

**Final
Work Plan
Northern Area
Sewer Line Investigation
Revision 2**

**Fort Wingate Depot Activity
McKinley County, New Mexico**

September 5, 2025

**Contract No.: W912PP22D0014
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Prepared for:



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14. ABSTRACT This Work Plan describes additional investigation activities within Northern Area Sewer Line at Fort Wingate Depot Activity, McKinley County, New Mexico. This document has been prepared for submission to the New Mexico Environment Department (NMED) Hazardous Waste Bureau (HWB), as required by Section VII.F.1 of the Resource Conservation and Recovery Act (RCRA) Permit, No. NM6213820974 and in response to a Notice of Disapproval letters dated 19 October, 2023 for Final Northern Area Groundwater RCRA Facility Investigation Report, Revision 3.					
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2 **Final Work Plan Northern Area Sewer Line Investigation, Revision 2**

3 **40 CFR 270.11**

4 **September 2025**

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12 *Cheryl Frischkorn*
13

14 Ms. Cheryl Frischkorn

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16 Wingate Depot Activity, BRAC Directorate

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1 **Final**
2 **Work Plan**
3 **Northern Area**
4 **Sewer Line Investigation**
5 **Revision 2**

6 **Fort Wingate Depot Activity**
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2 Notes:

3	BIA	=	Bureau of Indian Affairs
4	BIA-NRO	=	Bureau of Indian Affairs – Navajo Regional Office
5	BRAC	=	U.S. Army Base Realignment and Closure Division
6	FWDA BEC	=	Fort Wingate Depot Activity Base Realignment and Closure Environmental Coordinator
7	NM	=	New Mexico
8	NMED HWB	=	New Mexico Environment Department, Hazardous Waste Bureau
9	NN	=	Navajo Nation
10	OH	=	Ohio
11	USACE	=	U.S. Army Corps of Engineers
12	USEPA	=	U.S. Environmental Protection Agency

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ACRONYMS AND ABBREVIATIONS

1		
2	°C	Degree(s) Celsius
3	≤	Less than or equal to
4	%	Percent
5	%R	Percent recovery
6	µg/kg	Microgram(s) per kilogram
7	AOC	Area of Concern
8	APP	Accident Prevention Plan
9	Army	United States Department of the Army
10	atm-m3/mol	Atmospheres – cubic meter(s) per mol
11	AUF	Area use factor
12	bgs	Below ground surface
13	COC	Chain of custody
14	COPC	Chemical of potential concern
15	COPEC	Chemical of potential ecological concern
16	CSM	Conceptual site model
17	DAF	Dilution attenuation factor
18	DL	Detection limit
19	DO	Dissolved oxygen
20	DRMO	Defense Reutilization and Marketing Office
21	DRO	Diesel-range organics
22	EC	Effect concentration
23	EPC	Exposure point concentration
24	ESL	Ecological Screening Level
25	FWDA	Fort Wingate Depot Activity
26	g/mol	Gram(s) per mol
27	GPS	Global Positioning System
28	HI	Hazard index
29	HQ	Hazard quotient
30	HSA	Hollow-stem auger
31	HWB	Hazardous Waste Bureau
32	ID	Identification
33	IDW	Investigation-derived waste
34	LCS	Laboratory control sample
35	LOAEL	Lowest observed adverse effect level
36	LOD	Limit of detection
37	LOQ	Limit of quantitation
38	MCL	Maximum contaminant level
39	mg/kg	Milligram(s) per kilogram
40	mg/L	Milligram(s) per liter
41	MS	Matrix spike
42	MSD	Matrix spike duplicate
43	N/A	Not applicable
44	NASL	Northern Area Sewer Line
45	NHPA	National Historic Preservation Act

ACRONYMS AND ABBREVIATIONS (Continued)

1		
2	NMAC	New Mexico Administrative Code
3	NMED	New Mexico Environment Department
4	NM WQCC	New Mexico Water Quality Control Commission
5	NOAEL	No adverse effect level
6	NOD	Notice of Disapproval
7	NTU	Nephelometric turbidity unit
8	ORP	Oxidation reduction potential
9	OSE	(New Mexico) Office of the State Engineer
10	OSHA	Occupational Safety and Health Administration
11	Permit	RCRA Permit NM 6213820974 for the FWDA Permit
12	PID	Photoionization detector
13	PPE	Personal protective equipment
14	PVC	Polyvinyl chloride
15	QA	Quality assurance
16	QC	Quality control
17	QSM	Quality Systems Manual
18	RCRA	Resource Conservation and Recovery Act
19	RFI	RCRA Facility Investigation
20	RPD	Relative percent difference
21	RSL	Regional Screening Level
22	SLHQ	Screening level hazard quotient
23	SSL	Soil Screening Level
24	SSHO	Site Safety and Health Officer
25	SSHP	Site Safety and Health Plan
26	SVOC	Semi-volatile organic compound
27	SWMU	Solid Waste Management Unit
28	TAL	Target analyte list
29	TNT	Trinitrotoluene
30	TPH	Total petroleum hydrocarbons
31	TRV	Toxicity reference values
32	UCL	Upper confidence limit
33	U.S.	United States
34	USACE	United States Army Corps of Engineers
35	USEPA	United States Environmental Protection Agency
36	UTL	Upper tolerance limit
37	VI	Vapor intrusion
38	VOA	Volatile organic analysis
39	VOC	Volatile organic compound

1.0 INTRODUCTION

This Northern Area Sewer Line Investigation Work Plan describes the sewer line investigation activities to be completed within Parcel 11 and Parcel 21 at Fort Wingate Depot Activity (FWDA), in McKinley County, New Mexico (see **Figures 1.1, 1.2, and 1.3**). It has been prepared by the United States (U.S.) Army Corps of Engineers (USACE) Albuquerque District for submission to the New Mexico Environment Department (NMED) Hazardous Waste Bureau (HWB), as required by Section VII.H.1.a of the Resource Conservation and Recovery Act (RCRA) Permit (Permit) (NM 6213820974) for FWDA, which became effective December 1, 2005, and was most recently modified in February 2015 (NMED, 2015). The scope of this work plan is focused on determining whether the sewer line is a possible source area that could be impacting groundwater. Analytical data will be screened against NMED soil to ground water screening levels. Any evaluation of risk to human or ecological receptors will be done in the Northern Area Sewer Line Investigation Report.

This Work Plan has been prepared to address review comments provided by the NMED in Notice of Disapproval (NOD) letters dated January 25, 2022 (NMED, 2022a), July 25, 2022 (NMED, 2022b), March 27, 2023 (NMED, 2023a), August 19, 2024 (NMED, 2024), and the October 19, 2023 Approval With Modifications Letter (NMED, 2023b) for the *Final Northern Area Groundwater RCRA Facility Investigation Report, Fort Wingate Depot Activity, McKinley County, New Mexico* (USACE, 2023). Additionally, this Work Plan incorporates methodologies from the latest NMED Risk Assessment Guidance for Site Investigations and Remediation (NMED, 2022c and 2017).

In section 6.3.2 of the Northern Area Groundwater RCRA Facility Investigation Report (2023), the Army proposed to prepare a work plan to assess the locations and integrity of the sewer lines, and the potential of the sewer lines as a source of nitrate contamination to groundwater. In comments provided in the January 2022 NOD (NMED, 2022a) and the July 2022 NOD (NMED, 2022b), the NMED requested that the U.S. Department of the Army (Army) explain how wastewater generated from the buildings located in the Administration Area had been managed, provide a map showing the location of the sewer lines in the Administration Area, and conduct a subsurface investigation for potential source(s) of nitrate, including an evaluation of the integrity of the sewer lines. The Army received NMED approval to conduct the camera survey via email dated November 26, 2024. The NMED NOD Letter(s) and email correspondence are provided in **Appendix A**.

1.1 PURPOSE AND SCOPE

The purpose of this Northern Area Sewer Line Investigation Work Plan is to conduct an investigation at selected manholes and/or areas within the Northern Area as recommended by the Army in the *Northern Area Groundwater RCRA Facility Investigation Report, Fort Wingate Depot Activity McKinley County, New Mexico Revision 3*, June 30, 2023 (HDR, 2023) (hereafter referred to as the 2023 RFI Report), as well as comments received from the NMED HWB, contained in the 2022, 2023, and 2024 NOD Letters.

The scope of the Sewer Line Investigation includes:

- Conduct a video camera survey of the manholes and the sewer line to evaluate their integrity. In response to NMED comments (NMED, 2024), an investigation of the sewer

line integrity via camera survey was conducted from May 6 through May 8, 2025. Results from the camera survey are included in **Appendix B**.

Where cracks/breaks are identified along the sewer line, installation of soil borings adjacent to identified cracks/breaks in the sewer line and collection of soil samples below the bottom of the sewer line to evaluate if the sewer line was historically a potential source of nitrate in alluvial groundwater.

Where cracks/breaks are identified along the sewer line, installation and sampling of temporary monitoring wells in close proximity to identified cracks/breaks where monitoring wells currently are not present. Collection of soil samples from the borehole of each monitoring well.

Comparison of soil and groundwater sample results to evaluate whether the sewer line is a potential source of nitrate in alluvial groundwater.

Evaluation of soil and groundwater samples to determine if nitrate concentrations in soil exceed NMED soil to groundwater screening levels and evaluate if nitrate in soil at sample locations is a potential source of nitrate contamination in groundwater. Any evaluation of risk to human or ecological receptors will be done in the Northern Area Sewer Line Investigation Report.

1.2 BACKGROUND INFORMATION

FWDA is located 7 miles east of Gallup in McKinley County, New Mexico. Access to FWDA is south of U.S. Route 66 at mile marker 31. The Northern Area Sewer Line (**Figure 1.2**) is located in the FWDA Administration Area and Workshop Area in Parcel 11 and Parcel 21.

The Administration Area is located in the northern portion of FWDA. This area consists of 39 former office facilities, housing, equipment maintenance facilities, warehouse buildings, and utility support facilities. Munitions storage and shipping, fuel storage and dispensary, and mechanical maintenance activities were performed in this area.

The Workshop Area is located south of the Administration Area. It is a former industrial area that contained ammunition maintenance and renovation facilities, the TNT (trinitrotoluene) washout facility, and the TNT Leaching Beds Area (Solid Waste Management Unit [SWMU] 1). The buildings and other structures were demolished in 2010, and the TNT leaching beds were remediated in 2019 (Zapata, 2021).

Nitrate and Nitrite Plume The points of release for the groundwater nitrate/nitrite plume in the Northern Area appear to originate from SWMU 1 (TNT Leaching Beds), which were remediated in 2019 (Zapata, 2021). As shown on **Figure 1.2**, the plume extends across the Workshop Area and Administration Area. Wells TMW03, TMW34, TMW40S, and TMW46 have historically had the highest nitrate concentrations within the plume and are designated as downgradient relative to SWMU 1 (TNT Leaching Beds) (see **Figure 1.3**.) Starting in 2021, all wells sampled for nitrate and nitrite are also sampled for additional major anions to include chloride, fluoride, sulfate, phosphate, and bromide.

The sewer lines and manholes included in this investigation are within the Northern Area of FWDA, primarily in the Administration and Workshop Areas, which are located within Parcel 11 and Parcel 21 (see **Figure 1.2**). The buildings in the Administration and Workshop Areas were

1 served by a gravity flow sanitary sewer system beginning in 1941 with additional sewer lines
2 installed in 1951. In 1961, the sanitary system comprised 23,600 linear feet of vitrified clay tile
3 pipe ranging in diameter from 2 inches to 10 inches with 49 manholes (Admin Record, 1961). The
4 Fort Wingate database identifies 57 manholes historically associated with the Sewer Lines. The
5 database indicates that 27 manholes were abandoned in 2010.

6 Recommendations for additional investigation of the Northern Area Sewer Lines to determine if
7 the sewer lines may act as a source of nitrate to the groundwater were included in the 2023
8 Northern Area Groundwater RFI Report and comments provided by NMED in 2022 and 2023.

9 This work plan focuses on the sewer lines and manholes that may be in direct correlation with the
10 nitrate plume within the Administration and Workshop Areas.

11 The Army consulted with the Navajo Nation and the Pueblo of Zuni in 2015, pursuant to the 2008
12 Programmatic Agreement developed in consultation with the Navajo Nation, Pueblo of Zuni, and
13 the New Mexico State Historic Preservation Officer that specifies how Section 106 of the National
14 Historic Preservation Act (NHPA) will be addressed during Permit activities conducted on FWDA.

15 **1.3 PERFORMANCE OBJECTIVES**

16 The objective of the Sewer Line Investigation is to collect representative soil and groundwater
17 samples in close proximity to the sewer line and sewer line manholes to evaluate if the sewer line
18 was historically a potential source of nitrate in alluvial groundwater.

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2.0 SEWER LINE INVESTIGATION METHODS

2.1 NORTHERN AREA SEWER LINE

A subsurface soil and groundwater investigation of the Northern Area sewer line and associated manholes will be performed along sections of the sewer line and manholes located in Parcels 11 and 21. Inspections of the sewer pipes were conducted with a video camera to identify any potential source location(s) along the sewer line that may be contributing to the nitrate plume extending west of the Administration Area. A two-step investigation approach is being implemented: 1.) an inspection of the sewer lines was performed with a video camera to identify cracks/breaks within the pipes (**Appendix B**), and 2.) soil borings and temporary groundwater monitoring wells will be installed in the vicinity of the area where potential release(s) were identified during the first step of the investigation. Due to confined space entry limitations and because video inspection equipment was lowered into the manholes from the surface, entry into the manholes was not performed.

2.2 SOIL BORING SAMPLES

Investigation of the sewer line integrity via the camera survey confirmed that there is extensive damage in the sewer line within or near the nitrate/nitrite plume. The current camera survey cannot determine if the damage occurred prior to or subsequent to closure of the installation in 1993. However, the extent of the deterioration and obstruction indicate that the damage likely occurred after the use of the sewer line was discontinued, as the sewer line would not be functional in its current state. Segments of the sewer line were not investigated because sedimentation/damage obstructed access; details are provided in **Appendix B**.

The intent of the camera survey was to identify where cracks/breaks are present at the bottom of manholes and/or in the sewer line, so that a soil boring could be advanced downgradient of the crack in order to identify potential releases of contaminants from the sewer line to soil. However, due to the deterioration of the sewer line observed during the camera survey, it was not possible to identify individual cracks. After reviewing the camera survey results, soil boring locations were selected where there is extensive deterioration and in areas with generally significant damage that intersect the nitrate groundwater plume, and in areas of sewer line with significant uncertainties in video and sampling data. Therefore, sampling targets areas with both visible pipe deterioration and elevated plume signals, plus those with video inspection gaps. Five soil borings (NASL-SB01 through NASL-SB05) are proposed (**Figure 2.1**). Three samples will be collected from each soil boring at depths of 2.0, 5.0, and 10.0 feet below the bottom of the manhole/sewer line. The bottom of the manholes/sewer line are assumed to be 10 feet bgs; however, this depth will be confirmed in the field and sample depths adjusted appropriately. In addition, soil cores of the soil borings will be screened with a photoionization detector (PID), and if an elevated reading of the PID is identified, an additional soil sample will be collected from that depth interval as well. Furthermore, if the highest PID reading is identified at the proposed termination depth of 10 feet below the bottom of the manhole or sewer line, additional samples will be collected in 10-foot intervals until PID readings decrease, or bedrock or groundwater is encountered to delineate the vertical extent of the contamination. Proposed soil boring sample IDs are listed in **Table 2.1**.

Soil borings will be advanced using hollow-stem auger (HSA) or direct-push drilling methods. Soil samples will be collected in clean, decontaminated soil core barrels equipped with dedicated

liners. Core barrels will be decontaminated before each sample is collected using potable water and detergent followed by a deionized water rinse. Prior to advancing each borehole, drill tooling including rods, drive casing, and core barrels will be decontaminated using a high pressure power washer. Water generated during decontamination of drill tooling and sampling equipment will be managed as described in **Section 3.9** of this Work Plan.

Soil samples will be analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), nitrate, nitrite, major anions, explosives, and target analyte list (TAL) metals. A summary of analytical methods, sample containers, preservation, and holding times is included in **Table 2.2**. Soil borings will be sampled continuously using soil core barrels equipped with dedicated liners. Following retrieval of the soil core samples from the boreholes, the soil core liner will be extracted from the core barrel and split. The VOC sample will be collected immediately from the designated sample interval directly from the soil core liner using a dedicated TerraCore® sampler or equivalent. The remaining soil from the designated sample interval will be transferred to a decontaminated stainless steel bowl or plastic bag and homogenized. Samples will then be placed in laboratory supplied containers using a stainless steel spoon or disposable plastic spoon. Lids will be sealed by labels or custody seals to prevent tampering. The sample containers will then be placed into a cooler with ice and cooled to less than or equal to 6 degrees Celsius ($\leq 6^{\circ}\text{C}$). All sampling equipment, including core barrels, stainless steel spoons and stainless steel bowls, will be decontaminated using detergent and deionized water followed by a rinse with deionized water before each sample is collected.

2.3 TEMPORARY MONITORING WELL INSTALLATION

Three temporary monitoring wells (NASL-TMW73 through NASL-TMW75) will be installed in close proximity to identified cracks in the sewer line that are outside the known boundary of the alluvial nitrate plume to determine if nitrate in soil beneath the sewer line may have impacted site groundwater. The locations of the three proposed temporary monitoring wells target areas of uncertainty near the edge of the plume that are adjacent to portions of the sewer line investigated via the camera survey.

Soil samples will be collected from the borehole of each monitoring well at depths of 2.0, 5.0, and 10.0 feet below the bottom of the manhole/sewer line, vadose zone with the highest PID reading, at the water table (if applicable), and at the end of the borehole. Soil samples collected from the boreholes of monitoring wells will be analyzed for VOCs, SVOCs, nitrate, nitrite, major anions, explosives, and TAL metals per methods described in **Section 2.2**. Proposed temporary monitoring well soil sample IDs and estimated depths are included in **Table 2.2**.

Monitoring well installation and groundwater sampling will be performed in accordance with New Mexico Office of the State Engineer (OSE) regulations (OSE, 2016), the RCRA permit (NMED, 2015), and the New Mexico Administrative Code (NMAC) 19.27.4.29 and 20.6.2 (issued by OSE); (NMAC, 2017 and 2001).

Monitoring wells will be installed using sonic or HSA drilling methods. Boreholes using either method will be nominally 6 to 8 inches in diameter. Wells will be constructed using 2-inch-diameter, schedule 40 polyvinyl chloride (PVC) casing with 20 feet of 0.010-inch machine-slotted screen and a bottom endcap. Boreholes will be advanced 15 feet below the top of the alluvial aquifer water table so that 5 feet of screen in the completed well is above the water table. Wells will have centralizers placed at the top and bottom of the screen when appropriate. The filter pack

will be silica sand and will extend from the bottom of the borehole to 2 feet above the screened interval. A bentonite chip or pellet seal approximately 3 feet thick will be installed over the filter pack and hydrated with potable water at every 1-foot increment to provide a competent seal. The bentonite chips or pellets will be installed by gravity fall if the distance to the top of the filter pack is less than 20 feet below ground surface (bgs) or by a tremie pipe if the distance is greater than 20 feet bgs. Above the bentonite seal, a neat cement grout will be installed from the top of the bentonite seal to 3 feet bgs by gravity fall or a tremie pipe using the same distance criteria used for the bentonite chip seal.

The surface completion for each well will consist of an 8-inch-diameter by 6-foot-long protective steel monument that will be installed 3 feet above a concrete pad and 3 feet into the ground. The concrete pad will be 4 feet square by 4 inches thick. Field personnel will install 4-inch-diameter by 3-foot-tall steel bollards around the well on the outside of the concrete pad. The well will be equipped with a security lock and will be tagged with corrosion-resistant identification. The well monument will be coated with protective orange paint as required by FWDA.

Completed wells will be developed at least 24 hours after well installation. Field personnel will develop wells by surging followed by bailing, and/or pumping until the clear, artifact-free formation water is produced (EPA, 1992). Purge water generated during well development will be managed following the procedures described in **Section 3.9** of this Work Plan.

2.4 GROUNDWATER SAMPLES

A groundwater sample will be collected from each of the proposed temporary wells (TMW73 through TMW75). Groundwater samples will be analyzed for VOCs, SVOCs, nitrate, nitrite, major anions, explosives, and TAL metals. A summary of analytical methods, sample containers, preservation, and holding times is included in **Table 2.2**. Sample IDs for the proposed temporary monitoring wells are listed in **Table 2.3**.

Monitoring well sampling methods will depend on the aquifer recharge rate at each of the proposed wells to be sampled. Wells with adequate recharge rates will be sampled using low-flow sampling methods using bladder pumps. Wells will be purged at a flow rate that minimizes drawdown. Field parameters will be measured during purging and at the time of sampling. Field parameter measurements will include dissolved oxygen (DO), oxidation reduction potential (ORP), specific conductivity, pH, temperature, and turbidity. Field parameter stabilization criteria (EPA, 1996) are summarized as follows:

±10% of temperature, conductivity, and ORP

± 10% OR < 1.0 NTU for turbidity

± 10% OR < 1.0 milligram per liter (mg/L) for DO

Once field parameters have stabilized, samples will be collected in laboratory supplied containers. The sample containers will then be placed into a cooler with ice and cooled to $\leq 6^{\circ}\text{C}$. Lids will be sealed by labels or custody seals to prevent tampering. Sample containers, preservation, chain of custody procedures, and instrument calibration are discussed in **Section 3** of this Work Plan.

If the aquifer recharge rate is insufficient at any of the wells to collect groundwater samples using the low flow sampling method, three well volumes will be purged or bailed from the well. Samples will then be collected using a bladder pump or bailer.

1 If the aquifer recharge rate is insufficient to purge or bail three well volumes, the well will be
2 purged dry and allowed to recover to greater than 90% of the initial water column height. The
3 initial water column height will be determined by subtracting the measured depth to water prior to
4 pumping or bailing from the total depth of the well. Samples will then be collected using a bladder
5 pump or bailer. Field parameter stabilization will not be required using the three volume purge or
6 purge dry methods; however, field parameters will be measured and recorded if sufficient water is
7 available following sample collection. Monitoring wells that do not contain more than 6 inches of
8 water column in the well screen interval will be identified as dry and will not be sampled.

9 Water generated during purging activities and excess groundwater from sampling will be collected
10 in designated containers and managed as investigation-derived waste (IDW) following the
11 procedures described in **Section 3.9** of this Work Plan.

3.0 DESCRIPTION OF INVESTIGATION ACTIVITIES

This chapter provides general information regarding the planned field activities to be completed as part of this Work Plan.

3.1 SITE SAFETY AND AWARENESS

All work will be accomplished in accordance with Army safety measures. A project-specific Accident Prevention Plan (APP)/Site Safety and Health Plan (SSHP) has been developed for sampling activities at FWDA. The APP/SSHP defines the roles and responsibilities of site personnel, establishes proper levels of personal protective equipment (PPE), and describes emergency response and contingency procedures. The associated Activity Hazard Analyses define hazards associated with each type of work activity and how those hazards will be mitigated. The APP/SSHP will be reviewed by site personnel prior to performing any site work. In addition, task-specific Activity Hazard Analyses will be reviewed before any new tasks are performed and periodically during daily tailgate safety meetings.

All work will be completed by a supervisor, operators, and technicians that have successfully completed 40-hour Hazardous Waste Operations and Emergency Response training in accordance with 29 *U.S. Code of Federal Regulations* 1910.120. A dedicated Site Safety and Health Officer (SSHO) will be on site during all field activities associated with implementation of this Work Plan. The SSHO will be responsible for conducting site-specific training, daily tailgate safety meetings, and periodic safety inspections.

The SSHO will also be responsible for ensuring site monitoring, worker training, and effective selection and use of PPE. The SSHO will have completed the Occupational Safety and Health Administration (OSHA) 30-hour Construction Safety Course prior to being tasked to fill the position.

3.2 QUALITY CONTROL

In order to attain data of sufficient quality to support project objectives, specific procedures are required to allow evaluation of data quality. The quality assurance/quality control (QA/QC) procedures and requirements for their evaluation will comply with the U.S. Department of Defense Quality Systems Manual (QSM), Version 5.4 (U.S. Department of Defense, 2021).

3.2.1 Daily Progress Report

The Field Lead will be responsible for ensuring that all field activities are conducted in compliance with all work plans and requirements. The Field Lead will be on site during critical and complex field activities.

The Field Lead, with input from the Project Manager, will prepare Daily Progress Reports during field activities. Daily Progress Reports shall be submitted to the Government Project Manager the workday after the period covered by the report. The Daily Progress Report will contain the following information:

Date(s) of work that the report covers

Contract number and task order number

1 Summary of weather conditions
2 List of personnel on site and duties
3 Equipment on site
4 Location and description of work performed
5 Subcontractor personnel on site and duties
6 Subcontractor equipment on site
7 Location and description of work performed by subcontractors
8 Summary of QC inspections that took place and reference to QC reports

9 **3.2.2 Field and Laboratory Quality Control Samples**

10 Evaluation of field sampling procedures and laboratory equipment accuracy and precision requires
11 the collection and evaluation of field and laboratory QC samples. **Table 3.1** summarizes the
12 planned QC samples for this project. A description of each QC sample type is provided in the
13 following sections.

14 **3.2.2.1 Quality Control Analyses Originated by the Field Team**

15 Field QC samples will be collected to determine the accuracy and precision of the analytical
16 results. The QC sample frequencies are stated in the following sections.

17 **Equipment Blank**

18 Equipment blanks will be collected to monitor the cleanliness of sampling equipment and the
19 effectiveness of decontamination procedures. Contamination from the sampling equipment can
20 bias the analytical results high or lead to false positive results being reported. Equipment blanks
21 will be prepared by filling sample containers with laboratory-grade contaminant free water that
22 has been passed through a decontaminated or unused disposable sampling device. The required QC
23 limits for equipment blank concentrations are to be less than the method's reporting limit.

24 Equipment blanks will be collected at a frequency of 10% per sampling apparatus. Samples
25 associated with equipment blanks that have detected target compounds will be assessed during
26 the data validation process. The usability of the associated analytical data will be documented and
27 affected data will be appropriately qualified. Field corrective action to improve equipment
28 decontamination procedures may also be implemented by the Field Lead at the request of the
29 project chemist.

30 **Field Duplicate**

31 Field duplicates are collected in the field from a single aliquot of the sample to determine the
32 precision and accuracy of the field team's sampling procedures. Field duplicates will be collected
33 and analyzed at a frequency of 10%.

34 **Trip Blank**

35 Trip blanks are used to monitor for contamination during sample shipping and handling, and for
36 cross-contamination through volatile component migration among the collected samples. They
37 are prepared in the laboratory by pouring organic-free water into a volatile organic analysis (VOA)

sample container. They are then sealed, transported to the field, and transported back to the laboratory in the same cooler as the volatile component samples. One trip blank sample set (two VOAs) will accompany each volatile component sample cooler. Trip blanks will be analyzed for VOCs only (two VOAs per cooler), and results will be compared to sample concentrations to verify no cross-contamination has occurred.

3.2.2.2 Quality Control Analyses/Parameters Originated by the Laboratory

Method Blank

Method blanks are used to monitor each preparation or analytical batch for interference and/or contamination from glassware, reagents, and other potential sources within the laboratory. A method blank is a contaminant-free matrix (laboratory reagent water for aqueous samples or Ottawa sand, sodium sulfate, or glass beads [metals] for soil samples) to which all reagents are added in the same amount or proportions as are added to the samples. It is processed through the entire sample preparation and analytical procedures along with the samples in the batch.

There will be at least one method blank per preparation or analytical batch. If a target compound is found at a concentration that exceeds one-half the reporting limit, corrective action must be performed in an attempt to identify and, if possible, eliminate the contamination source. If sufficient sample volume remains in the sample container, samples associated with the blank contamination should be reprocessed and reanalyzed after the contamination source has been eliminated.

Laboratory Control Sample

The laboratory control sample (LCS) will consist of a contaminant-free matrix such as laboratory reagent water for aqueous samples or Ottawa sand, sodium sulfate, or glass beads (metals) for soil samples spiked with known amounts of compounds that come from a source different than that used for calibration standards. Target compounds will be spiked into the LCS. The spike levels will be less than or equal to the midpoint of the calibration range. If LCS results are outside the specified control limits, corrective action must be taken, including sample re-preparation and re-analysis, if appropriate. If more than one LCS is analyzed in a preparation or analytical batch, the results for each LCS must be reported. Any LCS recovery outside QC limits affects the accuracy for the entire batch and requires corrective action.

Matrix Spike/Matrix Spike Duplicate

A sample matrix fortified with known quantities of specific compounds is called a matrix spike (MS). It is subjected to the same preparation and analytical procedures as the native sample. For this project, all target compounds will be spiked into the MS sample. Sample MS recoveries are used to evaluate the effect of the sample matrix on the recovery of the analytes of interest. A matrix spike duplicate (MSD) is a second aliquot of the MS sample, fortified at the same concentration as the MS. The relative percent difference (RPD) between the results of the MS duplicates measures the precision of sample results.

Project-specific samples will be used by the laboratory for the MS/MSD samples, which will be designated on the chain-of-custody (COC) form. The spike levels will be less than or equal to the midpoint of the calibration range. Pairs of MS/MSDs will be collected at a frequency of 5%. MS/MSDs are required in every analytical batch regardless of the rate of collection and how samples are received at the laboratory.

3.2.3 Data Precision, Accuracy, Representativeness, Comparability and Completeness

Field QA/QC samples and laboratory internal QA/QC samples are collected and analyzed to assess the data's quality and usability. The following sections discuss the parameters that are used to assess the data quality.

Precision

The precision of laboratory analysis will be assessed by comparing the analytical results between MS/MSD and laboratory duplicate samples. The precision of the field sampling procedures will be assessed by reviewing field duplicate sample results. The RPD will be calculated for the duplicate samples using the equation:

$$\%RPD = \{(S - D)/[(S + D)/2]\} \times 100$$

where:

S = first sample value (original value)

D = second sample value (duplicate value)

The precision criteria for the duplicate samples will be $\pm 50\%$ in soil samples.

Accuracy

Accuracy of laboratory results will be assessed for compliance with the established QC criteria using the analytical results of method blanks, reagent/ preparation blanks, LCS and MS/MSD samples and surrogate results, where applicable. Laboratory accuracy will be assessed for compliance with the established QC criteria listed in Appendix C of the QSM (U.S. Department of Defense, 2021). The percent recovery (%R) of LCSs will be calculated using the equation:

$$\%R = (A/B) \times 100$$

where:

A = the analyte concentration determined experimentally from the LCS

B = the known amount of concentration in the sample

Completeness

The data completeness of laboratory analyses results will be assessed for compliance with the amount of data required for decision making. Complete data are data that are not rejected. Data with qualifiers such as "J" or "UJ" are deemed acceptable and can be used to make project decisions as qualified. Data qualifiers are listed in **Table 3.2**. The completeness of the analytical data is calculated using the equation:

$$\%Completeness = [(complete\ data\ obtained)/(total\ data\ planned)] \times 100$$

The percent completeness goal for this sampling event is 90% for each analytical method.

Representativeness

Representativeness is the degree to which sampling data accurately and precisely represent site conditions and is dependent on sampling and analytical variability and the variability of environmental media at the site. Representativeness is a qualitative “measure” of data quality.

Achieving representative data in the field starts with a properly designed and executed sampling program that carefully considers the project’s overall objectives. Proper location controls and sample handling are critical to obtaining representative samples.

The goal of achieving representative data in the laboratory is measured by assessing accuracy and precision. The laboratory will provide representative data when the analytical systems are in control. Therefore, representativeness is a redundant objective for laboratory systems if sample COC records and sample preservation are properly documented, analytical procedures are followed and holding times are met.

Comparability

Comparability is the degree of confidence to which one data set can be compared to another. Comparability is a qualitative “measure” of data quality.

Achieving comparable data in the field starts with a properly designed and executed sampling program that carefully considers the project’s overall objectives. Proper location controls and sample handling are critical to obtaining comparable samples.

The goal of achieving comparable data in the laboratory is measured by assessing accuracy and precision. The laboratory will provide comparable data when analytical systems are in control. Therefore, comparability is a redundant QC objective for laboratory systems if proper analytical procedures are followed and holding times are met.

Sensitivity

Sensitivity is the ability of the method or instrument to detect the contaminant of concern and other target compounds at the level of interest. Appropriate sampling and analytical methods will be selected that have QC acceptance limits that support the achievement of established performance criteria. For this project, the performance criteria are the Groundwater Protection Soil Screening Levels (SSLs) presented in the NMED Risk Assessment Guidance for Site Investigations and Remediation, Volumes I (NMED, 2022). The NMED SSLs will be used to evaluate contaminant concentrations in soil samples. Assessment of analytical sensitivity will require thorough data validation. The soil human health screening levels are presented in **Table 3.3**. The groundwater screening levels are presented in **Table 3.4**.

Limit of quantitation (LOQs), limits of detection (LODs), and detection limits (DLs) will be less than regulatory screening objectives when possible using a DoD Environmental Laboratory Accreditation Program-certified laboratory using standard EPA test methods. **Tables 3.3 and 3.4** identify the analytes for which the LOQ is greater than the project screening level. Limits for accuracy and precision have been based on requirements of the latest version of the Quality Systems Manual (DoD/DOE, 2021). Soil and groundwater analytical data will be considered suitable for final decision-making.

3.2.4 Data Verification and Data Review Procedures

Personnel involved in data validation will be independent of any data generation effort. The project chemist will be responsible for the oversight of data verification, review, and validation. Data verification and review will be performed when the data packages are received from the laboratory. Verification will be performed on an analytical-batch basis using the summary results of calibration and laboratory QC, as well as those of the associated field samples. There are five stages of review defined in the DoD General Data Validation Guidelines (DoD, November 2019):

1. Stage 1: Verification and validation based only on completeness and compliance of sample receipt condition checks
2. Stage 2A: Verification and validation based on completeness and compliance checks of sample receipt conditions and ONLY sample-related QC results
3. Stage 2B: Verification and validation based on completeness and compliance checks of sample receipt conditions and BOTH sample-related and instrument-related QC results
4. Stage 3: Verification and validation based on completeness and compliance checks of sample receipt conditions, both sample-related and instrument-related QC results, AND recalculation checks
5. Stage 4: Verification and validation based on completeness and compliance checks of sample receipt conditions, both sample-related and instrument-related QC results, recalculation checks, AND the review of actual instrument outputs

For this project, 100% of the data packages will undergo data verification and data review, 100% to Stage 2B in accordance with DoD General Data Validation Guidelines and DoD published data validation modules. Data validation will be performed by Parsons using automated data review software and/or manual data validation. Level II analytical laboratory reports will be included in the Northern Area Sewer Line Investigation Report.

3.2.5 Data Assessment

Limitations on data usability will be assigned, if appropriate, as a result of the validation process described earlier. The results of the data validation will be discussed in a separate report so that overall data quality can be verified through the precision, accuracy, representativeness, comparability, and completeness of sample results.

3.3 CHAIN OF CUSTODY

COC forms will be completed for each sample and will accompany each sample at all times. Data on the COC form will include the sample identification (ID) (as described in **Section 3.8**), depth interval, date sampled, time sampled, requested analysis, project name, project number, and signatures of those in possession of the sample. The COC forms will accompany those samples shipped to the designated laboratory so that sample possession information can be maintained. The field team will retain a separate copy of the COC form at the field office. Additionally, the sample ID, date and time collected, collection location, and analysis requested will be documented in the field logbook as discussed in **Section 3.5**.

3.4 PACKAGING AND SHIPPING PROCEDURES

All samples will be shipped by overnight air freight to the laboratory or hand delivered. Unless otherwise indicated, samples will be treated as environmental samples, shipped in heavy duty coolers, packed in materials to prevent breakage, and preserved with ice in sealed plastic bags. Each shipment will include the appropriate field QC samples (i.e., trip blanks, duplicates, and rinsates).

Corresponding COC forms will be placed in waterproof bags and taped to the inside of the cooler lids. Each cooler shipped from the laboratory containing aqueous sample bottles for VOC analyses will contain a trip blank. The trip blank will stay with the cooler until the cooler is returned to the analytical laboratory. All coolers will be taped shut and a custody seal will be placed over the tape to prevent tampering.

3.5 SAMPLE DOCUMENTATION

Sample control and tracking information will be recorded in bound dedicated field logbooks and will include the following information: sample number and location, date, sampler's name, method of sampling, sample depth, soil sample physical description, ambient weather conditions, and miscellaneous observations. At the conclusion of each day in the field, the sampling team leader will review each page of the logbook for errors and omissions. The sampling team leader will then date and sign each reviewed page.

3.6 FIELD INSTRUMENT CALIBRATION

All field instruments will be calibrated following manufacturer recommended calibration procedures and frequencies. Field instrument calibrations will be recorded in a designated portion of the field logbook at the time of the calibration. Adverse trends in instrument calibration behavior will be corrected.

3.7 SURVEY OF SAMPLE LOCATIONS

The location of each sample collected will be surveyed using appropriate instrumentation and procedures to obtain horizontal accuracy of less than 0.1 foot. A Trimble Total Station Global Positioning System (GPS), Trimble Static GPS, or equivalent, will be used to document each soil sample location. A North American Datum 1983 Northing and Easting in U.S. Survey Feet will be established for all surveyed points and recorded in a dedicated field notebook. Survey data will be reported in New Mexico State Plane and Universal Transverse Mercator Index coordinates.

3.8 SAMPLE IDENTIFICATION

During sampling, unique sample ID numbers will be assigned to each sample or subsample. Each sample ID number will consist of a combination of the Site Identifier, source of sample, boring number, depth of sample, and type of sample collection in accordance with the latest version of the FWDA *Environmental Information Management Plan* (USACE, 2007). Following is an example sample number and a description of the sample identifiers to be used during implementation of this Work Plan.

Example Sample ID: NASL-SB01-2.0-2.5-D-SO (soil), TMW73-MMYYY (water)

Site Identifier: in this case: (NASL) Northern Area Sewer Line (soil boring)

1 Source of Sample: in this case SB (soil boring)

2 Increment Number: Samples collected at each manhole location will be assigned sequential
3 2-digit or 3-digit numbers (in this case 01) (soil boring)

4 Depth Range: In feet (in this case 2.0 to 2.5 feet) (soil boring)

5 Type of Sample: D (discrete) (soil boring)

6 Matrix: Soil (SO) (soil boring)

7 Well ID number for water (TMW73)

8 MMYYY: month and year of water sample

9 QA/QC samples will carry the same sample nomenclature as the parent sample with a unique
10 suffix and numeral (if required) to distinguish individual samples. Equipment rinsate blanks, trip
11 blanks, and field blanks will carry the sample location identifier with an additional designation of
12 TBXX or EBXX (where XX represents the sequence number of the sample). Each blank will have
13 a unique tracking number.

14 **3.9 INVESTIGATION-DERIVED WASTE**

15 Several types of IDW may be generated during the sampling of environmental media during the
16 investigation activities: residual soil volume, decontamination fluids, monitoring well purge water,
17 and disposable sampling equipment/PPE. Proper management of this IDW is required to ensure
18 compliance with federal, state, and Army regulations applicable to the collection, storage,
19 transport, and disposal of potentially hazardous materials. Required IDW management measures
20 for FWDA investigations or remedial activities will be waste segregation, containerization and labeling,
21 temporary storage, waste characterization, and disposal.

22 Generated IDW will be segregated at each given soil boring location. Process knowledge such as
23 historical operational records, previous analytical data, and field screening results obtained during
24 previous investigations or remedial actions, will be used when available to segregate potentially
25 hazardous IDW from non-hazardous IDW. These preliminary categorizations of IDW will only be
26 qualitative; the application of process knowledge is intended to minimize costs associated with the
27 handling, transportation, and disposal of wastes.

28 Field personnel will place soil and sediment IDW in open-head drums or covered roll-off
29 containers. Field personnel will dispose of used, non-decontaminated sampling equipment and
30 PPE in polyethylene trash bags which will be placed in removable-head drums. Field personnel
31 will use portable water tanks to collect, manage, and characterize groundwater during drilling.
32 Drums and tanks will conform to United Nations Performance-Oriented Packaging standards and
33 Department of Transportation (DOT) specifications in 49 Code of Federal Regulations (CFR) 178.
34 General refuse and decontaminated sampling equipment and PPE will be placed in polyethylene
35 trash bags or other suitable containers.

36 Field personnel will collect representative samples from each container of soil/sediment,
37 groundwater, or decontamination fluids consisting of a composite of the material to characterize
38 IDW for disposal as hazardous, special, or non-hazardous waste. Samples may be collected as
39 containers are filled at the soil boring/well location, or within five days of transfer to the satellite
40 area. The analytical laboratory will provide analysis results within 15 days of sampling.

1 Characterization results for these media will serve to classify associated sampling equipment and
2 PPE for disposal unless the PPE and equipment were decontaminated prior to disposal, in which
3 case it will be handled as general refuse. Small volumes of decontamination fluids are anticipated.
4 Decontamination fluids will be contained within the temporary decontamination pad areas during
5 active sampling and decontamination activities at a site. Accumulated wash and rinse water will
6 be transported and disposed of at the evaporation tank.

7 A complete list of waste characterization parameters and analytical methods approved by the U.S.
8 Environmental Protection Agency (USEPA) is published in Test Methods for Evaluating Solid
9 Waste, Physical/Chemical Methods (SW-846). Process knowledge will be used to evaluate the
10 physical state of the IDW to determine which specific parameters will be required to properly
11 characterize waste generated from a given SWMU, AOC, or soil boring/well location.

12 A label reading "Caution: This Drum/Container May Contain Hazardous Material" or similar will
13 be affixed to each container containing IDW. In addition, each drum, roll-off, or portable tank
14 containing IDW will be labeled with a unique 12-character identifier: The first two characters are
15 "FW;" followed by the soil boring/well number; the next eight are the date, month, and year
16 (dd/mm/yyyy) on which filling commenced; and the last two are the consecutive number of the
17 container among all being filled on a given day. Characterization sampling will be composite
18 samples of the segregated groups as listed above. Sample analysis will be consistent with the
19 constituent of concerns as listed in the Work Plan and will include flash point, reactivity,
20 corrosivity, toxicity tests. A DOT-certified hazardous waste transporter and disposal company will
21 be contacted and will collect the hazardous IDW and ship it offsite to the disposal facility within
22 90 days. Shipment volume and disposal documentation will include waste manifests and
23 confirmation of receipt by the receiving waste disposal facility.

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4.0 DATA EVALUATION

All activities conducted as part of this Work Plan will be documented in the Northern Area Sewer Line Investigation Report. The report will contain, at a minimum, a detailed schedule of completed activities, a summary of analytical data, and a comparison of site data to the appropriate screening levels. The purpose of this investigation is to determine if there is evidence of a release of contaminants from the sewer line that may be affecting groundwater.

Cumulative risk associated with data collected in support of this investigation will be evaluated in the Northern Area Sewer Line Investigation Report. A cumulative risk evaluation will be conducted to compare the soil concentrations to the applicable soil-to-groundwater target soil leachate concentrations (**Table 3.3**).

4.1 POST-IMPLEMENTATION REPORTING

The forthcoming Northern Area Sewer Line Investigation Report will include a discussion of soluble release indicator compounds (major anions and explosives) in the groundwater data from the three proposed temporary monitoring wells and the four most recent groundwater sampling events from nearby alluvial wells within the nitrate plume boundary. Groundwater data will be evaluated with soil sampling results from this investigation to determine if the sewer line may act as a source of nitrate to the groundwater.

The data collected in support of the Northern Area Sewer Line Investigation will be evaluated to determine if there is evidence of a release of contaminants from the sewer line that may affect groundwater. The *NMED Risk Assessment Guidance for Site Investigations and Remediation, Volume I, Soil Screening Guidance for Human Health Risk Assessments* (NMED, 2022) outlines eight steps for conducting the human health screening risk assessment. However, as the goal of this investigation is to determine if groundwater may be affected by a release from the sewer line, only Steps 1 and 5 will be conducted to make that determination.

Step 1: Determine constituents of potential concern (COPCs) (further discussed in **Section 4.1.3.1**). This includes conducting a site attribution analysis and elimination of some constituents through comparison of site concentrations to background levels (**Section 4.1.3.2**).

Step 5: Compare the site concentrations to the soil-to-groundwater target soil leachate concentrations (based on a dilution attenuation factor of 20). Maximum detected concentrations should be applied first, followed by use of a refined EPC and/or site-specific data, if the initial comparison results in an exceedance of the applicable soil-to-groundwater target soil leachate concentrations.

4.1.1 Selection of Soil Screening Levels

Soil sample results will be evaluated for the Northern Area sewer lines by comparison to the applicable soil-to-groundwater target soil leachate concentrations, which are equivalent to the NMED tap water SSLs multiplied by a dilution attenuation factor (DAF). NMED publishes up to four SSLs for each analyte. Two of the four SSLs are based on risk-based values to which DAFs of 1 and 20 have been applied. Two of the four SSLs are based on drinking water standards to which DAFs of 1 and 20 have been applied. Use of the SSLs is allowed by NMED based on a DAF of 20 as reasonably protective (NMED, 2022c; Section 4.4), and allows use of the least

conservative SSL between the risk-based and drinking water-based SSLs (NMED, 2022c; Section 4.9). For analytes without an NMED SSL, the USEPA risk-based SSLs for the protection of groundwater will be adjusted to a DAF of 20 for consistency with the NMED presumption that this DAF is reasonably protective.

4.1.2 Selection of Groundwater Screening Levels

The screening values to be used to evaluate the groundwater results are taken from Section 7.1 of Attachment 7 of the RCRA permit (NMED, 2015), which references three sources of criteria from which a value is selected for the evaluation using the following hierarchy.

1. New Mexico Water Quality Control Commission (NM WQCC) standards for the analytes listed in NMAC 20.6.2.7.WW (toxic pollutant) having the values listed in NMAC 20.6.2.3103.A (human health standards) and NMAC 20.6.2.3103.B (other standards for domestic water supply) (NMAC, 2001).
2. USEPA drinking water maximum contaminant levels (MCLs) provided under 40 Code of Federal Regulations Part 141 and Part 143.
3. If both an NM WQCC standard and an USEPA MCL have been established for a COPC, the lowest value of 1. and 2. above will be selected.
4. If no NM WQCC standard or USEPA MCL has been established for a carcinogenic hazardous constituent, values will be selected from the most recent version of the USEPA RSLs for tap water adjusted to a target excess cancer risk level of 1×10^{-5} .
5. If no NM WQCC standard or USEPA MCL has been established for a noncarcinogenic hazardous constituent, values will be selected from the most recent version of the USEPA RSLs for tap water based on an HQ=1.

Groundwater is assumed to be used as drinking water until it can be demonstrated that an alternate source of drinking water is readily available to replace groundwater as the primary drinking water source. The evaluation of groundwater will be based on the comparison of soil results to target soil leachate concentrations, which are equivalent to the NMED-specific tap water SSLs multiplied by a DAF of 20, as well as comparison of groundwater results to the appropriate screening levels.

4.1.3 Approach for Evaluating Data

The data will be evaluated to determine if there is evidence of a release of contaminants that may affect groundwater. That evaluation will follow the steps described below.

4.1.3.1 Identification of Chemicals of Potential Concern (Step 1, Part 1)

Analytes detected in one or more samples from the data set for the sewer line will be retained as COPCs. Analytes that are not detected in any sample will not be retained as COPCs.

4.1.3.2 Evaluation of Metals Background Levels (Step 1, Part 2)

As allowed by NMED risk guidance (NMED, 2022c; Section 2.8.3.2), the evaluation process may incorporate a comparison to background concentrations before evaluating cumulative risks. This is consistent with Attachment 7 (Section 7.6) of the Permit (NMED, 2015), which indicates that

the screening level for naturally occurring (i.e., background) constituents can be set at the background level if a background level is approved by NMED. The NMED risk guidance (NMED, 2022c; Section 5.2) also allows for an evaluation of essential nutrients prior to evaluating cumulative risks. This section provides a summary of the background studies completed at the site, and the evaluation to be performed to determine if metals and essential nutrients should be retained as COPCs.

Summary of Metals Background Studies

At FWDA, site-specific background concentrations for metals in soil were established through the completion of a background study conducted in 2009 and documented in a report titled *Soil Background Study and Data Evaluation Report* (Shaw Environmental, 2010). The study included collection of 124 samples from areas of FWDA believed to be unimpacted by historical operations. Samples were collected in Parcels 1, 2, 5A, 8, 14, 15, 17, 19, and 20. The background value selected for each metal in soil included in the study is provided in Table 8.1 of the Shaw Environmental (2010) report. A supplemental background study was conducted in 2012 and documented in a report titled *Final Phase 2 Soil Background Report* (USACE, 2013). The purpose of the supplemental investigation was to refine the background levels for arsenic and antimony. The study resulted in a revised background value of 0.23 mg/kg for antimony, which is the 95% upper tolerance limit (UTL) from soil unit 350ss, as presented in Table 4.1 of the Final Phase 2 Soil Background Report (USACE, 2013), but arsenic concentrations at investigation areas without known arsenic sources still continued to exceed the background level.

In 2013, NMED issued a letter titled *The Evaluation of Background Levels for Arsenic in Soil* (NMED, 2013). This letter summarizes the background evaluations and provides a refined arsenic background value and guidance on how to use that value to assess investigation results. Specifically, the NMED letter states that if the maximum arsenic concentration is less than 5.6 mg/kg, then arsenic may be considered representative of background and no further action for arsenic is required. If the maximum arsenic concentration is greater than 5.6 mg/kg, then the range of arsenic concentrations in the sample data set is to be compared to the range of arsenic concentrations in the site-specific background data set (0.2 mg/kg to 11.2 mg/kg). If the range of arsenic concentrations in the sample data set is consistent with the range of concentrations in the site-specific background data set, then the arsenic concentrations can be considered representative of background and no further action for arsenic is required. If the range of arsenic concentrations in the sample dataset are not consistent with the range of concentrations in the background data set, then additional investigation or corrective action may be required.

The background values for soil that will be used to evaluate sample results are presented in **Table 3.3** and **Table 3.4**. At this time there is no approved background study for groundwater at Fort Wingate.

Evaluate the Maximum Concentration

The NMED risk guidance (NMED, 2022c; Section 2.8.3.2) indicates that metals can be eliminated from further consideration when the maximum detected concentration is less than or equal to its background level. The background levels for metals in soil described above will be used in the evaluation. In the case of arsenic, the range of arsenic concentrations may also be considered in the background evaluation. Metals detected in soil at concentrations less than background levels will not be retained as COPCs and are not evaluated further. Metals detected in soil at

concentrations greater than background levels or that are considered essential nutrients will be further evaluated.

Evaluate Essential Nutrients

The NMED risk guidance (NMED, 2022c; Section 5.3) allows for an evaluation of metals and other inorganics classified as essential nutrients separate from the cumulative risk evaluation. The metals and other inorganics classified as essential nutrients are calcium, chloride, magnesium, phosphorous, potassium, and sodium. The SSLs for essential nutrients developed by NMED are based on dietary guidelines developed by the Institute of Medicine and the National Academy of Sciences.

The maximum concentration will be compared to the SSL. Essential nutrients with maximum concentrations less than the SSL will not be retained as COPCs and are not evaluated further. Essential nutrients that are metals with maximum concentrations greater than the essential nutrient SSLs will be further evaluated.

Conduct Statistical Evaluation of Metals

Metals with maximum concentrations greater than background levels and the essential nutrient SSLs from discrete samples may undergo additional evaluation. The additional evaluation may include a comparison of the maximum concentration in the sample set to the maximum concentration in the background data set, comparison of the range of concentrations in the sample data set to the range of concentrations in the background data, comparison of the 95% upper confidence limit (UCL) to the maximum concentration in the background data set, or may proceed to a more robust statistical evaluation as described in Section 2.8.3.2 of the NMED risk guidance (NMED, 2022c) using ProUCL statistical software (most current version). The more robust statistical evaluation, if performed, includes conducting a two-sample hypothesis test for data sets consisting of at least eight samples and at least five detections, conducting a point-by-point comparison to background levels for data sets that are smaller, and preparing graphical displays to provide further rationale to determine if metals concentrations are consistent with background levels or elevated above background levels.

Metals determined to be consistent with background levels will not be retained as COPCs and are not evaluated further. Metals determined to be elevated above background levels will be further evaluated through a lines-of-evidence discussion.

Present Additional Lines of Evidence

NMED allows for a lines-of-evidence discussion to be developed to support exclusion of one or more metals as representative of background rather than being site-related, as long as there are sufficient data to define the nature and extent of areas of elevated concentrations. The lines of evidence could include information regarding site history and historical operations, an assessment of the number of detections versus non-detects, or an assessment of whether or not the distribution of results for one or more metals is indicative of a release or source area. Metals for which sufficient lines of evidence demonstrate they are not site-related or not significantly elevated above the background level will not be retained as COPCs and are not evaluated further. Metals without sufficient lines of evidence to eliminate them as COPCs will be carried forward to the cumulative risk evaluation.

1 **4.1.3.3 Migration to Groundwater Evaluation (Step 5)**

2 Per Section 4.9 of the NMED Risk Assessment Guidance for Human Health (NMED, 2018), soil
3 concentrations of contaminants will be directly compared to the highest NMED migration to
4 groundwater SL-SSL (included in **Table 3.3**). Migration to groundwater SL-SSLs were derived
5 using two criteria: tap water screening levels and the NMED groundwater and surface water
6 protection levels (20.6.2 NMAC), and/or Federal MCLs (Table A-3, NMED, 2018). The highest
7 migration to groundwater SL-SSL for a chemical based on a DAF of 20 will be applied for initial
8 screening to evaluate potential leaching and migration of contaminants from the vadose zone to
9 groundwater. All soil data, regardless of depth of detection, will be used in the evaluation of the
10 migration to groundwater pathway. The maximum detected concentrations in soil will initially be
11 compared to the SL-SSLs. If the initial comparison results in an exceedance of the migration to
12 groundwater SL-SSLs, a refined EPC and/or site-specific data will be compared to the NMED
13 migration to groundwater SL-SSL.

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5.0 SCHEDULE

The approximate schedule for conducting the sewer line and manhole activities at the Northern Area Sewer Line is summarized below.

1. Work Plan delivered to NMED – December 20, 2024
2. Fieldwork – initiates 90 days subsequent to NMED approval of the work plan
3. Northern Area Sewer Line Investigation Report to NMED – provided to NMED 120 days subsequent to completion of investigation activities including laboratory reporting, data validation, waste disposal and site restoration

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TABLES

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Table 2.1 – Northern Area Sewer Line Investigation Proposed Soil Sample Locations

Sample Identification Number	Sample Depth (feet) Below the Manhole Bottom Depth or Sewer Line Invert Elevation	Sample Analyses
NASL-SB01-2.0-2.5-D-SO	2.0 to 2.5	VOCs (SW8260D), SVOCs (SW8270E), Nitrate as Nitrogen, Nitrite as Nitrogen, major anions (SW9056A), Explosives (SW8033B), TAL Metals (SW6020B/ SW7471B)
NASL-SB01-5.0-5.5-D-SO	5.0 to 5.5	
NASL-SB01-10.0-10.5-D-SO	10.0 to 10.5	
NASL-SB01-xx-xx-D-SO	<i>TBD - Highest PID</i>	
NASL-SB02-2.0-2.5-D-SO	2.0 to 2.5	
NASL-SB02-5.0-5.5-D-SO	5.0 to 5.5	
NASL-SB02-10.0-10.5-D-SO	10.0 to 10.5	
NASL-SB02-xx-xx-D-SO*	<i>TBD - Highest PID</i>	
NASL-SB03-2.0-2.5-D-SO	2.0 to 2.5	
NASL-SB03-5.0-5.5-D-SO	5.0 to 5.5	
NASL-SB03-10.0-10.5-D-SO	10.0 to 10.5	
NASL-SB03-xx-xx-D-SO	<i>TBD - Highest PID</i>	
NASL-SB04-2.0-2.5-D-SO	2.0 to 2.5	
NASL-SB04-5.0-5.5-D-SO	5.0 to 5.5	
NASL-SB04-10.0-10.5-D-SO*	10.0 to 10.5	
NASL-SB04-xx-xx-D-SO	<i>TBD - Highest PID</i>	
NASL-SB05-2.0-2.5-D-SO	2.0 to 2.5	
NASL-SB05-5.0-5.5-D-SO	5.0 to 5.5	
NASL-SB05-10.0-10.5-D-SO	10.0 to 10.5	
NASL-SB05-xx-xx-D-SO	<i>TBD - Highest PID</i>	
TMW73-2.0-2.5-D-SO	2.0 to 2.5	
TMW73-5.0-5.5-D-SO*	5.0 to 5.5	
TMW73-10.0-10.5-D-SO	10.0 to 10.5	
TMW73-xx-xx-D-SO	<i>TBD - Highest PID</i>	
TMW73-xx-xx-D-SO	<i>Water Table</i>	
TMW73-xx-xx-D-SO	<i>Termination Depth</i>	

Table 2.1 – Northern Area Sewer Line Investigation Proposed Soil Sample Locations

Sample Identification Number	Sample Depth (feet) Below the Manhole Bottom Depth or Sewer Line Invert Elevation	Sample Analyses
TMW74-2.0-2.5-D-SO	2.0 to 2.5	VOCs (SW8260D), SVOCs (SW8270E), Nitrate as Nitrogen, Nitrite as Nitrogen, major anions (SW9056A), Explosives (SW8033B), TAL Metals (SW6020B/ SW7471B) [continued]
TMW74-5.0-5.5-D-SO	5.0 to 5.5	
TMW74-10.0-10.5-D-SO	10.0 to 10.5	
TMW74-xx-xx-D-SO	TBD - Highest PID	
TMW74-xx-xx-D-SO	Water Table	
TMW74-xx-xx-D-SO	Termination Depth	
TMW75-2.0-2.5-D-SO	2.0 to 2.5	
TMW75-5.0-5.5-D-SO	5.0 to 5.5	
TMW75-10.0-10.5-D-SO	10.0 to 10.5	
TMW75-xx-xx-D-SO	TBD - Highest PID	
TMW75-xx-xx-D-SO*	Water Table	
TMW75-xx-xx-D-SO	Termination Depth	
QC Samples to Be Collected		
Number of Primary Samples = 38		
Number of MS/MSD Samples (5%) = 2		
Number of Field Duplicate Samples (10%) = 4		

* Indicates that a Field Duplicate and/or MS/MSD will also be collected.

bgs = below ground surface

VOCs = Volatile Organic Compounds

SVOCs = Semi-Volatile Organic Compounds

TAL = Target Analyte List

TBD = to be determined

Table 2.2 – Summary of Analytical Methods, Sample Containers, Preservation, and Holding Times

Analysis (or Analysis Preparation Method)	Matrix	Analytical Method (EPA SW846 or ASTM)	Sample Volume/Container	Preservative	Maximum Holding Time (collection until extraction/extraction until analysis)
Volatile Organic Compounds	Soil	SW8260D	2 x Terracore, 40-mL VOA Vials with septa cap, pre-tared with stir bar and DI Water or Sodium Bisulfate 1 x Terracore, 40-mL VOA vial with closed cap, pre-tared with Methanol	Cool to $\leq 6^{\circ}\text{C}$ (Methanol)	14 days
Volatile Organic Compounds	Water	SW8260D	(3) 40-mL VOA Vial	HCl pH < 2 , $\leq 6^{\circ}\text{C}$, no headspace	14 days (preserved)
Semi-Volatile Organic Compounds	Soil	SW8270E	4-oz or 8-oz Glass Jar	Cool to $\leq 6^{\circ}\text{C}$	14/40 days
Semi-Volatile Organic Compounds	Water	SW8270E	(2) 125-mL amber glass bottle	Cool to $\leq 6^{\circ}\text{C}$	7/40 days
Nitrate as Nitrogen/Anions	Soil	SW9056A	(1) 4 oz glass jar with Teflon® lined lid	Cool to $\leq 6^{\circ}\text{C}$	28 days to leach/ 48 hours to analyze
Nitrite as Nitrogen/Anions	Soil	SW9056A	(1) 4 oz glass jar with Teflon® lined lid	Cool to $\leq 6^{\circ}\text{C}$	28 days to leach/ 48 hours to analyze
Nitrate as Nitrogen/Anions	Water	SW9056A	(1) 50-mL HDPE	Cool to $\leq 6^{\circ}\text{C}$	48 hours to analyze
Nitrite as Nitrogen/Anions	Water	SW9056A	(1) 50-mL HDPE	Cool to $\leq 6^{\circ}\text{C}$	48 hours to analyze
TAL Metals	Soil	SW6020B	4-oz or 8-oz Glass Jar	Cool to $\leq 6^{\circ}\text{C}$	6 months

Table 2.2 – Summary of Analytical Methods, Sample Containers, Preservation, and Holding Times

Analysis (or Analysis Preparation Method)	Matrix	Analytical Method (EPA SW846 or ASTM)	Sample Volume/Container	Preservative	Maximum Holding Time (collection until extraction/extraction until analysis)
TAL Metals	Water	SW6020B	(1) 250-mL or 500-mL HDPE	HNO ₃ to pH <2, Cool to ≤ 6°C	6 months
Mercury	Soil	SW7471B	4-oz or 8-oz Glass Jar	Cool to ≤ 6°C	28 days
Mercury	Water	SW7471B	(1) 250-mL or 500-mL HDPE	HNO ₃ to pH <2, Cool to ≤ 6°C	28 days
Explosives	Soil	SW8033B	(1) 4 oz glass or HDPE jar	Cool to ≤ 6°C	14/40 days
Explosives	Water	SW8033B	(2) 500-mL amber glass bottle	Cool to ≤ 6°C	7/40 days
% Moisture	Soil	ASTM D2216-98	4-oz or 8-oz Glass Jar	Cool to ≤ 6°C	14 days

Acronyms and Abbreviations:

< = less than
 ≤ = less than or equal to
 °C = degree Celsius
 oz = ounce
 HDPE = high density polyethylene
 pH = potential of hydrogen
 HCl = hydrochloric acid
 VOA = volatile organic analyte
 HNO₃ = Nitric acid
 L = liter
 mL = milliliter

**Table 2.3 – Northern Area Sewer Line Investigation
Proposed Temporary Monitoring Well Samples**

Well Sample Identification	Sample Analyses
TMW73-MMYYY*	VOCs (SW8260D), SVOCs (SW8270E), Nitrate as Nitrogen, Nitrite as Nitrogen, Major Anions (SW9056A), Explosives (SW8033B), TAL Metals (SW6020B/SW7471B)
TMW74-MMYYY	
TMW75-MMYYY	
QC Samples to Be Collected	
Number of Primary Samples = 3	
Number of MS/MSD Samples (5%) = 1	
Number of Field Duplicate Samples (10%) = 1	

* Indicates that a Field Duplicate and/or matrix spike/matrix spike duplicate (MS/MSD) will also be collected.

bgs = below ground surface

VOCs = Volatile Organic Compounds

SVOCs = Semi-Volatile Organic Compounds

TAL = Target Analyte List

Table 3.1 – Quality Control Samples for Precision and Accuracy

Quality Control Type	Precision	Accuracy	Minimum Frequency
Field	RPD Goal of $\leq 50\%$	Duplicate Sample Laboratory Analysis	One every 10 samples (10%)
		Equipment Blank	One per week for reusable equipment
		Trip Blank	One set (two VOAs) per each cooler containing VOC samples
Laboratory	MS/MSD (RPD goal of $\leq 20\%$ for metals, VOCs, and SVOCs, $\geq 30\%$ for all other analyte classes)	Method Blank	One per preparation or analytical batch, at least one every 20 samples (rounded up) (5%)
		Laboratory Control Sample or Blank Spike	One per preparation or analytical batch, at least one every 20 samples (rounded up) (5%)
		MS Percent Recovery (QSM Percent Recovery Goals)	One every 20 samples (rounded up) (5%)
		Surrogate Spike (for organics only)	All samples and QC

Notes:

- MS = matrix spike
- MSD = matrix spike duplicate
- QC = quality control
- QSM = Quality Systems Manual (U.S. Department of Defense)
- RPD = relative percent difference
- SVOC = semi-volatile organic compound
- VOA = volatile organic analysis
- VOC = volatile organic compound

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Table 3.2 – Data Validation Flags

Data Qualifiers	Definitions
U	The analyte was not detected and was reported as less than the limit of detection (LOQ). The LOQ has been adjusted for any dilution or concentration of the sample.
J	The reported result was an estimated value with an unknown bias.
J+	The result was an estimated quantity, but the result may be biased high.
J-	The result was an estimated quantity, but the result may be biased low.
UJ	The analyte was not detected and was reported as less than the LOQ. However, the associated numerical value is approximate.
X	The sample results (including non-detects) were affected by serious deficiencies in the ability to analyze the sample and to meet published method and project quality control criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance (J-flag) or rejection (R-flag) of the data should be decided by the project team.

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Note: Analytical data will report all detections at or above the detection limit (DL) and qualify all results between the DL and limit of quantitation (LOQ) “J” as estimated. All non-detect results will be reported at the LOQ and qualified “U”.

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Table 3.3 – Human Health Screening Levels in Soil

Analyte	Screening Level Surrogate	Analytical Method ⁽¹⁾	CASRN	Units	Background Value ⁽²⁾	Human Health Screening Levels - Groundwater Protection			Achievable Laboratory Limits		
						NMED Table A-3 and Table 6-4 Risk-based SSL ⁽³⁾	NMED Table A-3 NMGW/MCL based SSL ⁽³⁾	EPA-RSL Calculator Risk-based SSL ⁽⁴⁾	LOQ	LOD	DL
TAL Metals											
Aluminum	-	SW6020B	7429-90-5	mg/kg	23,340	597000	NS	-	11	10	3.77
Antimony	-	SW6020B	7440-36-0	mg/kg	0.23	6.56	5.42	-	0.2	0.12	0.0376
Arsenic	-	SW6020B	7440-38-2	mg/kg	5.60	0.499	5.83	-	0.6	0.2	0.0506
Barium	-	SW6020B	7440-39-3	mg/kg	482	2700	1650	-	0.4	0.2	0.0723
Beryllium	-	SW6020B	7440-41-7	mg/kg	1.49	196	63.2	-	0.1	0.08	0.0225
Cadmium	-	SW6020B	7440-43-9	mg/kg	0.224	9.39	7.52	-	0.1	0.06	0.0203
Calcium	-	SW6020B	7440-70-2	mg/kg	91,760	NS	NS	NS	50	25	8.9
Cobalt	-	SW6020B	7440-48-4	mg/kg	6.82	5.40	NS	-	0.1	0.025	0.00663
Copper	-	SW6020B	7440-50-8	mg/kg	18.4	556	915	-	0.6	0.45	0.2
Iron	-	SW6020B	7439-89-6	mg/kg	22,660	6960	NS	-	15	14	3.94
Lead (5)	-	SW6020B	7439-92-1	mg/kg	12.4	NS	270	-	0.4	0.12	0.0385
Magnesium (6)	-	SW6020B	7439-95-4	mg/kg	8,170	NS	NS	NS	50	10	2.5
Manganese	-	SW6020B	7439-96-5	mg/kg	1,058	2630	NS	-	0.5	0.3	0.0961
Mercury	-	SW7471B	7439-97-6	mg/kg	0.0300	0.654	2.09	-	0.017	0.0133	0.00553
Nickel	-	SW6020B	7440-02-0	mg/kg	19.5	485	NS	-	0.6	0.35	0.169
Potassium	-	SW6020B	7440-09-7	mg/kg	3,950	NS	NS	NS	25	19	5.29
Selenium	-	SW6020B	7782-49-2	mg/kg	0.513	10.2	5.17	-	0.5	0.12	0.0347
Silver	-	SW6020B	7440-22-4	mg/kg	0.130	13.8	NS	-	0.1	0.02	0.00539
Sodium	-	SW6020B	7440-23-5	mg/kg	2,526	NS	NS	NS	40	36	9.04
Thallium	-	SW6020B	7440-28-0	mg/kg	0.213	0.281	2.85	-	0.1	0.06	0.0177
Total Chromium	-	SW6020B	7440-47-3	mg/kg	18.1	205000	3600	-	0.6	0.2	0.0964
Vanadium	-	SW6020B	7440-62-2	mg/kg	27.2	1260	NS	-	0.5	0.3	0.104
Zinc	-	SW6020B	7440-66-6	mg/kg	49.2	7410	NS	-	2	1.4	0.688
Semi-Volatile Organic Compounds											
2,4,5-Trichlorophenol	-	SW8270E	95-95-4	mg/kg	N/A	66.2	NS	-	0.33	0.033	0.01
2,4,6-Trichlorophenol	-	SW8270E	88-06-2	mg/kg	N/A	0.674	NS	-	0.33	0.033	0.01
2,4-Dichlorophenol	-	SW8270E	120-83-2	mg/kg	N/A	0.825	NS	-	0.33	0.033	0.01
2,4-Dimethylphenol	-	SW8270E	105-67-9	mg/kg	N/A	6.45	NS	-	0.33	0.133	0.066
2,4-Dinitrophenol	-	SW8270E	51-28-5	mg/kg	N/A	0.669	NS	-	1.6	1	0.333
2,4-Dinitrotoluene	-	SW8270E	121-14-2	mg/kg	N/A	0.0492	NS	-	0.33	0.133	0.066
2,6-Dinitrotoluene	-	SW8270E	606-20-2	mg/kg	N/A	0.0102	NS	-	0.33	0.067	0.028
2-Chloronaphthalene	-	SW8270E	91-58-7	mg/kg	N/A	57.0	NS	-	0.33	0.033	0.01
2-Chlorophenol	-	SW8270E	95-57-8	mg/kg	N/A	1.15	NS	-	0.33	0.067	0.021
2-Methylphenol	-	SW8270E	95-48-7	mg/kg	N/A	NS	NS	15.1	0.33	0.033	0.013
2-Nitroaniline	-	SW8270E	88-74-4	mg/kg	N/A	NS	NS	1.60	1.6	0.133	0.05
2-Nitrophenol	-	SW8270E	88-75-5	mg/kg	N/A	NS	NS	NS	0.33	0.033	0.01

Table 3.3 – Human Health Screening Levels in Soil

Analyte	Screening Level Surrogate	Analytical Method ⁽¹⁾	CASRN	Units	Background Value ⁽²⁾	Human Health Screening Levels - Groundwater Protection			Achievable Laboratory Limits		
						NMED Table A-3 and Table 6-4 Risk-based SSL ⁽³⁾	NMED Table A-3 NMGW/MCL based SSL ⁽³⁾	EPA-RSL Calculator Risk-based SSL ⁽⁴⁾	LOQ	LOD	DL
						DAF = 20	DAF = 20	adjusted to DAF = 20			
3,3'-Dichlorobenzidine	-	SW8270E	91-94-1	mg/kg	N/A	0.124	NS	-	1.6	0.267	0.09
3-Nitroaniline	4-Nitroaniline	SW8270E	99-09-2	mg/kg	N/A	NS	NS	0.316	1.6	0.267	0.073
4,6-Dinitro-2-Methylphenol	-	SW8270E	534-52-1	mg/kg	N/A	0.0398	NS	-	1.6	1	0.33
4-Bromophenyl-phenyl ether	-	SW8270E	101-55-3	mg/kg	N/A	NS	NS	NS	0.33	0.067	0.019
4-Chloro-3-Methylphenol	-	SW8270E	59-50-7	mg/kg	N/A	NS	NS	34.3	0.33	0.067	0.0248
4-Chloroaniline	-	SW8270E	106-47-8	mg/kg	N/A	NS	NS	0.0311	0.33	0.267	0.0819
4-Chlorophenyl-phenyl ether	-	SW8270E	7005-72-3	mg/kg	N/A	NS	NS	NS	0.33	0.067	0.021
4-Nitroaniline	-	SW8270E	100-01-6	mg/kg	N/A	NS	NS	0.316	1.6	0.267	0.0725
4-Nitrophenol	-	SW8270E	100-02-7	mg/kg	N/A	NS	NS	NS	1.6	0.267	0.097
Bis(2-Chloroethoxy)Methane	-	SW8270E	111-91-1	mg/kg	N/A	NS	NS	0.270	0.33	0.067	0.023
Bis(2-Chloroethyl)Ether	-	SW8270E	111-44-4	mg/kg	N/A	0.000605	NS	-	0.33	0.033	0.0166
Bis(2-Ethylhexyl)Phthalate	-	SW8270E	117-81-7	mg/kg	N/A	200	21.5	-	0.33	0.133	0.046
Butylbenzylphthalate	-	SW8270E	85-68-7	mg/kg	N/A	NS	NS	47.3	0.33	0.133	0.043
Carbazole	Fluorene	SW8270E	86-74-8	mg/kg	N/A	80.0	NS	-	0.33	0.133	0.036
Dibenzofuran	-	SW8270E	132-64-9	mg/kg	N/A	NS	NS	2.91	0.33	0.067	0.02
Diethylphthalate	-	SW8270E	84-66-2	mg/kg	N/A	97.9	NS	-	0.66	0.067	0.026
Dimethylphthalate	-	SW8270E	131-11-3	mg/kg	N/A	NS	NS	NS	0.33	0.067	0.023
Di-N-Butylphthalate	-	SW8270E	84-74-2	mg/kg	N/A	33.8	NS	-	0.33	0.067	0.029
Di-n-Octylphthalate	-	SW8270E	117-84-0	mg/kg	N/A	NS	NS	1,130	0.33	0.133	0.0405
Hexachlorobenzene	-	SW8270E	118-74-1	mg/kg	N/A	0.0185	0.189	-	0.33	0.067	0.029
Hexachlorobutadiene	-	SW8270E	87-68-3	mg/kg	N/A	0.0413	NS	-	0.33	0.033	0.111
Hexachloroethane	-	SW8270E	67-72-1	mg/kg	N/A	0.0320	NS	-	0.33	0.067	0.0213
Isophorone	-	SW8270E	78-59-1	mg/kg	N/A	4.23	NS	-	0.33	0.067	0.017
Nitrobenzene	-	SW8270E	98-95-3	mg/kg	N/A	0.0144	NS	-	0.33	0.067	0.022
N-Nitroso-Di-N-Propylamine	-	SW8270E	621-64-7	mg/kg	N/A	NS	NS	0.00162	0.33	0.167	0.068
N-Nitrosodiphenylamine	-	SW8270E	86-30-6	mg/kg	N/A	10.0	NS	-	0.33	0.067	0.021
Pentachlorophenol	-	SW8270E	87-86-5	mg/kg	N/A	0.0629	0.152	-	1.6	1	0.33
Phenol	-	SW8270E	108-95-2	mg/kg	N/A	52.3	NS	-	0.33	0.067	0.018
Polycyclic Aromatic Hydrocarbons											
2-Methylnaphthalene	-	SW8270E	91-57-6	mg/kg	N/A	2.76	NS	-	0.33	0.067	0.019
Acenaphthene	-	SW8270E	83-32-9	mg/kg	N/A	82.5	0.0309	-	0.33	0.033	0.0103
Acenaphthylene	Pyrene	SW8270E	208-96-8	mg/kg	N/A	192	NS	-	0.33	0.267	0.0821
Anthracene	-	SW8270E	120-12-7	mg/kg	N/A	851	NS	-	0.33	0.067	0.017
Benzo(a)anthracene	-	SW8270E	56-55-3	mg/kg	N/A	0.637	NS	-	0.33	0.067	0.02
Benzo(a)pyrene	-	SW8270E	50-32-8	mg/kg	N/A	4.42	3.53	-	0.33	0.067	0.02
Benzo(b)fluoranthene	-	SW8270E	205-99-2	mg/kg	N/A	6.17	NS	-	0.33	0.067	0.0262
Benzo(k)fluoranthene	-	SW8270E	207-08-9	mg/kg	N/A	60.5	NS	-	0.33	0.133	0.04
Benzo(g,h,i)perylene	Pyrene	SW8270E	191-24-2	mg/kg	N/A	192	NS	-	0.33	0.033	0.016

Table 3.3 – Human Health Screening Levels in Soil

Analyte	Screening Level Surrogate	Analytical Method ⁽¹⁾	CASRN	Units	Background Value ⁽²⁾	Human Health Screening Levels - Groundwater Protection			Achievable Laboratory Limits		
						NMED Table A-3 and Table 6-4 Risk-based SSL ⁽³⁾	NMED Table A-3 NMGW/MCL based SSL ⁽³⁾	EPA-RSL Calculator Risk-based SSL ⁽⁴⁾	LOQ	LOD	DL
						DAF = 20	DAF = 20	adjusted to DAF = 20			
Chrysene	-	SW8270E	218-01-9	mg/kg	N/A	186	NS	-	0.33	0.067	0.027
Dibenz(a,h)anthracene	-	SW8270E	53-70-3	mg/kg	N/A	1.97	NS	-	0.33	0.067	0.019
Fluoranthene	-	SW8270E	206-44-0	mg/kg	N/A	1340	NS	-	0.33	0.133	0.036
Fluorene	-	SW8270E	86-73-7	mg/kg	N/A	80.0	NS	-	0.33	0.067	0.018
Indeno(1,2,3-cd)pyrene	-	SW8270E	193-39-5	mg/kg	N/A	20.1	NS	-	0.33	0.067	0.022
Naphthalene	-	SW8270E	91-20-3	mg/kg	N/A	0.0583	NS	-	0.33	0.067	0.031
Phenanthrene	-	SW8270E	85-01-8	mg/kg	N/A	85.9	NS	-	0.33	0.067	0.017
Pyrene	-	SW8270E	129-00-0	mg/kg	N/A	192	NS	-	0.4	0.033	0.0121
2-Methylnaphthalene	-	SW8270E SIM	91-57-6	mg/kg	N/A	2.76	NS	-	0.01	0.002	0.000618
Acenaphthene	-	SW8270E SIM	83-32-9	mg/kg	N/A	82.5	0.0309	-	0.01	0.002	0.000924
Acenaphthylene	Pyrene	SW8270E SIM	208-96-8	mg/kg	N/A	192	NS	-	0.01	0.002	0.000775
Anthracene	-	SW8270E SIM	120-12-7	mg/kg	N/A	851	NS	-	0.01	0.00433	0.00144
Benzo(a)anthracene	-	SW8270E SIM	56-55-3	mg/kg	N/A	0.637	NS	-	0.01	0.00433	0.0018
Benzo(a)pyrene	-	SW8270E SIM	50-32-8	mg/kg	N/A	4.42	3.53	-	0.01	0.00433	0.00148
Benzo(b)fluoranthene	-	SW8270E SIM	205-99-2	mg/kg	N/A	6.17	NS	-	0.01	0.00667	0.0024
Benzo(k)fluoranthene	-	SW8270E SIM	207-08-9	mg/kg	N/A	60.5	NS	-	0.01	0.00433	0.002
Benzo(g,h,i)perylene	Pyrene	SW8270E SIM	191-24-2	mg/kg	N/A	192	NS	-	0.01	0.00667	0.0022
Chrysene	-	SW8270E SIM	218-01-9	mg/kg	N/A	186	NS	-	0.01	0.00433	0.002
Dibenz(a,h)anthracene	-	SW8270E SIM	53-70-3	mg/kg	N/A	1.97	NS	-	0.01	0.00667	0.0026
Fluoranthene	-	SW8270E SIM	206-44-0	mg/kg	N/A	1340	NS	-	0.01	0.00433	0.002
Fluorene	-	SW8270E SIM	86-73-7	mg/kg	N/A	80.0	NS	-	0.01	0.00267	0.00094
Indeno(1,2,3-cd)pyrene	-	SW8270E SIM	193-39-5	mg/kg	N/A	20.1	NS	-	0.01	0.00667	0.0022
Naphthalene	-	SW8270E SIM	91-20-3	mg/kg	N/A	0.0583	NS	-	0.01	0.002	0.000652
Phenanthrene	-	SW8270E SIM	85-01-8	mg/kg	N/A	85.9	NS	-	0.01	0.00667	0.0022
Pyrene	-	SW8270E SIM	129-00-0	mg/kg	N/A	192	NS	-	0.01	0.00667	0.0022
Volatile Organic Compounds											
1,1,1,2-Tetrachloroethane	-	SW8260D	630-20-6	mg/kg	N/A	0.0360	NS	-	0.005	0.004	0.00222
1,1,1-Trichloroethane	-	SW8260D	71-55-6	mg/kg	N/A	51.1	1.28	-	0.005	0.004	0.00198
1,1,2,2-Tetrachloroethane	-	SW8260D	79-34-5	mg/kg	N/A	0.00481	NS	-	0.005	0.0008	0.000285
1,1,2-Trichloroethane	-	SW8260D	79-00-5	mg/kg	N/A	0.00223	0.0268	-	0.005	0.0032	0.00088
1,1-Dichloroethane	-	SW8260D	75-34-3	mg/kg	N/A	0.136	NS	-	0.005	0.0008	0.00021
1,1-Dichloroethene	-	SW8260D	75-35-4	mg/kg	N/A	1.95	0.0479	-	0.005	0.0016	0.00059
1,1-Dichloropropene	1,3-Dichloropropene	SW8260D	563-58-6	mg/kg	N/A	0.0281	NS	-	0.005	0.0004	0.000164
1,2,3-Trichlorobenzene	-	SW8260D	87-61-6	mg/kg	N/A	NS	NS	0.418	0.005	0.0032	0.00081
1,2,3-Trichloropropane	-	SW8260D	96-18-4	mg/kg	N/A	0.0000582	NS	-	0.005	0.0008	0.000218
1,2,4-Trichlorobenzene	-	SW8260D	120-82-1	mg/kg	N/A	0.176	3.10	-	0.005	0.0016	0.00073
1,2,4-Trimethylbenzene	-	SW8260D	95-63-6	mg/kg	N/A	NS	NS	1.62	0.005	0.004	0.00231

Table 3.3 – Human Health Screening Levels in Soil

Analyte	Screening Level Surrogate	Analytical Method ⁽¹⁾	CASRN	Units	Background Value ⁽²⁾	Human Health Screening Levels - Groundwater Protection			Achievable Laboratory Limits		
						NMED Table A-3 and Table 6-4 Risk-based SSL ⁽³⁾	NMED Table A-3 NMGW/MCL based SSL ⁽³⁾	EPA-RSL Calculator Risk-based SSL ⁽⁴⁾	LOQ	LOD	DL
						DAF = 20	DAF = 20	adjusted to DAF = 20			
1,2-Dibromo-3-Chloropropane	-	SW8260D	96-12-8	mg/kg	N/A	0.0000233	0.00139	-	0.01	0.009	0.00366
1,2-Dibromoethane	-	SW8260D	106-93-4	mg/kg	N/A	0.000352	0.000236	-	0.005	0.0016	0.00052
1,2-Dichlorobenzene	-	SW8260D	95-50-1	mg/kg	N/A	4.58	9.08	-	0.005	0.004	0.00187
1,2-Dichloroethane	-	SW8260D	107-06-2	mg/kg	N/A	0.00814	0.0238	-	0.005	0.0016	0.0007
1,2-Dichloropropane	-	SW8260D	78-87-5	mg/kg	N/A	0.0243	0.0277	-	0.005	0.0016	0.00055
1,3,5-Trimethylbenzene	-	SW8260D	108-67-8	mg/kg	N/A	NS	NS	1.73	0.005	0.004	0.00242
1,3-Dichloropropane	-	SW8260D	142-28-9	mg/kg	N/A	NS	NS	2.57	0.005	0.0004	0.000173
1,3-Dichlorobenzene	1,4-Dichlorobenzene	SW8260D	541-73-1	mg/kg	N/A	0.0720	1.12	-	0.005	0.0016	0.00048
1,4-Dichlorobenzene	-	SW8260D	106-46-7	mg/kg	N/A	0.0720	1.12	-	0.005	0.0008	0.000245
2,2-Dichloropropane	1,2-Dichloropropane	SW8260D	594-20-7	mg/kg	N/A	0.0243	0.0277	-	0.005	0.0016	0.00044
2-Butanone (MEK)	-	SW8260D	78-93-3	mg/kg	N/A	20.1	NS	-	0.02	0.0128	0.00389
2-Chlorotoluene	-	SW8260D	95-49-8	mg/kg	N/A	3.56	NS	-	0.005	0.0016	0.00051
2-Hexanone	-	SW8260D	591-78-6	mg/kg	N/A	NS	NS	0.175	0.02	0.0128	0.00489
4-Chlorotoluene	-	SW8260D	106-43-4	mg/kg	N/A	NS	NS	4.83	0.005	0.0008	0.000361
4-Methyl-2-Pentanone (MIBK)	-	SW8260D	108-10-1	mg/kg	N/A	4.80	NS	-	0.02	0.0128	0.00436
Acetone	-	SW8260D	67-64-1	mg/kg	N/A	49.8	NS	-	0.072	0.07	0.0356
Benzene	-	SW8260D	71-43-2	mg/kg	N/A	0.0380	0.0418	-	0.005	0.0004	0.000151
Bromobenzene	-	SW8260D	108-86-1	mg/kg	N/A	NS	NS	0.842	0.005	0.0016	0.00049
Bromochloromethane	-	SW8260D	74-97-5	mg/kg	N/A	NS	NS	0.415	0.005	0.004	0.00246
Bromodichloromethane	-	SW8260D	75-27-4	mg/kg	N/A	0.00621	NS	-	0.005	0.004	0.00213
Bromoform	-	SW8260D	75-25-2	mg/kg	N/A	0.147	NS	-	0.0051	0.005	0.00255
Bromomethane	-	SW8260D	74-83-9	mg/kg	N/A	0.0343	NS	-	0.01	0.0032	0.00135
Carbon Disulfide	-	SW8260D	75-15-0	mg/kg	N/A	4.42	NS	-	0.005	0.004	0.00166
Carbon Tetrachloride	-	SW8260D	56-23-5	mg/kg	N/A	0.0334	0.0367	-	0.005	0.004	0.00201
Chlorobenzene	-	SW8260D	108-90-7	mg/kg	N/A	0.836	1.08	-	0.005	0.004	0.00206
Chloroethane	-	SW8260D	75-00-3	mg/kg	N/A	107	NS	-	0.01	0.0064	0.00199
Chloroform	-	SW8260D	67-66-3	mg/kg	N/A	0.0109	NS	-	0.01	0.0008	0.00029
Chloromethane	-	SW8260D	74-87-3	mg/kg	N/A	0.0952	NS	-	0.01	0.0016	0.00077
cis-1,2-Dichloroethene	-	SW8260D	156-59-2	mg/kg	N/A	0.184	0.352	-	0.005	0.0008	0.000201
cis-1,3-Dichloropropene	1,3-Dichloropropene	SW8260D	10061-01-5	mg/kg	N/A	0.0281	NS	-	0.005	0.0004	0.0001
Dibromochloromethane	-	SW8260D	124-48-1	mg/kg	N/A	0.00755	NS	-	0.005	0.004	0.00227
Dibromomethane	-	SW8260D	74-95-3	mg/kg	N/A	0.0335	NS	-	0.005	0.0008	0.000317
Dichlorodifluoromethane	-	SW8260D	75-71-8	mg/kg	N/A	7.23	NS	-	0.01	0.0064	0.00274
Ethylbenzene	-	SW8260D	100-41-4	mg/kg	N/A	0.264	12.3	-	0.005	0.0008	0.000305
Hexachlorobutadiene	-	SW8260D	87-68-3	mg/kg	N/A	0.0413	NS	-	0.005	0.004	0.00217
Isopropylbenzene	-	SW8260D	98-82-8	mg/kg	N/A	11.4	NS	-	0.005	0.004	0.00241
m,p-Xylenes	Xylenes	SW8260D	179601-23-1	mg/kg	N/A	2.98	154	-	0.0032	0.003	0.00104

Table 3.3 – Human Health Screening Levels in Soil

Analyte	Screening Level Surrogate	Analytical Method ⁽¹⁾	CASRN	Units	Background Value ⁽²⁾	Human Health Screening Levels - Groundwater Protection			Achievable Laboratory Limits		
						NMED Table A-3 and Table 6-4 Risk-based SSL ⁽³⁾	NMED Table A-3 NMGW/MCL based SSL ⁽³⁾	EPA-RSL Calculator Risk-based SSL ⁽⁴⁾	LOQ	LOD	DL
						DAF = 20	DAF = 20	adjusted to DAF = 20			
Methyl Tert-Butyl Ether	-	SW8260D	1634-04-4	mg/kg	N/A	0.553	NS	-	0.02	0.0064	0.00211
Methylene Chloride	-	SW8260D	75-09-2	mg/kg	N/A	0.471	0.0221	-	0.005	0.0032	0.0016
Naphthalene	-	SW8260D	91-20-3	mg/kg	N/A	0.0583	NS	-	0.0067	0.005	0.00331
n-Butylbenzene	-	SW8260D	104-51-8	mg/kg	N/A	NS	NS	64.6	0.005	0.0016	0.00056
n-Propylbenzene	-	SW8260D	103-65-1	mg/kg	N/A	NS	NS	24.5	0.005	0.0016	0.00058
o-Xylene	-	SW8260D	95-47-6	mg/kg	N/A	2.98	NS	-	0.005	0.0008	0.000266
4-Isopropyltoluene	Isopropylbenzene	SW8260D	99-87-6	mg/kg	N/A	11.4	NS	-	0.005	0.0032	0.00114
Sec-Butylbenzene	-	SW8260D	135-98-8	mg/kg	N/A	NS	NS	117	0.005	0.0016	0.00077
Styrene	-	SW8260D	100-42-5	mg/kg	N/A	20.6	1.71	-	0.005	0.0008	0.00028
Tert-Butylbenzene	-	SW8260D	98-06-6	mg/kg	N/A	NS	NS	31.1	0.005	0.0016	0.0005
Tetrachloroethene	-	SW8260D	127-18-4	mg/kg	N/A	0.321	0.0398	-	0.005	0.004	0.00191
Toluene	-	SW8260D	108-88-3	mg/kg	N/A	12.1	11.1	-	0.005	0.0008	0.000227
Trans-1,2-Dichloroethene	-	SW8260D	156-60-5	mg/kg	N/A	0.342	0.503	-	0.005	0.0008	0.00039
Trans-1,3-Dichloropropene	1,3-Dichloropropene	SW8260D	10061-02-6	mg/kg	N/A	0.0281	NS	-	0.005	0.0002	0.000083
Trichloroethene	-	SW8260D	79-01-6	mg/kg	N/A	0.0161	0.0310	-	0.005	0.004	0.00191
Trichlorofluoromethane	-	SW8260D	75-69-4	mg/kg	N/A	15.7	NS	-	0.01	0.009	0.0032
Vinyl Chloride	-	SW8260D	75-01-4	mg/kg	N/A	0.00217	0.0134	-	0.005	0.0032	0.00134
Explosives											
1,3,5-Trinitrobenzene	-	SW8330B	99-35-4	mg/kg	N/A	NS	NS	42.4	0.1	0.04	0.0138
1,3-Dinitrobenzene	-	SW8330B	99-65-0	mg/kg	N/A	NS	NS	0.0353	0.1	0.04	0.0166
2,4-Dinitrotoluene	-	SW8330B	121-14-2	mg/kg	N/A	0.0492	NS	-	0.1	0.04	0.0147
2,6-Dinitrotoluene	-	SW8330B	606-20-2	mg/kg	N/A	0.0102	NS	-	0.1	0.04	0.0191
2,4,6-Trinitrotoluene (TNT)	-	SW8330B	118-96-7	mg/kg	N/A	0.861	NS	-	0.1	0.07	0.0307
2-Amino-4,6-Dinitrotoluene	-	SW8330B	35572-78-2	mg/kg	N/A	0.0230	NS	-	0.1	0.07	0.0329
2-Nitrotoluene	-	SW8330B	88-72-2	mg/kg	N/A	0.0458	NS	-	0.2	0.1	0.0472
3-Nitrotoluene	-	SW8330B	99-08-1	mg/kg	N/A	0.0250	NS	-	0.2	0.15	0.064
4-Amino-2,6-Dinitrotoluene	-	SW8330B	19406-51-0	mg/kg	N/A	0.0230	NS	-	0.1	0.07	0.0299
4-Nitrotoluene	-	SW8330B	99-99-0	mg/kg	N/A	0.613	NS	-	0.2	0.1	0.0365
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	-	SW8330B	121-82-4	mg/kg	N/A	0.0593	NS	-	0.2	0.1	0.043
Methyl-2,4,6-trinitrophenylnitramine (Tetryl)	-	SW8330B	479-45-8	mg/kg	N/A	5.59	NS	-	0.2	0.1	0.0439
Nitrobenzene	-	SW8330B	98-95-3	mg/kg	N/A	0.0144	NS	-	0.3	0.2	0.085
Nitroglycerin	-	SW8330B	55-63-0	mg/kg	N/A	0.0136	NS	-	2	0.7	0.215
Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	-	SW8330B	2691-41-0	mg/kg	N/A	19.4	NS	-	0.1	0.07	0.0227
Pentaerythritol Tetranitrate (PETN)	-	SW8330B	78-11-5	mg/kg	N/A	N/A	NS	5.18	2	1	0.493

Table 3.3 – Human Health Screening Levels in Soil

Analyte	Screening Level Surrogate	Analytical Method ⁽¹⁾	CASRN	Units	Background Value ⁽²⁾	Human Health Screening Levels - Groundwater Protection			Achievable Laboratory Limits		
						NMED Table A-3 and Table 6-4 Risk-based SSL ⁽³⁾	NMED Table A-3 NMGW/MCL based SSL ⁽³⁾	EPA-RSL Calculator Risk-based SSL ⁽⁴⁾	LOQ	LOD	DL
						DAF = 20	DAF = 20	adjusted to DAF = 20			
Total Phosphorus											
Total Phosphorus	-	EPA 365.1	STL00988	mg/kg	N/A	NS	NS	NS	76.5	61.4	30.7
Anions											
Nitrate as N	-	SW9056A	14797-55-8	mg/kg	N/A	425	135	-	5	4.61	0.842
Nitrite as N	-	SW9056A	14797-65-0	mg/kg	N/A	26.6	13.5	-	5	4.61	1.28
Bromide	-	SW9056A	24959-67-9	mg/kg	N/A	NS	NS	NS	2	2	0.92
Chloride	-	SW9056A	16887-00-6	mg/kg	N/A	NS	NS	NS	30	30	11.5
Fluoride	-	SW9056A	16984-48-8	mg/kg	N/A	NS	NS	2,400	10	2	0.82
Sulfate	-	SW9056A	14808-79-8	mg/kg	N/A	NS	NS	NS	50	25	9.15

- Notes:**
1. Analytical Method - EPA Test Methods for Evaluating Solid Waste latest edition (the most current version of each method the laboratory is accredited to will be used).

2. Selected FWDA background values are presented in Table 8-1 from *Soil Background Study and Data Evaluation Report* (Shaw, 2010), except arsenic and antimony:

- The arsenic background reference value is 5.6 mg/kg per Evaluation of Background Levels for Arsenic in Soil (NMED, 2013b). If the maximum arsenic concentration is greater than 5.6 mg/kg, then the range of arsenic concentrations in the sample data set is to be compared to the range of arsenic concentrations in the site-specific background data set (0.2 mg/kg to 11.2 mg/kg).

- The antimony background level of 0.23 mg/kg is from soil unit 350ss as presented in Table 4-1 of the *Phase 2 Soil Background Report* (USACE, 2013).

3. NMED *Risk Assessment Guidance for Site Investigations and Remediation* , November 2022 Revised (Appendix A, Table A-3, risk-based SSL and NMGW/MCL-based SSL, and Table 6-4 for petroleum hydrocarbon mixtures; DAF=20).

4. USEPA RSL Calculator (TR=1E-05, HQ=1), November 2023 (protection of groundwater risk-based SSL). All analytes are adjusted to a DAF of 20.

5. Lead human health screening levels appear in the non-cancer column, but the health effects of lead are not correlated with the typical carcinogenic or non-carcinogenic dose-based toxicity values that characterize other chemicals. Instead, the screening level for lead is based on a modeled concentration in soil that results in an acceptable blood lead level protective of adverse developmental health effects (USEPA, 2024).

6. The background value for manganese is greater than the NMED human health screening level for direct contact.
- Cells shaded in blue show that the screening level is lower than the achievable LOQ.

Acronyms and Abbreviations:

- CASRN = Chemical Abstracts Service Registry Number

DAF = Dilution attenuation factor

DL = Detection limit

DRO = Diesel-range organics

EPA = United States Environmental Protection Agency

FWDA = Fort Wingate Depot Activity

GRO = Gasoline-range organics

HQ = Hazard quotient
- LOD = Limit of detection

LOQ = Limit of quantitation

MCL = Maximum contaminant level

mg/kg = Milligram per kilogram

N/A = Not applicable

NMED = New Mexico Environment Department

NMGW = New Mexico groundwater

Table 3.4 – Groundwater Laboratory Analysis and Risk Evaluation Criteria

Method	Analyte	CAS	Water												
			Units	EPA MCL ^{1,2}	20.6.2 NMAC NM WQCC ³	Nov. 2023 EPA RSL Cancer Tap Water (target excess cancer risk level of 10 ⁻⁶)	Nov. 2023 EPA RSL Cancer Tap Water (target excess cancer risk level of 10 ⁻⁵)	Nov. 2023 EPA RSL Noncancer Tap Water (target hazard quotient of 1)	Final Selected SL ⁴	Final Selected SL Reference	Risk Endpoint c/nc	LOQ	LOD	DL	Notes
6020B	Aluminum	7429-90-5	µg/L	200	5,000			20,000	200	WQCC		200	30.0	8.25	
6020B	Calcium ⁷	7440-70-2	µg/L						NA			200	100	32.3	
6020B	Iron	7439-89-6	µg/L	300	1,000			14,000	300	WQCC		200	40.0	8.67	
6020B	Magnesium ⁷	7439-95-4	µg/L						NA			200	15.0	4.16	
6020B	Potassium ⁷	7440-09-7	µg/L						NA			1000	76.0	52.0	
6020B	Sodium ⁷	7440-23-5	µg/L						NA			1000	150	73.3	
6020B	Antimony	7440-36-0	µg/L	6	6			7.8	6	WQCC		2.00	1.00	0.400	
6020B	Arsenic	7440-38-2	µg/L	10	10	0.052	0.52	6	10	WQCC		5.00	2.00	0.500	
6020B	Barium	7440-39-3	µg/L	2,000	2,000			3,800	2,000	WQCC		3.00	0.950	0.380	
6020B	Beryllium	7440-41-7	µg/L	4	4			25	4	WQCC		1.00	0.600	0.303	
6020B	Cadmium	7440-43-9	µg/L	5	5			1.8	5	WQCC		1.00	0.750	0.190	
6020B	Chromium	7440-47-3	µg/L	100	50				50	WQCC		3.00	1.80	0.500	
6020B	Cobalt	7440-48-4	µg/L		50			6	50	WQCC		1.00	0.900	0.330	
6020B	Copper	7440-50-8	µg/L	1,300	1,000			800	1,000	WQCC		2.00	1.80	0.710	
6020B	Lead	7439-92-1	µg/L	15	15			15	15	WQCC		1.00	0.700	0.230	
6020B	Manganese	7439-96-5	µg/L	50	200			430	50	WQCC		3.00	1.80	0.510	
6020B	Nickel	7440-02-0	µg/L		200			390	200	WQCC		3.00	1.90	0.830	
6020B	Selenium	7782-49-2	µg/L	50	50			100	50	WQCC		5.00	4.00	1.00	
6020B	Silver	7440-22-4	µg/L	100	50			94	50	WQCC		1.00	0.150	0.0450	
6020B	Thallium	7440-28-0	µg/L	2	2			0.2	2	WQCC		1.00	0.750	0.210	
6020B	Vanadium	7440-62-2	µg/L					86	86	RSL	nc	5.00	3.00	1.12	
6020B	Zinc	7440-66-6	µg/L	5,000	10,000			6,000	5,000	WQCC		10.0	8.00	2.00	
7470A/ 7471B	Mercury	7439-97-6	µg/L	2	2			0.63	2	WQCC		0.200	0.0800	0.0610	
8015D	Diesel Range Organics (DRO) [C10 C28]	68334-30-5	µg/L						16.7	NMED RAG ⁶		0.250	0.120	0.0326	
8015D	Gasoline Range Organics (GRO) [C6 C10]	8006-61-9	µg/L						10.1	NMED RAG ⁶		25.0	20.0	10.0	
8260D	1,1,1,2-Tetrachloroethane	630-20-6	µg/L			0.57	5.7	480	5.7	RSL	c	1.00	0.8	0.577	
8260D	1,1,1-Trichloroethane	71-55-6	µg/L	200	200			8,000	200	WQCC		1.00	0.5	0.39	
8260D	1,1,2,2-Tetrachloroethane	79-34-5	µg/L		10	0.076	0.76	360	10	WQCC		1.00	0.8	0.21	
8260D	1,1,2-Trichloroethane	79-00-5	µg/L	5	5	0.28	2.8	0.41	5	WQCC		1.00	0.8	0.27	
8260D	1,1-Dichloroethane	75-34-3	µg/L		25	2.8	28	3,800	25	WQCC		1.00	0.8	0.22	

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8260D	1,1-Dichloroethene	75-35-4	µg/L	7	7			280	7	WQCC		1.00	0.8	0.23	
8260D	1,1-Dichloropropene (surrogate dichloropropene, 1,3)	563-58-6	µg/L			0.47	4.7	39	4.7	RSL	c	1.00	0.8	0.416	
8260D	1,2,3-Trichlorobenzene	87-61-6	µg/L					7	7	RSL	nc	2.00	0.8	0.704	
8260D	1,2,3-Trichloropropane	96-18-4	µg/L			0.00075	0.0075	0.62	0.0075	RSL	c	2.50	1.8	0.858	
8260D	1,2,4-Trichlorobenzene	120-82-1	µg/L	70	70	1.2	12	4	70	WQCC		1.00	0.8	0.584	
8260D	1,2,4-Trimethylbenzene	95-63-6	µg/L					56	56	RSL	nc	1.00	0.4	0.15	
8260D	1,2-Dibromo-3-Chloropropane	96-12-8	µg/L	0.2		0.00033	0.0033	0.37	0.2	MCL		5.00	4	1.76	
8260D	1,2-Dibromoethane	106-93-4	µg/L	0.05	0.05	0.0075	0.075	17	0.05	MCL		1.00	0.8	0.404	
8260D	1,2-Dichlorobenzene	95-50-1	µg/L	600	600			300	600	WQCC		1.00	0.5	0.372	
8260D	1,2-Dichloroethane	107-06-2	µg/L	5	5	0.17	1.7	13	5	WQCC		1.00	0.8	0.541	
8260D	1,3,5-Trimethylbenzene	108-67-8	µg/L					60	60	RSL	nc	1.00	0.5	0.368	
8260D	1,3-Dichlorobenzene (surrogate dichlorobenzene, 1,4)	541-73-1	µg/L	75	75	0.48	4.8	570	75	WQCC		1.00	0.4	0.334	
8260D	1,3-Dichloropropane	142-28-9	µg/L					370	370	RSL	nc	1.00	0.8	0.379	
8260D	1,4-Dichlorobenzene	106-46-7	µg/L	75	75	0.48	4.8	570	75	WQCC		1.00	0.5	0.389	
8260D	2,2-Dichloropropane (surrogate dichloropropane, 1,2)	594-20-7	µg/L	5	5	0.85	8.5	8.2	5	MCL		1.00	0.8	0.38	
8260D	2-Butanone (MEK)	78-93-3	µg/L					5,600	5,600	RSL	nc	15.00	12	5.95	
8260D	2-Chlorotoluene	95-49-8	µg/L					240	240	RSL	nc	1.00	0.4	0.341	
8260D	2-Hexanone	591-78-6	µg/L					38	38	RSL	nc	5.00	4	1.7	
8260D	4-Chlorotoluene	106-43-4	µg/L					250	250	RSL	nc	1.00	0.8	0.21	
8260D	4-Methyl-2-pentanone (MIBK)	108-10-1	µg/L					6,300	6,300	RSL	nc	5.00	3.2	0.98	methyl isobutyl ketone
8260D	Acetone	67-64-1	µg/L					18,000	18,000	RSL	nc	15.00	8	6.6	
8260D	Benzene	71-43-2	µg/L	5	5	0.46	4.6	33	5	WQCC		1.00	0.8	0.308	
8260D	Bromobenzene	108-86-1	µg/L					62	62	RSL	nc	1.00	0.5	0.397	
8260D	Bromochloromethane	74-97-5	µg/L					83	83	RSL	nc	1.00	0.8	0.403	
8260D	Bromodichloromethane	75-27-4	µg/L	80		0.13	1.3	150	80	MCL		1.00	0.5	0.386	
8260D	Bromoform	75-25-2	µg/L	80		3.3	33	380	80	MCL		2.00	1.8	1.21	
8260D	Bromomethane	74-83-9	µg/L					7.5	7.5	RSL	nc	5.00	4	2.36	
8260D	Carbon disulfide	75-15-0	µg/L					810	810	RSL	nc	2.00	0.8	0.631	
8260D	Carbon tetrachloride	56-23-5	µg/L	5	5	0.46	4.6	49	5	WQCC		1.00	0.8	0.566	
8260D	Chlorobenzene	108-90-7	µg/L	100				78	100	MCL		1.00	0.8	0.422	
8260D	Chloroethane	75-00-3	µg/L					8,300	8,300	RSL	nc	4.00	1.6	1.37	

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8260D	Chloroform	67-66-3	µg/L	80	100	0.22	2.2	97	80	MCL		1.00	0.8	0.358	
8260D	Chloromethane	74-87-3	µg/L					190	190	RSL	c	2.00	1	0.753	
8260D	cis-1,2-Dichloroethene	156-59-2	µg/L	70	70			25	70	WQCC		1.00	0.4	0.321	
8260D	cis-1,3-Dichloropropene (surrogate Dichloropropene, 1,3)	10061-01-5	µg/L			0.47	4.7	39	4.7	RSL	c	2.00	1.8	0.626	
8260D	Dibromochloromethane	124-48-1	µg/L	80		0.87	8.7	380	80	MCL		2.00	1.8	0.618	
8260D	Dibromomethane	74-95-3	µg/L					8.3	8.3	RSL	nc	1.00	0.4	0.343	
8260D	Dichlorodifluoromethane	75-71-8	µg/L					200	200	RSL	nc	3.00	2.5	0.962	
8260D	Ethylbenzene	100-41-4	µg/L	700	700	1.5	15	500	700	WQCC		1.00	0.4	0.303	
8260D	Hexachlorobutadiene	87-68-3	µg/L			0.14	1.4	6.5	1.4	RSL	c	2.00	1.8	1.17	8260 and 8270
8260D	Isopropylbenzene	98-82-8	µg/L					450	450	RSL	nc	1.00	0.5	0.363	
8260D	Methyl acetate	79-20-9	µg/L					20,000	20,000	RSL	nc	5.00	4	1.64	
8260D	Methyl tert butyl ether	1634-04-4	µg/L		100	14	140	6,300	100	WQCC	c	5.00	0.8	0.25	
8260D	Methylene Chloride	75-09-2	µg/L	5	5	11	110	110	5	WQCC		2.00	1.8	0.938	
8260D	m-Xylene & p Xylene	179601-23-1	µg/L	10,000	620			190	620	WQCC	nc	2.00	0.8	0.356	
8260D	Naphthalene	91-20-3	µg/L		30	0.12	1.2	6.1	30	WQCC		2.00	0.8	0.634	
8260D	n-Butylbenzene	104-51-8	µg/L					1000	1,000	RSL	nc	1.00	0.8	0.475	
8260D	N-Propylbenzene	103-65-1	µg/L					660	660	RSL	nc	1.00	0.8	0.531	
8260D	o-Xylene	95-47-6	µg/L	10,000	620			190	620	WQCC	nc	1.00	0.4	0.331	
8260D	sec-Butylbenzene	135-98-8	µg/L					2,000	2,000	RSL	nc	1.00	0.8	0.447	
8260D	Styrene	100-42-5	µg/L	100	100			1,200	100	WQCC		1.00	0.8	0.356	
8260D	tert-Butylbenzene	98-06-6	µg/L					690	690	RSL	nc	1.00	0.8	0.421	
8260D	Toluene	108-88-3	µg/L	1,000	1,000			1,100	1,000	WQCC		1.00	0.4	0.322	
8260D	trans-1,2-Dichloroethene	156-60-5	µg/L	100	100			68	100	WQCC		1.00	0.5	0.368	
8260D	trans-1,3-Dichloropropene (surrogate Dichloropropene, 1,3)	10061-02-6	µg/L			0.47	4.7	39	4.7	RSL	c	2.00	1.8	0.646	
8260D	Trichloroethene	79-01-6	µg/L	5	5	0.49	4.9	2.8	5	WQCC		1.00	0.4	0.3	
8260D	Trichlorofluoromethane	75-69-4	µg/L					5,200	5,200	RSL	nc	2.00	0.8	0.566	
8260D	Vinyl chloride	75-01-4	µg/L	2	2	0.019	0.19	44	2	WQCC		2.00	1	0.505	
8270E	1,2,4-Trichlorobenzene	120-82-1	µg/L	70	70	1.2	12	4	70	WQCC		1.00	0.8	0.584	
8270E	1,2-Dichlorobenzene	95-50-1	µg/L	600	600			300	600	WQCC		1.00	0.5	0.372	
8270E	1,3-Dichlorobenzene (Surrogate dichlorobenzene, 1,4)	541-73-1	µg/L	75	75	0.48	4.8	570	75	WQCC		1.00	0.4	0.334	

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8270E	1,4-Dichlorobenzene	106-46-7	µg/L	75	75	0.48	4.8	570	75	WQCC		1.00	0.5	0.389	
8270E	2,2-Oxybis(1-chloropropane)	108-60-1	µg/L					710	710	RSL	c	10.00	8	1.31	bis-(2-chloroisopropyl) ether
8270E	2,4,5-Trichlorophenol	95-95-4	µg/L					1,200	1,200	RSL	nc	10.00	8	0.9	
8270E	2,4,6-Trichlorophenol	88-06-2	µg/L			4.1	41	12	12	RSL	nc	10.00	8	0.71	
8270E	2,4-Dichlorophenol	120-83-2	µg/L					46	46	RSL	nc	10.00	8	0.64	
8270E	2,4-Dimethylphenol	105-67-9	µg/L					360	360	RSL	nc	10.00	8	1.36	
8270E	2,4-Dinitrophenol	51-28-5	µg/L					39	39	RSL	nc	30.00	20	12.8	
8270E	2,4-Dinitrotoluene	121-14-2	µg/L			0.24	2.4	38	2.4	RSL	c	10.00	8	1.43	
8270E	2,6-Dinitrotoluene	606-20-2	µg/L			0.049	0.49	5.7	0.49	RSL	c	10.00	8	1.42	8270 and 8330
8270E	2-Chloronaphthalene	91-58-7	µg/L					750	750	RSL	nc	4.00	3.2	1.27	
8270E	2-Chlorophenol	95-57-8	µg/L					91	91	RSL	nc	10.00	8	0.68	
8270E	2-Methylnaphthalene	91-57-6	µg/L		30			36	30	WQCC		4.00	3.2	1.22	
8270E	2-Methylphenol	95-48-7	µg/L					930	930	RSL	nc	10.00	8	0.77	
8270E	2-Nitroaniline	88-74-4	µg/L					190	190	RSL	nc	10.00	3.2	2.61	
8270E	2-Nitrophenol	88-75-5	µg/L						NS			10.00	8	3.48	
8270E	4-Methylphenol	106-44-5	µg/L					370	370	RSL	nc	10.00	8	0.8	4-methylphenol (**)
8270E	3,3-Dichlorobenzidine	91-94-1	µg/L			0.13	1.3		1.3	RSL	c	50.00	30	3.38	
8270E	3-Nitroaniline (<i>Surrogate 4-nitroaniline</i>)	99-09-2	µg/L			3.8	38	78	38	RSL	c	10.00	8	3.34	
8270E	4,6-Dinitro-2-methylphenol	534-52-1	µg/L					1.5	1.5	RSL	nc	50.00	30	4.03	
8270E	4-Bromophenyl phenyl ether	101-55-3	µg/L						NS			10.00	8	1.01	
8270E	4-Chloro-3-methylphenol	59-50-7	µg/L					1,400	1,400	RSL	nc	10.00	8	0.69	
8270E	4-Chloroaniline	106-47-8	µg/L			0.37	3.7	9.5	3.7	RSL	c	20.00	12.8	6.28	
8270E	4-Chlorophenyl phenyl ether	7005-72-3	µg/L						NS			10.00	8	1.24	
8270E	4-Nitroaniline	100-01-6	µg/L			3.8	38	78	38	RSL	c	10.00	8	2.61	
8270E	4-Nitrophenol (<i>Surrogate 2-chlorophenol</i>)	100-02-7	µg/L					91	91	RSL	nc	25.00	12.8	9.05	
8270E	Acenaphthene	83-32-9	µg/L					530	530	RSL	nc	4.00	3.2	0.96	
8270E	Acenaphthylene (<i>surrogate Pyrene</i>)	208-96-8	µg/L					120	120	RSL	nc	4.00	3.2	0.746	
8270E	Anthracene	120-12-7	µg/L					1,800	1,800	RSL	nc	4.00	3.2	0.58	
8270E	Benzaldehyde	100-52-7	µg/L			19	190	1,900	190	RSL	c	5.00	3.2	1.16	
8270E	Benzo[a]anthracene	56-55-3	µg/L			0.03	0.3		0.3	RSL	c	4.00	3.2	0.39	
8270E	Benzo[a]pyrene	50-32-8	µg/L	0.2	0.2	0.025	0.25	6	0.2	WQCC		4.00	3.2	0.5	
8270E	Benzo[b]fluoranthene	205-99-2	µg/L			0.25	2.5		2.5	RSL	c	4.00	3.2	1.19	
8270E	Benzo[g,h,i]perylene (<i>surrogate Pyrene</i>)	191-24-2	µg/L					120	120	RSL	nc	4.00	3.2	0.51	

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						2.5	25		25	RSL	c	4.00	3.2	0.4	
								59	59	RSL	nc	10.00	8	0.81	
						0.014	0.14		0.14	RSL	c	10.00	8	2.02	
				6		5.6	56	400	6	MCL		10.00	8	3.32	
						16	160	1,700	160	RSL	c	4.00	3.2	1.53	
								9,900	9,900	RSL	nc	15.00	10	5.51	
8270E	Carbazole (<i>Surrogate fluorene</i>)	86-74-8	µg/L					290	290	RSL	nc	4.00	3.2	0.5	
8270E	Chrysene	218-01-9	µg/L			25	250		250	RSL	c	4.00	3.2	1.99	
8270E	Dibenz(a,h)anthracene	53-70-3	µg/L			0.025	0.25		0.25	RSL	c	10.00	8	0.58	
8270E	Dibenzofuran	132-64-9	µg/L					7.9	7.9	RSL	nc	4.00	3.2	0.95	
8270E	Diethyl phthalate	84-66-2	µg/L					15,000	15,000	RSL	nc	4.00	3.2	0.589	
8270E	Dimethyl phthalate	131-11-3	µg/L						NS			4.00	3.2	0.75	
8270E	Di-n-butyl phthalate	84-74-2	µg/L					900	900	RSL	nc	4.00	3.2	0.45	
8270E	Di-n-octyl phthalate	117-84-0	µg/L					200	200	RSL	nc	10.00	8	3.6	
8270E	Fluoranthene	206-44-0	µg/L					800	800	RSL	nc	4.00	3.2	0.5	
8270E	Fluorene	86-73-7	µg/L					290	290	RSL	nc	4.00	3.2	0.784	
8270E	Hexachlorobenzene	118-74-1	µg/L	1		0.0098	0.098	0.2	1	MCL		10.00	8	0.86	
8270E	Hexachlorobutadiene	87-68-3	µg/L			0.14	1.4	6.5	1.4	RSL	c	2.00	1.8	1.17	8260 and 8270
8270E	Hexachlorocyclopentadiene	77-47-4	µg/L	50				0.41	50	MCL		50.00	48	16	
8270E	Hexachloroethane	67-72-1	µg/L			0.33	3.3	6.2	3.3	RSL	c	10.00	8	4.46	
8270E	Indeno(1,2,3-cd)pyrene	193-39-5	µg/L			0.25	2.5		2.5	RSL	c	10.00	8	1.34	
8270E	Isophorone	78-59-1	µg/L			78	780	3,800	780	RSL	c	10.00	8	1.98	
8270E	Naphthalene	91-20-3	µg/L		30	0.12	1.2	6.1	30	WQCC		2.00	0.8	0.634	
8270E	Nitrobenzene	98-95-3	µg/L			0.14	1.4	13	1.4	RSL	c	10.00	8	1.25	
8270E	N-Nitrosodi-n-propylamine	621-64-7	µg/L			0.011	0.11		0.11	RSL	c	10.00	8	1.91	
8270E	N-Nitrosodiphenylamine	86-30-6	µg/L			12	120		120	RSL	c	10.00	8	0.77	
8270E	Pentachlorophenol	87-86-5	µg/L	1	1	0.041	0.41	23	1	WQCC NMED		50.00	48	20	
8270E	Phenanthrene	85-01-8	µg/L						170	RAC ⁶		4.00	3.2	1.58	
8270E	Phenol	108-95-2	µg/L		5			5,800	5	WQCC		10.00	8	0.92	
8270E	Pyrene	129-00-0	µg/L					120	120	RSL	nc	10.00	8	0.53	
9056A	Nitrate as N	14797-55-8	mg/L	10	10			32	10	WQCC		0.005	0.00461	0.00084	
9056A	Nitrite as N	14797-65-0	mg/L	1	1			2	1	WQCC		0.005	0.00461	0.00084	

Table 3.4 – Groundwater Laboratory Analysis and Risk Evaluation Criteria

Method	Analyte	CAS	Water												Notes
			Units	EPA MCL ^{1,2}	20.6.2 NMAC NM WQCC ³	Nov. 2023 EPA RSL Cancer Tap Water (target excess cancer risk level of 10 ⁻⁶)	Nov. 2023 EPA RSL Cancer Tap Water (target excess cancer risk level of 10 ⁻⁵)	Nov. 2023 EPA RSL Noncancer Tap Water (target hazard quotient of 1)	Final Selected SL ⁴	Final Selected SL Reference	Risk Endpoint c/nc	LOQ	LOD	DL	
9056A	Fluoride	16984-48-8	mg/L	4	1.6			0.8	1.6	WQCC		0.002	0.002	0.00128	
9056A	Chloride	16887-00-6	mg/L	250	250				250	WQCC		0.03	0.03	0.0115	
9056A	Sulfate	14808-79-8	mg/L	250	600				250	WQCC		0.05	0.025	0.0915	
365.1	Phosphate	14265-44-2	mg/L						NS			NA	NA	NA	
9056A	Bromide	24959-67-9	mg/L						NS			0.002	0.002	0.00128	

Notes:

¹ U.S. Environmental Protection Agency (EPA), Drinking Water Primary and Secondary Maximum Contaminant Level (MCL) per 40 Code of Federal Regulations Sections 141 and 143.

² If an analyte has both a primary and secondary MCL, the primary was provided.

³ New Mexico Water Quality Control Commission (NM WQCC) standards per 20 New Mexico Administrative Code § 6.2.4103.A and B.

⁴ Following Attachment 7 of the February 2015 Resource Conservation and Recovery Act (RCRA) Permit, the selected screening level is the lower of the NM WQCC and the EPA MCL. If the analyte does not have an NM WQCC or MCL but has an EPA Tap Water RSL, the lower value between the adjusted carcinogenic RSL (target excess cancer risk level of 1 x 10⁻⁵) and the non-carcinogenic RSL (with a target hazard index of 1.0) was selected.

5 New Mexico Environment Department (NMED) Risk Assessment Guidance for Site Investigations and Remediation, Vol 1, November 2022.

⁶ The lesser of the a) NMED screening levels for residents, industrial/occupationl workers, and construction workers (or EPA RSL (target excess cancer risk level of 1 x 10⁻⁵) if there is no NMED screening level) and b) the highest groundwater protection SL based on a DAF of 20 was chosen as the screening level. For metals, if the selected value is below the background value, the background value was selected instead.

⁷ Analyte is considered an essential nutrient and risk is not evaluted for groundwater.

Abbreviations & Acronyms:

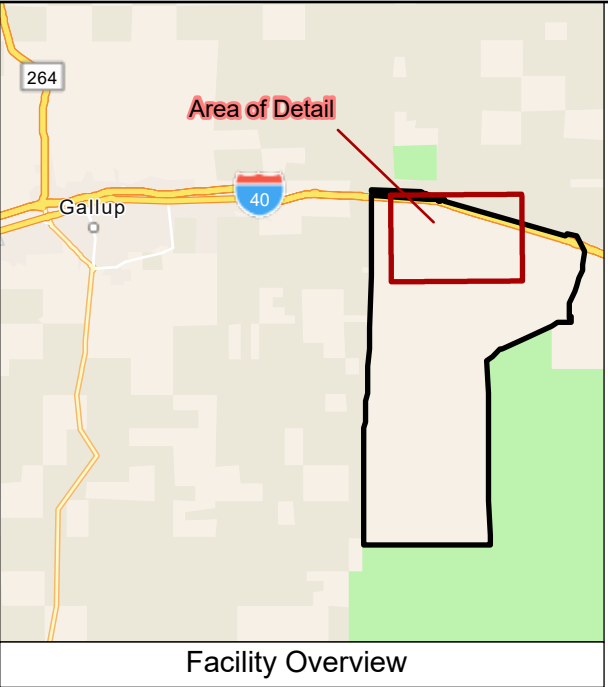
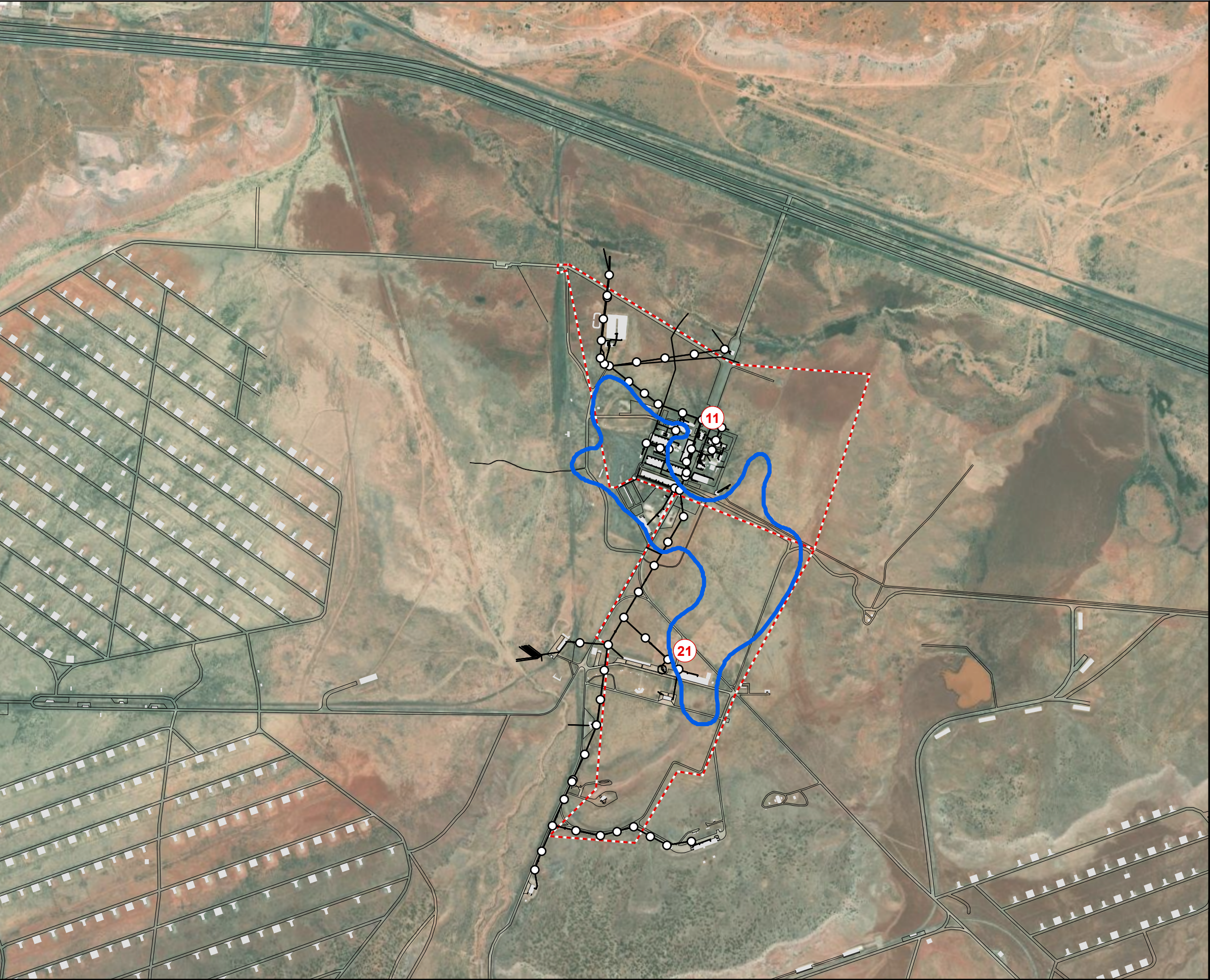
µg/L = micrograms per liter	HH = Human Health	NS = no standard
c = carcinogenic risk endpoint	MCL = U.S. Environmental Protection Agency	RSL = U.S. Environmental Protection Agency Regional Screening Level - Tap water screening level with cancer risk adjusted to 1x10 ⁻⁵
CAS = Chemical Abstract Service registry number	mg/L = milligrams per liter	SL = Screening Level
DAF = Dilution attenuation factor	NA = not applicable	WQCC = New Mexico Water Quality Control Commission standard
GW = Groundwater	nc = non-carcinogenic risk endpoint	

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FIGURES

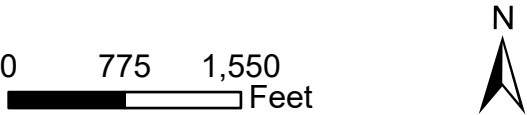
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Legend

- Sanitary Manhole
- Sanitary Sewer
- Alluvial Nitrate Contour, 10 mg/L (HDR, 2023)
- - - Parcel Boundary
- ⑪ Parcel Number



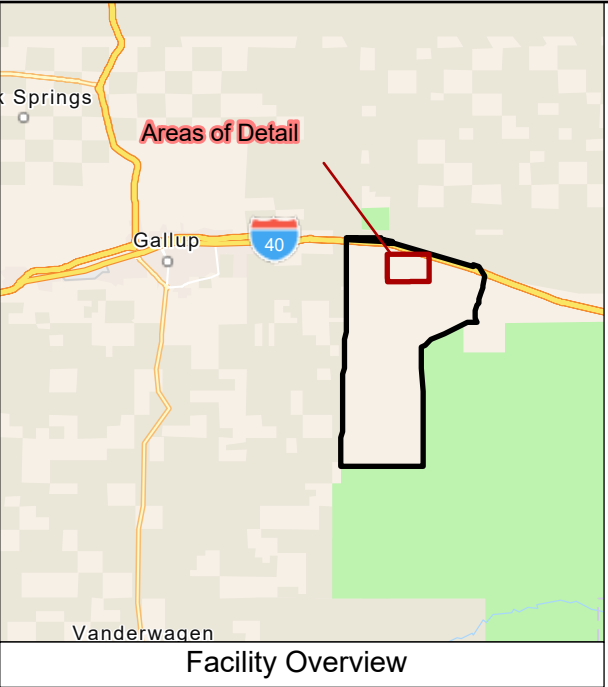
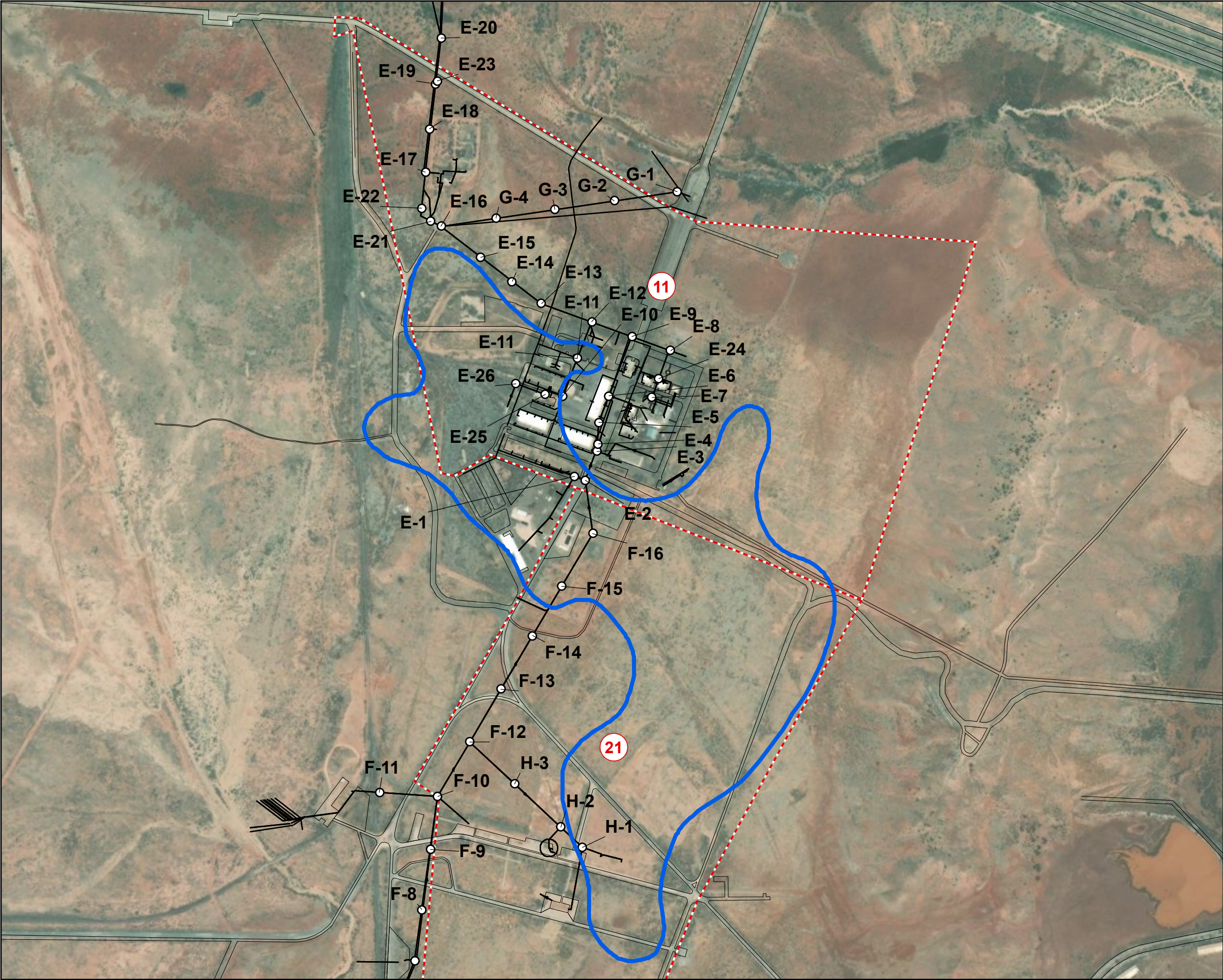
Work Plan
Northern Area Sewer Line Investigation
Fort Wingate Depot Activity
McKinley County, New Mexico

**Northern Area
Sewer Line Overview**

Figure	1.1	GIS by	AM	8/13/2025
Client	USACE, Albuquerque District	Checked by	JU	8/13/2025
		PM	CR	8/13/2025

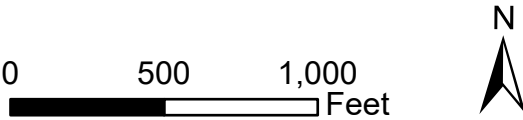
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Layout: Fig1.1_FacilitySewerLine_ManholeLocations Date Saved: 8/13/2025 2:54 PM Date Exported: 8/13/2025 2:56 PM

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Legend

- Sanitary Manhole
- Sanitary Sewer
- Alluvial Nitrate Contour, 10 mg/L (HDR, 2023)
- ▭ Parcel Boundary
- ⑪ Parcel Number



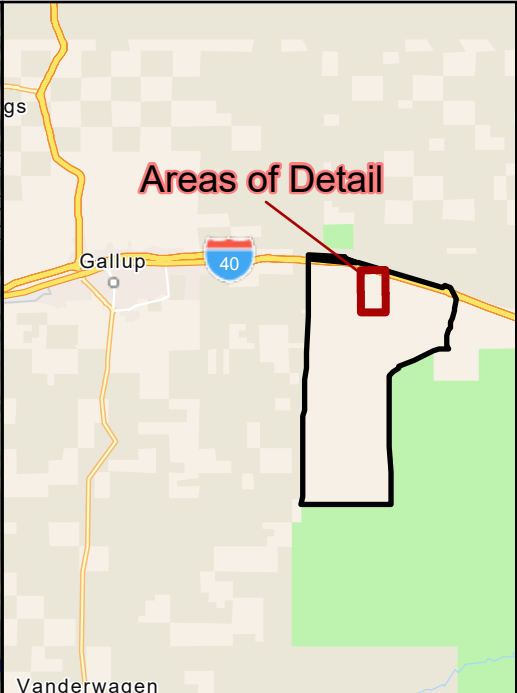
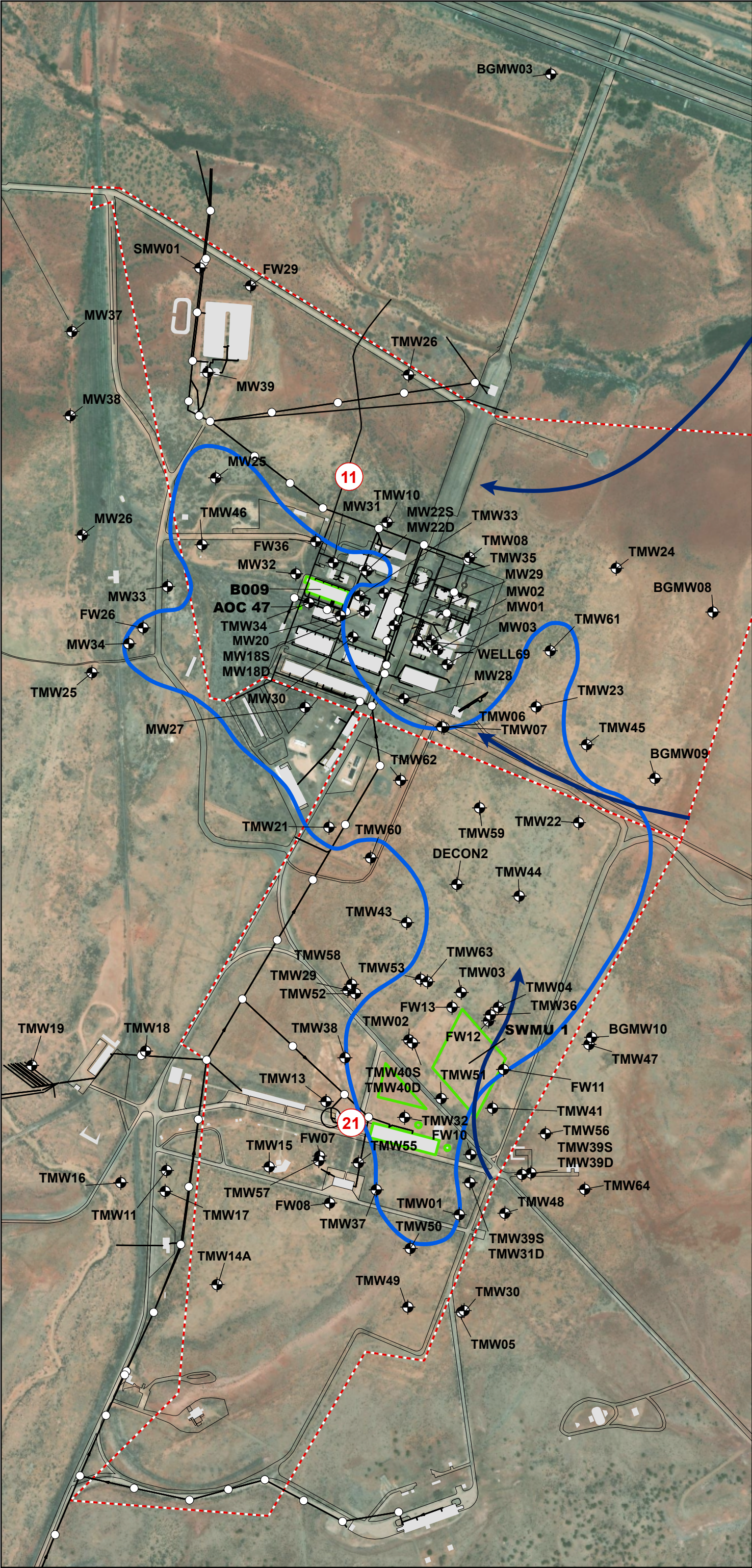
Work Plan
Northern Area Sewer Line Investigation
Fort Wingate Depot Activity
McKinley County, New Mexico

**Northern Area
Sewer Line Manhole IDs**

Figure	1.2	GIS by	AM	8/13/2025
Client	USACE, Albuquerque District	Checked by	KS	8/13/2025
		PM	CR	8/13/2025

Path: V:\MMP\ P\Win\Arch\PhotoSewerInvestigation\WorkPlan\Wingate_Sewer.aprx
Layout: Fig1.2_Manholes Date Saved: 8/13/2025 5:04 PM Date Exported: 8/13/2025 8:29 PM

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Facility Overview

Legend

- Monitoring Well
- Sanitary Manhole
- Sanitary Sewer
- Alluvial Nitrate Contour, 10 mg/L (HDR, 2023)
- Groundwater Flow Direction
- SWMU Boundary
- Parcel Boundary
- Parcel Number



Work Plan
Northern Area Sewer Line Investigation
Fort Wingate Depot Activity
McKinley County, New Mexico

**Northern Area
Monitoring Well Locations**

Figure	1.3	GIS by	AM	8/13/2025
Client	USACE, Albuquerque District	Checked	JU	8/13/2025
		PM	CR	8/13/2025

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2

APPENDIX A

NMED Disapproval Letters and Army Response Letters

1

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From: [Cushman, George H IV CIV USARMY HQDA DCS G-9 \(USA\)](#)
To: [Suzuki, Michiya, ENV](#)
Cc: [Thomas, Ian M CIV USARMY HQDA DCS G-9 \(USA\)](#); [Frischkorn, Cheryl A CIV USARMY HQDA DCS G-9 \(USA\)](#); [Soicher, Alan J CIV USARMY CESPA \(USA\)](#); [Christy Esler](#); [Angela Bogunovich](#); [Nance, JD, ENV](#); [Dhawan, Neelam, ENV](#); [Montgomery, Cheryl R CIV USARMY CEERD-EL \(USA\)](#)
Subject: RE: [EXTERNAL] FWDA Sewer Line Camera Survey
Date: Wednesday, April 2, 2025 3:07:43 PM

Michiya: Thank you for your quick response to the Army's query concerning the sewer line camera survey. I am forwarding the information and requirements you have provided to appropriate members of the FWDA Team for action. We will provide you responses to your requirements and anticipated submission dates as soon as possible.

Thank you again.

v/r,

George

-----Original Message-----

From: Suzuki, Michiya, ENV <Michiya.Suzuki@env.nm.gov>
Sent: Wednesday, April 2, 2025 3:00 PM
To: Cushman, George H IV CIV USARMY HQDA DCS G-9 (USA) <george.h.cushman.civ@army.mil>
Cc: Thomas, Ian M CIV USARMY HQDA DCS G-9 (USA) <ian.m.thomas2.civ@army.mil>; Frischkorn, Cheryl A CIV USARMY HQDA DCS G-9 (USA) <cheryl.a.frischkorn.civ@army.mil>; Soicher, Alan J CIV USARMY CESPA (USA) <Alan.J.Soicher@usace.army.mil>; cesler@thendncompanies.com; Angela Makin <amakin@sundance-inc.net>; Nance, JD, ENV <jd.nance@env.nm.gov>; Dhawan, Neelam, ENV <neelam.dhawan@env.nm.gov>
Subject: RE: [EXTERNAL] FWDA Sewer Line Camera Survey

Mr. Cushman,

Thank you for the question. The procedure of the camera survey does not need to be reapproved because NMED has already approved the proposal in the November 26, 2024 email.

The direction provided in the November 26, 2024 email requires the Permittee to include the proposed sampling locations that correspond to the findings of the camera survey in the revised Work Plan. This requirement can only be met after completion of the camera survey. Since the December 20, 2024 revised Work Plan has already been submitted, please submit figure(s) with the camera survey map and corresponding proposed sampling locations, following completion of the camera survey. The proposed sampling locations must be selected based on the findings of the camera survey (e.g., sign of release), as applicable, and must be documented in the revised Work Plan. Since some sections of the revised Work Plan need revisions to include the statement, please submit replacement pages as well.

Although NMED does not have an issue of extending the schedule of the camera survey or its procedure, there is an issue that prevents future approval of the December 20, 2024 revised Work Plan at this time. Comment 10 of the August 19, 2024 Disapproval states, "An approval of the Work Plan will be followed by an approval of the standalone document addressing the LOQ

issue." Since the December 19, 2024 Laboratory Analytical Approach for Groundwater Sampling has not been approved, the revised Work Plan cannot be approved regardless at this time. The revised Analytical Approach is to be submitted no later than June 6, 2025. Once the revised Analytical Approach is approved, NMED initiates its review of the revised Work Plan along with the required figures and replacement pages.

In the response to this email correspondence, please state the anticipated submission date of the figures and replacement pages of the revised Work Plan.

Please let me know if you have any questions.

Sincerely,

Michiya Suzuki, PE
Water Resource Professional IV
New Mexico Environment Department
Hazardous Waste Bureau
505-690-6930

-----Original Message-----

From: Cushman, George H IV CIV USARMY HQDA DCS G-9 (USA)
<george.h.cushman.civ@army.mil>
Sent: Wednesday, April 2, 2025 9:05 AM
To: Suzuki, Michiya, ENV <Michiya.Suzuki@env.nm.gov>
Cc: Thomas, Ian M CIV USARMY HQDA DCS G-9 (USA)
<ian.m.thomas2.civ@army.mil>; Frischkorn, Cheryl A CIV USARMY HQDA DCS G-9 (USA) <cheryl.a.frischkorn.civ@army.mil>; Soicher, Alan J CIV USARMY CESPA (USA) <Alan.J.Soicher@usace.army.mil>; cesler@thendncompanies.com; Angela Makin <amakin@sundance-inc.net>
Subject: [EXTERNAL] FWDA Sewer Line Camera Survey

CAUTION: This email originated outside of our organization. Exercise caution prior to clicking on links or opening attachments.

From: [Cushman, George H IV CIV USARMY HQDA DCS G-9 \(USA\)](#)
To: [Suzuki, Michiya, ENV](#)
Cc: [Thomas, Ian M CIV USARMY HQDA DCS G-9 \(USA\)](#); [Frischkorn, Cheryl A CIV USARMY HQDA DCS G-9 \(USA\)](#); [Soicher, Alan J CIV USARMY CESPA \(USA\)](#); [Christy Esler](#); [Angela Bogunovich](#)
Subject: FWDA Sewer Line Camera Survey
Date: Wednesday, April 2, 2025 11:05:33 AM

Michiya: In your e-mail of 26 November 2024, we received direction from NMED for the conduct of the FWDA sewer line camera survey (see below). However, it was not feasible to complete the camera survey and incorporate the results into a revised work plan by December 31, 2024.

Our team revised the work plan to include camera survey procedures and submitted it to NMED on 20 December 2024. We would like to request approval to schedule the camera survey within the next 2 months to accelerate this part of the work. Please let us know if this is an acceptable alternative to awaiting NMED approval on the Work Plan submitted on 20 December 2024 prior to scheduling the sewer line camera survey.

Thank you, and I hope all is well with you.

v/r,

George

From: Suzuki, Michiya, ENV <Michiya.Suzuki@env.nm.gov>
Sent: Tuesday, November 26, 2024 9:30 AM
To: Frischkorn, Cheryl A CIV USARMY HQDA DCS G-9 (USA) <cheryl.a.frischkorn.civ@army.mil>
Cc: Cushman, George H IV CIV USARMY HQDA DCS G-9 (USA) <george.h.cushman.civ@army.mil>; Thomas, Ian M CIV USARMY HQDA DCS G-9 (USA) <ian.m.thomas2.civ@army.mil>; Soicher, Alan J CIV USARMY CESPA (USA) <Alan.J.Soicher@usace.army.mil>; Wright, Kathy M CIV USARMY HQDA DCS G-9 (USA) <kathy.m.wright5.civ@army.mil>; cesler@sundance-inc.net; Dhawan, Neelam, ENV <neelam.dhawan@env.nm.gov>; amakin@sundance-inc.net; Nance, JD, ENV <jd.nance@env.nm.gov>
Subject: [Non-DoD Source] RE: [EXTERNAL] FWDA sewer line camera survey

Ms. Frischkorn,

NMED has reviewed the proposed scope of the sewer line camera survey and hereby issues this approval with the following directions:

1. Include the map and scope of the procedure in the upcoming sewer line revised work plan.
2. Attach this email authorization for the camera survey to the revised work plan.

3. The sampling locations must correlate with the findings of the camera survey.
4. The actual locations where the camera survey is conducted must be identified in the sewer line map. The map must be included in the investigation report.

Note that this approval is a partial approval of the work plan; a revised work plan, as required by the August 19, 2024 Disapproval, must still be submitted no later than **December 31, 2024**.

If you have any questions, please let me know.

Sincerely,

Michiya Suzuki, PE
New Mexico Environment Department
Hazardous Waste Bureau
121 Tijeras Ave NE, Suite 1000
Albuquerque, New Mexico
505-690-6930

From: Frischkorn, Cheryl A CIV USARMY HQDA DCS G-9 (USA) <cheryl.a.frischkorn.civ@army.mil>
Sent: Monday, November 25, 2024 11:02 AM
To: Suzuki, Michiya, ENV <Michiya.Suzuki@env.nm.gov>
Cc: Cushman, George H IV CIV USARMY HQDA DCS G-9 (USA) <george.h.cushman.civ@army.mil>; Thomas, Ian M CIV USARMY HQDA DCS G-9 (USA) <ian.m.thomas2.civ@army.mil>; Soicher, Alan J CIV USARMY CESPA (USA) <Alan.J.Soicher@usace.army.mil>; Wright, Kathy M CIV USARMY HQDA DCS G-9 (USA) <kathy.m.wright5.civ@army.mil>; cesler@sundance-inc.net; Dhawan, Neelam, ENV <neelam.dhawan@env.nm.gov>; amakin@sundance-inc.net; Nance, JD, ENV <jd.nance@env.nm.gov>
Subject: RE: [EXTERNAL] FWDA sewer line camera survey

Hello, Michiya----

Please see the attached regarding Fort Wingate's proposed camera survey of the sewer lines.

The attached includes a map and description of the camera survey.

Your guidance and swift review are appreciated.

Thank you,
Cher

Cheryl (Cher) Frischkorn

FWDA BRAC Environmental Coordinator (BEC)
Office of the Deputy Chief of Staff, G-9
DAIN-ISE, BRAC OPS
703.624.6429
cheryl.a.frischkorn.civ@army.mil

From: Suzuki, Michiya, ENV <Michiya.Suzuki@env.nm.gov>
Sent: Monday, November 18, 2024 9:30 AM
To: Frischkorn, Cheryl A CIV USARMY HQDA DCS G-9 (USA) <cheryl.a.frischkorn.civ@army.mil>
Cc: Cushman, George H IV CIV USARMY HQDA DCS G-9 (USA) <george.h.cushman.civ@army.mil>; Thomas, Ian M CIV USARMY HQDA DCS G-9 (USA) <ian.m.thomas2.civ@army.mil>; Soicher, Alan J CIV USARMY CESPA (USA) <Alan.J.Soicher@usace.army.mil>; Wright, Kathy M CIV USARMY HQDA DCS G-9 (USA) <kathy.m.wright5.civ@army.mil>; Christy Esler <cesler@sundance-inc.net>; Dhawan, Neelam, ENV <neelam.dhawan@env.nm.gov>; Angela Makin <amakin@sundance-inc.net>; Nance, JD, ENV <jd.nance@env.nm.gov>
Subject: RE: [EXTERNAL] FWDA sewer line camera survey

Ms. Frishkorn,

Comment 2 directs the Permittee to “[p]ropose to use additional inspection method(s) (e.g., video camera, smoke test, tracer test) to identify cracks/breaks within the pipes in the revised Work Plan.” NMED appreciates the Permittee’s effort to follow the direction provided by Comment 2. Completing the camera survey prior to determining appropriate sample collection locations makes good sense. The proposal is acceptable. Please send a map and description showing where and how the camera survey would be conducted via email. When NMED receives the information, NMED will review it expeditiously and approve/disapprove the proposal.

Sincerely,

Michiya Suzuki, PE
New Mexico Environment Department
Hazardous Waste Bureau
121 Tijeras Ave NE, Suite 1000
Albuquerque, New Mexico
505-690-6930

From: Frischkorn, Cheryl A CIV USARMY HQDA DCS G-9 (USA) <cheryl.a.frischkorn.civ@army.mil>
Sent: Thursday, November 14, 2024 12:57 PM
To: Suzuki, Michiya, ENV <Michiya.Suzuki@env.nm.gov>
Cc: Cushman, George H IV CIV USARMY HQDA DCS G-9 (USA) <george.h.cushman.civ@army.mil>; Thomas, Ian M CIV USARMY HQDA DCS G-9 (USA) <ian.m.thomas2.civ@army.mil>; Soicher, Alan J CIV USARMY CESPA (USA) <Alan.J.Soicher@usace.army.mil>; Wright, Kathy M CIV USARMY HQDA

DCS G-9 (USA) <kathy.m.wright5.civ@army.mil>; Christy Esler <cesler@sundance-inc.net>; Dhawan, Neelam, ENV <neelam.dhawan@env.nm.gov>; Angela Makin <amakin@sundance-inc.net>; Nance, JD, ENV <jd.nance@env.nm.gov>

Subject: [EXTERNAL] FWDA sewer line camera survey

Dear Michiya:

This is in regard to Comment #2 of NMED's August 19, 2024, Disapproval of Fort Wingate's Northern Area Sewer Line Investigation Work Plan. We are aware the revision of this work plan is due to your office no later than December 31, 2024; however, we'd like to complete the camera survey of the sewer lines before then. Completing the camera survey of the sewer lines within the next several weeks would assist us in identifying locations where the pipes may be compromised and, in turn, help us in refining our sample collection locations presented in the revised work plan. Please let me know if this is an acceptable way to proceed with the camera survey. If you agree our proposal is acceptable, we can send you a map showing where we plan to perform the camera survey and a description of how the camera survey would be done.

Thank you,
Cher

Cheryl (Cher) Frischkorn
FWDA BRAC Environmental Coordinator (BEC)
Office of the Deputy Chief of Staff, G-9
DAIN-ISE, BRAC OPS
703.624.6429
cheryl.a.frischkorn.civ@army.mil

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Certified Mail - Return Receipt Requested

August 19, 2024

George H. Cushman
Headquarters, Department of the Army
Office of the DCS, G-9
Army Environmental Office, Room 5C140
600 Army Pentagon
Washington, DC 20310-0600

**RE: DISAPPROVAL
FINAL WORK PLAN NORTHERN AREA SEWER LINE INVESTIGATION
FORT WINGATE DEPOT ACTIVITY
MCKINLEY COUNTY, NEW MEXICO
EPA ID# NM6213820974
HWB-FWDA-24-003**

Dear Mr. Cushman:

The New Mexico Environment Department (NMED) is in receipt of the Fort Wingate Depot Activity (Permittee) *Final Work Plan Northern Area Sewer Line Investigation* (Work Plan), dated March 15, 2024. NMED has reviewed the Work Plan and hereby issues this Disapproval with the following comments.

COMMENTS

1. Section 1.0, Introduction, lines 11-12, page 17

Permittee Statement: "Any evaluation of risk to human or ecological receptors will be done in the Parcel 11 Phase 2 RFI report."

NMED Comment: The Permittee submitted the *Final Phase 2 RCRA Facility Investigation Work Plan Parcel 11* (Parcel 11 Phase 2 RFI Work Plan) on April 30, 2024. The Parcel 11 Phase 2 RFI report must solely report the investigation results associated with the Parcel 11 Phase 2 RFI Work Plan. Similarly, the investigation results associated with this Sewer Line Investigation Work Plan must be reported in a dedicated standalone investigation report. Acknowledge this provision in the response letter and revise all applicable sections of the Work Plan.

2. Section 2.1, Northern Area Sewer Line, lines 5-12, page 21

Permittee Statement: “Manholes located near proposed soil boring locations will be visually inspected from the ground surface to identify any evidence of cracks or breaks in the structure of the manhole or visible sewer lines. The depth of the manholes and the depth to the sewer line within the manholes will be measured from existing ground surface during the inspection using a weighted measuring tape. The focus of the inspection is at manhole locations because the condition of both the manhole and the sewer line within the manhole can be visually assessed from the ground surface without performing excavation or entering the manholes. Due to confined space entry limitations, entry into the manholes will not be performed.”

NMED Comment: The integrity of the sewer lines cannot adequately be inspected visually because the sewer lines are mostly buried beneath the ground surface and not visible from the ground surface. Propose to use additional inspection method(s) (e.g., video camera, smoke test, tracer test) to identify cracks/breaks within the pipes in the revised Work Plan. This step is critical to identifying potential source location(s) along the sewer line that may be contributing to the nitrate plume extending west of the Administration Area. In addition, the use of additional inspection method(s) may potentially require entry into the manholes depending on the selected inspection method. If an entry is deemed necessary, ensure safety is in place by evaluating and providing appropriate personal safety equipment (e.g., self-contained breathing apparatus) and protocol is followed throughout the duration of the entries as described in Section 3.1 of the Work Plan.

3. Section 2.2, Soil Boring Samples, lines 17-19, page 21

Permittee Statement: “In order to identify potential releases of contaminants from the sewer line to soil, three samples will be collected at depths of 2.0, 5.0, and 10.0 feet below the bottom of the manhole from eight soil boring locations listed in Table 2.1.”

NMED Comment: NMED agrees that three samples per soil boring are sufficient. However, the sampling results do not provide any meaningful data unless cracks/breaks are present in the selected manholes. The soil samples must be collected from the locations where cracks/breaks are identified along the sewer line.

In addition, soil cores of the soil borings must be screened with a flame ionization detector (FID) or photoionization detector (PID), and if an elevated reading of the FID/PID is identified, an additional soil sample must be collected from the depth interval as well. In addition, if the highest FID/PID reading is identified at the proposed termination depth of 10 feet below the bottom of the manhole, extend the termination depth to delineate the vertical extent of the contamination. Include the provisions in the revised Work Plan.

4. Section 2.2, Soil Boring Samples, lines 23-27, page 21

Permittee Statement: “The proposed soil boring locations are shown on Figure 2.1. Proposed soil borings and existing monitoring wells located on the northern portion of the Administration Area are shown on Figure 2.2. Proposed soil borings and existing monitoring wells located on the southern portion of the Administration Area are shown on Figure 2.3.”

NMED Comment: Since there is no previous data that directly supports and justifies the proposed soil boring locations, it is speculative whether the proposed locations are relevant to any release(s) that may have previously occurred from the sewer line. The first step of the investigation should be to collect data that identifies the locations of potential release(s) along the sewer line/manhole, as stated in Comments 2 and 3 above. The result of the additional inspection (e.g., video camera, smoke test, tracer test) allows collection of the data that will guide appropriate locations of the soil borings. The second step of the investigation is to install soil borings in the vicinity of the area where potential release(s) is/are identified during the first step of the investigation. Provide a figure with the actual soil boring locations in the investigation report.

If no release is identified and the sewer line is found to be intact during the first step of the investigation, then it can be concluded that the sewer line is not a potential source for the nitrate plume extending from the Administration Area. Thus, the installation of the soil borings along the sewer line would be deemed unnecessary. Revise the Work Plan to incorporate this two-step investigation approach.

5. Section 2.2, Soil Boring Samples, lines 34-36, page 21

Permittee Statement: “Soil samples will be analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), nitrate, nitrogen, major anions, explosives, and target analyte list (TAL) metals as shown on Table 2.2.”

NMED Comment: The soil in the vicinity of the wastewater release may be under reduced conditions; therefore, nitrite may be present. Include nitrite analysis with the proposed analyses in the revised Work Plan.

6. Section 2.3, Temporary Monitoring Well Installation, lines 12-15, page 22

Permittee Statement: “The locations of the three temporary wells may be adjusted based on the results from the eight soil sample borings. Adjustments will be biased towards soil boring locations where the highest nitrate concentrations were detected in soil samples.”

NMED Comment: As stated in Comment 4 above, if cracks/breaks are not identified and the sewer line is determined to be intact during the first step of the investigation, the nitrate plume would be unlikely to originate from the sewer line. Thus, the installation of the

temporary monitoring wells along the sewer line would be unnecessary. Revise the Work Plan to incorporate the two-step investigation approach from Comment 4 above. If cracks/breaks are identified in the first step of the investigation, the Permittee can proceed with the proposed approach.

7. Section 2.3, Temporary Monitoring Well Installation, lines 21-22, page 22

Permittee Statement: “Monitoring wells will be installed using sonic or hollow-stem auger (HSA) drilling methods. Boreholes using either method will be nominally 6 to 8 inches in diameter.”

NMED Comment: The NMED’s January 22, 2020 *Approval with Modifications Final Northern Area Background Well Installation and Completion Report* and January 25, 2022 *Disapproval Final Northern Area Groundwater RCRA Facility Investigation Report* require the Permittee to collect soil samples during the installation of groundwater monitoring wells. A minimum of three soil samples must be collected from each boring at the vadose zone with the highest PID reading, if applicable, at the water table, and the termination depth. The analytical suite for the well-boring soil samples must be consistent with that of the soil samples. Include this provision in the revised Work Plan.

8. Section 2.4, Groundwater Samples, lines 4-6, page 23

Permittee Statement: “Three existing monitoring wells located in close vicinity of the Northern Area sewer line and the three new temporary monitoring wells will be sampled for site chemicals of potential concern (COPCs) listed on Table 2.3.”

NMED Comment: Since groundwater samples have already been collected semiannually from these existing wells (i.e., TMW21, MW20, and MW22D), it is unclear how additional data collected from the existing wells would be useful to the investigation. Provide an explanation in the revised Work Plan.

In addition, if tracer testing is proposed as the first step (see Comment 4 above), breakthrough of the tracer chemical may be monitored in the existing wells; however, there may be an issue with monitoring because the depth of the water table potentially exceeds 40 feet below ground surface (bgs) in the investigation area. Therefore, long-term monitoring as well as a large volume of the tracer solution may be required. If tracer testing is proposed, the sampling/monitoring requirements associated with the tracer test must also be included in the annual groundwater monitoring plan update.

9. Section 2.4, Groundwater Samples, lines 15-17, page 23

Permittee Statement: “Field parameter measurements included dissolved oxygen (DO), oxidation reduction potential (ORP), specific conductivity, pH, temperature, and turbidity.”

NMED Comment: If there are other field/analytical parameters that are indicative of the wastewater release (e.g., E. coli), include the parameters as well in the revised Work Plan.

10. Section 3.2.3, Data Precision, Accuracy, Representativeness, Comparability and Completeness, lines 36-39, page 29

Permittee Statement: “Analytical methods will be performed in accordance with the Army’s LOQ Phase 3 Study as described in the Army’s letter to NMED dated April 24, 2023. Tables 3.3 and 3.4 identify the analytes for which the LOQ is greater than the project screening level. Non-detected results will be reported at the LOQ.”

NMED Comment: The Permittee’s April 24, 2023 letter is not an approved document and must not be referenced. The risk evaluation approach for the constituents with the Limits of Quantitation (LOQ) exceeding the respective Soil Screening Levels (SSLs) presented in the April 24, 2023 letter is not acceptable. Remove the reference to the April 24, 2023 letter from the Work Plan.

Although the Permittee submitted Phases 1 and 2 Memorandums on July 18, 2022, and December 28, 2022, respectively, regarding the resolution of on-going LOQ issue, the Memorandums did not fully provide information requested by the February 1, 2021 email from Mr. Ben Wear of NMED to Mr. George Cushman of BRAC. In addition, NMED is not aware that Phase 3 Memorandum was formally submitted to NMED.

However, NMED notes that the April 24, 2024 email from Mr. Wear to Mr. Cushman states, “submittal of the massive amount of information [i.e., Phase 3 Memorandum] you referred to does not seem appropriate at this time.” Thus, NMED presumes that Phase 3 Memorandum was not submitted in accordance with the statement.

In order for NMED to evaluate the proposed risk evaluation approach for the constituents with the LOQ exceeding the respective SSLs and move forward with requirements for compliance, a standalone document in a letter report format, that (a) combines Phases 1 through 3 Memorandums, (b) provides information required by the NMED’s February 1, 2021 email, and (c) addresses all of the relevant directions provided by the following correspondence (e.g., NMED’s April 13, 2022 email) must be submitted to NMED no later than **December 31, 2024**. An approval of the Work Plan will be followed by an approval of the standalone document addressing the LOQ issue.

11. Section Data Verification and Data Review Procedures, lines 22-29, page 30

Permittee Statement: “For this project, 100% of the data packages will undergo data verification and data review, 100% to Stage 2B in accordance with DoD General Data Validation Guidelines and DoD published data validation modules. Data validation will be

performed by Parsons using automated data review software and/or manual data validation. The laboratory will submit the following data deliverables, a Stage 4 data package in PDF format as described in the DoD General Data Validation Guidelines and an electronic data deliverable (EDD) using the Staged Electronic Data Deliverables (SEDD) format in accordance with the most recently published version (SEDD Specification Document 5.2, Revision 1.1, October 2019)."

NMED Comment: It is not clear whether Level II or Level IV analytical laboratory reports will be submitted to NMED based on the statement. According to previous NMED letters (e.g., the November 7, 2018 *Disapproval Permittee-Initiated Interim Measures Report Parcel 6, Revision 1*), NMED requests that only Level II analytical laboratory reports be included in all submittals. Clarify the statement in the revised Work Plan.

12. Section 3.9, Investigation-Derived Waste, lines 10-11, page 33

Permittee Statement: "Accumulated wash and rinse water will be left within the decontamination pad and allowed to evaporate."

NMED Comment: Rather than leaving the accumulated water in the decontamination pad, the water must be transported to the evaporation tanks located at the site of former Building 542 in Parcel 6. Include the provision in the revised Work Plan.

13. Section 4.0, Data Evaluation, lines 8-11, page 35

Permittee Statement: "The approach to be used in the cumulative risk evaluation will be described in the forthcoming Parcel 11 Phase 2 RFI Work Plan and is based on the requirements contained in the NMED Risk Assessment Guidance for Site Investigations and Remediation (NMED, 2017 and 2022c)."

NMED Comment: The investigation results associated with this Work Plan must be reported as a standalone investigation report (see Comment 1 above). Since the purpose of this investigation is to determine if there is evidence of a release from the sewer line affecting groundwater, clarify that the cumulative risk evaluation will be conducted to compare the soil concentrations with the applicable soil-to-groundwater target soil leachate concentrations, rather than the human health screening levels in the revised Work Plan.

14. Section 4.1.2, Selection of Groundwater Screening Levels, lines 1-3 and 21-23, page 36

Permittee Statements: "The screening values to be used to evaluate the groundwater results is taken from Section 7.1 of 3 Attachment 7 of the RCRA permit (NMED, 2015)." and,

"The evaluation of groundwater will be based on the comparison of soil results to groundwater protection SSLs, as well as comparison of groundwater results to the

appropriate screening levels.”

NMED Comment: Note that the evaluation of groundwater should be based on the target soil leachate concentrations, which are equivalent to the NMED-specific tap water SSLs multiplied by a DAF (i.e., 20), to be consistent with the purpose of the investigation. Revise the statements for clarity.

15. Section 4.1.3.1, Identification of Chemicals of Potential Concern (Step 1, Part 1), lines 28-29, page 36

Permittee Statement: “Analytes detected in one or more samples from the data set for the sewer line will be retained as COPCs. Analytes that are not detected in any sample will not be retained as COPCs.”

NMED Comment: According to Tables 2.1, *Northern Area Sewer Line Investigation Proposed Soil Sample Locations*, and 2.3, *Northern Area Sewer Line Investigation Existing Wells and Proposed Temporary Monitoring Wells*, soil and groundwater samples will be collected in the vicinity of the sewer line; however, the results obtained from the sampling event may or may not correlate with the evidence of sewer line release unless the release locations are identified prior to sampling (see Comments 2 and 4 above). The sampling locations must be determined based on the locations where cracks/breaks are identified. Revise the Work Plan accordingly.

The Permittee must submit a revised Work Plan that addresses all comments contained in this letter. Two hard copies and two copies of the electronic version of the revised Work Plan must be submitted to the NMED. The Permittee must also include a redline-strikeout version in electronic format showing where all revisions to the Work Plan have been made. The revised Work Plan must be accompanied with a response letter that details where all revisions have been made to the Work Plan, cross-referencing NMED’s numbered comments. The revised Work Plan must be submitted to NMED no later than **December 31, 2024**. The document required by Comment 10 above must also be submitted to NMED no later than **December 31, 2024**.

Should you have any questions, please contact Michiya Suzuki of my staff at (505) 690-6930.

Sincerely,

JohnDavid Nance



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Nance
Date: 2024.08.19 15:34:22 -06'00'

JohnDavid Nance
Chief
Hazardous Waste Bureau

Mr. Cushman
August 19, 2024
Page 8

cc: N. Dhawan, NMED HWB
L. Tsinnajinnie, NMED HWB
M. Suzuki, NMED HWB
L. King, EPA Region 6 (6LCRRC)
S. Begay-Platero, Navajo Nation
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C. Esler, Sundance Consulting, Inc.
C. Frischkorn, BRAC
A. Soicher, USACE

File: FWDA 2024 and Reading



MICHELLE LUJAN GRISHAM
GOVERNOR

JAMES C. KENNEY
CABINET SECRETARY

Certified Mail - Return Receipt Requested



January 25, 2022

George H. Cushman
Headquarters, Department of the Army
Office of the DCS, G-9
Army Environmental Office, Room 5C140
600 Army Pentagon
Washington, DC 20310-0600

**RE: DISAPPROVAL
FINAL NORTHERN AREA GROUNDWATER RCRA FACILITY INVESTIGATION REPORT
FORT WINGATE DEPOT ACTIVITY
MCKINLEY COUNTY, NEW MEXICO
EPA ID# NM6213820974
HWB-FWDA-21-004**

Dear Mr. Cushman,

The New Mexico Environment Department (NMED) is in receipt of the Fort Wingate Depot Activity (FWDA or Permittee) *Final Northern Area Groundwater RCRA Facility Investigation Report* (Report), dated September 15, 2021. NMED has reviewed the Report, and hereby issues this Disapproval with the following comments.

GENERAL COMMENTS

1. Document Distribution List

NMED Comment: The Report includes an outdated document distribution list. Verify that the information presented in the distribution list is current and update the information in the revised Report, as necessary.

2. Data Link to Laboratory Analytical Reports

NMED Comment: The Permittee provided large quantities of data with no indication where to locate data for a specific sample within a specific analytical laboratory report. NMED's

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November 7, 2018 *Disapproval Final Permittee-Initiated Interim Measures Report Parcel 6, Revision 1* states:

For every document that includes analytical data, provide a link for each specific sample to a specific lab report filename (if multiple files are provided) or to a page number in the appendix where the specific lab report can be found (if multiple lab reports are combined into one large file). For Appendices C and F, the lab reports are indexed by lab report number. The Permittee must provide a link to the lab report number for each analyte. For Appendix J, no indexing is provided and multiple laboratory reports are combined. The Permittee must either provide indexing for each report and indicate which report contains which sample, or provide the specific page numbers for each sample ID that indicates where the sample can be found in the lab reports. This information can be provided either in a new table or in the analytical data electronic database.

The Permittee previously provided a Table of Contents listing sample identification with links to the relevant lab report and a page listing in a relevant appendix in the *Final Groundwater Periodic Monitoring Report January through June 2020 Revision 1*, dated September 2021 demonstrating that the Permittee has the ability to comply with the direction. Failure to follow NMED direction constitutes noncompliance and may result in an enforcement action. Resolve the issue in the revised Report.

SPECIFIC COMMENTS

3. Executive Summary, ES-1, Introduction, Purpose and Scope, lines 10-13, page ES-1

Permittee Statement: “The Study Area of the Northern Area Groundwater RFI includes all or portions of ten parcels: 6, 7, 10A, 10B, 11, 12, 13, 14, 18 and 21; with five areas of concern (AOCs): 47, 62, 63, 68, 86; and eight solid waste management units (SWMUs): 1, 2, 5, 6, 12, 27, 45, 70, as defined in the approved Northern Area Groundwater RFI Work Plan (Sundance, 2018).”

NMED Comment: According to Figure 2-1.1 (RFI Study Area and Parcel Locations), portions of Parcels 9, 22, and 25 are also included in the study area. In addition, according to Figure 2-4.1 (Potential Source Areas), Solid Waste Management Unit (SWMU) 50, which is identified as the source area for volatile organic compounds (VOCs), is also included in the study area. Resolve the discrepancies in the revised Report.

4. Executive Summary, ES-2.3, Groundwater Contaminant Plumes, Nitrate Plumes, lines 24-25, page ES-3

Permittee Statement: “Increased concentrations at the leading edge of the plume adjacent to Building B009 suggest a secondary soil source for nitrate at this location.”

NMED Comment: According to Figure 2-4.1 (Potential Source Areas), Building B009, which is suggested to be a secondary source for soil nitrate contamination, is not identified. Revise Figure 2-4.1 to identify the location of Building B009.

5. Executive Summary, ES-2.3, Groundwater Contaminant Plumes, Perchlorate Plumes, lines 3-5, page ES-4

Permittee Statement: “The high [perchlorate] concentrations in both the bedrock and alluvium suggest releases directly to each aquifer as opposed to vertical migration from alluvial to the bedrock aquifer. Geological factors prevent the monitoring of the head of these plumes.”

NMED Comment: According to Figure 2-3.3 (FWDA Geologic Map), the Petrified Forest Formation is exposed at the surface south of the Building 528 and, as stated in Section 2.3.7.2 (Bedrock Aquifer), lines 17-18, page 2-6, recharge to the bedrock aquifer occurs when precipitation infiltrates the soil and percolates to the bedrock in the southern portion of the Study Area. Since the alluvial aquifer is absent in the area south of the Building 528 where the bedrock outcrops, perchlorate could not simultaneously be released to each aquifer. Rather, perchlorate may have initially been released to the bedrock aquifer; then, migrated to the alluvial aquifer. The groundwater monitoring data indicate that the perchlorate concentrations in the groundwater samples collected from the bedrock aquifer have been higher than those collected from the alluvial aquifer and the size of the bedrock perchlorate plume has been larger than that of the alluvial aquifer. The data suggests that the alluvial perchlorate plume may have originated from the bedrock perchlorate plume. Hydraulic communication between the bedrock aquifer and the alluvial aquifer is evident in the area downgradient of the Building 528 (e.g., Workshop Area) where the alluvial and bedrock plumes co-locate. Revise the statement for accuracy.

6. Executive Summary, ES-2.3, Groundwater Contaminant Plumes, Other Constituents, Total Petroleum Hydrocarbons (TPH), lines 15-16, page ES-4

Permittee Statement: “Detections reported from remaining areas are not attributed to hydrocarbon impacts and are likely due to naturally occurring organic compounds in the TPH range of the analytical test.”

NMED Comment: The Permittee detected total petroleum hydrocarbons (TPH) in the groundwater samples collected from the wells that are located outside of the Administration Area. However, concluding that the TPH detections are likely a result of the presence of naturally occurring organic compounds is not supported. Remove the statement from the revised Report.

7. Executive Summary, ES-2.3, Groundwater Contaminant Plumes, Other Constituents, Metals, lines 17-20, page ES-4

Permittee Statement: “Metals were detected at concentrations exceeding screening levels from across the Study Area in both alluvial and bedrock wells. Metals are naturally occurring and are expected to be reported in both total and dissolved samples. In addition, highly turbid samples may have attributed to the high metals concentrations.”

NMED Comment: While metals may be naturally occurring, they have previously been released at FWDA as a result of the facility operations. It is misleading to omit the fact that metals are contaminants of concern (COCs) at the site. In addition, highly turbid groundwater should be filtered to eliminate suspended solids prior to collection of dissolved metal samples. Turbidity should not affect the results for dissolved metal analysis. Correct the statements for accuracy in the revised Report.

8. Section 1.1, Purpose and Scope, lines 17-18, page 1-1, and Section 1.3.1, State Problem, line 26, page 1-2

Permittee Statements: “Further define the horizontal and vertical extent of the following six identified groundwater contaminant plumes.”

and,

“The problem statement on a groundwater plume by groundwater plume basis is presented below...”.

NMED Comment: The VOC, nitrate, perchlorate, and explosives groundwater plumes are discussed in the subsequent paragraphs; however, the groundwater plumes associated with TPH are not included in the discussion. Since the TPH plumes are present in the Administration Area, include a discussion regarding the TPH plumes. In addition, refer to Comments 17 and 27 of the NMED’s July 1, 2020 *Disapproval Final Groundwater Periodic Monitoring Report January through June 2019* for the direction to delineate the TPH plumes in the Administration Area, and explain whether this was accomplished during the investigation. Failure to follow NMED direction constitutes noncompliance and may result in an enforcement action. Revise the Report accordingly.

9. Section 1.3.5, Analytical Approach, Nitrate Groundwater Contaminant Plumes, line 15, page 1-4, and Section 2.3.7.2, Bedrock Aquifer, lines 35-37, page 2-5

Permittee Statements: “Interaction between the first and second bedrock aquifers had not been determined....[t]his discontinuous sandstone interval is referred to as the ‘first bedrock aquifer’ and is characterized as a laterally discontinuous water bearing zone that does not yield sustainable water production.”

NMED Comment: The description of the first bedrock aquifer appears to represent the characteristics of well TMW02. Comment 3 in the NMED's *Approval with Modifications Response to Approval with Modifications, Final Revision 1 Groundwater Periodic Monitoring Report, July through December 2018*, letter dated November 5, 2020, states:

"[W]ell TMW02 represents alluvial groundwater quality rather than a mixture of both alluvial and bedrock groundwater quality. Therefore, it is more appropriate to retain well TMW02 as an alluvial groundwater monitoring well and continue to monitor groundwater quality [from it]. Designate well TMW02 as an alluvial well."

The purpose of well TMW02 is to monitor groundwater quality for the alluvial aquifer rather than the first bedrock aquifer. Remove the reference to separate aquifers among the bedrock aquifer unless such distinction is quantitatively defined (e.g., hydraulic conductivity, recharge rate). If such a distinction is made, then: (a) designate all bedrock wells with either the first bedrock wells or the second bedrock wells, and (b) provide a basis for the designation (e.g., hydraulic conductivity, recharge rate) with information regarding the depths of screened intervals.

Well BGMW08 may be defined as the first bedrock aquifer based on its low recharge rate; however, it is not clear whether the well was advanced to the discontinuous sandstone interval. In addition, there is evidence that hydraulic communication between the alluvial and bedrock aquifers occurs, because contaminants have already migrated vertically across the aquifers in the Study Area. However, interaction between the first and second bedrock aquifers has not been determined, because the presence/absence of separate aquifers among the bedrock aquifer has not been clearly demonstrated. Therefore, the former statement can be misleading. Revise the Report accordingly.

10. Section 2.3.7.1, Alluvial Aquifer, lines 29-30, page 2-5

Permittee Statement: "The relatively thin saturated zone within the alluvium and the presence of discontinuous clay layers, indicate the alluvium is a single aquifer within the Study Area."

NMED Comment: The Executive Summary (ES), lines 19-26, page ES-2, discusses the findings regarding the investigation of multiple alluvial aquifers in the Study Area, yet states that the investigation was inconclusive. The ES is ambivalent with regards to this finding. Resolve the discrepancy in the revised Report.

11. Section 2.4, Previous Investigations, lines 28-30, page 2-6

Permittee Statement: "Eight groundwater plumes are located within the Administration and Workshop areas, across Parcel 11, Parcel 21, and Parcel 22 (see Section 1.1) (Sundance, 2019)."

NMED Comment: Other sections of the Report only provide discussion regarding six identified groundwater plumes (e.g., Section 1.1). There appears to be a discrepancy (see Comment 8) regarding the number of the identified groundwater plumes. Resolve the discrepancy in the revised Report.

12. Section 2.4.1.2.3, Building 11 (SWMU 6, Parcel 11), Historical Uses, lines 30-32, page 2-8

Permittee Statement: "Diesel fuel for the generators was supplied by an aboveground storage tank (AST) and a UST, named as separate AOCs (AOC 46 and AOC 51, respectively)."

NMED Comment: The location of the Areas of Concern (AOC) 46 and 51 are not depicted on Figure 2-4.1 (Potential Source Areas). Provide the locations of AOC 46 and 51 in the revised Figure 2-4.1. In addition, AOC 47 is described as the VOC Source Area in Figure 2-4.1. According to Permit Attachment 8, AOC 47 is recorded as an area where photoflash powder was historically spilled. Photoflash powder, however, does not contain VOCs. T, but the Report states that AOC 46 and 51 are the potential source areas for VOCs. Resolve the discrepancy in the revised Report, as appropriate. Furthermore, a discussion regarding previous investigations of AOC 46 and 51 was not included in the Report. Include the discussion regarding previous investigations conducted at AOC 46 and 51 in the revised Report.

13. Section 2.4.1.3, Nature and Extent of VOC Groundwater Contamination, lines 31-33, page 2-9, and Section 2.4.5.3, Nature and Extent of TPH DRO and GRO Groundwater Contamination, lines 13-15, page 2-25

Permittee Statements: "Based on data from previous investigations, the saturated thickness of the alluvium in the VOC [and TPH GRO and DRO] groundwater plume[s] are] approximately 30 feet with no continuous confining layer present. Thus, the alluvium is considered one aquifer. Below the alluvium is a claystone bedrock."

NMED Comment: Alluvial groundwater monitoring wells TMW06 and TMW07 are located south, adjacent to the Administration Area. Comment 6 of NMED's November 3, 2017 *Approval with Modifications Final Groundwater Periodic Monitoring Report, July through December 2016* states, states that:

"[t]he nitrate concentrations in alluvial monitoring wells TMW06 and TMW07 are recorded as 13 mg/L and non-detect (ND), respectively, in Figure 5-1. These wells are in close proximity to each other. The nitrate concentration in well TMW06 has routinely exceeded the regulatory limit during the previous sampling events while the nitrate concentration in well TMW07 has been non-detect or depicting very low-level detections. The boring/well logs show no notable differences between these wells except the depths of the screened intervals. Well TMW06 is screened from 45 to 55

below ground surface (bgs) while well TMW07 is screened from 65 to 75 bgs.”

This comment indicates that the aquifer thickness in the vicinity of the Administration Area could be greater than 30 feet and that separate alluvial aquifers may be present. Unless additional data to support the assertion is provided, remove the statement from the revised Report. In addition, the bedrock aquifer potentially present within/beneath the claystone bedrock has not previously been investigated in the Administration Area; therefore, the presence/absence of groundwater contamination in the Administration Area is unknown at this time. Submit a work plan to investigate presence of potential groundwater contamination in the bedrock aquifer beneath the Administration Area no later than **June 30, 2022**.

14. Section 2.4.2.2.7, TNT Leaching Beds (SWMU 1, Parcel 21), Remediation Activities, and Soil Contamination Related to Nitrate Groundwater Plumes, lines 33-35, page 2-14, and lines 6-8, page 2-15, and Section 2.4.4.2.1, TNT Leaching Beds and Building 503 (SWMU 1, Parcel 21), Remediation Activities, and Soil Contamination Related to Explosives-contaminated Groundwater Plume, lines 27-29, page 2-21, and lines 13-14, page 2-22

Permittee Statements: “Given the low infiltration rate and with clean soil in place, migration of residual contamination into groundwater will be minimal to none.” and, “[a]lthough administrative actions are required before a no further action is granted, the Army no longer considers the site as a potential source of groundwater contamination.”

NMED Comment: Although the severity of leaching potential of contaminants may have been reduced after implementation of the remediation activities (e.g., excavation) at the former TNT Leaching Beds, the Permittee left significant soil contamination in place at the site. The Permittee also chose to forego NMED’s recommendation regarding evaluation and implementation of measures to address contamination at depths beyond the limits of the excavation prior to backfilling. NMED identified multiple shortcomings regarding the remediation activities conducted at the site in the NMED’s August 3, 2020 and March 15, 2021 Disapprovals. Therefore, the Permittee’s assertions are not appropriate and must be removed from the revised Report.

15. Section 2.4.2.3, Nature and Extent of Nitrate Groundwater Contamination, lines 28-31, page 2-16

Permittee Statement: “Groundwater [nitrate] contamination observed in the bedrock monitoring wells is believed to be the result of contaminant releases from facilities located on the bedrock outcrop recharge zone (TNT Leaching Beds / Building 503 (SWMU 1), Building 515 (SWMU 2), and Building 528 Complex (SWMU 27)).”

NMED Comment: Although the statement would be true for the origin of perchlorate contamination in the bedrock aquifer (see Comment 5), NMED does not agree with the

statement because nitrate contamination in the bedrock aquifer also likely originated from the alluvial plume. Revise the statement for accuracy.

16. Section 2.4.3.2.3, Building 528 Complex (SWMU 27, Parcel 22), Soil Contamination Related to Perchlorate Groundwater Plumes, line 6, page 2-20

Permittee Statement: “Perchlorate concentrations exceeded the SL-SSL in 126 samples (USACE, 2011) [at the Building 528 Complex].”

NMED Comment: Provide a description of remediation activities conducted at the site, if any. Otherwise, state that the source of perchlorate contamination still remains at the site in the revised Report.

17. Section 2.4.3.3, Nature and Extent of Perchlorate Groundwater Contamination, line 8, page 2-20

Permittee Statement: “The extent of groundwater perchlorate contamination is limited to Parcel 21 and Parcel 22.”

NMED Comment: The perchlorate concentrations in the groundwater samples collected from well TMW39D have exceeded the applicable screening level. Well TMW39D is located in Parcel 13; therefore, the extent of the perchlorate plume extends to Parcel 13. Revise the statement for accuracy.

18. Section 2.4.3.3, Nature and Extent of Perchlorate Groundwater Contamination, lines 13-14, page 2-20

Permittee Statement: “The highest perchlorate concentration was detected in the upper bedrock aquifer in the Workshop Area.”

NMED Comment: Although the presence/absence of separate bedrock aquifers has not been demonstrated (see Comment 9), other sections of the Report (e.g., Sections 1.3.5 and 2.3.7.2) also use the designations of separate bedrock aquifers (first and second bedrock aquifers). In this statement, the bedrock aquifer is designated differently as the “upper bedrock aquifer”. It is not clear whether the upper bedrock aquifer is equivalent to the first bedrock aquifer referenced in the other sections. The designation of the separate bedrock aquifers must be consistent if such distinction is used in the revised Report.

19. Section 2.4.5.2.1, Building 6 (SWMU 45, Parcel 11), Soil Contamination Related to TPH DRO and GRO Groundwater Plumes, lines 27-28, page 2-24

Permittee Statement: “USACE concluded that the vertical extent of contamination is approximately 20 feet bgs.”

NMED Comment: A depth to alluvial groundwater generally reaches more than 40 feet bgs in the Administration Area and TPH have consistently been detected in the groundwater samples collected from the wells installed in the Administration Area. Accordingly, the vertical extent of the TPH contamination extended to the water table (e.g., more than 40 feet bgs). The statement is not accurate. Acknowledge that the vertical extent of contamination extends to the depth of the water table in the Administration Area, and remove the statement from the revised Report.

20. Section 3.3, Soil Vapor Sampling, lines 35-37, page 3-2

Permittee Statement: “Sixty-eight soil borings were advanced in the Administration Area to collect soil vapor samples to delineate the boundaries of 1,2-DCA soil vapor plume (Figure 3-3.1).”

NMED Comment: Figure 3-3.1 (Soil Vapor Sample Locations) only depicts 62 soil vapor sample locations. Resolve the discrepancy or provide an explanation for the discrepancy in the revised Report.

21. Section 3.4.1, Drilling, lines 24-25, page 3-4

Permittee Statement: “The first and second bedrock aquifers were defined by the thickness of the target bedrock units.”

NMED Comment: The definition of the first and second bedrock aquifers is not consistent because Section 2.3.7.2 defines the first bedrock aquifer as a laterally discontinuous water bearing zone without sustainable water production. The definition of the separate bedrock aquifers must be consistent. Regardless, the presence/absence of separate bedrock aquifers has not been demonstrated in the Report (see Comments 9 and 18). Remove the designation of separate bedrock aquifers from the revised Report or clearly define the distinction.

22. Section 3.4.2, Soil Sampling during Monitoring Well Installation, line 19, page 3-5

Permittee Statement: “A schedule of soil analyses for each boring is presented in Table 3-4.1.”

NMED Comment: Comment 1 in NMED’s January 22, 2020 *Approval with Modifications Final Northern Area Background Well Installation and Completion Report* etter states, “[a] minimum of three soil samples should be collected from each boring at the vadose zone with the highest PID reading, if applicable, at the water table, and the termination depth.” Since the borings were advanced for well installation prior to January 2020, the Permittee did not submit soil samples for the appropriate analyses. The purpose of each monitoring

well was described in the March 23, 2018 *Final Groundwater Supplemental RCRA Facility Investigation Work Plan Revision 4* (Work Plan). Table 3-4.1 (Schedule of Soil; Analyses) presents a list of soil analyses, but it is not consistent with the purpose described in the Work Plan. Soil samples should have been collected from each boring to be consistent with the purpose described in the Work Plan. Section 3.7.2.1 (Data Quality Exceptions) explains that the soil samples were only analyzed for VOCs (eight samples) and chromium (one sample). The following items must be identified as potential data gaps in the revised Report:

- a. The Work Plan describes that the purpose of well MW28 is to determine the concentrations of nitrate in alluvium at the elbow of the nitrate plume. However, Table 3-4.1 does not indicate that nitrate analysis was conducted for the soil samples collected from the location. Therefore, the presence/absence of soil contamination associated with nitrate is unknown.
- b. The Work Plan describes that the purpose of well MW33 is to determine the concentrations of the nitrate plume to the west of the Administration Area. However, Table 3-4.1 does not indicate that nitrate analysis was conducted for the soil samples collected from the location. Therefore, the presence/absence of soil contamination associated with nitrate is unknown.
- c. The Work Plan describes that the purpose of well MW34 is to determine the western boundary of the nitrate plume. However, Table 3-4.1 does not indicate that nitrate analysis was conducted for the soil samples collected from the location. Therefore, the presence/absence of soil contamination associated with nitrate is unknown.
- d. The Work Plan describes that the purpose of well MW35 is to confirm the metals concentrations in alluvial groundwater east of the Workshop Area. However, Table 3-4.1 does not indicate that metals analysis was conducted for the soil samples collected from the location. Therefore, the presence/absence of soil contamination associated with metals is unknown.
- e. The Work Plan describes that the purpose of well TMW50 is to determine the southwestern boundary of nitrate plume in the bedrock water-bearing zone. However, Table 3-4.1 does not indicate that nitrate analysis was conducted for the soil samples collected from the location. Therefore, the presence/absence of soil contamination associated with nitrate is unknown.
- f. The Work Plan describes that the purpose of well TMW51 is to determine the southeastern boundary of nitrate plume in the bedrock water-bearing zone. However, Table 3-4.1 does not indicate that nitrate analysis was conducted for the soil samples collected from the location. Therefore, the presence/absence of soil contamination associated with nitrate is unknown.

- g. The Work Plan describes that the purpose of well TMW53 is to determine the northern extent of nitrate plume in the bedrock water-bearing zone. However, Table 3-4.1 does not indicate that nitrate analysis was conducted for the soil samples collected from the location. Therefore, the presence/absence of soil contamination associated with nitrate is unknown.
- h. The Work Plan describes that the purpose of well TMW57 is to determine the eastern boundary of perchlorate and chromium in the alluvial water-bearing zone underneath the former Acid Pond. However, Table 3-4.1 does not indicate that perchlorate and chromium analyses were conducted for the soil samples collected from the location. Therefore, the presence/absence of soil contamination associated with perchlorate and chromium is unknown.
- i. The Work Plan describes that the purpose of well TMW58 is to determine the western boundary of nitrate and perchlorate plumes in the bedrock water-bearing zone. However, Table 3-4.1 does not indicate that nitrate and perchlorate analyses were conducted for the soil samples collected from the location. Therefore, the presence/absence of soil contamination associated with perchlorate is unknown.
- j. The Work Plan describes that the purpose of well TMW59 is to determine the concentrations of explosives within the central portion of the explosives plume. However, Table 3-4.1 does not indicate that explosives analysis was conducted for the soil samples collected from the location. Therefore, the presence/absence of soil contamination associated with explosives is unknown.

Failure to follow the NMED-approved Work Plan, including failure to collect and analyze samples appropriately, has resulted in many data gaps at FWDA. Failure to perform the appropriate work that was approved in the Work Plan will require the Permittee to perform further work in order to provide data to fill the data gaps. Provide justification for not collecting appropriate samples and not having the appropriate analyses conducted in the revised Report. In addition, propose to submit a work plan for collection and analyses of soil samples to fill the data gaps listed above no later than **June 30, 2022**.

23. Section 3.4.2, Soil Sampling during Monitoring Well Installation, lines 40-42, page 3-5, and Section 4.4.1.2, Other Analytical Results, lines 33-34, page 4-6

Permittee Statements: "In the Workshop Area, one soil sample was collected from above the water table and analyzed for chromium, as presented in Table 3-1 of the Work Plan (Sundance, 2018), to determine the extent of chromium within the alluvial water-bearing zone underneath the former Acid Pond... [t]he one soil sample associated with the nitrate/perchlorate plumes in the Workshop Area was collected from TMW57 and was analyzed for chromium."

NMED Comment: Table 3-4.1 does not indicate that chromium analysis was conducted for the soil samples collected at the former Acid Pond (see also Comment 22h). Resolve the discrepancy in the revised Report.

24. Section 3.4.5, Groundwater Sampling, lines 37-38, page 3-6

Permittee Statement: “Groundwater samples were analyzed for the constituents presented in Table 3-4.3 (Sundance, 2018 and USACE 2019).”

NMED Comment: Although all groundwater samples were proposed to be analyzed for the full analytical suite according to the Work Plan, there are some variations of selected analytical suite among groundwater samples according to Table 3-4.3 (Schedule of Groundwater Analyses). For example, groundwater samples collected from wells BGMW13D, BGMW13S, MW36D, and MW36S were analyzed for five additional analyses (alkalinity, cations, chloride/sulfate, PCBs, herbicides), those collected from wells TMW63 and TMW64 were analyzed for two additional analyses (PCBs and herbicides), and those collected from wells MW37, MW38, and MW39 were analyzed for one additional analysis (cations). Explain the basis for the variation of selected analytical suites and discuss these deviations in the revised Report.

25. Section 3.7.1, Soil Vapor Screening Criteria, lines 30-39, page 3-12

Permittee Statement: “A soil vapor screening level was calculated using the New Mexico Water Quality Control Commission (NM WQCC) standard for groundwater protectiveness using Henry’s equilibrium partition for 1,2-DCA between vapor and water (Henry’s Law). The soil vapor screening value is calculated as follows:

$$H = C_{\text{air}} \div C_{\text{water}}$$

$$C_{\text{air}} = H * C_{\text{water}}$$

Where:

$$H = \text{Henry's Law constant for 1,2-DCA (0.048)}$$

$$C_{\text{water}} = \text{NM WQCC (5 } \mu\text{g/L)}$$

$$C_{\text{air}} = 0.048 * 5 \mu\text{g/L} = 0.24 \mu\text{g/L}”$$

NMED Comment: A value of the Henry’s Law constant is significantly affected by temperature and the chemical composition of the water. For example, the Henry’s Law constant for volatile hydrocarbons increases approximately threefold for a 10°C increase in temperature. It is prudent to obtain empirical rather than theoretical value of the Henry’s Law constant since the calculated soil vapor screening level is directly proportional to its value. NMED recommends obtaining a site-specific value of the Henry’s Law constant in the future when such calculation is necessary for a site where multiple plumes comeingle. In addition, explain whether the value used as the Henry’s Law constant (0.048) is

representative of the site's groundwater conditions (e.g., temperature and salinity) in the revised Report. If the selected value is not representative of the site's groundwater conditions and must be refined, revise all applicable sections and tables of the Report. In addition, a formula to convert the calculated soil vapor screening level from $\mu\text{g/L}$ to parts per billion by volume (ppbv) is presented in the subsequent paragraph. Standard units for soil vapor concentrations and NMED's vapor intrusion screening levels are $\mu\text{g/m}^3$. For all discussion or presentation of soil vapor or air quality data, the Permittee must use $\mu\text{g/m}^3$ for concentration units. Revise the Report accordingly.

26. Section 4.1.1, Drilling Observations 3.7.1, lines 9-12, page 4-1, and Section 4.1.2, Soil Vapor Analytical Results, lines 14-15, page 4-1

Permittee Statements: "Sixty-eight soil vapor borings were attempted in the Administration Area. Twelve soil vapor borings met refusal at various depths before reaching the target depth of 30 ft bgs due to subsurface obstructions such as concrete. Another four borings could not be sampled due to tight soil conditions which prevented the collection of a soil vapor sample." And, "[f]ifty-two soil vapor samples were collected from the Administration Area and analyzed for 1,2-DCA."

NMED Comment: Figure 3-3.1 (Soil Vapor Sample Locations) depicts 62 soil vapor sample locations. Resolve the discrepancy in the revised Report or provide an explanation for the discrepancy (see Comment 20). Figure 3-3.1 must also be revised to identify the boring locations where soil vapor samples were not collected.

27. Section 4.1.2, Soil Vapor Analytical Results, lines 17-18, page 4-1

Permittee Statement: "1,2-DCA analytical results are presented on Figure 4-1.1 and Table 4-1.1."

NMED Comment: Figure 4-1.1 (1,2-DCA Soil Vapor Plume) depicts the boundary of the plume; however, the extent of the plume (e.g., north, south and east of Building B005) is not delineated. Since the data indicates that the soil vapor concentration of 1,2-DCA beneath Building B005 potentially exceeds applicable vapor intrusion screening levels, the Permittee must propose to investigate the risk associated with vapor intrusion within Building B005 in the revised Report. Submit a work plan to investigate risks associated with vapor intrusion within Building B005 no later than **June 30, 2022**, as applicable.

28. Section 4.2.2, Bedrock Aquifer, lines 4-9, page 4-2, and Section 4.2.5, Groundwater Level Measurements and Elevations, lines 27-31, page 4-2

Permittee Statements: "Eight bedrock wells (Four upper unit bedrock wells and four lower unit bedrock wells) were drilled and installed in the Study Area. Upper unit bedrock well depths ranged from 100 ft bgs at TMW64 located east of the TNT Leaching Beds to 125 ft

bgs at TMW51 located between the TNT Leaching Beds. Lower unit bedrock well depths ranged from 70 ft bgs at TMW50 in the southern portion of the Study Area, south of the TNT Leaching Beds to 185 ft bgs at TMW58 located northwest of the TNT Leaching Beds.” And, “Alluvial and lower bedrock unit (BR2) groundwater elevation contours are illustrated on Figure 4-2.1 and Figure 4-2.2, respectively. Groundwater elevation contours were not generated for the upper bedrock unit (BR1) because there is inconsistent groundwater elevation data to provide a depiction of the piezometric surface and an approximation of the groundwater flow direction.”

NMED Comment: The presence of the separate bedrock aquifers has not been demonstrated (see Comments 9, 18 and 21). Revise the statement as directed by the previous comments.

29. Section 4.2.6, Groundwater Gradients, lines 5-7, page 4-3, and Section 5.1.2, Presence of Multiple Alluvial Aquifers, lines 4-6, page 5-2

Permittee Statements: “Vertical hydraulic gradients were evaluated between two alluvial aquifer well pairs, four alluvial aquifer and the upper bedrock unit aquifer well pairs, and two upper bedrock unit and lower bedrock unit well pairs.” And, “Comparison of multiple seasonal groundwater elevations and groundwater quality between the well pairs is necessary before a finding of the presence of multiple aquifers can be made.”

NMED Comment: Although the evaluation of vertical hydraulic gradients is useful to identify the potential for vertical migration of contaminants, the presence/absence of separate units within the alluvial/bedrock aquifers is still inconclusive (see Comments 9, 10, 18, 21, and 28). One way to evaluate the presence/absence of separate units within the alluvial/bedrock aquifers is to compare its groundwater quality and chemical composition of groundwaters (e.g., concentrations of dissolved metals, anions, and contaminants). The groundwater data collected from the new well pairs (e.g., MW36S/MW36D, BGMW13S/BGMW13D, TMW29/TMW52, TMW52/TMW58, TMW03/TMW53, TMW39S/TMW64, TMW53/TMW63) as well as the existing well pairs (e.g., TMW40S/TMW02, TMW02/TMW40D, TMW06/TMW07, TMW31S/TMW31D, TMW39S/TMW39D) should be evaluated and the discussion included in future periodic groundwater monitoring reports. No revision is required to the Report.

30. Section 4.2.7.2, Bedrock Aquifer, lines 19-22, page 4-4, Section 4.4.2.1, Alluvial Aquifer, lines 32-35, page 4-7, Section 4.4.2.2, Bedrock Aquifer, lines 11-13, page 4-8,

Permittee Statements: “The elevated dissolved oxygen measurements were likely the result of supersaturation of the water by air which could have been introduced by the sample hose to the groundwater, entrained bubbles within the sample hose, and/or from bubbles on the dissolved oxygen sensor.”

NMED Comment: Comment 2 of the NMED's *[Response to] Approval with Modifications, Final Revision 1 Groundwater Periodic Monitoring Report, January through June 2018*, dated July 6, 2021, states, "NMED agrees that in-situ DO measurement using downhole probes is more effective and accurate. Propose to use downhole probes for water quality measurements, where applicable, in future groundwater monitoring plan update." Use downhole probes, where applicable, to resolve the issue in future DO measurements. Since the comment was provided after the DO measurements were conducted, no revision is required to the Report. This comment serves as a reminder.

31. Section 4.3.1.1, Geotechnical Results, 4.2.7.2, lines 37-38, page 4-4

Permittee Statement: "Analyses included sample porosity, organic content, dry bulk density, and Atterberg limits. The geotechnical analysis results are presented in Table 4-3.1."

NMED Comment: Table 4-3.1 (Soil Analytical Results – Geotechnical) presents the porosity values for the soil samples; however, it is not clear whether the values represent total or effective porosity. Provide a clarification in the revised Report.

32. Section 4.3.1.2, Other Analytical Results, lines 4-6, page 4-5

Permittee Statement: "The soil samples were collected from MW29, MW30, MW31, and MW32 at depths ranging from 10 to 42 ft bgs. There were no soil exceedances of the screening levels (Table 4-3.2)."

NMED Comment: Table 4-3.2 (Soil Analytical Detections – Chemical) does not list all compounds detected from the samples. For example, 1,2,4-trimethylbenzene, acetone, benzene, ethylbenzene, tetrachloroethene, toluene, and xylenes are listed as detected compounds using EPA method 8260C DOD in the soil sample collected from boring MW29 at a depth of 10 – 11 feet bgs (11VAL-MW29SB-D10-11SO). However, the analytical report (J126165-1 USD Level 2 Report Rev(1) Final Report, page 6) also lists naphthalene as a detected compound. All detected compounds must be listed in Table 4-3.2 for accuracy in the revised Report. In addition, provide a link for each specific sample to a specific lab report filename or to a page number in the appendix where the specific lab report can be found. The Permittee has been directed to provide this link numerous times. Failure to follow NMED direction constitutes noncompliance and may result in an enforcement action. Revise the Report accordingly (see Comment 2).

33. Sections 4.4.1.2, 4.5.1.2, and 4.7.1.2, Other Analytical Results, lines 33-35, page 4-6, lines

15-17, page 4-10, and lines 32-34, page 4-13

Permittee Statements: “The one soil sample associated with the nitrate/perchlorate plumes in the Workshop Area was collected from TMW57 and was analyzed for chromium. The concentration of chromium was below the screening level (Table 4-3.2).”

NMED Comment: Table 4-3.2 (Soil Analytical Detections – Chemical) does not list analytical data collected from boring TMW57. Resolve the issue in the revised Report.

34. Section 4.4.3.1, Alluvial Aquifer, lines 22-24, page 4-8

Permittee Statement: “A total of 24 alluvial wells were sampled for nitrate analysis. Eight detections of nitrate were reported above the screening level of 10 mg/L at concentrations ranging from 11 mg/L in MW34 to 58 mg/L in MW32. Detections of alluvial well nitrate analyses are presented in Table 4-4.1.”

NMED Comment: According to Table 4-4.1 (Groundwater Analytical Detections – Nitrate), the nitrite concentrations in groundwater samples collected from wells MW27, MW35, and MW59 were also reported above the screening level of 1 mg/L. Note that none of the nitrite concentrations in groundwater samples collected from alluvial wells exceeded the screening level during the April 2019 sampling event. Explain whether the groundwater sampling technique utilized in the October/November 2019 sampling event was different from the previous technique or evaluate whether a nitrite plume is present at the site. Provide a discussion in the revised Report.

35. Section 4.4.3.2, Bedrock Aquifer, lines 29-30, page 4-8

Permittee Statement: “Detections of bedrock well nitrate analyses are presented in Table 4-4.2.”

NMED Comment: There is a typographical error in the statement. The referenced table is Table 4-4.1 rather than Table 4-4.2. Correct the error in the revised Report.

36. Section 4.6.3.1, Alluvial Aquifer, lines 27-28, page 4-12

Permittee Statement: “Two detections of the explosive RDX were reported above the screening level of 9.7 µg/L at a concentration of 61 µg/L in well TMW59 and at 13 µg/L in well TMW62, respectively.”

NMED Comment: Wells TMW21 and MW27 are located downgradient of well TMW62 and can be used as sentinel wells for the RDX plume. However, the distance from well TMW62 to the sentinel wells exceeds 500 feet; therefore, the RDX plume boundary west of well TMW62 is not well defined. Submit a work plan to install an additional well to delineate the

western boundary of the RDX plume no later than **June 30, 2022**. In addition, well TMW54 installed south of the former pre-1962 TNT Leaching Bed is recorded as dry; therefore, the RDX plume south of well TMW40S is not delineated. According to Table 4-2.1 (Monitoring Well Construction Details), well TMW54 is screened at depths 21.4 - 41.4 feet bgs. However, all neighboring alluvial wells were screened at deeper intervals and the screened intervals of TMW54 and the neighboring alluvial wells were not comparable. For example, well TMW40S located downgradient of TMW54 was screened at a depth of 50 – 60 feet bgs and the highest RDX concentrations have been detected in the groundwater samples collected from this well. Also, the data collected from historical groundwater depth measurements, as well as the data collected during the excavation of the former TNT Leaching Beds indicate that groundwater is not present at the depth of the screened interval of well TMW54 (21.4 – 41.4 feet bgs). According to the boring log for TMW54 included in Appendix E1 (Boring Logs), moisture was observed at a depth of 80 – 90 feet bgs in the soil (claystone). Due to potential artesian conditions at the location, the water observed at depth of 80 – 90 feet bgs may be a source of groundwater detected in the downgradient alluvial wells. Submit a work plan to replace well TMW54 with a well that is constructed with a more appropriate screened interval no later than **June 30, 2022**.

37. Section 4.7.2.1, Alluvial Aquifer, lines 3-4, page 4-15

Permittee Statement: “Sulfate; one detection above the screening level of 600 mg/L at a concentration of 4,200 mg/L in MW36S.”

NMED Comment: According to Table 4-7.2 (Groundwater Analytical Detections - Other Constituents), the sulfate concentration in the groundwater sample collected from alluvial well MW36D located adjacent to MW36S is recorded as 74 mg/L. The screened intervals of wells MW36S and MW36D are recorded as 30 – 50 feet bgs and 55 – 75 feet bgs, respectively. Although these wells were installed in the same alluvial aquifer, chemical composition of the groundwater samples was significantly different. A similar phenomenon was observed in the groundwater samples collected from wells TMW06 and TMW07 (see Comment 13). Evaluate the presence/absence of separate units within alluvial/bedrock aquifers in future periodic groundwater monitoring reports (see Comment 29).

38. Section 4.7.2.2, Bedrock Aquifer, lines 15-16, page 4-15

Permittee Statement: “TPH-DRO –Screening level exceedances for TPH-DRO are presented in Table 4-7.1. There were seven TPH-DRO exceedances.”

NMED Comment: The TPH-DRO concentrations in the groundwater samples collected from bedrock wells TMW50 and TMW52 are recorded as 420 and 580 µg/L, which are higher than those detected in groundwater samples collected from alluvial wells located in the Administration Area. TPH analysis must be conducted for groundwater samples collected from all new bedrock wells to evaluate aquifer conditions in future groundwater sampling

events. Propose to conduct TPH-DRO and TPH-GRO analyses for the groundwater samples collected from all new wells in the revised Report and update the sampling requirement in the upcoming Interim Northern Area Groundwater Monitoring Plan.

39. Section 4.8.3, Groundwater Analytical Data, Completeness, lines 29-31, page 4-20

Permittee Statement: “No results were rejected (R), therefore 100 percent of the results reported by the laboratory were complete, meeting the project completeness goal of 90 percent.”

NMED Comment: The discussion regarding accuracy of some analyses indicates that several LCS and CCV parameters were either too high or too low. Although the statement indicates that the results are acceptable, it is not clear how they are acceptable and whether they are biased. Provide an explanation in the revised Report.

40. Section 5.1.1, Alluvial Groundwater, lines 18-21, page 5-1

Permittee Statement: “The groundwater mound has been previously attributed to a decommissioned water storage cistern and/or from the inactive artesian Well 68 (USGS, 2011). Army staff have also reported that former production well 69 is suspected of leaking into the alluvial aquifer and potentially contributing to the groundwater mound.”

NMED Comment: The Permittee stated that the contract to plug wells 68 and 69 was awarded during the November 3, 2021 BRAC Cleanup Team (BCT) meeting. However, it is not clear when these wells will be plugged. Provide a timeline for when these wells will be abandoned/plugged in the revised Report.

41. Section 5.1.3, Bedrock Groundwater, lines 13-17, page 5-2

Permittee Statement: “Groundwater elevations between four wells in the upper bedrock unit (BR1) were inconsistent and groundwater parameters did not stabilize at these locations during sampling. Although the findings indicate the presence of water in the upper sandstone unit, it is unlikely to be an extensive water bearing zone. The extent and gradient of the first water bearing zone could not be completely and reliably assessed.”

NMED Comment: Provide data (examples) to support the assertion in the revised Report.

42. Section 5.2.2, Fate and Transport, lines 12-13, page 5-3, and Section 5.3.1.2, Fate and Transport, lines 17-18, page 5-4

Permittee Statements: “This figure illustrates the relationship between these two plumes as follows: the groundwater VOC plume originates in the same vicinity as the soil vapor plume.” And, “Based upon soil vapor results, the groundwater plume has a continuing

source of contamination (Figure 5-2.1). If the soil vapor source exists, the groundwater plume will persist.”

NMED Comment: VOCs detected as soil vapor continue to partition into groundwater and act as a source of the groundwater plume. Submit a work plan to investigate the extent of the soil vapor plume, including the potential for vapor intrusion, in the vicinity of Building B006 no later than **June 30, 2022**.

43. Section 5.3.1.2, Fate and Transport, lines 22-25, page 5-4

Permittee Statement: “The low VOC concentration at MW25 suggests that the VOC plume is attenuating at the margins via dilution and dispersion. This is further supported by the lack of degradation by-products reported by the analytical laboratory and by the aerobic groundwater conditions downgradient of B006 (Table 4-2.4).”

NMED Comment: The statement is speculative and inaccurate. The DO concentrations in the groundwater samples collected from wells MW18D and TMW33 during the April 2019 sampling event are recorded as 1.01 and 0.37 mg/L, respectively. According to Table 4-2.4 (Groundwater Quality Parameters), the DO concentration in well MW25 is recorded as 0.7 mg/L. The groundwater conditions downgradient of Building B006 are not aerobic. In addition, degradation by-products of 1,2-DCA (e.g., carbon dioxide) have not been analyzed by the analytical laboratory. Remove the statement from the revised Report. Furthermore, the terms VOC and 1,2-DCA are used interchangeably in some parts of the Report. Since 1,2-DCA is only one of the VOCs, the term VOC must not be used interchangeably for the contaminant. Revise the Report accordingly.

44. Section 5.3.2.2, Fate and Transport, lines 20-22, page 5-5

Permittee Statement: “In the alluvial aquifer, the northerly nitrate plume migration is consistent with the alluvial hydraulic gradient with prominent changes in direction at the southern boundary with Parcel 11 and again in the central portion of Parcel 11 (Figures 4-2.1 and 4-4.1).”

NMED Comment: According to Figure 4-2.1 (Groundwater Elevation Contours – Alluvial), groundwater flows toward the west in the vicinity of the former TNT Leaching Beds. However, according to Figure 4-4.1 (Alluvial Groundwater Plume – Nitrate), the nitrate plume expands north rather than west. The direction of the groundwater flow and the plume expansion does not appear to be consistent in some areas. A similar inconsistency is observed in the direction of the RDX plume expansion depicted on Figure 4-6.1 (Alluvial Groundwater Plume – Explosives). Evaluate the cause of the inconsistency between the direction of the groundwater flow and the plume expansion in some areas and provide a discussion in the revised Report.

45. Section 5.3.2.2, Fate and Transport, lines 23-25, page 5-5

Permittee Statement: “The change in plume direction is consistent with alluvial high groundwater elevation at MW27 which deflects the groundwater in this direction.”

NMED Comment: The influence of Well 69, a potential source of groundwater mounding, is likely unrelated to the observed groundwater elevation at well MW27. Discuss the potential cause of groundwater mounding in the vicinity of well MW27 in the revised Report.

46. Section 5.3.2.2, Fate and Transport, lines 35-38, page 5-5

Permittee Statement: “Nitrate is not observed in bedrock monitoring wells TMW36, TMW53, TMW52, and TMW63 despite these locations being overlain or in close proximity to the alluvial nitrate plume (Figure 4-4.2). This suggests a low potential for vertical migration of nitrate from the alluvial aquifer to the bedrock aquifer.”

NMED Comment: Note that the bedrock nitrate plume is already present upgradient of wells TMW36, TMW53, TMW52, and TMW63. Therefore, even if there is a low potential for vertical migration of nitrate from the alluvial aquifer to the bedrock aquifer, there will be a high potential for lateral migration of nitrate within the bedrock aquifer, and nitrate may be detected in the wells in the future; therefore, continued groundwater monitoring is important. No revision is required.

47. Section 5.3.5.1, Nature and Extent of Contamination, TPH, lines 12-13, page 5-9

Permittee Statement: “In the alluvial aquifer, most of the detections were located in the Administration Area (Parcel 11) where two former fueling facilities were located (Figure 2-4.1).”

NMED Comment: Although the statement is true, the TPH-DRO concentrations in the groundwater samples collected from wells located in areas other than the Administration Area (e.g., northwest corner of the Study Area and north of the former TNT Leaching Beds) also exceeded the screening level of 16.7 µg/L. These TPH-DRO exceedances must also be addressed in the revised Report.

48. Section 5.3.5.1, Nature and Extent of Contamination, TPH, lines 14-17 and 20-23, page 5-9

Permittee Statements: “Of the alluvial samples collected in the Administration Area, only one sample (MW39) displayed a typical diesel fuel pattern in the chromatogram. Therefore, the TPH-GRO and TPH-DRO contours in Parcel 11 were based upon groundwater sample results from the 2019 Groundwater Periodic Monitoring Report (Sundance, 2019).”

and,

“Reported detections of TPH-GRO or TPH-DRO do not necessarily mean the detection was

gasoline or diesel itself. The sample chromatograms are compared against chromatograms of actual gasoline or diesel fuel in order to establish whether the sample pattern matches the fuel pattern.”

NMED Comment: The contaminant contours must be prepared based on the results reported by the laboratory. Inclusion/exclusion of the data based on an examination of the chromatograms may introduce bias and is not appropriate. Revise all applicable sections, tables, and figures to include the data as reported by the analytical laboratory.

49. Section 5.3.5.1, Nature and Extent of Contamination, TPH, lines 25-28 and 33-35, page 5-9

Permittee Statements: “The TPH-DRO detections in the northwestern portion of the Study Area are not associated with a distinct source of diesel fuel, and the chromatograms for these detections lack a distinctive diesel pattern as observed in the diesel standard (Appendix F3).” And, “Therefore, these detections are likely due to naturally occurring organic compounds which were reported by the analytical laboratory as TPH-DRO, not as diesel fuel, and are not likely due to diesel fuel contamination.”

NMED Comment: The discussion is speculative because relevant compound-specific analyses (e.g., semi-volatile organic compound (SVOC)) were not conducted for the groundwater samples and no reference is made to comparisons to chromatograms for other types of fuels, solvents, or naturally occurring organic compounds. The compounds causing the elevated TPH-DRO concentrations may or may not be naturally occurring organic compounds and such determination cannot be made from the available data. Propose to conduct SVOC analysis for the groundwater samples collected from all wells where TPH-DRO was detected in the revised Report and update the sampling requirement in the upcoming Interim Northern Area Groundwater Monitoring Plan. This comment is also applicable to the subsequent discussion regarding the detection of TPH-DRO in the bedrock wells.

50. Section 6.2, Soil Vapor VOC Plume, lines 19-22, page 6-1

Permittee Statement: “To design a remedy for the soil vapor plume, it is recommended that the horizontal limits of the plume be defined by collection and analysis of additional soil vapor samples to the north, south and east of Building B005.”

NMED Comment: NMED concurs with the recommendation. Submit a work plan to investigate the extent of the soil vapor plume no later than **June 30, 2022** (see Comment 42).

51. Section 6.3.2, Nitrate Groundwater Plumes, lines 31-32, page 6-1

Permittee Statement: “It is recommended that the subsurface in the vicinity of Building

B009 and/or AOC 47 (Building 11) be investigated for potential source(s) of nitrate contamination to groundwater.”

NMED Comment: Explain how wastewater generated from the buildings located in the Administration Area has been managed, and provide a map showing the location of the sewer lines in the Administration Area. The subsurface investigation for potential source(s) of nitrate must include a provision to evaluate the integrity of the sewer lines. Submit a work plan to investigate the potential sources of nitrate contamination in groundwater no later than **June 30, 2022**.

52. Section 6.3.5, Other Constituents in Groundwater, TPH, lines 18-22, page 6-2

Permittee Statement: “No additional investigative activities are recommended for TPH. However, for those groundwater monitoring wells where TPH GRO and TPH DRO are reported, incorporation of a silica gel cleanup to the analytical protocol is recommended for comparative purposes. The silica gel cleanup removes naturally occurring organic matter to allow for a more representative result due solely to petroleum hydrocarbons.”

NMED Comment: Unless the TPH-GRO/DRO concentrations are proven to be false positives, additional provisions that address the detection of TPH-GRO/DRO are warranted (see Comments 38 and 49). Should the Permittee wish to utilize alternative sampling protocols, such as the use of silica gel to remove naturally occurring organic matter during the analysis, they must submit a petition for alternate sampling methods to NMED in accordance with 40 CFR 260.21, including a demonstration by comparison with results from the standard procedure that indicates the data quality is suitable for the project’s purpose. Any change to a sampling or analysis method must be evaluated and approved by NMED prior to its use. Acknowledge the requirement in the revised Report or remove the recommendation.

53. Section 6.3.5, Other Constituents in Groundwater, Herbicides, Pesticides and PCBs, lines 28-30, page 6-2

Permittee Statement: “Additional groundwater sampling and analysis of herbicides is recommended from monitoring wells MW36S, BGMW13D and BGMW07 to determine if the reported estimated herbicide detections are repeatable and present.”

NMED Comment: NMED concurs with the recommendation. In addition, two pesticide compounds were reported at concentrations below screening levels in the groundwater samples collected from wells TMW40S and TMW52. These wells also must be monitored for pesticides to determine if the detections are repeated. Propose to conduct pesticide analysis for the groundwater samples collected from wells TMW40S and TMW52 for a minimum of two consecutive groundwater sampling events in the revised Report and update the sampling requirement in the upcoming Interim Northern Area Groundwater

Monitoring Plan.

54. Section 6.3.5, Other Constituents in Groundwater, Herbicides, Pesticides and PCBs, lines 28-30, page 6-2

Permittee Statement: “At monitoring well MW36S, it is recommended that additional groundwater sampling and analysis of chloride and sulfate be performed as these constituents were reported at concentrations exceeding applicable screening level (Table 5-3.5).”

NMED Comment: NMED concurs with the recommendation. The analysis of chloride and sulfate also may be useful to determine the presence/absence of separate aquifers (see Comment 29). In the revised Report, propose to conduct chloride/sulfate analysis for the groundwater samples collected from all pertinent wells where such evaluation is relevant and potentially feasible. Update the sampling requirement in the upcoming Interim Northern Area Groundwater Monitoring Plan.

55. Figure 4-2.1, Groundwater Elevation Contours – Alluvial

NMED Comment: According to Figure 4-2.1, the groundwater elevation measured in piezometer PZ04 is recorded as 6,644.62 feet. However, piezometer PZ04 is located between the groundwater elevation contour lines of 6,650 and 6,645 feet. Similarly, the groundwater elevation measured in TMW60 is recorded as 6,628.31 feet. However, well TMW60 is located between the groundwater elevation contour lines of 6,645 and 6,640 feet. Resolve the discrepancy in the revised Report.

56. Figure 4-3.1, Alluvial Groundwater Plume – VOCs, and Figure 4-3.2, Bedrock Groundwater Concentrations – VOCs

NMED Comment: According to Table 4-3.3 (Groundwater Analytical Detections – VOCs), VOCs other than 1,2-DCA (e.g., benzene, toluene) were detected in the groundwater samples collected from alluvial and bedrock wells. Although Figures 4-3.1 and 4-3.2 are presented as depicting all VOC detections, detections of VOCs other than 1,2-DCA are recorded as “Not Detected (ND)” on the figures. Revise the purpose of the figures or include all VOC detections on the revised figures.

57. Figure 4-4.1, Alluvial Groundwater Plume – Nitrate

NMED Comment: The nitrate concentration in the groundwater sample collected from well BGMW02 exceeded the nitrate screening level of 10 mg/L. However, the exceedance is not identified on the figure. Correct the figure for accuracy in the revised Report.

58. Figure 4-7.1, Alluvial Groundwater Concentrations - TPH

NMED Comment: Figure 4-7.1 contains multiple inaccuracies. For example, although the TPH-DRO concentrations in the groundwater samples collected from well MW29, MW30, and MW31 are recorded as 55 J, 33 J, and 77 J $\mu\text{g/L}$, respectively, which all exceed the TPH-DRO screening level of 16.7 $\mu\text{g/L}$, these wells are depicted outside of the concentration contour line of 16.7 $\mu\text{g/L}$. Similarly, although the TPH-GRO concentration in the groundwater sample collected from well MW30 is recorded as 12 J $\mu\text{g/L}$, which exceeded the TPH-GRO screening level of 10.1 $\mu\text{g/L}$, the well is depicted outside of the concentration contour line of 10.1 $\mu\text{g/L}$. In addition, although multiple exceedances of TPH-DRO and TPH-GRO are recorded (e.g., 86 J $\mu\text{g/L}$ TPH-DRO in MW36S, 43 J $\mu\text{g/L}$ TPH-DRO and 21 J $\mu\text{g/L}$ TPH-GRO in BGMW13S, 40 J $\mu\text{g/L}$ TPH-DRO in BGMW11, 37 J $\mu\text{g/L}$ TPH-DRO in MW37, 36 J $\mu\text{g/L}$ TPH-DRO in MW25, 90 J $\mu\text{g/L}$ TPH-DRO in MW33, 32 J $\mu\text{g/L}$ TPH-DRO in MW34, 59 J $\mu\text{g/L}$ TPH-DRO in MW27, 51 J $\mu\text{g/L}$ TPH-DRO and 18 J $\mu\text{g/L}$ TPH-GRO in MW28, 94 J $\mu\text{g/L}$ TPH-DRO in TMW59), these exceedances are not identified in the figure. The size of the TPH-DRO and TPH-GRO plumes may be larger than those presented in the figure. Since the detections are not proven to be less than the cleanup level at this time, revise the figure for accuracy.

The Permittee must submit a revised Report that addresses all comments contained in this letter. Two hard copies and an electronic version of the revised Report must be submitted to the NMED. The Permittee must also include a redline-strikeout version in electronic format showing where all revisions to the Report have been made. The revised Report must be accompanied with a response letter that details where all revisions have been made, cross-referencing NMED's numbered comments. The revised Report must be submitted to NMED no later than **May 12, 2022**. In addition, the work plan required by Comments 13, 22, 27, 36, 42, 50, and 51 must be submitted no later than **June 30, 2022**. Furthermore, Comments 38, 49, 53, and 54 must be addressed in the upcoming Interim Northern Area Groundwater Monitoring Plan.

Should you have any questions, please contact Michiya Suzuki of my staff at (505) 690-6930.

Sincerely,

Rick Shean

Digitally signed by Rick
Shean
Date: 2022.01.25 06:01:09
-07'00'

Rick Shean
Chief
Hazardous Waste Bureau

cc: D. Cobrain, NMED HWB
B. Wear, NMED HWB

Mr. Cushman
January 25, 2022
Page 25

M. Suzuki, NMED HWB
L. McKinney, EPA Region 6 (6LCRRC)
L. Rodgers, Navajo Nation
S. Begay-Platero, Navajo Nation
M. Harrington, Pueblo of Zuni
C. Seoutewa, Southwest Region BIA
A. Whitehair, Southwest Region BIA
G. Padilla, Navajo BIA
J. Wilson, BIA
B. Howerton, BIA
R. White, BIA
C. Esler, Sundance Consulting, Inc.
A. Soicher, USACE

File: FWDA 2022 and Reading

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1 **APPENDIX B**
2 **Sewer Line Investigation Camera Survey Results**

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Date: May 20, 2025

Project Location: Fort Wingate Depot Activity, McKinley County, New Mexico

Subject: Sewer Line Investigation Camera Survey Results Summary

Prepared By: Parsons

This report outlines the objectives and methods of the sewer line investigation conducted at Fort Wingate Depot Activity (FWDA), located in McKinley County, New Mexico. The investigation involved a detailed camera inspection of sewer lines located within the alluvial groundwater nitrate plume within Parcels 11 and 21, which range from 4 to 8 inches in diameter and are situated approximately 10 feet below ground, as shown on Figure B.1. Access was achieved through existing sanitary manholes, thereby eliminating the need for confined space entry.

The sewer line investigation commenced at manholes H-1 and H-2 in the southern portion of the survey area in Parcel 21 and then advanced north through the sewer lines into Parcel 11. Both manholes H-1 and H-2 exhibited significant sediment infiltration, obstructing the sewer line openings and preventing data collection in the surrounding pipelines, as illustrated in the Figure B.2. The sediment intrusion reduced the workable diameter of the pipes, limiting the effectiveness of the camera crawler, which scraped against the pipe casing. Consequently, each manhole was assessed for crawler suitability, but only manhole F-15 was compatible. The remaining manholes were investigated using a push cable camera. Results of the sewer line survey are presented on Figures B.1 through B.4.

Sewer Line Survey Results

During the camera investigation, integrity issues were identified and documented with annotated photographs, detailing the type of damage and distance from the source. The Crawler Camera and Push Camera Reports are presented in Attachment B.2. Damage types included cracks, fractures, and breaks consisting of broken sections, offsets, root intrusion, and sediment limits. These are defined as follows:

- **Crack:** Small split or fissure in the pipe material, potentially allowing water seepage or soil entry.
- **Fracture:** Partial break indicating significant compromise, leading to leaks and potential complete breaks.
- **Break:**
 - **Broken:** Complete severance or shattering, resulting in total loss of function.
 - **Offset:** Misalignment of pipe sections, disrupting flow and causing blockages. Due to extensive sediment buildup and root intrusion, a comprehensive investigation of all lines was not feasible, even with the push cable camera.

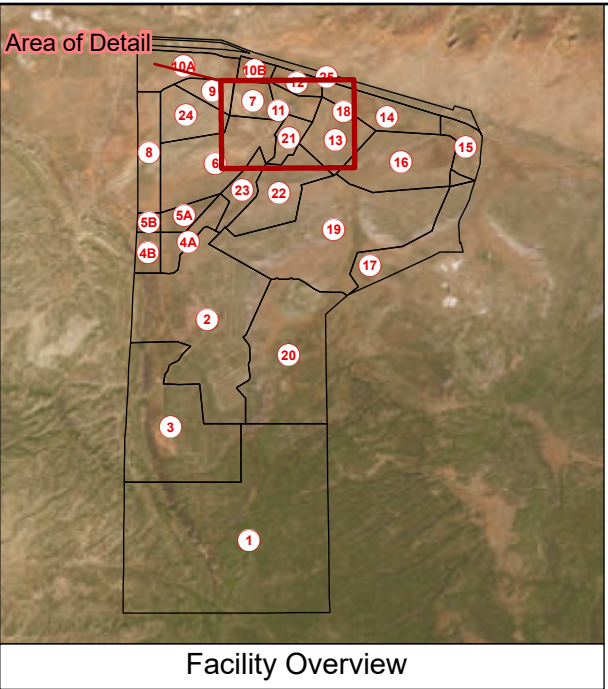
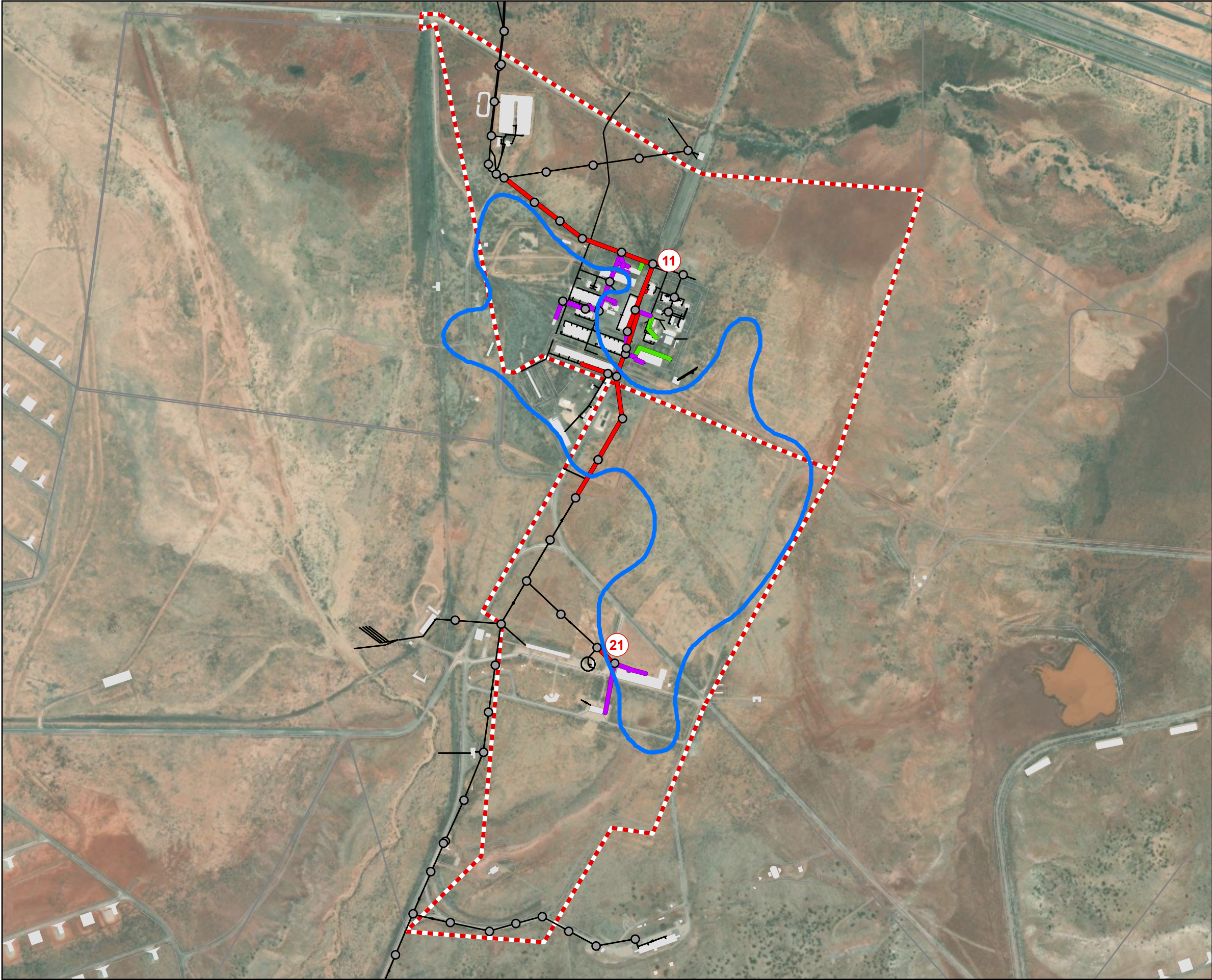
- **Root Intrusion:** Root intrusion occurs when tree or plant roots penetrate sewer pipes, seeking moisture and nutrients. Clay pipes, often used in older sewer systems, are particularly vulnerable to this type of damage due to their porous nature and the presence of joints. Roots can enter through small cracks, fractures, or gaps in the pipe joints, gradually expanding and causing blockages or further structural damage. Over time, root intrusion can lead to reduced flow capacity, backups, and even complete pipe failure if not addressed.
- **Sediment limit:** The term "sediment limit" refers to the point at which accumulated sediment within a sewer pipe becomes so substantial that it obstructs the passage of inspection equipment, such as a push camera. This buildup can result from various sources, including soil infiltration, debris, or mineral deposits, and it can significantly impede the ability to conduct a thorough inspection. When the sediment limit is reached, it indicates that the camera can no longer advance further into the pipe, preventing a complete assessment of the line's condition beyond that point.

Damaged and Missing Manholes

Several manholes were inaccessible due to sediment obstruction, damage, or absence. Manholes H-1, H-2, F-16, E-9, and E-16 were filled with sediment, preventing data collection in any direction. Manholes E-1, E-25, and E2-6 were not located during the survey. Although the well body of Manhole E-1 was found intact west of E-2, only a hollow concrete slab was discovered at its expected location. UXO technicians cleared surface sediment in an attempt to uncover an access point, but none was found. Extensive searches using an analog metal detector failed to locate Manholes E-25 and E-26, likely due to surface debris and proximity to railroad tracks and building foundations.

FIGURES

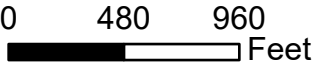
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Legend

- Sanitary Manhole
- Sanitary Sewer
- 4 IN Sanitary Line
- 6 IN Sanitary Line
- 8 IN Sanitary Line
- Alluvial Nitrate Contour, 10 mg/L
- - - Parcel Boundary
- ⑪ Parcel Number

Note: Sanitary sewer lines are inactive



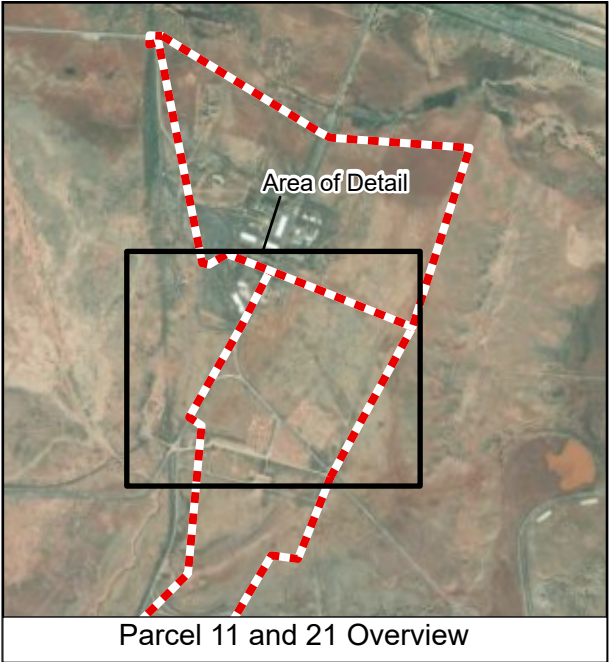
Work Plan
Northern Area Sewer Line Investigation
Fort Wingate Depot Activity
McKinley County, New Mexico

**Sewer Line Camera Survey,
Northern Area Sewer Line,
Overview**

Figure	B.1	GIS by	AM	6/23/2025
Client	USACE, Albuquerque District	Checked by	TV	6/23/2025
		PM	CR	6/23/2025

Path: V:\MMRP-FW\WinArcPro\SewerInvestigation\Analysis\Wingate_Sewer_Analysis.aprx
Layout: FigB.1_Sewer Line Camera Survey, Northern Area Sewer Line, Overview Date Saved: 6/23/2025 10:06 AM Date Exported: 6/23/2025 3:28 PM

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Legend

- Crack
- Fracture
- Break
- Monitoring Well
- Sanitary Manhole
- Sanitary Sewer
- Alluvial Nitrate Contour (10 mg/L)
- Sanitary Sewer - Obstructed, Not Investigated
- Parcel Boundary
- Parcel Number

Note: Sanitary sewer lines are inactive

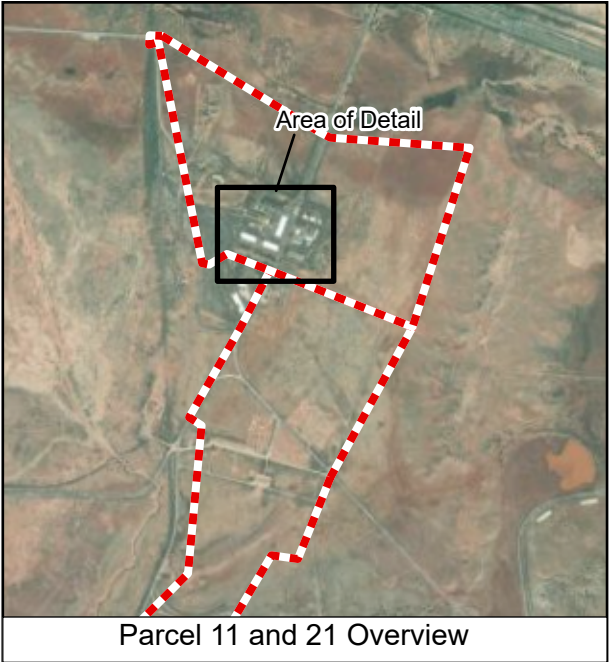
0 240 480 Feet

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Work Plan Northern Area Sewer Line Investigation Fort Wingate Depot Activity McKinley County, New Mexico				
Northern Area, Sewer Line Overview, Parcel 21, Manholes H-1 and H-2, F-14 through F-16, E-2				
Figure	B.2	GIS by	AM	6/26/2025
Client	USACE, Albuquerque District	Checked by	TV	6/26/2025
		PM	CR	6/26/2025

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Layout: FigB.2_Northern Area, Sewer Line Overview, Parcel 21 Date Saved: 6/25/2025 4:57 PM Date Exported: 6/26/2025 11:03 AM

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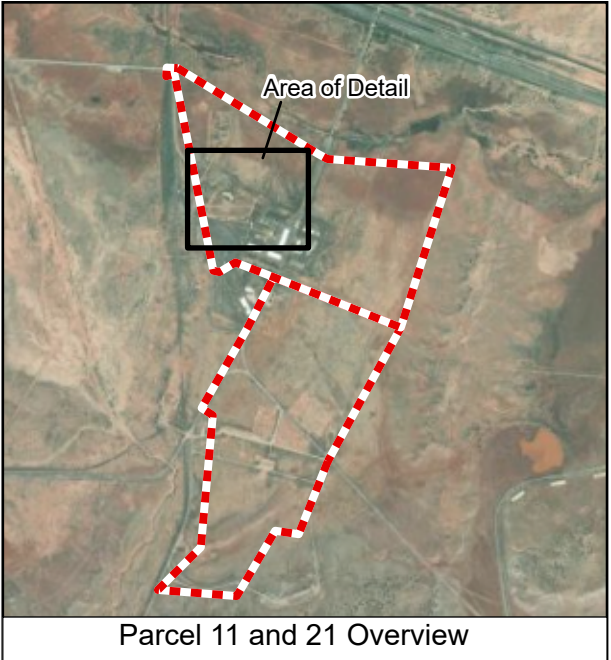
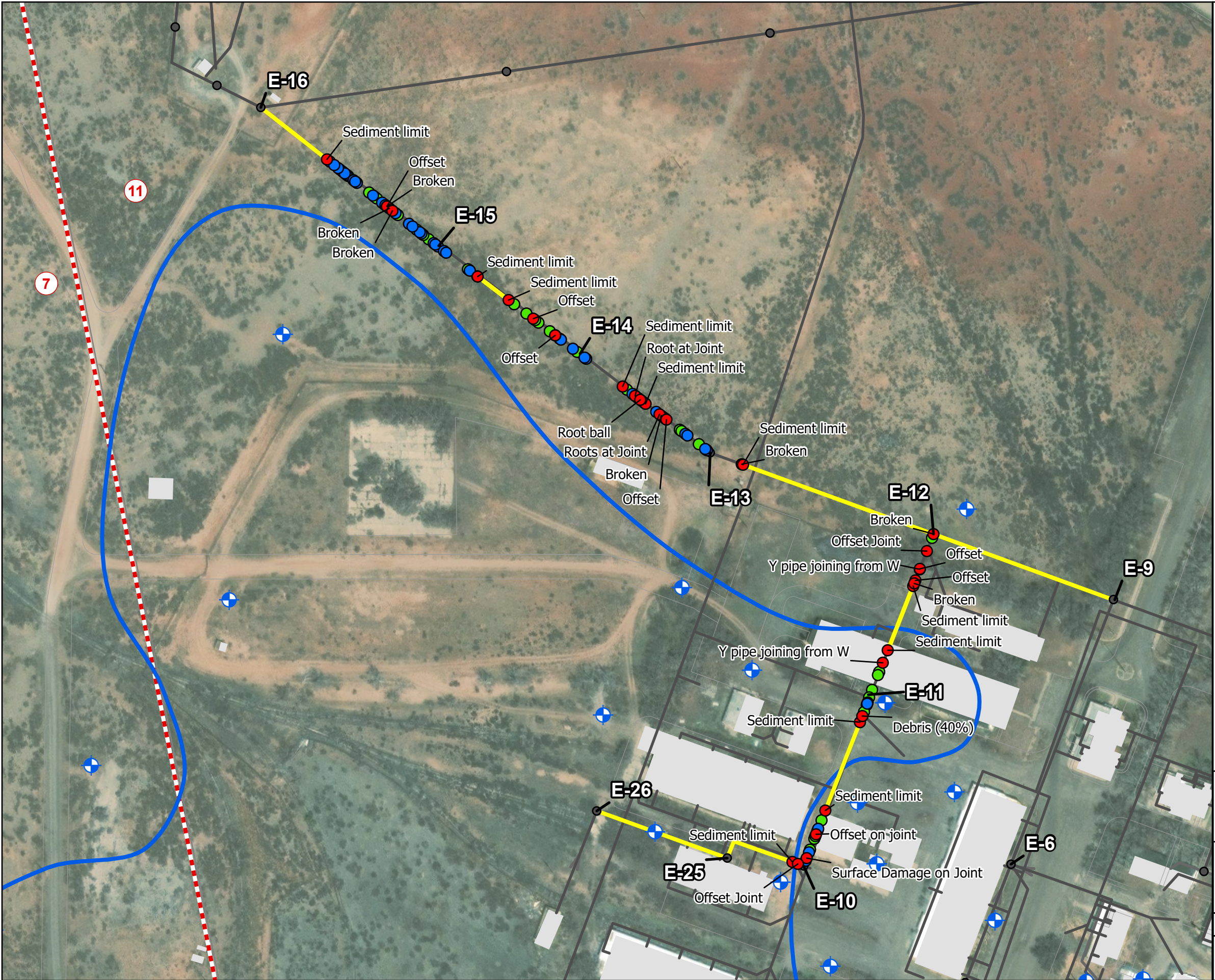
- Crack
- Fracture
- Break
- Monitoring Well
- Sanitary Manhole
- Alluvial Nitrate Contour (10 mg/L)
- Sanitary Sewer
- Sanitary Sewer - Obstructed, Not Investigated
- Parcel Boundary
- Parcel Number

Note: Sanitary sewer lines are inactive

0 150 300 Feet

Northern Area Sewer Line Investigation Fort Wingate Depot Activity McKinley County, New Mexico				
Northern Area Sewer Line Overview, Parcel 11 Manholes E-1 through E-9				
Figure	B.3	GIS by	AM	6/26/2025
Client	USACE, Albuquerque District	Checked by	JU	6/26/2025
		PM	CR	6/26/2025

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- Legend**
- Crack
 - Fracture
 - Break
 - Sanitary Manhole
 - Monitoring Well
 - Alluvial Nitrate Contour (10 mg/L)
 - Sanitary Sewer
 - Sanitary Sewer - Obstructed, Not Investigated
 - Parcel Boundary
 - Parcel Number

Note: Sanitary sewer lines are inactive

0 150 300 Feet

Northern Area Sewer Line Investigation Fort Wingate Depot Activity McKinley County, New Mexico				
Northern Area Sewer Line Overview, Parcel 11 Manholes E-9 through E-16, E-25 and E-26				
Figure	B.4	GIS by	AM	6/26/2025
Client	USACE, Albuquerque District	Checked by	JU	6/26/2025
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ATTACHMENT B.1
Photo Log

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Photo 1: (05/06/2025) Badger crew sets up 8" crawler camera on manhole H-1.



Photo 2: (05/06/2025) Badger crew sets up push cable camera on manhole F-14.



Photo 3: (05/06/2025) Manhole H-1 filled with sediment. Top of pipe entrance is barely visible on left side.



Photo 4: (05/06/2025) Manhole H-2 filled with sediment. Top of pipe barely visible top and left side of photo.



Photo 5: (05/06/2025) Manhole F-14. Access to sewer line unimpeded.



Photo 6: (05/06/2025) Manhole E-2



Photo 7: (05/07/2025) Manhole E-6 with 6" crawler camera deployed. Unable to bypass sediment at pipe entrance.



Photo 8: (05/07/2025) Suspected location of covered manholes E-3 and E-4.



Photo 9: (05/07/2025) Push camera deployed in manhole E-11.



Photo 10: (05/07/2025) Root intrusion identified on field screen at manhole E-11.



Photo 11: (05/08/2025) Damage inside manhole E-9 towards E-12.



Photo 12: (05/08/2025) Collapsed manhole F-16.



Photo 13: (05/08/2025) Push camera deployed in manhole E-16.



Photo 14: (05/08/2025) Manhole E-12 with sediment intrusion blocking E-W sewer lines access pipes. Two snakes found in manhole.

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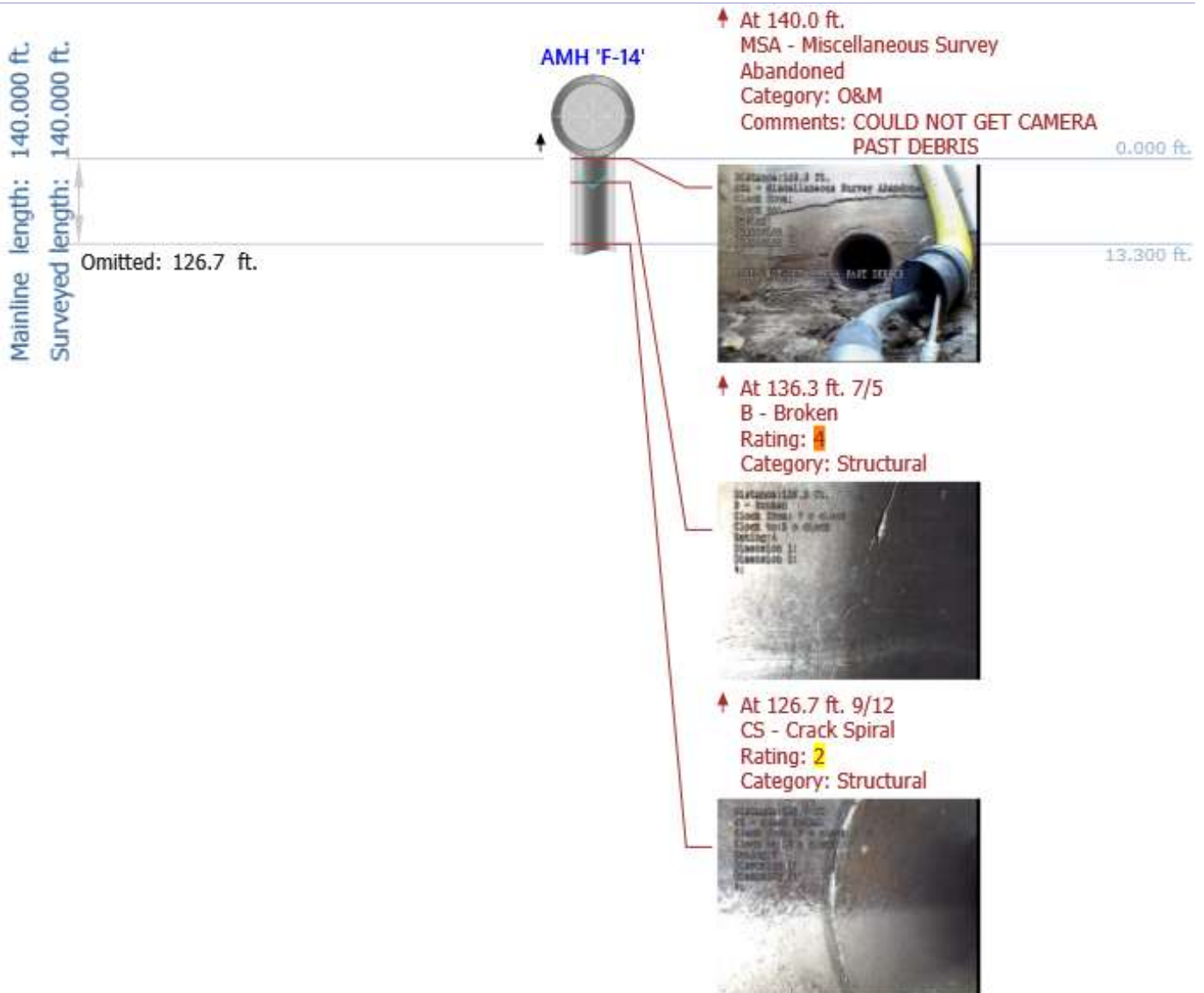
ATTACHMENT B.2
Camera Survey Reports

*(Provided in electronic format only due to page length [147 pages].
Hard copy available upon request.)*

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Main Inspections Pipe Run with Images

Project name:	Mainline ID:	City:	Street:
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Start date/time:	Direction:	Weather:	Location code:
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Shape:	Material:	Height:	Width:
C	VCP	8 in.	



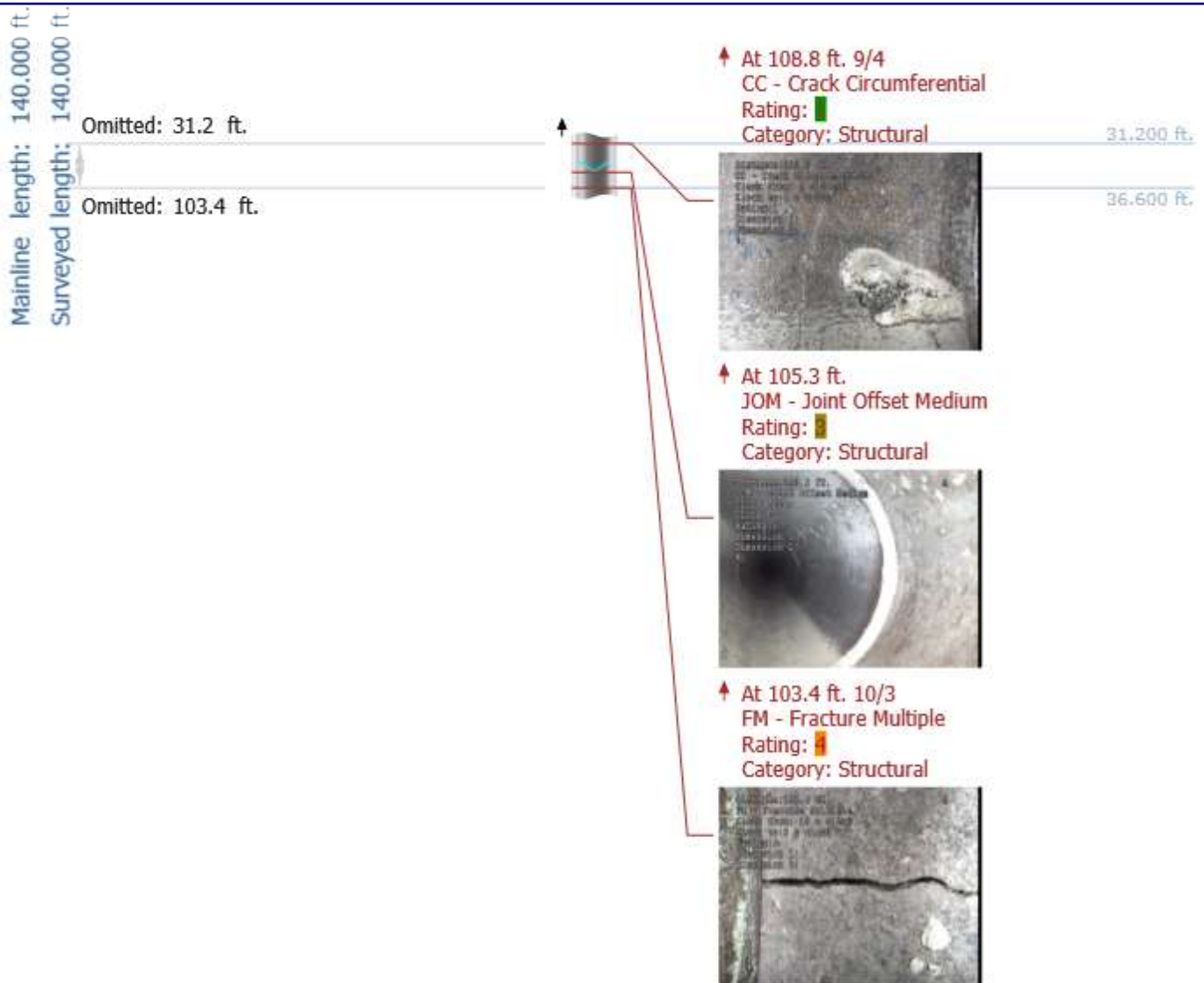
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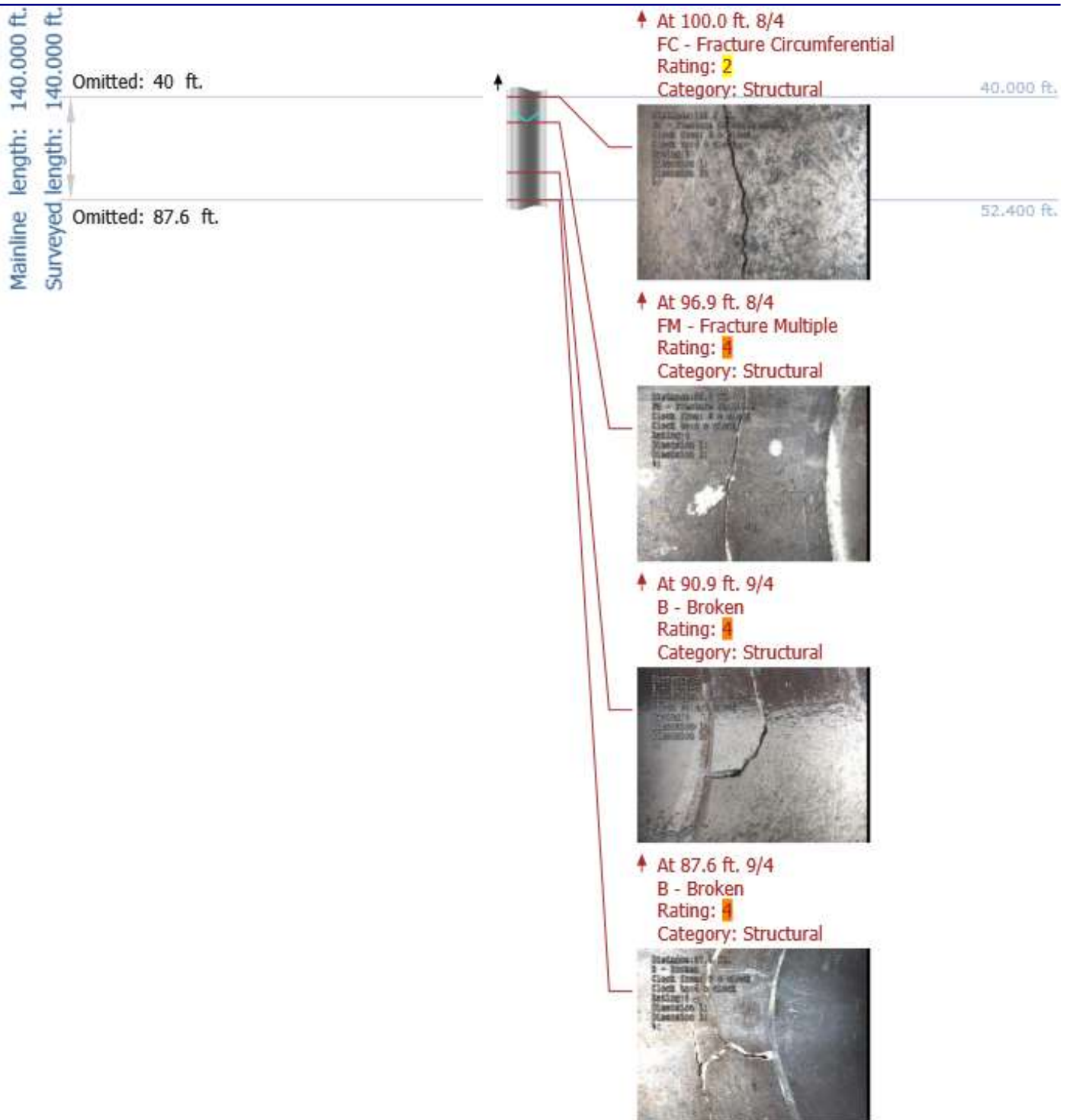
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F-15 TO F-14

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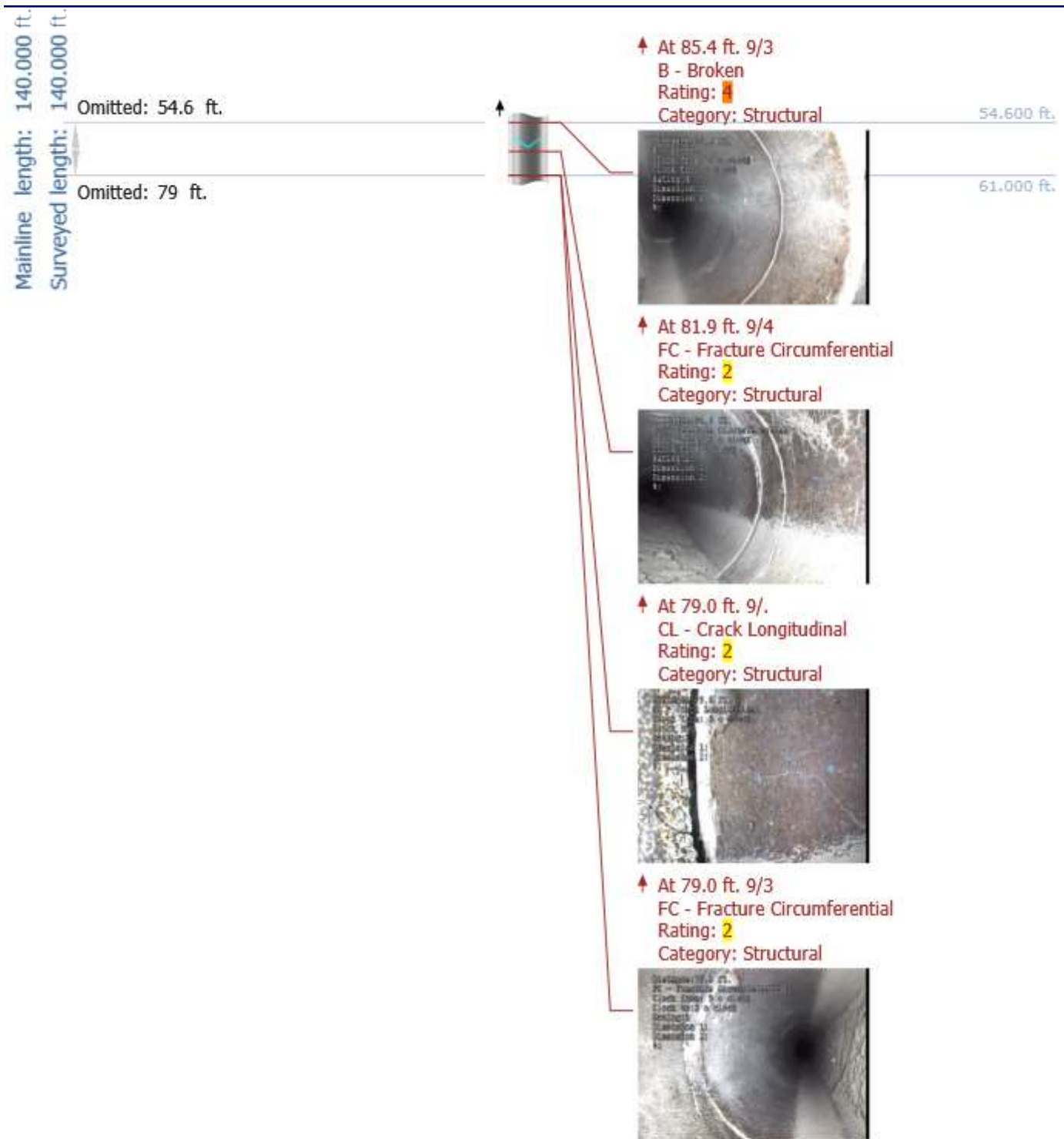
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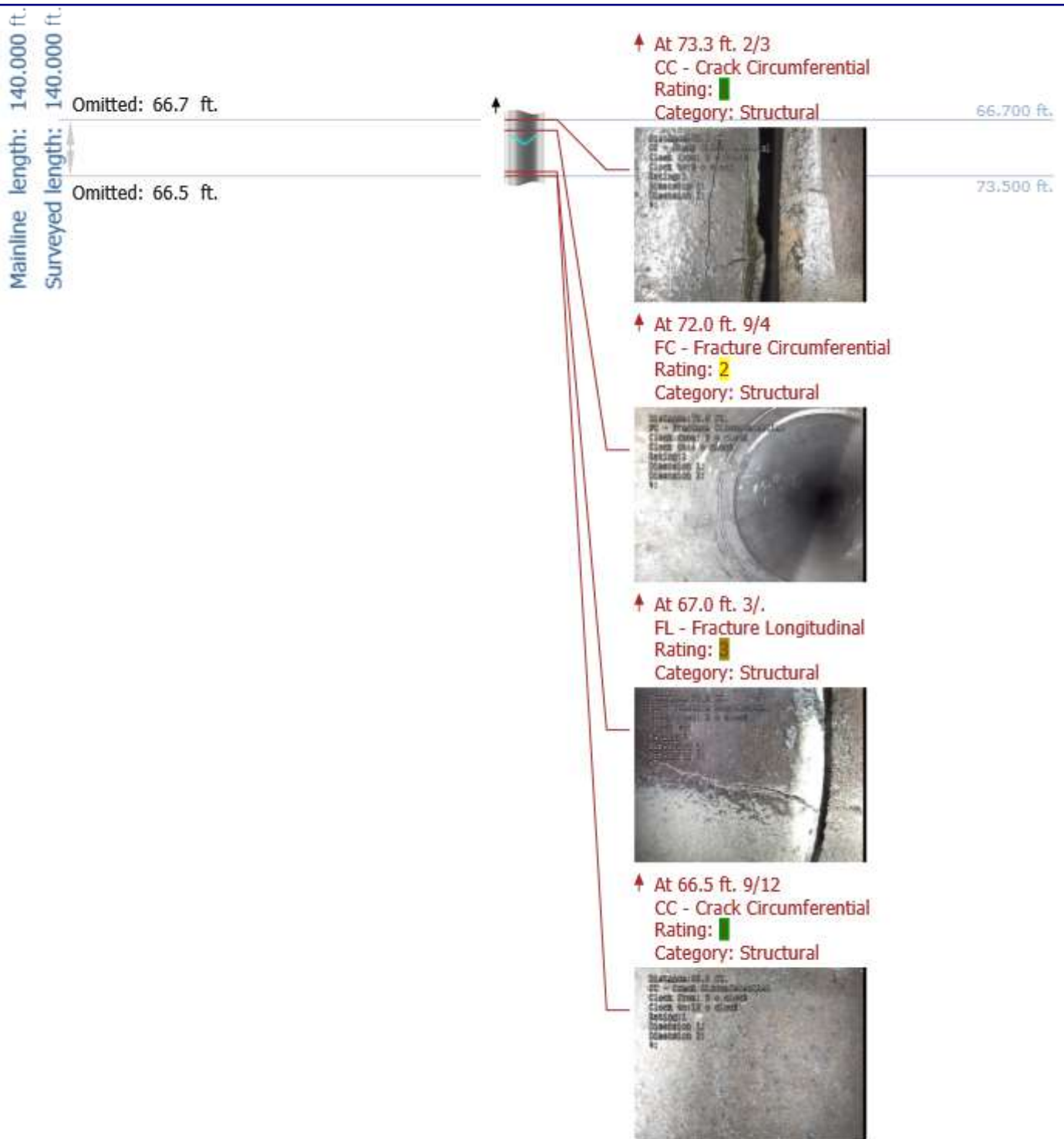
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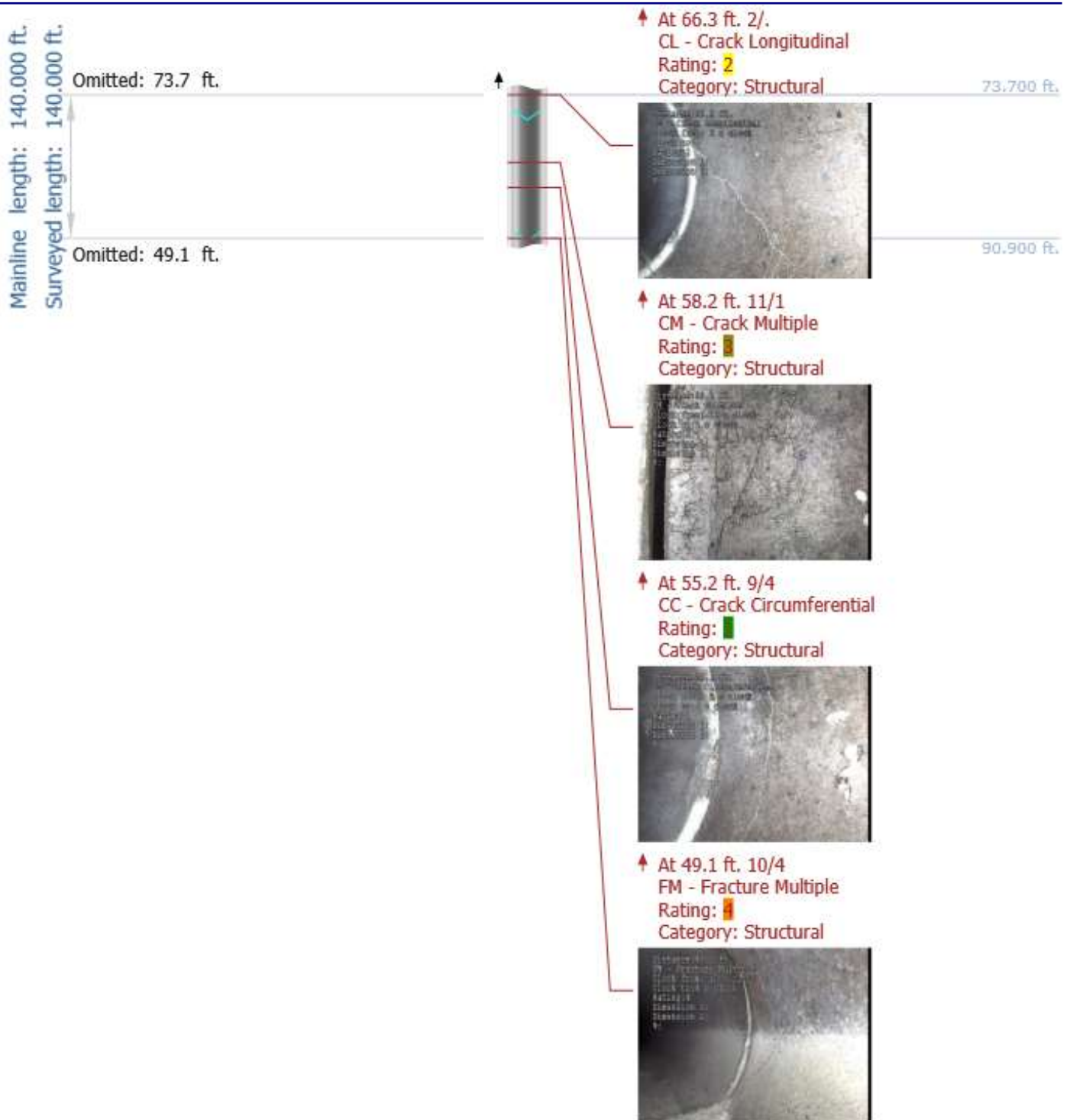
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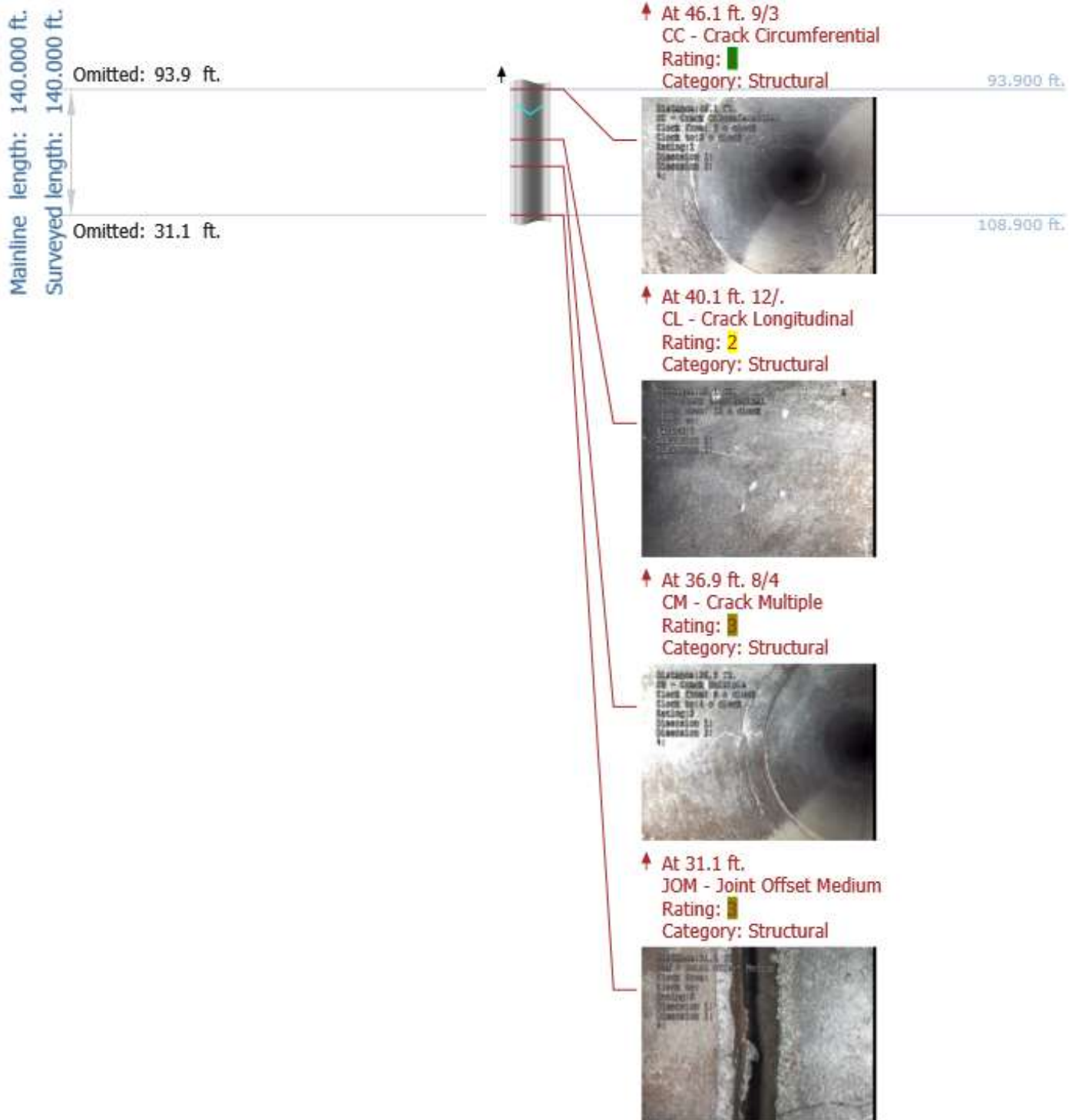
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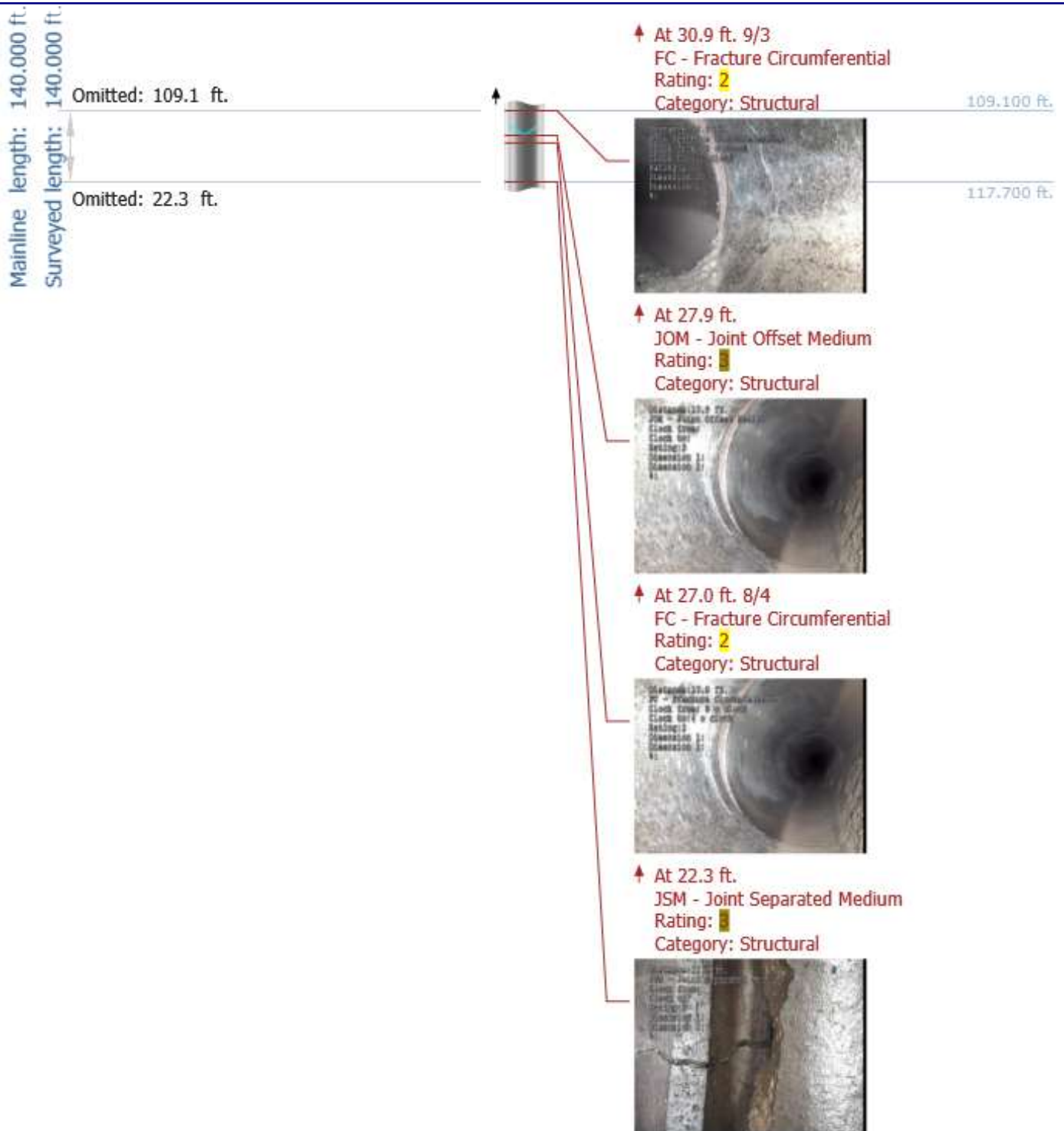
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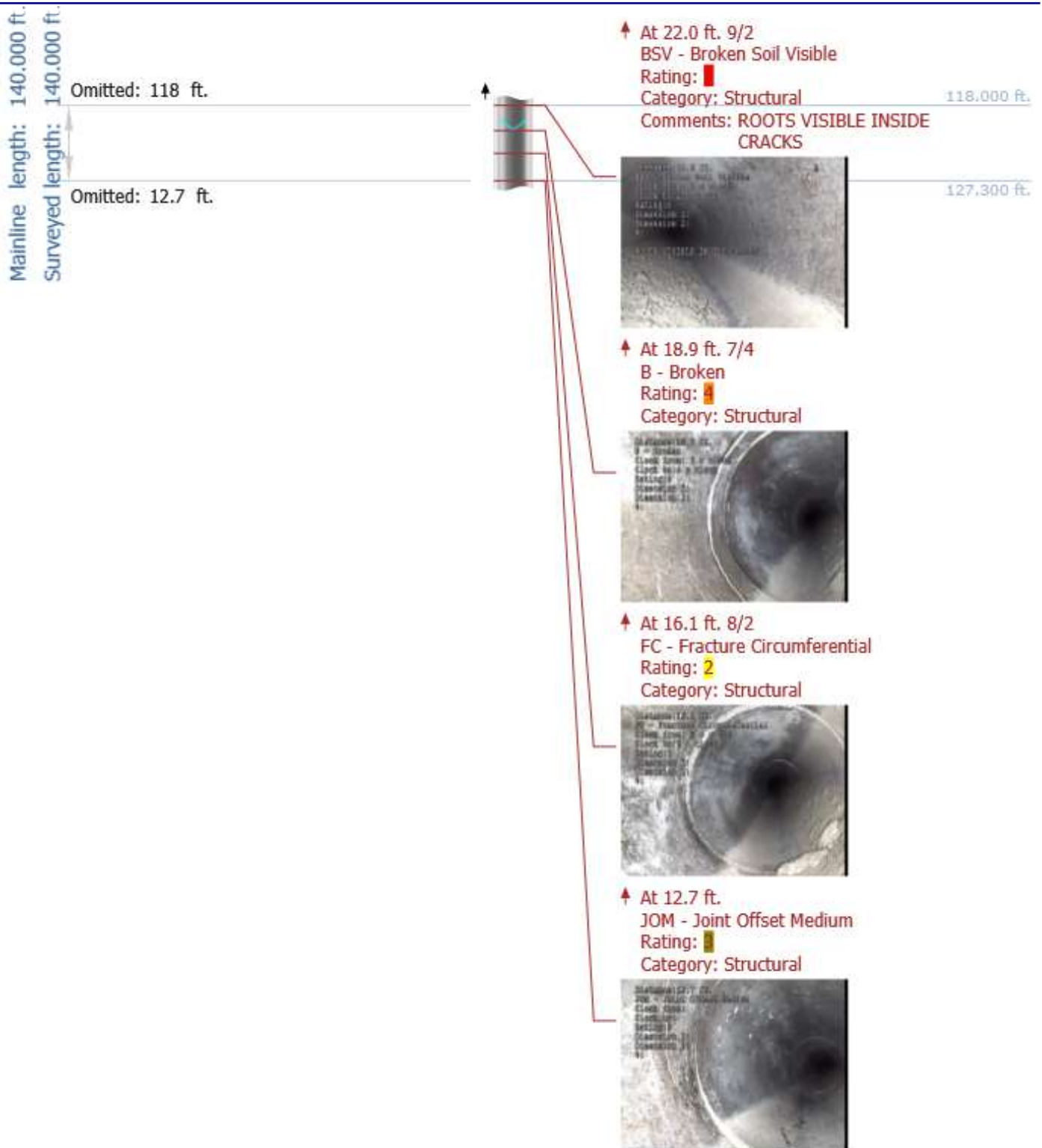


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Weather: 1

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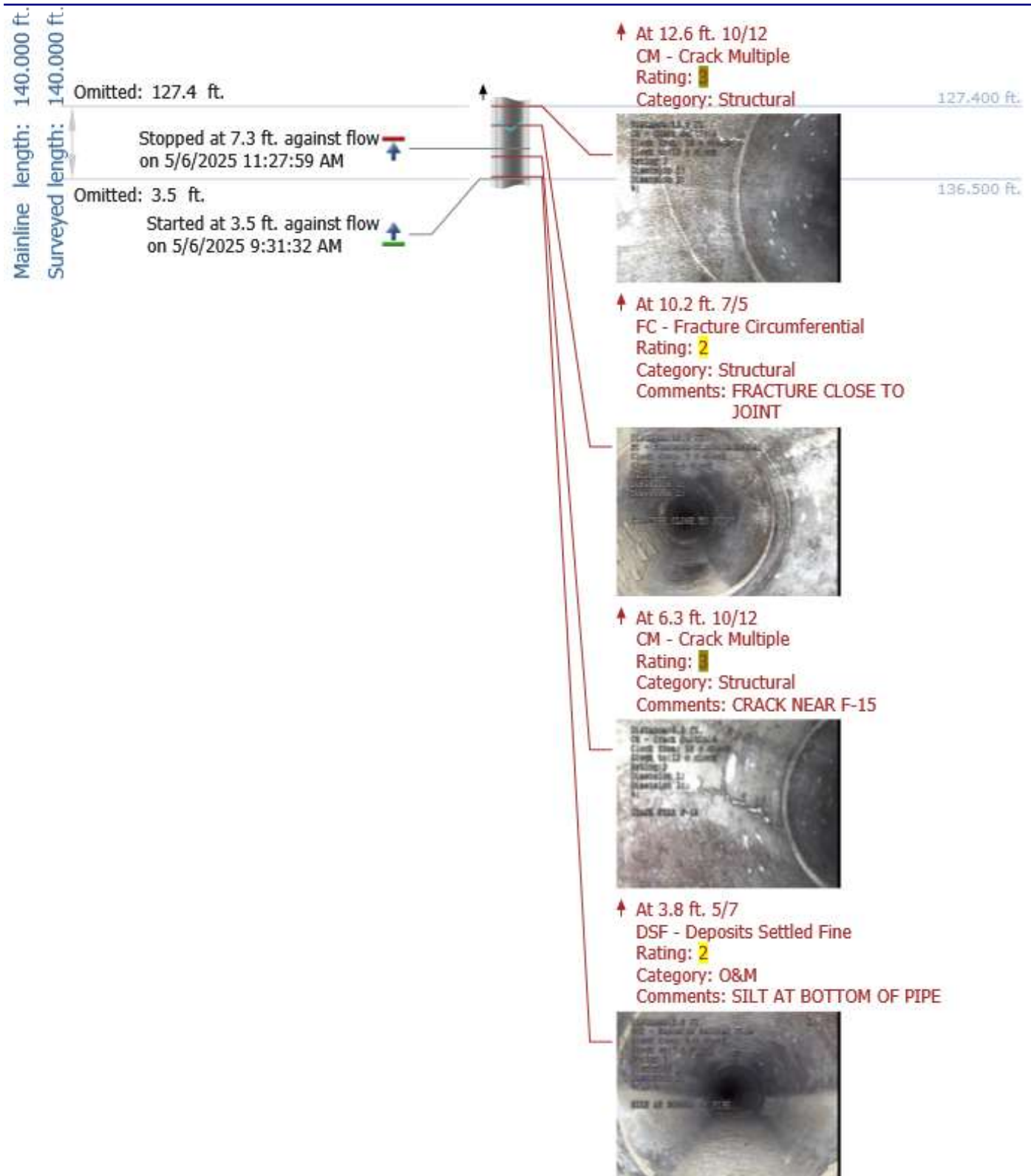
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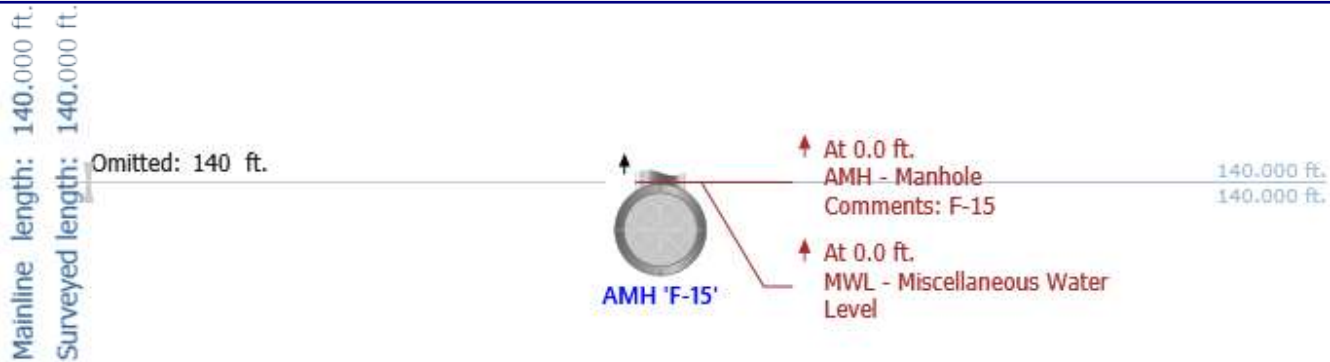
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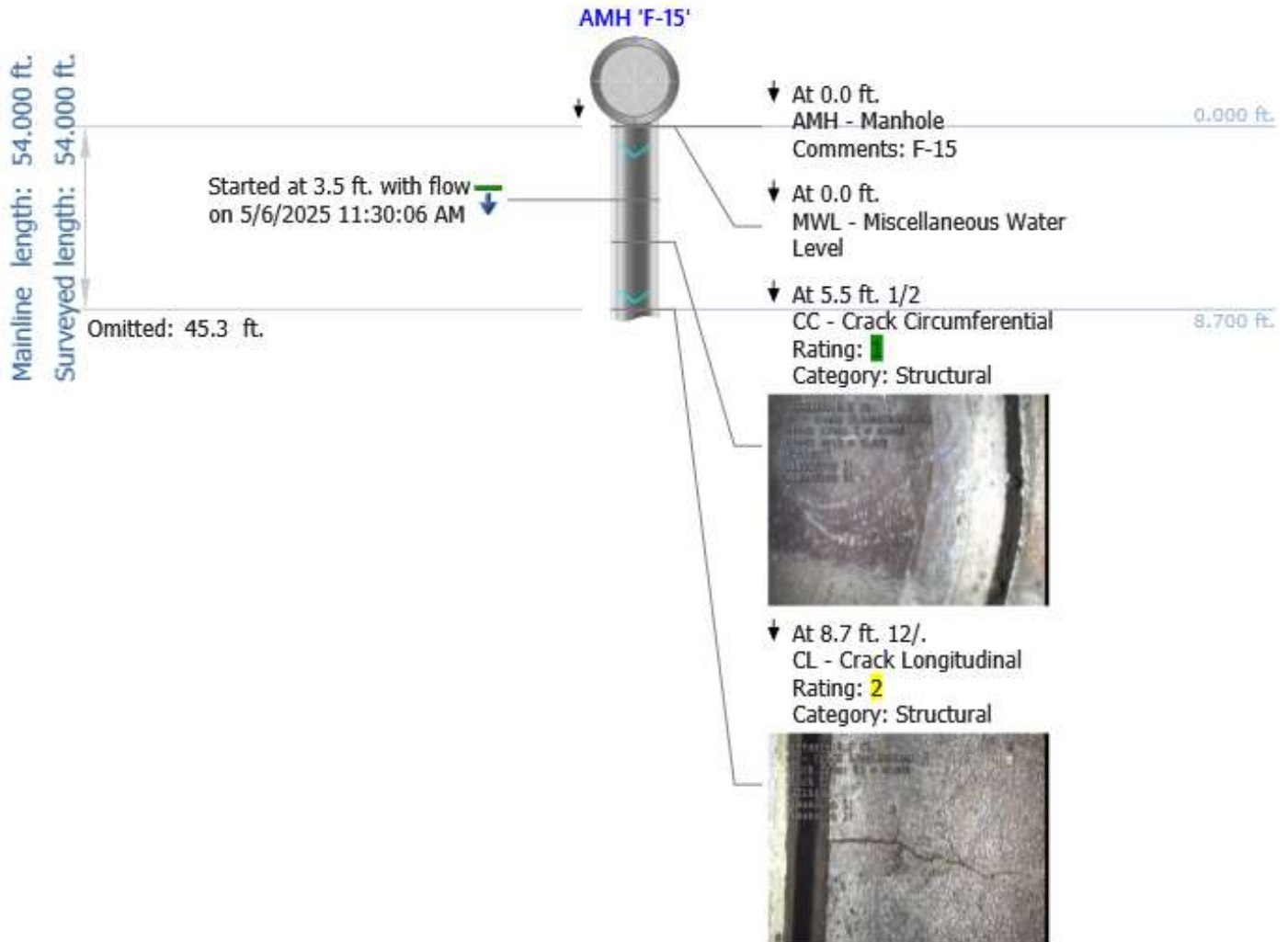
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Main Inspections Pipe Run with Images

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Start date/time:	Direction:	Weather:	Location code:
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Shape:	Material:	Height:	Width:
C	PVC	8 in.	



Project name:
FORT WINGATE DEPOT
SEWER

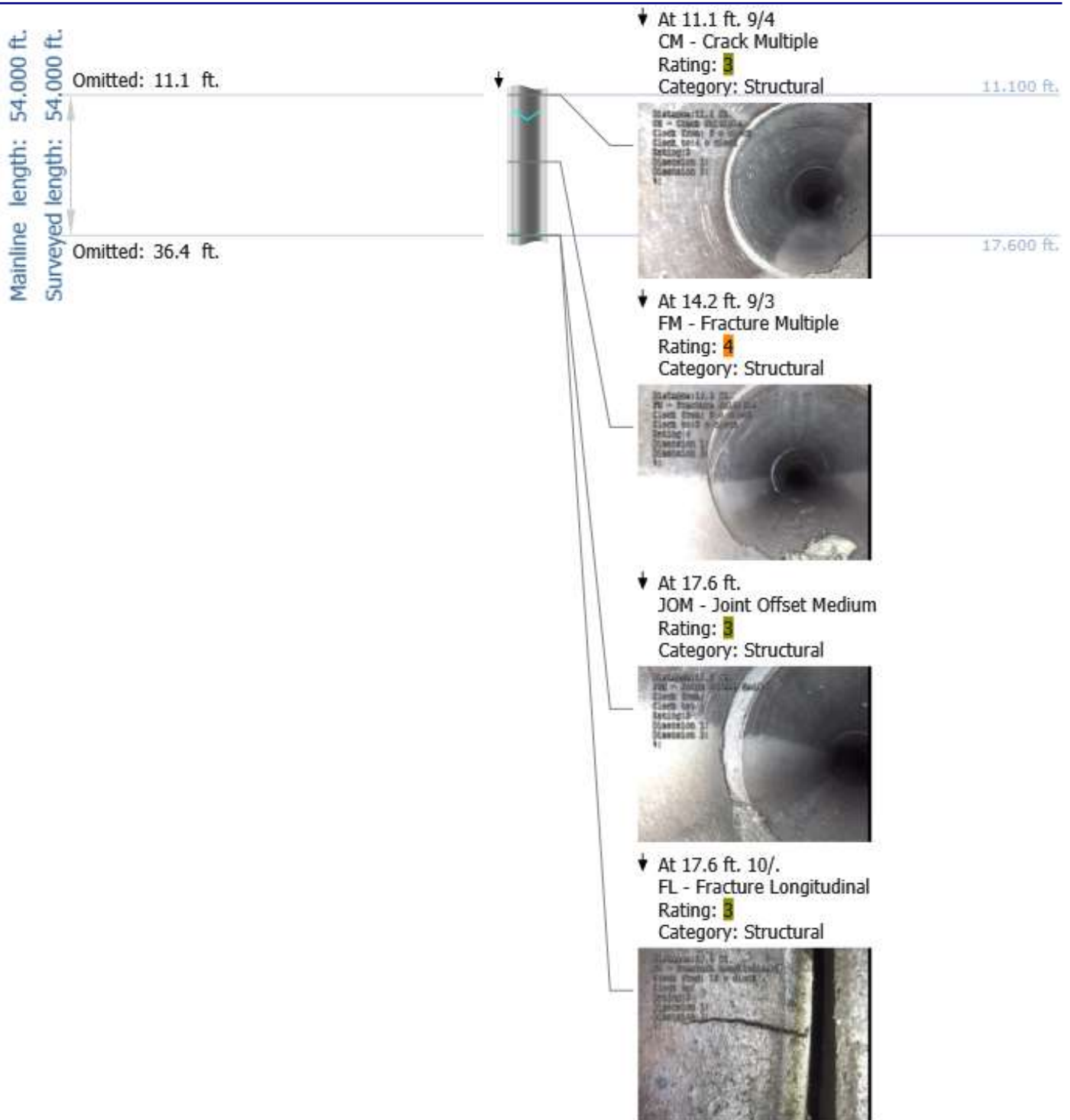
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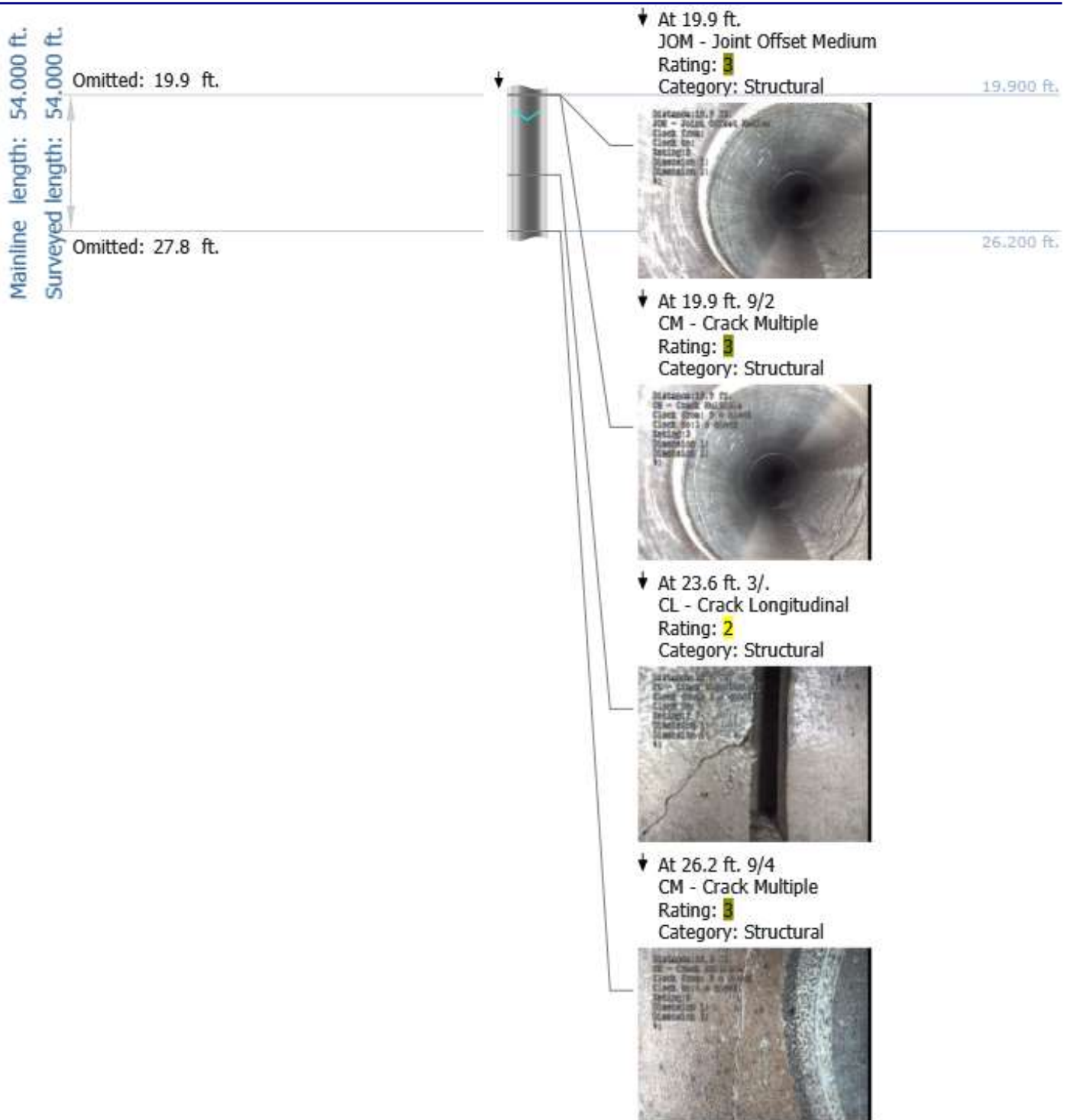
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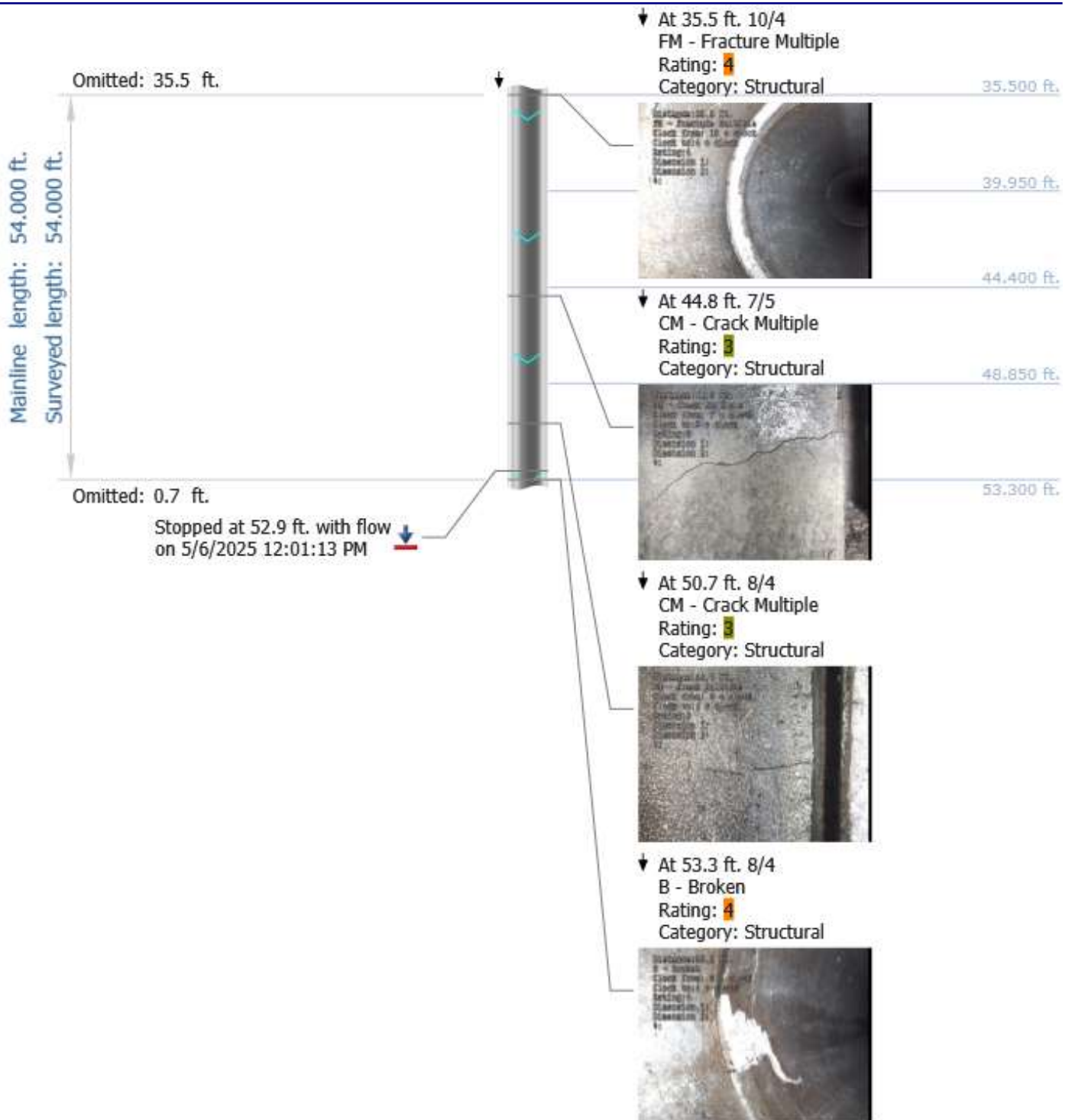
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F-15 TO F-16

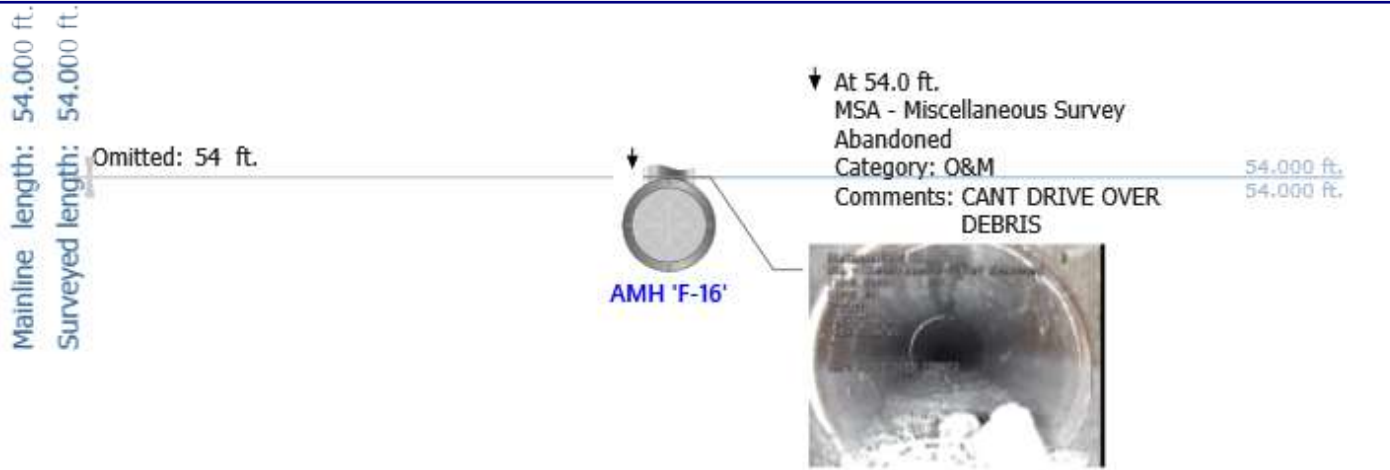
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5/6/2025 11:30 AM

Direction:
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Weather:

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Inspection Report

Date – May 6, 2025 through May 8, 2025

Badger Daylighting
8222 N. 67th Ave, Glendale, Arizona
85302,
480-272-3523

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14.1	Survey Header	74
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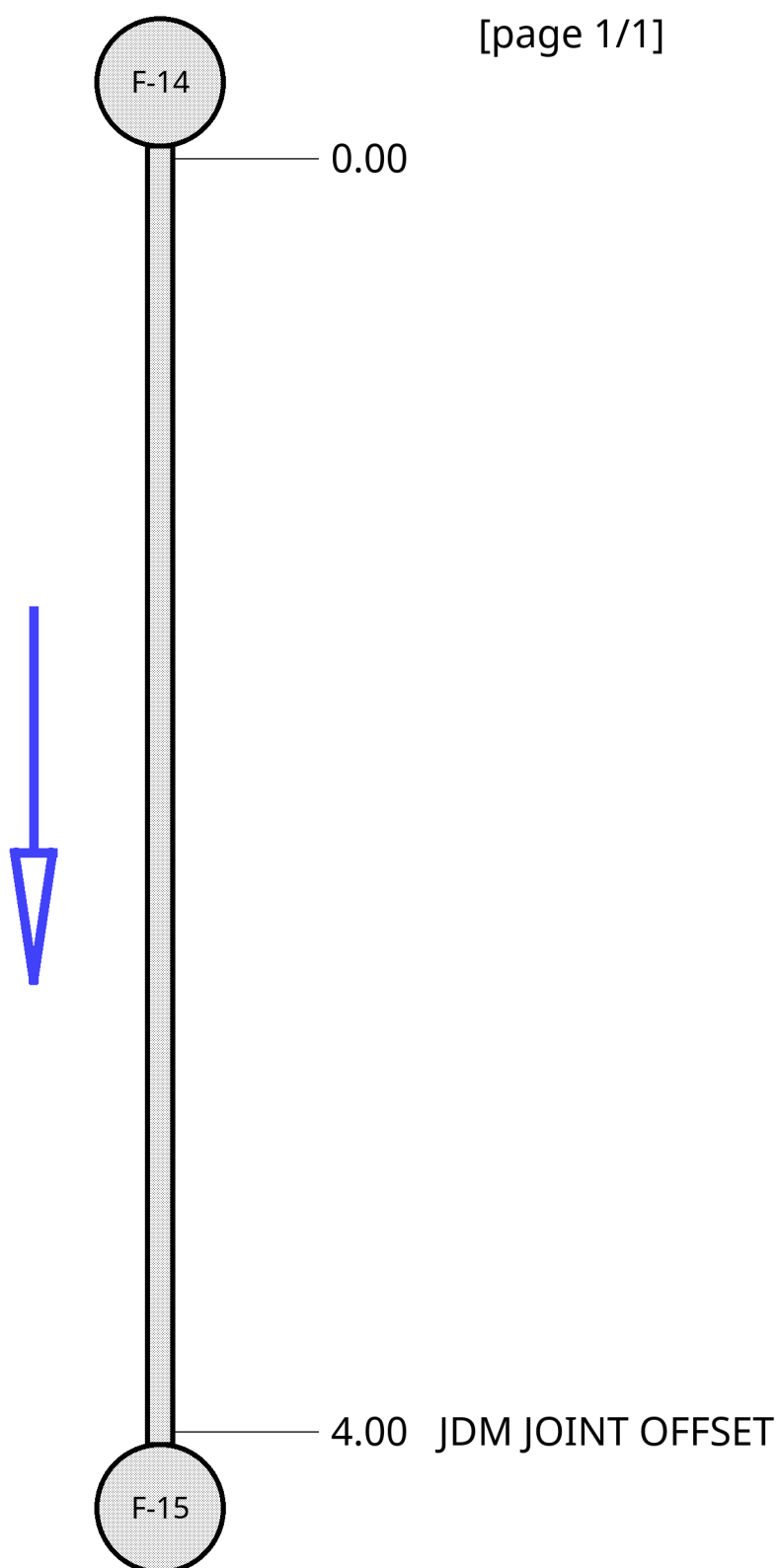
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1 Drain / Sewer Survey F-14 TO F-15

1.1 Survey Header

1.1.1	Surveyed by (Operator)	JEREMIAH
1.1.2	Contract no.	
1.1.3	Job no.	
1.1.4	Catchment (Drainage area)	
1.1.5	Division	
1.1.6	District	
1.1.7	Pipeline length ref	F-14 TO F-15
1.1.8	Date	060525
1.1.9	Time	08:25
1.1.10	Location	
1.1.11	Start manhole no.	F-14
1.1.12	Start depth	
1.1.13	Start cover level	
1.1.14	Start invert level	
1.1.15	Finish manhole no.	F-15
1.1.16	Finish depth	
1.1.17	Finish cover level	
1.1.18	Finish invert level	
1.1.19	Use of Drain	
1.1.20	Direction	(D) Survey downstream (camera pointing with flow)
1.1.21	Size 1 (diameter/height)	8mm
1.1.22	Size 2 (width)	
1.1.23	Shape	(C) Circular
1.1.24	Material	(VC) Vitrified clay (i.e. all clayware)
1.1.25	Lining	
1.1.26	Pipe length	
1.1.27	Total length	
1.1.28	Year laid	
1.1.29	Video cassette number	
1.1.30	Comments: General	
1.1.31	Purpose	
1.1.32	Sewer category	
1.1.33	Pre-cleaning	(N) No
1.1.34	Weather	
1.1.35	Location code	
1.1.36	Further location details	

1.2 Diagram



1.3 Observations

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
4.0	(JDM) Joint displaced medium	survey00000094/2025_05_06-07_28_46_996.jpg
		
	JOINT OFFSET	0:00:33

1.4 Photographs

(JDM) Joint displaced medium survey00000094/2025_05_06-07_28_46_996.jpg

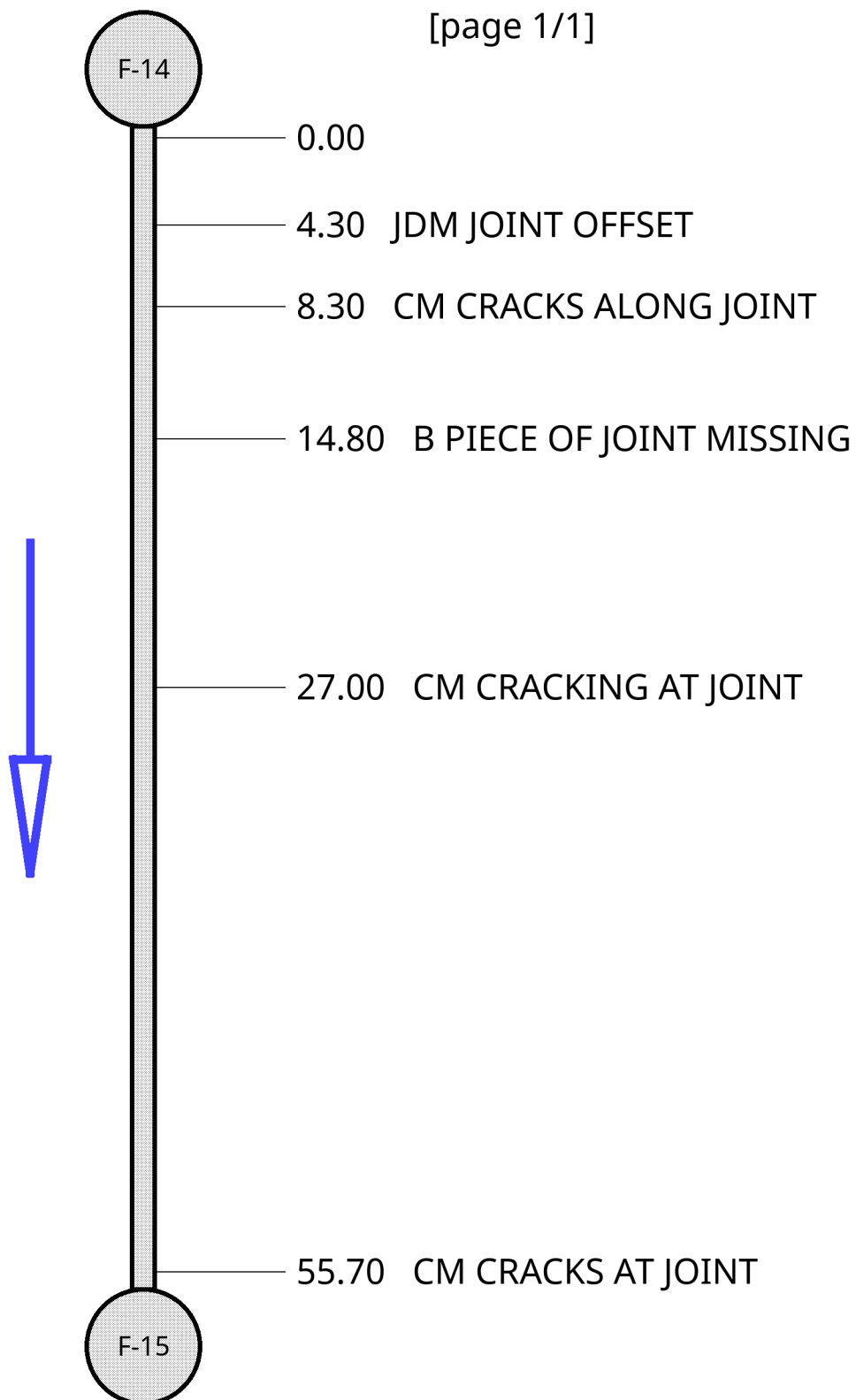


2 Drain / Sewer Survey F-14 TO F-15

2.1 Survey Header

2.1.1	Surveyed by (Operator)	JEREMIAH
2.1.2	Contract no.	
2.1.3	Job no.	
2.1.4	Catchment (Drainage area)	
2.1.5	Division	
2.1.6	District	
2.1.7	Pipeline length ref	F-14 TO F-15
2.1.8	Date	060525
2.1.9	Time	07:35
2.1.10	Location	
2.1.11	Start manhole no.	F-14
2.1.12	Start depth	
2.1.13	Start cover level	
2.1.14	Start invert level	
2.1.15	Finish manhole no.	F-15
2.1.16	Finish depth	
2.1.17	Finish cover level	
2.1.18	Finish invert level	
2.1.19	Use of Drain	
2.1.20	Direction	(D) Survey downstream (camera pointing with flow)
2.1.21	Size 1 (diameter/height)	8mm
2.1.22	Size 2 (width)	
2.1.23	Shape	(C) Circular
2.1.24	Material	(VC) Vitrified clay (i.e. all clayware)
2.1.25	Lining	
2.1.26	Pipe length	
2.1.27	Total length	
2.1.28	Year laid	
2.1.29	Video cassette number	
2.1.30	Comments: General	
2.1.31	Purpose	
2.1.32	Sewer category	
2.1.33	Pre-cleaning	(N) No
2.1.34	Weather	
2.1.35	Location code	
2.1.36	Further location details	

2.2 Diagram



2.3 Observations

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
4.3	(JDM) Joint displaced medium	survey00000095/2025_05_06-07_38_45_186.jpg
		
	JOINT OFFSET	0:00:41
8.3	(CM) Cracks multiple from ... to ... o'clock	survey00000095/2025_05_06-07_41_16_468.jpg
	Clock At/From: 09	
09 - 03	Clock To: 03	
	CRACKS ALONG JOINT	0:01:52
14.8	(B) Broken pipe at ... (OR from ... to ...) o'clock	survey00000095/2025_05_06-07_48_10_866.jpg
	Clock At/From: 10	
10 - 11	Clock To: 11	
	PIECE OF JOINT MISSING	0:03:59
27.0	(CM) Cracks multiple from ... to ... o'clock	survey00000095/2025_05_06-07_55_38_654.jpg
	Clock At/From: 09	
09 - 01	Clock To: 01	
	CRACKING AT JOINT	0:06:25
55.7	(CM) Cracks multiple from ... to ... o'clock	survey00000095/2025_05_06-08_01_38_529.jpg
	Clock At/From: 10	
10 - 02	Clock To: 02	
	CRACKS AT JOINT	0:09:43

2.4 Photographs

(JDM) Joint displaced medium survey00000095/2025_05_06-07_38_45_186.jpg (CM) Cracks multiple from ... to ... o'clock survey00000095/2025_05_06-07_41_16_468.jpg



(B) Broken pipe at ... (OR from ... to ...) o'clock survey00000095/2025_05_06-07_48_10_866.jpg (CM) Cracks multiple from ... to ... o'clock survey00000095/2025_05_06-07_55_38_654.jpg



(CM) Cracks multiple from ... to ... o'clock survey00000095/2025_05_06-08_01_38_529.jpg

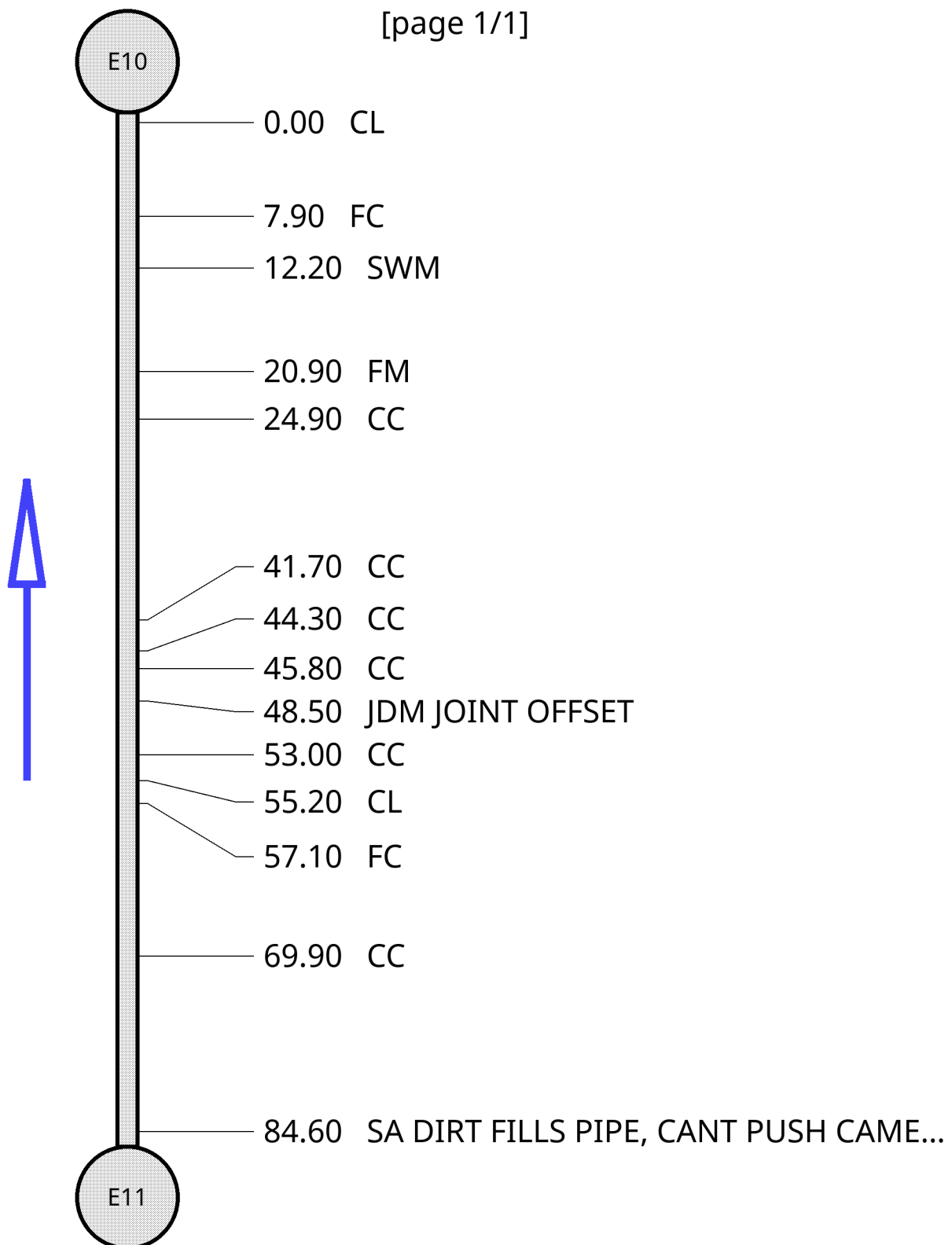


3 Drain / Sewer Survey E-10 TO E11

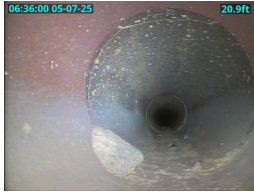
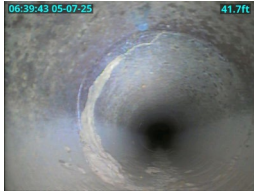
3.1 Survey Header

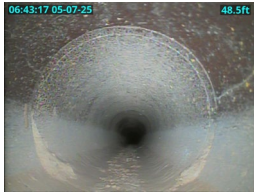
3.1.1	Surveyed by (Operator)	JEREMIAH
3.1.2	Contract no.	
3.1.3	Job no.	
3.1.4	Catchment (Drainage area)	
3.1.5	Division	
3.1.6	District	
3.1.7	Pipeline length ref	E-10 TO E11
3.1.8	Date	070525
3.1.9	Time	06:28
3.1.10	Location	
3.1.11	Start manhole no.	E10
3.1.12	Start depth	
3.1.13	Start cover level	
3.1.14	Start invert level	
3.1.15	Finish manhole no.	E11
3.1.16	Finish depth	
3.1.17	Finish cover level	
3.1.18	Finish invert level	
3.1.19	Use of Drain	
3.1.20	Direction	(U) Survey upstream (camera pointing against flow)
3.1.21	Size 1 (diameter/height)	6mm
3.1.22	Size 2 (width)	
3.1.23	Shape	(C) Circular
3.1.24	Material	(VC) Vitrified clay (i.e. all clayware)
3.1.25	Lining	
3.1.26	Pipe length	
3.1.27	Total length	
3.1.28	Year laid	
3.1.29	Video cassette number	
3.1.30	Comments: General	
3.1.31	Purpose	
3.1.32	Sewer category	
3.1.33	Pre-cleaning	(N) No
3.1.34	Weather	(3) Light rain
3.1.35	Location code	
3.1.36	Further location details	

3.2 Diagram

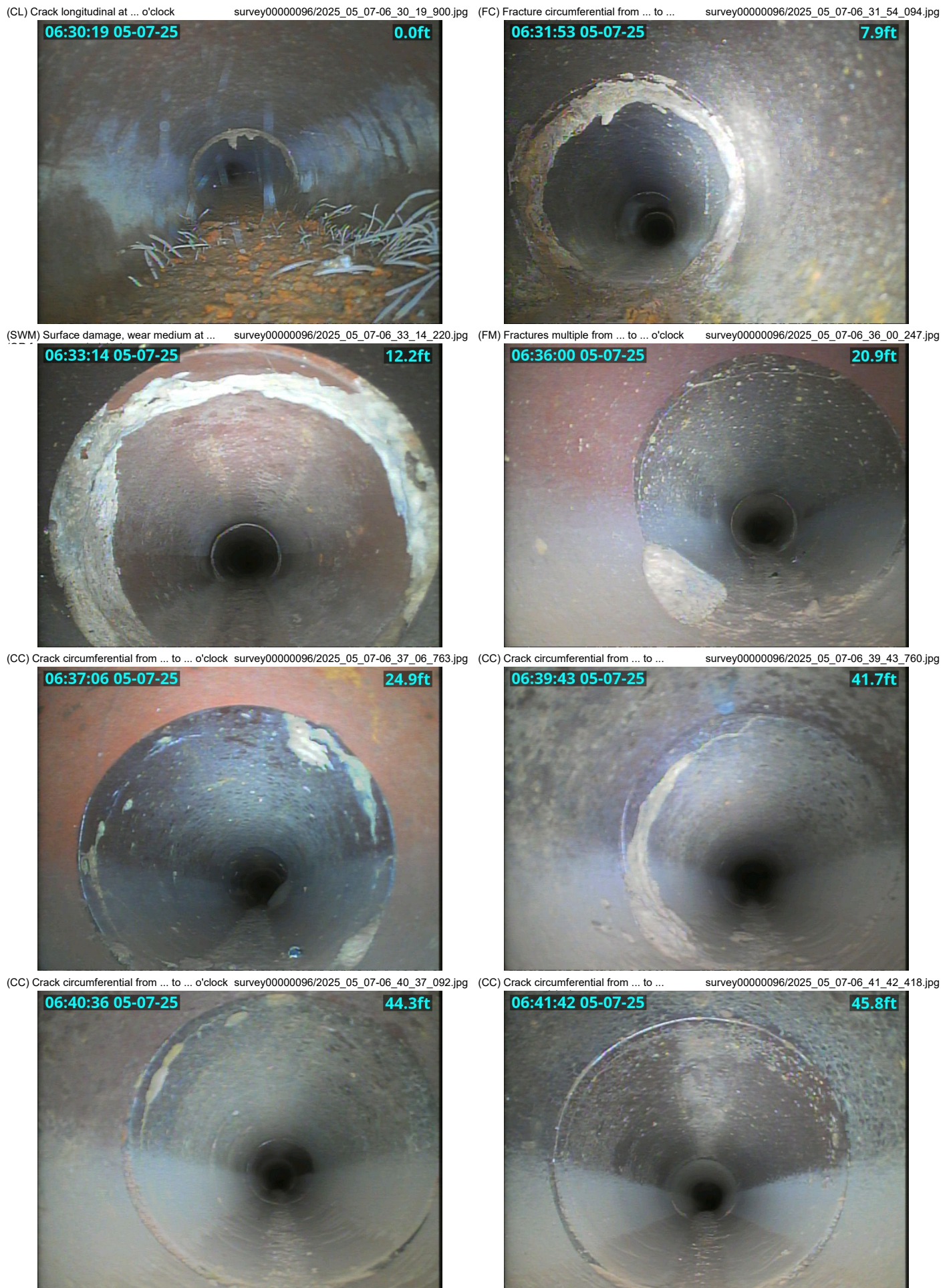


3.3 Observations

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
0.0	(CL) Crack longitudinal at ... o'clock	survey00000096/2025_05_07-06_30_19_900.jpg
	Clock At/From: 03	
03		
		0:00:00
7.9	(FC) Fracture circumferential from ... to ... o'clock	survey00000096/2025_05_07-06_31_54_094.jpg
	Clock At/From: 09	
	Clock To: 12	
09 - 12		
		0:01:13
12.2	(SWM) Surface damage, wear medium at ... (OR from ... to ...) o'clock	survey00000096/2025_05_07-06_33_14_220.jpg
	Clock At/From: 07	
	Clock To: 04	
07 - 04		
		0:02:09
20.9	(FM) Fractures multiple from ... to ... o'clock	survey00000096/2025_05_07-06_36_00_247.jpg
	Clock At/From: 09	
	Clock To: 01	
09 - 01		
		0:03:58
24.9	(CC) Crack circumferential from ... to ... o'clock	survey00000096/2025_05_07-06_37_06_763.jpg
	Clock At/From: 09	
	Clock To: 12	
09 - 12		
		0:04:43
41.7	(CC) Crack circumferential from ... to ... o'clock	survey00000096/2025_05_07-06_39_43_760.jpg
	Clock At/From: 09	
	Clock To: 12	
09 - 12		
		0:06:44
44.3	(CC) Crack circumferential from ... to ... o'clock	survey00000096/2025_05_07-06_40_37_092.jpg
	Clock At/From: 09	
	Clock To: 12	
09 - 12		
		0:07:09

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
45.8	(CC) Crack circumferential from ... to ... o'clock	survey00000096/2025_05_07-06_41_42_418.jpg
	Clock At/From: 09	
09 - 01	Clock To: 01	
		0:08:00
48.5	(JDM) Joint displaced medium	survey00000096/2025_05_07-06_43_17_324.jpg
		
	JOINT OFFSET	0:08:44
53.0	(CC) Crack circumferential from ... to ... o'clock	survey00000096/2025_05_07-06_51_07_261.jpg
	Clock At/From: 09	
09 - 02	Clock To: 02	
		0:09:36
55.2	(CL) Crack longitudinal at ... o'clock	survey00000096/2025_05_07-06_52_09_854.jpg
	Clock At/From: 09	
09		
		0:10:19
57.1	(FC) Fracture circumferential from ... to ... o'clock	survey00000096/2025_05_07-06_53_02_384.jpg
	Clock At/From: 08	
08 - 04	Clock To: 04	
		0:10:52
69.9	(CC) Crack circumferential from ... to ... o'clock	survey00000096/2025_05_07-06_55_17_609.jpg
	Clock At/From: 09	
09 - 03	Clock To: 03	
		0:12:42
84.6	(SA) Survey abandoned	survey00000096/2025_05_07-06_57_03_438.jpg
		
	DIRT FILLS PIPE, CANT PUSH CAMERA THROUGH	
		0:13:58

3.4 Photographs



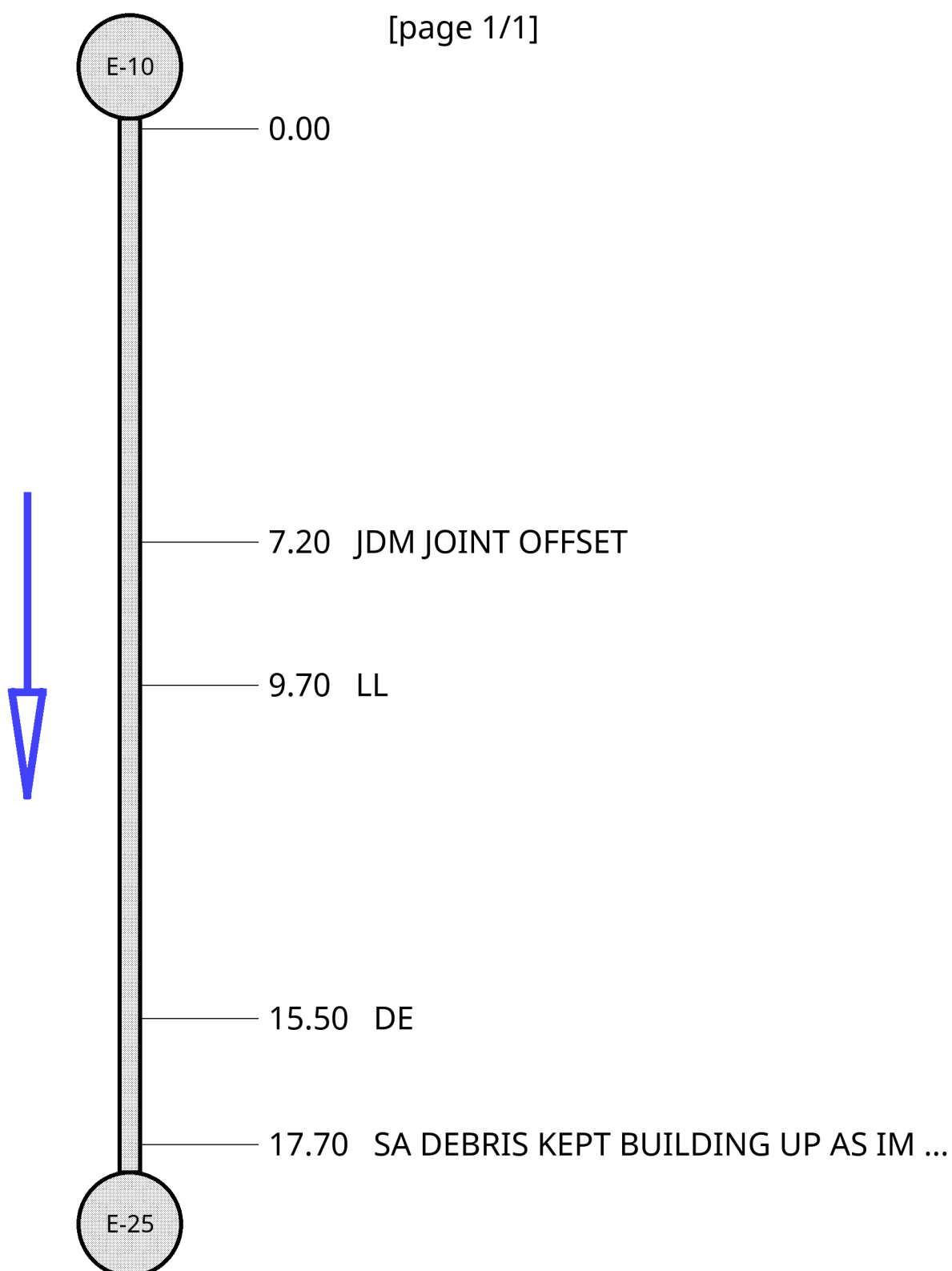


4 Drain / Sewer Survey E-10 TO E25

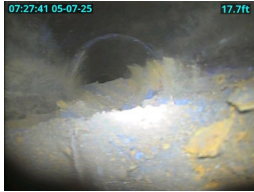
4.1 Survey Header

4.1.1	Surveyed by (Operator)	JEREMIAH
4.1.2	Contract no.	
4.1.3	Job no.	
4.1.4	Catchment (Drainage area)	
4.1.5	Division	
4.1.6	District	
4.1.7	Pipeline length ref	E-10 TO E25
4.1.8	Date	070525
4.1.9	Time	07:20
4.1.10	Location	
4.1.11	Start manhole no.	E-10
4.1.12	Start depth	
4.1.13	Start cover level	
4.1.14	Start invert level	
4.1.15	Finish manhole no.	E-25
4.1.16	Finish depth	
4.1.17	Finish cover level	
4.1.18	Finish invert level	
4.1.19	Use of Drain	
4.1.20	Direction	(D) Survey downstream (camera pointing with flow)
4.1.21	Size 1 (diameter/height)	6mm
4.1.22	Size 2 (width)	
4.1.23	Shape	(C) Circular
4.1.24	Material	(VC) Vitrified clay (i.e. all clayware)
4.1.25	Lining	
4.1.26	Pipe length	
4.1.27	Total length	
4.1.28	Year laid	
4.1.29	Video cassette number	
4.1.30	Comments: General	
4.1.31	Purpose	
4.1.32	Sewer category	
4.1.33	Pre-cleaning	(N) No
4.1.34	Weather	(3) Light rain
4.1.35	Location code	
4.1.36	Further location details	

4.2 Diagram



4.3 Observations

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
7.2	(JDM) Joint displaced medium	survey00000097/2025_05_07-07_23_22_627.jpg
		
	JOINT OFFSET	0:00:59
9.7	(LL) Line of sewer deviates left	survey00000097/2025_05_07-07_24_01_168.jpg
		
		0:01:20
15.5	(DE) Debris ...% cross-sectional area loss Percentage: 50%	survey00000097/2025_05_07-07_24_59_400.jpg
		
		0:02:04
17.7	(SA) Survey abandoned	survey00000097/2025_05_07-07_27_41_899.jpg
		
	DEBRIS KEPT BUILDING UP AS IM PUSHING FORWARD, CREATING A WALL	0:04:32

4.4 Photographs

(JDM) Joint displaced medium survey00000097/2025_05_07-07_23_22_627.jpg (LL) Line of sewer deviates left survey00000097/2025_05_07-07_24_01_168.jpg



(DE) Debris ...% cross-sectional area loss survey00000097/2025_05_07-07_24_59_400.jpg (SA) Survey abandoned survey00000097/2025_05_07-07_27_41_899.jpg

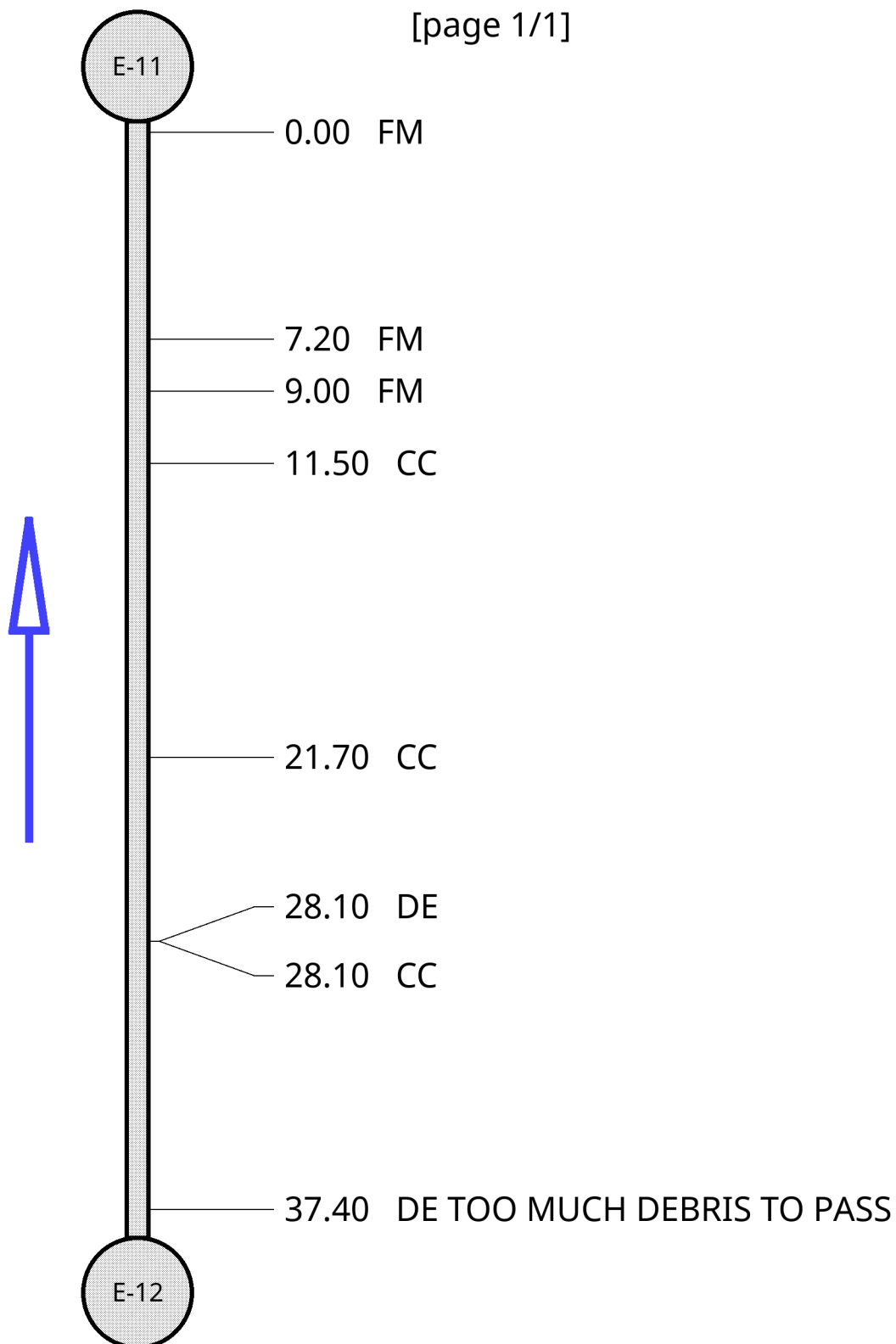


5 Drain / Sewer Survey E-11 TO E-12

5.1 Survey Header

5.1.1	Surveyed by (Operator)	JEREMIAH
5.1.2	Contract no.	
5.1.3	Job no.	
5.1.4	Catchment (Drainage area)	
5.1.5	Division	
5.1.6	District	
5.1.7	Pipeline length ref	E-11 TO E-12
5.1.8	Date	070525
5.1.9	Time	08:03
5.1.10	Location	
5.1.11	Start manhole no.	E-11
5.1.12	Start depth	
5.1.13	Start cover level	
5.1.14	Start invert level	
5.1.15	Finish manhole no.	E-12
5.1.16	Finish depth	
5.1.17	Finish cover level	
5.1.18	Finish invert level	
5.1.19	Use of Drain	
5.1.20	Direction	(U) Survey upstream (camera pointing against flow)
5.1.21	Size 1 (diameter/height)	6mm
5.1.22	Size 2 (width)	
5.1.23	Shape	(C) Circular
5.1.24	Material	(VC) Vitrified clay (i.e. all clayware)
5.1.25	Lining	
5.1.26	Pipe length	
5.1.27	Total length	
5.1.28	Year laid	
5.1.29	Video cassette number	
5.1.30	Comments: General	
5.1.31	Purpose	
5.1.32	Sewer category	
5.1.33	Pre-cleaning	(N) No
5.1.34	Weather	(3) Light rain
5.1.35	Location code	
5.1.36	Further location details	

5.2 Diagram



5.3 Observations

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
0.0	(FM) Fractures multiple from ... to ... o'clock	survey00000098/2025_05_07-08_04_40_146.jpg
	Clock At/From: 07	
	Clock To: 05	
07 - 05		
		0:00:00
7.2	(FM) Fractures multiple from ... to ... o'clock	survey00000098/2025_05_07-08_07_05_736.jpg
	Clock At/From: 10	
	Clock To: 03	
10 - 03		
		0:01:24
9.0	(FM) Fractures multiple from ... to ... o'clock	survey00000098/2025_05_07-08_07_56_246.jpg
	Clock At/From: 07	
	Clock To: 05	
07 - 05		
		0:01:52
11.5	(CC) Crack circumferential from ... to ... o'clock	survey00000098/2025_05_07-08_08_54_790.jpg
	Clock At/From: 07	
	Clock To: 01	
07 - 01		
		0:02:24
21.7	(CC) Crack circumferential from ... to ... o'clock	survey00000098/2025_05_07-08_10_04_045.jpg
	Clock At/From: 08	
	Clock To: 02	
08 - 02		
		0:03:14
28.1	(DE) Debris ...% cross-sectional area loss	survey00000098/2025_05_07-08_11_02_428.jpg
	Percentage: 40%	
		
		0:03:41
28.1	(CC) Crack circumferential from ... to ... o'clock	survey00000098/2025_05_07-08_11_27_416.jpg
	Clock At/From: 09	
	Clock To: 01	
09 - 01		
		0:03:54

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
37.4	(DE) Debris ...% cross-sectional area loss	survey00000098/2025_05_07-08_12_43_858.jpg
	Percentage: 80%	08:12:43 05-07-25 37.4ft 
	TOO MUCH DEBRIS TO PASS	0:04:51

5.4 Photographs

(FM) Fractures multiple from ... to ... o'clock survey00000098/2025_05_07-08_04_40_146.jpg (FM) Fractures multiple from ... to ... o'clock survey00000098/2025_05_07-08_07_05_736.jpg



(FM) Fractures multiple from ... to ... o'clock survey00000098/2025_05_07-08_07_56_246.jpg (CC) Crack circumferential from ... to ... survey00000098/2025_05_07-08_08_54_790.jpg



(CC) Crack circumferential from ... to ... o'clock survey00000098/2025_05_07-08_10_04_045.jpg (DE) Debris ...% cross-sectional area loss survey00000098/2025_05_07-08_11_02_428.jpg



(CC) Crack circumferential from ... to ... o'clock survey00000098/2025_05_07-08_11_27_416.jpg (DE) Debris ...% cross-sectional area loss survey00000098/2025_05_07-08_12_43_858.jpg

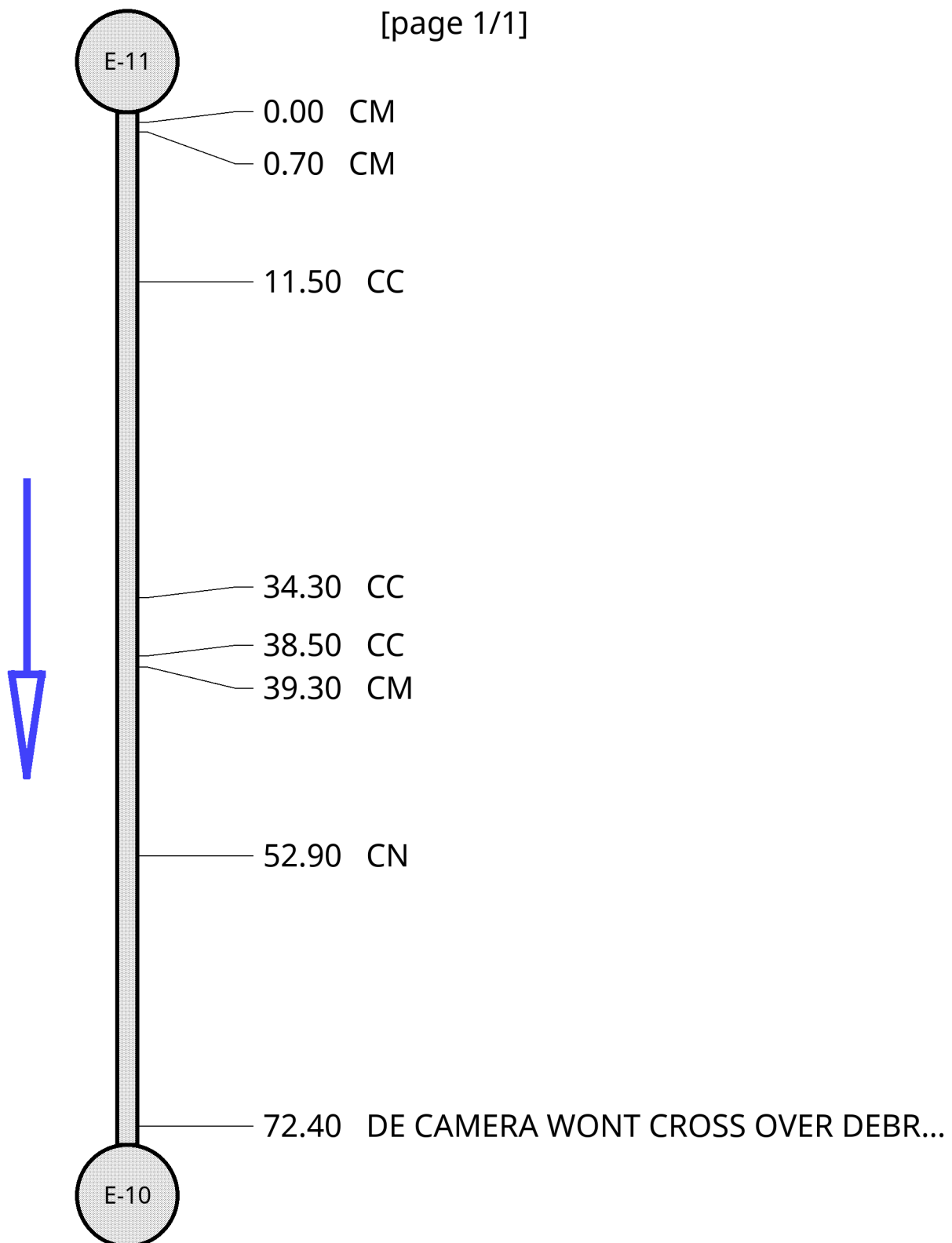


6 Drain / Sewer Survey E-11 TO E-10

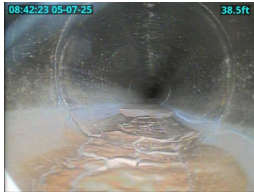
6.1 Survey Header

6.1.1	Surveyed by (Operator)	JEREMIAH
6.1.2	Contract no.	
6.1.3	Job no.	
6.1.4	Catchment (Drainage area)	
6.1.5	Division	
6.1.6	District	
6.1.7	Pipeline length ref	E-11 TO E-10
6.1.8	Date	070525
6.1.9	Time	08:20
6.1.10	Location	
6.1.11	Start manhole no.	E-11
6.1.12	Start depth	
6.1.13	Start cover level	
6.1.14	Start invert level	
6.1.15	Finish manhole no.	E-10
6.1.16	Finish depth	
6.1.17	Finish cover level	
6.1.18	Finish invert level	
6.1.19	Use of Drain	
6.1.20	Direction	(D) Survey downstream (camera pointing with flow)
6.1.21	Size 1 (diameter/height)	6mm
6.1.22	Size 2 (width)	
6.1.23	Shape	(C) Circular
6.1.24	Material	(VC) Vitrified clay (i.e. all clayware)
6.1.25	Lining	
6.1.26	Pipe length	
6.1.27	Total length	
6.1.28	Year laid	
6.1.29	Video cassette number	
6.1.30	Comments: General	
6.1.31	Purpose	
6.1.32	Sewer category	
6.1.33	Pre-cleaning	(N) No
6.1.34	Weather	(3) Light rain
6.1.35	Location code	
6.1.36	Further location details	

6.2 Diagram

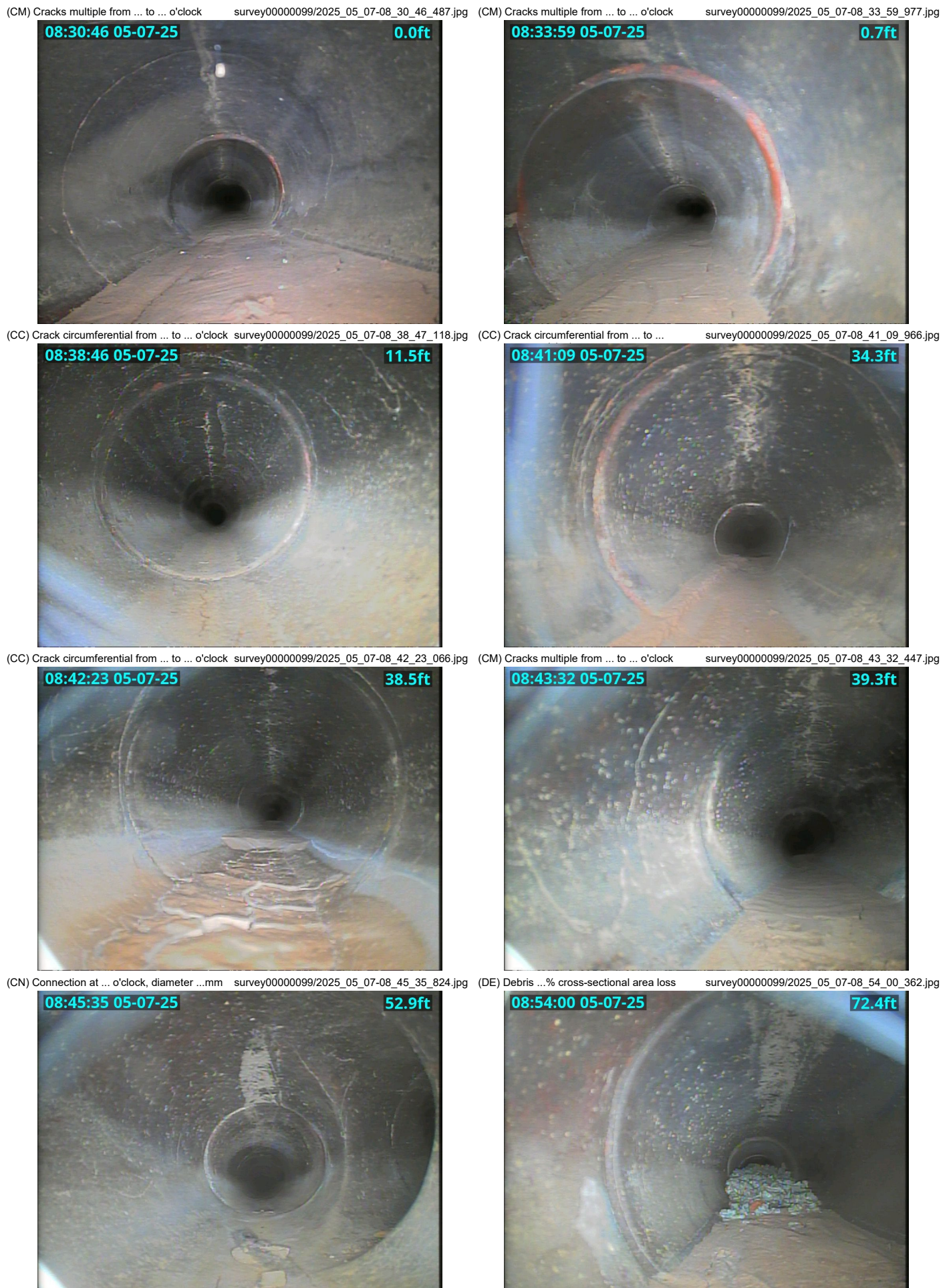


6.3 Observations

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
0.0	(CM) Cracks multiple from ... to ... o'clock	survey00000099/2025_05_07-08_30_46_487.jpg
S1	Clock At/From: 07	
07 - 04	Clock To: 04	
		0:00:10
0.7	(CM) Cracks multiple from ... to ... o'clock	survey00000099/2025_05_07-08_33_59_977.jpg
S1	Clock At/From: 07	
07 - 04	Clock To: 04	
		0:02:10
11.5	(CC) Crack circumferential from ... to ... o'clock	survey00000099/2025_05_07-08_38_46_118.jpg
	Clock At/From: 10	
10 - 03	Clock To: 03	
		0:06:30
34.3	(CC) Crack circumferential from ... to ... o'clock	survey00000099/2025_05_07-08_41_09_966.jpg
	Clock At/From: 09	
09 - 03	Clock To: 03	
		0:08:20
38.5	(CC) Crack circumferential from ... to ... o'clock	survey00000099/2025_05_07-08_42_23_066.jpg
	Clock At/From: 08	
08 - 04	Clock To: 04	
		0:09:17
39.3	(CM) Cracks multiple from ... to ... o'clock	survey00000099/2025_05_07-08_43_32_447.jpg
	Clock At/From: 08	
08 - 11	Clock To: 11	
		0:10:03
52.9	(CN) Connection at ... o'clock, diameter ...mm	survey00000099/2025_05_07-08_45_35_824.jpg
	Clock At/From: 03	
03	Diameter/Dimension: 6	
		0:11:36

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
72.4	(DE) Debris ...% cross-sectional area loss	survey00000099/2025_05_07-08_54_00_362.jpg
	Percentage: 80%	
	CAMERA WONT CROSS OVER DEBRIS	0:13:24

6.4 Photographs

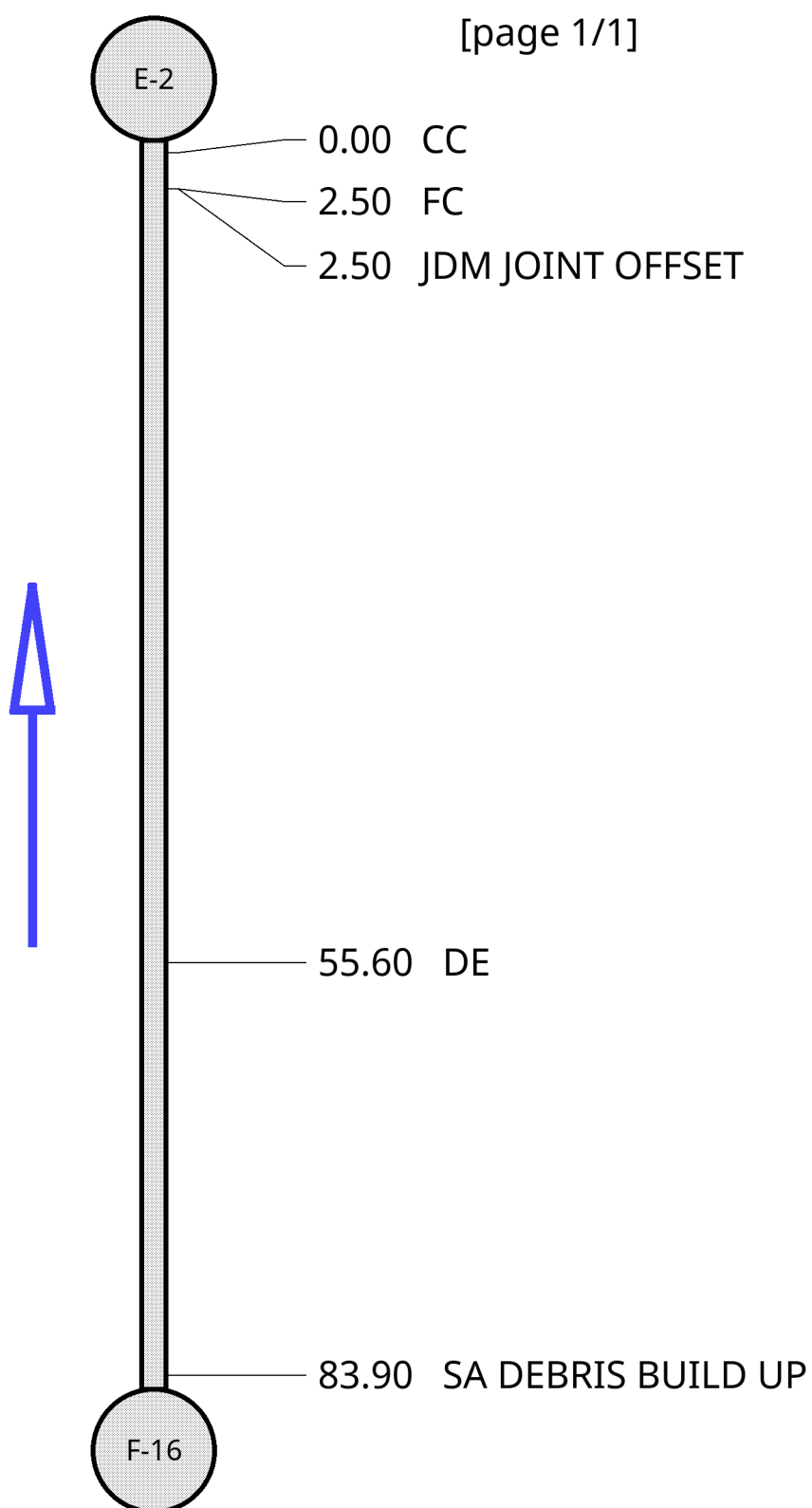


7 Drain / Sewer Survey E-2 TO F-16

7.1 Survey Header

7.1.1	Surveyed by (Operator)	JEREMIAH
7.1.2	Contract no.	
7.1.3	Job no.	
7.1.4	Catchment (Drainage area)	
7.1.5	Division	
7.1.6	District	
7.1.7	Pipeline length ref	E-2 TO F-16
7.1.8	Date	070525
7.1.9	Time	09:27
7.1.10	Location	
7.1.11	Start manhole no.	E-2
7.1.12	Start depth	
7.1.13	Start cover level	
7.1.14	Start invert level	
7.1.15	Finish manhole no.	F-16
7.1.16	Finish depth	
7.1.17	Finish cover level	
7.1.18	Finish invert level	
7.1.19	Use of Drain	
7.1.20	Direction	(U) Survey upstream (camera pointing against flow)
7.1.21	Size 1 (diameter/height)	8mm
7.1.22	Size 2 (width)	
7.1.23	Shape	(C) Circular
7.1.24	Material	(VC) Vitrified clay (i.e. all clayware)
7.1.25	Lining	
7.1.26	Pipe length	
7.1.27	Total length	
7.1.28	Year laid	
7.1.29	Video cassette number	
7.1.30	Comments: General	
7.1.31	Purpose	
7.1.32	Sewer category	
7.1.33	Pre-cleaning	(N) No
7.1.34	Weather	(3) Light rain
7.1.35	Location code	
7.1.36	Further location details	

7.2 Diagram



7.3 Observations

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
0.0	(CC) Crack circumferential from ... to ... o'clock	survey00000100/2025_05_07-09_30_34_292.jpg
	Clock At/From: 12	
12 - 03	Clock To: 03	
		0:00:00
2.5	(FC) Fracture circumferential from ... to ... o'clock	survey00000100/2025_05_07-09_31_57_842.jpg
	Clock At/From: 07	
07 - 06	Clock To: 06	
		0:00:34
2.5	(JDM) Joint displaced medium	survey00000100/2025_05_07-09_32_19_507.jpg
		
	JOINT OFFSET	0:00:39
55.6	(DE) Debris ...% cross-sectional area loss	survey00000100/2025_05_07-09_36_08_137.jpg
	Percentage: 40%	
		0:04:08
83.9	(SA) Survey abandoned	survey00000100/2025_05_07-09_43_33_210.jpg
		
	DEBRIS BUILD UP	0:10:44

7.4 Photographs

(CC) Crack circumferential from ... to ... o'clock survey00000100/2025_05_07-09_30_34_292.jpg (FC) Fracture circumferential from ... to ... survey00000100/2025_05_07-09_31_57_842.jpg



(JDM) Joint displaced medium survey00000100/2025_05_07-09_32_19_507.jpg (DE) Debris ...% cross-sectional area loss survey00000100/2025_05_07-09_36_08_137.jpg



(SA) Survey abandoned survey00000100/2025_05_07-09_43_33_210.jpg

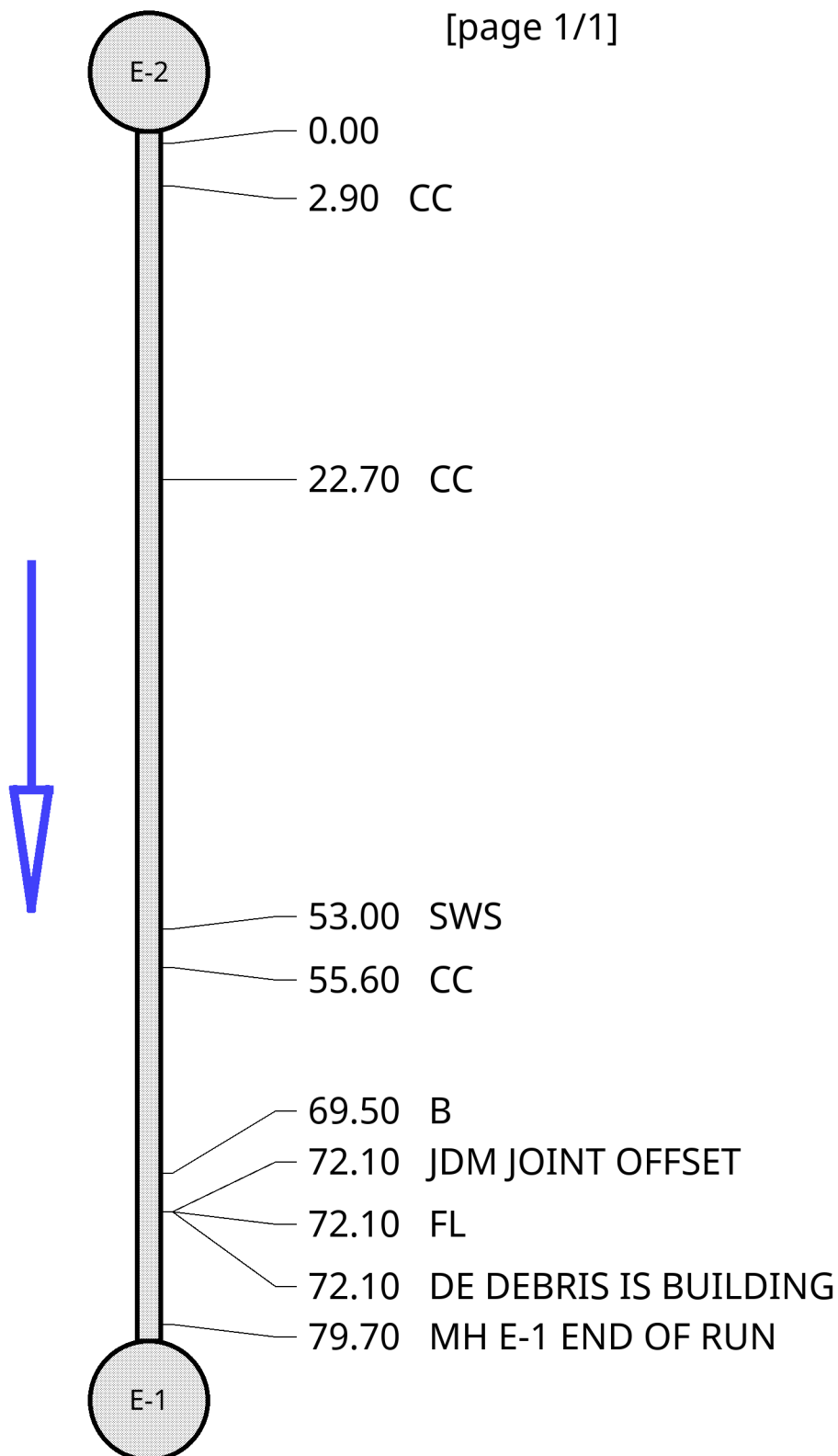


8 Drain / Sewer Survey E-2 TO E-1

8.1 Survey Header

8.1.1	Surveyed by (Operator)	JEREMIAH
8.1.2	Contract no.	
8.1.3	Job no.	
8.1.4	Catchment (Drainage area)	
8.1.5	Division	
8.1.6	District	
8.1.7	Pipeline length ref	E-2 TO E-1
8.1.8	Date	070525
8.1.9	Time	09:55
8.1.10	Location	
8.1.11	Start manhole no.	E-2
8.1.12	Start depth	
8.1.13	Start cover level	
8.1.14	Start invert level	
8.1.15	Finish manhole no.	E-1
8.1.16	Finish depth	
8.1.17	Finish cover level	
8.1.18	Finish invert level	
8.1.19	Use of Drain	
8.1.20	Direction	(D) Survey downstream (camera pointing with flow)
8.1.21	Size 1 (diameter/height)	8mm
8.1.22	Size 2 (width)	
8.1.23	Shape	(C) Circular
8.1.24	Material	(VC) Vitrified clay (i.e. all clayware)
8.1.25	Lining	
8.1.26	Pipe length	
8.1.27	Total length	
8.1.28	Year laid	
8.1.29	Video cassette number	
8.1.30	Comments: General	
8.1.31	Purpose	
8.1.32	Sewer category	
8.1.33	Pre-cleaning	(N) No
8.1.34	Weather	(3) Light rain
8.1.35	Location code	
8.1.36	Further location details	

8.2 Diagram



8.3 Observations

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
2.9	(CC) Crack circumferential from ... to ... o'clock	survey00000101/2025_05_07-09_58_29_196.jpg
	Clock At/From: 12	
	Clock To: 04	
12 - 04		
		0:01:14
22.7	(CC) Crack circumferential from ... to ... o'clock	survey00000101/2025_05_07-10_01_02_185.jpg
	Clock At/From: 12	
	Clock To: 04	
12 - 04		
		0:03:04
53.0	(SWS) Surface damage, wear slight at ... (OR from ... to ...) o'clock	survey00000101/2025_05_07-10_04_33_919.jpg
	Clock At/From: 09	
	Clock To: 03	
09 - 03		
		0:06:22
55.6	(CC) Crack circumferential from ... to ... o'clock	survey00000101/2025_05_07-10_06_04_188.jpg
	Clock At/From: 11	
	Clock To: 12	
11 - 12		
		0:06:49
69.5	(B) Broken pipe at ... (OR from ... to ...) o'clock	survey00000101/2025_05_07-10_07_22_758.jpg
	Clock At/From: 09	
	Clock To: 12	
09 - 12		
		0:07:51
72.1	(JDM) Joint displaced medium	survey00000101/2025_05_07-10_12_21_954.jpg
	JOINT OFFSET	0:08:25
72.1	(FL) Fracture longitudinal at ... o'clock	survey00000101/2025_05_07-10_12_43_882.jpg
	Clock At/From: 11	
11		
		0:08:28

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
72.1	(DE) Debris ...% cross-sectional area loss	survey00000101/2025_05_07-10_13_02_965.jpg
	Percentage: 40%	
	DEBRIS IS BUILDING	0:08:30
79.7	(MH) Manhole/node	survey00000101/2025_05_07-10_14_17_008.jpg
		
	E-1 END OF RUN	0:09:15

8.4 Photographs

(CC) Crack circumferential from ... to ... o'clock survey00000101/2025_05_07-09_58_29_196.jpg (CC) Crack circumferential from ... to ... survey00000101/2025_05_07-10_01_02_185.jpg



(SWS) Surface damage, wear slight at ... (OR survey00000101/2025_05_07-10_04_33_919.jpg (CC) Crack circumferential from ... to ... survey00000101/2025_05_07-10_06_04_188.jpg



(B) Broken pipe at ... (OR from ... to ...) o'clock survey00000101/2025_05_07-10_07_22_758.jpg (JDM) Joint displaced medium survey00000101/2025_05_07-10_12_21_954.jpg



(FL) Fracture longitudinal at ... o'clock survey00000101/2025_05_07-10_12_43_882.jpg (DE) Debris ...% cross-sectional area loss survey00000101/2025_05_07-10_13_02_965.jpg



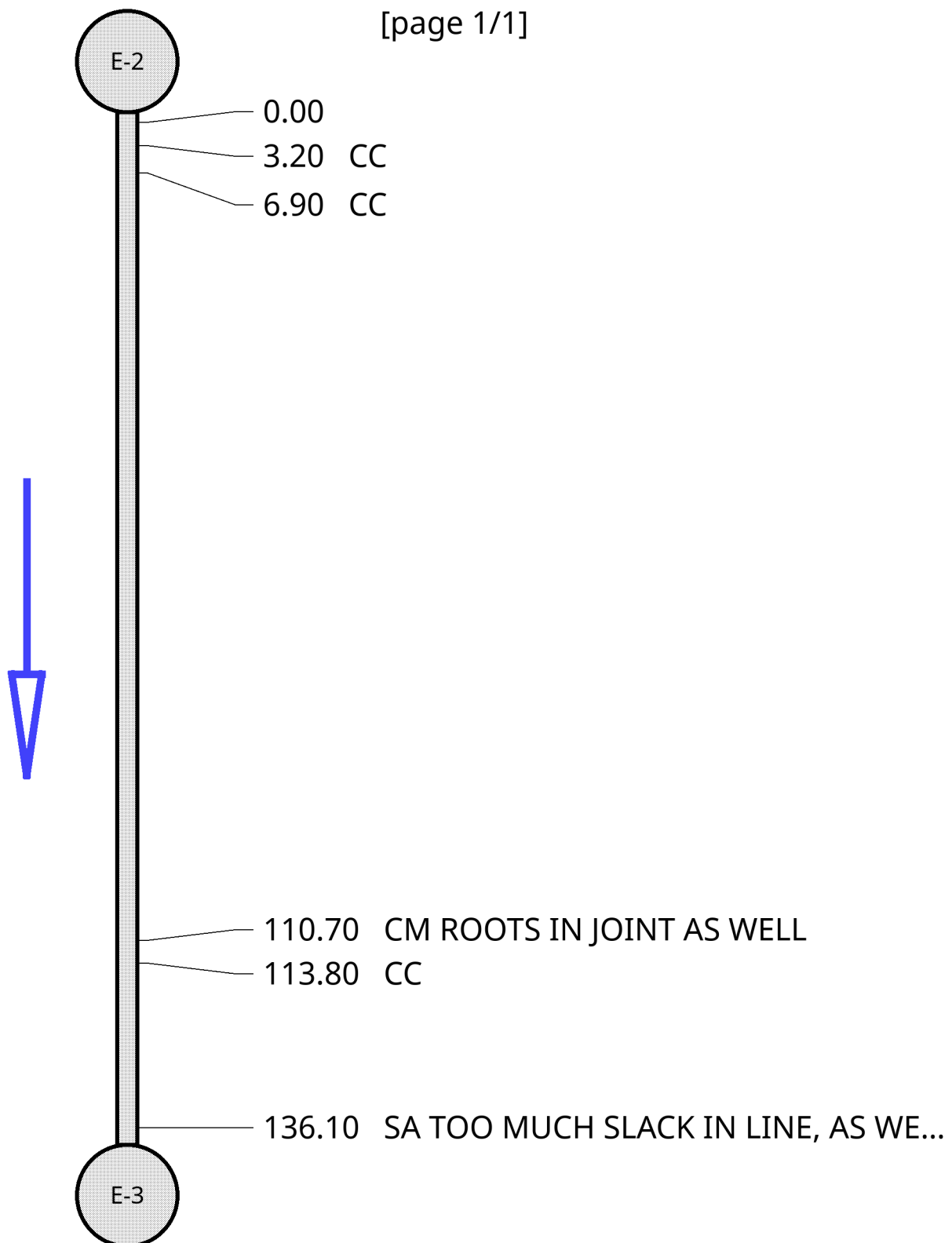


9 Drain / Sewer Survey E-2 TO E-3

9.1 Survey Header

9.1.1	Surveyed by (Operator)	JEREMIAH
9.1.2	Contract no.	
9.1.3	Job no.	
9.1.4	Catchment (Drainage area)	
9.1.5	Division	
9.1.6	District	
9.1.7	Pipeline length ref	E-2 TO E-3
9.1.8	Date	070525
9.1.9	Time	11:13
9.1.10	Location	
9.1.11	Start manhole no.	E-2
9.1.12	Start depth	
9.1.13	Start cover level	
9.1.14	Start invert level	
9.1.15	Finish manhole no.	E-3
9.1.16	Finish depth	
9.1.17	Finish cover level	
9.1.18	Finish invert level	
9.1.19	Use of Drain	
9.1.20	Direction	(D) Survey downstream (camera pointing with flow)
9.1.21	Size 1 (diameter/height)	8mm
9.1.22	Size 2 (width)	
9.1.23	Shape	(C) Circular
9.1.24	Material	(VC) Vitrified clay (i.e. all clayware)
9.1.25	Lining	
9.1.26	Pipe length	
9.1.27	Total length	
9.1.28	Year laid	
9.1.29	Video cassette number	
9.1.30	Comments: General	
9.1.31	Purpose	
9.1.32	Sewer category	
9.1.33	Pre-cleaning	(N) No
9.1.34	Weather	(1) Dry
9.1.35	Location code	
9.1.36	Further location details	

9.2 Diagram



9.3 Observations

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
3.2	(CC) Crack circumferential from ... to ... o'clock	survey00000102/2025_05_07-11_16_25_005.jpg
	Clock At/From: 10	
10 - 12	Clock To: 12	
		0:00:00
6.9	(CC) Crack circumferential from ... to ... o'clock	survey00000102/2025_05_07-11_17_10_531.jpg
	Clock At/From: 10	
10 - 02	Clock To: 02	
		0:00:00
110.7	(CM) Cracks multiple from ... to ... o'clock	survey00000102/2025_05_07-11_26_10_576.jpg
	Clock At/From: 10	
10 - 02	Clock To: 02	
	ROOTS IN JOINT AS WELL	0:00:00
113.8	(CC) Crack circumferential from ... to ... o'clock	survey00000102/2025_05_07-11_29_56_471.jpg
	Clock At/From: 09	
09 - 11	Clock To: 11	
		0:00:42
136.1	(SA) Survey abandoned	survey00000102/2025_05_07-11_38_25_274.jpg
		
	TOO MUCH SLACK IN LINE, AS WELL AS DEBRIS PILE UP	0:07:53

9.4 Photographs

(CC) Crack circumferential from ... to ... o'clock survey00000102/2025_05_07-11_16_25_005.jpg (CC) Crack circumferential from ... to ... survey00000102/2025_05_07-11_17_10_531.jpg



(CM) Cracks multiple from ... to ... o'clock survey00000102/2025_05_07-11_26_10_576.jpg (CC) Crack circumferential from ... to ... survey00000102/2025_05_07-11_29_56_471.jpg



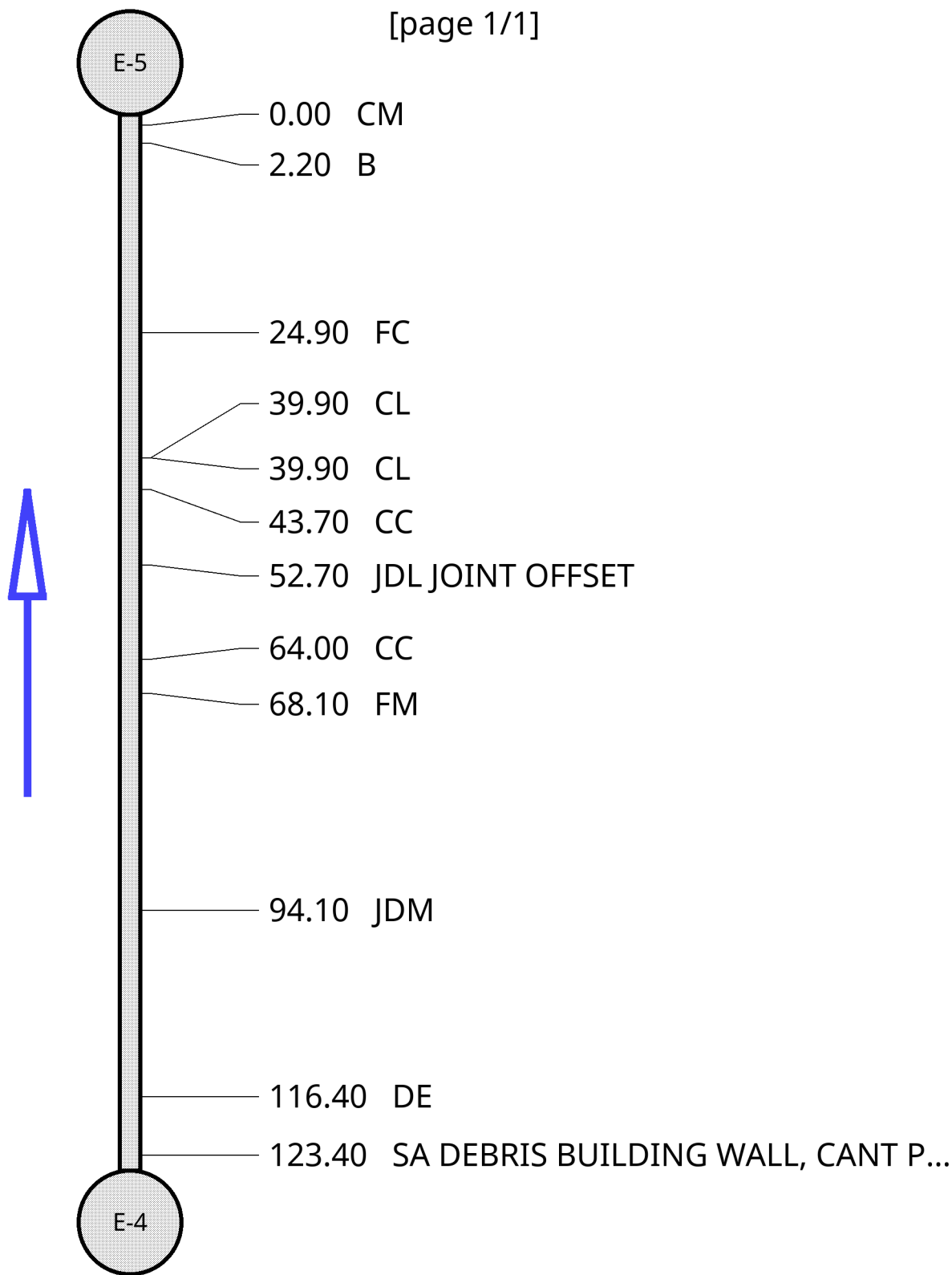
(SA) Survey abandoned survey00000102/2025_05_07-11_38_25_274.jpg



10 Drain / Sewer Survey E-5 TO E-4

10.1 Survey Header

10.1.1	Surveyed by (Operator)	JEREMIAH
10.1.2	Contract no.	
10.1.3	Job no.	
10.1.4	Catchment (Drainage area)	
10.1.5	Division	
10.1.6	District	
10.1.7	Pipeline length ref	E-5 TO E-4
10.1.8	Date	070525
10.1.9	Time	12:04
10.1.10	Location	
10.1.11	Start manhole no.	E-5
10.1.12	Start depth	
10.1.13	Start cover level	
10.1.14	Start invert level	
10.1.15	Finish manhole no.	E-4
10.1.16	Finish depth	
10.1.17	Finish cover level	
10.1.18	Finish invert level	
10.1.19	Use of Drain	
10.1.20	Direction	(U) Survey upstream (camera pointing against flow)
10.1.21	Size 1 (diameter/height)	6mm
10.1.22	Size 2 (width)	
10.1.23	Shape	(C) Circular
10.1.24	Material	(VC) Vitrified clay (i.e. all clayware)
10.1.25	Lining	
10.1.26	Pipe length	
10.1.27	Total length	
10.1.28	Year laid	
10.1.29	Video cassette number	
10.1.30	Comments: General	
10.1.31	Purpose	
10.1.32	Sewer category	
10.1.33	Pre-cleaning	(N) No
10.1.34	Weather	(1) Dry
10.1.35	Location code	
10.1.36	Further location details	

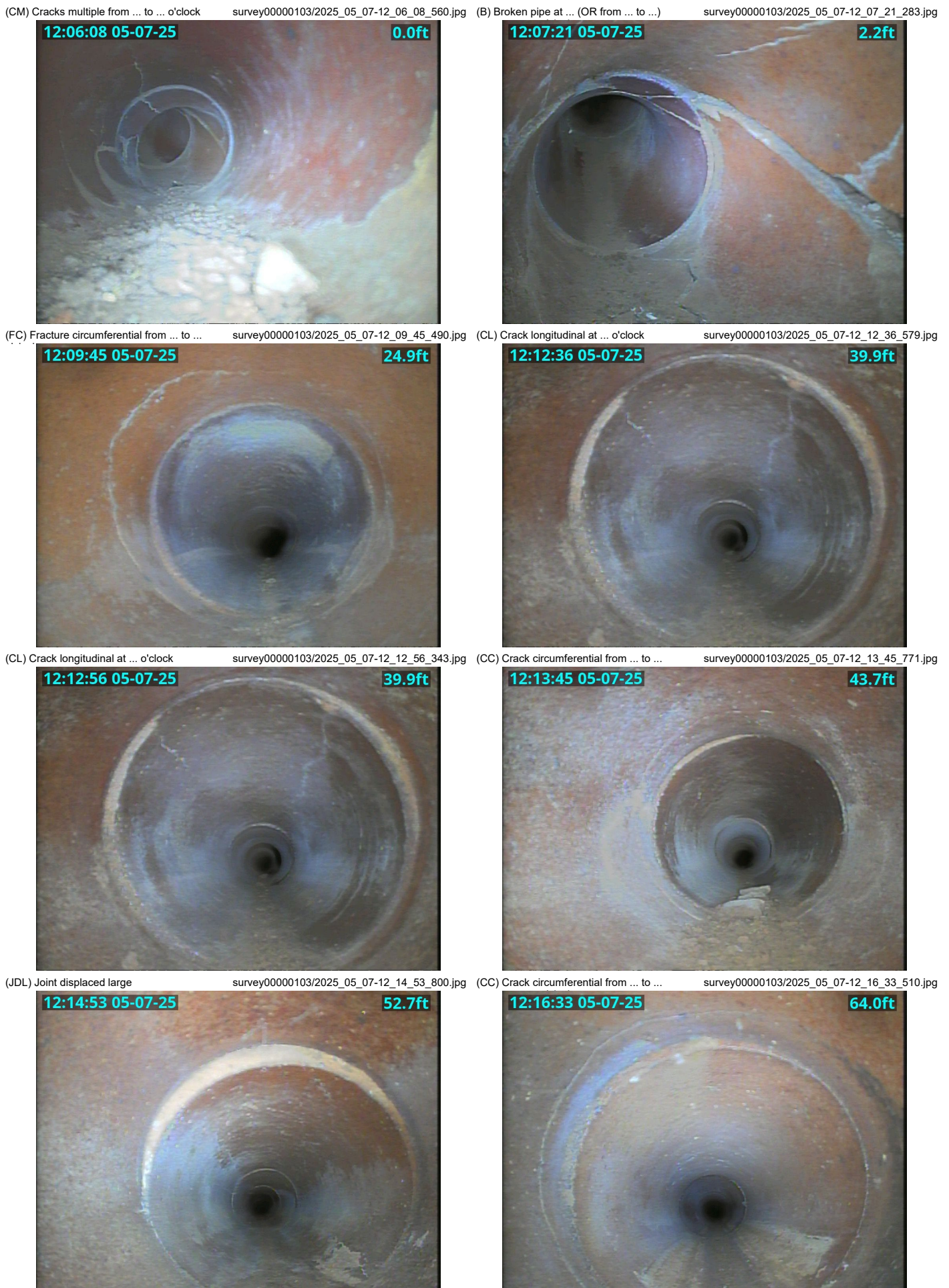


10.3 Observations

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
0.0	(CM) Cracks multiple from ... to ... o'clock	survey00000103/2025_05_07-12_06_08_560.jpg
	Clock At/From: 09	
	Clock To: 03	
09 - 03		
		0:00:02
2.2	(B) Broken pipe at ... (OR from ... to ...) o'clock	survey00000103/2025_05_07-12_07_21_283.jpg
	Clock At/From: 12	
	Clock To: 06	
12 - 06		
		0:00:49
24.9	(FC) Fracture circumferential from ... to ... o'clock	survey00000103/2025_05_07-12_09_45_490.jpg
	Clock At/From: 01	
	Clock To: 12	
01 - 12		
		0:02:44
39.9	(CL) Crack longitudinal at ... o'clock	survey00000103/2025_05_07-12_12_36_579.jpg
	Clock At/From: 11	
11		
		0:04:24
39.9	(CL) Crack longitudinal at ... o'clock	survey00000103/2025_05_07-12_12_56_343.jpg
	Clock At/From: 01	
01		
		0:04:28
43.7	(CC) Crack circumferential from ... to ... o'clock	survey00000103/2025_05_07-12_13_45_771.jpg
	Clock At/From: 07	
	Clock To: 05	
07 - 05		
		0:05:02
52.7	(JDL) Joint displaced large	survey00000103/2025_05_07-12_14_53_800.jpg
	JOINT OFFSET	0:05:46

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
64.0	(CC) Crack circumferential from ... to ... o'clock	survey00000103/2025_05_07-12_16_33_510.jpg
	Clock At/From: 07	
	Clock To: 02	
07 - 02		
		0:06:59
68.1	(FM) Fractures multiple from ... to ... o'clock	survey00000103/2025_05_07-12_17_24_970.jpg
	Clock At/From: 11	
	Clock To: 02	
11 - 02		
		0:07:22
94.1	(JDM) Joint displaced medium	survey00000103/2025_05_07-12_20_31_109.jpg
		0:10:10
116.4	(DE) Debris ...% cross-sectional area loss	survey00000103/2025_05_07-12_23_08_952.jpg
	Percentage: 50%	
		0:12:37
123.4	(SA) Survey abandoned	survey00000103/2025_05_07-12_27_32_384.jpg
	DEBRIS BUILDING WALL, CANT PUSH PAST	0:16:40

10.4 Photographs



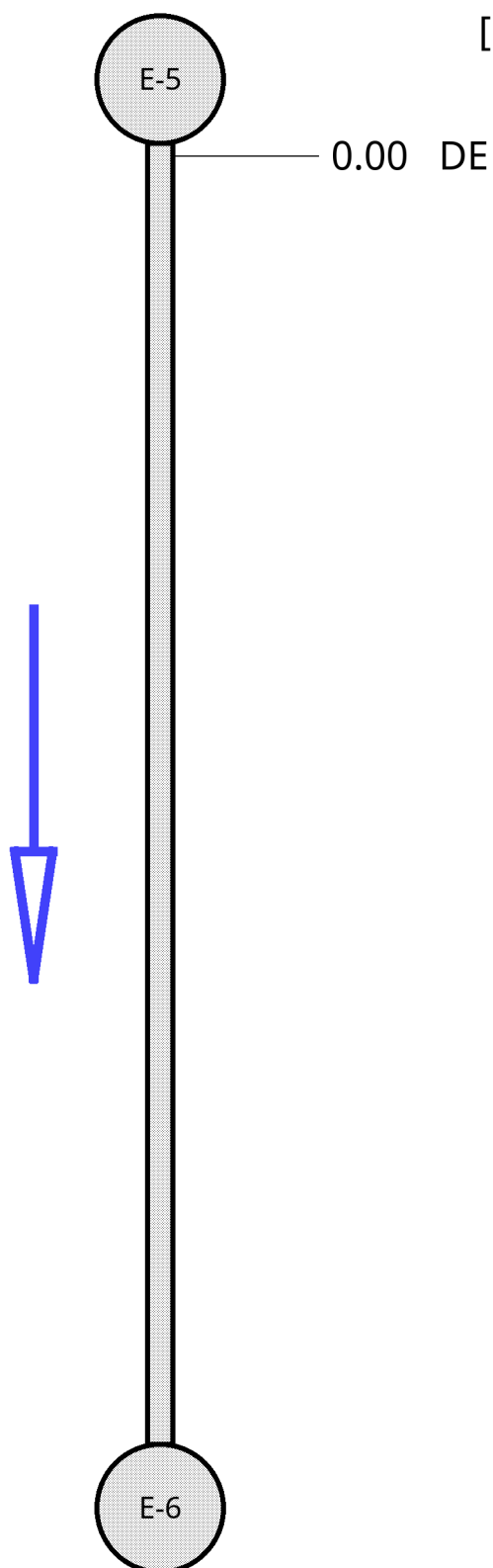


11 Drain / Sewer Survey E-5 TO E-6

11.1 Survey Header

11.1.1	Surveyed by (Operator)	JEREMIAH
11.1.2	Contract no.	
11.1.3	Job no.	
11.1.4	Catchment (Drainage area)	
11.1.5	Division	
11.1.6	District	
11.1.7	Pipeline length ref	E-5 TO E-6
11.1.8	Date	070525
11.1.9	Time	12:40
11.1.10	Location	
11.1.11	Start manhole no.	E-5
11.1.12	Start depth	
11.1.13	Start cover level	
11.1.14	Start invert level	
11.1.15	Finish manhole no.	E-6
11.1.16	Finish depth	
11.1.17	Finish cover level	
11.1.18	Finish invert level	
11.1.19	Use of Drain	
11.1.20	Direction	(D) Survey downstream (camera pointing with flow)
11.1.21	Size 1 (diameter/height)	8mm
11.1.22	Size 2 (width)	
11.1.23	Shape	(C) Circular
11.1.24	Material	(VC) Vitrified clay (i.e. all clayware)
11.1.25	Lining	
11.1.26	Pipe length	
11.1.27	Total length	
11.1.28	Year laid	
11.1.29	Video cassette number	
11.1.30	Comments: General	
11.1.31	Purpose	
11.1.32	Sewer category	
11.1.33	Pre-cleaning	(N) No
11.1.34	Weather	(3) Light rain
11.1.35	Location code	
11.1.36	Further location details	

[page 1/1]



11.3 Observations

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
0.0	(DE) Debris ...% cross-sectional area loss	survey00000104/2025_05_07-12_41_21_896.jpg
	Percentage: 40%	
		0:00:00

11.4 Photographs

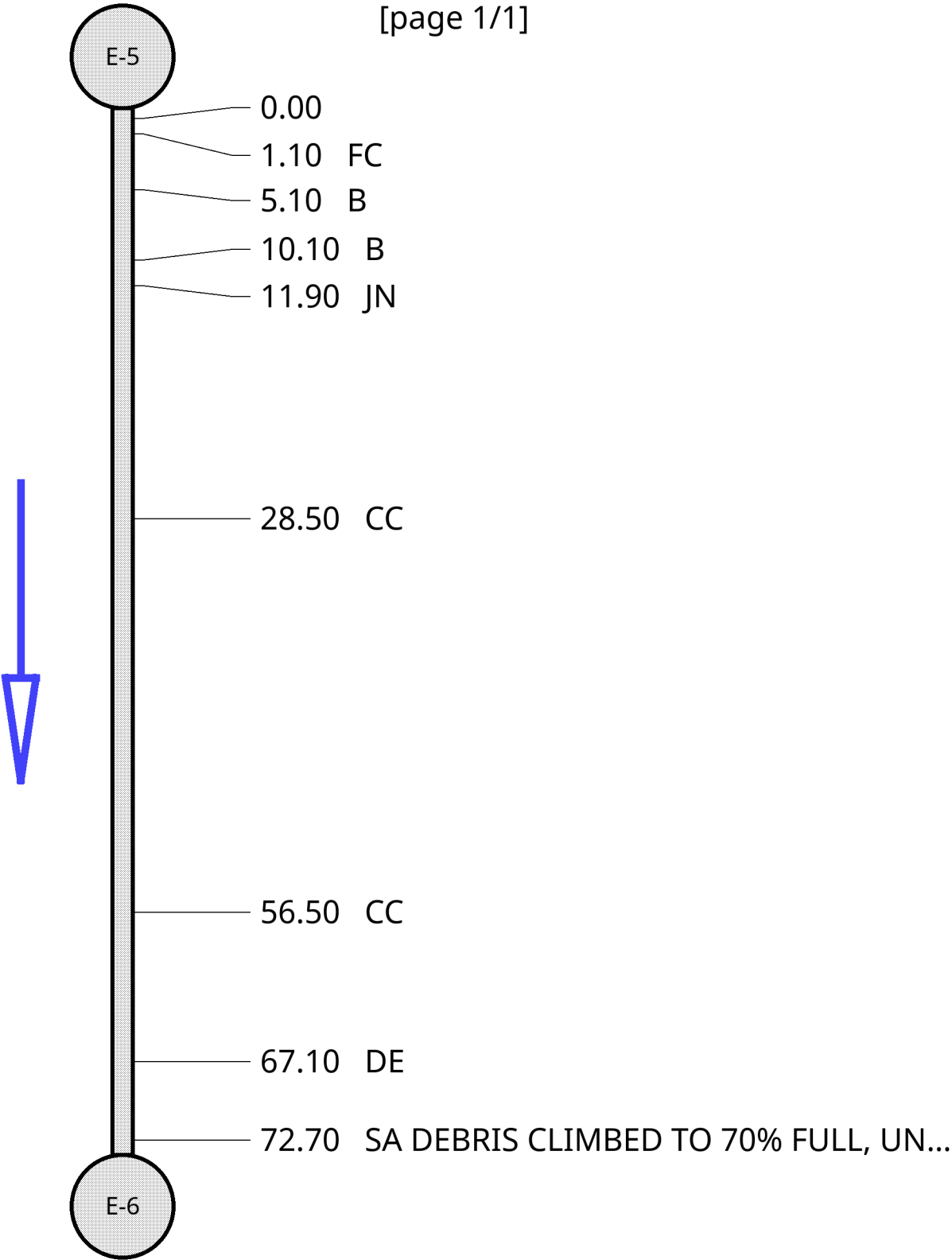
(DE) Debris ...% cross-sectional area loss survey00000104/2025_05_07-12_41_21_896.jpg



12 Drain / Sewer Survey E-5 TO E-6

12.1 Survey Header

12.1.1	Surveyed by (Operator)	JEREMIAH
12.1.2	Contract no.	
12.1.3	Job no.	
12.1.4	Catchment (Drainage area)	
12.1.5	Division	
12.1.6	District	
12.1.7	Pipeline length ref	E-5 TO E-6
12.1.8	Date	070525
12.1.9	Time	13:12
12.1.10	Location	
12.1.11	Start manhole no.	E-5
12.1.12	Start depth	
12.1.13	Start cover level	
12.1.14	Start invert level	
12.1.15	Finish manhole no.	E-6
12.1.16	Finish depth	
12.1.17	Finish cover level	
12.1.18	Finish invert level	
12.1.19	Use of Drain	
12.1.20	Direction	(D) Survey downstream (camera pointing with flow)
12.1.21	Size 1 (diameter/height)	8mm
12.1.22	Size 2 (width)	
12.1.23	Shape	(C) Circular
12.1.24	Material	(VC) Vitrified clay (i.e. all clayware)
12.1.25	Lining	
12.1.26	Pipe length	
12.1.27	Total length	
12.1.28	Year laid	
12.1.29	Video cassette number	
12.1.30	Comments: General	
12.1.31	Purpose	
12.1.32	Sewer category	
12.1.33	Pre-cleaning	(N) No
12.1.34	Weather	(3) Light rain
12.1.35	Location code	
12.1.36	Further location details	



12.3 Observations

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
1.1	(FC) Fracture circumferential from ... to ... o'clock	survey00000105/2025_05_07-13_15_31_184.jpg
	Clock At/From: 07	
	Clock To: 12	
07 - 12		
		0:00:29
5.1	(B) Broken pipe at ... (OR from ... to ...) o'clock	survey00000105/2025_05_07-13_16_22_071.jpg
	Clock At/From: 07	
	Clock To: 05	
07 - 05		
		0:00:59
10.1	(B) Broken pipe at ... (OR from ... to ...) o'clock	survey00000105/2025_05_07-13_17_07_550.jpg
	Clock At/From: 07	
	Clock To: 06	
07 - 06		
		0:01:28
11.9	(JN) Junction at ... o'clock, diameter ...mm	survey00000105/2025_05_07-13_17_59_345.jpg
	Clock At/From: 10	
	Diameter/Dimension: 6	
10		
		0:01:53
28.5	(CC) Crack circumferential from ... to ... o'clock	survey00000105/2025_05_07-13_19_53_376.jpg
	Clock At/From: 09	
	Clock To: 12	
09 - 12		
		0:02:56
56.5	(CC) Crack circumferential from ... to ... o'clock	survey00000105/2025_05_07-13_22_04_316.jpg
	Clock At/From: 04	
	Clock To: 09	
04 - 09		
		0:04:55
67.1	(DE) Debris ...% cross-sectional area loss	survey00000105/2025_05_07-13_23_26_004.jpg
	Percentage: 50%	
		
		0:05:54

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
72.7	(SA) Survey abandoned	survey00000105/2025_05_07-13_25_42_497.jpg
		
	DEBRIS CLIMBED TO 70% FULL, UNABLE TO GET CAMERA PASSED	0:07:12

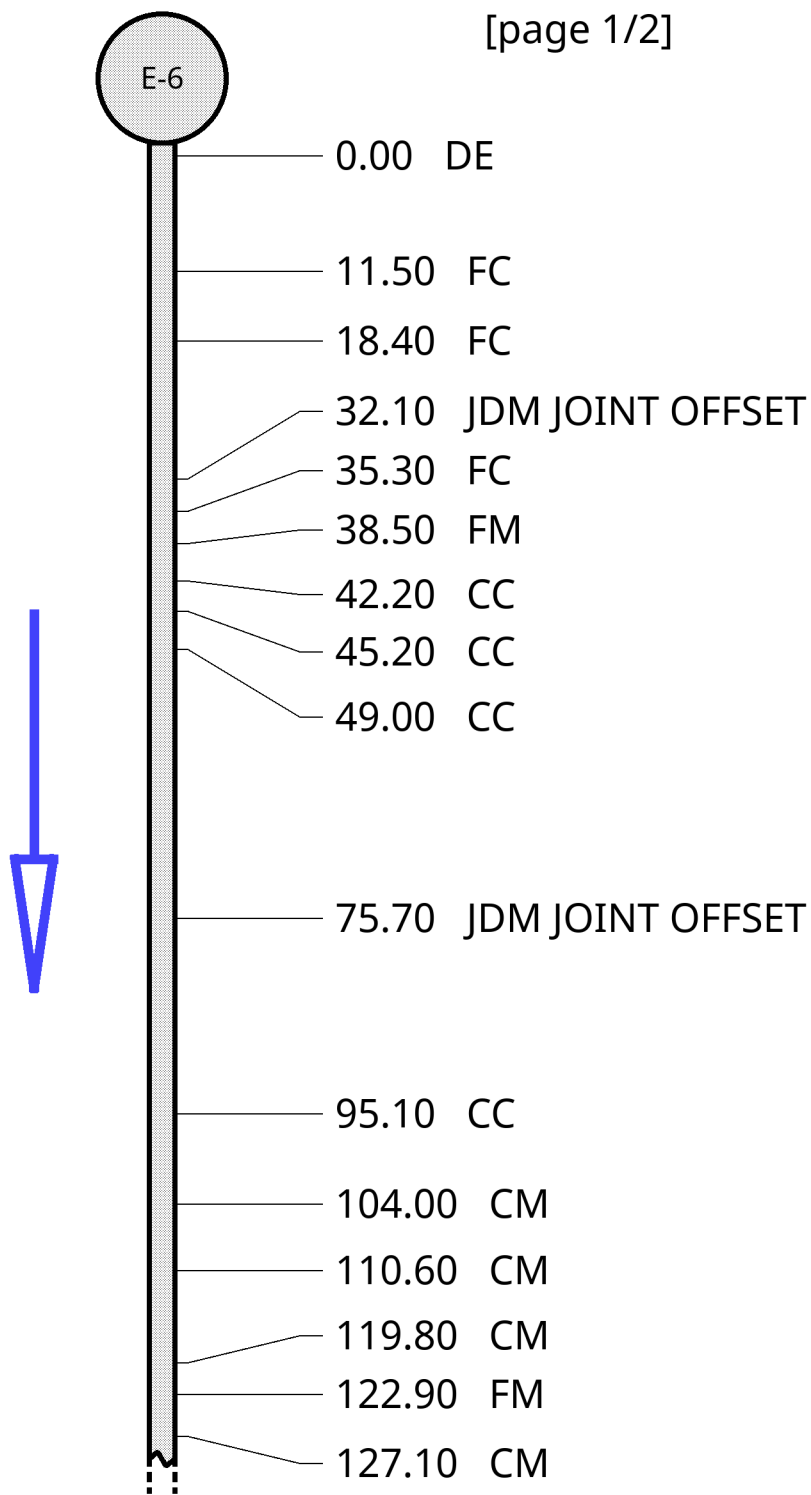
12.4 Photographs

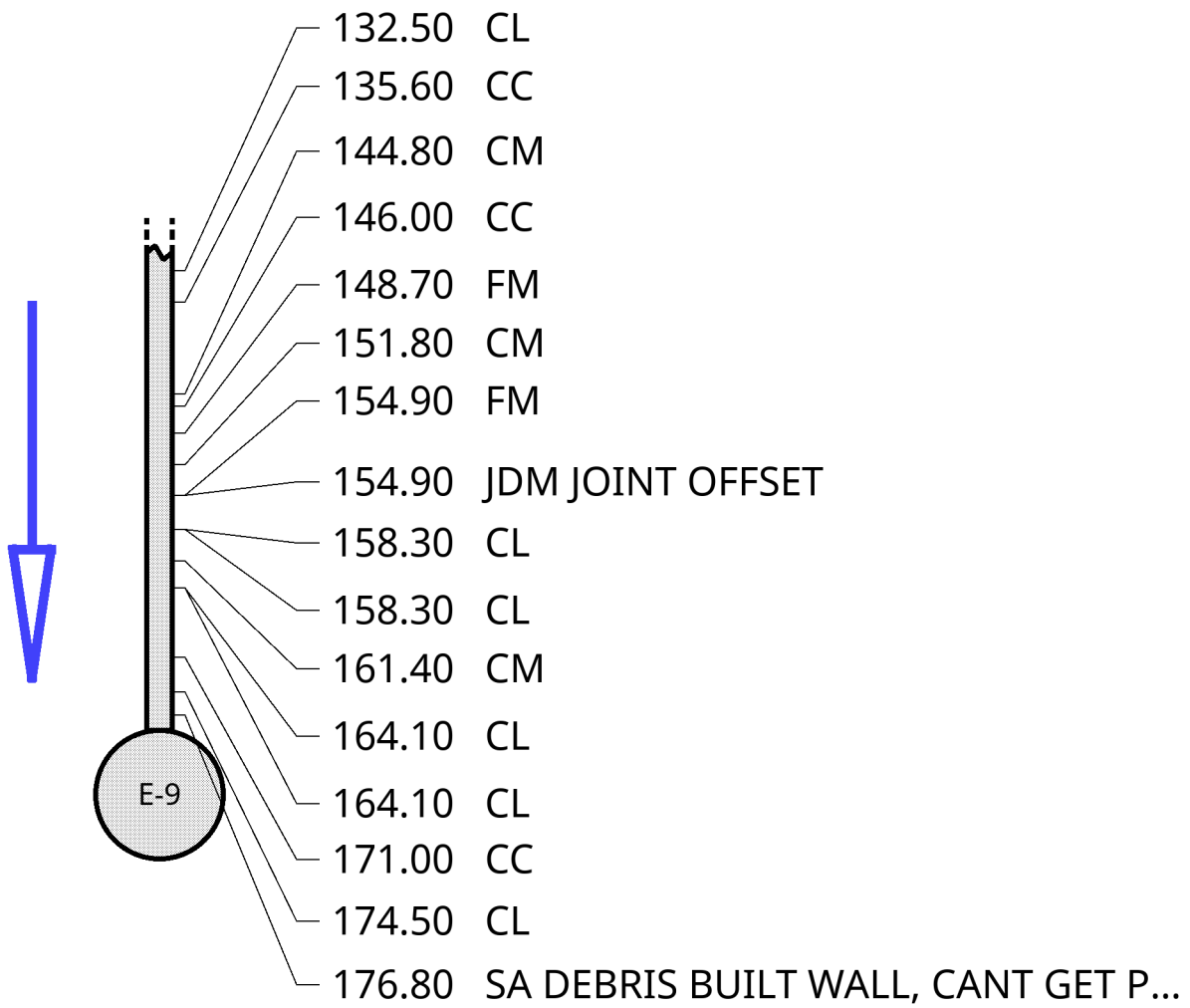


13 Drain / Sewer Survey E-6 TO E-9

13.1 Survey Header

13.1.1	Surveyed by (Operator)	JEREMIAH
13.1.2	Contract no.	
13.1.3	Job no.	
13.1.4	Catchment (Drainage area)	
13.1.5	Division	
13.1.6	District	
13.1.7	Pipeline length ref	E-6 TO E-9
13.1.8	Date	080525
13.1.9	Time	06:25
13.1.10	Location	
13.1.11	Start manhole no.	E-6
13.1.12	Start depth	
13.1.13	Start cover level	
13.1.14	Start invert level	
13.1.15	Finish manhole no.	E-9
13.1.16	Finish depth	
13.1.17	Finish cover level	
13.1.18	Finish invert level	
13.1.19	Use of Drain	
13.1.20	Direction	(D) Survey downstream (camera pointing with flow)
13.1.21	Size 1 (diameter/height)	8mm
13.1.22	Size 2 (width)	
13.1.23	Shape	(C) Circular
13.1.24	Material	(VC) Vitrified clay (i.e. all clayware)
13.1.25	Lining	
13.1.26	Pipe length	
13.1.27	Total length	
13.1.28	Year laid	
13.1.29	Video cassette number	
13.1.30	Comments: General	
13.1.31	Purpose	
13.1.32	Sewer category	
13.1.33	Pre-cleaning	(N) No
13.1.34	Weather	(3) Light rain
13.1.35	Location code	
13.1.36	Further location details	





13.3 Observations

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
0.0	(DE) Debris ...% cross-sectional area loss	survey00000106/2025_05_08-06_27_56_170.jpg
	Percentage: 30%	
		0:00:00
11.5	(FC) Fracture circumferential from ... to ... o'clock	survey00000106/2025_05_08-06_29_34_911.jpg
	Clock At/From: 12	
12 - 03	Clock To: 03	
		0:00:57
18.4	(FC) Fracture circumferential from ... to ... o'clock	survey00000106/2025_05_08-06_30_32_476.jpg
	Clock At/From: 12	
12 - 05	Clock To: 05	
		0:01:34
32.1	(JDM) Joint displaced medium	survey00000106/2025_05_08-06_31_33_154.jpg
		
	JOINT OFFSET	0:02:23
35.3	(FC) Fracture circumferential from ... to ... o'clock	survey00000106/2025_05_08-06_32_24_054.jpg
	Clock At/From: 01	
01 - 11	Clock To: 11	
		0:02:51
38.5	(FM) Fractures multiple from ... to ... o'clock	survey00000106/2025_05_08-06_33_20_665.jpg
	Clock At/From: 06	
06 - 11	Clock To: 11	
		0:03:30
42.2	(CC) Crack circumferential from ... to ... o'clock	survey00000106/2025_05_08-06_34_03_551.jpg
	Clock At/From: 07	
07 - 06	Clock To: 06	
		0:03:52

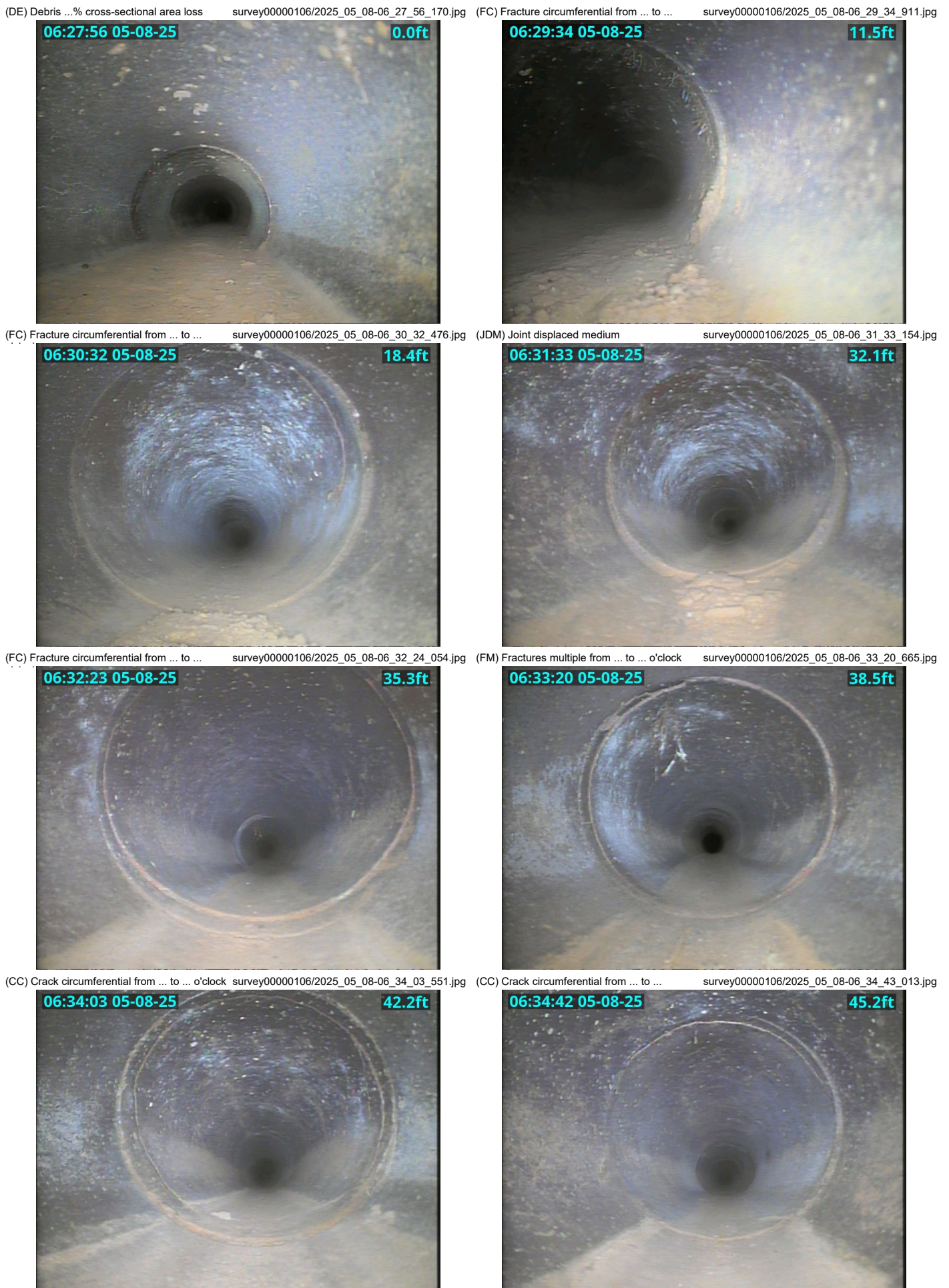
Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
45.2	(CC) Crack circumferential from ... to ... o'clock	survey00000106/2025_05_08-06_34_43_013.jpg
	Clock At/From: 10	
	Clock To: 02	
10 - 02		
		0:04:16
49.0	(CC) Crack circumferential from ... to ... o'clock	survey00000106/2025_05_08-06_35_21_626.jpg
	Clock At/From: 09	
	Clock To: 03	
09 - 03		
		0:04:36
75.7	(JDM) Joint displaced medium	survey00000106/2025_05_08-06_37_37_434.jpg
		
	JOINT OFFSET	0:06:25
95.1	(CC) Crack circumferential from ... to ... o'clock	survey00000106/2025_05_08-06_39_12_515.jpg
	Clock At/From: 07	
	Clock To: 05	
07 - 05		
		0:07:38
104.0	(CM) Cracks multiple from ... to ... o'clock	survey00000106/2025_05_08-06_40_23_819.jpg
	Clock At/From: 09	
	Clock To: 04	
09 - 04		
		0:08:27
110.6	(CM) Cracks multiple from ... to ... o'clock	survey00000106/2025_05_08-06_41_39_795.jpg
	Clock At/From: 07	
	Clock To: 05	
07 - 05		
		0:09:25
119.8	(CM) Cracks multiple from ... to ... o'clock	survey00000106/2025_05_08-06_44_55_170.jpg
	Clock At/From: 08	
	Clock To: 11	
08 - 11		
		0:12:21

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
122.9	(FM) Fractures multiple from ... to ... o'clock	survey00000106/2025_05_08-06_46_36_000.jpg
	Clock At/From: 08	
08 - 10	Clock To: 10	
		0:13:38
127.1	(CM) Cracks multiple from ... to ... o'clock	survey00000106/2025_05_08-06_47_28_766.jpg
	Clock At/From: 08	
08 - 10	Clock To: 10	
		0:14:04
132.5	(CL) Crack longitudinal at ... o'clock	survey00000106/2025_05_08-06_49_40_107.jpg
	Clock At/From: 09	
09		
		0:15:50
135.6	(CC) Crack circumferential from ... to ... o'clock	survey00000106/2025_05_08-06_50_52_677.jpg
	Clock At/From: 09	
09 - 12	Clock To: 12	
		0:16:51
144.8	(CM) Cracks multiple from ... to ... o'clock	survey00000106/2025_05_08-06_51_59_450.jpg
	Clock At/From: 10	
10 - 12	Clock To: 12	
		0:17:42
146.0	(CC) Crack circumferential from ... to ... o'clock	survey00000106/2025_05_08-06_52_29_853.jpg
	Clock At/From: 12	
12 - 11	Clock To: 11	
		0:17:59
148.7	(FM) Fractures multiple from ... to ... o'clock	survey00000106/2025_05_08-06_53_34_196.jpg
	Clock At/From: 09	
09 - 04	Clock To: 04	
		0:18:27

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
151.8	(CM) Cracks multiple from ... to ... o'clock	survey00000106/2025_05_08-06_54_09_689.jpg
	Clock At/From: 07	
07 - 10	Clock To: 10	
		0:18:49
154.9	(FM) Fractures multiple from ... to ... o'clock	survey00000106/2025_05_08-06_54_59_611.jpg
	Clock At/From: 07	
07 - 04	Clock To: 04	
		0:19:13
154.9	(JDM) Joint displaced medium	survey00000106/2025_05_08-06_55_23_444.jpg
		
	JOINT OFFSET	0:19:18
158.3	(CL) Crack longitudinal at ... o'clock	survey00000106/2025_05_08-06_56_00_481.jpg
	Clock At/From: 09	
09		
		0:19:43
158.3	(CL) Crack longitudinal at ... o'clock	survey00000106/2025_05_08-06_56_13_907.jpg
	Clock At/From: 03	
03		
		0:19:46
161.4	(CM) Cracks multiple from ... to ... o'clock	survey00000106/2025_05_08-06_56_47_750.jpg
	Clock At/From: 02	
02 - 11	Clock To: 11	
		0:20:12
164.1	(CL) Crack longitudinal at ... o'clock	survey00000106/2025_05_08-06_57_39_480.jpg
	Clock At/From: 09	
09		
		0:20:45

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
164.1	(CL) Crack longitudinal at ... o'clock	survey00000106/2025_05_08-06_58_10_885.jpg
	Clock At/From: 03	
03		
		0:20:47
171.0	(CC) Crack circumferential from ... to ... o'clock	survey00000106/2025_05_08-06_59_13_908.jpg
	Clock At/From: 02	
	Clock To: 03	
02 - 03		
		0:21:42
174.5	(CL) Crack longitudinal at ... o'clock	survey00000106/2025_05_08-07_01_19_638.jpg
	Clock At/From: 11	
11		
		0:23:29
176.8	(SA) Survey abandoned	survey00000106/2025_05_08-07_06_10_105.jpg
		
	DEBRIS BUILT WALL, CANT GET PASSED	0:28:06

13.4 Photographs





(CL) Crack longitudinal at ... o'clock survey00000106/2025_05_08-06_49_40_107.jpg (CC) Crack circumferential from ... to ... survey00000106/2025_05_08-06_50_52_677.jpg



(CM) Cracks multiple from ... to ... o'clock survey00000106/2025_05_08-06_51_59_450.jpg (CC) Crack circumferential from ... to ... survey00000106/2025_05_08-06_52_29_853.jpg



(FM) Fractures multiple from ... to ... o'clock survey00000106/2025_05_08-06_53_34_196.jpg (CM) Cracks multiple from ... to ... o'clock survey00000106/2025_05_08-06_54_09_689.jpg



(FM) Fractures multiple from ... to ... o'clock survey00000106/2025_05_08-06_54_59_611.jpg (JDM) Joint displaced medium survey00000106/2025_05_08-06_55_23_444.jpg



(CL) Crack longitudinal at ... o'clock survey00000106/2025_05_08-06_56_00_481.jpg (CL) Crack longitudinal at ... o'clock survey00000106/2025_05_08-06_56_13_907.jpg



(CM) Cracks multiple from ... to ... o'clock survey00000106/2025_05_08-06_56_47_750.jpg (CL) Crack longitudinal at ... o'clock survey00000106/2025_05_08-06_57_39_480.jpg



(CL) Crack longitudinal at ... o'clock survey00000106/2025_05_08-06_58_10_885.jpg (CC) Crack circumferential from ... to ... survey00000106/2025_05_08-06_59_13_908.jpg



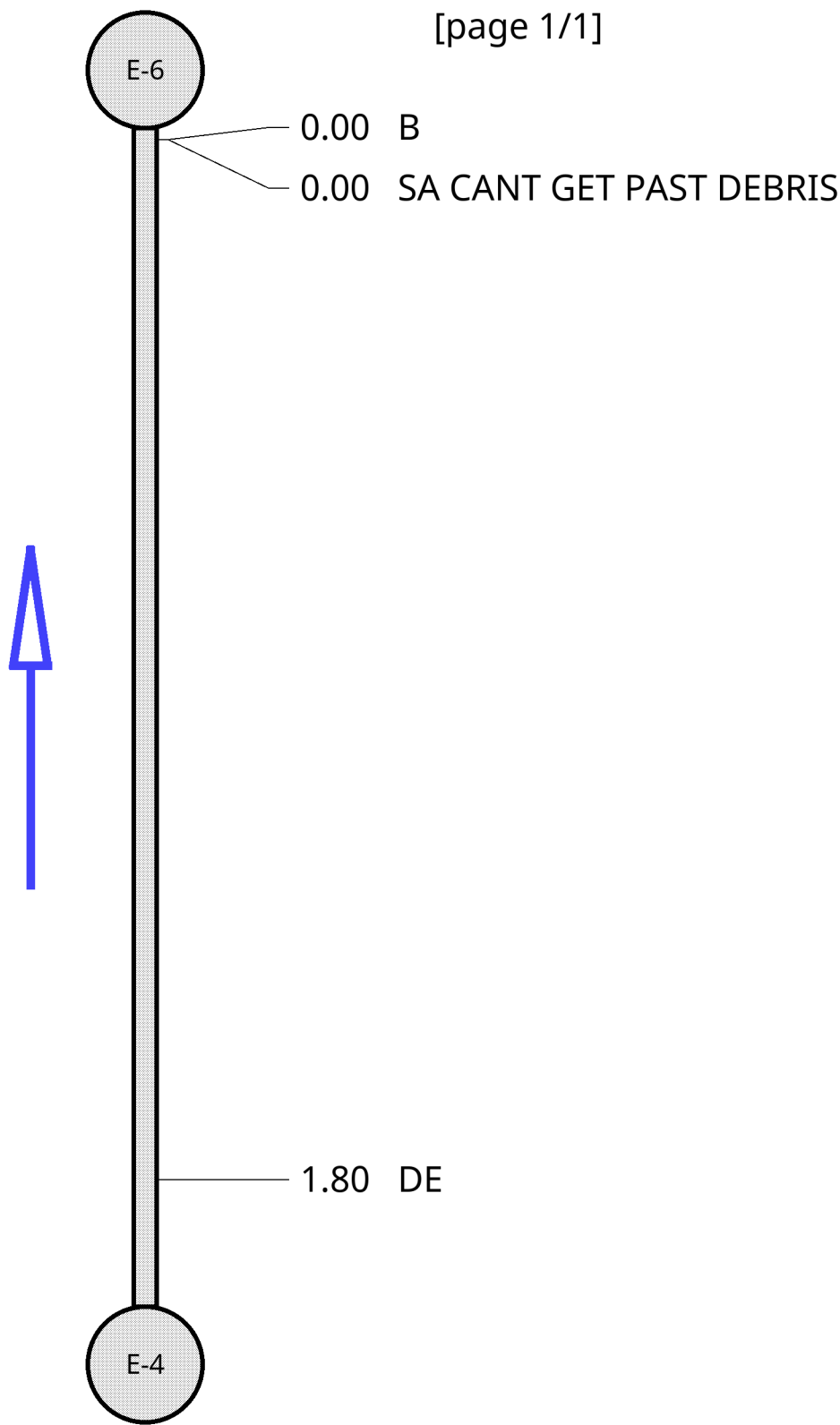
(CL) Crack longitudinal at ... o'clock survey00000106/2025_05_08-07_01_19_638.jpg (SA) Survey abandoned survey00000106/2025_05_08-07_06_10_105.jpg



14 Drain / Sewer Survey E-6 TO E-4

14.1 Survey Header

14.1.1	Surveyed by (Operator)	JEREMIAH
14.1.2	Contract no.	
14.1.3	Job no.	
14.1.4	Catchment (Drainage area)	
14.1.5	Division	
14.1.6	District	
14.1.7	Pipeline length ref	E-6 TO E-4
14.1.8	Date	080525
14.1.9	Time	07:15
14.1.10	Location	
14.1.11	Start manhole no.	E-6
14.1.12	Start depth	
14.1.13	Start cover level	
14.1.14	Start invert level	
14.1.15	Finish manhole no.	E-4
14.1.16	Finish depth	
14.1.17	Finish cover level	
14.1.18	Finish invert level	
14.1.19	Use of Drain	
14.1.20	Direction	(U) Survey upstream (camera pointing against flow)
14.1.21	Size 1 (diameter/height)	8mm
14.1.22	Size 2 (width)	
14.1.23	Shape	(C) Circular
14.1.24	Material	(VC) Vitrified clay (i.e. all clayware)
14.1.25	Lining	
14.1.26	Pipe length	
14.1.27	Total length	
14.1.28	Year laid	
14.1.29	Video cassette number	
14.1.30	Comments: General	
14.1.31	Purpose	
14.1.32	Sewer category	
14.1.33	Pre-cleaning	(N) No
14.1.34	Weather	(1) Dry
14.1.35	Location code	
14.1.36	Further location details	



14.3 Observations

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
0.0	(B) Broken pipe at ... (OR from ... to ...) o'clock	survey00000107/2025_05_08-07_19_22_965.jpg
	Clock At/From: 08	
08		
		0:01:16
0.0	(SA) Survey abandoned	survey00000107/2025_05_08-07_20_20_939.jpg
		
	CANT GET PAST DEBRIS	0:01:43
1.8	(DE) Debris ...% cross-sectional area loss	survey00000107/2025_05_08-07_16_49_789.jpg
	Percentage: 50%	
		0:00:00

14.4 Photographs

(B) Broken pipe at ... (OR from ... to ...) o'clock survey00000107/2025_05_08-07_19_22_965.jpg (SA) Survey abandoned survey00000107/2025_05_08-07_20_20_939.jpg



(DE) Debris ...% cross-sectional area loss survey00000107/2025_05_08-07_16_49_789.jpg

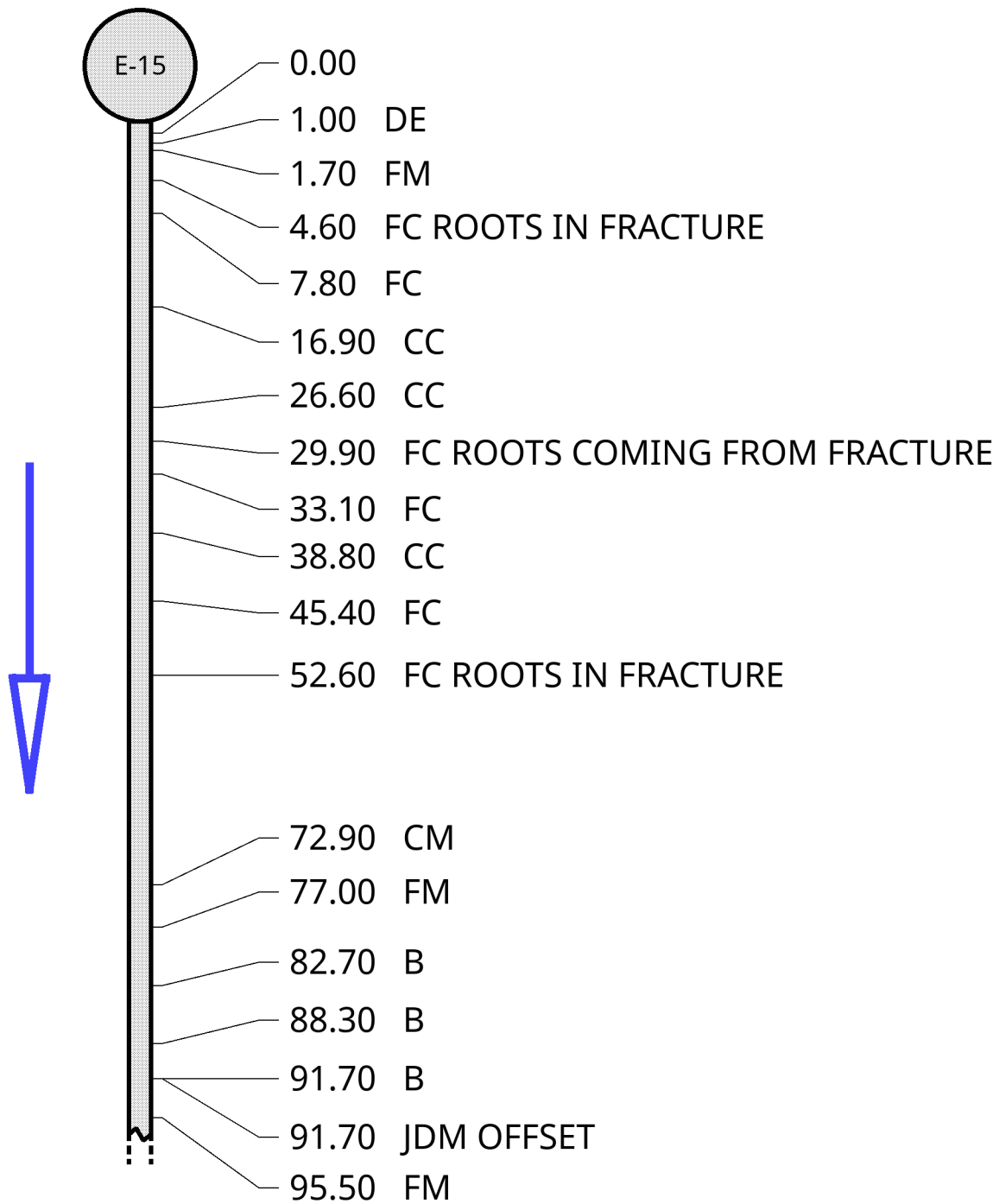


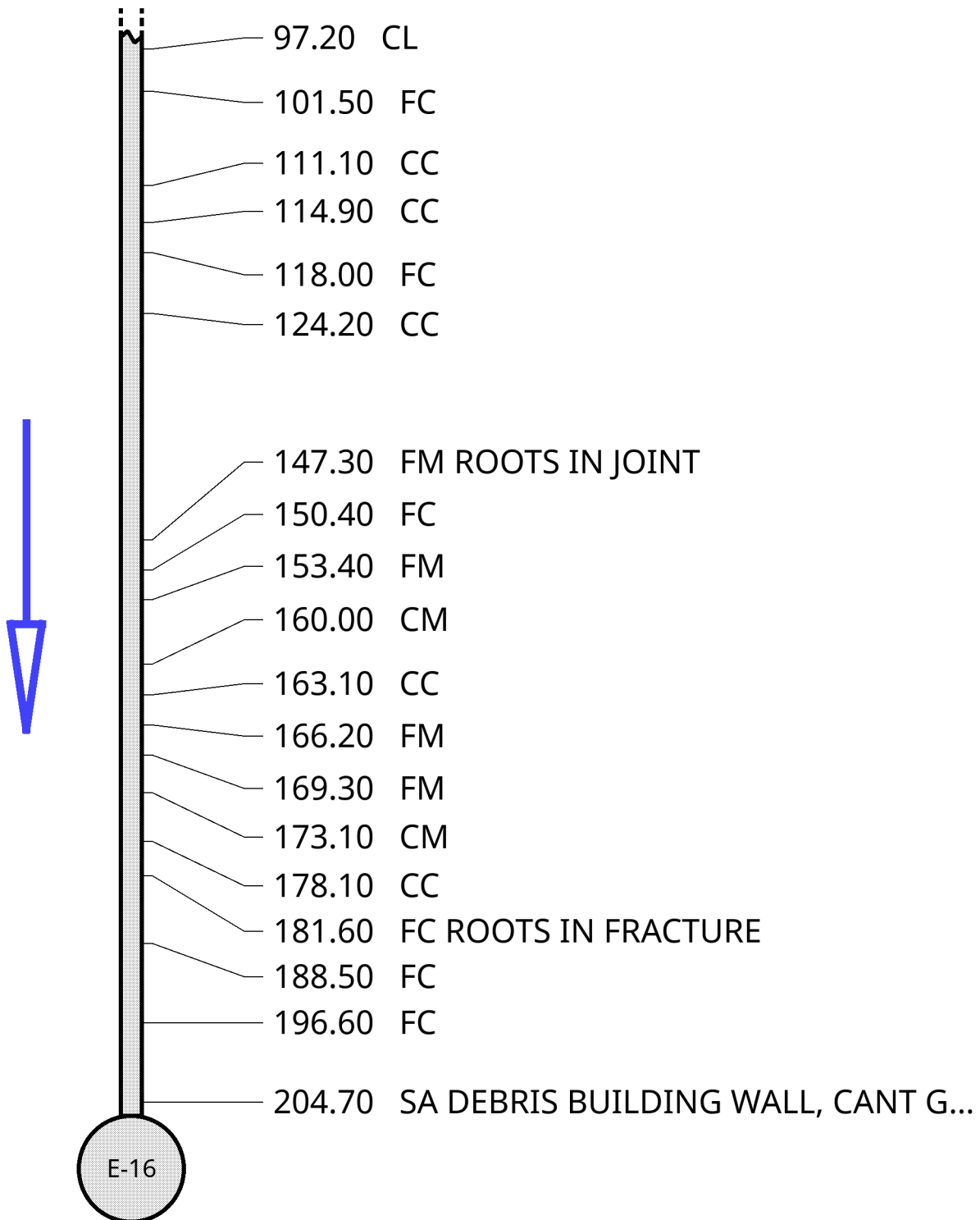
15 Drain / Sewer Survey E-15 TO E-16

15.1 Survey Header

15.1.1	Surveyed by (Operator)	JEREMIAH
15.1.2	Contract no.	
15.1.3	Job no.	
15.1.4	Catchment (Drainage area)	
15.1.5	Division	
15.1.6	District	
15.1.7	Pipeline length ref	E-15 TO E-16
15.1.8	Date	080525
15.1.9	Time	08:22
15.1.10	Location	
15.1.11	Start manhole no.	E-15
15.1.12	Start depth	
15.1.13	Start cover level	
15.1.14	Start invert level	
15.1.15	Finish manhole no.	E-16
15.1.16	Finish depth	
15.1.17	Finish cover level	
15.1.18	Finish invert level	
15.1.19	Use of Drain	
15.1.20	Direction	(D) Survey downstream (camera pointing with flow)
15.1.21	Size 1 (diameter/height)	8mm
15.1.22	Size 2 (width)	
15.1.23	Shape	
15.1.24	Material	
15.1.25	Lining	
15.1.26	Pipe length	
15.1.27	Total length	
15.1.28	Year laid	
15.1.29	Video cassette number	
15.1.30	Comments: General	
15.1.31	Purpose	
15.1.32	Sewer category	
15.1.33	Pre-cleaning	(N) No
15.1.34	Weather	(1) Dry
15.1.35	Location code	
15.1.36	Further location details	

[page 1/2]

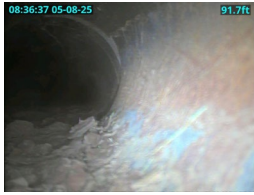




15.3 Observations

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
1.0	(DE) Debris ...% cross-sectional area loss	survey00000108/2025_05_08-08_23_26_731.jpg
	Percentage: 50%	
		0:00:00
1.7	(FM) Fractures multiple from ... to ... o'clock	survey00000108/2025_05_08-08_23_51_335.jpg
	Clock At/From: 12	
12 - 03	Clock To: 03	
		0:00:00
4.6	(FC) Fracture circumferential from ... to ... o'clock	survey00000108/2025_05_08-08_25_13_540.jpg
	Clock At/From: 11	
11 - 02	Clock To: 02	
	ROOTS IN FRACTURE	0:01:03
7.8	(FC) Fracture circumferential from ... to ... o'clock	survey00000108/2025_05_08-08_25_56_248.jpg
	Clock At/From: 11	
11 - 02	Clock To: 02	
		0:01:18
16.9	(CC) Crack circumferential from ... to ... o'clock	survey00000108/2025_05_08-08_27_00_119.jpg
	Clock At/From: 11	
11 - 02	Clock To: 02	
		0:02:07
26.6	(CC) Crack circumferential from ... to ... o'clock	survey00000108/2025_05_08-08_27_52_705.jpg
	Clock At/From: 11	
11 - 02	Clock To: 02	
		0:02:48
29.9	(FC) Fracture circumferential from ... to ... o'clock	survey00000108/2025_05_08-08_28_29_939.jpg
	Clock At/From: 12	
12 - 05	Clock To: 05	
	ROOTS COMING FROM FRACTURE	0:03:09

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
33.1	(FC) Fracture circumferential from ... to ... o'clock	survey00000108/2025_05_08-08_29_27_115.jpg
	Clock At/From: 12	
12 - 05	Clock To: 05	
		0:03:33
38.8	(CC) Crack circumferential from ... to ... o'clock	survey00000108/2025_05_08-08_30_33_303.jpg
	Clock At/From: 01	
01 - 04	Clock To: 04	
		0:04:22
45.4	(FC) Fracture circumferential from ... to ... o'clock	survey00000108/2025_05_08-08_31_13_441.jpg
	Clock At/From: 12	
12 - 04	Clock To: 04	
		0:04:48
52.6	(FC) Fracture circumferential from ... to ... o'clock	survey00000108/2025_05_08-08_31_55_552.jpg
	Clock At/From: 12	
12 - 05	Clock To: 05	
	ROOTS IN FRACTURE	0:05:16
72.9	(CM) Cracks multiple from ... to ... o'clock	survey00000108/2025_05_08-08_33_09_464.jpg
	Clock At/From: 12	
12 - 03	Clock To: 03	
		0:06:07
77.0	(FM) Fractures multiple from ... to ... o'clock	survey00000108/2025_05_08-08_33_56_156.jpg
	Clock At/From: 11	
11 - 02	Clock To: 02	
		0:06:40
82.7	(B) Broken pipe at ... (OR from ... to ...) o'clock	survey00000108/2025_05_08-08_34_56_327.jpg
	Clock At/From: 12	
12 - 04	Clock To: 04	
		0:07:24

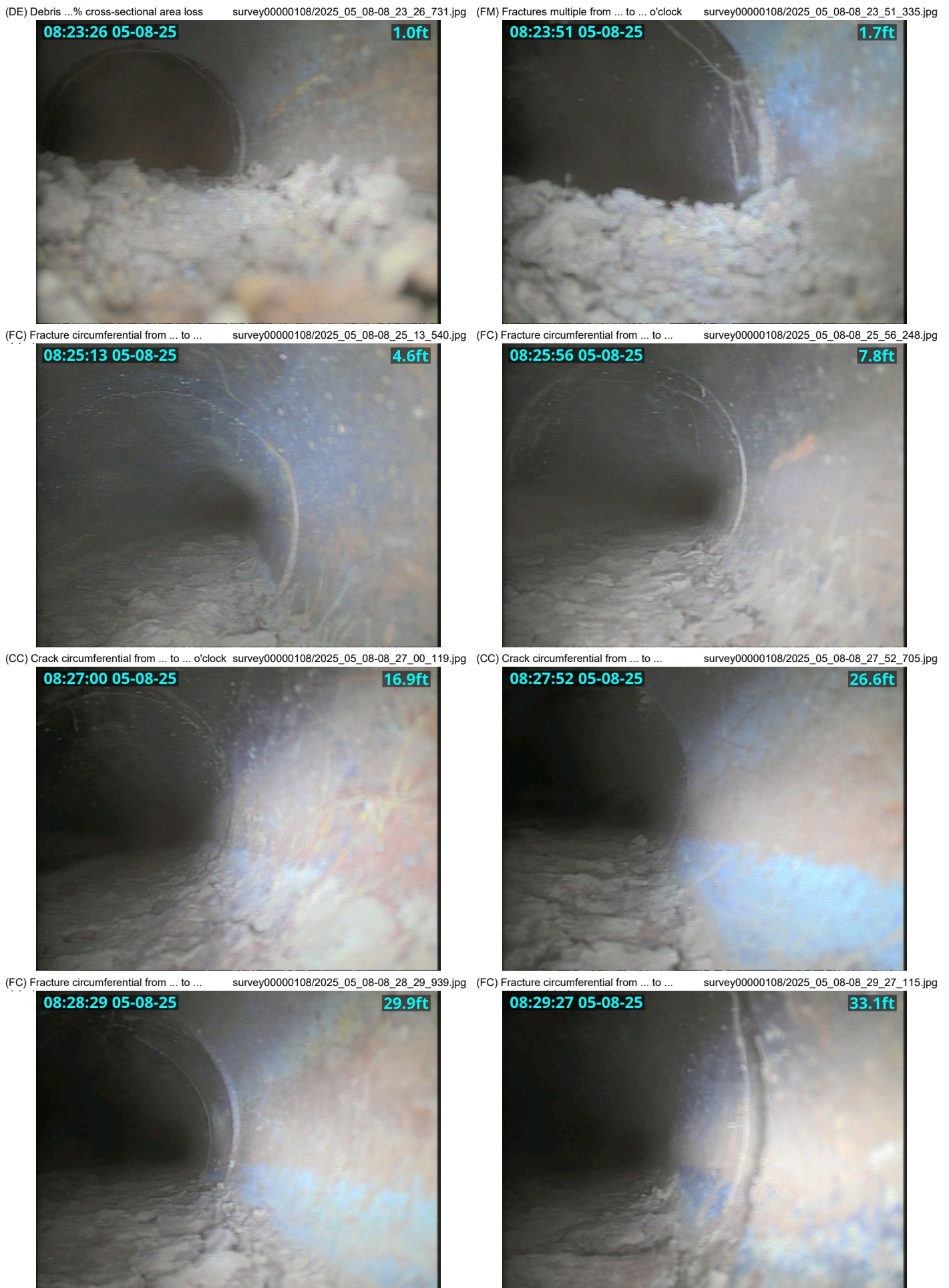
Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
88.3	(B) Broken pipe at ... (OR from ... to ...) o'clock	survey00000108/2025_05_08-08_35_42_374.jpg
	Clock At/From: 11	
11 - 05	Clock To: 05	
		0:07:57
91.7	(B) Broken pipe at ... (OR from ... to ...) o'clock	survey00000108/2025_05_08-08_36_37_747.jpg
	Clock At/From: 02	
02		
		0:08:39
91.7	(JDM) Joint displaced medium	survey00000108/2025_05_08-08_37_01_718.jpg
		
	OFFSET	0:08:42
95.5	(FM) Fractures multiple from ... to ... o'clock	survey00000108/2025_05_08-08_37_59_949.jpg
	Clock At/From: 12	
12 - 05	Clock To: 05	
		0:09:24
97.2	(CL) Crack longitudinal at ... o'clock	survey00000108/2025_05_08-08_38_35_330.jpg
	Clock At/From: 02	
02		
		0:09:44
101.5	(FC) Fracture circumferential from ... to ... o'clock	survey00000108/2025_05_08-08_39_15_209.jpg
	Clock At/From: 12	
12 - 05	Clock To: 05	
		0:10:15
111.1	(CC) Crack circumferential from ... to ... o'clock	survey00000108/2025_05_08-08_40_37_191.jpg
	Clock At/From: 12	
12 - 03	Clock To: 03	
		0:11:26

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
114.9	(CC) Crack circumferential from ... to ... o'clock	survey00000108/2025_05_08-08_41_30_596.jpg
	Clock At/From: 12	
12 - 04	Clock To: 04	
		0:12:00
118.0	(FC) Fracture circumferential from ... to ... o'clock	survey00000108/2025_05_08-08_42_43_509.jpg
	Clock At/From: 12	
12 - 04	Clock To: 04	
		0:12:44
124.2	(CC) Crack circumferential from ... to ... o'clock	survey00000108/2025_05_08-08_43_33_624.jpg
	Clock At/From: 12	
12 - 03	Clock To: 03	
		0:13:19
147.3	(FM) Fractures multiple from ... to ... o'clock	survey00000108/2025_05_08-08_45_30_850.jpg
	Clock At/From: 12	
12 - 05	Clock To: 05	
	ROOTS IN JOINT	0:15:05
150.4	(FC) Fracture circumferential from ... to ... o'clock	survey00000108/2025_05_08-08_46_40_782.jpg
	Clock At/From: 12	
12 - 05	Clock To: 05	
		0:15:41
153.4	(FM) Fractures multiple from ... to ... o'clock	survey00000108/2025_05_08-08_47_40_588.jpg
	Clock At/From: 01	
01 - 05	Clock To: 05	
		0:16:24
160.0	(CM) Cracks multiple from ... to ... o'clock	survey00000108/2025_05_08-08_48_47_215.jpg
	Clock At/From: 12	
12 - 04	Clock To: 04	
		0:17:16

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
163.1	(CC) Crack circumferential from ... to ... o'clock	survey00000108/2025_05_08-08_49_34_641.jpg
	Clock At/From: 12	
12 - 05	Clock To: 05	
		0:17:49
166.2	(FM) Fractures multiple from ... to ... o'clock	survey00000108/2025_05_08-08_50_26_070.jpg
	Clock At/From: 12	
12 - 04	Clock To: 04	
		0:18:22
169.3	(FM) Fractures multiple from ... to ... o'clock	survey00000108/2025_05_08-08_51_31_820.jpg
	Clock At/From: 12	
12 - 03	Clock To: 03	
		0:19:12
173.1	(CM) Cracks multiple from ... to ... o'clock	survey00000108/2025_05_08-08_52_28_931.jpg
	Clock At/From: 11	
11 - 05	Clock To: 05	
		0:19:58
178.1	(CC) Crack circumferential from ... to ... o'clock	survey00000108/2025_05_08-08_53_29_449.jpg
	Clock At/From: 12	
12 - 05	Clock To: 05	
		0:20:46
181.6	(FC) Fracture circumferential from ... to ... o'clock	survey00000108/2025_05_08-08_54_23_759.jpg
	Clock At/From: 11	
11 - 05	Clock To: 05	
	ROOTS IN FRACTURE	0:21:29
188.5	(FC) Fracture circumferential from ... to ... o'clock	survey00000108/2025_05_08-08_55_30_363.jpg
	Clock At/From: 11	
11 - 03	Clock To: 03	
		0:22:12

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
196.6	(FC) Fracture circumferential from ... to ... o'clock Clock At/From: 02 Clock To: 04	survey00000108/2025_05_08-08_56_52_266.jpg
		
02 - 04		
		0:23:19
204.7	(SA) Survey abandoned	survey00000108/2025_05_08-09_01_28_018.jpg
		
	DEBRIS BUILDING WALL, CANT GET PAST	0:27:33

15.4 Photographs



(CC) Crack circumferential from ... to ... o'clock survey00000108/2025_05_08-08_30_33_303.jpg (FC) Fracture circumferential from ... to ... survey00000108/2025_05_08-08_31_13_441.jpg



(FC) Fracture circumferential from ... to ... survey00000108/2025_05_08-08_31_55_552.jpg (CM) Cracks multiple from ... to ... o'clock survey00000108/2025_05_08-08_33_09_464.jpg



(FM) Fractures multiple from ... to ... o'clock survey00000108/2025_05_08-08_33_56_156.jpg (B) Broken pipe at ... (OR from ... to ...) survey00000108/2025_05_08-08_34_56_327.jpg



(B) Broken pipe at ... (OR from ... to ...) o'clock survey00000108/2025_05_08-08_35_42_374.jpg (B) Broken pipe at ... (OR from ... to ...) survey00000108/2025_05_08-08_36_37_747.jpg





(CL) Crack longitudinal at ... o'clock survey00000108/2025_05_08-08_38_35_330.jpg



(FC) Fracture circumferential from ... to ... survey00000108/2025_05_08-08_39_15_209.jpg



(CC) Crack circumferential from ... to ... o'clock survey00000108/2025_05_08-08_40_37_191.jpg



(CC) Crack circumferential from ... to ... survey00000108/2025_05_08-08_41_30_596.jpg



(FC) Fracture circumferential from ... to ... survey00000108/2025_05_08-08_42_43_509.jpg



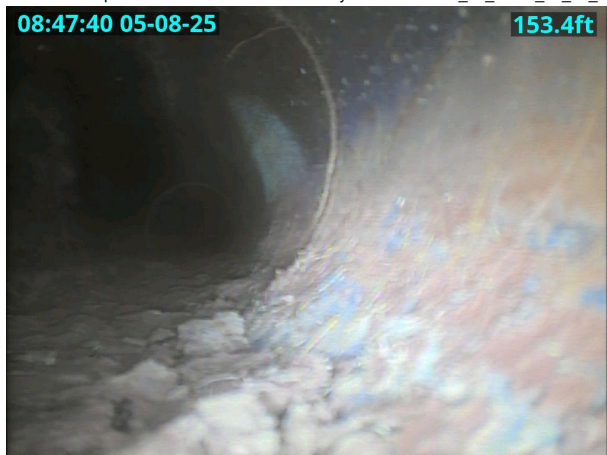
(CC) Crack circumferential from ... to ... survey00000108/2025_05_08-08_43_33_624.jpg



(FM) Fractures multiple from ... to ... o'clock survey00000108/2025_05_08-08_45_30_850.jpg (FC) Fracture circumferential from ... to ... survey00000108/2025_05_08-08_46_40_782.jpg



(FM) Fractures multiple from ... to ... o'clock survey00000108/2025_05_08-08_47_40_588.jpg (CM) Cracks multiple from ... to ... o'clock survey00000108/2025_05_08-08_48_47_215.jpg



(CC) Crack circumferential from ... to ... o'clock survey00000108/2025_05_08-08_49_34_641.jpg (FM) Fractures multiple from ... to ... o'clock survey00000108/2025_05_08-08_50_26_070.jpg



(FM) Fractures multiple from ... to ... o'clock survey00000108/2025_05_08-08_51_31_820.jpg (CM) Cracks multiple from ... to ... o'clock survey00000108/2025_05_08-08_52_28_931.jpg



(CC) Crack circumferential from ... to ... o'clock survey00000108/2025_05_08-08_53_29_449.jpg (FC) Fracture circumferential from ... to ... survey00000108/2025_05_08-08_54_23_759.jpg



(FC) Fracture circumferential from ... to ... survey00000108/2025_05_08-08_55_30_363.jpg (FC) Fracture circumferential from ... to ... survey00000108/2025_05_08-08_56_52_266.jpg



(SA) Survey abandoned survey00000108/2025_05_08-09_01_28_018.jpg

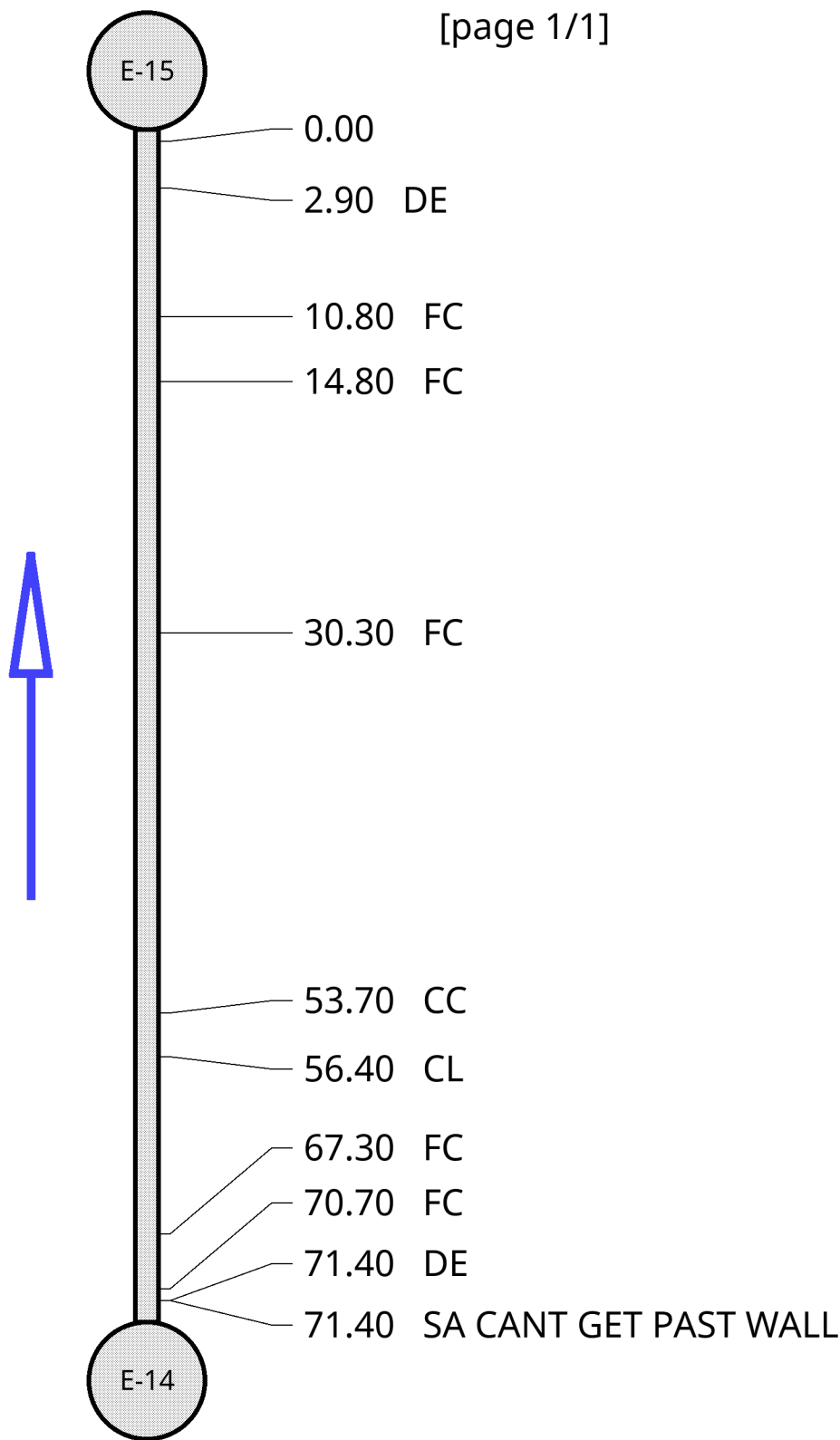


16 Drain / Sewer Survey E-15 TO E-14

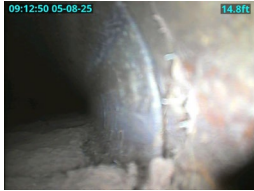
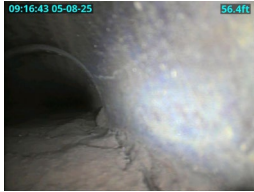
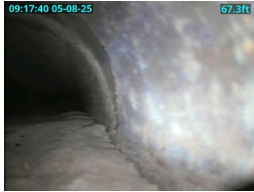
16.1 Survey Header

16.1.1	Surveyed by (Operator)	JEREMIAH
16.1.2	Contract no.	
16.1.3	Job no.	
16.1.4	Catchment (Drainage area)	
16.1.5	Division	
16.1.6	District	
16.1.7	Pipeline length ref	E-15 TO E-14
16.1.8	Date	080525
16.1.9	Time	09:08
16.1.10	Location	
16.1.11	Start manhole no.	E-15
16.1.12	Start depth	
16.1.13	Start cover level	
16.1.14	Start invert level	
16.1.15	Finish manhole no.	E-14
16.1.16	Finish depth	
16.1.17	Finish cover level	
16.1.18	Finish invert level	
16.1.19	Use of Drain	
16.1.20	Direction	(U) Survey upstream (camera pointing against flow)
16.1.21	Size 1 (diameter/height)	8mm
16.1.22	Size 2 (width)	
16.1.23	Shape	(C) Circular
16.1.24	Material	(VC) Vitrified clay (i.e. all clayware)
16.1.25	Lining	
16.1.26	Pipe length	
16.1.27	Total length	
16.1.28	Year laid	
16.1.29	Video cassette number	
16.1.30	Comments: General	
16.1.31	Purpose	
16.1.32	Sewer category	
16.1.33	Pre-cleaning	(N) No
16.1.34	Weather	(1) Dry
16.1.35	Location code	
16.1.36	Further location details	

[page 1/1]

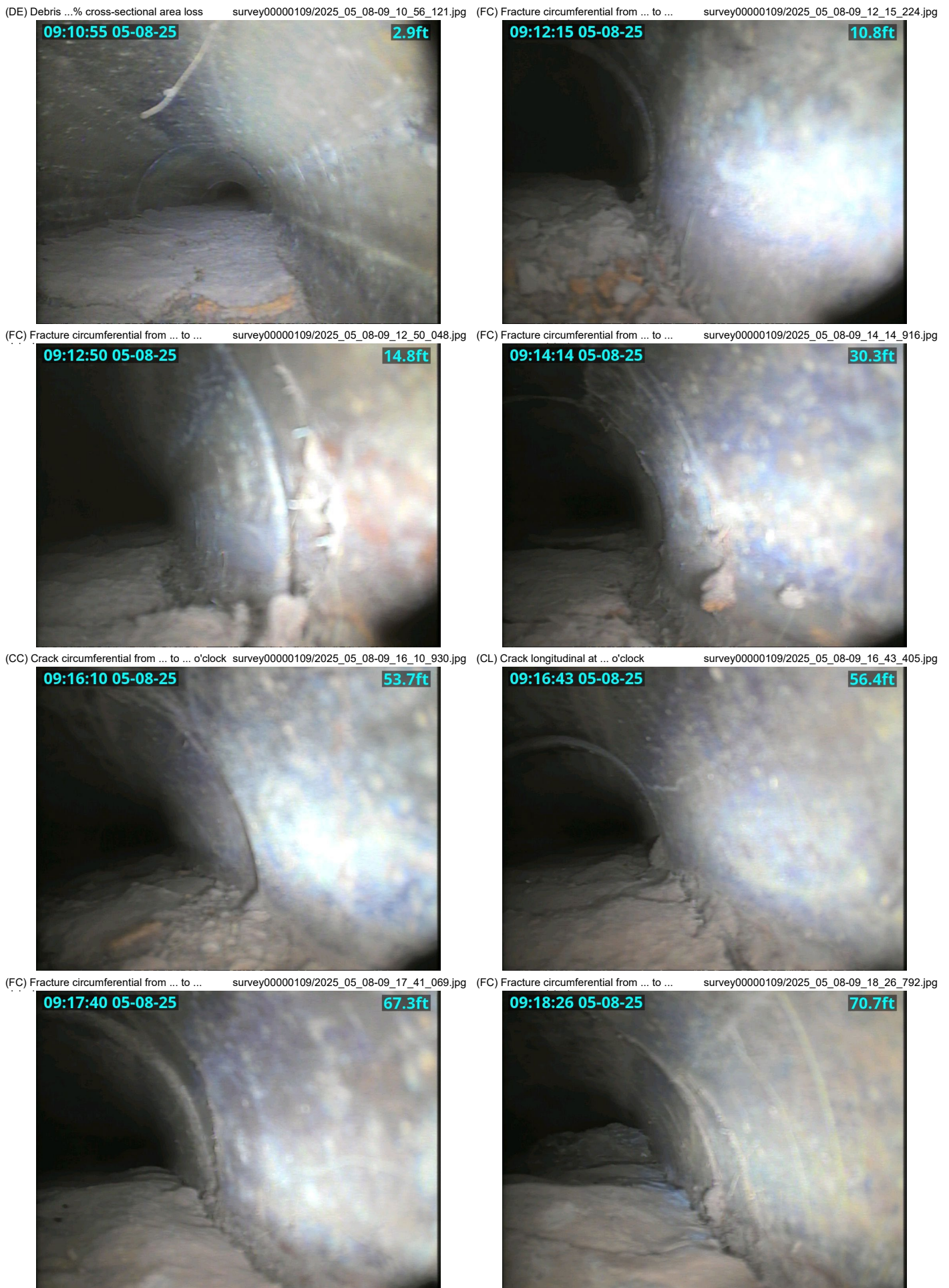


16.3 Observations

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
2.9	(DE) Debris ...% cross-sectional area loss	survey00000109/2025_05_08-09_10_56_121.jpg
	Percentage: 50%	
		0:00:11
10.8	(FC) Fracture circumferential from ... to ... o'clock	survey00000109/2025_05_08-09_12_15_224.jpg
	Clock At/From: 12	
12 - 03	Clock To: 03	
		0:01:19
14.8	(FC) Fracture circumferential from ... to ... o'clock	survey00000109/2025_05_08-09_12_50_048.jpg
	Clock At/From: 01	
01 - 04	Clock To: 04	
		0:01:42
30.3	(FC) Fracture circumferential from ... to ... o'clock	survey00000109/2025_05_08-09_14_14_916.jpg
	Clock At/From: 12	
12 - 04	Clock To: 04	
		0:02:53
53.7	(CC) Crack circumferential from ... to ... o'clock	survey00000109/2025_05_08-09_16_10_930.jpg
	Clock At/From: 11	
11 - 02	Clock To: 02	
		0:04:30
56.4	(CL) Crack longitudinal at ... o'clock	survey00000109/2025_05_08-09_16_43_405.jpg
	Clock At/From: 02	
02		
		0:04:49
67.3	(FC) Fracture circumferential from ... to ... o'clock	survey00000109/2025_05_08-09_17_41_069.jpg
	Clock At/From: 11	
11 - 05	Clock To: 05	
		0:05:33

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
70.7	(FC) Fracture circumferential from ... to ... o'clock	survey00000109/2025_05_08-09_18_26_792.jpg
	Clock At/From: 03	
03 - 05	Clock To: 05	
		0:06:03
71.4	(DE) Debris ...% cross-sectional area loss	survey00000109/2025_05_08-09_19_10_679.jpg
	Percentage: 100%	
		0:06:30
71.4	(SA) Survey abandoned	survey00000109/2025_05_08-09_19_30_029.jpg
		
	CANT GET PAST WALL	0:06:33

16.4 Photographs



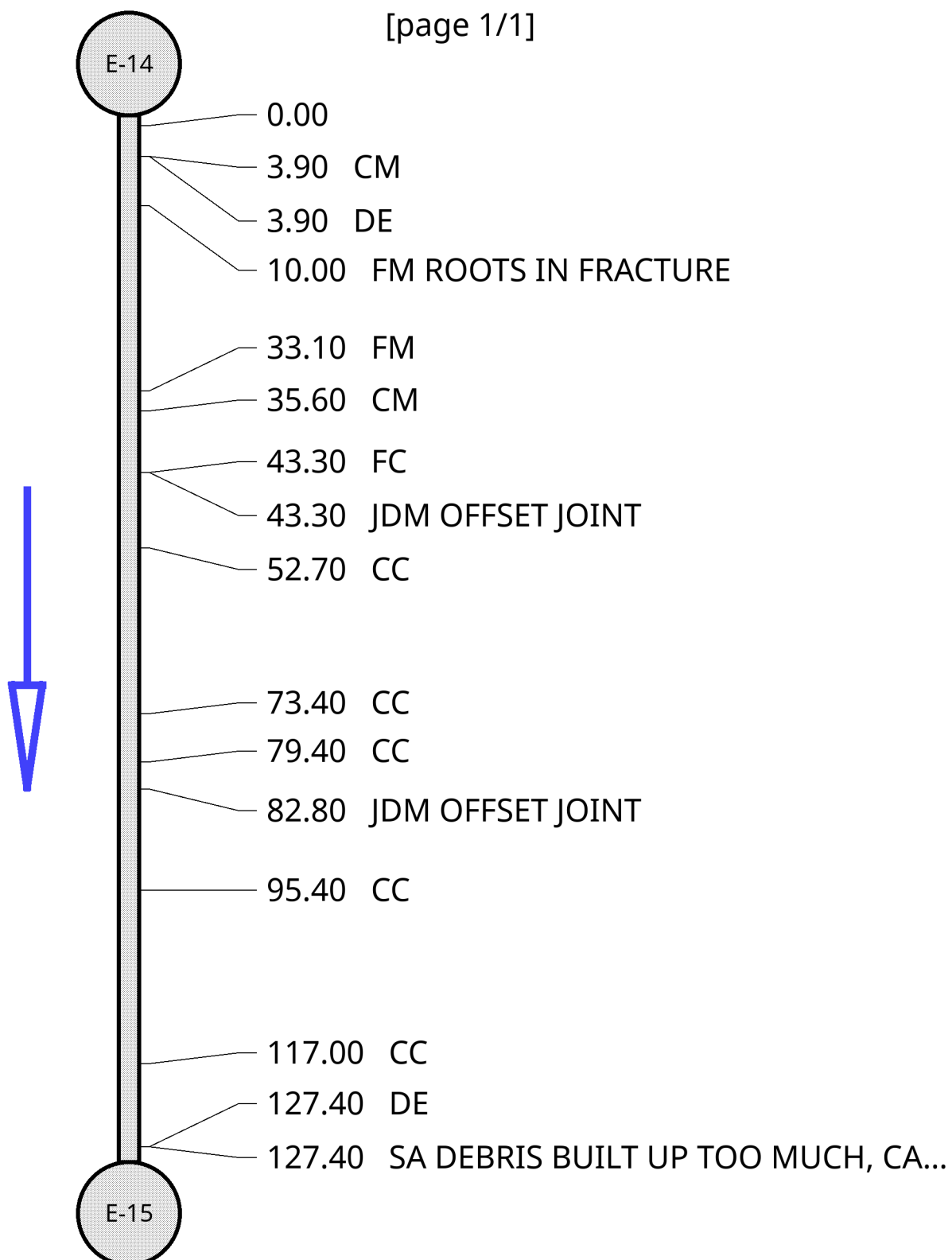


17 Drain / Sewer Survey E-14 TO E-15

17.1 Survey Header

17.1.1	Surveyed by (Operator)	JEREMIAH
17.1.2	Contract no.	
17.1.3	Job no.	
17.1.4	Catchment (Drainage area)	
17.1.5	Division	
17.1.6	District	
17.1.7	Pipeline length ref	E-14 TO E-15
17.1.8	Date	080525
17.1.9	Time	09:34
17.1.10	Location	
17.1.11	Start manhole no.	E-14
17.1.12	Start depth	
17.1.13	Start cover level	
17.1.14	Start invert level	
17.1.15	Finish manhole no.	E-15
17.1.16	Finish depth	
17.1.17	Finish cover level	
17.1.18	Finish invert level	
17.1.19	Use of Drain	
17.1.20	Direction	(D) Survey downstream (camera pointing with flow)
17.1.21	Size 1 (diameter/height)	8mm
17.1.22	Size 2 (width)	
17.1.23	Shape	(C) Circular
17.1.24	Material	(VC) Vitrified clay (i.e. all clayware)
17.1.25	Lining	
17.1.26	Pipe length	
17.1.27	Total length	
17.1.28	Year laid	
17.1.29	Video cassette number	
17.1.30	Comments: General	
17.1.31	Purpose	
17.1.32	Sewer category	
17.1.33	Pre-cleaning	(N) No
17.1.34	Weather	(1) Dry
17.1.35	Location code	
17.1.36	Further location details	

17.2 Diagram



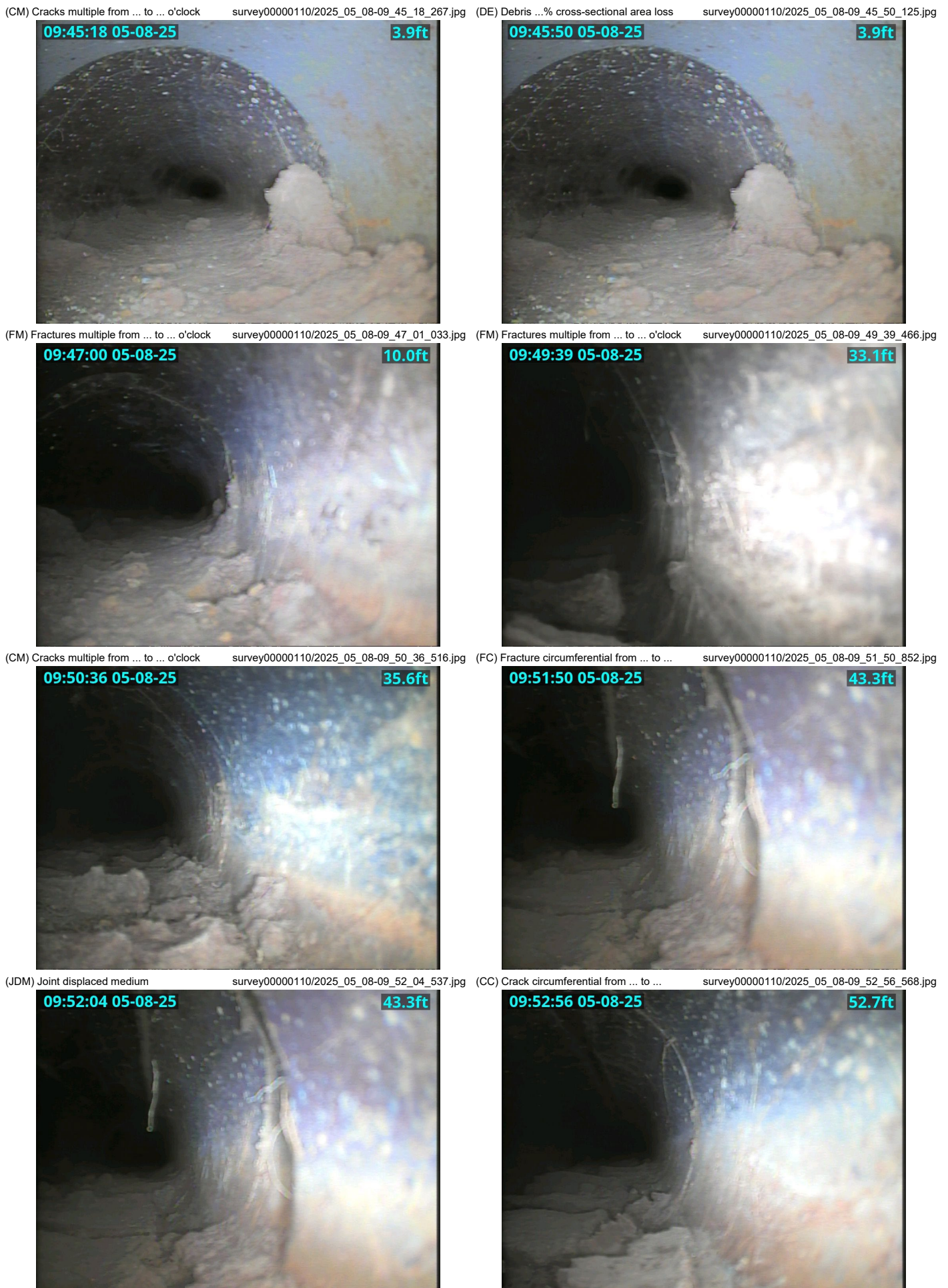
17.3 Observations

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
3.9	(CM) Cracks multiple from ... to ... o'clock	survey00000110/2025_05_08-09_45_18_267.jpg
	Clock At/From: 09	
	Clock To: 03	
09 - 03		
		0:00:00
3.9	(DE) Debris ...% cross-sectional area loss	survey00000110/2025_05_08-09_45_50_125.jpg
	Percentage: 50%	
		
		0:00:00
10.0	(FM) Fractures multiple from ... to ... o'clock	survey00000110/2025_05_08-09_47_01_033.jpg
	Clock At/From: 09	
	Clock To: 03	
09 - 03		
	ROOTS IN FRACTURE	0:00:00
33.1	(FM) Fractures multiple from ... to ... o'clock	survey00000110/2025_05_08-09_49_39_466.jpg
	Clock At/From: 12	
	Clock To: 04	
12 - 04		
		0:00:00
35.6	(CM) Cracks multiple from ... to ... o'clock	survey00000110/2025_05_08-09_50_36_516.jpg
	Clock At/From: 12	
	Clock To: 04	
12 - 04		
		0:00:00
43.3	(FC) Fracture circumferential from ... to ... o'clock	survey00000110/2025_05_08-09_51_50_852.jpg
	Clock At/From: 12	
	Clock To: 05	
12 - 05		
		0:00:00
43.3	(JDM) Joint displaced medium	survey00000110/2025_05_08-09_52_04_537.jpg
		
	OFFSET JOINT	0:00:00

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
52.7	(CC) Crack circumferential from ... to ... o'clock	survey00000110/2025_05_08-09_52_56_568.jpg
	Clock At/From: 02	
02 - 03	Clock To: 03	
		0:00:00
73.4	(CC) Crack circumferential from ... to ... o'clock	survey00000110/2025_05_08-09_54_47_963.jpg
	Clock At/From: 12	
12 - 03	Clock To: 03	
		0:00:00
79.4	(CC) Crack circumferential from ... to ... o'clock	survey00000110/2025_05_08-09_55_50_779.jpg
	Clock At/From: 01	
01 - 03	Clock To: 03	
		0:00:00
82.8	(JDM) Joint displaced medium	survey00000110/2025_05_08-09_56_30_288.jpg
		
	OFFSET JOINT	0:00:00
95.4	(CC) Crack circumferential from ... to ... o'clock	survey00000110/2025_05_08-09_57_46_839.jpg
	Clock At/From: 11	
11 - 02	Clock To: 02	
		0:00:00
117.0	(CC) Crack circumferential from ... to ... o'clock	survey00000110/2025_05_08-09_59_22_195.jpg
	Clock At/From: 12	
12 - 02	Clock To: 02	
		0:00:00
127.4	(DE) Debris ...% cross-sectional area loss	survey00000110/2025_05_08-10_00_31_866.jpg
	Percentage: 90%	
		0:00:00

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
127.4	(SA) Survey abandoned	survey00000110/2025_05_08-10_00_49_562.jpg
		
	DEBRIS BUILT UP TOO MUCH, CANNOT PASS	0:00:00

17.4 Photographs



(CC) Crack circumferential from ... to ... o'clock survey00000110/2025_05_08-09_54_47_963.jpg (CC) Crack circumferential from ... to ... survey00000110/2025_05_08-09_55_50_779.jpg



(JDM) Joint displaced medium survey00000110/2025_05_08-09_56_30_288.jpg (CC) Crack circumferential from ... to ... survey00000110/2025_05_08-09_57_46_839.jpg



(CC) Crack circumferential from ... to ... o'clock survey00000110/2025_05_08-09_59_22_195.jpg (DE) Debris ...% cross-sectional area loss survey00000110/2025_05_08-10_00_31_866.jpg



(SA) Survey abandoned survey00000110/2025_05_08-10_00_49_562.jpg

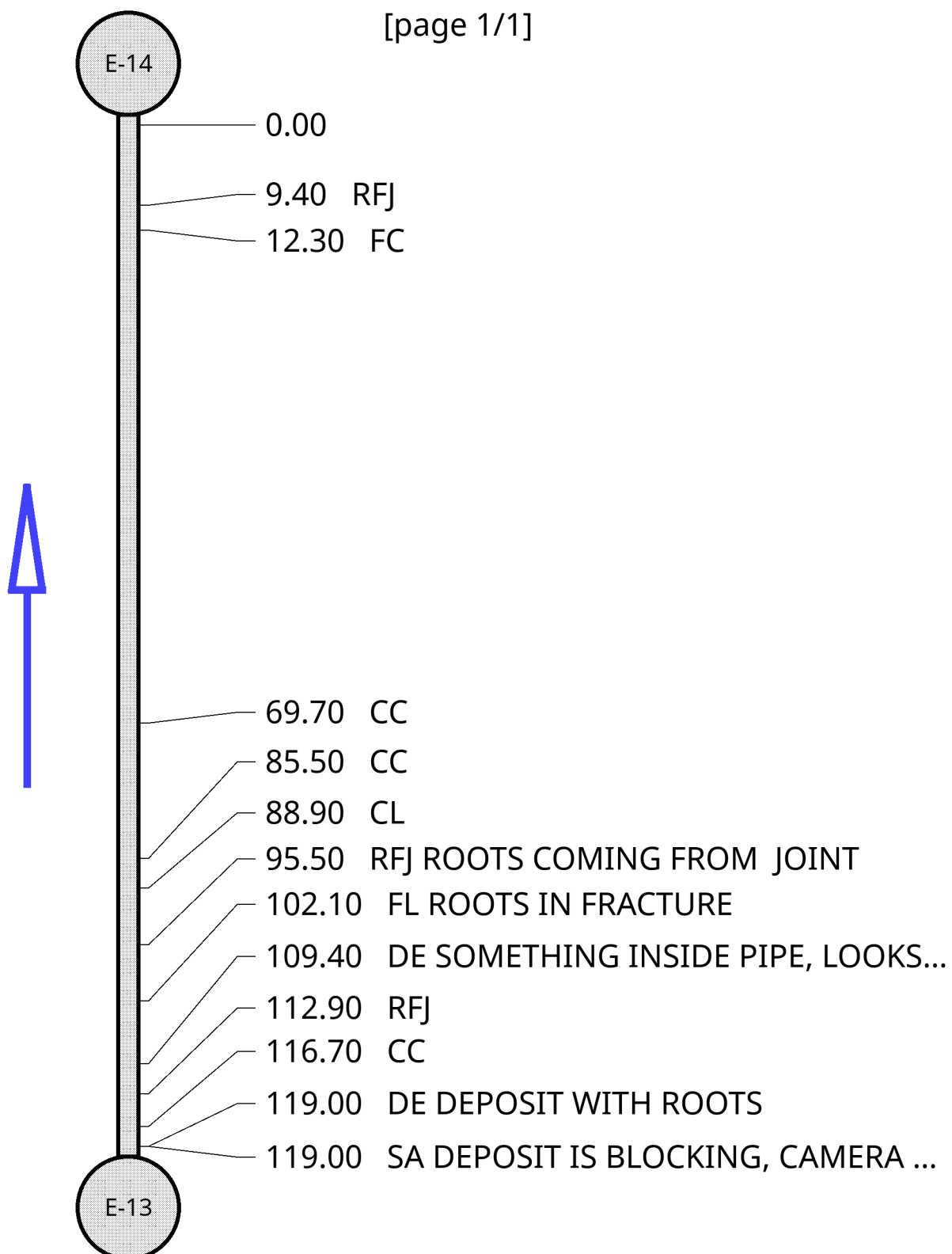


18 Drain / Sewer Survey E-14 TO E-13

18.1 Survey Header

18.1.1	Surveyed by (Operator)	JEREMIAH
18.1.2	Contract no.	
18.1.3	Job no.	
18.1.4	Catchment (Drainage area)	
18.1.5	Division	
18.1.6	District	
18.1.7	Pipeline length ref	E-14 TO E-13
18.1.8	Date	080525
18.1.9	Time	10:04
18.1.10	Location	
18.1.11	Start manhole no.	E-14
18.1.12	Start depth	
18.1.13	Start cover level	
18.1.14	Start invert level	
18.1.15	Finish manhole no.	E-13
18.1.16	Finish depth	
18.1.17	Finish cover level	
18.1.18	Finish invert level	
18.1.19	Use of Drain	
18.1.20	Direction	(U) Survey upstream (camera pointing against flow)
18.1.21	Size 1 (diameter/height)	8mm
18.1.22	Size 2 (width)	
18.1.23	Shape	(C) Circular
18.1.24	Material	(VC) Vitrified clay (i.e. all clayware)
18.1.25	Lining	
18.1.26	Pipe length	
18.1.27	Total length	
18.1.28	Year laid	
18.1.29	Video cassette number	
18.1.30	Comments: General	
18.1.31	Purpose	
18.1.32	Sewer category	
18.1.33	Pre-cleaning	(N) No
18.1.34	Weather	(1) Dry
18.1.35	Location code	
18.1.36	Further location details	

18.2 Diagram



18.3 Observations

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
9.4	(RFJ) Roots fine at joint	survey00000111/2025_05_08-10_07_52_049.jpg
		
		0:00:53
12.3	(FC) Fracture circumferential from ... to ... o'clock	survey00000111/2025_05_08-10_08_57_425.jpg
	Clock At/From: 10	
	Clock To: 01	
10 - 01		
		0:01:37
69.7	(CC) Crack circumferential from ... to ... o'clock	survey00000111/2025_05_08-10_14_00_493.jpg
	Clock At/From: 12	
	Clock To: 04	
12 - 04		
		0:06:20
85.5	(CC) Crack circumferential from ... to ... o'clock	survey00000111/2025_05_08-10_15_45_685.jpg
	Clock At/From: 12	
	Clock To: 03	
12 - 03		
		0:07:49
88.9	(CL) Crack longitudinal at ... o'clock	survey00000111/2025_05_08-10_16_57_503.jpg
	Clock At/From: 01	
01		
		0:08:51
95.5	(RFJ) Roots fine at joint	survey00000111/2025_05_08-10_18_19_156.jpg
	Clock At/From: 01	
	Clock To: 04	
01 - 04		
	ROOTS COMING FROM JOINT	0:09:53
102.1	(FL) Fracture longitudinal at ... o'clock	survey00000111/2025_05_08-10_20_21_414.jpg
	Clock At/From: 04	
04		
	ROOTS IN FRACTURE	0:10:43

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
109.4	(DE) Debris ...% cross-sectional area loss Percentage: 90%	survey00000111/2025_05_08-10_22_30_148.jpg 
	SOMETHING INSIDE PIPE, LOOKS TO BE WRAPPED IN ROOTS	0:11:48
112.9	(RFJ) Roots fine at joint	survey00000111/2025_05_08-10_24_04_784.jpg 
		0:11:48
116.7	(CC) Crack circumferential from ... to ... o'clock Clock At/From: 12 Clock To: 04	survey00000111/2025_05_08-10_25_25_409.jpg 
12 - 04		
		0:12:40
119.0	(DE) Debris ...% cross-sectional area loss Percentage: 90%	survey00000111/2025_05_08-10_26_14_203.jpg 
	DEPOSIT WITH ROOTS	0:13:15
119.0	(SA) Survey abandoned	survey00000111/2025_05_08-10_27_50_187.jpg 
	DEPOSIT IS BLOCKING, CAMERA CANNOT PASS	0:14:17

18.4 Photographs

(RFJ) Roots fine at joint

survey00000111/2025_05_08-10_07_52_049.jpg



(FC) Fracture circumferential from ... to ...

survey00000111/2025_05_08-10_08_57_425.jpg



(CC) Crack circumferential from ... to ... o'clock survey00000111/2025_05_08-10_14_00_493.jpg



(CC) Crack circumferential from ... to ...

survey00000111/2025_05_08-10_15_45_685.jpg



(CL) Crack longitudinal at ... o'clock

survey00000111/2025_05_08-10_16_57_503.jpg



(RFJ) Roots fine at joint

survey00000111/2025_05_08-10_18_19_156.jpg



(FL) Fracture longitudinal at ... o'clock

survey00000111/2025_05_08-10_20_21_414.jpg



(DE) Debris ...% cross-sectional area loss

survey00000111/2025_05_08-10_22_30_148.jpg

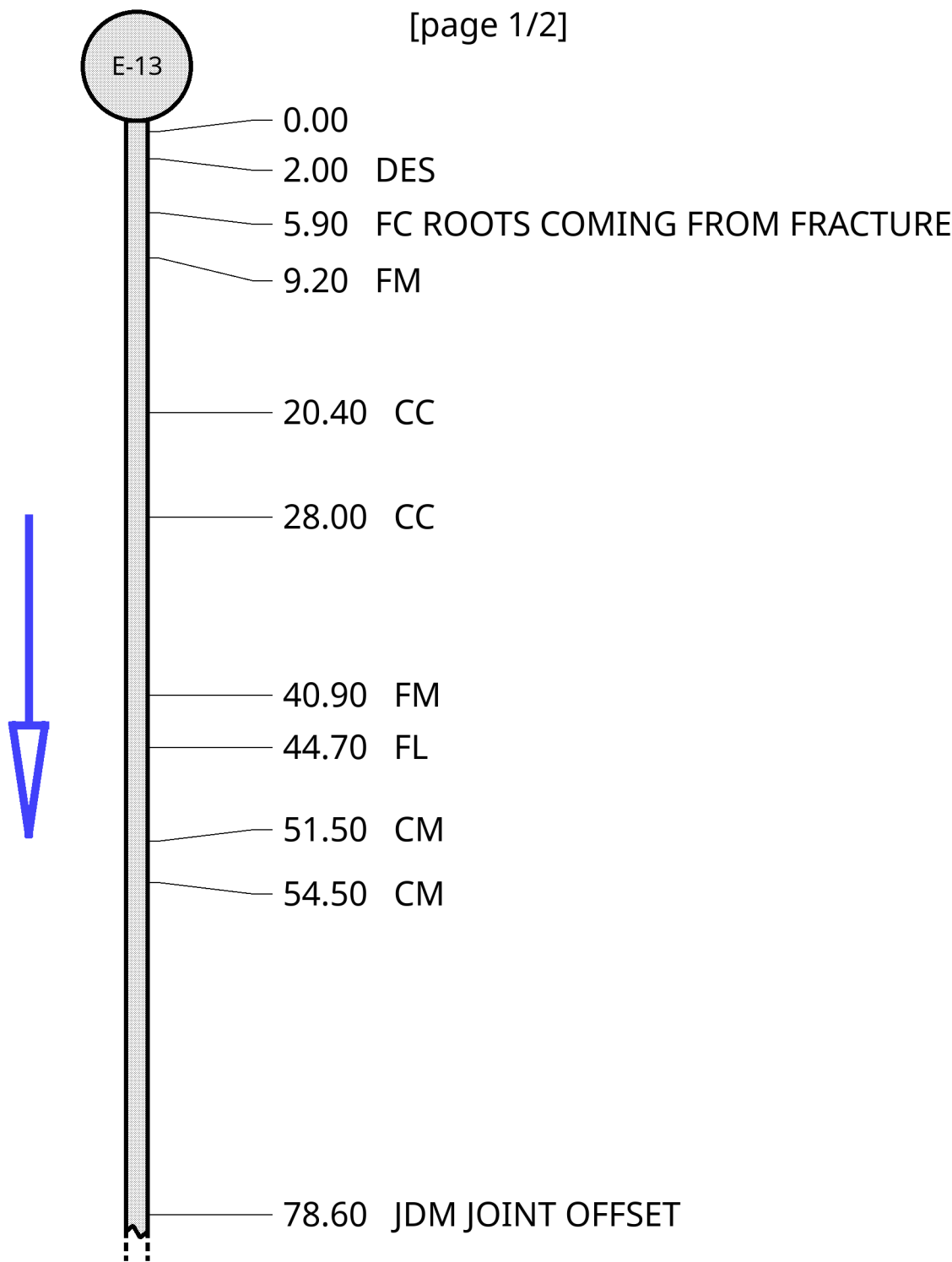


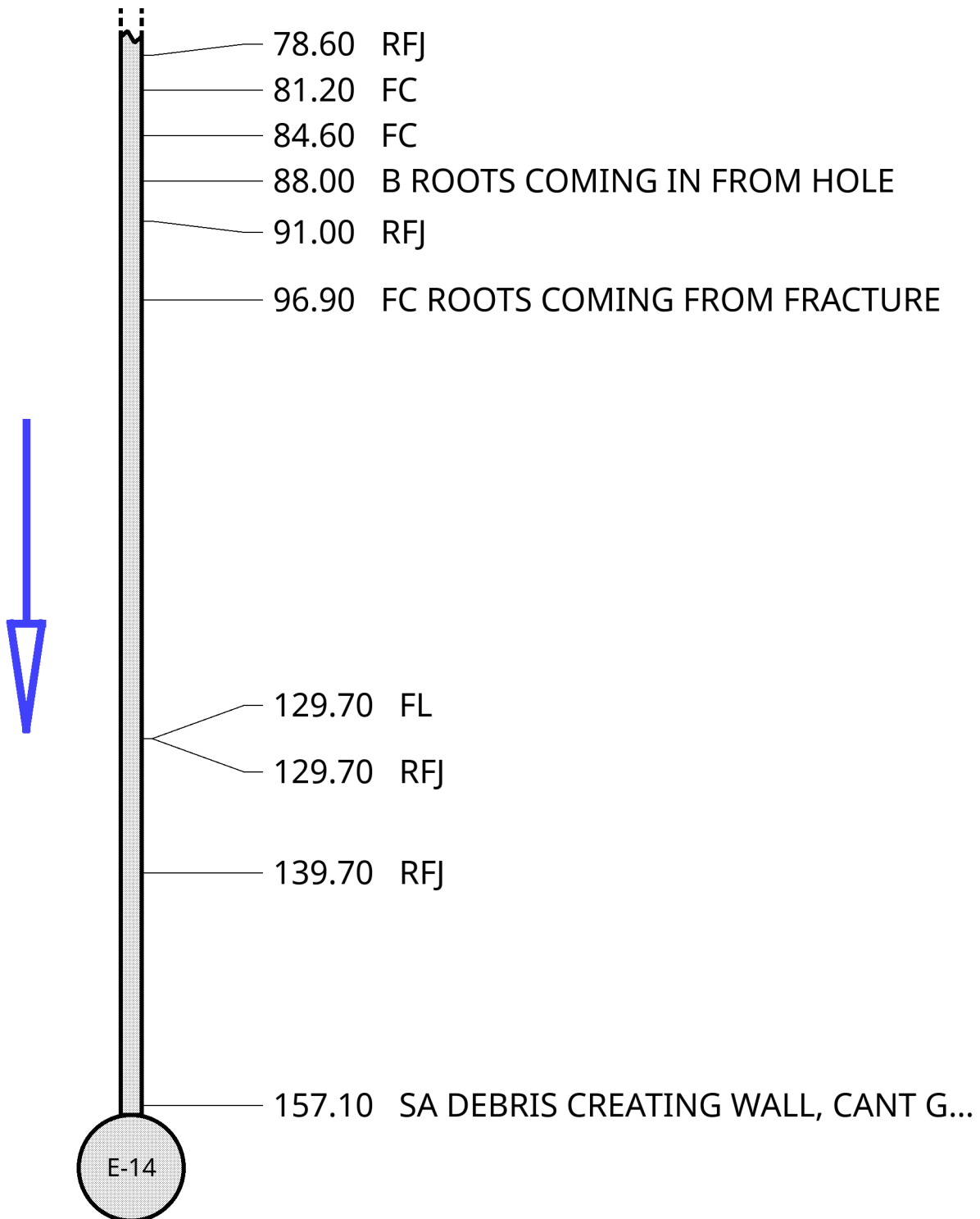


19 Drain / Sewer Survey E-13 TO E-14

19.1 Survey Header

19.1.1	Surveyed by (Operator)	JEREMIAH
19.1.2	Contract no.	
19.1.3	Job no.	
19.1.4	Catchment (Drainage area)	
19.1.5	Division	
19.1.6	District	
19.1.7	Pipeline length ref	E-13 TO E-14
19.1.8	Date	080525
19.1.9	Time	10:40
19.1.10	Location	
19.1.11	Start manhole no.	E-13
19.1.12	Start depth	
19.1.13	Start cover level	
19.1.14	Start invert level	
19.1.15	Finish manhole no.	E-14
19.1.16	Finish depth	
19.1.17	Finish cover level	
19.1.18	Finish invert level	
19.1.19	Use of Drain	
19.1.20	Direction	(D) Survey downstream (camera pointing with flow)
19.1.21	Size 1 (diameter/height)	8mm
19.1.22	Size 2 (width)	
19.1.23	Shape	(C) Circular
19.1.24	Material	(VC) Vitrified clay (i.e. all clayware)
19.1.25	Lining	
19.1.26	Pipe length	
19.1.27	Total length	
19.1.28	Year laid	
19.1.29	Video cassette number	
19.1.30	Comments: General	
19.1.31	Purpose	
19.1.32	Sewer category	
19.1.33	Pre-cleaning	(N) No
19.1.34	Weather	(1) Dry
19.1.35	Location code	
19.1.36	Further location details	





19.3 Observations

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
2.0	(DES) Debris silt ...% cross-sectional area loss	survey00000112/2025_05_08-10_41_33_655.jpg
	Percentage: 50%	
		0:00:00
5.9	(FC) Fracture circumferential from ... to ... o'clock	survey00000112/2025_05_08-10_42_25_325.jpg
	Clock At/From: 10	
10 - 05	Clock To: 05	
	ROOTS COMING FROM FRACTURE	0:00:37
9.2	(FM) Fractures multiple from ... to ... o'clock	survey00000112/2025_05_08-10_43_21_059.jpg
	Clock At/From: 09	
09 - 03	Clock To: 03	
		0:00:57
20.4	(CC) Crack circumferential from ... to ... o'clock	survey00000112/2025_05_08-10_44_23_776.jpg
	Clock At/From: 02	
02 - 04	Clock To: 04	
		0:01:43
28.0	(CC) Crack circumferential from ... to ... o'clock	survey00000112/2025_05_08-10_45_24_711.jpg
	Clock At/From: 12	
12 - 04	Clock To: 04	
		0:02:23
40.9	(FM) Fractures multiple from ... to ... o'clock	survey00000112/2025_05_08-10_46_58_407.jpg
	Clock At/From: 12	
12 - 04	Clock To: 04	
		0:03:27
44.7	(FL) Fracture longitudinal at ... o'clock	survey00000112/2025_05_08-10_47_32_873.jpg
	Clock At/From: 03	
03		
		0:03:46

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
51.5	(CM) Cracks multiple from ... to ... o'clock	survey00000112/2025_05_08-10_48_16_298.jpg
	Clock At/From: 12	
12 - 04	Clock To: 04	
		0:04:20
54.5	(CM) Cracks multiple from ... to ... o'clock	survey00000112/2025_05_08-10_49_04_163.jpg
	Clock At/From: 12	
12 - 03	Clock To: 03	
		0:04:51
78.6	(JDM) Joint displaced medium	survey00000112/2025_05_08-10_51_09_098.jpg
		
	JOINT OFFSET	0:06:46
78.6	(RFJ) Roots fine at joint	survey00000112/2025_05_08-10_51_24_840.jpg
		
		0:06:46
81.2	(FC) Fracture circumferential from ... to ... o'clock	survey00000112/2025_05_08-10_51_57_174.jpg
	Clock At/From: 12	
12 - 04	Clock To: 04	
		0:07:12
84.6	(FC) Fracture circumferential from ... to ... o'clock	survey00000112/2025_05_08-10_52_42_681.jpg
	Clock At/From: 01	
01 - 04	Clock To: 04	
		0:07:44
88.0	(B) Broken pipe at ... (OR from ... to ...) o'clock	survey00000112/2025_05_08-10_53_42_889.jpg
	Clock At/From: 01	
01 - 04	Clock To: 04	
	ROOTS COMING IN FROM HOLE	0:08:33

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
91.0	(RFJ) Roots fine at joint	survey00000112/2025_05_08-10_54_30_165.jpg 
		0:08:56
96.9	(FC) Fracture circumferential from ... to ... o'clock Clock At/From: 11 Clock To: 03	survey00000112/2025_05_08-10_55_31_046.jpg 
11 - 03		
	ROOTS COMING FROM FRACTURE	0:09:36
129.7	(FL) Fracture longitudinal at ... o'clock Clock At/From: 03	survey00000112/2025_05_08-10_58_09_227.jpg 
03		
		0:11:42
129.7	(RFJ) Roots fine at joint	survey00000112/2025_05_08-10_58_26_730.jpg 
		0:11:43
139.7	(RFJ) Roots fine at joint	survey00000112/2025_05_08-10_59_18_520.jpg 
		0:12:26
157.1	(SA) Survey abandoned	survey00000112/2025_05_08-11_02_55_029.jpg 
	DEBRIS CREATING WALL, CANT GET PASSED	0:15:52

19.4 Photographs

(DES) Debris silt ...% cross-sectional area loss survey00000112/2025_05_08-10_41_33_655.jpg (FC) Fracture circumferential from ... to ... survey00000112/2025_05_08-10_42_25_325.jpg



(FM) Fractures multiple from ... to ... o'clock survey00000112/2025_05_08-10_43_21_059.jpg (CC) Crack circumferential from ... to ... survey00000112/2025_05_08-10_44_23_776.jpg



(CC) Crack circumferential from ... to ... o'clock survey00000112/2025_05_08-10_45_24_711.jpg (FM) Fractures multiple from ... to ... o'clock survey00000112/2025_05_08-10_46_58_407.jpg



(FL) Fracture longitudinal at ... o'clock survey00000112/2025_05_08-10_47_32_873.jpg (CM) Cracks multiple from ... to ... o'clock survey00000112/2025_05_08-10_48_16_298.jpg



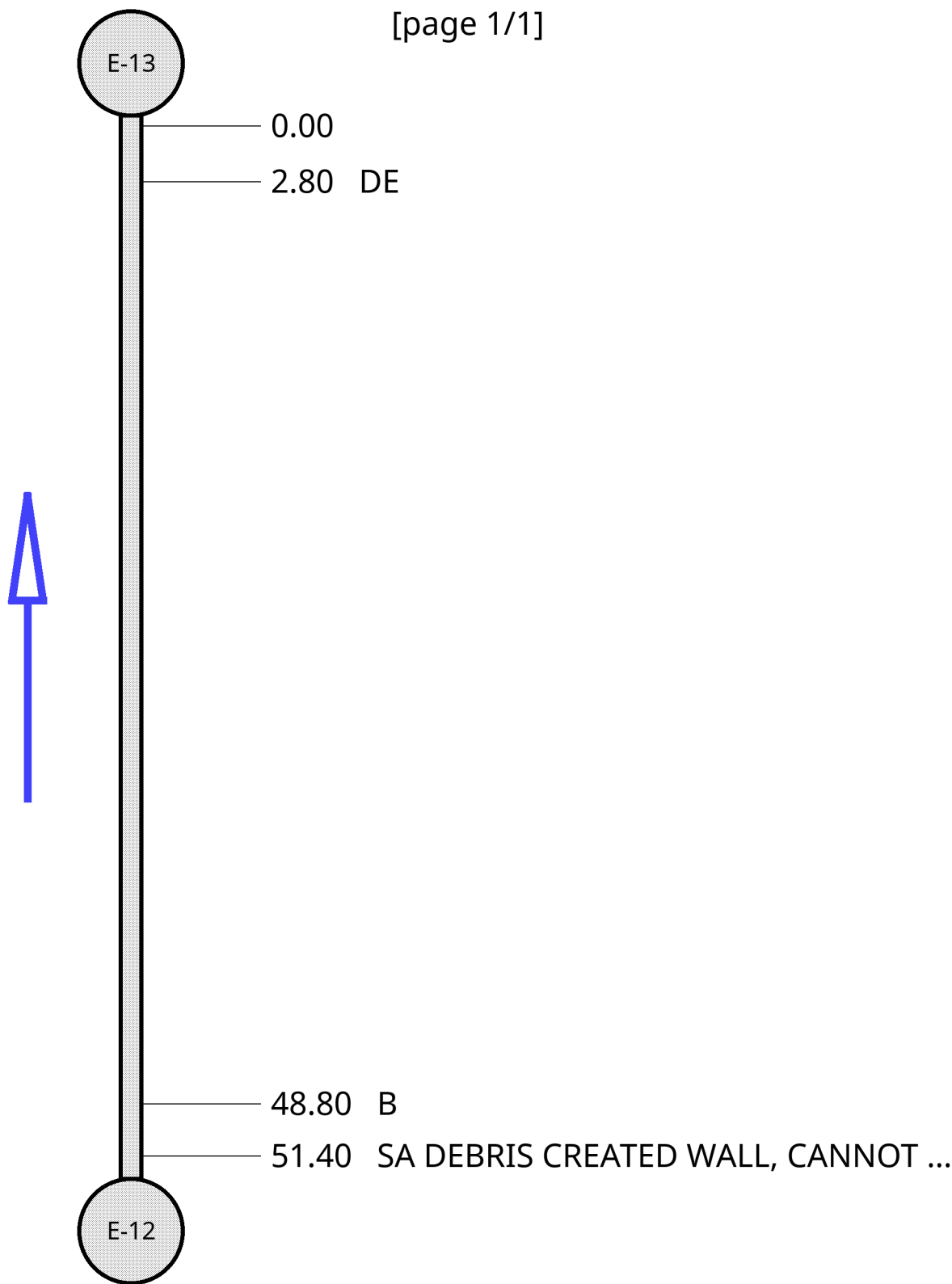




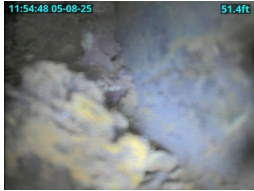
20 Drain / Sewer Survey E-13 TO E-12

20.1 Survey Header

20.1.1	Surveyed by (Operator)	JEREMIAH
20.1.2	Contract no.	
20.1.3	Job no.	
20.1.4	Catchment (Drainage area)	
20.1.5	Division	
20.1.6	District	
20.1.7	Pipeline length ref	E-13 TO E-12
20.1.8	Date	080525
20.1.9	Time	11:48
20.1.10	Location	
20.1.11	Start manhole no.	E-13
20.1.12	Start depth	
20.1.13	Start cover level	
20.1.14	Start invert level	
20.1.15	Finish manhole no.	E-12
20.1.16	Finish depth	
20.1.17	Finish cover level	
20.1.18	Finish invert level	
20.1.19	Use of Drain	
20.1.20	Direction	(U) Survey upstream (camera pointing against flow)
20.1.21	Size 1 (diameter/height)	8mm
20.1.22	Size 2 (width)	
20.1.23	Shape	(C) Circular
20.1.24	Material	(VC) Vitrified clay (i.e. all clayware)
20.1.25	Lining	
20.1.26	Pipe length	
20.1.27	Total length	
20.1.28	Year laid	
20.1.29	Video cassette number	
20.1.30	Comments: General	
20.1.31	Purpose	
20.1.32	Sewer category	
20.1.33	Pre-cleaning	(N) No
20.1.34	Weather	(1) Dry
20.1.35	Location code	
20.1.36	Further location details	



20.3 Observations

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
2.8	(DE) Debris ...% cross-sectional area loss	survey00000113/2025_05_08-11_50_09_427.jpg
	Percentage: 40%	
		0:00:13
48.8	(B) Broken pipe at ... (OR from ... to ...) o'clock	survey00000113/2025_05_08-11_53_36_965.jpg
	Clock At/From: 01	
01 - 04		0:03:32
51.4	(SA) Survey abandoned	survey00000113/2025_05_08-11_54_48_107.jpg
		
	DEBRIS CREATED WALL, CANNOT GET PAST	0:04:14

20.4 Photographs

(DE) Debris ...% cross-sectional area loss survey00000113/2025_05_08-11_50_09_427.jpg (B) Broken pipe at ... (OR from ... to ...) survey00000113/2025_05_08-11_53_36_965.jpg



(SA) Survey abandoned survey00000113/2025_05_08-11_54_48_107.jpg

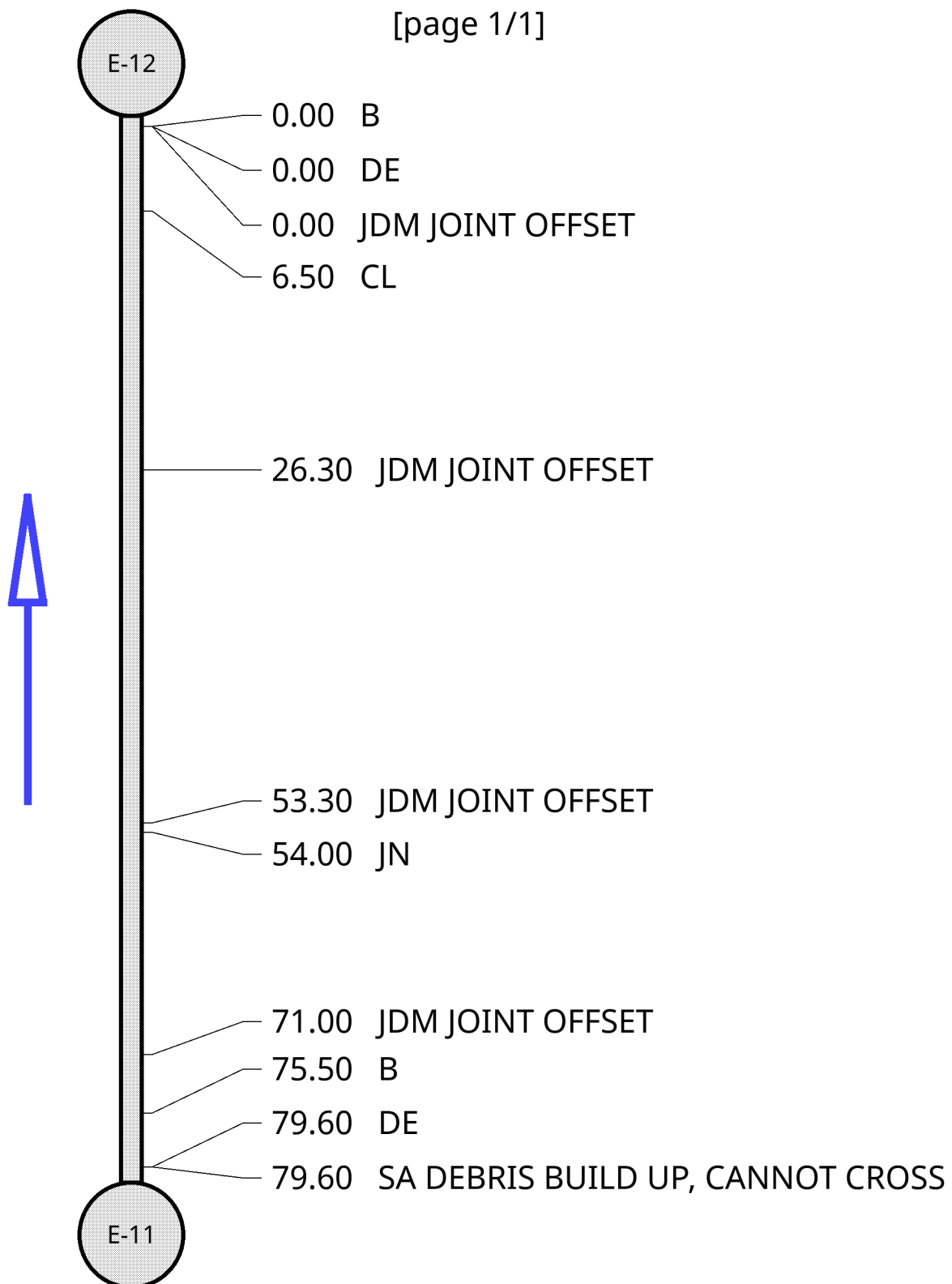


21 Drain / Sewer Survey E-12 TO E-11

21.1 Survey Header

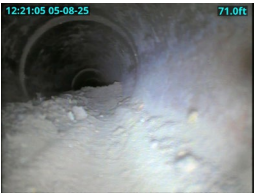
21.1.1	Surveyed by (Operator)	JEREMIAH
21.1.2	Contract no.	
21.1.3	Job no.	
21.1.4	Catchment (Drainage area)	
21.1.5	Division	
21.1.6	District	
21.1.7	Pipeline length ref	E-12 TO E-11
21.1.8	Date	080525
21.1.9	Time	12:07
21.1.10	Location	
21.1.11	Start manhole no.	E-12
21.1.12	Start depth	
21.1.13	Start cover level	
21.1.14	Start invert level	
21.1.15	Finish manhole no.	E-11
21.1.16	Finish depth	
21.1.17	Finish cover level	
21.1.18	Finish invert level	
21.1.19	Use of Drain	
21.1.20	Direction	(U) Survey upstream (camera pointing against flow)
21.1.21	Size 1 (diameter/height)	6mm
21.1.22	Size 2 (width)	
21.1.23	Shape	(C) Circular
21.1.24	Material	(VC) Vitrified clay (i.e. all clayware)
21.1.25	Lining	
21.1.26	Pipe length	
21.1.27	Total length	
21.1.28	Year laid	
21.1.29	Video cassette number	
21.1.30	Comments: General	
21.1.31	Purpose	
21.1.32	Sewer category	
21.1.33	Pre-cleaning	(N) No
21.1.34	Weather	(1) Dry
21.1.35	Location code	
21.1.36	Further location details	

21.2 Diagram



21.3 Observations

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
0.0	(B) Broken pipe at ... (OR from ... to ...) o'clock	survey00000114/2025_05_08-12_09_03_512.jpg
	Clock At/From: 09	
09 - 03	Clock To: 03	
		0:00:00
0.0	(DE) Debris ...% cross-sectional area loss	survey00000114/2025_05_08-12_10_14_200.jpg
	Percentage: 50%	
		0:00:24
0.0	(JDM) Joint displaced medium	survey00000114/2025_05_08-12_10_27_743.jpg
		
	JOINT OFFSET	0:00:26
6.5	(CL) Crack longitudinal at ... o'clock	survey00000114/2025_05_08-12_11_52_765.jpg
	Clock At/From: 12	
12		
		0:01:35
26.3	(JDM) Joint displaced medium	survey00000114/2025_05_08-12_13_59_241.jpg
		
	JOINT OFFSET	0:03:30
53.3	(JDM) Joint displaced medium	survey00000114/2025_05_08-12_16_59_128.jpg
		
	JOINT OFFSET	0:06:14
54.0	(JN) Junction at ... o'clock, diameter ...mm	survey00000114/2025_05_08-12_17_48_884.jpg
	Clock At/From: 03	
	Diameter/Dimension: 4	
03		0:06:47

Distance	Condition code and attributes	Photo Ref
Cont. Defect		
Clock (At – To)		
Junta	Remarks	Video Ref
71.0	(JDM) Joint displaced medium	survey00000114/2025_05_08-12_21_05_787.jpg
		
	JOINT OFFSET	0:09:09
75.5	(B) Broken pipe at ... (OR from ... to ...) o'clock	survey00000114/2025_05_08-12_22_37_372.jpg
	Clock At/From: 09	
09 - 03	Clock To: 03	
		0:10:19
79.6	(DE) Debris ...% cross-sectional area loss	survey00000114/2025_05_08-12_23_42_901.jpg
	Percentage: 90%	
		0:11:11
79.6	(SA) Survey abandoned	survey00000114/2025_05_08-12_23_59_930.jpg
		
	DEBRIS BUILD UP, CANNOT CROSS	0:11:16

21.4 Photographs

(B) Broken pipe at ... (OR from ... to ...) o'clock survey00000114/2025_05_08-12_09_03_512.jpg (DE) Debris ...% cross-sectional area loss survey00000114/2025_05_08-12_10_14_200.jpg



(JDM) Joint displaced medium survey00000114/2025_05_08-12_10_27_743.jpg (CL) Crack longitudinal at ... o'clock survey00000114/2025_05_08-12_11_52_765.jpg



(JDM) Joint displaced medium survey00000114/2025_05_08-12_13_59_241.jpg (JDM) Joint displaced medium survey00000114/2025_05_08-12_16_59_128.jpg



(JN) Junction at ... o'clock, diameter ...mm survey00000114/2025_05_08-12_17_48_884.jpg (JDM) Joint displaced medium survey00000114/2025_05_08-12_21_05_787.jpg



