and equipment for rehabilitation of approximately 500 manholes anywhere within the limits of Miami-Dade County, Florida, as ordered by the Department during a one year period. The work of the manhole rehabilitation shall include, but not be limited to, furnishing and installing concrete protective coating; high pressure cleaning; Post-cleaning video inspection; surface preparation; sealing leaks with chemical injection grout by drilling thru the manhole; sand blasting, if required; concrete repair and restoration; restoring manhole to the original shape or as otherwise approved by the Engineer; grouting voids; cleaning and restoring exposed reinforcing; applying cement underlayment; restoring manhole bench and flow channels; furnishing and installing plugs, thru plugs and thru pipe as required; bypass pumping of sewage, if necessary; traffic control; legal disposal of debris; furnishing and utilizing all required safety equipment; post-rehabilitation video inspection; and all other miscellaneous and appurtenant work for a complete manhole rehabilitation.

The manholes to be rehabilitated are located throughout Miami-Dade County. Recently, 155 of these manholes were coated with rubber-based coating which failed. The failed rubber-based coating and all other coatings shall be completely removed before repairs are made to the manholes.

This is a non-exclusive contract, and as such, the Department does not guarantee that the full amount of the Contract will be issued to the Contractor. The actual amount of Work Orders assigned will be the prerogative of the Department in its sole discretion and dependent only upon its needs.

The Miami Dade County Ordinance No.90-143 is applicable to this Project. The Contractor shall review the "Supplemental General Conditions" and the "Wage and Benefit Schedule" that are included within these documents.

Qualifications

The Contractor shall have completed a minimum of (450) four hundred fifty manhole rehabilitations or similar structures within the past 10 years. Verifiable references are required with Project Name, Organization Name, Contact Person, Phone Number, Date of Work and Work Performed. Submit experience history with references on the two most recent Contracts along with the bid. The work shall have been completed with the Contractor’s own forces or key personnel.

The experience of key senior personnel with other firms may be counted toward the experience requirement, if acceptable to the Engineer. Should such evidence not be satisfactory to the Engineer, whose decision shall be final, the bid will be considered non-responsive, and the second low bidder will be considered for award.

In the event a firm consists of executives, supervisors and other senior field staff (key employees) that would have met these minimum experience requirements with a prior firm, the Miami-Dade Water and Sewer Department reserves the right to qualify the firm based on WASD's sole determination and evaluation of the knowledge and prior experience of these key

employees employed by the new firm.

Standards

The Contractor is also alerted that various "Standards" are used herein for reference and criteria, and that he should obtain copies for his general use and protection. Abbreviated titles are used throughout these Specifications and although most of them are widely known, their complete titles are given below in order to avoid any misunderstanding.

ACI	American Concrete Institute
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
AWWA	American Water Works Association
DERM	Dade County Department of Environmental Resources Management
FDOT	Florida Department of Transportation
OSHA	Occupational Safety & Health Act
WASD	Miami-Dade Water and Sewer Department

The above list shall not be considered complete, as there are other "Standards" used; however, in most cases complete titles have been given.

Wherever, "Standards" are indicated herein for reference, the referenced portion shall have the same force and effect as if it were included herein in its entirety, latest edition or revision if the date of publication is not shown.

2.00 INFORMATION FURNISHED BY THE ENGINEER

The location(s) of work shall be identified in the Work Order(s) issued subsequent to the Award of the Contract. The combined total for all work authorized by the Work Order(s) shall not exceed the Contract Award amount.

The Department does not guarantee that the full amount of the Contract will be issued to the Contractor. The actual amount of Work Orders assigned will be the prerogative of the Department in its sole discretion and dependent only upon its needs.

3.00 SEQUENCE OF CONSTRUCTION, TIME OF COMPLETION AND GENERAL INFORMATION

3.00.1 SEQUENCE OF CONSTRUCTION AND GENERAL INFORMATION

Prior to the issuance of the Notice to Proceed, the Engineer will contact the Contractor to arrange for inspection of his equipment in accordance with Section 5.07 Following receipt of the Notice to Proceed with the work, and issuance of groups of work orders, the Contractor shall notify the Engineer at least seven (7) working days before he is ready to start actually cleaning, to allow the Department time to make arrangements for inspection of the work.

The general sequence of work shall be as follows in Section 3.00.3, but a detailed sequence of work shall be submitted by the Contractor and approved by the Engineer before any work is started. The Department reserves the right to make changes to the sequence as necessary to facilitate the work or to minimize any conflict with operations.

Work Issuances will be given to the Contractor in the order in which the Department wishes the manholes to be repaired. Issuances shall be worked upon and completed in the order in which they are issued and prior to beginning the work of subsequent Issuances, unless otherwise specifically permitted by the Engineer. While the Department will make every effort to issue specific work orders within the same area, there is no guarantee that repairs within the same Issuance will be confined to a particular region.

The Contractor is hereby advised that if, at any time, he has two groups of incomplete work orders, the Engineer reserves the right to withhold issuance of additional work orders, in accordance with Section 11 of the General Covenants and Conditions.

3.00.2 TIME OF COMPLETION AND LIQUIDATED DAMAGES

When the Department issues a group of work orders to the Contractor, he shall arrange his work to expeditiously complete the work of the group to a point of substantial completion, prior to requesting issuance of additional work. If at any time the Contractor has two outstanding incomplete groups of work orders, the Engineer reserves the right to hold issuance of additional work orders. In addition, the Contractor may be subject to the provisions of Section 11 of the General Covenants and Conditions. Time extensions will be reviewed, upon written request, for extenuating circumstances.

It is not the intent of the Department to penalize a Contractor who makes a good faith effort to quickly mobilize, works diligently and continuously to rehabilitate the sewer and utilizes equipment which does not break down excessively, halting production, or encounters abnormally and excessively dirty manholes. It is the intent of the Department to engender an atmosphere in which the Contractor will work continuously and efficiently through the inventory of work the Department needs performed and proceed at a rate of production to expedite contract capacity and contract time at a uniform rate. If extenuating circumstances are encountered, the Contractor may make a written request for a time extension, which will be reviewed on its merits.

It is recognized and agreed that the Engineer may withhold the issuance of further groups of work orders and hold the Contractor in Time Default should he not finish the work of an already assigned group of work orders in the time given plus any extensions of time granted by the Department. It is the intention of the Department to issue to the Contractor work orders in accordance with Department needs. Should the Contractor be issued a written notice that he is in a Time Default condition he shall be subject to the stipulations stated herein and provisions of Section 11, Construction Schedule, Time of Performance, of the General Covenants and Conditions.

With respect to the Contractor exceeding the assigned completion time of an individual group of work orders (beyond any extensions of time the Department may agree to, in accordance with Section 11 of the General Covenants and Conditions or for another good reason), the Department reserves the right not to issue the Contractor any further work orders until such time as he is no longer in Time Default and he has demonstrated, to the Department's satisfaction, that the reasons for his tardy production have been addressed and are not likely to be repeated in subsequent groups of work orders.

Should the Contractor remain in a Time Default condition for three consecutive weeks, and if he has not finally completed and been paid for at least fifty percent of the total bid value of the Contract, the amount of retainage deducted from his periodic progress payments will be increased to ten percent and will remain so until he has completed the "tardy" (beyond the assigned completion time) groups of work orders and the following assigned groups of work orders within the assigned completion time. If the Contractor remains in Time Default for a period exceeding six consecutive weeks, the Department may, at its option, retain another contractor to perform the work of this contract and/or terminate the Contract. While the Contractor is in Time Default, he may be barred from submitting proposals for subsequent or supplemental contracts. If his contract is terminated, he will be barred from submitting proposals until such time as the Department determines the circumstances which led to the Contractor's termination have been corrected and are unlikely to reoccur on future contracts.

Liquidated damages for this project shall be set at $1,000 per day. Liquidated damages will begin to accrue if the Contractor is in Time Default at the end of the project or in Time Default for six consecutive weeks on Work Orders during the contract period.

3.00.3 GENERAL SEQUENCE OF WORK

CAPITALIZED ITEMS INDICATE WORK OR FUNCTIONS TO BE PERFORMED BY DEPARTMENT FORCES. All other items shall be performed by the Contractor, with special emphasis on the fact that numerous standard and miscellaneous work phases are not mentioned specifically, but shall be performed by the Contractor as required for a completed Project.

The general sequence for the work, which is typical of each work location, shall be as follows:

Whenever the property owner's use of the sanitary sewer must be interrupted by the work, the Contractor shall notify the residents a minimum of 48 hours in advance of the interruption. They shall be informed when it will take place and the approximate duration. The Contractor shall make every effort to minimize inconvenience to the public and property owners. Should the Engineer order efforts above those instituted by the Contractor in this regard, his orders shall be final and no extra compensation shall be allowed.

General Notes

A. The Contractor shall be able to utilize different concrete protective coating systems for underground manholes. Manholes in the system are in different shapes and states of repair. Manhole rehabilitation systems such as Permacast may not work on uneven surfaces. The Contractor shall be prepared and experienced enough to perform cleaning, surface preparation and rehabilitation on manholes of all different shapes and conditions.

B. Exposed steel shall be cleaned to near-white metal and coated. A minimum of 2-inches of grout and coating material shall cover the exposed steel.

C. Patching of manholes walls and/or structures if necessary, shall be required in areas where voids exist, such as mortar missing, between bricks, around rung holes after the removal of rungs and steps, and spalled concrete. All loose, cracked and corroded

materials shall be removed from the area to be parched, exposing a sound substrate. A polymer mortar shall be applied to dampened surfaces.

D. When leaks are not readily identifiable upon cleaning operation use blower to dry interior for positive identification of leaks and weep areas.

E. Once the surface preparation is complete, the WASD Engineer shall determine the thickness of the concrete protective system that will be applied at each vertical foot of the manhole. The Engineer shall also determine if any rehabilitation will be done on the manhole bench areas. Payment for the rehabilitation work will be on a per square foot basis determined by the Engineer.

F. The Contractor shall have a NACE Certified Coating Inspector available for the work of this project. The Contractor's NACE Certified Coating Inspector shall be available upon request to provide the WASD Engineer information on surface preparation, rehabilitation methods, patching, coating application and testing.

G. The Contractor may encounter interceptor manholes as part of the work. Some large gravity lines may have been previously lined with Hobas Pipe and the top of the pipe cut out for access.

H. The Contractor shall prevent sand and debris from flowing down the gravity sewer with the use of screens, covers and other industry standard equipment acceptable to the Engineer.

I. Repair of deteriorated reinforcement shall only be done when ordered by the Engineer.

J. After surface preparation the Construction Manager along with the Contractor shall determine the thickness of repair required to rehabilitate the structure.

Sequence

The general sequence for the work, which is typical of each manhole rehabilitation location, shall be as follows:

1. Contractor shall visit all manholes assigned and proposed for rehabilitation and notify the Department in writing of any site conditions, such as lack of access, which would prevent the accomplishment of the work.

2. Submit to the Engineer the patching grout and concrete protective coating system used for the manhole rehabilitation. Coordinate with the Engineer and WASD Sewer Collection to determine the method of plugging and rerouting the existing sewage flows. Determine the time needed to rehabilitate the manhole and provide the approximate number of times the manhole would need to be isolated.

3. Contractor shall provide traffic cones, truck mounted beacons, and such additional maintenance of traffic measures as are required to satisfy local, state and federal highway requirements. See Section 10.00.2, "Maintenance of Traffic."

4. Prior to entering manholes the atmosphere shall be ventilated and evaluated by

the Contractor to determine the presence of toxic, flammable or explosive vapors or lack of oxygen in accordance with confined space entry requirements. Provide all applicable personal protective equipment. Prior to the start of resurfacing with concrete, the Contractor shall inspect the walls to verify that all groundwater infiltration has been completely stopped.

5. Place covers over sewer inverts to prevent extraneous material from entering the sewer lines. When performing work on the manhole bench, isolate the manhole by plugging flows, rerouting flows, intercepting laterals or other methods as approved by the Engineer.

6. Reroute or plug contributing sewer systems to minimize flow in sewer systems to minimize flow in sewer, if feasible, if approved by Engineer.

7. Remove foreign, loose and unsound concrete and/or bricks from the interior surfaces of the manhole by means of high pressure (4,000 psi minimum) water spray and or sand blasting. Loose unsound and protruding concrete and/or bricks not able to be removed by high pressure water spray may require the use of mason's or mechanical tools for removal.

8. Clean the interior surfaces of the manhole, with high pressure (4,000 psi minimum) water spray if necessary, using approved detergents (compatible with coating) to remove grease, oil and other contaminants that would prevent good bond between the existing manhole interior surface and the materials to be applied. If detergents or other cleaning agents are used, the final blast should be with clean water only.

9. Prior to the start of resurfacing the manhole, the Contractor shall video-inspect the manhole interior surfaces to verify that all groundwater infiltration has been completely stopped. Active hydrostatic leaks (infiltration) shall be stopped using rapid-setting specially formulated infiltration control gel. The Contractor shall seal the leak by injecting the sealing gel thru the manhole wall into the exterior space of the manhole.

10. Clean and prepare exposed reinforcement steel, and apply and cure bonding compound, in accordance with the product manufacturer's instructions and recommendations.

11. If the corrosion reaches into the reinforcing steel, clean the steel to near-white metal. Damaged steel rebars shall be repaired by splicing in new rebars attached to the existing undamaged steel with a bar-grip connection where ordered by the Engineer. This shall be done only where it is structurally needed to contain earth pressures.

12. The cleaned surface of the manhole shall be inspected by the Engineer. The surface of the manhole receiving the content patching compound or epoxy mortar shall be structurally sound, clean, dry and in a condition acceptable to the Engineer. Perform litmus test to determine if the concrete protective coating can be applied to the refurbished structure.

13. The corroded manhole shall be rehabilitated to its original wall thickness or as otherwise determined by the Engineer. For damaged or corroded concrete less

than 1-inch in depth use a Cement Patching Compound (Sika 123, Epoxy CPP, Tnemic Mortarcrete 217 or other specialty mix.) For damage or corroded concrete more than 1-inch depth, use an epoxy mortar mix to fill the voids up to 3/4-inch from the original surface of the manhole, and then apply the concrete patching compound in a 0.5-inch layer.

14. The damaged bench or manhole base including the flow channels shall be cleaned thoroughly including the breaking off the defective benching to ensure a complete manhole base. All work to be performed should ideally take place when the manhole is out-of-use and all flows have been stopped to ensure the correct amount of time required for the curing process. When sealing broken and/or fracture channels, ensure that as much or all moisture have been removed from the joints.

15. Contractor shall schedule and perform work in manner that does not cause or contribute to incidence of overflows, releases or spills of sewage from sanitary sewer system or bypass operation. Contractor shall consult with Engineer for location of pump. Contractor shall field locate existing utilities in the proposed bypass area and will allow minimal disturbance to existing utilities. During bypass pumping operation, protect sewer lines from damage inflicted by equipment.

16. Plugs: Selected and installed according to size of line to be plugged, pipe and manhole configurations, and based on specific site. Contractor shall have additional plugs available in the event a plug fails. Plugs will be inspected before use for defects which may lead to failure. Ensure plugs are properly rated for pressures required in this test; follow Manufacturer's safety and installation recommendations. Place plugs a minimum of 6 inches outside of manhole walls.

17. Apply cementitious epoxy lining to a minimum thickness in accordance with the manufacturer's instructions. Test thickness and perform a visual test in accordance with **Section 6.00.**

18. Perform all remaining work, restoration, and final cleanup.

19. Remove debris from the system and transport to a disposable site.

20. Video-inspect entire manhole interior surfaces after resurfacing interior of manhole and before returning manhole into service.

21. Remove all pipe plugs that may have been installed to stop the flow of sewage and return manhole into full service.

20. FINAL INSPECTION.

3.01 PRECONSTRUCTION CONFERENCE AND JOB MEETINGS

A. Preconstruction Conference

After the Award of Contract and prior to the issuance of the "Notice to Proceed," a Preconstruction Conference will be held with the Contractor, the Department, and others who are interested in the Project, for the purpose of coordinating the work. The time and place of

meeting will be set by the Engineer. The Engineer will discuss requirements of such matters as project supervision and inspections, progress schedules and reports, Contract Change Orders, insurance, safety, and other items pertinent to the Project. All parties to this conference should be prepared to discuss any problems anticipated with the execution of the work under this Contract

At this meeting, the Contractor shall submit a detailed staffing plan, with supporting data, demonstrating, to the Engineer's satisfaction, how the Contractor will perform all of the work listed in the Quotation during the contract time period. He must demonstrate the adequacy of the number of independent work crews (that he represented in the Quotation to be sufficient) to accomplish the total quantity of work. He shall increase the number of independent crews if he cannot demonstrate this to the Engineer's satisfaction. He shall also demonstrate that all of the crews he will provide to satisfy the need are, in fact, qualified and experienced, suitably equipped, available and ready to begin timely and productive work. In addition, a job meeting will be held sometime before each work authorization is issued. All parties to this meeting should be prepared to discuss any problems anticipated with the execution of the work under this Contract.

The Contractor shall also submit at this meeting a "Hurricane Preparedness Plan of Action" for approval. This plan shall be in accordance with the provisions of these specifications and be implemented when advised to do so by the Department.

In some cases the preconstruction conference may be held after the start work date stated in the written "Notice to Proceed." This may be due to difficulty with coordination of all parties concerned, or other similar reasons.

Such delays in holding the preconstruction meeting will not relieve the Contractor of any responsibilities hereunder, and will not be an acceptable reason for him to request additional work completion time beyond that provided since he could be obtaining permits, mobilizing his equipment and forces, ordering materials, performing minor work, or other work if approved by the Engineer, during the interim period.

B. Job Meetings

Weekly progress meetings shall be held at the project site as determined by the Engineer. The Contractor’s project manager or supervisory designee shall attend the weekly meeting to monitor the progress of the work.

Upon issuance of group of work orders, the Contractor shall prepare the work schedule, as described in Section 3.00.1, "Sequence of Work and General Information" of the Specifications and provide copies of same to others in attendance. The construction schedule shall include the place of beginning, the proposed order of progression, together with the estimated times for beginning and completing the various items of work. A construction schedule shall be prepared in advance and submitted to the Engineer weekly for the duration of the Contract.

3.02 PROJECT SIGNS

The County will supply portable signs for this Project. These signs will be produced, and furnished by County forces. During the construction period, the Contractor shall maintain the signs in good condition, satisfactory to the Engineer. Should the signs be defaced, damaged or destroyed, the Contractor shall be responsible for their repair or replacement to the satisfaction

of the Engineer and no extra compensation will be allowed. The Contractor shall place the signs at locations as directed by the Engineer at each deployment site. At the completion of the Contract, all signs must be returned to the Department.

3.03 PERMITS

All necessary permits shall be obtained by the Contractor. The Contractor shall familiarize himself with and comply with all requirements of these necessary permits.

The Contractor's particular attention is called to any special condition of the permits relating to the construction procedures, working hours, and all other general and specific conditions. In the event any of the conditions of the permits are in conflict with the requirements of these Specifications, the more stringent conditions shall take precedence.

Any deviations from the Specifications or permits must first be approved by the Engineer, even if approval for the change has been given by the permitting agency. The Contractor shall notify the appropriate Department Representative of the commencement of work and also immediately upon completion. The Contractor shall also furnish to the Representative an emergency 24-hour telephone number. The Contractor is responsible for all emergency activities required from the Permit.

The Contractor shall assume throughout the life of the Contract all obligations and responsibilities imposed on the Department as permittee of the above-mentioned permits. All expenses necessary for compliance with the regulations and requirements of each permitting agency and its permit shall be borne by the Contractor, and shall be included in his overall bid price. Reimbursement for permit fees only will be provided through the appropriate bid item in the Quotation. To facilitate reimbursement, the Contractor shall provide the Engineer with copies of permit fee receipts and upon request, copy of canceled check.

The cost of any fees such as impact fees, inspection fees, etc. and the direct cost of obtaining all required permits shall be borne by the Department. The Contractor shall pay the required fees, obtain the permit(s) and then upon submission of proof of cost to the Department, be reimbursed for said cost out of the Dedicated Allowance for permit fee reimbursement. This shall apply only to required permits and fees. Permits obtained or fees paid for the advantage of the Contractor or non-required permits obtained for whatever reason shall not be reimbursed. The necessity or non-necessity of a permit or fee shall be determined by the Engineer who's word shall be final. As specified in the paragraph above, all costs of compliance with the permit(s) shall be borne by the Contractor and included in his bid price. The retainage percentage as specified in Section 28 of GC & C and the 1/4 of one percent deduction for the Miami-Dade Inspector General as specified in Section 29 of the "Instructions to Bidders" will be deducted from any reimbursement payment.

The Contractor is required to close out the permit with the permitting agency having jurisdiction in order to receive the money from the Dedicated Allowance Account established for that purpose. Permit fees will be reimbursed by the Department only when the Engineer receives confirmation to his satisfaction that the permit has been closed.

3.04 SAFETY REQUIREMENTS

The Contractor shall be in compliance with all applicable provisions of the Occupational Safety and Health Act of 1970 and any subsequent amendments and revisions thereto. The Contractor's Manual of Safety Practices, dealing with the firm's policies on field safety

procedures for employees, shall be submitted to the Engineer for his review before "Notice to Proceed" will be issued.

The Contractor's personnel will be in the vicinity of raw sewage. For his own protection, as well as for his employees, he shall check with the Miami Dade County Health Department, and based upon their recommendation, shall have his personnel properly immunized against disease.

Under this contract, personnel may be required to enter the existing manholes/sewers to perform certain items of work. Before entering, the Contractor shall be in compliance with Miami-Dade County Manhole Ordinance No. 83-3 (which mandates, in part, that above-ground safety personnel shall be on duty at all times when someone enters or works in a manhole/sewer) and the air within a manhole/sewer shall be tested with a combination oxygen deficiency meter-explosion meter to determine oxygen content and explosion potential. A test for the presence of hydrogen sulfide shall also be performed. The work area must be ventilated mechanically by the use of an air blower, before entry and during occupancy, to insure that an adequate quantity of oxygen is supplied to the work area.

The Contractor shall comply with but not be limited to the following OSHA Regulations that are found applicable to this project:

Process Safety Management (29 CFR 1910.119)	Commercial Diving (29 CFR 1910.401)
Confined Space Entry Procedures (29 CFR 1910.146)	Welding and Cutting (29 CFR 1926.350)
Respiratory Protection (29 CFR 1910.134)	Movement of Traffic (DOT Index)
Fall Prevention Protection (29 CFR 1926.104)	Industrial Truck / Forklift (29 CFR 1910.178)
Excavation Protection (29 CFR 1926.650)	Electrical Safety (29 CFR 1910.301)
Personal Protective Equipment (29 CFR 1910.132)	Industrial Truck / Forklift (29 CFR 1910.178)
Lockout/Tagout (29 CFR 1910.147)	Crane Operations (29 CFR 1926 & ANSI)
Air Monitoring (29 CFR 1910.1000)	Scaffolding (29 CFR 1926.451)
Asbestos & Lead Abatement (29 CFR 1910.1001, 1025)	Blood Borne Pathogens (29 CFR 1910.1030)

In addition, the Contractor shall adhere to any other applicable Federal, State and Local Safety and Health Regulations involving General industry and/or Construction Standards not mentioned in the Specifications.

The Contractor shall conduct his operations in such a manner, utilizing warning devices such as traffic cones, barricades and warning lights, and personnel such as flagmen and uniformed police officers, that the public is given adequate warning of hazards of the work site as may be deemed necessary by the County and/or the Engineer. See Section 7.03 "Maintenance of Traffic."

In the instance of men working within the sewer or manholes, the Contractor shall provide safety provisions to cover the possible consequences of structural failure and/or flooding. Such provisions might take the form of, but not be limited to, pump down of ground

water level below pipe level; stand-by pumping equipment; extra air supplies; and such other measures as the situation and good construction practices might indicate.

Certain products specified in these Specifications contain warnings by the manufacturers that under certain conditions, if instructions for use of the product are not followed, a hazardous condition may exist. It is the Contractor's responsibility to instruct his workmen in the safe use of the product, or any product substitution and to provide them with the Material Safety Data Sheets.

3.05 HURRICANE PREPARDNESS

General

During such periods of time as are designated by the United States Weather Bureau as being a hurricane alert, the Contractor shall perform all precautions as necessary to safeguard the work and property, including the removal of all small equipment and materials from the site, lashing all other equipment and materials to each other and to rigid construction, and any other safety measures as may be directed by the Engineer.

Upon Notification of a Hurricane Watch

A formal notification to all Contractors to prepare and submit for approval a Plan of Action for the specific actions to be taken on their particular projects.

Upon Notification of a Hurricane Warning

a. Formal notification to the Contractors to implement their approved Plan of Action to protect the project and the public.

b. For Construction contracts at a Water or Sewer Plant, a copy of the notifications will be provided to the Plant Superintendent. The Plant Superintendent is also requested to notify the Construction Manager of any assistance he may need from the Contractor in order to secure Plant entities.

c. For pipeline construction projects within the public right-of-ways, the Contractor will be notified by the Construction Manager's Office to suspend his construction operations. The Contractor will backfill all open trenches, remove all construction equipment and materials from the right-of-way, remove unnecessary traffic barricades and signs, secure remaining barricades by "half burial" or "double sand bags".

4.00 MATERIALS AND EQUIPMENT FURNISHED BY THE DEPARTMENT

No material or equipment, except potable water will be furnished by the Department under this Contract. All other material, supplies and equipment necessary for completion of the work shall be furnished by the Contractor.

4.01 WATER USED IN CONSTRUCTION

A. The Department will furnish water for construction purposes free of charge from adjacent water mains, however, all water used must be metered through a Department meter. Failure of the Contractor to meter the water, or providing others with water, could result

in his being fined and/or a citation being issued against him in accordance with the rules and regulations of the Department's Tampering Section.

B. The Contractor can obtain the meter through proper application and payment of deposit fee at the Department's New Business Office, 3575 South LeJeune Road, Miami, Florida. The deposit fee will be refunded to the Contractor upon return of the meter in a sound satisfactory condition. The largest meter available is 2-inches NPS, and the required deposit is $2,500.00. Any additional fees which may be required by other governmental agencies for utilizing the fire hydrants shall be borne by the Contractor and shall be included in his bid.

C. All temporary piping, valves, hoses, equipment and other items required for handing water shall be furnished by the Contractor. Under no circumstance shall the Contractor utilize a water source until such source has been approved by the Engineer.

D. When the project is occurring in Unincorporated Dade County, the City of Miami or Coral Gables, the Contractor shall present a Dade County, City of Miami or Coral Gables, respectively, Fire Department Permit during application with New Business Office. This requirement may also apply to some municipal areas of Miami Dade County.

E. The deposit fee will be refunded to the Contractor upon return of the meter in a sound satisfactory condition. The largest meter available is 2-inches NPS. Effective October 1, 2007, the required deposit for a 2-inch meter is $2,500.00 plus $140.00 service charge. For current fees contact the Department's New Customer Division at (786) 268-5200. Additional fees may be required by other governmental agencies for utilizing existing sources of water.

F. All piping, fittings, valves and equipment, including pumps and power, required for handling the water shall be furnished by the Contractor. Care shall be exercised in the use of the water and provision shall be made to protect the water supply for contamination and indiscriminate use by unauthorized persons. The Contractor shall use only potable water unless otherwise specifically called out elsewhere herein and then only in the case of sewage force mains, reclaimed water mains or raw water mains.

G. Under no circumstance shall the Contractor utilize a water source, including existing piping, until such source or piping has been approved for use by the Department.

5.00 MATERIALS AND EQUIPMENT FURNISHED BY THE CONTRACTOR

The general requirements specified herein shall apply to all items of material and equipment in addition to the specifications for individual items appearing in the following Sections in the 5.00 series.

All materials furnished by the Contractor for use in the work shall be the products of reliable manufacturers or suppliers who, unless otherwise specified, have been regularly engaged in the manufacture of such materials and equipment for at least five (5) years. All fittings and components shall, wherever possible, be standard stock articles of well-known manufacturers. Where the Plans and Specifications designate the products of a particular manufacturer, the product specified has been found suitable for the intended use, but, unless otherwise provided, articles or products of similar characteristics may be offered for the approval of the Engineer. A minimum of six copies (more if so required elsewhere herein) of complete descriptive data shall be furnished regarding all materials furnished by the Contractor,

consisting of dimension drawings, catalog references and other information necessary to clearly identify and evaluate each article. When substitutions are permitted, the Contractor shall make all necessary changes in adjacent or connected structures and equipment at his expense and shall be solely responsible for all cost and time required by any difference in construction methods, fabrication or assembly required and no additional time will be allowed. Any re-permitting together with all costs and work associated therewith shall be performed by the Contractor and no additional compensation will be allowed.

The Contractor is advised that the Sewer Atlas plates are schematic in nature and surveys of the existing sewer system, if any are available, may contain inaccuracies. He shall, therefore, take accurate measurements prior to conducting the work. Any delays caused by such problems shall be at the Contractor's expense and no extension of time will be allowed.

The Contractor shall exercise care to prevent damage to existing material and equipment components of the sewer system for the duration of the Contract, and shall repair or replace (with new items acceptable to the Department) any damaged or lost materials and equipment components. He will be relieved of such responsibility only upon final acceptance of all of the work by the Engineer.

With the following exceptions, materials and equipment removed from existing structures shall not be reused in the work even if deemed savable by the Engineer. All manhole covers and frames, if removed during construction, shall be reinstalled on the structure from which they originated.

The following list is inclusive of all the work to be performed under this contract:

- Cleaning and surface preparation
- Rehabilitation of Manholes that are severely, moderately and superficially Corroded
- Leak Sealing with Injections of Chemical Grout
- Repairs of Base, Bench, and rebuilding of Channels
- Repairs of Corroded Reinforcing Steel, only when ordered by the Engineer
- Removal of Manhole Steps, Plugging and Waterproofing of Manhole wall Areas after the Removal of the Steps
- Bypass Pumping of Sewage Manholes
- Post-cleaning video inspection
- Post-rehabilitation video inspection

5.00.1 WARRANTY

All materials furnished by the Contractor, and particularly manufactured items, shall be certified by the manufacturers as to their materials properties and suitability for the intended service. In general, the materials and installation shall be fully warranted by the Contractor and manufacturers to be free from defects in material or function for one-year (1) basic period from the date of acceptance by the Department of all work performed and accepted by the Engineer during the Contract duration. During the warranty period, any defects which affect the strength, integrity of intended function of the repaired manholes or the repair components shall be repaired or replaced by and at the sole expense of the Contractor in a manner and with a method acceptable to the Engineer. Warranty period ends one year after acceptance of each manhole completed.

5.00.2 SHOP DRAWINGS

The Contractor shall submit to the Engineer for approval, shop drawings in accordance with the requirements of Section 9, "General Covenants and Conditions." Shop drawings shall be submitted for all materials and equipment to be furnished, methods proposed to be utilized, and the experience of the firm and personnel to be assigned to the cleaning and repair work. Submittal documents shall generally not be larger than 11 by 17 inches and shall be suitable for easy photocopying. If larger drawings are submitted, they shall be accompanied by a clear sepia for ease of reproducing review comments.

Prior to submission, the Contractor shall thoroughly check such drawings, satisfying himself that they meet the requirements for the Specifications and that they are coordinated with the arrangements set forth on other shop drawings, and shall place on them the date of his approval and his signature. Where items for which shop drawings are submitted are to meet special conditions listed in the Specifications, the conditions shall be so noted on the drawing. Where there is a deviation from the Specifications, the Contractor shall note it and state the reason why a deviation is required.

The approval of shop drawings and data will be general, and will mean that, upon examination of the shop drawings, no variations from the Contract requirements have been discovered, and approval will not relieve the Contractor of his responsibilities as defined under the Contract.

Satisfactory precautions shall be taken to protect the sanitary manholes from damage that might be inflicted upon them by the improper use of cleaning and coating/liner installation equipment. Any damage inflicted upon the sewer which is caused by the improper use of the cleaning and manhole repair equipment, regardless of the methods used, shall be repaired by the Contractor at no additional cost to the Department and to the satisfaction of the Engineer.

5.00.3 SUBSTITUTIONS

Changes in products, materials, equipment, and/or methods of construction required by the Contract Documents, which are proposed by the Contractor after award of the Contract is considered to be requests for substitutions. Where the Specifications designated the products of a particular manufacturer, the product specified has been found suitable for the intended use. Articles or products of similar characteristics may, prior to use, be offered for the approval of the Engineer, whose decision shall be final. Copies of complete descriptive data shall be furnished regarding all materials furnished by the Contractor, consisting of dimension drawings, catalog references, product data, cost, and other information necessary to clearly identify and evaluate each article. When submissions are permitted, the Contractor shall make all necessary changes in adjacent, connected or other structures and equipment at his expense.

Where contemplated changes, substitutions or appurtenant work requiring engineering design, in the opinion of the Engineer, the Contractor shall have such design services performed at his expense. Said engineering design services shall be of an extent satisfactory to the Engineer whose decision shall be final. Engineering services for contemplated changes, substitutions or appurtenant work, shall be performed by a Registered Professional Engineer licensed to practice in the State of Florida. Further, all drawings and submittals shall be signed and sealed by a Registered Professional Engineer licensed to practice in the State of Florida.

In some instances, a credit may be due to the Department. Unless specifically

authorized by the Engineer in writing, no additional contract time will be allowed, and a decrease in time may be appropriate.

5.01 MANHOLE REHABILITATION SYSTEMS

5.01.1 GENERAL

All concrete protective coating systems shall be pre-approved by the Water and Sewer Department based on testing done within the WASD system. Only products that have had a successful test application within the Miami-Dade Water and Sewer Department system and approved by WASD forces shall be allowed.

Each manhole shall be coated with an extremely low shrinkage cementitious repair product to waterproof and enhance the structural integrity of the manhole and then apply 100 percent solids epoxy for corrosion protection after the manhole has been properly prepared.

The materials used shall be designed, manufactured, and intended for sewer manhole rehabilitation and the specific application in which they are used. The selected product or system must bear the manufacturer's certification that it will fulfill the requirements described herein when applied in accordance with his recommendations. The Contractor shall supply a list of locations and references for other projects in which the product was used within the previous three years.

The materials shall be delivered to the job site in original unopened packages and clearly labeled with the manufacturer's identification and printed instructions. All material shall be stored and handled in accordance with recommendations of the manufacturer.

5.01.2 PRE-APPROVED PRODUCT LIST – CONCRETE PROTECTIVE COATING

A. PREAPROVED PRODUCTS LIST

1. Available Manufacturers: The manhole coating products below have passed the WASD testing protocol and have been approved for use for rehabilitation of standard manholes. The manhole rehabilitation products shall be used as a complete system with no third party products used unless approved in writing by the coating manufacturer. A one year warranty on the complete coating system from the project completion is required.

- **a. Uroflex as manufactured by Epoxytec International**
- **b. PPC as Manufactured by Polymorphic Polymers Corporation**
- **c. SP15 Spray Mortar, Sewer Guard HBS 100 Epoxy Liner by BASF**
- **d. Permaform MS-10,000 Fortified with ConShield or Cor-Guard Epoxy**
- **e. SprayRoq, Spray Wall and SprayShield GT Coating**
- **f. GEOKRETE System as manufactured by Quadex**
- **g. Mainstay DS-5 High Build Epoxy, Mainstay ML-72 Restoration Mortar**
- **h. GML Coating System: Green Monster Epoxy, GML-30 and GML-60 Epoxy Cement**
- **i. Raven Lining System: Raven 405 Epoxy, Raven 755 Epoxy**

Mortar

2. If a product on the Pre-approved list proves to be unsuccessful in WASD applications, the product can be removed at the discretion of the Engineer. The Contractor shall be required to utilize another concrete protective coating system at no additional cost.

3. If the Contractor selects an approved product that is not suitable for an application on a particular manhole due to irregular surfaces, cure time, location, access or other reasons, another suitable concrete protective coating shall be applied. No additional compensation will be allowed.

4. The concrete protective coating system used shall have a cement underlayment approved by the coating manufacturer for application with the product. The Contractor shall not use any underlayment that may void the manufacturer's warranty. The epoxy cement used shall have written approval from the coating manufacturer.

5. Calcium Aluminate coatings are not acceptable for rehabilitation of WASD manholes.

5.02 PREPARATION OF CONCRETE SURFACES

A. Work in this Section includes hydroblasting (Water Pressure) cleaning, sandblasting, concrete removal and testing for moisture content and soundness of concrete.

B. Blasting Sand: Clean sand blasting sand free of impurities passing through 200 sieve. Verify that surfaces are ready to receive work. Prepare and protect adjacent work from damage.

C. REHABILITATION CLEANING:

1. Prior to any rehabilitation work, the manhole shall be thoroughly cleaned to produce a clean interior surface free of all coatings, sand, rock, sludge or other damaging materials.

2. During all cleaning and preparation operations all necessary precautions shall be taken to protect the chamber from damage.

3. All sludge, dirt, sand, rock, grease and other solid or semi-solid materials resulting from cleaning or surface preparation operations shall be removed from the immediate work site.

4. The rubber-based coating and any other coatings shall be completely removed by any means acceptable to the Engineer.

5. All waste materials and debris resulting from the manhole preparation shall be removed and conveyed to the County's Class I sanitary landfill, the South Dade Solid Waste Disposal Facility, 24000 S.W. 97th Avenue, Dade County, Florida. All cost for such removal and disposal, including tipping fees, shall be included in the prices quoted under the various Bid Items and

no other compensation will be provided. Under no circumstances shall sludge or other debris removed during these operations be dumped or spilled onto the streets, ditches, storm drains or other sanitary sewers.

D. Preparation of Concrete Surfaces

1. Hydroblasting: The Contractor shall remove loose and deteriorated concrete and all existing coatings and contaminants in the areas that are to be lined by hydroblasting. The hydroblasting operation shall conform to:

   a. Hydroblasting shall be used to provide a clean, contamination free, roughened and sound surface. It is intended that the hydroblasting will alter the profile of the concrete and clean any exposed rebar. Flush out cracks and voids with water to remove laitance and dirt. Clean concrete surfaces of dirt or other contamination; wire brush using water; rinse surface and allow drying.
   b. Acceptably cleaned and prepared surfaces shall be free of laitance, efflorescence, oil, grease, rust and other penetrating contaminants. The surface shall be free of fins, projections and loosely adhering concrete and dirt particles. Remove fins and projections by mechanical means.
   c. Equipment shall sustain water pressure of at least 4,000 psi at the nozzle, be capable of delivering a minimum of five (5) gallons of water per minute which would require at least an 84 horsepower engine.
   d. Use the equipment in accordance with the manufacturer's instructions. Organize the work to thoroughly cover the area specified for repair.
   e. Particulate waste created by hydroblasting shall be removed and disposed. All of the waste or debris created shall be reclaimed and not allowed to move on downstream.
   f. The hydroblasting operation shall conform to all local, state and federal air quality standards and regulations.

E. REMOVAL OF DETERIORATED CONCRETE

1. Removing Deteriorated Concrete: After hydroblasting, concrete substrates with severe hydrogen sulfide damage shall have all contaminated concrete removed by scabbling, chipping, grinding, brushing, blasting or other methods to a depth where all the white calcium sulfate is removed and only hard grey concrete with a surface pH between 7.0 and 11.0 remains.

2. Any reinforcing steel exposed by removing deteriorated concrete shall be thoroughly cleaned by sandblasting to remove all contaminated concrete and rust particles and coated to inhibit rust.

3. Immediately after the cleaned reinforcing steel is inspected and accepted by the Engineer, the Contractor shall place a protective coating on the exposed reinforcing steel.

4. When the deteriorated concrete is removed, the Contractor shall

thoroughly clean the surface to remove all fines and deleterious materials that will adversely affect the bond of the proposed liner material.

F. INSPECTION OF SURFACES

1. Inspection of Concrete Surfaces: All surfaces where deteriorated concrete has been removed will require a Litmus Test inspection by the Engineer to determine sound concrete prior to commencement of the repair operation. The surfaces will be tested for acidity and moisture. If the pH of the surface is less than 7.0 additional concrete shall be removed to a depth where the surface reading is equal to or greater than a pH of 7.0.

G. ACCEPTANCE OF CONCRETE SURFACE

1. Acceptance: The Contractor shall measure the surface pH, moisture content and temperature of the prepared concrete surface prior to beginning the lining operation. The acceptable ranges, as recommended by the lining manufacturer, shall be used to determine whether lining application may proceed and shall determine the choice of primer to be applied. The Contractor shall also check the concrete surfaces for residual laitance by visual inspection with magnification if necessary and by primer application on suspect areas. If the primer does not penetrate the concrete surface by turning the surface dark and the laitance area can be visually detected; the Contractor shall not accept the surface and shall have the area sandblasted for laitance removal.

H. FIELD QUALITY CONTROL

1. Field inspection and testing will be performed per coating manufacturer's written instructions so as not to void any warranties provided.

2. Final Surface Inspection: Check surface pH and moisture content of the concrete to comply with the manufacturer requirements for pH and moisture content.

3. Test concrete for calcium chloride and moisture content during the execution of the Work.

5.03 CONCRETE REPAIR

A. The work under this section includes: Preparation of concrete and application of repair materials. Rehabilitation and Restoration of concrete surfaces. Repair of concrete internal reinforcement.

B. Indicate product standards, physical and chemical characteristics, technical specifications, limitations, maintenance instructions, and general recommendations regarding each material.

C. Manufacturer's Certificate: Certify that specified products meet or exceed specified requirements.

D. Accurately record actual locations of structural reinforcement repairs, type of

repair, and extent.

E. Perform welding work in accordance with ANSI/AWS D1.4.

F. MANUFACTURERS

1. Epoxytec International, Sika, SPRAYROQ, Tnemic or approved equal.

G. PATCHING MATERIALS

1. Concrete Patching Material: EPOXYTEC CPP, EPOXYTEC MortarTec Silicate, Sika 123 Plus, Tnemic Mortarcrete Series 217, or approved equal.

2. Repair of Removed Concrete Areas: EPOXYTEC CPP, EPOXYTEC MortarTec Silicate, Sika 123 Plus, Tnemic Mortarcrete Series 217, or approved equal. In cases where the deteriorated concrete is over 1–inch in depth, use a standard epoxy mortar to fill the void to 3/4-inch.

3. Bonding Agent: Polyvinyl acetate emulsion, dispersed in water while mixing, non-coagulant in mix, water resistant when cured.

4. Portland Cement or BASF Cement: ASTM C150, Type II, grey color.

5. Sand: ASTM C33 and C404; uniformly graded, clean.

6. Water: Clean and potable.

7. Cleaning Agent: Commercial muriatic acid.

H. REINFORCEMENT MATERIALS

1. Reinforcing Steel: ASTM A615, 60 ksi yield grade billet-steel deformed bars, epoxy finish.

2. Stirrup Steel: ANSI/ASTM A82.

3. Splicing Sleeves: Bar Grip or equal for the size of bar been spliced as manufactured by Barsplice Products, Inc.

I. MIXING MORTARS

1. Mix mortars in accordance with manufacturer's instructions for purpose intended.

2. Mix components in clean equipment or containers. Conform to pot life and workability limits.

J. EXAMINATION

1. Verify that surfaces are ready to receive work.

2. Beginning of installation means acceptance of substrate.

K. PREPARATION

1. Clean concrete surfaces of dirt, laitance, corrosion, or other contamination; wire brush using water; rinse surface and allow to dry.

2. Flush out cracks and voids with water to remove laitance and dirt.

3. Provide temporary entry ports spaced to accomplish movement of fluids between ports; no deeper than the depth of the crack to be filled or port size diameter no greater than the thickness of the crack. Provide temporary seal at concrete surface to prevent leakage of adhesive.

4. For areas patched with epoxy mortar, remove broken and soft concrete 3-inches deep. Remove corrosion from steel. Clean surfaces mechanically; wash and rinse with water.

5. Clean the exposed reinforcement steel surfaces. Mechanically cut away damaged portions of bar.

L. REPAIR WORK

1. Repair exposed structural, shrinkage, and settlement cracks of concrete by patching with Micor CPP, Sika 123 Plus, Tnemic Mortarcrete Series 217 or an approved equal patching compound.

2. Repair spalling. Fill voids flush with surface. Apply surface finish.

3. Repair reinforcement by attaching new bar reinforcement (#3 min.) to existing reinforcement with tie wires or sleeve splices.

M. REPAIR AND ACCEPTANCE OF CONCRETE SURFACE

1. Repair of Concrete Surfaces:

a. Concrete surfaces which are to receive a protective co-lining system and which have deteriorated to the point where they are not suitable for lining shall be repaired with a structural polymer cement patching compound and reinforcing steel. The Contractor shall rebuild the concrete surfaces to their original lines and shapes where damaged concrete has been removed as stated above.

b. All concrete surfaces that are repaired and which are to receive a protective co-lining system shall have a controlled pattern sweep of waterblast to remove all laitance from the repaired areas. The blast pattern shall be by systematic removal from a defined rectangular area. The blasting operation shall be followed by a thorough cleanup operation including air drying and vacuuming to provide a clean dry surface for the protective co-lining system.

c. Cement Patching Compound: CPP, EPOXYTEC MortarTec Silicate, Sika 123 Plus, Tnemic Mortarcrete Series 217 or approved equal, shall be used to repair the deteriorated concrete surfaces. The patching compound must be accepted by the protective lining manufacturer and the Engineer as to compatibility with the protective lining. The Contractor shall follow the instructions and recommendations of the patching compound

manufacturer as to application, giving special attention to their time requirements, depth of repair, surface preparation procedures and curing time.

2. Structural Concrete Repair:

   a. Structural concrete repair shall be used to repair deteriorated concrete surfaces with fill depths greater than 2 inches that have the existing reinforcing corroded away and at areas as may be required by the Engineer. The areas shall be repaired using Epoxytec CPP, Sika 123 Plus, Tnemic Mortarcrete placed as specified above along with reinforcing steel as needed. Existing reinforcing steel that remains and is exposed shall be coated with 40 mils of EPOXY TEC A-1 Primecoat with Micor Uroflex, Sikatop 108, Armatec, or 20 mils in two coats of Sika Armatec 110.

   b. All surfaces where structural concrete repair materials will bond with existing concrete shall be coated with the bonding agent Micor Primer with Micor Uroflex 20 mils, Sika Armatec 110, by Sika Corporation. The bonding agent shall be applied in strict accordance with the manufacturer’s instruction and shall have a minimum thickness of 20 mils.

3. Finish of Repaired Surfaces:

   a. General: The repaired concrete surface shall in general have a finish that will match the uncorroded surface.
   b. Surface Finish: "Ordinary Surface Finish" shall approximate the required finish for the protective co-lining system.
   c. Procedure for Finishing: The final finish shall be flat and smooth by wood float or steel troweling. The concrete repair material manufacturer's requirements as to finishing shall be strictly adhered to, particularly as to time and moisture requirements

4. Curing: Curing of repaired concrete with Structural Polymer Cement Patching compound shall be in accordance with manufacturer's instructions. Concrete curing compounds are not allowed. The Contractor shall protect the newly repaired concrete from scarring or other damage.

5. Cleanup:

   a. The Contractor shall provide a continuous cleanup operation for the concrete repair work. Sand, concrete debris, and other materials shall be removed daily.

   b. At completion of the concrete repair work, remove all construction equipment, surplus material, debris and sand; wash down and sweep the area clean, prior to beginning the protective co-lining application. The Contractor is also required to provide a collection system to prevent Structural Polymer, debris and other materials from entering the flow of any part of the sewer system that remains in operation.

N. Acceptance: The Contractor shall measure the surface pH, moisture content and

temperature of the prepared concrete surface prior to beginning the lining operation. The acceptable ranges, as recommended by the lining manufacturer, shall be used to determine whether final coating application may proceed and shall determine the choice of primer to be applied. The Contractor shall also check the concrete surfaces for residual laitance by visual inspection with magnification if necessary and by primer application on suspect areas. If the primer does not penetrate the concrete surface by turning the surface dark and the laitance area can be visually detected; the Contractor shall not accept the surface and shall have the area water-blasted again for laitance removal.

5.04 CHEMICAL SEALING MATERIALS FOR ACTIVE LEAKS

Chemical sealing materials used on this Project shall have the following properties: react quickly to form a permanent water tight seal; resultant seal shall be flexible and immune to the effects of wet/dry, freeze/thaw cycles; non-biodegradable and immune to the effects of acids, alkalis, and organics in sewage; component packaging and mixing compatible with field conditions and worker safety; cleanup can be accomplished without heavy use of flammable or hazardous chemicals; and extraneous sealant left inside manhole shall be readily removable.

Chemical sealing material shall be acrylic resin type and shall be furnished with activators, initiators, inhibitors and any other materials recommended by the manufacturer for a complete grout system. Sealing grout shall be furnished in liquid form in standard manufacturer's containers. Sealing grout shall be AV-118 manufactured by Avanti International, Houston, Texas (1-800-877-2570), Avanti Chemical Grout manufactured by Avanti International, Webster, Texas (1-800-877-2570) or approved equal.

Chemical grouts that are submitted as approved equals shall require successful test applications before any system-wide is allowed. Coordinate test applications and monitoring with WASD forces.

A. INJECTION - EPOXY RESIN ADHESIVE

1. Plug the leak with hydraulic cement, drill holes in manhole structure to plug the leak on the exterior of the manhole with a chemical injection acrylic resin. Inject adhesive into drilled locations in manhole ports under pressure using equipment appropriate for particular application.

2. Begin injection at lower entry port and continue until adhesive appears in adjacent entry port. Continue from port to port until entire crack is filled.

3. Remove temporary seal and excess adhesive.

4. Clean surfaces adjacent to repair and blend finish.

B. APPLICATION - EPOXY MORTAR

1. Trowel apply mortar mix to an average thickness of 2 inches. Tamp into place filling voids at spalled areas.

2. For patching honeycomb, trowel mortar onto surface, work mortar into honeycomb to bring surface flush with surrounding area. Finish trowel surface to match surrounding area.

3. Cover exposed steel reinforcement with epoxy mortar, feather edges to flush surface.

5.05 PROTECTIVE COATING

A. The Contractor shall utilize a concrete protective coating from the pre-approved product list to rehabilitate the manhole. The surface preparation shall be inspected and approved by the Engineer prior to application of the concrete protective system. Work that is continued from a previous day shall be re-cleaned as required for proper surface preparation. The substrate shall be allowed to cure for 24 to 48 hours before applying coatings.

B. Spalled or deteriorated concrete shall be repaired prior to coating application.

C. The purpose of this specification is to obtain a dense and durable concrete coating or liner for the repair of voids, for the restoration of structural integrity, and to provide corrosion resistant material.

D. Provided are procedures for:

a. Structure Preparation.
b. Cleaning.
c. Application.
d. Curing.

E. Product data for each coating system specified, including primers and surface preparation.

1. Provide the manufacturer's technical information, including label analysis and instructions for handling, storing, and applying each material proposed for use.

2. List each material and cross-reference the specific coating, finish system, and application. Identify each material by the manufacturer's catalog number and general classification.

3. Certifications by the manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOC's).

F. WARRANTY

1. This product shall be free from defects in materials and workmanship. Provide a manufacturer's warranty to include replacement cost of materials and installation for defects against leaks, surface deterioration, spalling, cracks, crazing, and other observable defects. Warranty shall cover one year (1) after final acceptance of the Project.

G. QUALITY ASSURANCE

1. Success of the coating application is dependent on the surface preparation. The Engineer and the coating manufacturer's field technician provided by the Contractor shall inspect the surface preparation prior to the coating.

2. The concrete patching paste used shall be of the same manufacturer and compatible with the coating.

H. PREPARATION

1. Remove any loose or unsound material by means of high water or sand spray in accordance with Section 5.02, “Preparation for Resurfacing Concrete,” and Section 5.03, “Concrete Repair” to grey concrete.

2. Completely remove any coated, scaly, or unsound masonry material to achieve a good bonding surface.

3. Check concrete surfaces for proper pH after preparation. If surfaces are not between ph 7.0 and 11.0, adjust pH in accordance with manufacturer’s recommendations. For high pH, wash surfaces with muriatic/hydrochloric acid wash, or with a magnesium solution. For low pH, wash concrete surfaces with common ammonia or caustic solution. Upon reaching proper pH, prime surfaces as soon as possible. Test results shall be retained for review by the Engineer.

I. MIXING AND APPLICATION

1. Preparation of patching material and protective coating shall be done in accordance with the manufacturer’s instructions. Provide the Engineer with the detailed product preparation and application guidelines established by the coating system manufacturer. Materials that did not receive proper storage, exceed the recommended pot life after mixing or have otherwise been compromised shall not be used on the project. The Engineer shall have the authority to order removal and re-application of improperly prepared or installed coating systems.
2. Apply the concrete protective coating as per manufacturer’s installation instructions.
3. Apply the concrete protective coating to the specified thickness.
4. Perform visual inspection of concrete protective coating system. Correct any defects and touchup areas determined by the Engineer.

5.06 MANHOLE BENCH AND CHIMNEY

A. The manhole bench and flow channel shall be rehabilitated and coated with a concrete protective coating where ordered by the Engineer on a per square foot basis. The Contractor shall plug and intercept the flow into the manhole and reconstruct the bench and flow channels. Coordinate with the Engineer to plug flows or install thru plugs into the manhole being rehabilitated.

B. The Engineer shall have the authority to order force curing of the flow channel and manhole bench grout and coatings if the surcharging of the gravity system cannot be maintained. Restricted flows due to smaller pipe diameters of thru plugs shall be monitored for unsustainable surcharging. The Contractor shall be responsible for utilizing materials and methods that will allow the rehabilitation work to be accomplished without having overflows or other detrimental effects on the sewage collection system. The Engineer can at any time order plugs or thru plugs removed to accommodate system needs.

C. The manhole Chimeny shall be rehabilitated with a flexible coating material that

will not crack due to vehicular loads. The acceptable coating for the chimeney shall be Epoxytec Uroflex (Uroseal for high traffic areas), GEOKRETE or approved equal. Provide an overlap of at least 10-inches with the flexible coating.

D. Grout used to reconstruct the manhole bench shall be a quick drying grout that will withstand erosion, Epoxytech CPP, Tnemic Mortarcrete Series 217, BASF Sewer Guard HBS 100 Epoxy Liner, GEOKRETE or approved equal. The Contractor shall have equipment that can force cure the grout in the conditions require immediate return to service.

E. Brick used to reconstruct the manhole bench shall be red clay brick. Cement or concrete brick shall not be used. Clay brick shall conform to ASTM Standard C62-91b, "Building Brick (Solid Masonry Units Made from Clay or Shale)".

F. Patching of manholes walls and/or structures if necessary, shall be required in areas where voids exist, such as mortar missing, between bricks, around rung holes after the removal of rungs and steps, and spalled concrete. All loose, cracked and corroded materials shall be removed from the area to be parched, exposing a sound substrate. A polymer mortar shall be applied to dampened surfaces.

G. The Flow Channels shall utilize a quick setting material that can allow the manhole to be returned to service within two hours or as otherwise approved by the Engineer. The Contractor shall have equipment for heat applied force curing the grout for immediate return to service. Acceptable products for this application are Epoxytec CPP, Sewer Guard HBS 100 Epoxy Liner by BASF, Cor+Gard Channel Line or approved equal. The thickness shall be 125 mils or 1/8-inch minimum.

H. The surface preparation and rehabilitation of the chimney shall be included in Bid Items 1, 2 and 3 depending on the thickness of the repair. The manhole bench is bid as a separate bid item, but the manhole chimney is included in the items for manhole restoration.

5.07 Minimum Equipment to be Carried by Each Independently Mobilized Crew

The Contractor shall provide at all times, as a minimum, the following equipment with each sanitary sewer manhole rehabilitation crew:

Use of an approved Debris Removal and Disposal Equipment (Vactor Truck)
Cleaning Equipment and Supplies
Waste Transportation Permit
Pressure Wash and Sand Blasting Equipment
Safety Cones (FDOT approved and as required by the permit)
First Aid Kit, Fire Extinguisher
Rolla-Tapes (1 each)
Metal Detector (Manhole Locators)
Air Blowers with Ducts of sufficient size and capacity to provide a safe atmosphere
Safety Harness with Rope
Safety Ladder
Safety Vests for each Crew Member
Various Picks, Shovels, Trowels, Pry Bars, Sledge Hammers, Hand Tools

Necessary Forms and Permits
Debris Traps and Platforms as necessary
Fire Hydrant Wrench (2 each)
Fire Hose (50' minimum)
Department Issued Water Meter
Oxygen Deficiency/Explosion / Hydrogen Sulfide / Methane / etc. Meters
Digital video and still cameras
Television Monitor and Recording Equipment for Video Inspection
Concrete Protective Coating System Product Instructions
Copy of the Contract Documents and Work Orders
Utility Location Tickets
Plugs, Inflatable Plugs, "J" Pipe Plug, Thru Plugs (8”, 10”, 12”, 15” and 24” are required)
Specialized Coating Spray Application Equipment (if required)
Illuminating Devices
Plaster machine
Tripod

6.00 FIELD TESTING

The manholes shall be visually inspected after each coating for leakage and for a smooth, even finish with good bonding to the manhole and of the two coatings.

Prior to installing coating system, the manhole shall exhibit no visible leakage in the structure, around pipe penetrations or at the interface to the cut open sewer pipe liner. Any leakage shall be corrected to the Engineer's satisfaction. The Contractor shall assure that the proper thickness of each coating is applied through wet gauge or other method approved by the Engineer. Any method that is destructive, such as a dry film scratch tester, shall be followed by a suitable repair to the liner following the test. Any unsuitable coating shall be supplemented or removed and replaced, as applicable. Any liner which is observed to be not properly adhering or buckling shall be replaced.

6.01 REHABILITATION OF MANHOLES

Any active flows shall be dammed, plugged or bypassed as required to ensure that the liquid flow is maintained below the surfaces to be lined and coated and that concrete to be coated has not reached moisture levels surpassing 90%. Flows should be totally plugged and/or diverted when lining any invert. All extraneous flows into the structures at or above the area lined shall be plugged and/or diverted until all materials fully cure.

Temperature of the surface to be lined should be maintained between 65F and 110F during application. Prior to and during application, care should be taken to avoid exposure of direct sunlight or other intense heat source to the structure being lined. Specified surfaces should be shielded to avoid exposure of direct sunlight or other intense heat source. Where varying surface temperatures do exist, lining and coating installation should be scheduled when the temperature is falling versus rising.

Prior to commencing surface preparation, Contractor shall inspect all surfaces specified to receive the coating and notify Engineer, of any noticeable disparity in the site, structure or surfaces which may interfere with the work, use of materials or procedures as specified herein.

Application procedures shall conform to the recommendations of the concrete protective coating manufacturer, including material handling, mixing, safety, and application equipment. Application procedures shall be supplied to the Engineer prior to use.

Patching Material

The concrete repair and patching materials must be compatible with the specified concrete protective coating system and shall be approved by the manufacturer. When mixed with the appropriate amount of water, a paste-like material will develop which may be hand applied, sprayed or cast into any area 1/2 inch and larger. This mortar will harden quickly without any need for special curing. Cure for 24 hours or as otherwise recommended by the manufacturer. Provide the Engineer the cure time and recoat time of any concrete repair and patching material used in the manhole rehabilitation.

Leaks and weeping shall be repaired prior to application of a uniform underlayment. Repairs above the water table shall be made with hydraulic cement. Leaks below the water table shall be repaired by drilling through the wet well structure and sealing the exterior of the leak with an expansive chemical grout and sealing the interior with hydraulic cement.

Finished Manhole Surface

The finished manhole surface shall be smooth, level and free of irregularities. Deteriorated manhole surfaces shall receive a minimum ½-inch layer of patching material to produce a uniform level surface for the concrete protective coating application. The final finished manhole shall have a smooth concrete protective coating surface that will produce a manhole with a similar shape and uniformity as originally constructed.

Completed manhole surfaces with voids and gaps are not allowed.

Manhole Bench and Flow Channels

Follow all published and manufacturer recommended application methods. Concrete repair and patching materials used for the bench and flow channel shall cure quickly. Properly mix and apply materials to all specified surfaces by hand-applied methods with trowel or trowel-type tools.

The Contractor shall provide thru plugs and pipe for the rehabilitation of the flow channels and manhole bench as required. The Contractor is responsible for plugs, thru pipes, intercepting laterals and otherwise protecting his work from the sewage flow.

Concrete Protective Coating

Once the cementitious liner cures, proceed with the application of the hybrid epoxy coating. If spraying, the spray equipment shall be specifically designed to accurately ratio and apply the specified hybrid epoxy coating materials and shall be regularly maintained and in proper working order. Top coating or additional coats of the hybrid epoxy coating should occur as soon as the prior coat becomes tacky to tack-free, but no later than the recoat window for the specified material(s). Additional surface preparation procedures will be required if this recoat window is exceeded.

Follow all published and manufacturer recommended application methods. Properly mix and apply materials to all rehabilitated surfaces. Application shall cover all rehabilitated surfaces to the minimum thickness specified for the project. If no minimum thickness has been specified, 40 mills shall be the required thickness.

Provide the Engineer the cure time and recoat time of any concrete protective coating material used in the manhole rehabilitation. The Contractor is responsible for plugs, intercepting laterals and otherwise protecting his work from the sewage flow.

During application, Applicator shall regularly perform and record epoxy coating thickness readings with a wet film thickness gage, such as those meeting ASTM D4414 - Standard Practice for Measurement of Wet Film Thickness of Organic Coatings by Notched Gages, to ensure uniform thickness during application or other similar measuring probe.

Testing shall be done visually by the Engineer. Any touch-ups, corrections or additional application shall be done immediately upon order of the Engineer.

Testing with holiday detection and spark testing shall be done at random in manholes determined by the Engineer. After the concrete protective coating has set hard to the touch, surfaces shall first be dried, an induced holiday shall then be made on to the coated concrete surface and shall serve to determine the minimum/maximum voltage to be used to test the coating for holidays at that particular area. The spark tester shall be initially set at 100 volts per 1 mil (25 microns) of film thickness applied but may be adjusted as necessary to detect the induced holiday (refer to NACE RPO188-99). All detected holidays shall be marked by the coating manufacturer's approved marking methods and repaired by abrading the coating surface with grit disk paper or other hand tooling method. After abrading and cleaning, additional epoxy coating material can be hand applied to the repair area. All touch-up/repair procedures shall follow the coating manufacturer's recommendations.

6.02 Post-Cleaning and Post-Coating video Recording Equipment

The digital television camera system used for the survey shall be specifically designed and constructed to inspect manholes. Lighting for the camera shall be suitable to allow a clear picture of the entire periphery of the manhole. The camera shall be operative in 100 percent humidity conditions. The camera, television monitor, and other components of the video system shall be capable of producing a minimum 700 total line resolution (with 460 horizontal lines) color video picture. Picture quality and definition shall be acceptable to the Engineer; and if unacceptable, equipment shall be removed and replaced with adequate equipment.

The video camera shall include a data view display feature capable of showing in the recording the following information:

- City and State
- Date
- Contractor's Name
- Manhole Identification

The Contractor shall submit a sample video recording for approval.

Provide a suitable blower to defog the line and promote a clear picture, as needed.

6.02.1 MANHOLE VIDEO RECORDINGS

The contractor is required to video record the manhole's interior surfaces to determine the detailed condition of the manhole after cleaning and after coating. The inspection system used by the selected contractor shall meet all the following specifications, The Engineer will then analyze these images to determine if the manhole repair and coating work completed by the Contractor is acceptable.

In addition, manholes shall be inspected for presence and/or condition of rain dish. If the manhole has a missing, old or a damaged rain dish, the Contractor shall replace the rain dish. Prior to replacing the manhole lid, the Contractor shall thoroughly clean the seat of the frame with a rotary type wire brush. The Contractor shall then install the new rain dish per the manufacturer's recommendations. MDWASD WILL SUPPLY THE CONTRACTOR WITH THE NEW RAIN DISH. The contractor shall include the cost of installing this dish as an incidental item under his general costs and not as a specific pay item.

The camera system must be 100% electronic/digital. Any analog or NTSC video camera will be deemed unacceptable. The video must be of high definition quality and must produce a panoramic view of the manhole inspected.

The intent is that MDWASD moves towards an electronic imaging system allowing the manhole image to be reviewed by trained reviewers in the office rather than the field operative having to make field defect calls. An electronic image will also allow historical images to be stored for future use and comparison. The bidders shall specify in their bid the type of system they intend to use for the duration of the project.

The inspection camera system must have two independently or simultaneously controlled digital cameras, one facing in the downward direction and one facing in the upward direction. Each camera must have a minimum of 185 degree field of view.

The inspection camera system must illuminate the interior of the manhole using a xenon strobe light. The light shall be positioned 360 degrees around the camera lens to distribute the light evenly onto the structure walls. The lighting must be able to illuminate manholes up to 120" in diameter without the need of any auxiliary lighting. Any systems not using strobe light technology will be deemed unacceptable due to motion blur during imaging recording.

The inspection system shall produce individual images or frames with no more than 0.001 inches of movement during image or frame exposure to produce crisp, clear images.

The inspection camera must provide a minimum of 3000 lines of vertical resolution in the side view and a minimum of 500 lines in the perspective view.

Digital files shall be delivered to the Engineer by one of two methods, physically delivery of hard drives (hard drives supplied by the contractor) or uploaded to a secure cloud/web based server with access granted to the Engineer and the Department and at no additional cost to the department.

Information obtained shall be recorded on a removable data storage device (USB flash or external drive) format to match the Department's Equipment (CUES format, unless otherwise approved in writing by the Engineer). This is a necessary part of the Specifications and the Contractor's equipment must be approved by the Engineer.

The Contractor will be required to have all removable data storage devices and necessary playback equipment readily accessible for review by the Engineer during the Project. The removable data storage device shall be submitted to the Engineer on a weekly basis and will be processed with the current monthly estimates.

All the pertinent parts of the manhole as identified inspected and noted

The Contractor will be required to have all images readily accessible for review by the Engineer during this Project. The completed inspection images shall be submitted to the Engineer in a timely manner as the work progresses, but no later than with each pay request. The Contractor shall be responsible for the completed inspection images until submitted to the Engineer. In the event of loss, the Contractor will be required to re-inspect the manholes at their own expense.

Contractor is responsible for reviewing collected videos, however the County must have the ability to view the digital film file in the way that the contractor can view them.

The digital video files must include an unfolded view of the manhole with a minimum of 3000 lines of vertical resolution.

The digital video files must include the capability to produce a three dimensional representation of the manhole structure. This data shall be used to perform geometric measurements. This file shall be exportable to common CAD programs for further analysis.

The digital video files must include a distortion-free virtual pan and tilt allowing the review of the manhole structure from any angle from any depth. The virtual pan and tilt must be able to view 360 degrees in any direction. The virtual pan and tilt must consist of views from the top and bottom camera, any virtual pan and tilts that artificially create this view from a single camera will be deemed unacceptable due to distorted images on the direct side view.

The virtual pan and tilt and up/down direction of the view must be able to be controlled from a computer mouse.

The virtual pan and tilt and unfolded views must be able to be viewable by the Department without the need of any third party data logging software

The contractor must supply the Department with a removable hard drive, or other pre-approved media with the videos.

All deliverables must be supplied to the Department within 5 days of completion of fieldwork.

Acceptance of the manhole inspections shall be made upon the successful completion of the inspections and submittal of the images to the satisfaction of the Engineer. If the manhole inspection videos are found to be unsatisfactory, the Contractor shall be required to re-inspect the manholes and / or re-submit the images until they are shown to be satisfactory.

6.02.3 INSPECTION METHODS

All work under this Contract shall be performed by skilled workmen experienced in similar installations, with the best current accepted practices of the building trades, and to all applicable codes, particularly the current Florida Building Code.

The Contractor shall provide bypass pumping of the sewer, where necessary. Bypass pumping is specified in Section 9.00, at no additional cost to the County.

The Contractor shall provide all barricades and/or flashing warning lights necessary to warn pedestrians and traffic of the construction throughout the Project. This shall be done at the Contractor's expense and to the satisfaction of the Engineer. Every effort shall be made to reduce inconveniences and nuisances to a minimum. Adequate barricades shall be erected and maintained by the Contractor to detour traffic from work zone during inspection.

Materials shall be stored in the Contractor's Yard. No storage sites will be provided by the Department.

CCTV Video
The Contractor will utilize a data logging system that is compatible with MDWASD's system. The videos submitted by the Contractor shall be compatible with department's Granite XP and Granite NET formats system. The Contractor shall be responsible for maintaining the software and software licenses. The Contractor will be required to have all video and CCTV data readily accessible for review by the Engineer during this Project.

Information obtained shall be stored to a removable hard drive and submitted to the Engineer in a timely manner for download. The Engineer will download the data into MDWASD database. The removable drives will be returned to the Contractor for repeat usage. The Contractor shall be responsible to backup the video and CCTV inspection data in their system. In the event of data loss, the Contractor will be required to re-televise the lost data at their own expense.

Acceptance of gravity sewer manhole CCTV inspection shall be made upon the successful completion of the CCTV inspection and submittal of the video and CCTV data to the satisfaction of the Engineer. If the CCTV inspection video and data are found to be unsatisfactory, the Contractor shall be required to re-inspect the sewer manhole until the submitted data is shown to be satisfactory.

6.02.4 Video Recordings

The manhole interior surfaces shall be video recorded after cleaning and after coating on removable flash drive media to match the Department equipment. This is a necessary part of the Specifications and the Contractor's equipment must be approved by the Engineer.

The Contractor will be required to have all flash drives and necessary playback equipment readily accessible for review by the Engineer during the Project. The flash drives shall be submitted to the Engineer on a weekly basis. Flash drives shall become the property of the Department.

7.00 CONSTRUCTION METHODS

The Contractor is referred to Section 3.00.3 for a General Sequence of Work, Time of Completion and General Information, some tasks of which are amplified in this Section. In addition to specific construction methods specified in the Section 7.00 Series, the following general requirements shall apply to the work under this Contract.

All work under this Contract shall be performed by skilled workmen experienced in similar installations, with the best current accepted practices of the building trades, and to all applicable

codes, particularly the South Florida Building Code.

The Contractor shall provide bypass pumping of the sewer, where necessary. Bypass pumping is specified in Section 9.00.

The Contractor shall provide all barricades and/or flashing warning lights necessary to warn pedestrians and traffic of the construction throughout the Project. This shall be done at the Contractor's expense and to the satisfaction of the Engineer. Every effort shall be made to reduce inconveniences and nuisances to a minimum. Adequate barricades shall be erected and maintained by the Contractor to detour traffic from above manhole during construction.

Materials shall be stored in the Contractor's Yard. No storage sites will be provided by the Department.

7.00.1 QUALIFICATION AND EXPERIENCE OF THE CONTRACTOR

The Contractor shall have completed a minimum of (450) four hundred fifty manhole rehabilitations or similar structures within the past 10 years. Verifiable references are required with Project Name, Organization Name, Contact Person, Phone Number, Date of Work and Work Performed. Submit experience history with a minimum of references along with the bid. The work shall have been completed with the Contractor’s own forces or key personnel.

The experience of key senior personnel with other firms may be counted toward the experience requirement, if acceptable to the Engineer. Should such evidence not be satisfactory to the Engineer, whose decision shall be final, the bid will be considered non-responsive, and the second low bidder will be considered for award.

In the event a firm consists of executives, supervisors and other senior field staff (key employees) that would have met these minimum experience requirements with a prior firm, the Miami-Dade Water and Sewer Department reserves the right to qualify the firm based on WASD's sole determination and evaluation of the knowledge and prior experience of these key employees employed by the new firm.

All product applicators must conform with the product manufacturer’s application requirements and techniques and shall be certified by such manufacturer.

7.00.2 USE OF PUBLIC STREETS

The use of public streets and alleys shall be such as to provide a minimum of inconvenience to the public and to other traffic. Any earth or other excavated material or waste from the sewer spilled from trucks shall immediately be removed by the Contractor and the streets cleaned to the satisfaction of the governing authority.

7.00.3 CARE OF TREES, SHRUBS AND GRASS

In the course of the work, it may become necessary to remove trees if they interfere with construction. Dade County and various municipalities have Ordinances regulating the removal, relocation and pruning of trees in the public right-of-way, and these ordinances shall be strictly adhered to. The Contractor shall obtain a permit from Dade County and/or other regulatory agencies having jurisdiction over the work area before removing, relocating and/or pruning any

tree.

The Contractor shall abide by all requirements and conditions of the permit, and shall include all costs under the various Proposal Items, and no other compensation will be provided.

The Contractor shall be fully responsible for maintaining in good condition all cultivated grassplots, trees and shrubs. Where maintained shrubbery, grass strips or area must be removed or destroyed incident to the construction operation, the Contractor shall, after completion of the work in said area, or as directed by the Engineer, replace or restore to the original condition all destroyed or damaged shrubbery or grass areas. Tree limbs which interfere with equipment operation and are approved for pruning shall be neatly trimmed and the tree cut coated with tree paint.

Weeded areas need not be replaced with grass sod, but shall be restored to a "green" area by dressing the area with a three-inch thick layer of top soil, and sowing a variety of permanent type grass seed over the area as approved by the Engineer. The seeded area shall be watered and maintained until the Engineer is assured a good grass growth has developed, but not to exceed a maximum period of sixty (60) days.

7.00.4 MAINTENANCE OF TRAFFIC (M.O.T.)

FHWA's MUTCD shall be the minimum standard under this Contract. The Contractor shall follow the basic principles and minimum standards contained in this manual for the design, application, installation, maintenance and removal of all traffic control devices and all warning devices and barriers which are necessary to protect the public and workers from hazards within the project limits. The Contractor must understand that the standards set forth in the aforementioned manual constitute the minimum requirements for normal conditions. The Engineer shall require additional traffic control devices, warning devices, barriers, or other safety devices where unusual, complex, or particularly hazardous conditions may exist.

The Contractor shall:

I. Maintain traffic within the limits of the Project for the duration of the construction period including any temporary suspensions of the work.
II. Construct and maintain any necessary detour facilities.
III. Provide necessary facilities for access to residences, businesses, etc., along the Project.
IV. Furnish, install, and maintain traffic control and safety devices during construction.
V. Provide any other special requirements for safe and expeditious movement of traffic as may be specified on the plans. The term Maintenance of Traffic includes all of such facilities, devices, and operations required for the safety and convenience of the public as well as for minimizing public nuisance.
VI. Maintain all signs and devices placed for the purpose of detour when it is specified that traffic be detoured over roads or streets outside the project area.
VII. Continually and adequately review traffic control devices to ensure proper installation and working order, including monitoring of lights and provide a responsible individual for this review who is certified as an American Traffic

Safety Services Association Certified Worksite Supervisor.

Prior to manhole rehabilitation, including associated cleaning or construction, the Contractor

shall submit a Traffic Control Plan in accordance with Florida=s Design Standards, 600 Series and the Manual on Uniform Traffic Control Devices for Streets and Highways (MUTCD). The Contractor shall also submit a letter to the Department providing the name and telephone number of the individual who will be the Worksite Traffic Supervisor (WTS). The WTS shall be responsible for the MOT on a 24-hour basis. The WTS shall be employed by the Contractor and shall be qualified by successfully completing an approved Advanced MOT training course given by an approved training agency. The MOT shall utilize traffic control devices listed in the Qualified Products List.

As used herein, any reference to Dade County, its departments, or its published regulations, permits and data, shall be synonymous and interchangeable with other recognized governing bodies over particular areas or streets, or their departments, published regulations (i.e., Manual of Uniform Traffic Control Devices, M.U.T.C.D., F.D.O.T. Roadway and Bridge Standard Index Drawing Book), permits or data. The Contractor shall abide by all applicable laws, regulations, and codes thereof pertaining to M.O.T. on public streets, detour of traffic, traffic control and other provisions as may be required for this Project.

The Contractor shall be fully responsible for the M.O.T. on public streets, detour of traffic (including furnishing and maintaining regulatory and informative signs along the detour route), traffic control, and other provisions, throughout the Project, as required by the Dade County Department of Public Works, Traffic Engineering Division (Traffic Division) or Florida Department of Transportation (FDOT) and the above noted standards. Traffic shall be maintained according to corresponding typical traffic control details as outlined in the Dade County Public Works Manual and the above noted standards. No Street shall be completely blocked, nor blocked more than one-half at any time, keeping the other one-half open for traffic, without specific approval.

If required by the Engineer, FDOT, and agency having authority or as otherwise authorized by the Engineer, the Contractor shall make arrangements for the employment of uniformed off-duty policemen to maintain and regulate the flow of traffic through the work area. The number of men required and the number of hours on duty necessary for the maintenance and regulation of the traffic flow shall be subject to approval. The cost of such off-duty policemen, as authorized by the Engineer, shall be paid from the Proposal Item established for this purpose. Traveling time for off-duty policemen shall not be paid. Payment will be made for each man-hour that such police officers actually provide this service at the work site. Both the off-duty police officer and the Department Inspector shall sign a Department provided form acknowledging actual hours that the officer was at the work site.

The Contractor shall provide all barricades with warning lights, necessary arrow boards and signs, to warn motorists of the work throughout the Project. Adequate approved devices shall be erected and maintained by the Contractor to detour traffic from above the sewer repair area above ground.

Excavated or other material stored adjacent to or partially upon a roadway pavement shall be adequately marked for traffic safety at all times. The Contractor shall provide necessary access to all adjacent property during work.

The Contractor shall be responsible for the provision, installation and maintenance of all M.O.T. and safety devices, in accordance with specifications outlined in the Dade County Public Works Manual and the above noted Standards. In addition, the Contractor shall be responsible for providing the Engineer with M.O.T. plans for lane closures and/or detours for approval. These plans (sketches) shall be produced by an individual employed by the Contractor and

certified as "Work Zone Traffic Safety Supervisor" by the International Municipal Signal Association.

The Contractor shall presume that a portion of the Work will be located in rights-of- way of State Roads and his bid price for traffic control shall include all additional costs (over and above normal traffic control measures) involved with complying with all F.D.O.T. requirements.

7.00.5 WORKING HOURS

In general, the Contractor will be allowed to work one eight hour shift between the hours of 7:00 a.m. through 4:00 p.m. or 8:00 a.m. through 5:00 p.m., Monday through Friday but excluding normal holidays as per Department needs or permit requirements. The Contractor should anticipate, and include in his bid, being directed to work night and/or weekend hours, including the 5:00 p.m. through 7:00 a.m. period, to accommodate work in areas of heavy traffic, high flows or surcharges, which cannot be reduced during normal hours. No additional payment will be made for requiring the Contractor to work these special shifts.

The Contractor shall provide the Engineer with a weekly schedule with sufficient advance notice so that the Engineer may schedule suitable inspection. The Contractor shall be responsible to pay the actual costs of inspection activities incurred by the Department for work outside the specified work hours unless the work is ordered by the Department or required by permit.

Work in the F.D.O.T. right-of-way shall only take place between the hours specified on the specific permit.

8.00 WARRANTY - WORKMANSHIP

The restoration and other items of work shall be warranted to be free from defects by the Contractor for a period of one year (1) from the date of acceptance by the Department of all work performed during the Contract duration. During the warranty period, any defects shall be repaired by and at the Contractor’s sole expense in a manner, and by a method, acceptable to the Engineer. If an item of work is replaced/repaired under the basic warranty within six (6) months of the expiration of the warranty period, the item of work shall be individually warranted in the same manner for an extended period of six (6) months from the date of acceptance of the repair or replacement as it was under the original basic warranty.

9.00 BYPASS PUMPING / FLOW CONTROL

The Contractor shall be prepared to bypass pump the sewage effluent as a part of his operations, if necessary. The Contractor shall provide all necessary pumps, piping, and other equipment to accomplish this task with each mobilized crew and shall be prepared to perform all construction; obtain all permits; pay all costs; and perform complete restoration of all existing facilities to equal or better condition and to the satisfaction of the Engineer. Bypass pumping will occur where high flow rates and insufficient upstream storage capacity make this necessary, and as approved by the Engineer. **All costs of accomplishing the bypass pumping tasks, at whatever volume, and all associated work, such as restoration, shall be incidental to the work and no extra compensation will be allowed.**

When sewer line flows are above the maximum requirements for proper manhole repair, the flows shall be reduced to levels such that the manhole work can be performed by one of the following methods: by the Contractor plugging/blocking of the flows, or by the Contractor

pumping/bypassing of the flows as acceptable to the Engineer.

In some applications, the sewer may be plugged and wastewater contained with the capacity of the collection system. This shall only be done when it has been determined the system can accommodate the surcharging without any adverse impact.

When sewer line flows at the manhole being repaired, in the opinion of the Contractor, are too excessive to plug while the rehabilitation is being performed; the Contractor shall submit a written plan, for approval by the Engineer, and pump/bypass the flow.

A. Surcharging Sewers

Where the raw sewage flow is blocked or plugged, sufficient precautions must be taken to protect the public health. The sewer lines shall also be protected from damage. The following occurrences will not be allowed:

1. No sewage shall be allowed to back up into any homes or buildings.
2. No sewage shall overflow any manholes, cleanouts or any other access to the sewers.
3. Users upstream of the repair area shall be able to use all their water and sewer utilities without interruption.

If any of the above occur or are expected to occur, the Contractor shall bypass pump to alleviate one or all of the conditions. Additionally, the Contractor is required to observe the conditions upstream of the plug and be prepared to immediately start bypass pumping, if needed.

B. Pump Discharge

Any sump pumps, bypass pumps, trash pumps or any other type pump which pulls sewage/water or any type of material out of the manhole or sewer shall discharge this material into another manhole, or appropriate vehicle or container acceptable to the Engineer. Under no circumstances shall this material be discharged, stored or deposited on the ground, swale, road or open environment.

C. Maintenance of Traffic for Bypass Pumping

The Contractor shall take appropriate steps to ensure that all pumps, piping and hoses that carry raw sewage are protected from vehicular traffic and pedestrian traffic. Maintenance of traffic shall be performed in accordance with Section 7.00.5.

D. Sewage Spills

In the event, that during any form of "Sewage Flow Control," raw sewage is spilled, discharged, leaked or otherwise deposited in the open environment, due to the Contractor's work, the Contractor is responsible for all cleanup of solids and disinfection of the area affected. This work shall be performed immediately at the Contractor's expense with no additional cost to the Department. The Contractor is also responsible for notifying the sewer system maintenance personnel and complying with any and all regulatory requirements in regards to the size spill with no additional cost to the Department.

The Contractor shall be back-charged for any fines, penalties or other costs or damages imposed upon the Department by any agency or private party as a result of a spill or improper discharge by the Contractor.

9.00.1 PLUGGING AND BLOCKING

A sewer line plug shall be inserted into the line upstream from the manhole being surveyed or repaired. The plug shall be so designed that all or any portion of the operation flows can be released. During the survey portion of the operation, flows shall be shut off or reduced to within the maximum flow limits specified. During repairs, the flows shall be shut-off and monitored or pumped/bypassed, as acceptable to the Engineer. After the work tasks have been completed, flows shall be restored to normal.

9.00.2 PUMPING AND BYPASSING

When pumping/bypassing is required, as determined by the Engineer, the Contractor shall supply the necessary pumps, conduits and other equipment to divert the flow around the section in which work is to be performed. The bypass system shall be of sufficient capacity to handle existing flows plus additional flow that may occur during periods of rainstorms. The Contractor shall be responsible for furnishing the necessary labor and supervision to set up and operate the pumping and bypassing system. A "setup" consists of the necessary pumps, conduits and other equipment to divert flow around a section, from the start to finish of work performed in the section.

At all times while the bypass pumping system is in operation, the Contractor shall maintain, at the site, a pump attendant who is competent and equipped to deal with any emergency, on a 24 hour basis, if required.

A maintenance person capable of starting, stopping, refueling and maintaining these pumps during the rehabilitation, shall continuously monitor pumps and equipment. Pump engines shall be equipped in a manner to keep noise to a minimum.

10.00 WORK IN STATE ROADS

This Section covers the work to be performed in State Roads. No work may take place in a State Road prior to the Preconstruction Meeting and prior to obtaining the necessary permits from FDOT.

All work performed within the right-of-way of the Florida Department of Transportation (F.D.O.T.) shall comply with the requirements and conditions of the F.D.O.T., including the requirements and conditions of this and other Sections of the Specifications.

The work shall be coordinated with the F.D.O.T. and the Engineer, and the Contractor shall not begin work until he has received permission from them to do so.

10.00.1 MAINTENANCE OF TRAFFIC PLANS (M.O.T.)

After Notification of Award, the Contractor's Certified Work Zone Traffic Safety Supervisor shall immediately prepare and submit Maintenance of Traffic (M.O.T.) Plans to the Engineer for approval. The traffic maintenance plan must also meet F.D.O.T. approval. Said Plans shall be in written form with sketches or drawings as necessary and shall comply with State of Florida Department of Transportation standards of M.O.T. in construction areas. The Plans shall be submitted as soon as possible after the Notice to Proceed, and not later than the Preconstruction Conference.

10.00.2 LANE CLOSURES

Lane closures require at least a 14 day prior notice to F.D.O.T. and 48-hour notice to local police (some police jurisdictions may require considerably more notice). Lane closures of a one day or less duration will generally not be approved for major collector streets nor for arterial streets during the hours of 7:00 a.m. to 9:00 a.m. and 4:00 p.m. to 6:00 p.m., weekdays.

No lane closures will be allowed at all between the periods of the day before Thanksgiving until the day following the New Year's holiday.

11.00 CLEANING UP SITE OF WORK

The Contractor shall at all times during the execution of this Contract keep the work site free and clear of all rubbish and debris. As soon as the work is completed or sooner, if so ordered by the Engineer, the accumulated rubbish or surplus materials shall be promptly removed. The Contractor shall also restore in an manner all property, both public and private, which has been displaced or damaged during the prosecution of the work, and shall leave the site and vicinity unobstructed and in a neat and presentable condition, as acceptable to the Engineer.

In the event of delay exceeding two days after written notice is given to the Contractor by the Engineer to remove such rubbish or materials or to restore displaced or damaged property, the Engineer may employ such labor and equipment as he may deem necessary for the purpose, and the cost of such work, together with the cost of supervision, shall be charged to the Contractor and shall be deducted from any monies due him. The Project shall not be considered as having been completed until all rubbish and surplus materials have been removed and disposed of properly.

12.00 MEASUREMENT AND PAYMENT

A. General:

1. Payment for all the work completed under this Project shall be made in accordance with the provisions of the Special Conditions on the basis of the specific provisions of this section of the Specifications.

2. The Contractor shall receive and accept the compensation as provided in the Quotation, the RPQ and "Invoices and Payments" of the Special Conditions as full payment for furnishing all labor, materials, tools and equipment, for performing all operations necessary to complete the work under this Contract, and also in full payment for all loss or damages arising from the nature of the Work, or from the action of the elements or from unforeseen difficulties which may be encountered during the prosecution of the work until the final acceptance by the Department.

3. The cost breakdown (or schedule of values) referred to herein is defined in "Schedule of Values" of the Special Conditions. The cost breakdown (schedule of values) approved by the Engineer will be used as the basis for making progress payments and for determining the cost of extra work which is the same or similar (as determined by the Engineer) to that defined in the schedule of values.

4. The prices stated in the Quotation includes full compensation for overhead and profit, all costs and expenses for taxes, labor, equipment, furnishing and repairing small tools and ordinary equipment, mobilization, home office expenses and general supervision, materials, commissions, transportation charges and expenses, patent fees and royalties, bond, insurance, labor for handling materials during inspection, together with any and all other costs and expenses for performing and completing the work as shown on the Plans and specified herein. In addition, the Contractor shall include the actual cost of social security taxes, unemployment insurance, worker's compensation, fringe benefits, inclusive of life and health insurance, union dues, pension, pension plans, vacations, and insurance and contractor's public liability and property damage insurance involved in the work based on the actual wages paid to such labor and all other general costs and profits, prorated to each item.

5. Unless otherwise specifically stated elsewhere herein, the Contractor shall include in the prices bid all materials, electrical supply, fuel, lubricants, temporary equipment, temporary wiring, temporary piping and fittings, pumps, gages, and all other items of whatever nature required to completely test, balance, disinfect if required, and put into fully operational condition all equipment and/or systems supplied by either the Department or the Contractor and installed as a part of this Project. Further, any test materials supplied by the Contractor shall be completely satisfactory to the Department. Any decision as to whether a particular material is suitable for test purposes shall be at the sole discretion of the Engineer whose decision shall be final. Any material considered not suitable shall be immediately replaced by the Contractor with suitable material and no extra compensation will be allowed."

6. It is the intent of the Department to obtain a complete and working installation under this Contract, and any items of labor, equipment or materials which may reasonably be assumed as necessary to accomplish this end shall be supplied whether or not they are specifically shown on the Plans or stated herein.

7. The Contractor will be paid each month the value of the work completed during the preceding month (less retainage) and the invoiced cost including applicable sales taxes and shipping value (less retainage) of materials not already used, but which have been furnished by the Contractor under the Specifications, provided that such materials have been delivered, properly stored and inspected by the Engineer and that payment therefore has been satisfactorily certified by the Contractor to the Engineer. Remaining cost for materials (less retainage) will be paid at the same time as installation. Any payment for materials which are not used will be withheld from the final payment.

8. For purposes of determining the monthly payments to be made to the Contractor for work accomplished, the value of the work completed shall be determined in the following manner:

    a. Preparatory work; preparation of Concrete surfaces; all of the necessary precautions to avoid any damage to the manhole

chamber; cleaning via hydro-blasting (water-pressure) and/or sand-blasting; concrete removal and testing for pH; moisture content testing; soundness of concrete; removal and disposal of all waste materials and debris resulting from the manhole cleaning or surface preparation; inspection of the concrete surfaces; visual inspection and acceptance; field quality control and testing performed by the liner manufacturer shall constitute twenty-five percent **(25%)** of the price bid for these Quotation Items.

b. Application of repair materials to the concrete surfaces of the manholes listed; accurate record of structural reinforcement repairs locations; performing welding work where necessary; material installation by a qualified installer approved by the manufacturer; shall constitute twenty-five percent **(25%)** of the price bid for these Quotation Items.

c. Application of the protective coating to the concrete surfaces of the manholes listed for repairs; furnishing all labor and equipment necessary to perform the work; appliances and materials in connection with the coating installation and the coating lining patching; inspection of the concrete surfaces; visual inspection and acceptance prior to the beginning of the protective coating process; field quality control and testing performed by the protective coating manufacturer as needed, where ordered by the Engineer. For under other Quotation Items shall constitute the remaining fifty percent **(50%)** of the price bid for these Quotation Items.

B. Prices Bid:

1. The price bid for each item shall be stated in both words and figures in the appropriate places in the Quotation form. All blank spaces for bid prices must be filled in with ink, or with a typewriter. The Bidder is further directed that any and all alterations, changes, corrections and modifications, made to the Quotation forms prior to submission of bids, must be initialed by the Bidder. Non-compliance by the Bidder of this directive may be grounds for rejection of his bid.

2. In the event that there is a discrepancy between the price written in words and the price written in numbers, the price written in words shall govern except where the number of units multiplied by the unit price shown in numbers equals the total price for that bid item. In such case the unit price shown in numbers shall govern over the unit price shown in words.

3. Where an error is made in the calculation of the total bid price of an item, the unit price shall govern.

4. If the bidder makes an error in his addition of the total bid prices of the applicable items in the Quotation, the correct sum of its' applicable bid item totals shall be the Total Bid.

5. It has been determined that the County is not exempt from the payment of Florida State Sales Tax under this Contract. All items of materials, equipment and supplies furnished by the Contractor and remaining a part

of the completed Project are subject to this Tax. The Bidder shall include a sufficient amount of money to pay for this Tax in his bid price. Sufficient money to pay the Tax for all miscellaneous materials and minor items shown on the Plans, specified herein, or necessary for the work, and which will remain a part of the completed Project, shall also be included in the price or prices bid, and no other compensation will be provided.

C. It is noted that in some instances, multiple Work Orders may be simultaneously issued or be in effect between two adjacent manholes. While work on these several Work Orders may be, from a practical point of view, linked and worked upon simultaneously or sequentially, from an administrative point of view, they are totally independent from each Work Order will only be paid for when all of its work its completed and accepted.

D. Quotation Items:

It is intended that all work required to complete this Project will be included in the various bid items as follows:

Item No. 1, For rehabilitation of deteriorated manholes where the structure is repaired to greater than 2.0-inches in depth, to include cleaning, surface preparation, concrete restoration and installing concrete protective coating (no steel replacement), will be paid for by square feet price bid, as accepted by the Engineer. The unit price shall be a full compensation for all work required and shall include, but not be limited to, furnish all materials equipment, and labor necessary to rehabilitate existing deteriorated manholes; cleaning and surface preparation of the existing manhole; cleaning corroded steel within manholes to white metal and coating exposed steel; furnish and install epoxy coating and primer for the exposed steel; performing reinforcing steel replacement if ordered by the Engineer; transporting, handling, and unloading materials and incorporating in the work; preventing debris from entering the sewer lines during cleaning and rehabilitation work; sealing leaks with hydraulic cement; providing platform and/or base covering as required; coordination with Department forces to perform the work and diverting the flows; providing personnel protective equipment to work inside the manhole; intercepting existing laterals; furnishing and installing thru plugs and piping, if required; installing and securing bladders to plug the flow and subsequent removal, if required; removal of existing liner or coating, if any is existing; hauling away and legally disposing of loose and deteriorated debris including paying any applicable tipping fees; high pressure water-blast the surfaces to thoroughly clean them, brushing, removing all defective concrete and air blasting any loose concrete and dust from damaged area; test surfaces for soundness and pH, repair and replace any damaged steel and patch; cleaning, surface preparation prior to installing concrete protective coating; protecting work from sewage flow; and all other appurtenant and miscellaneous work for a complete installation.

Item No. 2, For rehabilitation of deteriorated manholes where the structure is repaired to greater than 2.0-inches in depth, to include repairing corroded steel within manholes at locations determined by the Engineer, cleaning, surface preparation, concrete restoration and installing concrete protective coating, will be paid for by square feet price bid, as accepted by the Engineer. The unit price shall be a full compensation for all work required and shall include, but not be limited to, furnish all materials equipment, and labor necessary to rehabilitate existing deteriorated manholes; cleaning and surface preparation of the existing manhole; cleaning corroded steel within manholes to white metal and coating exposed steel; furnish and install epoxy coating and primer for the exposed steel; performing reinforcing steel replacement if ordered by the Engineer; furnishing and installing new steel reinforcing, bar-grip splices and tie wire; transporting, handling, and unloading materials and incorporating in the work; preventing

debris from entering the sewer lines during cleaning and rehabilitation work; sealing leaks with hydraulic cement; providing platform and/or base covering as required; coordination with Department forces to perform the work and diverting the flows; providing personnel protective equipment to work inside the manhole; intercepting existing laterals; furnishing and installing thru plugs and piping, if required; installing and securing bladders to plug the flow and subsequent removal, if required; removal of existing liner or coating, if any is existing; hauling away and legally disposing of loose and deteriorated debris including paying any applicable tipping fees; high pressure water-blast the surfaces to thoroughly clean them, brushing, removing all defective concrete and air blasting any loose concrete and dust from damaged area; test surfaces for soundness and pH, repair and replace any damaged steel and patch; cleaning, surface preparation prior to installing concrete protective coating; protecting work from sewage flow; and all other appurtenant and miscellaneous work for a complete installation.

Item No. 3, For the rehabilitation of deteriorated manholes where the structure is repaired in the range of 0.51-inch to 2.0-inches in depth, to include cleaning, surface preparation, concrete restoration and installing concrete protective coating, will be paid for by square feet price bid, as accepted by the Engineer. The unit price shall be a full compensation for all work required and shall include, but not be limited to, furnish all materials equipment, and labor necessary to rehabilitate existing deteriorated manholes; cleaning and surface preparation of the existing manhole; cleaning corroded steel within manholes the steel to white metal and coating exposed steel; furnish and install epoxy coating and primer for the exposed steel; transporting, handling, and unloading materials and incorporating in the work; preventing debris from entering the sewer lines during cleaning and rehabilitation work; sealing leaks with hydraulic cement; providing platform and/or base covering as required; coordination with Department forces to perform the work and diverting the flows; providing personnel protective equipment to work inside the manhole; intercepting existing laterals; furnishing and installing thru plugs and piping, if required; installing and securing bladders to plug the flow and subsequent removal, if required; removal of existing liner or coating, if any is existing; hauling away and legally disposing of loose and deteriorated debris including paying any applicable tipping fees; high pressure water-blast the surfaces to thoroughly clean them, brushing, removing all defective concrete and air blasting any loose concrete and dust from damaged area; removal of grit and debris; test surfaces for soundness and pH, repair and replace any damaged steel and patch; cleaning, surface preparation prior to installing concrete protective coating; protecting work from sewage flow; and all other appurtenant and miscellaneous work for a complete installation.

Item No. 4, For the rehabilitation of deteriorated manholes identified as minimally corroded, where the structure is repaired less than 0.50-inches in depth), cleaning, surface preparation, concrete patching and installing concrete protective coating, will be paid for by square feet price bid, as accepted by the Engineer. The unit price shall be a full compensation for all work required and shall include, but not be limited to, furnish all materials equipment, and labor necessary to rehabilitate existing deteriorated manholes; cleaning and surface preparation of the existing manhole; cleaning corroded steel within manholes to white metal and coating exposed steel; furnish and install epoxy coating and primer for the exposed steel; transporting, handling, and unloading materials and incorporating in the work; preventing debris from entering the sewer lines during cleaning and rehabilitation work; sealing leaks with hydraulic cement; providing platform and/or base covering as required; coordination with Department forces to perform the work and diverting the flows; providing personnel protective equipment to work inside the manhole; intercepting existing laterals; furnishing and installing thru plugs and piping, if required; installing and securing bladders to plug the flow and subsequent removal, if required; removal of existing liner or coating, if any is existing; hauling away and legally disposing of loose and deteriorated debris including paying any applicable tipping fees; high pressure water-blast the surfaces to thoroughly clean them, brushing, removing all defective concrete and air blasting

any loose concrete and dust from damaged area; test surfaces for soundness and pH, repair and replace any damaged steel and patch; cleaning, surface preparation prior to installing concrete protective coating; protecting work from sewage flow; and all other appurtenant and miscellaneous work for a complete installation.

Item No. 5, For sealing leaks by drilling through the manhole structure and filling the underground void with a chemical injection grout, will be paid for at the unit prices per manhole. The unit price shall be a full compensation for all work required and shall include, but not be limited to, locating the leaks inside of a manhole structure; drilling or excavation to the exterior of the manhole; injecting chemical grout to seal the leak and fill the underground voids; sealing the leak areas with a grout for a permanently sealed structure; providing personnel protective equipment to work inside the manhole; cleaning and preparation; test surfaces for soundness and pH; and all other appurtenant and miscellaneous work for a complete installation.

Note: The Engineer shall determine which manholes need to be sealed with a chemical grout. Manholes that are weeping above the groundwater shall be repaired with grout or other patching materials approved by the Engineer. Repairs with grout or other patching materials inside the manhole are considered part of the normal cleaning and rehabilitation of the manhole and paid for under that bid item.

Item No. 6, For rehabilitation of manholes base, bench including the surface preparation and coating, will be paid for at the unit price bid times the quantity of square feet rehabilitated and accepted by the Engineer. The price bid shall include, but not be limited to, high pressure water cleaning; removal of grit and unsound material; all required preparation work to the satisfaction of the Engineer; furnishing and installing clay brick; furnishing concrete and grout materials; furnishing and installing concrete protective coating; furnishing temporary plugs; furnishing, installing and maintaining thru plugs when rehabilitating the flow channel and if needed on the bench; removal of thru plugs once the coating on the flow channel has cured; patching repairs; rehabilitation and concrete protective coating of the manhole flow channel; heat applied force curing of the manhole flow channels where required; heat applied force curing of the manhole bench, if required to return manhole to service; monitoring flows to avoid overflows; coordinating work with the Engineer; and all other appurtenant and miscellaneous work for a complete repair and restoration.

Item No. 7, For repairing manholes base, bench with the rebuilding of channels to include surface preparation, removal and legal disposal of debris, forming new channel and coating, will be paid for at the unit price bid times the quantity of square feet rehabilitated and accepted by the Engineer. The price bid shall include, but not be limited to, high pressure water cleaning; removal of grit and unsound material; all required preparation work to the satisfaction of the Engineer; furnishing and installing clay brick; furnishing concrete and grout materials; furnishing and installing concrete protective coating; furnishing temporary plugs; furnishing, installing and maintaining thru plugs when rehabilitating the flow channel and if needed on the bench; removal of thru plugs once the coating on the flow channel has cured; forming and restoring flow channels; sloping channels; patching repairs; making any modifications to the structure at locations where erosion is taking place within the manhole bench; rehabilitation of the manhole flow channel; heat applied force curing of the manhole flow channels where required; heat applied force curing of the manhole bench, if required to return manhole to service; monitoring flows to avoid overflows; coordinating work with the Engineer; and all other appurtenant and miscellaneous work for a complete repair and restoration.

Item No. 8, Supplemental costs for performing rehabilitation work on manholes with exposed brick, will be paid for at the unit price bid times the quantity of manholes with exposed brick rehabilitated by the Contractor.

Item No. 9, For supplemental cost for performing rehabilitation work in manholes in residential backyard easements to include all additional costs for logistics, accessibility and other required work, the price per lot (paid only once independent of quantity of crew or duration). This item is supplemental and will be paid in addition to other Bid Items for work performed in backyard easements with one payment per lot and shall be full compensation for all additional cost incurred for working within backyard easements.

Item No. 10, Supplemental costs for performing rehabilitation work on access manholes above sewage interceptors (36-inches or larger mains), will be paid for at the unit prices per manhole interceptor. This item is supplemental and will be paid in addition to other Bid Items for work performed above large diameter sewer interceptors defined as 36-inch and larger gravity systems and shall be full compensation for additional cost incurred for work above gravity interceptors.
Note: Interceptor manholes are normally constructed above an opening in the large diameter gravity main. The Contractor shall include in his supplemental cost bid, his cost to repair and seal deterioration and gaps in the joint between the pipe and manhole wall.

Item No. 11, For post-cleaning and post-rehabilitation video inspection of manholes, will be paid for at the unit price bid times the number of manholes video recorded and accepted by the Engineer. The price bid for Item 11 in the Proposal Form shall provide complete compensation for the video inspection of the manholes. This item shall include, but is not limited to: all necessary and required equipment, labor and materials to video inspect the manholes. This item also includes submittal of the video recordings to the Department for approval.

Item No. 12, Supplemental cost for removal and legal disposal of existing rubber-based coating materials from manholes, will be paid for at the unit price bid times the number of manholes completed and accepted by the Engineer. The price bid for Item 12 in the Proposal Form shall provide complete compensation for the removal and disposal of the existing coating materials from the manholes. This item shall include, but is not limited to: all necessary and required equipment, labor, materials and transportation to completely remove and dispose of the existing coating materials from the manholes.

Item No. 13, Furnish Traffic Control for the project, will be paid from the aggregate sum amount bid. Such amount represents the amount the Contractor feels necessary to provide sufficient flagmen, signs, barricades and similar items and work directing traffic and maintaining safety in accordance with applicable standards and agency requirements.

Payment to the Contractor under Traffic Control will be a monthly percentage, creating a monthly fund that corresponds to the percentage of the Project's work items completed and paid for that month, as approved by the Engineer. The amount of monthly fund shall be proportional to the total amount bid for maintenance of traffic (M.O.T), under this item, to the same degree that the amount of overall work to be paid that month is proportional to the total amount of work bid in the quotation.

Should one-year contract expire prior to the completion by the Contractor of all the work listed in the Quotation, no further payments will be due to the Contractor, beyond the proportional amount described above the actual work completed by the contractor. Any portion

of this monthly fund remaining after all required payments have been made by the Department will remain with the Department. Conversely, no requests for additional reimbursement will be approved.

Item No. 14, For all cost for furnishing, installing, operating (manned 24 hours per day) and maintaining a sewer bypass pumping of sewage manholes with gravity systems, will be paid for per each manhole bypass, as accepted by the Engineer. Shall include, but not be limited to: installing, operating, maintaining and manning a bypass pumping system (24) hours per day which includes providing a portable pump able to handle the flow capacity, on-site at all times while the by-pass is active during the process of rehabilitating the manhole. The Contractor shall perform this work complete as specified. Payment includes by-pass system mobilization, demobilization and removal and any necessary repairs, traffic control associated with installation, operation and maintenance of by-pass system, including pavement restoration, to return the site to its condition prior to the by-pass operation, and all appurtenant and miscellaneous work for a complete bypass installation.
Note: Bypass pumping shall only be used when, in the opinion of the Engineer, the rehabilitation work cannot be completed without the bypass pumping. All other methods which include surcharging, platforms, thru plugs, thru pipes shall be the primary option.
Gravity interceptors are not subject to bypass pumping and not included in this bid item.

Item No. 15, (Contingent Item) For the repair of an existing manhole with fiberglass insert (the cone shall be removed and reinstalled by Department forces), as approved by the Engineer, will be paid at the unit price per vertical foot of fiberglass insert installed and accepted. Shall include, but not be limited to: furnish all materials, equipment, and labor necessary to rehabilitate the manhole with the rubber or fiberglass insert; all applicable work of the manhole rehabilitation Bid Item; furnishing and installing fiberglass manhole insert; furnishing and installing grout; installing openings for mains and laterals; transporting, handling, and unloading materials and incorporating in the work; coordination with Department forces to perform the work and diverting the flows; providing personnel protective equipment to work inside the manhole; intercepting existing laterals; installing and securing bladders to plug the flow and subsequent removal; removal of the existing liner (if existing) or existing loose materials; cleaning; surface preparation; hauling away and legally disposing of demolition debris including paying any applicable tipping fees; installation of liner that has been approved by Engineer; performing the work within any time limitations; and all appurtenant and miscellaneous work for a complete installation.

Item No. 16, Subtotal, the total of Bid Items No. 1 through 15.

Item No. 17 (Dedicated Allowance) For the cost providing off-duty police officer as required for the purposes of maintenance of traffic, where directed by the Department of Public Works, Traffic Engineering Division and/or FDOT and where authorized by the Engineer, no overhead or other additional cost will be allowed. The cost of providing off-duty police officers for maintenance of traffic shall be paid for under Item No. 11, which shall be full compensation for any and all costs involved. Payment shall only reimburse the Contractor for the cost for each man-hour that such police officers, actually provided this service at the work site where authorized by the Engineer. The time of arrival and departure shall be recorded on a Department issued form and acknowledged by the Department Inspector and the officer. Any portion of this fund remaining after all authorized payments have been made will be withheld from contract payment and will remain with the County.

Item No. 18 (Dedicated Allowance), This item establishes a fund for reimbursement of the cost of all required construction permits and fees, if authorized by the Engineer. Payment shall

reimburse the Contractor for only the cost of the construction permit or fee. Any question of whether a construction permit or fee is required shall be decided by the Engineer who's word shall be final. Any portion of this fund remaining after all authorized payments have been made will be withheld from contract payments and will remain with the County.

Permit fees will not be reimbursed immediately upon obtaining the permit from the Public Works Department or other governing agency having jurisdiction. The Contractor shall be reimbursed for the permit fees only once the work is complete and upon proper documentation of permit closeout.

Where the project or part of the project is located in the City of Miami, in accordance with the City of Miami Code, a special paving bond is required by the City of Miami Public Works Department. The Contractor shall obtain and execute this bond between the City of Miami and himself. The cost of this bond will not be reimbursed under the Approved Permit Fee Reimbursement item.

Item No. 19 (Allowance Account), funds may be used for unforeseen conditions, construction changes, for additional work or materials not covered by other Quotation Items and for quantity adjustments, if ordered by the Engineer.

This account is for all labor, materials, equipment and services necessary for modification or extra work required to complete the Project because of unforeseen conditions, unforeseen conflicts between existing elements of work and the proposed work; for changes required to resolve any unforeseen conditions, revised regulations, technological and products development, operational changes, schedule requirements, program interface, quantity adjustments, emergencies and other miscellaneous costs; all if ordered by the Engineer.

Payment to the Contractor under this item will only be made for work ordered in writing by the Engineer, and in accordance with Section 13 of the General Covenants and Conditions entitled "Extra Work and Payment Therefore". Any portion of this account remaining after all authorized payments have been made will be withheld from Contract payments, and will remain with the County.

Because of the nature of the Dedicated Allowance Items 15 and 16 the Allowance Account Bid Item 17, they may or may not be used at the option of the Department. Any overrun or underrun provisions contained within the Contract Documents shall not be applicable to this Item. Allowance Account funds may be used for any quantity adjustments for overruns or underruns in the unit items of the Contract Documents. If one account has been depleted and funds are available in the other accounts the Engineer may use some of the available funds to complete the Project.

Unused funds in the various bid items of the Proposal may be transferred to the Allowance account by the Engineer to be used as stated in the General Covenants and Conditions Section 33 "Allowance Account Items in the Proposal".

END OF SPECIFICATIONS

APPENDIX E - Manhole Coating Work Order List

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Miami-Dade Water and Sewer Department
Manholes Coating Work Order List
3/17/2017

Work Order	Description	Status Code	Status	Dept.	Equipment	Class	Reported By	Sched. Start Date
1003338835	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	370798	WWCMHR	00001508	3/8/2017
1003338813	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	367420	WWCMHR	00001508	3/8/2017
1003335814	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	416026	WWCMHR	00016397	3/6/2017
1003277850	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	397933	WWCMHR	00035204	1/9/2017
1003243753	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	435223	WWCMHR	00032708	11/30/2016
1003237742	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	402089	WWCMHR	00001508	11/21/2016
1003237720	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	414137	WWCMHR	00001508	11/21/2016
1003237716	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	440472	WWCMHR	00001508	11/21/2016
1003237708	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	411341	WWCMHR	00001508	11/21/2016
1003237698	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	398054	WWCMHR	00001508	11/21/2016
1003237691	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	433359	WWCMHR	00001508	11/21/2016
1003237689	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	396001	WWCMHR	00001508	11/21/2016
1003237688	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	396042	WWCMHR	00001508	11/21/2016
1003233019	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	445093	WWCMHR	00035204	11/16/2016
1003231948	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	405339	WWCMHR	00032708	11/15/2016
1003231929	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	440357	WWCMHR	00001508	11/15/2016
1003231918	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	427161	WWCMHR	00001508	11/15/2016
1003231914	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	419467	WWCMHR	00001508	11/15/2016
1003230268	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	426484	WWCMHR	00035204	11/14/2016
1003230243	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	415068	WWCMHR	00035204	11/14/2016
1003230166	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	375753	WWCMHR	00001508	11/14/2016
1003230163	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	359671	WWCMHR	00001508	11/14/2016
1003230160	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	368501	WWCMHR	00001508	11/14/2016
1003230155	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	376211	WWCMHR	00001508	11/14/2016
1003229871	Plug and Waterproof-Coat Entire Manhole	R	Released/Open	840	WWC-B0001-MH	WWCMHR	00001508	11/14/2016
1003228949	Plug and Waterproof-Coat Entire Manhole	R	Released/Open	840	368088	WWCMHR	00001508	11/10/2016
1003228943	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	386872	WWCMHR		11/10/2016

Miami-Dade Water and Sewer Department
Manholes Coating Work Order List
3/17/2017

Work Order	Description	Status Code	Status	Dept.	Equipment	Class	Reported By	Sched. Start Date
1003228935	Plug and Waterproof-Coat Entire Manhole	R	Released/Open	840	378684	WWCMHR	00001508	11/10/2016
1003228932	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	343270	WWCMHR	00032708	11/10/2016
1003228930	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	383050	WWCMHR	00032708	11/10/2016
1003228914	Plug and Waterproof-Coat Entire Manhole	R	Released/Open	840	375560	WWCMHR	00001508	11/10/2016
1003228913	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	362497	WWCMHR	00001508	11/10/2016
1003228908	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	378529	WWCMHR	00001508	11/10/2016
1003228903	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	362681	WWCMHR	00001508	11/10/2016
1003228897	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	365184	WWCMHR	00032708	11/10/2016
1003228891	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	WWC-B0001-MH	WWCMHR	00001508	11/10/2016
1003228886	Plug and Waterproof-Coat Entire Manhole	R	Released/Open	840	WWC-B0001-MH	WWCMHR	00001508	11/10/2016
1003228882	Plug and Waterproof-Coat Entire Manhole	R	Released/Open	840	WWC-B0001-MH	WWCMHR	00001508	11/10/2016
1003228880	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	WWC-B0001-MH	WWCMHR	00032708	11/10/2016
1003228872	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	344045	WWCMHR	00032708	11/10/2016
1003228869	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	355000	WWCMHR	00001508	11/10/2016
1003180153	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	392662	WWCMHR	00001508	9/21/2016
1003177298	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	408343	WWCMHR	00001508	9/19/2016
1003177292	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	405208	WWCMHR	00001508	9/19/2016
1003172479	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	583811	WWCMHR	00032708	9/14/2016
1003170121	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	553885	WWCMHR	00035204	9/13/2016
1003155964	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	538861	WWCMHR	00001508	8/25/2016
1003155913	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	538736	WWCMHR	00001508	8/25/2016
1003155897	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	539147	WWCMHR	00001508	8/25/2016
1003155825	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	538791	WWCMHR	00001508	8/25/2016
1003155813	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	539009	WWCMHR	00001508	8/25/2016
1003155811	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	539146	WWCMHR	00001508	8/25/2016
1003155810	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	538932	WWCMHR	00001508	8/25/2016
1003125426	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	404788	WWCMHR	00001508	7/26/2016

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1003125422	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	422638	WWCMHR	00001508	7/26/2016
1003125412	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	404652	WWCMHR	00001508	7/26/2016
1003125389	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	441817	WWCMHR	00001508	7/26/2016
1003125384	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	415126	WWCMHR	00001508	7/26/2016
1003125366	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	443134	WWCMHR	00001508	7/26/2016
1003115436	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	419839	WWCMHR	00001508	7/14/2016
1003115432	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	402054	WWCMHR	00001508	7/14/2016
1003114962	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	425047	WWCMHR	00001508	7/13/2016
1003114898	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	400113	WWCMHR		7/13/2016
1003114894	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	445720	WWCMHR	00001508	7/13/2016
1003107429	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	439880	WWCMHR		
1003107428	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	410521	WWCMHR		
1003107427	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	419522	WWCMHR		
1003107426	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	385038	WWCMHR		
1003107425	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	430438	WWCMHR		
1003107424	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	408945	WWCMHR		
1003107423	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	387974	WWCMHR		
1003107422	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	368384	WWCMHR		
1003107421	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	406412	WWCMHR		
1003107366	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	440758	WWCMHR		
1003107353	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	400269	WWCMHR		
1003107352	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	406185	WWCMHR		
1003107343	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	394628	WWCMHR		
1003107341	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	412028	WWCMHR		
1003107338	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	415837	WWCMHR		
1003107332	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	425049	WWCMHR		
1003107330	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	425919	WWCMHR		

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1003107319	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	442254	WWCMHR		
1003107318	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	414610	WWCMHR		
1003107304	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	407134	WWCMHR		
1003107303	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	428703	WWCMHR		
1003107302	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	437133	WWCMHR		
1003107301	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	402809	WWCMHR		
1003107298	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	431571	WWCMHR		
1003107297	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	427007	WWCMHR		
1003107296	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	397128	WWCMHR		
1003107294	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	415628	WWCMHR		
1003107292	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	421637	WWCMHR		
1003107290	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	419450	WWCMHR		
1003107288	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	441303	WWCMHR		
1003107279	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	423768	WWCMHR		
1003107275	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	393623	WWCMHR		
1003107268	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	448336	WWCMHR		
1003107267	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	419448	WWCMHR		
1003107266	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	437451	WWCMHR		
1003107257	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	434823	WWCMHR		
1003107241	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	429145	WWCMHR		
1003107230	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	401994	WWCMHR		
1003107216	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	407374	WWCMHR		
1003107213	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	405961	WWCMHR		
1003107202	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	410161	WWCMHR		
1003107200	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	401945	WWCMHR		
1003107195	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	413073	WWCMHR		
1003107173	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	397219	WWCMHR		

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1003107172	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	397219	WWCMHR		
1003107170	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	410210	WWCMHR		
1003107169	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	406420	WWCMHR		
1003107168	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	390310	WWCMHR		
1003107167	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	387852	WWCMHR		
1003107163	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	403806	WWCMHR		
1003107162	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	419572	WWCMHR		
1003107155	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	423540	WWCMHR		
1003107154	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	396635	WWCMHR		
1003107153	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	417352	WWCMHR		
1003107152	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	438631	WWCMHR		
1003107151	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	392749	WWCMHR		
1003107150	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	425371	WWCMHR		
1003107147	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	391969	WWCMHR		
1003107146	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	408466	WWCMHR		
1003107144	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	424689	WWCMHR		
1003107143	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	433735	WWCMHR		
1003107140	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	394545	WWCMHR		
1003107138	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	429057	WWCMHR		
1003107136	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	448594	WWCMHR		
1003107135	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	390150	WWCMHR		
1003107134	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	405533	WWCMHR		
1003107133	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	393988	WWCMHR		
1003107132	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	414763	WWCMHR		
1003107131	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	396125	WWCMHR		
1003107129	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	411899	WWCMHR		
1003107127	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	411567	WWCMHR		

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1003107125	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	422770	WWCMHR		
1003107123	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	389705	WWCMHR		
1003107122	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	430297	WWCMHR		
1003107119	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	403988	WWCMHR		
1003107118	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	402331	WWCMHR		
1003107117	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	387429	WWCMHR		
1003107109	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	439168	WWCMHR		
1003107106	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	410520	WWCMHR		
1003107104	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	414954	WWCMHR		
1003107095	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	393912	WWCMHR		
1003107083	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	399964	WWCMHR		
1003107076	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	398608	WWCMHR		
1003107043	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	388891	WWCMHR		
1003107023	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	414579	WWCMHR		
1003106956	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	449460	WWCMHR		
1003106954	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	435935	WWCMHR		
1003106953	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	450126	WWCMHR		
1003106951	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	429857	WWCMHR		
1003106950	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	409467	WWCMHR		
1003106948	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	409467	WWCMHR		
1003106947	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	414054	WWCMHR		
1003106913	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	449345	WWCMHR		
1003106903	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	422189	WWCMHR		
1003106900	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	417679	WWCMHR		
1003106899	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	447931	WWCMHR		
1003106897	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	411170	WWCMHR		
1003106890	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	396692	WWCMHR		

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1003106885	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	405909	WWCMHR		
1003106883	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	450651	WWCMHR		
1003106882	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	393883	WWCMHR		
1003106880	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	414656	WWCMHR		
1003106879	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	413824	WWCMHR		
1003106877	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	448383	WWCMHR		
1003106869	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	392326	WWCMHR		
1003106867	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	396688	WWCMHR		
1003106866	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	424617	WWCMHR		
1003106865	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	411261	WWCMHR		
1003106863	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	421770	WWCMHR		
1003106862	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	441921	WWCMHR		
1003106860	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	397549	WWCMHR		
1003106859	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	415611	WWCMHR		
1003106858	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	450269	WWCMHR		
1003106849	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	444470	WWCMHR		
1003106844	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	438181	WWCMHR		
1003106839	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	449617	WWCMHR		
1003106819	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	449524	WWCMHR		
1003106816	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	417849	WWCMHR		
1003106815	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	406179	WWCMHR		
1003106808	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	441015	WWCMHR		
1003106797	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	399075	WWCMHR		
1003106796	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	402166	WWCMHR		
1003106720	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	418502	WWCMHR		
1003106693	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	348536	WWCMHR		
1003106691	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	377226	WWCMHR		

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1003106670	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	366070	WWCMHR		
1003106664	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	383573	WWCMHR		
1003106659	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	382160	WWCMHR		
1003106658	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	346635	WWCMHR		
1003106650	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	383196	WWCMHR		
1003106649	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	366049	WWCMHR		
1003106645	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	356066	WWCMHR		
1003106644	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	349137	WWCMHR		
1003106641	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	357790	WWCMHR		
1003106638	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	345869	WWCMHR		
1003106588	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	386240	WWCMHR		
1003106553	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	373741	WWCMHR		
1003106547	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	342434	WWCMHR		
1003106533	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	347224	WWCMHR		
1003106532	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	368776	WWCMHR		
1003106531	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	372873	WWCMHR		
1003106528	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	371346	WWCMHR		
1003106518	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	366387	WWCMHR		
1003106517	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	382606	WWCMHR		
1003106515	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	341791	WWCMHR		
1003106512	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	383154	WWCMHR		
1003106509	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	350616	WWCMHR		
1003106503	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	354635	WWCMHR		
1003106502	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	380519	WWCMHR		
1003106501	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	352382	WWCMHR		
1003106500	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	374550	WWCMHR		
1003106497	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	375783	WWCMHR		

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1003106496	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	377086	WWCMHR		
1003106495	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	375360	WWCMHR		
1003106485	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	355279	WWCMHR		
1003092929	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	403746	WWCMHR	00001508	6/7/2016
1003085155	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	371972	WWCMHR	00316220	5/23/2016
1003085123	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	377064	WWCMHR	00316220	5/23/2016
1003084974	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	383980	WWCMHR	00316220	5/23/2016
1003078544	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	586226	WWCMHR	00013797	5/10/2016
1003076443	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	388905	WWCMHR	MONGU	5/5/2016
1003076437	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	404947	WWCMHR	MONGU	5/5/2016
1003076403	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	404947	WWCMHR	MONGU	5/5/2016
1003076398	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	435418	WWCMHR	MONGU	5/5/2016
1003051533	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	400558	WWCMHR	MONGU	4/4/2016
1003051531	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	398312	WWCMHR	MONGU	4/4/2016
1003051496	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	440888	WWCMHR	MONGU	4/4/2016
1003051490	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	427045	WWCMHR	MONGU	4/4/2016
1003051477	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	444888	WWCMHR	MONGU	4/4/2016
1003051473	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	401372	WWCMHR	MONGU	4/4/2016
1003051458	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	409671	WWCMHR	MONGU	4/4/2016
1003051438	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	436886	WWCMHR	MONGU	4/4/2016
1003051435	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	417698	WWCMHR	MONGU	4/4/2016
1003039718	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	356894	WWCMHR	MONGU	3/14/2016
1003038866	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	410582	WWCMHR	MONGU	3/11/2016
1003038855	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	392205	WWCMHR	MONGU	3/11/2016
1003038846	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	431552	WWCMHR	MONGU	3/11/2016
1003038842	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	390967	WWCMHR	MONGU	3/11/2016
1003038828	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	426872	WWCMHR	MONGU	3/11/2016

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1003038826	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	422085	WWCMHR	MONGU	3/11/2016
1003038573	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	436183	WWCMHR	MONGU	3/11/2016
1003038549	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	406413	WWCMHR	MONGU	3/11/2016
1003038541	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	410418	WWCMHR	MONGU	3/11/2016
1003038533	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	413446	WWCMHR	MONGU	3/11/2016
1003038516	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	412026	WWCMHR	MONGU	3/11/2016
1003038416	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	397630	WWCMHR	MONGU	3/11/2016
1003038410	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	427096	WWCMHR	MONGU	3/11/2016
1003038406	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	437756	WWCMHR	MONGU	3/11/2016
1003038398	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	395161	WWCMHR	MONGU	3/11/2016
1003038386	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	394056	WWCMHR	MONGU	3/11/2016
1003037786	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	447458	WWCMHR	MONGU	3/10/2016
1003037781	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	438586	WWCMHR	MONGU	3/10/2016
1003037778	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	396777	WWCMHR	MONGU	3/10/2016
1003037775	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	419831	WWCMHR	MONGU	3/10/2016
1003037772	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	424133	WWCMHR	MONGU	3/10/2016
1003037766	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	417972	WWCMHR	MONGU	3/10/2016
1003037756	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	396158	WWCMHR	MONGU	3/10/2016
1003037752	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	435709	WWCMHR	MONGU	3/10/2016
1003037748	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	450825	WWCMHR	MONGU	3/10/2016
1003037743	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	423883	WWCMHR	MONGU	3/10/2016
1003037741	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	432307	WWCMHR	MONGU	3/10/2016
1003036971	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	435907	WWCMHR	MONGU	3/9/2016
1003036964	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	423192	WWCMHR	MONGU	3/9/2016
1003036956	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	429326	WWCMHR	MONGU	3/9/2016
1003036950	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	402734	WWCMHR	MONGU	3/9/2016
1003036949	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	387539	WWCMHR	MONGU	3/9/2016

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1003036936	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	388657	WWCMHR	MONGU	3/9/2016
1003036929	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	424605	WWCMHR	MONGU	3/9/2016
1003036926	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	413002	WWCMHR	MONGU	3/9/2016
1003035368	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	367556	WWCMHR	MONGU	3/7/2016
1003035365	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	368557	WWCMHR	MONGU	3/7/2016
1003035361	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	363776	WWCMHR	MONGU	3/7/2016
1003035359	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	381343	WWCMHR	MONGU	3/7/2016
1003035354	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	367796	WWCMHR	MONGU	3/7/2016
1003019531	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	397027	WWCMHR	00001508	2/9/2016
1003019292	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	436708	WWCMHR	00001508	2/9/2016
1003019228	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	428175	WWCMHR	00001508	2/9/2016
1003019227	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	428175	WWCMHR	00001508	2/9/2016
1003004828	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	400134	WWCMHR	00013797	1/19/2016
1003004793	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	393081	WWCMHR	00013797	1/19/2016
1003004645	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	444021	WWCMHR	00013797	1/19/2016
1003004644	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	438373	WWCMHR	00013797	1/19/2016
1003004642	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	410396	WWCMHR	00013797	1/19/2016
1003004638	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	419513	WWCMHR	00013797	1/19/2016
1003004621	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	442020	WWCMHR	00013797	1/19/2016
1003004519	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	416611	WWCMHR	00013797	1/19/2016
1003004479	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	432971	WWCMHR	00013797	1/19/2016
1003004371	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	412364	WWCMHR	00013797	1/19/2016
1003004364	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	397100	WWCMHR	00013797	1/19/2016
1003004333	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	432523	WWCMHR	00013797	1/19/2016
1003000725	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	401227	WWCMHR	MONGU	1/12/2016
1002998644	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	419618	WWCMHR	MONGU	1/7/2016
1002998566	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	421970	WWCMHR	MONGU	1/7/2016

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1002998565	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	417915	WWCMHR	MONGU	1/7/2016
1002998563	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	397948	WWCMHR	MONGU	1/7/2016
1002998560	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	419142	WWCMHR	MONGU	1/7/2016
1002998556	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	396992	WWCMHR	MONGU	1/7/2016
1002998538	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	392027	WWCMHR	MONGU	1/7/2016
1002998537	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	394811	WWCMHR	MONGU	1/7/2016
1002998535	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	549730	WWCMHR	MONGU	1/7/2016
1002998525	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	400143	WWCMHR	MONGU	1/7/2016
1002998403	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	398079	WWCMHR	MONGU	1/7/2016
1002991170	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	400754	WWCMHR	MONGU	12/21/2015
1002988442	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	421171	WWCMHR	MONGU	12/15/2015
1002988395	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	393486	WWCMHR	MONGU	12/15/2015
1002988386	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	399258	WWCMHR	MONGU	12/15/2015
1002988336	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	408013	WWCMHR	MONGU	12/15/2015
1002981082	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	448720	WWCMHR	MONGU	12/2/2015
1002957652	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	345508	WWCMHR	MONGU	10/19/2015
1002956769	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	375281	WWCMHR	MONGU	10/16/2015
1002956767	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	380771	WWCMHR	MONGU	10/16/2015
1002955811	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	382456	WWCMHR	00001508	10/15/2015
1002955434	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	385030	WWCMHR	MONGU	10/14/2015
1002955314	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	358289	WWCMHR	MONGU	10/14/2015
1002954336	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	364132	WWCMHR	MONGU	10/13/2015
1002950528	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	539006	WWCMHR	00001508	10/5/2015
1002950491	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	559080	WWCMHR	00001508	10/5/2015
1002950482	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	539211	WWCMHR	00001508	10/5/2015
1002945515	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	390891	WWCMHR	00032708	9/25/2015
1002932233	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	376735	WWCMHR	00013797	9/2/2015

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1002916481	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	347658	WWCMHR	00013797	8/13/2015
1002899831	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	413606	WWCMHR	00013797	7/16/2015
1002899830	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	431070	WWCMHR	00013797	7/16/2015
1002899826	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	407534	WWCMHR	00013797	7/16/2015
1002899541	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	420077	WWCMHR	00013797	7/16/2015
1002899538	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	403994	WWCMHR	00013797	7/16/2015
1002899534	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	410888	WWCMHR	00013797	7/16/2015
1002899533	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	435719	WWCMHR	00013797	7/16/2015
1002899525	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	409349	WWCMHR	00013797	7/16/2015
1002899520	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	394203	WWCMHR	00013797	7/16/2015
1002899515	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	445236	WWCMHR	00013797	7/16/2015
1002899510	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	406447	WWCMHR	00013797	7/16/2015
1002899495	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	398723	WWCMHR	00013797	7/16/2015
1002899488	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	440884	WWCMHR	00013797	7/16/2015
1002899485	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	405448	WWCMHR	00013797	7/16/2015
1002899484	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	399332	WWCMHR	00013797	7/16/2015
1002899480	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	417037	WWCMHR	00013797	7/16/2015
1002899477	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	402137	WWCMHR	00013797	7/16/2015
1002899473	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	434540	WWCMHR	00013797	7/16/2015
1002899469	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	408390	WWCMHR	00013797	7/16/2015
1002899466	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	410320	WWCMHR	00013797	7/16/2015
1002899457	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	388294	WWCMHR	00013797	7/16/2015
1002899451	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	392870	WWCMHR	00013797	7/16/2015
1002899439	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	400621	WWCMHR	00013797	7/16/2015
1002899431	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	449258	WWCMHR	00013797	7/16/2015
1002899402	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	420907	WWCMHR	00013797	7/16/2015
1002899399	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	387016	WWCMHR	00013797	7/16/2015

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1002899390	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	387116	WWCMHR	00013797	7/16/2015
1002899378	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	427208	WWCMHR	00013797	7/16/2015
1002899372	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	425658	WWCMHR	00013797	7/16/2015
1002899365	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	412941	WWCMHR	00013797	7/16/2015
1002898860	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	407080	WWCMHR	00013797	7/15/2015
1002898858	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	400096	WWCMHR	00013797	7/15/2015
1002898853	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	420856	WWCMHR	00013797	7/15/2015
1002898851	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	397967	WWCMHR	00013797	7/15/2015
1002898849	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	439148	WWCMHR	00013797	7/15/2015
1002898846	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	401980	WWCMHR	00013797	7/15/2015
1002898844	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	435184	WWCMHR	00013797	7/15/2015
1002898843	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	422287	WWCMHR	00013797	7/15/2015
1002898834	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	389124	WWCMHR	00013797	7/15/2015
1002898831	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	401291	WWCMHR	00013797	7/15/2015
1002898829	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	450371	WWCMHR	00013797	7/15/2015
1002898825	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	442827	WWCMHR	00013797	7/15/2015
1002898599	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	446196	WWCMHR	00013797	7/15/2015
1002898590	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	450260	WWCMHR	00013797	7/15/2015
1002898586	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	436177	WWCMHR	00013797	7/15/2015
1002898577	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	421577	WWCMHR	00013797	7/15/2015
1002898575	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	449278	WWCMHR	00013797	7/15/2015
1002898568	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	391761	WWCMHR	00013797	7/15/2015
1002898560	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	427255	WWCMHR	00013797	7/15/2015
1002898556	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	389309	WWCMHR	00013797	7/15/2015
1002898553	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	444228	WWCMHR	00013797	7/15/2015
1002898548	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	442523	WWCMHR	00013797	7/15/2015
1002898545	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	435510	WWCMHR	00013797	7/15/2015

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1002898541	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	389991	WWCMHR	00013797	7/15/2015
1002898525	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	389991	WWCMHR	00013797	7/15/2015
1002898524	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	391687	WWCMHR	00013797	7/15/2015
1002898521	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	449870	WWCMHR	00013797	7/15/2015
1002898517	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	404375	WWCMHR	00013797	7/15/2015
1002898512	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	388737	WWCMHR	00013797	7/15/2015
1002898511	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	407027	WWCMHR	00013797	7/15/2015
1002898467	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	442743	WWCMHR	00013797	7/15/2015
1002898462	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	418402	WWCMHR	00013797	7/15/2015
1002898460	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	404693	WWCMHR	00013797	7/15/2015
1002898457	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	449310	WWCMHR	00013797	7/15/2015
1002898447	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	409684	WWCMHR	00013797	7/15/2015
1002898442	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	406505	WWCMHR	00013797	7/15/2015
1002898438	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	428357	WWCMHR	00013797	7/15/2015
1002898433	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	422569	WWCMHR	00013797	7/15/2015
1002898428	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	436697	WWCMHR	00013797	7/15/2015
1002898424	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	420547	WWCMHR	00013797	7/15/2015
1002898422	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	391575	WWCMHR	00013797	7/15/2015
1002898420	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	403853	WWCMHR	00013797	7/15/2015
1002898407	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	405974	WWCMHR	00013797	7/15/2015
1002898404	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	445135	WWCMHR	00013797	7/15/2015
1002898216	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	390746	WWCMHR	00013797	7/14/2015
1002898215	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	414051	WWCMHR	00013797	7/14/2015
1002898214	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	429743	WWCMHR	00013797	7/14/2015
1002898213	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	426068	WWCMHR	00013797	7/14/2015
1002898209	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	446607	WWCMHR	00013797	7/14/2015
1002898207	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	408487	WWCMHR	00013797	7/14/2015

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1002898205	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	410724	WWCMHR	00013797	7/14/2015
1002898203	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	403191	WWCMHR	00013797	7/14/2015
1002898200	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	440771	WWCMHR	00013797	7/14/2015
1002898191	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	407340	WWCMHR	00013797	7/14/2015
1002898190	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	393616	WWCMHR	00013797	7/14/2015
1002898188	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	403649	WWCMHR	00013797	7/14/2015
1002898187	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	387209	WWCMHR	00013797	7/14/2015
1002898186	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	415703	WWCMHR	00013797	7/14/2015
1002898184	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	408284	WWCMHR	00013797	7/14/2015
1002898183	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	443797	WWCMHR	00013797	7/14/2015
1002898181	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	433304	WWCMHR	00013797	7/14/2015
1002898180	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	439312	WWCMHR	00013797	7/14/2015
1002898179	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	398972	WWCMHR	00013797	7/14/2015
1002898178	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	438319	WWCMHR	00013797	7/14/2015
1002898176	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	442730	WWCMHR	00013797	7/14/2015
1002898175	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	414470	WWCMHR	00013797	7/14/2015
1002898172	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	443031	WWCMHR	00013797	7/14/2015
1002898171	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	394346	WWCMHR	00013797	7/14/2015
1002898169	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	437735	WWCMHR	00013797	7/14/2015
1002898157	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	405060	WWCMHR	00013797	7/14/2015
1002898154	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	403689	WWCMHR	00013797	7/14/2015
1002898153	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	436741	WWCMHR	00013797	7/14/2015
1002898152	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	429764	WWCMHR	00013797	7/14/2015
1002898149	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	437843	WWCMHR	00013797	7/14/2015
1002898142	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	438997	WWCMHR	00013797	7/14/2015
1002898135	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	408914	WWCMHR	00013797	7/14/2015
1002898131	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	435764	WWCMHR	00013797	7/14/2015

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1002897970	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	402587	WWCMHR	00013797	7/14/2015
1002897909	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	392986	WWCMHR	00013797	7/14/2015
1002897907	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	438290	WWCMHR	00013797	7/14/2015
1002897902	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	397461	WWCMHR	00013797	7/14/2015
1002897900	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	426219	WWCMHR	00013797	7/14/2015
1002897892	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	414057	WWCMHR	00013797	7/14/2015
1002897807	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	423844	WWCMHR	00013797	7/14/2015
1002896619	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	425807	WWCMHR	00013797	7/13/2015
1002896616	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	404714	WWCMHR	00013797	7/13/2015
1002896615	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	390551	WWCMHR	00013797	7/13/2015
1002896402	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	390551	WWCMHR	00013797	7/13/2015
1002896219	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	393797	WWCMHR	00013797	7/13/2015
1002895741	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	432832	WWCMHR	00013797	7/10/2015
1002895740	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	396934	WWCMHR	00013797	7/10/2015
1002895737	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	418953	WWCMHR	00013797	7/10/2015
1002895715	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	419584	WWCMHR	00013797	7/10/2015
1002895696	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	392293	WWCSGM	00013797	7/10/2015
1002895688	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	443849	WWCMHR	00013797	7/10/2015
1002895687	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	406104	WWCMHR	00013797	7/10/2015
1002895684	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	387047	WWCMHR	00013797	7/10/2015
1002895529	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	395928	WWCMHR	00013797	7/10/2015
1002895527	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	430525	WWCMHR	00013797	7/10/2015
1002895525	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	432178	WWCMHR	00013797	7/10/2015
1002895522	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	418308	WWCMHR	00013797	7/10/2015
1002895514	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	390558	WWCMHR	00013797	7/10/2015
1002895512	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	436819	WWCMHR	00013797	7/10/2015
1002895495	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	404016	WWCMHR	00013797	7/10/2015

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1002890958	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	429333	WWCMHR	00032708	7/2/2015
1002890919	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	445122	WWCMHR	00032708	7/2/2015
1002890875	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	404367	WWCMHR	00032708	7/2/2015
1002869536	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	390789	WWCMHR	00032708	6/3/2015
1002869520	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	402447	WWCMHR	00032708	6/3/2015
1002869495	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	398977	WWCMHR	00032708	6/3/2015
1002867696	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	374404	WWCMHR	00001508	6/1/2015
1002838639	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	450063	WWCMHR	00032708	4/16/2015
1002837934	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	449044	WWCMHR	00032708	4/15/2015
1002837854	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	396927	WWCMHR	00032708	4/15/2015
1002837852	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	405920	WWCMHR	00032708	4/15/2015
1002837849	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	430042	WWCMHR	00032708	4/15/2015
1002837776	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	439847	WWCMHR	00032708	4/14/2015
1002837773	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	426364	WWCMHR	00032708	4/14/2015
1002837750	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	428566	WWCMHR	00032708	4/14/2015
1002837739	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	445968	WWCMHR	00032708	4/14/2015
1002785378	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	346601	WWCMHR	00009391	1/28/2015
1002785340	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	519711	WWCMHR	00009391	1/28/2015
1002784246	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	425546	WWCMHR	00032708	1/27/2015
1002783571	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	376834	WWCMHR	00009391	1/27/2015
1002783568	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	384102	WWCMHR	00009391	1/27/2015
1002783567	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	384102	WWCMHR	00009391	1/27/2015
1002783564	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	379155	WWCMHR	00009391	1/27/2015
1002783507	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	375170	WWCMHR	00009391	1/26/2015
1002783506	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	382348	WWCMHR	00009391	1/26/2015
1002783451	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	365572	WWCMHR	00009391	1/26/2015
1002783443	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	372962	WWCMHR	00009391	1/26/2015

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1002783437	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	378063	WWCMHR	00009391	1/26/2015
1002783280	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	381345	WWCMHR	00009391	1/26/2015
1002783271	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	351799	WWCMHR	00009391	1/26/2015
1002783260	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	568186	WWCMHR	00009391	1/26/2015
1002783127	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	386158	WWCMHR	00009391	1/26/2015
1002783109	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	376179	WWCMHR	00009391	1/26/2015
1002783094	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	361039	WWCMHR	00009391	1/26/2015
1002783052	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	564247	WWCMHR	00009391	1/26/2015
1002783036	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	564246	WWCMHR	00009391	1/26/2015
1002783020	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	382064	WWCMHR	00009391	1/26/2015
1002782984	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	381933	WWCMHR	00009391	1/26/2015
1002782912	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	373260	WWCMHR	00009391	1/26/2015
1002782895	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	376608	WWCMHR	00009391	1/26/2015
1002782838	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	367353	WWCMHR	00009391	1/26/2015
1002782829	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	377473	WWCMHR	00009391	1/26/2015
1002782778	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	377839	WWCMHR	00009391	1/26/2015
1002782774	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	377839	WWCMHR	00009391	1/26/2015
1002782759	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	368675	WWCMHR	00009391	1/26/2015
1002782751	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	360942	WWCMHR	00009391	1/26/2015
1002782731	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	374617	WWCMHR	00009391	1/26/2015
1002782729	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	384669	WWCMHR	00009391	1/26/2015
1002782699	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	383747	WWCMHR	00009391	1/26/2015
1002782696	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	358229	WWCMHR	00009391	1/26/2015
1002782689	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	381625	WWCMHR	00009391	1/26/2015
1002781712	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	404834	WWCMHR	00001508	1/22/2015
1002781709	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	433946	WWCMHR	00001508	1/22/2015
1002780551	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	408913	WWCMHR	00009391	1/21/2015

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1002777323	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	445325	WWCMHR	00009391	1/15/2015
1002777322	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	433465	WWCMHR	00009391	1/15/2015
1002777226	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	415470	WWCMHR	00009391	1/14/2015
1002777222	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	423917	WWCMHR	00009391	1/14/2015
1002777220	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	390501	WWCMHR	00009391	1/14/2015
1002777204	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	418231	WWCMHR	00009391	1/14/2015
1002777187	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	400312	WWCMHR	00009391	1/14/2015
1002776670	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	413964	WWCMHR	00009391	1/14/2015
1002776632	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	446872	WWCMHR	00009391	1/14/2015
1002776601	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	393097	WWCMHR	00009391	1/14/2015
1002776586	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	429917	WWCMHR	00009391	1/14/2015
1002776582	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	442904	WWCMHR	00009391	1/14/2015
1002776580	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	432739	WWCMHR	00009391	1/14/2015
1002776575	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	444415	WWCMHR	00009391	1/14/2015
1002776573	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	400362	WWCMHR	00009391	1/14/2015
1002776560	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	428754	WWCMHR	00009391	1/14/2015
1002776542	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	440773	WWCMHR	00009391	1/14/2015
1002776453	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	391912	WWCMHR	00009391	1/13/2015
1002776433	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	432244	WWCMHR	00009391	1/13/2015
1002776432	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	404935	WWCMHR	00009391	1/13/2015
1002776404	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	429195	WWCMHR	00009391	1/13/2015
1002776364	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	444154	WWCMHR	00009391	1/13/2015
1002776341	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	539299	WWCMHR	00009391	1/13/2015
1002776308	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	406833	WWCMHR	00009391	1/13/2015
1002776118	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	441589	WWCMHR	00009391	1/13/2015
1002775997	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	441693	WWCMHR	00009391	1/13/2015
1002775922	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	448793	WWCMHR	00009391	1/13/2015

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1002775862	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	405282	WWCMHR	00009391	1/13/2015
1002775843	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	414871	WWCMHR	00009391	1/13/2015
1002775825	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	422001	WWCMHR	00009391	1/13/2015
1002775817	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	434851	WWCMHR	00009391	1/13/2015
1002775812	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	391163	WWCMHR	00009391	1/13/2015
1002775811	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	429626	WWCMHR	00009391	1/13/2015
1002775696	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	409079	WWCMHR	00009391	1/12/2015
1002775315	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	441106	WWCMHR	00009391	1/12/2015
1002775250	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	402104	WWCMHR	00009391	1/12/2015
1002775245	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	404834	WWCMHR	00009391	1/12/2015
1002775223	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	533326	WWCMHR	00009391	1/12/2015
1002775095	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	435539	WWCMHR	00009391	1/12/2015
1002775025	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	398564	WWCMHR	00009391	1/12/2015
1002775010	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	447606	WWCMHR	00009391	1/12/2015
1002774964	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	441026	WWCMHR	00009391	1/12/2015
1002774963	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	390692	WWCMHR	00009391	1/12/2015
1002774958	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	430313	WWCMHR	00009391	1/12/2015
1002774956	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	446620	WWCMHR	00009391	1/12/2015
1002774952	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	388847	WWCMHR	00009391	1/12/2015
1002774950	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	435306	WWCMHR	00009391	1/12/2015
1002774947	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	428543	WWCMHR	00009391	1/12/2015
1002774733	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	437188	WWCMHR	00009391	1/9/2015
1002774725	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	407402	WWCMHR	00009391	1/9/2015
1002774723	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	431673	WWCMHR	00009391	1/9/2015
1002774719	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	396113	WWCMHR	00009391	1/9/2015
1002774716	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	433170	WWCMHR	00009391	1/9/2015
1002774709	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	396660	WWCMHR	00009391	1/9/2015

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1002774707	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	402661	WWCMHR	00009391	1/9/2015
1002774692	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	402726	WWCMHR	00009391	1/9/2015
1002774691	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	434367	WWCMHR	00009391	1/9/2015
1002774149	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	417544	WWCMHR	00009391	1/9/2015
1002774137	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	414814	WWCMHR	00009391	1/9/2015
1002774110	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	434405	WWCMHR	00009391	1/9/2015
1002774101	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	435932	WWCMHR	00009391	1/9/2015
1002774096	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	448198	WWCMHR	00009391	1/9/2015
1002773744	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	447642	WWCMHR	00009391	1/8/2015
1002773741	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	418918	WWCMHR	00009391	1/8/2015
1002773735	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	421055	WWCMHR	00009391	1/8/2015
1002773730	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	395689	WWCMHR	00009391	1/8/2015
1002773696	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	379387	WWCMHR	00009391	1/8/2015
1002773680	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	368859	WWCMHR	00009391	1/8/2015
1002773638	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	410387	WWCMHR	00009391	1/8/2015
1002773625	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	407458	WWCMHR	00009391	1/8/2015
1002773594	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	413047	WWCMHR	00009391	1/8/2015
1002773361	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	426558	WWCMHR	00009391	1/8/2015
1002773307	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	438999	WWCMHR	00009391	1/8/2015
1002773288	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	425580	WWCMHR	00009391	1/8/2015
1002773272	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	431342	WWCMHR	00009391	1/8/2015
1002773253	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	418935	WWCMHR	00009391	1/8/2015
1002773248	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	389255	WWCMHR	00009391	1/8/2015
1002773242	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	391851	WWCMHR	00009391	1/8/2015
1002773239	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	427142	WWCMHR	00009391	1/8/2015
1002773236	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	437866	WWCMHR	00009391	1/8/2015
1002773234	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	443552	WWCMHR	00009391	1/8/2015

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1002773233	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	423362	WWCMHR	00009391	1/8/2015
1002773090	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	430187	WWCMHR	00009391	1/7/2015
1002772857	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	437560	WWCMHR	00009391	1/7/2015
1002772819	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	394270	WWCMHR	00009391	1/7/2015
1002772592	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	447668	WWCMHR	00009391	1/7/2015
1002772586	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	445133	WWCMHR	00009391	1/7/2015
1002772531	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	445133	WWCMHR	00009391	1/7/2015
1002771407	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	406950	WWCMHR	00009391	1/6/2015
1002771404	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	427042	WWCMHR	00009391	1/6/2015
1002771398	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	423331	WWCMHR	00009391	1/6/2015
1002771389	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	389380	WWCMHR	00009391	1/6/2015
1002771385	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	444345	WWCMHR	00009391	1/6/2015
1002771295	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	418326	WWCMHR	00009391	1/6/2015
1002771263	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	418326	WWCMHR	00009391	1/6/2015
1002770972	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	411374	WWCMHR	00009391	1/6/2015
1002770963	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	413516	WWCMHR	00009391	1/6/2015
1002770954	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	393533	WWCMHR	00009391	1/6/2015
1002770949	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	409084	WWCMHR	00009391	1/6/2015
1002770947	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	443254	WWCMHR	00009391	1/6/2015
1002770945	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	446364	WWCMHR	00009391	1/6/2015
1002770943	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	446364	WWCMHR	00009391	1/6/2015
1002770941	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	446364	WWCMHR	00009391	1/6/2015
1002770140	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	393334	WWCMHR	00009391	1/5/2015
1002770109	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	419689	WWCMHR	00009391	1/5/2015
1002770105	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	424425	WWCMHR	00009391	1/5/2015
1002770104	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	389328	WWCMHR	00009391	1/5/2015
1002770101	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	432221	WWCMHR	00009391	1/5/2015

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1002770100	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	441834	WWCMHR	00009391	1/5/2015
1002765815	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	382574	WWCMHR	00001508	12/26/2014
1002765232	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	352239	WWCMHR	00009391	12/24/2014
1002765195	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	353964	WWCMHR	00009391	12/24/2014
1002764965	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	371157	WWCMHR	00001508	12/23/2014
1002764750	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	380920	WWCMHR	00001508	12/23/2014
1002764745	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	381803	WWCMHR	00009391	12/23/2014
1002764744	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	381803	WWCMHR	00009391	12/23/2014
1002764741	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	381803	WWCMHR	00009391	12/23/2014
1002764725	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	350551	WWCMHR	00001508	12/23/2014
1002764688	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	384897	WWCMHR	00001508	12/23/2014
1002764660	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	347559	WWCMHR	00001508	12/23/2014
1002764654	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	379981	WWCMHR	00001508	12/23/2014
1002764645	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	369550	WWCMHR	00001508	12/23/2014
1002764423	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	344180	WWCMHR	00001508	12/22/2014
1002764419	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	358419	WWCMHR	00001508	12/22/2014
1002764418	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	379665	WWCMHR	00001508	12/22/2014
1002764415	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	367018	WWCMHR	00001508	12/22/2014
1002764409	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	383082	WWCMHR	00001508	12/22/2014
1002764400	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	382654	WWCMHR	00001508	12/22/2014
1002764399	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	360238	WWCMHR	00001508	12/22/2014
1002764388	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	374184	WWCMHR	00001508	12/22/2014
1002764382	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	364875	WWCMHR	00001508	12/22/2014
1002764362	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	352304	WWCMHR	00001508	12/22/2014
1002764360	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	371576	WWCMHR	00001508	12/22/2014
1002764358	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	377329	WWCMHR	00001508	12/22/2014
1002764331	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	381108	WWCMHR	00001508	12/22/2014

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1002764138	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	385732	WWCMHR	00001508	12/22/2014
1002764134	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	381537	WWCMHR	00001508	12/22/2014
1002764130	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	363582	WWCMHR	00001508	12/22/2014
1002764127	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	385192	WWCMHR	00001508	12/22/2014
1002764125	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	385717	WWCMHR	00001508	12/22/2014
1002764115	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	362351	WWCMHR	00001508	12/22/2014
1002764108	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	363795	WWCMHR	00001508	12/22/2014
1002764107	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	383873	WWCMHR	00001508	12/22/2014
1002764106	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	381569	WWCMHR	00001508	12/22/2014
1002764104	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	372783	WWCMHR	00001508	12/22/2014
1002764086	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	384111	WWCMHR	00001508	12/22/2014
1002764085	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	353484	WWCMHR	00001508	12/22/2014
1002763673	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	375729	WWCMHR	00009391	12/22/2014
1002763606	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	377858	WWCMHR	00009391	12/22/2014
1002763211	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	374800	WWCMHR	00001508	12/19/2014
1002763204	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	559373	WWCMHR	00001508	12/19/2014
1002763154	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	348015	WWCMHR	00001508	12/19/2014
1002763137	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	371421	WWCMHR	00001508	12/19/2014
1002763134	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	353987	WWCMHR	00001508	12/19/2014
1002763112	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	347926	WWCMHR	00009391	12/19/2014
1002763103	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	375378	WWCMHR	00001508	12/19/2014
1002763101	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	365244	WWCMHR	00001508	12/19/2014
1002763099	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	346726	WWCMHR	00001508	12/19/2014
1002763085	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	362843	WWCMHR	00001508	12/19/2014
1002763027	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	377041	WWCMHR	00009391	12/19/2014
1002762750	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	371219	WWCMHR	00001508	12/18/2014
1002762748	Plug a Waterproof - Coat Entire Manhole	R	Released/Open	840	364802	WWCMHR	00001508	12/18/2014

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1002762696	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	367589	WWCMHR	00001508	12/18/2014
1002762693	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	378571	WWCMHR	00001508	12/18/2014
1002762686	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	368795	WWCMHR	00001508	12/18/2014
1002762668	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	384335	WWCMHR	00001508	12/18/2014
1002762454	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	371219	WWCMHR		12/17/2014
1002762452	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	374838	WWCMHR	00001508	12/17/2014
1002762451	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	374400	WWCMHR	00001508	12/17/2014
1002762440	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	352586	WWCMHR	00001508	12/17/2014
1002762439	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	342241	WWCMHR	00001508	12/17/2014
1002762438	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	367816	WWCMHR	00001508	12/17/2014
1002762412	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	343741	WWCMHR	00001508	12/17/2014
1002762403	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	372504	WWCMHR	00009391	12/17/2014
1002762401	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	372504	WWCMHR	00009391	12/17/2014
1002762400	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	374540	WWCMHR	00001508	12/17/2014
1002762399	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	372504	WWCMHR	00009391	12/17/2014
1002762395	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	362727	WWCMHR	00001508	12/17/2014
1002762393	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	357161	WWCMHR	00001508	12/17/2014
1002762391	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	375272	WWCMHR	00001508	12/17/2014
1002762387	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	385596	WWCMHR	00001508	12/17/2014
1002762309	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	347648	WWCMHR	00009391	12/17/2014
1002762303	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	347648	WWCMHR	00009391	12/17/2014
1002762301	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	347648	WWCMHR	00009391	12/17/2014
1002762294	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	384990	WWCMHR	00001508	12/17/2014
1002762290	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	342440	WWCMHR	00001508	12/17/2014
1002761951	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	348349	WWCMHR	00009391	12/17/2014
1002761846	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	379967	WWCMHR	00009391	12/17/2014
1002761832	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	352893	WWCMHR	00009391	12/17/2014

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1002761826	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	380675	WWCMHR	00009391	12/17/2014
1002761822	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	380675	WWCMHR	00009391	12/17/2014
1002761806	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	386038	WWCMHR	00009391	12/17/2014
1002761805	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	368550	WWCMHR	00009391	12/17/2014
1002761803	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	385513	WWCMHR	00009391	12/17/2014
1002761802	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	375829	WWCMHR	00009391	12/17/2014
1002761799	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	361565	WWCMHR	00009391	12/17/2014
1002761144	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	359853	WWCMHR	00009391	12/16/2014
1002761119	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	359853	WWCMHR	00009391	12/16/2014
1002759237	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	357001	WWCMHR	00009391	12/15/2014
1002757670	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	372279	WWCMHR	00009391	12/11/2014
1002757571	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	385462	WWCMHR	00009391	12/11/2014
1002757497	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	384257	WWCMHR	00009391	12/11/2014
1002757481	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	384301	WWCMHR	00009391	12/11/2014
1002757431	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	348326	WWCMHR	00009391	12/11/2014
1002757427	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	365491	WWCMHR	00009391	12/11/2014
1002757415	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	566570	WWCMHR	00009391	12/11/2014
1002757405	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	359728	WWCMHR	00009391	12/11/2014
1002757403	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	381274	WWCMHR	00009391	12/11/2014
1002756819	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	356679	WWCMHR	00009391	12/10/2014
1002756781	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	379372	WWCMHR	00009391	12/10/2014
1002756772	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	346444	WWCMHR	00009391	12/10/2014
1002756766	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	384074	WWCMHR	00009391	12/10/2014
1002756762	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	377006	WWCMHR	00009391	12/10/2014
1002756734	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	359915	WWCMHR	00009391	12/10/2014
1002756636	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	374357	WWCMHR	00009391	12/9/2014
1002755028	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	376127	WWCMHR	00009391	12/8/2014

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1002755015	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	355825	WWCMHR	00009391	12/8/2014
1002754980	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	383571	WWCMHR	00009391	12/8/2014
1002754947	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	382657	WWCMHR	00009391	12/8/2014
1002754943	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	372794	WWCMHR	00009391	12/8/2014
1002754531	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	344299	WWCMHR	00009391	12/5/2014
1002754133	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	384208	WWCMHR	00009391	12/5/2014
1002754007	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	375614	WWCMHR	00009391	12/5/2014
1002751620	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	379404	WWCMHR	00009391	12/3/2014
1002751607	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	376950	WWCMHR	00009391	12/3/2014
1002751511	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	360852	WWCMHR	00009391	12/2/2014
1002751458	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	355906	WWCMHR	00009391	12/2/2014
1002750991	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	563600	WWCMHR	00009391	12/2/2014
1002750902	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	379666	WWCMHR	00009391	12/2/2014
1002750894	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	379666	WWCMHR	00009391	12/2/2014
1002750859	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	378297	WWCMHR	00009391	12/2/2014
1002750856	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	378297	WWCMHR	00009391	12/2/2014
1002750822	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	366600	WWCMHR	00009391	12/2/2014
1002750821	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	366600	WWCMHR	00009391	12/2/2014
1002750817	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	367151	WWCMHR	00009391	12/2/2014
1002750815	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	367151	WWCMHR	00009391	12/2/2014
1002750806	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	381997	WWCMHR	00009391	12/2/2014
1002750805	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	381997	WWCMHR	00009391	12/2/2014
1002749456	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	385875	WWCMHR	00013797	11/26/2014
1002749275	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	383780	WWCMHR	00009391	11/26/2014
1002749245	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	366786	WWCMHR	00009391	11/26/2014
1002749231	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	348914	WWCMHR	00009391	11/26/2014
1002749225	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	348914	WWCMHR	00009391	11/26/2014

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1002749209	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	348914	WWCMHR	00009391	11/26/2014
1002748816	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	376962	WWCMHR	00009391	11/25/2014
1002748793	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	377878	WWCMHR	00009391	11/25/2014
1002748647	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	349748	WWCMHR	00009391	11/25/2014
1002748642	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	349748	WWCMHR	00009391	11/25/2014
1002748636	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	349748	WWCMHR	00009391	11/25/2014
1002748599	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	372500	WWCMHR	00009391	11/25/2014
1002746718	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	384588	WWCMHR	00001508	11/21/2014
1002746601	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	374606	WWCMHR	00009391	11/21/2014
1002746578	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	377991	WWCMHR	00009391	11/21/2014
1002745936	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	372794	WWCMHR	00009391	11/20/2014
1002745928	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	361362	WWCMHR	00009391	11/20/2014
1002745914	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	379811	WWCMHR	00009391	11/20/2014
1002745909	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	368726	WWCMHR	00009391	11/20/2014
1002745866	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	343311	WWCMHR	00009391	11/20/2014
1002745861	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	365149	WWCMHR	00009391	11/20/2014
1002745822	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	372297	WWCMHR	00009391	11/20/2014
1002745813	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	374472	WWCMHR	00009391	11/20/2014
1002745335	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	341743	WWCMHR	00009391	11/19/2014
1002745323	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	367114	WWCMHR	00009391	11/19/2014
1002745307	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	373399	WWCMHR	00009391	11/19/2014
1002744574	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	363377	WWCMHR	00001508	11/18/2014
1002744517	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	358871	WWCMHR	00009391	11/18/2014
1002744464	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	353286	WWCMHR	00009391	11/18/2014
1002744448	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	374630	WWCMHR	00009391	11/18/2014
1002744409	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	386604	WWCMHR	00009391	11/18/2014
1002744390	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	355231	WWCMHR	00009391	11/18/2014

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1002744347	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	380719	WWCMHR	00009391	11/18/2014
1002744339	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	366425	WWCMHR	00009391	11/18/2014
1002744333	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	563689	WWCMHR	00009391	11/18/2014
1002744276	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	376242	WWCMHR	00009391	11/18/2014
1002744273	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	379882	WWCMHR	00009391	11/18/2014
1002744238	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	376048	WWCMHR	00009391	11/18/2014
1002744213	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	563602	WWCMHR	00009391	11/18/2014
1002744207	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	345524	WWCMHR	00009391	11/18/2014
1002744201	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	366663	WWCMHR	00009391	11/18/2014
1002744191	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	364914	WWCMHR	00009391	11/18/2014
1002744146	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	349636	WWCMHR	00009391	11/18/2014
1002743699	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	362470	WWCMHR	00009391	11/17/2014
1002722714	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	343162	WWCMHR	00001508	10/15/2014
1002722575	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	370075	WWCMHR	00001508	10/15/2014
1002722273	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	379156	WWCMHR	00001508	10/15/2014
1002722267	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	384253	WWCMHR	00001508	10/15/2014
1002722259	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	379221	WWCMHR	00001508	10/15/2014
1002721671	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	559875	WWCMHR	00009391	10/14/2014
1002716151	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	356357	WWCMHR	00009391	10/3/2014
1002716144	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	369219	WWCMHR	00009391	10/3/2014
1002716121	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	561371	WWCMHR	00009391	10/3/2014
1002716086	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	371901	WWCMHR	00009391	10/3/2014
1002715634	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	383861	WWCMHR	00009391	10/2/2014
1002715631	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	351121	WWCMHR	00009391	10/2/2014
1002715619	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	377663	WWCMHR	00009391	10/2/2014
1002715611	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	386153	WWCMHR	00009391	10/2/2014
1002715580	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	367904	WWCMHR	00009391	10/2/2014

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1002715577	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	379735	WWCMHR	00009391	10/2/2014
1002715564	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	362807	WWCMHR	00009391	10/2/2014
1002715556	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	375220	WWCMHR	00009391	10/2/2014
1002715359	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	354361	WWCMHR	00009391	10/2/2014
1002704959	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	344183	WWCMHR	00009391	9/16/2014
1002654130	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	371009	WWCMHR	00013797	6/25/2014
1002654095	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	382900	WWCMHR	00013797	6/25/2014
1002654077	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	378628	WWCMHR	00013797	6/25/2014
1002633113	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	444615	WWCMHR	00009391	5/22/2014
1002626807	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	446954	WWCMHR	00009391	5/9/2014
1002625703	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	411162	WWCMHR	00032708	5/7/2014
1002600566	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	424462	WWCMHR	00032708	3/19/2014
1002600560	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	422575	WWCMHR	00032708	3/19/2014
1002600555	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	439717	WWCMHR	00032708	3/19/2014
1002595535	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	442181	WWCMHR	00001508	3/11/2014
1002595529	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	432511	WWCMHR	00001508	3/11/2014
1002595527	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	405712	WWCMHR	00001508	3/11/2014
1002595139	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	414199	WWCMHR	00032708	3/10/2014
1002589028	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	416753	WWCMHR	00013797	2/28/2014
1002588629	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	404874	WWCMHR	00013797	2/27/2014
1002588328	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	388310	WWCMHR	00032708	2/27/2014
1002587798	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	447513	WWCMHR	00032708	2/26/2014
1002587737	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	408481	WWCMHR	00032708	2/26/2014
1002587730	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	444755	WWCMHR	00032708	2/26/2014
1002587720	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	388077	WWCMHR	00032708	2/26/2014
1002583138	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	446560	WWCMHR	00001508	2/19/2014
1002529997	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	376301	WWCMHR	00032708	11/27/2013

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1002505946	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	352314	WWCMHR	00001508	10/8/2013
1002505862	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	353647	WWCMHR	00001508	10/8/2013
1002497353	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	429866	WWCMHR	00013797	9/20/2013
1002480475	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	417397	WWCMHR	00001508	8/20/2013
1002480235	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	404415	WWCMHR	00001508	8/20/2013
1002475035	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	420210	WWCMHR	00001508	8/8/2013
1002363105	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	440583	WWCMHR	00032708	1/29/2013
1002363083	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	547301	WWCMHR	00032708	1/29/2013
1002363077	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	418048	WWCMHR	00032708	1/29/2013
1002319667	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	360781	WWCMHR	00032708	10/31/2012
1002319665	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	367365	WWCMHR	00032708	10/31/2012
1002319664	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	363275	WWCMHR	00032708	10/31/2012
1002319659	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	363902	WWCMHR	00032708	10/31/2012
1002319650	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	386118	WWCMHR	00032708	10/31/2012
1002319646	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	383865	WWCMHR	00032708	10/31/2012
1002308923	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	407282	WWCMHR	00013797	10/11/2012
1002308907	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	422324	WWCMHR	00013797	10/11/2012
1002308887	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	444857	WWCMHR	00013797	10/11/2012
1002299826	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	391796	WWCMHR	00013797	9/24/2012
1002293266	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	WWC-B0002-MH	WWCMHR	00032708	9/12/2012
1002290101	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	439940	WWCMHR	00013797	9/6/2012
1002282113	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	380552	WWCMHR	00032708	8/23/2012
1002282107	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	348283	WWCMHR	00032708	8/23/2012
1002282103	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	384544	WWCMHR	00032708	8/23/2012
1002282084	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	384466	WWCMHR	00032708	8/23/2012
1002282055	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	370980	WWCMHR	00032708	8/23/2012
1002280640	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	545817	WWCMHR	00032708	8/21/2012

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1002279730	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	545816	WWCMHR	00032708	8/20/2012
1002279716	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	354648	WWCMHR	00032708	8/20/2012
1002249898	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	407609	WWCMHR	00032708	7/9/2012
1002249833	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	416494	WWCMHR	00032708	7/9/2012
1002249706	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	432684	WWCMHR	00032708	7/9/2012
1002249670	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	434263	WWCMHR	00032708	7/9/2012
1002249535	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	412078	WWCMHR	00032708	7/9/2012
1002248135	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	447711	WWCMHR	00001508	7/5/2012
1002208367	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	479449	WWCMHR	00001508	5/9/2012
1002206016	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	424299	WWCMHR	00001508	5/3/2012
1002205035	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	424718	WWCMHR	00001508	5/2/2012
1002204956	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	423324	WWCMHR	00001508	5/2/2012
1002203620	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	493704	WWCMHR	00001508	4/30/2012
1002175421	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	368336	WWCMHR	00001508	3/20/2012
1002175346	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	370179	WWCMHR	00001508	3/20/2012
1002175344	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	360909	WWCMHR	00001508	3/20/2012
1002175334	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	379694	WWCMHR	00001508	3/20/2012
1002169254	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	489202	WWCSGM	00001508	3/9/2012
1002169238	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	512849	WWCMHR	00013797	3/9/2012
1002162570	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	396756	WWCMHR	00001508	2/29/2012
1002162542	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	420190	WWCMHR	00001508	2/29/2012
1002162538	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	439277	WWCMHR	00001508	2/29/2012
1002162536	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	435026	WWCMHR	00001508	2/29/2012
1002162533	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	393338	WWCMHR	00001508	2/29/2012
1002162511	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	406599	WWCMHR	00001508	2/29/2012
1002162509	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	398039	WWCMHR	00001508	2/29/2012
1002162504	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	427090	WWCMHR	00001508	2/29/2012

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1002162464	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	427185	WWCMHR	00001508	2/29/2012
1002162463	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	387010	WWCMHR	00001508	2/29/2012
1002162460	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	435825	WWCMHR	00001508	2/29/2012
1002162457	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	446539	WWCMHR	00001508	2/29/2012
1002162453	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	437684	WWCMHR	00001508	2/29/2012
1002162451	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	430356	WWCMHR	00001508	2/29/2012
1002162447	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	434049	WWCMHR	00001508	2/29/2012
1002162422	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	399668	WWCMHR	00001508	2/29/2012
1002162410	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	418172	WWCMHR	00001508	2/29/2012
1002162396	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	414227	WWCMHR	00001508	2/29/2012
1002162392	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	399958	WWCMHR	00001508	2/29/2012
1002154935	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	410465	WWCMHR	00001508	2/28/2012
1002154896	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	410540	WWCMHR	00001508	2/28/2012
1002139820	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	451624	WWCMHR	00013797	2/23/2012
1002043157	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	427161	WWCMHR	00001508	12/14/2011
1002043022	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	389421	WWCMHR	00001508	12/14/2011
1002040354	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	394610	WWCMHR	00001508	12/8/2011
1002040348	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	405375	WWCMHR	00001508	12/8/2011
1002040347	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	413491	WWCMHR	00001508	12/8/2011
1002040234	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	364199	WWCMHR	00001508	12/8/2011
1002035548	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	406872	WWCMHR	00032708	11/28/2011
1002035441	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	405408	WWCMHR	00032708	11/28/2011
1002034239	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	359452	WWCMHR	00001508	11/22/2011
1001999018	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	396976	WWCMHR	00001508	11/1/2011
1001998991	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	390627	WWCMHR	00001508	11/1/2011
1001995668	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	401362	WWCMHR	00001508	10/31/2011
1001995659	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	442903	WWCMHR	00001508	10/31/2011

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1001995646	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	411466	WWCMHR	00001508	10/31/2011
1001995642	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	423553	WWCMHR	00001508	10/31/2011
1001995631	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	403249	WWCMHR	00001508	10/31/2011
1001995629	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	450612	WWCMHR	00001508	10/31/2011
1001995627	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	402131	WWCMHR	00001508	10/31/2011
1001995621	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	430301	WWCMHR	00001508	10/31/2011
1001995619	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	436389	WWCMHR	00001508	10/31/2011
1001991602	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	446249	WWCMHR	00001508	10/25/2011
1001991589	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	414597	WWCMHR	00001508	10/25/2011
1001923076	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	387935	WWCMHR	00032708	6/28/2011
1001919716	Plug and Waterproof- Coat Manhole cone	R	Released/Open	840	428252	WWCMHR	00032708	6/20/2011
1001917666	Plug and Waterproof-Coat Manhole Wall	R	Released/Open	840	448983	WWCMHR	00013797	6/14/2011
1001909868	Plug and Waterproof-Coat Entire Manhole	R	Released/Open	840	419179	WWCMHR	00001508	5/23/2011
1001909849	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	388905	WWCMHR	00001508	5/23/2011
1001909843	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	404947	WWCMHR	00001508	5/23/2011
1001909728	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	444037	WWCMHR	00001508	5/23/2011
1001904949	Plug and Waterproof-Coat Entire Manhole	R	Released/Open	840	415628	WWCMHR	00013797	5/10/2011
1001839708	Plug and Waterproof-Coat Intire Manhole	R	Released/Open	840	357770	WWCMHR	00013797	2/2/2011
1001838108	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	431692	WWCMHR	00032708	1/28/2011
1001838105	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	418671	WWCMHR	00032708	1/28/2011
1001838101	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	387662	WWCMHR	00032708	1/28/2011
1001838096	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	396348	WWCMHR	00032708	1/28/2011
1001806168	MANHOLE	R	Released/Open	840	392078	WWCMHR	00013797	11/2/2010
1001806166	MANHOLE	R	Released/Open	840	410294	WWCMHR	00013797	11/2/2010
1001801031	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	406299	WWCMHR	00032708	10/21/2010
1001801016	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	425202	WWCMHR	00032708	10/21/2010
1001801010	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	445153	WWCMHR	00032708	10/21/2010

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1001801001	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	391707	WWCMHR	00032708	10/21/2010
1001800922	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	425760	WWCMHR	00032708	10/21/2010
1001800462	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	441268	WWCMHR	00032708	10/20/2010
1001800452	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	425374	WWCMHR	00032708	10/20/2010
1001800356	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	434465	WWCMHR	00001508	10/20/2010
1001800347	Plug and Waterproof- Coat Manhole cone	R	Released/Open	840	389827	WWCMHR	00001508	10/20/2010
1001800315	Plug and Waterproof-Coat Manhole Cone	R	Released/Open	840	392672	WWCMHR	00001508	10/20/2010
1001800312	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	438591	WWCMHR	00001508	10/20/2010
1001800288	Plug and Waterproof- Coat Manhole cone	R	Released/Open	840	439297	WWCMHR	00001508	10/20/2010
1001800279	Plug and Waterproof -Coat Manhole cone	R	Released/Open	840	42734	WWCMHR	00001508	10/20/2010
1001800274	Plug and Waterproof -Coat Manhole cone	R	Released/Open	840	400088	WWCMHR	00001508	10/20/2010
1001799908	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	422402	WWCMHR	00001508	10/19/2010
1001799903	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	423790	WWCMHR	00001508	10/19/2010
1001799782	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	432442	WWCMHR	00001508	10/19/2010
1001799775	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	448756	WWCMHR	00001508	10/19/2010
1001799760	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	407828	WWCMHR	00001508	10/19/2010
1001799758	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	423732	WWCMHR	00001508	10/19/2010
1001799742	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	390050	WWCMHR	00001508	10/19/2010
1001799738	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	421870	WWCMHR	00001508	10/19/2010
1001799735	Plug and Waterproof -Coat Entire Manhole	R	Released/Open	840	421870	WWCMHR	00001508	10/19/2010
1001799725	Plug and Waterproof-Coat Entire Manhole	R	Released/Open	840	442858	WWCMHR	00001508	10/19/2010
1001799317	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	420730	WWCMHR	00001508	10/18/2010
1001799253	Plug and Waterproof-Coat Manhole Cone	R	Released/Open	840	432035	WWCMHR	00001508	10/18/2010
1001784998	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	424225	WWCMHR		6/20/2001
1001784996	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	446423	WWCMHR		6/20/2001
1001784995	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	436935	WWCMHR		6/20/2001
1001784993	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	407234	WWCMHR		6/20/2001

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1001784992	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	407234	WWCMHR		6/20/2001
1001784907	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	418147	WWCMHR		9/26/2001
1001784868	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	434168	WWCMHR		9/20/2001
1001784721	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	439454	WWCMHR		3/9/2000
1001784714	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	437439	WWCMHR		3/8/2000
1001784711	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	416032	WWCMHR		3/8/2000
1001784701	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	395906	WWCMHR		3/8/2000
1001784686	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	394294	WWCMHR		3/8/2000
1001784682	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	408170	WWCMHR		3/8/2000
1001784676	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	418658	WWCMHR		3/8/2000
1001784673	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	412035	WWCMHR		3/8/2000
1001784671	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	400181	WWCMHR		3/8/2000
1001784668	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	387096	WWCMHR		3/8/2000
1001784659	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	447346	WWCMHR		3/8/2000
1001784576	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	424487	WWCMHR		6/12/2000
1001784573	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	440397	WWCMHR		6/12/2000
1001784570	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	415013	WWCMHR		6/12/2000
1001784568	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	433559	WWCMHR		6/9/2000
1001784564	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	394390	WWCMHR		6/9/2000
1001784201	Plug and Waterproof-Coat Entire Manhole	R	Released/Open	840	438877	WWCMHR		10/8/2009
1001784174	Plug and Waterproof-Coat Entire Manhole	R	Released/Open	840	388744	WWCMHR		6/19/2009
1001784157	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	394325	WWCMHR		4/22/2010
1001783914	Plug and Waterproof-Coat Entire Manhole	R	Released/Open	840	439940	WWCMHR		2/11/2009
1001783646	Plug and Waterproof - Coat Entire Manhole	R	Released/Open	840	447363	WWCMHR		5/14/2010
1001783413	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	395256	WWCMHR		5/23/2001
1001783301	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	422401	WWCMHR		5/5/2006
1001783299	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	433659	WWCMHR		5/5/2006

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1001783297	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	438617	WWCMHR		5/5/2006
1001783295	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	420908	WWCMHR		5/5/2006
1001783293	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	406759	WWCMHR		5/5/2006
1001783203	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	398017	WWCMHR		12/1/2000
1001783199	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	392154	WWCMHR		12/1/2000
1001783197	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	405165	WWCMHR		12/1/2000
1001782505	Plug and Waterproof-Coat Entire Manhole	R	Released/Open	840	436470	WWCMHR		6/4/2010
1001782435	Plug and Waterproof-Coat Entire Manhole	R	Released/Open	840	396215	WWCMHR		6/15/2010
1001781971	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	402569	WWCMHR		5/20/2008
1001781866	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	WWC-B0600-MH	WWCMHR		6/24/2008
1001779803	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	381553	WWCMHR		4/3/2001
1001778681	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	376213	WWCMHR		1/17/2001
1001777743	Plug and Waterproof-Coat Manhole Walls	R	Released/Open	840	350054	WWCMHR		5/9/2008
1001777742	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	350054	WWCMHR		5/9/2008
1001777741	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	350054	WWCMHR		5/9/2008
1001777733	Plug and Waterproof-Coat Manhole cone	R	Released/Open	840	382228	WWCMHR		5/9/2008
1001777732	Plug and Waterproof Coat Manhole Chimney	R	Released/Open	840	382228	WWCMHR		5/9/2008
1001777371	Plug and Waterproof-Coat Entire Manhole	R	Released/Open	840	353202	WWCMHR		5/9/2008
1001777075	Plug and Waterproof-Coat Entire Manhole	R	Released/Open	840	378058	WWCMHR		4/23/2010
1001776740	Plug and Waterproof-Coat Entire Manhole 520	R	Released/Open	840	WWC-B0001-MH	WWCMHR		6/15/2010
1001776242	Plug and Waterproof-Coat Entire Manhole 140	R	Released/Open	840	WWC-B0001-MH	WWCMHR		8/24/2010


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