25-Year Capital Improvements Plan
Grant Water and Sanitation District
Jefferson County, Colorado

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1.0 Introduction

This 25-Year Capital Improvement Plan (CIP) has been prepared for the Grant Water and Sanitation District (District) for planning purposes and for future capital improvements to their aging infrastructure. The Grant Water and Sanitation District is located in portions of the City of Denver, City of Lakewood and unincorporated sections of Jefferson County, Colorado. The District provides sanitary sewer and underdrain service to an area generally located between South Wadsworth Boulevard and Sheridan Boulevard from Clement Park to the Bowles Reservoir. There are approximately 1,550 residential sanitary sewer and underdrain connections. In addition to residential connections, the District also provides sanitary sewer service to four commercial areas located along South Wadsworth Boulevard, as well as for three schools, Southwest Health Park, and Raccoon Creek Golf Course.

The District currently owns and maintains approximately 117,160 linear feet of sanitary sewer collection piping system ranging in size from 8-inch diameter to 21-inch diameter. The District's sanitary sewer collection system connects at four locations to other downstream special district sanitary sewer collection systems that eventually connect to the Littleton/Englewood Wastewater Treatment Plant. Three of these connections are to the Platte Canyon Water and Sanitation District (PCWSD) and one is to the Southwest Metropolitan Water and Sanitation District (SW Metro WSD). The District has entered into a Sewer Agreement with PCWSD and SW Metro WSD, which establishes a maintenance and replacement cost-sharing strategy for the interceptors to which GWSD connects.

The District also owns and maintains approximately 78,000 linear feet of underdrain collection system consisting of 6-inch diameter perforated and unperforated pipe. The underdrain system provides collection and discharge of building foundation drains and sanitary sewer pipe bedding dewatering. The underdrain collection system outfalls at six locations to stormwater infrastructure (gravity pipe systems and ponds) owned and maintained by the Bowles Metropolitan District.

The District also owns and maintains two sanitary sewer lift stations and approximately 2,380 linear feet of 8-inch diameter ductile iron pipe (DIP) force main. Each lift station has a duplex submersible pump system that pumps collected wastewater from a wet-well into force mains. Each lift station also has a standby generator and an alarm call out system.

1.1 History

The bulk of the District's collection systems were constructed in the 1980's and 1990's with polyvinyl chloride (PVC) pipe. Portions of the sanitary sewer collection system that cross under Raccoon Creek and other high-traffic areas were constructed of ductile iron pipe (DIP). Sanitary sewer and underdrain collection systems were developed concurrently. The lift stations and associated force mains were built in 1996 and 1997. Required maintenance of the existing infrastructure has been performed over time and has become more frequent in recent years as infrastructure ages.

1.2 Purpose

According to the Environmental Protection Agency's (EPA's) *Asset Management: Best Practices Guide* (2008), there are five important steps for preparation of a 25-Year CIP. These steps include:

- Determining the current state of assets;
- Establishing a sustainable level of service;
- Determining assets critical to system performance;
- Establishing the minimum life cycle cost; and
- Creating a long-term funding plan

The District has implemented several of these procedures (such as determining the current state of assets through regular CCTV inspection) in the past, and has requested their District Engineer, Martin/Martin Consulting Engineers (Martin/Martin) to develop this 25-Year CIP in conjunction with operations, maintenance, and asset management and a Geographical Information System (GIS). Current state of assets, critical assets, and other attribute data pertinent to system sustainability, life cycle cost, and long-term funding requirements have been compiled and recorded into the District's newly developed GIS. This datum was used to analyze the existing underdrain and sanitary sewer collection systems and develop this CIP.

This CIP serves to identify the need to establish a sustainable level of service and a minimum life cycle cost associated with ownership, operations and maintenance of the underdrain and sanitary sewer collection systems. While this CIP does not address an associated required financial funding plan. This CIP also intends is to identify the need and requirement to initiate discussion of the sustainable level of service that the District can afford to provide based on the minimum life cycle infrastructure costs projected over the next 25 years.

2.0 Existing Conditions of the District Infrastructure

Since Martin/Martin was hired as District Engineer in 2013, there have been multiple changes associated with the means and methods by which the District operates and maintains their infrastructure. These generally include:

- Sanitary sewer cleaning and CCTV inspection schedule,
- Lift station operations plan,
- Grease interceptor inspection schedule and procedures,
- Underdrain cleaning and remediation plan, and
- District GIS system.

The sanitary sewer collection system that services residential areas of the District is cleaned (jetted) once every three-years and televised once every six-years in accordance with EPA recommendations. The commercial areas of the sanitary sewer system are cleaned and televised once every four-years, with some areas being cleaned more often to mitigate historical increased build-up of debris and grease in the sewer mains. Martin/Martin also performed a study of the excessive calcium carbonate accumulation within the underdrain collection system. The conclusions and resulting recommendations of the study have been pilot tested and implemented in full scale with success.

2.1 Sanitary Sewer Collection System

The District's sanitary sewer collection system consists of approximately 22 miles of PVC pipe ranging in size from 8-inch to 21-inch in diameter. As stated previously, there are some small sections of ductile iron pipe located within the system. Since most this system was constructed with PVC pipe in the 1980s and 1990s, it is not expected to reach its anticipated design life (75 years) in the time period of this CIP. On-going periodic maintenance (cleaning and CCTV inspection) is required to keep the system operating efficiently and to mitigate the potential for backups and sanitary sewer overflows (SSOs).

There are 661 concrete sanitary sewer manholes spaced 200 feet apart on average within the District. Recent manhole maintenance has been conducted for manhole cover ring support issues and interior manhole deterioration from sewer gases.

For administrative purposes, the sanitary sewer collection system is divided into individual areas that serve residential and commercial customers. Residential areas of the system are further divided into three areas that are cleaned and televised on a rotating basis. Each of these three residential areas represent roughly one-third of the total residential sewer system. As previously stated, the maintenance plan for the residential areas was modified so that cleaning in combination with CCTV inspection would occur every other year (even numbered years), and cleaning only occurring in odd numbered years. Following this maintenance schedule allows for savings on CCTV inspection and review costs on odd numbered years.

Portions of the sanitary sewer collection system that service the commercial areas located along Wadsworth Boulevard are maintained separately from the residential areas of the sewer system. The commercial areas are divided into four areas, one of which is cleaned and televised every year. Currently, the sanitary sewer system serving the Bowles Crossing shopping center is being cleaned every six-months due to the historically

documented excessive build-up of debris and grease in this portion of the District's sanitary sewer system. It is apparent that several of the sewer mains in this area were designed and installed with shallower than recommended slopes. This in combination with lower peak flows than anticipated and large pipe diameters produces lower flow velocities that likely do not scour the pipe on a regular basis; as should be the case and as occurs in other parts of the system. Subsequent sections of this CIP evaluates the need for increased cleaning frequency in the Bowles Crossing area as well as the recommended need for accelerated cleaning in other areas of the District.

When Martin/Martin was hired as District Engineer in 2013 the Board and District Manager identified grease build-up and grease interceptor inspection and maintenance as key issues for maintenance of the existing sanitary sewer collection system. Since 2013, five new businesses have installed new grease interceptors that discharge to the District sewer system and one business has been remodeled at which time the existing grease interceptor was repaired. Through coordination with Littleton/Englewood Wastewater Treatment Plant's (L/E WWTP) Industrial Pretreatment personnel and the District's operation and maintenance contractor, C&L Water Solutions (C&L), fats, oils, and grease (FOG) best management practices (BMP) educational materials have been distributed to managers and other personnel at all the businesses with grease interceptors in the District. The grease interceptor inspection schedule has also been modified so that interceptors are inspected at a minimum once every six-months. If one of these inspections results in a failure notification, the establishment is moved to a quarterly inspection schedule. If a quarterly inspection is failed, the frequency is increased to once every two-months, and if a two-month inspection is failed, the interceptor is inspected monthly. Currently, there are two businesses that are inspected monthly for repeat failed inspections. If the inspections are passed for six consecutive months, the inspection frequency is reduced in the same order. When new businesses open, their grease interceptors are inspected quarterly, and if three consecutive inspections are passed they are moved to a six-month inspection schedule.

2.2 Sanitary Sewer Lift Stations

The District's system currently includes two lift stations that collect wastewater from two sanitary sewer collection systems located within the existing collection system and pump it to parts of the system that can flow by gravity to the downstream connections with PCWSD and SW Metro WSD sanitary sewer collection systems. The Northeast Lift Station, built in 1997, is located in the eastern corner of the Heron Estates neighborhood and serves a residential area. The Chanson Plaza Lift Station, built in 1996, is located on the north side of the Chanson Plaza shopping center along Bowles Avenue and serves a commercial area.

Each of these lift stations contains a duplex submersible pump system that pumps collected wastewater from a wet-well into a DIP force main. The duplex pump systems are controlled by level sensors within the wet-well, variable frequency drives, and integrated controllers that alternate operation of the pumps and give alarms in case of high water level, power outage, pump failure, or other emergency conditions. Each lift station is equipped with a standby generator and automatic transfer switch that will automatically start the generator to operate the lift station in case of power failure or outage.

2.3 Underdrain Collection System

The District's underdrain collection system consists of approximately 15 miles of 6-inch diameter perforated and unperforated PVC pipe. The underdrain system conveys groundwater collected from foundation drains installed at residences within the District via the unperforated piping as well as that collected by perforated underdrains for dewatering sanitary sewer mains in some areas of the District. This system was constructed concurrently with the sanitary sewer collection system, with the pipes laid in the same trench. Underdrain manholes were typically installed next to every other sanitary sewer manhole throughout the residential areas of the District. This resulted in the bending of underdrain pipes around sanitary sewer manholes. There are 274 underdrain manholes located approximately 300 feet apart on average within the District.

Historically, the underdrain collection system was not maintained as regularly as the sanitary sewer collection system. After several backups an investigation was performed by the previous District Engineer and contractors. It was discovered that much of the system had hardened calcium carbonate encrustation in the mains. This encrustation is commonly referred to as tuberculation. Some areas of tuberculation were found built-up to over half the pipe diameter in depth.

At that time, several remediation methods were pilot tested with varying results. These methods included chemical (acid) cleaning, mechanical (chain-cutter) cleaning, and removing and replacement of section of underdrain piping. Chemical cleaning and replacement of sections of underdrain piping, although successful, were found to be cost prohibitive for large scale implementation.

Martin/Martin subsequently performed an evaluation of the causes of this encrustation and methods for remediation. Martin/Martin reported that the underdrain tuberculation was likely caused by high levels of calcium carbonate and other minerals from native or imported soils and soil conditioners that are leaching into the groundwater and then precipitate and accumulate in the underdrains. Leaching occurs from rain, snow-melt, and yard irrigation and can be enhanced and increased by the use of fertilizers. Precipitation of the calcium carbonate within the underdrains was suspected due to shallow pipe slopes and subsequent slow flow velocity, seasonal variations in flow through the underdrain system resulting in standing water within the pipe and infrequent cleaning maintenance on the system. Over time the precipitated minerals built up in layers on the bottom of the mains. Martin/Martin recommended the use of mechanical cleaning as a cost effective method of underdrain tuberculation remediation. Martin/Martin contacted out-of-state construction specialists and it was determined mechanical cleaning with a vibrating cleaning head could potentially be the most cost effective and feasible method for underdrain cleaning. The small vibrating mechanical cleaning head was pilot tested on a section of underdrain by the out-of-state construction specialist in 2014. The pilot test was successful. In an effort to provide an even higher level of cost efficiency local maintenance contractors were contacted and found capable of providing the same means of underdrain remediation utilizing their existing equipment and upon purchase of the proper vibrating cleaning heads.

An overall remediation schedule was developed by Martin/Martin as part of the underdrain evaluation, and was presented to the Board of Directors in 2013 and subsequently finalized in 2015. This remediation schedule was implemented in 2015, with approximately one-fourth of the underdrain system scheduled for cleaning. The remediation schedule initially focused on the areas that were found to have the highest

degree of tuberculation. The entire underdrain system was scheduled to be remediated in four-years. There were a few problem areas where the underdrain mains were not fully remediated as scheduled throughout 2015 and 2016. Despite these areas that are taking longer than expected to remediate, the underdrain system remediation is scheduled to be completed in 2017. After this initial remediation, a regular maintenance schedule will be developed similar to the sanitary sewer collection system, in which approximately one-third of the underdrain system will be cleaned and televised every year. Should it be determined in the future that this frequency of cleaning and CCTV inspection is not warranted, this maintenance schedule will be modified.

3.0 Capital Improvements

Since Martin/Martin became District Engineer in 2013 several capital improvements have been undertaken as needed in the District. These projects included manhole rehabilitation lining to mitigate corrosion and infiltration, pump replacement at the Northeast Lift Station, and cured-in-place pipe (CIPP) lining of the identified sections of sanitary sewer ductile iron pipe. This 25-Year CIP seeks to identify future locations where capital improvements will be needed and to plan for these project instead of completing them on an as needed basis.

3.1 Sanitary Sewer Collection System

As previously stated, the majority of the sanitary sewer collection system was constructed of PVC pipe. The actual useful life of PVC pipe is not currently documented since failure due to age has not been documented since its introduction into the industry over 50 years ago. Some sources indicate a useful life may be as much as 75 or 100 years. For this CIP, a design life of 75 years will be used for planning purposes. This is the design life of PVC pipe water/wastewater conveyance systems before the pipe may need to be replaced. The majority of the sewer system was constructed in the mid to late 1990s and will not first reach this 75-year design life within the 25-year planning period (2016 through 2040) of this report.

PVC pipe material is more resistant to corrosion, root intrusion, and pipe degradation than other pipe materials such as vitrified clay (VCP) and DIP, however, buried PVC pipe can be more susceptible to earth movement. Sags, deformation, and offset/separated joints can result from earth movement from normal physical cycles such as freeze/thaw, expansion of clayey soils, and groundwater or induced pressures such as traffic loads and vibrations. These defects could require replacement of the sewer main should the flow be impeded or point repairs be required to mitigate infiltration or exfiltration. The District's on-going maintenance program has identified sanitary sewer pipes with these defects through the use of CCTV inspection. Utilizing the National Association of Sewer Service Companies (NASSCO) Pipeline Assessment and Certification Program (PACP), which is the industry standard for categorizing pipe defects through CCTV inspection, Martin/Martin has complied pipe defect data for the sanitary sewer mains in the District; in a GIS database format. Pipe defects have been graded on a scale from 1 to 5 based on the severity of the defect by using the PACP protocol; a grade of 1 being the least severe and 5 being the most severe.

Martin/Martin anticipates that sewer mains with these defects will need to be replaced from manhole to manhole over the time period of this CIP. Table 3.1 in Appendix A shows the sag severity compared to the time frame in which the mains are projected to be replaced. Replacement of all of these mains may not be necessary. For example, mains with moderately severe sags (<= 30% of the pipe diameter) may not need replacement if they are maintained on an accelerated basis to mitigate the solids/debris buildup. This is contingent upon the sag not increasing in severity to the point that flow is impeded. For planning purposes of this report, it was assumed that any mains with existing moderately severe sags would not require replacement. The phase in which replacements would be required was determined from the severity of the sag, age of the main, and consideration of location. For example, mains with sags in commercial areas were given higher priority for replacement over residential areas because of the potential for grease buildup within commercial areas.

Table 3.2 in Appendix A summarizes the sanitary sewer mains found with deformations. These mains were scheduled for replacement based on the severity of the deformation, the area in which the main is located (residential vs. commercial), the age of the main, and size of the main. Several of these mains are only slightly out of round, with the deformation reducing the flow area by less than 10 percent. This deformation also has not increased over time, based on review of historical CCTV inspection videos. It is anticipated that regular maintenance and inspection can mitigate the need for all of these mains to be replaced within the planning period of this report. Where mains were found slightly deformed in combination with other defects such as sags and where mains were found to be more severely deformed, they were planned for replacement. Tables 3.1 and 3.2 in Appendix A summarize the projected sewer main replacements (manhole to manhole) over the 25 year CIP planning period.

Other pipe defects such as fractures, holes, and offset/separated joints have also been found via CCTV inspection and recorded in the District's GIS database. These defects were also graded using PACP and these defect grades were used to prioritize and schedule point repairs. All needed point repairs were scheduled to be completed within the first 5 years of this plan's timeframe (2016 – 2020), the most severe being scheduled first and least severe based on PACP being scheduled in subsequent years. It is anticipated that point repairs will be needed throughout the 25-year planning period of this CIP. For planning purposes, Martin/Martin expects there may be 10 point repairs required during each 5-year planning phase. Table 3.3 in Appendix A summarizes anticipated point repairs scheduled to be undertaken based on the latest available CCTV inspection data for each location.

In previous years, the District has undertaken several projects to line manholes that show corrosion, degradation, and/or infiltration. Manholes have been lined with epoxy coating that provides a barrier to corrosive microorganisms and gases and seals holes against groundwater infiltration. The District's cleaning contractor provides manhole inspections following the National Association of Sewer Service Company's (NASSCO) Manhole Assessment and Certification Program (MACP) protocol for identifying manhole defects. These observations have been recorded in the District's GIS database and were used to prioritize and schedule manhole lining projects. A particular focus for these projects should be given to commercial areas that tend to exhibit greater concentrations of high-strength wastewater that could contribute to manhole corrosion. All manholes that have not been previously lined in commercial areas of the District have been scheduled for lining within the next 10 years under this CIP. Based upon past experience and the relative age of the District's sanitary sewer collection system, it is anticipated that 10 residential area manholes will need to be lined in each 5-year phase of this CIP. Table 3.4 below summarizes the number of manholes to be lined within each 5 year phase of this report and Figures B-1 – B-22 in Appendix B indicates the current condition of the District's sanitary sewer manholes.

Table 3.4: Anticipated Manhole Lining Schedule

Phase	Commercial Manholes to be Lined	Residential Manholes to be Lined	Total Manholes to be Lined
I (2016 – 2020)	40	10	50
II (2021 – 2025)	38	10	48
II (2026 – 2030)	0	10	10
IV (2031 – 2035)	0	10	10
V (2036 – 2040)	0	10	10

3.2 Lift Stations and Force Mains

Since 2013, several required capital improvements have been undertaken at both lift stations. At the Northeast Lift Station, one of the pumps and the autodialer were replaced in 2015, the ultrasonic level controller was replaced with a pressure transducer level controller in 2014, and both variable frequency drives (VFDs) and pumps were replaced in 2016 along with some improvements to the electrical/controls associated with these projects. At the Chanson Plaza Lift Station, the ultrasonic level controller was replaced in 2015 and the autodialer and one set of the check/gate valves was replaced in 2016. This Capital Improvement Plan seeks to project the need for this type of improvements over the next 25 years.

Typically, lift station equipment such as pumps, variable frequency drives, and controls have limited design lives and much of this equipment has been in use since the lift stations were constructed. For planning purposes it was assumed that submersible pumps and motor variable frequency drives will need to be replaced after 15-20 years of operation. Electrical equipment such as autodialers, generators, automatic transfer switches, and controllers are projected to be replaced after 30 years of operation. It is anticipated that the pressure transducer level controller at both lift stations will have a 20-year design life. Each pump discharge piping is equipped with gate and check valves in a separate valve vault at each lift station, it is anticipated that these valves will have a 20-year design life. Considering that the existing lift stations are starting to require equipment replacements and are just under 20 years old, the design life may be extended for the lift station equipment. These anticipated replacement time periods are based upon past experience operating this type of equipment in lift stations and the age of each piece of equipment. Table 3.5 below summarizes the age of each critical piece of equipment at each lift station and when it is expected to need replacement.

The force main and associated valves that convey wastewater from the lift stations to the connections to the gravity sewer collection system will also degrade over time and eventually need replacement. Typical design life for lined DI pipe and valves that serve as wastewater force mains is 50 years. Thus, it is not anticipated that the force mains will need to be replaced within the planning period of this CIP.

Table 3.5: Lift Station Equipment

Equipment	Year Originally Installed	Year Replaced	Design Life
NE Lift Station Pump 1	1997	2016	15 years
NE Lift Station Pump 2	1997	2016	15 years
NE Lift Station Motor VFD 1	1997	2016	20 years
NE Lift Station Motor VFD 2	1997	2016	20 years
NE Lift Station Controls (Autodialer, Alarms, etc.)	1997	2015	30 years
NE Lift Station Generator and Automatic Transfer	1997	-	30 years
NE Lift Station Pressure Transducer Level Sensor	2014	-	20 years
NE Lift Station Valves	1997	-	20 years
Chanson Plaza Pump 1	1996	-	15 years
Chanson Plaza Pump 2	1996	2009	15 years
Chanson Plaza VFD 1	1996	-	20 years
Chanson Plaza VFD 2	1996	-	20 years
Chanson Plaza Controls (Autodialer, Alarms, etc.)	1996	2016	30 years
Chanson Plaza Generator and Automatic Transfer	1996	-	30 years
Chanson Plaza Pressure Transducer Level Sensor	2015	-	20 years
Chanson Plaza Valves	1996	2016*	20 years

**One set of the check/gate valves were replaced in the Chanson Plaza Lift Station in 2016, the check/gate valves on Pump #2 at this lift station have not been replaced.*

3.3 Underdrain Collection System

All of the underdrain collection system was constructed of PVC pipe. While the actual useful life of PVC pipe is not known, as stated previously, a design life of 75 years is recommended for CIP planning purposes. The majority of the underdrain system was constructed in the mid to late 1990s and will not reach the 75 year design life in the planning period of this report.

As previously stated, sags, deformation, and offset/separated joints in PVC pipe can result from earth movement from normal cycles or from applied manmade pressures. These defects could require point repairs or entire section replacement of the underdrain main should the flow be impeded. The District's on-going maintenance program has identified mains with these defects through CCTV inspection. Utilizing PACP, Martin/Martin has complied pipe defect data on the underdrain mains in the District in a GIS database. Pipe defects were graded on a scale from 1 to 5 based on the severity of the defect by using the PACP protocol, a Grade of 1 being the least severe and 5 being the most severe.

Encrustation with calcium carbonate and other minerals has been observed as the most important issue within the underdrain collection system. Remediation of the underdrain mains by cleaning with a vibrating mechanical cleaning head was started in 2015, with the remainder of the system scheduled to be remediated by the end of 2017. In accordance with the Underdrain Collection System study, prepared by Martin/Martin, mains that are found to have more than 50% of the pipe diameter encrusted with minerals will be chemically treated with acid to soften the encrustation to more effectively utilize the mechanical cleaning head. It is expected that these methods of removing the encrustation will successfully remediate the system and main replacements due to high levels of encrustation will not be necessary. However, in

some case where a combination of pipe sags or deformation contribute to increased buildup of encrustation main replacements (manhole to manhole) may be warranted.

4.0 Phase I Planning – 2016 through 2020

Due to the age of the District's sanitary sewer and underdrain collection system infrastructure, several capital improvements are anticipated to take place during the first 5-year phase of the 25-year CIP planning timeframe. Martin/Martin expects the lift stations and sanitary sewer collection system to require the most capital improvements during the next 5 years. It is also anticipated that the underdrain remediation will be completed in this phase

Costs to complete expected capital improvements was estimated based on recent capital improvement bid tabs, quotations, and proposals for similar work. The anticipated total cost for capital improvements from 2016 through 2020 is approximately $845,000, which is equivalent to approximately $169,000 per year. Table 4.0 in Appendix A shows the cost calculations for all planning phases. Table 4.1 below summarizes the anticipated capital improvements required for planning Phase I and the expected cost for these improvements.

Table 4.1: Phase I Anticipated Capital Improvement

Improvement	Quantity	Anticipated Unit Cost	Anticipated Total Cost
Sanitary Sewer Main Replacement	866 LF	$ 400	$ 346,400
Sanitary Sewer Point Repairs	10 Ea.	$ 15,000	$ 150,000
Sanitary Sewer Manhole Lining	50 Ea.	$ 4,000	$ 200,000
Chanson Plaza Pump 1	1 Ea.	$ 15,000	$ 15,000
Chanson Plaza Motor VFD	2 Ea.	$ 5,000	$ 10,000
Chanson Plaza Valves	1 Ea.	$ 8,000	$ 8,000
NE Lift Station Valves	2 Ea.	$ 8,000	$ 16,000
Underdrain Remediation	1 Ea.	$ 100,000	$ 100,000
		Phase I Total=	**$ 845,400**
		Phase I Total per Year=	**$ 169,080**

5.0 Phase II Planning – 2021 through 2025

There are several capital improvement projects anticipated for Phase II of this 25-year CIP. These projects are expected to include sanitary sewer main replacements, point repairs, and improvements to both lift stations. Sanitary sewer main replacements to mitigate sags and deformations are expected to be the most costly during this phase. It is expected that the District will perform increased maintenance on most of the sanitary sewer main found with slight sags or deformation; however, it is anticipated that approximately 950 LF of mains will need to be replaced in this phase.

Costs to complete expected capital improvements was estimated based on recent capital improvement bid tabs, quotations, and proposals for similar work. The future cost was calculated using the future value formula in Microsoft Excel. A conservative 4% interest rate was used in this calculation to forecast the future cost of capital improvements in Phase II of this CIP. The anticipated total cost for capital improvements from 2021 through 2025 is approximately $$901,500, which is equivalent to approximately $180,300 per year. Table 5.1 below summarizes the anticipated capital improvements required for planning Phase II and the expected cost for these improvements.

Table 5.1: Phase II Anticipated Capital Improvement

Improvement	Quantity	Anticipated Unit Cost	Anticipated Total Cost
Sanitary Sewer Main Replacement	949 LF	$ 490	$ 465,010
Sanitary Sewer Point Repairs	10 Ea.	$18,300	$ 183,000
Sanitary Sewer Manhole Lining	48 Ea.	$ 4,9000	$ 235,200
Chanson Plaza Pump 2	1 Ea.	$ 18,300	$ 18,300
		Phase II Total=	**$ 901,510**
		Phase II Total per Year=	**$ 180,302**

6.0 Phase III Planning – 2026 through 2030

In addition to point repairs, manhole lining, and sanitary sewer main replacements, it is anticipated the Lift Stations may require capital improvements in Phase III (2026 – 2030). It is anticipated that the generators at each lift station will need to be replaced during this phase. The most costly capital improvements expected for this phase continue to be replacement of sanitary mains with sags and/or deformations.

Costs to complete expected capital improvements was estimated based on recent capital improvement bid tabs, quotations, and proposals for similar work. The future cost was calculated using the future value formula in Microsoft Excel. A conservative 4% interest rate was used in this calculation to forecast the future cost of capital improvements in Phase III of this CIP. The anticipated total cost for capital improvements from 2026 through 2030 is approximately $1.07 million, which is equivalent to approximately $215,000 per year. Table 6.1 below summarizes the anticipated capital improvements required for planning Phase III and the expected cost for these improvements.

Table 6.1: Phase III Anticipated Capital Improvement

Improvement	Quantity	Anticipated Unit Cost	Anticipated Total Cost
Sanitary Sewer Main Replacement	1,119 LF	$600	$ 671,400
Sanitary Sewer Point Repairs	10 Ea.	$22,350	$ 223,500
Sanitary Sewer Manhole Lining	10 Ea.	$ 6,000	$ 60,000
NE Lift Station Generator	1 Ea.	$ 59,650	$ 59,650
Chanson Plaza Generator	1 Ea.	$ 59,650	$ 59,650
		Phase III Total=	**$ 1,074,200**
		Phase III Total per Year=	**$ 214,840**

7.0 Phase IV Planning – 2031 through 2035

Sanitary Sewer main replacement for deformations and sags are projected to drive expected capital improvement costs in Phase IV of this CIP. Again, increased maintenance will mitigate some of these potential needed improvements. Lift Station capital improvements to replace pumps and controls is also expected within the planning phase.

Costs to complete expected capital improvements was estimated based on recent capital improvement bid tabs, quotations, and proposals for similar work. The future cost was calculated using the future value formula in Microsoft Excel. A conservative 4% interest rate was used in this calculation to forecast the future cost of capital improvements in Phase IV of this CIP. The anticipated total cost for capital improvements from 2026 through 2030 is approximately $ 1.01 million, which is equivalent to approximately $ 201,300 per year. Table 6.1 below summarizes the anticipated capital improvements required for planning Phase IV and the expected cost for these improvements.

Table 7.1: Phase IV Anticipated Capital Improvement

Improvement	Quantity	Anticipated Unit Cost	Anticipated Total Cost
Sanitary Sewer Main Replacement	749 LF	$ 730	$ 546,770
Sanitary Sewer Point Repairs	10 Ea.	$ 27,300	$ 273,000
Sanitary Sewer Manhole Lining	10 Ea.	$ 7,300	$ 73,000
NE Lift Station Pump	2 Ea.	$ 27,3000	$ 54,600
NE Lift Station Level Sensor	1 Ea.	$ 16,000	$ 16,000
Chanson Plaza Level Sensor	1 Ea.	$ 16,000	$ 16,000
Chanson Plaza Pump 1	1 Ea.	$ 27,300	$ 27,300
		Phase I Total=	**$ 1,006,670**
		Phase I Total per Year=	**$ 201,334**

8.0 Phase V Planning – 2036 through 2040

Sanitary sewer main replacements and lift station capital improvements are expected to represent the majority of the capital improvement costs in Phase V of this CIP planning period. It is anticipated that only 588 LF of sanitary mains will need to be replaced in this phase as most of the main with sever sags and deformations will have been replaced.

Costs to complete expected capital improvements was estimated based on recent capital improvement bid tabs, quotations, and proposals for similar work. The future cost was calculated using the future value formula in Microsoft Excel. A conservative 4% interest rate was used in this calculation to forecast the future cost of capital improvements in Phase V of this CIP. The anticipated total cost for capital improvements from 2026 through 2030 is approximately $ 1.02 million, which is equivalent to $ 205,000 per year. Table 6.1 below summarizes the anticipated capital improvements required for planning Phase V and the expected cost for these improvements.

Table 8.1: Phase V Anticipated Capital Improvement

Improvement	Quantity	Anticipated Unit Cost	Anticipated Total Cost
Sanitary Sewer Main Replacement	588 LF	$ 890	$ 523,320
Sanitary Sewer Point Repairs	10 Ea.	$ 33,340	$ 333,400
Sanitary Sewer Manhole Lining	10 Ea.	$ 8,900	$ 89,000
NE Lift Station Motor VFD	2 Ea.	$ 11,100	$ 22,200
Chanson Plaza Pump 2	1 Ea.	$ 33,340	$ 33,340
Chanson Plaza Motor VFD	2 Ea.	$ 11,100	$ 22,200
Chanson Plaza Valves	1 Ea.	$ 17,800	$ 17,800
NE Lift Station Valves	2 Ea.	$ 17,800	$ 35,600
		Phase I Total=	**$ 1,023,460**
		Phase I Total per Year=	**$ 204,692**

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Table 3.1: Sanitary Sewer Mains with Sags

AREA: BELVEDERE

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	REPLACEMENT PHASE
D7-15	D7-14	112	8	1997	< 30% SAG	-
D7-7.0	D7-6.0	319	8	1997	< 30% SAG	-
D7-9.0	D7-8	325	8	1997	< 30% SAG	-
	TOTAL LENGTH:	756				

AREA: BOWLES CROSSING

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	REPLACEMENT PHASE
BC-B5	BC-B4	348	8	1999	< 30% SAG	-
BC-B6	BC-B5	317	8	1999	< 30% SAG	-
	TOTAL LENGTH:	665				

AREA: CHANSON PLAZA

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	REPLACEMENT PHASE
CHP-3.1	CHP-3.0	300	8	1996	< 30% SAG	-
CHP-3.2	CHP-3.1	283	8	1996	< 30% SAG	-
CHP-4	CHP-3	122	8	1996	< 30% SAG	-
CHP-5.0	CHP-4	326	8	1996	< 30% SAG	-
CHP-5.1	CHP-5.0	110	8	1996	< 30% SAG	-
CHP-6	CHP-5.0	300	8	1996	< 30% SAG	-
CHP-7	CHP-6	231	8	1996	< 30% SAG	-
CHP-8	CHP-7	125	8	1996	< 30% SAG	-
CHP-9	CHP-8	170	8	1996	< 30% SAG	-
CHP-9A	CHP-9	41	8	2001	< 30% SAG	-
	TOTAL LENGTH:	2,008				

AREA: COVE

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	REPLACEMENT PHASE
MH-4	MH-6	228	8	2003	< 30% SAG	-
	TOTAL LENGTH:	228				

AREA: CROSSINGS

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	REPLACEMENT PHASE
D3-2.2	D3-2.1.0	157	8	1996	</= 50% SAG	III
D3-2B	D3-2A	80	8	1996	< 30% SAG	-
	TOTAL LENGTH:	237				

AREA: DORADO GREENS

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	REPLACEMENT PHASE
D13-1	D14-5.0	162	8	1998	< 30% SAG	-
D14-1.1	D14-1.0	90	8	1998	< 30% SAG	-
D14-2	D14-1.0	107	8	1998	< 30% SAG	-
D14-3.0	D14-2	217	8	1998	< 30% SAG	-
D14-3.1	D14-3.0	154	8	1998	< 30% SAG	-
D14-3.4	D14-3.3	58	8	1998	< 30% SAG	-
D14-3.5	D14-3.4	145	8	1998	< 30% SAG	-
D14-4	D14-3.0	427	8	1998	< 30% SAG	-
D14-5.0	D14-4	44	8	1998	< 30% SAG	-
D14-5.1	D14-5.0	72	8	1998	< 30% SAG	-
D14-5.2	D14-5.1	212	8	1998	< 30% SAG	-
	TOTAL LENGTH:	1,688				

AREA: IMAGES

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	REPLACEMENT PHASE
D2-3	D2-2.0	217	8	1996	< 30% SAG	
D2-4.0	D2-3	152	8	1996	<30% SAG, OUT OF ROUND <10%	IV
D2-4.1	D2-4.0	130	8	1996	<30% SAG, OUT OF ROUND <10%	IV
D2-6.0	D2-5	187	8	1996	<30% SAG, OUT OF ROUND <10%	IV
D2-7	D2-6.0	280	8	1996	<30% SAG, OUT OF ROUND <10%	IV
	TOTAL LENGTH:	966				

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AREA: OASIS

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	REPLACEMENT PHASE
OL-A6	OL-A5	369	8	1996	< 30% SAG	-
OL-B1	28.17.12	143	8	1996	> 50% SAG	I
	TOTAL LENGTH:	512				

AREA: POPPY HILLS

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	REPLACEMENT PHASE
D13-10	D13-9	33	8	1998	</= 50% SAG	II
D13-11	D13-10	60	8	1998	< 30% SAG	-
D13-12	D13-11	218	8	1998	< 30% SAG	-
D13-13	D13-12	47	8	1998	< 30% SAG	-
D13-14	D13-13	46	8	1998	< 30% SAG	-
D13-16	D13-15	47	8	1998	< 30% SAG	-
D13-18	D13-17	93	8	1998	< 30% SAG	-
D13-19	D13-18	47	8	1998	< 30% SAG	-
D13-2.0	D13-1	104	8	1998	< 30% SAG	-
D13-2.1	D13-2.0	130	8	1998	< 30% SAG	-
D13-2.2	D13-2.1	77	8	1998	< 30% SAG	-
D13-2.3	D13-2.2	44	8	1998	< 30% SAG	-
D13-21	D13-20	74	8	1998	< 30% SAG	-
D13-23	D13-22	74	8	1998	< 30% SAG	-
D13-3.0	D13-2.0	86	8	1998	< 30% SAG	-
D13-3.1	D13-3.0	203	8	1998	< 30% SAG	-
D13-3.4	D13-3.3	182	8	1998	< 30% SAG	-
D13-4	D13-3.0	326	8	1998	< 30% SAG	-
D13-6	D13-5	41	8	1998	< 30% SAG	-
D13-7	D13-6	41	8	1998	</= 50% SAG	II
D13-9	D13-8	97	8	1998	< 30% SAG	-
	TOTAL LENGTH:	2,070				

AREA: PROMENADE

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	REPLACEMENT PHASE
J3A5-1	J3B2-2.2	114	8	1996	< 30% SAG	-
J3B2-2.0	J3B2-1	75	8	1997	< 30% SAG	-
J3B2-2.1	J3B2-2.0	57	8	1996	< 30% SAG	-
J3B2-2.2	J3B2-2.1	233	8	1996	< 30% SAG	-
J3B2-4	J3B2-3	178	8	1997	< 30% SAG	-
		657				

AREA: REGATTA

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	REPLACEMENT PHASE
D7-2.0	VRC-E23	181	8	1997	< 30% SAG	-
D7-2.1	D7-2.0	209	8	1998	< 30% SAG	-
D7-2.2	D7-2.1	146	8	1998	< 30% SAG	-
D7-3.0	D7-2.0	294	8	1997	< 30% SAG	-
D7-3.1	D7-3.0	222	8	1998	<30% SAG, OUT OF ROUND <10%	V
D7-4	D7-3.0	93	8	1997	< 30% SAG	-
D7-5	D7-4	165	8	1997	<30% SAG, OUT OF ROUND <10%	V
	TOTAL LENGTH:	1,310				

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AREA: SAN MARINO

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	REPLACEMENT PHASE
J4-1.2.0	J4-1.1	271	8	1998	< 30% SAG	-
J4-1.3.0	J4-1.2.0	285	8	1998	< 30% SAG	-
J4-1.6	J4-1.5	143	8	1998	</= 50% SAG	II
J4-2.1	J4-2.0	112	8	1998	< 30% SAG	-
	TOTAL LENGTH:	811				

AREA: SOUTHWEST HEALTH PARK

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	REPLACEMENT PHASE
G-1	SW-1	155	12	1985	</= 50% SAG	II
G-2	G-1	233	12	1985	> 50% SAG	II
G-3	G-3A	344	8	1985	</= 50% SAG	II
G-3	G-2	32	8	1985	< 30% SAG	-
G-4	G-3A	58	8	1985	< 30% SAG	-
	TOTAL LENGTH:	821				

AREA: TAPESTRY

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	REPLACEMENT PHASE
J3A3-1.0	VRC-E8	167	8	1996	</= 50% SAG	III
	TOTAL LENGTH:	167				

AREA: TRUNK LINE E

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	REPLACEMENT PHASE
VRC-E23	VRC-E22	215	10	1995	< 30% SAG	-
	TOTAL LENGTH:	215				

AREA: VISTA POINTE

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	REPLACEMENT PHASE
J3A5-5	J3A5-2.6	201	8	1996	<30% SAG, OUT OF ROUND <10%	V
	TOTAL LENGTH:	201				
	TOTAL LENGTH:	13,312				

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Table 3.2: Sanitary Sewer Mains with Deformations

AREA: BELLEVIEW SHORES

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	PHASE
BS-C6.C	BS-C6.B	206	8	1994	OUT OF ROUND <10%	-
	TOTAL LENGTH:	206				

AREA: BELVEDERE

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	PHASE
D7-10	D7-9.0	180	8	1997	OUT OF ROUND <10%	-
D7-16	D7-15	136	8	1997	OUT OF ROUND <10%	-
D7-7.5	D7-7.4	154	8	1997	OUT OF ROUND <10%	-
D7-7.6	D7-7.5	238	8	1997	OUT OF ROUND <10%	-
D7-7.8	D7-7.7	301	8	1997	OUT OF ROUND <10%	-
	TOTAL LENGTH:	1,009				

AREA: BOWLES CROSSING

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	PHASE
BC-C6.B	BC-C6.A	144	8	1986	OUT OF ROUND <10%	-
	TOTAL LENGTH:	144				

AREA: CELEBRATIONS

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	PHASE
D10-1.4.2	D10-1.4.1	67	8	1998	OUT OF ROUND <10%	-
D10-2.5.0	D10-2.4.0	111	8	1998	OUT OF ROUND <10%	-
	TOTAL LENGTH:	178				

AREA: CELMENT PARK

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	PHASE
CP-3	CP-2	226	8	1986	OUT OF ROUND <10%	-
	TOTAL LENGTH:	226				

AREA: CROSSINGS

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	PHASE
D3-2.1.2.0	D3-2.1.1	347	8	1996	OUT OF ROUND <10%	-
D3-2.1.3	D3-2.1.2.0	216	8	1996	OUT OF ROUND <10%	-
D3-2A	D3-2.0	166	8	1996	OUT OF ROUND <10%	-
D3-3	D3-2.0	155	8	1996	OUT OF ROUND <10%	-
D3-4	D3-3	366	8	1996	OUT OF ROUND <10%	-
D3-5.0	D3-4	360	8	1996	OUT OF ROUND CANNOT PASS	I
D3-5.1	D3-5.0	98	8	1996	OUT OF ROUND <10%	-
D3-6	D3-5.0	264	8	1996	OUT OF ROUND <10%	-
D3-7	D3-6	391	8	1996	OUT OF ROUND <10%	-
J3B1-1.1	J3B1-1.0	214	8	1997	OUT OF ROUND <10%	-
J3B1-1.2	J3B1-1.1	231	8	1997	OUT OF ROUND <10%	-
J3B1-2	J3B1-1.0	312	8	1997	OUT OF ROUND <10%	-
J3B1-4	J3B1-3	218	8	1997	OUT OF ROUND <10%	-
J3B1-5	J3B1-4	241	8	1997	OUT OF ROUND <10%	-
J3B1-7	J3B1-6	48	8	1997	OUT OF ROUND <10%	-
	TOTAL LENGTH:	3,627				

AREA: HILLSBORO

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	PHASE
J2-3	J2-2	253	8	1996	OUT OF ROUND CANNOT PASS	I
J3A1-6	J3A1-5	217	8	1996	OUT OF ROUND <10%	-
	TOTAL LENGTH:	470				

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AREA: IMAGES

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	PHASE
D2-2.0	D2-1	127	8	1996	OUT OF ROUND <10%	-
D2-2.4	D2-2.3	176	8	1996	OUT OF ROUND <10%	-
D2-4.0	D2-3	152	8	1996	<30% SAG, OUT OF ROUND <10%	IV
D2-4.1	D2-4.0	130	8	1996	<30% SAG, OUT OF ROUND <10%	IV
D2-5	D2-4.0	101	8	1996	OUT OF ROUND <10%	-
D2-6.0	D2-5	187	8	1996	<30% SAG, OUT OF ROUND <10%	IV
D2-6.1	D2-6.0	410	8	1996	OUT OF ROUND <10%	-
D2-7	D2-6.0	280	8	1996	<30% SAG, OUT OF ROUND <10%	IV
D2-8	D2-7	133	8	1996	OUT OF ROUND <10%	-
D2-9	D2-8	379	8	1996	OUT OF ROUND <10%	-
	TOTAL LENGTH:	2,075				

AREA: OASIS

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	PHASE
OL-A4	OL-A3	226	8	1996	OUT OF ROUND <10%	-
	TOTAL LENGTH:	226				

AREA: ORCHARDS

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	PHASE
D8-12	D8-11	165	8	1997	OUT OF ROUND <10%	-
	TOTAL LENGTH:	165				

AREA: PARK PLACE

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	PHASE
D9-6.0	D9-5.0	272	8	1997	OUT OF ROUND <10%	-
	TOTAL LENGTH:	272				

AREA: PROVENCE

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	PHASE
DST-2.0	DST-1.0	103	8	1998	OUT OF ROUND <10%	-
DST-2.1	DST-2.0	78	8	1998	OUT OF ROUND <10%	-
DST-3.0	DST-2.0	90	8	1998	OUT OF ROUND <10%	-
DST-4.0	DST-3.0	42	8	1998	OUT OF ROUND <10%	-
	TOTAL LENGTH:	313				

AREA: REFLECTIONS

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	PHASE
D12N-5	D12N-4	174	8	1997	OUT OF ROUND <10%	-
	TOTAL LENGTH:	174				

AREA: REGATTA

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	PHASE
D7-2.3	D7-2.2	250	8	1998	OUT OF ROUND <10%	-
D7-2.5	D7-6.4	250	8	1998	OUT OF ROUND <10%	-
D7-2.5	D7-2.4	339	8	1998	OUT OF ROUND <10%	-
D7-3.1	D7-3.0	222	8	1998	<30% SAG, OUT OF ROUND <10%	V
D7-3.2	D7-3.1	87	8	1998	OUT OF ROUND <10%	-
D7-5	D7-4	165	8	1997	<30% SAG, OUT OF ROUND <10%	V
D7-6.0	D7-5	71	8	1997	OUT OF ROUND <10%	-
D7-6.2	D7-6.1	236	8	1998	OUT OF ROUND <10%	-
D7-6.3	D7-6.2	226	8	1998	OUT OF ROUND <10%	-
	TOTAL LENGTH:	1,846				

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AREA: SAN MARINO

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	PHASE
J4-1.7	J4-1.6	200	8	1998	OUT OF ROUND <10%	-
J4-7	J4-6.0	176	8	1998	OUT OF ROUND <10%	-
VRC-C5	J4-6.3	170	8	1998	OUT OF ROUND <10%	-
	TOTAL LENGTH:	546				

AREA: TAPESTRY

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	PHASE
J3C-4.1	J3C-4.0	254	8	1997	OUT OF ROUND <10%	-
	TOTAL LENGTH:	254				

AREA: TRUNK LINE E

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	PHASE
D12-0.0	VRC-E15.3	186	8	1995	OUT OF ROUND <10%	-
VRC-E15.3	VRC-E15.2	237	8	1995	OUT OF ROUND <10%	-
VRC-E18.1	VRC-E18	110	10	1995	OUT OF ROUND CANNOT PASS	I
VRC-E19	VRC-E18.1	91	10	1995	OUT OF ROUND <10%	-
VRC-E20	VRC-E19	341	10	1995	OUT OF ROUND <10%	-
	TOTAL LENGTH:	965				

AREA: VISTA POINTE

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	PHASE
J3A5-2.5	J3A5-2.4	194	8	1996	OUT OF ROUND <10%	-
J3A5-5	J3A5-2.6	201	8	1996	<30% SAG, OUT OF ROUND <10%	V
	TOTAL LENGTH:	395				

AREA: WESTLAKE GREENS

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION	PHASE
MR-3	MR-2.0	103	8	1996	OUT OF ROUND <10%	-
	TOTAL LENGTH:	103				
	TOTAL LENGTH:	13,194				

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Table 3.3: Sanitary Sewer Point Repairs

AREA: BELLEVIEW SHORES

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION
BS-B-0A	BS-B0	237	8	1990	HOLE
BS-C6.B	BS-C6.A	416	8	1994	JOINT OFFSET - MEDIUM
	TOTAL LENGTH:	653			

AREA: COVE

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION
MH-19	MH-24	27	8	2003	JOINT SEPARATED - MEDIUM
MH-2	MH-3	353	8	2003	JOINT SEPARATED - MEDIUM
MH-25	MH-26	394	8	2003	JOINT SEPARATED - MEDIUM
	TOTAL LENGTH:	774			

AREA: CROSSINGS

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION
J3B1-1.0	D3-2B	146	8	1997	INFILTRATION GUSHER
	TOTAL LENGTH:	146			

AREA: EAGLE RIDGE

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION
D4-1.0	28.17.9	91	8	1996	INFILTRATION RUNNER
	TOTAL LENGTH:	91			

AREA: SOUTHWEST HEALTH PARK

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION
G-7A	G-6A	88	8	2001	BROKEN - SOIL VISIBLE
	TOTAL LENGTH:	88			

AREA: WEST TRUNK LINE

UPSTREAM MANHOLE	DOWNSTREAM MANHOLE	LENGTH	SIZE	YEAR BUILT	CONDITION
28.17.5	28.17.4	292	18	1995	INFILTRATION RUNNER
28.17.8	28.17.7	321	18	1995	FRACTURE/INFILTRATION
	TOTAL LENGTH:	613			
	TOTAL LENGTH:	2,365			

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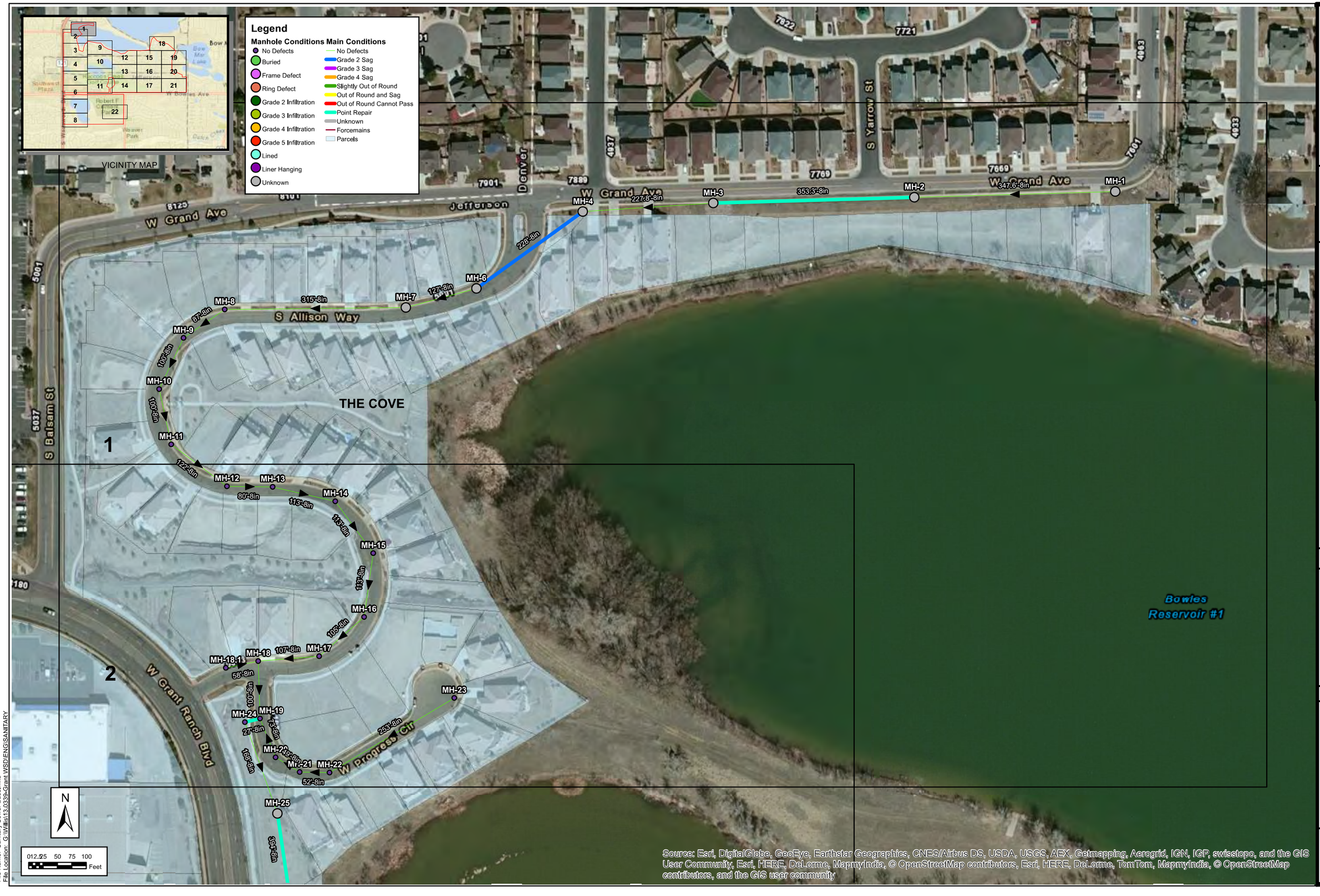
Phase I (2016 - 2020)				
Improvement	Quantity	Units	Anticipated Unit Cost	Anticipated Total Cost
Main Replacement	866	LF	$ 400.00	$ 346,400.00
Point Repair	10	EA	$ 15,000.00	$ 150,000.00
Manhole Lining	50	EA	$ 4,000.00	$ 200,000.00
Chanson Plaza Pump 1	1	EA	$ 15,000.00	$ 15,000.00
Chanson Plaza Motor VFD	2	EA	$ 5,000.00	$ 10,000.00
Chanson Plaza Valves	1	EA	$ 8,000.00	$ 8,000.00
NE Lift Station Valves	2	EA	$ 8,000.00	$ 16,000.00
Underdrain Remediation	1	EA	$ 100,000.00	$ 100,000.00
			Phase I Total =	**$ 845,400.00**
			Phase I Total per Year =	**$ 169,080.00**

Phase II (2021 - 2025)					Interest rate:	4%
Improvement	Quantity	Units	Anticipated Unit Cost	Anticipated Total Cost	Round Unit Cost	Round Total Cost
Main Replacement	949	LF	$ 488.40	$ 463,490.31	$ 490.00	$ 465,010.00
Point Repair	10	EA	$ 18,314.95	$ 183,149.49	$ 18,300.00	$ 183,000.00
Manhole Lining	48	EA	$ 4,883.99	$ 234,431.35	$ 4,900.00	$ 235,200.00
Chanson Plaza Pump 2	1	EA	$ 18,314.95	$ 18,314.95	$ 18,300.00	$ 18,300.00
			Phase II Total =	**$ 899,386.09**		**$ 901,510.00**
			Phase II Total per Year =	**$ 179,877.22**		**$ 180,302.00**

Phase III (2026 - 2030)						
Improvement	Quantity	Units	Anticipated Unit Cost	Anticipated Total Cost	Round Unit Cost	Round Total Cost
Main Replacement	1,119	LF	$ 596.33	$ 667,296.71	$ 600.00	$ 671,400.00
Point Repair	10	EA	$ 22,362.49	$ 223,624.90	$ 22,350.00	$ 223,500.00
Manhole Lining	10	EA	$ 5,963.33	$ 59,633.31	$ 6,000.00	$ 60,000.00
NE Lift Station Generator	1	EA	$ 59,633.31	$ 59,633.31	$ 59,650.00	$ 59,650.00
Chanson Plaza Generator	1	EA	$ 59,633.31	$ 59,633.31	$ 59,650.00	$ 59,650.00
			Phase III Total =	**$ 1,069,821.53**		**$ 1,074,200.00**
			Phase III Total per Year =	**$ 213,964.31**		**$ 214,840.00**

Phase IV (2031 - 2035)						
Improvement	Quantity	Units	Anticipated Unit Cost	Anticipated Total Cost	Round Unit Cost	Round Total Cost
Main Replacement	749	LF	$ 728.12	$ 545,362.37	$ 730.00	$ 546,770.00
Point Repair	10	EA	$ 27,304.52	$ 273,045.24	$ 27,300.00	$ 273,000.00
Manhole Lining	10	EA	$ 7,281.21	$ 72,812.07	$ 7,300.00	$ 73,000.00
NE Lift Station Pump	2	EA	$ 27,304.52	$ 54,609.05	$ 27,300.00	$ 54,600.00
NE Lift Station Level Sensor	1	EA	$ 16,018.65	$ 16,018.65	$ 16,000.00	$ 16,000.00
Chanson Plaza Level Sensor	1	EA	$ 16,018.65	$ 16,018.65	$ 16,000.00	$ 16,000.00
Chanson Plaza Pump 1	1	EA	$ 27,304.52	$ 27,304.52	$ 27,300.00	$ 27,300.00
			Phase IV Total =	**$ 1,005,170.56**		**$ 1,006,670.00**
			Phase IV Total per Year =	**$ 201,034.11**		**$ 201,334.00**

Phase V (2036 - 2040)						
Improvement	Quantity	Units	Anticipated Unit Cost	Anticipated Total Cost	Round Unit Cost	Round Total Cost
Main Replacement	588	LF	$ 889.03	$ 522,751.31	$ 890.00	$ 523,320.00
Point Repair	10	EA	$ 33,338.73	$ 333,387.31	$ 33,340.00	$ 333,400.00
Manhole Lining	10	EA	$ 8,890.33	$ 88,903.28	$ 8,900.00	$ 89,000.00
NE Lift Station Motor VFD	2	EA	$ 11,112.91	$ 22,225.82	$ 11,100.00	$ 22,200.00
Chanson Plaza Pump 2	1	EA	$ 33,338.73	$ 33,338.73	$ 33,340.00	$ 33,340.00
Chanson Plaza Motor VFD	2	EA	$ 11,112.91	$ 22,225.82	$ 11,100.00	$ 22,200.00
Chanson Plaza Valves	1	EA	$17,780.66	$ 17,780.66	$ 17,800.00	$ 17,800.00
NE Lift Station Valves	2	EA	$17,780.66	$ 35,561.31	$ 17,800.00	$ 35,600.00
			Phase V Total =	**$ 1,022,832.28**		**$ 1,023,460.00**
			Phase V Total per Year =	**$ 204,566.46**		**$ 204,692.00**



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SANITARY SEWER EXISTING CONDITIONS

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Job Number: 13.0339
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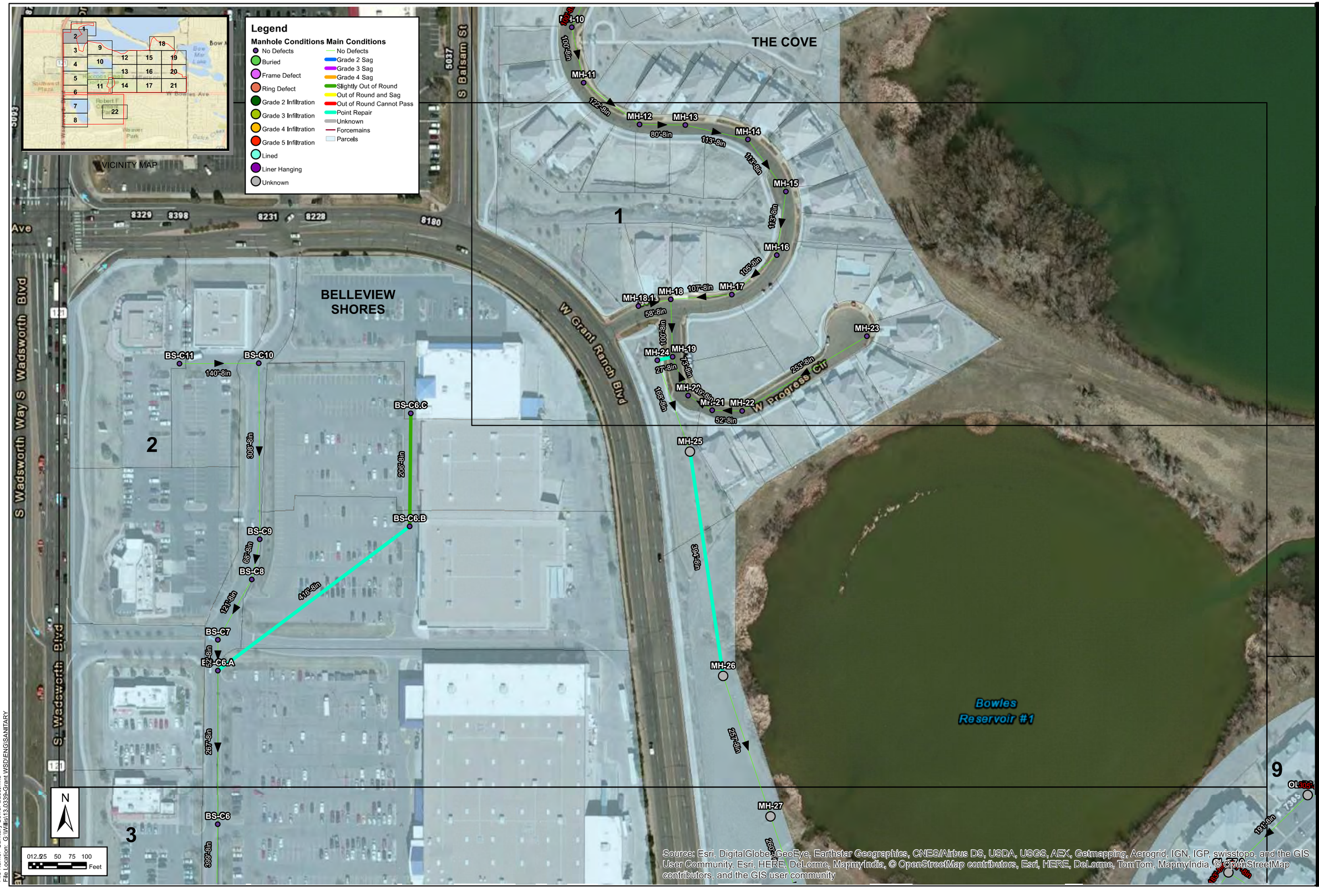

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Drawn By: JVM
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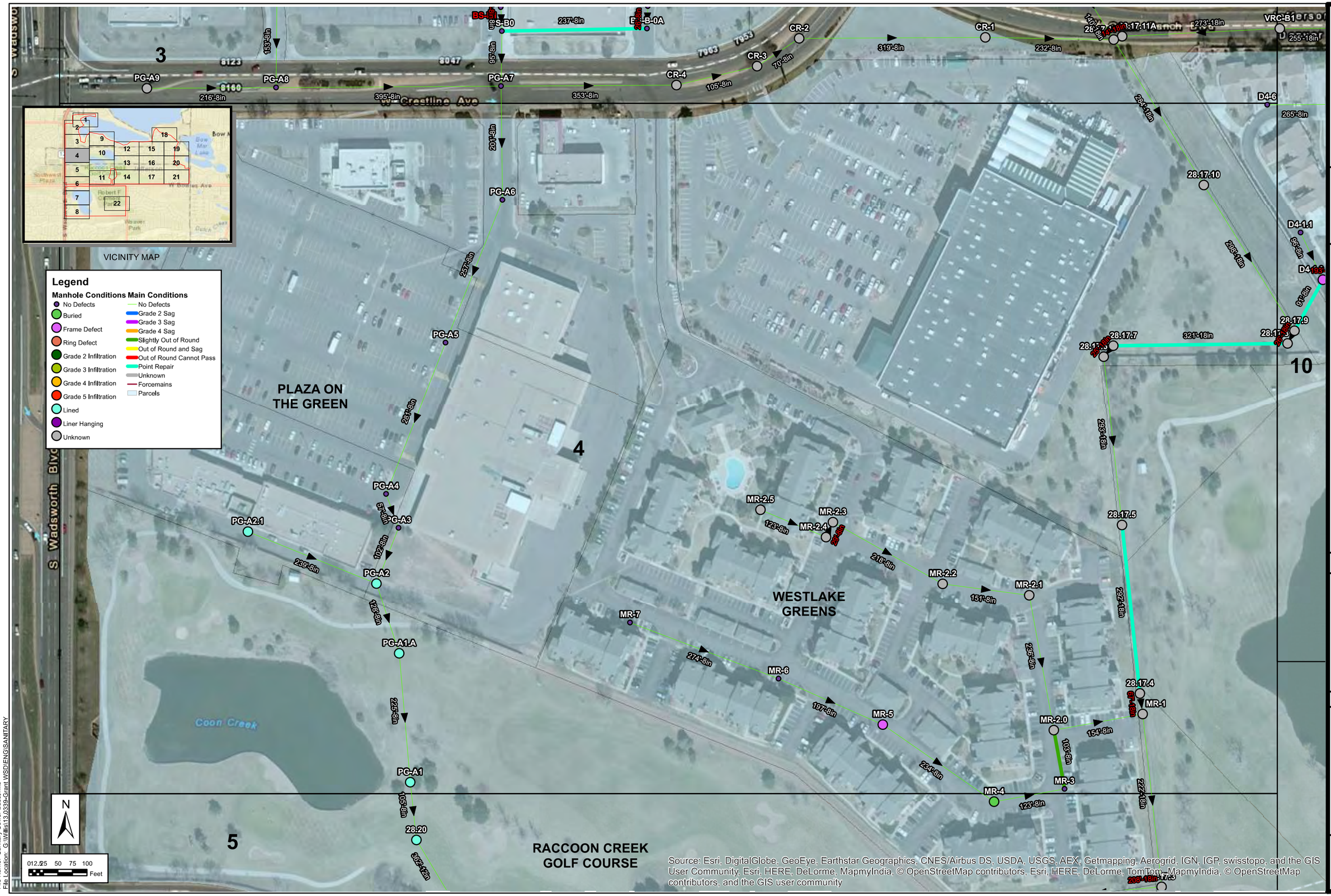
B-3



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Job Number: 13.0339
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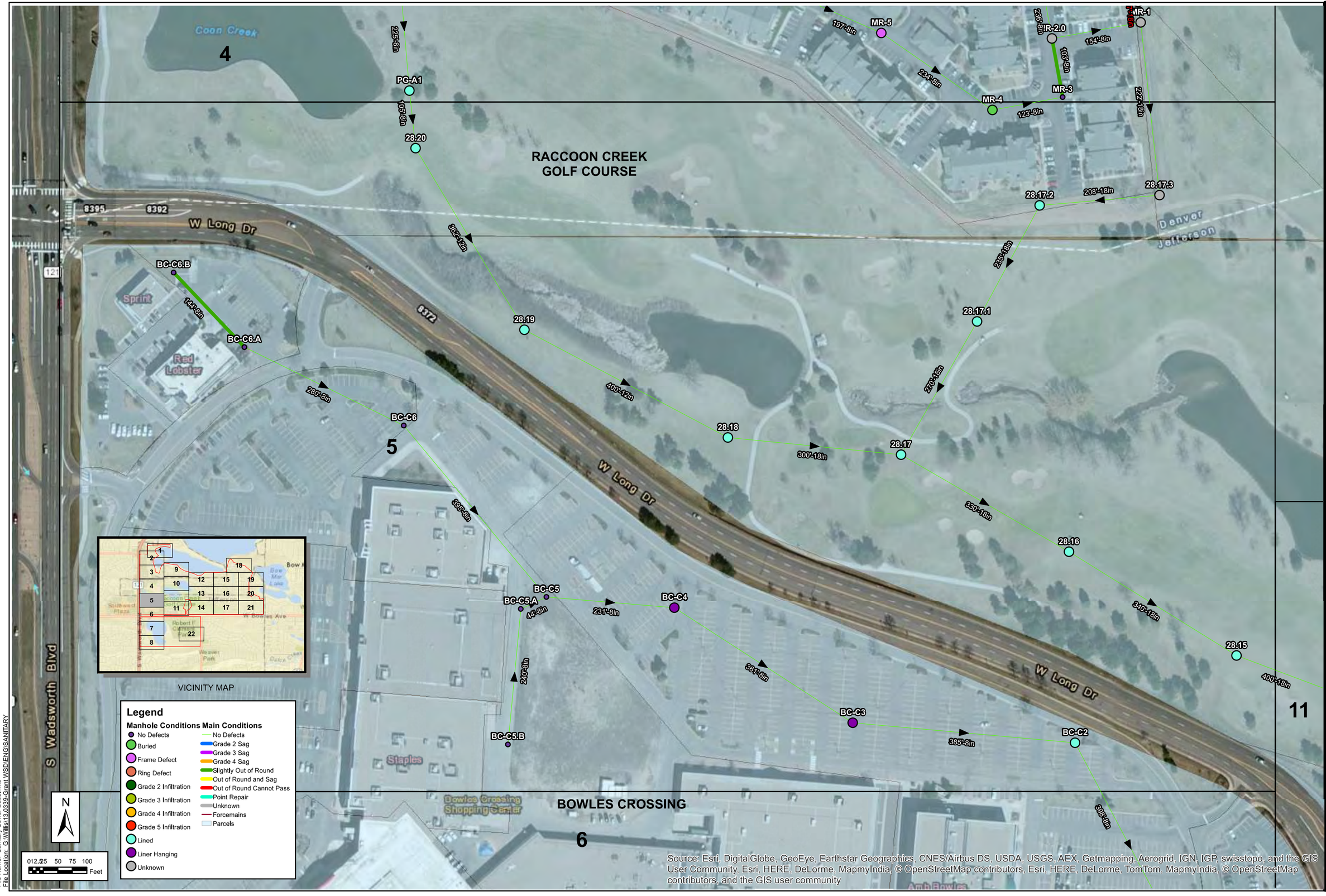
B-4



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Drawn By: JVM
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Sheet Number:

B-6

VICINITY MAP

Legend

Manhole Conditions
- No Defects
- Buried
- Frame Defect
- Ring Defect
- Grade 2 Infiltration
- Grade 3 Infiltration
- Grade 4 Infiltration
- Grade 5 Infiltration
- Lined
- Liner Hanging
- Unknown

Main Conditions
- No Defects
- Grade 2 Sag
- Grade 3 Sag
- Grade 4 Sag
- Slightly Out of Round
- Out of Round and Sag
- Out of Round Cannot Pass
- Point Repair
- Unknown
- Forcemains
- Parcels

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Job Number: 13.0339
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Drawn By: JVM
Checked By: JAM

Sheet Number:

B-7

VICINITY MAP

Legend

Manhole Conditions
- No Defects
- Buried
- Frame Defect
- Ring Defect
- Grade 2 Infiltration
- Grade 3 Infiltration
- Grade 4 Infiltration
- Grade 5 Infiltration
- Lined
- Liner Hanging
- Unknown

Main Conditions
- No Defects
- Grade 2 Sag
- Grade 3 Sag
- Grade 4 Sag
- Slightly Out of Round
- Out of Round and Sag
- Out of Round Cannot Pass
- Point Repair
- Unknown
- Forcemains
- Parcels

N

0 12.5 25 50 75 100 Feet

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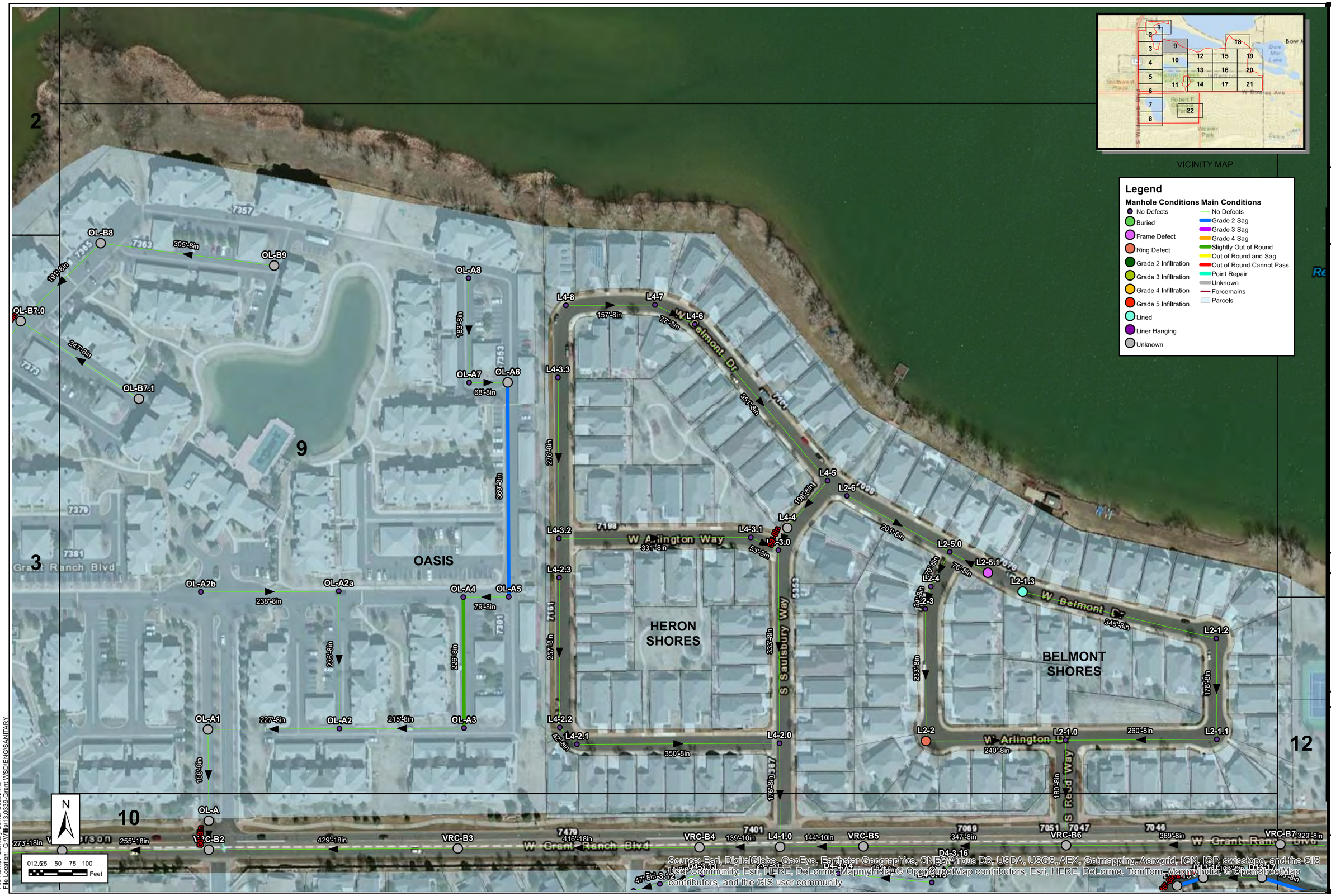

VICINITY MAP

Legend

Manhole Conditions
- No Defects
- Buried
- Frame Defect
- Ring Defect
- Grade 2 Infiltration
- Grade 3 Infiltration
- Grade 4 Infiltration
- Grade 5 Infiltration
- Lined
- Liner Hanging
- Unknown

Main Conditions
- No Defects
- Grade 2 Sag
- Grade 3 Sag
- Grade 4 Sag
- Slightly Out of Round
- Out of Round and Sag
- Out of Round Cannot Pass
- Point Repair
- Unknown
- Forcemains
- Parcels

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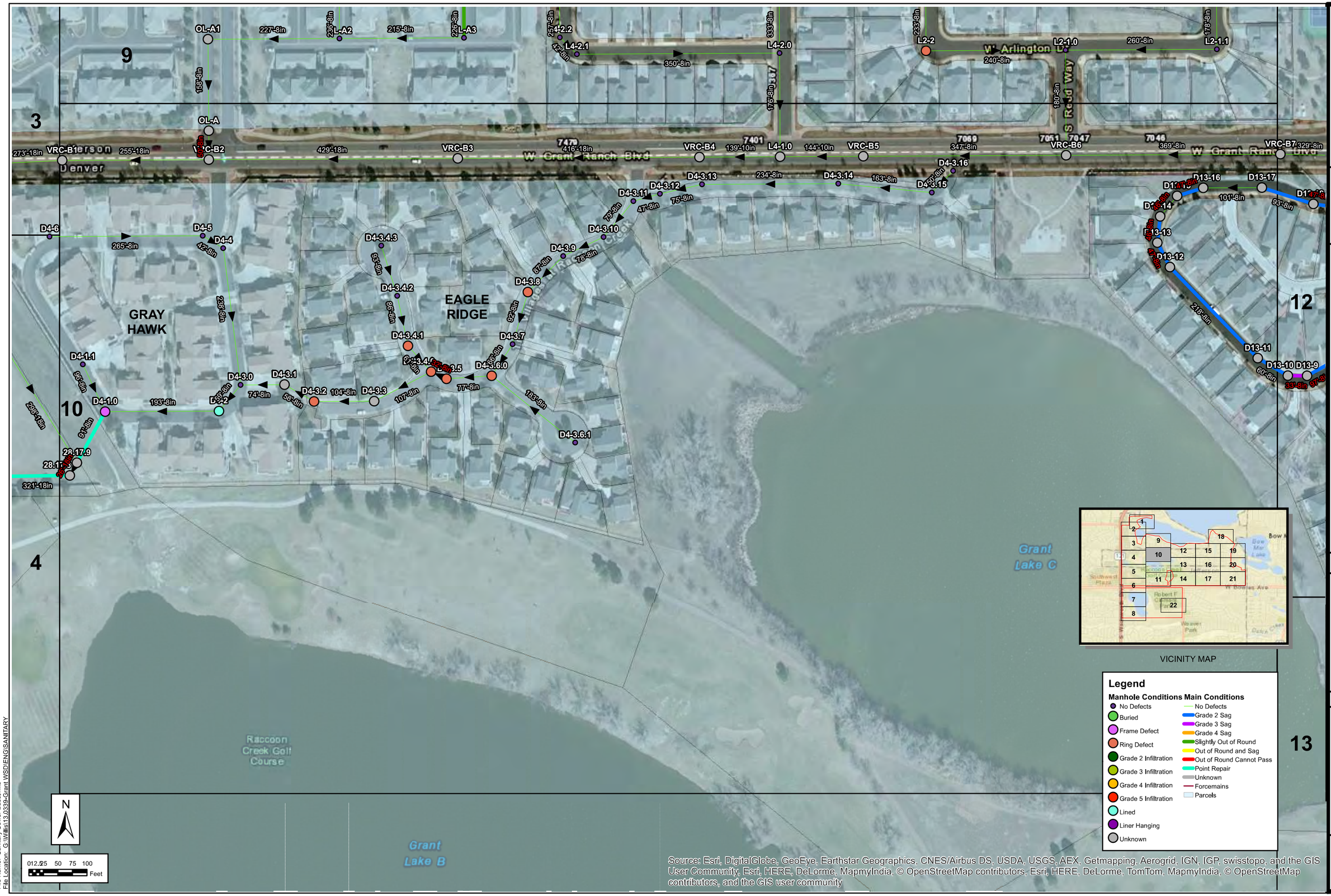
B-9



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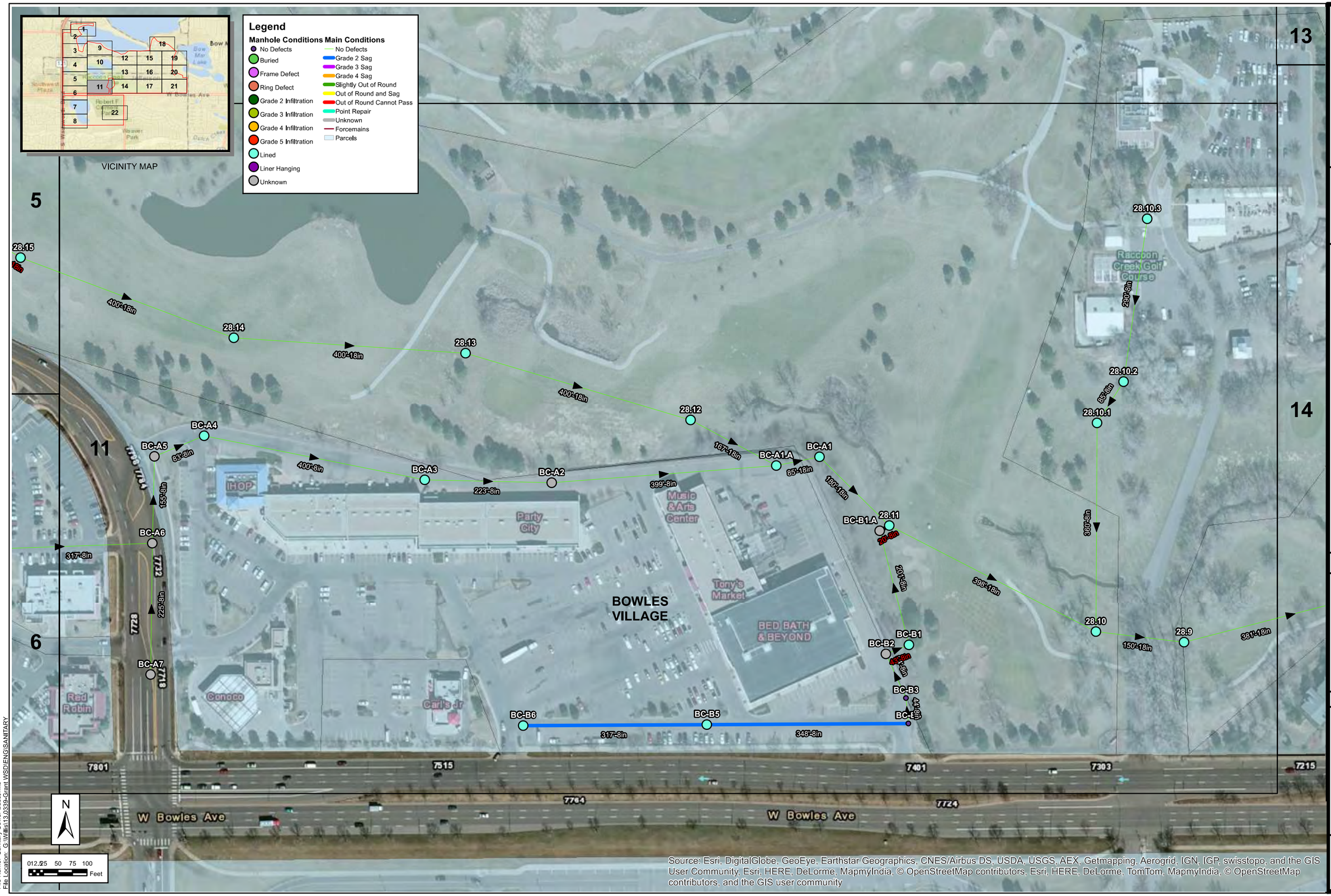
B-10



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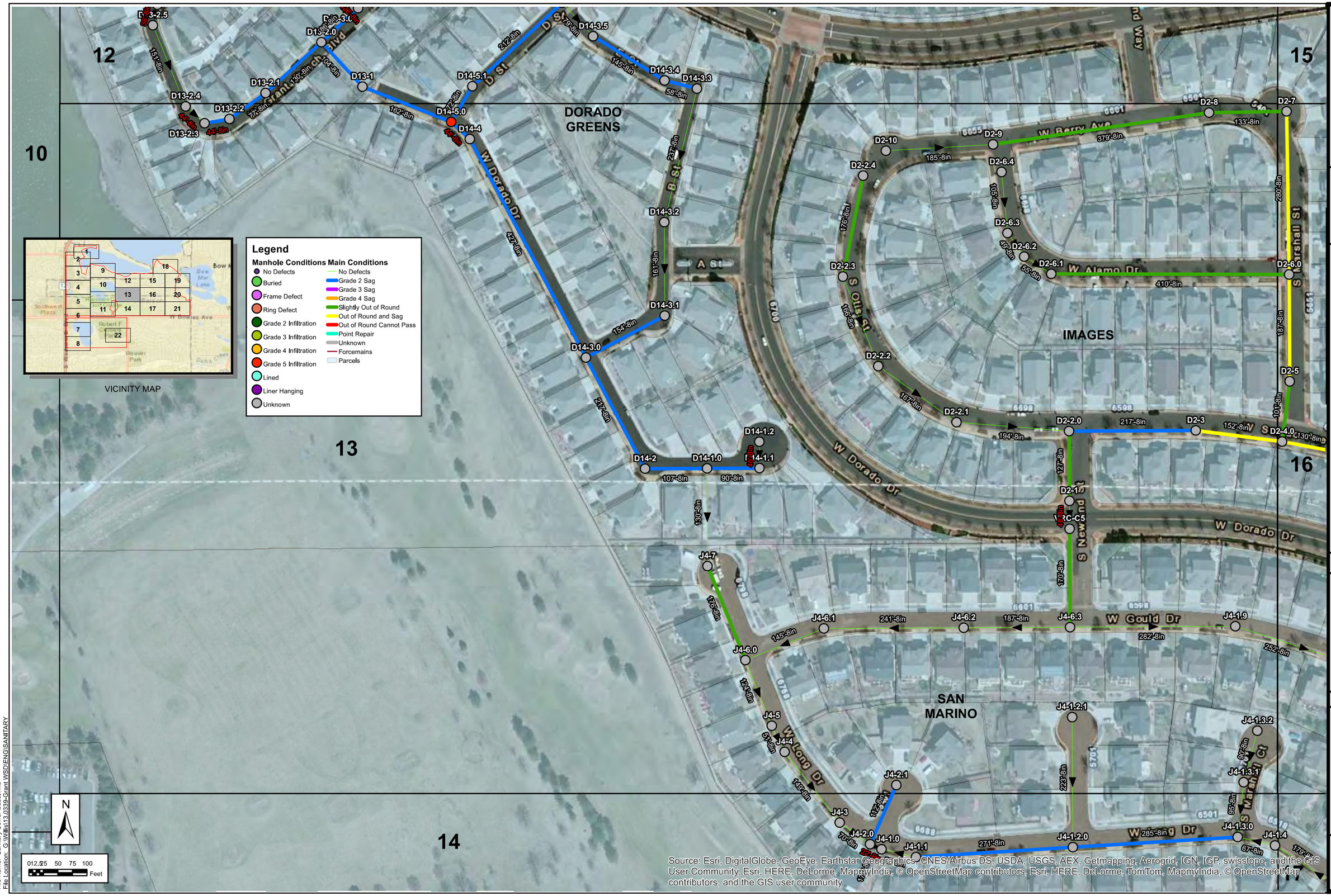

VICINITY MAP

Legend

Manhole Conditions Main Conditions

- No Defects
- Buried
- Frame Defect
- Ring Defect
- Grade 2 Infiltration
- Grade 3 Infiltration
- Grade 4 Infiltration
- Grade 5 Infiltration
- Lined
- Liner Hanging
- Unknown

- No Defects
- Grade 2 Sag
- Grade 3 Sag
- Grade 4 Sag
- Slightly Out of Round
- Out of Round and Sag
- Out of Round Cannot Pass
- Point Repair
- Unknown
- Forcemains
- Parcels

N

0 12.5 25 50 75 100 Feet

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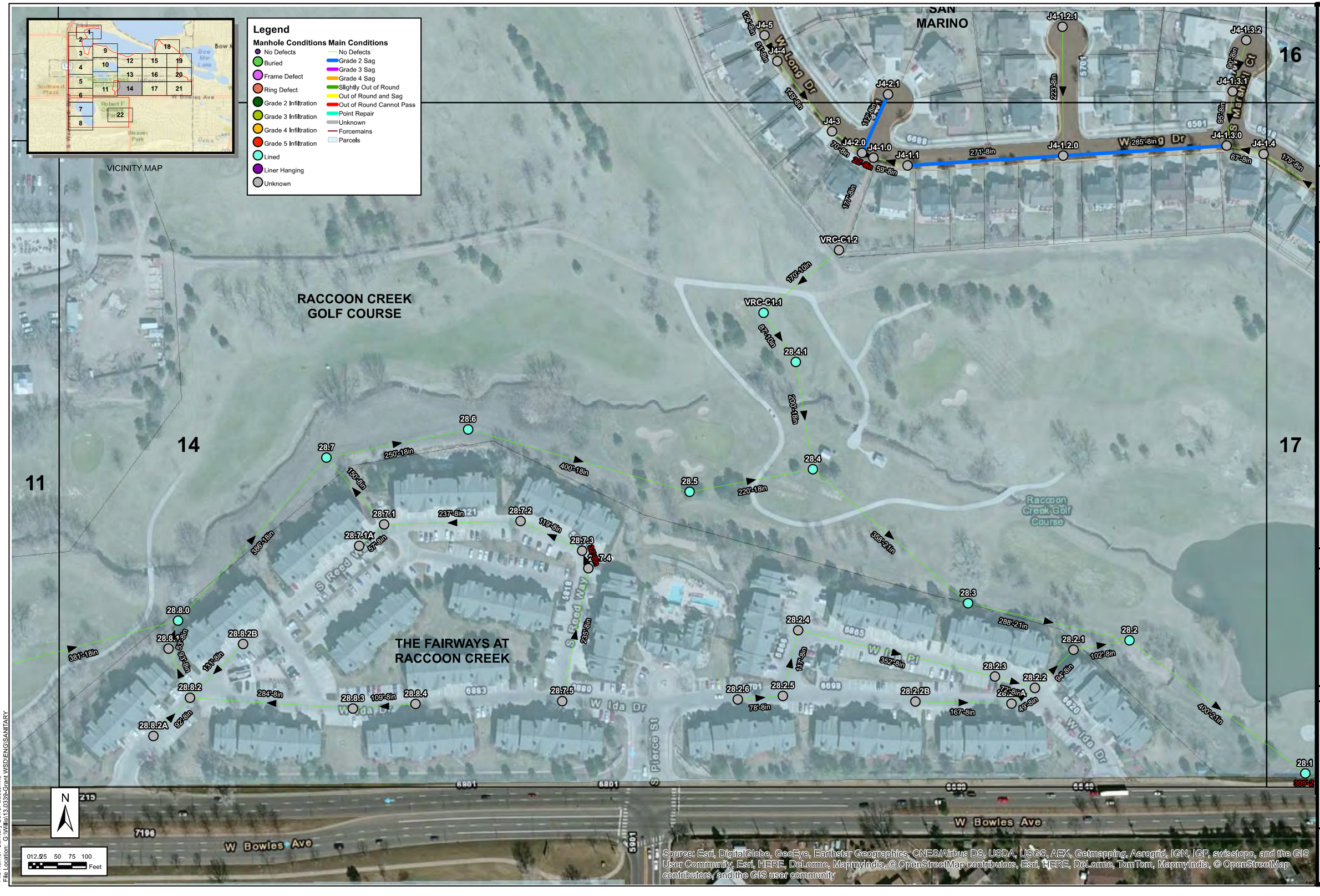

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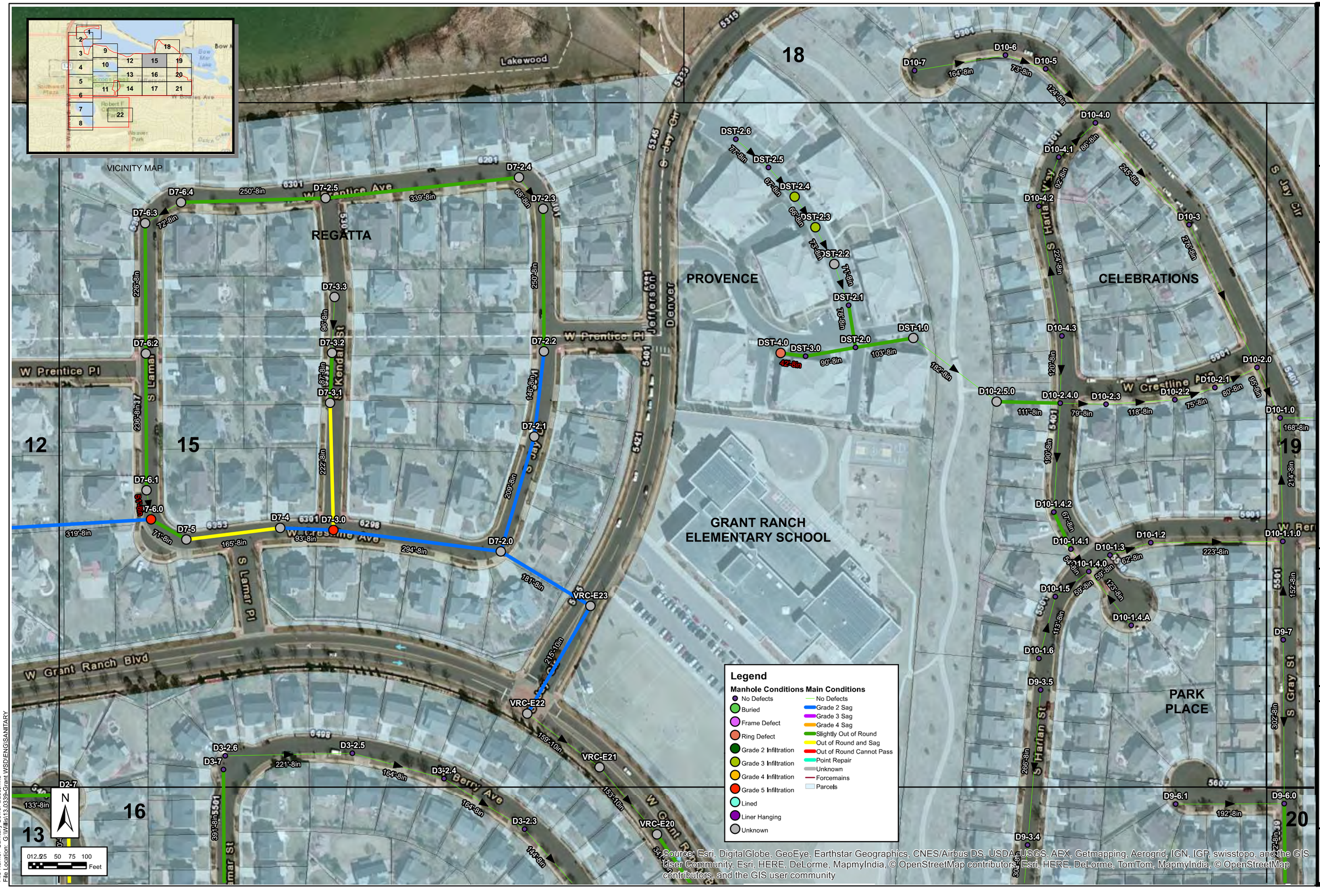

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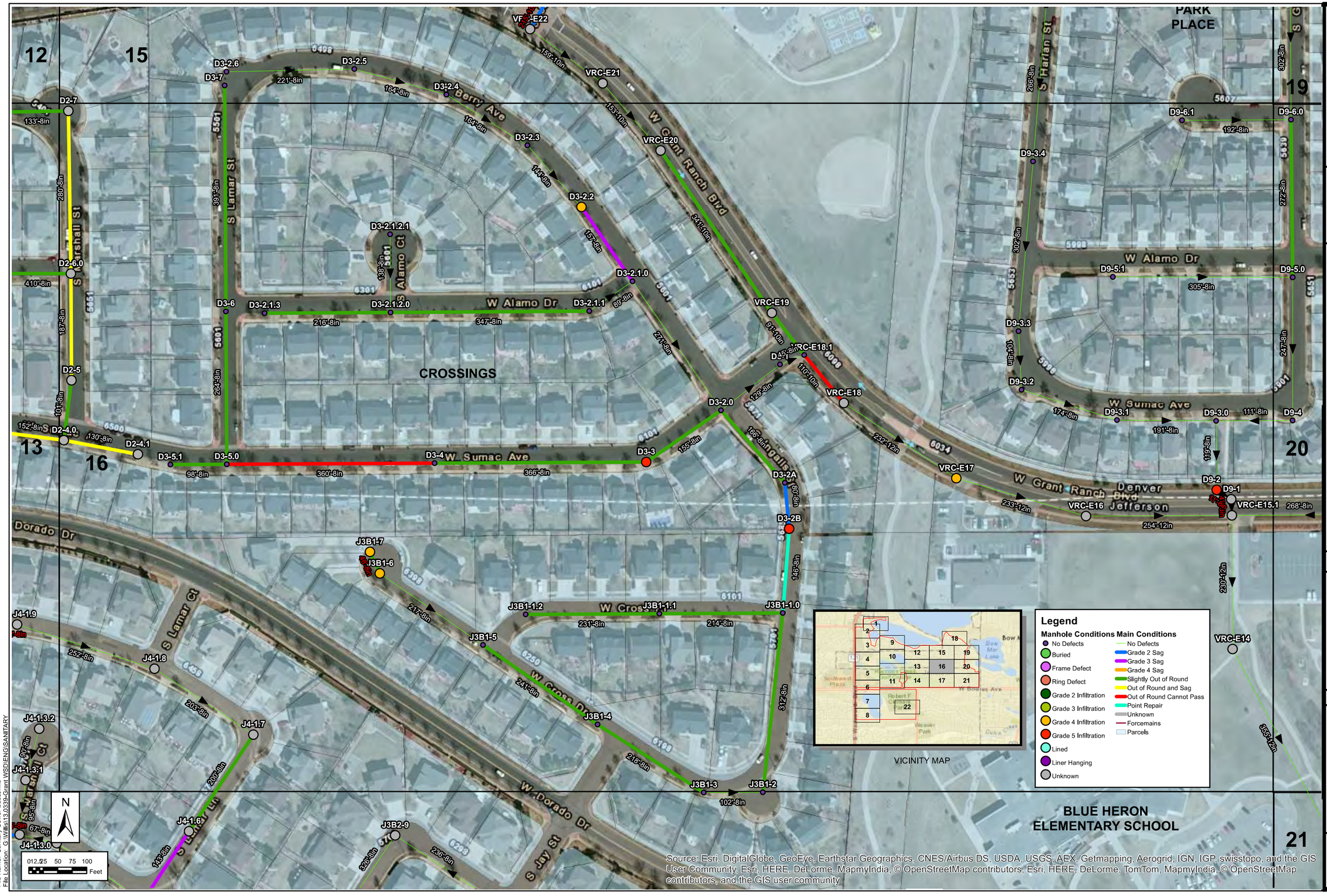

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No.	Description of Revisions	Date	Name

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Job Number: 13.0339
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B-20

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No.	Description of Revisions	Date	Name

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Job Number: 13.0339
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Drawn By: JVM
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Sheet Number:

B-21

VICINITY MAP

Legend

Manhole Conditions
- No Defects
- Buried
- Frame Defect
- Ring Defect
- Grade 2 Infiltration
- Grade 3 Infiltration
- Grade 4 Infiltration
- Grade 5 Infiltration
- Lined
- Liner Hanging
- Unknown

Main Conditions
- No Defects
- Grade 2 Sag
- Grade 3 Sag
- Grade 4 Sag
- Slightly Out of Round
- Out of Round and Sag
- Out of Round Cannot Pass
- Point Repair
- Unknown
- Forcemains
- Parcels

CP-7
194'-8in
CP-6
230'-8in
CP-5
219'-8in
CP-4
383'-8in
CP-3
226'-5in
CP-2
314'-8in
CP-1.B
351'-9in
CP-1.A

22

CLEMENT PARK

Robert F Clement Park

COLUMBINE HIGH SCHOOL

Leawood Park

S Newland Cir
S Pierce St
S Pierce St
S Marshall St
W
6117
6117
6189
6201
6221
6009

N

0 12.5 25 50 75 100 Feet

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GRANT WATER AND SANITATION DISTRICT

SANITARY SEWER EXISTING CONDITIONS

No.	Description of Revisions	Date	Name

Date: DECEMBER, 2016
Job Number: 13.0339
Design By: JVM
Drawn By: JVM
Checked By: JAM

Sheet Number:

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SANITARY SEWER CAPITAL IMPROVEMENTS

No.	Description of Revisions	Date	Name

Date: DECEMBER, 2016
Job Number: 13.0339
Design By: JVM
Drawn By: JVM
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Sheet Number:

C-1

GIS MAP INFORMATION
File Name: Sanitary Sewer Base.mxd
File Location: G:\Willis\13.0339-Grant WSD\ENG\SANITARY

Sheet Number: C-2

Date: DECEMBER, 2016
Job Number: 13.0339
Design By: JVM
Drawn By: JVM
Checked By: JAM

No.	Description of Revisions	Date	Name

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SANITARY SEWER CAPITAL IMPROVEMENTS

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Sheet Number: C-3

Date: DECEMBER, 2016
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Design By: JVM
Drawn By: JVM
Checked By: JAM

No.	Description of Revisions	Date	Name

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SANITARY SEWER CAPITAL IMPROVEMENTS

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Drawn By: JVM
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Sheet Number:

C-4

GIS MAP INFORMATION
File Name: Sanitary Sewer Base.mxd
File Location: G:\Wills\13.0339-Grant WSD\ENG\SANITARY

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SANITARY SEWER CAPITAL IMPROVEMENTS

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Job Number: 13.0339
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Drawn By: JVM
Checked By: JAM

Sheet Number:

C-5

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No.	Description of Revisions	Date	Name

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GIS MAP INFORMATION
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Drawn By: JVM
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SANITARY SEWER CAPITAL IMPROVEMENTS

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VICINITY MAP

Legend

- Sewer Manholes
- Sanitary Mains
- Remove/Replace, Phase I
- Remove/Replace, Phase II
- Remove/Replace, Phase III
- Remove/Replace, Phase IV
- Remove/Replace, Phase V
- Point Repair, Phase I
- Forcemains
- Parcels

GIS MAP INFORMATION
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Job Number: 13.0339
Design By: JVM
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Sheet Number:

C-10

VICINITY MAP

Legend

- Sewer Manholes
- Sanitary Mains
- Remove/Replace, Phase I
- Remove/Replace, Phase II
- Remove/Replace, Phase III
- Remove/Replace, Phase IV
- Remove/Replace, Phase V
- Point Repair, Phase I
- Forcemains
- Parcels

N

0 12.5 25 50 75 100 Feet

GIS MAP INFORMATION
File Name: Sanitary Sewer Base.mxd
File Location: G:\Wills\13.0339-Grant WSD\ENG\SANITARY

GIS MAP INFORMATION
File Name: Sanitary Sewer Base.mxd
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Sheet Number:

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GIS MAP INFORMATION
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GIS MAP INFORMATION
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Sheet Number:
C-13

GIS MAP INFORMATION
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GIS MAP INFORMATION
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C-15

GIS MAP INFORMATION
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No.	Description of Revisions	Date	Name

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Sheet Number:

C-18

VICINITY MAP

Legend

- Sewer Manholes
- Sanitary Mains
- Remove/Replace, Phase I
- Remove/Replace, Phase II
- Remove/Replace, Phase III
- Remove/Replace, Phase IV
- Remove/Replace, Phase V
- Point Repair, Phase I
- Forcemains
- Parcels

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Sheet Number:

C-21

GIS MAP INFORMATION
File Name: Sanitary Sewer Base.mxd
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N

0 12.5 25 50 75 100 Feet

VICINITY MAP

Legend

- Sewer Manholes
- Sanitary Mains
- Remove/Replace, Phase I
- Remove/Replace, Phase II
- Remove/Replace, Phase III
- Remove/Replace, Phase IV
- Remove/Replace, Phase V
- Point Repair, Phase I
- Forcemains
- Parcels

CP-7
194'-8in
CP-6
230'-8in
CP-5
219'-8in
CP-4
383'-8in
CP-3
226'-5in
CP-2
314'-8in
CP-1.B
351'-8in
CP-1.A

22

CLEMENT PARK

Robert F Clement Park

COLUMBINE HIGH SCHOOL

S Newland Cir
S Pierce St
S Marshall St
W Bowles Ave
Leawood Park
6117
6189
6201
6221
6009

N

0 12.5 25 50 75 100 Feet

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Job Number: 13.0339
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C-22