CITY OF GOODYEAR
PUBLIC WORKS DEPARTMENT
WATER AND WASTEWATER FACILITIES CONDITION ASSESSMENT

PHASE 1 SUMMARY REPORT

FINAL
May 2015

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City of Goodyear Public Works Department
Water and Wastewater Facilities Condition Assessment

PHASE 1 SUMMARY REPORT

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* Provided with earlier submittal

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LIST OF ABBREVIATIONS

AMP	asset management program
CCTV	closed circuit television
CIP	capital improvement list
City	City of Goodyear
CMMS	computerized maintenance management system
CMOM	capacity, management operations, and maintenance
Department	Public Works Department
DIP	ductile iron pipe
EPA	Environmental Protection Agency
ERP	Enterprise Resource Planning
ESD	Environmental Services Division
FTE	full-time employee
FY	fiscal year
GIS	Geographic Information System
ITSD	Information and Technology Services Division
LF	linear feet
LOS	level of service
LS	lift station
O&M	operations and maintenance
OH&P	Overhead and profit
PM	preventative maintenance
PM/CM	program management/construction management
PS	pump station
PVC	polyvinyl chloride
R&R	rehabilitation and replacement
RAS	return activated sludge
RO	reverse osmosis
SST	stainless steel
VCP	vitrified clay pipe
VPN	virtual private network
WAS	waste activated sludge
WRF	water reclamation facility
WWTP	wastewater treatment plant

PHASE 1 SUMMARY REPORT

1.0 PURPOSE OF REPORT

The purpose of the Phase 1 Summary Report is to summarize the findings, and recommendations of the Phase 1 Condition Assessment assignment developed in collaboration with the City of Goodyear Public Works Department (Department).

2.0 BACKGROUND

The City of Goodyear (City) has recently adopted their Master Plan that identifies a population of approximately 240,000 in 2040. The City's existing water and wastewater-related facilities include the following:

- Water production is provided by 12 active production wells, 10 booster pump stations, 10 reservoirs, 2 arsenic treatment, and 2 RO treatment facilities.
- Water distribution system consists of over 1.9 million feet of water pipe, 8,814 valves, and 482 control valves.
- Wastewater collection system includes over 1.2 million feet of sewer pipe, over 5,400 manholes, and 12 sewer lift stations.
- Wastewater treatment is provided by three wastewater treatment facilities: the Goodyear Water Reclamation Facility (WRF) (157th Avenue Wastewater Treatment Plant [WWTP]) serving the City north of the Gila River, and Corgett WRF and Rainbow Valley WRF serving the City south of the Gila River.

The Department retained Carollo to conduct a field condition assessment of its water and wastewater assets, and to evaluate and prioritize the recommendations of Waterworks Corgett WRF, Rainbow Valley WRF, and Goodyear WRF reports.

2.1 Interview Workshop and Staff Interviews

Carollo conducted a series of initial asset management workshops with Department staff from each of the following groups:

- Information Services – Lucity Computerized Maintenance Management System (CMMS)
- Water/Wastewater Treatment
- Water/Wastewater Operations (collection, distribution, well production)
- The project initiation meeting was held on December 4, 2014 and was a 3-hour workshop. Minutes from that initial meeting were distributed to attendees. Minutes of this meeting are located in **Appendix A**.

- Individual staff interviews were held on December 24, 2014 with the Water Distribution System supervisor, and with the Lucity CMMS utilities department lead. Information from those two meetings is included in this report.

3.0 PHASE 1 CONDITION ASSESSMENT

The Phase 1 field condition assessment activities consisted of Carollo engineering teams visiting the following facilities during the months of December 2014 and January 2015.

- Wastewater Lift Stations – December 18, 2014
- Wells, Pump Stations and Reservoirs – December 30, 2014
- Bullard Reverse Osmosis (RO) Campus – December 30, 2014
- Goodyear WRF, Corgett WRF, and Rainbow Valley WRF – January 9, 2015

Each team completed a Field Condition Assessment form ranking the major components on a scale of 1 to 5 with 5 being the worst rating. The team also included comments from the utilities staff regarding aspects of each facility that were taken into account when ranking the facility overall.

Photographs taken during the site visits, and the field condition forms are included in **Appendix B** and **Appendix C**.

3.1 Project Initiation Meeting and One-on-One Staff Interviews

From the project initiation meeting and from the one-on-one staff interviews, the following primary points were stressed:

- The recommendations of the Waterworks Reports and Technical Memorandums are to be evaluated and prioritized within a proposed 5-year Capital Improvement List (CIP).
- Field Condition Assessments are separate from the Master Planning efforts that are ongoing. Both will be included in the proposed 5-year CIP. Avoid duplication.
- City staffs repair and replacement budgets are to be included in the proposed 5-year CIP, after discussion with staff. Avoid duplication.
- Linear assets (collection system pipelines and water distribution pipelines) will not be assessed in the field during Phase 1. They will be assessed using the Geographic Information System (GIS) database with respect to pipe materials and age.
- Special attention will be given to the water distribution ductile iron pipes (DIP) that are located south of the Gila River that were buried without plastic wrap in “hot soils.” These pipes are developing leaks yet are only about 15 years old.

3.1.1 Water Distribution and Production System

The City's water distribution system is comprised of over 1.9 million feet of pipeline, 8,814 valves, 482 control valves, 6,193 fire hydrants, 10 booster pump stations, 10 reservoirs, 2 arsenic treatment, and 2 RO treatment facilities. Figure 1 illustrates the water pipe material for the system north of the Gila River, and Figure 2 indicates the water pipe age for the system north of the Gila River.

Likewise, Figure 3 and Figure 4 illustrate the water pipe material and age respectively for the water system south of the Gila River.

Table 1 lists the water distribution system by pipe size and pipe material.

3.1.2 Wastewater Collection System

The City's wastewater collection system is comprised of over 1.2 million feet of pipe with over 5,400 associated manholes, and 12 lift stations. Figure 5 and Figure 6 illustrate the collection pipe material and age respectively for the system north of the Gila River, and Figure 7 and Figure 8 illustrate the collection pipe material and age respectively for the system south of the Gila River.

Table 2 lists the collection system by pipe size and pipe material.

4.0 FIELD CONDITION ASSESSMENT OF VERTICAL ASSETS

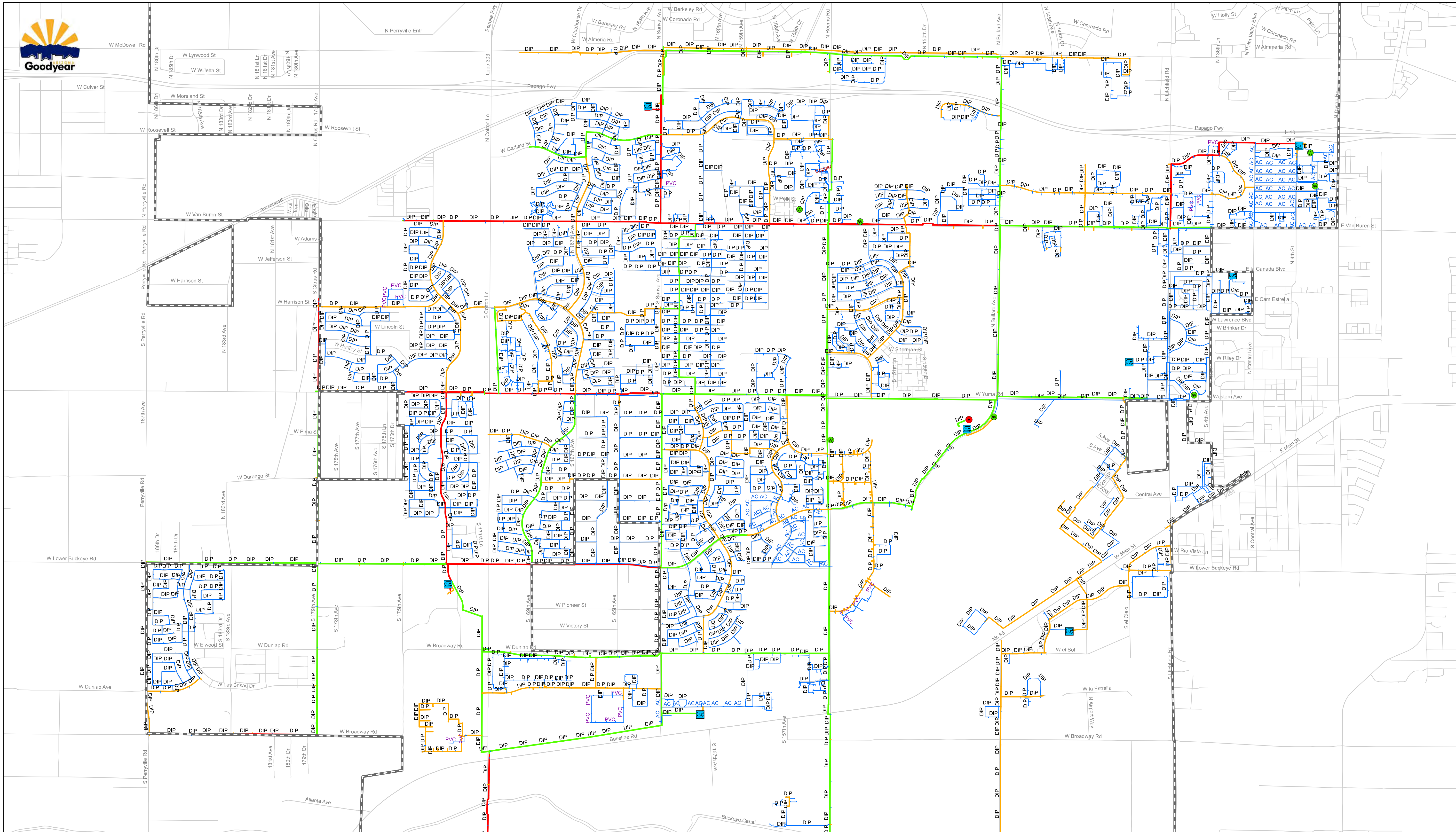
Aboveground facilities, such as treatment plants, pump stations, and reservoirs are generally classified as "vertical assets" under an asset management program (AMP). The condition assessment of these vertical assets were evaluated by a multi-discipline engineering team experienced in the areas of civil/sanitary, mechanical, structural, and electrical/instrumentation engineering. The assessment teams visited each of the facilities and inspected each of the major assets at each vertical asset.

Carollo conducted this appraisal level field condition assessment of the City's water and wastewater vertical assets during the months of December 2014 and January 2015.

The information gathered during the Phase 1 condition assessment provides a standardized record of the asset condition specific to each discipline. Component information such as manufacturer and installation year was catalogued, where available. In addition, other relevant information (such as recent performance history) was obtained, and the existing condition of all assets was documented with digital photos.

Appendix B contains the Field Photos of the Vertical Assets.

Appendix C contains the Field Assessment Condition Reports of the Vertical Assets.



Legend

- Booster Pump and Tank
- Well
- Centerra R.O. Treatment Plant
- Planning Boundary

Diameter

- 10-in or smaller
- 12-in
- 16-in or 18-in
- 20-in or larger
- Streets

N

Miles
0 0.5 1

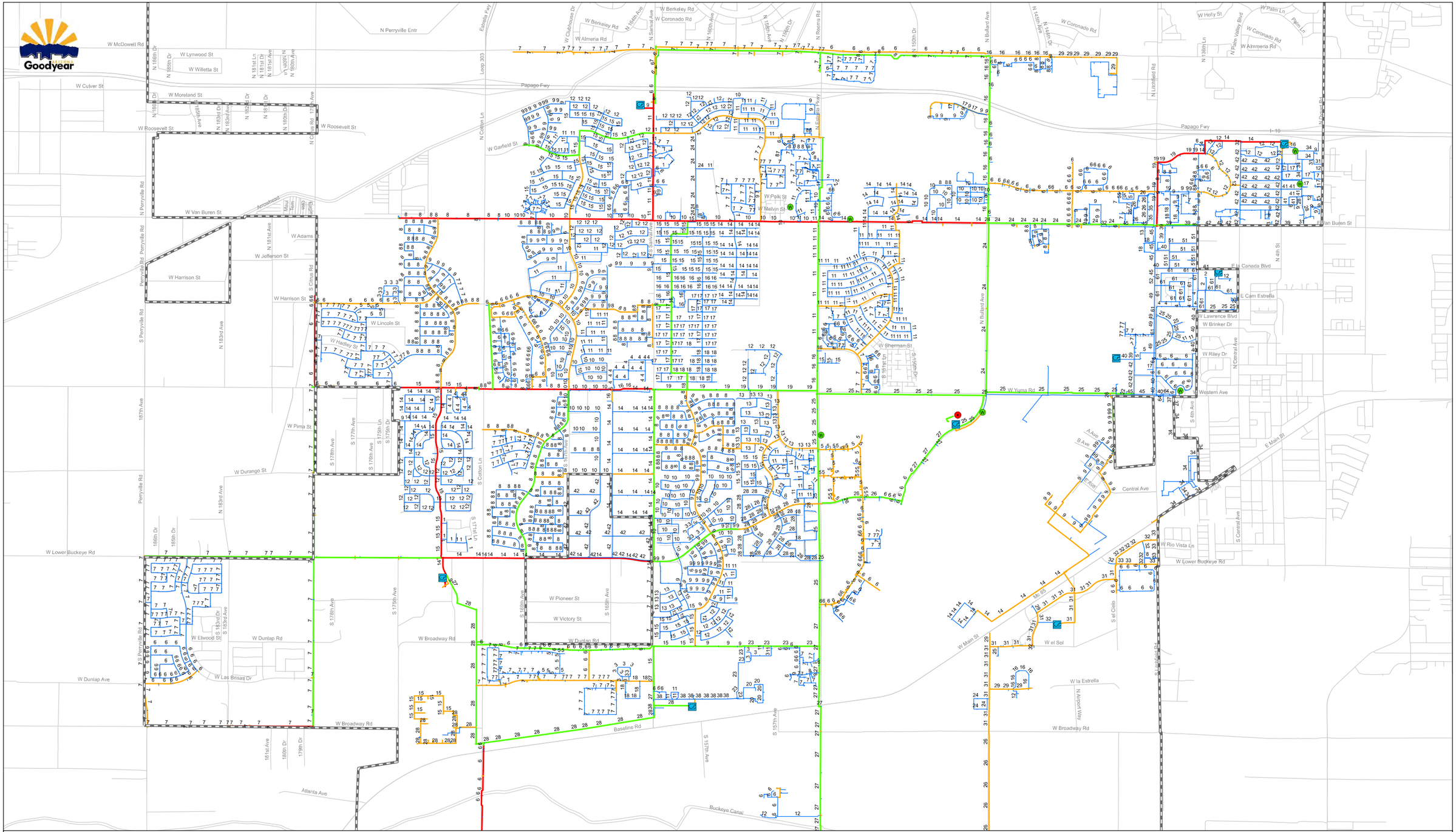
carollo

WATER SYSTEM WITH MATERIAL LABELS

NORTH OF GILA RIVER

FIGURE 1

CITY OF GOODYEAR
PHASE I SUMMARY REPORT



Legend

- Booster Pump and Tank
- Centerra R,O. Treatment Plant
- Well
- Planning Boundary

Diameter

- 10-in or smaller
- 12-in
- 16-in or 18-in
- 20-in or larger
- Streets

N

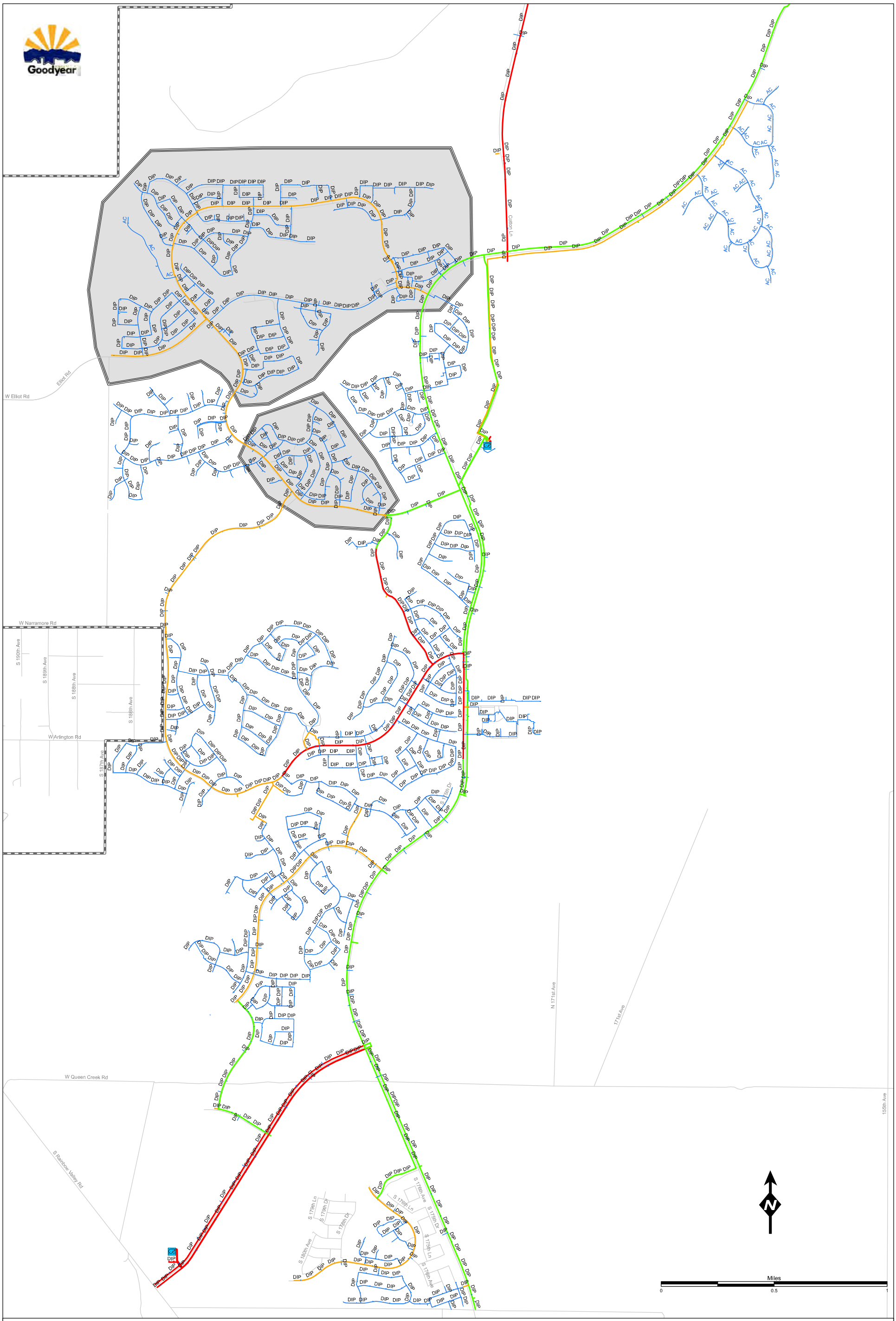
Miles
0 0.5 1

WATER SYSTEM WITH AGE LABELS

NORTH OF GILA RIVER

FIGURE 2

CITY OF GOODYEAR
PHASE I SUMMARY REPORT



Legend

- Booster Pump and Tank
- Centerra R.O. Treatment Plant
- Well
- Planning Boundary

Diameter

- 10-in or smaller
- 12-in
- 16-in or 18-in
- 20-in or larger
- Streets
- Unwrapped DIP in "Hot Soil"

WATER SYSTEM WITH MATERIAL LABELS

SOUTH OF GILA RIVER

FIGURE 3

CITY OF GOODYEAR
PHASE I SUMMARY REPORT

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Goodyear

Cotton Ln

Elliot Rd

W Elliot Rd

W Narramore Rd

S 190th Ave

S 189th Ave

S 188th Ave

S 186th Ave

W Arlington Rd

S 197th Ave

S 178th Dr

N 171st Ave

171st Ave

W Queen Creek Rd

155th Ave

S Rainbow Valley Rd

S 179th Ln

S 179th Dr

S 178th Dr

S 178th Ave

S 176th Ln

S 175th Dr

S 175th Ln

S 175th Ave

S 174th Ave

S 180th Ave

N

Miles

0 0.5 1

Legend

- Booster Pump and Tank
- Well
- Centerra R.O. Treatment Plant
- Planning Boundary

Diameter

- 10-in or smaller
- 12-in
- 16-in or 18-in
- 20-in or larger
- Streets
- Unwrapped DIP in "Hot Soil"

carollo

WATER SYSTEM WITH AGE LABELS

SOUTH OF GILA RIVER

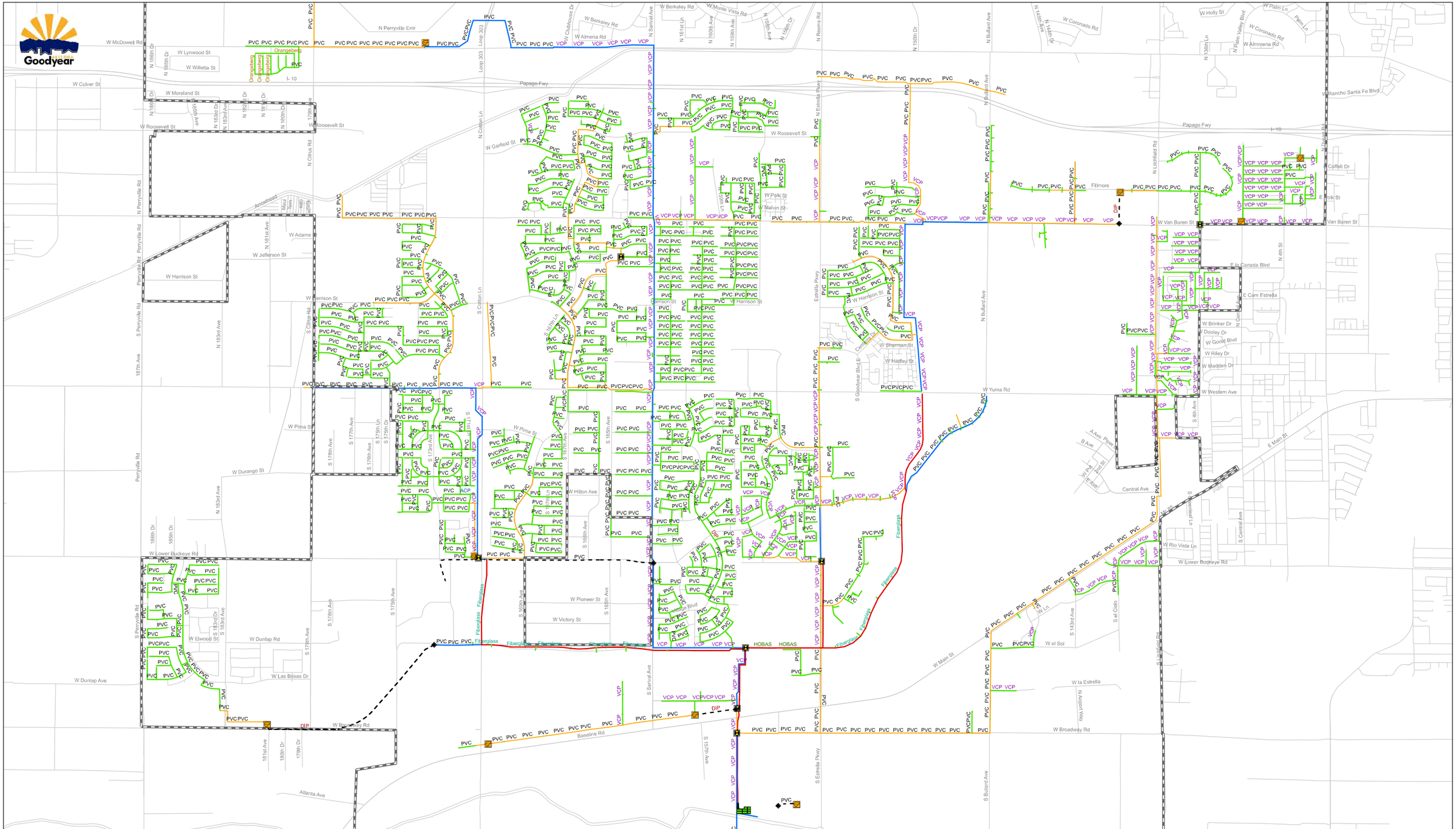
FIGURE 4

CITY OF GOODYEAR
PHASE I SUMMARY REPORT

Table 1 Distribution System Pipe Material and Size
Water and Wastewater Facilities Condition Assessment
City of Goodyear Public Works Department

Material\ Size	6" or less (LF)	8" (LF)	10" (LF)	12" (LF)	16" (LF)	18" (LF)	20" (LF)	24" (LF)	30" (LF)	36" (LF)	Total
Asbestos Cement	24,761	25,858	1,277	2,546	0	0	0	0	0	0	54,442
Ductile Iron	591,241	626,677	26,666	291,328	244,081	1,336	17,476	76,600	20,740	298	1,896,443
PVC	3,077	4,224	3,708	539	0	0	0	0	0	0	11,548
Unknown	64	0	0	0	0	0	0	0	0	0	64
Total	**619,143**	**656,759**	**31,651**	**294,413**	**244,081**	**1,336**	**17,476**	**76,600**	**20,740**	**298**	**1,962,497**

Abbreviations:
LF = linear feet
PVC = polyvinyl chloride



Legend

- Force Main Outfall
- Water Reclamation Facility
- Diversion Manhole
- Lift Station

Sewer Pipe Diameter

- 10-in or smaller
- 12-in to 18-in
- 21-in to 30-in
- 33-in or larger
- Force Main
- Streets
- Planning Boundary

N

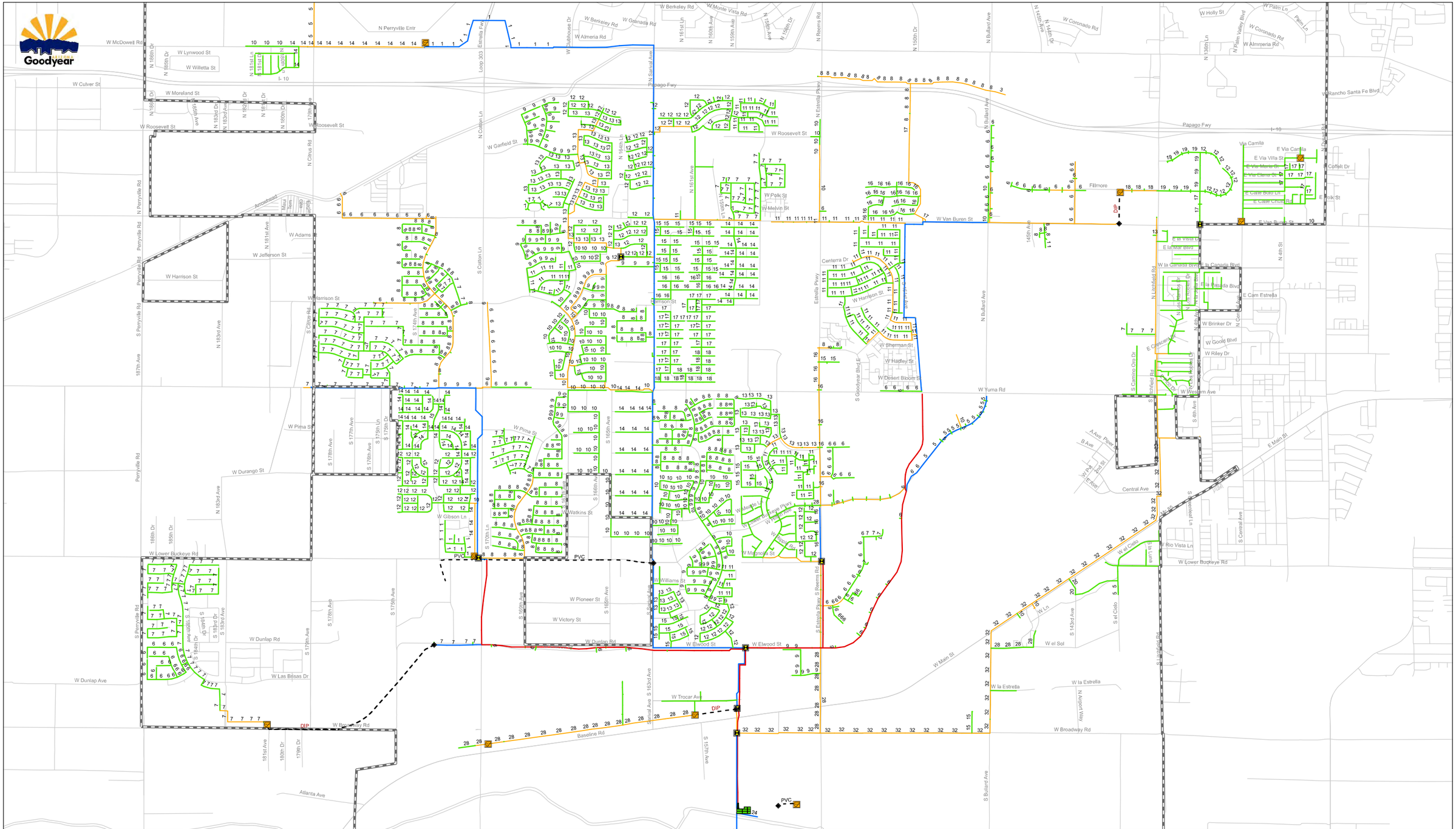
Miles
0 0.5 1

COLLECTION SYSTEM WITH MATERIAL LABELS

NORTH OF GILA RIVER

FIGURE 5

CITY OF GOODYEAR
PHASE I SUMMARY REPORT



Legend

- Force Main Outfall
- Water Reclamation Facility
- Diversion Manhole
- Lift Station

Sewer Pipe Diameter

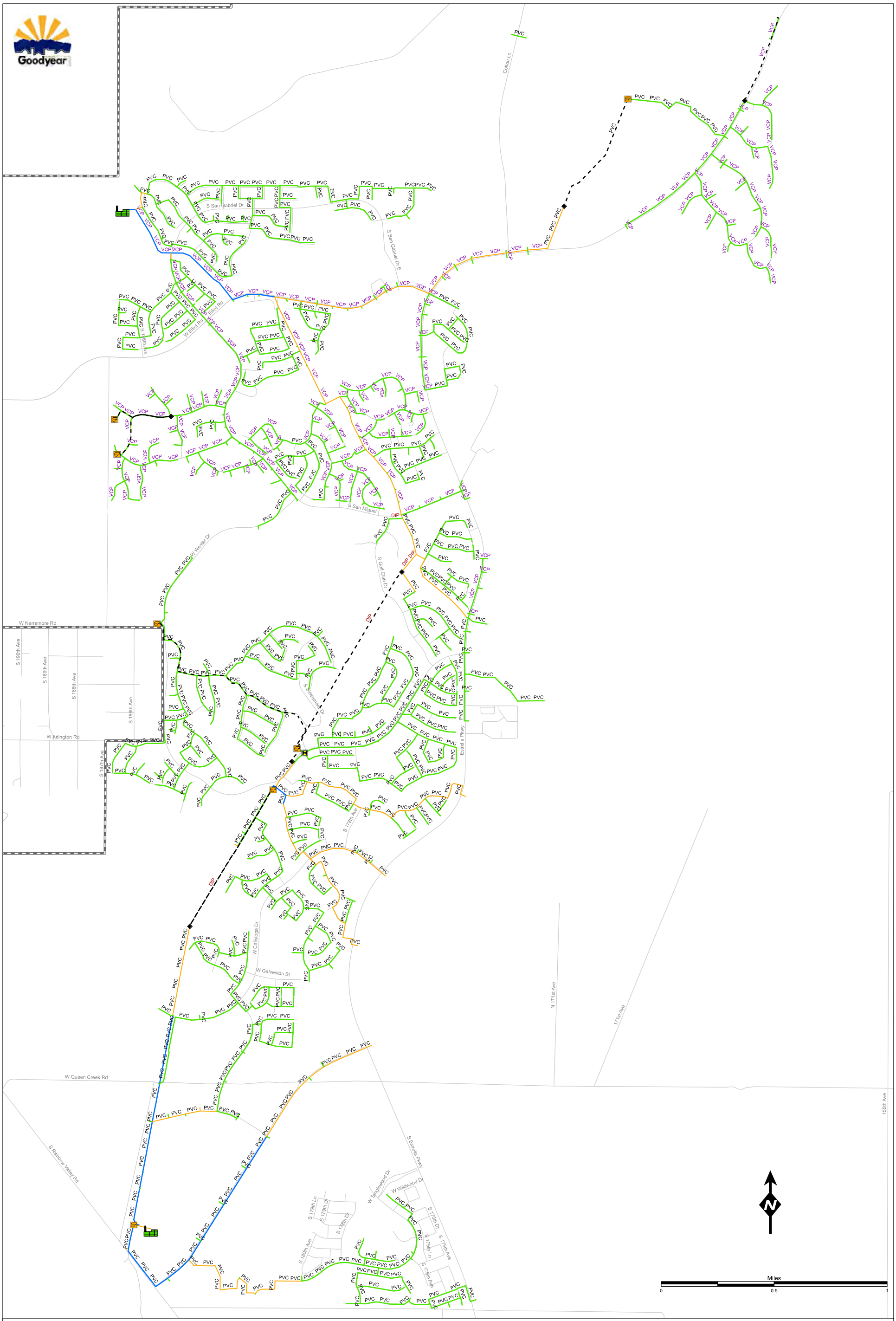
- 10-in or smaller
- 12-in to 18-in
- 21-in to 30-in
- 33-in or larger
- Force Main
- Streets
- Planning Boundary

COLLECTION SYSTEM WITH AGE LABELS

NORTH OF GILA RIVER

FIGURE 6

CITY OF GOODYEAR
PHASE I SUMMARY REPORT



Legend

- Force Main Outfall
- Water Reclamation Facility
- Diversion Manhole
- Lift Station

Sewer Pipe Diameter

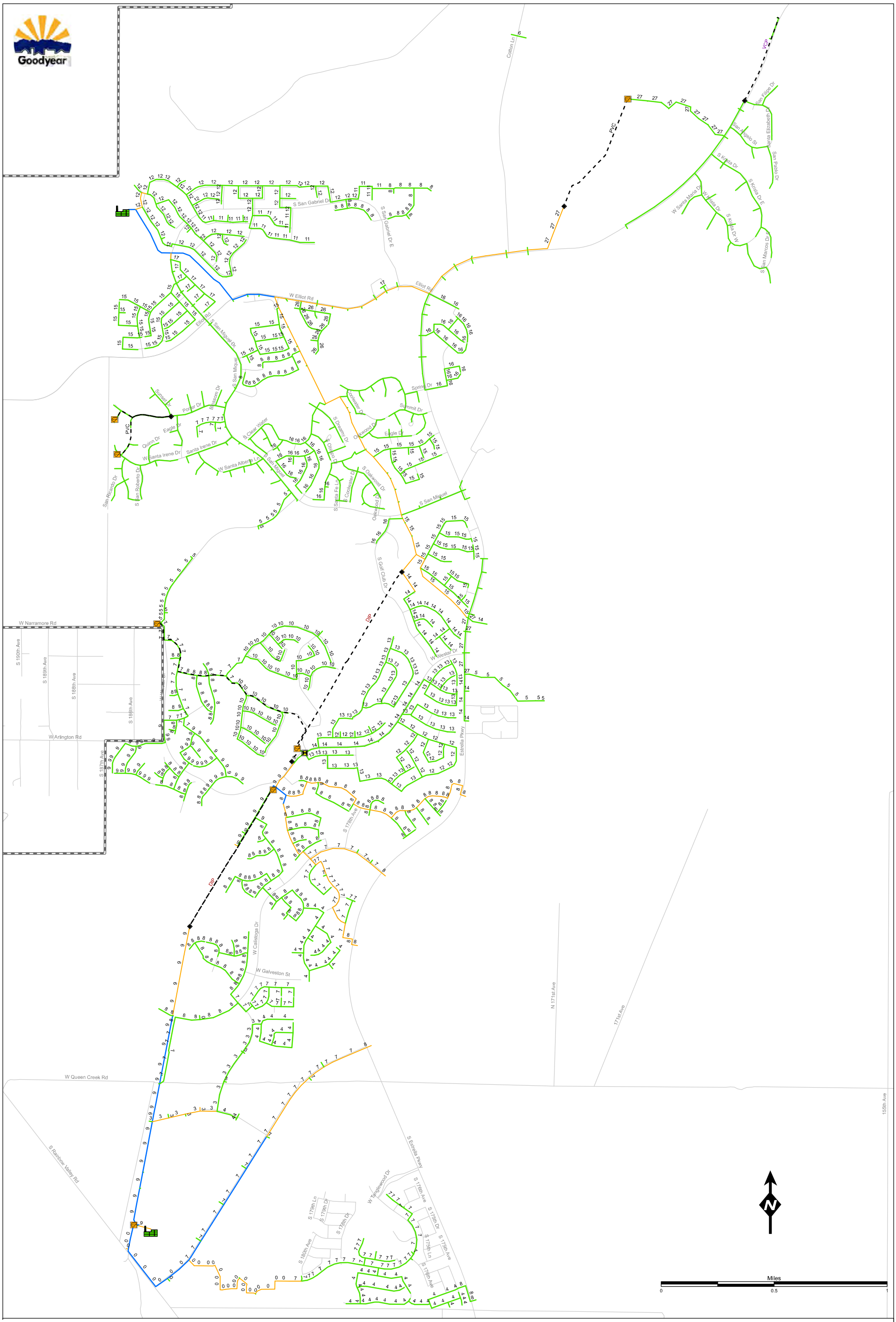
- 10-in or smaller
- 12-in to 18-in
- 21-in to 30-in
- 33-in or larger
- Force Main
- Streets
- Planning Boundary

COLLECTION SYSTEM WITH MATERIAL LABELS

SOUTH OF GILA RIVER

FIGURE 7

CITY OF GOODYEAR
PHASE I SUMMARY REPORT



Legend

- Force Main Outfall
- Water Reclamation Facility
- Diversion Manhole
- Lift Station

Sewer Pipe Diameter

- 10-in or smaller
- 12-in to 18-in
- 21-in to 30-in
- 33-in or larger
- Force Main
- Streets
- Planning Boundary

COLLECTION SYSTEM WITH AGE LABELS

SOUTH OF GILA RIVER

FIGURE 8

CITY OF GOODYEAR
PHASE I SUMMARY REPORT

Table 2 **Collection System Pipe Material and Size**
Water and Wastewater Facilities Condition Assessment
City of Goodyear Public Works Department

Material\Size	8" or less (LF)	10" (LF)	12" (LF)	15" (LF)	16" (LF)	18" (LF)	20" (LF)	21" (LF)	24" (LF)	27" (LF)	30" (LF)	33" (LF)	36" (LF)	42" (LF)	54" (LF)	60" (LF)	Total
Asbestos Cement	0	314	0	0	0	0	0	0	0	0	0	0	0	0	0	0	314
Cement	0	0	0	0	0	0	0	0	0	0	0	0	2,684	401	0	0	3,085
Ductile Iron	431	452	527	0	0	0	0	0	288	0	46	0	0	0	0	0	1,743
Fiberglass	0	0	0	0	0	0	0	0	170	0	458	0	8,907	20	8,237	1,964	19,757
HOBAS	0	0	0	0	0	0	81	31	0	0	0	0	2,624	2,406	0	0	5,142
Orangeburg	5,503	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5,503
Plastic	689,186	52,670	72,254	43,566	327	35,311	0	10,397	11,768	0	8,577	0	0	0	0	0	924,056
Vitrified Clay	144,903	10,548	18,921	9,285	369	16,367	0	4,920	27,796	6,154	8,328	3,046	0	0	0	0	250,638
Total	**840,023**	**63,984**	**91,702**	**52,851**	**696**	**51,678**	**81**	**15,348**	**40,022**	**6,154**	**17,410**	**3,046**	**14,215**	**2,827**	**8,237**	**1,964**	**1,210,239**

4.1 Condition Ranking System, Useful Lives, and Component Information

The condition assessment effort resulted in a condition ranking being assigned to each vertical asset on a scale from 1 to 5, the meaning of each value is presented in Table 3. This scale is an internationally accepted, industry-wide standard for determining asset condition. Generally speaking, the condition ranking is related to the percentage of the value of an asset needed to repair/rehabilitate the asset to return it to its original condition. This ranking was utilized by the Carollo team member when they made site visits to the City's vertical assets. Those Field Condition Assessment forms are appended to this report.

Table 3 Asset Condition Ranking Scale[1][2]
Water and Wastewater Facilities Condition Assessment
City of Goodyear Public Works Department

Ranking	Description	Percentage of Asset Requiring Repair[2]
1	Very Good Condition	0%
2	Minor Defects	5%
3	Maintenance Required to Return to Accepted Level of Service	10 - 20%
4	Requires Rehabilitation	20 - 40%
5	Asset Unserviceable	> 50%

Notes:
(1) Adapted from the International Infrastructure Management Manual.
(2) "Percentage of asset requiring repair" is that percentage of the value of the asset needed to return the asset to a condition ranking of one.

4.2 Ranking Importance of Replacement and Rehabilitation Projects

The repair percentages associated with each condition ranking are used to calculate the evaluated remaining useful life, evaluated value, and the necessary repair/rehabilitation costs to return the component to its original condition. The original useful life values for different types of assets are presented in Table 4.

Table 4	Estimated Useful Life Based on Asset Type Water and Wastewater Facilities Condition Assessment City of Goodyear Public Works Department
Asset Type	**Original Useful Life**
Mechanical(1)	25 years
Structural(1)	50 years
Electrical	30 years
Instrumentation	15 years
Pipeline	75 years

Note:
(1) Environmental Protection Agency (EPA) Construction Grants 1985 (CG-85) Guidelines for Municipal Wastewater Treatment and Title 40 Code of Federal Regulations, 1994.

4.2.1 Level of Service Goals

Not all assets are equally important in the day-to-day delivery of water or treatment of wastewater. In addition to the asset condition, the relative criticality of each asset is considered in order to identify the most important assets requiring repair/rehabilitation or replacement. The relative importance of rehabilitation and replacement (R&R) needs is based on consideration of four criteria:

- Level of Service (LOS) Goals
- Vulnerability
- Criticality
- Risk

4.2.2 Level of Service Goals

The strategic objectives of any water or wastewater utility are reflected in their LOS goals. LOS goals are usually based on several criteria, including customer service expectations, regulatory requirements, the agency's mission statement or philosophy, and available resources to meet supply and demand needs.

Carollo proposes that the City maintain each asset in a condition of three or greater. As illustrated in Table 3 previously, an asset with a condition ranking of three has 10-20 percent of asset value to return to the accepted LOS. This baseline LOS value is considered the minimum necessary for the City to meet its LOS goals. The condition assessment will be used to quantify any differences between the baseline LOS value and the current condition of each asset.

As assets drop below a condition ranking of three, those assets will be added to the capital improvement list (CIP). The timing and priority of those projects; however, will be determined by associated risk and economic factors.

4.2.3 Vulnerability

Vulnerability is the probability or likelihood of asset failure. Failure can occur from physical failure, performance failure, or technological obsolescence.

Performance failure of an asset is the most likely failure mode, and is the primary focus of this vulnerability assessment. The vulnerability of an asset is inversely proportional to the evaluated remaining useful life, which is determined as part of the condition assessment.

4.2.4 Criticality

Criticality measures the consequence of asset failure. Criticality ranking includes four categories based on relative impact of failure:

- Public Health and Safety
- Effect on Customers
- Environmental
- Cost of Repair

Table 5 shows the criticality ranking scale used in the condition assessment of each asset type. As shown in Table 5, the criticality scoring for an asset (the sum of the individual categories) ranges from a possible high of 39 points (highly critical) to a possible low of 2 points (not critical). As can be seen in Table 5, each category is weighted differently. The highest importance is Public Health and Safety, and Effect on Customers because these two categories have the highest consequence potential if an asset failure occurs.

Table 5 Criticality Ranking Scale[(1)(2)]
Water and Wastewater Facilities Condition Assessment
City of Goodyear Public Works Department

Criticality Factor Description	Ranking
Public Health and Safety	
Multiple illness or injury	15
Significant seasonal impact	10
Single illness or injury	5
No effect	0
Effect on Customers	
Major or repeat occurrence	10
Minor	5
No effect	0

Table 5 Criticality Ranking Scale[1][2] Water and Wastewater Facilities Condition Assessment City of Goodyear Public Works Department	
Criticality Factor Description	**Ranking**
Environmental	
Major	8
Minor	4
No effect	0
Cost of Repair	
More than $20,000	6
Between $5,000 and $20,000	4
Less than $5,000	2

Notes:
(1) Adapted from the International Infrastructure Management Manual.
(2) An overall criticality is developed by summing the rankings of the four categories.

4.2.5 Risk

Risk is the mathematical product of the criticality score and the vulnerability probability, and is a relative indicator of priority/need for corrective action. The equation used to determine the risk associated with an asset is as follows:

Risk = Criticality x Vulnerability

Risk provides information crucial to making more informed management decisions. For example, decisions must differentiate need and priority between replacing an asset with a high-risk value, and alternately choosing to implement an ongoing repair or maintenance strategy in lieu of replacement. **At a minimum, assets with higher risk rankings must be closely monitored and targeted for corrective or preventative action, including maintenance, repair, or replacement.**

Below-grade facilities, such as buried water and sewer infrastructure, are generally classified as “linear assets” under an AMP. Asset management of the Department’s linear assets is similar to that of the program proposed for the vertical assets. However, because the City’s linear assets are less visible, their condition is often less known. Therefore, significant weight is assigned to pipe material, pipe age, soil conditions, and history of repairs.

4.3 Condition Assessment of Vertical Assets – Water Production and Distribution

Carollo's field team visited all water production, storage, and booster pumping facilities, and completed written field condition assessments of the major assets. Carollo took digital photos of the assets at each facility and have included them in a memory stick for future use by the City. Samples of the field photographs taken at each facility are included in **Appendix B**.

4.3.1 Wells, Water Storage and Pump Stations

Carollo conducted field condition assessments of all the City's well, water storage and pump stations during the months of December 2014 and January 2015. The completed Field Condition Assessment forms are included in **Appendix C**. Using the ranking system of 1-5, Carollo developed a proposed 5-year CIP for these assets. The estimated costs for rehabilitation or replacement of the identified assets is listed on Table 11, page 40. Over $4 million is recommended for re-drilling and equipping wells that have exceeded their useful lives. These wells are included in the City's water production portfolio into the year 2020, and their loss would require makeup from another source. The proposed grand total for the water 5-year CIP is **$4,835,000,** without escalation.

4.3.2 Bullard RO Campus

Carollo conducted an appraisal level field condition assessment of the Bullard RO Campus specifically to review this critical facility for assets that might require rehabilitation or replacement in the next 5 years. The City has already developed an operations and maintenance (O&M) plan for the next 5 years, so items on that list were not double-counted. The South filter units should be rehabilitated, and the stainless steel (SST) piping upstream of the RO units should be repaired. A more detailed assessment of this facility can be conducted should the City move forward with a Phase 2 AMP.

4.4 Condition Assessment of Vertical Assets – Water Reclamation Facilities

Carollo reviewed the Waterworks Reports and Technical Memorandums as well as conducted an appraisal level field condition assessment of each WRF with regards to identifying and prioritizing rehabilitation and / or improvements in a proposed 5-year CIP.

Carollo reviewed and evaluated the following Waterworks Reports and Technical Memoranda:

- Corgett WRF Process Evaluation and Improvement Report – May 2014
- Rainbow Valley WRF Phase 1 Process Evaluation and Improvement Report – May 2014
- Goodyear WRF Technical Memorandum – Solids Handling – May 28, 2014
- Goodyear WRF Technical Memorandum – Digester Rehabilitation – October 20, 2014

4.4.1 Goodyear WRF (157th Avenue WWTP)

Carollo conducted a field condition assessment visit to the Goodyear WRF on January 9, 2015, and identified the following assets to be included in the wastewater 5-year CIP:

- Solids Handling Upgrade – Screens and existing equipment
- Solids Handling Upgrade – Redundancy with third centrifuge

4.4.2 Corgett WRF

At the Corgett WRF, Carollo identified the following assets for inclusion in the wastewater 5-year CIP:

- Influent PS and Headworks Improvements
- Chlorine Contact Basin Improvements
- Scum PS Addition & Chemical Storage and Feed System Improvements

4.4.3 Rainbow Valley WRF

At the Rainbow Valley WRF, Carollo identified the following assets for inclusion in the wastewater 5-year CIP:

- Waterline Extension and Fire Hydrant project
- Aeration Basin Improvements and Membrane Replacement
- RAS/WAS PS Improvements
- Solids Handling Area Improvements
- Tertiary Filter Unit Replacement

4.4.4 Summary Table for Water Reclamation Facilities Proposed 5-Year CIP

Table 6 is a summary of the Wastewater Reclamation Facilities proposed 5-year CIP program.

Table 6	**Water Reclamation Facilities Proposed 5-year CIP Water and Wastewater Facilities Condition Assessment City of Goodyear Public Works Department**				
	FY 2016	**FY 2017**	**FY 2018**	**FY 2019**	**FY 2020**
Rainbow Valley WRF Sludge Holding Tanks	$157,700				
Goodyear WRF Solids Handling Facility upgrade	$1,351,900				
Perryville Grinder Station - grinder and auger units	$300,000				
Goodyear WRF Solids Handling Facility upgrade		$1,204,300			
Corgett WRF Influent PS & Headworks Improvements		$793,400			
Rainbow Valley WRF Waterline Extension		$123,500			
Rainbow Valley WRF Aeration Basin Improvements & Membranes replacement		$237,600			
Rainbow Valley WRF RAS/WAS PS Improvements		$51,700			
Rainbow Valley WRF Solids Handling Area Improvements		$63,200			
Corgett WRF Chlorine Contact Basin Improvements			$157,300		
Rainbow Valley WRF Tertiary Filter Unit Replacement				$552,000	
Corgett WRF Scum Pump Station Improvements					$86,400
Proposed 5-Year CIP Totals	**$1,809,600**	**$2,473,700**	**$157,300**	**$552,000**	**$86,400**

Note:
(1) These are Project costs. They include 18% for Engineering, 30% Contingency, and 23% Contractor's overhead and profit (OH&P). They DO NOT include escalation

Abbreviations:
PS = pump station
RAS/WAS = return activated sludge/waste activated sludge

5.0 ASSESSMENT OF LINEAR ASSETS (NO FIELD ASSESSMENT)

Because it is not economically feasible to invasively inspect the hundreds of miles of pipelines associated with the water distribution and sewer collection systems, under this Phase 1 Condition Assessment assignment, Carollo conducted a desktop evaluation of the linear assets using the City's existing GIS database. This analysis examined each asset characteristic that influences the condition of that asset, namely material, age and soil condition.

5.1 Assessment of Wastewater Collection System

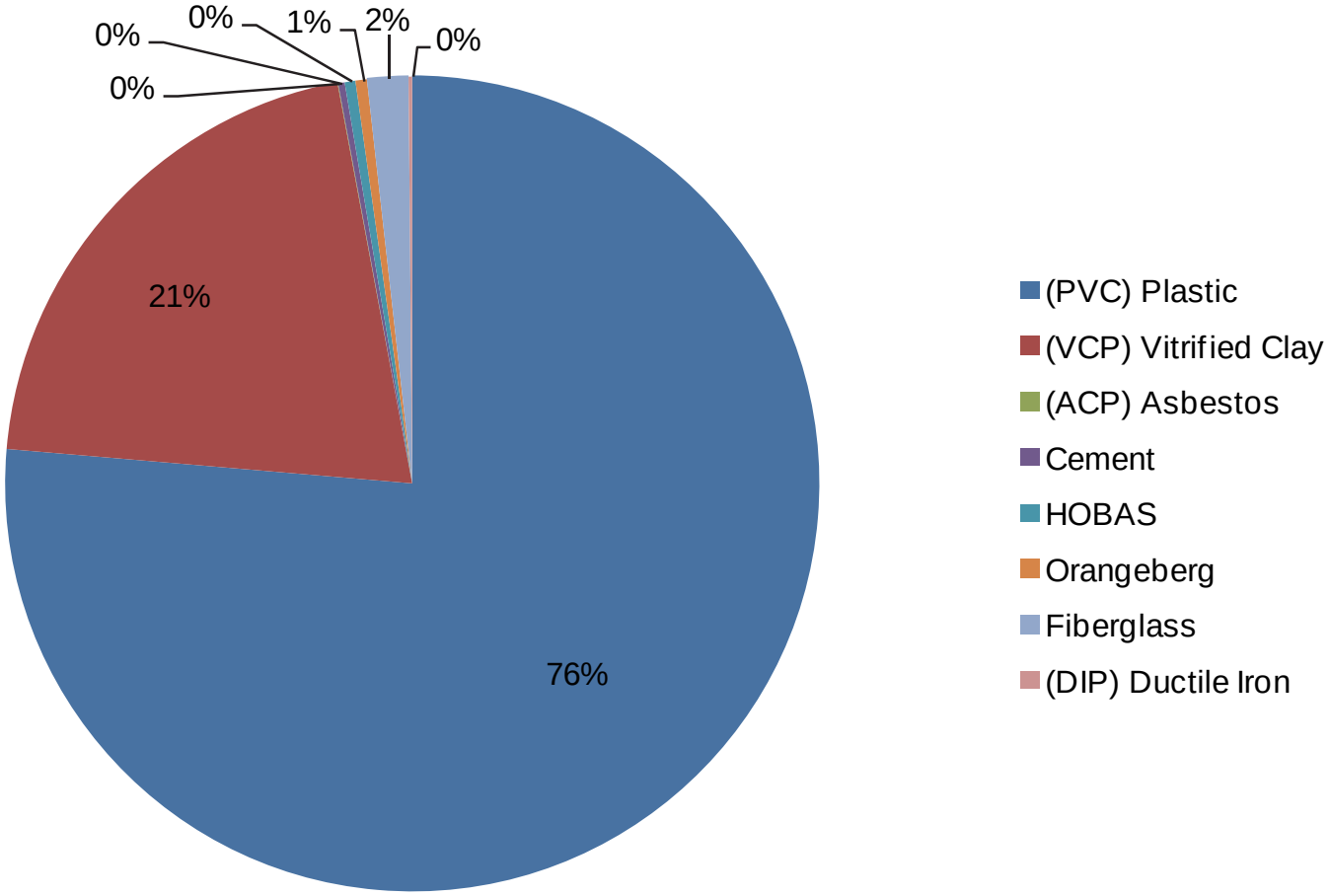
For this Phase 1 Condition Assessment assignment, Carollo did not conduct field assessments of the collection system pipeline and manholes. The exception to this was at many of the discharge manholes associated with force mains. Our recommendations for their rehabilitation are listed in the Wastewater CIP Project Summary located in **Appendix D**.

Carollo recommends that the City undertake a Capacity, Management Operations, and Maintenance (CMOM) program as soon as possible so that the field condition of the system is known. Being predominately a gravity system, closed circuit television (CCTV) digital inspections are practical and economical to perform.

5.1.1 Collection System Pipelines and Manholes

According to the GIS database, over 97 percent of the City's collection system pipe material is non-corrosion, being either polyvinyl chloride (PVC) or vitrified clay pipe (VCP). Based on pipe material alone, the vulnerability for failure due to corrosion is very low. Figure 9 illustrates the collection system pipe material types.

From the same GIS database, Carollo observed that 69 percent of the collection system is 8-inch in diameter or smaller. This suggests that overflow caused by debris or root intrusion is likely and that a CMOM program would be beneficial to the City. Figure 10 illustrates the collection system pipe diameters.



COLLECTION SYSTEM PIPE MATERIAL

FIGURE 9

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carollo

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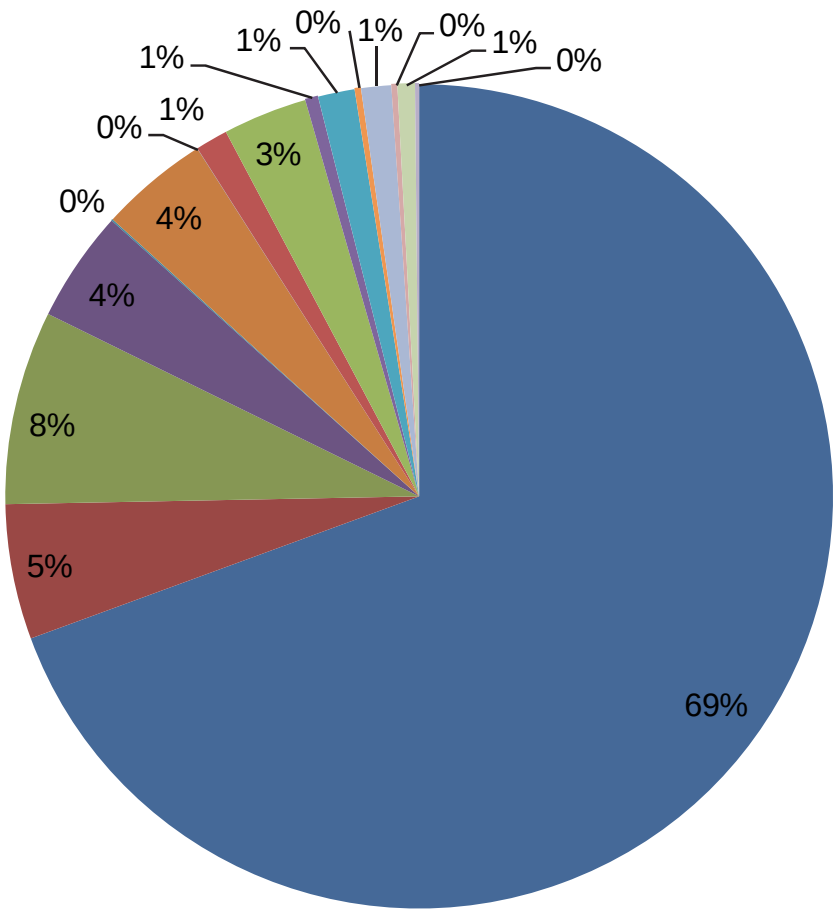


COLLECTION SYSTEM PIPE DIAMETERS

FIGURE 10

CITY OF GOODYEAR
PHASE I SUMMARY REPORT

5.1.2 Collection System Proposed 5-Year CIP – Pipelines and Manholes

Table 7 lists the pipelines and manholes recommended for rehabilitation or replacement over the next 5 years. It also includes budget to implement the City's CMOM program. Although not yet mandated by the State of Arizona, most larger municipalities undertake the CMOM program to be proactive in the prevention of reportable spills or overflow events.

Table 7 Collection System Proposed 5-year CIP – Pipelines and Manholes
Water and Wastewater Facilities Condition Assessment
City of Goodyear Public Works Department

	FY 2016	FY 2017	FY 2018	FY 2019	FY 2020
Upsize gravity pipeline from Prison	$190,000				
Rehab of severely corroded discharge manholes	$106,000				
Implement CMOM program	$100,000				
Rehab of severely corroded discharge manholes		$81,000			
Rehab of corroded collection system manholes		$1,000,000			
Rehab of severely corroded discharge manholes			$83,000		
Rehab of corroded collection system manholes				$1,000,000	
Rehab of corroded collection system manholes					$500,000
Proposed 5-Year CIP Totals	**$396,000**	**$1,081,000**	**$83,000**	**$1,000,000**	**$500,000**

Note:
(1) These are Project costs. They include 18% for Engineering, 30% Contingency, and 23% Contractor's OH&P. They DO NOT include escalation

Table 8 lists the collection system lift stations recommended for rehabilitation over the next 5 years.

Table 8	Collection System Proposed 5-year CIP – Lift Stations Water and Wastewater Facilities Condition Assessment City of Goodyear Public Works Department				
	FY 2016	**FY 2017**	**FY 2018**	**FY 2019**	**FY 2020**
Rainbow Valley WRF Influent Lift Station (LS)	$70,100				
Replace Wells Fargo Lift Station force main	$556,000				
Lift Station 12 influent piping and wet well coatings rehabilitation	$148,000				
Lift Station 7 - Ricardo LS - pumps replacement, guide rails, chains, wet well coating rehabilitation	$107,000				
Lift Station 8- Irene LS - pumps replacement, guide rails, chains, wet well coating rehabilitation	$107,000				
Lift Station 5 - Bio Flora pumps replacement, piping guides		$184,000			
Lift Station 10 - Lum LS pumps replacement, piping		$167,000			
Lift Station 6 - Lost LS pumps replacement and wet well coating rehabilitation			$275,000		
Lift Station 3 - Palm Valley LS pumps replacement, piping			$90,000		
Lift Station 12 - Rainbow Valley LS pump replacement			$101,000		
Lift Station 13 - Las Brisas LS install third pump				$102,000	
Lift Station 12 - Rainbow Valley LS pump replacement				$101,000	
Lift Station 12 - Rainbow Valley LS pump replacement					$101,000
Lift Station 2 - Del Camino LS wet well coating rehabilitation					$70,000
Proposed 5-Year CIP Totals	**$988,100**	**$351,000**	**$466,000**	**$203,000**	**$171,000**

Note:
(1) These are Project costs. They include 18% for Engineering, 30% Contingency, and 23% Contractor's OH&P. They DO NOT include escalation

5.2 Assessment of Water Distribution System

As with the collection system, Carollo did not conduct field assessments of the water distribution system rather relying on the accuracy of the GIS database to arrive at conclusions and recommendations.

5.2.1 Water Distribution System Pipelines and Appurtenances

According to the GIS database, 96 percent of the water distribution system is ductile iron pipe (DIP). Figure 11 illustrates the water system pipe material types. Although DIP is a good choice from a durability point of view, from a corrosion standpoint, it can be susceptible to reduction in useful life if it was not properly protected during installation. From staff interviews, many pipes in south Goodyear were installed without plastic wrapping, and were installed in “hot soils.” The result for many pipes has been leaks and breaks, and likely more to come in the years ahead. Figure 12 illustrates the distribution of water pipe sizes over the approximate 1.9 million feet in the system. Over 65 percent is 8-inch or smaller in diameter indicating that they are distribution rather than transmission pipelines. Should the city proceed with field condition assessment of their liner water assets, we recommend they begin with the 35 percent of the pipelines since they represent the “backbone” of the water system.

6.0 EVALUATION OF LUCITY CMMS SYSTEM

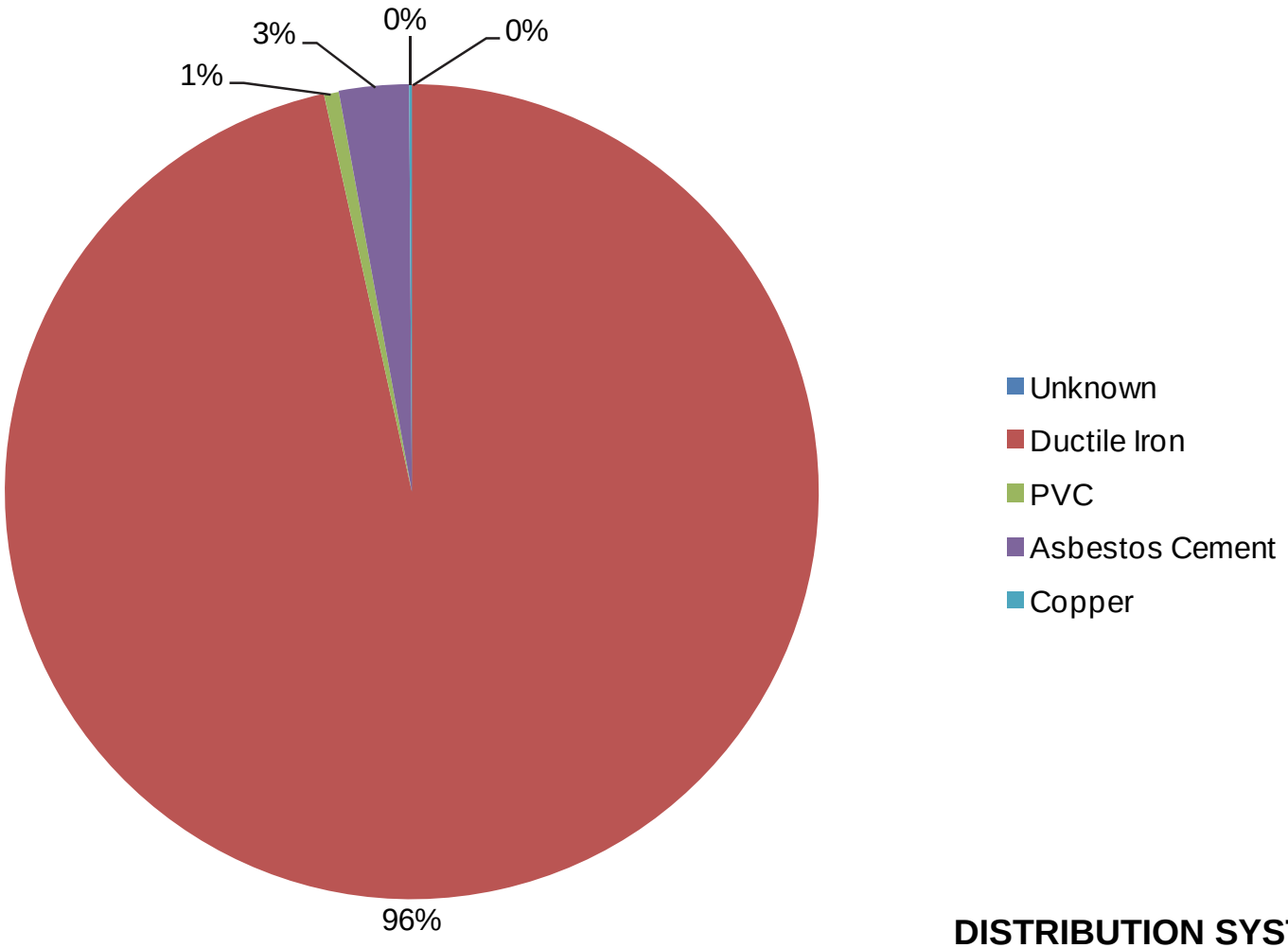
6.1 Background

The purpose of this section is to describe the current state of the City’s Computerized Maintenance Management System (CMMS), discuss the goals for the system related to maintenance and asset management for the Environmental Services Division (ESD) of the Public Works Department, and present recommendations for achieving these goals along with estimated costs. Due to the limited scope of this assessment, the recommendations contained in this section should be considered as high level guidance for the City, and the assumption is that the specific follow-on actions and costs will need to be further detailed in future efforts related to the CMMS.

6.2 Current State of ESD’s Lucity CMMS

6.2.1 City and ESD’s Current use of Lucity CMMS

The City is currently using the 2014 version of the Lucity CMMS for water and wastewater system asset and maintenance management. Lucity, formerly named GBA Master Series, is a well-known CMMS that is used extensively in the water industry and has a substantial customer base in Arizona as well as the Midwest due to their headquarters location in Overland Park, Kansas. The Lucity software has extensive maintenance and asset management functionality that is more specific to water and wastewater utilities than most other CMMS software alternatives. Their latest software is an entirely new web-based version that was released in 2012.



DISTRIBUTION SYSTEM PIPE MATERIAL

FIGURE 11

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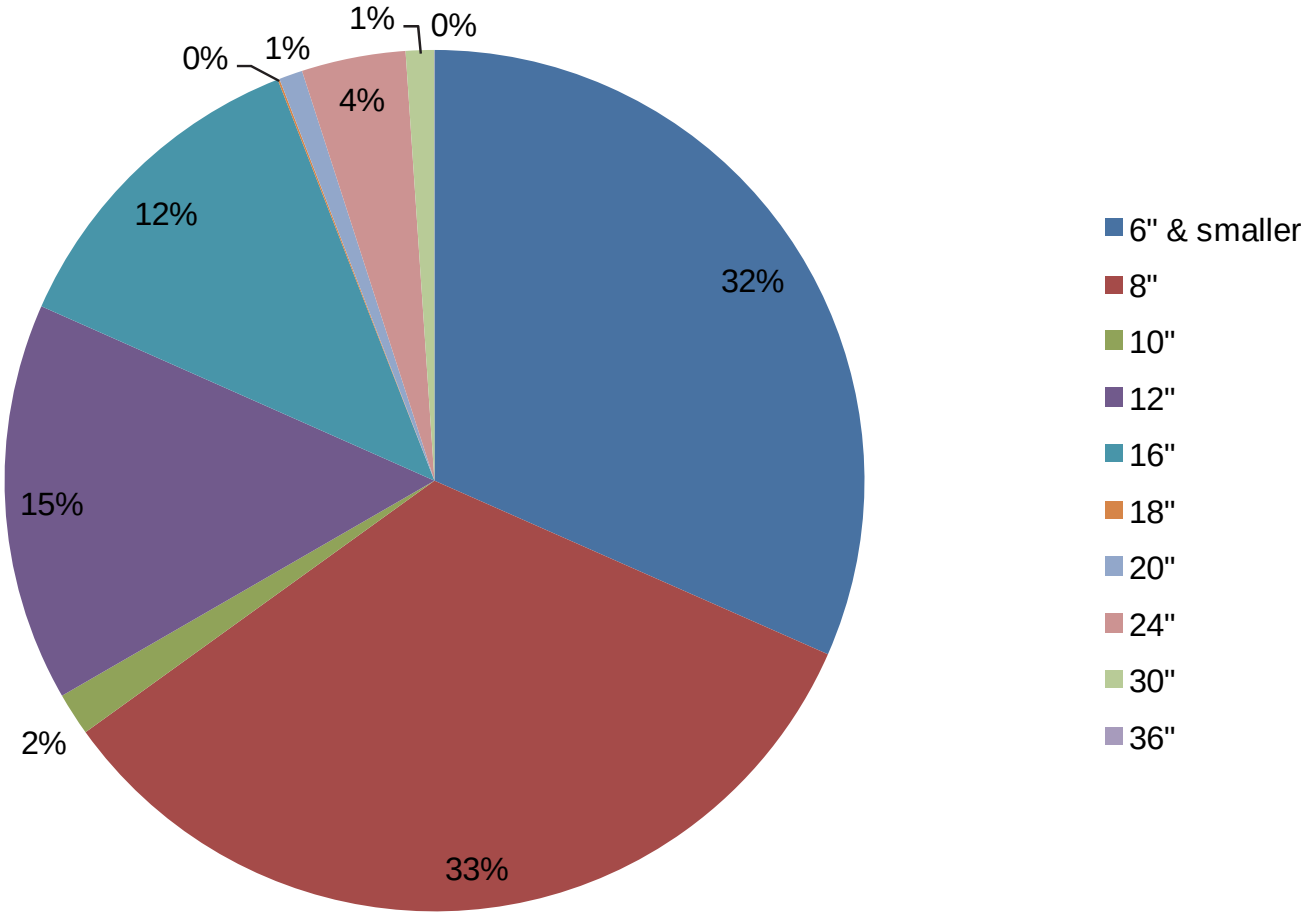


DISTRIBUTION SYSTEM PIPE DIAMETERS

FIGURE 12

CITY OF GOODYEAR
PHASE I SUMMARY REPORT

Lucity's current web-based software version is very flexible and functional for maintenance management of water and wastewater assets. The software has a powerful dashboard interface that can be customized for each user based on their organizational role and need to view high priority items from one screen. Similar to the older client-server application, Lucity is forms-based, with each entry form customizable to the City's terminology, workflows, and data requirements.

The City originally implemented Lucity approximately 7 years ago, starting with streets, pavement, stormwater, and other related assets managed by the Public Works Department. ESD has more recently started using Lucity in the last 2 years for water distribution and wastewater collection system assets. The Lucity software modules that have been implemented by the City to-date consist of the following:

- Work Administrator
- Work Orders
- Warehouse
- Facilities
- Water (ESD)
- Sewer (ESD)
- Equipment (ESD)

As noted, currently ESD has only purchased licenses for the water, sewer, and equipment modules. However, because the City's Information and Technology Services Division (ITSD) manages the Lucity licenses from a centralized server, and Lucity is used by the Public Works Department as a whole, ESD would have access to the Work Administrator, Work Orders, and Warehouse modules, if needed. The City and ESD have not yet taken advantage of some of the more advanced software functionality and modules, such as Lucity's dashboard, mobile, and GIS capabilities, because the initial efforts have been on getting the basic asset data and work order functionality established.

6.2.2 Alternative Software Considerations – SAP ERP

ITSD is currently beginning the process to replace the City's current HTE Naviline ERP (Enterprise Resource Planning) software with the more robust SAP ERP. The City has expressed an interest in evaluating whether to replace the Lucity CMMS with the SAP work and asset management modules. As with any major information technology decision like this, there are pros and cons to implementing a complex, multi-functional, fully integrated, enterprise system versus a relatively simple, focused functionality, "best of breed" software.

While a detailed analysis and comparison of these options is beyond the scope of this report, it is the general experience of Carollo that niche CMMS software options, such as Lucity, have been more successfully implemented by water and wastewater utilities similar in size to the City, than the maintenance/work management modules of major ERP systems such as SAP, Oracle, or Tyler Technologies. Some of the considerations to be made in this comparison include: specific functionality for water/sewer assets (e.g. CCTV inspection data); pre-configured water/sewer asset data types and fields; ease-of-use and simplicity for operations and maintenance staff; complexity of integration with utility specific systems such as GIS, SCADA, and CCTV; resource availability and cost for configuration, programming, data conversion, and training; and comparable user groups of similar utilities for common support and experience sharing. The primary benefit of an ERP over a niche CMMS such as Lucity is the tight integration and workflows between the maintenance/work management module and other ERP modules such as core financials, purchasing, and inventory management.

Ultimately, it is the City's decision whether to continue the efforts to improving the use of the current Lucity CMMS, or halting these efforts in anticipation of replacing it with the alternative SAP modules. Before a decision is made, it is Carollo's recommendation that the City develops an overall lifecycle cost analysis and considers the benefits, risks, and opportunities associated with each alternative. A major consideration that should not be underestimated is the amount of time and level of experienced resources needed to complete the implementation of the CMMS-related modules of SAP. One of the largest challenges for other organizations that have implemented SAP (e.g. City of Dallas and City of San Diego) is the lack of experienced resources, both internal and external, that are capable of properly configuring SAP to meet the specific needs of water and wastewater utilities. To address this issue, if the City decides to proceed down the SAP path for maintenance/work management, Carollo recommends that the City hire a consultant that has specifically implemented these SAP modules for other water utilities.

6.2.3 Data

The City's Lucity database has been populated with asset data starting with the Public Works Department and is now being further developed with ESD assets. The current ESD assets that are in Lucity primarily consist of converted GIS data and consist of the following:

- Water assets:
  - Hydrants
  - Valves including in-line, air relief, and pressure regulating valves
  - Water meters
  - Service lines with addresses

- Sewer assets:
  - Sewer mains
  - Manholes
  - Lift stations with location (pumps are currently being added)

As can be seen from this list, the current water assets in Lucity do not include major items such as the water mains, pump stations, and equipment at the water treatment plants. Currently, Lucity also does not include any wastewater treatment plant assets or equipment.

In terms of the attribute data for these asset datasets, there are many gaps and incomplete information in many of the fields. For example, because the attribute data was primarily converted from GIS, there is typically information on sewer main lengths, materials, and line types, but there is no data on installation dates or diameters. As new asset data is added, the attributes are typically more complete than the original data that was converted into Lucity from GIS.

6.2.4 Integration

The City has currently implemented very limited integration between Lucity and other information systems. The City has purchased the Lucity API, which allows the programming of interfaces for data exchanges between Lucity and other applications. The API has been used to develop integration between Lucity and PublicStuff, which is a customer service application for residents and businesses of the City to submit service requests, but this is not directly used by ESD for water or wastewater services.

ESD water meter and utility billing data are currently managed in the HTE Naviline ERP system, which is not integrated with Lucity. The City is in the early stages of replacing HTE with the more robust SAP ERP. The SAP implementation could reasonably take 2 or 3 years to complete, and the City does not currently plan to integrate Lucity with the HTE ERP in the interim period while it is being replaced.

The City is also using third-party web GIS software developed by EMS called EMSWebMap. EMSWebMap provides web-based GIS leveraging the ESRI Silverlight API and provides City staff with access to detailed maps and asset data via a web browser. There is some limited integration between EMSWebMap and Lucity to provide links to view asset data and work order history for water distribution and wastewater collection system assets via hyperlinks that open the Lucity application. The Public Works Department also has the Lucity GIS Desktop application that allows for administration and management of the related data between GIS and Lucity.

6.3 Strategies and Goals for ESD CMMS

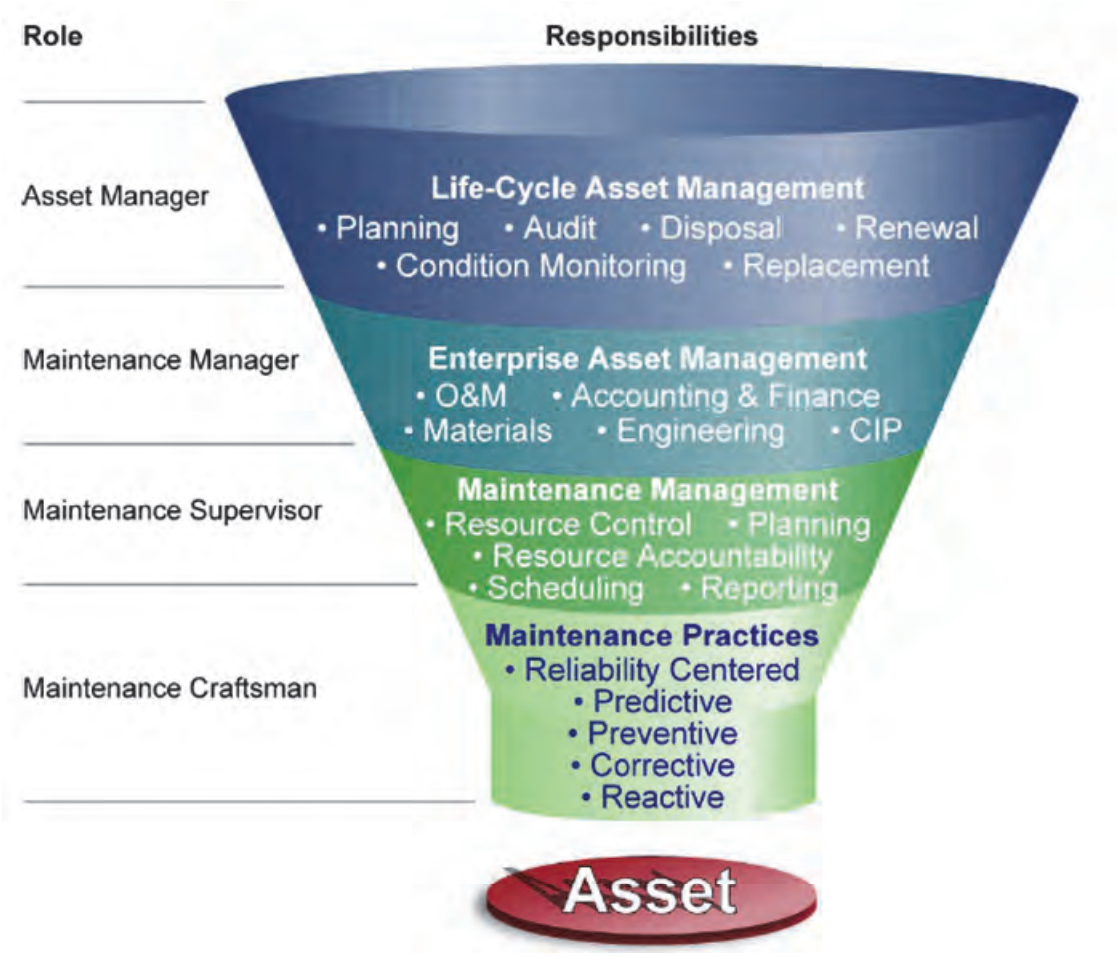
This section presents overall strategies and specific goals to achieve the ultimate vision for the ESD CMMS in support of asset and maintenance management for ESD water and wastewater services.

6.3.1 Asset and Maintenance Management Strategies

Asset management and maintenance management are integrally linked in that both are focused on the planning, tracking, reporting, and management of asset related information. As shown in Figure 13, maintenance management is typically focused on the more detailed and daily work planning, scheduling, and management activities involving the assets. Asset management, on the other hand, involves the higher-level functions of life cycle asset planning, condition monitoring, and renewal or replacement decision-making, which are dependent on the information provided from maintenance and work management activities. Both functions are critical to the overall effective and efficient performance of a water utility and integrate aspects of engineering, finance, operations and maintenance.

There are multiple of benefits of implementing an asset management program and the supporting information systems for the City. Some of these benefits include:

- Protecting and extending the life of water and wastewater assets beyond an average expected useful life
- Reducing equipment downtime and risk of unexpected failures through proper preventive maintenance and asset renewal planning
- Defensibility and support for the equipment manufacturer's warranty after installation
- Improved operations and maintenance staff productivity through better resource planning, coordination, and management
- More accurate predictions of annual staffing and O&M budgetary requirements
- Support for regulatory agency permit and reporting requirements
- Ability to demonstrate that the City is meeting specific levels of service for its customers
- Specific CMMS Implementation Goals



INTEGRATED ASSET AND MAINTENANCE MANAGEMENT PRACTICES

FIGURE 13

The City and ESD have a vision of implementing a complete CMMS that supports the strategies outlined above for asset and maintenance management. In order to achieve this vision, there are specific goals for complete development of the City's CMMS that will need to be met, as follows:

- **Develop complete asset inventory:** The CMMS should ultimately be the primary repository of vertical asset data for pump stations, reservoirs, treatment plant equipment, etc. and synchronized with GIS for all linear asset data for the water distribution and wastewater collection systems. Attribute data should be complete and accurate for all asset data types, and provide a historical record of asset repairs, rehabilitation, and replacement.
- **Implement preventive maintenance (PM) program:** ESD should implement a PM program of recurring, scheduled, work orders with detailed instructions, resources, and time/cost estimates that are used to extend the useful life of assets, maintain manufacturer warranties, and reduce unexpected failures. The CMMS should provide the foundation for ESD to migrate from the current reactive maintenance mode to a preventive and predictive maintenance program.
- **Implement inventory management program:** ESD should implement an inventory management program consisting of centralized storerooms or warehouses, a catalogued inventory of spare parts and materials used for maintenance, and a process for restocking inventory through purchasing from approved vendors.
- **Integrate GIS with CMMS:** The City's GIS spatial data should be fully integrated with the CMMS to provide ESD field staff and management the ability to visualize, retrieve, input, and manage maintenance and asset management data from a map-based user interface.
- **Integrate ERP with CMMS:** The City's ERP system should be integrated with the CMMS to support seamless workflows such as the following: customer service requests to maintenance work orders; inventory purchasing, parts receiving, and accounts payable; resource budgeting, project accounting, and activity-based cost tracking.
- **Integrate SCADA with CMMS:** The SCADA system used to monitor and control the water and wastewater systems should provide automated triggers for preventive maintenance of critical equipment, such as pumps, blowers, and other rotating equipment, based on run-time data.
- **Integrate CCTV with CMMS:** The wastewater system CCTV inspection videos and data should be integrated with the CMMS to provide vital asset management information to identify problem sewer lines and manholes, direct sewer repair work, and plan for sewer rehabilitation and replacement.

- **Provide mobile access to CMMS:** The CMMS should provide complete mobile access to water and wastewater services field staff to be able to access asset data, work orders, and other maintenance information from laptops, tablets, and handheld devices. Staff should have mobile access to the CMMS without an active network connection, and data automatically synchronized when a network becomes available.

6.4 Recommendations for ESD CMMS Improvements

This section presents recommendations for improvements to the ESD CMMS to achieve the future vision and goals discussed in the previous section of this report. The recommendations are not presented in an order of priority, which should be determined by the City based on funding availability and other related efforts that may be achieved more cost effectively in alignment with the CMMS improvements.

6.5 Software Improvements

Carollo recommends that the City proceed with the purchase of an unlimited license for the core modules of the Lucity CMMS currently in use by ESD. This is the most cost effective approach for the 40 or more potential users in ESD of the asset data and work order modules in Lucity. In discussions with the Lucity representative, the recommended unlimited use licenses would include the following modules:

- **Water:** Module that supports unique water assets and data attributes
- **Sewer:** Module that supports unique sewer assets and data attributes
- **Equipment:** Module that supports unique equipment assets and data attributes, such as those at treatment facilities
- **Work management:** Module that includes work orders and work administration for corrective, preventive, and predictive maintenance
- **Warehouse:** Module that provides warehouse, inventory, and parts management capabilities

Furthermore, in order to enhance the integration capabilities of Lucity with other City information systems, it is recommended that ESD consider the following software modules:

- **Web GIS:** The current integration of GIS with Lucity is fairly limited due to the incomplete water and wastewater asset data currently available, as well as the lack of mobile access. ESD should implement complete mobile GIS capabilities for field staff and consider the options to enhance the EMSWebApp or implement the Lucity web GIS module.
- **Sewer CCTV Import:** With improvement to sewer cleaning and inspection, implementing the sewer CCTV import module would provide a seamless interface to import and review inspection videos and defect data.

Integration with SCADA and ERP systems is not provided by Lucity with out-of-the box software, so these capabilities would need to be custom programmed interfaces as described under integration improvements.

In addition, the Lucity Mobile solution is recommended to provide ESD field staff with the ability to access asset data and work orders from mobile devices, with the capability to be detached from network connections and automatically synchronize data when networks are available. This would alleviate some of the current issues with difficulty accessing Lucity via mobile devices and virtual private network (VPN) connections.

6.6 Data Improvements

Carollo recommends that the City focus on the further development of the asset datasets in Lucity as one of the highest priorities. The biggest gaps in asset data should be addressed by major asset classes, starting with the water mains to complete the water distribution system assets, then proceeding to the water and wastewater treatment facility assets. With the implementation of GIS integration, it is important to have access to the Lucity data that accompanies the spatial data for assets such as the water mains.

The asset data gaps analysis in the previous section on the current state of the ESD CMMS provides some guidance on the areas to focus the additional data gathering efforts. A preliminary recommendation on the order in which to develop the major missing asset datasets is as follows:

- Water mains
- Sewer lift stations
- Water reclamation facility equipment
- Water treatment facility equipment

With the implementation of these additional asset datasets, in addition to the standard dimensional and descriptive attribute data, it is valuable to address the unique requirements of asset management by focusing on the development of fields such as:

- Installation date
- Rehabilitation cost
- Replacement cost
- Useful service life
- Estimated remaining service life
- Current condition rating
- Vulnerability/likelihood of failure
- Criticality/consequence of failure
- Risk rating

This asset management data should be stored in the CMMS and developed in coordination with an overall asset management plan for the water and wastewater systems.

6.7 Integration Improvements

The integration of Lucity with other City information systems should be developed in order to streamline workflows, enhance ease-of-use, and improve timely and accurate completion of maintenance tasks. It is recommended that ESD work toward the ultimate vision of CMMS integration as discussed in the previous section, and in an order of priority, as follows:

- **Improve GIS integration:** Enhance the existing EMSWebApp or implement the Lucity GIS Web module to provide full integration of linear asset data between CMMS and GIS.
- **Implement SCADA integration:** Develop custom integration of equipment run times from the SCADA system to trigger preventive maintenance tasks in Lucity.
- **Implement CCTV integration:** Implement the Lucity sewer CCTV import tool to provide integration of CCTV inspection videos and data with the CMMS and GIS applications.
- **Integrate ERP with CMMS:** Develop custom integration with the City's ERP system for workflows and data exchanges that would provide the greatest benefit. Consider interfaces for service requests to work orders; inventory management and purchasing; and activity-based cost tracking.

6.7.1 Other Recommendations

Carollo recommends that ESD implement a CMMS training program for continual development of staff knowledge in maintenance and asset management practices using Lucity. The training program should be implemented in modules that cover the major functionality and workflows that are supported by Lucity including:

- Work orders and preventive maintenance
- Inventory management
- Asset registry and data management
- User customizable dashboards and custom reporting

Training could include a combination of vendor-provided training courses, as well as customized training by ESD staff with consulting assistance. All training courses should provide documentation of the specific ESD business processes, data, and user interfaces.

6.7.2 Cost Estimates for Recommended Improvements

This section provides planning level cost estimates for the improvements recommended above to be used for purposes of budgeting. Ranges of costs are given due to the preliminary information gathered as part of this assessment, and the wide variability in the level of effort to implement many of the improvements. As the City decides to implement the recommendations, further analysis should be made of the specific tasks to be completed, and better cost estimates developed with the assistance of the CMMS vendor and consulting support.

The cost estimates listed in Table 9 are provided for software licensing and implementation services for software configuration, data collection and conversion, systems integration, and user training.

Table 9 Cost Estimates
Water and Wastewater Facilities Condition Assessment
City of Goodyear Public Works Department

Item	Description	Estimated Cost
Software		
Lucity Core License Upgrades	Upgrade to unlimited user licenses for water, sewer, and equipment modules	$28,000
Lucity Work Management Upgrades	Upgrade to unlimited user licenses for work orders, work administration, and warehouse modules	$45,000
Lucity Mobile and Mobile Work	Unlimited user licenses for mobile work order modules for Android and iOS platforms	$25,000
Lucity GIS Web	Site license for web-based GIS integration module	$10,000
Lucity Sewer CCTV Import	Single user license for importing and integrating sewer CCTV inspection videos and data	$2,000
	Software Subtotal	$110,000
	Additional Annual Software Support & Maintenance	$22,000

Table 9 Cost Estimates Water and Wastewater Facilities Condition Assessment City of Goodyear Public Works Department		
Item	**Description**	**Estimated Cost**
Services		
Software Configuration	Services to configure additional Lucity software modules and complete setup of existing software functionality	$75,000 - $150,000
Data Collection and Conversion	Additional data collection and conversion for water mains, pump stations, water reclamation facilities, and water treatment facilities (not including asset management data fields).	$50,000 - $200,000
GIS Integration Improvements	Enhance existing EMSWebApp or implement Lucity GIS Web	$15,000 - $30,000
SCADA Integration	Develop custom SCADA integration with Lucity for equipment run-times	$20,000 - $40,000
Sewer CCTV Integration	Implement Lucity Sewer CCTV Import module and workflows	$10,000 - $20,000
ERP Integration	Develop custom ERP integration for service requests, inventory, purchasing, and cost data	$50,000 - $200,000
User Training	Develop and implement a customized CMMS training program with documentation	$50,000 - $100,000
	Services Subtotal	$270,000 - $740,000
	Total	**$380,000 - $850,000**

7.0 SUMMARY AND RECOMMENDATIONS

Table 10 is a summary table for wastewater collection system and treatment facilities for rehabilitation or replacement projects over the next 5 years. The grand total for the proposed wastewater 5-year CIP is **$10,318,100**, without escalation.

Table 10	Summary Table for Wastewater Collection System and Treatment Facilities – Proposed 5-Year CIP Water and Wastewater Facilities Condition Assessment City of Goodyear Public Works Department				
	FY 2016	**FY 2017**	**FY 2018**	**FY 2019**	**FY 2020**
Collection System Pipelines and Manholes	$396,000	$1,081,000	$83,000	$1,000,000	$500,000
Collection System Lift Stations	$988,100	$351,000	$466,000	$203,000	$171,000
Water Reclamation Facilities (WRF)	$1,809,600	$2,473,700	$157,300	$552,000	$86,400
Proposed Wastewater 5-Year CIP Totals	**$3,193,700**	**$3,905,700**	**$706,300**	**$1,755,000**	**$757,400**

Note:
(1) These are Project costs. They include 18% for Engineering, 30% Contingency, and 23% Contractor's OH&P. They DO NOT include escalation

Table 11 is a summary table for the water system facilities. The grand total for the proposed water 5-year CIP is **$4,835,000**, without escalation.

Table 11	Summary Table for Water Wells, Storage and Pump Stations – Proposed 5-Year CIP Water and Wastewater Facilities Condition Assessment City of Goodyear Public Works Department				
	FY 2016	**FY 2017**	**FY 2018**	**FY 2019**	**FY 2020**
Well Rehabilitation – re-drilling and equipping		$2,000,000	$1,000,000	$1,000,000	
Storage and Pump Stations, including Bullard RO Campus	$550,000	$135,000			$150,000
Proposed Water 5-Year CIP Totals	**$550,000**	**$2,135,000**	**$1,000,000**	**$1,000,000**	**$150,000**

Note:
(1) These are Project costs. They include 18% for Engineering, 30% Contingency, and 23% Contractor's OH&P. They DO NOT include escalation

The Environmental Services Department's proposed 5-year CIP program for the combined water and wastewater utilities will require a dedicated program manager or full-time employee (FTE) to administer. The number or projects spread over many facilities each with their own contract are overwhelming if simply added to the daily duties of the existing utilities staff. We recommend that the City hire either a FTE or a consultant firm that has water and wastewater utilities design experience and program management / construction management (PM/CM) experience.

APPENDIX A – KICKOFF MEETING MINUTES

City of Goodyear

2015 Integrated Water Resources, Water, Wastewater and Reclaimed Water Master Plan

PHASE 1 ASSESSMENT MEETING MINUTES

Project:	Condition Assessment of Water and Wastewater Infrastructure	**Mtg. Date:**	December 4, 2014
Client:	City of Goodyear	**Issue Date:**	December 16, 2014
Location:	4980 South 157th Avenue Goodyear, AZ 85338	**Project No.**	9728A00
Purpose:	Kickoff Meeting		
Attendees:	**City of Goodyear:** Pilar Avila, Ray Diaz, Todd Carpenter, Willy Elizondo, Ruben Veloz, Vanessa Enríquez, Mark J. Seamans, Ryan Penny **Carollo:** Rob Buss, Chad Meyer, Judd Hunemuller, Melanie Sikes, Richard Humpherys, Humberto Acuña		

Discussion:
The following is our understanding of the subject matter covered in this meeting. If it differs from your understanding, please notify us.

PURPOSE OF THE PHASE 1 ASSESSMENT PROGRAM

The purpose of this program is for Carollo engineers to:

1. Perform appraisal level assessments of water and wastewater assets belonging to the City of Goodyear.
2. Wastewater Treatment Plants
3. Wells and Water Production Facilities
4. Bullard RO Campus
5. Lift Stations
6. Collection System pipelines and manholes
7. Water Distribution System pipelines and appurtenances
8. Identify, prioritize, and assign a cost to projects to be included within the upcoming 5-year C.I.P. (FY2016-2021)
9. Provide advice regarding improvement of operations, maintenance procedures, inspection methods and frequencies, and preventive maintenance.

WASTEWATER TREATMENT PLANTS

1. 157th Avenue WWTP

1. BACKGROUND: The current average flow rate is 3.2 mgd. A repair and/or replacement (R&R) schedule is needed for elements of this plant. Equipment is aging, especially the membranes, actuators and DO probes. The filters are reported to be working satisfactorily. However, Todd Carpenter said they are included in their CIP for replacement with Disc Filters as an upgrade project.
2. HEADWORKS: Current flow rate is 3.2 mgd versus 10 mgd design flow rate. Many floatable materials go through the bar screens. There is an apparent need for a "tighter" screen, having smaller openings.
3. RAS/WAS: There is a pump capacity issue. Backwash rates may need to be reduced. Or a replacement pump installed.
4. DISINFECTION: All chlorine contact is done at the reservoir. A request has been made to install a chlorine contact basin. TTHM formation and fecal formation are both issues.
5. SOLIDS HANDLING: The pumps are old and are needing replacement. The North Digester needs to be placed back in line soon per ADEQ requirements. An HDPE liner is planned to be installed. System needs more capacity and redundancy. The centrifuges are exposed to the elements and have received much wear. The MCC panels are exposed and need upgrade.
6. ELECTRICAL POWER: There is only one electrical feed to the plant, making the plant service potentially less reliable and vulnerable to sustained outage. Parts of the system are old (1970s) and have been expanded in a patchwork fashion. The electrical system needs to be reviewed completely and recommendations for improvement made.

2. Corgett WRF

1. The steel support members of the FRP odor control dome of aeration basin are badly corroded. The exposed electrical conduit is also corroded. A "flat dome" is scheduled to replace this dome.
2. The blower operation needs to be made more efficient.
3. The RAS/WAS are brand new. The boundaries of this plant are very close to the community and the plant's odor control equipment is not operating properly.

3. Rainbow Valley WRF

This plant was purchased used from the City of Glendale. The City of Goodyear is currently working on replacing the process equipment to this plant.

WELLS AND WATER PRODUCTION FACILITIES

1. Well Maintenance

1. The maintenance cycles for the wells need to be validated. Currently, the shafts are pulled out every 5 years. There is no current “true” maintenance program, but the City feels that the wells are well maintained. A spreadsheet is used for monitoring maintenance. Well casings usually last approximately 25 years and some wells are past this period. The City would like to know what could be done differently concerning maintenance. The last investments in wells cost the City approximately $1.2 Million per well. Well videos are also available for review.

2. Individual Well Status

1. Well #11 is old and has collapsed.
2. Well #3 currently has holes in its casing and the City needs a recommendation for its repair. Well #3 water goes directly into the distribution system.
3. The City needs Carollo to identify the critical wells and to carefully plan the asset management of these. The plan should include the frequency of replacement of critical components. Well Adaman 1 is critical. Richard Humphreys is to supply the “perfect storm” report, drafted by Mark Seamans, to the Carollo team members. Well #20 is also critical. Some MCCs at the well sites are 12 to 20 years old. Well sites #11,#12, and #13 are in this condition, with site #11 being the highest priority.
4. Improving the efficiencies of the motors with VFDs is to be taken into account. Sand separators are installed on all wells. The Amiad filters are constantly being backwashed. The pipeline to Bullard “spikes” sand to the RO. Typical well flow rates are 500-1000 GPM. The City is monitoring well drawdown and well capacity over time.

3. Water Treatment Facilities

Water is treated at several well sites for arsenic, nitrates and fluoride. The City has four (4) treatment facilities:

1. Bullard RO Campus: Well Sites #22 and #19 supply the Bullard RO Campus. Fine sediments (10-20 microns in size) collect at a pipe dip on the supply line from Well #19. “Ice pigging” may be a solution for the sediment removal. If wells #19 or #22 are lost, a blending imbalance is created resulting in the need to shut down the whole system of wells connected to the Bullard RO Campus. Well Site #11 has water blending. Five (5) wells in total, supply the Bullard RO Campus. As far as maintenance is concerned, one (1) R.O. train per year is replaced at the Bullard RO Campus. This frequency is to be validated. Bacteria are corroding parts of their stainless steel piping. This issue needs to be resolved.

2. Well Site #12,
3. Well Site #21, and
4. Well Site #18. There is arsenic treatment at Well Site #18B.

4. Reservoirs

1. Reservoirs currently are inspected biannually. This frequency needs to be validated. Site 13 reservoir has leaks, apparently due to corrosive soils. Repair priorities must be addressed.
2. Always to keep in mind during site visits: What needs to be done in the next five years?

LIFT STATIONS AND COLLECTION SYSTEMS

1. Lift Stations

1. The City operates twelve (12) lift stations. None of the lift stations has odor control. A critical lift station is the Wells Fargo lift station located on Central and Van Buren. There is very little detention time in the wet well. Its coatings are deteriorated.
2. At the Palm Valley lift station, the discharge manhole is corroded.
3. The City is looking for direction on maintenance frequencies for the lift stations. The original equipment was installed in 1987 for three (3) of these lift stations. When inspecting these lift stations, age of the equipment must be carefully looked at.
4. The Rainbow lift station has odor issues.
5. There is only one force main in the system. Its condition must be assessed. CMOM Program: Look into its implementation and maintenance costs.
6. At the Perryville Grinder Station, the solids go into the gravity sewer system. An option to remove the solids at the station is to be looked into.

2. Collection Systems

1. There is a sag on the sewer line located on Litchfield Rd. Solids collect at the bottom. A solution for inspection and removal of the solids is to be provided. There are some oversized lines that are being eaten away due to low flows. The gas line road sewer line is oversized and corroding.
2. Conditions on city manholes must be addressed. Rob Buss is to provide cost rates on manhole rehabilitation.

WATER LINES

1. At Sarival Gardens there are several issues with the water lines: there are different-sized pipes, the fire hydrants are obsolete, there is low water pressure, there are several broken valves, and there are several varieties of pipe material.
2. At Estrella, a 12-inch main water line was not wrapped and it is rapidly corroding due to the "hot" soils. A method to inspect this line is to be proposed. It is recommended that a pilot study for internal inspection be done at the 12-inch line at Estrella.
3. There is also a 30-inch raw water transmission line needing inspection. The City is looking for ideas on preventive maintenance.
4. Approximately 2700 hydrants are in place. The valves on these are exercised annually. The City is looking for EPA or ADEQ guidance on the DMOM Program.

5-YEAR REPAIR AND REPLACEMENT PLAN FY 14-18.

Vanessa distributed four (4) sheets from the City of Goodyear with information on the 5-year Repair and Replacement Plan FY 14-18.

Asset Assessment work schedule is as follows:

Dec. 8-19 – Site Visits

Dec. 22-29 – Develop report

Dec. 31 – Deliver report

Prepared By:

Humberto Acuña, P.E.,
Senior Engineer
Carollo Engineers, Inc.

City of Goodyear Environmental Services
5 Year Repair & Replacement Plan
FY 14 - 18

Water Distribution									
	FY13 Req	FY13 Funded	FY14	FY15	FY16	FY17	FY18	Five year total	FY14 Priority
Equipment									
Meters-10 to 12 Year Replacement Program	$200,000	$0	$250,000	$200,000	$200,000	$200,000	$150,000	**$1,000,000**	
Replace Toughbook laptops (how many?)				$6,000	$12,000	$6,000		**$24,000**	
Radio reading equipment Replacement				$50,000				**$50,000**	
Handheld Reader Replacement (For Meter Installs)				$12,000				**$12,000**	
ARV Replacement				$5,000		$4,000		**$9,000**	
Replace Tamper						$2,500		**$2,500**	
Replace Jackhammer						$5,500		**$5,500**	
Valve Exercising Machine					$62,000		$62,000	**$124,000**	
Lucity CMMS Program - 1/3	$10,000	$0	$10,000	$1,200	$2,700	$1,200	$1,200	**$16,300**	Was not requested in FY13 supplemental; done with FY12 funds
Leak Detectors - Replacement					$10,000			**$10,000**	
Projects									
Estrella Bridge Water Line Emergency taps	$250,000		$250,000					**$250,000**	This was not a FY13 supplemental
Estrella Bridge Water Line Connection Materials	$250,000		$250,000					**$250,000**	This was not a FY13 supplemental
Estrella Bridge Water Line Repair/Replacement				$500,000	$1,500,000			**$2,000,000**	
Hydrant Replacement				$100,000		$150,000		**$250,000**	
Critical Valve Replacement	$125,000		$125,000	$100,000	$100,000	$75,000	$75,000	**$475,000**	This was not a FY13 supplemental
Yearly Totals	**$835,000**	**$0**	**$885,000**	**$974,200**	**$1,886,700**	**$444,200**	**$288,200**	**$4,478,300**	

City of Goodyear Environmental Services
5 Year Repair & Replacement Plan
FY 14 - 18

Environmental Quality									
	FY13 Req	**FY13 Funded**	**FY14**	**FY15**	**FY16**	**FY17**	**FY18**	**Five year total**	**FY14 Priority**
DR 3500 Spectrophotometer for Rainbow WRF, Corgett WRF	$4,500	$0	$4,500				$5,000	**$9,500**	4
New benchtop turbidimeters for all 3 WRFs			$2,200	$2,200	$2,200			**$6,600**	5
Refrigerated sampler (influent Corgett, RV; effluent Corgett)			$13,000	$6,500			$6,500	**$26,000**	1
Portable refrigerated cooler			$4,500			$4,500		**$9,000**	2
ATV for MW access			$12,000					**$12,000**	3
LMS system for receiving/tracking all wastewater lab data or update OPS 32				$24,000				**$24,000**	
Yearly Totals	**$4,500**	**$0**	**$36,200**	**$32,700**	**$2,200**	**$4,500**	**$11,500**	**$87,100**	

City of Goodyear Environmental Services
5 Year Repair & Replacement Plan
FY 14 - 18

Water Production										
	Acct #	FY13 Req	FY13 Funded	FY14	FY15	FY16	FY17	FY18	Five year total	FY14 Priority
Chlorinators/Instrumentation	43-21			$10,000	$10,000	$10,000	$10,000	$10,000	$50,000	
15 year program, one/ year				Well #1	Well #3	Well #18A	Well #11	Well 12		
Booster Pump/Motor Repair	74-12	$25,000	$25,000	$70,000	$70,000	$70,000	$70,000	$70,000	$350,000	
5 year program , Seven/year		BPS#18		BPS#3-(P 1,2); BPS#7-(P1,2,3); BPS#10-(P1,2)	BPS#11-(P2,3,4,6); BPS#21-(P 1,2,4)	BPS#11-(P1,5); BPS#21-(P3,5); BPS#23-(P1,2,3)	BPS#8-(P1,2); BPS#12-(P1,2,3); BPS#18-(P1,2,3)	BPS#13_Z1-(P1,2,3,4); BPS#13_Z2-(P1,2)		
Meter Replacement-Turbo for Mags	43-62			$10,000	$10,000	$10,000	$10,000	$10,000	$50,000	
10 Year program, One/year				BPS #18	BPS #21	Liberty Water	BWC	BPS #11		
SCADA Equipment (Radios, PLC's)	61-23			$10,000	$10,000	$10,000	$10,000	$10,000	$50,000	Note 1
10 year program, One/year				Ball Park	BPS #23	BPS #11	BPS #12	BPS #13		
VFD Replacement	74-14	$10,000	In base budget	$15,000	$15,000	$15,000	$15,000	$15,000	$75,000	
10 year program, One/ year				BPS #21 , P1	BPS #21 P2	TBD	TBD	TBD		
Electrical Control Center-Upgrades	74-14	$10,000	$10,000	$20,000	$25,000	$25,000	$25,000	$25,000	$120,000	
20 year and older				Well #11	BPS #10	BPS #7	BPS #8	Well #22		
Valve Replacement	43-62			$20,000	$25,000	$25,000	$25,000	$25,000	$120,000	
20 Year Program, Five/year				BPS #11 (P1,3,5)	BPS #13-(P1,2, 3)	BPS #13-(P1,2,4)	BPS #12-(P1,2,5)	Well #3, P1, 2		
Well Rehabilitation	74-11	$30,000	$30,000	$65,000	$65,000	$65,000	$65,000	$65,000	$325,000	
5 Year program, Two/year		Well 12		Well#18B, #1	Well#3, #12	Well #18A, #11	Well #A1, A2	Well #19, #22		
R.O. Normalization and Cleaning	22-15			$10,000	$20,000	$20,000	$20,000	$20,000	$90,000	
Annually, 9 skids/year										
Amiad Filter Maintenance	43-62			$7,000	$10,000	$10,000	$10,000	$10,000	$47,000	
Tank Rehabilitation	Removed			$300,000	$150,000	$200,000	$150,000	$150,000	$850,000	1
10 Year program, One/Year				BPS #13	BPS #21	BPS #12	BPS #11	BPS #10		
18B Arsenic Vessel Rehab	Removed			$70,000					$70,000	3
Catch Basin and Drain - Site #21										
Water Mixers for Tanks-WQ		$45,000	$45,000		$40,000	$20,000	$20,000	$30,000	$110,000	
One Time		RV Reservoir			Booster #23	Booster #12	Booster #7	Booster #8		
Amiad Filter Repairs and Replacement					$50,000		$50,000		$100,000	
10 Year Program					South Bank		North Bank			
Addl 1500 gpm Pump at Site 13	Removed			$50,000						2
Well #12 Modifications		$50,000	$50,000		$50,000				$50,000	Note 3
Stainless Steel Replacement BWC							$30,000	$30,000	$60,000	
Annually after 10 year at BWC							Pipe/Fittings	Pipe/ Fittings		
Lucity CMMS Program - 1/3					$10,000			$10,000	$20,000	
Every five years					Laptops					
VFD at BS #11						$100,000	$250,000		$350,000	
One Time						Design	Construction			
Well #5 Tank Demolition							$30,000		$30,000	
Yearly Totals		$170,000	$160,000	$557,000	$560,000	$580,000	$790,000	$480,000	$2,967,000	

1 SCADA System costs were developed in discussion with I & C Tech. His observations of the existing system and his experience suggests we budget annually for component and software replacements in each area
2 System Tanks are in the 10 year cycle for rehabilitation work Should be made permanent supplemental
3 Requested/approved for $50,000 for Well 12 decommission in FY13 - not feasible to decommission well 12 until 3rd Adaman Well is operational

City of Goodyear Environmental Services
5 Year Repair & Replacement Plan
FY 14 - 18

Water Reclamation										
	Acct #	FY13 Req	FY13 Funded	FY14	FY15	FY16	FY17	FY18	Five year total	FY14 Priority
157th Avenue Water Reclamation Facility										
Centrifuge ancillary components	74-14	$35,000	$35,000	$40,000	$40,000	$40,000	$40,000	$40,000	$200,000	1
Replace components every 5000-8000 hrs										
20 Hp Influent Pumps- Flygt	74-12	$30,000	$30,000	$15,000	$15,000	$15,000	$15,000	$15,000	$75,000	1
Begin Pump Program - 1 per year				Pump #2	Pump #3	Pump #7	Pump #1	Pump #5		
Electrical and VFD controls	74-16	$10,000	$10,000	$15,000	$15,000	$15,000	$15,000	$15,000	$75,000	1
Begin upgrade/repair program of Starters and VFD's				Pump #2	Pump #3	Pump #4	Pump #6			
SCADA Equipment (Radios, PLC's)				$10,000	$10,000	$10,000	$10,000	$10,000	$50,000	1
SCADA Licensing Fees				$8,850	$7,500	$7,500	$7,500	$7,500	$38,850	1
Aerator Mixers/IMLRs 7.5 Hp - Flygt	74-14	$30,000	$30,000	$15,000	$15,000	$15,000	$15,000	$15,000	$75,000	1
Begin 3 year Program - 4 per year				AB #1	AB #2	AB #3	AB #1	AB #2		
WAS Pump Replacements-Flygt	74-14			$10,000	$10,000				$20,000	1
Replacement of Original-Begin 5 yr program				Pump 1	Pump 2					
Reclaim Booster Pump Replacement	74-14			$15,000	$15,000	$15,000	$15,000	$15,000	$75,000	1
Begin Pump and Check Valve Program - 1 per year										
Annual Crane Certifications	43-62			$10,000	$10,000	$10,000	$10,000	$10,000	$50,000	1
Consultant Fees	73-15			$15,000	$10,000	$10,000	$10,000	$14,000	$59,000	1
Centrifugal Blowers 150 hp-Lamson/Hoffman		$55,000	$55,000		$110,000			$110,000	$220,000	
Begin Blower Program					Replace #3			Replace #1		
Bio Solids Centrifuge-Centrisys					$260,000		$260,000		$520,000	
Replace units every 8-10 yrs					W-Unit 2004		E-Unit 2008			
Filter disc replacement							$35,000		$35,000	
Assumes Disc Filters installed FY 15-16										
Corgett Water Reclamation Facility										
20 Hp Influent Pump - Flygt	74-12			$15,000		$15,000		$15,000	$45,000	1
Begin Pump Program -1 per year				Pump #1		Pump #2		Pump #3		
Electrical and VFD controls	74-14			$15,000	$15,000	$15,000	$15,000	$15,000	$75,000	1
Begin upgrade/replacement program of Starters and VFD's				Pump #1	Pump #2	Pump #3	Pump #1	Pump #2		
Aerator Mixers/IMLRs 7.5 Hp (1)	74-14			$30,000	$30,000	$30,000	$30,000	$30,000	$150,000	1
Begin 3 year Program-2 per year.				N-S IMLR	N-Mixers	S-Mixers	N-S IMLR	N-Mixers		
WAS Pump Replacements					$10,000	$10,000	$10,000	$10,000	$40,000	1
Replacement of Original-Begin 5 yr Program										
SCADA Equipment (Radios, PLC's)	61-23			$10,000	$10,000	$10,000	$10,000	$10,000	$50,000	1
Consultant Fees	73-15			$10,000	$10,000	$10,000	$10,000	$10,000	$50,000	1
High Speed Turbo Blower -Lamson Hoffman	74-14			$105,000		$105,000		$105,000	$315,000	2
Begin Blower Program				Blower #1		Blower #2		Blower #3		
Upgrade of the Scum Drain	Removed			$50,000						3
Irrigation Pumps - Flygt	74-14			$15,000		$20,000	$20,000		$55,000	
Begin Pump Program -1 per year										
Filter Disc Replacement					$35,000	$35,000	$35,000	$35,000	$140,000	
Begin Disc Program -1 per year										
Reuse Water Pumps - Flygt						$10,000	$10,000		$20,000	
Begin Pump Program -1 per year										

Replace centrifuge conveyor belt, augers, hydraulic pumps, rotor differential, etc. Rotor differential's life is approx. 5,000 hrs

Influent Pump Station rotation is 2-3-7-1-5-4-8-6

Replace 1 per year at $15K

VFDs (Variable Frenquency Drives)require periodic upgrades on electronics. #7 influent Pump's is burnt

Updated definition to include electrical starters and MCC's as well as VFD's

Replace 1 per year at $15k

Some of these units are interchangeable within the plants. These pumps fail a lot and currently there are no spares

All of the cranes in use at the 3 WRF's Need to be certified annually according to Risk management. This should be included in annual operation costs

Blower note - while we have 2 large blowers ready for future expansions, running them now is very inefficient

Replace 1 per year at $15K

Updated definition to include electrical starters and MCC's as well as VFD's

The facilty has mixers that are unique to the process

New pumps installed as part of the FY 13 Corgett Expansion

To insure the plant will creat A+ Reclaimed water, the scum needs to be pumped to the digester instead of back to the influent. This project will insure the plant has the best chance of creating the required effluent

Pumps installed in early 2013, will need replacement due to 24 hour operation to continue to meet the obligation/agreement with Newland

APPENDIX B – FIELD PHOTOS OF VERTICAL ASSETS

Provided with earlier submittal.

APPENDIX C – FIELD CONDITION ASSESSMENT REPORTS OF VERTICAL ASSETS

Provided with earlier submittal.

APPENDIX D – WASTEWATER AND WATER 5-YEAR CIP PROJECTS SUMMARY

Provided with earlier submittal.