LINERTYPE	String	20	Liner Type	The method used to line the pipe	piLiningMethod		true		
ENABLED	SmallInteger	2	Enabled Flag	Indicates if the asset is enabled within a geometric network.	EnabledDomain	1	true		
FIELDNOTES	String	255	Field Notes	Comments or notes from field staff, including surveyors, that are relevant to the asset			true		
NOTES	String	200	GIS Notes	GIS entry notes or comments relevant to the asset			true		
created_user	String	255	created_user	created_user			true		
created_date	Date	8	created_date	created_date			true		
last_edited_user	String	255	last_edited_user	last_edited_user			true		
last_edited_date	Date	8	last_edited_date	last_edited_date			true		

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ssLateralLine - FeatureClass

Name ssLateralLine
ShapeType Polyline
FeatureType Simple
AliasName ss Lateral Lines
HasM false
HasZ false
HasAttachments false
Description Sanitary sewer lateral pipes.

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYNUM	Integer	4	Facility Number	Locally asssigned numeric unique identifier populated by database admin created database trigger		0	true		
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
ACTIVESTATUS	String	20	Active Status	Identifies whether the asset is in use, not in use or removed from the ground	piActiveStatus	Active	true		
ACTIVEFLAG	SmallInteger	2	Active Flag	Identifies whether the feature is in use/active	BooleanDomain	1	true		

INVCLASS	String	20	Inventory Class	The method used to establish the geographic location of the asset	InventoryClass		true		
COLLECTEDDATE	Date	8	GPS Collected Date	Date the feature was located by a surveyor			true		
OWNEDBY	SmallInteger	2	Owned By	Indicates which organization owns the asset	AssetOwner	1	true		
MAINTBY	SmallInteger	2	Maintained By	Indicates which organization maintains the asset	AssetManager	1	true		
INSTALLDATE	Date	8	Install Date	The date the asset was installed			true		
MATERIAL	String	20	Pipe Material	Identifies the construction material of the pipe connection	piPipeMaterial		true		
LINEDYEAR	String	4	Year Lined	The year the pipe was last lined			true		
LINERTYPE	String	30	Liner Type	The method used to line the pipe	piLiningMethod		true		
DIAMETER	Double	8	Diameter	Identified the size of meter (meter_sz in Utility Billing database)	piPipeDiameter	0	true		
DISTANCE	Integer	4	Distance	Distance		0	true		
WATERTYPE	String	30	Water Type	Identifies the type of water in the pipe	ssWaterType		true		
LOCATION	String	200	Location Description	Identifies the meter box location (area_served in Utility Billing database). Value is copied to Cityworks work order Location Details field when attached to a work order.			true		
ADDRESS	String	50	Address	The address or closest address to the asset. Value is copied to Cityworks work order Address field when attached to a work order (address in Utility Billing database)			true		
PURCHASEDATE	Date	8	Purchase Date	The purchase date of the asset. Used for future asset management analysis.			true		

WARRANTYDATE	Date	8	Warranty Date	The date the warranty expires on the asset. If populated and asset is still under warranty, asset record will show up pink on the Cityworks work order.			true		
ASSETCOST	Double	8	Asset Cost	The replacement cost of the asset. If populated, this will be used for asset management analysis and repair/replace decisions.		0	true		
CONDITION	SmallInteger	2	Condition Rating	The condition rating of the asset. Used by Cityworks Analytics for condition analysis output. May be calculated within a Cityworks Inspection and updated from there to GIS.	piConditionPACP		true		
CONDITIONDATE	Date	8	Condition Date	The date of the last condition assessment. Can be updated from Cityworks Inspection to the GIS.			true		
SERVICELIFE	SmallInteger	2	Service Life	The expected number of years an asset is physically capable of continuing to operate. Used to anticipate retirement of assets and project funding needs.		0	true		
RUL	SmallInteger	2	Remaining Useful Life	The Remaining Useful Life of an asset calculated by subtracting the number of years since installation, from the sevice life. It will be heavily relied upon for asset management analysis.		0	true		
COF	SmallInteger	2	Consequence of Failure	The consequence of failure. Used in the BRE model as the impact due to asset failure.		0	true		

POF	SmallInteger	2	Probability of Failure	Probability of Failure. Used in the BRE model to estimate the likelihood the predicted asset (or service) failure will occur and is adjusted for backup and redundancy of the asset.		0	true		
BRE	SmallInteger	2	Business Risk Exposure	Business Risk Exposure is a the product of probablity of failure (POF) and consequence of failure (COF). Values range from 1 (low risk) to 100 (high risk) and is used to prioritize investments.		0	true		
LASTINSPECTDATE	Date	8	Last Inspection Date	The date the asset was most recently inspected			true		
LASTMAINTDATE	Date	8	Last Maintenance Date	The date of the most recent maintenance activity			true		
MANUFACTURER	String	50	Manufacturer	The manufacturer or brand of the asset (company_cd in Utility Billing database)			true		
PROJECTNUM	String	32	City Project Number	The City's Project Number under which the asset was installed			true		
FILENUM	String	32	City File Number	The City's File Number			true		
WORKORDERNUM	String	60	City Work Order Number	The work order number for performing work on the asset (Cityworks, Qalert, etc)			true		
SURVEYRPTNUM	String	32	Survey Report Number	The City's Surveyor's Report Number under which the location of an asset or group of assets are captured, may be the same as the Service Request or Work Order Number			true		
ENABLED	SmallInteger	2	Enabled Flag	Indicates if the asset is enabled within a geometric network.	EnabledDomain	1	true		

FIELDNOTES	String	255	Field Notes	Comments or notes from field staff, including surveyors, that are relevant to the asset			true		
NOTES	String	200	GIS Notes	GIS entry notes or comments relevant to the asset			true		
created_user	String	255	created_user	created_user			true		
created_date	Date	8	created_date	created_date			true		
last_edited_user	String	255	last_edited_user	last_edited_user			true		
last_edited_date	Date	8	last_edited_date	last_edited_date			true		

ssManhole - FeatureClass

Name ssManhole
ShapeType Point
FeatureType Simple
AliasName ss Manholes
HasM false
HasZ false
HasAttachments false
Description Manhole features may connect two or more pipes and control the flow of water in the network through pipe elevations.

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYNUM	Integer	4	Facility Number	Locally asssigned numeric unique identifier populated by database admin created database trigger		0	true		
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
INVCLASS	String	20	Inventory Class	The method used to establish the geographic location of the asset	InventoryClass		true		
MHTYPE	String	15	Manhole Type	The type of manhole	piManholeType		true		
ACTIVESTATUS	String	20	Active Status	Identifies whether the asset is in use, not in use or removed from the ground	piActiveStatus	Active	true		
ACTIVEFLAG	SmallInteger	2	Active Flag	Identifies whether the feature is in use/active	BooleanDomain	1	true		

COLLECTEDDATE	Date	8	GPS Collected Date	Date the feature was located by a surveyor			true		
OWNEDBY	SmallInteger	2	Owned By	Indicates which organization owns the asset	AssetOwner	1	true		
MAINTBY	SmallInteger	2	Maintained By	Indicates which organization maintains the asset	AssetManager	1	true		
INSTALLDATE	Date	8	Install Date	The date the asset was installed			true		
LOCATION	String	200	Location Description	Identifies the meter box location (area_served in Utility Billing database). Value is copied to Cityworks work order Location Details field when attached to a work order.			true		
ADDRESS	String	50	Address	The address or closest address to the asset. Value is copied to Cityworks work order Address field when attached to a work order (address in Utility Billing database)			true		
PURCHASEDATE	Date	8	Purchase Date	The purchase date of the asset. Used for future asset management analysis.			true		
WARRANTYDATE	Date	8	Warranty Date	The date the warranty expires on the asset. If populated and asset is still under warranty, asset record will show up pink on the Cityworks work order.			true		
ASSETCOST	Double	8	Asset Cost	The replacement cost of the asset. If populated, this will be used for asset management analysis and repair/replace decisions.		0	true		
CONDITION	SmallInteger	2	Condition Rating	The condition rating of the asset. Used by Cityworks Analytics for condition analysis output.	piConditionPACP		true		

				May be calculated within a Cityworks Inspection and updated from there to GIS.					
CONDITIONDATE	Date	8	Condition Date	The date of the last condition assessment. Can be updated from Cityworks Inspection to the GIS.			true		
SERVICELIFE	SmallInteger	2	Service Life	The expected number of years an asset is physically capable of continuing to operate. Used to anticipate retirement of assets and project funding needs.		0	true		
RUL	SmallInteger	2	Remaining Useful Life	The Remaining Useful Life of an asset calculated by subtracting the number of years since installation, from the sevice life. It will be heavily relied upon for asset management analysis.		0	true		
COF	SmallInteger	2	Consequence of Failure	The consequence of failure. Used in the BRE model as the impact due to asset failure.		0	true		
POF	SmallInteger	2	Probability of Failure	Probability of Failure. Used in the BRE model to estimate the likelihood the predicted asset (or service) failure will occur and is adjusted for backup and redundancy of the asset.		0	true		
BRE	SmallInteger	2	Business Risk Exposure	Business Risk Exposure is a the product of probablity of failure (POF) and consequence of failure (COF). Values range from 1 (low risk) to 100 (high risk) and is used to prioritize investments.		0	true		

LASTINSPECTDATE	Date	8	Last Inspection Date	The date the asset was most recently inspected			true		
LASTMAINTDATE	Date	8	Last Maintenance Date	The date of the most recent maintenance activity			true		
MANUFACTURER	String	50	Manufacturer	The manufacturer or brand of the asset (company_cd in Utility Billing database)			true		
PROJECTNUM	String	32	City Project Number	The City's Project Number under which the asset was installed			true		
FILENUM	String	32	City File Number	The City's File Number			true		
WORKORDERNUM	String	60	City Work Order Number	The work order number for performing work on the asset (Cityworks, Qalert, etc)			true		
SURVEYRPTNUM	String	32	Survey Report Number	The City's Surveyor's Report Number under which the location of an asset or group of assets are captured, may be the same as the Service Request or Work Order Number			true		
CVTYPE	String	20	Cover Type	The type of stormwater manhole cover	piManholeCoverType		true		
WALLMAT	String	25	Wall Material	The material used to construct the manhole wall	piPipeMaterial		true		
CUTDEPTH	Double	8	Pavement Cut Depth	Pavement cut depth		0	true		
LINED	String	3	Lined	Indicates if the manhole is lined	YesNo		true		
WATERTYPE	String	30	Water Type	Identifies the type of water in the pipe	ssWaterType		true		
SUMFLOW	Double	8	Flow Summary	The sum of flow		0	true		
FLOWDIR	String	25	Flow Direction	Defines the direction of flow using geometric flow direction values	Direction		true		
RIMELEV	Double	8	Rim Elevation	The elevation of the inlet rim		0	true		
HIGHELEV	Double	8	High Pipe Elevation	High pipe elevation inside manhole		0	true		
INVERT	Double	8	Invert	Invert		0	true		
INVERTELEV	Double	8	Invert Elevation	The invert elevation		0	true		

INVERT1ELEV	Double	8	Invert1 Elevation	The invert elevation		0	true		
INVERT1DIR	String	50	Invert 1 Direction	Invert 1 Direction	Direction		true		
INVERT1SIZE	Double	8	Invert 1 Size	Invert 1 Size	piPipeDiameter		true		
INVERT1MAT	String	50	Invert1 Pipe Material	The construction material of the invert pipe	piPipeMaterial		true		
INVERT2ELEV	Double	8	Invert2 Elevation	The invert elevation		0	true		
INVERT2DIR	String	50	Invert 2 Direction	Invert 2 Direction	Direction		true		
INVERT2SIZE	Double	8	Invert 2 Size	Invert 2 Size	piPipeDiameter		true		
INVERT2MAT	String	50	Invert2 Pipe Material	The construction material of the invert pipe	piPipeMaterial		true		
INVERT3ELEV	Double	8	Invert 3 Elevation	The invert elevation		0	true		
INVERT3DIR	String	50	Invert 3 Direction	Invert 3 Direction	Direction		true		
INVERT3SIZE	Double	8	Invert 3 Size	Invert 3 Size	piPipeDiameter		true		
INVERT3MAT	String	50	Invert 3 Pipe Material	The construction material of the invert pipe	piPipeMaterial		true		
INVERT4ELEV	Double	8	Invert 4 Elevation	The invert elevation		0	true		
INVERT4DIR	String	50	Invert 4 Direction	Invert 4 Direction	Direction		true		
INVERT4SIZE	Double	8	Invert 4 Size	Invert 4 Size	piPipeDiameter		true		
INVERT4MAT	String	50	Invert 4 Pipe Material	The construction material of the invert pipe	piPipeMaterial		true		
INVERT5ELEV	Double	8	Invert 5 Elevation	The invert elevation		0	true		
INVERT5DIR	String	50	Invert 5 Direction	Invert 5 Direction	Direction		true		
INVERT5SIZE	Double	8	Invert 5 Size	Invert 5 Size	piPipeDiameter		true		
INVERT5MAT	String	50	Invert 5 Pipe Material	The construction material of the invert pipe	piPipeMaterial		true		
INVERT6ELEV	Double	8	Invert 6 Elevation	The invert elevation		0	true		
INVERT6DIR	String	50	Invert 6 Direction	Invert 6 Direction	Direction		true		
INVERT6SIZE	Double	8	Invert 6 Size	Invert 6 Size	piPipeDiameter		true		
INVERT6MAT	String	50	Invert 6 Pipe Material	The construction material of the invert pipe	piPipeMaterial		true		
XYCONVERTED	String	5	X, Y Converted	XYCONVERTED	YesNo		true		
XCOORD	Double	8	X Coordinate	XCOORD			true		
YCOORD	Double	8	Y Coordinate	YCOORD			true		
ZCOORD	Double	8	Z Coordinate	ZCOORD			true		
ANCILLARYROLE	SmallInteger	2	Ancillary Role	ANCILLARYROLE	AncillaryRoleDomain		true		
ENABLED	SmallInteger	2	Enabled	ENABLED	EnabledDomain	1	true		
FIELDNOTES	String	255	Field Notes	FIELDNOTES			true		
NOTES	String	200	GIS Notes	NOTES			true		
created_user	String	255	created_user	created_user			true		
created_date	Date	8	created_date	created_date			true		
last_edited_user	String	255	last_edited_user	last_edited_user			true		
last_edited_date	Date	8	last_edited_date	last_edited_date			true		

ssNetworkStructure - FeatureClass

Name ssNetworkStructure
ShapeType Point
FeatureType Simple
AliasName ss Network Structures
HasM false
HasZ false
HasAttachments false
Description Sanitary sewer network structures such as pump stations or pipe ends.

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYNUM	Integer	4	Facility Number	Locally asssigned numeric unique identifier populated by database admin created database trigger		0	true		
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
STRUCTTYPE	String	30	Structure Type	The teyp of water structure	ssNetworkStructureType		true		
NAME	String	100	Name	The name of the facility or location the pump is housed in			true		
ACTIVESTATUS	String	20	Active Status	Identifies whether the asset is in use, not in use or removed from the ground	piActiveStatus	Active	true		
ACTIVEFLAG	SmallInteger	2	Active Flag	Identifies whether the feature is in use/active	BooleanDomain	1	true		
INVCLASS	String	20	Inventory Class	The method used to establish the geographic location of the asset	InventoryClass		true		
COLLECTEDDATE	Date	8	GPS Collected Date	Date the feature was located by a surveyor			true		
OWNEDBY	SmallInteger	2	Owned By	Indicates which organization owns the asset	AssetOwner	1	true		
MAINTBY	SmallInteger	2	Maintained By	Indicates which organization maintains the asset	AssetManager	1	true		
INSTALLDATE	Date	8	Install Date	The date the asset was installed			true		

LOCATION	String	200	Location Description	Identifies the meter box location (area_served in Utility Billing database). Value is copied to Cityworks work order Location Details field when attached to a work order.			true		
ADDRESS	String	50	Address	The address or closest address to the asset. Value is copied to Cityworks work order Address field when attached to a work order (address in Utility Billing database)			true		
PURCHASEDATE	Date	8	Purchase Date	The purchase date of the asset. Used for future asset management analysis.			true		
WARRANTYDATE	Date	8	Warranty Date	The date the warranty expires on the asset. If populated and asset is still under warranty, asset record will show up pink on the Cityworks work order.			true		
ASSETCOST	Double	8	Asset Cost	The replacement cost of the asset. If populated, this will be used for asset management analysis and repair/replace decisions.		0	true		
CONDITION	SmallInteger	2	Condition Rating	The condition rating of the asset. Used by Cityworks Analytics for condition analysis output. May be calculated within a Cityworks Inspection and updated from there to GIS.	piConditionPACP		true		
CONDITIONDATE	Date	8	Condition Date	The date of the last condition assessment. Can be updated			true		

				from Cityworks Inspection to the GIS.					
SERVICELIFE	SmallInteger	2	Service Life	The expected number of years an asset is physically capable of continuing to operate. Used to anticipate retirement of assets and project funding needs.		0	true		
RUL	SmallInteger	2	Remaining Useful Life	The Remaining Useful Life of an asset calculated by subtracting the number of years since installation, from the sevice life. It will be heavily relied upon for asset management analysis.		0	true		
COF	SmallInteger	2	Consequence of Failure	The consequence of failure. Used in the BRE model as the impact due to asset failure.		0	true		
POF	SmallInteger	2	Probability of Failure	Probability of Failure. Used in the BRE model to estimate the likelihood the predicted asset (or service) failure will occur and is adjusted for backup and redundancy of the asset.		0	true		
BRE	SmallInteger	2	Business Risk Exposure	Business Risk Exposure is a the product of probablity of failure (POF) and consequence of failure (COF). Values range from 1 (low risk) to 100 (high risk) and is used to prioritize investments.		0	true		
LASTINSPECTDATE	Date	8	Last Inspection Date	The date the asset was most recently inspected			true		
LASTMAINTDATE	Date	8	Last Maintenance Date	The date of the most recent maintenance activity			true		

MANUFACTURER	String	50	Manufacturer	The manufacturer or brand of the asset (company_cd in Utility Billing database)			true		
PROJECTNUM	String	32	City Project Number	The City's Project Number under which the asset was installed			true		
FILENUM	String	32	City File Number	The City's File Number			true		
WORKORDERNUM	String	60	City Work Order Number	The work order number for performing work on the asset (Cityworks, Qalert, etc)			true		
SURVEYRPTNUM	String	32	Survey Report Number	The City's Surveyor's Report Number under which the location of an asset or group of assets are captured, may be the same as the Service Request or Work Order Number			true		
XYCONVERTED	String	5	X, Y Converted	X, Y Converted	YesNo		true		
XCOORD	Double	8	X Coordinate	X-Coordinate of the asset (FL State Plane-East)		0	true		
YCOORD	Double	8	Y Coordinate	Y-Coordinate of the asset (FL State Plane-East)		0	true		
ZCOORD	Double	8	Z Coordinate	Z-Coordinate of the asset		0	true		
OPDATE	Date	8	Operational Date	Date when the facility was put into service			true		
DIAMETER	Double	8	Diameter	Identified the size of meter (meter_sz in Utility Billing database)	piPipeDiameter		true		
ANCILLARYROLE	SmallInteger	2	Ancillary Role	Identifies whether the asset participates in a geometric network as either a source or a sink	AncillaryRoleDomain	0	true		
ROTATION	Double	8	Rotation	Map symbol rotation value		0	true		
ENABLED	SmallInteger	2	Enabled Flag	Indicates if the asset is enabled within a geometric network.	EnabledDomain	1	true		

FIELDNOTES	String	255	Field Notes	Comments or notes from field staff, including surveyors, that are relevant to the asset			true		
NOTES	String	200	GIS Notes	GIS entry notes or comments relevant to the asset			true		
created_user	String	255	created_user	created_user			true		
created_date	Date	8	created_date	created_date			true		
last_edited_user	String	255	last_edited_user	last_edited_user			true		
last_edited_date	Date	8	last_edited_date	last_edited_date			true		

ssPressurizedMain - FeatureClass

Name ssPressurizedMain
ShapeType Polyline
FeatureType Simple
AliasName ss Pressurized Mains
HasM false
HasZ false
HasAttachments false
Description Pressurized sanitary sewer mains.

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYNUM	Integer	4	Facility Number	Locally asssigned numeric unique identifier populated by database admin created database trigger		0	true		
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
ACTIVESTATUS	String	20	Active Status	Identifies whether the asset is in use, not in use or removed from the ground	piActiveStatus	Active	true		
ACTIVEFLAG	SmallInteger	2	Active Flag	Identifies whether the feature is in use/active	BooleanDomain	1	true		
INVCLASS	String	20	Inventory Class	The method used to establish the geographic location of the asset	InventoryClass		true		
COLLECTEDDATE	Date	8	GPS Collected Date	Date the feature was located by a surveyor			true		

OWNEDBY	SmallInteger	2	Owned By	Indicates which organization owns the asset	AssetOwner	1	true		
MAINTBY	SmallInteger	2	Maintained By	Indicates which organization maintains the asset	AssetManager	1	true		
INSTALLDATE	Date	8	Install Date	The date the asset was installed			true		
LOCATION	String	200	Location Description	Identifies the meter box location (area_served in Utility Billing database). Value is copied to Cityworks work order Location Details field when attached to a work order.			true		
ADDRESS	String	50	Address	The address or closest address to the asset. Value is copied to Cityworks work order Address field when attached to a work order (address in Utility Billing database)			true		
PURCHASEDATE	Date	8	Purchase Date	The purchase date of the asset. Used for future asset management analysis.			true		
WARRANTYDATE	Date	8	Warranty Date	The date the warranty expires on the asset. If populated and asset is still under warranty, asset record will show up pink on the Cityworks work order.			true		
ASSETCOST	Double	8	Asset Cost	The replacement cost of the asset. If populated, this will be used for asset management analysis and repair/replace decisions.		0	true		
CONDITION	SmallInteger	2	Condition Rating	The condition rating of the asset. Used by Cityworks Analytics for condition analysis output. May be calculated within a Cityworks Inspection and	piConditionPACP		true		

				updated from there to GIS.					
CONDITIONDATE	Date	8	Condition Date	The date of the last condition assessment. Can be updated from Cityworks Inspection to the GIS.			true		
SERVICELIFE	SmallInteger	2	Service Life	The expected number of years an asset is physically capable of continuing to operate. Used to anticipate retirement of assets and project funding needs.		0	true		
RUL	SmallInteger	2	Remaining Useful Life	The Remaining Useful Life of an asset calculated by subtracting the number of years since installation, from the sevice life. It will be heavily relied upon for asset management analysis.		0	true		
COF	SmallInteger	2	Consequence of Failure	The consequence of failure. Used in the BRE model as the impact due to asset failure.		0	true		
POF	SmallInteger	2	Probability of Failure	Probability of Failure. Used in the BRE model to estimate the likelihood the predicted asset (or service) failure will occur and is adjusted for backup and redundancy of the asset.		0	true		
BRE	SmallInteger	2	Business Risk Exposure	Business Risk Exposure is a the product of probablity of failure (POF) and consequence of failure (COF). Values range from 1 (low risk) to 100 (high risk) and is used to prioritize investments.		0	true		
LASTINSPECTDATE	Date	8	Last Inspection Date	The date the asset was most recently inspected			true		

LASTMAINTDATE	Date	8	Last Maintenance Date	The date of the most recent maintenance activity			true		
MANUFACTURER	String	50	Manufacturer	The manufacturer or brand of the asset (company_cd in Utility Billing database)			true		
PROJECTNUM	String	32	City Project Number	The City's Project Number under which the asset was installed			true		
FILENUM	String	32	City File Number	The City's File Number			true		
WORKORDERNUM	String	60	City Work Order Number	The work order number for performing work on the asset (Cityworks, Qalert, etc)			true		
SURVEYRPTNUM	String	32	Survey Report Number	The City's Surveyor's Report Number under which the location of an asset or group of assets are captured, may be the same as the Service Request or Work Order Number			true		
MATERIAL	String	20	Pipe Material	Identifies the construction material of the pipe connection	piPipeMaterial		true		
DIAMETER	Double	8	Diameter	Identified the size of meter (meter_sz in Utility Billing database)	piPipeDiameter		true		
LINED	String	3	Lined	Indicates if the manhole is lined	YesNo		true		
LINEDYEAR	String	4	Year Lined	The year the pipe was last lined			true		
LINERTYPE	String	20	Liner Type	The method used to line the pipe	piLiningMethod		true		
FROMSTRUC	String	20	From Structure	From Structure			true		
TOSTRUC	String	20	To Structure	To Structure			true		
WATERTYPE	String	30	Water Type	Identifies the type of water in the pipe	ssWaterType		true		
CASING	String	5	Casing	Identifies whether the asset is enclosed in casing	YesNo		true		
ENABLED	SmallInteger	2	Enabled Flag	Indicates if the asset is enabled within a geometric network.	EnabledDomain	1	true		

FIELDNOTES	String	255	Field Notes	Comments or notes from field staff, including surveyors, that are relevant to the asset			true		
NOTES	String	200	GIS Notes	GIS entry notes or comments relevant to the asset			true		
created_user	String	255	created_user	created_user			true		
created_date	Date	8	created_date	created_date			true		
last_edited_user	String	255	last_edited_user	last_edited_user			true		
last_edited_date	Date	8	last_edited_date	last_edited_date			true		

ssPumpStation - FeatureClass

Name ssPumpStation
ShapeType Point
FeatureType Simple
AliasName ss Pump Stations
HasM false
HasZ false
HasAttachments false
Description Sanitary sewer pump stations.

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYNUM	Integer	4	Facility Number	Locally asssigned numeric unique identifier populated by database admin created database trigger		0	true		
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
NAME	String	100	Name	The name of the facility or location the pump is housed in			true		
ACTIVESTATUS	String	20	Active Status	Identifies whether the asset is in use, not in use or removed from the ground	piActiveStatus	Active	true		
ACTIVEFLAG	SmallInteger	2	Active Flag	Identifies whether the feature is in use/active	BooleanDomain	1	true		
INVCLASS	String	20	Inventory Class	The method used to establish the geographic location of the	InventoryClass		true		

				asset					
COLLECTEDDATE	Date	8	GPS Collected Date	Date the feature was located by a surveyor			true		
CPSETA	String	50	Control Point A	Control Point A	ControlSetRef		true		
CPSETB	String	50	Control Point B	Control Point B	ControlSetRef		true		
CPSETC	String	50	Control Point C	Control Point C	ControlSetRef		true		
CPSETD	String	50	Control Point D	Control Point D	ControlSetRef		true		
CPAYCOORD	Double	8	Control Point A Y Coord	Control Point A Y Coord		0	true		
CPAXCOORD	Double	8	Control Point A X Coord	Control Point A X Coord		0	true		
CPAZCOORD	Double	8	Control Point A Z Coord	Control Point A Z Coord		0	true		
CPBYCOORD	Double	8	Control Point B Y Coord	Control Point B Y Coord		0	true		
CPBXCOORD	Double	8	Control Point B X Coord	Control Point B X Coord		0	true		
CPBZCOORD	Double	8	Control Point B Z Coord	Control Point B Z Coord		0	true		
CPCYCOORD	Double	8	Control Point C Y Coord	Control Point C Y Coord		0	true		
CPCXCOORD	Double	8	Control Point C X Coord	Control Point C X Coord		0	true		
CPCZCOORD	Double	8	Control Point C Z Coord	Control Point C Z Coord		0	true		
CPDYCOORD	Double	8	Control Point D Y Coord	Control Point D Y Coord		0	true		
CPDXCOORD	Double	8	Control Point D X Coord	Control Point D X Coord		0	true		
CPDZCOORD	Double	8	Control Point D Z Coord	Control Point D Z Coord		0	true		
OWNEDBY	SmallInteger	2	Owned By	Indicates which organization owns the asset	AssetOwner	1	true		
MAINTBY	SmallInteger	2	Maintained By	Indicates which organization maintains the asset	AssetManager	1	true		
INSTALLDATE	Date	8	Install Date	The date the asset was installed			true		
LOCATION	String	200	Location Description	Identifies the meter box location (area_served in Utility Billing database). Value is copied to Cityworks work order Location Details field when attached to a work order.			true		
ADDRESS	String	50	Address	The address or closest address to the asset. Value is copied to Cityworks work order Address field when attached to a work order (address in Utility Billing database)			true		

PURCHASEDATE	Date	8	Purchase Date	The purchase date of the asset. Used for future asset management analysis.			true		
WARRANTYDATE	Date	8	Warranty Date	The date the warranty expires on the asset. If populated and asset is still under warranty, asset record will show up pink on the Cityworks work order.			true		
ASSETCOST	Double	8	Asset Cost	The replacement cost of the asset. If populated, this will be used for asset management analysis and repair/replace decisions.		0	true		
CONDITION	SmallInteger	2	Condition Rating	The condition rating of the asset. Used by Cityworks Analytics for condition analysis output. May be calculated within a Cityworks Inspection and updated from there to GIS.	piConditionPACP		true		
CONDITIONDATE	Date	8	Condition Date	The date of the last condition assessment. Can be updated from Cityworks Inspection to the GIS.			true		
SERVICELIFE	SmallInteger	2	Service Life	The expected number of years an asset is physically capable of continuing to operate. Used to anticipate retirement of assets and project funding needs.		0	true		
RUL	SmallInteger	2	Remaining Useful Life	The Remaining Useful Life of an asset calculated by subtracting the number of years since installation, from the sevice life. It will be heavily relied upon for asset management analysis.		0	true		

COF	SmallInteger	2	Consequence of Failure	The consequence of failure. Used in the BRE model as the impact due to asset failure.		0	true		
POF	SmallInteger	2	Probability of Failure	Probability of Failure. Used in the BRE model to estimate the likelihood the predicted asset (or service) failure will occur and is adjusted for backup and redundancy of the asset.		0	true		
BRE	SmallInteger	2	Business Risk Exposure	Business Risk Exposure is a the product of probablity of failure (POF) and consequence of failure (COF). Values range from 1 (low risk) to 100 (high risk) and is used to prioritize investments.		0	true		
LASTINSPECTDATE	Date	8	Last Inspection Date	The date the asset was most recently inspected			true		
LASTMAINTDATE	Date	8	Last Maintenance Date	The date of the most recent maintenance activity			true		
MANUFACTURER	String	50	Manufacturer	The manufacturer or brand of the asset (company_cd in Utility Billing database)			true		
PROJECTNUM	String	32	City Project Number	The City's Project Number under which the asset was installed			true		
FILENUM	String	32	City File Number	The City's File Number			true		
WORKORDERNUM	String	60	City Work Order Number	The work order number for performing work on the asset (Cityworks, Qalert, etc)			true		
SURVEYRPTNUM	String	32	Survey Report Number	The City's Surveyor's Report Number under which the location of an asset or group of assets are captured, may be the same as			true		

				the Service Request or Work Order Number					
XYCONVERTED	String	5	X, Y Converted	X, Y Converted	YesNo		true		
XCOORD	Double	8	X Coordinate	X-Coordinate of the asset (FL State Plane-East)		0	true		
YCOORD	Double	8	Y Coordinate	Y-Coordinate of the asset (FL State Plane-East)		0	true		
ZCOORD	Double	8	Z Coordinate	Z-Coordinate of the asset		0	true		
OPDATE	Date	8	Operational Date	Date when the facility was put into service			true		
PSTYPE	String	30	Pump Station Type	Pump Station Type	ssPumpStationType		true		
ANCILLARYROLE	SmallInteger	2	Ancillary Role	Identifies whether the asset participates in a geometric network as either a source or a sink	AncillaryRoleDomain	0	true		
ROTATION	Double	8	Rotation	Map symbol rotation value		0	true		
ENABLED	SmallInteger	2	Enabled Flag	Indicates if the asset is enabled within a geometric network.	EnabledDomain	1	true		
FIELDNOTES	String	255	Field Notes	Comments or notes from field staff, including surveyors, that are relevant to the asset			true		
NOTES	String	200	GIS Notes	GIS entry notes or comments relevant to the asset			true		
created_user	String	255	created_user	created_user			true		
created_date	Date	8	created_date	created_date			true		
last_edited_user	String	255	last_edited_user	last_edited_user			true		
last_edited_date	Date	8	last_edited_date	last_edited_date			true		

ssServiceConnection - FeatureClass

Name ssServiceConnection
ShapeType Point
FeatureType Simple
AliasName ss Service Connections
HasM false
HasZ false
HasAttachments false
Description A point of service at the end of a lateral where sanitary sewer service is connected.

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYNUM	Integer	4	Facility Number	Locally asssigned numeric unique identifier populated by		0	true		

				database admin created database trigger					
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
FACILITYNAME	String	100	Facility Name	Facility Name			true		
LARGEMETER	SmallInteger	2	Large Meter Flag	Large Meter Flag	BooleanDomain	0	true		
ACTIVESTATUS	String	20	Active Status	Identifies whether the asset is in use, not in use or removed from the ground	piActiveStatus	Active	true		
ACTIVEFLAG	SmallInteger	2	Active Flag	Identifies whether the feature is in use/active	BooleanDomain	1	true		
INVCLASS	String	20	Inventory Class	The method used to establish the geographic location of the asset	InventoryClass		true		
COLLECTEDDATE	Date	8	GPS Collected Date	Date the feature was located by a surveyor			true		
OWNEDBY	SmallInteger	2	Owned By	Indicates which organization owns the asset	AssetOwner	1	true		
MAINTBY	SmallInteger	2	Maintained By	Indicates which organization maintains the asset	AssetManager	1	true		
INSTALLDATE	Date	8	Install Date	The date the asset was installed			true		
LOCATION	String	200	Location Description	Identifies the meter box location (area_served in Utility Billing database). Value is copied to Cityworks work order Location Details field when attached to a work order.			true		
ADDRESS	String	50	Address	The address or closest address to the asset. Value is copied to Cityworks work order Address field when attached to a work order (address in Utility Billing database)			true		

PURCHASEDATE	Date	8	Purchase Date	The purchase date of the asset. Used for future asset management analysis.			true		
WARRANTYDATE	Date	8	Warranty Date	The date the warranty expires on the asset. If populated and asset is still under warranty, asset record will show up pink on the Cityworks work order.			true		
ASSETCOST	Double	8	Asset Cost	The replacement cost of the asset. If populated, this will be used for asset management analysis and repair/replace decisions.		0	true		
CONDITION	SmallInteger	2	Condition Rating	The condition rating of the asset. Used by Cityworks Analytics for condition analysis output. May be calculated within a Cityworks Inspection and updated from there to GIS.	piConditionPACP		true		
CONDITIONDATE	Date	8	Condition Date	The date of the last condition assessment. Can be updated from Cityworks Inspection to the GIS.			true		
SERVICELIFE	SmallInteger	2	Service Life	The expected number of years an asset is physically capable of continuing to operate. Used to anticipate retirement of assets and project funding needs.		0	true		
RUL	SmallInteger	2	Remaining Useful Life	The Remaining Useful Life of an asset calculated by subtracting the number of years since installation, from the sevice life. It will be heavily relied upon for asset management analysis.		0	true		

COF	SmallInteger	2	Consequence of Failure	The consequence of failure. Used in the BRE model as the impact due to asset failure.		0	true		
POF	SmallInteger	2	Probability of Failure	Probability of Failure. Used in the BRE model to estimate the likelihood the predicted asset (or service) failure will occur and is adjusted for backup and redundancy of the asset.		0	true		
BRE	SmallInteger	2	Business Risk Exposure	Business Risk Exposure is a the product of probablity of failure (POF) and consequence of failure (COF). Values range from 1 (low risk) to 100 (high risk) and is used to prioritize investments.		0	true		
LASTINSPECTDATE	Date	8	Last Inspection Date	The date the asset was most recently inspected			true		
LASTMAINTDATE	Date	8	Last Maintenance Date	The date of the most recent maintenance activity			true		
MANUFACTURER	String	50	Manufacturer	The manufacturer or brand of the asset (company_cd in Utility Billing database)			true		
PROJECTNUM	String	32	City Project Number	The City's Project Number under which the asset was installed			true		
FILENUM	String	32	City File Number	The City's File Number			true		
WORKORDERNUM	String	60	City Work Order Number	The work order number for performing work on the asset (Cityworks, Qalert, etc)			true		
SURVEYRPTNUM	String	32	Survey Report Number	The City's Surveyor's Report Number under which the location of an asset or group of assets are captured, may be the same as the Service			true		

				Request or Work Order Number					
SUMFLOW	Double	8	Flow Summary	The sum of flow		0	true		
XYCONVERTED	String	5	X, Y Converted	X, Y Converted	YesNo		true		
XCOORD	Double	8	X Coordinate	X-Coordinate of the asset (FL State Plane-East)		0	true		
YCOORD	Double	8	Y Coordinate	Y-Coordinate of the asset (FL State Plane-East)		0	true		
ZCOORD	Double	8	Z Coordinate	Z-Coordinate of the asset		0	true		
ROTATION	Double	8	Rotation	Map symbol rotation value		0	true		
ACCOUNTID	String	20	Account ID	Utility billing account identifier			true		
LOCATIONID	String	20	Location Identifier	Location Identifier			true		
CRITICAL	SmallInteger	2	Critical Customer	Flag to indicate if this is a critical customer	BooleanDomain	0	true		
ENABLED	SmallInteger	2	Enabled Flag	Indicates if the asset is enabled within a geometric network.	EnabledDomain	1	true		
FIELDNOTES	String	255	Field Notes	Comments or notes from field staff, including surveyors, that are relevant to the asset			true		
NOTES	String	200	GIS Notes	GIS entry notes or comments relevant to the asset			true		
created_user	String	255	created_user	created_user			true		
created_date	Date	8	created_date	created_date			true		
last_edited_user	String	255	last_edited_user	last_edited_user			true		
last_edited_date	Date	8	last_edited_date	last_edited_date			true		

ssSystemValve - FeatureClass

Name ssSystemValve
ShapeType Point
FeatureType Simple
AliasName ss System Valves
HasM false
HasZ false
HasAttachments false
Description Sanitary sewer network valves used to isolate mains for maintenance and repair.

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYNUM	Integer	4	Facility Number	Locally asssigned numeric unique identifier populated by database admin created database trigger		0	true		
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique			true		

				identifier populated by database admin created database trigger					
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
ACTIVESTATUS	String	20	Active Status	Identifies whether the asset is in use, not in use or removed from the ground	piActiveStatus	Active	true		
ACTIVEFLAG	SmallInteger	2	Active Flag	Identifies whether the feature is in use/active	BooleanDomain	1	true		
INVCLASS	String	20	Inventory Class	The method used to establish the geographic location of the asset	InventoryClass		true		
COLLECTEDDATE	Date	8	GPS Collected Date	Date the feature was located by a surveyor			true		
OWNEDBY	SmallInteger	2	Owned By	Indicates which organization owns the asset	AssetOwner	1	true		
MAINTBY	SmallInteger	2	Maintained By	Indicates which organization maintains the asset	AssetManager	1	true		
INSTALLDATE	Date	8	Install Date	The date the asset was installed			true		
LOCATION	String	200	Location Description	Identifies the meter box location (area_served in Utility Billing database). Value is copied to Cityworks work order Location Details field when attached to a work order.			true		
ADDRESS	String	50	Address	The address or closest address to the asset. Value is copied to Cityworks work order Address field when attached to a work order (address in Utility Billing database)			true		
PURCHASEDATE	Date	8	Purchase Date	The purchase date of the asset. Used for future asset management analysis.			true		

WARRANTYDATE	Date	8	Warranty Date	The date the warranty expires on the asset. If populated and asset is still under warranty, asset record will show up pink on the Cityworks work order.			true		
ASSETCOST	Double	8	Asset Cost	The replacement cost of the asset. If populated, this will be used for asset management analysis and repair/replace decisions.		0	true		
CONDITION	SmallInteger	2	Condition Rating	The condition rating of the asset. Used by Cityworks Analytics for condition analysis output. May be calculated within a Cityworks Inspection and updated from there to GIS.	piConditionPACP		true		
CONDITIONDATE	Date	8	Condition Date	The date of the last condition assessment. Can be updated from Cityworks Inspection to the GIS.			true		
SERVICELIFE	SmallInteger	2	Service Life	The expected number of years an asset is physically capable of continuing to operate. Used to anticipate retirement of assets and project funding needs.		0	true		
RUL	SmallInteger	2	Remaining Useful Life	The Remaining Useful Life of an asset calculated by subtracting the number of years since installation, from the sevice life. It will be heavily relied upon for asset management analysis.		0	true		
COF	SmallInteger	2	Consequence of Failure	The consequence of failure. Used in the BRE model as the impact due to asset		0	true		

				failure.					
POF	SmallInteger	2	Probability of Failure	Probability of Failure. Used in the BRE model to estimate the likelihood the predicted asset (or service) failure will occur and is adjusted for backup and redundancy of the asset.		0	true		
BRE	SmallInteger	2	Business Risk Exposure	Business Risk Exposure is a the product of probablity of failure (POF) and consequence of failure (COF). Values range from 1 (low risk) to 100 (high risk) and is used to prioritize investments.		0	true		
LASTINSPECTDATE	Date	8	Last Inspection Date	The date the asset was most recently inspected			true		
LASTMAINTDATE	Date	8	Last Maintenance Date	The date of the most recent maintenance activity			true		
MANUFACTURER	String	50	Manufacturer	The manufacturer or brand of the asset (company_cd in Utility Billing database)			true		
PROJECTNUM	String	32	City Project Number	The City's Project Number under which the asset was installed			true		
FILENUM	String	32	City File Number	The City's File Number			true		
WORKORDERNUM	String	60	City Work Order Number	The work order number for performing work on the asset (Cityworks, Qalert, etc)			true		
SURVEYRPTNUM	String	32	Survey Report Number	The City's Surveyor's Report Number under which the location of an asset or group of assets are captured, may be the same as the Service Request or Work Order Number			true		
DIAMETER	Double	8	Diameter	Identified the size of meter (meter_sz in	piPipeDiameter		true		

				Utility Billing database)					
XYCONVERTED	String	5	X, Y Converted	X, Y Converted	YesNo		true		
XCOORD	Double	8	X Coordinate	X-Coordinate of the asset (FL State Plane-East)		0	true		
YCOORD	Double	8	Y Coordinate	Y-Coordinate of the asset (FL State Plane-East)		0	true		
ZCOORD	Double	8	Z Coordinate	Z-Coordinate of the asset		0	true		
TOPNUTELEV	Double	8	Top Nut Elevation	Top Nut Elevation		0	true		
ANCILLARYROLE	SmallInteger	2	Ancillary Role	Identifies whether the asset participates in a geometric network as either a source or a sink	AncillaryRoleDomain	0	true		
ROTATION	Double	8	Rotation	Map symbol rotation value		0	true		
VALVETYPE	String	30	Valve Type	Type of control valve	piSystemValveType		true		
VALVEUSE	Integer	4	Valve Use	Valve Use	ssValveUse		true		
INMH	String	5	In Manhole	In Manhole	YesNo		true		
BYPASSVALVE	SmallInteger	2	Bypass Valve?	Identifies whether the asset is a bypass valve	BooleanDomain	0	true		
CLOCKTOCLOSE	SmallInteger	2	Clockwise To Close	Clockwise To Close	BooleanDomain	1	true		
NORMALLYOPEN	SmallInteger	2	Normally Open?	Identifies whether the asset is normally open	BooleanDomain	1	true		
TURNSTOCLOSE	Integer	4	Turns to Close	The number of turns required to close the asset		0	true		
OPERABLE	SmallInteger	2	Operable	Is inlet operable?	BooleanDomain	1	true		
CURROPEN	SmallInteger	2	Currently Open?	Identifies whether the asset is currently open	BooleanDomain	1	true		
ENABLED	SmallInteger	2	Enabled Flag	Indicates if the asset is enabled within a geometric network.	EnabledDomain	1	true		
FIELDNOTES	String	255	Field Notes	Comments or notes from field staff, including surveyors, that are relevant to the asset			true		
NOTES	String	200	GIS Notes	GIS entry notes or comments relevant to the asset			true		
created_user	String	255	created_user	created_user			true		
created_date	Date	8	created_date	created_date			true		
last_edited_user	String	255	last_edited_user	last_edited_user			true		

last_edited_date	Date	8	last_edited_date	last_edited_date			true		

DynamicValue - Table

Name DynamicValue
AliasName Dynamic Value
HasAttachments false
Description DynamicValue

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
TABLENAME	String	254	Table Name	Table Name			true		
FIELDNAME	String	64	Field Name	Field Name			true		
VALUEMETHOD	String	254	Value Method	Value Method	ValueMethod		true		
VALUEINFO	String	254	Value Info	Value Info			true		
ON_CREATE	SmallInteger	2	On Create	On Create	EnabledDomain	1	true		
ON_CHANGE	SmallInteger	2	On Change (Attribute)	On Change (Attribute)	EnabledDomain	1	true		
ON_CHANGEGEO	SmallInteger	2	On Change (Geometry)	On Change (Geometry)	BooleanDomain	1	true		
ON_MANUAL	SmallInteger	2	Manual Only	Manual Only	EnabledDomain	0	true		
RUN_WEIGHT	SmallInteger	2	Rule Weight	Rule Weight		0	true		
COMMENTS	String	255	Comments	Used to record any pertinent information that the user or the City staff should be made aware of.			true		
created_user	String	255	created_user	created_user			true		
created_date	Date	8	created_date	created_date			true		
last_edited_user	String	255	last_edited_user	last_edited_user			true		
last_edited_date	Date	8	last_edited_date	last_edited_date			true		

GDB_ServiceItems - Table

Name GDB_ServiceItems
AliasName GDB Service Items
HasAttachments false
Description GDB_ServiceItems

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
ItemType	SmallInteger	2	ItemType	ItemType			false		
ItemInfo	String	100000000	ItemInfo	ItemInfo			false		
ItemId	Integer	4	ItemId	ItemId			false		
DatasetName	String	1024	DatasetName	DatasetName			false		
AdvancedDrawingInfo	String	100000000	Advanced Drawing Information	Advanced Drawing Information			true		
created_user	String	255	created_user	created_user			true		
created_date	Date	8	created_date	created_date			true		
last_edited_user	String	255	last_edited_user	last_edited_user			true		
last_edited_date	Date	8	last_edited_date	last_edited_date			true		

GenerateId - Table

Name GenerateId
AliasName Generate Id
HasAttachments false
Description GenerateId

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
SEQNAME	String	75	Sequence Name	Sequence Name			true		
SEQCOUNTER	Integer	4	Sequence Counter	Sequence Counter		0	true		
SEQINTERV	SmallInteger	2	Interval Value	Interval Value		0	true		
COMMENTS	String	255	Comments	Used to record any pertinent information that the user or the City staff should be made aware of.			true		
created_user	String	255	created_user	created_user			true		
created_date	Date	8	created_date	created_date			true		
last_edited_user	String	255	last_edited_user	last_edited_user			true		
last_edited_date	Date	8	last_edited_date	last_edited_date			true		

ssBendReference - Table

Name ssBendReference
AliasName Sanitary Sewer Bend Reference
HasAttachments false
Description ssBendReference

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
FEATUREID	Integer	4	FEATURE_ID	Feature ID from Unkown Point		0	true		
OLDID	String	6	Old ID	Old ID			true		
PROJECTNUM	String	32	City Project Number	The City's Project Number under which the asset was installed			true		
FILENUM	String	32	City File Number	The City's File Number			true		
DENUM	String	32	City Detail Number	The City's Detail Number			true		
IMPROVENUM	String	32	City Improvement Number	The City's Improvement Number			true		
DATUM	String	8	Datum	Identifies the datum used to establish the asset's vertical elevation	Datum		true		
IMAGEID	String	12	Old Image ID	Old Image ID			true		
INTDETAIL	String	4	City Intersection Detail	The City's Intersection Detail			true		
ASBUILTLOC	String	255	As-built Location	The URL or filepath to the electronic as-built documents			true		
created_user	String	255	created_user	created_user			true		
created_date	Date	8	created_date	created_date			true		

last_edited_user	String	255	last_edited_user	last_edited_user			true		
last_edited_date	Date	8	last_edited_date	last_edited_date			true		

ssCleanOutReference - Table

Name ssCleanOutReference
AliasName Sanitary Sewer Clean Out Reference
HasAttachments false
Description ssCleanOutReference

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
FEATUREID	Integer	4	FEATURE_ID	Feature ID from Unkown Point		0	true		
OLDID	String	6	Old ID	Old ID			true		
PROJECTNUM	String	32	City Project Number	The City's Project Number under which the asset was installed			true		
FILENUM	String	32	City File Number	The City's File Number			true		
DENUM	String	32	City Detail Number	The City's Detail Number			true		
IMPROVENUM	String	32	City Improvement Number	The City's Improvement Number			true		
DATUM	String	8	Datum	Identifies the datum used to establish the asset's vertical elevation	Datum		true		
IMAGEID	String	12	Old Image ID	Old Image ID			true		
INTDETAIL	String	4	City Intersection Detail	The City's Intersection Detail			true		
ASBUILTLOC	String	255	As-built Location	The URL or filepath to the electronic as-built documents			true		
created_user	String	255	created_user	created_user			true		
created_date	Date	8	created_date	created_date			true		
last_edited_user	String	255	last_edited_user	last_edited_user			true		
last_edited_date	Date	8	last_edited_date	last_edited_date			true		

ssControlValveReference - Table

Name ssControlValveReference
AliasName Sanitary Sewer Control Valve Reference
HasAttachments false
Description ssControlValveReference

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric			true		

				unique identifier populated by database admin created database trigger					
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
FEATUREID	Integer	4	FEATURE_ID	Feature ID from Unkown Point		0	true		
OLDID	String	6	Old ID	Old ID			true		
PROJECTNUM	String	32	City Project Number	The City's Project Number under which the asset was installed			true		
FILENUM	String	32	City File Number	The City's File Number			true		
DENUM	String	32	City Detail Number	The City's Detail Number			true		
IMPROVENUM	String	32	City Improvement Number	The City's Improvement Number			true		
DATUM	String	8	Datum	Identifies the datum used to establish the asset's vertical elevation	Datum		true		
IMAGEID	String	12	Old Image ID	Old Image ID			true		
INTDETAIL	String	4	City Intersection Detail	The City's Intersection Detail			true		
ASBUILTLOC	String	255	As-built Location	The URL or filepath to the electronic as-built documents			true		
created_user	String	255	created_user	created_user			true		
created_date	Date	8	created_date	created_date			true		
last_edited_user	String	255	last_edited_user	last_edited_user			true		
last_edited_date	Date	8	last_edited_date	last_edited_date			true		

ssEmergencyOverflowReference - Table

Name ssEmergencyOverflowReference
AliasName Sanitary Sewer Emergency Overflow Reference
HasAttachments false
Description ssEmergencyOverflowReference

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
FEATUREID	Integer	4	FEATURE_ID	Feature ID from Unkown Point		0	true		
OLDID	String	6	Old ID	Old ID			true		
PROJECTNUM	String	32	City Project Number	The City's Project Number under which the asset			true		

				was installed					
FILENUM	String	32	City File Number	The City's File Number			true		
DENUM	String	32	City Detail Number	The City's Detail Number			true		
IMPROVENUM	String	32	City Improvement Number	The City's Improvement Number			true		
DATUM	String	8	Datum	Identifies the datum used to establish the asset's vertical elevation	Datum		true		
IMAGEID	String	12	Old Image ID	Old Image ID			true		
INTDETAIL	String	4	City Intersection Detail	The City's Intersection Detail			true		
SEWERBOOK	String	2	Sewer Book	Sewer Book			true		
SEWERBOOKNUM	String	4	Sewer Book Sheet	Sewer Book Sheet			true		
ASBUILTLOC	String	255	As-built Location	The URL or filepath to the electronic as-built documents			true		
created_user	String	255	created_user	created_user			true		
created_date	Date	8	created_date	created_date			true		
last_edited_user	String	50	last_edited_user	last_edited_user			true		
last_edited_date	Date	8	last_edited_date	last_edited_date			true		

ssFittingReference - Table

Name ssFittingReference
AliasName Sanitary Sewer Fitting Reference
HasAttachments false
Description ssFittingReference

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
FEATUREID	Integer	4	FEATURE_ID	Feature ID from Unkown Point		0	true		
OLDID	String	6	Old ID	Old ID			true		
PROJECTNUM	String	32	City Project Number	The City's Project Number under which the asset was installed			true		
FILENUM	String	32	City File Number	The City's File Number			true		
DENUM	String	32	City Detail Number	The City's Detail Number			true		
IMPROVENUM	String	32	City Improvement Number	The City's Improvement Number			true		
DATUM	String	8	Datum	Identifies the datum used to establish the asset's vertical	Datum		true		

				elevation					
IMAGEID	String	12	Old Image ID	Old Image ID			true		
INTDETAIL	String	4	City Intersection Detail	The City's Intersection Detail			true		
ASBUILTLOC	String	255	As-built Location	The URL or filepath to the electronic as-built documents			true		
created_user	String	255	created_user	created_user			true		
created_date	Date	8	created_date	created_date			true		
last_edited_user	String	255	last_edited_user	last_edited_user			true		
last_edited_date	Date	8	last_edited_date	last_edited_date			true		

ssGravityMainReference - Table

Name ssGravityMainReference
AliasName Sanitary Sewer Gravity Main Reference
HasAttachments false
Description ssGravityMainReference

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
FEATUREID	Integer	4	FEATURE_ID	Feature ID from Unkown Point		0	true		
UNITID2	String	20	Old Downstream Unit ID	Old Downstream Unit ID			true		
OLDID	String	16	Old ID	Old ID			true		
PROJECTNUM	String	32	City Project Number	The City's Project Number under which the asset was installed			true		
FILENUM	String	32	City File Number	The City's File Number			true		
DENUM	String	32	City Detail Number	The City's Detail Number			true		
IMPROVENUM	String	32	City Improvement Number	The City's Improvement Number			true		
DATUM	String	8	Datum	Identifies the datum used to establish the asset's vertical elevation	Datum		true		
IMAGEID	String	12	Old Image ID	Old Image ID			true		
INTDETAIL	String	4	City Intersection Detail	The City's Intersection Detail			true		
SEWERBOOK	String	2	Sewer Book	Sewer Book			true		
SEWERBOOKNUM	String	5	Sewer Book Sheet	Sewer Book Sheet			true		
ASBUILTLOC	String	255	As-built Location	The URL or filepath to the electronic as-built documents			true		
created_user	String	255	created_user	created_user			true		

created_date	Date	8	created_date	created_date			true		
last_edited_user	String	255	last_edited_user	last_edited_user			true		
last_edited_date	Date	8	last_edited_date	last_edited_date			true		

ssLateralLineReference - Table

Name ssLateralLineReference
AliasName Sanitary Sewer Lateral Line Reference
HasAttachments false
Description ssLateralLineReference

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
PROJECTNUM	String	32	City Project Number	The City's Project Number under which the asset was installed			true		
FILENUM	String	32	City File Number	The City's File Number			true		
DENUM	String	32	City Detail Number	The City's Detail Number			true		
IMPROVENUM	String	32	City Improvement Number	The City's Improvement Number			true		
DATUM	String	8	Datum	Identifies the datum used to establish the asset's vertical elevation	Datum		true		
INTDETAIL	String	4	City Intersection Detail	The City's Intersection Detail			true		
ASBUILTLOC	String	255	As-built Location	The URL or filepath to the electronic as-built documents			true		
created_user	String	255	created_user	created_user			true		
created_date	Date	8	created_date	created_date			true		
last_edited_user	String	255	last_edited_user	last_edited_user			true		
last_edited_date	Date	8	last_edited_date	last_edited_date			true		

ssManholeReference - Table

Name ssManholeReference
AliasName Sanitary Sewer Manhole Reference
HasAttachments false
Description ssManholeReference

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a			true		

				related table.					
FEATUREID	Integer	4	FEATURE_ID	Feature ID from Unkown Point		0	true		
OLDID	String	6	Old ID	Old ID			true		
PROJECTNUM	String	32	City Project Number	The City's Project Number under which the asset was installed			true		
FILENUM	String	32	City File Number	The City's File Number			true		
DENUM	String	32	City Detail Number	The City's Detail Number			true		
IMPROVENUM	String	32	City Improvement Number	The City's Improvement Number			true		
DATUM	String	8	Datum	Identifies the datum used to establish the asset's vertical elevation	Datum		true		
IMAGEID	String	12	Old Image ID	Old Image ID			true		
INTDETAIL	String	4	City Intersection Detail	The City's Intersection Detail			true		
SEWERBOOK	String	2	Sewer Book	Sewer Book			true		
SEWERBOOKNUM	String	5	Sewer Book Sheet	Sewer Book Sheet			true		
ASBUILT	String	10	As-built Location	As-built Location			true		
ASBUILTLOC	String	255	As-built Location	The URL or filepath to the electronic as-built documents			true		
created_user	String	255	created_user	created_user			true		
created_date	Date	8	created_date	created_date			true		
last_edited_user	String	255	last_edited_user	last_edited_user			true		
last_edited_date	Date	8	last_edited_date	last_edited_date			true		

ssNetworkStructureReference - Table

Name ssNetworkStructureReference
AliasName Sanitary Sewer Network Structure Reference
HasAttachments false
Description ssNetworkStructureReference

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
FEATUREID	Integer	4	FEATURE_ID	Feature ID from Unkown Point		0	true		
OLDID	String	6	Old ID	Old ID			true		
PROJECTNUM	String	32	City Project Number	The City's Project Number under which the asset was installed			true		
FILENUM	String	32	City File Number	The City's File Number			true		

DENUM	String	32	City Detail Number	The City's Detail Number			true		
IMPROVENUM	String	32	City Improvement Number	The City's Improvement Number			true		
DATUM	String	8	Datum	Identifies the datum used to establish the asset's vertical elevation	Datum		true		
IMAGEID	String	12	Old Image ID	Old Image ID			true		
INTDETAIL	String	4	City Intersection Detail	The City's Intersection Detail			true		
ASBUILTLOC	String	255	As-built Location	The URL or filepath to the electronic as-built documents			true		
created_user	String	255	created_user	created_user			true		
created_date	Date	8	created_date	created_date			true		
last_edited_user	String	255	last_edited_user	last_edited_user			true		
last_edited_date	Date	8	last_edited_date	last_edited_date			true		

ssPressurizedMainReference - Table

Name ssPressurizedMainReference
AliasName Sanitary Sewer Pressurized Main Reference
HasAttachments false
Description ssPressurizedMainReference

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
FEATUREID	Integer	4	FEATURE_ID	Feature ID from Unkown Point		0	true		
UNITID2	String	20	Old Downstream Unit ID	Old Downstream Unit ID			true		
OLDID	String	16	Old ID	Old ID			true		
PROJECTNUM	String	32	City Project Number	The City's Project Number under which the asset was installed			true		
FILENUM	String	32	City File Number	The City's File Number			true		
DENUM	String	32	City Detail Number	The City's Detail Number			true		
IMPROVENUM	String	32	City Improvement Number	The City's Improvement Number			true		
DATUM	String	8	Datum	Identifies the datum used to establish the asset's vertical elevation	Datum		true		
INTDETAIL	String	4	City Intersection Detail	The City's Intersection Detail			true		

ASBUILTLOC	String	255	As-built Location	The URL or filepath to the electronic as-built documents			true		
created_user	String	255	created_user	created_user			true		
created_date	Date	8	created_date	created_date			true		
last_edited_user	String	255	last_edited_user	last_edited_user			true		
last_edited_date	Date	8	last_edited_date	last_edited_date			true		

ssPumpStationReference - Table

Name ssPumpStationReference
AliasName Sanitary Sewer Pump Station Reference
HasAttachments false
Description ssPumpStationReference

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
FEATUREID	Integer	4	FEATURE_ID	Feature ID from Unkown Point		0	true		
OLDID	String	6	Old ID	Old ID			true		
PROJECTNUM	String	32	City Project Number	The City's Project Number under which the asset was installed			true		
FILENUM	String	32	City File Number	The City's File Number			true		
DENUM	String	32	City Detail Number	The City's Detail Number			true		
IMPROVENUM	String	32	City Improvement Number	The City's Improvement Number			true		
DATUM	String	8	Datum	Identifies the datum used to establish the asset's vertical elevation	Datum		true		
IMAGEID	String	12	Old Image ID	Old Image ID			true		
INTDETAIL	String	4	City Intersection Detail	The City's Intersection Detail			true		
ASBUILTLOC	String	255	As-built Location	The URL or filepath to the electronic as-built documents			true		
created_user	String	255	created_user	created_user			true		
created_date	Date	8	created_date	created_date			true		
last_edited_user	String	255	last_edited_user	last_edited_user			true		
last_edited_date	Date	8	last_edited_date	last_edited_date			true		

ssServiceConnectionReference - Table

Name ssServiceConnectionReference
AliasName Sanitary Sewer Service Connection Reference

HasAttachments false
Description ssServiceConnectionReference

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
PROJECTNUM	String	32	City Project Number	The City's Project Number under which the asset was installed			true		
FILENUM	String	32	City File Number	The City's File Number			true		
DENUM	String	32	City Detail Number	The City's Detail Number			true		
IMPROVENUM	String	32	City Improvement Number	The City's Improvement Number			true		
DATUM	String	8	Datum	Identifies the datum used to establish the asset's vertical elevation	Datum		true		
INTDETAIL	String	4	City Intersection Detail	The City's Intersection Detail			true		
ASBUILTLOC	String	255	As-built Location	The URL or filepath to the electronic as-built documents			true		
created_user	String	255	created_user	created_user			true		
created_date	Date	8	created_date	created_date			true		
last_edited_user	String	255	last_edited_user	last_edited_user			true		
last_edited_date	Date	8	last_edited_date	last_edited_date			true		

ssSystemValveReference - Table

Name ssSystemValveReference
AliasName Sanitary Sewer System Valve Reference
HasAttachments false
Description ssSystemValveReference

Field	DataType	Length	AliasName	Description	Domain	DefaultValue	IsNullable	Precision	Scale
FACILITYID	String	20	Facility Identifier	Locally asssigned alpha-numeric unique identifier populated by database admin created database trigger			true		
LEGACYID	String	20	Legacy ID (Unit ID)	Former asset identifier. To be moved to a related table.			true		
FEATUREID	Integer	4	FEATURE_ID	Feature ID from Unkown Point		0	true		
OLDID	String	6	Old ID	Old ID			true		
PROJECTNUM	String	32	City Project Number	The City's Project Number under which the asset was installed			true		

FILENUM	String	32	City File Number	The City's File Number			true		
DENUM	String	32	City Detail Number	The City's Detail Number			true		
IMPROVENUM	String	32	City Improvement Number	The City's Improvement Number			true		
DATUM	String	8	Datum	Identifies the datum used to establish the asset's vertical elevation	Datum		true		
IMAGEID	String	12	Old Image ID	Old Image ID			true		
INTDETAIL	String	4	City Intersection Detail	The City's Intersection Detail			true		
ASBUILTLOC	String	255	As-built Location	The URL or filepath to the electronic as-built documents			true		
created_user	String	255	created_user	created_user			true		
created_date	Date	8	created_date	created_date			true		
last_edited_user	String	255	last_edited_user	last_edited_user			true		
last_edited_date	Date	8	last_edited_date	last_edited_date			true		

ssBendReferenceRC - RelationshipClass

Name ssBendReferenceRC
Cardinality OneToOne
IsAttributed false
IsComposite false
ForwardPathLabel ssBendReference
BackwardPathLabel ssBend
Description ssBendReferenceRC

Origin Class Name	Origin Primary Key	Origin Foreign Key
ssBend	FACILITYID	FACILITYID

Destination Class Name	Destination Primary Key	Destination Foreign Key
ssBendReference		

ssCleanOutReferenceRC - RelationshipClass

Name ssCleanOutReferenceRC
Cardinality OneToOne
IsAttributed false
IsComposite false
ForwardPathLabel ssCleanOutReference
BackwardPathLabel ssCleanOut
Description ssCleanOutReferenceRC

Origin Class Name	Origin Primary Key	Origin Foreign Key
ssCleanOut	FACILITYID	FACILITYID

Destination Class Name	Destination Primary Key	Destination Foreign Key
ssCleanOutReference		

ssControlValveReferenceRC - RelationshipClass

Name ssControlValveReferenceRC

Cardinality OneToOne
IsAttributed false
IsComposite false
ForwardPathLabel ssControlValveReference
BackwardPathLabel ssControlValve
Description ssControlValveReferenceRC

Origin Class Name	Origin Primary Key	Origin Foreign Key
ssControlValve	FACILITYID	FACILITYID

Destination Class Name	Destination Primary Key	Destination Foreign Key
ssControlValveReference		

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ssEmergencyOverflowReferenceRC - RelationshipClass

Name ssEmergencyOverflowReferenceRC
Cardinality OneToOne
IsAttributed false
IsComposite false
ForwardPathLabel ssEmergencyOverflowReference
BackwardPathLabel ssEmergencyOverflow
Description ssEmergencyOverflowReferenceRC

Origin Class Name	Origin Primary Key	Origin Foreign Key
ssEmergencyOverflow	FACILITYID	FACILITYID

Destination Class Name	Destination Primary Key	Destination Foreign Key
ssEmergencyOverflowReference		

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ssFittingReferenceRC - RelationshipClass

Name ssFittingReferenceRC
Cardinality OneToOne
IsAttributed false
IsComposite false
ForwardPathLabel ssFittingReference
BackwardPathLabel ssFitting
Description ssFittingReferenceRC

Origin Class Name	Origin Primary Key	Origin Foreign Key
ssFitting	FACILITYID	FACILITYID

Destination Class Name	Destination Primary Key	Destination Foreign Key
ssFittingReference		

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ssGravityMainReferenceRC - RelationshipClass

Name ssGravityMainReferenceRC
Cardinality OneToOne
IsAttributed false
IsComposite false
ForwardPathLabel ssGravityMainReference
BackwardPathLabel ssGravityMain
Description ssGravityMainReferenceRC

Origin Class Name	Origin Primary Key	Origin Foreign Key

ssGravityMain	FACILITYID	FACILITYID

Destination Class Name	Destination Primary Key	Destination Foreign Key
ssGravityMainReference		

ssLateralLineReferenceRC - RelationshipClass

Name ssLateralLineReferenceRC
Cardinality OneToOne
IsAttributed false
IsComposite false
ForwardPathLabel ssLateralLineReference
BackwardPathLabel ssLateralLine
Description ssLateralLineReferenceRC

Origin Class Name	Origin Primary Key	Origin Foreign Key
ssLateralLine	FACILITYID	FACILITYID

Destination Class Name	Destination Primary Key	Destination Foreign Key
ssLateralLineReference		

ssManholeReferenceRC - RelationshipClass

Name ssManholeReferenceRC
Cardinality OneToOne
IsAttributed false
IsComposite false
ForwardPathLabel ssManholeReference
BackwardPathLabel ssManhole
Description ssManholeReferenceRC

Origin Class Name	Origin Primary Key	Origin Foreign Key
ssManhole	FACILITYID	FACILITYID

Destination Class Name	Destination Primary Key	Destination Foreign Key
ssManholeReference		

ssNetworkStructureReferenceRC - RelationshipClass

Name ssNetworkStructureReferenceRC
Cardinality OneToOne
IsAttributed false
IsComposite false
ForwardPathLabel ssNetworkStructureReference
BackwardPathLabel ssNetworkStructure
Description ssNetworkStructureReferenceRC

Origin Class Name	Origin Primary Key	Origin Foreign Key
ssNetworkStructure	FACILITYID	FACILITYID

Destination Class Name	Destination Primary Key	Destination Foreign Key
ssNetworkStructureReference		

ssPressurizedMainReferenceRC - RelationshipClass

Name ssPressurizedMainReferenceRC
Cardinality OneToOne
IsAttributed false
IsComposite false
ForwardPathLabel ssPressurizedMainReference
BackwardPathLabel ssPressurizedMain
Description ssPressurizedMainReferenceRC

Origin Class Name	Origin Primary Key	Origin Foreign Key
ssPressurizedMain	FACILITYID	FACILITYID

Destination Class Name	Destination Primary Key	Destination Foreign Key
ssPressurizedMainReference		

ssPumpStationReferenceRC - RelationshipClass

Name ssPumpStationReferenceRC
Cardinality OneToOne
IsAttributed false
IsComposite false
ForwardPathLabel ssPumpStationReference
BackwardPathLabel ssPumpStation
Description ssPumpStationReferenceRC

Origin Class Name	Origin Primary Key	Origin Foreign Key
ssPumpStation	FACILITYID	FACILITYID

Destination Class Name	Destination Primary Key	Destination Foreign Key
ssPumpStationReference		

ssServiceConnectionReferenceRC - RelationshipClass

Name ssServiceConnectionReferenceRC
Cardinality OneToOne
IsAttributed false
IsComposite false
ForwardPathLabel ssServiceConnectionReference
BackwardPathLabel ssServiceConnection
Description ssServiceConnectionReferenceRC

Origin Class Name	Origin Primary Key	Origin Foreign Key
ssServiceConnection	FACILITYID	FACILITYID

Destination Class Name	Destination Primary Key	Destination Foreign Key
ssServiceConnectionReference		

ssSystemValveReferenceRC - RelationshipClass

Name ssSystemValveReferenceRC
Cardinality OneToOne
IsAttributed false
IsComposite false
ForwardPathLabel ssSystemValveReference
BackwardPathLabel ssSystemValve
Description ssSystemValveReferenceRC

Origin Class Name	Origin Primary Key	Origin Foreign Key
ssSystemValve	FACILITYID	FACILITYID

Destination Class Name	Destination Primary Key	Destination Foreign Key
ssSystemValveReference		

AncillaryRoleDomain - Domain

DomainName AncillaryRoleDomain
FieldType SmallInteger
Domain Type CodedValue

Code	Name
0	None
1	Source
2	Sink

AssetManager - Domain

DomainName AssetManager
Description Indicates which organization maintains the asset
FieldType SmallInteger
Domain Type CodedValue

Code	Name
1	City
2	County
3	State
4	Private
5	Other
-99	Unknown

AssetOwner - Domain

DomainName AssetOwner
Description Indicates which organization owns the asset
FieldType SmallInteger
Domain Type CodedValue

Code	Name
1	City
2	County
3	State
4	Private
5	Other
-99	Unknown

BooleanDomain - Domain

DomainName BooleanDomain
FieldType SmallInteger
Domain Type CodedValue

Code	Name
0	False
1	True

ControlSetRef - Domain

DomainName ControlSetRef
FieldType String
Domain Type CodedValue

Code	Name
N	North
NE	North East
E	East
SE	South East
S	South
SW	South West
W	West
NW	North West
NORTH RIM	North Rim

Datum - Domain

DomainName Datum
Description Identifies the datum used to establish the asset's vertical elevation
FieldType String
Domain Type CodedValue

Code	Name
29	NGVD 29
88	NAVD 88
-99	Unknown

Direction - Domain

DomainName Direction
FieldType String
Domain Type CodedValue

Code	Name
East	East
North	North
South	South
West	West
Northeast	Northeast
Northwest	Northwest
Southeast	Southeast
Southwest	Southwest
North/South	North/South
East/West	East/West
Northeast/Northwest	Northeast/Northwest
Southeast/Southwest	Southeast/Southwest

EnabledDomain - Domain

DomainName EnabledDomain
FieldType SmallInteger
Domain Type CodedValue

Code	Name
0	False
1	True

InventoryClass - Domain

DomainName	InventoryClass
Description	The method used to establish the geographic location of the asset
FieldType	String
Domain Type	CodedValue

Code	Name
DGPS	DGPS (1-meter)
GIS	GIS Entry
GPS	GPS (< 1-foot)
GPS-Converted	GPS Asbuilt Converted (< 1-foot)

piAccessDiameter - Domain

DomainName	piAccessDiameter
Description	The diameter of the receiving chamber for circular access points
FieldType	Double
Domain Type	Range

Minimum Value	Maximum Value
0	72

piAccessType - Domain

DomainName	piAccessType
Description	Method for accessing the opening
FieldType	String
Domain Type	CodedValue

Code	Name
Door	Door
Grate	Grate
Cover	Cover
Hand	Hand
Lid	Lid
Unknown	Unknown

piActiveStatus - Domain

DomainName	piActiveStatus
Description	Describes the status of the easement, whether Vacated or Dedicated. Vacated is used to identify easements that have been released and are no longer active (no longer Dedicated). Dedicated are easements that are valid and are in effect.
FieldType	String
Domain Type	CodedValue

Code	Name
Active	Active
Abandoned	Abandoned
Inactive	Inactive
Removed	Removed
Not Found	Not Found
Inactive-Plugged	Inactive-Plugged

piCleanoutTypes - Domain

DomainName piCleanoutTypes
FieldType String
Domain Type CodedValue

Code	Name
Cleanout	Cleanout
Flushing Structure	Flushing Structure
Lamp Hole	Lamp Hole
Other	Other
Unknown	Unknown

piConditionPACP - Domain

DomainName piConditionPACP
Description The condition rating of the asset. Used by Cityworks Analytics for condition analysis output. May be calculated within a Cityworks Inspection and updated from there to GIS.
FieldType SmallInteger
Domain Type CodedValue

Code	Name
1	Severity 1 - Minor defect grade
2	Severity 2 - Minor to moderate defect grade
3	Severity 3 - Moderate defect grade
4	Severity 4 - Significant defect grade
5	Severity 5 - Most significant defect grade

piControlValveType - Domain

DomainName piControlValveType
Description The type of control valve
FieldType String
Domain Type CodedValue

Code	Name
Altitude	Altitude
Blowoff	Blowoff
Combination	Combination
Vacuum	Vacuum
Air Control	Air Control
Air Gap	Air Gap
Air Release	Air Release
Atmospheric Vacuum	Atmospheric Vacuum
Backflow Control	Backflow Control
Double Check	Double Check
Pressure Vacuum	Pressure Vacuum
Pressure Reducer	Pressure Reducer
Simple Check	Simple Check
Vacuum Breaker	Vacuum Breaker
Vacuum Release	Vacuum Release
Surge Relief	Surge Relief
Snubber	Snubber
CLA	CLA
RPZ	Reduced Pressure Zone
Other	Other
Unknown	Unknown

piDischargePointType - Domain

DomainName piDischargePointType
Description The type of sanitary sewer discharge
FieldType String
Domain Type CodedValue

Code	Name
Outfall	Outfall
Overflow	Overflow
Standard Outlet	Standard Outlet
Other	Other
Unknown	Unknown

piFittingType - Domain

DomainName piFittingType
Description The type of fitting
FieldType String
Domain Type CodedValue

Code	Name
Bend	Bend
Cap	Cap
Coupling	Coupling
Cross	Cross
Expansion Joint	Expansion Joint
Over Under	Over Under
Reducer	Reducer
Reducing Cross	Reducing Cross
Reducing Tee	Reducing Tee
Sleeve	Sleeve
Tap	Tap
Tee	Tee
Transition	Transition
Other	Other
Unknown	Unknown
Wye	Wye
Taping Tee	Taping Tee
Offset	Offset
Plug	Plug

piLiningMethod - Domain

DomainName piLiningMethod
Description The type of lining method
FieldType String
Domain Type CodedValue

Code	Name
CP	Cured in Place
FF	Fold and Form or Deform/Reform
SN	Segmented Panel
SP	Segmented Pipe
SW	Spiral Wound
OTH	Other
NONE	None

piManholeCoverType - Domain

DomainName piManholeCoverType
Description The type of manhole cover
FieldType String
Domain Type CodedValue

Code	Name
Standard W/ Lock	Standard W/ Lock
Standard W/ Ears	Standard W/ Ears
Non-District	Non-District
Water Tight	Water Tight
27" Diameter	27" Diameter
42" Diameter	42" Diameter
Large - Water Tight	Large - Water Tight
Rectangular	Rectangular
Other	Other
Unknown	Unknown

piManholeType - Domain

DomainName piManholeType
Description The type of manhole
FieldType String
Domain Type CodedValue

Code	Name
STD	Standard
DRP	Drop
SPL	Split
DIV	Diversion
SED	Sedimentation
OTH	Other
UNK	Unknown
CON	Conflict
TER	Terminal
WEI	Weir

piPipeDiameter - Domain

DomainName piPipeDiameter
Description The diameter of the asset
FieldType Double
Domain Type CodedValue

Code	Name
0.75	3/4"
1	1"
1.25	1 1/4"
1.5	1 1/2"
2	2"
2.5	2 1/2"
3	3"
4	4"
6	6"
8	8"
10	10"
12	12"
14	14"

15	15"
16	16"
18	18"
20	20"
24	24"
30	30"
36	36"
40	40"
42	42"
48	48"
54	54"
60	60'
66	66"
72	72"
75	75"
-1	Other
11	11"
13	13"
19	19"
21	21"
22	22"
23	23"
27	27"
33	33"
45	45"
84	84"
96	96"
102	102"
-99	Unknown
-88	Not Applicable
41	41"
52	52"
5	5"

piPipeMaterial - Domain

DomainName	piPipeMaterial
Description	The construction material of the asset
FieldType	String
Domain Type	CodedValue

Code	Name
ABS	ABS Plastic
ASP	Asphalt
BR	Brick
CT	Clay Tile
CSB	Concrete Segments (Bolted)
CSU	Concrete Segments (Unbolted)
CMP	Corrugated Metal
CIPP	Cured In Place
DIP	Ductile Iron
FRP	Fiberglass Reinforced
EARGEO	Earth & Geotextile
EAR	Earthen
GEO	Geotextile
GRC	Glass Reinforced Cement
OB	Pitch Fiber (Orangeburg)

PSC	Plastic/Steel Composite
PE	Polyethylene
PP	Polypropylene
PVC	Polyvinyl Chloride
PCCP	Pre-Stressed Concrete Cylinder
RCP	Reinforced Concrete
RPM	Reinforced Plastic (Truss)
SB	Segmented Block
SP	Steel
TTE	Transite
VCP	Vitrified Clay
WD	Wood
BMP	Brick Masonry
HDPE	High Density Polyethylene
STL	Stainless Steel
RCPC	Reinforced concrete pipe w cylinder
PBL	Polybutylene
CSTL	Corrugated Steel
CAL	Corrugated Aluminimum
CPEL	Corrugated Polyethylene
ALU	Aluminum pipe
CONC	Concrete (Non-Reinforced)
ACP	Asbestos Cement
CIP	Cast Iron
CUP	Copper
GIP	Galvanized Pipe
ZZZ	Other
XXX	Unknown
LEAD	Lead

piPipeShape - Domain

DomainName piPipeShape
Description The shape of the main
FieldType String
Domain Type CodedValue

Code	Name
Circular	Circular
Horseshoe	Horseshoe
Oblong	Oblong
Rectangular	Rectangular
Trapezoidal	Trapezoidal
Triangular	Triangular
Other	Other
Unknown	Unknown

piSystemValveType - Domain

DomainName piSystemValveType
Description Type of control valve
FieldType String
Domain Type CodedValue

Code	Name
Ball	Ball
Butterfly	Butterfly

Cone	Cone
Gate	Gate
Plug	Plug
Roundway	Roundway
Other	Other
Unknown	Unknown
Tapping	Tapping
Bypass	Bypass
Check	Check

ssNetworkStructureType - Domain

DomainName ssNetworkStructureType
Description The type of control structure
FieldType String
Domain Type CodedValue

Code	Name
Diversion Chamber	Diversion Chamber
Diversion Point	Diversion Point
Junction Chamber	Junction Chamber
Production Well	Production Well
Pump Station	Pump Station
Split Manhole	Split Manhole
Storage Basin	Storage Basin
Tide Chamber	Tide Chamber
Treatment Plant	Treatment Plant
Lift Station	Lift Station
Discharge Structure	Discharge Structure
Unknown	Unknown
Other	Other
Virtual Junction	Virtual Junction
Flow Meter	Flow Meter
Monitoring Well	Monitoring Well
Pump	Pump
Backflow Prevention	Backflow Prevention
Grease Separator	Grease Separator
Injection Well	Injection Well
ASR Well	Aquifer Storage and Recovery Well
Master Meter	Master Meter

ssPumpStationType - Domain

DomainName ssPumpStationType
Description Type of pump station
FieldType String
Domain Type CodedValue

Code	Name
Lift Station	Lift Station
Pump Around Station	Pump Around Station
Pump Station	Pump Station
Repump Station	Repump Station
Unknown	Unknown

ssValveUse - Domain

DomainName ssValveUse
Description Use of the valve
FieldType Integer
Domain Type CodedValue

Code	Name
23	Bypass
24	Shutoff/Isolation
25	Backflow preventor
26	Tapping
-99	Unknown

ssWaterType - Domain

DomainName ssWaterType
Description Type of control valve
FieldType String
Domain Type CodedValue

Code	Name
Treated	Treated Water
Combined	Combined Waste Water
Potable	Potable Water
Raw	Raw Water
Reclaimed	Reclaimed Water
Salt	Salt Water
Sewage	Sewage
Storm	Storm Runoff
Effluent	Waste Water Effluent
Overflow	Overflow

ValueMethod - Domain

DomainName ValueMethod
FieldType String
Domain Type CodedValue

Code	Name
ANGLE	ANGLE
AUTONUMBER	AUTONUMBER
CASCADE_ATTRIBUTE	CASCADE_ATTRIBUTE
COPY_FEATURE	COPY_FEATURE
COPY_LINKED_RECORD	COPY_LINKED_RECORD
CREATE_LINKED_RECORD	CREATE_LINKED_RECORD
CREATE_PERP_LINE	CREATE_PERP_LINE
CREATE_PERP_LINE_TO_LINE	CREATE_PERP_LINE_TO_LINE
CURRENT_USER	CURRENT_USER
EDGE_STATS	EDGE_STATS
EXPRESSION	EXPRESSION
FEATURE_STATS	FEATURE_STATS
FIELD	FIELD
FIELD_TRIGGER	FIELD_TRIGGER
FROM_EDGE_FIELD	FROM_EDGE_FIELD
FROM_EDGE_MULTI_FIELD_INTERSECT	FROM_EDGE_MULTI_FIELD_INTERSECT
FROM_EDGE_STATS	FROM_EDGE_STATS
FROM_JUNCTION_FIELD	FROM_JUNCTION_FIELD
GENERATE_ID	GENERATE_ID

GENERATE_ID_BY_INTERSECT	GENERATE_ID_BY_INTERSECT
GET_ADDRESS_FROM_CENTERLINE	GET_ADDRESS_FROM_CENTERLINE
GET_ADDRESS_USING_ARCGIS_SERVICE	GET_ADDRESS_USING_ARCGIS_SERVICE
GET_ADDRESS_USING_GEOCODER	GET_ADDRESS_USING_GEOCODER
GUID	GUID
INTERSECT_STATS	INTERSECT_STATS
INTERSECTING_BOOLEAN	INTERSECTING_BOOLEAN
INTERSECTING_COUNT	INTERSECTING_COUNT
INTERSECTING_EDGE	INTERSECTING_EDGE
INTERSECTING_FEATURE	INTERSECTING_FEATURE
INTERSECTING_FEATURE_DISTANCE	INTERSECTING_FEATURE_DISTANCE
INTERSECTING_LAYER_DETAILS	INTERSECTING_LAYER_DETAILS
INTERSECTING_RASTER	INTERSECTING_RASTER
JUNCTION_ROTATION	JUNCTION_ROTATION
LAST_VALUE	LAST_VALUE
LATITUDE	LATITUDE
LENGTH	LENGTH
LINK_TABLE_ASSET	LINK_TABLE_ASSET
LONGITUDE	LONGITUDE
MAP_INFO	MAP_INFO
MINIMUM_LENGTH	MINIMUM_LENGTH
MULTI_FIELD_INTERSECT	MULTI_FIELD_INTERSECT
NEAREST_FEATURE	NEAREST_FEATURE
NEAREST_FEATURE_ATTRIBUTES	NEAREST_FEATURE_ATTRIBUTES
OFFSET	OFFSET
PREVIOUS_VALUE	PREVIOUS_VALUE
PROMPT	PROMPT
SET_MEASURES	SET_MEASURES
SIDE	SIDE
SPLIT_INTERSECTING_FEATURE	SPLIT_INTERSECTING_FEATURE
TIMESTAMP	TIMESTAMP
TO_EDGE_FIELD	TO_EDGE_FIELD
TO_EDGE_MULTI_FIELD_INTERSECT	TO_EDGE_MULTI_FIELD_INTERSECT
TO_EDGE_STATS	TO_EDGE_STATS
TO_JUNCTION_FIELD	TO_JUNCTION_FIELD
TRIGGER_AAEVENT_FROM_EDGE	TRIGGER_AAEVENT_FROM_EDGE
TRIGGER_AAEVENT_FROM_JUNCTION	TRIGGER_AAEVENT_FROM_JUNCTION
TRIGGER_AAEVENT_INTERSECTING_FEATURE	TRIGGER_AAEVENT_INTERSECTING_FEATURE
TRIGGER_AAEVENT_TO_EDGE	TRIGGER_AAEVENT_TO_EDGE
TRIGGER_AAEVENT_TO_JUNCTION	TRIGGER_AAEVENT_TO_JUNCTION
UPDATE_FROM_EDGE_FIELD	UPDATE_FROM_EDGE_FIELD
UPDATE_FROM_JUNCTION_FIELD	UPDATE_FROM_JUNCTION_FIELD
UPDATE_INTERSECTING_FEATURE	UPDATE_INTERSECTING_FEATURE
UPDATE_LINKED_RECORD	UPDATE_LINKED_RECORD
UPDATE_TO_EDGE_FIELD	UPDATE_TO_EDGE_FIELD
UPDATE_TO_JUNCTION_FIELD	UPDATE_TO_JUNCTION_FIELD
VALIDATE_ATTRIBUTE_LOOKUP	VALIDATE_ATTRIBUTE_LOOKUP
VALIDATE_ATTRIBUTES	VALIDATE_ATTRIBUTES
VALIDATE_CONNECTIVITY	VALIDATE_CONNECTIVITY
VALIDATE_DOMAIN	VALIDATE_DOMAIN
X_COORDINATE	X_COORDINATE
Y_COORDINATE	Y_COORDINATE

YesNo - Domain

DomainName YesNo
FieldType String

Domain Type CodedValue

Code	Name
Yes	Yes
No	No

SECTION 01400

QUALITY CONTROL

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. Testing Laboratory Services

1. Laboratory testing and checking and all certifications required by the Specifications, including the cost of transporting all samples and test specimens, shall be provided by the Contractor unless otherwise indicated in the Specifications. Payment for laboratory services shall be made from the Allowance item entitled “Laboratory Testing Fees”. Payment shall be made based on the actual cost of service upon submission of paid invoices.

2. The Contractor shall retain the services of an independent, certified testing laboratory to perform all testing required by the Contract Documents and by permitting agencies. The Contractor shall submit the name of the testing laboratory and evidence of all appropriate certifications for approval by the Engineer and the City.

2. In the case of a conflict between this Specification Section and the Contractor’s Quality Management Plan, the more stringent requirement between the two documents shall govern.

3. Procedure

a. The Contractor shall plan and conduct his operations to permit taking of field samples and test specimens, as required, and to allow adequate time for laboratory tests.

b. The collection, field preparation and storage of field samples and test specimens shall be performed by the Contractor as required by the Specifications and as directed by the City.

4. Supplementary and Other Testing

a. Nothing shall restrict the Contractor from conducting tests he may require. Should the Contractor at any time request the City to consider such test results, the test reports shall be certified by an independent testing laboratory acceptable to the City. Testing of this nature shall be conducted at no additional cost to the City.

1.02 OBSERVATION AT PLACE OF MANUFACTURE

A. Unless otherwise specified, all products, materials, and time and equipment shall be subject to observation by the Engineer at the place of manufacture.

B. The presence of the Engineer at the place of manufacture however, shall not relieve the Contractor of the responsibility for furnishing products, materials, and equipment which comply with all requirements of the Contract Documents. Compliance is a duty of the Contractor, and said duty shall not be avoided by any act or omission on the part of the Engineer.

1.03 SAMPLING AND TESTING

A. Unless otherwise specified, all sampling and testing shall be in accordance with the methods prescribed in the current standards of the ASTM, as applicable to the class and nature of the article or materials considered; however, the City reserves the right to use any generally-accepted system of sampling and testing which, in the opinion of the Engineer, will ensure the City that the quality of the work is in full accord with the Contract Documents.

B. Any waiver by the City of any specific testing or other quality assurance measures, whether or not such waiver is accompanied by a guarantee of substantial performance as a relief from the specified testing or other quality assurance requirements as originally specified, and whether or not such guarantee is accompanied by a performance bond to assure execution of any necessary corrective or remedial Work, shall not be construed as a waiver of any requirements of the Contract Documents.

C. Notwithstanding the existence of such waiver, the Engineer reserves the right to make independent investigations and tests and failure of any portion of the Work to meet any of the requirements of the Contract Documents, shall be reasonable cause for the Engineer to require the removal or correction and reconstruction of any such Work in accordance with the General Conditions.

D. Materials to be tested include, but are not necessarily limited to the following:

1. cement,
2. concrete aggregate,
3. concrete,
4. bituminous paving materials,
5. structural and reinforcing steel,
6. waterproofing,
7. select backfill, subgrade, base material, crushed stone or gravel and sand,
8. water during pipeline disinfection and bacteriological testing

1.04 SITE INVESTIGATION AND CONTROL

A. The Contractor shall verify all dimensions in the field and shall check field conditions continuously during construction. The Contractor shall be solely responsible for any inaccuracies built into the Work due to its failure to comply with this requirement.

B. The Contractor shall inspect related and appurtenant Work and shall report in writing to the Engineer any conditions which will prevent proper completion of the Work. Failure to report any such conditions shall constitute acceptance of all site conditions, and any required removal, repair, or replacement caused by unsuitable conditions shall be performed by the Contractor within the scope of the Project.

1.05 OBSERVATION AND TESTING

A. The work or actions of the testing laboratory shall in no way relieve the Contractor of its obligations under the Contract. The laboratory testing work will include such observations and testing required by the Contract Documents, existing laws, codes, ordinances, etc. The testing laboratory will have no authority to change the requirements of the Contract Documents, nor perform, accept or approve any of the Contractor's Work.

B. The Contractor shall allow the Engineer ample time and opportunity for field observation and testing materials and equipment to be used in the Work. The Contractor shall advise the Engineer promptly upon placing orders for materials and equipment so that arrangements may be made, if desired, for observation before shipment from the place of manufacture. The Contractor shall at all times furnish the Engineer and its representatives, facilities including labor, and allow proper time for inspecting and testing materials, equipment, and installation. The Contractor must anticipate that possible delays may occur in the execution of its work due to the necessity of materials and equipment being inspected and accepted for use. The Contractor shall furnish, at its own expense, all samples of materials required by the Engineer for testing, and shall make its own arrangements for providing water, electric power, or fuel for the various observations and tests of structures and equipment.

C. The Contractor shall furnish the services of representatives of the manufacturers of certain equipment, as prescribed in other Sections of the Specifications. The Contractor shall also place his orders for such equipment on the basis that, after the equipment has been tested prior to final acceptance of the work, the manufacturer will furnish the City with certified statements that the equipment has been installed properly and is ready to be placed in functional operation. Tests and analyses required of equipment shall be paid for by the Contractor, unless specified otherwise in the Section which covers a particular piece of equipment.

D. Where other tests or analyses are specifically required in other Sections of these Specifications, the cost thereof shall be borne by the party (City or Contractor) so designated in such Sections. The City will bear the cost of all tests, observations, or investigations undertaken by the order of the Engineer for the purpose of determining conformance with the Contract Documents if such tests, observations, or investigations are not specifically required by the Contract Documents, and if conformance is ascertained thereby. Whenever nonconformance is determined by the Engineer as a result of such tests, observations, or investigations, the Contractor shall bear the full cost thereof or shall reimburse the City for said cost. In this connection, the cost of any additional tests and investigations, which are ordered by the Engineer to ascertain subsequent conformance with the Contract Documents, shall be borne by the Contractor.

E. Significance of Tests

1. Test results shall be binding on both the Contractor and the City, and shall be considered irrefutable evidence of compliance or noncompliance with the Specification requirements, unless supplementary testing shall prove, to the satisfaction of the City, that the initial samples were not representative of actual conditions.

F. Supplementary and Other Testing

1. Nothing shall restrict the Contractor from conducting tests he may require. Should the Contractor at any time request the City to consider such test results, the test reports shall be certified by an independent testing laboratory acceptable to the City. Testing of this nature shall be conducted at the Contractor's expense.

1.06 RIGHT OF REJECTION, IMPERFECT WORK, EQUIPMENT, OR MATERIALS

A. The Engineer, acting for the City, shall have the right, at all times and places, to reject any articles or materials to be furnished hereunder which, in any respect, fail to meet the requirements of the Contract Documents, regardless of whether the defects in such articles or materials are detected at the point of manufacture or after completion of the Work at the site, or during the subsequent guarantee period. If the Engineer or its representative, through an oversight or otherwise, has accepted materials or Work which is defective, or which is contrary to the Contract Documents, such materials, no matter in what stage or condition of manufacture, delivery, or erection, may be subsequently rejected by the Engineer for the City. Any defective or imperfect work, equipment, or materials furnished by the Contractor which is discovered shall be removed immediately even though it may have been overlooked by the Engineer and estimated for payment. Satisfactory work or materials shall be substituted for that rejected.

B. The Contractor shall promptly remove rejected articles or materials from the site of the Work after notification of rejection. All costs of removal and replacement of rejected articles or materials as specified herein shall be borne by the Contractor.

C. The Engineer may order tests of imperfect or damaged work, equipment, or materials to determine the required functional capability for possible acceptance, if there is no other reason for rejection. The cost of such tests shall be borne by the Contractor; and the nature, tester, extent and supervision of the tests will be as determined by the Engineer. If the results of the tests indicate that the required functional capability of the work, equipment, or material was not impaired, consistent with the final general appearance of same, the work, equipment, or materials may be deemed acceptable. If the results of such tests reveal that the required functional capability of the questionable work, equipment, or materials has been impaired, then such work, equipment, or materials shall be deemed imperfect and shall be replaced. The Contractor may elect to replace the imperfect work, equipment, or material in lieu of performing the tests.

1.07 OTHER CONSTRUCTION CONSIDERATIONS

A. Sleeves and Openings: The Contractor shall provide all openings, chases, etc., to fit its own work and that of any other subcontractors and Contractor's. All such openings or chases shown on the Contract Drawings, or reasonably implied thereby, or as confirmed

or modified by acceptable shop, setting or erecting drawings, shall be provided by the Contractor.

B. Where pipes or conduits are to pass through slabs or walls, or where equipment frames or supports are to be installed as integral part of an opening, the sleeves, openings, forms or frames shall be furnished by the installer of the pipes, conduits or equipment, but shall be placed by the Contractor. Where hanger inserts, anchor bolts and similar items are to be embedded in concrete as an integral part of a slab or wall, they shall be furnished by the installer of the pipe or other equipment requiring the hanger, etc., but shall be placed by the Contractor.

C. Weather Conditions: Work that may be affected by inclement weather shall be suspended until proper conditions prevail. In the event of impending storms, the Contractor shall take necessary precautions to protect all work, materials and equipment from exposure.

D. Fire Protection: The Contractor shall take all necessary precautions to prevent fires at or adjacent to the Work, including its own buildings and trailers. Adequate fire extinguisher and hose line stations shall be provided throughout the work area.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 BUOYANCY

A. The Contractor shall be completely responsible for any tanks, pipelines, utility access, foundations or similar improvements that may become buoyant during the construction operations due to groundwater levels. Should there be any possibility of buoyancy, the Contractor shall take the necessary steps to prevent damage due to floating or flooding, and shall repair or replace said improvements at no additional cost to the City.

- END OF SECTION -

SECTION 01510

TEMPORARY UTILITIES

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. It shall be the CONTRACTOR's responsibility to provide equipment that is adequate for the performance of the Work under this Contract within the time specified. All equipment shall be kept in satisfactory operating condition, shall be capable of safely and efficiently performing the required Work, and shall be subject to review by the City's representative at any time within the duration of the Contract. All Work hereunder shall conform to the applicable requirements of the OSHA Standards for Construction.

B. The CONTRACTOR shall provide for utilities and services for its own operations. The CONTRACTOR shall furnish, install and maintain all temporary utilities during the contract period including removal upon completion of the Work.

C. The CONTRACTOR shall provide temporary facilities as specified in the Construction Constraints section.

1.02 POWER AND LIGHTING

A. Power: The CONTRACTOR shall provide all necessary power required for its operations under the Contract, and shall provide and maintain all temporary power lines required to perform the Work in a safe and satisfactory manner.

B. Construction Lighting: All Work conducted at night or under conditions of deficient daylight shall be suitably lighted to ensure proper Work and to afford adequate facilities for inspection and safe working conditions. Temporary lighting shall be maintained during nonworking periods if the area is subject to access by the public or City's personnel.

C. Electrical Connections: All temporary connections for electricity shall be subject to review by the ENGINEER and the power company representative, and shall be removed in like manner at the CONTRACTOR's expense prior to final acceptance of the Work.

D. Separation of Circuits: Unless otherwise permitted by the ENGINEER, circuits separate from lighting circuits shall be used for all power purposes.

E. Construction Wiring: All wiring for temporary electric light and power shall be properly installed and maintained and shall be securely fastened in place. All electrical facilities shall conform to the requirements of Subpart K of the OSHA Safety and Health Standards for Construction.

1.03 WATER SUPPLY

A. General: Except as noted otherwise, the CONTRACTOR shall make arrangements for and pay for all costs for all water used during construction including general construction used, testing, CONTRACTOR's trailer and ENGINEER's trailer. The CONTRACTOR shall provide and maintain all piping, fittings, adapters, and valving as may be required.

B. If a temporary connection is made to a potable water system on-site (e.g., a fire hydrant), the CONTRACTOR must install a back flow prevention device and a meter, obtained from the City. The CONTRACTOR shall provide temporary piping for the metering and use of potable water. The cost of the water for the testing will be charged to the CONTRACTOR at the standard City rates including deposits, monthly charges and usage charges.

C. Water Connections: The CONTRACTOR shall not make connection to, or draw water from, any fire hydrant or pipeline without first obtaining permission of the authority having jurisdiction over the use of said fire hydrant or pipeline and from the agency owning the affected water system. For each such connection made, the CONTRACTOR shall first attach to the fire hydrant or pipeline a valve and a meter, if required by the said authority, of a size and type acceptable to said authority and agency.

D. Removal of Water Connections: Before final acceptance of the Work on the project, all temporary connections and piping installed by the CONTRACTOR shall be entirely removed, and all affected improvements shall be restored to their original condition, or better, to the satisfaction of the ENGINEER and to the agency owning the affected utility.

E. Fire Protection: The construction, and all other parts of the Work shall be connected with the CONTRACTOR's water supply system and shall be adequately protected against damage by fire. Hose connections and hose, water casks, chemical equipment, or other sufficient means shall be provided for fighting fires in the temporary structures and other portions of the Work, and responsible persons shall be designated and instructed in the operation of such fire apparatus so as to prevent or minimize the hazard of fire. The CONTRACTOR's fire protection program shall conform to the requirements of Subpart F of the OSHA Standards for Construction and all local Fire Department Requirements.

1.04 TEMPORARY SANITARY FACILITIES

A. The CONTRACTOR shall provide and maintain adequate and clean sanitary facilities for the construction work force and visitors. The facilities shall comply with local codes and regulations and be situated in an acceptable location.

1.05 CONFINED SPACES

A. The CONTRACTOR shall provide and maintain a safe working environment in confined spaces. The CONTRACTOR shall follow the applicable requirements of the OSHA Standards for Construction and NIOSH Publications for working in confined spaces.

1.06 TEMPORARY VENTILATION

A. The CONTRACTOR shall provide and maintain adequate ventilation for a safe working environment. In addition, forced air ventilation shall be provided for the curing of installed materials, humidity control and the prevention of hazardous accumulations of dust, gases or vapors.

PART 2 -- PRODUCTS (NOT USED)

PART 3 -- EXECUTION (NOT USED)

- END OF SECTION -

PROJECT NO. 11868

SECTION 01520

CONSTRUCTION CONSTRAINTS

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. The intent of this Section is to outline the minimum requirements necessary to provide continuous public services throughout the construction period.

B. Work under the Contract shall be scheduled and performed in such a manner as to result in the least possible disruption to the operation of existing water, wastewater, and stormwater transmission facilities and nearby residents.

C. The Contractor has the option of providing additional temporary facilities that can eliminate a constraint, provided it is done without cost to the City (including additional City labor) and provided that all requirements of these Specifications are fulfilled. Work not specifically covered in the following paragraphs may, in general, be done at any time during the contract period, subject to the operating requirements and constraints and construction requirements outlined hereinafter. All references to days in this Section shall be consecutive calendar days.

1.02 CONNECTION OF EXISTING SYSTEMS

A. All connections to existing systems shall be performed in such a manner that no damage and minimal interruption is caused to the existing installation. Any damage caused to existing installations shall be repaired or replaced by the Contractor at no additional cost to the City.

B. The Contractor shall note that some of the work in this Contract will require the Contractor to connect to existing pipelines and structures. The Contractor shall be responsible for the proper containment and disposal of wastewater, or other materials drained from existing pipelines and structures during construction, unless otherwise specifically noted to be performed by the City.

C. The Contractor shall contain such wastewater or other materials (in accordance with all applicable codes) and shall dispose of such within the existing collection system as approved by the City. The Contractor shall be responsible for the prevention of wastewater or other material spills within the Work.

1.03 OPERATION REQUIREMENTS

A. Coordination with Private Property Owners: Stormwater work is located in City of Fort Lauderdale right-of-way areas. Work is also adjacent to private residences and public access areas. The Contractor shall coordinate work with the City and shall minimize impacts to private property owners and public access areas. Contractor shall replace surrounding ground affected including but not limited to pavers, sidewalks, sod, landscape and bring it to original or better conditions. Sequence of certain major events and identification of time constraints for removing existing facilities from active service and installation of new facilities are described below. No phase of work (or tasks within a phase)

shall preclude or be performed in parallel with a subsequent phase unless specifically defined so in these documents. In all cases, work in each phase shall be checked out an accepted for satisfactory use, subject to the City's approval, prior to the Contractor proceeding to the next phase of construction.

B. Critical events in the sequence of construction are specified herein. The outlined sequence of construction does not include all items necessary to complete the Work, but is intended to identify the sequence of critical events necessary to eliminate disruption to the public and to the City's facilities. It shall be understood by the Contractor that the critical events identified are not all inclusive and that additional items of work not shown may be required. The sequence of construction is a precedence requirement and does not attempt to schedule the Contractor's work.

1.04 SEQUENCE OF CONSTRUCTION

A. Mobilization / Site Preparation

1. Mobilize for work – video roadways, swales and adjacent area, obtain permits, develop and submit construction schedule, submit shop drawing schedule and being shop drawing submittals and procurement of materials.

2. For interfering utilities, construct new utilities up to tie-in points, perform tests, make final connections with minimum amount of shut down time. After acceptance of new utilities, remove existing interfering underground utilities and structures. Provide temporary services as required to maintain continuous operation.

i. Upon the Contractor's initial mobilization, the Contractor shall provide a 24" HDPE temporary bypass pipe (24" HDPE) and connect to the existing catch basin located on the west side of the preserve area to maintain the stormwater connection for the preserve area to the outfall into the New River. Prior to removal of existing headwall & drainage structure located near the proposed pump station location in the northwest area of the Preserve.

B. During installation of the proposed 72" RCP from Structure S74 & S75, the contractor shall install a 24" single wall HDPE pipe under the proposed 72" RCP to maintain the temporary bypass connection until final Certification and Acceptance of the pump station and final inlet tie-in into the 72" RCP is installed. After certification and acceptance of new pump station by City, the Contractor shall plug the south invert of S482 and grout fill the temporary 24" by-pass piping from Structure S482 to S361.Detailed Construction

1. Project Notification shall be performed in accordance with the requirements of Section 01580.

2. The Contractor shall be responsible for all damages/claims resulting from its activities on the surrounding neighborhood and its residents.

C. All work in the Preserve in the vicinity of the pump station from the west plug to Structure S379 and from the east plug to Structure S73, including temporary bypass drainage (1.04 B) must be furnished, installed and completed within six (6) months of the Notice to Proceed. All work must be approved by Engineer and City prior to the six (6) month deadline. The remainder of the pipe and associated work within the Preserve shall be

completed prior to the completion of the pump station. Contractor is responsible for coordination of all entities involved in the work within the Preserve.

D. Final Site Work and Closeout

1. Final grading, paving, sodding, landscaping, miscellaneous work, demobilization and related closeout activities shall be as defined elsewhere in the Contract Documents.

1.05 CONSTRUCTION CONSTRAINTS

A. Construction Dewatering

1. All dewatering equipment such as pumps, air compressors, generators, etc. proposed for use during construction in residential areas shall be provided with noise enclosures suitable to meet the requirements of the City of Fort Lauderdale Noise Ordinance, whichever is more stringent.

2. The Contractor is responsible for draining and dewatering all existing utilities impacted by the work as required to complete the relocation, demolition, bypass, or tie-in connections. Contractor is responsible for disposal of the contents of each line.

3. Additional requirements for construction dewatering are defined on the Drawings.

B. Work in City of Fort Lauderdale Right-of-Way

1. Contractor shall coordinate with City of Fort Lauderdale Engineering Department prior to start of restoration.

2. Contractor shall not begin new construction on the next section of roadway until the previous roadway is significantly complete. A roadway shall be considered significantly complete when all work is complete including the first lift of asphalt. The milling of the roadway and placement of the final lift of asphalt, final striping, and landscape restoration shall be done at the end of the project.

3. Construction within the right-of-way of affected roads shall be scheduled so that all improvements are completed at once, and the residents are only disrupted for one time period. This excludes water or sewer plumbing work outside the roadway which shall be scheduled after mains are tested and accepted for connection by individual services.

4. At any time, the entire length of the project area shall remain unobstructed and open to through traffic for each section. Access for emergency vehicles shall be maintained at all times to all homes and businesses. Excavation must be backfilled or barricaded at the end of each work day to prevent hazardous conditions. If a trench, excavation, or structure is to be left open, it must be covered with a steel plate and barricaded at the end of each work day or when work will be suspended for more than eight (8) hours.

5. Transportation provisions for handicapped or disabled residents shall be made by the Contractor if construction temporarily prevents access to homes. Constant access shall be provided for residents on the Special Needs List.

6. The Contractor shall also make provisions with local bus, school bus, garbage collection, mail delivery, and other agencies for continuation of service. A traffic maintenance plan indicating detours, schedules, and alternate routes which has been approved by the Engineer, the City, and Broward County Traffic Engineering Division shall be submitted to all affected agencies for coordination and routing purposes.

7. Pipe and material shall not be strung out along installation routes for longer than two (2) weeks prior to installation.

8. A safe walk route for all schools within the vicinity of the construction zone shall be maintained during the arrival and dismissal of school. Contractor shall not block bus access to schools during school hours.

C. Maintenance of Existing Facilities

1. It may be necessary to interrupt the operation of the existing water and/or sewer system. In all cases where the Contractor must cause an interruption, the Contractor shall prepare and submit to the Engineer seven (7) working days prior to commencing work, a complete description of the proposed procedure and a guaranteed time schedule. At least 24 hours prior to the time proposed for starting the Work, the Contractor will be notified by the Engineer whether or not the Work will be permitted as proposed.

2. The Engineer reserves the right to require the Contractor to work 24 hours per day in all cases where interference with operation of the system may result in dangerous health hazards or offensive conditions.

3. In no case will the Contractor be permitted to interfere with the existing system until all materials, supplies, equipment, tools and incidentals necessary to complete the work are on site. Backup equipment and/or materials on key items shall be required on work necessitating interference with the existing system.

4. The Contractor shall be responsible for draining and dewatering existing utilities as required to complete tie-in activities. The Contractor is responsible for the disposal of contents of the line(s) in accordance with all federal, state, and local regulations.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

3.01 COORDINATION WITH EXISTING UTILITIES AND OTHER AGENCIES

A. The Contractor shall notify all utilities in writing with a copy to the City/Engineer prior to construction commencement. The Contractor shall cooperate with these utility owners as necessary to minimize service interruptions.

- END OF SECTION -

SECTION 01525

MAINTENANCE OF TRAFFIC

PART 1 - GENERAL

1.01 GENERAL

A. The Contractor shall maintain pedestrian and vehicular traffic within the limits of the projects for the duration of the construction period, including any temporary suspensions of the work, construct and maintain detours, provide facilities for access to adjacent residences, schools, bus pick up and drop off locations, common grounds, businesses, etc., along the project, furnish, install and maintain traffic control and safety devices during construction, furnish and install work zone pavement markings for maintenance of traffic in construction areas and provide any other special requirements for safe and expeditious movement of pedestrian and vehicular traffic in accordance with the Contract Documents. Maintenance of Traffic includes all facilities, devices and operations as required for safety and convenience of the public within the work zones, and shall include provisions for pedestrian, residential, and school student traffic as well as vehicular traffic.

The Contractor shall not maintain traffic over those portions of the project where no work is to be accomplished or where construction operations will not affect existing roads. Do not obstruct or create a hazard to any traffic during the performance of the work, and repair any damage to existing pavement open to traffic.

B. Beginning Date of Contractor's Responsibility: The Contractor shall maintain traffic starting the day work begins on the project. No work shall commence without approved and constructed Traffic Control Plans in place.

C. Worksite Traffic Supervisor: The Contractor shall provide a Worksite Traffic Supervisor. Requirements are as follows:

1. Ensure that the Worksite Traffic Supervisor is available on a 24-hour per day basis, participates in all changes to traffic control and reviews the project on a day-to-day basis.

2. Ensure that the Worksite Traffic Supervisor is present to direct the initial setup of the traffic control plan and any changes. Provide the Worksite Traffic Supervisor with all equipment and materials needed to set up, and maintain traffic control and handle traffic-related situations.

3. Ensure that the Worksite Traffic Supervisor immediately corrects all safety deficiencies. Do not allow minor deficiencies that are not immediate safety hazards to remain uncorrected for more than 24-hours.

4. Ensure that the Worksite Traffic Supervisor is available within 45 minutes after notification of an emergency situation and is prepared to positively respond to repair the work zone traffic control or to provide alternate traffic arrangements.

5. The City may disqualify and remove from the project a Worksite Traffic Supervisor that fails to comply with the provisions of this specification. The City may suspend all activities, except traffic and erosion control and such other activities that are necessary for project maintenance and safety, for failure to comply with these provisions.

6. Ensure that the Worksite Traffic Supervisor performs a drive-through inspection and observes traffic flow as soon as the work zone is activated and in each subsequent phase of work as they are opened to traffic. Provide to the Engineer and City a report that includes a listing of any deficiencies and proposed corrective measures.

7. Ensure that the Worksite Traffic Supervisor conducts within the limits of the project, daily daytime and weekly night time inspections within the limits of the project for projects with predominate daytime work activities and daily nighttime and weekly daytime inspections for projects with predominate nighttime work, of all traffic control devices, traffic flow, pedestrian, bicyclist, student, bus rider, school, residence and business accommodations.

8. Advise the project personnel of the schedule of these inspections and give them the opportunity to join in the inspection as is deemed necessary. Submit a comprehensive weekly report to the Engineer and City and include the condition of all traffic control devices (including pavement markings) being used. The inspection report shall also include assurances that pedestrians are accommodated with a safe travel path around work sites and safely separated from mainline traffic, that existing or detoured bicyclist paths and bus routes and stops are being maintained satisfactorily throughout the project limits, that existing residences in the work areas are being provided with adequate access for vehicular and pedestrian traffic at all times and that existing businesses in the work areas are being provided with adequate entrances for vehicular and pedestrian traffic during business hours. The Worksite Traffic Supervisor shall sign the report and certify that all of the above issues are being handled in accordance with the Contract Documents. If deficiencies are noted, the Worksite Traffic Supervisor shall note such deficiencies and include the proposed corrective actions in the report and implement immediate corrective action.

D. Traffic Control Plan

1. The Contractor is responsible for preparing a Traffic Control Plan (TCP) to be signed and sealed by a licensed Florida Engineer competent and trained in the preparation of TCP. The licensed Florida Engineer (TCPE) signing and sealing the Traffic Control Plan shall review all of the reports from the Worksite Traffic Supervisor and inspect the installation for compliance with his approved plan upon the initial installation and for each subsequent phase of the plan. The Contractor shall provide the Engineer and City with an inspection report from the TCPE indicating compliance with his approved TCP. The TCP shall meet the requirements of the Manual on Uniform Traffic Control Devices (MUTCD) Part VI, and the following jurisdictional agencies.

   a. City of Fort Lauderdale Transportation and Mobility

   b. City of Fort Lauderdale Department of Sustainable Development

c. City of Fort Lauderdale Fire Department

d. City of Fort Lauderdale Police Department

e. School Board of Broward County

2. Standards: FDOT Design Standards (DS) are the minimum standards for the use in the development of all traffic control plans. The MUTCD Part VI is the minimum national standard for traffic control for highway construction, maintenance, and utility operations. Follow the basic principles and minimum standards contained in these documents for the design, application, installation, maintenance, and removal of all traffic control devices, warning devices and barriers which are necessary to protect the public and workers from hazards within the project limits.

3. The Contractor shall provide sufficient time in the construction schedule to develop and obtain approval for each TCP.

4. The Contractor shall include provisions for detouring pedestrians and providing maintenance of traffic plans and conveyances that meet current ADA (Americans with Disabilities Act) requirements.

5. The Contractor shall submit approved maintenance of traffic plans and schedules for the development, review, approval and implementation of the maintenance of traffic plan in accordance with the Contract Documents and Section 01300, “Submittals”.

PART 2 -- PRODUCTS (Not Used)

PART 3 – EXECUTION

3.01 GENERAL

A. Maintenance of Roadway Surfaces: Maintain all lanes that are being used for the maintenance of traffic, including those on detours and temporary facilities, under all weather conditions. Keep the lanes free of dust, dirt, muck, potholes and rutting. Provide the lanes with the drainage facilities necessary to maintain a smooth riding surface under all weather conditions.

B. Number of Traffic Lanes:

1. Maintain one lane of traffic in each direction.

2. Maintain two lanes of traffic in each direction at existing four (or more) lane cross roads.

3. Construct each lane used for maintenance of traffic at least as wide as the traffic lanes existing in the area before commencement of construction. Do not allow traffic control and warning devices to encroach on lanes used for maintenance of traffic.

4. The Engineer may allow the Contractor to restrict traffic to one-way operation for short periods of time provided that the Contractor employs adequate means of

traffic control and does not unreasonable delay traffic, and conforms to the approved requirements in the TCP. The Contractor shall include as a part of the TCP the estimated periods of one-way traffic operations and estimation of reasonable time delays and shall obtain the prior approval of the City Engineer having jurisdiction for these time periods and time delays. The Contractor shall include the TCP as a part of his Plan of Operation and MOT plan and in accordance with Section 01300, “Submittals”.

C. Crossings and Intersections: Provide and maintain adequate accommodations for intersecting and crossing traffic. Do not block or unduly restrict any road or street crossing the project unless approved by the Engineer and City Engineer. Maintain all existing actuated or traffic responsive mode signal operations for main and side street movements for the duration of the Contract. Restore any loss of detection within twelve (12) hours. Use only detection technology approved by the Engineer to restore detection capabilities. Before beginning any construction, provide the Engineer a plan for maintaining detection devices for each intersection and the name(s) and phone numbers of persons that can be contracted when signal operation malfunctions.

D. Access for Residences and Businesses: Provide continuous access to all residences and all places of business, adjacent schools, common property and community facilities.

E. Safe Walk Route: The safe walk route for all school students within the vicinity of the construction zone shall be maintained during the times students are arriving at or leaving school. If the current walking surface cannot be maintained, a temporary road-rock four-ft walkway shall be created in accordance with Broward County requirements. Accommodations shall be made immediately by the Contractor for the disabled persons.

F. Protection of the Work from Injury by Traffic: Where traffic would be injurious to a base, surface course, or structure constructed as a part of the work, maintain all traffic outside the limits of such areas until the potential for injury no longer exists.

G. Flagger: Provide trained flaggers as required by approved TCPs. State certified school crossing guards or off duty police officers shall be required to cross students at any locations other than those currently used.

H. Use of High Visibility Safety: Provide personnel with appropriate high visibility safety garments. Ensure that these garments be worn whenever the workers are within fifteen (15) feet of the edge of the travel way and during nighttime operations. Workers operating machinery or equipment in which loose clothing could become entangled during operation shall be required to wear appropriate high visibility clothing that will not be subject to entanglement such as orange shirts or jackets. Require Contractor personnel to wear reflective orange vest/garment during nighttime operations.

I. Existing Pavement Markings: Where a detour changes the lane use of where normal vehicle paths are altered during construction, remove all existing pavement markings that will conflict with the adjusted vehicle paths. Do not overpaint. Remove existing pavement markings using a method that will not damage the surface texture of the pavement and which will eliminate the previous marking pattern regardless of weather and light conditions. Remove all pavement markings that will be in conflict with “next phase of operation” vehicle paths as described above, before opening to traffic.

J. Detours

1. General: Construct and maintain detour facilities wherever it becomes necessary to divert traffic from any existing roadway or bridge, or wherever construction operations block the flow of traffic.

2. Construction: Plan, construct, and maintain detours for the safe passage of traffic in all conditions of weather. Provide the detour with all facilities necessary to meet this requirement.

3. Construction Methods: Select and use construction methods and materials that provide a stable and safe detour facility. Construct the detour facility to have sufficient durability to remain in good condition, supplemented by maintenance, for the entire period that the detour is required.

4. Removal of Detours: Remove detours when they are no longer needed and before the Contract is completed. Restore the area used for detours to a condition equal to or better than existed before beginning of construction. Take ownership of all materials from the detour and remove them.

5. Detours Over Existing Roads and Streets: When the TCP specifies that traffic be detoured over roads or streets outside the project area, do not maintain such roads or streets; however, maintain all signs and other devices placed for the purpose of the detour.

K. Traffic Control Officer.

1. Provide uniformed law enforcement officers, including marked law enforcement vehicles, to assist in controlling and directing traffic in the work zone when traffic control in a signalized intersection is necessary when signals are not in use.

L. Driveway Maintenance.

1. General: Ensure that each residence and or business has safe, stable, and reasonable access.

2. Construction Methods: Place, level, manipulate, compact, and maintain the material, to the extent appropriate for the intended use. As permanent driveway construction is accomplished at a particular location, the Contractor may salvage and reuse previously placed materials that are suitable for reuse on other driveways.

M. Temporary Traffic Control Devices.

1. Installation and Maintenance: Install and maintain adequate traffic control devices, warning devices and barriers to protect the traveling public and workers, and to safeguard the work area. Erect the required traffic control devices, warning devices and barriers to prevent any hazardous conditions and in conjunction with any necessary traffic re-routing. Immediately remove, turn or cover any devices or barriers that do not apply to existing conditions.

2. Notify the Engineer, City, and City Engineer's representative of any scheduled operation, which will affect traffic patterns or safety, sufficiently in advance of commencing such operation to permit his review of the plan for the proposed installation of traffic control devices, warning devices of barriers.

3. Ensure an employee is assigned the responsibility of maintaining the position and condition of all traffic control devices, warning devices and barriers throughout the duration of the Contract. Keep the Engineer, City, and City Engineer's representative advised at all times of the identification and means of contacting this employee on a 24-hour basis.

4. Keep traffic control devices, warning devices, safety devices and barriers in the correct position, properly directed, clearly visible and clean, at all times. Immediately repair, replace or clean damaged, defaced or dirty devices or barriers.

N. Work Zone Signs: Provide signs in accordance with the approved TCPs and Design Standards.

O. High Intensity Flashing Lights: Furnish Type B lights in accordance with the approved TCPs and Design Standards.

P. Warning/Channelizing Devices: Furnish warning/channelizing devices in accordance with the approved TCPs and Design Standards.

1. Reflective Collars for Traffic Cones: At night use cone collars, designed to properly fit the taper of the cone when installed. Place the upper 6-inch collar a uniform 3 ½ inch distance from the top of the cone and the lower 4 inch collar a uniform 2 inch distance below the bottom of the upper 6 inch collar. Ensure that the collars are capable of being removed for temporary use or attached permanently to the cone in accordance with the manufacturer's recommendations. Provide a white sheeting having a smooth outer surface and that essentially has the property of a retro-reflector over its entire surface.

2. Barrier Wall (Temporary): Furnish, install, maintain, remove and relocate a temporary barrier wall in accordance with the approved TCPs.

3. Glare Screen (Temporary): Furnish, install, maintain, remove and relocate glare screen systems in conjunction with temporary barrier wall at locations identified in the approved TCPs. Ensure the anchorage of the glare screen to the barrier is capable of safely resisting an equivalent tensile load of 600 lb/ft of glare screen, with a requirement to use a minimum of three (3) fasteners per barrier section. When glare screen is utilized on temporary barrier wall, warning lights will not be required.

Q. Guardrail (Temporary): Furnish guardrail (temporary) in accordance with the approved TCPs.

R. Advance Warning Arrow Panel: Furnish advance warning panel in accordance with the approved plans, Design Standards and approved TCPs.

S. Temporary Traffic Control Signals: furnish, install and operate temporary traffic control signals as indicated in the approved TCPs. Temporary traffic control signals will consist of either portable or fixed traffic signals. Provide certification that the portable traffic signals meet the requirements of the Design Standards. The Engineer may approve used signal equipment if it is in acceptable condition.

T. Work Zone Pavement Marking.

1. Description: Furnish and install Work Zone Pavement Markings for maintenance of traffic construction areas and in close conformity with the lines and details shown on the plans. Measure the reflectivity of white and yellow stripes in accordance with Florida Method FM 5-541. Re-stripe anytime the reflectivity falls below the final values shown in FM 5-541. Use only pavement marking materials that do not contain any lead or chromium compounds.

2. Centerlines, lane lines, edge lines, stop bars and turn arrows in work zones will be required in accordance with the MUTCD with the following additions:

a. Install edge lines on paved shoulders.

b. Place edge lines on all detours where vehicle paths are altered from normal operations and where a lane is narrowed from its normal width for any reason.

c. Apply Work zone Pavement Markings, including arrows and messages as determined by the TCPE to be required for the safe operation of the facility, before the end of the day if the highway is open to traffic. Channelizing devices may be used to direct traffic during the day before placing the Work Zone Pavement Markings.

d. Work Zone Pavement Markings shall be designated in the approval TCPs as removable or non-removable.

- END OF SECTION -

SECTION 01530

PROTECTION OF EXISTING FACILITIES

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall be responsible for the preservation and protection of property adjacent to the work site against damage or injury as a result of its operations under this Contract. Any damage or injury occurring on account of any act, omission or neglect on the part of the Contractor shall be restored in a proper and satisfactory manner or replaced by and at the expense of the Contractor to an equal or superior condition than previously existed.

B. The Contractor shall comply promptly with such safety regulations as may be prescribed by the City or the local authorities having jurisdiction and shall, when so directed, properly correct any unsafe conditions created by, or unsafe practices on the part of, its employees. In the event of the Contractor's failure to comply, the City may take the necessary measures to correct the conditions or practices complained of, and all costs thereof will be deducted from any monies due the Contractor. Failure of the Engineer to direct the correction of unsafe conditions or practices shall not relieve the Contractor of its responsibility hereunder.

C. In the event of any claims for damage or alleged damage to property as a result of work under this Contract, the Contractor shall be responsible for all costs in connection with the settlement of or defense against such claims. Prior to commencement of work in the vicinity of property adjacent to the work site, the Contractor, at its own expense, shall take such surveys as may be necessary to establish the existing condition of the property. Before final payment can be made, the Contractor shall furnish satisfactory evidence that all claims for damage have been legally settled or sufficient funds to cover such claims have been placed in escrow, or that an adequate bond to cover such claims has been obtained.

1.02 PROTECTION OF WORK AND MATERIAL

A. During the progress of the work and up to the date of final payment, the Contractor shall be solely responsible for the care and protection of all work and materials covered by the Contract.

B. All work and materials shall be protected against damage, injury or loss from any cause whatsoever, and the Contractor shall make good any such damage or loss at its own expense. Protection measures shall be subject to the approval of the Engineer.

1.03 BARRICADES, WARNING SIGNS AND LIGHTS

A. The Contractor shall provide, erect and maintain as necessary, strong and suitable barricades, danger signs and warning lights along all roads accessible to the public, as required by the authority having jurisdiction, to insure safety to the public. All barricades and obstructions along public roads shall be illuminated at night and all lights for this purpose shall be kept burning from sunset to sunrise.

B. Each Contractor shall provide and maintain such other warning signs and barricades in areas of and around their respective work as may be required for the safety of all those employed in the work, City operating personnel, or those visiting the site.

1.04 TEMPORARY BRIDGES

A. Construct temporary bridges at all points where maintenance of traffic across pipeline construction is necessary.

B. Make bridges over public streets, roads, and highways acceptable to authority having jurisdiction thereover.

C. Bridges erected over private roads and driveways shall be adequate for service to which they will be subjected.

D. Provide substantial guardrails and suitably protected approaches.

E. Provide foot bridges not less than 4 feet wide with handrails and uprights of dressed lumber.

F. Maintain bridges in place as long as conditions of the Work require their use for safety of public, except that when necessary for proper prosecution of the Work in immediate vicinity of bridge. Bridge may be relocated or temporarily removed for such period as Engineer may permit.

1.05 EXISTING UTILITIES AND STRUCTURES

A. The term existing utilities shall be deemed to refer to both publicly-owned and privately-owned utilities such as electric power and lighting, telephone, water, gas, storm drains, process lines, sanitary sewers and all appurtenant structures.

B. Where existing utilities and structures are indicated on the Drawings, it shall be understood that all of the existing utilities and structures affecting the work may not be shown and that the locations of those shown are approximate only. It shall be the responsibility of the Contractor to ascertain the actual extent and exact location of existing utilities and structures. In every instance, the Contractor shall notify the proper authority having jurisdiction and obtain all necessary directions and approvals before performing any work in the vicinity of existing utilities.

C. Prior to beginning any excavation work, the Contractor shall, through field investigations, determine any conflicts or interferences between existing utilities and new utilities to be constructed under this project. This determination shall be based on the actual locations, elevations, slopes, etc., of existing utilities as determined in the field investigations, and locations, elevation, slope, etc. of new utilities as shown on the Drawings. If interference exists, the Contractor shall bring it to the attention of the Engineer as soon as possible. If the Engineer agrees that interference exists, it shall modify the design as required.

D. Additional costs to the Contractor for this change shall be processed through a Change Order as detailed elsewhere in these Contract Documents. In the event the Contractor fails to bring a potential conflict or interference to the attention of the Engineer prior to beginning excavation work, any actual conflict or interference which does arise during the Project shall be corrected by the Contractor, as directed by the Engineer, at no additional expense to the City.

E. The work shall be carried out in a manner to prevent disruption of existing services and to avoid damage to the existing utilities. Temporary connections shall be provided, as required, to insure uninterrupted existing services. Any damage resulting from the work of

this Contract shall be promptly repaired by the Contractor at its own expense in a manner approved by the Engineer and further subject to the requirements of any authority having jurisdiction. Where it is required by the authority having jurisdiction that they perform their own repairs or have them done by others, the Contractor shall be responsible for all costs thereof.

F. Where excavations by the Contractor require any utility lines or appurtenant structures to be temporarily supported and otherwise protected during the construction work, such support and protection shall be provided by the Contractor. All such work shall be performed in a manner satisfactory to the Engineer and the respective authority having jurisdiction over such work. In the event the Contractor fails to provide proper support or protection to any existing utility, the Engineer may, at its discretion, have the respective authority to provide such support or protection as may be necessary to insure the safety of such utility, and the costs of such measures shall be paid by the Contractor.

G. Protection of existing utilities, structures and other facilities: The underground pipes, utilities and structures shown on the Plans are located according to the best information available, but may vary by several feet from both the position and elevation shown. The Contractor shall explore far enough ahead of its work to determine the exact location and condition of such utilities, structures or facilities so that, before the Work is installed, the Engineer may change the line or grade of the pipe or other facility, should that become necessary to avoid a conflict. Should this exploration reveal that adjustments to the work are necessary; the Contractor shall immediately notify the Engineer and coordinate with him to adjust the work in a timely fashion avoiding delays to construction. No request for additional compensation or Contract time (except for a non-compensable time extension at the sole discretion of the Engineer, whose decision shall be final) resulting from encountering utilities or structures not shown, or differing in location or elevation from that shown, will be considered. The Contractor shall explore sufficiently ahead of the Work to allow time for any necessary adjustment without delay occasioned by encountering underground utilities or structures which could have or should have been discovered by timely exploration ahead of the Work shall rest solely with the Contractor.

H. Relocation of existing utilities: The relocation of existing utilities, as noted on the Plans, or for the convenience of the Contractor shall be the responsibility of the Contractor. This work shall be completed by either the forces of the existing utility or the Contractor's forces at the discretion of the responsible utility. If the work is to be performed by the Contractor, all work shall be done in accordance with the utility company's requirements. Under no circumstances shall the Contractor be authorized extra payment for this work, and all cost for the relocation shall be the responsibility of the Contractor.

I. Any conflicts between the field investigation and the information shown on the Plans shall be brought to the immediate attention of the Engineer

1.06 TREES WITHIN PROJECT LIMITS

A. General: The Contractor shall exercise all necessary precautions so as not to damage or destroy any trees on the project site, and shall not trim or remove any trees unless such trees have been approved for trimming or removal by the jurisdictional agency or City. All existing trees which are damaged during construction shall be replaced by the Contractor or a certified tree company to the satisfaction of the City.

B. Replacement: The Contractor shall immediately notify the City if any tree is damaged by the Contractor's operations. If, in the opinion of the City, the damage is such that replacement is necessary, the Contractor shall replace the tree at its own expense. The tree shall be of a like size and variety as the tree damaged, or, if of a smaller size, the Contractor shall pay to the City compensatory payment acceptable to the City.

1.07 NOTIFICATION BY THE CONTRACTOR

A. Prior to any excavation in the vicinity of any existing underground facilities, including all water, sewer, storm drain, gas, petroleum products, or other pipelines; all buried electric power, communications, or television cables; all traffic signal and street lighting facilities; and all roadway and state highway rights-of-way the Contractor shall notify the respective authorities representing the owners or agencies responsible for such facilities not less than three days nor more than seven days prior to excavation.

1.08 DETOURS

A. Where authority having jurisdiction requires that traffic be maintained over construction work in a public street, road, or highway, and traffic cannot be maintained on original roadbed or pavement, construct and maintain detour around the Work. Coordinate traffic routing with that of others working in same or adjacent areas.

1.09 RESTORATION OF PAVEMENT

A. General: All paved areas including asphaltic concrete berms cut or damaged during construction shall be replaced with similar materials and of equal thickness to match the existing adjacent undisturbed areas, except where specific resurfacing requirements have been called for in the Contract Documents. All pavements which are subject to partial removal shall be neatly saw cut in straight lines.

B. Temporary Resurfacing: Wherever required by the public authorities having jurisdiction, the Contractor shall place temporary surfacing, signage, striping and/or other traffic controls as required, promptly after backfilling and shall maintain such surfacing for the period of time fixed by said authorities before proceeding with the final restoration of improvements.

C. Permanent Resurfacing: In order to obtain a satisfactory junction with adjacent surfaces, the Contractor shall saw cut back and trim the edge so as to provide a clean, sound, vertical joint before permanent replacement of an excavated or damaged portion of pavement. Damaged edges of pavement along excavations and elsewhere shall be trimmed back by saw cutting in straight lines. All pavement restoration and other facilities restoration shall be constructed to finish grades compatible with adjacent undisturbed pavement.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

- END OF SECTION -

SECTION 01550

SITE ACCESS AND STORAGE

PART 1 - GENERAL

1.01 HIGHWAY LIMITATIONS:

A. The CONTRACTOR shall make its own investigation of the condition of available public and private roads and of clearances, restrictions, bridge load limits, and other limitations affecting transportation and ingress and egress to the site of the WORK. It shall be the CONTRACTOR's responsibility to construct and maintain any haul roads required for its construction operations.

1.02 TEMPORARY CROSSINGS:

A. General: Continuous, unobstructed, safe, and adequate pedestrian and vehicular access shall be provided to fire hydrants, commercial and industrial establishments, churches, schools, parking lots, service stations, motels, fire and police stations, and hospitals. Safe and adequate public transportation stops and pedestrian crossings at intervals not exceeding 300 feet shall be provided. The CONTRACTOR shall cooperate with parties involved in the delivery of mail and removal of trash and garbage so as to maintain existing schedules for such services. Vehicular access to residential driveways shall be maintained to the property line except when necessary construction precludes such access for reasonable periods of time.

B. Emergency Access and Security: In order to provide protection to the workers and residents, the CONTRACTOR shall maintain emergency access to all adjacent properties at all times during construction. If a road is required to be closed to vehicular traffic and the distance of the closure exceeds 150 feet between stabilized surfaces, or prevents access to properties for a distance that exceeds 150 feet, the CONTRACTOR shall provide a 10-foot wide stabilized accessway on one side of the trench capable of supporting a Fire Truck. CONTRACTOR shall also provide stabilized accessways across the trench or unstabilized area a minimum of 6 feet in width at a spacing not to exceed 100 feet capable of supporting foot traffic. These accessways shall be protected and delineated with lighted barricades or other such devices as approved by the regulatory agency. Both ends of the emergency accessway shall be blocked in accordance with the MOT permit approved by City with signage indicating that this accessway is to be used by emergency vehicles only.

C. No trenches or holes shall be left open after working hours. In the event a trench must be left open after hours, it shall be done so only with the express written permission from the Engineer, and it shall be the CONTRACTOR's responsibility to provide proper protection of the open trench or hole as required by the regulatory agency. In addition, the CONTRACTOR shall provide a security guard at the site whenever the CONTRACTOR's personnel are not present, 24 hours per day/7 days per week. It shall be the Security Guard’s responsibility to protect the open trench or hole from trespassers and to direct emergency personnel on site. The Security Guard shall not have any other responsibilities such as operating pumps or equipment but shall be dedicated to protecting the trench or open hole. The Security Guard shall be equipped with a wireless telephone capable of calling 911 to report an emergency and shall keep that telephone

on their person at all times. In addition to this provision the CONTRACTOR shall maintain trench safety and comply with current OSHA regulations and the Trench Safety Act. The CONTRACTOR shall maintain and keep all safety barricades, signage, flashers, and detours, in operating condition. A copy of the approved MOT plans, and details, shall be on site at all times.

D. Measurement and payment for security guard services shall be included in the Mobilization unit price.

E. Temporary Bridges: Wherever necessary, the CONTRACTOR shall provide suitable temporary bridges or steel plates over unfilled excavations, except in such cases as the CONTRACTOR shall secure the written consent of the individuals or authorities concerned to omit such temporary bridges or steel plates, which written consent shall be delivered to the Engineer prior to excavation. All such bridges or steel plates shall be maintained in service until access is provided across the backfilled excavation. Temporary bridges or steel plates for street and highway crossing shall conform to the requirements of the authority having jurisdiction in each case, and the CONTRACTOR shall adopt designs furnished by said authority for such bridges or steel plates, or shall submit designs to said authority for approval, as may be required.

F. Street Use: Nothing herein shall be construed to entitle the CONTRACTOR to the exclusive use of any public street, alleyway, or parking area during the performance of the WORK hereunder, and it shall so conduct its operations as not to interfere unnecessarily with the authorized WORK of utility companies or other agencies in such streets, alleyways, or parking areas. No street shall be closed to the public without first obtaining permission of the Engineer and proper governmental authority. Where excavation is being performed in primary streets or highways, one lane in each direction shall be kept open to traffic at all times unless otherwise indicated. Toe boards shall be provided to retain excavated material if required by the Engineer or the agency having jurisdiction over the street or highway. Fire hydrants on or adjacent to the WORK shall be kept accessible to fire-fighting equipment at all times. Temporary provisions shall be made by the CONTRACTOR to assure the use of sidewalks and the proper functioning of all gutters, storm drain inlets, and other drainage facilities.

G. Traffic Control: For the protection of traffic in public or private streets and ways, the CONTRACTOR shall provide, place, and maintain all necessary barricades, traffic cones, warning signs, lights, and other safety devices in accordance with the requirements of City and the "Manual of Uniform Traffic Control Devices, Part VI - Traffic Controls for Street and Highway Construction and Maintenance Operations," published by U.S. Department of Transportation, Federal Highway Administration (ANSI D6.1).

H. The CONTRACTOR shall take all necessary precautions for the protection of the WORK and the safety of the public. All barricades and obstructions shall be illuminated at night, and all lights shall be kept burning from sunset until sunrise. The CONTRACTOR shall station such guards or flaggers and shall conform to such special safety regulations relating to traffic control as may be required by the public authorities within their respective jurisdictions. All signs, signals, and barricades shall conform to the requirements of the Florida Department of Transportation.

I. The CONTRACTOR shall submit 3 copies of a traffic control plan to the Broward County Traffic Engineering Division for approval a minimum of 2 weeks prior to construction.

The CITY reserves the right to observe these traffic control plans in use and to make any changes as field conditions warrant. Any changes shall supersede these plans and be done solely at the CONTRACTOR's expense.

J. The CONTRACTOR shall remove traffic control devices when no longer needed, repair all damage caused by installation of the devices, and shall remove post settings and backfill the resulting holes to match grade.

K. Temporary Driveway Closure: The CONTRACTOR shall notify the CITY of the closure of the driveways to be closed more than one eight-hour work day at least 2 weeks prior to the closure. The CONTRACTOR shall minimize the inconvenience and minimize the time period that the driveways will be closed. The CONTRACTOR shall fully explain to the CITY/occupant how long the WORK will take and when closure is to start.

1.03 CONTRACTOR'S WORK AND STORAGE AREA:

A. The CONTRACTOR shall designate and arrange for the use of a portion of the property, adjacent to the WORK for its exclusive use during the term of the Contract as a storage and shop area for its construction operations relative to this Contract. This shall include but not be limited to interim storage of suitable materials for fill or backfill. Storage areas shall be fenced for the safety of the surrounding neighborhood (minimum 6 foot chain link fence).

B. The CONTRACTOR shall make its own arrangements for any necessary off-site storage or shop areas necessary for the proper execution of the WORK. This shall include but not be limited to interim storage of suitable materials for fill or backfill.

C. The CONTRACTOR shall construct and use a separate storage area for hazardous materials used in constructing the WORK.

1. For the purpose of this paragraph, hazardous materials to be stored in the separate area are all products labeled with any of the following terms: Warning, Caution, Poisonous, Toxic, Flammable, Corrosive, Reactive, or Explosive. In addition, whether or not so labeled, the following materials shall be stored in the separate area: diesel fuel, gasoline, new and used motor oil, hydraulic fluid, cement, paints and paint thinners, two-part epoxy coatings, sealants, asphaltic products, glues, solvents, wood preservatives, sand blast materials, and spill absorbent.

2. Hazardous materials shall be stored in groupings according to the Material Safety Data Sheets.

3. The CONTRACTOR shall develop and submit to the Engineer a plan for storing and disposing of the materials above.

4. The CONTRACTOR shall obtain and submit to the Engineer a single EPA number for wastes generated at the site.

5. The separate storage area shall meet all the requirements of all authorities having jurisdiction over the storage of hazardous materials.

6. All hazardous materials which are delivered in containers shall be stored in the original containers until use. Hazardous materials which are delivered in bulk shall be stored in containers which meet the requirements of authorities having jurisdiction.

1.04 PARKING:

A. The CONTRACTOR shall:

1. Provide temporary parking areas as follows:

a. 4 spaces for the CITY and Engineer

b. 1 space designated for the handicapped or as required by regulatory agencies

2. The CONTRACTOR shall direct its employees to park in designated areas secured by the CONTRACTOR.

3. Traffic and parking areas shall be maintained in a sound condition, free of excavated material, construction equipment, mud, and construction materials. The CONTRACTOR shall repair breaks, potholes, low areas which collect standing water, and other deficiencies.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

- END OF SECTION -

SECTION 01560

TEMPORARY ENVIRONMENTAL CONTROLS

PART 1 - GENERAL

1.01 EXPLOSIVES AND BLASTING

A. The use of explosives on the Work will not be permitted.

1.02 DUST ABATEMENT

A. The Contractor shall furnish all labor, equipment, and means required and shall carry out effective measures wherever and as often as necessary (as determined by the Engineer) to prevent its operation from producing dust in amounts damaging to property, cultivated vegetation, or domestic animals, or causing a nuisance to persons living in or occupying buildings in the vicinity. The Contractor shall be responsible for any damage resulting from any dust originating from its operations. The dust abatement measures shall be continued until the Contractor is relieved of further responsibility by the Engineer. No separate payment will be allowed for dust abatement measures and all costs thereof shall be included in the Contractor's bid price.

1.03 RUBBISH CONTROL

A. During the progress of the Work, the Contractor shall keep the site of the Work and other areas used by it in a neat and clean condition, and free from any accumulation of rubbish. The Contractor shall dispose of all rubbish and waste materials of any nature occurring at the Work site, and shall establish regular intervals of collection and disposal of such materials and waste. The Contractor shall also keep its haul roads free from dirt, rubbish, and unnecessary obstructions resulting from its operations. Disposal of all rubbish and surplus materials shall be off the site of construction in accordance with local codes and ordinances governing locations and methods of disposal, and in conformance with all applicable safety laws, and to the particular requirements of Part 1926 of the OSHA Safety and Health Standards for Construction.

1.04 SANITATION

A. Toilet Facilities: Fixed or portable chemical toilets shall be provided wherever needed for the use of employees. Toilets at construction job sites shall conform to the requirements of Part 1926 of the OSHA Standards for Construction.

B. Such facilities shall be made available when the first employees arrive on the Work, shall be properly secluded from public observation, and shall be constructed and maintained in suitable numbers and at such points and in such manner as may be required.

C. The Contractor shall maintain the sanitary facilities in a satisfactory and sanitary condition at all time and shall enforce their use. It shall rigorously prohibit the committing of

nuisances on the site of the Work, on the lands of the City, or on adjacent property.

D. The City and the Engineer shall have the right to inspect any building or other facility erected, maintained, or used by the Contractor, to determine whether or not the sanitary regulations have been complied with.

E. Sanitary and Other Organic Wastes: The Contractor shall establish a regular daily collection of all sanitary and organic wastes. All wastes and refuse from sanitary facilities provided by the Contractor or organic material wastes from any other source related to the Contractor's operations shall be disposed of away from the site in a manner satisfactory to the Engineer and in accordance with all laws and regulations pertaining thereto.

1.05 CHEMICALS

A. All chemicals used during project construction or furnished for project operation, whether defoliant, soil sterilant, herbicide, pesticide, disinfectant, polymer, paint, fuel, solvent or reactant of other classification, shall show approval of either the U.S. Environmental Protection Agency or the U.S. Department of Agriculture. The handling, storage, use and disposal of all such chemicals and disposal of residues shall be in strict accordance with all applicable rules and regulations of Federal, State and local jurisdictional agencies and the printed instructions of the manufacturer and all regulatory requirements. Copies of antidote literature shall be kept at the storage site and at the Contractor's job site office. A supply of antidotes shall be kept at the Contractor's office.

1.06 NOISE CONTROL

A. Noise resulting from the Contractor's work shall not exceed the noise levels and other requirements stated in local ordinances. The Contractor shall be responsible for curtailing noise resulting from its operation. It shall, upon written notification from the Engineer or noise control officers, make any repairs, replacements, adjustments, additions and furnish mufflers when necessary to fulfill requirements.

1.07 EROSION ABATEMENT AND WATER POLLUTION

A. It is imperative that any Contractor dewatering operation not contaminate or disturb the environment of the properties adjacent to the Work. The Contractor shall, therefore, schedule and control its operations to confine all runoff water from disturbed surfaces, water from dewatering operations that becomes contaminated with silt, muck and other deleterious matter, fuels, oils, bitumens, calcium chloride, chemicals and other polluting materials.

B. The Contractor shall construct temporary silting basin(s) of adequate size and provide all necessary temporary materials, operations and controls including, but not limited to, filters, coagulants, screens, and other means necessary to attain the required discharge water quality.

C. The Contractor shall be responsible for providing, operating and maintaining materials and equipment used for conveying the clear water to the point of discharge. All pollution prevention procedures, materials, equipment and related items shall be operated and maintained until such time as the dewatering operation is discontinued. Upon the removal of the materials, equipment and related items, the Contractor shall restore the area to the condition prior to its commencing work.

D. The Contractor shall be responsible for acquiring all applicable permits for discharge of waters as necessary, except as may have otherwise been provided in other sections of these specifications.

1.08 MANATEE CONDITIONS FOR IN WATER WORK

A. The Contractor shall comply with the conditions outlined in the “Standard Manatee Conditions for In-Water Work” as published by the Florida Fish and Wildlife Conservation Commission. See the attached document at the end of this specification section for additional information.

1.09 PRECAUTIONS DURING ADVERSE WEATHER

A. During adverse weather, and against the possibility thereof, the Contractor shall take all necessary precautions so that the Work may be properly done and satisfactory in all respects. When required, protection shall be provided by use of tarpaulins, wood and building paper shelters, or other acceptable means. The Contractor shall be responsible for all changes caused by adverse weather.

B. The City may suspend construction operations at any time when, in its judgment, the conditions are unsuitable or the proper precautions are not being taken, whatever the weather conditions may be, in any season.

1.10 HURRICANE PRECAUTIONS

A. The requirements of the Contract Documents apply to the work of this section.

B. The Contractor shall take all precautions necessary to protect the job site during hurricane and tropical storm watches and warnings.

C. Within 30 days of the date of Notice to Proceed, the Contractor shall submit to the Engineer and City a Hurricane Preparedness Plan. The plan should outline the necessary measures which the Contractor proposes to perform at no additional cost to the City. The Plan shall be provided for informational purposes only and will not be reviewed by the Engineer or City.

1.11 PERIODIC CLEANUP AND BASIC SITE RESTORATION

A. During construction, the Contractor shall regularly remove from the site all accumulated debris and surplus materials of any kind which results from its operations. Unused equipment and tools shall be stored at the Contractor's yard or base of operations for the

project.

B. The Contractor shall perform the cleanup work on a regular basis and as frequently as ordered by the Engineer. Basic site restoration in a particular area shall be accomplished immediately following the installation or completion of the required facilities in that area. Furthermore, such work shall also be accomplished, when ordered by the Engineer, if partially completed facilities must remain incomplete for some time period due to unforeseen circumstances.

C. Upon failure of the Contractor to perform periodic clean-up and basic restoration of the site to the Engineer's satisfaction, the Engineer may, upon five days prior written notice to the Contractor, employ such labor and equipment as it deems necessary for the purpose, and all costs resulting therefrom shall be charged to the Contractor and deducted from amounts of money that it may be due.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

- END OF SECTION -

STANDARD MANATEE CONDITIONS FOR IN-WATER WORK
2011

The permittee shall comply with the following conditions intended to protect manatees from direct project effects:

a. All personnel associated with the project shall be instructed about the presence of manatees and manatee speed zones, and the need to avoid collisions with and injury to manatees. The permittee shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing manatees which are protected under the Marine Mammal Protection Act, the Endangered Species Act, and the Florida Manatee Sanctuary Act.

b. All vessels associated with the construction project shall operate at "Idle Speed/No Wake" at all times while in the immediate area and while in water where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will follow routes of deep water whenever possible.

c. Siltation or turbidity barriers shall be made of material in which manatees cannot become entangled, shall be properly secured, and shall be regularly monitored to avoid manatee entanglement or entrapment. Barriers must not impede manatee movement.

d. All on-site project personnel are responsible for observing water-related activities for the presence of manatee(s). All in-water operations, including vessels, must be shutdown if a manatee(s) comes within 50 feet of the operation. Activities will not resume until the manatee(s) has moved beyond the 50-foot radius of the project operation, or until 30 minutes elapses if the manatee(s) has not reappeared within 50 feet of the operation. Animals must not be herded away or harassed into leaving.

e. Any collision with or injury to a manatee shall be reported immediately to the Florida Fish and Wildlife Conservation Commission (FWC) Hotline at 1-888-404-3922. Collision and/or injury should also be reported to the U.S. Fish and Wildlife Service in Jacksonville (1-904-731-3336) for north Florida or in Vero Beach (1-772-562-3909) for south Florida, and emailed to FWC at ImperiledSpecies@myFWC.com.

f. Temporary signs concerning manatees shall be posted prior to and during all in-water project activities. All signs are to be removed by the permittee upon completion of the project. Temporary signs that have already been approved for this use by the FWC must be used. One sign which reads *Caution: Boaters* must be posted. A second sign measuring at least 8½ " by 11" explaining the requirements for "Idle Speed/No Wake" and the shut down of in-water operations must be posted in a location prominently visible to all personnel engaged in water-related activities. These signs can be viewed at http://www.myfwc.com/WILDLIFEHABITATS/manatee_sign_vendors.htm. Questions concerning these signs can be forwarded to the email address listed above.

CAUTION: MANATEE HABITAT

All project vessels

IDLE SPEED / NO WAKE

When a manatee is within 50 feet of work
all in-water activities must

SHUT DOWN

Report any collision with or injury to a manatee:

Wildlife Alert:

1-888-404-FWCC(3922)

cell *FWC or #FWC

SECTION 01580

PROJECT IDENTIFICATION AND SIGNS

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall furnish, install and maintain project identification signs and provide temporary on-site informational signs to identify key elements of construction facilities. Signs shall be removed upon completion of construction.

B. The Contractor shall notify property owners that may be affected by construction operation at least five (5) working days in advance.

1.02 RELATED REQUIREMENTS

A. All applicable sections of the Technical Specifications.

B. Conditions of the Contract.

1.03 PROJECT IDENTIFICATION SIGN

A. Up to two (2) painted signs, of not less than 32 square feet area each, with painted graphic content. Signs shall be in accordance with the General Conditions. Project signs must be submitted to the City for approval prior to fabrication and installation.

B. Graphic design, style of lettering, and colors: As designated by Engineer.

C. Erect on the site at a lighted location of high public visibility at a location outside the public Right-of-Way, as approved by Engineer.

D. An example project sign is provided at the end of this section.

1.04 INFORMATIONAL SIGNS

A. Painted signs and painted lettering, or standard products:

1. Size of signs and lettering: As required by regulatory agencies, or as appropriate to usage.

2. Colors: As required by regulatory agencies, otherwise of uniform colors throughout project.

B. Erect at appropriate locations to provide required information.

1.05 PROPERTY OWNER NOTIFICATION

A. All homes and businesses affected by construction activities shall be notified by use of a “doorhanger” type announcement describing at a minimum, the nature of the Work, the proposed schedule, and the Contractor’s contact information. An example door hanger is provided at the end of this section.

B. Door hangers shall be submitted to the City for approval prior to use.

C. Door hangers shall be printed and distributed by the Contractor.

1.06 QUALITY ASSURANCE

A. Sign Painter: Professional experience in type of Work required.

B. Finishes, Painting: Adequate to resist weathering and fading for scheduled construction period.

PART 2 - PRODUCTS

2.01 SIGN MATERIALS

A. Structure and Framing: May be new or used, wood or metal, in sound condition structurally adequate to Work and suitable for specified finish.

B. Sign Surfaces: Exterior softwood plywood with medium density overlay, standard large sizes to minimize joints.

C. Thickness: As required by standards to span framing members, to provide even, smooth surface without wave or buckles.

D. Rough Hardware: Galvanized.

E. Paint: Exterior quality:

1. Use Bulletin colors for graphics.

2. Colors for structure, framing, sign surfaces and graphics: As selected by Engineer.

PART 3 - EXECUTION

3.01 PROJECT IDENTIFICATION SIGN

A. Paint exposed surfaces of supports, framing and surface material; one coat of primer and one coat of exterior paint.

B. Paint graphics in styles, sizes and colors selected.

3.02 INFORMATIONAL SIGNS

A. Paint exposed surfaces: One coat of primer and one coat of exterior paint.

B. Paint graphics in styles, sizes and colors selected.

C. Install at a height for optimum visibility, on ground-mounted poles or attached to temporary structural surfaces.

3.03 MAINTENANCE

A. Maintain signs and supports in a neat, clean condition; repair damages to structure, framing or sign.

B. Relocate informational signs as required by progress of the Work.

3.04 REMOVAL

A. Remove signs, framing, supports and foundations at completion of project.

3.05 MEASUREMENT AND PAYMENT

A. There shall be no special measurement or payment for the Work under this section, it shall be included in the lump sum price bid for item ‘Mobilization’.

- END OF SECTION -

City of Fort Lauderdale

Stormwater Master Plan Improvements

Creating a resilient and safe coastal community

What's Happening?

What's Happening: The City of Fort Lauderdale is proactively preparing for the future by investing in new stormwater infrastructure to reduce flooding throughout our community.

(954) 828-8000
www.fortlauderdale.gov

WE BUILD COMMUNITY

Planned Improvements

- Installing a tidal valves
- Installing a new seawall
- Pavement Restoration
- Landscaping Restoration
- Installing new drainage pipe
- Installing new drainage structures

Cost

Expected Completion

Project Number

Contractor

Fort Lauderdale City Commission

Dean J. Trantalis	Heather Moraitis	Steven Glassman	Robert L. McKinzie	Ben Sorensen	Chris Lagerbloom, ICMA-CM
Mayor	Commissioner, District I	Commissioner, District II	Vice Mayor, District III	Commissioner, District IV	City Manager

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All-America City

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[CONTRACTOR'S NAME]

[CONTRACTOR'S STREET ADDRESS]

[CONTRACTOR'S CITY, STATE AND ZIP]

[CONTRACTOR'S TELEPHONE NUMBER]

[CONTRACTOR'S FAX NUMBER]

MEMORANDUM

TO: **RESIDENTS OF [LOCATION OF CONSTRUCTION]**

DATE: **[CURRENT DATE]**

RE: **CONSTRUCTION IN YOUR AREA**

FROM: **[CONTRACTOR'S NAME}**

Construction in your area will commence on [date of construction commencement].

The construction area is from [boundary #1] to [boundary #2].

Access to the area will be limited at certain times due to the construction activities. We apologize for any inconvenience and we will do our best to accommodate access to residents.

Thank you,

[Contractor Name]

PROJECT NO. 11868

SECTION 01590

FIELD OFFICE, EQUIPMENT AND SERVICES

PART 1 -- GENERAL

1.01 THE REQUIREMENT

A. The CONTRACTOR shall furnish and install one (1) field office trailer for its own use at the project site, during the entire time of construction beginning at the commencement date stated in the Notice to Proceed until the date of final acceptance of the Work by the CITY.

B. The CONTRACTOR shall furnish and install one (1) field office trailer for the ENGINEER's use at the project site, during the entire time of construction. The field office shall be fully equipped, furnished, stocked and ready for occupancy at the project site designated location beginning within fifteen (15) days after the Notice to Proceed. The field trailer shall be occupied by the ENGINEER until the date of final acceptance of the Project Closeout by the CITY.

B. The CONTRACTOR shall locate the field offices in the location approved by the City and ENGINEER. The field offices shall remain the property of the CONTRACTOR and shall be removed (including mountings, connections and hookups) from the site upon completion of the Work, returning the site and all improvements to their pre-Notice-To-Proceed condition.

C. No invoice for mobilization will be recommended for payment for any work done under the Contract until all field office facilities specified herein have been provided and accepted by the ENGINEER.

1.02 SUBMITTALS

A. Submit shop drawings and other information as required demonstrating that the ENGINEER's field office meets the requirements of this Section.

B. Prior to installation of the field trailer, CONTRACTOR shall submit a certification from the supplier indicating that trailer walls, floor, and ceiling are free from mold.

1.03 GENERAL FIELD OFFICE REQUIREMENTS

A. The CONTRACTOR shall provide steps and platforms with handrails to permit entry to the offices. This work shall conform to the Florida Building Code and OSHA requirements.

B. The trailers shall be blocked up and hurricane straps installed conforming to the applicable building codes.

C. The CONTRACTOR is responsible for procuring all necessary permits for the installation of the field offices at the location approved by the City and Engineer.

1.04 ENGINEER'S OFFICE

A. The CONTRACTOR shall furnish a field office for the use of the ENGINEER. The field office shall be new, or like new, and consist of a nominal 56-foot by 12-foot single wide (or equivalent) trailer with two private offices and conference area, each separated by walls and with an interior door. A unisex restroom shall be provided. Floor plan subject to acceptance by ENGINEER.

B. The structure shall be watertight with suitable windows and doors with substantial locks. All windows shall have venetian blinds and aluminum screens. Adequate lighting shall be furnished with wall switches provided for all ceiling lighting fixtures which shall either be installed flush or recessed into the ceiling.

C. The trailer shall conform to HUD requirements. Minimum ceiling height shall be 7 foot 6 inches. The interior shall have vinyl tile floor covering, wall paneling, 100 amp electrical service, copper wiring, 20-gallon electric water heater, copper water piping, a six cubic foot refrigerator, 600 watt microwave oven and two wall mounted fire extinguishers. Washroom shall be equipped with a flush toilet, cabinet mounted wash basin and medicine cabinet complete with supplies. Plumbing fixtures shall be acceptable house type, trapped and vented.

D. Air conditioning shall be provided which is capable of lowering the temperature to 72 degrees Fahrenheit in South Florida, worst case, summer heat and humidity conditions. Heating shall be provided which is capable of raising the temperature to 78 degrees Fahrenheit in cold weather. CONTRACTOR shall be responsible for providing a new air filter once every month for the duration of the project.

E. The CONTRACTOR shall install the field office trailer and provide services for the specified project duration as follows and as identified on the Drawings:

1. The CONTRACTOR shall furnish and install necessary sanitary, water, electric, and telephone connections between the source and its trailer as shown on the drawings. In addition, the CONTRACTOR shall coordinate with the local utility to arrange for startup and invoicing of electric and telephone services accordingly. The CONTRACTOR shall make arrangements for and pay for all costs for all water used during construction as specified in the Section entitled “Temporary Utilities.”

2. The CONTRACTOR shall provide and maintain adequate and clean sanitary facilities for the construction work force and visitors. The facilities shall comply with local codes and regulations and be situated in an acceptable location.

3. The CONTRACTOR shall furnish the ENGINEER’s field office with voice over internet protocol phone, high speed Wi-Fi internet services and a 4-port DSL router. The trailer shall be provided with seven (7) two-line speaker/intercom telephones. All jack locations shall be subject to review and acceptance by the ENGINEER.

4. The CONTRACTOR shall permit the ENGINEER, the CITY, or their authorized representatives or employees free and unlimited use of said telephone facilities for all calls that do not involve published toll charges. Calls originated by the ENGINEER, the CITY, the authorized representative or employees which involve

toll or message unit charges shall be billed to the CITY by the CONTRACTOR at the rates charged by the telephone company.

5. The CONTRACTOR shall furnish and replace electric bulbs and/or fluorescent tubes, toilet paper, towels and soap, water cooler with reusable jugs, cups, and maintain the office copiers, telecopiers and other equipment in first-class condition, including all paper, ink, and repairs until final acceptance of the work under this Contract. Single-use plastic water bottles are not acceptable.

6. The CONTRACTOR shall provide fire insurance, extended coverage and vandalism, malicious mischief and burglary and theft insurance coverage for the ENGINEER'S field office trailer in the amount of $100,000 and for field office equipment in the amount of $50,000.

7. The CONTRACTOR shall furnish a free-standing electric water cooler to dispense hot and cold water from 5-gallon bottles with regular water bottle delivery service.

8. The CONTRACTOR shall furnish weekly janitorial service to the ENGINEER’S trailer.

9. The CONTRACTOR shall provide 500 feet of Category 6E Ethernet Cable for computer network wiring to the ENGINEER’s field office. Layout of the cable shall be subject to comment and revision by the ENGINEER prior to acceptance. The CONTRACTOR shall install cables to approved locations. Terminations shall be furnished by the CONTRACTOR as directed by the ENGINEER.

10. The CONTRACTOR shall provide monthly pest control services covering both the interior and exterior areas of the trailer.

F. The field office trailer shall remain the property of the CONTRACTOR and shall be removed upon completion of the work. All affected work areas shall be restored to their original condition.

G. The CONTRACTOR shall furnish and install/arrange new or like new office furniture for the ENGINEER's field office. Model numbers listed below are to establish minimum product quality. Office furniture shall consist of the following:

1. Two double-pedestal desks, Hon Metrostandard Series No. HON-34961-WP with 60 inches x 30 inches top size, or equal.

2. Two conventional office chairs HON HVL702 mesh chair, United Chari Co. Model No. UP13, or equal.

3. Two four-drawer letter size (52 inches high) filing cabinets, with lock HON 510 series, Steelmaster, or equal.

4. One 72-inch-high storage cabinet with five adjustable shelves 36W x 24D HON model HSC2472, or equal.

5. Two 30 inches x 60 inches reference tables HON UTM 3060, or equal.

6. Two bookcases - 60 inches high x 36 inches wide x 11 inches deep with five shelves, HON Model No. H1895, or equal.

7. Two desk lamps with two 15-watt tubes, Dazor Model 2324, LUDU F 30L, or equal.

8. Ten conventional office chairs, HON Model HLV702, United Chair Co. Model No. UP12, or equal.

9. One dry erase "white board" 4 feet x 6 feet wall mount type Quartet Aluminum Frame QRT-S537, full length marker rail, two erasers and two boxes of four color dry erase markers, or equal.

10. Three wastepaper baskets.

11. One aluminum framed cork faced bulletin board 36-inch x 60-inch wall mount type.

12. Lease one Xerox WorkCentre 7800i series color copier complete with scanner, fax and email including Wi-Fi, automatic document feeder, stapling**,** sorter, stand, service contract should include a minimum of 2500 copies per month for duration of Project, consumables and other necessary accessories, or equal. Copier shall be set and provided with trays to print copies on 8-1/2 x 11 inches, 8-1/2 x 14 inches and 11 x 17 inches paper.

13. Two Canon Powershot cameras or equal, built in flash, minimum 20 Megapixel, 1280 x 720 image resolution, 5x optical plus 4x digital zoom with auto focus, 1080p video. Provide a 16 GB memory card, spare battery pack, and battery charger.

14. One first aid cabinet conforming to OSHA requirements for an office up to 5 persons or a construction site of up to 5 persons.

1.05 UTILITIES FOR FIELD OFFICES

A. The CONTRATOR shall arrange with Florida Power and Light (FPL) for construction power service and pay all costs for the Work and power necessary for the field offices. The CONTRACTOR shall be responsible for all connections and wiring to and from the point of service. In addition, the CONTRACTOR shall coordinate with the local utility to arrange startup and invoicing for service.

B. Telephone service connections shall be obtained from off-site by the CONTRACTOR. The CONTRACTOR shall be responsible for all connections and wiring between the telephone carrier service point and the field office. In addition, the CONTRACTOR shall coordinate with the local phone company to arrange startup and invoicing for service.

C. Contractor shall supply water service to the field office. Water supply shall be in accordance with the Section entitled “Temporary Utilities.” Cleaning, flushing, and related permit requirements for all connections are the Contractor's responsibility.

D. Contractor shall supply sanitary service to the field office. The Contractor shall be responsible for connection and piping requirements between municipal collection system and its office trailer to meet all applicable code and regulatory requirements.

E. The CONTRACTOR retains responsibility for procuring all necessary permits for the installation of field offices at the approved location.

F. The CONTRACTOR shall familiarize itself with the existing power, telephone, water and sewer connections. All costs associated with “hooking-up” to these existing items shall be included in the CONTRACTOR’s base bid.

PART 2 -- PRODUCTS (Not Used)

PART 3 -- EXECUTION (Not Used)

- END OF SECTION -

SECTION 01600

MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. The word "Products," as used herein is defined to include purchased items for incorporation into the Work, regardless of whether specifically purchased for project or taken from Contractor's stock of previously purchased products.

B. The word "Materials," is defined as products which must be substantially cut, shaped, worked, mixed, finished, refined, or otherwise fabricated, processed, installed, or applied to form units of Work.

C. The word "Equipment" is defined as products with operational parts, regardless of whether motorized or manually operated, and particularly including products with service connections (wiring, piping, and other like items).

D. Definitions in this Section are not intended to negate the meaning of other terms used in Contract Documents, including "specialties," "systems," "structure," "finishes," "accessories," "furnishings," “special construction," and similar terms, which are self-explanatory and have recognized meanings in the construction industry.

1.02 QUALITY ASSURANCE

A. Source Limitations: To the greatest extent possible for each unit of Work, the Contractor shall provide products, materials, or equipment of a singular generic kind from a single source.

B. Compatibility of Options: Where more than one choice is available as options for Contractor's selection of a product, material, or equipment, the Contractor shall select an option which is compatible with other products, materials, or equipment already selected. Compatibility is a basic general requirement of product/material selections.

1.03 DESIGN

A. Equipment and appurtenances shall be designed in conformity with the ASME, AIEE, NEMA and other generally accepted applicable standards and shall be of rugged construction and sufficient strength to withstand all stresses which may occur during fabrication, testing, transportation, installation and all conditions of operation. All bearings and moving parts shall be adequately protected by bushings or other acceptable means against wear, and provision shall be made for adequate lubrication by readily accessible devices. Details shall be designed for appearance as well as utility. Protruding members, joints, corners, gear covers, etc., shall be finished in appearance.

B. All exposed welds on machinery shall be ground smooth and the corners of structural shapes shall be rounded or chamfered.

1.04 PRODUCT DELIVERY-STORAGE-HANDLING

A. The Contractor shall deliver, handle, and store products in accordance with supplier's written recommendations and by means and methods that will prevent damage, deterioration, and loss including theft. Delivery schedules shall be controlled to minimize long-term storage of products at site and overcrowding of construction spaces. In particular, the Contractor shall provide delivery/installation coordination to ensure minimum holding or storage times for products recognized to be flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other sources of loss.

1.05 TRANSPORTATION AND HANDLING

A. Products shall be transported by methods to avoid product damage and shall be delivered in undamaged condition in supplier's unopened containers or packaging, dry.

B. The Contractor shall provide equipment and personnel to handle products, materials, and equipment including those provided by City, by methods to prevent soiling and damage.

C. The Contractor shall provide additional protection during handling to prevent marring and otherwise damaging products, packaging, and surrounding surfaces.

1.06 STORAGE AND PROTECTION

A. Products shall be stored in accordance with supplier's written instructions, with seals and labels intact and legible. Sensitive products shall be stored in weather-tight enclosures and temperature and humidity ranges shall be maintained within tolerances required by supplier's written instructions.

B. For exterior storage of fabricated products, they shall be placed on sloped supports above ground. Products subject to deterioration shall be covered with impervious sheet covering; ventilation shall be provided to avoid condensation.

C. Loose granular materials shall be stored on solid surfaces in a well-drained area and shall be prevented from mixing with foreign matter.

D. Storage shall be arranged to provide access for inspection. The Contractor shall periodically inspect to assure products are undamaged and are maintained under required conditions.

E. Storage shall be arranged in a manner to provide access for maintenance of stored items and for inspection.

1.07 MAINTENANCE OF STORAGE

A. Stored products shall be periodically inspected on a scheduled basis.

B. The Contractor shall maintain a log of inspections and make said log available to the Engineer on request.

C. The Contractor shall verify that storage facilities comply with supplier's product storage requirements.

D. The Contractor shall verify that supplier-required environmental conditions are maintained continually.

E. The Contractor shall verify that surfaces of products exposed to the elements are not adversely affected and that any weathering of finishes is acceptable under requirements of Contract Documents.

1.08 MAINTENANCE OF EQUIPMENT STORAGE

A. For mechanical and electrical equipment in long-term storage, the Contractor shall provide a copy of the supplier's service instructions to accompany each item, with notice on enclosed instruction shown on exterior of package.

B. Equipment shall be serviced on a regularly scheduled basis, and a log of services shall be maintained and submitted as a record document to the Engineer.

1.09 LUBRICANTS

A. During testing and prior to acceptance, the Contractor shall furnish all lubricants necessary for the proper lubrication of all equipment furnished under this Contract.

1.10 SPECIAL TOOLS

A. For each type of equipment furnished by it, the Contractor shall provide a complete set of all special tools (including calibration and test equipment) which may be necessary for the adjustment, operation, maintenance and disassembly of such equipment.

B. Special tools shall be delivered at the same time as the equipment to which they pertain. The Contractor shall properly store and safeguard such special tools until completion of the Work, at which time they shall be delivered to the City.

1.11 PROTECTION AGAINST ELECTROLYSIS

A. Where dissimilar metals are used in conjunction with each other, suitable insulation shall be provided between adjoining surfaces so as to eliminate direct contact and any resultant electrolysis. The insulation shall be bituminous impregnated felt, heavy bituminous coatings, nonmetallic separators or washers, or other acceptable materials.

1.12 FASTENERS

A. All necessary bolts, anchor bolts, nuts, washers, plates and bolt sleeves shall be furnished by the Contractor in accordance herewith.

B. Bolts shall have suitable washers and, where so required, their nuts shall be hexagonal.

C. All bolts, anchor bolts, nuts, washers, plates, and bolt sleeves shall be Type 316 stainless steel unless otherwise specifically indicated or specified.

D. Unless otherwise specified, stud, tap, and machine bolts shall be of the best quality refined bar iron. Hexagonal nuts of the same quality of metal as the bolts shall be used.

1.13 SALVAGED AND EXCAVATED MATERIALS

A. In the absence of special provisions in other Sections of the Specifications, salvage materials, equipment or supplies that occur are the property of the City and shall be cleaned and stored as directed by the Engineer.

B. All excavated materials needed for backfilling operation shall be stored on site. Where additional area is needed for stockpiling, it shall be obtained by the Contractor.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

- END OF SECTION -

SECTION 01660

EQUIPMENT TESTING AND STARTUP

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. Equipment testing and startup are requisite to satisfactory completion of the contract and, therefore, shall be completed within the contract time. The Contractor shall allow sufficient time in its construction schedule to complete testing, trouble shooting and start-up activities.

B. As construction of the project enters the final stages of completion, the Contractor shall, in accordance with the requirements set forth in the Contract Documents, attend to the following items:

1. Schedule equipment manufacturer's visits to site.

2. Calibration of instruments and controls.

3. Perform required testing, adjusting and balancing of project components.

4. Schedule start-up and initial operation.

5. Furnish skilled personnel during initiation operation to provide back-up maintenance services to equipment, as necessary.

6. Furnish operation and maintenance training to City's personnel per requirements of the Contract documents.

1.02 EQUIPMENT TESTING

A. The Contractor shall provide the services of an experienced and authorized representative of the supplier of each item of equipment (excluding minor items of equipment specifically exempted by the Engineer in writing), who shall visit the site of the Work and inspect, check, adjust if necessary, and approve the equipment installation. In each case, the Contractor shall arrange to have the supplier's representative revisit the job site as often as necessary until any and all trouble is corrected and the equipment installation and operation are satisfactory to the Engineer. The Contractor shall provide effective coordination of all parties necessary for complete system testing, including Suppliers, subcontractors, the Engineer, and the City.

B. The Contractor shall require that each supplier's representative furnish to the Engineer a written report addressed to the City, and copied to the Engineer, certifying that the equipment has been properly installed and lubricated, is in accurate alignment, is free from any undue stress imposed by connecting piping or anchor bolts, has been operated

satisfactorily under full-load conditions is ready for operation and the City's operating personnel have been instructed in the operation, maintenance and lubrication of the equipment.

C. The Contractor shall be responsible for scheduling all operations testing. The Contractor is advised that the Engineer and the City's operating personnel will witness operations testing.

D. The supplier's representative shall instruct the City's operating personnel in correct operation and maintenance procedures. The instruction shall demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment. Such instruction shall be scheduled at a time arranged with the City at least 2 weeks in advance and shall be provided while the respective representative's equipment is fully operational. On-site instruction shall be given by qualified persons who have been made familiar in advance with the equipment and systems in the plant. The Contractor shall have submitted, and had accepted, the O&M Manuals (specified in the Section entitled "Submittals") prior to commencement of training.

E. The Contractor shall notify the Engineer at least 14 days in advance of each equipment test or City training session.

F. Training shall be provided to two separate shifts of the City's personnel. Training may occur anytime over a 24-hour period.

G. The Contractor shall furnish all personnel, power, water, chemicals, fuel, oil, grease, and all other necessary equipment, facilities, and services required for conducting the tests except as otherwise accepted by the Engineer.

1.03 STARTUP

A. The Contractor shall provide the effective coordination of all parties necessary for the successful startup, including suppliers, subcontractors, the Engineer, and the City.

B. It is not the intent of the Engineer to instruct the Contractor in the startup of the facilities; however, the Engineer will be available prior to and during startup to provide technical support to the Contractor.

C. The Contractor shall be required to startup the equipment, under direction of the Engineer and City, and operate it for a continuous 7-day (24 hours per day) period at design conditions. The Contractor shall be available at all times during this period to provide necessary maintenance support services as may be deemed necessary by the City and/or Engineer. This 7-day period must be successfully completed prior to the issuance of Substantial Completion.

D. Not less than 3 months prior to startup, the Contractor shall submit to the Engineer for review, a detailed schedule of operations which will be necessary for a successful initial operation and sustained period of operation for the duration of the required startup period

as specified in the Section entitled "Submittals."

E. The startup shall not be commenced until all required leakage tests, disinfection, and equipment tests, as applicable, have been completed to the satisfaction of the Engineer.

F. All defects in materials or quality which appear during this startup period shall be immediately corrected by the Contractor. Time lost for equipment repairs, wiring corrections, control point settings, or other reasons which actually interrupt the startup may, at the discretion of the Engineer, be justifiable cause for extending the startup test duration or beginning the startup test period again.

G. During the startup, the Contractor shall provide the services of authorized representatives of the suppliers, in addition to those services required under operations testing, as necessary, to correct faulty equipment operation.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

- END OF SECTION -

SECTION 01770

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. Comply with requirements stated in Conditions of the Contract and in Specifications for administrative procedures in closing out the WORK.

1.02 RELATED REQUIREMENTS

A. All applicable sections of the Technical Specifications.

B. Conditions of the Contract

1.03 SUBSTANTIAL COMPLETION

A. When CONTRACTOR considers the WORK is substantially complete, the CONTRACTOR shall submit to ENGINEER:

1. A written notice that the WORK, or designated portion thereof, is substantially complete.

2. A list of items to be completed or corrected.

3. Final as-builts per requirements of Section 01320 and City of Fort Lauderdale As-Built Plan Requirements.

B. Within a reasonable time after receipt of such notice, City and ENGINEER will make an inspection to determine the status of completion.

C. Should ENGINEER determine that the WORK is not substantially complete:

1. ENGINEER will promptly notify the CONTRACTOR in writing, giving the reasons therefore.

2. CONTRACTOR shall remedy the deficiencies in the WORK, and send a second written notice of substantial completion to the ENGINEER.

3. ENGINEER will reinspect the WORK.

D. When ENGINEER concurs that the WORK is substantially complete, ENGINEER will:

1. Prepare a Certificate of Substantial Completion accompanied by CONTRACTOR's list of items to be completed or corrected, as verified and amended by the ENGINEER.

2. Submit the Certificate to the CITY and the CONTRACTOR for their written acceptance of the responsibilities assigned to them in the Certificate.

1.04 FINAL INSPECTION

A. On completion of the WORK, the CONTRACTOR shall submit written certification that:

1. Contract Documents have been reviewed.

2. WORK has been inspected for compliance with Contract Documents.

3. WORK has been completed in accordance with Contract Documents.

4. Equipment and systems have been tested in the presence of the ENGINEER and are operational.

5. WORK is completed and ready for final inspection.

B. ENGINEER will make an inspection to verify the status of completion with reasonable promptness after receipt of such certification.

C. Should ENGINEER consider that the WORK is incomplete and defective:

1. ENGINEER will promptly notify the CONTRACTOR, in writing, listing the incomplete or defective WORK.

2. CONTRACTOR shall take immediate steps to remedy the stated deficiencies, and send a second written certification to ENGINEER that the WORK is complete.

3. ENGINEER will reinspect the WORK.

D. When the ENGINEER finds that the WORK is acceptable under the Contract Documents, the ENGINEER shall request the CONTRACTOR to make closeout submittals.

1.05 REINSPECTION FEES

A. Should CITY or ENGINEER perform reinspections due to failure of the WORK to comply with the claims of status of completion made by the CONTRACTOR:

1. CONTRACTOR will compensate CITY or ENGINEER for such additional services, and/or.

2. CITY will deduct the amount of such compensation from the final payment to the CONTRACTOR.

1.06 CONTRACTOR'S CLOSEOUT SUBMITTALS TO CITY’s REPRESENTATIVE

A. Evidence of compliance with requirements of governing authorities:

1. Certificate of Occupancy

2. Permit Closeout Certification

3. Certificates of Inspection

   a. Mechanical

   b. Electrical

   c. Other, as may be required

B. Project Record Documents: To requirements of Section 01320

C. Operating and Maintenance Data, Instructions to City's Personnel: To requirements of Section 01300

D. Guarantees and Bonds: To requirements of Section 01300

E. Evidence of Payment and Release of Liens: To requirements of General and Supplementary General Conditions

F. Certificate of Insurance for Products and Completed Operations

1.07 FINAL ADJUSTMENT OF ACCOUNTS

A. Submit a final statement of accounting to ENGINEER.

B. Statement shall reflect all adjustments to the Contract Sum:

1. The original Contract Sum

2. Additions and deductions resulting from:

   a. Previous Change Orders

   b. Allowances

   c. Unit Prices

   d. Deductions for uncorrected WORK

   e. Penalties and Bonuses

   f. Deductions for liquidated damages

   g. Deductions for reinspection payments

   h. Other adjustments

3. Total Contract Sum, as required

4. Previous payments

5. Sum remaining due

C. ENGINEER will prepare a final Change Order, reflecting approved adjustments to the Contract Sum which were not previously made by Change Orders.

1.08 FINAL APPLICATION FOR PAYMENT

A. CONTRACTOR shall submit the final Application for Payment in accordance with procedures and requirements stated in the Conditions of the Contract.

PART 2 - PRODUCTS

(NOT USED)

PART 3 - EXECUTION

(NOT USED)

- END OF SECTION -

SECTION 02015

MOBILIZATION AND DEMOBILIZATION

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. The Work specified in this section consists of all Work necessary to move in personnel and equipment and prepare the site for construction, complete and to remove the same personnel and equipment from the site when construction is complete.

B. The limits of the Contractor's staging area and other applicable restrictions are shown on the Drawings.

PART 2 - PRODUCTS

2.01 TEMPORARY UTILITIES

A. The Contractor shall provide all temporary facilities required for performing the Work as specified in Section entitled "CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS".

PART 3 - EXECUTION

3.01 LAYOUT

A. The Contractor shall set up construction facilities in a neat and orderly manner within designated areas as noted on the Staging Plan drawing of the Contract documents. It shall accomplish all required Work in accordance with applicable portions of these specifications and shall confine its operations to Work areas as shown on the drawings.

3.02 DEMOBILIZATION

A. At the completion of Work the Contractor shall remove its personnel, equipment, and temporary facilities from the site in a timely manner. The Contractor shall also be responsible for transporting all unused materials belonging to the City to a place of storage on site designated by the City and for removing from the site and disposing of all other materials and debris resulting from the construction. It shall then return all areas used for its activities to a condition as noted on the Contract documents.

- END OF SECTION -

PROJECT NO. 11868

SECTION 02100

EROSION AND SEDIMENTATION CONTROL – STORMWATER POLLUTION PREVENTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide all work and take all measures necessary to control soil erosion resulting from construction operations, prevent flow of sediment from construction site, and contain construction materials (including excavation and backfill) within protected working area as to prevent damage to any stream or wetlands.

B. The Contractor is responsible for creating a Stormwater Pollution Prevention Plan (SWPPP) for regulatory approval and enforcing its requirements in accordance with applicable Federal, State (F.A.C. Chapter 62-621), and local regulations. The complete SWPPP shall be submitted by the Contractor and approved by the regulatory agencies having jurisdiction before the start of construction. The Contractor shall provide all labor, materials, and equipment required in the prevention of environmental pollution and degradation and thereby for the protection of all environmental resources encountered during construction.

C. The Contractor is responsible for all permitting and reporting forms as required through the Florida Department of Environmental Protection (FDEP) – National Pollutant Discharge Elimination System (NPDES) program for construction activities.

D. Temporary erosion controls may include, but are not limited to, mulching, netting, and watering on site surfaces and spoil and borrow area surfaces and providing interceptor ditches at ends of berms and at those locations that will ensure erosion during construction will be either eliminated or maintained within acceptable limits as established by the City.

E. Temporary sedimentation controls may include, but are not limited to, silt dams, barriers, turbidity curtains, hay bales, drop inlet protection, curb inlet protection, and appurtenances at the foot of sloped surfaces and other areas that will ensure sedimentation pollution will be either eliminated or maintained within acceptable limits as established by the City.

1.02 REFERENCE

A. “Guidelines for Erosion and Sediment Control, Planning and Implementation” published by the United States Environmental Protection Agency.

B. “Processes, Procedures and Methods to Control Pollution Resulting from all Construction Activity”, published by the United States Environmental Protection Agency.

C. “The Florida Stormwater, Erosion, and Sedimentation Control Inspector’s Manual” published by the Florida Department of Environmental Protection.

D. NPDES Stormwater Program: www.dept.state.fl.us/water/stormwater/npdes/

1.03 SUBMITTALS

A. Contractor shall provide a copy of all permit applications, approvals, and reporting documentation submitted in support to SWPPP.

B. Contractor shall submit a copy of the SWPPP in accordance with Section 01300.

1.04 QUALITY ASSURANCE

A. Operations restricted to areas of work indicated on drawings and area which must be entered for construction of temporary or permanent facilities.

B. Engineer has authority to limit surface area of erodible earth material exposed by clearing and grubbing, excavation, borrow and fill operations and to direct immediate permanent or temporary pollution control measures to prevent contamination of any stream or wetlands, including construction of temporary berms, dikes, dams, sediment basins, sediment traps, slope drains, and use of temporary mulches, mats, or other control devices or methods as necessary to control erosion.

PART 2 - PRODUCTS

2.01 GENERAL

A. All products shall be in accordance with Drawings and approved SWPPP.

PART 3 - EXECUTION

3.01 GENERAL

A. Prior to the start of work, provide and install the site sedimentation and erosion control as indicated on the Drawings and the Contractor prepared SWPPP and as required by applicable regulations. Maintain such system for the duration of the project.

B. Should any of the temporary erosion and sediment control measures employed by the Contractor fail to produce results that comply with the requirements of the City or SWPPP, Contractor shall immediately take any and all necessary steps to correct the deficiency at his own expense.

C. Construct earth berms or diversions to intercept and divert runoff water from critical areas.

D. Discharge silt-laden water from excavations onto filter fabric mat and/or baled hay or straw sediment traps to ensure that only sediment-free water is returned to watercourses.

E. Do not place excavated soil material adjacent to watercourse in manner that will cause it to wash away by high water or runoff.

F. Prevent damage to vegetation by excessive watering or silt accumulation in the discharge area.

G. Do not dump soiled material into any streams, wetlands, surface waters, or unspecified

locations.

H. Do not pump silt-laden water from trenches or excavations into surface waters, streams, wetlands, or natural or man-made channels leading thereto.

I. Prevent damage to vegetation adjacent to or outside of construction area limits.

J. Do not dispose of trees, brush, debris, paints, chemicals, asphalt products, concrete curing compounds, fuels, lubricants, insecticides, washwater from concrete trucks or hydroseeders, or any other pollutant in streams, wetlands, surface waters, or natural or man-made channels leading thereto, or unspecified locations.

K. Do not alter flow line of any stream unless indicated or specified.

L. All exposed graded, cleared, filled, etc. land to remain shall be stabilized with sod, filter fabric and/or vegetation acceptable to the City.

3.02 Contractor REQUIREMENTS

A. The Contractor is notified that the City of Fort Lauderdale has submitted a Notice of Intent to Use Generic Permit for Stormwater Discharge from Large and Small Construction Activities, (FDEP Form 62-621.300(4)(b)).

B. The Contractor shall provide all necessary labor and materials to maintain compliance with the permit requirements as found in FDEP document 62-621.300(4)(a) and the preliminary Stormwater Pollution Prevention Plan (SWPPP). These documents are included in the Appendices of the contract documents for convenience.

C. The SWPPP submitted by the City is preliminary in nature. The Contractor shall be responsible for preparing, submitting, and complying with a final SWPPP in full accordance with all regulatory requirements

3.03 RETENTION OF RECORDS

A. Retain a copy of the SWPPP at the construction site and at the Contractor’s office from the date that it became effective to the date of project completion.

B. At project closeout, submit to the City all NPDES forms and certifications, as well as a copy of the SWPPP. Stormwater pollution prevention records will be retained by the City for a period of three (3) years from the date of project completion.

3.04 REQUIRED NOTICES

A. The following notices shall be posted by the Contractor within 60 days of a notice to proceed until the date of project final completion:

1. A copy of the submitted NOI and a brief project description, as given in the SWPPP, shall be posted at the construction site and at the Contractor’s office in a prominent place for public viewing.

2. Notice to drivers of equipment and vehicles, instructing them to stop, check and clean tires of debris and mud before driving onto traffic lanes. Post such notices at every stabilized construction exit area.

3. Post a notice of waste disposal procedures in an easily visible location on site.

4. Notice of hazardous material handling and emergency procedures shall be posted with the NOI on site. Keep copies of Material Safety Data Sheets at a location on site that is known to all personnel.

- END OF SECTION -

SECTION 02200

SITE PREPARATION

PART 1 - GENERAL

1.01 DEFINITIONS

A. Interfering or Objectionable Material: Trash, rubbish, and junk; vegetation and other organic matter, whether alive, dead, or decaying; topsoil.

B. Clearing: Removal of interfering or objectionable material lying on or protruding above ground surface.

C. Grubbing: Removal of vegetation and other organic matter including stumps, buried logs, and roots greater than 2 inches caliper to a depth of 12 inches below subgrade.

D. Scalping: Removal of sod without removing more than upper 3 inches of topsoil.

E. Stripping: Removal of topsoil remaining after applicable scalping is completed.

F. Project Limits: Areas, as specified, within which Work is to be performed.

1.02 QUALITY ASSURANCE

A. Obtain Engineer's approval of staked clearing, grubbing, and stripping limits, prior to commencing clearing, grubbing, and stripping.

1.03 SCHEDULING AND SEQUENCING

A. Prepare site only after adequate erosion and sediment controls are in place. Limit areas exposed uncontrolled to erosion during installation of temporary erosion and sediment controls.

PART 2 - MATERIALS

(NOT USED)

PART 3 - EXECUTION

3.01 GENERAL

A. Clear, grub, and strip areas actually needed for waste disposal, borrow, or site improvements within limits specified.

B. Property obstructions which are to remain in-place, such as buildings, sewers, drains, water or gas pipes, bridges, etc., are to be carefully protected from damage.

C. Do not injure or deface vegetation that is not designated for removal. All branches potentially interfering with construction operations shall be pruned prior to starting work and following approval of the City and the City of Fort Lauderdale Urban Forester.

3.02 LIMITS

A. As Follows, but not to extend beyond project limits.

1. Excavation Including Trenches: 5 feet beyond top of cut slopes or shored wall.
2. Fill:
    a. Clearing and Grubbing: 5 feet beyond toe of permanent fill.
    b. Stripping and Scalping: 2 feet beyond toe of permanent fill.
3. Waste Disposal:
    a. Clearing: 5 feet beyond perimeter.
    b. Scalping and Stripping: Not required.
    c. Grubbing: Around perimeter as necessary for neat finished appearance.
4. Overhead Utilities:
    a. Clearing, Grubbing, Scalping, and Stripping: Wherever grading is required, including borrow pits, ditches, etc.
    b. Other Areas: As shown.

B. Remove rubbish, trash, and junk from entire area within Project limits.

3.03 TEMPORARY REMOVAL OF INTERFERING PLANTINGS

A. Remove and store, as specified in the Contract Documents, trees, plants, and ground covers, shrubs and trees that are not designated for removal but do interfere with construction or could be damaged by construction activities.

B. Photograph and document location, orientation, and condition of each plant prior to its removal. Record sufficient information to uniquely identify each plant removed and to assure accurate replacement.

3.04 CLEARING

A. Clear areas within limits specified.

B. Fell trees so that they fall away from facilities and vegetation not designated for removal.

C. Cut stumps not designated for grubbing 12 inches below the ground surface.

D. Cut off shrubs, brush, weeds, and grasses to within 2 inches of ground surface.

3.05 GRUBBING

A. Grub areas within limits specified.

3.06 SCALPING

A. Do not remove sod until after clearing and grubbing is completed and resulting debris is removed.

B. Scalp areas within limits specified.

3.07 STRIPPING

A. Do not remove topsoil until after scalping is completed.

B. Strip areas within limits to minimum depths specified. Do not remove subsoil with topsoil.

C. Stockpile strippings, meeting requirements of Section 02911, Soil Preparation, for topsoil, separately from other excavated material.

3.08 TREE REMOVAL OUTSIDE CLEARING LIMITS

A. Remove Within Project Limits:

1. Dead, dying, leaning, or otherwise unsound trees that may strike and damage Project facilities in falling.

2. Trees designated by Engineer.

3. Cut stumps off flush with ground, remove debris, grind stump and if disturbed, restore surrounding area to its original condition.

3.09 TREE TOPPING

A. Top trees designated by the City so remaining portion will not strike facilities in falling. Where topping will remove more than 1/2 of a tree's crown, remove entire tree.

B. Treat wounds resulting from topping in accordance with standard horticultural practice to preserve the natural character of the tree.

3.10 PRUNING

A. Remove branches below the following heights:

1. Sixteen feet above roadways and shoulders.

2. Nine feet above sidewalks.

3. Six feet above roofs.

B. Prune only after planting and in accordance with standard horticultural practice to preserve the natural character of the plant. Perform in presence of the Engineer. Remove all dead wood, suckers, and broken or badly bruised branches. Use only clean, sharp tools. Do not cut lead shoot.

3.11 DISPOSAL

A. Clearing and Grubbing Debris:

1. Woody debris may be chipped. Chips may be sold to Contractor's benefit or used for landscaping onsite as mulch or uniformly mixed with topsoil, provided that resulting mix will be fertile and not support combustion. Maximum dimensions of chipped material used onsite shall be 1/4-inch by 2 inch. Dispose of chips that are unsaleable or unsuitable for landscaping or other uses with unchipped debris.

2. Limit offsite disposal of clearing and grubbing debris to locations that are approved by federal, state, and local authorities, and that will not be visible from Project.

B. Scalpings: As specified for clearing and grubbing debris.

C. Strippings:

1. Dispose of strippings that are unsuitable for topsoil or that exceed quantity required for topsoil offsite or in waste disposal areas approved by Engineer.

2. Stockpile topsoil in sufficient quantity to meet Project needs. Dispose of excess strippings as specified for clearing and grubbing.

- END OF SECTION -

SECTION 02220

DEMOLITION

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. Removal and disposal of structures, pavement surfaces, sidewalks, underground obstructions, and other facilities necessary to prepare the area for construction of proposed facilities.

PART 2 - MATERIALS

(NOT USED)

PART 3 - EXECUTION

3.01 GENERAL

A. Utilities:

1. Notify City or appropriate utilities to turn off affected services before starting demolition or alterations. Provide not less than seven (7) days' notice to the owner of the utility prior to the shutdown.

2. Remove utility lines exposed by demolition excavation.

3. Remove electric, sanitary, and storm drainage adjacent to buildings to be demolished.

4. Excavate utility lines serving buildings to be demolished and provide a permanent leak-proof closure for water and gas lines.

5. Plug sewerlines at locations shown or at limits of excavation if not shown with concrete length of plug, 5 feet minimum to prevent groundwater infiltrating sewer systems.

B. Removal and Storage of Equipment for Reuse:

1. Do not remove equipment and materials without approval of Engineer.

2. Properly store and maintain equipment and materials in same condition as when removed.

3. Engineer will determine condition of equipment and materials prior to removal.

3.02 DEMOLITION

A. Additional quantities of new construction or additional work caused by the demolition, beyond the limits, will be performed at the Contractor's expense.

B. Drawings define minimum portion of structures to be removed. Unless otherwise shown, rough cuts or breaks may be made exceeding limits of demolition shown. Provide sawcut at limits of all pavement removal. Structures shall be removed in such a way as to leave no obstructions to any proposed new structures or to any waterways.

C. Core drill floor slabs, catch basins, and other concrete improvements to remain in place below ground, or break holes at structure's lowest point to allow water to freely migrate through.

D. Remove piping from areas to be backfilled. Pipe, valves, and fittings adjacent to those to be removed may also be removed as salvage.

E. Remove all materials associated with existing equipment that is to be removed or relocated.

F. Cut off concealed or embedded conduit, boxes, or other materials a minimum of 2” inches below final finished surface.

G. Extract existing piling, which conflict with new piles, prior to driving new piles.

3.03 DISPOSAL

A. Dispose of debris and other nonsalvaged materials offsite in licensed landfills.

3.04 BACKFILLING

A. Demolished Areas: Backfill to existing ground level or foundation level of new construction.

B. Backfill Material and Compaction:

1. Conform to Sections 02222 and 02224.

2. Do not use demolition debris as backfill material.

3.05 SALVAGE

A. Equipment and materials, including piping within the limits of demolition, unless otherwise specified, will become the property of Contractor.

B. Any material designated to remain by the City shall be stored in neat piles in a location directed by the City.

C. Fire Hydrants:

1. Salvage for future use by City.

2. Remove and leave for City in location directed by the City.

- END OF SECTION -

SECTION 02222

EXCAVATION AND BACKFILL FOR UTILITIES

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. Excavate, grade and backfill as required for underground piping systems and appurtenances as shown on the Drawings and specified herein.

B. All excavation for the project is unclassified.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Division 15

B. Division 16

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Codes: All codes, as referenced herein, are specified in Section 01090, "Reference Standards".

B. Commercial Standards:

ASTM D 422	Standard Test Method for Particle-Size Analysis of Soils.
ASTM D 698	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
ASTM D 1556	Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
ASTM D 1557	Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort.
ASTM D 2419	Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.
ASTM D6938	Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

1.04 SUBMITTALS

A. General: Submit information and samples to the Engineer for review as specified herein in accordance with the Section entitled "Submittals".

B. Dewatering: The Contractor shall submit to the Engineer its proposed methods of handling trench water and the locations at which the water will be disposed of. Methods shall be acceptable to the Engineer before starting the excavation

C. Bedding and Backfill Materials: The Contractor shall notify the Engineer of the off-site sources of bedding and backfill materials.

1. Submit to the Engineer a representative sample weighing approximately 25 lbs. The sample shall be delivered to a location at the work site determined by the Engineer.

2. The Contractor shall notify the Engineer in writing of the sources of each material at least ten calendar days prior to the anticipated use of the materials.

D. Sheeting System: Drawings of the sheeting system and design computations shall be submitted to the Engineer; however, the review of these drawings shall in no way relieve the Contractor of the responsibility to provide a safe and satisfactory sheeting and shoring system. Sheeting and shoring shall be designed by the Contractor, and the proposed design shall be sealed by a Professional Engineer registered in the State of Florida. If the Engineer is of the opinion that at any point sufficient or proper supports have not been provided, it may order additional supports put in at the Contractor's expense.

E. Dewatering Permits: If the quantity or nature of water withdrawn requires approval/permits from regulatory agencies, the Contractor shall procure such permits at its expense and submit copies to the Engineer before commencing the work.

1.05 QUALITY CONTROL

A. An independent testing laboratory will be retained by the City to do appropriate testing as described in the Section entitled "Quality Control". The Contractor shall schedule its work so as to permit a reasonable time for testing before placing succeeding lifts and shall keep the laboratory informed of his progress. A minimum of 48 hours of notice shall be provided to the testing laboratory to mobilize its activities.

B. Field Density Testing Frequency for Pipeline Backfill: The frequency of the field density testing shall be in accordance with the notes on the Drawings. If the Drawings do not indicate a frequency then field density testing shall be as follows:

1. Pipe installed: for each layer (i.e., lift) of compacted material perform a minimum of one density test at 150-foot interval.

1.06 SUBSURFACE INFORMATION

A. A separate geotechnical report is provided for information purposes with the Contract Documents. The report identifies properties below grade and also offers recommendations for foundation design, primarily for use of the Engineer. The recommendations shall not be construed as requirements of the Contract.

B. The City and the Engineer will not assume responsibility for variations of sub-soil quality or conditions at locations other than places shown and at the time the geotechnical investigation was made. The Contractor shall examine the site and review the available geotechnical report or undertake its own subsurface investigation prior to submitting its bid, taking into consideration all conditions that may affect its work.

1.07 GROUNDWATER

A. The Contractor shall be responsible for anticipating groundwater conditions and shall provide positive control measures as required. Such measures shall ensure stability of excavations, groundwater pressure control, prevention of tanks, pipes, and other structures from being lifted by hydrostatic pressures, and avoiding the disturbance of subgrade bearing materials.

B. The Contractor shall be responsible for obtaining all permits required for dewatering operations.

1.08 TRENCH SAFETY ACT COMPLIANCE

A. The Contractor by signing and executing the contract is, in writing, assuring that it will perform any trench excavation in accordance with the Florida Trench Safety Act, Section 553.60 et. seq. The Contractor has further identified the separate item(s) of cost of compliance with the applicable trench safety standards as well as the method of compliance as noted in the "Bid Forms" Section of the Contract front-end documents.

B. The Contractor acknowledges that this cost is included in the applicable items of the Proposal and Contract and in the Grand Total Bid and Contract Price.

C. The Contractor is, and the City and Engineer are not, responsible to review or assess the Contractor's safety precautions, programs or costs, or the means, methods, techniques or technique adequacy, reasonableness of cost, sequences or procedures of any safety precaution, program or cost, including but not limited to, compliance with any and all requirements of Florida Statute Section 553.60 et. seq. cited as the "Trench Safety Act". The Contractor is, and the City and Engineer are not, responsible to determine if any safety or safety related standards apply to the project, including but not limited to, the "Trench Safety Act".

1.09 PROTECTION OF PROPERTY AND STRUCTURES

A. The Contractor shall, at its own expense, sustain in place and protect from direct or indirect injury, all pipes, poles, conduits, walls, buildings, and all other structures, utilities, and property in the vicinity of its Work. Such sustaining shall be done by the Contractor. The Contractor shall take all risks attending the presence or proximity of pipes, poles, conduits, walls, buildings, and all other structures, utilities, and its Work. It shall be responsible for all damage, and assume all expenses, for direct or indirect injury and damage, caused by its Work, to any such pipe, structures, etc., or to any person or property, by reason of injury to them, whether or not such structures, etc., are shown on the Drawings.

B. Barriers shall be placed at each end of all excavations and at such places as may be necessary along excavations to warn all pedestrian and vehicular traffic of such excavations. Barricades with flashing lights shall also be placed along excavation from sunset each day to sunrise of the next day until such excavation is entirely refilled, compacted, and paved. All excavations shall be barricaded where required to meet OSHA, local and Federal Code requirements, in such a manner to prevent persons from falling or walking into any excavation within the site fenced property limits.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Materials shall be furnished as required from on-site excavations or from acceptable off-site sources as required. The Contractor shall notify the Engineer in writing of the sources of each material at least ten calendar days prior to the anticipated use of the materials.

2.02 BEDDING

A. Pipe Bedding: In general, clean sandy materials excavated from the utility trench, that is free from organics, clay and construction debris, can be used as pipe bedding when construction is in a dry condition and when the bedding is not sided by muck. Pipe bedding material shall be able to pass through a 3/4-inch sieve. Separation of suitable material for pipe bedding from other material shall be made during the excavation.

B. Sand shall be used for all copper and other service lines.

C. In the case of a “dry” installation, sand shall be used for PVC and ductile iron pipe where the bottom of the trench is located in the limestone zone.

D. In the case of a “wet” installation, pearock shall be used for PVC and ductile iron pipe where the bottom of the trench is located in the limestone zone.

E. Precast concrete items shall use crushed stone.

2.03 PEAROCK

A. Pearock shall consist of hard, durable particles of proper size and gradation, and shall be free from organic material, wood, trash, sand, loam, clay, excess fines, and other deleterious materials. Refer to specification section entitled “Earthwork” for size and gradation conformance requirements.

2.04 CRUSHED STONE (3/4-INCH ROCK)

A. Crushed stone shall consist of hard, durable, subangular particles of proper size and gradation, and shall be free from organic material, wood, trash, sand, loam, clay, excess fines, and other deleterious materials. Refer to specification section entitled “Earthwork” for size and gradation conformance requirements.

2.05 SAND

A. Sand shall be used for bedding polyvinyl chloride, fiberglass, HDPE and other plastic pipe when installed under dry trench conditions. Refer to specification section entitled “Earthwork” for size and gradation conformance requirements.

2.06 SELECT BACKFILL

A. Select Backfill: It is the intent of these specifications to obtain clean sandy material passing through a 3/4-inch sieve as select backfill material for utility and structural applications.

B. At locations where subsurface preparations for structures have been performed under this or other previous construction contracts, clean excavated material (structural fill) may be used as select backfill. Any excess fill shall be disposed of off-site by the Contractor.

2.07 GENERAL BACKFILL

A. General backfill (for grading applications) shall be placed above the select backfill. General backfill shall be clean granular soil, free of organics or other deleterious material. Refer to specification section entitled “Earthwork” for size and gradation conformance requirements.

B. General backfill used under roadways shall be compatible with the materials and compaction specified under the Sections entitled “Asphaltic Pavement” and “Concrete Curb and Sidewalk”.

PART 3 - EXECUTION

3.01 EXCAVATION

A. The Contractor shall perform all excavation of every description and of whatever substance encountered, to the dimensions, grades and depths shown on the Drawings, or as directed. For projects within the treatment plant, all excavations shall be made by open cut unless shown otherwise on the Drawings. For projects within the right-of-way, unless shown otherwise on the Drawings, all excavations shall be made by open cut, except for service connections to houses located across the road from the watermain, where directional boring shall be used. All existing utilities such as pipes, poles and structures shall be carefully located, supported and protected from injury; in case of damage, they shall be restored at the Contractor's expense.

B. Pipe trenches for piping shall be excavated to a width within the limits of the top of the pipe and the trench bottom so as to provide a clearance on each side of the pipe barrel, measured to the face of the excavation, or sheeting if used as defined in specification section entitled Earthwork”. Excavation depths in other types of materials and conditions shall be made as hereinafter specified.

C. In areas where trench widths are not limited by right-of-way and/or easement widths, property line restrictions, existing adjacent improvements, including pavements, structures and other utilities, and maintenance of traffic, the trench sides may be sloped to a stable angle of repose of the excavated material but only from a point one foot above the crown of the pipe. A substantially and safely constructed movable shield, "box" or "mule" may be used in place of sheeting when the trench is opened immediately ahead of the shield and closed immediately behind the shield as pipe laying proceeds inside the shield.

D. Ladders or steps shall be provided for and used by Workmen to enter and leave trenches, in accordance with OSHA requirements.

E. Excavation for appurtenances shall be sufficient to provide a clearance between their outer surfaces and the face of the excavation or sheeting, if used, of not less than 12 inches.

F. Excavated unsuitable material shall be removed from the site and disposed of by the Contractor. Materials removed from the trenches shall be stored and in such a manner that will not interfere unduly with any on-site operations, traffic on public roadways and sidewalks and shall not be placed on private property. In congested areas, such materials as cannot be stored adjacent to the trench or used immediately as backfill shall be removed to other convenient places of storage acceptable to the City at the Contractor's expense.

G. Excavated material that is suitable for use as backfill shall be used in areas where sufficient material is not available from the excavation. Suitable material in excess of backfill requirements shall be either used on the site as directed by the Engineer or disposed of the Contractor.

H. Barriers shall be placed at excavations in accordance with OSHA requirements.

3.02 SHEETING AND BRACING

A. The Contractor shall furnish, place and maintain sheeting and bracing to support sides of the excavation as necessary to provide safe working conditions in accordance with OSHA requirements, and to protect pipes, structures and other Work from possible damage. Where wood sheeting or certain designs of steel sheeting are used, the sheeting shall be cut off at a level of 2 feet above the top of the installed pipe and that portion below the level shall be left in place. If interlocking steel sheeting is used, it may be removed providing removal can be accomplished without disturbing the bedding, pipe or alignment of the pipe. Any damage to the pipe bedding, pipe or alignment of the constructed utility caused by the removal of sheeting shall be cause for rejection of the affected portion of the work. The City may permit sheeting to be left in place at the request and expense of the Contractor, or the City may order him in writing to leave in place, for the preventing of damage to structures or property. Payment for sheeting ordered to remain in place shall be paid for at a negotiated price.

B. If the Engineer is of the opinion that at any point sufficient or proper supports, have not be provided, he may order additional supports put in at the Contractor’s expense. The Contractor shall be responsible for the adequacy of all sheeting used and for all damage resulting from sheeting and bracing failure or from placing, maintaining and removing it.

3.03 REMOVAL OF WATER

A. General: It is a basic requirement of these Specifications unless otherwise authorized per Article 3.10 that excavations shall be free from water before pipe or structures are installed.

B. The Contractor shall provide pumps, and other appurtenant equipment necessary to remove and maintain water at such a level as to permit construction in a dry condition. The Contractor shall continue dewatering operations until backfilling has progressed to a sufficient depth over the pipe to prevent flotation or movement of the pipe in the trench or so that it is above the water table. If at any point during the dewatering operation it is determined that fine material is being removed from the excavation sidewalls, the dewatering operation shall be stopped. If any of the subgrade or underlying material is disturbed by movement of groundwater, surface water, or any other reason, it shall be replaced at the Contractor’s expense with crushed stone or gravel.

C. The Contractor shall use dewatering systems that include automatic starting devices, and standby pumps that will ensure continuous dewatering in the event of an outage of one or more pumps.

D. Disposal: Water from the trenches and excavation shall be disposed of in such a manner as will not cause injury to public health, to public or private property, to the Work completed or in progress, to the surface of the streets, cause any interference with the use of the same by the public, or cause pollution of any waterway or stream. The Contractor shall submit his proposed methods of handling trench water and locations at which the water will be disposed of to the Engineer for review and shall receive acceptance before starting the excavation. Disposal to any surface water body will require silt screens to prevent any degration in the water body. The Contractor shall have responsibility for acquiring all necessary permits for disposal.

3.04 TRENCH STABILIZATION

A. No claim for extras, or additional payment will be considered for cost incurred in the stabilization of trench bottoms which are rendered soft or unstable as a result of construction methods, such as improper or inadequate sheeting, dewatering or other causes. In no event shall pipe be installed when such conditions exist and the Contractor shall correct such conditions so as to provide proper bedding or foundations for the proposed installation at no additional cost to the City before placing the pipe or structures.

3.05 PIPE BEDDING

A. Pipe trenches shall be excavated as described in specification section entitled “Earthwork”. The resulting excavation shall be backfilled with acceptable pipe bedding material, up to the level of the centerline of the proposed pipe barrel. This backfill shall be tamped and compacted to provide a proper bedding for the pipe and shall then be shaped to receive the pipe. Bedding shall be provided under the branch of all fittings to furnish adequate support and bearing under the fitting.

B. Any over excavation below the levels required for installation of the pipe shall be backfilled with acceptable bedding material, tamped, compacted and shaped to provide proper support for the proposed pipe, at the Contractor’s expense.

3.06 BACKFILL

A. Pipeline trenches shall be backfilled to a level 12 inches above the top of the pipe with select backfill obtained from the trench excavation. When placed in the dry, such material shall be placed in 6-inch layers, each compacted to the densities specified in Article 3.07. Only hand operated mechanical compacting equipment shall be used within six inches of the installed pipe.

B. After the initial portion of backfill has been placed as specified above, and after all excess water has completely drained from the trench, backfilling of the remainder of the trench may proceed. The remainder of the backfill shall be selected material obtained from the excavation and shall be placed in horizontal layers, the depth of which shall not exceed the ability of the compaction equipment employed, and in no event shall exceed

a depth of 9 inches. Each layer shall be moistened, tamped, puddled, rolled or compacted to the densities specified in Article 3.07.

3.07 COMPACTION AND DENSITIES

A. Compaction of backfill shall be per specification section entitled “Earthwork”. More thorough compaction may be required when Work is performed in other regulatory agencies jurisdictions, such as the FDOT. Methods of control and testing of backfill construction are described in specification section entitled “Earthwork”.

B. Testing: Laboratory and field density tests, which in the opinion of the Engineer are necessary to establish compliance with the compaction requirements of these Specifications, shall be ordered by the Engineer. The Contractor shall coordinate and cooperate with the testing laboratory. The testing program will be implemented by the Engineer establishing depths and locations of tests. Modifications to the program will be made as job conditions change.

C. Trench backfill which does not comply with the specified densities, as indicated by such tests, shall be reworked and recompacted until the required compaction is secured, at no additional cost to the City. The costs for retesting such Work shall be paid for by the Contractor.

3.08 ADDITIONAL EXCAVATION AND BACKFILL

A. Where organic material, such as roots, muck, or other vegetable matter, or other material which, in the opinion of the Engineer, will result in unsatisfactory foundation conditions, is encountered below the level of the proposed pipe bedding material, it shall be removed to a depth of two feet below the outside bottom of the pipe or to a greater depth as directed by the Engineer and removed from the site. Sheeting shall be installed if necessary, to maintain pipe trenches within the limits identified by the Engineer. The resulting excavation shall be backfilled with suitable backfill material, placed in 12-inch layers, tamped and compacted up to the level of the bottom of the proposed pipe bedding material. Sufficient compaction of this material shall be performed to protect the proposed pipe against settlement. Lean concrete may be used in lieu of backfill when pipe installation is in the wet or at the Contractor’s option. Construction shall then proceed in accordance with the provisions of Article 3.05 “Pipe Bedding”.

B. Additional excavation (more than two feet below the pipe) shall be performed when ordered by the Engineer. Where organic or other material is encountered in the excavation, the Contractor shall bring the condition to the attention of the Engineer and obtain his determination as to whether or not the material will require removal, prior to preparing the pipe bedding. The excavation of material up to a depth of two feet below the outside bottom is an incidental item of construction and the Work shall be done at no additional cost to the City. Where ordered by the Engineer, excavation greater than two feet below the pipe and additional backfill will be compensated by the City.

3.09 FINE GRADING

A. After piping trenches backfilled, the disturbed areas of the site shall be fine graded. Any lumber, undesirable materials and rocks larger than the 3-inch size shall be removed

from the surface. The completed surface shall be to the preconstruction elevation unless otherwise directed by the City. Minor adjustments to line and grade may be required as the work progresses in order to satisfy field conditions.

3.10 ALTERNATE METHOD OF CONSTRUCTION

A. Use of This Method: A combination of conditions in the substrate, water table, or method of disposal may be encountered during the course of the work which makes dewatering impossible, or only possible through the use of unusual methods, the cost of which is excessive. When such conditions are encountered, but only after all reasonable means (pumps, well points, etc.) to dewater the excavation have been employed without success, the Contractor, may request to employ the following Alternate Method of Construction. The concurrence of the Engineer shall be obtained in writing and shall limit the use of the alternate method of construction to such specific portions of the Work as the Engineer shall determine.

B. The requirements set forth in other sections of these Specifications shall establish the required standards of construction quality for this work. Use of the alternate method of construction described hereinafter shall in no way be construed as relieving the Contractor of the work. No additional payment will be made to the Contractor for excavation, backfill, sheeting or any cost incurred for Work or materials, or any other costs incurred as a result of the use of this alternate method of construction. The prices established in the Proposal shall be for full payment for the various items of work.

C. Subject to all the requirements stated herein, including written acceptance of the Engineer, construction will be permitted in accordance with the following specifications. All requirements of these Specifications shall apply to this construction unless otherwise specifically modified herein.

D. Removal of Water: The installation of pipe and appurtenances under water will be permitted and the requirements of Article 3.03 will be waived.

E. Excavation shall be performed in accordance with Article 3.01.

F. Pipe Bedding: Pipe bedding shall be placed from 6 inches below the outside bottom of the proposed pipe barrel up to the centerline of the pipe barrel. The bedding material shall be pearock as specified in Article 2.03 "Pearock". Limerock screenings, sand or other fine organic material shall not be used.

G. The bedding material shall be placed and then be shaped to receive the pipe at the intended elevation. Bedding shall be provided under the branch of all fittings to furnish adequate support and bearing under the fitting.

H. Backfill: After the pipe is installed, backfilling shall proceed in accordance with the provisions of Article 3.06 "Backfill" and 3.07 "Compaction and Densities". Select backfill material shall be used to backfill around the pipe and to a level one foot above the crown of the pipe. Under no circumstances will material other than select backfill or specified pipe bedding material be considered satisfactory for this purpose.

I. If the Alternate Method of Construction is used, all backfill material, including specified pipe bedding material, shall be carefully lifted into the trench and not released to fall freely therein until the bucket or container is at or just above water level. Under no

circumstances will backfill material be dumped or pushed into the trenches containing water. Below existing water level, the backfill material shall be carefully rammed into place in uniform layers, of equal depth on each side of the pipe, up to the water level. Above the water level, backfill material shall be placed and compacted for normal backfill as previously specified.

3.09 RESTORATION OF EXISTING SURFACES

A. Restore all grassed areas disturbed by the trenching operations by resodding in accordance with the Section entitled “Sodding” or the Section entitled “Landscaping”.

B. Restore all asphaltic concrete pavement areas disturbed by the trenching operations in accordance with the Section entitled “Asphaltic Concrete Pavement.”

C. Restore all concrete pavement, curbs, and sidewalks disturbed by the trenching operations in accordance with the Section entitled “Concrete Curbs and Sidewalks”.

- END OF SECTION -

SECTION 02224

EXCAVATION AND BACKFILL FOR STRUCTURES

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. This Section includes, except as elsewhere provided, excavation, filling and compacting within the limits defined on the Contract Drawings for complete construction of structures for this project.

B. All excavation for the project is unclassified.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Division 2, Specification Section entitled “Earthwork

1.03 QUALITY CONTROL

A. Codes and Standards: Excavation and backfill work shall be performed in compliance with applicable codes, standards and requirements of governing authorities having jurisdiction in the area.

B. Testing and Inspection Service: An independent testing laboratory shall be retained by the City to conduct appropriate soils and other testing in accordance with the Contract Documents.

1.04 JOB CONDITIONS

A. General

1. A separate geotechnical report is provided for information purposes with the Contract Documents. The report identifies properties below grade and also offers recommendations for foundation design, primarily for use of the Engineer. The recommendations shall not be construed as requirements of the Contract unless specifically referenced by the Contract Documents.

2. The City and/or the Engineer will not assume responsibility for variations of sub-soil quality or conditions at locations other than places shown and at the time the geotechnical investigation was made. The Contractor shall examine the site and review the available geotechnical report or undertake its own subsurface investigation prior to submitting its bid, taking into consideration all conditions that may affect its work.

B. Existing Utilities

1. Locate existing underground utilities in the areas of work. Accurate "As Built” Information describing existing pipelines and underground utilities is not available.

Test pits and hand excavation in critical areas will be required prior to initiating work.

2. All existing utilities including piping, electrical conduits, electric duct banks and telephone cables that are shown on the Contract Drawings to be relocated, shall be relocated prior to initiating earth work. Excavation and backfill for relocation of existing utilities shall conform to the requirements of Section 02222. The Contractor shall coordinate relocation of utilities with utility companies having jurisdiction in the area. Should unknown or incorrectly identified piping or other utilities be encountered during excavation, the Contractor shall consult the City and the Engineer of such piping or utility immediately for directions.

3. The Contractor shall cooperate with the City and utility companies in keeping respective services and facilities in operation.

1.05 PROHIBITION OF BLASTING

A. The use of explosives for excavation work is strictly prohibited on this project.

1.06 SUBMITTALS

A. The Contractor shall submit information and samples to the Engineer for review as specified herein in accordance with Section 01300. The information shall include:

1. Detailed description of dewatering method chosen and sequence of dewatering operations.

2. Plans showing the methods and location of dewatering and discharge. The drawings shall include a sufficient number of detailed sections to clearly illustrate the scope of work. The drawings showing all of the above information, including calculations, shall be prepared by a qualified Professional Engineer registered in the state of Florida, and shall bear its seal and signature. If required by regulatory agencies, a copy of the dewatering permit shall be submitted.

3. Lists of materials and equipment to be used. Detailed description of the method(s) of excavation, fill and compaction to be used.

4. Plans of open cut excavations showing side slopes and limits of the excavation at grade where not shown on the Contract Drawings.

5. Design computation of sheeting system. Sheeting and shoring plans shall be designed and sealed by a Professional Engineer registered in the State of Florida. Submittals shall indicate depth of penetration.

6. The Contractor shall furnish the Engineer, for approval, a representative sample of structural fill material from off-site sources at least ten calendar days prior to the date of anticipated use of such material. The sample shall be delivered to the site at a location determined by the Engineer. The submittal shall identify the source of the material.

1.07 PROTECTION OF PROPERTY AND STRUCTURES

A. The Contractor shall, at its own expense, sustain in place and protect from direct and indirect injury, its work at all times as well as all pipes, poles, conduits, walls, buildings, and all other structures, utilities and property in the vicinity of its work. Such sustaining shall be done by the Contractor. The Contractor shall take all risks attending the presence or proximity of pipes, poles, conduits, walls, buildings and all other structures, utilities, and property in the vicinity of its work. It shall be responsible for all damage, and assume all expenses, for direct or indirect injury and damage, caused by its work, to any such pipes, structures, etc., or to any person or property, by reason of injury to them, whether or not such structures, etc., are shown on the Drawings.

B. Barriers and lights shall be placed at all excavations in accordance with OSHA requirements.

C. Safe and suitable ladders for access to trenches shall be provided in accordance with OSHA requirements.

PART 2 - PRODUCTS

2.01 GENERAL

A. Specific locations/areas of work where these materials shall be utilized are defined on the Drawings.

2.02 STRUCTURAL FILL

A. Fill material shall be noncohesive, nonplastic, granular mixture of local clean sand or local clean sand and limerock free from vegetation, organic material, muck or deleterious matter per specification section entitled “Earthwork”. Broken Portland cement or asphaltic concrete shall not be considered an acceptable fill material. Fill material containing limerock shall have sufficient sand to fill the voids in the limerock. All structural fill materials shall be obtained from off-site sources.

2.03 CRUSHED LIMESTONE

A. Crushed limestone placed below foundation slabs shall be hard, durable, subangular particles of proper size and gradation, and shall be free from organic materials, wood, trash, sand, loam, chalk, excess fines and other deleterious materials. Refer to specification section entitled “Earthwork for additional information.

2.04 OTHER MATERIALS

A. Requirements for any other fill material, if needed, are defined in the Drawings and under specification section entitled “Earthwork”.

PART 3 - EXECUTION

3.01 CONTRACTOR INSPECTIONS

A. Examine the areas and conditions under which excavating, filling, and grading are to be performed. Do not proceed with the work until unsatisfactory conditions have been corrected.

B. Examine and accept existing grade of the project site walkways, pavements, etc., prior to commencement of work and report to Engineer if elevations of existing subgrade substantially vary from elevations shown on the Drawings.

3.02 EXCAVATION FOR STRUCTURES

A. Unless otherwise indicated on the Drawings, all excavation shall be made in such a manner, and to such widths, as will give ample room for properly constructing and inspecting the structures they are to contain. Excavation shall be made in accordance with the details shown on the Drawings, and as specified herein. Attention shall be given to the proper handling of storm water runoff. The Contractor shall intercept and collect surface run off both at the top and bottom of cut slopes. The excavating equipment shall operate in an organized fashion so as to remove silt from one edge of the excavation to the other so as not to trap silt within the undercut area.

B. Where required on the Drawings, unsuitable material (silt layer) beneath the groundwater encountered at the site shall be removed using a drag line or hydraulic excavator, as approved by the Engineer. The equipment shall operate in an organized manner so as to remove silt from one edge of the excavation to the other so as not to trap silt within the undercut area. Unsuitable material shall be hauled to and stockpiled temporarily by the Contractor at the “Temporary Muck Storage” location defined on the Drawings. Once drained, and during “dry” weather as determined by the Engineer in the field, the Contractor shall remove and dispose of it off-site. The Contractor shall be responsible for managing and maintaining the temporary muck storage area and shall ensure impact of this area, including providing dust control, runoff control, etc. is minimized. Also, the Contractor shall clean all roadways impacted by his demucking, hauling, temporary stockpiling and removal operations at a frequency as determined by the Engineer in the field.

C. In excavating for footings, structures and foundations, the Contractor shall take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive concrete.

D. The Contractor shall ensure that its excavation work does not adversely affect the bearing capacity of the structural subsurface. Also, the Contractor shall proceed with foundation work immediately after excavation work and as expeditiously as possible so as to minimize any potential for subsurface disturbance due to environmental factors, adverse weather, etc. The Contractor shall also take all necessary precautions to protect its work from potential adverse impacts. Where excavated areas are disturbed by subsequent operations or adverse weather, scarify surface reshape, fill as required and compact to required density.

E. All excavated soil material, removed underground utilities including pipes and fittings, electrical conduits and duct banks, and other undefined materials removed within the limits of the excavation, shall be disposed off-site by the Contractor.

F. Refer to the Drawings for additional requirements for excavation for specific locations/areas of work.

3.03 UNAUTHORIZED EXCAVATION

A. Excavation work carried outside of the work limits required by the Contract Documents shall be at the Contractor's expense, and shall be backfilled by the Contractor at its own expense with structural fill, as directed by the Engineer. Where, in the judgement of the Engineer, such over-excavation requires use of lean concrete or crushed stone, the Contractor, at its expense, shall furnish and place such materials.

3.04 SHEETING AND BRACING

A. The term "sheeting" shall represent any type of shoring used to support sides of the excavation. Walls of the excavation shall be kept vertical where open cut is not practical and, if required to protect the safety of workmen, the general public, this or other work or structure, or excavation walls, the excavation shall be properly sheeted and braced for conditions encountered and OSHA requirements. Excavation for the structures shall be sufficient to provide a clearance between their outer surfaces and the face of the excavation, sheeting, or bracing, of not less than two feet, unless otherwise indicated on the Drawings. Materials encountered in the excavation, which have a tendency to slough or flow into the excavation, undermine the bank, weaken the overlying strata, or are otherwise rendered unstable by the excavation operation shall be retained by sheeting, stabilization, grouting or other acceptable methods.

B. Minimum length of embedment below the deepest part of the excavation shall be 0.3 times the depth of excavation being supported or greater depending on the sheeting. The design of the sheeting arrangement shall be the responsibility of the Contractor.

C. Sheeting shall be removed provided its removal will not jeopardize pipes or structures. Any sheeting left in place shall be cut-off two feet below finished grade, or as directed. The Contractor will not receive extra compensation for sheeting left in place or the cut off work required.

3.05 REMOVAL OF WATER

A. General

1. The Contractor shall provide pumps, well points, and other appurtenant equipment necessary to remove and maintain water at such a level as to permit construction in the dry where defined on the Drawings. The ground water level shall be controlled so as to permit the placing and curing of concrete and the maintenance of supporting foundations and adjacent work and structures in the dry.

2. The Contractor shall use dewatering systems that include automatic starting devices, and standby pumps that will ensure continuous dewatering in the event of an outage of one or more pumps.

3. If excavations to be dewatered cannot be maintained dry by the Contractor's dewatering efforts, then the Contractor shall provide tremie seals at no additional cost to the City. The placement of tremie seals shall not preclude dewatering operations specified herein. The limits of tremie seals shall be recommended by the Contractor and reviewed and accepted by the Engineer.

B. Disposal: The Contractor shall be responsible to dispose of water from the dewatering operation in accordance with the Contract Documents and shall obtain all necessary permits and conform to all local regulations and codes. Water from the excavation shall be disposed of in such a manner as will not cause injury to public health, to public or private property, to the work completed or in progress, to the surface of the streets, will not cause any interference with the use of the same by the public, or will not cause pollution of any waterway or stream. Water from dewatering operation may be disposed at locations directed by the City with the proper installation of siltation screens and operation of the dewatering system in accordance with all local regulations and codes. The Contractor shall submit its dewatering method and point(s) of discharge to the Engineer for review at least twenty (20) days prior to any dewatering activities. The Contractor shall provide maintenance of canal(s) and drainage ditches to which it discharges. The cost of maintaining drainage ditches and canal(s) shall be included in the bid price. The Contractor shall remove siltation and haul, and dispose of this material on a regular basis to maintain the original base conditions at all time, so as not to impact drainage in the general area.

3.06 FILL PLACEMENT AND COMPACTION

A. General

1. Fill material (including structural fill and other fill material) shall be placed within the limits of excavations as shown on the Drawings. When placed in the wet, fill material shall be placed in standing groundwater to a level one foot above stabilized groundwater. The material shall be placed at one edge of the excavation and pushed to the other so as to move residuals across the bottom of the excavation. The leading edge of the fill should be cleaned regularly to remove it of the advancing residuals. All residuals shall be disposed at off-site locations shown on the Drawings or specified herein.

2. Once fill materials have been placed one foot above the stabilized groundwater, then the entire lift should be rolled with six passes from a 10-ton roller. The coverages shall be overlapping and shall occur while the compactor operated at a travel speed of not more than two feet per second. If a vibratory compactor is used, it should be operated with the vibrator off so as not to induce capillary moisture into the dry fill soils.

3. Fill materials placed following this initial lift shall be placed in the dry with loose lift thickness of eight inches or less. Refer to specification section entitled “Earthwork”

for additional information. Fill materials shall be placed within two percent of optimum moisture content.

B. Inspection and Testing: The fill placement and compaction shall be observed by the Engineer. Refer to specification section entitled “Earthwork for in-place density testing requirements. The Contractor shall coordinate and cooperate with the testing laboratory.

C. Final Grades: Final structure fill grades shall be within 0.1 feet of elevations shown. Where shown on the Drawings, surfaces shall be sloped for drainage or other surfaces.

D. Refer to the Drawings for additional fill and compaction requirements for specific locations/areas of work.

3.07 BACKFILL AGAINST STRUCTURES

A. Backfill against nonwater holding structures shall not be performed until the concrete has been inspected by the Engineer. Backfill against walls shall also be deferred until the structural slab for floors above the top fill line have been placed and attained design strength. Partial backfilling against adequately braced walls may be considered by the Engineer on an individual situation basis. Where walls are to be waterproofed, all work shall be completed and membrane materials dried or cured according to the manufacturer’s instructions before backfilling.

B. Backfill against tanks and other structures which are to retain liquids shall not be performed until leakage tests are completed and accepted by the Engineer.

- END OF SECTION -

SECTION 02225

CONTAMINATED SOILS AND GROUNDWATER

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. This Section includes, except as elsewhere provided, the work necessary to remove, transport, and properly dispose of contaminated soils and groundwater required for complete construction of structures and underground piping systems and appurtenances as shown on the Drawings and specified herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Section 02222 – Excavation and Backfill for Utilities

B. Section 02224 – Excavation and Backfill for Structures

1.03 QUALITY CONTROL

A. Codes and Standards: All work associated with dewatering, excavation, removal, transportation and disposal of contaminated soils and groundwater shall be performed in compliance with applicable codes, standards and requirements of governing authorities having jurisdiction in the area.

B. Testing and Inspection Service: A testing laboratory certified by the Broward County Environmental Protection and Growth Management Department (BCEPGMD) and the State of Florida shall be retained by the Contractor to conduct appropriate soils and groundwater testing in accordance with regulatory requirements and the Contract Documents.

1.04 SUBMITTALS

A. The Contractor shall submit information and samples to the City for review as specified herein in accordance with Section 01300. The information shall include:

1. Detailed description of the proposed methods for temporary stockpiling, transportation, and disposal of all contaminated soils and groundwater.

2. Copies of permits for all disposal facilities.

3. Copies of all manifest and documentation for handling and disposing of all contaminated soil and groundwater in full compliance with local, state and federal requirements. This documentation must be provided prior to requesting payment under this Bid item.

4. Copies of all laboratory analyses required for transportation and disposal of all contaminated soils and groundwater in full compliance with local, state and federal requirements.

5. Names, addresses and contact numbers of all subcontractors.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 CONTAMINATED SOILS

A. The Contractor shall retain a laboratory certified by the BCEPGM and the State of Florida to sample the groundwater in the excavation, the stored soil and soil samples in the perimeter of the excavated hole for petroleum contamination (EPA Methods 601, 602, 610). The number of samples shall be sufficient to comply with the requirements of the Contractor's approved Dewatering Plan and all local, state and federal regulations. The results of the tests shall be forwarded to the City.

B. Excavated materials which are deemed to be contaminated shall be removed, treated and disposed of by the Contractor in accordance with all applicable regulatory requirements. The soil may be contaminated with petroleum product which may be partly or entirely diesel fuel or gasoline. When such soil conditions are encountered, they shall be brought to the City's attention. The extent of excavation shall be determined in the field by the City. Payment for this work shall be in accordance with the allowance bid item for excavation, treatment and disposal of contaminated soil, included in the Schedule of Prices Bid.

C. All contaminated soil which is excavated shall be stockpiled in an area designated for contaminated soils. The Contractor shall take whatever precautions are necessary to ensure that contaminated soils are not co-mingled with non-contaminated stockpiled soils and/or mucks.

D. Contaminated soils must be placed on an impermeable barrier when temporarily stockpiled and must be covered with visquine to prevent runoff. All stockpile leachate or runoff must be collected for disposal in accordance with federal, state and local regulations.

E. Contaminated soils shall be processed and treated at a state licensed facility. These soils shall be transported and disposed of in accordance with federal, state and local regulations.

F. The Contractor shall be responsible for testing soil which has been treated to certify treated soil meets applicable federal, state, and local regulations for final disposal.

3.02 CONTAMINATED GROUNDWATER

A. All water generated, pumped or removed from excavations as a result of excavation dewatering activities shall be collected, containerized, and managed prior to discharge and/or treatment at an approved discharge point in accordance with local, state and federal regulations and the requirements of the Contract Documents. If groundwater contamination is identified at any time during the performance of the Work, Contractor shall immediately notify the City.

B. If contaminated groundwater in the dewatering excavation area is encountered, the contaminated groundwater shall be removed, treated and discharged by the Contractor in accordance with all applicable regulatory requirements. Payment for this work shall be in accordance with the allowance bid item for treatment and discharge of contaminated groundwater, included in the Schedule of Prices Bid.

C. Treatment of contaminated groundwater will include the following options, depending on the magnitude of the contamination in the trench: Granular Activated Carbon (GAC) Treatment vessels, mobile air stripping units, vacuum truck removal and disposal or other method as approved by the City and regulatory agencies with jurisdiction.

D. If contaminated groundwater is encountered during construction, Contractor shall provide reference information for the qualified groundwater remediation subcontractor to be utilized, including phone number, contact name, and address. The selected groundwater treatment/recycling facility for hauling contaminated groundwater shall also be identified.

E. Effluent water from the treatment system will be analyzed by the certified laboratory to confirm that concentrations are below regulatory limits. Effluent water will then be directed to a pre-approved location as determined by local regulatory agencies and/or the City.

3.03 TRANSPORT AND DISPOSAL

A. Transport Regulations: The Contractor shall be responsible for the loading, labeling, placarding, marking, weighing, and transporting of all waste materials in accordance with the Florida Department of Transportation Regulations, and U.S. Department of Transportation Regulations. The Contractor shall use only transporters that are licensed and competent to haul these wastes.

3.04 WASTE CONTAINERS

A. Each transport container of waste shall be visually inspected by the Contractor for leaks, drips, or container damage prior to being loaded. Containers which are found to be leaking or damaged shall not be loaded until the damage is repaired. The Contractor shall prepare the transport container to prevent spillage or contamination. The Contractor shall notify the City two hours before any loaded transport leaves the site.

B. All transport containers leaving the site shall be inspected by the Contractor to ensure that no waste material adheres to the wheels or undercarriage.

C. All vehicles on which waste is adhering shall be cleaned by sweeping tires and undercarriage or by other dry methods prior to leaving the site.

3.05 SHIPPING RECORDS

A. The Contractor shall prepare accurate shipping records for any wastes leaving the site in accordance with applicable federal and state regulations. The Contractor shall be responsible for providing copies of the records to the City and shall immediately notify the City of any problems in completing shipments and disposal of wastes.

B. The CONTRACTOR shall:

1. Be responsible for appropriate measurement of unit quantity (weight or volume) of waste material removed from the site.

2. Coordinate vehicle inspection and recording of quantities leaving the site with the City. These quantities shall be compared to recorded quantities received at the treatment or disposal facilities. The Contractor shall resolve any discrepancies occurring immediately, determining the probable cause for the discrepancy.

3. Be solely responsible for any and all actions necessary to remedy situations involving waste spiked in transit.

C. The Contractor shall ensure that a copy of the manifest is returned to the City by the designated treatment or disposal facility within 14 days of receipt of the material to be disposed.

- END OF SECTION -

SECTION 02240
DEWATERING

PART 1 - GENERAL

(NOT USED)

PART 2 - MATERIALS

(NOT USED)

PART 3 - EXECUTION

3.01 GENERAL

A. The Contractor shall be responsible for design, installation, and operation of a dewatering system to dewater specified excavations.

1. The dewatering system shall be designed in accordance with the Best Management Practices (BMP's) adopted by FDEP.

2. Inspection and control of dewatering system operations will be in accordance with the FDEP guidelines established in the Florida Erosion and Sediment Control Inspector's Manual (current edition).

B. Continuously manage and control excavation water recharge in order to facilitate and not impede construction activities at all times, including weekends, holidays, and during periods of work stoppages, and furnish and install, and operate, a contingency backup dewatering system to maintain control of excavation water levels to facilitate construction (i.e.; no construction delays).

3.02 SUBMITTALS

A. Submittals shall be made in accordance with the requirements specified in Contract Documents and the requirements of this Section.

B. Provide name, address, and phone numbers of all subcontractors.

C. The Contractor shall submit a Dewatering Best Management Practices (BMP) Plan prior to the start of excavation expected to include dewatering operations. The Plan shall provide detailed descriptions of dewatering procedures to be utilized to meet the requirements of this Section. Methodologies to control dewatering discharge contamination include, but are not limited to:

1. Holding tanks of adequate size and volume.

2. Wellpoint systems.

3. Sump pumping systems.

4. Chemical precipitation of particulates.

5. Filter systems and siltation controls.

6. Outfall booms.

D. The Contractor shall provide a Site Health and Safety Plan and Activity Hazard Analysis (AHA) for contaminated soil as specified in the Contract Documents and/or groundwater as specified in this Section, to include the following:

1. A written description of the proposed method for temporary stockpiling, transportation, and disposal of all wastes.

2. Copy of permits of disposal facilities.

3. Certification of disposal of all wastes.

4. Directions to the nearest hospital and phone number.

5. Emergency contact phone numbers.

6. Laboratory analyses and sampling plan required for transportation and disposal of all wastes in accordance with applicable federal, state, and local requirements.

E. Upon Completion of Remediation Activities, the following shall be provided:

1. Copy of manifests for all wastes leaving the site.

2. Copy of the laboratory analyses results from all sampling activities.

3. Copy of closure reports that may be required.

3.03 SURFACE WATER CONTROL

A. Remove surface runoff controls when no longer needed.

B. Seal off or berm catch basins in the area of construction to prevent discharge of untreated dewatering effluent or runoff from unstabilized construction areas into storm drains.

C. All drain inlets or catch basins used for dewatering discharge shall be provided with silt and sediment removal barriers as approved by the Engineer.

1. All barriers shall be cleaned regularly to avoid sediment discharge into the storm drain system.

2. Construction activities will be stopped at no cost to the City until sediment controls are properly maintained, installed, and in compliance with the dewatering permit.

3. All barriers shall be removed upon issuance of a hurricane warning.

3.04 DEWATERING SYSTEMS

A. Design, furnish, and install, operate, and maintain a dewatering system of sufficient size and capacity to permit excavation and subsequent construction activities in water-free conditions, and to lower and maintain the excavation area groundwater level a minimum of 2 feet below the lowest point of excavation. The dewatering system shall be designed and operated such that the system continuously maintains excavations water levels so as to maintain the excavation water level in order to allow for the initiation and completion of excavation backfill compaction and restoration activities.

B. Dewatering systems shall include, but is not limited to, furnishing and installing wells or well points, and or other equipment and appurtenances as may be necessary, including system components or equipment, installed outside the outermost perimeter of the excavation limits, and sufficiently below lowest point of excavation, to maintain the specified or required groundwater elevation.

C. Open trench pumping maybe permitted upon the approval of the Engineer.

D. Design and Operate Dewatering Systems:

1. To prevent loss of ground as water is removed.

2. To avoid inducing settlement or damage to existing facilities, completed Work, or adjacent property.

3. Avoid surface water pollution or discharge of sediment to storm drain systems or waterways.

E. Provide supplemental ditches and sumps only as necessary to collect water from local seeps. Do not use ditches and sumps as primary means of dewatering. The Contractor shall not direct any flow of water over pavement surfaces. Discharge of water shall be conducted as approved by the local, state, and federal agencies and the Engineer.

F. Provide controls to prevent surface water from entering excavation pits, trenches, or stockpiled materials.

3.05 PIPELINES CONSTRUCTED UNDER WATER

A. In the event that it is found that the water in a trench cannot be lowered by ordinary means, i.e., well points and pumps, an alternate construction method may be proposed by the Contractor. Complete details, specifications, manufacturer's descriptive literature, installation lists and any other pertinent data regarding the proposed alternate method shall be submitted as an alternate by the Contractor to the City within 5 calendar days of the time that the Contractor anticipates using such alternate method.

B. If the City approves the alternate method in writing, it may be used, so long as the Work is performed in a manner which, in the opinion of the Engineer, conforms to the method and procedure as set forth in the information supplied by the Contractor in his original application for use of an alternate method. The City may revoke approval of the alternate method if at any time, in his opinion, the Work is not conforming to any applicable portion of these Specifications.

C. No pipeline shall be laid under water without approval of the City.

D. If the dewatering system is eliminated or the effort reduced, and the pipe is laid underwater, additional pipe zone material will be required as backfill to the water table elevation, or to the level it was reduced to.

3.06 DISPOSAL OF WATER

A. All water generated, pumped, or removed from excavations as a result of excavation dewatering activities shall be collected, containerized, and managed prior to discharge and or treatment at an approved discharge point or facility, in accordance with Broward County Code of Regulation, Sections 27. Contractor shall secure, obtain, and pay for all necessary local, state, and federal permits, licenses, fees, and or approvals to discharge water or perform onsite or offsite treatment and disposal. Treat water collected by dewatering operations as required by regulatory agencies, prior to discharge.

B. Discharge water as permitted, and in regulatory compliance with Contractor obtained discharge permits/licenses.

1. All discharge activities shall be performed so as to prevent silt and sediment discharge and eliminate any soil erosion or flooding, or otherwise damage existing facilities, completed Work, or adjacent property.

2. Maximum allowable turbidity of discharges to surface waters or storm drains will be 10 NTU’s or the maximum permitted by the agency having jurisdiction, whichever is less.

3. Sump discharges cannot be discharged directly to storm drains or surface waters without treatment.

C. Affected storm sewer outfalls shall be protected with floating silt booms as approved by the Broward County Department of Environmental Protection and Growth Management Division (BCEPGMD) and the Engineer. All accumulated debris resulting from the dewatering discharge collecting in the boom shall be removed on a daily basis.

D. Visible silt plumes emanating from the area around the outfalls will be considered a failure of the silt and sediment removal measures and may result in a Notice of Violation issued by BCEPGMD. The Contractor will be responsible for all fines associated with the violation of the dewatering permit conditions issued to the Contractor.

E. Failure to control dewatering discharges as described above and as detailed in the Florida Erosion and Sediment Control Inspector’s Manual, may result in an order to cease dewatering operations until the discharge problems are corrected. No claims will be accepted for costs or delays associated with unacceptable dewatering discharge practices.

3.07 WELL POINT REMOVAL

A. Well point holes shall be filled with sand which shall be washed into the hole.

B. Well point holes located within asphalt pavement surfaces or concrete pavements, shall be filled with sand to the subgrade. The remaining hole shall be filled with nonshrink grout.

3.08 CONTAMINATED GROUNDWATER AND DISPOSAL REQUIREMENTS

A. If Contractor suspects, witnesses, or identifies, groundwater contamination at any time during the performance of the Work, Contractor shall notify the City immediately. Results will be obtained by the onsite mobile laboratory.

B. If analytical testing documents and indicates elevated concentrations above FDEP action levels (Chapter 62-777, Florida Administrative Code) dewatering operations will be suspended until appropriate treatment and or construction measures can be implemented. Contractor shall not resume operations until notified to do so in writing by the City and construction of the remaining pipelines in that area will be installed in the wet or normal construction activities shall be resumed in other areas determined by the Engineer. There shall be no delay or mobilization claim associated with moving to another project area, unless all other Work has been completed. In addition, the local agency will be immediately notified via telephone and in writing by the Contractor. Dewatering activities in the area will not proceed until review of the matter with the local agency is resolved and written authorization is issued.

C. The Contractor shall submit a dewatering plan to the City for review. The Contractor is advised that the SFWMD, FDOT, BCEPGMD, etc. may require that a dewatering plan, prepared by a state of Florida licensed Professional Engineer or registered Professional Geologist, be submitted and approved prior to issuance of a dewatering permit. The Contractor will retain a state of Florida licensed Professional Engineer or registered Professional Geologist to provide an initial report of potential dewatering issues in the site vicinity. The Contractor shall retain a state of Florida licensed Professional Engineer or registered Professional Geologist to provide any additional services required by regulatory agencies regarding dewatering and contaminated sites.

D. The Contractor is advised that the BCEPGMD may have identified contaminated sites within ¼ mile radius of the project site. The Contractor may be required to provide testing and monitoring of the dewatering operations, and to institute dewatering methods and controls, as required by BCEPGMD, SFWMD, FDOT etc. The contractor will be responsible for all costs associated with means and methods of dewatering which will be set forth by dewatering permits.

E. Treatment of the groundwater will include three options depending on the magnitude of the contamination in the trench or as determined by the Engineer: Granular Activated Carbon (GAC) Treatment Vessels, Mobile Air Stripping Units, or Vacuum Truck Removal and Disposal or other method as approved by the Engineer. The Contractor will provide a submittal list of all qualified groundwater remediation subcontractors for GAC vessel treatment/portable air stripping unit and vacuum truck disposal including phone numbers, contact names, and addresses prior to start of construction. The selected groundwater treatment/recycling facility for hauling contaminated groundwater shall also be identified.

F. If contaminated groundwater in the dewatering trench is encountered, the remediation operations will begin once local agency approval is obtained. Contaminated water will be disposed first into a high volume holding (FRAC) tank and then treated through a GAC unit/portable air stripper or recovered into vacuum hauling trucks for disposal.

G. Effluent water from the treatment system will be analyzed by the onsite mobile laboratory to confirm that concentrations are below regulatory limits. Effluent water will then be directed to a pre-approved alternative location as determined by local agency and/or the Engineer.

- END OF SECTION -

SECTION 02300

EARTHWORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1 - General Requirements shall govern the WORK under this Section.

1.02 WORK INCLUDED

A. Provide all labor, materials, necessary equipment and services to complete the Earthwork, as indicated on the DRAWINGS, as specified herein or both, except as for items specifically indicated as "Not in Contract (N.I.C.) ITEMS"

B. Including but not necessarily limited to the following:

1. Excavation, including demucking.

2. Backfilling.

3. Filling.

4. Grading, general site and building pads.

5. Compaction.

6. Coordination with ENGINEER for offsite disposal of all excess materials and stock piling of suitable materials to be used as fill or backfill.

C. Cutting, proof rolling, filling and grading to required lines, dimensions, contours and elevations for proposed improvements as shown and implied on the DRAWINGS and required by these specifications.

D. Scarifying, compaction, moisture content conditioning and control, and removal of unsuitable material to ensure proper preparation of areas for the proposed improvements.

E. Undertake any special construction procedures for the site recommended in the geotechnical report for preparation of building and pavement areas.

F. There shall be no classification of excavation for measurement of payment regardless of materials encountered.

G. The WORK of this Section includes all earthwork required for construction of the WORK. Such earthwork shall include, but not be limited to, the loosening, removing, loading, transporting, depositing, and compacting in its final location of all materials wet and dry, as required for the purposes of completing the WORK specified in the Contract Documents, which shall include, but not be limited to, the furnishing, placing, and removing of sheeting and bracing necessary to safely support the sides of all excavation; all pumping, ditching, draining, and other required measures for the removal or exclusion of water from the

excavation; the supporting of structures above and below the ground; all backfilling around structures and all backfilling of trenches and pits; the disposal of excess excavated materials; borrow of materials to makeup deficiencies for fills; and all other incidental earthwork, all in accordance with the requirement of the Contract Documents.

1.03 RELATED WORK

A. All applicable sections of Technical Specifications.

1.04 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. Codes: All codes, as referenced herein, are specified in Section 01420, "Reference Standards".

B. American Society for Testing and Materials (ASTM) – latest edition

1. ASTM D 422 - Method for Particle-Size Analysis of Soils.

2. ASTM D 698 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, using 5.5-lb (2.49-kg) Rammer and 12-in (304.8- mm) Drop.

3. ASTM D 1556 - Test Method for Density of Soil in Place by the Sand Cone Method.

4. ASTM D 1557 - Test Methods for Moisture-Density Relations of Soils and Soil Aggregate Mixtures Using 10-lb (4.54-kg) Rammer and 18-in (457- mm) Drop.

5. ASTM D 1633 - Test Method for Compressive Strength of Molded Soil-Cement Cylinders.

6. ASTM D 2216 - Laboratory Determination of Moisture content of Soil.

7. ASTM D 2419 - Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

8. ASTM D 2487 - Classification of Soils for Engineering Purposes.

9. ASTM D 2901 - Test Method for Cement Content of Freshly-Mixed Soil-Cement.

10. ASTM D 2922 - Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).

11. ASTM D 3017 - Test for Water Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)

12. ASTM D 4253 - Test Methods for Maximum Index Density of Soils Using a Vibratory Table.

13. ASTM D 4254 - Test Methods for Minimum Index Density of Soils and Calculation of Relative Density.

14. ASTM D 4318 - Test for Plastic Limit, Liquid Limit, and Plasticity Index of Soils

15. ASTM D 4429 - Standard Test Method for CBR (California Bearing Ratio) of Soils in

Place

C. American Association of State Highway and Transportation Officials (AASHTO) - latest edition

1. T 88 Particle Size Analysis of Soils

1.05 SUBSOIL INFORMATION

A. Refer to Section 02210 - Subsurface Investigation.

1.06 SITE INSPECTION

A. The CONTRACTOR shall visit the site and acquaint themselves with all existing conditions. Make their own subsurface investigation to satisfy themselves as to site and subsurface conditions, but such subsurface investigations shall be performed only under time schedules and arrangements approved in advance by the CITY and ENGINEER.

1.07 TOPOGRAPHIC INFORMATION

A. The existing grades shown on the DRAWINGS are approximate only and no representation is made as to their accuracy or consistency. The CONTRACTOR shall verify all existing grades to the extent necessary to insure completion of the job to the proposed grades indicated on the DRAWINGS.

1.08 DISPOSAL OF SURPLUS OR UNSUITABLE MATERIAL

A. Unsuitable material encountered during the course of construction shall be removed from the construction site at the expense of the CONTRACTOR. Unsuitable material shall not be stockpiled on-site. All suitable material shall be stockpiled at areas approved by the ENGINEER.

1.09 BENCHMARKS AND MONUMENTS

A. CONTRACTOR shall employ a registered Professional Surveyor and Mapper to lay out lines and grades as indicated. Benchmarks shall be established by a Professional Surveyor and Mapper registered in the State of Florida. Benchmarks shall be permanent and easily accessible and maintained and replaced if disturbed or destroyed. All benchmarks shall be North American Vertical Datum 1988 (NAVD).

1.10 UTILITIES

A. Before starting site operations, disconnect or arrange for the disconnection of all utility services designated to be removed.

B. Locate all existing active utility lines traversing the site and determine the requirements for their protection. Preserve in operating condition all active utilities adjacent to or traversing the site and/or designated to remain.

C. Observe rules and regulations governing respective utilities in working under requirements of this section. Adequately protect utilities from damage, remove or replace as indicated, specified or required. Remove, plug or cap inactive or abandoned utilities encountered in

excavation. Record location of all utilities.

1.11 QUALITY ASSURANCE

A. A geotechnical engineer may be retained by the CITY to observe performance of WORK in connection with excavating, filling, grading, and compaction. This inspection will not relieve the CONTRACTOR from responsibility to complete the WORK in accordance with the DRAWINGS and specifications. The CONTRACTOR shall re-adjust all WORK performed that does not meet technical or design requirements but make no deviations from the Contract documents without specific and written acceptance of the ENGINEER.

B. Visual field confirmation and density testing of subgrade preparation and fill placement procedures shall be performed by the field geotechnical engineer as part of the construction testing requirements. The CONTRACTOR shall be informed as soon as possible of the test results.

C. The ENGINEER shall prepare field reports that indicate compaction test location, elevation data, testing results and acceptability. The CITY and CONTRACTOR shall be provided with written copies of the results within 24 hours of time test was performed.

D. All costs related to reinspection, due to failures, shall be paid for by the CONTRACTOR at no additional expense to CITY. The CITY reserves the right to direct any inspection that is deemed necessary. CONTRACTOR shall provide free access to site for inspection activities.

E. Where soil material is required to be compacted to a percentage of maximum density, the maximum density at optimum moisture content will be determined in accordance with ASTM D 1557. Where cohesionless, free draining soil material is required to be compacted to a percentage of relative density, the calculation of relative density will be determined in accordance with ASTM D 4253 and D 4254. Field density in-place tests will be performed in accordance with ASTM D 1556, ASTM D 2922, or by such other means acceptable to the ENGINEER.

F. In case the tests of the fill or backfill show non-compliance with the required density, the CONTRACTOR shall accomplish such remedy as may be required to insure compliance. Subsequent testing to show compliance shall be by a testing laboratory selected by the CITY and shall be at the CONTRACTOR's expense.

G. Particle size analysis of soils and aggregates will be performed using ASTM D 422.

H. Determination of sand equivalent value will be performed using ASTM D 2419.

I. Unified Soil Classification System: References in these specifications are to soil classification types and standards set forth in ASTM D 2487. The CONTRACTOR shall be bound by all applicable provisions of said ASTM D 2487 in the interpretation of soil classifications.

J. Comply with requirements of all applicable building codes and other public agencies having jurisdiction upon the WORK.

1.12 SUBMITTALS

A. Within 10 days after Notice to Proceed (NTP), the CONTRACTOR shall submit to the CITY, a schedule detailing the sequence, and time of completion of all phases of WORK under this section.

B. At least 2 weeks in advance of imported fill use, the CONTRACTOR shall submit the following laboratory test data to the ENGINEER for each type of imported soil/gravel material to be used as compacted fill.

1. Moisture and Density Relationship - ASTM D1557 or D698 as required by project geotechnical engineering study;

2. Mechanical Analysis - AASHTO T-88; and,

3. Plasticity Index - ASTM D 4318.

C. Together with the above test data, the CONTRACTOR shall submit a 5-pound sample of each type of off-site fill material in an air tight container for the approval of the ENGINEER and CITY.

D. Submit the name of each material supplier and specific type and source of each material. Any change in source or soil type throughout the job requires approval of the CITY and the ENGINEER.

PART 2 - PRODUCTS

2.01 SUITABLE FILL AND BACKFILL MATERIAL REQUIREMENTS

A. General: Fill, backfill, and embankment materials shall be suitable selected or processed clean, fine earth, rock, or sand, free from grass, roots, brush, or other vegetation.

B. Fill and backfill materials to be placed within 6 inches of any structure or pipe shall be free of rocks or unbroken masses of earth materials having a maximum dimension larger than 2 inches.

C. Suitable Materials: Soils not classified as unsuitable as defined in Paragraph entitled, "Unsuitable Material" herein, are defined as suitable materials and may be used in fills, backfilling, and embankment construction subject to the specified limitations. In addition, when acceptable to the ENGINEER, some of the material listed as unsuitable may be used when thoroughly mixed with suitable material to form a stable composite.

D. Suitable materials may be obtained from on-site excavations, may be processed on-site materials, or may be imported. If imported materials are required to meet the requirements of this Section or to meet the quantity requirements of the project the CONTRACTOR shall provide the imported materials at no additional expense to the CITY, unless a unit price item is included for imported materials in the bidding schedule.

E. On-site fill

1. On-site materials for use as fill shall consist of excavated soil from other portions of

the site;

2. The CONTRACTOR shall use the on-site soil judiciously to facilitate the construction schedule including the use of the most readily compactable soil for fill in building areas and as fill within 2 feet of pavement subgrade;

3. Topsoil shall not be utilized as engineered fill;

4. Excavated material containing rock, stone or masonry debris smaller than 2 feet in its largest dimension, may be mixed with suitable material and utilized up to 3 feet below proposed subgrade;

5. Excavated material containing rock, stone or masonry debris smaller than 6 inches in its largest dimension may be mixed with suitable material and utilized up to 18 inches below proposed subgrade;

6. No material greater than 2 inches in its largest dimension may be utilized within 18 inches of proposed subgrade;

7. No material greater than 2 inches in its largest dimension may be utilized as backfill for storm drainage or utility trenches.

8. Prior to placement, on-site material to be used as fill shall not contain:

   a. Debris other than crushed concrete and brick meeting the above requirements.

   b. Timber or railroad ties.

   c. Other deleterious materials such as steel rails, rebar, trash, etc.

   d. Hazardous material - Unsuitable and deleterious materials and debris shall be disposed of off-site in accordance with all applicable regulations.

F. Off-site imported fill

1. If necessary, off-site fill shall be obtained and provided by the CONTRACTOR;

2. Fill shall be clean, well graded granular soil which is non-expansive and non-collapsible and shall have less than 20% by weight passing the #200 sieve. The portion passing the #200 shall be non-plastic.

3. Fill with less fines (less than #200) may be required on project specific basis and as required by ENGINEER. Likewise, fill with more than 20% fines may be acceptable on a project specific basis or as identified in a geotechnical engineering study;

4. Imported fill shall be free of all hazardous substances. Certification of compliance and, if requested, test results substantiating compliance shall be furnished to the CITY and ENGINEER by the CONTRACTOR not less than one week prior to its intended use;

5. The CITY reserves the right to test off-site fill material for conformance with these specifications; and,

6. The CONTRACTOR shall be responsible for all permits and regulatory requirements associated with offsite borrow sources.

G. The following types of suitable materials are designated and defined as follows:

1. Type 1 (one inch minus granular backfill): Crushed rock, gravel, or sand with 100 percent passing a 1-inch sieve and a sand equivalent value not less than 50.

2. Type 2 (one half inch minus granular backfill): Crushed rock, gravel, or sand with 100 percent passing a 1/2-inch sieve and a sand equivalent value not less than 50.

3. Type 3 (sand backfill): Sand with 100 percent passing a 3/8-inch sieve, at least 90 percent passing a number 4 sieve, and a sand equivalent value not less than 30.

4. Type 4 (coarse rock backfill): Crushed rock or gravel with 100 percent passing a 1-inch sieve and not more than 10 percent passing a Number 4 sieve.

5. Type 5 (pea gravel backfill - ASTM #89): Crushed rock or gravel with 100 percent passing a 1/2-inch sieve, 90 percent passing a Number 8 sieve and not more than 10 percent passing a Number 4 sieve.

6. Type 6 (coarse drainrock - ASTM #4): Crushed rock or gravel meeting the following gradation requirements:

Sieve Size	Percentage Passing
2-inch	100
1 1/2-inch	90 - 100
1-inch	20 - 55
3/4-inch	0 - 15
No. 200	0-3

7. Type 7 (graded drainrock): Crushed rock or gravel, durable and free from slaking or decomposition under the action of alternate wetting or drying. The material shall be uniformly graded and shall meet the following gradation requirements.

Sieve Size	Percentage Passing
1-inch	100
3/4-inch	90 - 100
3/8-inch	40 - 100
No. 4	25 - 40
No. 8	18 - 33
No. 30	5 - 15
No. 50	0 - 7
No. 200	0 - 3

8. The drainrock shall have a sand equivalent value not less than 75. The finish graded

surface of the drainrock immediately beneath hydraulic structures shall be stabilized to provide a firm, smooth surface upon which to construct reinforced concrete floor slabs.

9. Type 8 (Ballast Rock / ¾ inch Rock): Crushed rock or gravel, durable and free from slaking or decomposition under the action of alternate wetting or drying. The material shall be uniformly graded and shall meet the following gradation requirements.

Sieve Size	Percentage Passing
1-inch	100
3/4-inch	40 - 60
No. 4	0 - 3
No. 8	0 - 3

10. Type 9: (Bedding rock - ASTM #67): Well graded crushed rock or gravel meeting the following gradation:

Sieve Size	Percentage Passing
1-inch	100
3/4-inch	98 - 100
1/2-inch	55 - 70
3/8-inc	30 - 40
No. 4	0 - 6

11. Type 10 (Class I crushed stone - ASTM #57): Manufactured angular, granular crushed stone, rock, or slag, with 100 percent passing a 1-inch sieve and less than 5 percent passing a Number 4 sieve.

12. Type 11 (aggregate base): Crushed rock aggregate base material of such nature that it can be compacted readily by watering and rolling to form a firm, stable base for pavements. At the option of the CONTRACTOR, the grading for either the 1-1/2-inch maximum size or 3/4-inch maximum size shall be used. The sand equivalent value shall be not less than 22, and the material shall meet the following gradation requirements.

Sieve Size	1-1/2-inch Max. 3/4-inch Max.	Percentage Passing
2-inch	100	--
1-1/2-inch	90 – 100	-
1-inch	--	100
3/4-inch	50 - 85	90 - 100
No. 4	25 - 45	35 - 55
No. 30	10 - 25	10 - 30
No. 200	2 - 9	2 - 9

13. Type 12 (aggregate subbase): Crushed rock aggregate subbase material that can be compacted readily by watering and rolling to form a firm stable base. The sand equivalent value shall be not less than 18 and shall meet the following gradation requirements.

Sieve Size	Percentage Passing
3-inch	100
2 1/2-inch	87 - 100
No. 4	35 - 95
No. 200	0 - 29

14. Type 13 (cement-treated backfill): Material which consists of Type 7 material, or any mixture of Types B, C, G and H materials which has been cement-treated so that the cement content of the material is not less than 5 percent by weight when tested in accordance with ASTM D 2901. The ultimate compressive strength at 28 days shall be not less than 400 psi when tested in accordance with ASTM D 1633.

15. Type 14 (topsoil): Stockpiled topsoil material which has been obtained at the site by removing soil to a depth not exceeding 2 feet. Removal of the topsoil shall be done after the area has been stripped of vegetation and debris as specified.

16. Type 15 (trench plug): Low permeable fill material, a nondispersible clay material having a minimum plasticity index of 10.

H. If approved by the ENGINEER, any bituminous concrete on the site shall be milled/removed prior to placing any fill and shall be reused only onsite immediately below the pavement stone base course.

2.02 UNSUITABLE MATERIAL

A. Unsuitable soils for fill material shall include soils which, when classified under ASTM D 2487, fall in the classifications of Pt, OH, CH, MH or OL.

B. In addition, any soil which cannot be compacted sufficiently to achieve the percentage of maximum density specified for the intended use shall be classed as unsuitable material.

2.03 USE OF FILL, BACKFILL, AND EMBANKMENT MATERIAL TYPES

A. The CONTRACTOR shall use the types of materials as designated herein for all required fill, backfill, and embankment construction hereunder.

B. Where these Specifications conflict with the requirements of any local agency having jurisdiction, or with the requirements of a material manufacturer, the ENGINEER shall be immediately notified. In case of conflict therewith, the CONTRACTOR shall use the most stringent requirement, as determined by the ENGINEER.

C. Fill and backfill types shall be used in accordance with the following provisions:

1. Embankment fills shall be constructed of any mixture of Type 1 through Type 11 materials.

2. Pipe zone backfill, as defined under Paragraph 3.15 "Pipe and Utility Trench Backfill" herein, shall consist of the following materials for each pipe material listed below. Where pipelines are installed on grades exceeding 4 percent, and where backfill materials are graded such that there is less than 10 percent passing a Number 4 sieve, trench plugs of Type 13 or 14 materials shall be provided at maximum intervals of 200 feet or as shown on the DRAWINGS.

    a. Mortar coated pipe, concrete pipe, and uncoated ductile iron pipe shall be provided Type 1, 2, 3, 4, 5, 9 or 10 pipe zone backfill materials.

    b. Coal tar enamel coated pipe, polyethylene encased pipe, tape wrapped pipe, and other non-mortar coated pipe shall be backfilled with Type 3 pipe zone backfill material.

    c. Plastic pipe and vitrified clay pipe shall be backfilled with Type 9 or 10 pipe zone backfill material.

3. Trench zone backfill for pipelines as defined under Paragraph 3.15 "Pipe and Utility Trench Backfill" shall be or any of Types 1 through 11 backfill materials or any mixture thereof, except that Type K material may be used for trench zone backfill in agricultural areas unless otherwise shown or specified.

4. Final backfill material for pipelines under paved area, as defined under Paragraph 3.15 "Pipe and Utility Trench Backfill" shall be Type 11 backfill material. Final backfill under areas not paved shall be the same material as that used for trench backfill, except that Type K material shall be used for final backfill in agricultural areas unless otherwise shown or specified.

5. Trench backfill and final backfill for pipelines under structures shall be the same material as used in the pipe zone, except where concrete encasement is required by the Contract Documents.

6. Aggregate base materials under pavements shall be Type 11 material constructed to the thicknesses shown or specified. Where specified or shown, aggregate subbase shall be Type 12 Material.

7. Backfill around structures shall be or Types 1 through Type 11 materials, or any mixture thereof.

8. Backfill materials beneath structures shall be as follows:

9. Drainrock materials under hydraulic structures or other water retaining structure with underdrain systems shall be Type 7 or Type 8 material.

10. Under concrete hydraulic structures or other water retaining structures without underdrain systems, Types 7, 8 or 11 materials shall be used.

11. Under structures where groundwater must be removed to allow placement of concrete, Type 6 material shall be used.

12. Under all other structures, Type 4, 5, 6, 7, 8, 9 or 11 material shall be used.

13. Backfill used to replace pipeline trench over-excavation shall be a layer of Type 6, 7, 8, 9 or 10 materials. This backfill material shall be wrapped with filter fabric to prevent migration of fines for wet trench conditions. The same material as used for the pipe zone backfill may be used if the trench conditions are not wet. Filter fabric shall be Mirafi 140 N, Mirafi 700 X, or equal.

14. The top 6 inches of fill on reservoir roofs, embankment fills around hydraulic structures, and all other embankment fills shall consist of Type 14 material, topsoil.

2.04 EMBANKMENT

A. The maximum sizes of rock which will be permitted in the completed fill areas are as follows:

Depth Below Finish Grade	Maximum Allowable Diameter
Top 4-inches	1-inch
4-inches to 12-inches	3-1/2-inches
12-inches to 2-feet	6-inches
2-feet to 4-feet	12-inches
4-feet to 8-feet	24-inches
Below 8-feet	36-inches

B. Embankments shall be constructed of material containing no muck, stumps, roots, brush, vegetable matter, rubbish or other material that will not compact into a suitable and enduring roadbed, and material designated as undesirable shall be removed from the site. Where embankments are constructed adjacent to bridge end bents or abutments, rock larger than 3-1/2 inches in diameter shall not be placed within three feet of the location of any abutment.

C. Fill material containing debris, sod, biodegradable materials shall not be used as fill in construction areas.

D. Fill material required for the building pads and for pavement subgrade shall be granular fill, free of organic material.

E. Fill material required for pervious and sodded areas shall have a maximum organic component of 10%. CONTRACTOR shall provide, at without any cost to the CITY, organic content test results for approval by the ENGINEER.

2.05 EQUIPMENT

A. Compactor for mass earthwork shall be minimum 3 ton static drum weight vibratory roller or 5 ton static drum weight sheeps footed compactor as appropriate for the type of soil material at the site or other compactor approved by the ENGINEER.

B. Compactor for trenches and where access or maneuverability is limited use, a double drum walk behind roller or vibratory plate compactor or "jumping jack" tampers.

PART 3 - EXECUTION

3.01 GENERAL

A. Prior to bidding of all WORK within this section, the CONTRACTOR shall become thoroughly familiar with the geotechnical engineering study, if available, as well as the site, site conditions, and all portions of the WORK falling within this section.

B. The CONTRACTOR shall refer to the erosion control DRAWINGS, if provided, for staging of earthwork operations and for erosion control measures to be implemented prior to commencement of earthwork.

C. Locate and identify existing utilities that are to remain and protect them from damage.

D. Notify utility companies to allow removal and/or relocation of any utilities that are in conflict with the proposed improvements.

E. Protect fences, structures, sidewalks, paving, curbs, etc. to remain from equipment and vehicular traffic.

F. Protect benchmarks, property corners and all other survey monuments from damage or displacement. If a marker needs to be removed/relocated it shall be referenced by a licensed land surveyor and replaced, as necessary, by the same at no additional cost to the CITY.

G. Remove from the site, material encountered in grading operations that, in opinion of CITY or ENGINEER, is unsuitable or undesirable for backfilling in pavement or building areas as per Paragraph 2.01.

H. Identify required lines, levels, contours and datum to bring site grades to the proposed subgrade conditions inferred from the DRAWINGS.

I. Do not perform any WORK associated with this section prior to completion of all required inspections, tests and approvals.

J. When performing grading operations during periods of prolonged wet or dry weather, provide adequate measures for surface drainage and ground water control, and moisture control of soils (i.e., wetting or drying, scarify and discing) so as to place and compact the soil within the moisture content range a few percentage points of its optimum water content. Any disturbed areas should be proofrolled at the end of each day.

K. Sloping, shoring, bracing, and fencing shall be installed in accordance with Federal OSHA requirements as well as the requirements of all regulatory authorities having jurisdiction.

L. Allow no debris to accumulate on-site. Haul debris away from the site and dispose of at no cost to the CITY.

M. The CONTRACTOR shall remove and dispose of all excess excavated material at a site selected by the CONTRACTOR and reviewed by the ENGINEER.

3.02 JOB CONDITIONS

A. Protection: Use all means necessary to protect existing objects and vegetation. In the event of damage, immediately make all repairs, and replacements necessary to the acceptance of the ENGINEER at no cost to the CITY.

3.03 BACKFILL, FILLING & GRADING

A. Grades:

1. Cut, backfill, fill and grade to proper grade levels indicated. The proposed grades shown on the DRAWINGS are for establishing a finished grade over the site.

B. Filling:

1. Fill material shall be placed in horizontal layers and spread to obtain a uniform thickness.

2. After compaction, layers of fill are not to exceed twelve (12) inches for cohesive soils or eight (8) inches for noncohesive soils.

3.04 STRUCTURE, ROADWAY, AND EMBANKMENT EXCAVATION

A. General: Except when specifically provided to the contrary, excavation shall include the removal of all materials of whatever nature encountered, including all obstructions of any nature that would interfere with the proper execution and completion of the WORK. The removal of said materials shall conform to the lines and grades shown or ordered. Unless otherwise provided, the entire construction site shall be stripped of all vegetation and debris, and such material shall be removed from the site prior to performing any excavation or placing any fill. The CONTRACTOR shall furnish, place, and maintain all supports and shoring that may be required for the sides of the excavations, and all pumping, ditching, or other measure for the removal or exclusion of water, including taking care of storm water, groundwater, and wastewater reaching the site of the WORK from any source so as to prevent damage to the WORK or adjoining property. Excavations shall be sloped or otherwise supported in a safe manner in accordance with applicable State safety requirements and the requirements of OSHA Safety and Health Standards for Construction (29CFR1926).

B. Excavation Beneath Structures and Embankments: Except where otherwise specified for a particular structure or ordered by the ENGINEER, excavation shall be carried to the grade of the bottom of the footing or slab. Where shown or ordered, areas beneath structures or fills shall be over-excavated. The subgrade areas beneath embankments shall be excavated to remove not less than the top 6 inches of native material and where such subgrade is sloped, the native material shall be benched. When such over excavation is shown, both over-excavation and subsequent backfill to the required grade shall be performed by the CONTRACTOR. When such over-excavation is not shown but is ordered by the ENGINEER, such over- excavation and any resulting backfill will be paid for under a separate unit price bid item if such bid item has been established; otherwise, payment will be made in accordance with a negotiated price. After the required excavation or over-excavation has been completed, the exposed surface shall be scarified to a depth of 6 inches, brought to optimum moisture content, and rolled with heavy compaction equipment

to obtain 98 percent of maximum density.

C. Excavation Beneath Paved Areas: Excavation under areas to be paved shall extend to the bottom of the aggregate base or subbase, if such base is called for; otherwise it shall extend to the paving thickness. After the required excavation has been completed, the top 12 inches of exposed surface shall be scarified, brought to optimum moisture content, and rolled with heavy compaction equipment to obtain 98 percent of maximum density. The finished subgrade shall be even, self-draining, and in conformance with the slope of the finished pavement. Areas that could accumulate standing water shall be regraded to provide a self-draining subgrade.

D. Notification of ENGINEER: The CONTRACTOR shall notify the ENGINEER at least 3 days in advance of completion of any structure excavation and shall allow the ENGINEER a review period of at least one day before the exposed foundation is scarified and compacted or is covered with backfill or with any construction materials.

3.05 PIPELINE AND UTILITY TRENCH EXCAVATION

A. General: Unless otherwise shown or ordered, excavation for pipelines and utilities shall be open-cut trenches. Trench widths shall be kept as narrow as is practical for the method of pipe zone densification selected by the CONTRACTOR, but shall have a minimum width at the bottom of the trench equal to the outside diameter of the pipe plus 24 inches for mechanical compaction methods and 18 inches for water consolidation methods. The maximum width at the top of the trench shall be equal to the outside diameter of the pipe plus 36 inches for pipe diameters 18 inches and larger and to the outside diameter of the pipe plus 24 inches for pipe diameters less than 18 inches, or as shown on the DRAWINGS.

B. Trench Bottom: Except when pipe bedding is required, the bottom of the trench shall be excavated uniformly to the grade of the bottom of the pipe. The trench bottom shall be given a final trim, using a string line for establishing grade, such that each pipe section when first laid will be continually in contact with the ground along the extreme bottom of the pipe. Rounding out the trench to form a cradle for the pipe will not be required. Excavations for pipe bells and welding shall be made as required.

C. Open Trench: The maximum amount of open trench permitted in any one location shall be determined by FDOT MOT approvals. All trenches shall be fully backfilled at the end of each day. The above requirements for backfilling will be waived in cases where the trench is located further than 100 feet from any traveled roadway or occupied structure. In such cases, however, barricades meeting OSHA requirements shall be provided and maintained. Requirements of Section 01550, paragraph 1.02B shall also apply.

D. Trench Over-Excavation: Where the DRAWINGS indicate that trenches shall be over-excavated, they shall be excavated to the depth shown, and then backfilled to the grade of the bottom of the pipe.

E. Over-Excavation: When ordered by the ENGINEER, whether indicated on the DRAWINGS or not, trenches shall be over-excavated beyond the depth shown. Such over-excavation shall be to the depth ordered. The trench shall then be backfilled to the grade of the bottom of the pipe. All WORK specified in this Section shall be performed by the CONTRACTOR when the over-excavation ordered by the ENGINEER is less than 6 inches below the limits shown.

When the over-excavation ordered by the ENGINEER is 6 inches or greater below the limits shown, additional payment will be made to the CONTRACTOR for that portion of the WORK which is located below said 6-inch distance. Said additional payment will be made under separate unit price bid items for over-excavation and bedding if such bid items have been established; otherwise payment will be made in accordance with a negotiated price.

F. Where pipelines are to be installed in embankment or structure fills, the fill shall be constructed to a level at least one foot above the top of the pipe before the trench is excavated.

3.06 OVER-EXCAVATION NOT ORDERED, SPECIFIED, OR SHOWN

A. Any over-excavation carried below the grade ordered, specified, or shown, shall be backfilled to the required grade with the specified material and compaction. Such WORK shall be performed by the CONTRACTOR at its own expense.

3.07 EXCAVATION IN LAWN AREAS

A. Where excavation occurs in lawn areas, the sod shall be carefully removed, kept damp, and stockpiled to preserve it for replacement. Excavated material may be placed on the lawn; provided that a drop cloth or other suitable method is employed to protect the lawn from damage. The lawn shall not remain covered for more than 72 hours. Immediately after completion of backfilling and testing of the pipeline, the sod shall be replaced and lightly rolled in a manner so as to restore the lawn as near as possible to its original condition. CONTRACTOR shall provide new sod if stockpiled sod has not been replaced within 72 hours.

3.08 EXCAVATION IN VICINITY OF TREES

A. Except where trees are shown to be removed, trees shall be protected from injury during construction operations. No tree roots over 2 inches in diameter shall be cut without express permission of the ENGINEER. Trees shall be supported during excavation by any means previously reviewed and approved by the ENGINEER.

3.09 ROCK EXCAVATION

A. Rock is defined as follows:

1. Rock shall be classified as material having a blow count in excess of 30 blows per foot from a Standard Penetration Test (ASTM D-1586) and exceeding 1000 psi from an Unconfined Compression Strength Test (ASTM D-2938); and,

2. General Excavation - Any material that cannot be excavated with a single-toothed ripper drawn by a crawler tractor having a minimum draw bar pull rated at not less than 71,000 lbs. (Caterpillar D9N or equivalent), and occupying an original volume of at least 2 cubic yards or more; and,

3. Trench Excavation - Any material that cannot be excavated with a backhoe having a break out force rated at not less than 44,000 pounds (Caterpillar 235D or equivalent), and occupying an original volume of at least 2 cubic yards.

B. Rock excavation shall include removal and disposal of the following: (1) all boulders measuring 1/3 of a cubic yard or more in volume; (2) all rock material in ledges, bedding deposits, and unstratified masses which cannot be removed without systematic drilling and blasting; (3) concrete or masonry structures which have been abandoned; and (4) conglomerate deposits which are so firmly cemented that they possess the characteristics of rock as described in Paragraph 3.09(A).

C. Said rock excavation shall be performed by the CONTRACTOR; provided, that should the quantity of rock excavation be affected by any change in the scope of the WORK, an appropriate adjustment of the contract price will be made under a separate bid item if such bid item has been established; otherwise payment will be made in accordance with a negotiated price.

D. Explosives and Blasting: Blasting will not be permitted, except by express permission of the ENGINEER on a case-by-case basis. The use of explosives will be subject to the approval and regulations of all agencies having jurisdiction. If blasting is utilized at the site of the WORK, the CONTRACTOR shall take all precautions and provide all protective measures necessary to prevent damage to property and structures or injury to person. Prior to blasting, the CONTRACTOR shall secure all permits required by law for blasting operations and shall provide any additional hazard insurance required by the CITY. The CONTRACTOR shall have a fully qualified and experienced blasting supervisor in charge of all blasting operations.

E. The CONTRACTOR will be held responsible for all and shall make good any damage caused by blasting or resulting from its possession or use of explosives on the WORK.

F. All operations involving the handling, storage, and use of explosives shall be conducted in accordance with the requirements of the OSHA Standards for Construction, and in accordance with all local laws and regulations.

3.10 DISPOSAL OF UNSUITABLE EXCAVATED MATERIAL

A. The CONTRACTOR shall remove and dispose of all unsuitable excavated material. This shall include muck, tree roots, rocks, garbage, debris, or any other material designated as unsuitable by Part 2 of this Section. Disposal shall be at a site selected by the CONTRACTOR that is designated as an approved disposal site for the unsuitable material.

3.11 BACKFILL - GENERAL

A. Backfill shall not be dropped directly upon any structure or pipe. Backfill shall not be placed around or upon any structure until the concrete has attained sufficient strength to withstand the loads imposed. Backfill around water retaining structures shall not be placed until the structures have been tested, and the structures shall be full of water while backfill is being placed.

B. Except for drainrock materials being placed in over-excavated areas or trenches, backfill shall be placed after all water is removed from the excavation.

3.12 PLACING AND SPREADING OF BACKFILL MATERIALS

A. Backfill materials shall be placed and spread evenly in layers. When compaction is achieved using mechanical equipment the layers shall be evenly spread so that when compacted each layer shall not exceed 6 inches in thickness.

B. During spreading each layer shall be thoroughly mixed as necessary to promote uniformity of material in each layer. Pipe zone backfill materials shall be manually spread, tamped, and haunched around the pipe so that when compacted the pipe zone backfill will provide uniform bearing and side support.

C. Where the backfill material moisture content is below the optimum moisture content water shall be added before or during spreading until the proper moisture content is achieved.

D. Where the backfill material moisture content is too high to permit the specified degree of compaction the material shall be dried until the moisture content is satisfactory.

3.13 COMPACTION - GENERAL

A. Compact each layer of fill in designated areas with approved equipment to achieve a maximum density at optimum moisture, AASHTO T 180 - latest edition.

1. Building Pads: compaction shall be to 98% of maximum density, unless otherwise shown on the DRAWINGS or specifications. Building pads shall be within plus or minus one-tenth (0.1) of a foot of the elevations shown on the plans.

2. Refer to Sections 02772 Asphaltic Concrete Paving for compaction requirements in the affected areas.

3. Under landscaped area, compaction shall be to 85% of maximum density, unless otherwise shown on the DRAWINGS.

B. No backfill shall be placed against any masonry or other exposed building surface until permission has been given by the ENGINEER and in no case until the masonry has been in place seven days.

C. Heavy construction equipment will not be permitted within ten (10) feet of any masonry or other exposed building surface.

D. Compaction in limited areas shall be obtained by the use of mechanical tampers or approved hand tampers. When hand tampers are used, the materials shall be deposited in layers not more than four inches thick. The hand tampers used shall be suitable for this purpose and shall have a face area of not more than 100 square inches. Special precautions shall be taken to prevent any wedging action against masonry, or other exposed building surfaces.

3.14 COMPACTION OF FILL, BACKFILL, AND EMBANKMENT MATERIALS

A. Each layer of Types 1, 2, 3, 7, 8, and 14 backfill materials as defined herein, where the material is graded such that at least 10% passes a No. 4 sieve, shall be mechanically compacted to the specified percentage of maximum density. Equipment that is consistently

capable of achieving the required degree of compaction shall be used and each layer shall be compacted over its entire area while the material is at the required moisture content.

B. Each layer of Type 4, 5, 6, and 13 backfill materials shall be compacted by means of at least 2 passes from a flat plate vibratory compactor. When such materials are used for pipe zone backfill, vibratory compaction shall be used at the top of the pipe zone or at vertical intervals of 24 inches, whichever is the least distance from the subgrade.

C. Type 9 and 10 material requires mechanical spreading and placement to fill voids but does not require mechanical compaction or vibration. Tamping shall be used in pipe zone areas.

D. Fill on structure roof slabs shall be deposited at least 30 days after the concrete roof slab has been placed. Equipment weighing more than 10,000 pounds when loaded shall not be used on a roof. A roller weighing not more than 8,000 pounds shall be used to compact fill on a roof.

E. Flooding, ponding, or jetting shall not be used for fill on roofs, backfill around structures, backfill around reservoir walls, for final backfill materials, or aggregate base materials.

F. Pipe zone backfill materials that are granular may be compacted by a combination of flooding and vibration using concrete vibrators or by jetting, when acceptable to the ENGINEER. Tamping shall be used to ensure adequate bedding in the pipe zone.

G. Pipeline trench zone backfill materials, containing 5% or less of material passing a No. 200 sieve, may be compacted using flooding and jetting or vibration if the CONTRACTOR uses effective procedures that yield the specified compaction test results. Flooding and jetting shall not be done in such a manner that the pipe or nearby utilities are damaged, in areas of poorly draining or expansive soils, or where the use of the procedure is prohibited by any agency having jurisdiction over the street or right-of-way. Approved jet pipes or immersible vibrators shall be used so that each backfill layer is saturated and consolidated to its full depth before the next layer is placed. Jet pipes shall be kept at least 6 inches away from the pipe where the backfills being consolidated and 2 feet away from other pipes or utilities.

H. Equipment weighing more than 10,000 pounds shall not be used closer to walls than a horizontal distance equal to the fill at that time. Hand operated power compaction equipment shall be used where use of heavier equipment is impractical or restricted due to weight limitations.

I. Compaction Requirements: The following compaction test requirements shall be in accordance with AASHTO T-180, T-99-C or ASTM D 2487 as applicable. Where agency or utility company requirements govern, the highest compaction standards shall apply.

Location or Use of Fill	Percentage of Maximum Density AASHTO T-180	Testing Frequency 1 per lift per
Pipe zone backfill portion above bedding for flexible pipe.	100	100 LF
Pipe zone backfill bedding and over-excavated zones under bedding/pipe for flexible pipe, including trench plugs.	100	100 LF
Pipe zone backfill portion above bedding for rigid pipe.	100	100 LF
Pipe zone backfill bedding and over-excavated zones under bedding/pipe for rigid pipe.	100	100 LF
Final backfill, beneath paved areas or structures.	100	10,000 SF
Final backfill, not beneath paved areas or structures.	95	20,000 SF
Trench zone backfill, not beneath paved areas or structures, including trench plugs.	95	100 LF
Embankments.	98	20,000 LF
Embankments, beneath paved areas or structures.	100	10,000 SF
Backfill beneath structures, hydraulic structures.	100	100 SF
Backfill around structures.	98	100 SF
Topsoil (type 14 material)	85	20,000 SF
Aggregate base or subbase (type 11or 12 material)	100	10,000 SF

J. Trench Backfill Requirements: the pipe has been structurally designed based upon the trench configuration specified herein.

K. The CONTRACTOR shall maintain the indicated trench cross section up to a horizontal plane lying 6 inches above the top of the pipe.

L. If, at any location under said horizontal plane, the CONTRACTOR slopes the trench walls or exceeds the maximum trench widths indicated in the Contract Documents, the pipe zone backfill shall be "improved" or the pipe class increased as specified herein, at no additional cost to the CITY. "Improved" backfill shall mean sand-cement backfill or other equivalent materials acceptable to the ENGINEER.

M. If the allowable deflection specified for the pipe is exceeded, the CONTRACTOR shall expose and reround or replace the pipe, repair all damaged lining and coating, and reinstall the pipe zone material and trench backfill as specified at no additional expense to the CITY.

3.15 PIPE AND UTILITY TRENCH BACKFILL

A. Pipe Zone Backfill: The pipe zone is defined as that portion of the vertical trench cross-section lying between a plane 6 inches below the bottom surface of the pipe, i.e., the trench subgrade, and a plane at a point 6 inches above the top surface of the pipe. The bedding for flexible pipe is defined as that portion of pipe zone backfill material between the trench subgrade and the bottom of the pipe. The bedding for rigid pipe is defined as that portion of the pipe zone backfill material between the trench subgrade and a level line which varies from the bottom of the pipe to the springline as shown.

B. Bedding shall be provided for all sewers, drainage pipelines, and other gravity flow pipelines. Unless otherwise specified or shown, for other pipelines the bedding may be omitted if all the following conditions exist.

1. The pipe bears on firm, undisturbed native soil which contains only particles that will pass a one-inch sieve.

2. The excavation is not through rock or stones.

3. The trench subgrade soils are classified as suitable fill and backfill materials per Paragraph 2.01.

4. The trench subgrade soils have, as a maximum, a moisture content that allows compaction.

C. Where bedding is required, after compacting the bedding the CONTRACTOR shall perform a final trim using a stringline for establishing grade, such that each pipe section when first laid will be continually in contact with the bedding along the extreme bottom of the pipe. Excavation for pipe bells and welding shall be made as required.

D. The pipe zone shall be backfilled with the specified backfill material. The pipe zone shall be well tamped per manufacturer's recommendation to prevent sags or settlement of the pipe. The CONTRACTOR shall exercise care to prevent damage to the pipeline coating, cathodic bonds, or the pipe itself during the installation and backfill operations.

E. Trench Zone Backfill: After the pipe zone backfill has been placed as specified above, and after all excess water has completely drained from the trench, backfilling of the trench zone may proceed. The trench zone is defined as that portion of the vertical trench cross-section lying between a plane 6 inches above the top surface of the pipe and a plane at a point 18 inches below the finished surface grade, or if the trench is under pavement, 18 inches below the roadway subgrade. If flooding, ponding, or jetting is used the pipe shall be filled with water to prevent flotation.

F. Final Backfill: Final backfill is all backfill in the trench cross-sectional area within 18 inches of finished grade, of if the trench is under pavement, all backfill within 18 inches of the roadway subgrade.

3.16 EMBANKMENT CONSTRUCTION

A. The area where an embankment is to be constructed shall be cleared of all vegetation, roots and foreign material. Following this, the surface shall be moistened, scarified to a

depth of 6 inches, and rolled or otherwise mechanically compacted. Embankment fill material shall be placed and spread evenly in approximately horizontal layers. Each layer shall be moistened or aerated, as necessary. Unless otherwise approved by the ENGINEER, each layer shall not exceed 6 inches of compacted thickness. The embankment fill and the scarified layer of underlying ground shall be compacted to 95% of maximum density under structures and paved areas, and 90% of maximum density elsewhere.

B. When an embankment fill is to be made and compacted against hillsides or fill slopes steeper than 4:1, the slopes of hillsides or fills shall be horizontally benched to key the embankment fill to the underlying ground. A minimum of 12 inches normal to the slope of the hillside or fill shall be removed and recompacted as the embankment fill is brought up in layers. Material thus cut shall be recompacted along with the new fill material at the CONTRACTOR's expense. Hillside of fill slopes 4:1 or flatter shall be prepared in accordance with Paragraph A, above.

C. Where embankment or structure fills are constructed over pipelines, the first 4 feet of fill over the pipe shall be constructed using light placement and compaction equipment that does not damage the pipe. Heavy construction equipment shall maintain a minimum distance from the edge of the trench equal to the depth of the trench until at least 4 feet of fill over the pipe has been completed.

3.17 COMPACTION OF SUBGRADE SURFACES

A. Any soft areas exhibiting excessive weaving or unsatisfactory material identified during excavation, fill placement, compaction and proof testing shall be removed, replaced with suitable fill, and compacted as specified.

B. Prior to preparing the subgrade in low lying areas, perform the following procedures:

1. Drain standing water by gravity or with a pump. Water should not be discharged directly to a storm drain system;

2. After drainage of low area is complete, remove mulch, mud, debris, and other unsuitable material using equipment and methods that will minimize disturbance to the underlying soils;

3. Thoroughly compact subgrade as specified.

4. If proposed for fill, all muck, mud and other materials removed from above low areas shall be dried on-site by spreading in thin layers for observation by CITY or ENGINEER. If, after observation by CITY material is found to be unsuitable, it shall be removed from the site.

3.18 UNDERCUT EXCAVATION

A. When approved by CITY and recommended by the ENGINEER, the CONTRACTOR may be required to remove natural soil materials in areas where fills are to be placed when determined to be undesirable in their location or condition. The CONTRACTOR shall be required to remove the undesirable material and backfill with approved material properly compacted.

B. At locations where unstable soil is shown on the DRAWINGS or identified within the geotechnical engineering study, the removal and replacement of such soil shall be as directed on the DRAWINGS or as directed by the ENGINEER and the CITY.

C. At locations where soil is wet of optimum moisture, the CONTRACTOR shall provide a "good faith" effort in drying and discing these areas prior to completing undercut excavation as approved by the ENGINEER and CITY.

D. Where undercutting is required adjacent or beneath the location of the proposed drainage structure, undercut and backfill shall be done over a sufficient distance adjacent to the installation to prevent future operations from disturbing the completed drainage structure.

E. All material removed in the WORK of undercut excavation will be classified by the geotechnical engineer and CITY as either suitable for other use without excessive manipulation and utilized by the CONTRACTOR elsewhere in the WORK, or unsuitable for future use and disposed of by the CONTRACTOR as directed by the ENGINEER.

F. The CONTRACTOR shall conduct undercut operations in such a way that the necessary measurements can be taken before any backfill is placed.

G. Backfill in undercut areas shall be placed as a continuous operation along with the undercutting operation. No backfill material shall be placed in water unless otherwise permitted by the ENGINEER.

3.19 EXCAVATION, FILL, AND SUBGRADE PREPARATION

A. General

1. The building limits shall be as identified on the construction DRAWINGS. The building subgrade shall be constructed to include a minimum of 10 feet beyond the building limits, or as directed by the CITY;

2. Structures include buildings, footings, foundations, retaining walls, embankment berms for storm water detention basins, slabs, tanks, curbs, mechanical and electrical appurtenances or other man-made stationary features constructed above or below the ground surface;

3. The building pad subgrade shall be prepared in strict accordance with the geotechnical engineering study and these specifications, whichever is more stringent; and,

4. The CONTRACTOR shall cut or fill to the proposed subgrade elevations based on finished grades and the pavement thicknesses as shown on the DRAWINGS. Subgrade elevations shall be constructed to within 0 to minus ½ inch of the proposed grades specified.

B. Excavation

1. Where existing grades are above proposed subgrade elevation, excavate materials in the building areas to line and grade as shown in the DRAWINGS being careful not to over excavate beyond the elevations needed for building subgrades;

2. Excavate organic soils from within the building area. Excavated on-site organic soils, which are unsuitable for building fill, may be used in landscaped areas. Otherwise this material shall be disposed of off-site;

3. Unsuitable material, such as wood and any other deleterious materials determined to be unsuitable by the geotechnical engineer for use as on-site fill, shall be disposed of offsite.

C. Subgrade Preparation for Fill

1. Existing grades below building areas shall be leveled prior to fill placement. The CONTRACTOR shall remove existing lawn and top soil in these areas prior to placement of any fill; and,

2. All existing grades below building areas shall be proofrolled and compacted per this section.

D. Fill Placement

1. No fill material shall be placed in areas of standing water, in areas of frozen or thawing ground, or in areas that have not been approved by the ENGINEER;

2. No fill materials shall be placed during unfavorable weather conditions. When WORK is interrupted by heavy rains, fill operations shall not be resumed until all saturated surficial soils are returned to satisfactory moisture content as determined by the ENGINEER;

3. Fill lift surfaces shall be made smooth and free from ruts or indentations at the end of any workday when precipitation is forecast to prevent saturation of surficial fill material. Fill surfaces shall be graded to drain and sealed with a smooth drum roller at the completion of each work day;

4. The fill shall be placed in uniform loose lifts not exceeding 12 inches and compacted in systemic method to achieve at least 6 passes of the compactor. Larger lift thickness, but no greater than 2 feet shall be permitted if broken rock is utilized and placed at least 6 feet below of finished grade;

5. Shot rock may be utilized as engineered fill as approved by the ENGINEER;

6. Each lift shall be compacted to the minimum densities listed in this section as appropriate for the project and as specified in the geotechnical engineering study;

7. The CONTRACTOR shall adjust the water content by aeration or adding water to achieve the required density. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to achieve proper compaction and facilitate the construction schedule;

8. Wet, saturated material shall be air dried as necessary to achieve the field densities specified in this Section. Removal and replacement shall not occur without prior approval or CITY. Removal and replacement shall be used if necessary to facilitate the construction schedule;

9. Remove areas of finished subgrade found to have insufficient compaction density of depth necessary and replace with suitable compacted fill as approved by the CITY or ENGINEER. Surface of subgrade after compaction shall be hard, uniform, smooth, stable, and true to grade and cross-section; and,

10. Fill placed on slopes greater than 1 vertical to 3 horizontal shall have each lift benched onto the slope at least 3 feet.

3.20 PROOFROLLING

A. The WORK covered by this subsection consists of furnishing and operating, proofrolling equipment at the direction of the ENGINEER.

B. Proofrolling shall be under the observation of the geotechnical engineer as described herein and under the following schedule:

1. Immediately following the completion of excavation to proposed subgrades in cut areas, proofrolling shall be performed as specified; and,

2. Immediately prior to and following stone base course placement, in pavement and building pad areas for final floor slab preparation, all subgrade and stone base areas shall be proofrolled. Any areas which deflect, rut or pump under the loaded dump truck shall be undercut and replaced with compacted fill material or stone base course as directed by the ENGINEER and approved by the CITY, at no additional cost to the CITY.

C. Proofrolling shall be done with 1 pass of a fully loaded tandem dump truck equal to or exceeding 50,000 pounds or other construction equipment if approved by the ENGINEER.

D. Construction methods shall be as follows:

1. After the subgrade or stone base course has been completed the subgrade or stone base course shall then be proofrolled. The coverage areas and methods will be identified by the ENGINEER;

2. The equipment shall be operated at a speed that the ENGINEER can comfortably and slowly walk alongside the equipment;

3. If it becomes necessary to take corrective action, such as but not limited to underdrain installation, undercut and backfill of an unsuitable material, and aeration of excessively wet material in areas that have been proofrolled, see Paragraph 3.18. These areas shall be proofrolled again following the completion of the necessary corrections. If the corrections are necessary due to the negligence of the CONTRACTOR, the corrective WORK and additional proofrolling shall be performed by the CONTRACTOR at no cost to the CITY;

4. The CONTRACTOR shall protect all structural facilities on the project, such as but not limited to box culverts, pipe culverts, and utilities, from damage by the proofrolling equipment.

3.21 MAINTENANCE OF SUBGRADE

A. Finished subgrades shall be verified by the CONTRACTOR to ensure proper elevation and conditions for construction above subgrade.

B. Protect subgrade from excessive construction traffic and wheel loading including concrete and dump trucks.

C. Remove areas of finished subgrade judged to be unsatisfactory to the depth necessary and replace in a manner that will comply with compaction requirements by use of material equal to or better than the best subgrade material on site. Surface of subgrade after compaction shall be hard, uniform, smooth, stable, and true to grade and cross-section.

3.22 CORRECTION OF GRADE

A. Bring to required grade levels areas where settlement, erosion or other grade changes occur.

3.23 MAINTENANCE AND PROTECTION OF WORK

A. While construction is in progress adequate drainage for the roadbed shall be maintained at all times.

B. The CONTRACTOR shall maintain all earthwork construction throughout the life of the contract, unless otherwise provided, and shall take all reasonable precautions to prevent loss of material from the roadway due to the action of wind or water. The CONTRACTOR shall repair without any additional expense to the CITY, except as otherwise provided herein, any slides, washouts, settlement, subsidence, or other mishap which may occur prior to final acceptance of the WORK.

C. All channels excavated as a part of the contract WORK shall be maintained against natural shoaling or other encroachments to the lines, grades, and cross sections shown on the plans, until final acceptance of the project.

3.24 AS-BUILT SURVEY

A. At the completion of the WORK and prior to final inspection of the area, the CONTRACTOR shall provide the ENGINEER with an as-built topographic survey made by a Florida Licensed Professional Surveyor & Mapper.

B. The Florida Licensed Professional Surveyor & Mapper is to certify on the survey whether or not the as-built conditions conform to the elevations shown on the DRAWINGS to within plus or minus one- tenth (0.1) of a foot.

3.25 MEASUREMENT AND PAYMENT

A. There shall be no special measurement or payment for the WORK under this section, it shall be included in the associated bid item for this WORK.

-END OF SECTION -

SECTION 02371
GEOTEXTILES

PART 1 - GENERAL

1.01 DEFINITIONS

A. Fabric: Geotextile, a permeable geosynthetic comprised solely of textiles.

B. Minimum Average Roll Value (MinARV): Minimum of series of average roll values representative of geotextile furnished.

C. Maximum Average Roll Value (MaxARV): Maximum of series of average roll values representative of geotextile furnished.

D. Nondestructive Sample: Sample representative of finished Work, prepared for testing without destruction of Work.

E. Overlap: Distance measured perpendicular from overlapping edge of one sheet to underlying edge of adjacent sheet.

F. Seam Efficiency: Ratio of tensile strength across seam to strength of intact geotextile, when tested according to ASTM D4884.

1.02 DELIVERY, STORAGE, AND HANDLING

A. Deliver each roll with sufficient information attached to identify it for inventory and quality control.

B. Handle products in manner that maintains undamaged condition.

C. Do not store products directly on ground. Ship and store geotextile with suitable wrapping for protection against moisture and ultraviolet exposure. Store geotextile in way that protects it from elements. If stored outdoors, elevate and protect geotextile with waterproof cover.

PART 2 - PRODUCTS

2.01 SUBMITTALS

A. Submittals shall be in accordance with Section 01300 – Submittals.

2.02 NONWOVEN GEOTEXTILE

A. Pervious sheet of polypropylene, or polyethylene fabricated into stable network of fibers that retain their relative position with respect to each other. Nonwoven geotextile shall be composed of continuous or discontinuous (staple) fibers held together through needle-punching, spun-bonding, thermal-bonding, or resin-bonding.

B. Geotextile Edges: Selvaged or otherwise finished to prevent outer material from pulling away from geotextile.

C. Unseamed Sheet Width: Minimum 6 feet.

D. Physical Properties: Conform to requirements in Table No. 1.

TABLE NO 1
PHYSICAL PROPERTY REQUIREMENTS FOR NONWOVEN GEOTEXTILE

Property	Requirement	Test Method
Water Permittivity	14 $sec.^{-1}$, MinARV	ASTM D4491 (Falling Head)
Air Permeability	200 cf/min/sq ft, MinARV	ASTM D737
Transmissivity, Planar Waterflow/Siphonage	0.5 ft^2/sec., MinARV	ASTM D4716
Apparent Opening Size (AOS)	30 U.S. Standard Sieve Size	ASTM D4751
Grab Tensile Strength, Machine Direction	400 lb/in, MinARV	ASTM D4632
Grab Elongation, Machine Direction	50 percent, MaxARV	
Puncture Strength	400 lb, MinARV	ASTM D4833
Trapezoid Tear Strength	400 lb, MinARV	ASTM D4533
Abrasion Resistance	20 percent loss, 250 cycles, MaxARV	ASTM D4886
Ultraviolet Radiation Resistance	80 percent strength retention, MinARV after 500 hours	ASTM D4355

PART 3 - EXECUTION

3.01 LAYING GEOTEXTILE

A. Lay and maintain geotextile smooth and free of tension, folds, wrinkles, or creases.3.02

3.02 SHEET ORIENTATION FOR SUBSURFACE DRAINAGE

A. Orient geotextile in the trench with the long dimension parallel to the trench.

B. The filter material shall not be dropped on the geotextile from heights greater than 3 feet.

3.03 JOINTS

A. Unseamed Joints:

1. Overlapped.

2. Overlap, unless otherwise shown:

a. Foundation/Subgrade Stabilization: Minimum 18 inches.

b. Riprap: Minimum 18 inches.

c. Other Applications: Minimum 12 inches.

3.04 INSTALLING GEOTEXTILE IN TRENCHES

A. Place geotextile in a way that will completely envelope granular drain material to be placed in trench and with specified overlap at joints. Overlap geotextile in direction of flow. Place geotextile in a way and with sufficient slack for geotextile to contact trench bottom and sides fully when trench is backfilled.

B. After granular drain material is placed to required grade, fold geotextile over top of granular drain material, unless otherwise shown. Maintain overlap until overlying fill or backfill is placed.

3.05 REPAIRING GEOTEXTILE

A. Repair or replace torn, punctured, flawed, deteriorated, or otherwise damaged geotextile.

B. Repair Procedure:

1. Place patch of undamaged geotextile over damaged area and at least 18 inches in all directions beyond damaged area.

2. Remove interfering material as necessary to expose damaged geotextile for repair.

3. Sew patches or secure them with heat fusion tacking or with pins and washers, as specified above in Article SECURING GEOTEXTILE, or by other means approved by Engineer.

3.06 REPLACING CONTAMINATED GEOTEXTILE

A. Protect geotextile from contamination that would interfere, in Engineer's opinion, with its intended function. Remove and replace contaminated geotextile with clean geotextile.

- END OF SECTION -

SECTION 02481

TREE RELOCATION AND PROTECTION

PART 1 – GENERAL

1.01 WORK TO BE PERFORMED AND WORK INCLUDED

A. Hire a Certified Landscape Architect and/or ISA Certified Arborist as necessary to prepare Tree Disposition, Relocation and Installation Plans as required to obtain all necessary permits with the limits of the City Right of Way.

B. Prepare and relocate trees and palms designated for relocation within the project boundaries, to include all aspects of preparation, relocation, protection, and maintenance.

C. Protection and care of existing trees and palms to remain within the project boundaries, to include all aspects of protection, pruning, fertilization, and watering.

D. Watering by water truck.

E. Follow up maintenance as required by these Specifications.

F. Labor, materials, equipment, and services to complete all preparation, relocations and protection work as shown on the Drawings, as specified herein, or both.

1.02 SUBMITTALS

A. Copy of all permits submitted for tree relocations and removals.

B. Verification of Qualifications: The Contractor shall provide a list of references and project list of a minimum of five (5) projects that the Contractor has successfully completed that are similar in scope and nature.

C. List of all equipment to be utilized during tree preparation and transplanting.

D. Literature on specified wetting agents, fertilizers, and soil conditioners.

1.03 APPLICABLE STANDARDS AND SPECIFICATIONS

A. Comply with the following standards and specifications for all materials, methods, and workmanship unless otherwise noted:

1. Codes and Standards of the American Association of Nurserymen.

2. Codes and Standards of the National Arborists Association.

3. Codes and Standards of the International Society of Arboriculturists.

1.04 PERMITS

A. The Contractor shall secure any permits required, including tree removal and tree relocation permits, in order to complete the work under this Section. Cost of permit fees

associated with tree removals and/or relocations shall be paid for under the “Permits Allowance” bid item.

1.05 DESCRIPTION

A. Trees to be relocated within the project area will be specifically designated in the field as project work progresses or as noted in tree disposition plans on the drawings.

B. Existing trees to be relocated shall be crown pruned and be treated with soil amendments prior to relocation.

C. Existing trees to be relocated or to remain shall be protected with barricades during construction. Trees or shrubs to remain which are scarred or destroyed shall be replaced at the direction of the City Forester with the same species, size, and quality at no cost to the City.

D. Tree pits resulting from relocated material shall be backfilled with clean fill and brought flush with surrounding grade.

1.06 GUARANTEES

A. The Contractor shall guarantee his work in the following way:

1. Any tree or palm that dies or is deemed in unacceptable condition for one year following final project acceptance shall be removed by the Contractor, including root ball, and backfilling of pit, at no cost to the City.

2. The Contractor shall provide a comparable specimen at no additional cost to the City.

3. The guarantee shall be enforced if it is deemed by the City Forester that tree mortality or decline is a product of negligence by the Contractor.

PART 2 – MATERIALS

2.01 SOIL AMENDMENTS

A. Root stimulant shall be Roots Biostimulant, concentrate or powder, as manufactured by LISA Products Corp., (305) 797-6801, or City-approved equal. Stimulant shall be applied either as a wash, or by injection, mixed per manufacturer’s recommendation.

B. Soil conditioner shall be Lesco Wet, as manufactured by Lesco, Inc. or NoburN, as manufactured by Roots or City-approved equal.

C. Minor element liquid fertilizer mix shall be Micro Mix liquid as produced by Lesco, Inc., or equal; to be diluted at a rate of 1 gallon per 100 gallons of water and applied at a rate of 50 gallons per 1,000 square feet of canopy, or Iron Roots, applied per manufacturer’s instructions.

D. Time Release Fertilizer tablets shall be Agriform, 15 grams, designation 8-8-8; or approved equal.

2.02 EQUIPMENT

A. Soil amendments shall be injected into the soil by means of a spray apparatus utilizing mechanical agitation to keep powdered amendments suspended.

B. Root pruning equipment shall be designed for this task, and shall produce clean cuts of roots without damage to the resulting root ball.

C. Relocation equipment shall be capable of lifting and transporting trees without damage.

2.03 SOIL

A. Soil to be placed once trees or palms are transplanted shall meet the requirements specified in the Contract Documents.

2.04 WATER

A. Water shall be clean and potable.,

2.05 MULCH

A. Grade A Eucalyptus mulch, free of viable weed seeds.

2.06 BRACING AND STAKES

A. All bracing and stakes shall be pressure treated pine. Compression bands shall be stainless steel.

PART 3 – EXECUTION

3.01 EXCAVATING NEAR EXISTING TREES

A. Maintain a minimum 6-foot clearance from all tree trucks except palm trees.

B. Use a 24-inch minimum depth saw cut in pavement or dirt/gravel roadway before start of excavation in areas where there are large trees close to the construction area. No coating application is required after saw cutting roots.

3.02 PREPARATION FOR RELOCATION OF TREES AND PALMS WITHIN THE PROJECT BOUNDARIES

A. Crown Pruning: All trees and palms shall be crown pruned prior to relocation.

1. Broadleaf Trees:

a. All trees are to be trimmed by thinning the crown only, and not by reducing crown dimensions. Trim to conform to NAA Standards, including removal of dead wood.

b. Repair any existing injuries to trees including cavities and machinery marks.

2. Palms:

   a. Remove all fruits and seed pods, and all but the seven (7) youngest fronds.

   b. Tie all remaining fronds with untreated cotton twine or burlap straps.

B. Fertilization and Watering:

1. Preparation: Clear the root ball area of all foreign material, trash, etc., to expose undisturbed soil.

2. Application/Schedule:

   a. Trees shall be deep injection fertilized a minimum of 14 days prior to relocation. Specified liquid fertilizer shall be used and applied at the concentration and application rates stated herein.

   b. Mix wetting agent, biostimulant, and minor element mix to produce a single fluid with each component included at the specified concentration. Inject into the root zone within the limits of proposed root ball at the rate of 50 gallons fluid per 1,000 square feet of tree canopy, using only approved spray equipment.

   c. Form an earth berm 6 inches high outside the proposed root ball prior to watering. Water application shall saturate the root ball to its entire depth.

C. Root Pruning:

1. Technique:

   a. All trees shall be excavated by digging a trench a minimum of 36 inches deep by 6 inches wide, either by hand or with a trenching machine designed for this purpose. Provide continuous trenching around the tree or palm at a minimum distance of 30 inches from the trunk. Hand cut broadleaf tree roots after trenching to produce clean cuts with no splits or tears.

   b. Barricades: Barricade all root pruned trees and palms at outside of soil berm with minimum 4-foot chain link fence or other barricade approved by the City.

   c. Timing:

      1) All oaks to be relocated shall be maintained for a minimum of 10 weeks after root pruning prior to relocation.

      2) Palms shall be maintained a minimum of 4 weeks prior to relocation.

3.03 RELOCATION OF TREES AND PALMS

A. General: Trees to be relocated shall be as directed by the Engineer.

B. Preparation:

1. Trees and palms shall be injected with soil amendments a minimum of 14 days prior to relocation. Apply at manufacturer's recommended concentration and application rates.

2. Trees and palms shall be thoroughly soaked to the full depth of the root ball daily for seven (7) consecutive days prior to relocation.

3. Accurately locate position and elevation where all trees are intended to be planted, for verification by City Forester. Verify that no overhead or underground utilities, existing or proposed, conflict with proposed locations.

4. Ascertain that all proposed paths for machinery are clear of utilities and other obstructions.

C. Excavation of Tree Pits: Dig all pits with vertical sides and flat bottom. Existing soil may be utilized as backfill as directed by the City Forester. All Tree Pits to be lined with root barrier adjacent to roadways and sidewalks as directed by City.

D. Digging and Handling - Broadleaf Trees:

1. Notify City 2 business days in advance of each relocation to allow for observation of procedures.

2. Determine line of previous root pruning and excavate around root mass to leave area 12 inches out from line of root pruning undisturbed. Digging shall be accomplished so as to produce clean cuts on all roots without tearing or splitting. Trenching shall be a minimum of 36 inches deep.

3. Trees are to be handled in such a way as to avoid damage to bark and limbs subject to support cables or chains. Attach padded support cables or chains at multiple points where possible. Alternatively, tree trunks may be drilled and doweled for broadleaf trees. The City Forester reserves the right to require doweling in lieu of lifting by straps.

4. Root balls are to be undercut prior to lifting. Do not force tree from ground prior to undercutting. Ball depth to be determined upon assessing conditions at time of trenching, to keep intact the entire root ball.

5. Trees shall be properly wrapped during moving so trunks will not be scarred and damaged and to avoid broken limbs. Broken limbs or scarred trunks shall cause tree to be unacceptable and rejected at the City's option. Broken limbs and wounds which do not (in the judgment of the City Forester) cause the tree to be rejected shall be cleanly cut.

6. Transport plant material on vehicles of adequate size to prevent overcrowding, broken limbs, foliage damage or root ball damage.

7. Root balls and foliage shall be kept moist during all phases of relocation.

8. Partially backfill tree pits with 12 inches of approved planting soil prior to setting tree. This layer of soil to be thoroughly drenched prior to relocation to achieve a stable platform at the correct elevation so that the top of rootball is 1 inch above proposed grade.

9. Rotate tree prior to setting to achieve best positioning relative to adjacent trees and viewing angles.

E. Backfilling:

1. Flood bottom soil layer to settle tree into best position and to remove air pockets.

2. Continue to flood root ball as planting soil is deposited to ensure removal of all air pockets.

3. Create a saucer to retain water.

F. Bracing:

1. Support tree with machinery until bracing is complete.

2. Buttresses may support separate trunks on multiple trunk trees.

3. Maintain braces until completion of project. Removal of braces shall be by others.

G. Watering: Relocated trees shall by watered using water-truck. Watering schedule shall be: once per day for first 6 weeks; followed by 3 times per week for following 6 weeks.

- END OF SECTION -

SECTION 02535

STRUCTURES

PART 1 - GENERAL

1.01 THE REQUIREMENT

A. The Contractor shall construct all precast concrete items as required in the Contract Documents, including all appurtenances necessary to make a complete installation.

1.02 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1 - General Requirements shall govern the work under this section.

1.03 WORK INCLUDED

A. The work covered by this section shall include the furnishing of all labor, equipment, services, materials, products and tests to perform all operations in connection with the construction of all structures as shown on the plans, defined in these specifications and subject to the terms and conditions of this contract, including, but not limited to, manhole, catch basins, and inlets.

1.04 SUBMITTALS

A. The Contractor shall furnish the Engineer shop drawings of the precast manhole for approval. Shop drawings should illustrate all dimensions, reinforcements and specifications for the complete manual.

PART 2 - PRODUCTS

2.01 MORTAR

A. Mortar for use in constructing and plastering sewer structures shall conform to ASTM C-270, "Specifications for Mortar for Unit Masonry". A Portland cement-hydrated lime mixture or a masonry cement may be used provided that the same materials are used throughout the project.

B. Mortar materials shall be proportioned by volume and shall consist of one part Type II Portland Cement to two parts aggregate (sand). Portland Cement shall conform to ASTM C-150, "Specifications for Portland Cement". Aggregate shall conform to ASTM C-144, "Specifications for Aggregate for Masonry Units."

2.02 PRECAST CONCRETE MANHOLE

A. Precast manhole sections shall conform to the plans or ASTM C-478, Specifications for Precast Reinforced Concrete Manhole Sections as modified thereto whichever is more restrictive. Concrete shall attain a minimum compressive strength of 4,000 psi at 28 days. Minimum wall thickness shall be eight (8”) inches. All manholes shall be designed and manufactured for a minimum H-20 traffic loading.

B. Unless otherwise specified on the plans, all joints shall be made with neoprene or rubber "O" ring compression joints; mastic joint sealing compound, or approved equal. After assembly, all joints shall be filled with mortar and pointed to provide a smooth surface without joint voids.

C. The base and walls that compose the bottom section of precast manhole shall be of monolithic construction, minimum 8 inches thick, and the edge of the base slab shall project a minimum 4 inches beyond the outside diameter of the wall.

D. Holes for piping shall be 6 inches larger than the outside diameter of the respective pipe. After the pipe is set, the void space between the pipe and the hole perimeter shall be completely filled with non-shrinking, quick-setting, waterproof cement mortar and struck smooth.

E. The minimum height of precast base section shall be 36 inches from the bottom of the base slab; however, no holes for piping shall be cast less than 8 inches from the top of the base section or less than 2 inches from the top of the base slab.

2.03 ENDWALLS, CATCH BASINS, INLETS AND JUNCTIONS BOXES

A. Endwalls, catch basins, inlets and junction boxes shall be constructed at the locations shown and to the dimensions indicated on site plans. Unless otherwise specified on the plans, inlets, junction boxes, catch basins, and similar structures may be constructed of brick, concrete block, poured concrete or precast concrete. Precast catch basins shall conform to latest A.C.I. and P.C.A. specifications. Concrete shall have not less than 4,000 psi compressive strength at 28 days. Minimum wall thickness shall be six (6”) inches. All structures shall be designed and manufactured for a minimum H-20 traffic loading.

B. Unless otherwise specified on the plans, all concrete for these structures shall be Class I concrete as specified in the Florida Department of Transportation "Standard Specifications for Road and Bridge Construction", latest revision, Section 345. Mortar for use in constructing and plastering shall be as previously set forth in this section.

C. Brick shall be solid hard-burned clay conforming to ASTM Serial C-32-93, Grade SM. Concrete brick shall conform to ASTM Serial C-55-75, Grade P-I. Concrete block shall conform to ASTM Serial C-90-78, Grade PI.

D. All brick or concrete block structures covered in this Section shall be plastered inside and outside with 1/2 inch of cement mortar. Inside surfaces shall be smooth and even.

E. Base slabs and walls of concrete structures shall be constructed in a continuous pour between expansion joints.

F. For each grate type inlet, two layers of Mirafi 140 fabric of "Poly Filter X" polypropylene material or approved equal, shall be sandwiched between 2 x 2 x 10/10 welded wire fabric cut to the grate size and attached to the underside of the grate. The sandwiched filter material shall be wired to the cross members of the grate each way on 4-inch centers. After inlet construction and the roadway construction is completed and the project site work (including landscaping) has been established, the filter material and fabric shall be removed with any retained silt or sand.

2.04 CASTINGS (INCLUDING FRAMES, COVERS AND GRATINGS)

A. Iron castings shall conform to ASTM A-48, "Specifications for Gray Iron Castings", and shall be Class 30. Frames and grates may be Class 20.

B. All castings shall be made of clean, even grain, tough grey cast iron. The castings shall be smooth, true to pattern and free from projections, san holes, warp and other defects. The horizontal surface of the frame cover seats and the under surface of the frame cover seat which rests upon the cover seat shall be machined. After machining, it shall not be possible to rock any after it has been seated in any position in its associated frame. Machining shall be required only on those frames and covers intended for vehicular traffic.

C. Bearing surfaces between cast frames, covers and grates shall be machined and fitted together to assure a true and even fit. Within areas of vehicular traffic, the frames, covers and gratings shall be machined-ground so that irregularity of contact will be reduced to a minimum and will be rattle-proof.

D. All manhole covers shall be provided with concealed pick holes. Manufacturer's name and catalog number shall be cast on all frames, covers, grates, etc. Covers shall be lettered "Storm" "Storm Drain" or "Storm Sewer" or "Sanitary Sewer" as applicable and shall be plainly visible. The manhole frames and covers shall be flush with finished grade. Sanitary Sewer manhole covers shall bear the City logo as manufactured by US Foundry or approved equal.

E. Grates and covers for inlets shall be as shown on the plans, set to the grades indicated and conforming with the requirements of the castings described above. Grates shall be furnished complete with frames specifically constructed to provide full bearing at all points of contract.

PART 3 - EXECUTION

3.01 CHANNELS

A. Channels shall be accurately and smoothly formed in accordance with the plans. Channels shall be constructed of concrete with trowel finished surfaces. The upper surface of the manhole shall be sloped toward the channels as shown.

B. Drop pipe at sanitary sewer manhole shall be installed when the difference in elevation between the pipe invert and the invert at the center of the manhole exceeds two feet (2'), or where directed by the City. The drop manhole shall be built according to the plans and specifications.

C. After channels are formed and section joints are pointed, the interior of the manhole shall be painted with two coats of Koppers Bitumastic 300-M (7 mils per coat) or approved equal. The exterior shall be painted in a similar manner, if required by local regulations.

3.02 CONCRETE GRADE RINGS

A. All concrete grade rings shall meet ASTM C478 and shall be a minimum 4,000 psi @ 28 days. Concrete grade rings shall be a minimum thickness of 2 inches and a maximum thickness of 6 inches. No more than 8 inches of concrete grade rings shall be installed on one manhole. Concrete grade rings shall be laid in mortar and all joints shall be finished smooth and not be less than ¼ inch or more than ½ inch in thickness. Concrete grade rings shall be painted with two coats of Koppers Bitumastic 300-M (7 mils per coat) or approved equal.

3.03 MANHOLE AND STRUCTURES

A. All joints shall be finished water tight, all openings for sewers, frames, etc., in precast manhole and catch basins shall be cast at time of manufacture. Spaces around all piping entering or leaving manhole shall be completely filled with Embeco mortar or equal.

B. All manhole shall be set plumb to line and grade and shall rest on a firm carefully graded subgrade which shall provide uniform bearing under base.

C. Grout for manhole bottoms shall consist of broken block, brick and 2:1 cement mortar.

3.04 CLEANING AND MAINTENANCE

A. All structures shall be cleaned and maintained in workable condition until accepted by the City.

- END OF SECTION -

SECTION 02630

STORM DRAINAGE FACILITIES

PART 1 - GENERAL

1.01 SUMMARY

A. Work under this section shall consist of providing all labor, plant facilities, materials, tools, equipment, shop drawings and supervision necessary and required to install all of the storm drainage facilities, including piping, fittings, structures, bedding, and backfilling, as specified in accordance with the contract documents.

1.02 WORK INCLUDED

A. Provide all labor, materials, necessary equipment and services to complete the Storm Drainage Facilities work, as indicated on the drawings, as specified herein or both, except as for items specifically indicated as "NIC ITEMS".

1.03 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. A185 – Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
2. A615 – Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
3. A760 – Corrugated Steel Pipe, Metallic-Coated for Sewers and Drains
4. A798 – Installation of Corrugated-Steel Pipe for Sewers and Other Applications
5. A929 – Metallic-Coated by the Hot-Dip Process for Corrugated Steel Pipe
6. C76 – Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe
7. C478 – Precast Reinforced Concrete Manhole Sections
8. C1479 – Installation of Reinforced Concrete Pipe
9. C990-01A – Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
10. D2321 – Installation of Thermoplastic Pipe for Sewer/Gravity-Flow Applications
11. D3034 – Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
12. D3212 – Joints for Drain and Sewer Plastic Pipes Using Elastomeric Seals
13. F477 – Elastomeric Seals (Gaskets) for Joining Plastic Pipe

14. F794 – Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter

15. F949 – Poly (Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings

B. American Association of State Highway and Transportation Officials (AASHTO)

1. M198 – Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets

2. M252 – Corrugated Polyethylene Drainage Tubing

3. M274 – Aluminum-Coated (Type 2), for Corrugated Steel Pipe

4. M294 – Corrugated Polyehtylene Pipe. 12-to-14-inch Diameter

5. M36 – Metallic Coated Corrugated Steel Culverts and Underdrains

6. M190 – Bituminous Coated Corrugated Metal Culvert Pipe and Pipe Arches

7. M199 – Standard Specification for Precast Reinforced Concrete Manhole Sections

C. American Water Works Association (AWWA)

1. C110 – Ductile-Iron and Gray-Iron Fittings, 3 in through 48 in (75 mm through 1200 mm), for Water and Other Liquids (revision of ANSI/AWWA C110/A21.10-93)

2. C111 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings

3. C151 – Ductile-Iron Pipe, Centrifugally Cast, for Water

D. American Concrete Institute (ACI)

1. 301 – Structural Concrete for Buildings, Specifications for

2. 318 – Building Code Requirements for Structural Plain Concrete

1.04 EXISTING UTILITIES

A. Furnish temporary support, adequate protection and maintenance of all underground and surface utility structures, drains, sewers, cables, etc., and other obstructions encountered in the progress of the work.

B. When the grade of alignment of the pipe is obstructed by existing utility structures, such as conduits, ducts, pipes, branch connections to water or sewer mains, and other obstructions, the obstructions shall be permanently supported, relocated, removed or reconstructed by the Contractor in cooperation with the owners of such structures. No deviation shall be made from the required line or grade except as directed in writing by the Engineer.

C. It shall be the responsibility of the Contractor to notify the owners of existing utilities in the area of construction a minimum of 48 hours prior to any excavation adjacent of such utilities, so that field locations of said utilities may be established.

D. Temporary relocation of existing utilities (to be removed) to accommodate installation of storm drain pipe shall be the responsibility of the Contractor and approved by the Engineer. No additional payment shall be made for temporary relocation of existing utilities and shall be considered part of the bid item for the pipe.

1.05 QUALITY ASSURANCE

A. All costs related to re-inspection due to failures shall be paid for by the Contractor at no additional expense to the City. City reserves the right to direct any inspection that is deemed necessary. Contractor shall provide free access to site for inspection activities.

PART 2 - PRODUCTS

2.01 REINFORCED CONCRETE PIPE (RCP)

A. REINFORCED CONCRETE PIPE – ASTM C 76

1. Unless noted otherwise, all RCP pipe shall be in accordance with the requirements of “Reinforced Concrete Pipe – ASTM C 76”.

2. RCP shall be manufactured in accordance with ASTM C 76, Wall Type B or C, unless otherwise specified herein; and shall be of the class that equals or exceeds the pipe class as specified in the Contract Documents. Minimum pipe laying lengths shall be four (4) feet. Portland cement shall conform to ASTM C 150, Type II.

3. Pipe shall have bell and spigot ends with O-ring rubber gaskets. The gaskets shall be smooth solid rubber of circular and uniform cross section conforming to ASTM C 43. The spigot end of the pipe shall contain a special groove or slot to receive and hold the gasket in position during the joint assembly. The complete joint shall be subjected to hydrostatic tests conforming to ASTM C 443.

4. All pipe and specials shall be aged at the manufacturing plant for at least fourteen (14) days before delivery to the job site.

B. REINFORCED CONCRETE PIPE – ASTM C361

1. Reinforced concrete low-head pressure pipe shall be manufactured in accordance with ASTM C361, and shall be of the class that equals or exceeds the pipe class as specified in the Contract Documents. Minimum pipe laying lengths shall be twelve (12) feet.

2. Pipe shall have steel joint rings with O-ring rubber gaskets. The gaskets shall be smooth solid rubber of circular and uniform cross section and shall be confined in an annular space formed by shoulders on the bell and spigot or in a special groove in the spigot to receive and hold the gasket in position during the joint assembly. The complete joint shall be subjected to hydrostatic tests conforming to ASTM C361.

3. All pipe and specials shall be aged at the manufacturing plant for at least fourteen (14) days before delivery to the job site.

C. CONCRETE CULVERT AND DRAIN PIPE

1. All reinforced concrete culvert and drain pipe shall be manufactured in accordance with ASTM C76, Wall Type B or C, and shall be of the class that equals or exceeds the pipe class as specified herein or as shown on the Contract Drawings. Minimum pipe laying lengths shall be four (4) feet. Testing shall be in accordance with the Contract Documents. Portland cement shall conform to ASTM C150, Type II.

2. Joints for the reinforced concrete culvert and drain pipe shall have bell and spigot ends with flexible plastic gaskets meeting the requirements of AASHTO M198, Type B.

3. All pipe shall be aged at the manufacturing plant for at least fourteen (14) days before delivery to the job site.

2.02 HIGH PERFORMANCE POLYPROPYLENE PIPE

1. High Performance polypropylene storm pipe shall be produced by a reputable manufacturer engaged in the full-time business of manufacturing of piping.

2. All High-Performance polypropylene storm pipe shall have a smooth wall interior and annular exterior corrugations conforming to the requirements of ASTM F2736 and AASHTO M330.

3. Joints: Pipe shall be joined with a gasket integral bell and spigot joint meeting the requirements of ASTM F2736. Joint must be completely water tight according to the requirements of ASTM 3212. Spigots shall have gaskets meeting requirements of ASTM F477. The gasket joint on the inside of the bell shall be installed on the pipe at the plant by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant provided from the manufacturer shall be used on the gasket and bell during assembly. All materials and accessories for the gasket joint and the methods of jointing shall be in strict conformance with the pipe manufacturer's direction and recommendation.

2.03 HIGH DENSITY POLYETHYLENE PIPE:

1. High Density Polyethylene Pipe (HDPE), shall be corrugated type, smooth interior, conforming to ASTM F2648, ASTM F477, ASTM 3212, AASHTO M252 and AASHTO M294 and shall be smooth interior and annular exterior corrugations with a Manning’s “n” value of 0.012l.

2. Basic Material:

a. Extruded Pipe and Blow Molded Fittings: Pipe and fittings shall be made of virgin PE compounds which conform with the requirements for Type III, Category 4 or 5, Grade P33, Class C; or Grade P34, Class C, as defined and described in ASTM D 1248.

b. Rotational Molded Pipe and Fittings: Pipe and fittings shall be made of virgin PE compounds which conform with the requirements of Type III, Category 3, Grade P33, Class C: or Grade P34, Class C, as defined and described in ASTM D1248.

3. Corrugated Polyethylene Pipe shall meet the requirements as describe in ASTM D 2412 for pipe stiffness.

4. Corrugated Polyethylene Pipe shall be in accordance for brittleness with ASTM D 2444.

2.04 PVC CORRUGATED PIPE

1. PVC Corrugated storm pipe shall be produced by a reputable manufacturer engaged in the full-time business of manufacturing of piping and conform to the requirements of ASTM F949.

2. PVC Corrugated storm pipe shall have smooth wall interior and annular exterior corrugations. Pipe shall be made of PVC having a minimum cell classification of 12454 per ASTM D1784.

3. Joints: Pipe shall be joined with a gasket integral bell and spigot joint meeting the requirements of ASTM F2736. Joint must be completely water tight according to the requirements of ASTM 3212. Spigots shall have gaskets meeting requirements of ASTM F477. The gasket joint on the inside of the bell shall be installed on the pipe at the plant by the pipe manufacturer and covered with a removable, protective wrap to ensure the gasket is free from debris. A joint lubricant provided from the manufacturer shall be used on the gasket and bell during assembly. All materials and accessories for the gasket joint and the methods of jointing shall be in strict conformance with the pipe manufacturer's direction and recommendation.

PART 3 – EXECUTION

3.01 GENERAL

A. Contractor shall only use the pipe material as specified on the plans. Alternate materials will not be allowed unless approved by the Engineer in writing.

B. The Contractor shall install all drainage structures and pipe in the locations shown on the drawings and/or as approved by the City. Pipe shall be of the type and sizes specified on the drawings and shall be laid accurately to line and grade. Structures shall be accurately located and properly oriented.

C. Excavation and Backfilling for Utilities – The provisions of the Contract Documents for Excavation and Backfilling shall govern all work under this Section.

D. Storage and Handling of Pipe – All pipe shall be protected against impact, shock and free fall, and only equipment of sufficient capacity and proper design shall be used in the handling of the pipe. Storage of pipe on the job shall be in accordance with the pipe manufacturer's recommendations.

E. Damage to Pipe

1. Pipe which is defective from any cause, including damage caused by handling, and determined by the City as unrepairable, shall be unacceptable for installation and shall be replaced at no cost to the City and as directed by the City; and,

2. Pipe that is damaged or disturbed through any cause prior to acceptance of the work, shall be repaired realigned or replaced as directed by the City, at the Contractor's expense.

F. Manholes, catch basins and drain inlets shall be constructed as soon as the pipe laying reaches the location of the structures. Should the Contractor continue his pipe laying without making provisions for completion of the structures, the City shall have the authority to stop the pipe laying operations until the structure is completed.

G. Any structure, which is mislocated or oriented improperly, shall be removed and re-built in its proper location, alignment and orientation at the Contractor's expense.

3.02 EXCAVATION AND BACKFILL

A. Excavation and backfill shall be as per the Section entitled "Excavation and Backfill for Utilities".

3.03 PIPE INSTALLATION

A. Laying Pipe

1. Unloading and Handling: All pipes shall be unloaded and handled with reasonable care. Pipes shall not be rolled or dragged over gravel or rock during handling. The Contractor shall take necessary precautions to ensure the method used in lifting or placing the pipe does not induce stress fatigue in the pipe and the lifting device used uniformly distributes the weight of the pipe along its axis or circumference.

2. Each length of pipe shall be inspected for defects and cracks before carefully lowered into the trench. Any damaged or any pipe that has had its grade disturbed after laying shall be removed and replaced. Bituminous coated pipe shall be handled with special care and repair of damaged coating shall conform with AASHTO M190.

3. Lay pipe on prepared foundation starting at the downgrade end according to line and grade with the necessary drainage structures, fittings, bends and appurtenances as shown on the drawings. Rigid pipes shall be laid with the bell

or groove ends upgrade with the spigot or tongue fully inserted. Reinforced concrete pipe shall be installed in accordance with ASTM C1479.

4. Pipe sections shall be firmly joined together with appropriate gaskets or bands.

5. Pipe shall be protected during handling against impact shocks and free falls. Pipe shall be kept clean at all times and no pipe shall be used that does not conform to the Specifications.

6. The laying of the pipe shall be commenced at the lowest point with spigot ends pointing in the direction of flow. All pipe shall be laid with ends abutting and true to line and grade. They shall be laid in accordance with manufacturer's requirements as approved by the Engineer.

7. Pipe shall be laid accurately to the line and grade as designated on the plans. Preparatory to making pipe joints, all surfaces of the portions of the pipe to be jointed, or of the factory-made jointing material, shall be clean and dry. Lubricant, primers, adhesive, etc., shall be used as recommended by the pipe or joint manufacturer's specifications. The jointing materials or factory fabricated joints shall then be placed, fitted, joined and adjusted in such a manner as to obtain a water tight line. As soon as possible after the joint is made, sufficient backfill material shall be placed along each side of the pipe to prevent movement of pipe off line and grade.

8. The exposed ends of all pipe shall be suitably plugged to prevent earth, water, or other substances from entering the pipe when construction is not in progress.

3.04 CONCRETE ENCASEMENT OF DRAINAGE PIPE

A. Trenches in which encasement for pipe are to be placed may be excavated completely with mechanical equipment. Prior to formation of the encasement, temporary supports consisting of timber wedges or masonry shall be used to support the pipe in place. Temporary supports shall have minimum dimensions and shall support the pipe at no more than two places, one at the bottom of the barrel of the pipe adjacent to the shoulder of the socket and the other near the spigot end.

3.05 DRAINAGE STRUCTURES

A. All structures shall be built to the line and grade shown on drawings. All reinforced concrete work shall be in strict conformance with the concrete specifications contained herein. After erection of the forms and placing of the steel, the Contractor must have inspection and approval from the Engineer before placing any concrete. After removal of the forms, the Contractor shall backfill around each structure with approved granular fill. The fill shall be placed in layers not exceeding 8 inches in depth measured loose and compacted to 98% of the maximum density as determined by the modified proctor, AASHTO T-180. No defects of any kind in the pipe section will be accepted. All pipe stubs shall be made of the same type of pipe. Pipe stubs shall be sealed with a concrete plug, water tight. The ends of the pipes which enter masonry shall be neatly cut to fit the inner face of the masonry. Cutting shall be done before the pipes are built in.

3.06 INFILTRATION AND EXFILTRATION TESTS

A. Tests for watertightness shall be made by the Contractor. Leakage of completed storm drainage system shall not exceed 500 U.S. gallons per day per inch diameter per mile of pipe under minimum hydrostatic pressure of 2 feet. Test shall be conducted in a manner satisfactory to the Engineer. Any portion of the project not conforming to the above requirements shall be corrected by the Contractor, at his own expense, prior to acceptance by the Engineer.

3.07 PROTECTION AND CLEANING

A. The Contractor shall maintain all pipe installations and drainage structures in a condition such that they will function continuously and shall be kept clean of silt, debris and other foreign matter from the pipe and drainage structure is installed until the project is accepted.

3.08 FINAL INSPECTION

A. All storm sewers shall be lamped by the Engineer prior to acceptance of the work. Repairs or misalignment shown necessary by the tests shall be corrected at the Contractor's expense. All sewers shall be thoroughly cleaned before being placed into use and shall be kept clean until final acceptance by the Engineer.

B. Upon completion of the work and before final acceptance by the City, the entire drainage system shall be subject to a final inspection in the presence of the City and/or Engineer. The work shall not be considered as complete until all requirements for line, grade, cleanliness, and workmanship have been completed.

- END OF SECTION -

SECTION 02710

LIMEROCK BASE

PART 1 - GENERAL

1.01 DEFINITIONS

A. Completed Course: Compacted, unyielding, free from irregularities, with smooth, tight, even surface, true to grade, line, and cross section.

B. Completed Lift: Compacted with uniform surface reasonably true to cross-section.

PART 2 - MATERIALS

2.01 LIMEROCK BASE ROCK

A. The material used in limerock base shall be material classified as Miami Oolite Formation.

B. The minimum of carbonates of calcium and magnesium in the limerock shall be 70 percent. The maximum percentage of water-sensitive clay material shall be 3.

C. Limerock material shall be uniform in color and not contain cherty or other extremely hard pieces, or lumps, balls, or pockets of sand or clay size material in sufficient quantities as to be detrimental to the proper bonding, finishing, or strength of the limerock base.

D. The limerock base shall be uniformly graded from coarse to fine with 97 percent passing a 3-1/2-inch sieve, 80 percent passing a 2-inch sieve. The fine material shall consist entirely of dust of fracture. All crushing or breaking up, which might be necessary in order to meet such size requirements, shall be done before the material is placed on the road.

E. Physical Qualities:

1. Liquid Limit, AASHTO T89: Maximum 35 percent.

2. Nonplastic.

3. Limerock material shall have an average limerock bearing ratio (LBR) value of not less than 100.

2.02 SOURCE QUALITY CONTROL

A. Contractor: Perform tests necessary to locate acceptable source of materials meeting specified requirements.

B. Final approval of aggregate material will be based on materials' test results on installed materials.

C. Should separation of coarse from fine materials occur during processing or stockpiling, immediately change methods of handling materials to correct uniformity in grading.

PART 3 - EXECUTION

3.01 SUBGRADE PREPARATION

A. As specified in the Contract Documents.

B. Obtain City's acceptance of subgrade before placement of limerock base rock.

C. Do not place base materials on soft, muddy subgrade.

3.02 EQUIPMENT

A. Use mechanical rock spreaders, equipped with a device that strikes off the rock uniformly to laying thickness, capable of producing even distribution. For areas where the use of a mechanical spreader is not practicable, the Contractor may spread the rock using bulldozers or blade graders.

3.03 HAULING AND SPREADING

A. Hauling Materials:

1. The limerock shall be transported to the point where it is to be used and dumped on the end of the preceding spread.

2. Do not haul over surfacing in process of construction.

3. Loads: Of uniform capacity.

4. Maintain consistent gradation of material delivered; loads of widely varying gradations will be cause for rejection.

B. Spreading Materials:

1. Distribute material to provide required density, depth, grade and dimensions with allowance for subsequent lifts.

2. Produce even distribution of material upon roadway without segregation.

3. Should segregation of coarse from fine materials occur during placing, immediately change methods of handling materials to correct uniformity in grading.

3.04 CONSTRUCTION OF COURSES

A. General: Complete each lift in advance of laying succeeding lift to provide required results and adequate inspection.

B. Limerock Base:

1. Maximum Completed Lift Thickness: 6 inches or equal thickness.

2. Completed Course Total Thickness: As shown on the Drawings and in the Contract Documents.

3. Spread lift on preceding course to required cross-section.

4. Lightly blade and roll surface until thoroughly compacted.

5. Blade or broom surface to maintain true line, grade, and cross-section.

C. Gravel Surfacing:

1. Maximum Completed Lift Thickness: 6 inches or equal thickness.

2. Completed Course Total Thickness: As shown on the Drawings and in the Contract Documents.

3. Spread on preceding course in accordance with cross-section shown.

4. Blade lightly and roll surface until material is thoroughly compacted.

3.05 ROLLING AND COMPACTION

A. Commence compaction of each layer of base after spreading operations and continue until density of 98 percent of maximum density has been achieved as determined by AASHTO T 180.

B. Density tests will be conducted every 500 square yards or as directed by the City.

C. Roll each course of surfacing until material shall not creep under roller before succeeding course of surfacing material is applied.

D. Commence rolling at outer edges of surfacing and continue toward center; do not roll center of road first.

E. When the material does not have the proper moisture content to ensure the required density, wet or dry, as required. When adding water, uniformly mix it in by disking to the full depth of the course that is being compacted. During wetting or drying operations, manipulate as a unit, the entire width and depth of the course that is being compacted.

F. Place and compact each lift to required density before succeeding lift is placed.

G. Bind up preceding course before placing leveling course. Remove floating or loose stone from surface.

H. Blade or otherwise work surfacing as necessary to maintain grade and cross-section at all times, and to keep surface smooth and thoroughly compacted.

I. Surface Defects: Remedy surface defects by loosening and rerolling. Reroll entire area, including surrounding surface, until thoroughly compacted.

J. Finished Surface: True to grade and crown before proceeding with surfacing.

3.06 SURFACE TOLERANCES

A. Finished Surface of Base Course and Leveling Course: Within plus or minus 0.04-foot of grade shown at any individual point.

B. Compacted Surface of Leveling Course: Within 0.04-foot from lower edge of 10-foot straightedge placed on finished surface, parallel to centerline.

C. Overall Average: Within plus or minus 0.01-foot from crown and grade specified.

3.07 GRAVEL DRIVEWAY RESURFACING

A. Replace gravel surfacing on driveways which were gravel surfaced prior to construction.

B. Provide compacted gravel surfacing to depth equal to original, but not less than 4 inches.

C. Leave each driveway in as good or better condition as it was before start of construction.

3.08 FIELD QUALITY CONTROL

A. In-Place Density Tests:

1. Construct base course so areas shall be ready for testing.

2. Allow reasonable length of time for City to perform tests and obtain results during normal working hours.

3.09 CLEANING

A. Remove excess material; clean stockpile areas of aggregate.

- END OF SECTION -

SECTION 02761

PAVEMENT MARKING

PART 1 - GENERAL

1.01 STANDARD SPECIFICATIONS

A. When referenced in this section, Standard Specifications shall mean Florida Department of Transportation, Standard Specifications for Road and Bridge Construction, current edition. All Pavement Markings and Signage shall conform to the Broward County Traffic Engineering Division (BCTED) Standards, latest revision.

1.02 SUBMITTALS

A. The Contractor shall submit all products used for pavement markings in accordance with the Section entitled “Submittals”.

1.03 DELIVER, STORAGE, AND PROTECTION

A. Packaging and Labeling: All coatings and traffic marking materials shall be shipped in strong containers plainly marked with the weight in pounds per gallon, the volume of coatings and traffic marking materials content in gallons, the color, user information, date of manufacture, LOT, batch and DOT code number. Each batch manufactured shall have a unique number. A true statement of the percentage composition of the pigment, the proportion of pigment to vehicle, and the name and address of the manufacturer, also shall be shown. The label shall warn the user of any special handling or precautions of the material, as recommended by the manufacturer. Any package not so marked will not be accepted for use under these Specifications.

B. Storage: Any coatings and traffic marking materials which, although inspected and approved at the point of manufacture, hardens or livers in the containers so that it cannot be readily broken up with a paddle to a smooth, uniform painting consistency, will be rejected. All materials shall have a container storage life of one year from date of manufacture. Any coatings and traffic marking materials not acceptable for proper application will be rejected, even though it conforms to these Specifications in all other respects.

C. Mixing: All paints except aluminum shall be delivered to the project completely mixed, and ready to be used without additional oil or thinner. Gasoline shall not be used for thinner under any circumstances.

PART 2 - MATERIALS

2.01 PAINT

A. Color: White, yellow, or blue traffic striping meeting the requirements of BCTED and the Standard Specifications.

B. Homogeneous, easily stirred to smooth consistency, with no hard settlement or other objectionable characteristics during a storage period of 6 months.

2.02 THERMOPLASTIC STRIPING

A. White or yellow thermoplastic striping material meeting the requirements of BCTED and the Standard Specifications.

2.03 RAISED REFLECTIVE MARKERS

A. Metallic or nonmetallic, or prismatic reflector type, of permanent colors retaining color and brightness under action of traffic.

B. Rounded surfaces presenting a smooth contour to traffic. The minimum area of each reflective face shall be 2-1/2 inches squared.

C. Marker and adhesive epoxy in accordance with ASTM D4280

D. Markers shall meet the requirements of BCTED and the Standard Specifications.

2.04 GLASS SPHERES

A. Glass spheres shall be of a composition designed to be highly resistant to traffic wear and to the effects of weathering.

B. In accordance with AASHTO M247, Type I with moisture resistant coating or a formulation specified by the traffic striping material manufacturer and the BCTED and the Standard Specifications.

PART 3 - EXECUTION

3.01 SURFACE PREPARATION

A. Cleaning:

1. Thoroughly clean surfaces to be marked before application of pavement marking material.

2. Remove dust, dirt, and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water or a combination of these methods.

3. Completely remove rubber deposits, surface laitance, existing paint markings, and other coatings adhering to pavement with scrapers, wire brushes, sandblasting, approved chemicals, or mechanical abrasion.

4. Scrub areas of old pavement affected with oil or grease with several applications of trisodium phosphate solution or other approved detergent or degreaser, and rinse thoroughly after each application.

5. Surfaces shall be completely free of dry dirt and ice, and dry of water at the time of application of any of the materials specified herein.

6. Oil-Soaked Areas: After cleaning, seal with cut shellac to prevent bleeding through the new paint.

7. Reclean surfaces when Work has been stopped due to rain.

8. Existing Pavement Markings:

   a. Remove existing pavement markings that may interfere or conflict with newly applied marking patterns, or that may result in a misleading or confusing traffic pattern.

   b. Do not apply thermoplastic markings over existing preformed or thermoplastic markings.

   c. Perform grinding, scraping, sandblasting or other operations so finished pavement surface is not damaged.

B. Pretreatment for Early Striping: Where early striping is required on rigid pavements, pretreat with an aqueous solution containing 3 percent phosphoric acid and 2 percent zinc chloride.

C. New Concrete Pavement:

1. Allow a minimum cure time of 30 days before cleaning and marking.

2. Clean by either sandblasting or water blasting to the following results:

   a. No visible evidence of curing compound on peaks of textured concrete surface.

   b. No heavy puddled deposits of curing compound in valleys of textured concrete surface.

   c. Remaining curing compound is intact, with loose and flaking material completely removed.

   d. Peaks of textured pavement surface are rounded in profile and free of sharp edges and irregularities.

3. Allow a minimum drying time of 24 hours after water blasting before applying thermoplastic markings.

3.02 ALIGNMENT FOR MARKINGS

A. The Contractor shall be responsible for all measurements, reference points and marks, string lining, and any other steps required in establishing pavement marking locations and alignment. On tangents and on curves up to 1 degree, the alignment of the marking shall not deviate from the string line by more than 1 inch. On curves exceeding 1 degree, the maximum permissible deviation shall be 2 inches. All alignment width and location shall conform to the details shown on the Drawings.

3.03 PAINT APPLICATION

A. General:

1. Thoroughly mix pigment and vehicle together prior to application, and keep thoroughly agitated during application.

2. Do not add thinner.

3. Apply only when air and pavement temperatures are above 40 degrees F and less than 95 degrees F. Maintain paint temperature within these same limits.

4. Apply only when surface is dry.

5. Do not apply when conditions are windy to the point of causing overspray or fuzzy line edges.

6. New Asphalt Pavement: Allow a minimum pavement cure time as recommended by the manufacturer before applying paint.

7. Provide guide lines and templates to control paint application.

8. Take special precautions in marking numbers, letters, and symbols.

9. Sharply outline edges of markings and apply without running or spattering.

B. Rate of Application:

1. Reflective Markings:

a. Paint: Apply evenly, 105 plus or minus 5 square feet per gallon.

b. Glass Beads: Apply uniformly, 6 plus or minus 0.5 pounds of glass spheres per gallon of paint.

2. Nonreflective Markings: Apply paint evenly to pavement surface at a rate of 105 plus or minus 5 square feet per gallon.

3. On new pavement or new asphalt surface treatments, apply two coats of paint at a uniform rate of 210 square feet per gallon.

C. Drying:

1. Provide maximum drying time to prevent undue softening of bitumen and pickup, displacement, or discoloration by traffic.

2. If drying is abnormally slow, discontinue painting operations until cause is determined and corrected.

3.04 THERMOPLASTIC MARKING APPLICATION

A. Following specified surface preparation, prime and apply marking and glass beads to provide a reflectorized strip as shown on Drawings.

B. The material shall be applied to the pavement by the extrusion method only, wherein one side of extrusion shaping die is the pavement and the other sides are formed by suitable equipment for heating and controlling the flow of the material.

C. Application Temperatures:

1. Pavement Surface: Minimum 40 degrees F and rising.

2. Thermoplastic: Minimum 375 degrees F, maximum 425 degrees F.

D. Primer:

1. On portland cement concrete and existing asphalt pavements, apply epoxy resin primer/sealer according to the thermoplastic manufacturer's recommendations.

2. All primer/sealer to dry prior to applying thermoplastic.

E. Thermoplastic Marking:

1. Extrude in a molten state, free of dirt or tint. at a thickness of 0.10 to 0.15 inch for lane lines and 0.07 to 0.10 inch for edge or other lines in accordance with FDOT Design Standards.

2. Apply centerline, skipline, edgeline, and other longitudinal type markings with a mobile applicator.

3. Apply special markings, crosswalks, stop bars, legends, arrows, and similar patterns with a portable, extrusion-type applicator.

F. Glass Bead Application:

1. Immediately after marker application, mechanically apply such that the beads are held by and imbedded in the surface of the molten material.

2. Application Rate: One pound per 20 square feet of compound.

G. Cool completed marking to ambient temperature prior to allowing vehicular traffic.

3.05 INSTALLATION OF RAISED REFLECTIVE MARKERS

A. Apply markers to the bonding surface using bituminous adhesives only.

B. Apply the adhesive to the binding surface (not the marker) so that 100 percent of the bonding area of the marker will be covered.

C. Align markers carefully, projecting no more than 3/4-inch above level of pavement. Reflective face of the marker shall be perpendicular to a line parallel to the roadway centerline. Do not install markers over longitudinal or transverse joints of the bonding surface.

D. Spacing: As shown on the Drawings or as required by BCTED.

E. Immediately remove excess adhesive from the bonding surface and exposed surface of the marker.

F. Use only a mineral spirits meeting Federal Specifications TT-T-291 to remove adhesive from exposed faces of markers.

3.06 GLASS BEAD APPLICATION

A. Apply immediately following application of paint.

B. Use evenly distributed, drop-on application method.

C. Rate: 10 pounds per gallon of paint.

3.07 PROTECTION

A. The Contractor shall erect adequate warning signs and/or provide sufficient number of flagmen, and take all necessary precautions for the protection of the materials and safety of the public.

B. Protect surfaces from disfiguration by paint spatters, splashes, spills, or drips.

3.08 CLEANUP

A. Remove paint spatters, splashes, spills, or drips from Work and staging areas and areas outside of the immediate Work area where spills occur.

- END OF SECTION -

PROJECT NO. 11868

SECTION 02765

CURED-IN-PLACE PIPE LINING

PART 1 - GENERAL

1.01 SUMMARY

A. It is the intent of this specification to provide for the reconstruction of pipelines and conduits by the installation of a resin-impregnated flexible tube which is formed to the original conduit and cured to produce a continuous and tight fitting Cured-In-Place Pipe (CIPP).

B. The work specified in this Section includes all labor, materials, accessories, equipment and tools necessary to install and test cured-in-place sanitary sewer and storm sewer pipe lining in main lines and in-service laterals.

1.02 GENERAL

A. This specification references ASTM F1216 (Rehabilitation of pipelines by the inversion and curing of a resin-impregnated tube), ASTM F1743 (Rehabilitation of pipelines by pulled-in-place installation of a cured-in-place thermosetting resin pipe), and ASTM D790 (Test methods for flexural properties of unreinforced plastics) which are made a part hereof by such reference and shall be the latest edition and revision thereof. In case of conflicting requirements between this specification and these referenced documents, this specification will govern. ASTM F1216 is applicable to CIP mainline pipe lining, ASTM F2561 is the governing standard for CIP main/lateral pipe connection lining.

1.03 SUBMITTALS

A. The CONTRACTOR shall submit shop drawings and other information to the CITY for review in accordance with Section 01340, "Submittals".

B. With the bid, the following submittals are required.

1. Documentation as outlined herein under the section titled, PRODUCT AND INSTALLER ACCEPTABILITY, including installation references of projects that are similar in size and scope to this project. The submittal shall include, at a minimum, the client contact name, phone number, and the diameter and footage of pipe rehabilitated. Documentation for product and installation experience must be satisfactory to the CITY.

C. After contract award, the following submittals are required.

1. Detailed design calculations as specified herein under the section titled, MATERIALS FOR MAIN LINES.

2. Various test results as specified herein under the section titled, TESTING REQUIREMENTS.

3. Documentation as specified herein under the sections titled WET-OUT AND CURE REPORT and TELEVISION SURVEY.

1.04 PRODUCT AND INSTALLER ACCEPTABILITY

A. Since sewer products are intended to have a 50-year design life, and in order to minimize the CITY'S risk, only proven products and installers with substantial successful long-term track records will be approved.

B. Products and installers seeking approval must document an ability to meet all of the following criteria to be deemed commercially acceptable:

1. For a product to be considered commercially proven, a minimum of 1,000,000 linear feet or 4,000 manhole-to-manhole line sections of successful wastewater collection system installations in the U.S. must be documented to the satisfaction of the CITY to assure commercial viability. In addition, at least 500,000 linear feet of the product shall have been in successful service within the State of Florida for a minimum of five years.

2. For an Installer to be considered as commercially proven, the installer must satisfy all insurance, financial, and bonding requirements of the CITY, and must have had at least 5 (five) years active experience in the commercial installation of the product in Florida. For sewer mains, the installer must have successfully installed at least 500,000 feet of the product in wastewater collection systems in Florida.

3. Sewer rehabilitation products submitted for approval must provide third party test results supporting the long-term performance and structural strength of the product and such data shall be satisfactory to the CITY. Test samples shall be prepared so as to simulate installation methods and trauma of the product. No product will be approved without independent third-party testing verification.

PART 2 - PRODUCTS

2.01 MATERIALS FOR MAIN LINES

A. The sewn tube shall consist of one or more layers of absorbent non-woven felt fabric and meet the requirements of ASTM F1216 or ASTM F1743, Section 5. The tube shall be constructed to withstand installation pressures, have sufficient strength to bridge breaks and missing sections of the existing pipe, and stretch to fit irregular pipe sections. The new jointless pipe-within-a-pipe must fit tightly against the old pipe wall and consolidate all disconnected sections into a single continuous conduit, substantially reducing or eliminating infiltration or exfiltration.

B. The wetout tube shall have a uniform thickness that when compressed at installation pressures will meet or exceed the Design thickness.

C. The tube shall be sewn to a size that when installed will tightly fit the internal circumference and length of the original pipe with minimal shrinkage, in such a way as to minimize water migration (tracking) between the liner and the host pipe. Allowance should be made for circumferential stretching during inversion, and longitudinal

stretching during pull in. Overlapped layers of felt in longitudinal seams that cause lumps in the final product shall not be utilized.

D. The minimum tube length shall be that deemed necessary by the Contractor to effectively span the distance between the access points and to facilitate a good, "non-tracking" seal. The Contractor shall verify the lengths in the field before cutting liner to length and otherwise preparing it for installation.

E. The outside layer of the tube (before wetout) shall be coated with an impermeable, flexible membrane that will contain the resin and facilitate monitoring of resin saturation during the resin impregnation (wetout) procedure.

F. The tube shall be homogeneous across the entire wall thickness containing no intermediate or encapsulated elastomeric layers. No material shall be included in the tube that may cause delamination in the cured CIPP. No dry or unsaturated layers shall be evident.

G. The wall color of the interior pipe surface of CIPP after installation shall be a light reflective color so that a clear detailed examination with closed circuit television inspection equipment may be made.

H. Seams in the tube shall be stronger than the unseamed felt.

I. The outside of the tube shall be marked for distance at regular intervals along its entire length, not to exceed 5 ft. Such markings shall include the Manufacturers name or identifying symbol. The tubes must be manufactured in the USA.

J. Contractor is to install Hydrophilic End Seals at all manhole penetrations. The End Seals must be in a tubular form which when installed will form a 360-degree seal between the host pipe and the newly installed liner and must be a minimum of three inches wide. The use of caulking, rope or band type of an end seal will not be allowed. Acceptable End Seals are Insignia™ End Seals by LMK Enterprises, 1779 Chessie Lane, Ottawa, IL 61350 (815) 433- 1275, or pre-approved equal.

K. The resin system shall be a corrosion resistant polyester, vinyl ester, or epoxy and catalyst system that when properly cured within the tube composite meets the requirements of ASTM F1216 and ASTM F1743, the physical properties herein, and those which are to be utilized in the Design of the CIPP for this project. The resin shall produce CIPP which will comply with the structural and chemical resistance requirements of this specification.

L. The finished pipe in place shall be fabricated from materials which when cured will be chemically resistant to withstand internal exposure to domestic sewage. All constituent materials will be suitable for service in the environment intended. The final product will not deteriorate, corrode or lose structural strength that will reduce the projected product life. In industrial areas a liner system using epoxy vinyl ester resin shall be utilized and a polyester resin shall be used in non-industrial areas. The CITY shall determine the type of appropriate resin to be utilized for each line segment.

M. The CIPP shall be designed as per ASTM F1216, Appendix X1. The CIPP design shall assume no bonding to the original pipe wall. The structural performance of the

finished pipe must be adequate to accommodate all anticipated loads throughout its design life.

N. The CIPP must have a minimum design life of fifty (50) years. The minimum design life may be documented by submitting life estimates by national and/or international authorities or specifying agencies. Otherwise, long-term testing and long-term in-service results (minimum ten (10) years) may be used, with the results extrapolated to fifty (50) years.

O. The CONTRACTOR must have performed long-term testing for flexural creep of the CIPP pipe material installed by his company. Such testing results are to be used to determine the long-term, time dependent flexural modulus to be utilized in the product design. This is a performance test of the materials (tube and resin) and general workmanship of the installation and curing. A percentage of the instantaneous flexural modulus value (as measured by ASTM D-790 testing) will be used in design calculations for external buckling.

The percentage, or the long-term creep retention value utilized, will be verified by this testing. Values in excess of 50% will not be applied unless substantiated by qualified third party test data. The materials utilized for the contracted project shall be of a quality equal to or better than the materials used in the long-term test with respect to the initial flexural modulus used in design.

P. The minimum required structural CIPP wall thickness shall be based on the physical and structural properties described herein and in accordance with the design equations in the appendix of ASTM F 1216, and the following design parameters:

Design Safety Factor	2.0
Retention Factor for Long-Term Flexural Modulus to be used in Design *(as determined by Long-Term tests described in paragraph 2.02.B)*	50 %
Ovality*	2 %
Water Table = Grade Elevation	ft.
Soil Depth (above crown)*	ft.
Soil Modulus	700 psi
Soil Density	120 pcf
Live Load	One H20 passing truck
Design Condition	Fully deteriorated
**Denotes information which can be provided here or in inspection video tapes or project construction plans. Multiple line segments may require a table of values.*	

Q. The lining manufacturer shall submit to the CITY for review complete design calculations for the liner, signed and sealed by a Professional Engineer registered in the State of Florida and certified by the manufacturer as to the compliance of his materials to the values used in the calculations. The buckling analysis shall account for the combination of dead load, live load, hydrostatic pressure and grout pressure (if any). The liner side support shall be considered as if provided by soil pressure against the liner. The existing pipe shall not be considered as providing any structural support. Modulus of soil reaction shall be 700, corresponding to a moderate degree of compaction of bedding and a fine-grained soil as shown in AWWA Manual M45, Fiberglass Pipe

Design.

R. As part of the design calculation submittal, the liner manufacturer shall submit a tabulation of time versus temperature. This tabulation shall show the lengths of time that exposed portions of the liner will endure without self-initiated cure or other deterioration beginning. This tabulation shall be at five-degree Fahrenheit increments ranging from 70 degrees F to 100 degrees F. The manufacturer shall also submit his analysis of the progressive effects of such "pre-cure" on the insertion and cured properties of the liner. This information shall be submitted in a timely fashion prior to the preconstruction conference so that the CITY may set procedures for dealing with such an instance caused by construction delays.

S. The layers of the cured CIPP shall be uniformly bonded. It shall not be possible to separate any two layers with a probe or point of a knife blade so that the layers separate cleanly or the probe or knife blade moves freely between the layers. If separation of the layers occurs during testing of field samples, new samples will be cut from the work. Any reoccurrence may cause rejection of the work.

T. Any layers of the tube that are not saturated with resin prior to insertion into the existing pipe shall not be included in the structural CIPP wall thickness computation.

U. Liner shall be neither accepted nor installed until design calculations are acceptable to the CITY. Liner shall be as manufactured by Inliner Technologies, 1468 West Hospital Road, Paoli, Indiana 47454-9215, or approved equal.

2.02 STRUCTURAL REQUIREMENTS FOR MAIN LINES

A. Since the pipe strength is related to the uniformity and density of the pipe wall, only resin vacuum impregnation will be allowed. Resin impregnation without vacuum entraps air and creates voids which weaken the pipe wall. If reinforcing materials (fiberglass, etc.) are used, the reinforcing material must be fully encapsulated within the resin to assure that the reinforcement is not exposed, either to the inside of the pipe or at the interface of the CIPP and the existing pipe.

B. The design for the CIPP wall thickness will be based on the following strengths, unless otherwise submitted to and approved by the CITY.

Property	Test Method	Cured Composite per ASTM F1216
Flexural Modulus of Elasticity	ASTM D-790	250,000 psi
Flexural Stress	ASTM D-790	4,500 psi

2.03 TESTING REQUIREMENTS

A. Chemical Resistance - The CIPP shall meet the chemical resistance requirements of ASTM F1216, Appendix X2. CIPP samples for testing shall be of tube and resin system similar to that proposed for actual construction. It is required that CIPP samples with and without plastic coating meet these chemical testing requirements.

B. Hydraulic Capacity - Overall, the hydraulic profile shall be maintained as large as possible. The CIPP shall provide at least 100 percent of the flow capacity of the original pipe before rehabilitation. In lieu of actual measurements, calculated capacities may be derived using commonly accepted equations and values of the Manning flow coefficients (designated "n" coefficients). The original pipe material and condition at the time of reconstruction will determine the Manning coefficient used in the host pipe. A Manning coefficient of 0.009 for a jointless, relatively smooth-wall cured-in-place pipe will be used for the lateral CIPP flow calculation.

C. CIPP Field Samples - When requested by the CITY, the CONTRACTOR shall submit test results from field installations in the USA of the same resin system and tube materials as proposed for the actual installation. These test results must verify that the CIPP physical properties specified herein have been achieved in previous field applications.

D. Prior to any liner installation, the CONTRACTOR shall submit technical data sheets showing the physical and chemical properties and infrared spectrum analysis per ASTM E1252 (chemical fingerprint) of the proposed resin system as modified for the cured-in-place process. Additionally, copies of the certificates of analysis for resin used on the project must be made available to the CITY. The CONTRACTOR shall test each lot of resin used by conducting infrared spectrum analyses on field samples. These analyses shall be conducted at the CONTRACTOR's expense.

E. The CONTRACTOR shall provide resin samples as directed by the CITY during the duration of the project and infrared spectrography chemical fingerprints shall be run and compared to the submitted fingerprint to verify the resin used is the resin submitted for use on this project. These analyses shall be conducted at the CITY's expense.

F. In the case of liner installation performed under this contract, CIPP samples shall be prepared and physical properties tested in accordance with ASTM F1216 or ASTM F1743, Section 8, using either method proposed.

1. The CONTRACTOR shall submit a method to the CITY, for approval, to obtain representative samples from the installed liners. These samples will be tested by the CITY, at the CITY's expense, to verify compliance with the installed material specifications. The CONTRACTOR shall produce these test samples when so directed by the CITY. The CITY reserves the right to request samples from as many as 10 percent of the liners installed, unless a pattern of failure occurs. In this case, the CONTRACTOR will be requested to provide a greater quantity of samples, up to 100 percent, at no additional cost, and the CONTRACTOR shall bear all costs of this additional testing. Liners which do not pass these material tests may be accepted at reduced payment or rejected pursuant to Section 01025.

2. The cost for sample collection shall be included in the bid price for rehabilitation.

3. Test specimens shall be marked in indelible ink with the appropriate lateral or main section, work order number, date of installation, and orientation to the top of the pipe (direction of up) so the results can be correlated to the field work performed. All test results shall use this designated labeling as a reference.

4. The extraction and labeling of test specimens shall be done in the presence of the CITY. The CITY and CONTRACTOR shall, upon completion of sample extraction and labeling, both sign a chain-of-custody form that shall subsequently accompany the sample at all times and shall ultimately be received and signed at the testing laboratory. Test reports shall include a copy of the chain-of-custody form with all signatures to ensure that reported test results are for the correct sample.

5. The flexural properties must meet or exceed the values specified herein.

6. Wall thickness of samples shall be determined as described in paragraph 8.1.6 of ASTM F1743.

7. Visual inspection of the CIPP shall be by closed-circuit television.

PART 3 - EXECUTION

3.01 CLEANING/SURFACE PREPARATION

A. It shall be the responsibility of the CONTRACTOR to clean the pipeline with a high-pressure water jet and to remove all internal debris out of the pipeline in accordance with Section 02751, "Cleaning and Root Removal".

3.02 SEWER REPAIRS

A. Any protruding pieces of concrete, dropped joints or broken pipe shall be subjected to point repairs so that the pipe is left in a clean smooth condition in all respects ready for lining, unless otherwise jointly determined by the Contractor and the CITY that the defect will not compromise the integrity of the liner.

B. If conditions such as broken pipe and major blockages are found that will prevent proper cleaning, or where additional damage would result if cleaning is attempted or continued, the CONTRACTOR, with the advance concurrence of the CITY, shall perform the necessary point repair(s), and then complete the cleaning.

3.03 JOINT, CRACK, ANNULAR SPACE, AND LINER END CHEMICAL SEALING

A. Prior to cured-in-place liner installation, all active leaks of a magnitude to compromise the integrity of the liner shall be stopped using chemical grout, at no additional cost to the CITY.

B. 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; and shall be compatible with the CIPP liner resin system utilized. The chemical sealing materials 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-100 manufactured by Avanti International, Houston, Texas (1-800-877-2570), or approved equal.

C. The Contractor shall modify his equipment as necessary to seal the leaks, however both his equipment and sealing method must meet the approval of the CITY prior to use. Extreme caution shall be utilized during leak sealing (pressure) operations in order to avoid damaging the already weakened sewer pipe. If any damage occurs, it shall be repaired at the CONTRACTOR's cost and to the satisfaction of the CITY. 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.

3.04 FLOW CONTROL

A. Flow control shall be exercised as required to ensure that no flowing sewage comes into contact with sections of the sewer under repair. See Section 02750, "Wastewater Flow Control" for additional information.

3.05 LINER INSTALLATION FOR MAIN LINES

A. The pre-lining video of the prepared pipe shall be reviewed and be acceptable to the CITY for cleanliness and smoothness before the CONTRACTOR begins to line the pipe.

B. The CONTRACTOR shall present to the CITY, for review, a description of his methods for avoiding liner stoppage due to conflict and friction with such points as the manhole entrance and the bend into the pipe entrance. He shall also present plans for dealing with a liner stopped by snagging within the pipe. This information shall be rendered to the CITY in a timely fashion prior to the preconstruction conference.

C. The CONTRACTOR shall immediately notify the CITY of any construction delays taking place during the insertion operation. Such delays shall possibly require sampling and testing by an independent laboratory of portions of the cured liner at the CITY's discretion. The cost of such test shall be borne by the CONTRACTOR and no extra compensation will be allowed. Any failure of sample tests or a lack of immediate notification of delay shall be automatic cause for rejection of that part of the work at the CITY's discretion.

D. The CONTRACTOR shall designate a location where the tube will be impregnated with resin prior to installation. The CONTRACTOR shall allow the CITY and/or CITY to inspect the materials and the "wet-out" procedure.

E. The CONTRACTOR shall submit construction schedules for advance approval by the CITY. At no time will any service lateral remain inoperative for more than an eight (8)-hour period. Any service that will be out of service for more than eight (8) hours will be temporarily by-passed into a mainline sanitary sewer, at the CONTRACTOR's expense.

F. The materials and processes must be reasonably available for pre-installation, installation and post-installation inspections. Areas which require inspection include, but are not limited to, the following:

1. Product materials should exhibit sufficient transparency to visually verify the quality of resin impregnation.

2. Temperature sensing devices, such as thermocouples, shall be located between the existing pipe and the CIPP to ensure the quality of the cure of the wall

laminate.

3.06 LINER INSTALLATION FOR MAIN LINES

A. After the inversion is complete, the CONTRACTOR shall supply a suitable heat source and water recirculation equipment to circulate heated water throughout the pipeline. The equipment shall be capable of delivering hot water throughout the pipeline to uniformly raise the water temperature to a level required to effectively cure the resin. The heat source shall be fitted with suitable monitors to gauge the temperature of the incoming and outgoing water supply. Another such gage shall be placed between the tube and the host pipe at the termination end at or near the bottom to determine the temperatures during cure. Water temperature in the pipe during the cure period shall be as recommended by the resin manufacturer.

B. Initial cure shall be deemed complete when the exposed portions of the tube appear to be hard and sound and the temperature sensor indicates that the temperature is of a magnitude to realize an exotherm. The cure period shall be of a duration recommended by the resin manufacturer and may require continuous recirculation of the water to maintain the temperature. The CONTRACTOR shall have on hand at all times, for use by his personnel and the CITY, a digital thermometer or other means of accurately and quickly checking the temperature of exposed portions of the liner.

C. CIPP installation shall be in accordance with ASTM F1216, Section 7, or ASTM F1743, Section 6, with modifications as listed herein.

D. Resin Impregnation: The quantity of resin used for tube impregnation shall be sufficient to fill the volume of air voids in the tube with additional allowances for polymerization shrinkage and the loss of resin through cracks and irregularities in the original pipe wall. A vacuum impregnation process shall be used. To ensure thorough resin saturation throughout the length of the felt tube, the point of vacuum shall be no further than 25 feet from the point of initial resin introduction. After vacuum in the tube is established, a vacuum point shall be no further than 75 feet from the leading edge of the resin. The leading edge of the resin slug shall be as near to perpendicular as possible. A roller system shall be used to uniformly distribute the resin throughout the tube. If the Installer uses an alternate method of resin impregnation, the method must produce the same results. Any alternate resin impregnation method must be proven.

E. Tube Insertion: The wetout tube shall be positioned in the pipeline using either inversion or a pull-in method. If pulled into place, a power winch should be utilized and care should be exercised not to damage the tube as a result of pull-in friction. The tube should be pulled-in or inverted through an existing manhole or approved access point and fully extend to the next designated manhole or termination point.

F. Temperature gauges shall be placed inside the tube at the invert level of each end to monitor the temperatures during the cure cycle.

G. Curing shall be accomplished by utilizing hot water under hydrostatic pressure in accordance with the manufacturer's recommended cure schedule.

H. Cooldown: The CONTRACTOR shall cool the hardened pipe to a temperature below 100 F before relieving the hydrostatic head. Cooldown may be accomplished by the introduction of cool water into the inversion standpipe to replace water being pumped

out of the manhole. Care should be taken in release of static head so that vacuum will not be developed that could damage the newly installed liner.

I. Finish: The new pipe shall be cut off in the manhole at a suitable location. The finished product shall be continuous over the length of pipe reconstructed and be free from dry spots, delamination and lifts. Should the liner not make a tight seal at the inside manhole wall, a watertight seal shall be made by use of extra polyester fiber felt and epoxy resin. Pipe entries and exists shall be smooth, free of irregularities, and watertight. No visible leaks shall be present and the CONTRACTOR shall be responsible for grouting to remove leaks or fill voids between the host pipe and the liner. 100% of all lateral reconnections, drop connections and manhole connections are to be chemically grouted. During the warranty period, any defects which will affect the integrity or strength of the product shall be repaired at the CONTRACTOR's expense, in a manner mutually agreed upon by the CITY and the CONTRACTOR.

3.07 REINSTATEMENT OF SERVICE LATERALS, BRANCH CONNECTIONS, AND DROP MANHOLE CONNECTIONS

A. After the pipe has been cured in place, the CONTRACTOR shall reconnect the existing service connections. This shall be done from the interior of the pipeline without excavation using a robotic cutter. Where holes are cut through the liner, they shall be neat and smooth in order to prevent blockage at the service connections. Cut-in service connections shall be opened to a minimum of 95 percent of the flow capacity of the building sewer. Cuts shall be wire-brushed to remove jagged edges. All coupons shall be recovered at the downstream manhole and removed. The CONTRACTOR shall stop all visible leaks, including at service connections. All reinstated service lateral connections (between the liner and the existing pipe) shall be grouted.

B. The CONTRACTOR shall seal all laterals after the reinstatements are 100% cut and brushed. The sealing is to be in compliance with ASTM F2454. The lateral sealing area is to include the first joint or 18” into the lateral pipe whichever is more. A test is necessary after the annular space is sealed in keeping with the ASTM Standard. If the test fails any resealing will be done at the expense of the contractor. All grout sealing required (lateral connections and manholes penetrations) are to be 100% complete before the final video is done to document that the completed section is ready to be submitted for payment. The final video must show the entire surface of the lateral (pan the lateral) and the up and down stream manhole connections. During the sealing and testing of the lateral connections the contractor is to have an inspector present to document the procedure. The contractor is also directed to video tape the seal and completed testing as follows. To be paid for a lateral reinstatement the video must show 1) a 5 second video prior to sealing, 2) a 15 second video of the test pressure showing the lateral passed the pressure test. The screen must have the lift station number, manhole to manhole numbers and the station footage of the lateral on the main. The video must not run the entire time, just as described above.

C. It is the intent of these specifications that service laterals be reopened without excavation, utilizing a remote-controlled cutting device, monitored by a video TV camera. The Contractor shall certify he has a minimum of 2 complete working cutters plus spare key components on the site before each liner installation. No additional payment will be made for excavations for the purpose of reopening connections and the Contractor will be responsible for all costs and liability associated with such

excavation and restoration work.

D. Unless otherwise directed by the CITY, all laterals will be reinstated. The CITY will provide specific direction concerning any laterals that will be abandoned and will therefore not require reinstatement. The CONTRACTOR shall abandon a lateral by not reinstating the lateral only with the written consent of the CITY.

E. The language in this section applies equally to branch connections and drop manhole connections.

3.08 ACCEPTANCE

A. The finished liner shall be continuous over the entire length of the installation. The liner shall be free from visual defects, damage, deflection, holes, delamination, uncured resin, and the like. No pinholes, cracks, thin spots, dry spots, or other defects in the liner will be permitted. There shall be no visible infiltration through the liner or from behind the liner at manholes and service connections. Cut-ins and attachments at service connections shall be neat and smooth.

B. Ridges or wrinkles in the installed liner shall be accepted or rejected at the sole discretion of the CITY. If, in the opinion of the CITY, such defects could cause structural weakening of the liner, impede the progress of a camera during internal television inspection, or encourage solids deposition and potential interruptions to flow, such defects shall be corrected at the CONTRACTOR's expense in a manner acceptable to the CITY.

3.10 WET-OUT AND CURE REPORT

A. The CONTRACTOR shall submit "wet out" and "cure" reports documenting the specific details of the liner's vacuum impregnation and saturation with resin and the CIPP installation of the liner. A copy of all "wet out" and "cure" records shall be made available to the CITY upon request, and shall be turned over to the CITY on a weekly basis and prior to request for payment. If the "wet out" and "cure" reports are not presented prior to a payment request for a repair work order, payment for the work will not be made and the request will be rejected. At a minimum, this report shall include, in addition to CONTRACTOR and Contract identification:

1. Line identification and location
2. Wet-out date
3. Sample identification(s) and technician
4. Installation (in sewer) date
5. Host sewer pipe inside diameter
6. Liner thickness
7. Liner length
8. Liner and resin batch numbers
9. Resin type

10. Wet out length
11. Quantity of resin and catalyst utilized
12. Wet out technicians
13. Time wet out started and completed
14. Applicable remarks
15. Boiler and liner heating fluid pressure and temperature versus time log during cure period
16. Cool down report

3.11 CLEANUP

A. After the liner installation has been completed and accepted, the CONTRACTOR shall cleanup the entire project area and return the ground cover to the original or better condition. All excess material and debris not incorporated into the permanent installation shall be disposed of by the CONTRACTOR.

3.12 TELEVISION SURVEY

A. Television survey, including Preconstruction Survey, Post Construction Survey, and Warranty Survey, as indicated in Section 02752 "Television Survey", is required for all cured-in-place lining, including main lines and service laterals, and shall be completed within 2 weeks of liner installation.

3.13 PUBLIC NOTIFICATION

A. The Contractor shall make every effort to maintain service usage throughout the duration of the project. In the event that a service will be out of service, the maximum amount of time of no service shall be 8 hours for any property served by the sewer. A public notification program shall be implemented, and shall as a minimum, require the Contractor to be responsible for contacting each home or business connected to the sanitary sewer and informing them of the work to be conducted, and when the sewer will be off-line. The Contractor shall also provide the following:

1. Whether or not an interruption in service is expected, written notice to be delivered to each home or business the day prior to the beginning of work being conducted on the section, and a local telephone number of the Contractor the home or business can call to discuss the project or any problems which could arise.

2. Personal contact with any home or business which cannot be reconnected within the time stated in the written notice.

3.14 WARRANTY

A. The liner shall be certified by the manufacturer for specified material properties for a particular job. The manufacturer warrants the liner to be free from defects in raw materials for five years from the date of acceptance. During the warranty period, any defects which affect the integrity or strength of the pipe shall be repaired at the CONTRACTOR's expense in a manner mutually agreed by the CITY and the

CONTRACTOR.

B. The CONTRACTOR warrants his work to be sealed tight at each end of the liner, drop connections, and also at each service connection for a period of five years.

– END OF SECTION –

SECTION 02771

CONCRETE CURBS AND SIDEWALKS

PART 1 - GENERAL (NOT USED)

PART 2 - MATERIALS

2.01 EXPANSION JOINT FILLER

A. 1/2-inch thick, preformed asphalt-impregnated, expansion joint material meeting AASHTO M153 Type I, II, or III, or AASHTO M213, or cellulose fiber types meeting the requirements of AASHTO M213, except the asphalt content is acceptable provided they contain minimum of 0.2 percent copper pentachlorophenate as a preservative and 1 percent water proofing wax.

2.02 CONCRETE

A. Ready-mixed meeting ASTM C94, Option A, with compressive strength of 3,000 psi at 28 days.

B. Maximum Aggregate Size: 1-1/2 inch.

C. Slump: 2 to 4 inches.

2.03 CURING COMPOUND

A. Liquid membrane-forming, clear or translucent, suitable for spray application and meeting ASTM C309, Type 1.

PART 3 - EXECUTION

3.01 FORMWORK

A. Lumber Materials:

1. 2-inch dressed dimension lumber, or metal of equal strength, straight, free from defects that would impair appearance or structural quality of completed curb and sidewalk.

2. 1-inch dressed lumber or plywood may be used where short-radius forms are required.

B. Metals: Steel in new undamaged condition.

C. Setting Forms:

1. Construct forms to shape, lines, grades, and dimensions.

2. Stake securely in place.

D. Bracing:

1. Brace forms to prevent change of shape or movement resulting from placement.

2. Construct short-radius curved forms to exact radius.

E. Tolerances:

1. Do not vary tops of forms from gradeline more than 1/8 inch when checked with 10-foot straightedge.

2. Do not vary alignment of straight sections more than 1/8 inch in 10 feet.

3.02 PLACING CONCRETE

A. Excavate to the required depth, place and compact limerock base rock as specified in the Contract Documents. Compact directly under the area and 1 foot beyond each side of the sidewalk and curb.

B. Prior to placing concrete, remove water from excavation and debris and foreign material from forms.

C. Place concrete as soon as possible, and within 1-1/2 hours after adding cement to mix without segregation or loss of ingredients, and without splashing.

D. Place, process, finish, and cure concrete in accordance with applicable requirements of ACI 304, and this section. Wherever requirements differ, the more stringent shall govern.

E. To compact, vibrate until concrete becomes uniformly plastic.

F. All edges shall be smooth and rounded.

3.03 CURB CONSTRUCTION

A. Construct ramps at pedestrian crossings in compliance with FDOT and PROWAG minimum standards. Standards apply to work in the City's Rights of Way.

B. Expansion Joints: Place at maximum 20-foot intervals and at the beginning and end of curved portions of curb, and at connections to existing curbs. Install expansion joint filler at each joint.

C. Gutter minimum slope shall be 0.33% unless otherwise approved by the City.

D. Curb Facing: Do not allow horizontal joints within 7 inches from top of curb.

E. All gutters and curb and gutters shall have a minimum 4" think limerock "curb pad" LBR 100.

F. Contraction Joints:

1. Maximum 10-foot intervals in curb.

2. Provide open joint type by inserting thin, oiled steel sheet vertically in fresh concrete to force coarse aggregate away from joint.

3. Insert steel sheet to full depth of curb.

4. Remove steel sheet with sawing motion after initial set has occurred in concrete and prior to removing front curb form.

5. Finish top of curb with steel trowel and finish edges with steel edging tool.

G. Front Face:

1. Remove front form and finish exposed surfaces when concrete has set sufficiently to support its own weight.

2. Finish formed face by rubbing with burlap sack or similar device to produce uniformly textured surface, free of form marks, honeycomb, and other defects.

3. Remove and replace *defective* concrete.

4. Apply curing compound to exposed surfaces of curb upon completion of finishing.

5. Continue curing for minimum of 5 days.

H. Backfill curb with earth upon completion of curing period, but not before 7 days has elapsed since placing concrete.

1. Backfill shall be free from rocks 2 inches and larger and other foreign material.

2. Compact backfill firmly.

3.04 SIDEWALK CONSTRUCTION

A. Thickness:

1. 6 inches.

B. Connection to Existing Sidewalk:

1. Remove old concrete back to an existing contraction joint.

2. Clean the surface.

3. Apply a neat cement paste immediately prior to placing new sidewalk.

C. Expansion Joints: Place at maximum 20-foot intervals, at adjacent curb expansion joint, where sidewalk ends at curb, and around posts, poles, or other objects penetrating sidewalk. Install expansion joint filler at each joint.

D. Contraction Joints:

1. Provide transversely to walks at locations opposite contraction joints in curb.

2. Dimensions: 3/16-inch by 1-inch weakened plane joints.

3. Construct straight and at right angles to surface of walk.

E. Finish:

1. Broom surface with fine-hair broom at right angles to length of walk and tool at edges, joints, and markings.

2. Ensure that the surface variations are not more than ¼ inch under a 10-foot straightedge, or more than 1/8 inch on a 5-foot transverse section.

3. Mark walks transversely at 5-foot intervals, or in pattern shown on Drawings, with jointing tool; finish edges with rounded steel edging tool.

4. Apply curing compound to exposed surfaces upon completion of finishing.

5. Protect sidewalk from damage and allow to cure for at least 7 days.

F. Curb Ramps:

1. All curb ramps and detectable warnings shall comply with the current FDOT Index 304 and the Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way by the United States Access Board.

- END OF SECTION -

SECTION 02772

ASPHALT CONCRETE PAVEMENT

PART 1 - GENERAL

1.01 STANDARD SPECIFICATIONS

A. When referenced in this Section, Standard Specifications shall mean Florida Department of Transportation, Standard Specifications for Road and Bridge Construction, current edition.

1.02 QUALITY ASSURANCE

A. Qualifications:

1. Independent Testing Laboratory: In accordance with ASTM E329.

2. Asphalt concrete mix formula shall be prepared by an approved certified independent laboratory under the supervision of a certified asphalt technician.

1.03 SUBMITTALS

A. The Contractor shall submit its proposed formula for the asphaltic concrete paving for review in accordance with the Section entitled “Submittals”.

1.04 ENVIRONMENTAL REQUIREMENTS

A. Temperature: Do not apply asphalt materials or place asphalt mixes when ground temperature is lower than 10 degrees C (50 degrees F), or air temperature is lower than 4 degrees C (40 degrees F). Measure ground and air temperature in shaded areas away from heat sources or wet surfaces.

B. Moisture: Do not apply asphalt materials or place asphalt mixes when application surface is wet.

PART 2 - MATERIALS

2.01 MATERIALS

A. Prime Coat: Cut-back asphalt, Grades RC-70 or RC-250 meeting the requirements of the Standard Specifications.

B. Tack Coat: Emulsified asphalt, Grade RS-2, SS-1, or SS-1H meeting the requirements of the Standard Specifications. The bituminous material shall be heated to a suitable consistency as directed by the City.

C. Sand (Blotter Material): Clean, dry, with 100 percent passing a 4.75 mm (No. 4) sieve, and a maximum of 10 percent passing a 75 mm (No. 200) sieve.

2.02 ASPHALT CONCRETE MIX

A. General:

1. Mix formula shall not be modified except with the written approval of City.

2. Source Changes:

a. Should material source(s) change, establish a new asphalt concrete mix formula before the new material(s) is used.

b. Perform check tests of properties of the plant-mix bituminous materials on the first day of production and as requested by City to confirm that properties are in compliance with design criteria.

c. Make adjustments in gradation or asphalt content as necessary to meet design criteria.

B. Asphalt Concrete: Type SP meeting the requirements of the FDOT Standard Specifications.

C. Composition: Hot-plant mix of aggregate, mineral filler, and paving grade asphalt cement. The several aggregate fractions shall be sized, uniformly graded, and combined in such proportions that the resulting mixture meets the grading requirements of the mix formula.

D. Aggregate:

1. The aggregate shall meet the requirements of the Standard Specifications.

2. Mineral Filler shall meet the requirements of the Standard Specifications

E. Asphalt Cement: Paving Grade AC-30 meeting the requirements of the Standard Specifications.

PART 3 - EXECUTION

3.01 GENERAL

A. Traffic Control: Minimize inconvenience to traffic, but keep vehicles off freshly treated or paved surfaces to avoid pickup and tracking of asphalt.

B. Driveways: Repave driveways from which pavement was removed. Leave driveways in as good or better condition than before start of construction.

3.02 LINE AND GRADE

A. Provide and maintain intermediate control of line and grade, independent of the underlying base to meet finish surface grades and minimum thickness.

B. Shoulders: Construct to line, grade, and cross-section shown.

3.03 PREPARATION

A. Prepare subgrade as specified in the Contract Documents.

B. Existing Roadway:

1. Modify profile by grinding, milling, or overlay methods as approved, to provide meet lines and surfaces and to produce a smooth riding connection to existing facility.

2. Resurface entire roadway following adjustment of base and asphalt grades.

3. Paint edges of meet line with tack coat prior to placing new pavement.

C. Thoroughly coat edges of contact surfaces (curbs, manhole frames) with emulsified asphalt or asphalt cement prior to laying new pavement. Prevent staining of adjacent surfaces.

3.04 PAVEMENT APPLICATION

A. General: Place asphalt concrete mixture on an approved, prepared base in conformance with this Section.

B. Cold Milling

1. Milling of existing asphalt pavement shall be at the depth and location as indicated on the Construction Drawings or as directed by the City.

2. The milled surface shall be reasonably smooth and free of excessive scarification marks, gouges, ridges, continuous grooves, or other damage. The milled pavement surface shall be thoroughly cleaned of all loose aggregate particles, dust, and other objectionable material by the use of power brooms, power blowers, power vacuums or other means.

3. The Contractor shall coordinate the adjustment of maintenance access structures, meter boxes, drainage inlets, and valve boxes with the milling operation.

4. All milled material shall become the property of the Contractor and shall be disposed of off-site or used in conformance with the Contract Documents, or for utilization as Reclaimed Asphalt Pavement, in conformance with the specification provided above, as approved by the City.

C. Prime Coat:

1. Heat cut-back asphalt between 100 degrees F and 150 degrees F prior to application.

2. Apply uniformly to clean, dry surfaces. Avoiding overlapping of applications.

3. Do not apply when moisture content of upper 3 inches of base exceeds optimum moisture content of base, or if free moisture is present.

4. Application Rate: Minimum 0.1 gallons per square yard of surface area.

5. Remove or redistribute excess material.

6. Allow a minimum of 5 full days for curing of primed surface before placing asphalt concrete.

D. Tack Coat:

1. Apply uniformly to clean, dry surfaces. Avoiding overlapping of applications.

2. Do not apply more tack coat than necessary for the day's paving operation.

3. Touch up missed or lightly coated surfaces and remove excess material.

4. Application Rate:

a. Minimum 0.05 gallons to maximum 0.12 gallons of asphalt (residual if diluted emulsified asphalt) per square yard of surface area.

b. Apply at rate, within range specified, sufficient to assure good bonding, but not so heavy that surplus asphalt flushes into asphalt concrete being placed.

E. Pavement Mix:

1. Prior to Paving:

a. Sweep primed surface free of dirt, dust, or other foreign matter.

b. Patch holes in primed surface with asphalt concrete pavement mix.

c. Blot excess prime material with sand.

2. Place asphalt concrete pavement mix in lifts as shown.

3. Compacted Lift Thickness:

a. Minimum: Twice the maximum aggregate size, but in no case less than 1 inch. Minimum thickness for Type SP-9.5 is 1.0 inches.

b. Maximum: 4 inches.

4. Total Compacted Thickness: Per Contract Documents.

5. Apply such that meet lines are straight and edges are vertical.

6. Collect and dispose of segregated aggregate from raking process. Do not scatter material over finished surface.

7. Joints:

    a. Offset edge of each layer a minimum of 6 inches so joints are not directly over those in underlying layer.

    b. Offset longitudinal joints in roadway pavements, so longitudinal joints in wearing layer coincide with pavement centerlines and lane divider lines.

    c. Form transverse joints by cutting back on previous day's run to expose full vertical depth of layer.

8. Succeeding Lifts: Apply tack coat to pavement surface between each lift.

9. After placement of pavement, seal meet line by painting a minimum of 6 inches on each side of the joint with cut-back or emulsified asphalt. Cover immediately with sand.

F. Compaction:

1. Roll until roller marks are eliminated and compacted to 100 percent of the laboratory compacted mixture.

2. Joint Compaction:

    a. Place top or wearing layer as continuously as possible.

    b. Pass roller over unprotected end of freshly laid mixture only when placing of mix is discontinued long enough to permit mixture to become chilled.

    c. Cut back previously compacted mixture when Work is resumed to produce a slightly beveled edge for full thickness of layer.

    d. Cut away waste material and lay new mix against fresh cut.

G. Tolerances:

1. General: Conduct measurements for conformity with crown and grade immediately after initial compression. Correct variations immediately by removal or addition of materials and by continuous rolling.

2. Completed Surface or Wearing Layer Smoothness:

    a. Uniform texture, smooth, and uniform to crown and grade.

    b. Maximum Deviation: 1/8 inch from lower edge of a 12-foot straightedge, measured continuously parallel and at right angle to centerline.

    c. If surface of completed pavement deviates by more than twice the specified tolerances, remove and replace wearing surface.

3. Transverse Slope Maximum Deviation: ¼ inch in 12 feet from the rate of slope shown.

4. Finished Grade:

   a. Perform a field differential level survey on a maximum 50-foot grid and along all grade breaks.

   b. Maximum Deviation: 0.02 foot from the grade shown.

H. Seal Coat:

1. General: Apply seal coat of paving grade or emulsified asphalt to finished surface at longitudinal and transverse joints, joints at abutting pavements, areas where the asphalt concrete was placed by hand, patched surfaces, and other areas as directed by the City.

2. Preparation:

   a. Maintain surfaces that are to be sealed free of holes, dry, and clean of dust and loose material.

   b. Seal in dry weather and when the temperature is above 35 degrees F.

3. Application:

   a. Fill cracks over 1/16 inch in width with an asphalt-sand slurry or approved crack sealer prior to sealing.

   b. When sealing patched surfaces and joints with existing pavements, extend minimum 6 inches beyond edges of patches.

3.05 PAVEMENT OVERLAY

A. Preparation:

1. Remove fatty asphalt, grease drippings, dust, and other deleterious matter.

2. Surface Depressions: Fill with asphalt concrete mix, and thoroughly compact.

3. Damaged Areas: Remove broken or deteriorated asphalt concrete and patch as specified in Article Patching.

4. Portland Cement Concrete Joints: Remove joint filler to minimum 1/2 inch below surface.

B. Application:

1. Tack Coat: As specified in this Section.

2. Place and compact asphalt concrete as specified in Article Pavement Application.

3. Place first layer to include widening of pavement and leveling of irregularities in the surface of the existing pavement.

4. When leveling irregular surfaces and raising low areas, the actual compacted thickness of any one lift shall not exceed 2 inches.

5. The actual compacted thickness of intermittent areas of 120 square yards or less may exceed 2 inches, but not 4 inches.

6. Final wearing layer shall be of uniform thickness, and meet grade and cross-section as shown.

3.06 PATCHING HOT MIX ASPHALT

A. Preparation:

1. Remove damaged, broken, or unsound asphalt concrete adjacent to patches. Trim to straight lines exposing smooth, sound, vertical edges.

2. Prepare patch subgrade as specified in the Contract Documents.

B. Application:

1. Patch Thickness: 3 inches or thickness of adjacent asphalt concrete, whichever is greater.

2. Place asphalt concrete mix across full width of patch in layers of equal thickness.

3. Spread and grade asphalt concrete with hand tools or mechanical spreader, depending on size of area to be patched.

C. Compaction:

1. Roll patches with power rollers capable of providing compression of 200 to 300 pounds per linear inch. Use hand tampers where rolling is impractical.

2. Begin rolling top course at edges of patches, lapping adjacent asphalt surface at least 1/2 the roller width. Progress toward center of patch overlapping each preceding track by at least 1/2 the width of roller.

3. Make sufficient passes over entire area to remove roller marks and to produce desired finished surface.

D. Tolerances:

1. Finished surface shall be flush with and match grade, slope, and crown of adjacent surface.

2. Tolerance: Surface smoothness shall not deviate more than plus 1/4 inch or minus 0 when a straightedge is laid across patched area between edges of new pavement and surface of old surfacing.

3.07 FIELD QUALITY CONTROL

A. General: Provide services of an approved certified independent testing laboratory to conduct tests.

B. Field Density Tests:

1. Perform tests from cores or sawed samples.

2. Measure with properly operating and calibrated nuclear density gauge.

3. Maximum Density: In accordance with ASTM D2041, using a sample of mix taken prior to compaction from the same location as the density test sample.

C. Testing Frequency:

1. Quality Control Tests:

a. Asphalt Content, Aggregate Gradation: Once per every 500 tons of mix or once every 4 hours, whichever is greater.

b. Mix Design Properties, Measured Maximum (Rice's) Specific Gravity: Once every 1,000 tons or once every 8 hours, whichever is greater.

2. Density Tests: Once every 500 tons of mix or once every 4 hours, whichever is greater.

- END OF SECTION -

SECTION 02795

PERVIOUS CONCRETE

PART 1 - GENERAL

1.01 THE REQUIREMENTS

A. The Contractor is responsible for installing pervious concrete to manage post-construction stormwater runoff. This item covers the work necessary for installation of the pervious concrete. The Contractor shall furnish all material, labor, and equipment necessary for the proper installation of this facility.

B. It is the intent of this Specification that the Contractor conducts the construction activities in such a manner that the pervious concrete functions as a stormwater management practice, which includes the minimization of upstream erosion and sedimentation.

C. Installation of the pervious concrete shall occur after the contributing watershed has been stabilized. It shall be the responsibility of the Contractor to make any necessary repairs if the performance of the system is impacted by sediment during construction or due to improper construction sequencing. The Contractor shall implement additional measures as deemed necessary to prevent sediment impacts to the pervious concrete during construction.

D. Activities related to the installation of pervious concrete shall include but not be limited to the following items of work:

1. Excavation of pervious concrete subgrade.

2. Installation of concrete headers and edge restraints.

3. Installation of pervious concrete components, including aggregate, underdrains, cleanouts, observation wells, and surface pavement materials.

E. All Work shall be conducted in accordance with the most current version of all applicable codes, standards, and permits.

1.02 SUBMITTALS

A. In accordance with the procedures and requirements set forth in the General Conditions, the Contractor shall submit the following:

1. Name and location of all material suppliers.

2. Certificate of compliance with the standards specified for each source of each material.

3. Shop drawings of precast pervious concrete paving slab with permanent lifting points embedded in the surface of the slab, edge restraint details, profiles, and sections.

4. Test results performed by an independent testing laboratory of the following:

a. Infiltration rate in accordance with ASTM C 1701/C 1701M and bulk density for the precast slabs conforming to ACI 522R.

b. Compressive strength in accordance with ASTM C39/C39M of cores obtained in accordance with ASTM C42/C42M.

c. Particle-size analysis in accordance with ASTM C136 for the stone base and crushed stone choker course (if applicable) with source of supply noted.

5. List of disposal sites for waste and unsuitable materials and all required permits for use of those sites.

6. Results of functional testing.

1.03 GUARANTEE

A. All work related to the installation of the pervious concrete shall be subject to the guarantee period of the Contract as specified in the General Conditions.

PART 2 - MATERIALS

2.01 GENERAL

A. All pervious concrete facilities and facility components shall meet the latest ADA requirements and accessibility guidelines.

B. All pervious concrete facilities shall support AASHTO HS-20 loads.

C. Pervious concrete materials shall at a minimum satisfy the safety and durability requirements established by the City for sidewalk and/or roadway surfaces.

2.02 PERVIOUS CONCRETE PAVEMENT

A. Pervious concrete shall be precast panels unless otherwise approved by the Engineer.

B. Pervious concrete slabs shall be 5 inches thick or as shown on the Contract Drawings.

C. Pervious concrete slabs shall have the following properties:

1. Color: standard natural grey concrete

2. Minimum compressive strength: 3,000 lbs/in² per ASTM C39/C39M

3. Minimum infiltration rate: 250 in/hr per ASTM C1701/1701M

4. Concrete average unit weight: 125 lb/ft³ (+/- 5% conforming to ACI 522R)

D. Pervious concrete slabs shall not be shipped until the concrete has cured to achieve 85% of the minimum compressive strength.

E. All pervious concrete slabs shall be provided by the same manufacturer.

F. The slab units shall include a minimum of 2 permanent lifting points embedded in the top of the slabs for ease of installation, maintenance, removal, and reinstallation.

2.03 UNDERDRAINS

A. Underdrains shall be constructed of Schedule 40 or SDR 35 smooth wall PVC pipe. The minimum pipe diameter shall be 4 inches. The underdrains shall be installed within the stone base.

B. A minimum of 4 rows of perforations shall be provided around the diameter of the underdrain pipe and the perforations shall be placed 6 inches on center within each row for the entire length of the drainage lateral. Perforations shall be 3/8 inch diameter. More perforations shall be provided for pipes 10 inches in diameter and larger.

C. Filter socks or geotextile fabric shall not be used to wrap the underdrain pipes within the stone base.

D. Underdrain pipes directing flow outside the pervious concrete facility shall be solid starting at a point a minimum of 1 foot from the interior wall of the pervious concrete before exiting.

E. The minimum slope of all non-perforated piping within the underdrain system shall be 0.5 percent.

F. Connections within the underdrain system and to any outflow structures, manholes, or catch basins shall be watertight.

G. Cleanouts shall be provided at the end of all underdrain lines (minimum one per every 1,000 square feet of surface area). Cleanouts shall consist of Schedule 40 or SDR 35 smooth wall PVC pipe with a threaded cleanout cover.

H. All pipes and pipe system components including but not limited to joints, caps, and cleanouts, shall meet DOT requirements for structural loading when installed within areas subject to vehicular or pedestrian traffic loads.

I. The maximum allowable angle for change in direction of any pipe segment shall not exceed forty-five (45) degrees, unless the change in direction occurs within a manhole or catch basin.

J. The underdrain shall have sufficient capacity to drain the pervious concrete system within 8 hours.

2.04 STONE BASE

A. A stone base layer shall be provided at the bottom depths of the pervious concrete system. Underdrains, if required, shall be installed within the stone base.

B. The stone base shall consist of #57 stone per ASTM C33 (or AASHTO M 6/M 80).

C. The stone base shall have a minimum installed porosity of 0.4.

D. Aggregates used in the stone base shall consist of clean, tough, durable fragments of crushed stone of uniform quality.

E. Aggregates shall be double-washed and free of fines and foreign material.

F. Aggregates shall have no more than 0.5% wash loss per AASHTO T-11 wash loss test.

G. Aggregates shall be free from clay balls, organic matter, and other deleterious substances.

2.05 LEVELING COURSE

A. A leveling course with a minimum depth of 2” shall be installed between the pervious concrete slabs and stone base.

B. Leveling course shall consist of #8 stone per ASTM C33 (or AASHTO M 6/M 80).

C. Leveling course stone shall consist of clean, tough, durable fragments of crushed stone of uniform quality.

D. Aggregates shall be double-washed and free of fines and foreign material.

E. Aggregates shall have no more than 0.5% wash loss per AASHTO T-11 wash loss test.

F. Aggregates shall be free from clay balls, organic matter, and other deleterious substances.

2.06 GEOTEXTILE

A. The Contractor shall furnish and install non-woven geotextile in accordance with the Contract Drawings and as directed by the Engineer.

B. Geotextile fabric shall not be installed horizontally across the base of the pervious concrete system or between any stone layers unless directed by the Engineer.

C. Geotextile fabric shall be in accordance with the section entitled “Geotextiles”.

2.07 EDGE RESTRAINT

A. Edge restraints shall consist of one of the following:

1. Saw cut edges of existing pavement with expansion joint filler positioned between the precast pervious concrete paving slabs and existing pavement.

2. Existing curb with expansion joint filler positioned between precast pervious concrete paving slabs and existing curb.

3. Cast-in-place edge restraints as shown on the Contract Drawings with expansion joint filler positioned between the precast pervious concrete paving slabs and edge restraint.

2.08 JOINT FILLER

A. Filler for expansion joints shall be installed between pervious concrete panels and as otherwise indicated in the Contract Drawings.

B. Preformed expansion joint filler shall meet the requirements of AASHTO M 153, Type II.

PART 3 - EXECUTION

3.01 GENERAL

A. The Contractor shall keep the construction site neat at all times and free of debris at the conclusion of each workday. The Contractor shall conduct work such that debris and other construction materials do not unintentionally leave the construction site. Any debris or construction material that does leave the construction site shall be immediately removed and properly disposed of at no additional cost to the City.

B. Installation of precast pervious concrete panels shall be in accordance with manufacturer's recommendations and the requirements herein.

C. All pavement and curbing disturbed or damaged during construction shall be repaired and/or replaced in accordance with City requirements.

D. Pervious concrete slabs shall be handled and transported in a position consistent with their shape and design to avoid stresses which could cause cracking or damage.

E. Units must be lifted or supported only at the points shown on the working drawings or as recommended by the manufacturer.

F. The Contractor shall test the bearing capacity of underlying soils for all pervious concrete subject to vehicular traffic in accordance with ASTM D4429. The Contractor shall consult the Engineer before proceeding if the measured CBR is below 4%.

G. Protection of pervious concrete facilities:

1. The Contractor shall protect pervious concrete surfaces, excavations, and materials storage areas from severe weather conditions and contamination by dust, dirt, mud, cement, or other fine-grained material or sediment.

2. Pervious concrete footprints and all materials, including aggregates, shall be protected from the start of construction until final acceptance of the project. Any damage caused by the Contractor's equipment or lack of compliance with these requirements shall be repaired by the Contractor at no cost to the City.

3. Runoff onto pervious concrete or areas where materials are stored shall be prohibited until the site is fully stabilized.

4. Any sediment or debris accumulation onto the pervious concrete or underlying layers may require cleaning or removal and replacement of those materials to the satisfaction of the Engineer at no cost to the City.