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2022 Operational Reliability Assessment of the Longhorn Pipeline System

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March 27, 2024

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Final Report

2022 Operational Reliability Assessment of the Longhorn Pipeline System

to

Magellan Pipeline Company

on

March 27, 2024

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EXECUTIVE SUMMARY

This report presents the annual Operational Reliability Assessment (ORA) of the Longhorn Pipeline System for the 2022 operating year. Kiefner and Associates, Inc. (Kiefner) conducted the ORA, which provides Magellan Pipeline Company, L.P. (Magellan) with a technical assessment of the effectiveness of the System Integrity Plan (SIP), its Safety Management System. The technical assessment incorporates SIP elements' results to evaluate the Longhorn assets' condition. In addition, recommendations are provided to preserve the long-term integrity and mitigate areas of potential concern.

Kiefner conducted a pressure cycle fatigue analysis of the refined product and crude oil pipeline segments. Based on this analysis, two pipeline segments have suggested reassessment due dates prior to 2030—the Crane to Texon and Cartman to Kimble crude oil segments with suggested reassessment dates of April and August 2027, respectively.

The 2022 maintenance and non-destructive evaluation (NDE) reports were reviewed and correlated to in-line inspection (ILI) assessments from 2020 and 2021 to validate the ILI specified tool performance using the supplied background information and the API 1163 ILI validation methodology. Magellan performed 38 ILI anomaly investigations digs in 2022. Thirty-five anomaly investigations targeted crack-like anomalies. In all, Magellan inspected 41 ILI-reported crack-like features. In-ditch evaluations confirmed 27 cracks, 13 lack of fusion (LOF), and one target anomaly was not found. One dig on the Barnhart to Cartman segment targeted a crack-like inspection anomaly, and in-ditch evaluations did not find any anomaly within ±5.0 ft of the ILI call-out location. A precautionary Type B Sleeve was installed at the ILI call-out location. Magellan continues conducting field investigations to remediate and validate metal loss.

The corrosion management data, including internal corrosion coupon data, rectifier inspection, test point survey, close interval surveys (CIS), and atmospheric inspections, have been reviewed. Internal corrosion coupons show low corrosion rates (≤0.13 mpy). A CIS was performed in April 2022 and received by Magellan in July 2022 for the Tier III pipeline right-of-way (ROW) from Mile Post 11.593 to 276.832. Semi-annual surveys are conducted on Tier II and Tier III areas per Longhorn Mitigation Commitment (LMC) 32. Table 20 summarizes the details of the CIS data where the pipe segments are either not meeting a minimum of 100 mV of cathodic polarization or the polarized potential of -850 mV. AC pipe-to-soil voltages were collected during the CIS, showing the highest reading of 7.711 V at Mile Post 170.295 (Brodie Lane WSD). This AC voltage level should not cause personnel safety issues. A remote control unit (RMU) with an AC current density monitoring device was installed at this location on May 5th, 2022, showing the AC current density was 2.6 A/m^2. This level of AC current density is not expected to cause AC-induced corrosion on the pipe.

Atmospheric inspection reports indicate no immediate action is required. Monitoring should continue to identify future potential changes. Six tanks were inspected in 2022, including Tanks 1, 13, 14, 24, and 30 in El Paso and Tank 60 in Crane. No items requiring immediate corrective action were noted in the inspection reports.

Laminations were reviewed concurrently with reported inside diameter (ID) reductions to determine if there were any potential hydrogen blisters on the line segments inspected in 2022. Kiefner compared the 44 ID reductions identified from the 2022 electronic geometry pig (EGP) assessments on the Warda to Buckhorn segment to laminations reported by the 2009 UT assessment. One dent and four geometric anomalies (GMA) were present on the same joint as a lamination reported from the 2009 UT assessment. Based on the 2022 maintenance reports, no laminations were found during in-ditch inspections. Monitoring reported laminations for ID reductions might indicate the initiation of a hydrogen blister. Magellan should continue to monitor for lamination anomalies with ILI tools.

From the standpoint of earth movement and water forces, the primary integrity concerns are ground movement from aseismic faults and soil erosion caused by scouring at water crossings. Our analysis shows that the overall movement rates at six of the seven faults (Akron, Melde, Breen, McCarty, Negyev, and Oates) continue to be slow. The pipeline crossing those faults has more than 100 years[1] to reach the allowable displacement. However, the short-term rate of movements at these faults reveals that they have been more active lately, suggesting close monitoring. In particular, Hockley and McCarty Faults show high movement rates in the past few resurveys. Due to the small allowable displacement for the pipeline crossing the McCarty Fault, a quarterly survey of this fault was performed in 2022. Kiefner recommends following the same quarterly monitoring during 2023 and re-evaluating it each time. For the rest of the faults, Kiefner recommends continuing the semi-annual surveys to assess the need for any intervention, if necessary.

A depth-of-cover (DOC) survey was conducted in 2022 for five water crossings: Cypress Creek, Live Oak Creek, Buffalo Creek, Main Line Canal, and an Unnamed Creek (#3475). These surveys were documents in the Magellan's Outside Forces Database and assessed per Magellan's River Crossing Program. Additional assessment, surveys, monitoring, and mitigation will be scheduled per the program. Details of the 2022 surveys are given in Section 2.4.4 Waterway Inspections and Depth-of-Cover Program.

The Longhorn third-party damage (TPD) prevention program exceeds the minimum requirements of federal and Texas state pipeline safety regulations. Aerial surveillance and ground patrol frequencies met the LMP goals, with several exceptions to the Galena Park patrol due to weather events in February, November, and December of 2022. In this instance, Magellan began and completed patrols following event cessation within 72 hours.

Magellan performs incident investigations on all events, including near misses. There was one minor incident investigation on the Longhorn Pipeline in 2022. The incident was classified as a one-call/encroachment and, therefore, was not reportable to PHMSA. This incident was formally documented and investigated. Corrective actions were implemented following Magellan's incident investigation report.

Magellan has recorded no stress-corrosion cracking (SCC) on the pipeline, including the 449 miles of existing pipeline. Kiefner recommends Magellan continue to carry out inspections per

[1] This is the total time calculated from when the pipe is free of stress, i.e., since installation or the last time some form of stress relief was performed on it.

procedure as part of the normal dig program by conducting an SCC examination program that uses magnetic particle testing or equivalent methodology at each dig site.

The 2022 facilities data indicates that the pump stations and terminal facilities have been properly maintained and operated and have had no adverse impact on public safety. Magellan performs Process Hazard Analyses (PHAs) on all new above-ground facilities and when existing facilities are modified. The latest PHA was completed in 2019 as a 5-year revalidation per Magellan's LMP requirement found under 3.5.11. No PHAs were completed in 2022.

A probabilistic risk model is used to effectively manage pipeline integrity and evaluate risk per 49 CFR 195.452. The results show that none of the pipeline segments exceeded Magellan's risk threshold; therefore, no additional mitigation measures were required or recommended.

The technical assessment of the SIP indicated that Magellan is achieving its goal of preventing incidents that threaten human health or safety or cause environmental harm. Regarding activity measures, Magellan exceeded the minimum required mileage for aerial surveillance and ground patrol in the total number of miles patrolled and exceeded the frequency requirement for patrol when weather permitted. In addition, Magellan held public awareness meetings and implemented its damage prevention program to ensure the safety and reliability of the Longhorn Pipeline System.

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TERMS, DEFINITIONS, AND ACRONYMS

The terms and definitions are taken directly from Section 2.0 of the ORA Process Manual (ORAPM), titled Terms, Definitions, and Acronyms. Definitions in the ORAPM or Longhorn Mitigation Plan are italicized.

Accident	An undesired event that results in harm to people or property damage.
AC	Alternating Current
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
Bbl	Barrels
bpd	Barrels per day
CFR	Code of Federal Regulations
CGR	Corrosion growth rate
CIS	Close interval survey
CMP	Corrosion Management Plan
CP	Cathodic Protection – A method of protection against galvanic corrosion of a buried or submerged pipeline through the application of protective electric currents.
Def	Deformation
Defect	An imperfection of a type or magnitude exceeding acceptable criteria. Definition based on API Publication 570 – Piping Inspection Code. (Also see anomaly).
Dent	An ID Reduction greater than or equal to 2% of the pipe diameter
DOC	Depth-of-cover
DOT	Department of Transportation
EA	Environmental Assessment – The National Environmental Policy Act (NEPA) process begins when a federal agency develops a proposal to take major federal action. These actions are defined in 40 CFR 1508.18. The environmental review under NEPA can involve three different levels of analysis: • Categorical Exclusion Determination (CATEX) • Environmental Assessment/Finding of No Significant Impact • Environmental Impact Statement (EIS)
EFW	Electric-flash weld is a type of EW using electric-induction to generate weld heat.

EGP	Electronic geometry pig
Encroachments	Unannounced or unauthorized entries of the pipeline right-of-way by persons operating farming, trenching, drilling, or other excavating equipment. Also, debris and other obstructions along the right-of-way must be removed periodically to facilitate prompt pipeline access for routine or emergency repair activities. The System Integrity Plan (SIP) includes provisions for surveillance to prevent and minimize the effects of right-of-way encroachments.
EPA	Environmental Protection Agency
ERW	Electric-resistance weld is a type of EW using electric-resistance to generate weld heat.
EW	Electric welding is a process of forming a seam for electric resistance (ERW) or electric-induction (EFW) welding, wherein the edges to be welded are mechanically pressed together, and the resistance to the flow of the electric current generates the heat for welding. EW pipe has one longitudinal seam produced by the EW process.
Excavation Damage	Any excavation activity that results in the need to repair or replace a pipeline due to a weakening, or the partial or complete destruction, of the pipeline, including, but not limited to, the pipe, appurtenances to the pipe, protective coatings, support, cathodic protection or the housing for the line device or facility.
Existing Pipeline	Originally defined in the EA, it consists of the portion of the pipeline originally constructed by Exxon in 1949-1950 that runs from Valve J-1 to Crane pump station. Currently, the in-service portion of the Existing Pipeline runs from MP 9 to Crane because the 2-mile section from Valve J-1 to MP 9 is not in use.
External Corrosion	Deterioration of the pipe due to an electrochemical reaction between the pipe material and the environment outside the pipe
FEA	Finite element analysis
GMA	Geometric Anomaly – An ID Reduction of less than 2% of the pipe diameter
HCA	High Consequence Area – As defined in 49 CFR 195.450, a location where a pipeline release might have a significant adverse effect on one or more of the following: • Commercially navigable waterway • High population area • Other populated area • Unusually sensitive area (USA)
Hydrostatic Test	An integrity verification test that pressurizes the pipeline with water is called a hydro test or hydrostatic pressure test.
ID	Inside nominal diameter of line pipe
ID Reduction	A deformation of pipe diameter detected by the ILI tool

ILI	In-Line Inspection – The use of an electronically instrumented device that travels inside the pipeline to measure the characteristics of the pipe wall and detect anomalies such as metal loss due to corrosion, dents, gouges, and/or cracks, depending upon the type of tool used.
ILI Final Report	ILI vendor report that provides the operator with a comprehensive interpretation of the data from an ILI.
Incident	An event defined in the Incident Investigation Program of the LMP Includes accidents, near-miss cases, repairs, and/or any combination thereof. Incidents are divided into three categories: major, significant, and minor. A "PHMSA (or DOT) reportable incident" is a failure in a pipeline system in which there is a release of product resulting in explosion or fire, volume exceeding 5 gallons (5 barrels from a pipeline maintenance activity), death of any person, personal injury necessitating hospitalization, or estimated property damage exceeding $50,000.
Internal Corrosion	Deterioration of the pipe due to an electrochemical reaction between the pipe material and the environment outside the pipe
J-1 Valve	The Mainline pipeline valve in the Houston area is described in the LMP as the junction of the Existing Pipeline and a New Pipeline extension. Although this valve still exists, it is not a part of the currently active Longhorn Pipeline, and the actual junction is at MP 9 (2 miles from the J-1 Valve).
Jct	Junction
Kiefner	Kiefner and Associates, Inc.
Leak Detection System	Two technology-based leak detection systems are used for the Longhorn system: (1) A system-wide computer-based monitoring and alarm network using real-time flow information from various locations along the pipeline and (2) a buried sensing cable installed over the Edwards Aquifer recharge zone and the Slaughter Creek watershed in the Edwards Aquifer contributing zone.
LMC	Longhorn Mitigation Commitment – Commitments made by Longhorn are described in Chapter 1 of the LMP.
LMP	Longhorn Mitigation Plan – Commitments made by Longhorn to protect human health and the environment by conducting up-front (prior to pipeline start-up) and ongoing activities regarding pipeline system enhancements and modifications, integrity management, operations and maintenance, and emergency response planning.
Magellan	Magellan Pipeline Company, L.P.
Major Incident	The Longhorn Mitigation Plan – Includes events that result in: • Fatality • Three or more people hospitalized • Major news media coverage • Property loss, casualty, or liability potentially greater than $500,000

	• Major uncontrolled fire/explosion/spill/release that presents an imminent and serious or substantial danger to employees, public health, or the environment
MASP	Maximum Allowable Surge Pressure
Minor Incident	The Longhorn Mitigation Plan – Includes events that result in: • Fire/explosion/spill/release or other events with casualty/property/liability loss potential under $25,000 • Employee or contractor OSHA recordable injury/illness without lost workday cases • Citations under $25,000
MFL	Magnetic flux leakage – The flow of magnetic flux from a magnetized material, such as the steel wall of a pipe, into a medium with lower magnetic permeability, such as gas or liquid. Often used in reference to an ILI tool that makes MFL measurements.
ML	Metal loss
MOCR	Management of Change Request
MOP	Maximum Operating Pressure
MOV	Motor Operated Valve
MP	Mile Post
mpy	Mils per year – Often referenced in conjunction with corrosion growth rates
NACE International	Formerly known as the National Association of Corrosion Engineers
NDE	Non-destructive Evaluation
Near-Miss	The number of unplanned/undesired third-party-related events that did not result in a significant loss but which, under slightly different circumstances, could have resulted in a minor, serious, or major incident. Near miss data are obtained from Hazard / Near Miss cards, incident investigations, aerial patrol reports, maintenance reports, and ROW inspection reports. An event is defined in the Incident Investigation Program of the LMP as an undesired event that could have resulted in harm to people or damage to property under slightly different circumstances. In addition, the LMP states that a specific scenario of a minor accident (minor actual loss) could also be a major near-miss (major potential loss). Thus, a near-miss may or may not result in an incident.
NEPA	National Environmental Policy Act
New Pipeline	In 1998, extensions were added to the Existing Pipeline to make the current Longhorn Pipeline. Extensions were added from Galena Park to MP 9 and Crane to El Paso Terminal. Laterals were added from Crane to Odessa and El Paso Terminal to Diamond Junction. In 2010, a 7-mile loop (3 ½ miles each way) was added, connecting Magellan's East Houston terminal to MP 6.

OD	The nominal outside diameter of the line pipe.
One-Call	A notification system through which a person can notify pipeline operators of planned excavation to facilitate the locating and marking of any pipelines in the excavation area. Texas 811 is a computerized notification center that establishes a communications link between those who dig underground (excavators) and those who operate underground facilities. The Texas Underground Facility Damage Prevention Act requires that excavators in Texas notify a One-Call notification center 48 hours before digging so the location of an underground facility can be marked. The Texas 811 System can be reached at toll-free number 811 or the website http://www.texas811.org/.
One-Call Violation	A violation of the requirements of the Texas Underground Facility Damage Prevention and Safety Act by an excavator. This ORA is concerned about violations within the Longhorn Pipeline ROW.
One-Call Violations	The number of excavations that occurred within the ROW boundaries where a one-call was not made and should have been. Texas One-Call (Utilities Code: Title 5, Chapter 251, Section 251.002, Sub-Section 5) defines excavate as "to use explosives or a motor, engine, hydraulic or pneumatically powered tool, or other mechanized equipment of any kind and includes auguring, backfilling, boring, compressing, digging, ditching, drilling, dragging, dredging, grading, mechanical probing, plowing-in, pulling-in, ripping, scraping, trenching, and tunneling to remove or otherwise disturb the soil to a depth of 16 or more inches." Additionally, one-call violations are identified when company personnel discover third-party activity on the ROW and inform the third party that a one-call is required. One-call violation data are obtained from Hazard / Near-Miss cards, One-Call tickets, incident investigations, aerial patrol reports, maintenance reports, and ROW inspection reports.
Operator	An entity or corporation responsible for the day-to-day operation and maintenance of pipeline facilities
OPS	Office of Pipeline Safety – Co-lead agency who performed the EA, now a part of PHMSA
ORA	Operational Reliability Assessment – Annual assessment activities to be performed on the Longhorn Pipeline System to determine its mechanical integrity and manage risk over time
ORAPM	The Operational Reliability Assessment Process Manual
PHA	Process Hazard Analysis
PHMSA	The Pipeline and Hazardous Materials Safety Administration – a federal agency within the DOT with safety jurisdiction over interstate pipelines.
PMI	Positive Material Identification

Positive Material Identification (PMI) Field Services	A process and procedure developed by T. D. Williamson to determine tensile strength, yield strength, and chemical composition on pipe in the field. The process includes mobile automated ball indention for mechanical properties and optical emission spectrometry for chemical composition.
POE	Probability of Exceedance – The likelihood that an event will be greater than a pre-determined level used in the ORA to evaluate corrosion defect failure pressures versus intended operating pressures. The POE for depth (POE_D) is the probability that an anomaly is deeper than 80% of the wall thickness. The POE for pressure (POE_P) is the probability that the burst pressure of the remaining wall thickness will be less than the system operating pressure or surge pressure. The POE for each pipe joint is POE joint.
POF	Probability of Failure
Recommendation	Suggestions for activities or changes in procedures that are intended to enhance integrity management systems but are not specifically mandated in the LMP
Repair	The LMP describes a repair as a temporary or permanent alteration made to the pipeline or its affiliated components intended to restore the allowable operating pressure capability or correct a deficiency or possible breach in the mechanical integrity of the asset.
Requirement	Activities that must be performed to comply with the LMP commitments
Risk	A measure of loss is measured in terms of both incident likelihood of occurrence and magnitude of the consequences.
Risk Assessment	A systematic, analytical process in which potential hazards from facility operation are identified and the likelihood and consequences of potential adverse events are determined. Risk assessments can have varying scopes and be performed at varying levels of detail depending on the operator's objectives.
ROW	Right-of-way – A strip of land where, through a legal agreement, some property rights have been granted to Magellan and its affiliates. The ROW agreement enables Magellan to operate, inspect, repair, maintain, or replace the pipeline.
SCC	Stress-Corrosion Cracking – A form of environmental attack on the pipe steel involving the interaction of a local corrosive environment and tensile stresses in the metal, resulting in the formation and growth of cracks. (ASME 31.8S[2])
Significant Incident	The Longhorn Mitigation Plan – Includes events that result in: • Fire/explosion/spill/release/ less than three hospitalized or other events with casualty/property/liability loss potential of $25,000 - $500,000 • Employee or contractor OSHA recordable injury/illness lost workday cases • Citations with potential fines greater than $25,000
SIP	System Integrity Plan – A program designed to gather unique physical attributes of the Longhorn Pipeline System, identify and assess the public and environmental

[2] ASME 31.8S (2016), Managing System Integrity of Gas Pipelines, ASME Code for Pressure Piping, B31

	risks, and actively manage those risks by implementing the identified Process Elements. See LMP Chapter 3.
SMYS	Specified Minimum Yield Strength – A common measure of the minimum
Surge Pressure	Short-term pipeline pressure increases due to equipment operation changes such as valve closure or pump start-up. Surge pressures must be limited to no more than MOP in Tier II and Tier III areas and no more than 110% of MOP elsewhere.
TDW	T.D. Williamson
Tier I Areas	Areas of normal cross-country pipeline
Tier II Areas	Areas designated in the EA as environmentally sensitive due to population or environmental factors
Tier III Areas	Areas designated in the EA as environmentally hypersensitive due to the presence of high population or other environmentally sensitive areas
TFI	Transverse Field Inspection – An MFL Inspection tool with the magnetic field oriented in the circumferential direction. The tool differs from conventional MFL because these conventional tools have their field oriented in the axial direction or along the axis of the pipe.
TPD	Third-party damage – Accidental or intentional damage by a third party (that is, not the pipeline operator or contractor) that causes an immediate failure or introduces a weakness (such as a dent or gouge) into the pipe
TPD Annual Assessment	"Longhorn System Annual Third-Party Damage Prevention Program Assessment" Report. The annual report written by the operator summarizes the TPD prevention program. This report is found in Appendix D of the ORAPM as Item 71, Annual Third-Party Damage Assessment Report.
UT	Ultrasonic testing – A non-destructive testing technique using ultrasonic waves
WT	The wall thickness of the line pipe
WTI	West Texas Intermediate (crude oil grade)
WTS	West Texas Sour (crude oil grade)

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1 INTRODUCTION

1.1 Objective

Kiefner and Associates, Inc. (Kiefner) has conducted the annual Operational Reliability Assessment (ORA) report on the Longhorn Pipeline System for the 2022 operating year. The ORA report provides Magellan Pipeline Company, L.P. (Magellan), with a technical assessment of the effectiveness of the System Integrity Plan (SIP) on the Longhorn Pipeline. Results from all SIP elements are incorporated into the technical assessment to help evaluate the condition of the Longhorn assets. Kiefner provides recommendations to preserve long-term integrity and mitigate areas of potential concern.

1.2 Background

Magellan has operated the Longhorn pipeline system since 2005 and has held ownership since 2009. The previous owner, Longhorn Partners Pipeline, LP, participated in an Environmental Assessment (EA) prepared by the U.S. Environmental Protection Agency (EPA) and the Department of Transportation (DOT) in 1999 and 2000. The EA took place before the pipeline's refined product service started. The EA "Finding of No Significant Impact" was conditioned upon Longhorn's commitment to implement certain integrity-related activities and plans before pipeline start-up and periodically throughout the system's operation. The Longhorn Mitigation Plan (LMP) specifies Longhorn's commitment to minimizing the likelihood and consequences of product releases. These commitments included the Longhorn Continuing Integrity Commitment, where Longhorn agreed to implement System Integrity and Mitigation Commitments and conduct annual ORAs. A list of the Longhorn Mitigation Commitments (LMCs) addressed in the ORA report is provided in Appendix A – Mitigation Commitments.

The LMP committed Longhorn to implement a SIP, which Magellan maintains. Magellan's SIP has three elements:

- Management tasks addressing the integrity management program for the Longhorn pipeline system, including a commitment to perform an annual self-audit report.
- Direct operator interface with the daily operations and maintenance of the Longhorn pipeline system assets.
- An independent third-party technical company performs an annual ORA; the third-party technical company is subject to the Pipeline and Hazardous Materials Safety Administration (PHMSA) review and approval.
    - Longhorn selected and PHMSA approved Kiefner as the ORA contractor, and Magellan continues with this agreement.

The LMP stipulates specific and general requirements of the ORA. Those requirements were extracted from the LMP and used to develop the ORA Process Manual (ORAPM). The ORA is carried out according to the ORAPM. The "Mock ORA for Longhorn Pipeline" that Kiefner

performed before the pipeline commissioning provided additional information on the execution of the ORA. The ORAPM requires the ORA contractor to provide annual reports to Magellan and PHMSA.

The ORA contractor will assess the pipeline operating data and the results of integrity assessments, surveys, and inspections and make appropriate recommendations regarding the seven potential threats to pipeline integrity. The ORAPM identifies the data needed to conduct the ORA; Appendix B – New Data used in this analysis lists the data used for the 2022 ORA Report. Managing these threats and preserving the integrity of the Longhorn system assets are among the goals of the SIP. The seven pipeline integrity threats are:

1. Pressure-Cycle-Induced Fatigue
2. Corrosion
3. Laminations and Hydrogen Blisters
4. Earth Movement and Water Forces
5. Third-Party Damage (TPD)
6. Stress-Corrosion Cracking (SCC)[3]
7. Threats to Facilities Other than Line Pipe

1.3 ORA Interaction with the SIP

The ORA report also reviews the inspection and pipeline system operation data collected and generated from Longhorn's SIP:

1. Corrosion Management Plan
2. In-Line Inspection (ILI) and Rehabilitation Program
3. Key Risk Area Identification and Assessment
4. Damage Prevention Program
5. Encroachment Procedures
6. Incident Investigation Program
7. Management of Change
8. Depth-of-Cover Program
9. Fatigue Analysis & Monitoring Program
10. Scenario-Based Risk Mitigation Analysis
11. Incorrect Operations Mitigation
12. System Integrity Plan Scorecarding and Performance Metrics Plan

1.4 Longhorn Pipeline System Description

The Longhorn pipeline system comprises a crude oil system (Eastern portion) and a refined products system (Western portion). Figure 1 through Figure 3 show the Longhorn System Map, Tier Levels, and a close-up of the Houston area.

[3]SCC has not been identified as a threat of concern to the Longhorn Pipeline and has not been recognized as a threat in the past but was added as SCC has been an unexpected problem for some pipelines.

The Eastern portion of the Longhorn system transports crude oil through an 18-inch pipeline over 424 miles from Crane Station to Satsuma Station. Intermediate pumping stations include Texon, Barnhart, Cartman, Kimble, James River, Eckert, Cedar Valley, Bastrop, Warda, and Buckhorn. The crude system continues with 32 miles of 20-inch pipe from Satsuma Station to East Houston Terminal and 9 miles of 20-inch pipe from East Houston Terminal to 9th Street Junction. The crude system contains some of the Existing Pipeline (as named in the original EA) built in 1949-1950 with some replacements and extensions in the Houston area.

The Western portion of the Longhorn system transports refined products from Odessa to El Paso, TX. The refined product system is 237 miles of 18-inch pipe from Crane Station to the El Paso Terminal and 29 miles of 8-inch pipe from Odessa to Crane Station. At the El Paso Terminal, there are four 9.4-mile laterals connecting the El Paso Terminal to El Paso Junction (also known as the El Paso Laterals). Most of the refined pipe system was built in 1998.

Table 1 lists the station locations for the Longhorn pipeline systems. The current flow rate for the crude system is 292,000 barrels per day (bpd) from Crane to East Houston. The flow rate for the refined product system is 92,180 bpd from Odessa to El Paso. Figure 4 shows a timeline of the history of the Longhorn Pipeline System.

Table 1. Longhorn Pipeline Station Locations

System	Station	Type	Milepost	Tier	MOP (psig)
Crude	Crane	Pump	457.5	II	1034
	Texon	Pump	416.6	II	898
	Barnhart	Pump	373.4	II	953
	Cartman	Pump	344.3	II	952
	Kimble	Pump	295.2	II	898
	James River	Pump	260.2	I	965
	Eckert	Pump	227.9	I	959
	Cedar Valley	Pump	181.6	II	965
	Bastrop	Pump	141.8	I	1012
	Warda	Pump	112.9	I	965
	Buckhorn	Pump	68.0	I	787
	Satsuma	Pump	34.1	III	786
	E. Houston	Terminal	2.35	II	1168
Refined Product	Odessa[4]	Meter	N/A	I	1440
	Crane	Pump	457.5	I	1440
	Cottonwood	Valve	576.3	I	1440
	El Paso	Terminal	694.4	I	1440
	8” Chevron	Meter	N/A	I	2160
	8” Kinder Morgan Flush Line	Meter	N/A	I	1440
	8” Strauss	Meter	N/A	I	1440
	12” Kinder Morgan	Meter	N/A	I	1440

[4] The Longhorn Mitigation Plan (LMP) covers the Odessa pig trap. The tanks and metering are not covered by the LMP.

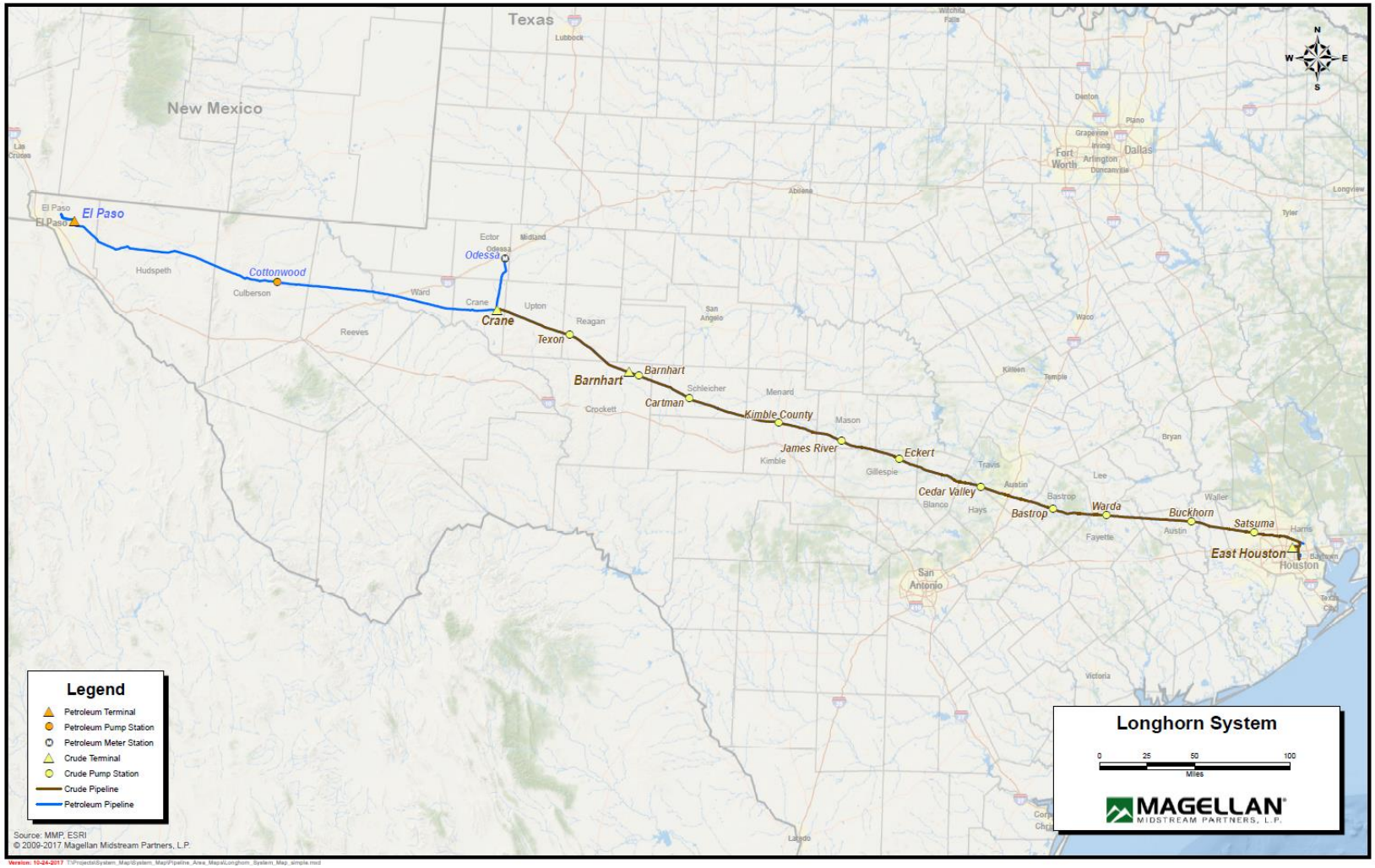

Figure 1. Longhorn System Map (2022)

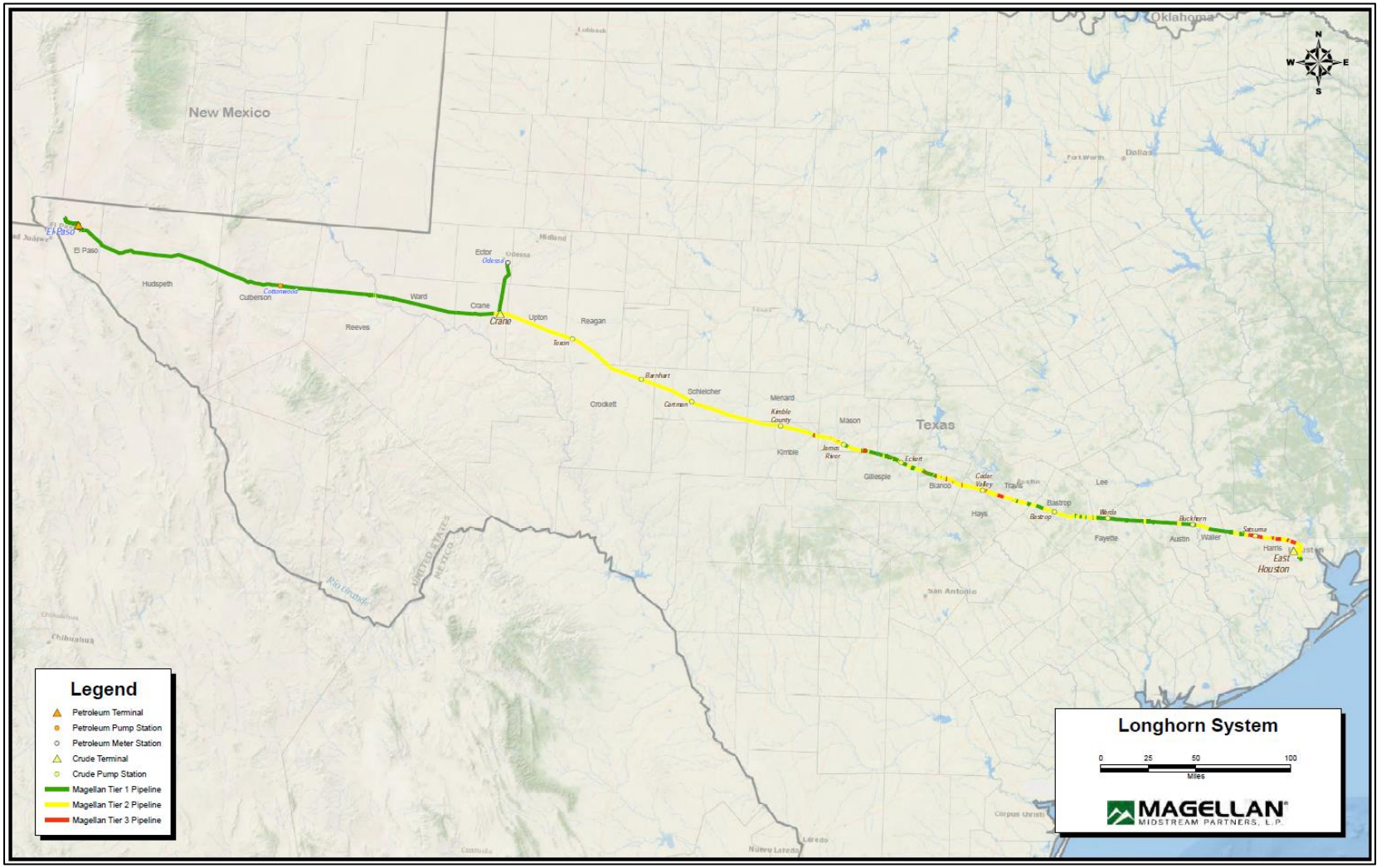

Figure 2. Longhorn System Map showing Tier Level (2022)

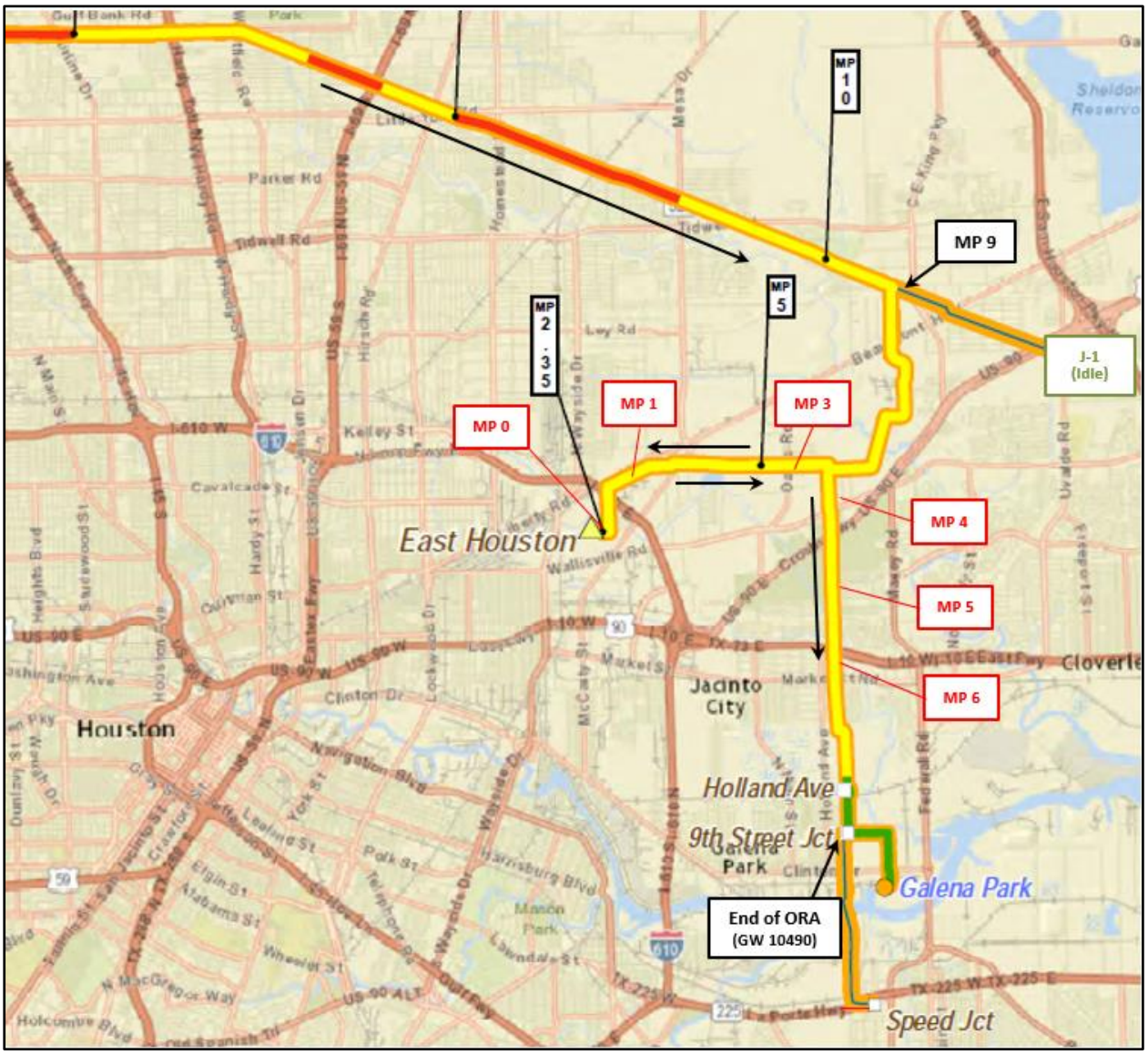

Figure 3. Map of Longhorn System within the Houston Area (2022)

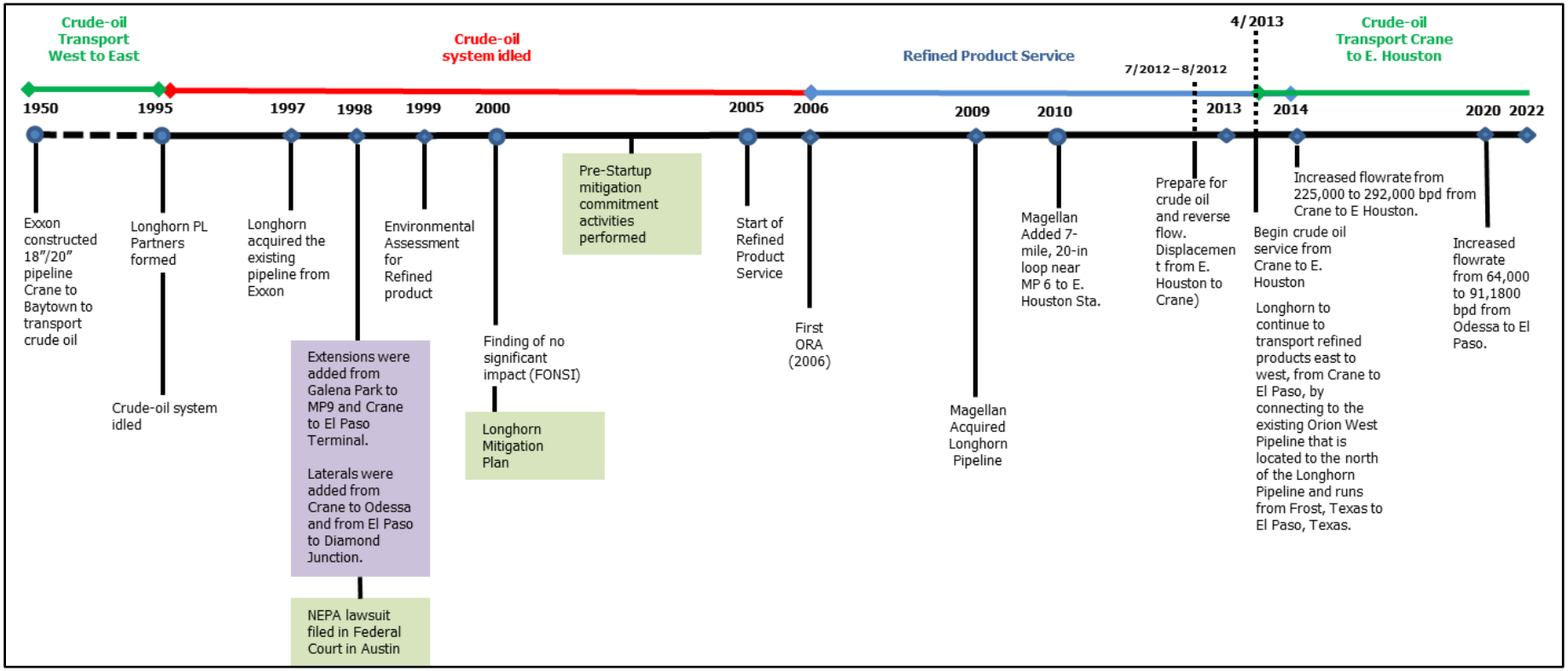

Figure 4. Timeline of the Longhorn Pipeline System

2 LMP AND SIP ANALYSES AND REVIEW

To maintain the integrity and reliability of the Longhorn pipeline, Magellan identifies, analyzes, and manages the risks associated with the operation of the pipeline and its associated assets. The LMP and SIP both help implement this policy.

The LMP helps maintain the integrity of the Longhorn pipeline by identifying and monitoring threats such as pressure-cycle-induced fatigue cracking, corrosion, pipe laminations, hydrogen blisters, earth movement, TPD, SCC, and threats to facilities other than line pipe. Magellan had four pipeline segments assessed, with final reports received in 2022. T.D. Williamson's (TDW) magnetic flux leakage (MFL) and Deformation tools were used to assess the following segments: Cottonwood to El Paso, 8" El Paso to Chevron, and 8" Kinder Morgan Flush Line. The TDW Deformation tool was also used to assess the Warda to Buckhorn segment. Refer to Table 2 for a list of assessments performed in 2022 by pipeline segment.

The SIP maintains the integrity of the Longhorn pipeline by identifying and managing incidents that would threaten human health and safety or cause environmental harm. The SIP contains 12 process elements. These elements are most closely related to the threats addressed by the ORAPM. They are summarized in detail with recommendations to preserve the long-term integrity and mitigate areas of potential concern. These 12 process elements are listed in this report in Section 1.3 ORA Interaction with the SIP.

Table 2. Longhorn System ILI Assessments

Warda to Buckhorn	**Cottonwood to El Paso**	**8" El Paso to Chevron**	**8" Kinder Morgan Flush Line**	**12" El Paso to Kinder Morgan**
112.9 to 68.0	**576.3 to 694.4**	**0 to 9.4**	**0 to 9.4**	**0 to 9.4**
Corrosion				
	GMFL	MFL	MFL	Hydrotest
	8/4/2022	6/2/2022	6/1/2022	June 2022
Third-Party Damage				
Deformation	Deformation	Deformation	Deformation	Hydrotest
2/15/2022	7/1/2022	6/2/2022	6/1/2022	June 2022

2.1 Fatigue Analysis and Monitoring Program

It is well documented that pre-existing long seam defects may cause pipeline failures due to pressure-cycle-induced fatigue.[5] These flaws are more prevalent in pipes manufactured prior to 1970 due to obsolete long-seam welding techniques such as low-frequency electrical resistance welding (LF-ERW) and flash welding (EFW). These vintage welds typically exhibit lower toughness and a higher prevalence of manufacturing flaws than the modern, post-1970 pipe. As a result, manufacturing flaws in or adjacent to the ERW or EFW long seams of the Existing Pipeline, manufactured in 1950, are considered to be susceptible to pressure-cycle-induced fatigue. A flaw that was too small to fail at the initial hydrostatic test after construction could

[5] Kiefner, J. F., Kolovich, C. E., Wahjudi, T. F., and Zelenak, P. A., *"Estimating Fatigue Life For Pipeline Integrity Management"*, Paper Number IPC04-0167, Proceedings of IPC 2004, International Pipeline Conference, Calgary, Alberta, Canada (October 4 - 8, 2004).

grow due to pressure-cycle-induced fatigue and become large enough to cause a failure. Accordingly, Section 3 of the ORAPM requires monitoring of pressure cycles during the operation of the pipeline, calculating the worst-case crack growth in response to such cycles, and reassessing the integrity of the pipeline at appropriate intervals to find and eliminate potentially growing cracks before they reach a critical size.

The failure pressure of each potential flaw is controlled not only by its size but also by the pipe's diameter, wall thickness, strength, and toughness. Toughness is the ability of the material containing a given-size crack to resist tearing at a particular value of applied tensile stress. Toughness in line pipe materials has been found to correspond reasonably well to the value of "upper-shelf" energy as determined utilizing standard Charpy V-notch impact tests. As noted in Reference [1], the full-size Charpy V-notch energy levels (CVN) for samples of the 1950 material ranged from 15 to 26 ft-lbs. To be conservative, Kiefner used the lower-bound CVN value of 15 ft-lbs for fatigue analysis.

Kiefner's Pipelife software performs fatigue assessment using the following methodology:

- Process the operating pressure data using rainflow-counting.
- Segment the pipeline according to location, elevation, diameter, grade, and wall thickness.
- Establish initial crack sizes based on the most recent hydrostatic test, ILI crack-tool run, or API 5L inspection standards.
- Simulate crack growth using Paris' law.
- Calculate the cracks' final (critical) sizes at failure when the predicted burst pressure reaches MOP.
- Estimate the time (predicted remaining life) for the known or potential cracks to grow to critical size.

2.1.1 Pressure Cycle Processing

For the 2022 analysis, Magellan supplied the 2022 operational pressure data for the crude oil pipeline system from Crane Station to 9th Street Jct. and the refined product system from Odessa to El Paso. The pressure data used in the analyses were recorded at stations' and facilities' discharge, suction, and receipt points. The 2022 pressure readings were recorded from January 1, 2022, to December 31, 2022, at 1-minute intervals. Kiefner added the 2022 pressure data to all available pressure data from previous years to create an operational pressure history for each segment. The amount of cumulative pressure data used in each analysis depended on the number of consecutive years that Magellan provided pressure data to Kiefner in the same time interval and the date of the ILI run for the UCD ILI anomaly analyses. Table 3 shows the years of cumulative pressure data used in each analysis.

Table 3. Years of Operational Pressure Data Used for Each Pressure-Cycle-Fatigue Analysis

Analysis	Years of Pressure Data Used
UCD ILI Defects, Crane to E. Houston (Crude)	All since UCD ILI run (~2.5 to 4.5)
Threshold Defects, Crane to E. Houston (Crude)	All since UCD ILI run (~2.5 to 4.5)
Threshold Defects, E. Houston to 9th St. Jct. (Crude)	7.5
Threshold Defects, Odessa to Crane (Product)	4.0
Threshold Defects, Crane to El Paso (Product)	9.0

Kiefner used rainflow-counting to prepare the pressure data for analysis. Rainflow-counting converts a sequence of varying stresses into an equivalent set of constant amplitude stress reversals, transforming the complex pressure data into simple peaks and valleys to optimize computation time. According to Paris' law, rainflow-counted pressure cycles are used to simulate crack growth. Kiefner's rainflow-counting process complies with ASTM E1049-85 guidelines for rainflow-counting.[6]

Due to the density of liquid products, elevation changes impact the internal pressure loading of the pipe due to hydrostatic head losses and gains. Data for the intermediate locations between the pressure measurement locations were calculated based on elevation changes and the hydraulic pressure gradient.

2.1.2 Initial Flaw Size

Since 2018, all of the Existing Pipeline segments built around 1950 from Crane Station to the East Houston terminal have been inspected using ultrasound crack detection (UCD) ILI tools. The refined product system, installed in 1998, has not been inspected by ILI tools capable of reliably detecting cracks.

ILI Defects

For the pipeline segments where ILI detected crack-like defects, the lengths and depths reported by the ILI tool were used as the initial flaw sizes with tool tolerance added. For features identified by the UCD tools, the tool tolerance was 0.3" for length and 0.036" for depth, so those values were added to the ILI-reported lengths and depths to use as initial flaw sizes.

Threshold Defects

In addition to the known ILI features, hypothetical flaws based on the ILI and API 5L detection thresholds were simulated at every change in the pipeline's physical properties, such as wall thickness, diameter, and grade, according to the procedure in Section 3.4 of the ORAPM. For segments inspected by the UCD tool, Kiefner used a depth of 0.036" from the manufacturer's tool specification. For the segments where no UCD ILI crack tool was run, Kiefner used the inspection standards for API 5L line pipe in 1998[7], where the pipe was inspected ultrasonically using a standard calibration block with a 10% wall thickness (N10) notch. A flaw was simulated at each change in pipe properties along the pipeline segment to guarantee that all possible pipe property scenarios were evaluated with respect to their location and elevation.

[6] ASTM, "Standard Practices for Cycle Counting in Fatigue Analysis", E 1049, Annual Book of Standards, 2002.
[7] API 5L, "Specification for Line Pipe," 41st Edition. April 1, 1995.

Kiefner used the following conservative initial length calculation for threshold defects based on known fatigue failure data:[8]

$$L = 2\sqrt{Dt}$$

Where D is the outside diameter, and t is the wall thickness.

Locations near a pump discharge typically experience more aggressive pressure cycles than locations away from the pump discharge. For the current analysis, the pipe closest to the upstream pump station was used in the analysis where a pipe with similar attributes (grade, wall thickness, and other attributes) was present in a given segment. Calculating fatigue life at points further downstream is unnecessary as they will have a longer fatigue life based on the hydraulic gradient and need not be evaluated as long as its difference in elevation relative to upstream locations is not significant.

Appendix C – Threshold Anomaly Fatigue Evaluation Results and Appendix D – Crack Detection ILI Anomaly Fatigue Evaluation Results contain all pressure-cycle-fatigue analysis results sorted by reassessment interval.

2.1.3 Fatigue Crack Growth Assessment

The pressure-cycle analysis for the Longhorn Pipeline was conducted using Paris' law[9], shown below:

$$\frac{da}{dN} = C(K)^n$$

Kiefner's Pipelife software uses Paris law to simulate the incremental crack growth for a given flaw in response to the pressure cycles counted from the rainflow method (da/dN is the increment of crack growth per load cycle, ΔK is the range of cyclic stress-intensity at the crack-tip, and C and n are material crack-growth parameters). The cyclic stress intensity factor was determined using the Raju-Newman equation.[10] These equations are available in the Mock ORA (Reference [2]). The pressure cycles were applied, and crack growth was calculated until failure was predicted at the MOP at the feature location. The cumulative pressure cycles at failure were then converted to predicted time to failure in years. The fatigue life is the time in years for the defect to grow from the initial crack size to the final critical size. Kiefner calculated the recommended reassessment interval by taking 45% of the shortest predicted remaining life, corresponding to a safety factor of 2.22 (1/0.45) as specified in the ORAPM and per the LMP.

The material-parameter constants used in Paris' law affect the crack growth calculated in response to a given pressure cycle. The constants are commonly referred to as the "crack-growth rate" parameters. These parameters are constants that depend on the nature of the material and the environment in which the crack exists. In the absence of empirical data for the particular crack-growth environment of the Longhorn Pipeline, values for the constants have

[8] Baker, Michael Jr. "OPS TTO5 – Low Frequency ERW and Lap Welded Longitudinal Seam Evaluation," Department of Transportation, April 2004.
[9] Paris, P. C. and Erdogan, F., *"A Critical Analysis of Crack Propagation Laws"*, Transactions of the ASME, Journal of Basic Engineering, Series D, Vol. 85, No. 5, pp 405-09.
[10] Newman, J.C. and Raju, I.S., "An Empirical Stress-Intensity Factor Equation for the Surface Crack", Engineering Fracture Mechanics, Vol 15, No 1-2, pp. 185-192, 1981.

been established through large numbers of laboratory tests published in the Fitness-For-Service API Standard 579-1/ASME FFS-1.[11]

Table 4 shows line segment locations with a predicted reassessment date before 2030. Kiefner applied a safety factor of 2.22 to the calculated time to failure for each UCD ILI and threshold flaw to determine a reassessment interval.

The earliest reassessment due date for the refined product segments was 9/27/2093, indicating that cyclic fatigue is an unlikely failure mode for these segments. Kiefner used the API 5L manufacturing inspection thresholds since Magellan has not run a UCD ILI tool on the refined product segments.

For the Existing Pipeline crude oil segments, Crane to Texon had the earliest reassessment due date of 4/5/2027. Kiefner conducted all crude oil analyses using UCD ILI data except for East Houston to 9th Street Jct, which used the API 5L manufacturing inspection thresholds since Magellan has not run a UCD ILI tool on East Houston to 9th Street Jct.

The results for the crude pipeline segment remained relatively consistent with the 2021 assessment performed by Kiefner, suggesting that pressure cycling for this pipeline has not changed significantly since the 2021 Kiefner assessment. Table 5 compares the current 2022 fatigue assessment results with previous assessments.

Table 4. Reassessment Due Date Before 2030

Pipeline Segment	OD (inch)	WT (inch)	Yield Stress (psi)	Defect Location (feet)	Elevation (feet)	Re-assessment Interval (years)	Re-assessment Due Date	ILI Date
Crane to Texon	18	0.246	52,000	24015+71	2,539	8.5	04/05/2027	10/19/2018
Crane to Texon	18	0.285	65,000	24080+38	2,540	8.5	04/09/2027	10/19/2018
Cartman to Kimble	18	0.266	45,000	18086+30	2,433	7.0	08/28/2027	08/25/2020
Crane to Texon	18	0.246	52,000	23603+80	2,678	9.5	04/09/2028	10/19/2018
Crane to Texon	18	0.256	52,000	24040+22	2,531	10.5	05/02/2029	10/19/2018
Crane to Texon	18	0.256	52,000	22496+50	2,697	11.0	10/01/2029	10/19/2018
Crane to Texon	18	0.246	52,000	22041+83	2,663	11.1	11/20/2029	10/19/2018

[11] API RP 579-1/ASME FFS-1, Fitness-For-Service, Third Edition, 6/1/2016

Table 5. Comparison of Reassessment Dates from Past ORAs

Segment	2017 Report	2018 Report	2019 Report	2020 Report	2021 Report	2022 Report
East Houston to 9th Street	7/11/2174	3/15/2195	3/23/2170	8/4/2173	2/10/2033	11/27/2128
Satsuma to East Houston	4/1/2035	9/7/2034	4/3/2084*	3/3/2045*	3/29/2046*	4/07/2048*
Buckhorn to Satsuma	3/1/2034	10/17/2034	5/5/2034	11/27/2046*	8/9/2047*	8/05/2048*
Warda to Buckhorn	11/23/2027	9/19/2030	3/6/2030	3/22/2039*	1/10/2041*	6/04/2043*
Bastrop to Warda	4/5/2024	10/6/2024	8/9/2024	8/10/2035*	5/12/2054*	2/02/2036*
Cedar Valley to Bastrop	2/9/2040	3/8/2044	8/8/2043	6/11/2053*	7/14/2054*	12/22/2052*
Eckert to Cedar Valley	8/9/2034	10/7/2032	9/12/2031	4/4/2042*	9/17/2044*	2/18/2047*
James River to Eckert	6/27/2025	3/28/2025	4/30/2025	2/20/2043*	8/16/2042*	5/07/2043*
Kimble to James River	8/28/2030	9/6/2027	10/28/2027	1/16/2028	10/23/2047*	2/11/2047*
Cartman to Kimble	10/20/2023	5/20/2024	7/4/2024	11/13/2040*	2/21/2041*	8/28/2027*
Barnhart to Cartman	4/22/2045	12/1/2036	10/22/2037	1/31/2039*	9/27/2038*	11/13/2038*
Texon to Barnhart	12/11/2022	12/25/2022	12/28/2022	6/24/2037*	6/27/2040*	8/13/2030*
Crane to Texon	10/14/2027	1/28/2023	8/7/2025*	6/29/2024*	12/21/2026*	4/05/2027*
Crane to El Paso	3/22/2109	1/4/2498	1/4/2498	3/25/2233	3/25/2233	3/25/2233
Odessa to Crane	N/A	N/A	N/A	N/A	4/08/2084	9/27/2093

*Based on as-called ILI indication sizes with tool tolerance added.

2.2 In-Line Inspection and Rehabilitation Program

Magellan is committed to performing ILI assessments on the Longhorn pipeline system. In 2022, three pipeline segments were assessed using MFL and electronic geometry pigs (EGP) technology, and one pipeline segment was addressed using EGP. Refer to Table 2 for a list of assessments performed in 2022 by pipeline segment. Magellan performed 38 ILI anomaly investigations in 2022. Kiefner's review of the in-line inspection and rehabilitation program included the following: performing a run-to-run comparison corrosion growth assessment, reviewing reported crack-like features, reviewing maintenance reports and in-ditch evaluations, reviewing reported ID reductions, and comparing ID reductions to laminations for hydrogen blisters.

2.2.1 Run-to-Run Comparison Corrosion Growth Assessment

Kiefner reviewed the current ILI assessments with an understanding of the background and approach for API 1163 ILI verification. API 1163 Second Edition, April 2013, describes methods in Sections 7 and 8 that can be applied to verify that the ILI tool was performing as expected and that reported inspection results are within the performance specification for the inspected pipeline. For further background and approach on API 1163 Section Edition, April 2013, refer to Appendix E – Approach to API 1163 Verification.

Process verification and quality control were reviewed for each 2022 assessment in Table 2. The general results for all of the reviewed 2022 MFL and EGP assessments were that the functionality of the inspection tools was determined to be within normal standard operating conditions, and the locating of reference points by the ILI tools was determined to be consistent over the entirety of the ILI assessments.

The threat of corrosion can be monitored using ILI assessments, which pipeline operators commonly use to identify and evaluate corrosion-caused metal loss and plan remediation. This

typically involves running an ILI tool to identify and size corrosion features, followed by remediation of features that exceed a depth or a pressure failure threshold. This method is a valid approach for addressing line pipe corrosion. ILI assessments completed in 2022 are listed in Table 2. An overall ILI re-assessment schedule can be found in Section 4, Table 34 for the crude system, and Table 35 for the refined system. The next crude system assessment for corrosion is in 2023 for the Crane to Texon segment. The next refined system assessment for corrosion is in 2023 for the following segments: Crane to Cottonwood and the 8" El Paso to Strauss.

A run-to-run comparison was performed to determine corrosion growth rates (CGRs) on the Cottonwood to El Paso segment utilizing the ILI assessment received in 2022 and the 2017 Cottonwood to El Paso assessment. No pipe replacements were noted between the two assessments. The matched results from the run-to-run comparison are shown in Table 6. The comparison indicated 65 external/internal ML feature mismatches between the 2022 and 2017 assessments. CGRs were calculated for the Cottonwood to El Paso segment and are shown in Table 7. There were not enough data pairs to support CGR calculations for internal ML mill anomaly features. Data correlations were done using Kiefner's CorroSure software.

Table 6. Run-to-Run Comparison Results

Segment	Matched Features		Total Matched Features	Maximum Available Matches	% Matched Features
	Corrosion	Manufacturing			
Cottonwood to El Paso	5,621	23	5,644	12,657	44.6

Table 7. Corrosion Growth Rate Results

Segment	Upper Bound CGR (mpy)			
	EXT ML	INT ML	EXT/INT ML Mismatches	INT ML Mill Anomalies
Cottonwood to El Paso	6.28	7.36	5.41	N/A

CGR calculations were not performed on the 8" El Paso to Chevron and the 8" Kinder Morgan Flush Line segments due to not enough data pairs to support the calculations. External corrosion growth along a pipeline should be expected to have the potential for variability along the length of the pipeline due to differences in cathodic protection, coating conditions, pipe age, and environment. Internal corrosion growth should also be expected to potentially vary along the length of the pipeline due to elevation changes, potential liquid along the inside of the pipeline, and pipe age. A histogram of ML frequency (occurrences or count) along the linear distance of the pipeline can indicate where ML features are more likely. Figure 5 provides an ML frequency histogram for the Cottonwood to El Paso segment.

- Figure 5 shows histograms for the Cottonwood to El Paso segment's external and internal ML features. Both assessments (2017 and 2022) had a 10% WT depth threshold and used a 6t x 6t interaction rule. The 2017 assessment shows more features than the 2022 assessment. All reported ML features from both assessments had reported depth ≤39% WT. Figure 6 shows a histogram comparing internal ML features >15% WT for both assessments. This comparison shows that the current assessment has a higher feature count of internal ML features >15% WT than the 2017 assessment. One possible

reason for the reported difference in internal metal loss features is due to two different tool technologies being used for the assessments. The 2017 assessment used TDW's MFL tool while the 2022 assessment used TDW's gas magnetic flux leakage (GMFL) tool. Another possible reason for the difference in internal metal loss features reported between the 2017 and 2022 ILI assessments is that features are reported longer in the 2022 assessment, see Figure 7. The longer features from the 2022 assessment could comprise multiple features reported from the 2017 assessment; see Figure 8 - an example screenshot from Kiefner's CorroSure software. The 2017 ILI assessment reported 638 internal ML features with lengths ≥ 5 inches, while the 2022 ILI assessment reported 1076 features.

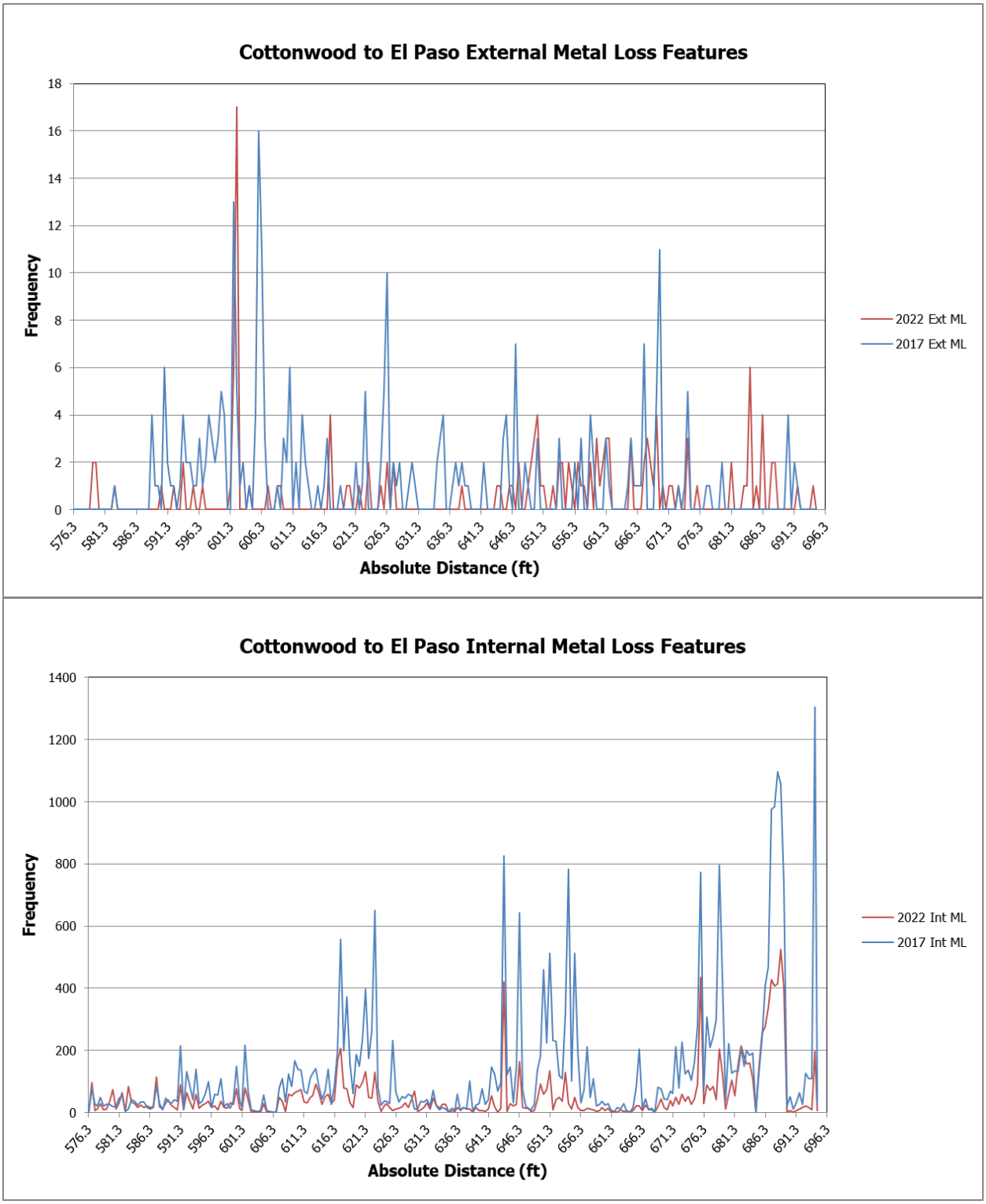

Figure 5. Cottonwood to El Paso ML Frequency by Linear Distance Along the Pipeline (2017 MFL vs 2022 MFL)

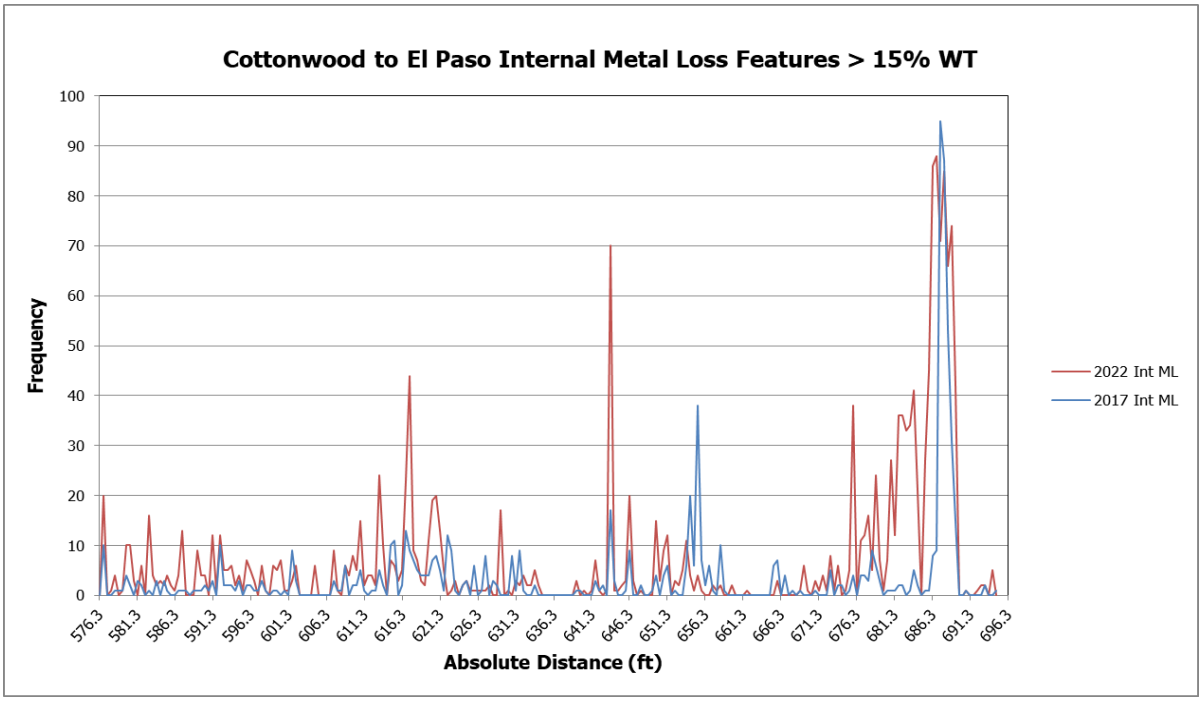

Figure 6. Cottonwood to El Paso Internal ML > 15% WT Frequency by Linear Distance Along the Pipeline (2017 MFL vs 2022 MFL)

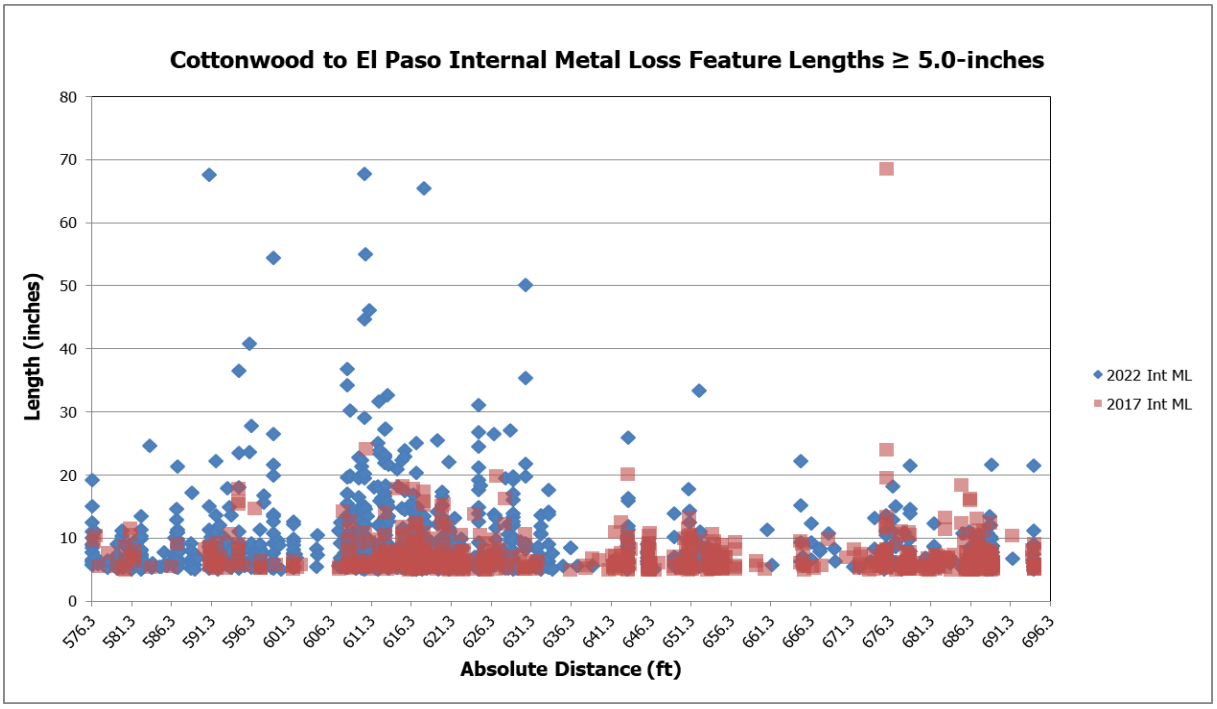

Figure 7. Cottonwood to El Paso Internal ML Length ≥ 5.0 inches by Linear Distance Along the Pipeline (2017 MFL vs 2022 MFL)

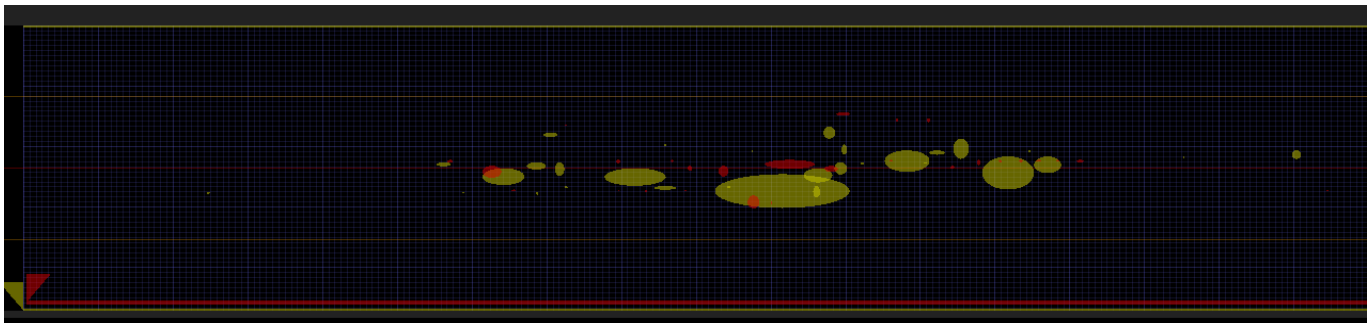

Figure 8. Screenshot from Kiefner's CorroSure Software
Cottonwood to El Paso GW 102250 – 2017 ILI Data (Red) and 2022 ILI Data (Yellow)

2.2.2 Maintenance Reports and In-Ditch Evaluations

In 2022, Magellan performed 38 in-ditch ILI assessments corresponding to ILI assessments (2020 MFL/UCD and 2021 MFL/EGP). Anomaly investigations included nondestructive evaluation (NDE) reports with detailed investigation results. Table 8 provides a breakdown, per pipeline segment, of where the in-ditch assessments occurred (HCA, segment, and tier). The total number of ILI anomalies addressed per pipeline segment in 2022 is listed in Table 9; the total number includes the targeted ILI anomalies and any anomaly found in the repair area for that associated dig.

The 2012 Environmental Assessment requires PMI[12] tests to be completed at 50% of the ILI anomaly investigation locations that do not have material documentation. In 2022, Magellan performed 38 ILI anomaly investigations, and 37 sites met the PMI requirement. Magellan performed PMI testing at 19 of the 37 anomaly investigation locations (51%), satisfying PMI requirements. Since the start of PMI testing in 2014, Magellan has performed PMI testing at 394 dig locations. Table 10 gives an overview of PMI testing from the initiation of the PMI testing.

An additional assessment of the PMI data was done to review what segments remain to be addressed based on the requirements provided in 49 CFR 192.607. For sampling multiple pipe segments, excavations should be performed until completion of the lesser of either "one excavation per mile rounded up to the nearest whole number" or "150 excavations if the population is more than 150 miles." Magellan provided linefill data that was sorted according to the manufacturer to evaluate where digs have occurred relative to the potentially unknown pipe properties. For this assessment, the total remaining unknown pipe mileage was calculated, regardless of previous evaluations for the sampling process. The total mileage requiring PMI was then calculated, eliminating any segments with digs performed post-2014 when the PMI program began. This incorporates the sampling that has already been performed for that particular span. The maximum span length of the unknown segment was then evaluated to determine where any gaps may lie that would need to be addressed. Finally, each distinct span was evaluated for how many total spans are present on the line that need to be addressed, giving us a value of the individual spans per line segment that still require PMI testing. The final amount of digs may be higher depending on how long the span is, i.e., a 5-mile span would require 5 PMI tests in succession. The final summary is shown in Table 11.

[12] 2012 Longhorn Pipeline Reversal EA (Reference [6]).

Table 8. ILI Anomaly Investigation Digs per Maintenance Reports Completed in 2022

	18″ Cottonwood to El Paso	18″ Crane to Cottonwood	18″ Crane to Texon	18″ Texon to Barnhart	18″ Barnhart to Cartman	18″ Cartman to Kimble	18″ Kimble to James River	18″ James River to Eckert	18″ Eckert to Cedar Valley	18″ Cedar Valley to Bastrop	18″ Bastrop to Warda	18″ Warda to Buckhorn	18″ Buckhorn to Satsuma	20″ Satsuma to E. Houston	20″ E. Houston to Speed Jct	8″ El Paso to Chevron	8″ Kinder Morgan Flush Line	8″ El Paso to Kinder Morgan	12″ El Paso to Kinder Morgan	8″ Crane to Odessa
ILI Date				5/15/20	6/16/20	12/31/20	12/31/20					2/15/22*								9/8/21
Regraded ILI Report				1/17/22	1/24/22	1/31/22	2/7/2022													
Maintenance Report	No	No	No	Yes	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No	No	No	No	Yes
Tier I	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Tier II	0	0	0	26	3	2	6	0	0	0	0	0	0	0	0	0	0	0	0	0
Tier III	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Digs	0	0	0	26	3	2	6	0	0	0	0	0	0	0	0	0	0	0	0	1
HCA	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
Non-HCA	0	0	0	26	3	2	3	0	0	0	0	0	0	0	0	0	0	0	0	1

*Only performed an EGP assessment in 2022.

Table 9. Reported ILI Anomalies Excavated per 2022 ILI Anomaly Investigation Reports

ILI Anomaly Called	Number of Anomalies Addressed	18″ Cottonwood to El Paso	18″ Crane to Cottonwood	18″ Crane to Texon	18″ Texon to Barnhart	18″ Barnhart to Cartman	18″ Cartman to Kimble	18″ Kimble to James River	18″ James River to Eckert	18″ Eckert to Cedar Valley	18″ Cedar Valley to Bastrop	18″ Bastrop to Warda	18″ Warda to Buckhorn	18″ Buckhorn to Satsuma	20″ Satsuma to E. Houston	20″ E. Houston to Speed Jct	8″ El Paso to Chevron	12″ El Paso to Kinder Morgan	8″ Crane to Odessa
External ML	**2**	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Internal ML	**1**	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Internal ML at Girth Weld	**2**	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
Mill Anomaly w/ML	**2**	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crack-like feature at Seam Weld	**41**	0	0	0	32	3	2	4	0	0	0	0	0	0	0	0	0	0	0
Crack-like feature at Girth Weld	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crack-like feature at Seam & Girth Weld	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crack Colony	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ID Reduction	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ID Reduction with associated ML	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ID Reduction on Weld	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ID Reduction L<1.5D	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ID Reduction L>1.5D	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Geometric Anomaly	**1**	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Geometric Anomaly Affecting Seam Weld	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Geometric Anomaly Affecting Girth Weld	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Geometric Anomaly associated w/Mill Anomaly	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Geometric Anomaly associated w/ML	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Geometric Anomaly associated w/ML affecting Seam Weld	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Girth Weld Anomaly	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lack of Fusion External	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lack of Fusion Mid-wall	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lack of Fusion Internal	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lamination	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lamination – Variable Depth	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lamination Intermittent	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Lamination Intermittent associated w/ML	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Seam Weld Anomaly	**0**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	**49**	**0**	**0**	**0**	**35**	**3**	**3**	**7**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**1**

Table 10. Positive Material Identification Testing Activity

	Pipeline Segment	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
Refined System*	8″ El Paso to Chevron	0	0	0	0	0	0	0	0	0	0
	8″ Crane to Odessa	0	0	0	0	0	0	0	0	0	0
	12″ El Paso to Kinder Morgan	0	0	0	0	0	0	0	0	0	0
	18″ Cottonwood to El Paso	0	0	0	0	0	0	0	0	0	0
	18″ Crane to Cottonwood	0	0	0	0	0	0	0	0	0	0
Crude System	18″ Crane to Texon	0	1	7	0	4	15	0	4	0	31
	18″ Texon to Barnhart	0	0	8	3	0	0	2	18	13	44
	18″ Barnhart to Cartman	0	0	11	0	0	0	0	14	2	27
	18″ Cartman to Kimble	0	0	12	0	0	0	0	21	1	34
	18″ Kimble to James River	0	0	5	0	0	0	0	9	3	17
	18″ James River to Eckert	0	1	3	0	0	0	0	24	0	28
	18″ Eckert to Cedar Valley	1	0	6	7	0	0	15	6	0	35
	18″ Cedar Valley to Bastrop	0	0	20	6	0	0	35	7	0	68
	18″ Bastrop to Warda	0	1	3	4	0	0	34	6	0	48
	18″ Warda to Buckhorn	0	2	0	14	0	0	18	0	0	34
	18″ Buckhorn to Satsuma	0	0	0	8	0	0	8	0	0	16
	20″ Satsuma to E. Houston	0	4	0	0	0	3	4	1	0	12
	20″ E. Houston to 9th Street Junction*	0	0	0	0	0	0	0	0	0	0
Total PMI Tests Performed		**1**	**9**	**75**	**42**	**4**	**18**	**116**	**110**	**19**	**394**
Segments without available Material Documentation		**2**	**18**	**141**	**64**	**7**	**31**	**232**	**195**	**37**	**727**
Percentage Addressed (Requirement of 50%)		**50%**	**50%**	**53%**	**65%**	**57%**	**58%**	**50%**	**56%**	**51%**	**54%**

*The Refined System and the 20″ East Houston to 9th Street Junction segments do not require PMI testing per the EA.

Table 11. Summary of PMI Status Based on Linefill Data

	Total Unknown Pipe Mileage (mi)	Mileage Requiring PMI (mi)	Max Span of Unknown Segment (mi)	Distinct Spans Requiring PMI
Crane to Texon	39.0	16.1	3.0	14
Texon to Barnhart	42.2	22.6	5.6	10
Barnhart to Cartman	25.9	13.9	3.0	7
Cartman to Kimble	48.8	26.8	3.6	18
Kimble to James River	33.8	21.5	3.9	11
James River to Eckert	31.6	7.5	1.9	11
Eckert to Cedar Valley	67.4	7.4	2.4	8
Cedar Valley to Bastrop	26.5	2.7	2.5	3
Bastrop to Warda	40.2	5.3	1.5	7
Warda to Buckhorn	44.1	21.7	4.0	13
Buckhorn to Satsuma	31.2	10.9	5.1	9
Satsuma to East Houston	23.8	3.2	2.1	5

The 2020 MFL and UCD assessments correlated with the 2022 dig results for the following segments: Texon to Barnhart, Barnhart to Cartman, Cartman to Kimble, and Kimble to James River. The Odessa to Crane segment correlated to the 2021 MFL/EGP assessment. Dig results were provided through in-ditch ILI anomaly investigation maintenance and NDE reports. The ILI anomaly investigation digs resulted in five individually correlated metal loss features, one individually correlated ID reduction feature, and 41 individually correlated crack-like features. Table 12 shows the ILI anomaly investigation data correlations for metal loss and ID reduction features. Statistical analysis was not performed on the pipeline segments (Odessa to Crane, Texon to Barnhart, Cartman to Kimble, and Kimble to James River) as they all had less than five data pairs.

Table 12. 2022 ILI Field Investigation Correlations

Pipeline Segment	EXT ML to Gouge	INT ML (GW) to Lack of Penetration	INT ML (GW) to Undercut on GW	Internal Mill Anomaly to Internal Mill Defect	Internal Mill Anomaly to No Anomaly Found	Geometric Anomaly to Geometric Anomaly	Total Data Correlations
8-in El Paso to Chevron	0	0	0	0	0	0	**0**
8-in Odessa to Crane	1	0	0	0	0	0	**1**
12-in El Paso to Kinder Morgan	0	0	0	0	0	0	**0**
18-in Cottonwood to El Paso	0	0	0	0	0	0	**0**
18-in Crane to Cottonwood	0	0	0	0	0	0	**0**
18-in Crane to Texon	0	0	0	0	0	0	**0**
18-in Texon to Barnhart	0	0	0	1	1	0	**2**
18-in Barnhart to Cartman	0	0	0	0	0	0	**0**
18-in Cartman to Kimble	0	0	0	0	0	1	**1**
18-in Kimble to James River	0	1	1	0	0	0	**2**
18-in James River to Eckert	0	0	0	0	0	0	**0**
18-in Eckert to Cedar Valley	0	0	0	0	0	0	**0**
18-in Cedar Valley to Bastrop	0	0	0	0	0	0	**0**
18-in Bastrop to Warda	0	0	0	0	0	0	**0**
18-in Warda to Buckhorn	0	0	0	0	0	0	**0**
18-in Buckhorn to Satsuma	0	0	0	0	0	0	**0**
18-in Satsuma to E. Houston	0	0	0	0	0	0	**0**
18-in E. Houston to Speed Jct	0	0	0	0	0	0	**0**
Total	**1**	**1**	**1**	**1**	**1**	**1**	**6**

Based on the ILI vendor's review of NDE findings, the 2020 UCD data was regraded and revised reports were received in January and February 2022. Crack analyses on the regraded data resulted in 35 ILI anomaly investigations which targeted crack-like features reported from the 2020 UCD regraded assessments on the four pipeline segments between Texon and James River. Table 13 shows the results for the UCD-reported crack-like features.

Magellan targeted 41 crack-like features in 2022 on four pipeline segments, Table 13. Targeted crack-like features were found in-ditch as cracks 27 times. One pipeline segment, Texon to

Barnhart, targeted five or more reported crack-like features. Reported crack-like features investigated in-ditch on this segment were found as cracks 59.4% of the time (19 cracks out of 32 reported crack-like features). The 13 other crack-like features on the Texon to Barnhart segment were all found in-ditch as lack of fusion (LOF) indications.

Table 13. In-Ditch Dig Results for ILI Reported Crack-Like Features

Pipeline Segment	ILI Reported Crack-Like Features	In-Ditch Field Results			Percentages (%)	
		Crack	LOF	No Anomaly Found	Crack-like to Crack	Crack-like to LOF
Texon to Barnhart	32	19	13	-	59.4	40.6
Barnhart to Cartman	3	2	-	1	66.7	-
Cartman to Kimble	2	2	-	-	100	-
Kimble to James River	4	4	-	-	100	-
Total	**41**	**27**	**13**	**1**	**65.9**	**31.7**

2.2.3 ID Reductions

Magellan runs EGPs to assess TPD's threat and monitor for possible hydrogen blistering. The ORA classifies ID reductions as deformation of pipe diameter detected by the ILI tool; ID reductions ≥ 2.0% of the pipe diameter are classified as dents, and ID reductions < 2.0% are classified as GMAs.

The 2022 EGP assessments reported 67 ID reductions (ten dents and 57 GMAs) with depths ranging from 1.0% to 3.3% OD. As noted in the ILI pipeline listings, four ID reductions (all four reported as GMAs) have been previously repaired. Ten dents and 53 GMAs constitute the remaining 63 ID reductions. The ILI assessments reported one dent associated with metal loss in a non-HCA on the Cottonwood to El Paso segment. The ILI assessments reported no dents or GMAs associated with seam welds.

Three ID reductions are reported in an HCA; Table 14 provides a breakdown of the ID reductions reported in an HCA. The largest reported unmitigated ID reduction depth per pipeline segment is noted in Table 14. The Cottonwood to El Paso segment did not have ID reductions reported in an HCA. The remaining unmitigated ID reductions do not meet regulatory repair criteria (equal to or greater than 2% OD and interact with a long seam or girth weld).

Table 14. ID Reductions Reported within HCAs [13]

Segment	Quantity	Quantity Noted as Repaired	Peak Depth (% OD)	Comment
Warda to Buckhorn	1	0	1.0	• 1 GMA
8" El Paso to Chevron	1	0	1.0	• 1 GMA
8" Kinder Morgan Flush Line	1	0	1.0	• 1 GMA
Total	**3**	**0**		

[13] ID reductions are classified as either dents or geometric anomalies. A dent is an ID reduction greater than or equal to 2% OD and a geometric anomaly is an ID reduction less than 2% OD.

2.2.4 Laminations and Hydrogen Blisters

Continued monitoring of the lamination anomalies for the possibility of blister growth with ILI tools was recommended per the Longhorn Pipeline Reversal EA, Section 6.2.1.2. Laminations can occur due to oxides or other impurities trapped in the material. As the material cools in manufacturing, a small pocket may form internally in the steel plate or billet. A lamination can eventually lead to failure when it is oriented such that it eventually grows to the inner or outer wall of the pipe or pipeline component through pressure cycles. Laminations parallel to the pipe wall surface generally do not pose an integrity concern unless a blister is formed. Crude oil may contain hydrogen sulfide, which can lead to the formation of hydrogen through anaerobic internal corrosion. Laminations in the pipe wall can trap hydrogen from the corrosion reaction and generate blisters. Elevated cathodic protection (CP) can also lead to hydrogen migration and blistering. Managing internal corrosion and monitoring CP levels could help mitigate these threats.

Kiefner correlated ID reductions identified from the 2022 EGP assessment on the Warda to Buckhorn segment with laminations reported from the 2009 UT assessment. One dent and four GMAs reported from the 2022 Warda to Buckhorn assessment were present on the same joint with lamination(s) reported from the 2009 UT assessment (see Table 15). The dent and GMAs did not correlate directly to the 2009 UT assessment laminations.

Table 15. ID Reductions Correlating with Laminations[14]

Segment	Quantity			Peak Depth (% OD)	List of Joints from 2022 Assessment	Comment
	Joint(s)	Dent(s)	GMA(s)			
Warda to Buckhorn	5	1	4	1.2~	3120*, 9820*, 12070*, 17990~, and 19990*	• 2022 Joint 3120 has one reported GMA; the 2009 UT assessment reported four ` Laminations,' three 'Intermittent Laminations,' and two 'Lamination Bulging' on the associated joint. • 2022 Joint 9820 has one reported GMA; the 2009 UT assessment reported one 'Intermittent Lamination. • 2022 Joint 12070 has one reported GMA; the 2009 UT assessment reported one 'Intermittent Lamination' and one Geometric Anomaly on Weld on the associated joint. • 2022 Joint 17990 has one reported GMA; the 2009 UT assessment reported two 'Intermittent Laminations' on the associated joint. • 2022 Joint 19990 has one reported Dent; the 2009 UT assessment reported one 'Intermittent Lamination' on the associated joint.
Total	**5**	**1**	**4**			

*Feature has been repaired or addressed.
~Largest unmitigated GMA.

A review of the 2022 maintenance reports showed that no digs were scheduled as an ILI anomaly investigation due to a reported lamination. No laminations were found during in-ditch

[14] Features may not be directly correlating (i.e., overlapping area), but were identified in this table if reported on the same joint.

assessments in 2022. Monitoring reported laminations for ID reductions might indicate the initiation of a hydrogen blister. Per the Longhorn EA Section 9.3.2.3, the monitoring frequency recommended should coincide with the EGP tool assessment schedule. EGP assessments are required for the Existing Pipe every three years, according to the LMP. The next EGP assessments for the crude system are in 2023 for the eight segments between Texon to Warda and the Buckhorn to Satsuma segment; see Table 34.

2.3 Corrosion Management Plan

The LMP entails an extensive Corrosion Management Plan (CMP) to control the extent of corrosion. The 2022 CMP considered the following items: Probability of Exceedance (POE), review of internal corrosion coupons, review of field digs reports (covered under Section 2.2.2 Maintenance Reports and In-Ditch Evaluations), review of CP system for buried pipelines, review of atmospheric inspection for above grade appurtenances, and review of tank inspections.

2.3.1 Probability of Exceedance Analysis

POE calculations were only performed on the Cottonwood to El Paso segment assessed by MFL in 2022. The POE calculations incorporated the ILI tool specifications (TDW MFL) and utilized a CGR of 5 mpy for external ML and 1 mpy for internal ML over a 5-year range. Two metal loss features had a calculated POE value exceeding $10E^{-7}$, see Table 16

Table 16. Metal Loss with a POE Value Greater than $10E^{-7}$

Pipeline Segment	Absolute Distance (feet)	Predicted Depth (% WT)	Predicted Length (inch)	POE	POE Type
Cottonwood to El Paso	278250.5	23	17.00	1.72E-06	Pressure
Cottonwood to El Paso	119915.0	19	54.48	1.11E-06	Pressure

2.3.2 Internal Corrosion Coupons

Magellan monitors internal corrosion using internal corrosion coupons placed at six locations along the Longhorn Crude Lines and six locations along the Longhorn Refined Lines. The inserted and removed dates of coupons fell between 12/3/2021 to 1/3/2023. The Longhorn system's coupon testing days were from 93 to 170 days. Magellan achieved three evaluation times in 2022 for all crude and refined line locations. One coupon from the 8-inch Odessa to Crane segment was lost in the line. The coupon testing results for the remaining coupons observed corrosion rates ranging from no corrosion to the maximum of 0.13 mpy on the internal corrosion coupons for the Longhorn system. Monitoring should continue to identify future potential changes in the pipelines. Table 17 and Table 18 list internal corrosion coupon results for the crude and refined line, respectively.

Table 17. Internal Corrosion Coupon Results for Crude Line

Pipe OD (inch)	Location	Line Designation (Line ID)	Coupon Number	Inserted	Removed	Exposure (days)	Rate (mpy)
20	Speed Jct	Speed Jct Manifold from E Houston (6643)	AB3046	12/7/2021	4/13/2022	127	0.05
20	Speed Jct	Speed Jct Manifold from E Houston (6643)	AB5222	4/13/2022	Lost in the mail.		
20	Speed Jct	Speed Jct Manifold from E Houston (6643)	AB5248	8/15/2022	12/9/2022	116	0.04
20	E. Houston	East Houston ML (6645)	Y8772	12/15/2021	4/19/2022	125	0.06
20	E. Houston	East Houston ML (6645)	N3916	4/19/2022	8/9/2022	112	0.06
20	E. Houston	East Houston ML (6645)	N3929	8/9/2022	12/14/2022	127	0.03
18	Austin	18" Satsuma Station (6645)	AB3049	12/10/2021	4/15/2022	126	0.07
18	Austin	18" Satsuma Station (6645)	AB5219	4/15/2022	8/15/2022	122	0.02
18	Austin	18" Satsuma Station (6645)	AB5245	8/15/2022	12/14/2022	121	0.03
18	Austin	18" Cedar Valley Station (6645)	AB3048	12/3/2021	4/15/2022	133	0.04
18	Austin	18" Cedar Valley Station (6645)	AB5220	4/15/2022	8/8/2022	115	0.05
18	Austin	18" Cedar Valley Station (6645)	AB5246	8/8/2022	12/15/2022	129	0.13
18	Austin	18" Cartman Station (6645)	AB3047	12/9/2021	4/6/2022	118	0.08
18	Austin	18" Cartman Station (6645)	AB5221	4/6/2022	9/15/2022	162	0.04
18	Austin	18" Cartman Station (6645)	AB5247	9/15/2022	12/22/2022	98	0.00
24	Crane	24" Tank Manifold	Y8769	12/9/2021	3/23/2022	104	0.07
24	Crane	24" Tank Manifold	N3913	3/23/2022	9/9/2022	170	0.04
24	Crane	24" Tank Manifold	N3922	9/9/2022	12/15/2022	97	0.03

Table 18. Internal Corrosion Coupon Results for Refined Line

Pipe OD (inch)	Location	Line Designation (Line ID)	Coupon Number	Inserted	Removed	Exposure (days)	Rate (mpy)
12	El Paso	KM 12" (6651)	AB3043	12/15/2021	3/29/2022	104	0.01
12	El Paso	KM 12" (6651)	AB5097	3/29/2022	8/15/2022	139	0.00
12	El Paso	KM 12" (6651)	AB5251	8/15/2022	1/3/2023	141	0.00
8	El Paso	KM 8" flush (6652)	AB3044	12/15/2021	3/29/2022	104	0.03
8	El Paso	KM 8" flush (6652)	AB5224	3/29/2022	8/15/2022	139	0.00
8	El Paso	KM 8" flush (6652)	AB5250	8/15/2022	1/3/2023	141	0.00
8	El Paso	Strauss 8" (6653)	AB3050	12/15/2021	3/29/2022	104	0.04
8	El Paso	Strauss 8" (6653)	AB5218	3/29/2022	8/15/2022	139	0.00
8	El Paso	Strauss 8" (6653)	AB5244	8/15/2022	1/3/2023	141	0.05
8	Crane	8" Odessa to Crane (6648)	Y8770	1/9/2022	4/12/2022	93	0.04
8	Crane	8" Odessa to Crane (6648)	N3914	4/12/2022	Lost in line.		
8	Crane	8" Odessa to Crane (6648)	N3931	9/9/2022	12/15/2022	97	0.05
18	El Paso	18" ML (6645)	N0018	12/15/2021	3/29/2022	104	0.03
18	El Paso	18" ML (6645)	N0017	3/29/2022	8/15/2022	139	0.00
18	El Paso	18" ML (6645)	N0009	8/15/2022	12/20/2022	127	0.00
8	El Paso	Plains-8" (6650)	N0019	12/15/2021	3/29/2022	104	0.05
8	El Paso	Plains-8" (6650)	N0012	3/29/2022	8/15/2022	139	0.07
8	El Paso	Plains-8" (6650)	N0008	8/15/2022	12/20/2022	127	0.03

2.3.3 Cathodic Protection System

The rectifier surveys, test point surveys, and CIS were reviewed to evaluate the effectiveness of the current CP systems for the Longhorn pipeline system. The rectifiers were inspected in 2022, including the inspection date, as-found voltage and current, and as-left voltage and current, referring to the "2023 LH CP Audit Report" and "6645 Longhorn Tier III Executive Summary - Actions." Test point surveys were conducted throughout the Longhorn system in 2022, referring to the "2023 LH CP Audit Report." A CIS was performed in April 2022 and received by Magellan in July 2022 for pipeline ROW 6645 tier 3 segment from Mile Post 11.593 to 276.832, referring to "6645 Longhorn Tier III Executive Summary - Actions." This CIS survey covers 124 test

stations, nine casings, 67 rectifiers, and one foreign line crossing. The CIS data were analyzed and summarized in Table 20. Semi-annual surveys are being conducted on Tier II and Tier III areas per LMP 32.

Based on the Longhorn CMP, corrosion control activities are governed by company policies and procedures and DOT Part 195 regulations and are consistent with NACE International RP01-69, ASME, and API recommended practices where applicable.

AMPP (Association for Materials Protection and Performance), formerly known as NACE International, has established criteria considered indicative of CP for metallic piping in AMPP Standard Practice SP0169-2013 – "Control of External Corrosion on Underground or Submerged Metallic Piping Systems." The Standard lists the following criteria:

- A minimum of 100 mV of cathodic polarization. The formation or the polarization's decay must be measured to satisfy this criterion.
- A structure-to-electrolyte potential of -850 mV or more negative, as measured with respect to a saturated copper/copper sulfate (CSE) reference electrode. This potential may be either a direct measurement of the polarized or current-applied potential. Interpreting a current-applied measurement requires considering the significance of voltage drops in the earth and metallic paths.

Table 19 summarizes the details of the CIS data where the pipe segments are either not meeting a minimum of 100 mV of cathodic polarization or the polarized potential of -850 mV. At the writing of this report, it has been reported to Kiefner that all areas on the CIS that did not meet a criteria during the 2022 CIS were cleared during the 2022 depolarization survey and the 2023 IR free CIS.

The 2022 CIS data also indicates that some pipe sections had the "instant off" readings slightly more electronegative than -1200 mV with respect to a CSE reference electrode, meaning the CP system may overprotect these pipe sections. Such areas are summarized in Table 20. Over-cathodic protection may deteriorate pipe coatings due to electrical osmosis and hydrogen reactions weakening the bonding between coating and pipe steel. The LMP states, "While no evidence exists that would indicate that excessive cathodic protection has caused damage to the external coating on the Longhorn Pipeline, the entire pipeline will be monitored for overprotection as well as under protection. As necessary, cathodic protection system adjustments will be made to remediate areas of concern. Overprotection will be monitored and minimized through the analysis of data from annual pipe-to-soil potential surveys, close-interval pipe-to-soil potential surveys, and pipeline visual inspections. A practical value of -1.2 V (polarized) in reference to copper/copper sulfate cell will be used as the value beyond which monitoring for overprotection shall be implemented."

Table 19. CIS Areas not Meeting Any Criteria (pg 1 of 2)

Exception #	Start ST	End ST	Total Feet	Start MP	End MP	Starting GPS		Ending GPS		P/S On	P/S Off	P/S Depol	Lowest Exception
						Latitude	Longitude	Latitude	Longitude				
#8 MP 179.003 - 179.846													
1	9490+29	9490+31	2	179.740	179.741	30.23841286	-97.99158478	30.23841286	-97.99158478	-2.078	-0.5	-0.406	0.094
2	9490+76	9490+76	3	179.749	179.749	30.23844147	-97.99173737	30.23844147	-97.99173737	-2.093	-0.506	-0.41	0.096
3	9490+83	9490+88	5	179.751	179.752	30.23844147	-97.99173737	30.23844147	-97.99173737	-2.103	-0.506	-0.41	0.096
4	9491+00	9491+04	4	179.754	179.755	30.23843765	-97.99178314	30.23843956	-97.99179077	-2.079	-0.506	-0.41	0.096
5	9491+09	9491+47	38	179.755	179.763	30.23844147	-97.99180603	30.23846817	-97.99195099	-2.074	-0.495	-0.409	0.086
6	9495+14	9495+14	3	179.832	179.832	30.23857689	-97.99320221	30.23857689	-97.99320221	-2.095	-0.487	-0.387	0.1
7	9495+58	9495+68	10	179.841	179.842	30.23859406	-97.99331665	30.23859978	-97.99336243	-2.093	-0.48	-0.388	0.092
8	9495+77	9495+79	2	179.844	179.845	30.23860550	-97.99338531	30.23860550	-97.99338531	-2.094	-0.48	-0.385	0.095
#9 MP 180.830 - 181.687													
1	9547+82	9550+04	222	180.830	180.872	30.23935890	-98.00966644	30.23944092	-98.01027679	-2.036	-0.427	-0.399	0.028
2	9550+15	9550+22	7	180.874	180.875	30.23944664	-98.01029968	30.23945045	-98.01032257	-2.036	-0.499	-0.403	0.096
3	9550+35	9550+38	3	180.878	180.878	30.23945236	-98.01036072	30.23945236	-98.01036072	-2.017	-0.457	-0.372	0.085
4	9550+75	9550+76	1	180.885	180.886	30.23946571	-98.01046753	30.23946953	-98.01047516	-1.957	-0.422	-0.337	0.085
5	9550+82	9554+04	322	180.887	180.948	30.23947334	-98.01048279	30.23960304	-98.01142120	-1.983	-0.388	-0.367	0.021
6	9554+10	9554+13	3	180.949	180.949	30.23960876	-98.01144409	30.23961258	-98.01145935	-1.899	-0.465	-0.366	0.099
7	9554+93	9557+36	243	180.965	181.011	30.23966217	-98.01174164	30.23978424	-98.01250458	-1.969	-0.421	-0.363	0.058
8	9557+43	9558+13	70	181.012	181.025	30.23978806	-98.01253510	30.23982239	-98.01276398	-2.034	-0.45	-0.384	0.066
9	9558+31	9559+07	76	181.029	181.043	30.23983383	-98.01284027	30.23986626	-98.01304626	-2.062	-0.411	-0.372	0.039
10	9559+18	9559+23	5	181.045	181.046	30.23987198	-98.01309204	30.23987579	-98.01310730	-2.052	-0.465	-0.371	0.094
11	9559+31	9560+69	138	181.048	181.074	30.23987961	-98.01313019	30.23994446	-98.01355743	-2.035	-0.409	-0.377	0.032
12	9560+85	9560+85	3	181.077	181.077	30.23995209	-98.01361847	30.23995209	-98.01361847	-2.097	-0.453	-0.356	0.097
13	9560+93	9561+92	99	181.078	181.097	30.23995399	-98.01363373	30.24000549	-98.01396942	-2.123	-0.415	-0.359	0.056
14	9562+17	9562+80	63	181.102	181.114	30.24001694	-98.01404572	30.24005508	-98.01420593	-2.127	-0.425	-0.357	0.068
15	9563+00	9563+99	99	181.117	181.136	30.24009132	-98.01433563	30.24014664	-98.01469421	-2.128	-0.408	-0.366	0.042
16	9564+04	9564+93	89	181.137	181.154	30.24015427	-98.01472473	30.24022102	-98.01502228	-2.117	-0.419	-0.358	0.061
17	9565+00	9565+13	13	181.155	181.158	30.24022484	-98.01503754	30.24023438	-98.01507568	-2.171	-0.436	-0.358	0.078
18	9565+56	9565+77	21	181.166	181.170	30.24026108	-98.01518250	30.24026871	-98.01525116	-2.139	-0.446	-0.361	0.085
19	9566+30	9567+72	142	181.180	181.207	30.24029350	-98.01540375	30.24037933	-98.01583862	-2.161	-0.4	-0.356	0.044
20	9567+79	9567+97	18	181.208	181.212	30.24038506	-98.01586914	30.24039650	-98.01589966	-2.074	-0.423	-0.355	0.068
21	9568+23	9568+48	25	181.216	181.221	30.24040985	-98.01596832	30.24042702	-98.01604462	-2.157	-0.442	-0.353	0.089
22	9568+59	9568+59	3	181.223	181.223	30.24044037	-98.01609039	30.24044037	-98.01609039	-2.157	-0.451	-0.363	0.088
23	9568+66	9569+61	95	181.225	181.243	30.24044228	-98.01610565	30.24050331	-98.01637268	-2.146	-0.398	-0.356	0.042
24	9569+70	9569+74	4	181.244	181.245	30.24051285	-98.01644135	30.24051285	-98.01644135	-2.16	-0.456	-0.365	0.091
25	9570+05	9570+50	45	181.251	181.259	30.24055481	-98.01657867	30.24055862	-98.01666260	-2.12	-0.413	-0.374	0.039
26	9570+57	9570+64	7	181.261	181.262	30.24056053	-98.01667023	30.24056816	-98.01668549	-2.175	-0.45	-0.353	0.097
27	9570+71	9570+75	4	181.263	181.264	30.24057388	-98.01672363	30.24057388	-98.01672363	-2.175	-0.45	-0.355	0.095
28	9570+78	9571+31	53	181.265	181.275	30.24056816	-98.01673889	30.24059486	-98.01688385	-2.18	-0.444	-0.358	0.086
29	9571+34	9571+36	2	181.275	181.276	30.24059677	-98.01689911	30.24059677	-98.01689911	-2.173	-0.457	-0.359	0.098
30	9572+14	9572+23	9	181.291	181.292	30.24064255	-98.01716614	30.24064255	-98.01716614	-2.17	-0.453	-0.357	0.096
31	9572+44	9572+57	13	181.296	181.299	30.24064827	-98.01718903	30.24064636	-98.01722717	-2.175	-0.416	-0.352	0.064
32	9572+71	9572+71	3	181.301	181.301	30.24066162	-98.01728058	30.24066162	-98.01728058	-2.159	-0.446	-0.347	0.099
33	9572+75	9572+95	20	181.302	181.306	30.24066162	-98.01728058	30.24067688	-98.01733398	-2.159	-0.446	-0.351	0.095
34	9573+25	9573+33	8	181.312	181.313	30.24069214	-98.01741028	30.24069786	-98.01744080	-2.096	-0.448	-0.352	0.096
35	9573+36	9573+69	33	181.314	181.320	30.24069977	-98.01744843	30.24071503	-98.01753235	-2.173	-0.438	-0.355	0.083
36	9574+55	9574+55	3	181.336	181.336	30.24076462	-98.01776886	30.24076462	-98.01776886	-2.159	-0.457	-0.363	0.094
37	9575+04	9575+24	20	181.345	181.349	30.24079704	-98.01789093	30.24081230	-98.01795959	-2.175	-0.424	-0.345	0.079

Tabe 19 (continued). CIS Areas not Meeting Any Criteria (pg 2 of 2)

#9 MP 180.830 - 181.687 (continued)													
Exception #	Start ST	End ST	Total Feet	Start MP	End MP	Starting GPS		Ending GPS		P/S On	P/S Off	P/S Depol	Lowest Exception
						Latitude	Longitude	Latitude	Longitude				
38	9578+32	9578+37	5	181.408	181.409	30.24098778	-98.01885223	30.24099350	-98.01886749	-2.185	-0.445	-0.348	0.097
39	9580+10	9580+34	24	181.441	181.446	30.24109459	-98.01936340	30.24110413	-98.01943970	-2.234	-0.391	-0.326	0.065
#10 MP 182.060 - 182.668													
1	9617+89	9645+89	2800	182.157	182.687	30.24346733	-98.03119659	30.24634743	-98.03893280	-1.742	-0.304	-0.365	-0.061
#31 MP 275.539 - 276.833													
1	14616+67	14616+75	8	276.831	276.832	30.62560463	-99.52731323	30.62562943	-99.52743530	-0.979	-0.777	-0.777	0

Table 20. 2022 CIS Areas Where Off Potentials are More Negative Than -1.250 V (pg 1 of 3)

#5 MP 34.189 - 38.328										
Exception #	Start ST	End ST	Total Feet	Start MP	End MP	Starting GPS		Ending GPS		Highest Exception
						Latitude	Longitude	Latitude	Longitude	
1	1881+03	1884+18	315	35.626	35.685	29.91490364	-95.64250946	29.91502190	-95.64338684	-1.307
2	1887+53	1889+67	214	35.749	35.789	29.91513634	-95.64431763	29.91523743	-95.64488983	-1.360
3	1889+86	1897+36	750	35.793	35.935	29.91524124	-95.64495850	29.91548157	-95.64696503	-1.516
4	1899+53	1910+87	1134	35.976	36.191	29.91556740	-95.64749908	29.91605568	-95.65110016	-1.422
5	1911+00	1911+74	74	36.193	36.207	29.91606712	-95.65116882	29.91607475	-95.65139771	-1.313
6	1912+84	1914+52	168	36.228	36.260	29.91613007	-95.65175629	29.91617966	-95.65213013	-1.311
7	1914+81	1915+06	25	36.265	36.270	29.91621590	-95.65244293	29.91622162	-95.65245056	-1.257
8	1915+28	1916+76	148	36.274	36.302	29.91624069	-95.65243530	29.91629410	-95.65287781	-1.276
9	1935+64	1935+70	6	36.660	36.661	29.91699600	-95.65838623	29.91699600	-95.65838623	-1.254
10	1936+17	1936+38	21	36.670	36.674	29.91701126	-95.65850830	29.91702461	-95.65856934	-1.271
11	1936+76	1937+13	37	36.681	36.688	29.91704941	-95.65884399	29.91705132	-95.65884399	-1.259
12	1938+29	1938+50	21	36.710	36.714	29.91710091	-95.65921783	29.91710854	-95.65926361	-1.253
13	1938+60	1938+97	37	36.716	36.723	29.91711426	-95.65930939	29.91712570	-95.65940094	-1.258
14	1941+38	1943+91	253	36.769	36.816	29.91723824	-95.66014862	29.91732216	-95.66090393	-1.294
15	1944+15	1944+71	56	36.821	36.832	29.91733170	-95.66096497	29.91735649	-95.66113281	-1.298
16	1944+84	1945+75	91	36.834	36.851	29.91736603	-95.66116333	29.91738892	-95.66139221	-1.286
17	1946+23	1957+77	1154	36.860	37.079	29.91740608	-95.66152191	29.91786575	-95.66484070	-1.333
18	1958+00	1958+56	56	37.083	37.094	29.91787910	-95.66491699	29.91790009	-95.66508484	-1.288
19	1958+77	1959+51	74	37.098	37.112	29.91790771	-95.66516113	29.91791916	-95.66542053	-1.292
20	1960+17	1961+02	85	37.124	37.141	29.91796875	-95.66567230	29.91800499	-95.66595459	-1.279
21	1961+15	1963+35	220	37.143	37.185	29.91801643	-95.66597748	29.91806793	-95.66670990	-1.291
22	1963+57	1971+49	792	37.189	37.339	29.91807175	-95.66679382	29.91846657	-95.66950226	-1.382
23	1971+90	1972+09	19	37.347	37.350	29.91849899	-95.66983032	29.91849899	-95.66983032	-1.293
24	1972+24	1984+26	1202	37.353	37.581	29.91849899	-95.66983032	29.91900444	-95.67337799	-1.374
25	1984+54	2009+72	2518	37.586	38.063	29.91902351	-95.67346954	29.92009163	-95.68160248	-1.403
26	2009+98	2010+08	10	38.068	38.070	29.92010880	-95.68169403	29.92011452	-95.68172455	-1.253
27	2012+72	2013+44	72	38.120	38.133	29.92022133	-95.68253326	29.92024612	-95.68276978	-1.298
28	2013+80	2013+95	15	38.140	38.143	29.92027092	-95.68290710	29.92027473	-95.68294525	-1.273
29	2014+14	2015+76	162	38.147	38.177	29.92028046	-95.68300629	29.92034721	-95.68354034	-1.307
30	2016+50	2016+95	45	38.191	38.200	29.92038536	-95.68379211	29.92040825	-95.68395233	-1.280
31	2017+14	2017+22	8	38.203	38.205	29.92041397	-95.68402100	29.92041397	-95.68402100	-1.257
32	2020+68	2021+78	110	38.270	38.291	29.92056465	-95.68517303	29.92062569	-95.68553162	-1.286

Table 20 (continued). 2022 CIS Areas Where Off Potentials are More Negative Than -1.250 V (pg 2 of 3)

Exception #	Start ST	End ST	Total Feet	Start MP	End MP	Starting GPS		Ending GPS		Highest Exception
						Latitude	Longitude	Latitude	Longitude	
#16 MP 201.870 - 202.688										
1	10672+53	10672+69	16	202.131	202.134	30.32571411	-98.34199524	30.32571602	-98.34203339	-1.318
#18 MP 204.770 - 206.323										
1	10811+85	10819+27	742	204.770	204.910	30.33361244	-98.38503265	30.33413315	-98.38713837	-2.038
2	10820+44	10833+56	1312	204.933	205.181	30.33422089	-98.38747406	30.33526802	-98.39140320	-1.441
#20 MP 213.097 - 213.639										
1	11256+33	11256+46	13	213.188	213.191	30.36433601	-98.52119446	30.36434555	-98.52123260	-1.253
#21 MP 229.002 - 229.942										
1	12109+46	12109+60	14	229.346	229.348	30.45002174	-98.76750946	30.45002556	-98.76752472	-1.302
2	12124+80	12124+91	11	229.636	229.638	30.45089722	-98.77208710	30.45090866	-98.77212524	-1.279
3	12125+03	12126+78	175	229.641	229.674	30.45090675	-98.77214050	30.45109558	-98.77268219	-1.337
4	12127+07	12127+87	80	229.679	229.695	30.45112228	-98.77276611	30.45119095	-98.77304077	-1.309
5	12127+91	12129+49	158	229.695	229.725	30.45118713	-98.77304840	30.45133972	-98.77353668	-1.343
6	12129+63	12132+18	255	229.728	229.776	30.45134163	-98.77355194	30.45162201	-98.77430725	-1.484
7	12134+26	12138+82	456	229.816	229.902	30.45178795	-98.77497864	30.45219040	-98.77629089	-1.791
#23 MP 232.937 - 233.470										
1	12318+41	12318+90	49	233.303	233.313	30.47084618	-98.82802582	30.47089386	-98.82817841	-1.306
#27 MP 247.451 - 248.880										
1	13065+41	13094+32	2891	247.451	247.998	30.51772308	-99.05813599	30.51894760	-99.06734467	-1.466
2	13095+52	13095+73	21	248.021	248.025	30.51898003	-99.06771851	30.51898575	-99.06777954	-1.268
3	13095+95	13120+80	2485	248.029	248.500	30.51899910	-99.06784058	30.51992607	-99.07523346	-1.387
4	13121+47	13124+18	271	248.513	248.564	30.51996534	-99.07541502	30.52010155	-99.07621002	-1.337
5	13124+43	13136+35	1192	248.569	248.795	30.52011871	-99.07627869	30.52050018	-99.08004761	-1.598
6	13136+68	13140+83	415	248.801	248.879	30.52050209	-99.08012390	30.52067757	-99.08132172	-1.484
#28 MP 249.411 - 250.373										
1	13169+51	13169+65	14	249.423	249.425	30.52138710	-99.09062958	30.52139091	-99.09068298	-1.263
2	13173+89	13174+11	22	249.505	249.510	30.52147675	-99.09223175	30.52148247	-99.09230804	-1.254
3	13174+37	13174+77	40	249.515	249.522	30.52148628	-99.09239960	30.52150345	-99.09253693	-1.261
4	13174+97	13179+10	413	249.526	249.604	30.52150345	-99.09261322	30.52156830	-99.09385681	-1.294
5	13179+30	13182+12	282	249.608	249.661	30.52157211	-99.09393311	30.52158737	-99.09492493	-1.312
6	13182+50	13182+66	16	249.669	249.672	30.52157593	-99.09503174	30.52158546	-99.09508514	-1.313
7	13182+83	13183+37	54	249.675	249.685	30.52159119	-99.09515381	30.52159119	-99.09535980	-1.315
8	13183+43	13188+98	555	249.686	249.791	30.52159309	-99.09539032	30.52168655	-99.09732056	-1.335
9	13189+14	13190+25	111	249.794	249.815	30.52169228	-99.09737396	30.52171135	-99.09774017	-1.320
10	13190+40	13195+91	551	249.818	249.923	30.52169609	-99.09779358	30.52181816	-99.09976959	-1.312
11	13196+11	13199+19	308	249.926	249.985	30.52182579	-99.09985352	30.52187347	-99.10090637	-1.302
12	13199+28	13207+50	822	249.986	250.142	30.52185440	-99.10092163	30.52198219	-99.10343933	-1.337
13	13207+72	13208+25	53	250.146	250.156	30.52198410	-99.10350037	30.52199173	-99.10364532	-1.261
14	13209+25	13209+65	40	250.175	250.183	30.52201271	-99.10392761	30.52202797	-99.10403442	-1.289
15	13210+54	13210+69	15	250.200	250.202	30.52201080	-99.10431671	30.52201653	-99.10436249	-1.254
16	13212+16	13212+42	26	250.230	250.235	30.52203751	-99.10475922	30.52203751	-99.10481262	-1.298
17	13217+04	13217+24	20	250.323	250.327	30.52206421	-99.10609436	30.52207184	-99.10615540	-1.251
18	13217+60	13219+66	206	250.333	250.372	30.52207756	-99.10626984	30.52211952	-99.10687256	-1.318

Table 20 (continued). 2022 CIS Areas Where Off Potentials are More Negative Than -1.250 V (pg 3 of 3)

#29 263.636 - 264.050										
1	13919+98	13941+81	2183	263.636	264.049	30.58275032	-99.31453705	30.58482933	-99.32077789	-3.932
#30 MP 267.612 - 267.930										
1	14129+91	14146+67	1676	267.612	267.929	30.60505867	-99.37560272	30.60648918	-99.38092041	-1.611
#31 MP 275.539 - 276.833										
Exception #	Start ST	End ST	Total Feet	Start MP	End MP	Starting GPS		Ending GPS		Highest Exception
						Latitude	Longitude	Latitude	Longitude	
1	14562+69	14562+79	10	275.809	275.810	30.62236023	-99.51088715	30.62236977	-99.51091766	-1.287
2	14566+27	14566+37	10	275.876	275.878	30.62260437	-99.51206207	30.62260437	-99.51206207	-1.255
3	14567+48	14567+83	35	275.899	275.906	30.62268066	-99.51245880	30.62270546	-99.51255035	-1.280
4	14568+23	14568+41	18	275.913	275.917	30.62272835	-99.51268005	30.62273788	-99.51274109	-1.267
5	14569+08	14569+23	15	275.930	275.932	30.62278748	-99.51301575	30.62279320	-99.51305389	-1.257
6	14569+62	14569+79	17	275.940	275.943	30.62282562	-99.51318359	30.62284088	-99.51324463	-1.285
7	14569+98	14570+12	14	275.947	275.949	30.62283707	-99.51330566	30.62285233	-99.51335907	-1.314
8	14570+79	14571+12	33	275.962	275.968	30.62289810	-99.51356506	30.62291908	-99.51367950	-1.307
9	14571+31	14571+68	37	275.972	275.979	30.62294388	-99.51377869	30.62297058	-99.51390076	-1.279
10	14572+10	14572+41	31	275.987	275.993	30.62301064	-99.51411438	30.62301636	-99.51414490	-1.258
11	14572+54	14572+83	29	275.995	276.001	30.62303734	-99.51420593	30.62306976	-99.51435089	-1.282
12	14572+87	14572+95	8	276.001	276.003	30.62306976	-99.51435089	30.62306976	-99.51435089	-1.254
13	14573+08	14573+27	19	276.005	276.009	30.62307167	-99.51441956	30.62307167	-99.51448059	-1.255
14	14573+73	14574+10	37	276.018	276.025	30.62311554	-99.51470184	30.62312698	-99.51478577	-1.313
15	14574+45	14574+50	5	276.031	276.032	30.62315178	-99.51497650	30.62315178	-99.51497650	-1.311
16	14574+64	14574+89	25	276.035	276.040	30.62316895	-99.51506042	30.62318420	-99.51514435	-1.319
17	14575+02	14575+58	56	276.042	276.053	30.62317848	-99.51519775	30.62322426	-99.51541138	-1.341
18	14575+74	14577+60	186	276.056	276.091	30.62322998	-99.51544952	30.62333107	-99.51607513	-1.334
19	14577+77	14578+43	66	276.094	276.107	30.62334061	-99.51611328	30.62337875	-99.51633453	-1.371
20	14578+60	14578+66	6	276.110	276.111	30.62338257	-99.51638794	30.62338066	-99.51639557	-1.333
21	14578+77	14586+39	762	276.113	276.257	30.62339592	-99.51644135	30.62388039	-99.51870728	-1.507
22	14586+60	14595+18	858	276.261	276.424	30.62389946	-99.51879883	30.62438202	-99.52127838	-1.692
23	14595+34	14604+53	919	276.427	276.601	30.62442398	-99.52146912	30.62488365	-99.52380371	-1.622
24	14605+07	14607+65	258	276.611	276.660	30.62491035	-99.52395630	30.62506485	-99.52479553	-1.387
25	14611+38	14611+63	25	276.731	276.735	30.62528229	-99.52595520	30.62529373	-99.52601624	-1.273

2.3.4 AC Potential Survey

The pipe-to-soil AC voltage survey was conducted when the 2022 CIS was performed for the pipeline ROW segment 6645. The AC voltage survey collected 122 test points during the CIS survey in April 2022, with a maximum reported AC voltage of 7.711 V at Mile Post 170.295 (Brodie Lane WSD). This AC voltage level should not cause personnel safety issues and is less likely to lead to AC-induced corrosion on the pipe, depending on the soil resistivity and coating condition. A remote control unit (RMU) with an AC current density monitoring device was installed at this location on May 5th, 2022, showing the AC current density was 2.6A/m^2. This level of AC current density is not expected to cause AC-induced corrosion on the pipe. It is recommended to continue monitoring the AC readings during the future CIS survey, especially for the locations with historically elevated AC readings.

2.3.5 Atmospheric Inspections

Magellan monitors the condition of above-grade appurtenances following annual atmospheric inspections, including station piping, tanks, valve settings, and exposed piping. Table 21 lists the locations of concern in the Longhorn Pipeline System where corresponding repairs were performed in 2022.

Table 21. Atmospheric Maintenance Summary (pg 1 of 2)

Atmospheric Facility Type	Location Description	Inspection Date	Repair Corrected Date	Milepost	Inspection Remarks
East Houston to Speed Jct – station piping	E. Houston in-bound trap	5/13/2020	3/13/2022	0.000	The valve cap flange on the outbound trap valve needs a touchup and one inch at the sample port.
East Houston to Speed Jct – station piping	E. Houston in-bound trap	5/13/2020	6/27/2022	0.000	The riser on inbound from E. Houston bypass – flange at grade needs transitional coating. The valve cap flange on the outbound trap valve needs a touchup and one inch at the sample port.
East Houston to Speed Jct – station piping	E. Houston in-bound trap	8/4/2021	6/27/2022	0.000	The sample port and pressure gauge valve housing need touch-up work on the inbound pig trap.
Satuma to East Houston – station piping	E. Houston out-bound trap	8/4/2021	6/4/2022	2.360	Inadequate coating on the piping North of valve 236 on the outbound risers.
Buckhorn to Satsuma – exposed pipe	SE1A South of Tuckerton Valve	5/6/2021	5/6/2022	47.067	Not exposed – underwater. Mostly submerged by running water.
Buckhorn to Satsuma – exposed pipe	500’ West of TP 46.440	4/27/2020	7/1/2022	65.800	There is a large coating deficiency on top of the pipe. Excavated and recoated.
Warda to Buckhorn – exposed pipe	West of Schuster Rd. East of Pond	4/7/2022	10/26/2022	107.290	Not exposed – underwater. Re-inspected in fall 2022.
Warda to Buckhorn – exposed pipe	West of Schuster Rd. West of Pond	4/7/2022	10/26/2022	107.450	Not exposed – underwater. Re-inspected in fall 2022.
Warda to Buckhorn – exposed pipe	Between Rauch Rd and FM 2145	4/7/2022	10/26/2022	108.130	Not exposed – underwater. Re-inspected in fall 2022.
Bastrop to Warda – exposed pipe	E of CR 448	4/21/2021	3/23/2022	116.200	Less than ten spots were repaired with an aerosol can.
Bastrop to Warda – exposed pipe	W of FM 448	6/30/2022	11/17/2022	117.920	Silted in. Re-inspected in fall 2022.
Cedar Valley to Bastrop – exposed pipe	Between Elroy & McAngus	4/12/2022	10/13/2022	157.481	Silted in by wet weather and creek. Re-inspected in fall 2022.
Eckert to Cedar Valley – exposed pipe	East of 1320	4/22/2022	10/13/2022	210.050	Silted in. Re-inspected in fall 2022.
James River to Eckert – exposed river	Pasture Exposure	4/21/2022	10/13/2022	232.070	Silted in. Re-inspected in fall 2022.
James River to Eckert – exposed river	Rocky Creek	4/21/2022	10/13/2022	257.914	Silted in. Re-inspected in fall 2022.
Kimble to James River – exposed pipe	West of Hwy 377	3/16/2022	9/1/2022	281.520	Not exposed – underwater. Re-inspected in fall 2022.
Cartman to Kimble – exposed pipe	Exposed in ROW	3/22/2022	9/1/2022	335.500	Not exposed – underwater. Re-inspected in fall 2022.
Texon to Barnhart – exposed pipe	Exposure in Sand Flat	4/6/2022	10/1/2022	412.282	Not exposed – underwater. Re-inspected in fall 2022.
Texon to Barnhart – exposed pipe	Exposure in Sand Flat	4/6/2022	10/1/2022	412.312	Not exposed – underwater. Re-inspected in fall 2022.
Eckert Station – Station piping	Receiver/Incoming bypass and drain line	6/9/2021	3/9/2022	227.90	Recoat top of motor operated valves (MOV) 2 and 3/1” bypass/3” flange G206.
Eckert Station – Station piping	Launcher/Outgoing and drain line	6/9/2021	3/9/2022	227.90	Recoat top of MOVs 7 and 8/MOV 8 flange
Satsuma Station – Station piping	Launcher/Outgoing and drain line	5/7/2021	5/7/2022	34.10	Spot repairs on g1014/1” relief lines/stair supports/grating.
Eckert Station – Station piping	Strainer Manifold	6/9/2021	3/9/2022	227.90	Recoat top of 4 MOVs/20 ft of 1” bypass.
Eckert Station – Station piping	MOV 5/MOV 6 Manifold	6/9/2021	3/9/2022	227.90	MOV 5 and MOV 6 flange bolts/1” bypass.

Table 21 (continued). Atmospheric Maintenance Summary (pg 2 of 2)

Atmospheric Facility Type	Location Description	Inspection Date	Repair Corrected Date	Milepost	Inspection Remarks
Satsuma Station – Station piping	Receiver/Incoming and drain line	5/7/2021	5/7/2022	34.10	Spot repairs on MOV 16 and G1003 piping.
Satsuma Station – Station piping	West piping/valves	5/7/2021	5/7/2022	34.10	Spot repairs on ½" reliefs and 1" piping near MOV 6.
Satsuma Station – Station piping	Central piping/valves	5/7/2021	5/7/2022	34.10	Flange at MOV 1020b/bottom of 16" BV/horizontal surface of valve 1010A.
Satsuma Station – Station piping	North Pump suction/discharge	5/7/2021	5/7/2022	34.10	Recoat sump lines from pump containment.
Satsuma Station – Station piping	South Pump suction/discharge	5/7/2021	5/7/2022	34.10	Recoat sump lines from the pump.
Warda Station – Station piping	Strainer manifold	6/21/2021	3/20/2022	112.89	Recoat the top of 4 MOVs and a small spot on the strainer riser.
Bastrop Station – Station piping	Central piping/valves	6/22/2021	3/12/2022	141.72	Recoat tops of 4 MOVs.
James River Station – Station piping	Central piping/valves	6/8/2021	3/5/2022	260.12	Top of 6 corroded (<12.5% WT) MOVs.
Cedar Valley Station – Station piping	Receiver/Incoming and drain line	1/1/2021	3/10/2022	181.59	Unallocated for 2022, as needed.
Cedar Valley Station – Station piping	Launcher/Outgoing and drain line	7/1/2021	3/10/2022	181.59	Recoat 2-inch line near rov9.
Cedar Valley Station – Station piping	East and West pumps	7/1/2021	3/10/2022	181.59	Recoat incoming and outing piping on both pumps.
Kimble Station – Station piping	Central piping/valves	5/12/2021	8/12/2022	-	Completed touch ups.
Texon Station – Station piping	East pump & pump piping	7/20/2021	7/20/2022	416.66	Completed touch ups.

2.3.6 Tank Inspections

Magellan inspected six tanks in 2022; Table 22 lists the tanks inspected and their inspection type. The inspection reports show that no problems requiring immediate action were found on the foundation, shell, piping and appurtenances, fixed roof, and access structure for Tanks 1, 13, 14, 24, and 30 in El Paso and Tank 60 in Crane. The anchorage requirements were not part of the evaluation during the foundation inspection for the tanks listed in Table 22. The floating roof inspection was from the access hatch for the tanks.

Table 22. Tank Inspection Summary

Tank #	Tank location	Product	Inspection type	Inspection Date	Comments
1	EI Paso	Gasoline	External API-653	02-10-2022	No items requiring immediate corrective action were noted
13	EI Paso	Diesel	External API-653	02-10-2022	No items requiring immediate corrective action were noted
14	EI Paso	Diesel	External API-653	02-10-2022*	No items requiring immediate corrective action were noted
24	EI Paso	Gasoline	External API-653	02-10-2022	No items requiring immediate corrective action were noted
30	EI Paso	Transmix	External API-653	06-21-2022	No items requiring immediate corrective action were noted
60	Crane	Crude Oil	External API-653	02-09-2022	No items requiring immediate corrective action were noted
*The inspection date of 2-10-2033 is stated on the report cover. It is believed to be 2-10-2022.					

2.4 Earth Movement and Water Forces

The LMP evaluates the integrity concerns resulting from the ground movement from aseismic faults and soil erosion caused by scouring. Fault crossings, allowable displacement at faults, and fault movements from the past 18.5 years were compared to evaluate any integrity threats on the Longhorn Pipeline System. In addition, waterway inspections and periodic depth of cover inspections were conducted at some of the river crossing locations.

2.4.1 Fault Crossings

The Longhorn Pipeline System crosses several aseismic faults between Harris County (Houston area) and El Paso, TX. No active fault crossing the pipeline is reported West of Harris County[15]. Within Harris County, the pipeline crosses seven aseismic faults that are considered to be active. Those active faults are Akron, Melde, Breen, and Hockley, which cross the original Longhorn pipeline, and McCarty, Negyev, and Oates faults, which cross the new East Houston line constructed in 2012. Table 23 includes approximate location information for each benchmark based on hand-held global positioning system (GPS) and pipeline alignment measurements. The stations have two benchmarks, one on each side of a fault trace. One benchmark is installed on the upthrown block (the side of the fault that appears to move up relative to the opposite side), and the other benchmark is installed on the downthrown block (the side of the fault that appears to move down relative to the opposite side). Table 24 summarizes the available geologic data for Akron, Melde, Breen, and Hockley faults.

Table 23. Approximate Location Information for each Fault Benchmark[16]

Fault	Benchmark	Latitude & Longitude		Drawing	Station
		North	West		
Akron	A-1	29.77605	-95.23153	GEA-160-009	202+90±60
	A-2	29.77530	-95.23175		
Melde	M-1	29.80163	-95.23200	-	298+60±50
	M-2	29.80193	-95.23200		
Breen	B-1	29.89350	-95.48500	-	1364+85±50
	B-2	29.89370	-95.48540		
Hockley	H-1	29.93790	-95.81740	GEA-161-050	2446+60±70
	H-2	29.93795	-95.81687		
McCarty	M-1	29.80271	-95.27849	3485-AL-02	34+00
	M-2	29.80245	-95.27854		
Negyev	N-1	29.80689	-95.24691	3485-AL-05	141+00
	N-2	29.80688	-95.24711		
Oates	O-1	29.80637	-95.24509	3485-AL-06	145+00
	O-2	29.80639	-95.24524		

[15] "Study of Aseismic Faults and Regional Subsidence along Longhorn Partners Pipeline", IT Corporation, June 14, 2000.
[16] From Geosyntec Semi-Annual Fault Displacement Monitoring Report for 2nd half of 2022.

Table 24. Geologic Data for Akron, Melde, Breen, and Hockley Faults

Fault	Location	Fault				Soil	
	MP	Orientation	Dip	Displacement	Width (feet)	Classification	Formation
Akron	3.84	N85E	-	down N	-	CL*	-
Melde	5.66	N64E	-	down N	-	CL	Beaumont
Breen	25.85	N50E	-	down NW	13	CL	Lissie
Hockley	46.34	N56W	67SW	-	80	CL	Lissie

*CL refers to low-plasticity clay.
Note: Blank fields indicate that data was unavailable.

2.4.2 Allowable Displacement at Faults

Kiefner has conducted two series of stress analyses on the pipes to determine the allowable displacements at the faults, one in the 2005 ORA Report and one in the 2014 ORA Report. The original stress analysis in the 2005 ORA Report was conducted for the Akron, Melde, Breen, and Hockley faults. Assumptions used in that analysis included allowable stress levels based on the version of ASME B31.4[17] available at that time; stress resulting from regular operation (instead of fault movement) in the pipeline was determined by ASME B31.4 stress analysis; and soil properties were determined from the best estimate of obtainable properties.

The 2014 ORA Annual Report determined allowable displacements at the McCarty, Negyev, and Oates faults. Due to the high rate of movement and the relatively low allowable displacement at the Hockley fault, the stress analysis was repeated for the 2014 ORA Report. In the 2014 analysis, the stresses in the pipelines at various fault displacements were predicted through finite element analysis (FEA) with the same soil properties used in the previous 2005 analysis. The allowable fault displacement was then determined when the stress reached the allowable stress levels at the pipe based on the ASME B31.4-2012, which was the latest version at the time. In ASME B31.4-2012, the allowable longitudinal stress level increased from 54% SMYS to 90% SMYS compared to the previous versions. This new limit was considered for the stress analysis of McCarty, Negyev, and Oates faults. Given the pipeline vintage of the Hockley fault, Kiefner opted for a lower limit of 80% SMYS to determine the critical displacement. Please see the 2014 ORA Report for details of the analysis. Table 25 presents the resulting allowable displacement at each fault.

2.4.3 Fault Movements

Fault displacement is defined as the difference between two benchmark readings, one on each side of the fault trace: the upthrown block and the downthrown block. The spacing of the benchmarks allows the measurement of relative vertical displacement across the fault plane.

Monitoring stations across the Akron, Melde, Breen, and Hockley faults were installed in March 2004 in accordance with Section 6.2 of the ORAPM. Baseline readings were taken in late May and early June 2004. Thirty-seven subsequent displacement readings[18] have been taken at approximately 6-month intervals. Figure 9 shows a plot of the vertical displacements over time.

[17] ASME B31.4-2002, Pipeline Transportation Systems for Liquids and Slurries, ASME Code for Pressure Piping, B31. The standard allows longitudinal stress up to 54% of SMYS.
[18] Geosyntec Semi-Annual Fault Displacement Monitoring Reports. The last report is for the 2nd half of 2022.

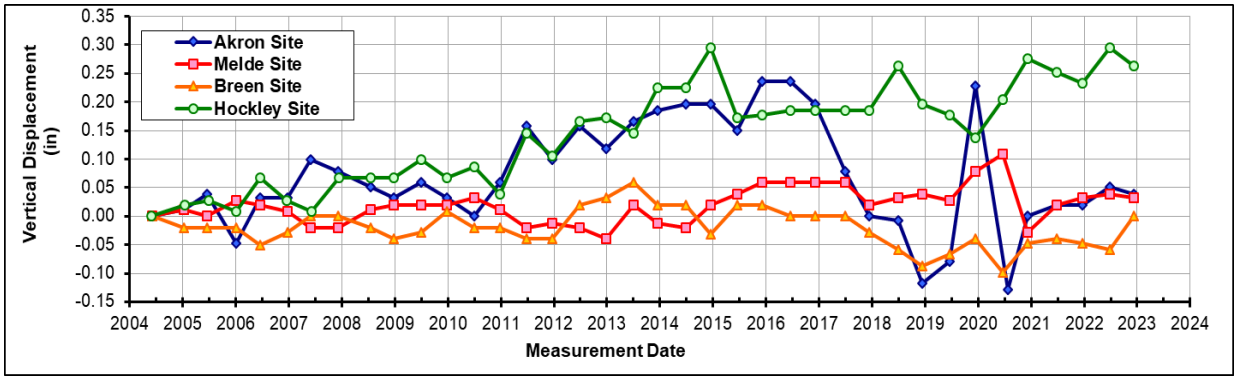

Figure 9. Fault Displacement over 18.5-Year Monitoring Period at Akron, Melde, Breen, and Hockley Faults

Since 2017, the benchmark recordings have shown Akron fault's multiple backward and rebound movements. Based on the 2022 readings, this fault experienced a relatively small amount of movement oscillating near its baseline displacement.

Data collected at Melde and Breen faults since the benchmarks were installed in 2004 shows slow progressive movement, as verified by the 36th and 37th resurveys[19] in 2022. The recent resurveys indicate movement above the average historical rate for the Hockley fault, suggesting continuous monitoring is required.

In 2012, three additional faults were instrumented for the lines constructed to connect the existing Longhorn line to East Houston. These are the McCarty Fault near Station 35+80, the Negyev Fault near Station 140+00, and the Oates Fault near Station 147+00. Baseline readings were taken for the McCarty, Negyev, and Oates faults in September 2012. After the baseline readings, there have been 25 readings taken between December 2012 and December 2022, as shown in Figure 10.

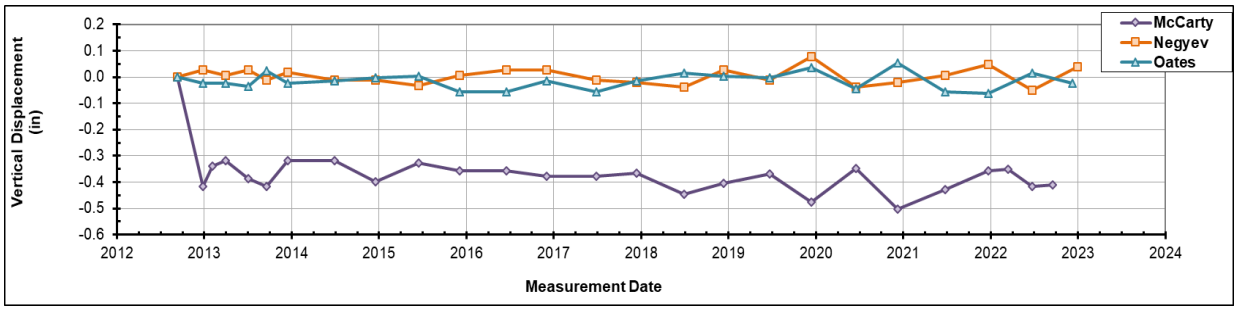

Figure 10. Fault Displacement over 10.5-Year Monitoring Period at McCarty, Negyev, and Oates Faults

The readings at the McCarty station from the baseline measurement in September 2012 to December 2012 indicated a jump of about one-half inch of displacement had occurred. No other large movement has been observed subsequent to the initial jump. This jump could be indicative of the benchmark equilibrating with its environment after installation or due to

[19] Geosyntec – First-half and second-half Semi-Annual Fault Displacement Monitoring Reports.

measurement error of the baseline reading. Accordingly, in calculating the McCarty fault's rate of movement, the baseline measurement in September 2012 was not considered. Instead, the December 2012 measurement was set as the basis for calculations. Since 2019, the resurveys have shown a relatively large rate of movement at McCarty fault. The Negyev and Oates fault movements are slightly above the average historical rate.

Table 25 shows the allowable displacement at each fault, the rate of the movement, which is calculated in three different ways, and the time to reach the allowable displacement based on each of those three rates. The rate of movement for each fault is determined using the following methods:

- Historical rate: Linear regression of the recorded fault movements over the whole monitoring period.
- Short-term rate: Linear regression of the recorded fault movements over the last two years. This reflects the fault line's short-term trend and shows whether recent movement requires closer monitoring.
- Current rate: Dividing the last recorded fault movement (plus measurement error) by the total years monitored. This indicator combines the long-term effect and the latest fault motion.

The time to reach the allowable displacement for each fault (shown in the last column of Table 25) is obtained by dividing the allowable displacement by the rate of movement. This is the total time from when the pipe is free of stress to the final failure.

Table 25. Summary of Estimated Allowable Fault Displacement

Fault	Allowable Displacement (inch)	Average Rate of Movement (inch/year)			Time to Reach Allowable Displacement (years)		
		Long-term[ii]	Short-term[iii]	Current[iv]	Long-term	Short-term	Current
Akron	4.17	0.000	0.022	0.007	>1000	187	620
Melde	4.13	0.002	0.028	0.006	>1000	147	658
Breen	1.50	0.002	0.015	0.004	852	103	334
Hockley[i]	1.25	0.014	0.004	0.020	88	325	64
McCarty	0.95	0.006	0.054	0.009	163	18	107
Negyev	2.65	0.000	0.012	0.011	>1000	225	231
Oates	2.65	0.000	0.018	0.010	>1000	146	265

[i] Following the December 2018 fault monitoring, Magellan performed maintenance activities to relieve stress on the pipeline near the Hockley fault.
[ii] Average movement over the monitoring period.
[iii] Average based on the last two years.
[iv] Based solely on the last recorded fault movement.

Calculations based on the long-term historical rate of movement indicate that all the faults, except Hockley, continue to move slowly. The pipeline crossing those faults has more than 100 years to reach the allowable displacement.

In some cases, the long-term historical rates appear to be less conservative estimates of time to potential failure. Hence, Kiefner also computed two additional assessments for each fault by considering the behavior of the fault during the last two years and its last recorded

displacement. In the past decade, the relatively large displacement and oscillation about the baseline at the Akron fault grants closer monitoring. However, the fault has been less active in the past two years. Since the pipeline crossing the Akron fault allows for a relatively large displacement at the fault location (4.17 inches), the semi-annual survey would be sufficient for now. The Melde and Breen faults have shown a slower rate of movement and oscillation in the past two years compared to previous years. However, the overall movements of these faults still suggest continuous semi-annual monitoring. The shortest calculated time to reach allowable displacement at the Hockley fault is 64 years. Following the December 2018 fault monitoring, Magellan performed maintenance activities to relieve strain on the pipeline near the Hockley benchmark. With this mitigation, semi-annual monitoring would be sufficient.

Since December 2020, the resurveys have shown large activity in the McCarty fault. Based on the short-term trend of movement in the past two years (2021 & 2022) and the small allowable displacement at the pipeline crossing this fault, the time to reach allowable displacement is estimated to be 18 years. Accordingly, at the request of Magellan, the McCarty fault was monitored quarterly during 2022. Kiefner recommends following the same quarterly monitoring during 2023 and re-evaluating it each time. Note that no readings at the McCarty fault were collected during the December 2022 survey due to transmission line construction at the site. Geosyntec observed timber mats covering both benchmarks obstructing access to the monuments.

In Negyev and Oates, the shortest time to reach allowable displacement is more than 100 years. This indicates that the pipeline crossing is far from approaching the acceptance limits at these two faults; nevertheless, Kiefner recommends continuing the semi-annual resurveys. According to the U.S. Geological Survey of September 2005[20], there are documented cases of fault movement reinitiating.

It should be noted that Section 6.4 on Aseismic Faulting/Subsidence Hazards in Appendix 9E of the EA (Reference [5]) estimated the rates of movement on the order of 0.20 inch/year based on field observations at the top four faults listed in Table 25. Actual measurements over the past 18.5 years show rates less than an order of magnitude of the estimates from the EA. Thus, one of the original reasons for monitoring these four faults was overly conservative in estimating fault movement rates.

2.4.4 Waterway Inspections and Depth-of-Cover Program

Since 2015, Magellan has conducted waterway inspections by measuring the depth-of-cover (DOC) of the pipeline at water crossings. Once a water crossing has been surveyed, it is categorized and entered in Magellan's Waterway Crossing Program. The Magellan's Outside Forces Database will calculate the Risk Score based on the River Risk Model Scoring Rubric. Some of the factors[21] playing role in the risk score are pipeline minimum DOC, exposures or suspension lengths, presence of debris, signs of bank erosion, propensity for bank failure, propensity for avulsion, historic or ongoing channel migration, flood history, and potential for scour from upstream river obstructions. Additionally, the risk score is valued based on the

[20] Verbeek, E.R., Ratzlaff, K.W., Clanton, U.S., Faults in Parts of North-Central and Western Houston Metropolitan Area, Texas, U.S. Geological Survey, September 2005.
[21] Based on Magellan's Procedure Number: 7.05-ADM-043.

presence of HCAs, stream order, and ordinary high-water width of a river crossing. In general, the higher the total risk score, the more perceived risk the crossing represents. Once ranked, Magellan assesses each crossing and determines if it needs mitigation, rainfall monitoring, or place it within the re-inspection pool. Table 26 summarizes the findings of the recent 3rd party inspections. Based on the findings of these surveys, no mitigation measures are planned by Magellan Waterway; however, all crossings listed in Table 26 are candidates of re-inspection within one year.

Table 26. Summary of Water Crossing Inspections in 2022

River Name	Route Name	Survey Comments
Cypress Creek	Satsuma-Buckhorn	19′ of suspension with good coating condition is reported. Signs of erosion are noted. Downstream of tributary confluence
Live Oak Creek	Satsuma-Buckhorn	No exposure. Minimum DOC of 5′-3″. Signs of erosion are noted. Downstream of tributary confluence
Buffalo Creek	Warda-Buckhorn	No exposure. Overall, a minimal DOC was measured. Erosion is significant.
Unnamed Creek	Bastrop–Cedar Valley	12′ of suspension and 8′ of exposure with good coating conditions are reported. Easily erodible banks. Downstream of flow constriction.
Main Line Canal	Crane-Cottonwood	No exposure. Minimum DOC of 14′-6″. Flood control gate upstream of crossing.

A 3rd party inspection company conducted a DOC survey of the Satsuma-Buckhorn pipeline crossing Cypress Creek in Harris County, Texas, in February 2022. The 3rd party inspection company reported that the pipeline is suspended across the entire channel width (i.e., 19 feet of suspension). The coating on the exposed pipeline was found by, the 3rd party, to be in good condition. At the writing of this report the Cypress Creek crossing does not trigger any immediate mitigation action for Magellan, and will be placed into the pool of reinspection candidates to be assessed for a follow-up survey. It was observed that the East and West Banks show signs of erosion, including upstream and downstream of the centerline. Comparisons of data from 2017, 2021, and 2022 reveal a general loss of cover within the channel bed over time, with a more notable loss of cover at the center of the channel. There was a nearby suspended foreign pipeline on the upstream side. Also, the pipeline crossing was found to be approximately 100 feet downstream of a tributary confluence.

Satsuma-Buckhorn pipeline also crosses Live Oak Creek in Waller County, Texas. The survey in February 2022 reports a minimum DOC of 5 feet and 3 inches at the East Bank water's edge and a maximum DOC of 12 feet and 2 inches at the East Bank water's edge. The East and West Banks showed signs of erosion. On the day of the survey, the waterway was flooded and created areas of standing water.

Warda-Buckhorn pipeline crosses Buffalo Creek in Austin County, Texas. The 3rd party DOC survey in February 2022 identified a minimum DOC of 9 inches at the center of the channel and a maximum DOC of 1 foot and 5 inches at the East Bank water's edge. The overall DOC was rather minimal. Erosion control fabric was observed to be exposed and in poor condition on the day of the survey. The East and West Banks showed signs of significant erosion, including upstream and downstream of the centerline. Signs of cattle ranching practices observed that could be a partial cause of bank degradation at the crossing. As of the writing of this report, the Buffalo Creek Crossing does not trigger any immediate mitigation action for Magellan, and will be placed in the pool of reinspection candidates to be assessed for a follow-up survey.

A DOC survey was performed for an Unnamed Creek that crosses the Bastrop to Cedar Valley pipeline in Bastrop County, Texas, in March 2022. This crossing was found exposed for 8 feet and suspended for 12 feet. The coating was reported to be in good condition. The pipeline has a maximum DOC of 2 feet and 9 inches at the East Bank water's edge. The East and West Banks showed signs of erosion, including Upstream and Downstream of the centerline. The crossing was located downstream of a large concrete bridge, causing flow constriction and inducing scouring. Ranching practices were observed on both river banks. As of the writing of this report, the Unnamed Creek crossing does not trigger any immediate mitigation action for Magellan, and will be placed into the pool of reinspection candidates to be assessed for a follow-up survey.

A DOC survey of the Crane-Cottonwood Pipeline that crosses the Main Line Canal in Ward County, Texas, was conducted in February 2022. No surface water was observed in the canal on the day of the survey; a minimum DOC of 14 feet at the toe of the North Bank and a maximum DOC of 16 feet and 3 inches at the South Bank's edge of the dry bed. The pipeline intersected the waterway approximately 520 feet downstream of a floodgate-like structure that was estimated to impede flow.

Additionally, it was recommended by Kiefner to resume inspections at the Pin Oak Creek crossing with the East Houston to El Paso Pipeline at an annual rate to monitor its condition. Magellan's Outside Forces program has evaluated and determined no required mitigation at this time. The crossing will be placed into the pool of reinspection candidates to be assessed for a follow-up survey.

Flood monitoring should be conducted periodically to identify existing and potential problem areas, especially for lack of coating in flooded regions. For Magellan, a "Natural Event Response Procedure" is in place that provides a method for upfront planning, communication, monitoring, and establishment of safeguards for natural events such as flooding. No flood inspection was reported for Kiefner review in 2022.

2.5 Damage Prevention Program

The Longhorn Damage Prevention Program far exceeds the minimum requirements of federal or Texas State Pipeline Safety Regulations and represents a model program for the industry. Damage prevention and inspection activities that continued to be successful in 2022 include ROW surveillance, One-Call System, and public awareness activities. The aerial surveillance and ground patrol frequencies for ROW surveillance exceeded the frequencies outlined in the LMP with no exception.

There was one Longhorn system incident in 2022. The minor incident occurred on January 6th, 2022, in Houston, Texas. While performing routine inspections of the ROW, Magellan Operations employees encountered a fence built over the ROW on the Longhorn Line ID 6645. The fencing contractor began working outside the scope of the original one-call and struck the pipeline with an auger while installing a fence post. The Magellan employees implemented corrective actions for the incident, including assessing the damage and repairing the pipe coating with Polyguard RD-6 Coating System. The estimated cost of this violation was $25,000. This incident was not DOT reportable and was formally documented and investigated. Corrective actions were

implemented following Magellan's incident investigation report. This incident falls under two sections: section 2.5.1 Third-Party Damage and section 2.5.3 One-Call Ticket Analysis.

An ILI tool should be run if three or more one-call violations occur on any 25-mile pipeline segment within 12 months. The one-call violation threshold was not met in 2022. These ILI assessments are required per the ORAPM using EGP and high-resolution MFL or UT tools. LMC 12A requires that ILI assessments for TPD detection between Valve J-1 and Crane Station be performed within three years of the previous inspection. EGP inspection tools were run in 2020 on eight sections from Texon to Warda and Buckhorn to Satsuma. EGP tools are required to be run at least every three years; the next EGP assessments for the crude system are in 2023. For specific inspection dates to fulfill the requirement for each of the 12 intervals spanning the Existing Pipeline from Crane to East Houston, see Table 34 in Section Integration of Intervention Requirements and Recommendations.

2.5.1 Third-Party Damage

TPD refers to accidental or intentional damage by a third party, not the pipeline operator or subcontractor, which causes an immediate failure or introduces a weakness (such as a dent or gouge) in the pipe. A pipeline's susceptibility to third-party excavation damage is dependent on characteristics such as the extent and type of excavation or agricultural activity along the pipeline ROW, the effectiveness of the One-Call System in the area, the amount of patrolling of the pipeline by the operator, the placement and quality of ROW markers, and the DOC over the pipeline. In all cases, different threats could exist at different locations along the pipeline.

The annual Third-Party Damage Prevention Program Assessment contains information and data specific to the Longhorn pipeline, including the number of detected unauthorized ROW encroachments, changes in activity levels and one-call frequency, physical hits, near-misses, DOC, and repairs along the pipeline. Potential TPD, such as dents, scrapes, and gouges detected by both ILI tools and maintenance activities, are also part of this assessment.

Kiefner received a complete log of aerial patrol and ground patrol reports for 2022. Each patrol report includes the date of inspections, the date of the previous inspection, the number of inspections year-to-date (YTD), ROW miles covered, and deadhead miles, in addition to the observations of the patroller. These observations range in significance from no impact on the ROW to those that could damage the pipeline without intervention from the pipeline operator. Each patrol report is identified by location (MP), inspection date, and whether or not there has been an emergency observation. In addition to the observations, these planned actions are recorded as well.

Based on a review of the TPD data and a review of the 2022 Third-Party Damage Annual Assessment, Kiefner concluded:

- There was one physical hit to the pipeline in 2022[22].
- There were two ROW near-misses in 2022.
- There was one one-call violation in 2022[22].
- There was an increase of approximately 7% in aerial patrol observations.
- There was one unauthorized encroachment recorded.

[22] The one physical hit and one one-violation in 2022 on the Longhorn pipeline were from the same incident.

- One-call frequency decreased by approximately 4%, and the number of tickets sent to Field Operations for clearing/locating decreased by 4% from 2021 to 2022.

2.5.2 ROW Surveillance

Total possible surveillance mileage includes the 694-mile mainline, the 29-mile lateral from Crane to Odessa, and the four 9.4-mile laterals from El Paso Terminal to Diamond Junction. The 3.5-mile double lateral from East Houston to MP 6 was added to the patrol mileage in 2011. Tier-II and Tier-III areas from Galena Park to Pecos River (Segment 301) must be inspected every 2½ days, not exceeding 72 hours. The Tier-I area from the Pecos River to El Paso (Segment 303) needs to be inspected once per week, not exceeding 12 days, and at least 52 times per year. Daily patrols are also required over the Edwards Aquifer Recharge Zone (MP 170.5 to 173.3), with one patrol per week to be a ground-level patrol. To meet the minimum ROW surveillance mileage, Magellan would need to perform 64,560 miles of aerial patrol for the Galena Park to MP 528 segment and 8,153 miles of aerial patrol from MP 528 to 694. For ground patrol, Magellan needs to perform a minimum of 583 miles in the Edwards Aquifer area.

The pipeline ROW was flown over daily, weather permitting, from Galena Park to the Pecos River (MP 528) segment, as well as weekly from the Pecos River (MP 528) to the El Paso Terminal (MP 694) segment, weather permitting. In addition, regular ground patrols were made in the Edwards Aquifer Recharge Zone (MP 170.5 to 173.3), weather permitting. Table 27 shows the 2022 cumulative miles of patrols for these three areas listed by month.

Table 27. Cumulative Miles of Patrols

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Tiers II & III: Aerial Patrol (every 2.5 days, not to exceed 72 hours)													
301: Galena Park to MP 528	13,288	11,526	14,090	8,006	12,364	16,140	16,140	15,574	16,033	16,174	11,064	10,803	**169,806**
Tier I: Aerial Patrol (once/week, not to exceed 12 days)													
303: MP 528 to 694	1,052	1,052	1,315	1,052	1,315	1,052	1,052	1,315	1,052	1,052	1,315	1,052	**13,676**
Ground Patrol (once/week)													
Edwards Aquifer: MP 170.5 to 173.3	66	55	55	55	55	55	66	55	55	55	44	55	**671**

Magellan met the Longhorn commitment to inspect Tier I areas from the Pecos River (MP 528) to the El Paso Terminal (MP 694), including the El Paso Laterals, at least once a week. The Annual Third-Party Damage Prevention Program reported one unauthorized ROW encroachment.

2.5.3 One-Call Ticket Analysis

In 2022, there were 7,583 one-call tickets, of which 35% of the required "field locates" were potential ROW encroachments. There was one one-call violation during the 2022 year. The violations were due to third parties not following One-Call directives.

Magellan is effectively screening the one-calls and separating them based on the location, information associated with each "ticket," and the likely encroachments from the "no locates" (one-call locations that are sufficiently remote from the ROW to assure that no effort is needed to mark the location of the pipeline).

Most one-call tickets continue to occur in Harris and Travis counties. Harris County (Houston) accounted for 2,837 (37.4%) of the one-call tickets, while Travis County (Austin) accounted for 2,296 (30.3%) of the one-call tickets. Thus, 43.1% of the one-call notifications on the pipeline occurred in these large metropolitan areas. Based on those data, these two areas present the greatest potential for third-party damage. The Crane area has the next highest number of one-calls, with 1,112 tickets (14.7%).

2.5.4 Public Awareness

The Longhorn Public Awareness Plan incorporates various activities to reach stakeholder audiences and provide them with damage prevention information in 12 languages: English, Spanish, French, German, Hmong, Hungarian, Italian, Japanese, Korean, Norwegian, Polish, and Vietnamese. The damage prevention information includes annual mailings, emergency response/excavator meetings, door-to-door visits, meetings with emergency response agencies, conversations with public officials, local school presentations, public service announcements, sponsorships, banners, advertisements, and PSAs in the press and media, and safety information on the Magellan website.

The Magellan website is a communication tool used to inform the public about pipeline safety, damage prevention, emergency preparedness, and mitigation measures. Information about Magellan's operations is posted on the website, such as the annual self-audit report and the results of the annual ORA.

Through the current Longhorn Public Awareness Plan, Magellan targets schools in the Austin area, and the Safe at Home School Program targets schools in the Houston area, located within a 1-mile radius of the Longhorn pipeline system. This program educates 4th and 5th-grade students about pipeline safety, damage prevention, and emergency preparedness. Schools in Austin are given presentations to provide to their students. Schools in Houston are given presentations by a Safe at Home representative. In 2021, Magellan proposed replacing these two programs with a program run by the Smalley Foundation. This program offers a custom School Pipeline Safety Webpage, an annual mailer to school officials, documentation of all outreaches to measure effectiveness (metrics), and an in-person visit to school officials on a 4-year rotating calendar. This new program would help expand Magellan's current outreach and target more schools in Houston and Austin. These changes will take effect in 2023.

2.5.5 Encroachment Procedures

Magellan defines encroachments as entities that intrude on the Longhorn Pipeline System ROW. Encroachments are most frequently made by non-Magellan personnel operating farming, trenching, drilling, or other excavating equipment. Removing debris and other obstructions along the ROW to facilitate prompt access to the pipeline for routine or emergency repair activities is also considered an encroachment.

The SIP includes provisions for surveillance to prevent and minimize the effects of unannounced or unauthorized ROW encroachments. Encroachments are typically identified by: aerial patrols, one-call tickets, or encroachment agreements. There was one unauthorized encroachment in 2022. There was damage to the pipeline's coating, which was repaired with RD-6. When properly followed by the encroaching party, the encroachment procedures have effectively

prevented TPD to the pipeline. Corrective actions were implemented to help prevent a recurrence in all instances. The SIP outlines programs to help mitigate and investigate ROW encroachments.

2.6 Incident Investigation Program

Magellan performs incident investigations on all incidents and near-misses, whether or not they are Department of Transportation (DOT)-reportable[23]. Magellan achieved a record-low number of zero PHMSA reportable releases in 2022. There was one minor release that occurred at the El Paso facility. Excessive vibration caused a nipple to crack, and 0.10 bbl of product was released; this is considered a small amount, so no incident investigation was completed. Magellan should continue to record all relevant data on incident reports, including a detailed description of the incident, root cause, and contributing factors to help improve the overall effectiveness of the incident investigation program.

The Magellan Integrity Management Program (IMP) is a written plan included in the SIP by which Magellan manages operational risk through integrity management activities such as assessment, inspection, and maintenance of the pipeline system. The Magellan IMP also includes activities to assess and improve the program's performance. The primary goal of IMP is Mission Zero, eliminating preventable incidents through evaluation, risk analysis, inspection, and maintenance of pipeline systems as described in the SIP.

In alignment with Mission Zero, Magellan assessed multiple tools and vendors to replace the current reporting system to better track incidents and near misses and communicate lessons learned. Enablon, a third-party software, is an upgraded Incident Management system that tracks incidents and near-misses. This program will be piloted at the Odessa location in 2023. The 2023 ORA report will discuss the pilot program in further details.

In 2022. the practice of entering Near Misses and tracking near misses continued to be an area of focus for Magellan. From the standpoint of facility data acquired, one can conclude that the facilities were well maintained. Kiefner recommends that Magellan continue its detailed documentation of incidents, its facility integrity processes, and its reporting of the facility maintenance program.

2.7 Incorrect Operations Mitigation Program

In addition to their investigation program, Magellan also implements an Incorrect Operations Mitigation Program to identify and reduce the likelihood of human errors that could impact the mechanical integrity of the Longhorn Pipeline System. "Incorrect Operations" is described as incorrect operation or maintenance procedures or a failure of pipeline operator personnel to follow procedures correctly. There was one one-call/third-party damage incident in 2022. The incident was not DOT reportable and was formally documented and investigated.

[23] DOT-Reportable Requirement**.** A "PHMSA (or DOT) reportable incident" is a failure in a pipeline system in which there is a release of product resulting in explosion or fire, volume exceeding 5 gallons (5 barrels from a pipeline maintenance activity), death of any person, personal injury necessitating hospitalization, or estimated property damage exceeding $50,000.

2.8 Threats to Facilities

Threats to facilities address the operational reliability of facilities other than line pipes, including pump stations, terminals, and associated mechanical components. Magellan monitors the integrity of these facilities through scheduled maintenance and inspection activities prescribed by the SIP. The SIP Mechanical Integrity Program focuses on maintaining the integrity of all equipment within the Longhorn system (e.g., station pumps, tanks, valves, and control systems). The program includes the following activities:

- Identification and categorization of equipment and instrumentation
- Inspection and testing methods and procedures
- Testing acceptance criteria and documentation of test results
- Maintenance procedures and training of maintenance personnel
- Documentation of specific manufacturer recommendations

Magellan implements their preventive maintenance program through its Enviance/Compliance Management System. This software system establishes an inspection and maintenance schedule for equipment items in the Longhorn System and can be adjusted based on the risk level. An Action Item Tracking and Resolution Initiative (database) provides a method of tracking mechanical integrity recommendations.

A Facility Risk Management Program is in place to manage the risks at above-ground facilities, at the writing of this report all facilities have a reassessment interval no greater than 5 years. The LMP requires that all changes on the Longhorn system be evaluated using an appropriate PHA methodology and that the change be assessed to ensure that the appropriate risk mitigation levels on the system are maintained. PHAs are conducted for all new facilities and significant changes. No PHAs were required to be completed in 2022.

Facility inspections addressing items related to safety, security, and environmental compliance are conducted regularly. Staffed facilities are inspected yearly; unstaffed facilities are inspected every two years. Pump stations located in sensitive and hypersensitive areas are inspected every two and one-half days. Technicians are onsite regularly to perform routine maintenance and operation activities. Technicians are also on-call to respond to emergencies or other operational events. Additionally, remote cameras are in place for monitoring purposes. Atmospheric Inspection surveys are conducted annually at pre-assigned above-ground piping and facilities. Kiefner received safety review reports for fourteen facilities, as shown in Table 28.

Table 28. Facility Inspections received in 2022

Facility	Inspection Date
Cottonwood Station	10/28/2022
Crane Station	10/31/2022
Texon Station	10/21/2022
Barnhart Pump Station	10/18/2022
Barnhart Terminal	10/31/2022
Cartman Station	11/14/2022
Kimble Station	11/14/2022
James River Station	11/21/2022
Eckert Station	11/22/2022
Cedar Valley Station	11/18/2022
Bastrop Station	11/18/2022
Warda Station	11/7/2022
Buckhorn Station	11/7/2022
Satsuma Station	11/7/2022

Facility Risk Assessments (FRA) continued throughout 2022, making it the third year of assessments since the program was enhanced. Assessments aim to minimize the number and size of potential releases. Magellan completed 10 FRAs on the Eckert to Bastrop line segment in 2022, including mileposts 148, 167, 171, 172, 175, 176, 177, 185, 186, and 194.

2.9 Stress-Corrosion Cracking (SCC)

SCC is a form of environmental attack on pipe steel involving the interaction of a local corrosive environment and tensile stresses in the metal, resulting in the formation and growth of cracks. The Longhorn Pipeline has not identified SCC as a threat but added SCC as a threat since SCC has been an unexpected problem for some pipelines. The existing pipeline has been in operation for 73 years, and there are no SCC failures; no SCC has been discovered in-ditch at any location on the pipeline, and ILI assessments have reported no SCC.

Per the LMC 19(a) and the 2003 Office of Pipeline Safety (OPS) Advisory Bulletin ADM-05-03 "Stress-Corrosion Cracking (SCC) Threat to Gas and Hazardous Liquid Pipelines," Longhorn was required to inspect for SCC for the first three years (2005-2007) by selecting specific sites most susceptible to SCC. Magellan has continued subsequent inspection for SCC as a supplemental examination when the pipe is exposed and examined for other reasons, such as ILI anomaly excavations.

In 2022, Magellan continued checking the exposed pipe surface for SCC using magnetic particle testing during ILI investigation digs. Magnetic particle inspection is conducted on the entire pipe circumference between coating cuts. The coating is typically removed a couple of feet to either side of the ILI target anomaly. If multiple ILI target anomalies within a single joint, the coating is typically removed for the entire distance between anomaly targets (unless the two target anomalies are at opposite ends of the joint). Since no evidence of SCC has been detected, it is not necessary to recommend an intervention measure. Magellan will continue to monitor this threat through their current method, which consists of looking for evidence of SCC during maintenance excavations.

2.10 Risk Analysis Program

In the SIP, two functions address Risk on the Longhorn Pipeline system:

1.) Key Risk Areas Identification and Assessment,
2.) Scenario-Based Risk Mitigation Analysis.

Magellan's Key Risk Areas Identification and Assessment program aims to ensure that resources are focused on those areas of the Longhorn Pipeline System with the highest identified or perceived risks. The objective of Magellan's Scenario-Based Risk Mitigation Analysis program is to identify preventive measures and/or modifications that can be recommended that would reduce the risks to the environment and the population in the event of a product release. The Key Risk Area Identification and Assessment Program results are incorporated into the Scenario-Based Risk Mitigation Analysis Program.

2.10.1 Key Risk Areas Identification and Assessment

The Longhorn Pipeline System traverses various unique areas of land use, topography, and population density; it presents a variety of risk concerns to these lands and to the people who either inhabit or are present in these areas. To help prioritize risk management efforts, Magellan has categorized the Longhorn Pipeline System with the following designations:

- Tier I – normal cross-country pipeline
- Tier II – sensitive areas
- Tier III – hypersensitive areas

Further, the area across the Edwards Aquifer in South Austin is a Tier III designated area of additional heightened environmental sensitivity, resulting in even more scrutiny and the commitment to incremental risk mitigation measures.

Magellan's probabilistic risk model utilizes integrated data and incorporates a dynamic segmentation process to maintain adequate resolution and avoid mischaracterization or loss of detail. The risk measurement methodology includes a POF threshold management to manage pipeline integrity and evaluate risk in accordance with 49 CFR 195.452. The POF measurement integrates all available information about the integrity of the pipeline. This integration aids in the identification of preventive and mitigation measures to protect areas along the pipeline.

The LMP risk management plan commitment is to maintain pipeline-related failure rates at or below a probability level of 1 in 10,000 (0.0001) per mile-year. The scenario-based risk mitigation analysis (SBRMA) for the 2022 operating year was performed in 2023. The results show that none of the pipeline segments exceeded the risk threshold; therefore, no additional mitigation measures were required or recommended.

Magellan began enhancing its Facility Integrity Management Program (FIMP) in 2018. In 2020, Magellan implemented a new FIMP element of its Integrity Management Plan. The FIMP requires a detailed FRA, which provides risk analysis and re-inspection interval recommendations based on an assessment of data from the various FIMP elements in place to protect the integrity of the facility. FRAs focus on leak detection, mechanical integrity, prime equipment, corrosion control, operating pressure programs, fire safety, and re-inspection intervals and are prioritized

on a risk-based schedule. Magellan completed 10 FRAs on the Eckert to Bastrop line segment in 2022, including mileposts 148, 167, 171, 172, 175, 176, 177, 185, 186, and 194.

2.10.2 Scenario-Based Risk Mitigation Analysis

The primary focus of Magellan's scenario-based risk mitigation analysis is mechanical integrity, operating controls, and prevention of TPD. The pipeline risk model was updated and executed in 2023 with information from operations in 2022. Results show no areas along the pipeline with POF greater than $1E^{-4}$ failures and, as such, support the effectiveness of Magellan's existing Integrity Management Program.

2.11 Management of Change Program

Magellan has established an effective program to manage changes to process chemicals, technology, equipment, procedures, and facilities across the Longhorn Pipeline System. The Longhorn Mitigation Plan requires that all changes to the Longhorn system be evaluated using an appropriate PHA. The Magellan Management of Change Request (MOCR) process helps identify changes that impact the LMP. In 2022, Magellan had 46 MOCRs on the Longhorn Pipeline System; 15 of the 46 were determined to have some impact on the LMP. Per the Self-Audit Report, all 15 MOCRs had detailed reports and were reviewed by the appropriately impacted Magellan personnel or departments.

2.12 System Integrity Plan Scorecarding and Performance Metrics Plan

Magellan has implemented an effective method for evaluating the effectiveness of the SIP on an annual basis using performance measures (or scorecarding) from three categories:

- Activity measures – proactive activities aimed at preserving pipeline integrity;
- Deterioration measures – evidence of deterioration of pipeline integrity and
- Failure measures – occurrences of failures or near-failures.

The technical assessment of the SIP indicated that Magellan is achieving the goal of the SIP, namely, preventing incidents that would threaten human health or safety or cause environmental harm. Magellan provides educational outreach programs to schools within a 1-mile radius of the LPS. A total of six schools participated in the program. Due to COVID-19 concerns, Austin schools participated in an online survey tied in with the "Pipelines All Around You" presentation. A total of 115 teachers at 21 elementary schools were targeted; three schools participated (Table 29). Magellan exceeded the minimum required mileage for both aerial surveillance and ground patrol. In addition, ROW markers and signs were repaired or replaced where necessary, and public awareness meetings were held.

Regarding metal loss deterioration measures, two metal loss features met POE dig requirements from the 2022 ILI runs. Regarding failure measures, there was one one-call violation, one physical hit to the pipeline (associated with the one-call violation), two ROW near-misses, and no DOT-reportable incidents.

Table 29. Educational and Outreach Meetings

EVENT	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Emergency Responder / Excavator Meetings	14	12	11	11	11	11	11	11	11	25	30	30	16	16	24	25	25	25
School Program - Houston	2	2	3	4		6	5	6	1	3	4	4	5	5	5	4	6	6
School Program - Austin	3	2	7	3	4	3	4	5	5	2	2	2	3	2	3		3	3
Texas Statewide School Pipeline Safety Outreach													16	3	30			
Neighborhood Meetings	2	2																
Misc. Meetings:													*	*	*	*	*	*
Creekside Nursery	1																	
Cy Fair ISD	1																	
Region 6 LEPC Conference (Houston)	1																	
Public Events	4		4	3	2	2							*	12	12	17	9	8
TOTAL	28	18	25	21	17	22	20	22	17	30	36	36	24	38	75	46	43	42

NOTE: Public meetings were tallied for the years 2005-2022 as follows:

- Emergency Responder / Excavator Meetings: Count only the number of meetings (not the total number of counties).
- School Program: Houston Program - count the schools that request the Safe at Home Program; Austin Program - count only schools where Longhorn/Magellan gave presentations.
- Texas Statewide: Texas School Safety Conference
- Neighborhood Meetings: Phased out in 2007 and replaced by school programs and public events enhancements.
- Misc. Meetings: Count all other meetings that are not public events (i.e., daycares, church meetings, public speaking engagements, etc.).
- Public Events: Count events such as rodeos, county fairs, fundraisers, home shows, Safety Day Camps, etc.

*Refer to the 2022 TPD Annual Assessment for details.

3 OVERALL SIP PERFORMANCE MEASURES

The LMP describes the philosophy of the SIP. By this philosophy, Magellan commits to "constructing, operating and maintaining the Longhorn Pipeline assets in a manner that ensures the long-term safety of the public, and to its employees, and that minimizes the potential for negative environmental impacts." The ORAPM provides a method for evaluating the effectiveness of the SIP annually using performance measures (or scorecarding) from three categories (listed below). The 2022 status of each measure is evaluated in Sections 3.1 through 3.3.

- Activity measures – proactive activities aimed at preserving pipeline integrity
- Deterioration measures – evidence of deterioration of pipeline integrity
- Failure measures – occurrences of failures or near-failures

3.1 Activity Measures

The activity measures monitor the surveillance and preventive activities that Magellan has implemented since the preceding ORA. These measures indicate how well Magellan implements the various SIP elements; Table 30 summarizes the SIP Activity Measures from 2005 through 2022. The activity measures are:

- The number of miles inspected in 12 months by aerial and ground survey (per pipeline segment). The minimum patrol mileage needed for ROW aerial surveillance to meet this requirement is 64,560 miles for Galena Park to MP 528 and 8,153 miles for MP 528 to 694. For ground patrol, 583 miles are needed for the Edwards Aquifer area. This metric is compared to the previous 12-month period. Magellan met this commitment in 2022.

- The number of warning or ROW identification signs installed, replaced, or repaired in 12 months. The metric is compared to previous Magellan performance. This metric is used to measure consistent effort by Magellan to protect the ROW and prevent TPD. There is no "passing grade" because proper placement and maintenance of signs may lead to fewer signs being replaced or repaired in future years, and this decline will not indicate any failure on the part of Magellan. Tracking the replacement or repair of signs by pipeline segment may indicate potential third-party vandalism or carelessness in certain system segments; this could be used as a leading indicator that additional public education might be needed in that region of the pipeline route.

- The number of outreach or training meetings (listed with locations and dates) to educate and train the public and third parties about pipeline safety. This metric is used to gauge consistent effort by Magellan to educate the public regarding pipeline safety and to prevent TPD to the pipeline. There is no "passing grade," although comparing the results from this metric with sign placement, repair, and replacement can be used to see if public education is being emphasized in the same geographic region where sign maintenance indicates problems.

- The number of calls into the one-call system to mark or flag the Longhorn Pipeline (sorted by Tier-I, Tier-II, or Tier-III). This is completed to measure the effectiveness of the one-call system in preventing TPD. The measure is compared to previous years of Magellan records. Since this is a metric that is not subject to control by Magellan, there

is no "passing grade." This metric can be compared to encroachments, allowing an overall measurement of the efficiency of the one-call process.

Table 30. System Integrity Plan Activity Measures

Year	Measure		
	Miles of pipelines inspected by aerial and ground survey (73,296 mi required)	*No. of warning or ROW identification signs installed, replaced, or repaired*	*No. of outreach or training meetings to educate and train the public and third parties about pipeline safety*
2005	203,081	979	28
2006	197,234	732	18
2007	188,884	237	25
2008	187,931	536	21
2009	181,308	460	17
2010	180,045	291	22
2011	188,564	76	20
2012	188,722	66	22
2013	179,107	539	17
2014	176,884	266	30
2015	175,920	130	36
2016	173,996	315	36
2017	162,030	194	24
2018	152,322	105	24
2019	160,553	93	33
2020	154,252	195	29
2021	171,861	2372*	31
2022	183,482	1508	42

*The increase in marker repairs was due to the replacement of stickers along the line, not due to damaged signs.

3.2 Deterioration Measures

Deterioration measures evaluate maintenance trends to indicate when the system's integrity could be seen as declining despite preventive actions. Table 31 provides a summary of the deterioration measures from 2006 through 2022. In 2022, there were:

- There are no immediate conditions as defined by the SIP and 49 CFR 195.452.
- Two ILI-reported metal loss features met POE evaluation dig requirements in 2022.
- Hydrostatic test leaks per mile have not been an indicator of performance. Only one hydrostatic test has been performed for pipeline integrity purposes.

The monitoring and excavation program should continue to address significant ILI-reported anomalies, and POE calculations should continue to be performed.

Table 31. System Integrity Plan Deterioration Measures

Year	Measure					
	Number of immediate ILI anomalies per mile pigged	Number of immediate ILI anomalies per mile pigged, sorted by tier classification			Total number of anomalies per hydrostatic test*	Number of POE Evaluations per mile pigged
		Tier 1	Tier 2	Tier 3		
2005	0.029	N/A	N/A	0.192	N/A	1.48
2006	0.0203	0.212	0.0208	N/A	N/A	0.54
2007	0.038	0.035	N/A	0.003	N/A	0.69
2008	0.004	0.006	N/A	N/A	N/A	0
2009	0	0	0	0	N/A	0.017
2010	0	0	0	0	N/A	0.14
2011	0	0	0	0	N/A	0.035
2012	0	0	0	0	N/A	0.025
2013	0	0	0	0	N/A	0.033
2014	0	0	0	0	N/A	0.017
2015	0.004	0	0.004	0	N/A	0.013~
2016	0	0	0	0	N/A	0
2017	0	0	0	0	N/A	0
2018	0	0	0	0	N/A	0.067
2019	0	0	0	0	N/A	0.15
2020	0.036	0.012	0.024	0	N/A	0.28^
2021	0	0	0	0	N/A	0
2022	0	0	0	0	0`	0.017

*Hydrostatic tests were performed for pipeline commissioning purposes.

~POE calculations were only performed on the MFL assessments; the number of POE evaluations per mile pigged did not include the TFI mileage.
^The number of POE evaluations per mile did not include the UCD mileage.`
`Performed for pipeline integrity purposes.

3.3 Failure Measures

Failure Measures are generated from leak history, incident reports, incident responses, and product loss accounting. These metrics can be used to gauge progress towards fewer spills and improved response or to measure the deterioration of overall system integrity. These measures are listed below in Table 32. Response times, volumes, and costs are for DOT-reportable leaks. Service interruptions, both scheduled and unscheduled, that were reported during 2022 are shown in Table 33.

Table 32. System Integrity Plan Failure Measures

Measure		2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Number of leaks (DOT-reportable)		2	0	1	3	0	1	2	0	2	2	0	0	3	1	0	1	0	0
Average response time in hours for a product release.	Tier I	Immed.	NA	Immed.	Immed.	N/A	Immed.	Immed.	N/A	Immed.	Immed.	N/A	N/A	Immed.	Immed.	N/A	N/A	Immed.	N/A
	Tier II	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Immed.	Immed.	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	Tier III	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Immed.	Immed.	N/A	N/A	Immed.	N/A	N/A	N/A	N/A	N/A
Average product volume released per incident (bbl)	Tier I	5.7	0	5.7	0.4	N/A	0.4	1.2	N/A	0.47	2.74	N/A	N/A	1048	282	0	N/A	0.24	N/A
	Tier II	0	0	0	0	N/A	0	0	N/A	0	0	N/A	N/A	N/A	N/A	0	N/A	0	N/A
	Tier III	0	0	0	0	N/A	0	0	N/A	4	0	N/A	N/A	28	N/A	0	N/A	0	N/A
Total product vol. released in 12-month period (bbl)	Tier I	17	0	5.7	1.3	N/A	0.4	2.5	N/A	0.47	5.48	N/A	N/A	2096	94	0	N/A	0.24	N/A
	Tier II	0	0	0	0	N/A	0	0	N/A	0	0	N/A	N/A	N/A	N/A	0	N/A	0	N/A
	Tier III	0	0	0	0	N/A	0	0	N/A	4 bbls	0	N/A	N/A	28	N/A	0	N/A	0	N/A
Cleanup cost totals per year		< $100k	$0	< $200k	< $150k	N/A	< $50	< $50	N/A	> $100k	< $25	N/A	N/A	>$528k	$7.2M	<$500K	$500	N/A	N/A
Cleanup cost per incident		< $35k	N/A	< $200k	< $50k	N/A	< $50	< $25	N/A	< $25k < $50k > $100k	< $25	N/A	N/A	$28k $500k No info	$7.2M	<$500K	$500	N/A	N/A
Reports from aerial surveys or ground surveys of encroachments into the pipeline ROW without proper one-call		1	0	1	3	3	1	1	2	2	0	3	2	4	5	4	1	6	1
Number of known physical hits (contacts with pipeline) by third-party activities		0	0	0	0	0	0	2	0	0	0	0	0	1	0	0	0	0	1
Number of near-misses to the pipeline by third parties		7	1	7	5	6	2	4	3	2	0	4	0	8	2	1	1	1	2
Number of service interruptions		115	165	155	74	16*	17	9	8	15	15	11	8	13	114	141	43	132	180

Table 33. Service Interruptions per Month for 2022[24]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
No./Month	13	13	10	15	11	35	30	13	17	11	8	4	**180**

[24] Service interruptions include both scheduled and unscheduled interruptions.

4 INTEGRATION OF INTERVENTION REQUIREMENTS AND RECOMMENDATIONS

4.1 Integration of Primary Line Pipe Inspection Requirements

Section 11 of the ORAPM specifies the integration of primary line pipe inspection requirements addressing corrosion, fatigue-cracking, lamination and hydrogen blisters, TPD, and earth movement. Magellan has four remediation commitments for using ILI for the pipeline: LMC 10, LMC 11, LMC 12, and LMC 12A. These commitments required Magellan: use an MFL tool for corrosion inspection in the first three months of operation, use a TFI tool for seam inspection (which includes hook cracks and preferential seam corrosion) within the first three years of operation, use a UT wall measurement tool within the first five years of operation for inspection of laminations and detection of blisters, and use an EGP tool at least every three years for inspection of TPD to the pipe. Future inspection requirements are based on reassessment interval procedures set by the ORAPM, with the additional requirement that EGP tools must be run at least every three years.

There is an overlap in anomaly detection capabilities of the various commercially available ILI tools and considerable variability in vendor availability. As each cycle of the ORA is performed, additional data will become available from ILI tools, routine maintenance reports, and ILI anomaly investigation reports. The ORA process will continue to integrate these data to minimize the level of risk to the pipeline system integrity from each identified failure mode. To maintain and further reduce risk where possible, the ORA will identify and recommend the most appropriate ILI technology to obtain the necessary additional information. One ILI tool technology may satisfy multiple inspection requirements for a pipe segment. The tools Magellan has committed to using have multiple capabilities.

Table 34 and Table 35 present the most recently completed ILI assessment and note requirement dates for future planned assessments for the crude and refined pipelines. The required reassessments are specified per the ORAPM. Reassessment requirements for pressure-cycle-fatigue crack growth reassessment intervals were based on the analysis performed in Section 2.1. Reassessment requirements for corrosion and TPD are based on the most recent inspection date; corrosion inspections are required every five years, while TPD is required every three years for the crude line and every five years for the refined line. Earth movement, the fifth component for threat integration, is not included in Table 34 and Table 35 because it is currently addressed using surface surveys rather than ILI technology. For a complete listing of all ILI assessments on the crude and refined pipeline systems, refer to the 2017 Longhorn ORA Final Report.

Table 34. Completed ILI Runs and Planned Future ILIs for Longhorn Crude System

		E. Houston to Speed Jct	Satsuma to E. Houston	Buckhorn to Satsuma	Warda to Buckhorn	Bastrop to Warda	Cedar Valley to Bastrop	Eckert to Cedar Valley	James River to Eckert	Kimble to James River	Cartman to Kimble	Barnhart to Cartman	Texon to Barnhart	Crane to Texon
	Mileage	**0 to 10.8**	**2.35 to 34.1**	**34.1 to 68.0**	**68.0 to 112.9**	**112.9 to 141.8**	**141.8 to 181.6**	**181.6 to 227.9**	**227.9 to 260.2**	**260.2 to 295.2**	**295.2 to 344.3**	**344.3 to 373.4**	**373.4 to 416.6**	**416.6 to 457.5**
Assessments	**Corrosion**													
	Tool	Multi-Data	Multi-Data	TFI	TFI	TFI	TFI	TFI	TFI	TFI	TFI	TFI	TFI	TFI
	Date of Tool Run	2-Oct-14	1-Oct-14	18-Dec-15	16-Dec15	11-Dec-15	8-Dec-15	4-Dec-15	19-Aug-15	1-Sep-15	29-Aug-15	24-Aug-15	11-Aug-15	17-Jul-15
	Tool	GMFL	MFL		MFL									MFL
	Date of Tool Run	28-Aug-19	13-Aug-19		5-Nov-19									16-Oct-18
	Tool			MFL		MFL	MFL	MFL	MFL	MFL	MFL	MFL	MFL	
	Date of Tool Run			14-Jan-20		9-Jan-20	6-Jan-20	4-Feb-20	4-Mar-20	11-Aug-20	8-Jul-20	12-Jun-20	5-May-20	
	Pressure Cycle Induced Fatigue													
	Tool		TFI ‡	TFI	TFI	TFI	TFI	TFI	TFI	TFI	TFI	TFI	TFI	TFI
	Date of Tool Run		6-Jul-07	18-Dec-15	16-Dec-15	11-Dec-15	8-Dec-15	4-Dec-15	19-Aug-15	1-Sep-15	29-Aug-15	24-Aug-15	11-Aug-15	17-Jul-15
	Tool		UCD	UCD	UCD									UCD
	Date of Tool Run		16-Aug-19	6-Dec-19	8-Nov-19									19-Oct-18
	Tool					UCD	UCD	UCD	UCD	UCD	UCD	UCD	UCD	
	Date of Tool Run					28-Jan-20	16-Jan-20	4-Mar-20	11-Mar-20	20-Oct-20	25-Aug-20	16-Jun-20	15-May-20	
	Laminations & Hydrogen Blisters													
	Tool		UT	UT	UT	UT	UT	UT	UT	UT	UT	UT	UT	UT
	Date of Tool Run		22-Sep-09	24-Nov-09	24-Nov-09	24-Jan-10	24-Jan-10	20-Feb-10	25-Jun-10	25-Jun-10	25-Jun-10	8-Jul-10	8-Jul-10	8-Jul-10
	Third-Party Damage													
	Tool	Def.			Def.									
	Date of Tool Run	28-Aug-19			5-Nov-19									
	Tool			Def.		Def.	Def.	Def.	Def.	Def.	Def.	Def.	Def.	
	Date of Tool Run			14-Jan-20		9-Jan-20	6-Jan-20	4-Feb-20	4-Mar-20	11-Aug-20	8-Jul-20	12-Jun-20	5-May-20	
	Tool		Def.		Def.									Def.
	Date of Tool Run		6-Jul-21		15-Feb-22									9-9-21
	Next Required Assessment													
	Corrosion	28-Aug-24	13-Aug-24	14-Jan-25	5-Nov-24	9-Jan-25	6-Jan-25	4-Feb-25	4-Mar-25	11-Aug-25	8-Jul-25	12-Jun-25	5-May-25	16-Oct-23
	Pressure-Cycle Induced Fatigue	2128	2048	2048	2043	2036	2052	2047	2043	2091	2058	2094	2059	05-Apr-27
	Third-Party Damage*	28-Aug-24	6-Jul-24	14-Jan-23	15-Feb-25	9-Jan-23	6-Jan-23	4-Feb-23	4-Mar-23	11-Aug-23	8-Jul-23	12-Jun-23	5-May-23	9-Sep-24

‡The TFI was used to remediate Phase I and Phase II corrosion anomalies and, in some cases, was used to remediate POE anomalies but was not used to set the next corrosion reassessment using the POE process.
*Per Longhorn EA section 9.3.2.3, EGP assessments are required every 3 years per the LMP. ID reductions identified from these assessments will be correlated to the existing laminations found from the UT assessments.

Table 35. Completed ILI Runs and Planned Future Inspections for Longhorn Refined System

		Crane to Cottonwood	Cottonwood to El Paso	Odessa to Crane	8" El Paso to Chevron	8" Kinder Morgan Flush Line	8" El Paso to Strauss	12" El Paso to Kinder Morgan
Mileage		**457.5 to 576.3**	**576.3 to 694.4**	**0 to 29.26**	**0 to 9.4**	**0 to 9.4**	**0 to 9.4**	**0 to 9.4**
Assessments	**Corrosion**							
	Tool		MFL		SMFL	SMFL		SMFL
	Date of Tool Run		1-Nov-17		13-Jul-17	13-Jul-17		14-Jul-17
	Tool	MFL					MFL	
	Date of Tool Run	18-Apr-18					25-Oct-18	
	Tool			MFL				
	Date of Tool Run			8-Sep-21				
	Tool		GMFL		MFL	MFL		Hydrotest
	Date of Tool Run		5-Aug-22		2-Jun-22	1-Jun-22		25-June-22
	Third-Party Damage							
	Tool		Deformation		Deformation	Deformation		Deformation
	Date of Tool Run		14-Aug-17		13-Jul-17	13-Jul-17		14-Jul-17
	Tool						Deformation	
	Date of Tool Run						25-Oct-18	
	Tool	Deformation		Deformation				
	Date of Tool Run	8-Nov-20		8-Sep-21				
	Tool		Deformation		Deformation	Deformation		Hydrotest
	Date of Tool Run		1-Jul-22		2-Jun-22	1-Jun-22		25-June-22
Next Required Assessment								
Corrosion		18-Apr-23	5-Aug-27	8-Sep-26	2-Jun-27	1-Jun-27	25-Oct-23	25-June 2027
Pressure-Cycle Induced Fatigue		2233	2233	2093	Not susceptible~	Not susceptible~	Not susceptible~	Not susceptible~
Third-Party Damage		8-Nov-25	1-Jul-27	8-Sep-26	2-Jun-27	1-Jun-27	25-Oct-23	25-June 2027

~These line segments were constructed in 2002 with high-frequency ERW pipe and, therefore, have a lower risk of cyclic fatigue.

4.2 Integration of DOT HCA Inspection Requirements

Magellan must comply with the DOT Integrity Management Rule, 49 CFR 195.452, for HCAs and meet the LMP requirements. The pipeline from 9th Street Junction to El Paso is under DOT jurisdiction, including the four laterals connecting El Paso to Diamond Junction and the lateral from Odessa to Crane.

The HCA rule states that an operator must establish 5-year intervals, not to exceed 68 months, for continually assessing the pipeline's integrity. An operator must base the assessment intervals on the risk the line pipe poses to the HCA to determine the priority for assessing the pipe. At this time, corrosion has proven to be the higher priority risk of the five threats to pipeline integrity. Because of the LMP requirements and the multiple capabilities of each tool, the HCA line pipe between the 9th Street Junction and Crane has been inspected in less than five years intervals. The HCA requirement will continue to be integrated into the ILI requirements as additional tool runs are completed to ensure the required 5-year interval is not exceeded.

LMC 12A requires an EGP tool to be run every three years on the existing pipeline (between Valve J-1 and Crane). This interval is due to a greater risk of mechanical damage to the existing

pipeline. The existing pipeline is often buried shallower than 30 inches below the surface because of burial requirements when the pipeline was built. The HCA requirement (49 CFR 195.452) for the new pipeline extensions requires an EGP tool to be run every five years. The risk of mechanical damage on the New Pipeline is less because the pipeline is buried at least 30 inches deep.

4.3 Pipe Replacement Schedule

There were no pipe replacements in 2022.

5 NEW INTEGRITY MANAGEMENT TECHNOLOGIES

The LMP requires incorporating and considering new and emerging technologies and processes that will assess or prove the integrity of the pipeline system. There is no requirement to incorporate these processes, but as the analyses improve and evolve in the industry, they may be used where appropriate.

5.1 Plausible Profile (Psqr) Model for Corrosion Assessment

A new corrosion assessment model[25] seeks to mitigate the significant integrity risks that internal and external corrosion pose to oil and gas pipelines. While existing models, primarily based on the ASME B31G model family, including derivatives such as Modified B31G (0.85dL) and RSTRENG, maintain varying degrees of conservatism and accuracy, the newly introduced Psqr model aims to enhance precision while preserving safety margins. This innovative approach diverges from the singular worst-case river bottom characterization of corrosion used in the RSTRENG model, adopting multiple plausible profiles (Psqr) instead to depict corrosion anomalies accurately. This more accurate corrosion model allows operators to prioritize their remediation strategies to maximize safety.

Psqr solves the problem of RSTRENG calculating overly conservative predicted failure pressures (PFP) for very wide corrosion morphologies using the following algorithm: first, the Psqr model calculates hundreds of possible failure profiles using the RSTRENG model for each corrosion anomaly. Then, the model calculates the PFP for each plausible profile. Lastly, the model calculates the final PFP using the 5th percentile lowest PFP calculated from the hundreds of plausible profiles. Essentially, this algorithm tries to choose the worst physically possible scenario of a pipe rupturing from corrosion.

For qualification, the Psqr model underwent rigorous validation and verification procedures encompassing various analyses, such as sensitivity analysis for optimizing model parameters and comparison with full-scale hydrostatic burst test data gathered by operators and other public domain resources. Pilot studies examining internal data sets were also conducted, including scrutiny of corrosion features discerned through laser pipeline inspection tools and MFL-identified corrosion features. Initial results indicate that the Psqr model excels in accuracy and precision and significantly reduces model bias and error standard deviation, notably within the full-scale hydrostatic burst tests. Moreover, the Psqr model demonstrated a substantial decrease

[25] Kariyawasam, Shahani. *Plausible Profiles (Psqr) Model for Corrosion Assessment.* TC Energy and Pipeline Research Council International, Inc. September 23, 2019.

in the number of overly conservative predicted failure pressures for wide corrosion anomalies. However, the efficacy of reducing conservatism varies depending upon the corrosion morphology, and it retains the original limitations inherent to the RSTRENG model. The full Psqr report further contains an insightful discussion regarding the prerequisites for utilizing assessment models effectively for corrosion evaluation.

6 REFERENCES

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2. Kiefner, J. F., Johnston, D. C., and Kolovich, C. E., "Mock ORA for Longhorn Pipeline," Kiefner and Associates, Inc., Final Report 00-49 to Longhorn Pipeline Partners, LP (October 16, 2000).
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5. Environmental Assessment, Appendix 9E, Longhorn Mitigation Plan Mandated Studies Summaries.
6. Final Environmental Assessment of the Longhorn Pipeline Reversal, PHMSA-2012-0175, December 2012.
7. The Longhorn Mitigation Plan, September 2000.

APPENDIX A – MITIGATION COMMITMENTS

Table A-1. Longhorn Mitigation Commitments (pg. 1 of 7)

No.	Description	Timing of Implementation	Risk(s) Addressed
1	Longhorn shall hydrostatically test the hypersensitive (Tier III) and sensitive (Tier II) areas of the pipeline and those portions of the pipeline identified by the Surge Pressure Analysis as being potentially subject to surge pressures in excess of the current MASP. See Mitigation Appendix, Items 1 and 9.	Prior to startup / Completed	Outside Force Damage, Corrosion, Material Defects, and Previous Defects; Establish Safety Factor
2	Longhorn shall "proof test" all portions of the pipeline from the J-1 Valve to Crane Station that have not been hydrostatically tested pursuant to Mitigation Commitment No. 1. See Mitigation Appendix, Item 2	Prior to startup / Completed	Outside Force Damage, Corrosion, Material Defects, and Previous Defects
3	Longhorn shall replace approximately 19 miles of the existing pipeline over the Edwards Aquifer recharge and contributing zones with thick-walled pipe; the pipe will be protected by a concrete barrier. See Mitigation Appendix, Item 3	Prior to startup / Completed	Outside Force Damage, Corrosion, Material Defects, and Operator Error
4	Longhorn shall perform the following additional cathodic protection mitigation work: (a) Install 13 additional CP ground beds at locations described in Mitigation Appendix, Item 4. (b) Perform interference testing at 20 locations, if necessary, as described in Mitigation Appendix, Item 4. (c) Replace at least 600 feet of coating identified by the CP survey analysis as described in Mitigation Appendix, Item 4. (d) Repair or replace, as necessary, 12 shorted casings identified by the CP survey analysis at the locations described in Mitigation Appendix, Item 4.	Prior to startup / Completed	Corrosion
5	Longhorn shall lower, replace, or recondition, if necessary, the pipe at 12 locations per the Environmental Assessment (including Marble Creek). See Mitigation Appendix, Item 5.	Prior to startup / Completed	Outside Force Damage, Corrosion, and Material Defects
6	Longhorn shall remove stopple fittings at the following locations: Station Nos. 9071+36, 8936+35, and 8796+99 (MP 171.86, 169.25, and 166.61). See Mitigation Appendix, Item 6.	Prior to startup / Completed	Material Defects
7	Longhorn shall excavate the pipeline at two locations, near Satsuma Station and in Waller County, indicated by the 1995 in-line inspection, and determine condition and repair, if necessary. See Mitigation Appendix, Item 7.	Prior to startup / Completed	Material Defects and Corrosion
8	Longhorn shall replace the pipeline at the crossing of Rabb's Creek and investigate at least 5 dent locations identified by Kiefner, based upon the 1995 in-line inspection and repair, if necessary. See Mitigation Appendix, Items 8 and 19.	Prior to startup / Completed	Material Defects, Corrosion, and Outside Force Damage

Table A-2 (continued). Longhorn Mitigation Commitments (pg. 2 of 7)

No.	Description	Timing of Implementation	Risk(s) Addressed
9	Longhorn shall remediate any maximum allowable surge pressure (MASP) problems identified by Longhorn's most recent Surge Pressure Analysis by hydrostatically testing those portions of the pipeline which the Surge Pressure Analysis indicates could exceed MASPs. The hydrostatic test will requalify the portions of the pipeline, which will be tested to a MASP which is within permissible limits as established by the most recent Surge Pressure Analysis. Further, Longhorn will implement appropriate measures in all Tier II and Tier III areas of the pipeline to eliminate the possibility of conditions causing a surge pressure exceeding maximum operating pressure (MOP). See Mitigation Appendix, Item 9 and Longhorn Mitigation Commitment 34.	Prior to startup / Completed	Material Defects and Corrosion
10	Longhorn shall, following the use of sizing and (where appropriate) geometry tools, perform an in-line inspection of the Existing Pipeline (Valve J-1 to Crane) with a transverse field magnetic flux inspection (TFI) tool and remediate any problems identified. See the Longhorn Pipeline System Integrity Plan in Sec. 3.5.2 and the associated Operational Reliability Assessment in Sec. 4.0.	At such intervals as established by the ORA, provided that an inspection shall be performed no more than 3 years after system startup in Tier II and III areas.	Material Defects, Corrosion, Outside Force Damage and Previous Defects
11	Longhorn shall, following the use of sizing and (where appropriate) geometry tools, perform an in-line inspection of the Existing Pipeline (Valve J-1 to Crane) with a high-resolution magnetic flux leakage (HRMFL) tool and remediate any problems identified. Until Mitigation Item 11 has been completed, an interim MOP (MOPi) shall be established for the Existing Pipeline at a pressure equal to 0.88 times the MOP. (NOTE: 1.25 times the MOPi is equal to the Proof Test Pressure discussed in Mitigation Item 2 above). See the SIP in Sec. 3.5.2 and the associated ORA in Sec. 4.0.	Within 3 months of startup and thereafter at such intervals as are established by the ORA.	Corrosion, Outside Force Damage, and Previous Defects
12	Longhorn shall, following the use of sizing and (where appropriate) geometry tools, perform an in-line inspection of the Existing Pipeline (Valve J-1 to Crane) with an ultrasonic wall measurement tool and remediate any problems identified. See the SIP in section 3.5.2 and the associated ORA in Sec. 4.0.	At such intervals as established by the ORA, provided that an inspection shall be performed no more than 5 years after system startup.	Corrosion, Material Defects, Outside Force Damage, and Previous Defects
12A	Longhorn shall perform an in-line inspection of the Existing Pipeline (Valve J-1 to Crane) with a "smart" geometry inspection tool and remediate any problems identified. See the SIP in Sec. 3.5.2 and the associated ORA in Sec. 4.0.	At such intervals, as are established by the ORA, provided that no more than 3 years shall pass without an in-line inspection being performed using an inspection tool capable of detecting third-party damage (e.g., TFI, MFL, or geometry)	Outside Force Damage

Table A-3 (continued). Longhorn Mitigation Commitments (pg. 3 of 7)

No.	Description	Timing of Implementation	Risk(s) Addressed
13	Longhorn shall install an enhanced leak detection and control system, which will include a transient model-based leak detection system utilizing 9-meter stations (6 clamp-on meters and 3 turbine meters). Additionally, a leak detection system will be installed over the Edwards Aquifer Recharge Zone and the Slaughter Creek watershed in the Edwards Aquifer Contributing Zone that will detect a leak of extremely minute volume in 12 to 120 minutes from contact, depending upon the product sensed by the system. That leak detection system will be a buried hydrocarbon sensing cable system designed to meet the leak detection performance specifications described in the preceding sentence. The pipeline system is designed to achieve an emergency shutdown within 5 minutes of a probable leak indication. See Mitigation Appendix, Item 13.	System installation prior to startup and system operational within 6 months of startup / Completed	Leak Detection and Control
14	Longhorn shall perform close interval pipe to soil potential surveys to survey (a) hypersensitive areas and (b) pipeline segments which were not surveyed by the 1998 close interval survey (Station Nos. 10753+40 – 10811+06 [MP 203.66 – 204.75], 8897+60 – 8945+40 [MP 168.52 – 169.42], and 1729+24 – 1734+81 [MP 32.75 – 32.86]) and remediate corrosion-related conditions identified by the surveys as necessary. See Mitigation Appendix, Item 4 (Areas 12, 13, and 15) and the Longhorn Pipeline System Integrity Plan, section 3.5.1.	Prior to startup / Completed	Corrosion
15	Longhorn shall perform an engineering analysis to verify that all pipeline spans are adequately supported and protected from external loading. Longhorn shall implement the recommendations of such analysis to ensure the stability of such spans. Longhorn shall provide documentary or analytical confirmation of the pipe grade or the pipeline across the Colorado River. See Mitigation Appendix, Item 15.	Prior to startup / Completed	Material Defects, Outside Force Damage and Corrosion, Establish Safety Factors
16	Longhorn shall remove all encroachments along the pipeline right-of-way that could reasonably be expected to obstruct prompt access to the pipeline for routine or emergency repair activities, or that could reasonably be expected to hinder Longhorn's ability to promptly detect leaks or other problems. Potential encroachments will be evaluated using the guidelines in section 3.5.5, Encroachment Procedures of the Longhorn Pipeline System Integrity Plan.	Within one year of startup / Completed	Outside Force Damage, Leak Detection and Control
17	Longhorn shall clear the right-of-way to excellent condition (right-of-way encroachments shall be resolved by Longhorn pursuant to Mitigation Commitment 16). See Mitigation Appendix, Item 17.	Prior to startup and continuously thereafter	Outside Force Damage, Leak Detection and Control

Table A-4 (continued). Longhorn Mitigation Commitments (pg. 4 of 7)

No.	Description	Timing of Implementation	Risk(s) Addressed
18	As necessary, Longhorn shall inspect, repair, or replace 26 locations identified by Williams in its risk assessment model as areas requiring further investigation. See Mitigation Appendix, Item 18.	Prior to startup / Completed	Outside Force Damage, Material Defects, Corrosion, and Previous Defects
19	Longhorn has performed studies evaluating each of the following matters along the pipeline and shall implement the recommendations of such studies:	Prior to startup / Completed	Outside Force Damage, Corrosion, and Material Defects
	(a) Stress-corrosion cracking potential.		Outside Force Damage and Corrosion
	(b) Scour, erosion, and flood potential.		Outside Force Damage
	(c) Seismic activity.		Outside Force Damage
	(d) Ground movement, subsidence, and aseismic faulting.		Outside Force Damage
	(e) Landslide potential.		Outside Force Damage
	(f) Soil stress.		Outside Force Damage
	(g) Root cause analysis on all historical leaks and repairs.		Outside Force Damage, Corrosion, Material Defects, and Operator Error
20	Longhorn shall increase the frequency of patrols in hypersensitive and sensitive areas every 2-1/2 days, daily in the Edwards Aquifer area and weekly in all other areas. See the SIP, Section 3.5.4.	Continuously after startup	Outside Force Damage, Corrosion, Material Defects, Leak Detection and Control
21	Longhorn shall increase the frequency of inspections at pump stations to every two and one-half days in sensitive and hypersensitive areas. Additionally, remote cameras for monitoring pump stations will be installed within 6 months of startup for existing stations and at future stations prior to startup. See Mitigation Appendix, Item 21.	Continuously after startup	Outside Force Damage, Corrosion, Material Defects, Leak Detection and Control
22	Longhorn shall commission a study that quantifies the costs and benefits of additional valves at the following river and stream crossings: Marble Creek, Onion Creek, Long Branch, Barton Creek, Fitzhugh Creek, Flat Creek, Cottonwood Creek, Hickory Creek, White Oak Creek, Crabapple Creek, Squaw Creek, Threadgill Creek, and James River. Longhorn shall install additional valves if it determines, on the basis of the study, with DOT/OPS concurrence, that additional valves will be beneficial. See Mitigation Appendix, Item 22.	Prior to startup / Completed	Outside Force Damage, Corrosion, Material Defects, and Leak Detection and Control
23	Longhorn shall develop a response center in the middle area of the pipeline, which will include available response equipment and personnel such that under normal conditions, a maximum 2-hour full response can be assured. See Mitigation Appendix, Items 23, 24, and 26. (Items 23, 24, and 26 are grouped under the "Enhanced Facility Response Plan" heading in the Mitigation Appendix.)	Prior to startup / Completed	Leak Detection and Control

Table A-5 (continued). Longhorn Mitigation Commitments (pg. 5 of 7)

No.	Description	Timing of Implementation	Risk(s) Addressed
24	Longhorn shall revise its facilities response plan to better address firefighting outside of metropolitan areas (Houston, Austin, and El Paso) where HAZMAT units do not exist. See Mitigation Appendix, Items 23, 24, and 26. (Items 23, 24, and 26 are grouped under the "Enhanced Facility Response Plan" heading in the Mitigation Appendix.)	Prior to startup / Completed	Leak Detection and Control
25	Longhorn shall develop enhanced public education/damage prevention programs to, inter alia, (a) ensure awareness among contractors and potentially affected public, (b) promote cooperation in protecting the pipeline, and (c) provide information to potentially affected communities with regard to detection of and responses to well water contamination. See the SIP, Section 3.5.4. See Mitigation Appendix, Item 25. (This item has been superseded in large part by API RP 1162.)	Continuously after startup	Outside Force Damage, Leak Detection and Control
Appendix Item 3	Longhorn will replace approximately six miles of Existing Pipeline in the Pedernales River watershed that is characterized as having a time of travel for a spill from Lake Travis of eight hours or less.	Segment 5 prior to startup. Segments 1 through 4 were replaced as determined by the System Integrity Plan and ORA, but in any case, no later than seven years from the startup date. / Completed	Outside force damage
26	Longhorn shall revise its facility response plan to provide more detailed response planning for areas where high populations of potentially sensitive receptors are on or adjacent to the pipeline right-of-way. See Mitigation Appendix, Items 23, 24, and 26. (Items 23, 24, and 26 are grouped under the "Enhanced Facility Response Plan" heading in the Mitigation Appendix.)	Prior to startup / Completed	Leak Detection and Control
27	Longhorn shall provide evidence (as-built engineering drawings and similar such documentation) that secondary containment was installed during construction, under and around all storage and relief tanks, in accordance NFPA 30. Longhorn shall install secondary containment at the Cedar Valley pump station in Hays County.	Prior to startup / Completed	Leak Detection and Control
28	Longhorn shall revise its facility response plan, if or as necessary, to make it consistent, to the extent practicable; the referenced plans are Control with the City of Austin's Barton Springs oil spill developed contingency plan and the United States Fish and Wildlife Service's Barton Springs Salamander Recovery Plan. See Mitigation Appendix, Item 28.	Prior to startup / Completed	Leak Detection and Control

Table A-6 (continued). Longhorn Mitigation Commitments (pg. 6 of 7)

No.	Description	Timing of Implementation	Risk(s) Addressed
29	Longhorn shall provide funding for a contractor (employing personnel with the necessary education, training, and experience) to conduct water quality monitoring at each of the 12 locations in proximity to stream crossings of the pipeline to determine the presence of gasoline constituents. See Mitigation Appendix, Item 29.	For a period of two years after startup to evaluate the effectiveness of the program and thereafter as dictated by the Longhorn ORA (See Section 4.0).	Leak Detection and Control
30	Longhorn shall provide alternate water supplies to certain water municipalities and private well users as detailed in Longhorn's contingency plans. See Mitigation Appendix, Item 30.	Prior to startup / Completed	Leak Detection and Control
31	Longhorn shall perform a surge pressure analysis prior to any increase in the pumping capacity above those rates for which analyses have been performed or any other change which has the capability to change the surge pressures in the system. Longhorn will be required to submit mitigation measures acceptable to DOT/OPS prior to any such change in the system, which mitigation measures will adequately address any MASP problems on the system identified by the surge pressure analysis.	Prior to any change in the system that has the capability to cause surge pressures to occur on the system.	Material Defects
32	Longhorn shall perform pipe-to-soil potential surveys semi-annually over sensitive and hypersensitive areas (which is twice the frequency required by DOT regulation – 49 CFR 195.573), and corrective measures will be implemented, as necessary, where indicated by the surveys. See Longhorn Pipeline System Integrity Plan, Section 3.5.1.	No more than six months after startup and semi-annually thereafter.	Corrosion
33	(a) Longhorn shall provide the necessary funding to establish an adequate refugium and captive breeding program for the Barton Springs Salamander to offset any losses that might occur in the highly unlikely event of a release that caused the loss of individual salamanders. This program will be conducted in coordination with the Austin Ecological Services Field Office of the U.S. Fish and Wildlife Service and	Within 30 days of startup / Completed	Potential adverse effects to the Barton Springs Salamander
	(b) Longhorn shall perform conservation measures developed in consultation with the U.S. Fish and Wildlife Service to mitigate potential impacts to threatened and endangered species in the highly unlikely event that future pipeline construction activities and operation may adversely affect such species or their habitat. See Mitigation Appendix, Item 33.	At any time, such activity could have an adverse effect on listed species or habitat.	Potential adverse effects to listed species or habitat

Table A-7 (continued). Longhorn Mitigation Commitments (pg. 7 of 7)

No.	Description	Timing of Implementation	Risk(s) Addressed
34	Longhorn shall implement system changes through system and equipment modification and/or observance of operating practices to limit surge pressure to no more than MOP in sensitive and hypersensitive areas. Such system changes shall include (a) replacement of the pipe at the following locations: 6752+06 – 6758+40 (MP 127.88 – 128.00) and 10489+47 – 10490+00 (MP 198.66 – 198.67) and (b) installation of pressure active by-pass systems at the Brazos, Colorado, Pedernales, and Llano rivers. In addition, Longhorn shall replace one 671-foot section of pipe previously characterized as Grade B. See Mitigation Appendix, Item 34 and Longhorn Mitigation Commitment 9.	Prior to startup and thereafter	Outside Force Damage, Corrosion, Operator Error, and Material Defects
35	Longhorn shall not transport products through the pipeline system that contains the additive methyl tertiary butyl ether (MTBE) or similar aliphatic ether additives (e.g., TAME, ETBE, and DIPE) in greater than trace amounts. This limitation will be incorporated into the Longhorn product specifications.	During the operational life of the pipeline system	Potential adverse impacts to water resources
36	Longhorn shall prepare site-specific environmental studies for each new pump station planned for construction. These studies shall be responsive to National Environmental Policy Act (NEPA) requirements as supplements to the EA of the Proposed Longhorn Pipeline System. For each such pump station, Longhorn shall submit the site-specific environmental study to the U.S. DOT no less than 180 days prior to the commencement of construction.	Prior to construction of any new pump station	Consistency with NEPA
37	Longhorn shall maintain pollution legal liability insurance of no less than $15 million to cover on-site and off-site third-party claims for bodily injury, property damage, and costs of response and clean-up in the event of a release of product from the Longhorn Pipeline System.	Prior to startup and during the operational life of the pipeline system	Financial Assurance
38	Longhorn shall submit periodic reports to DOT/OPS that will include information about the status of mitigation commitment implementation, the character of interim developments as related to mitigation commitments, and the results of mitigation-related studies and analyses. The reports shall also summarize developments related to its ORA. The reports shall be made available to the public.	Quarterly during the first 2 years of system operation and annually thereafter for the operational life of the pipeline system.	Assurance of mitigation commitment implementation and public access to related information
39	The Longhorn Mitigation Plan and associated Pipeline System Integrity Plan and ORA shall not be unilaterally changed. The LMP may be modified only after Longhorn has reviewed the proposed changes with DOT/OPS and received written concurrence from DOT/OPS with the proposed modifications.	During the operational life of the pipeline system	Assurance of full implementation of the Longhorn Mitigation Commitments

APPENDIX B – NEW DATA USED IN THIS ANALYSIS

Table B-1. 2022 ORA Data List (pg. 1 of 2)

Topics	Data / Notes
1. Pipeline and Facilities	• Alignment Sheets – 6643 – E. Houston to 9th Street – 6645 – E. Houston to El Paso • Linefill Sheets • Maps and Flow Schematics (strip maps, KMZ files) • Tier Classifications • List of HCAs • Facility Inspection Reports – Cottonwood Station (10/22) – Crane Station (10/22) – Texon Station (10/22) – Barnhart Pump Station (10/22) – Barnhart Terminal (10/22) – Cartman Station (11/2022) – Kimble Station (11/2022) – James River Station (11/2022) – Eckert Station (11/2022) – Cedar Valley Station (11/2022) – Bastrop Station (11/2022) – Warda Station (11/2022) – Buckhorn Station (11/2022) – Satsuma Station (11/2022)
2. Flow and Pressure Data	• Monthly spreadsheet of flow and pressures • Service Interruptions
3. ILI & Anomaly Investigation Reports	• Deformation Reports: – Warda to Buckhorn • GMFL and Deformation Reports: – Cottonwood to El Paso • MFL and Deformation Reports: – 8" El Paso to Chevron – 8" Kinder Morgan Flush Line • Tool specifications
4. Hydrostatic Testing Reports	• Hydrostatic test report for the 12" El Paso to Kinder Morgan pipeline segment.
5. Corrosion Management Surveys & Reports	• Cathodic Protection Data – Rectifier Inspection Reports – Rectifier Maintenance Reports – Test Point Exception Reports – CIS Reports • Coupon Data • Atmospheric Inspection Reports • Tank inspections performed in 2022: – Tank 1, 13, 14, 24, 30, and 60

Table B-1 (continued). 2022 ORA Data List (pg. 2 of 2)

Topics	Data / Notes
6. Earth Movement & Water Forces	• Fault monitoring (semi-annual reports) • Depth of cover surveys – Buffalo Creek (Warda to Buckhorn segment) – Cypress Creek (Buckhorn to Satsuma segment) – Live Oak Creek (Buckhorn to Satsuma segment) – Main Line Canal (Crane to Cottonwood segment) – Unnamed Creek (Cedar Valley to Bastrop segment) • Master River Inspections Spreadsheet • Flood monitoring (daily)
7. Maintenance and Inspection Reports	• Maintenance Reports • Nondestructive Evaluation (NDE) • Positive Material Identification (PMI) • Mainline Valve Inspection Reports • Longhorn Year-end Preventive Maintenance Tasks Summary
8. Project Work Progress and Quality Control Reports	• CMS Year-End Task Report • Preventive Maintenance Summary • Scorecards • Annual Asset Integrity Summary for 2022 • 2022 Annual Commitment Implementation Status Report • 2022 Annual Self-Audit
9. One-Call Violations and Third-Party Damage Prevention Data	• Third-Party Damage Report • One-call list • Encroachments • Patrol Data • Website Visits • Damage Prevention Training (2022 Public Awareness Summary Report)
10. Incident, Root Cause, and Metallurgical Failure Analysis Reports	• Incident Data and Incident Investigation Reports
11. Other SIP / Risk Assessment Studies, Evaluations, and other Program Data	• Process Hazard Analyses – None performed in 2022.
12. Leak Detection	• Pipeline Leak Monitoring (PLM) Records • Description of System(s)
13. Integrity Management Plan (IMP) & Related Procedures	• IMP Plan and related procedures

B.2. Major Pipeline Incidents, Industry, or Agency Advisories Affecting Pipeline Integrity

B.2.1 PHMSA Advisories

None were applicable to the Longhorn Pipeline during 2022.

B.2.2 PHMSA Notices

Hazardous Materials: Information Collection Activities, 1/13/2022.
PHMSA published this document to seek comments on information collection as pertains to the transportation of hazardous materials, which PHMSA intends to renew with the Office of Management and Budget.

Pipeline Safety: Potential for Damage to Pipeline Facilities Caused by Earth Movement and Other Geological Hazards, 6/2/2022.
PHMSA issued this advisory update to remind owners and operators of the damage potential to pipeline facilities due to earth movement in steep, rugged, and variable terrain. PHMSA also notes weather pattern changes due to climate change (i.e., increased rainfall and higher temperatures) may impact soil stability. Owners and operators should consider geological and environmental monitoring around pipeline facilities.

Hazardous Materials: Request for Information on Electronic Hazard Communication Alternatives, 7/11/2022.
PHMSA published this document to seek input on electronic communication as an alternative to physical documentation requirements.

Hazardous Materials: Harmonization with International Standards, 7/26/2022.
PHMSA published this document to amend the Hazardous Materials Regulations (HMR) to align with international regulations and standards. The various amendments are changes to:

- Proper shipping names, hazard classes, packing groups and authorizations, special provisions, air transport quantity limitations, and vessel stowage requirements.

Hazardous Materials: Harmonization with International Standards; Correction, 8/16/2022.
PHMSA published this document to provide corrections to the Hazardous Materials: Harmonization with Internal Standards publication from 7/26/2022.

Pipeline Safety: Periodic Standards Update II, 8/29/2022.
PHMSA issued this notice of proposed rulemaking to propose amendments incorporating all or parts of updated editions from 80 voluntary, consensus, and industry technical standards.

B.2.3 DOT Regulations

Section §192.617 Investigation of Failures, 10/5/2022.
Section title updated to 'Investigation of Failures and Incidents' and items (a) through (d) updated.

Section §192.634 Transmission Lines: Onshore Valve Shut-off for Rupture Mitigation, 10/5/2022. New section.

Section §192.635 Notification of Potential Rupture, 10/5/2022. New section.

Section §192.636 Transmission Lines: Response to a rupture; capabilities of rupture-mitigation valves (RMVs) or alternative equivalent technologies, 10/5/2022. New section.

Section §192.745 Valve Maintenance: Transmission Lines, 10/5/2022. Updated items (c) through (f).

B.2.4 Literature Reviewed

See references.

APPENDIX C – THRESHOLD ANOMALY FATIGUE EVALUATION RESULTS

Table C-1 and Table C-2 show the predicted remaining life for pipeline segments with hypothetical anomalies that may have escaped detection. These hypothetical anomalies have been simulated for all variations in pipe properties, including wall thickness, grade, pipe OD, elevation, and nearness to the pump station discharge. Fatigue reassessment results are sorted by the earliest reassessment interval.

Note that a simulation cap of 500 years was imposed to reduce the calculation time. Also, note that the reassessment intervals were calculated using a safety factor of 2.22, consistent with the specification for safety factor in the Magellan ORA Manual, which requires that the reassessment interval be taken as 45% of the shortest fatigue life.

Table C-1. Reassessment Intervals for Threshold Defects on Refined Product Segments

Pipeline Segment	Assessment Location	OD (inch)	Wall Thickness (inch)	Grade	Elevation (feet)	Year of Installation	Threshold Flaw Depth (inch)	Threshold Anomaly Depth at API 5L Detection Threshold (% WT)	Re-assessment Interval (years)	Re-assessment Due Date
Odessa to Crane	1516+94	8.625	0.188	60	2847	1998	0.019	10	95.7	09/27/2093
Odessa to Crane	1526+10	8.625	0.250	60	2857	1998	0.025	10	198.9	12/01/2196
Odessa to Crane	1483+32	8.625	0.250	46	2863	1998	0.025	10	214.6	08/04/2212
Odessa to Crane	1413+58	8.625	0.250	42	2853	1998	0.025	10	225.2	03/26/2223
Odessa to Crane	1517+42	8.625	0.277	60	2848	1998	0.028	10	225.2	03/26/2223
Odessa to Crane	1521+51	8.625	0.277	35	2855	1998	0.028	10	225.2	03/26/2223
Odessa to Crane	1544+20	8.625	0.322	42	2862	1998	0.032	10	225.2	03/26/2223
Odessa to Crane	1544+68	8.625	0.322	52	2864	1998	0.032	10	225.2	03/26/2223
Odessa to Crane	1544+74	8.625	0.322	35	2863	1998	0.032	10	225.2	03/26/2223
Crane to Cottonwood	27879+57	18	0.500	52	2621	2008	0.050	10	225.2	03/25/2233
Crane to Cottonwood	30429+00	18	0.281	65	3843	1998	0.028	10	225.2	03/26/2223
Crane to Cottonwood	30429+60	18	0.375	65	3840	2008	0.038	10	225.2	03/25/2233
Crane to Cottonwood	30430+16	18	0.375	52	3841	2008	0.038	10	225.2	03/25/2233
Cottonwood to El Paso	36642+98	18	0.375	65	4017	1998	0.038	10	225.2	03/26/2223
Cottonwood to El Paso	36664+58	18	0.281	65	4022	1998	0.028	10	225.2	03/26/2223
Cottonwood to El Paso	36665+05	18	0.375	52	4022	1998	0.038	10	225.2	03/26/2223

Table C-2. Reassessment Intervals for Threshold Defects on Crude Segments (pg 1 of 4)

Pipeline Segment	Assessment Location	OD (inch)	Wall Thickness (inch)	Grade	Elevation (feet)	Year of Installation	Threshold Flaw Depth (inch)	Threshold Anomaly Depth at ILI Detection Threshold (% WT)	Re-assessment Interval (years)	Re-assessment Due Date
Crane to Texon	24062+95	18	0.250	52	2,525	1953	0.040	16	45.6	03/15/2065
Texon to Barnhart	21999+54	18	0.250	52	2,675	1953	0.040	16	52.7	09/05/2066
Bastrop to Warda	7483+48	18	0.281	46	395	1950	0.040	14	57.1	07/28/2076
James River to Eckert	13733+47	18	0.281	45	1,705	1950	0.040	14	64.4	07/26/2083
Cartman to Kimble	18168+81	18	0.281	45	2,445	1950	0.040	14	65.8	12/17/2080
Cartman to Kimble	18173+61	18	0.281	65	2,445	1950	0.040	14	69.1	12/24/2083
Crane to Texon	24157+75	18	0.281	65	2,524	1998	0.040	14	70.8	11/17/2090
Bastrop to Warda	7157+10	18	0.281	65	348	1950	0.040	14	85.7	10/21/2110
Cartman to Kimble	17883+21	18	0.281	52	2,399	1950	0.040	14	87.2	10/16/2102
Kimble to James River	14758+39	18	0.219	52	1,669	1967	0.040	18	97.9	09/21/2099
James River to Eckert	13371+07	18	0.281	65	1,649	2013	0.040	14	100.7	08/11/2120
Cartman to Kimble	18174+51	18	0.312	45	2,445	1950	0.040	13	101.7	09/30/2113
Barnhart to Cartman	19716+78	18	0.281	65	2,605	2013	0.040	14	105.8	01/09/2120
Buckhorn to Satsuma	3587+47	18	0.281	45	171	1950	0.040	14	118.5	08/22/2135
E Houston to Speed Jct	0+02	20	0.375	35	37	2010	0.038	10	118.9	11/27/2128
Warda to Buckhorn	5702+41	18	0.281	45	380	1950	0.040	14	120.3	11/15/2122
James River to Eckert	13585+57	18	0.312	60	1,777	1950	0.040	13	122.5	07/17/2141
E Houston to Speed Jct	0+14	20	0.375	52	37	2010	0.038	10	123.6	08/05/2133
Eckert to Cedar Valley	12033+42	18	0.281	45	1,736	1950	0.040	14	125.5	08/13/2130
Warda to Buckhorn	5961+54	18	0.312	45	359	1950	0.040	13	140.0	02/25/2138
Kimble to James River	15584+59	18	0.281	45	2,223	1950	0.040	14	141.9	11/16/2126
Barnhart to Cartman	19726+03	18	0.312	45	2,603	1950	0.040	13	155.0	03/08/2166
E Houston to Speed Jct	188+83	20	0.312	52	17	1998	0.031	10	155.8	10/21/2153
Barnhart to Cartman	19717+38	18	0.312	52	2,605	1998	0.040	13	159.0	01/19/2170
Barnhart to Cartman	19262+28	18	0.281	45	2,533	1950	0.040	14	159.0	04/07/2174
Cedar Valley to Bastrop	08965+58	18	0.281	45	790	1950	0.040	14	173.3	10/29/2196
Texon to Barnhart	21388+14	18	0.281	65	2,664	1998	0.040	14	174.2	12/19/2172
Bastrop to Warda	6789+27	18	0.312	45	470	1950	0.040	13	184.2	06/04/2228
Eckert to Cedar Valley	12029+82	18	0.312	45	1,744	1950	0.040	13	194.4	04/04/2191
James River to Eckert	13735+06	18	0.375	35	1,712	1950	0.040	11	202.1	10/15/2218
Cartman to Kimble	18178+76	18	0.375	35	2,446	2004	0.040	11	204.7	01/14/2208
Bastrop to Warda	7360+80	18	0.375	35	394	2002	0.040	11	205.9	03/18/2229
Kimble to James River	15260+29	18	0.281	65	2,123	2013	0.040	14	207.2	10/20/2178
Crane to Texon	24158+24	18	0.375	35	2,524	1998	0.040	11	208.8	12/29/2230
Crane to Texon	22422+53	18	0.281	46	2,664	1995	0.040	14	210.9	05/08/2212
Eckert to Cedar Valley	11499+12	18	0.281	45	1,648	2012	0.040	14	221.0	09/16/2218
Satsuma to E Houston	1800+22	20	0.312	35	126	1947	0.040	13	222.6	03/23/2160
Crane to Texon	24112+45	18	0.375	65	2,540	1998	0.040	11	225.2	01/11/2244
Crane to Texon	24020+03	18	0.385	65	2,537	2000	0.040	10	225.2	01/11/2244

Table C-2 (continued). Reassessment Intervals for Threshold Defects on Crude Segments (pg 2 of 4)

Pipeline Segment	Assessment Location	OD (inch)	Wall Thickness (inch)	Grade	Elevation (feet)	Year of Installation	Threshold Flaw Depth (inch)	Threshold Anomaly Depth at ILI Detection Threshold (% WT)	Re-assessment Interval (years)	Re-assessment Due Date
Crane to Texon	23916+23	18	0.375	52	2,575	1998	0.040	11	225.2	01/11/2244
Texon to Barnhart	22000+11	18	0.375	35	2,675	2012	0.040	11	225.2	08/07/2245
Texon to Barnhart	21998+94	18	0.375	42	2,674	2012	0.040	11	225.2	08/07/2245
Texon to Barnhart	21599+94	18	0.385	65	2,723	2000	0.040	10	225.2	08/07/2245
Texon to Barnhart	21353+94	18	0.375	65	2,665	1999	0.040	11	225.2	08/07/2245
Texon to Barnhart	21351+54	18	0.312	45	2,666	1950	0.040	13	225.2	08/07/2245
Texon to Barnhart	19727+34	18	0.375	52	2,602	1998	0.040	11	225.2	08/07/2245
Barnhart to Cartman	19265+88	18	0.385	65	2,532	2000	0.040	10	225.2	09/08/2245
Barnhart to Cartman	18862+38	18	0.312	60	2,501	2000	0.040	13	225.2	09/08/2245
Barnhart to Cartman	18860+28	18	0.375	60	2,501	2000	0.040	11	225.2	09/08/2245
Barnhart to Cartman	18853+98	18	0.312	65	2,501	2000	0.040	13	225.2	09/08/2245
Barnhart to Cartman	18852+18	18	0.375	65	2,501	2000	0.040	11	225.2	09/08/2245
Barnhart to Cartman	18561+24	18	0.375	52	2,477	2007	0.040	11	225.2	09/08/2245
Barnhart to Cartman	18303+24	18	0.500	52	2,452	2012	0.040	8	225.2	09/08/2245
Barnhart to Cartman	18180+24	18	0.375	45	2,446	2012	0.040	11	225.2	09/08/2245
Cartman to Kimble	18037+41	18	0.500	52	2,426	2012	0.040	8	225.2	11/17/2245
Cartman to Kimble	17884+41	18	0.375	65	2,400	2002	0.040	11	225.2	11/17/2245
Cartman to Kimble	17586+21	18	0.385	65	2,414	2000	0.040	10	225.2	11/17/2245
Cartman to Kimble	17307+51	18	0.375	52	2,271	2002	0.040	11	225.2	11/17/2245
Cartman to Kimble	17141+01	18	0.375	45	2,229	2000	0.040	11	225.2	11/17/2245
Kimble to James River	15585+23	18	0.375	52	2,221	1998	0.040	11	225.2	01/12/2246
Kimble to James River	15144+49	18	0.375	65	2,106	2002	0.040	11	225.2	01/12/2246
Kimble to James River	14878+99	18	0.375	42	1,827	1995	0.040	11	225.2	01/12/2246
Kimble to James River	14607+19	18	0.385	65	1,528	2000	0.040	10	225.2	01/12/2246
Kimble to James River	14604+19	18	0.375	45	1,511	1950	0.040	11	225.2	01/12/2246
Kimble to James River	14596+69	18	0.375	45	1,533	2013	0.040	11	225.2	01/12/2246
James River to Eckert	13586+77	18	0.375	65	1,778	1950	0.040	11	225.2	06/03/2245
James River to Eckert	13448+47	18	0.375	42	1,842	1950	0.040	11	225.2	06/03/2245
James River to Eckert	13435+87	18	0.385	65	1,783	1950	0.040	10	225.2	06/03/2245
James River to Eckert	13200+97	18	0.375	52	1,511	1950	0.040	11	225.2	06/03/2245
James River to Eckert	12921+69	18	0.375	65	1,698	2012	0.040	11	225.2	06/03/2245
James River to Eckert	12186+09	18	0.375	70	1,606	1950	0.040	11	225.2	06/03/2245
James River to Eckert	12039+26	18	0.312	45	1,717	1950	0.040	13	225.2	06/03/2245
Eckert to Cedar Valley	12035+40	18	0.375	52	1,728	2006	0.040	11	225.2	05/25/2245
Eckert to Cedar Valley	11998+62	18	0.375	65	1,822	2012	0.040	11	225.2	05/25/2245
Eckert to Cedar Valley	11439+42	18	0.500	35	1,705	2012	0.040	8	225.2	05/25/2245
Eckert to Cedar Valley	11389+62	18	0.385	65	1,585	2000	0.040	10	225.2	05/25/2245
Eckert to Cedar Valley	10508+23	18	0.375	35	996	2012	0.040	11	225.2	05/25/2245
Cedar Valley to Bastrop	09590+73	18	0.375	65	1,032	2002	0.040	11	225.2	04/09/2245

Table C-2 (continued). Reassessment Intervals for Threshold Defects on Crude Segments (pg 3 of 4)

Pipeline Segment	Assessment Location	OD (inch)	Wall Thickness (inch)	Grade	Elevation (feet)	Year of Installation	Threshold Flaw Depth (inch)	Threshold Anomaly Depth at ILI Detection Threshold (% WT)	Re-assessment Interval (years)	Re-assessment Due Date
Cedar Valley to Bastrop	09561+68	18	0.385	65	973	2002	0.040	10	225.2	04/09/2245
Cedar Valley to Bastrop	09099+68	18	0.375	52	865	2002	0.040	11	225.2	04/09/2245
Cedar Valley to Bastrop	08896+16	18	0.312	45	708	1950	0.040	13	225.2	04/09/2245
Cedar Valley to Bastrop	08430+98	18	0.281	65	553	2013	0.040	14	225.2	04/09/2245
Cedar Valley to Bastrop	07828+82	18	0.500	65	503	2012	0.040	8	225.2	04/09/2245
Bastrop to Warda	7115+70	18	0.375	65	337	2002	0.040	11	225.2	04/20/2245
Bastrop to Warda	7115+40	18	0.385	65	337	2000	0.040	10	225.2	04/20/2245
Bastrop to Warda	7113+00	18	0.375	45	337	1950	0.040	11	225.2	04/20/2245
Bastrop to Warda	6887+67	18	0.375	52	356	1995	0.040	11	225.2	04/20/2245
Bastrop to Warda	6797+67	18	0.375	42	430	1950	0.040	11	225.2	04/20/2245
Bastrop to Warda	5965+07	18	0.312	65	355	1967	0.040	13	225.2	04/20/2245
Warda to Buckhorn	5945+30	18	0.375	65	315	2002	0.040	11	225.2	01/29/2245
Warda to Buckhorn	5518+21	18	0.375	35	512	1950	0.040	11	225.2	01/29/2245
Warda to Buckhorn	5041+21	18	0.375	52	391	2012	0.040	11	225.2	01/29/2245
Warda to Buckhorn	4539+01	18	0.385	65	319	1950	0.040	10	225.2	01/29/2245
Warda to Buckhorn	4506+01	18	0.281	45	338	2012	0.040	14	225.2	01/29/2245
Warda to Buckhorn	4080+61	18	0.385	65	229	2000	0.040	10	225.2	01/29/2245
Warda to Buckhorn	4027+51	18	0.375	52	340	1950	0.040	11	225.2	01/29/2245
Buckhorn to Satsuma	3387+21	18	0.5	42	150	1950	0.040	8	225.2	02/26/2245
Buckhorn to Satsuma	3386+91	18	0.5	42	150	2012	0.040	8	225.2	02/26/2245
Buckhorn to Satsuma	3386+31	18	0.375	42	150	1998	0.040	11	225.2	02/26/2245
Buckhorn to Satsuma	3373+11	18	0.375	45	141	1998	0.040	11	225.2	02/26/2245
Buckhorn to Satsuma	3372+81	18	0.375	45	141	1950	0.040	11	225.2	02/26/2245
Buckhorn to Satsuma	3371+01	18	0.375	65	142	2012	0.040	11	225.2	02/26/2245
Buckhorn to Satsuma	3073+11	18	0.375	65	177	1950	0.040	11	225.2	02/26/2245
Buckhorn to Satsuma	3071+61	18	0.385	65	177	2002	0.040	10	225.2	02/26/2245
Buckhorn to Satsuma	3064+08	18	0.281	45	179	2013	0.040	14	225.2	02/26/2245
Buckhorn to Satsuma	2496+20	18	0.281	65	176	2002	0.040	14	225.2	02/26/2245
Buckhorn to Satsuma	2025+86	18	0.375	52	143	1950	0.040	11	225.2	02/26/2245
Buckhorn to Satsuma	1983+64	18	0.375	35	142	1984	0.040	11	225.2	02/26/2245
Buckhorn to Satsuma	1955+44	18	0.281	52	137	1950	0.040	14	225.2	02/26/2245
Buckhorn to Satsuma	1947+38	18	0.375	52	136	2010	0.040	11	225.2	02/26/2245
Buckhorn to Satsuma	1803+16	18	0.375	35	126	1947	0.040	11	225.2	02/26/2245
Satsuma to E Houston	1688+49	20	0.375	60	117	2012	0.040	11	225.2	11/07/2244
Satsuma to E Houston	1572+09	20	0.375	35	121	1988	0.040	11	225.2	11/07/2244
Satsuma to E Houston	1171+67	20	0.375	42	86	1988	0.040	11	225.2	11/07/2244
Satsuma to E Houston	1122+56	20	0.375	52	83	2004	0.040	11	225.2	11/07/2244
Satsuma to E Houston	832+03	20	0.312	60	57	2000	0.040	13	225.2	11/07/2244

Table C-2 (continued). Reassessment Intervals for Threshold Defects on Crude Segments
(pg 4 of 4)

Pipeline Segment	Assessment Location	OD (inch)	Wall Thickness (inch)	Grade	Elevation (feet)	Year of Installation	Threshold Flaw Depth (inch)	Threshold Anomaly Depth at ILI Detection Threshold (% WT)	Re-assessment Interval (years)	Re-assessment Due Date
Satsuma to E Houston	490+46	20	0.375	60	39	1947	0.040	11	225.2	11/07/2244
Satsuma to E Houston	482+41	20	0.312	52	39	1998	0.040	13	225.2	11/07/2244
E Houston to Speed Jct	403+64	20	0.5	42	0	2011	0.050	10	225.2	03/25/2236
Satsuma to E Houston	381+01	20	0.344	52	30	1998	0.040	12	225.2	11/07/2244
E Houston to Speed Jct	363+98	20	0.5	52	5	1998	0.050	10	225.2	03/26/2223
Satsuma to E Houston	312+01	20	0.25	52	35	2010	0.040	16	225.2	11/07/2244
E Houston to Speed Jct	235+10	20	0.344	52	18	1998	0.034	10	225.2	03/26/2223
E Houston to Speed Jct	187+12	20	0.375	60	19	2013	0.038	10	225.2	03/26/2238

APPENDIX D – CRACK DETECTION ILI ANOMALY FATIGUE EVALUATION RESULTS

Table D-1 through Table D-12 show the reassessment intervals for anomalies detected by crack detection ILI tools. The results are sorted by earliest reassessment interval.

Note that a simulation cap of 500 years was imposed to reduce the calculation time. Also, note that the reassessment intervals were calculated using a safety factor of 2.22, consistent with the specification for safety factor in the Magellan ORA Manual, which requires that the reassessment interval be taken as 45% of the shortest fatigue life.

Table D-1. Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies
Crane to Texon – ILI Date October 19, 2018 (pg. 1 of 8)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
24015+71	2,539	18	0.246	52,000	3.83	0.088	8.5	04/05/2027
24080+38	2,540	18	0.285	65,000	4.07	0.122	8.5	04/09/2027
23603+80	2,678	18	0.246	52,000	5.13	0.088	9.5	04/09/2028
24040+22	2,531	18	0.256	52,000	7.83	0.074	10.5	05/02/2029
22496+50	2,697	18	0.256	52,000	8.07	0.090	11.0	10/01/2029
22041+83	2,663	18	0.246	52,000	3.24	0.107	11.1	11/20/2029
23905+26	2,577	18	0.256	52,000	4.07	0.090	11.2	01/09/2030
22274+39	2,674	18	0.256	52,000	4.30	0.108	11.4	03/13/2030
24047+56	2,530	18	0.246	52,000	6.30	0.068	12.0	10/20/2030
22330+21	2,664	18	0.250	52,000	3.60	0.109	12.0	10/29/2030
24015+66	2,539	18	0.246	52,000	4.42	0.075	12.1	11/06/2030
23009+60	2,702	18	0.256	52,000	3.24	0.120	12.2	01/08/2031
23574+82	2,712	18	0.256	52,000	4.07	0.095	13.4	03/05/2032
22169+17	2,655	18	0.256	52,000	5.36	0.095	13.4	03/13/2032
23983+38	2,549	18	0.256	52,000	4.07	0.082	13.5	04/25/2032
23538+93	2,763	18	0.256	52,000	3.24	0.103	14.1	12/05/2032
23087+02	2,662	18	0.256	52,000	8.54	0.082	14.9	09/19/2033
22528+36	2,697	18	0.246	52,000	2.18	0.127	14.9	09/28/2033
23973+77	2,561	18	0.256	52,000	2.77	0.090	15.2	01/12/2034
23060+85	2,696	18	0.246	52,000	3.83	0.095	15.3	02/13/2034
23395+80	2,792	18	0.246	52,000	3.95	0.088	15.6	05/11/2034
23464+41	2,785	18	0.246	52,000	2.89	0.095	16.6	05/09/2035
23983+37	2,549	18	0.256	52,000	4.30	0.074	17.1	11/19/2035
23717+74	2,630	18	0.246	52,000	2.65	0.088	17.1	12/03/2035
24012+05	2,541	18	0.246	52,000	3.83	0.068	17.3	02/04/2036
23053+11	2,681	18	0.256	52,000	1.60	0.154	17.9	09/06/2036
23710+02	2,634	18	0.256	52,000	3.13	0.090	17.9	09/16/2036
22614+78	2,707	18	0.256	52,000	4.54	0.095	18.8	08/24/2037
23901+65	2,578	18	0.246	52,000	2.89	0.075	19.1	11/12/2037
23591+08	2,691	18	0.256	52,000	1.95	0.115	19.2	12/15/2037
22151+61	2,646	18	0.256	52,000	6.42	0.082	19.2	12/27/2037
23960+12	2,561	18	0.246	52,000	2.07	0.083	19.4	02/24/2038
22403+42	2,662	18	0.256	52,000	5.01	0.090	19.7	07/14/2038
24006+01	2,543	18	0.256	52,000	3.24	0.074	20.2	01/17/2039
22944+94	2,629	18	0.246	52,000	3.83	0.088	20.6	05/08/2039
23824+96	2,592	18	0.246	52,000	1.71	0.095	20.7	07/05/2039
22261+55	2,670	18	0.246	52,000	3.60	0.088	21.0	10/05/2039
24040+95	2,531	18	0.246	52,000	1.36	0.095	21.1	11/21/2039
23816+52	2,597	18	0.246	52,000	2.77	0.075	21.6	06/05/2040
24000+46	2,543	18	0.256	52,000	6.19	0.062	21.6	06/06/2040
22237+61	2,661	18	0.256	52,000	3.48	0.095	22.6	05/27/2041
23637+28	2,666	18	0.246	52,000	1.36	0.115	22.7	07/01/2041
23957+54	2,563	18	0.246	52,000	1.24	0.102	22.7	07/07/2041
23736+57	2,624	18	0.246	52,000	1.71	0.095	22.7	07/07/2041
22082+18	2,658	18	0.246	52,000	1.71	0.115	23.1	12/03/2041
23983+43	2,549	18	0.256	52,000	5.36	0.062	23.6	05/13/2042
23445+69	2,774	18	0.246	52,000	2.54	0.088	23.6	05/21/2042

Table D-1 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Crane to Texon – ILI Date October 19, 2018 (pg. 2 of 8)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
22316+25	2,666	18	0.246	52,000	2.30	0.102	24.0	10/18/2042
22656+09	2,713	18	0.256	52,000	2.18	0.120	24.0	10/19/2042
23538+79	2,764	18	0.256	52,000	1.71	0.115	24.0	10/20/2042
23999+74	2,543	18	0.246	52,000	2.42	0.068	24.1	11/08/2042
23532+45	2,776	18	0.246	52,000	1.60	0.107	24.1	11/12/2042
22316+35	2,666	18	0.246	52,000	1.83	0.115	24.1	11/24/2042
23983+43	2,549	18	0.256	52,000	2.65	0.074	24.1	11/30/2042
23293+68	2,769	18	0.246	52,000	1.48	0.122	24.3	01/19/2043
22758+47	2,698	18	0.246	52,000	4.07	0.083	24.4	02/25/2043
22528+44	2,697	18	0.246	52,000	1.60	0.127	24.4	03/25/2043
24012+12	2,541	18	0.246	52,000	1.36	0.088	24.8	08/23/2043
24015+78	2,539	18	0.246	52,000	2.77	0.063	25.0	11/02/2043
24001+84	2,543	18	0.246	52,000	1.36	0.088	25.1	12/11/2043
22024+89	2,666	18	0.256	52,000	6.30	0.074	25.4	02/24/2044
23076+67	2,661	18	0.246	52,000	4.89	0.075	25.6	05/25/2044
22205+98	2,659	18	0.246	52,000	2.42	0.095	25.6	05/26/2044
23529+07	2,774	18	0.256	52,000	1.83	0.108	25.6	05/27/2044
23727+74	2,629	18	0.246	52,000	3.36	0.068	25.7	07/02/2044
22537+13	2,698	18	0.256	52,000	2.18	0.115	26.4	03/18/2045
23428+08	2,762	18	0.256	52,000	2.07	0.103	26.7	07/11/2045
23521+84	2,767	18	0.256	52,000	2.54	0.090	26.8	08/02/2045
22322+80	2,666	18	0.246	52,000	4.77	0.075	27.0	10/07/2045
23983+38	2,549	18	0.256	52,000	2.77	0.069	27.0	10/09/2045
22807+78	2,654	18	0.246	52,000	2.54	0.095	27.1	11/21/2045
24028+80	2,534	18	0.256	52,000	2.54	0.069	27.3	01/21/2046
22830+50	2,662	18	0.246	52,000	1.95	0.107	27.9	09/06/2046
22519+65	2,698	18	0.246	52,000	1.71	0.115	28.1	11/12/2046
23994+37	2,545	18	0.256	52,000	3.48	0.062	28.8	08/15/2047
24048+17	2,530	18	0.256	52,000	1.24	0.095	28.9	08/31/2047
23948+94	2,567	18	0.246	52,000	1.12	0.095	29.1	11/09/2047
24023+50	2,536	18	0.256	52,000	1.95	0.074	29.4	03/17/2048
23308+00	2,785	18	0.256	52,000	2.07	0.103	29.5	04/27/2048
23771+58	2,602	18	0.256	52,000	1.60	0.095	29.8	08/05/2048
23612+46	2,673	18	0.246	52,000	1.12	0.115	29.9	09/12/2048
24019+76	2,537	18	0.246	52,000	1.12	0.088	30.1	11/23/2048
22279+25	2,672	18	0.246	52,000	2.89	0.083	30.7	07/13/2049
22840+70	2,646	18	0.256	52,000	1.60	0.128	31.1	11/16/2049
22632+38	2,710	18	0.256	52,000	1.95	0.115	31.1	11/30/2049
23845+50	2,591	18	0.256	52,000	1.24	0.103	31.6	06/10/2050
22769+90	2,687	18	0.256	52,000	8.77	0.069	32.2	12/27/2050
23996+83	2,544	18	0.256	52,000	1.48	0.082	32.4	03/26/2051
23439+51	2,770	18	0.256	52,000	1.60	0.108	32.5	04/19/2051
23960+82	2,562	18	0.256	52,000	2.18	0.069	32.8	08/08/2051
22945+89	2,626	18	0.246	52,000	1.48	0.115	32.8	08/17/2051
23925+54	2,574	18	0.256	52,000	2.30	0.069	32.8	08/22/2051
23442+16	2,769	18	0.246	52,000	1.60	0.095	33.0	10/08/2051
24035+87	2,533	18	0.256	52,000	2.54	0.062	33.0	10/13/2051

Table D-1 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Crane to Texon – ILI Date October 19, 2018 (pg. 3 of 8)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
24017+51	2,538	18	0.256	52,000	1.95	0.069	33.4	03/06/2052
24000+46	2,543	18	0.256	52,000	1.71	0.074	33.5	04/22/2052
23665+38	2,651	18	0.256	52,000	2.65	0.074	33.9	08/24/2052
24043+13	2,530	18	0.256	52,000	1.60	0.074	33.9	08/26/2052
22100+06	2,662	18	0.256	52,000	3.13	0.082	34.1	11/14/2052
23956+01	2,564	18	0.256	52,000	2.07	0.069	34.3	02/13/2053
22721+23	2,700	18	0.246	52,000	2.07	0.095	34.8	07/23/2053
23158+08	2,752	18	0.246	52,000	1.60	0.102	35.0	10/30/2053
22718+16	2,699	18	0.246	52,000	7.60	0.063	35.5	04/14/2054
22461+31	2,673	18	0.256	52,000	2.07	0.103	36.2	12/23/2054
22818+99	2,654	18	0.256	52,000	2.77	0.090	36.2	01/16/2055
22486+89	2,693	18	0.246	52,000	1.71	0.102	36.3	02/13/2055
22372+74	2,662	18	0.256	52,000	2.65	0.090	36.5	04/24/2055
23651+85	2,658	18	0.256	52,000	1.48	0.095	36.6	06/02/2055
22009+84	2,675	18	0.246	52,000	3.36	0.068	37.1	11/13/2055
22517+70	2,698	18	0.246	52,000	3.36	0.075	37.5	05/05/2056
23933+21	2,572	18	0.256	52,000	1.36	0.082	37.7	06/17/2056
23864+26	2,585	18	0.256	52,000	1.24	0.090	38.5	04/21/2057
24012+23	2,541	18	0.246	52,000	1.48	0.063	38.9	09/18/2057
22354+97	2,665	18	0.256	52,000	2.18	0.095	39.3	02/12/2058
23984+97	2,548	18	0.246	52,000	1.12	0.075	39.4	03/26/2058
23434+38	2,771	18	0.256	52,000	1.36	0.108	39.5	04/19/2058
23282+94	2,764	18	0.246	52,000	2.42	0.075	39.8	08/03/2058
22661+48	2,713	18	0.256	52,000	1.95	0.103	39.8	08/06/2058
23651+31	2,659	18	0.256	52,000	1.12	0.108	40.3	02/10/2059
22694+43	2,705	18	0.256	52,000	2.54	0.090	40.4	03/07/2059
22494+28	2,696	18	0.246	52,000	3.01	0.075	40.8	08/13/2059
22160+42	2,650	18	0.246	52,000	2.54	0.075	40.9	09/14/2059
22406+99	2,661	18	0.256	52,000	1.83	0.103	41.0	10/06/2059
23925+58	2,574	18	0.256	52,000	1.24	0.082	41.4	03/12/2060
23566+84	2,720	18	0.256	52,000	2.77	0.069	41.8	08/22/2060
23996+39	2,544	18	0.256	52,000	1.12	0.082	42.2	01/04/2061
23561+10	2,730	18	0.256	52,000	1.83	0.082	42.3	01/21/2061
23751+36	2,612	18	0.246	52,000	1.95	0.063	42.3	02/13/2061
23994+88	2,544	18	0.256	52,000	1.48	0.069	42.4	03/09/2061
23463+42	2,785	18	0.246	52,000	2.42	0.068	42.4	03/25/2061
22045+68	2,662	18	0.246	52,000	1.60	0.088	42.4	03/27/2061
23816+48	2,597	18	0.246	52,000	1.24	0.075	43.1	12/09/2061
23535+12	2,773	18	0.256	52,000	2.30	0.074	43.4	03/30/2062
23241+44	2,752	18	0.246	52,000	3.83	0.063	43.5	04/03/2062
23845+46	2,591	18	0.256	52,000	1.12	0.090	43.6	05/29/2062
23263+07	2,730	18	0.246	52,000	2.18	0.075	43.7	07/14/2062
23458+97	2,781	18	0.256	52,000	3.01	0.069	44.1	11/07/2062
23853+47	2,590	18	0.256	52,000	1.71	0.069	44.2	12/21/2062
22614+77	2,707	18	0.256	52,000	2.07	0.095	44.3	01/28/2063
22733+22	2,705	18	0.246	52,000	1.36	0.107	44.4	03/19/2063
23406+31	2,782	18	0.246	52,000	2.42	0.068	44.4	03/19/2063

Table D-1 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Crane to Texon – ILI Date October 19, 2018 (pg. 4 of 8)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
23845+23	2,591	18	0.256	52,000	1.71	0.069	44.5	05/01/2063
23385+38	2,796	18	0.256	52,000	1.71	0.090	44.8	07/22/2063
22403+20	2,661	18	0.256	52,000	2.65	0.082	45.6	05/11/2064
23974+41	2,561	18	0.246	52,000	1.12	0.068	45.6	05/29/2064
23764+41	2,606	18	0.256	52,000	1.60	0.074	45.9	08/24/2064
22049+12	2,661	18	0.246	52,000	1.48	0.088	46.0	10/05/2064
23533+89	2,775	18	0.246	52,000	2.42	0.063	46.1	11/05/2064
22567+86	2,703	18	0.246	52,000	2.07	0.083	46.2	12/28/2064
22959+30	2,632	18	0.246	52,000	1.95	0.083	46.3	02/16/2065
23534+09	2,774	18	0.256	52,000	1.71	0.082	46.4	03/03/2065
22128+79	2,653	18	0.246	52,000	1.36	0.095	46.5	04/03/2065
23500+62	2,752	18	0.256	52,000	1.48	0.090	46.7	06/12/2065
23148+27	2,746	18	0.256	52,000	3.01	0.074	47.1	11/24/2065
23328+41	2,814	18	0.246	52,000	2.42	0.068	47.6	05/25/2066
22823+25	2,660	18	0.246	52,000	1.36	0.102	47.8	07/22/2066
22899+53	2,626	18	0.246	52,000	1.24	0.107	47.8	08/04/2066
22820+97	2,658	18	0.256	52,000	1.36	0.115	48.2	01/18/2067
22109+70	2,663	18	0.256	52,000	1.60	0.095	48.3	01/21/2067
23322+88	2,805	18	0.256	52,000	2.54	0.074	48.4	03/21/2067
22423+10	2,664	18	0.256	52,000	1.83	0.095	48.5	04/08/2067
22727+73	2,703	18	0.256	52,000	3.48	0.074	48.5	04/18/2067
23539+02	2,763	18	0.256	52,000	1.12	0.103	48.9	09/18/2067
22774+47	2,686	18	0.256	52,000	2.07	0.090	49.1	11/28/2067
22558+77	2,701	18	0.246	52,000	1.12	0.115	49.1	12/07/2067
23688+18	2,642	18	0.246	52,000	1.24	0.075	49.3	02/13/2068
23816+43	2,597	18	0.246	52,000	1.24	0.068	49.6	06/08/2068
23972+81	2,561	18	0.256	52,000	1.24	0.069	50.1	11/16/2068
23024+26	2,672	18	0.256	52,000	1.48	0.103	50.4	03/17/2069
23021+92	2,671	18	0.256	52,000	3.71	0.069	50.6	05/17/2069
23399+68	2,789	18	0.246	52,000	1.24	0.088	51.2	12/14/2069
23207+54	2,752	18	0.246	52,000	1.12	0.102	51.4	03/02/2070
23241+44	2,752	18	0.246	52,000	1.83	0.075	51.8	08/01/2070
23527+95	2,773	18	0.246	52,000	1.71	0.068	51.9	09/21/2070
22899+42	2,625	18	0.246	52,000	1.24	0.102	52.1	11/23/2070
23671+54	2,649	18	0.256	52,000	1.12	0.090	52.2	01/04/2071
22042+51	2,663	18	0.256	52,000	1.83	0.082	52.4	03/27/2071
23471+39	2,778	18	0.246	52,000	1.48	0.075	52.6	05/13/2071
22669+53	2,712	18	0.236	52,000	2.07	0.069	53.0	10/16/2071
22230+54	2,656	18	0.256	52,000	2.07	0.082	53.0	10/20/2071
23432+96	2,771	18	0.256	52,000	3.24	0.062	53.3	02/19/2072
22928+97	2,678	18	0.246	52,000	3.48	0.063	53.4	03/16/2072
23426+99	2,761	18	0.256	52,000	3.24	0.062	53.5	04/13/2072
23083+10	2,658	18	0.256	52,000	1.71	0.090	53.5	04/18/2072
22746+56	2,703	18	0.246	52,000	3.71	0.063	53.6	05/17/2072
22879+76	2,617	18	0.246	52,000	1.71	0.083	53.7	06/12/2072
22018+99	2,669	18	0.246	52,000	1.36	0.083	53.9	09/07/2072
23205+84	2,751	18	0.246	52,000	1.48	0.083	54.0	10/13/2072

Table D-1 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Crane to Texon – ILI Date October 19, 2018 (pg. 5 of 8)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
23205+85	2,751	18	0.246	52,000	1.48	0.083	54.0	10/13/2072
23733+39	2,625	18	0.246	52,000	1.24	0.068	54.2	12/19/2072
22928+96	2,678	18	0.246	52,000	2.07	0.075	54.3	02/09/2073
22958+97	2,632	18	0.246	52,000	1.48	0.088	54.6	06/03/2073
23757+67	2,609	18	0.246	52,000	1.36	0.063	54.6	06/05/2073
23120+63	2,706	18	0.256	52,000	1.12	0.115	55.1	11/18/2073
22114+87	2,663	18	0.256	52,000	2.30	0.074	55.1	11/25/2073
23691+23	2,641	18	0.256	52,000	1.60	0.069	55.2	12/21/2073
23527+39	2,773	18	0.256	52,000	2.65	0.062	55.3	02/02/2074
23892+60	2,579	18	0.256	52,000	1.48	0.062	55.4	03/06/2074
22733+18	2,705	18	0.246	52,000	1.71	0.083	55.4	03/07/2074
23525+11	2,770	18	0.246	52,000	1.12	0.083	55.6	06/02/2074
23574+64	2,712	18	0.256	52,000	1.60	0.074	55.7	07/10/2074
22288+85	2,665	18	0.246	52,000	1.12	0.102	55.9	09/08/2074
22704+04	2,699	18	0.256	52,000	2.18	0.082	56.6	05/13/2075
23374+93	2,801	18	0.256	52,000	1.12	0.103	56.6	05/17/2075
24052+17	2,529	18	0.256	52,000	1.12	0.062	57.0	10/02/2075
22354+33	2,665	18	0.246	52,000	1.24	0.095	57.5	05/05/2076
23207+49	2,752	18	0.246	52,000	1.12	0.095	57.7	06/14/2076
23751+35	2,612	18	0.246	52,000	1.12	0.068	57.9	09/13/2076
22665+96	2,712	18	0.246	52,000	1.48	0.088	57.9	09/25/2076
23147+75	2,745	18	0.256	52,000	1.24	0.103	58.1	12/03/2076
23827+03	2,591	18	0.256	52,000	1.12	0.074	58.2	01/07/2077
22632+54	2,710	18	0.256	52,000	3.36	0.069	58.3	01/23/2077
22141+15	2,638	18	0.256	52,000	1.48	0.090	58.4	03/31/2077
23607+01	2,673	18	0.246	52,000	1.12	0.075	58.7	06/25/2077
22995+61	2,688	18	0.246	52,000	1.36	0.088	58.9	09/29/2077
23951+85	2,566	18	0.256	52,000	1.24	0.062	59.0	10/24/2077
23817+00	2,596	18	0.256	52,000	1.24	0.069	59.2	01/17/2078
22534+85	2,697	18	0.256	52,000	1.36	0.103	59.3	02/18/2078
23009+91	2,702	18	0.256	52,000	4.30	0.062	59.9	09/17/2078
23276+79	2,750	18	0.256	52,000	1.36	0.090	60.5	04/08/2079
22289+91	2,664	18	0.256	52,000	2.77	0.069	60.7	07/07/2079
23752+28	2,611	18	0.256	52,000	1.60	0.062	60.8	07/22/2079
23360+53	2,809	18	0.256	52,000	1.83	0.074	60.9	09/06/2079
23085+40	2,660	18	0.256	52,000	1.36	0.095	61.7	07/10/2080
22865+78	2,601	18	0.256	52,000	1.60	0.090	62.1	11/08/2080
22274+27	2,674	18	0.256	52,000	1.48	0.090	63.0	10/08/2081
23521+95	2,767	18	0.256	52,000	1.24	0.082	63.1	11/15/2081
23300+37	2,775	18	0.256	52,000	1.83	0.074	63.1	11/29/2081
23214+03	2,754	18	0.246	52,000	1.48	0.075	63.5	04/26/2082
22551+84	2,700	18	0.256	52,000	1.60	0.090	63.5	04/28/2082
22718+18	2,699	18	0.246	52,000	2.18	0.068	65.2	12/21/2083
23150+84	2,748	18	0.256	52,000	1.12	0.103	65.2	01/07/2084
22362+55	2,664	18	0.246	52,000	1.36	0.083	65.5	05/03/2084
23149+72	2,747	18	0.256	52,000	1.95	0.074	65.9	09/08/2084
22831+45	2,659	18	0.246	52,000	2.54	0.063	66.5	04/17/2085

Table D-1 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Crane to Texon – ILI Date October 19, 2018 (pg. 6 of 8)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
23264+00	2,730	18	0.256	52,000	1.24	0.090	66.8	07/28/2085
23121+33	2,706	18	0.256	52,000	1.24	0.095	67.0	10/08/2085
22359+00	2,665	18	0.246	52,000	1.95	0.068	67.1	11/27/2085
22008+86	2,676	18	0.246	52,000	1.24	0.075	68.0	10/05/2086
22516+52	2,698	18	0.246	52,000	1.24	0.088	68.3	01/25/2087
22661+60	2,713	18	0.256	52,000	1.48	0.090	69.2	01/05/2088
23009+93	2,701	18	0.256	52,000	2.30	0.069	70.3	01/18/2089
23646+44	2,661	18	0.256	52,000	1.24	0.069	70.6	05/28/2089
22820+12	2,656	18	0.256	52,000	2.42	0.069	71.5	05/07/2090
23133+69	2,728	18	0.246	52,000	1.12	0.083	73.7	06/14/2092
22122+41	2,661	18	0.256	52,000	2.42	0.062	74.0	11/01/2092
22560+99	2,701	18	0.246	52,000	1.83	0.068	74.1	11/17/2092
22247+53	2,668	18	0.256	52,000	1.24	0.090	74.1	12/08/2092
22480+25	2,688	18	0.256	52,000	1.24	0.095	74.2	12/17/2092
22248+72	2,668	18	0.256	52,000	1.24	0.090	74.2	12/20/2092
22708+93	2,691	18	0.256	52,000	3.24	0.062	74.3	01/25/2093
22939+60	2,645	18	0.246	52,000	1.71	0.068	74.7	07/04/2093
22504+99	2,698	18	0.246	52,000	1.24	0.083	74.7	07/13/2093
23671+40	2,649	18	0.256	52,000	1.12	0.069	74.9	09/28/2093
22331+50	2,664	18	0.256	52,000	1.48	0.082	75.2	12/31/2093
22776+27	2,685	18	0.256	52,000	1.24	0.095	75.2	01/05/2094
23485+80	2,751	18	0.246	52,000	1.12	0.068	75.5	05/05/2094
22624+51	2,709	18	0.246	52,000	1.24	0.083	75.8	08/06/2094
22209+96	2,656	18	0.256	52,000	1.36	0.082	76.7	07/18/2095
23157+46	2,752	18	0.246	52,000	1.24	0.075	76.8	08/18/2095
23461+94	2,784	18	0.256	52,000	1.71	0.062	77.7	07/04/2096
23551+00	2,748	18	0.256	52,000	1.24	0.069	78.0	10/18/2096
22708+87	2,691	18	0.256	52,000	2.18	0.069	78.2	01/01/2097
22232+43	2,658	18	0.246	52,000	1.48	0.068	78.7	07/07/2097
22965+56	2,629	18	0.256	52,000	1.71	0.074	78.9	09/28/2097
22659+80	2,713	18	0.256	52,000	1.83	0.074	79.4	03/13/2098
22928+95	2,678	18	0.246	52,000	1.60	0.068	79.4	03/16/2098
22181+97	2,661	18	0.256	52,000	1.12	0.090	79.4	03/19/2098
23192+17	2,728	18	0.246	52,000	1.36	0.068	80.0	10/04/2098
22007+62	2,676	18	0.256	52,000	1.48	0.069	80.8	08/04/2099
23344+92	2,815	18	0.256	52,000	1.12	0.082	81.3	02/03/2100
22719+49	2,700	18	0.246	52,000	1.60	0.068	82.8	08/21/2101
22390+27	2,657	18	0.256	52,000	1.36	0.082	83.0	10/05/2101
22905+54	2,645	18	0.256	52,000	1.36	0.082	83.8	08/13/2102
23558+58	2,737	18	0.256	52,000	1.12	0.069	84.2	12/14/2102
23228+97	2,755	18	0.256	52,000	1.36	0.074	84.5	04/25/2103
22076+71	2,659	18	0.256	52,000	1.12	0.082	84.7	07/10/2103
22460+43	2,674	18	0.256	52,000	1.36	0.082	84.7	07/16/2103
23259+98	2,729	18	0.256	52,000	1.48	0.069	85.3	01/26/2104
22537+80	2,698	18	0.256	52,000	1.36	0.082	86.2	01/03/2105
22459+30	2,673	18	0.256	52,000	1.83	0.069	86.8	08/03/2105
23448+55	2,776	18	0.256	52,000	1.48	0.062	86.9	09/07/2105

Table D-1 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Crane to Texon – ILI Date October 19, 2018 (pg. 7 of 8)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
22694+40	2,705	18	0.256	52,000	1.36	0.082	87.0	10/29/2105
22807+07	2,659	18	0.246	52,000	1.71	0.063	87.5	04/03/2106
22041+78	2,663	18	0.246	52,000	1.12	0.068	87.5	04/04/2106
22559+31	2,701	18	0.246	52,000	1.24	0.075	87.8	07/24/2106
23647+45	2,661	18	0.256	52,000	1.12	0.062	87.8	08/11/2106
22571+05	2,703	18	0.256	52,000	2.42	0.062	88.1	11/07/2106
22050+86	2,661	18	0.246	52,000	1.12	0.068	88.1	11/29/2106
23014+75	2,691	18	0.256	52,000	1.24	0.082	88.2	12/24/2106
22716+78	2,697	18	0.246	52,000	1.71	0.063	88.7	06/28/2107
22999+90	2,692	18	0.256	52,000	1.24	0.082	88.7	07/03/2107
22638+28	2,711	18	0.256	52,000	1.60	0.074	88.8	07/29/2107
23179+91	2,737	18	0.246	52,000	1.36	0.063	90.1	12/05/2108
22443+11	2,673	18	0.246	52,000	1.60	0.063	90.6	05/23/2109
22338+31	2,661	18	0.256	52,000	2.07	0.062	91.5	04/09/2110
23137+69	2,733	18	0.256	52,000	1.12	0.082	91.7	07/18/2110
23222+48	2,755	18	0.246	52,000	1.12	0.068	92.5	04/07/2111
22822+16	2,659	18	0.246	52,000	1.36	0.068	92.7	06/14/2111
22410+69	2,661	18	0.246	52,000	1.12	0.075	93.0	10/03/2111
23347+11	2,814	18	0.256	52,000	1.12	0.074	93.2	01/18/2112
22303+97	2,661	18	0.256	52,000	1.36	0.074	93.7	07/04/2112
22117+92	2,662	18	0.256	52,000	1.36	0.069	93.8	07/29/2112
22807+79	2,654	18	0.246	52,000	1.12	0.075	95.4	03/31/2114
22517+79	2,698	18	0.246	52,000	1.12	0.075	95.6	06/13/2114
23031+39	2,644	18	0.246	52,000	1.36	0.063	96.6	05/21/2115
22074+67	2,659	18	0.256	52,000	1.24	0.069	97.9	09/19/2116
22537+10	2,698	18	0.256	52,000	1.60	0.069	98.0	10/20/2116
23283+57	2,765	18	0.246	52,000	1.12	0.063	98.2	12/19/2116
22572+81	2,703	18	0.246	52,000	1.48	0.063	98.4	03/10/2117
22402+16	2,661	18	0.256	52,000	1.12	0.082	100.0	10/05/2118
22135+39	2,646	18	0.256	52,000	1.12	0.074	101.3	01/21/2120
22614+77	2,707	18	0.256	52,000	1.95	0.062	101.5	04/05/2120
22012+27	2,674	18	0.256	52,000	1.12	0.069	101.5	04/10/2120
22648+82	2,711	18	0.256	52,000	1.36	0.074	101.7	06/18/2120
23347+09	2,814	18	0.256	52,000	1.12	0.069	102.1	12/01/2120
22600+57	2,705	18	0.256	52,000	1.12	0.082	104.2	01/10/2123
22954+89	2,631	18	0.256	52,000	1.71	0.062	104.7	07/08/2123
22928+41	2,680	18	0.256	52,000	1.24	0.074	105.3	02/14/2124
23374+45	2,802	18	0.256	52,000	1.24	0.062	105.5	05/03/2124
23112+12	2,697	18	0.256	52,000	1.12	0.074	106.5	04/05/2125
22899+31	2,625	18	0.246	52,000	1.12	0.068	106.5	04/11/2125
22389+15	2,657	18	0.256	52,000	1.36	0.069	107.0	10/19/2125
22944+89	2,629	18	0.246	52,000	1.24	0.063	107.2	12/16/2125
23095+91	2,683	18	0.256	52,000	1.24	0.069	107.9	09/26/2126
22571+03	2,703	18	0.256	52,000	1.24	0.074	109.3	01/21/2128
22571+01	2,703	18	0.256	52,000	1.24	0.074	109.3	01/21/2128
22578+24	2,704	18	0.256	52,000	1.24	0.074	109.3	02/18/2128
22553+38	2,700	18	0.246	52,000	1.12	0.068	109.8	08/25/2128

Table D-1 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Crane to Texon – ILI Date October 19, 2018 (pg. 8 of 8)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
22777+42	2,684	18	0.246	52,000	1.24	0.063	111.9	09/24/2130
22847+46	2,624	18	0.256	52,000	1.60	0.062	113.3	02/04/2132
22405+91	2,661	18	0.256	52,000	1.12	0.074	115.0	10/23/2133
22858+68	2,607	18	0.256	52,000	1.12	0.074	116.7	07/08/2135
22537+48	2,698	18	0.256	52,000	1.24	0.069	119.7	06/20/2138
23293+75	2,769	18	0.256	52,000	1.12	0.062	120.1	11/19/2138
22750+92	2,702	18	0.246	52,000	1.12	0.063	121.9	08/30/2140
22656+82	2,713	18	0.256	52,000	1.48	0.062	122.8	07/27/2141
22131+45	2,650	18	0.256	52,000	1.12	0.062	126.5	05/06/2145
22825+21	2,663	18	0.256	52,000	1.12	0.069	129.3	01/22/2148
22389+15	2,657	18	0.256	52,000	1.24	0.062	132.6	05/26/2151
22667+16	2,712	18	0.256	52,000	1.24	0.062	139.4	03/22/2158
22911+56	2,662	18	0.256	52,000	1.12	0.062	144.8	08/15/2163
22673+63	2,712	18	0.256	52,000	1.12	0.062	150.6	06/11/2169

Table D-2. Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Texon to Barnhart – ILI Date May 15, 2020 (pg. 1 of 6)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
21854+81	2,570	18	0.246	52,000	4.43	0.088	10.2	08/13/2030
21981+43	2,574	18	0.246	52,000	3.25	0.088	11.9	03/21/2032
21647+30	2,626	18	0.246	52,000	4.67	0.088	12.4	09/21/2032
21694+78	2,600	18	0.256	52,000	5.50	0.090	12.5	11/11/2032
21983+33	2,575	18	0.246	52,000	2.19	0.095	14.6	01/06/2035
21911+69	2,578	18	0.256	52,000	3.13	0.090	16.1	06/09/2036
21915+00	2,576	18	0.246	52,000	2.54	0.088	16.2	08/02/2036
21884+85	2,575	18	0.246	52,000	2.90	0.083	17.0	05/19/2037
21878+56	2,572	18	0.246	52,000	2.78	0.083	17.8	03/02/2038
21674+08	2,605	18	0.256	52,000	2.54	0.103	18.8	03/08/2039
21817+14	2,575	18	0.246	52,000	1.72	0.102	19.8	02/26/2040
21878+58	2,572	18	0.246	52,000	1.48	0.102	21.9	04/15/2042
21647+03	2,626	18	0.246	52,000	1.84	0.102	22.1	06/24/2042
21984+76	2,577	18	0.246	52,000	1.48	0.095	22.3	09/12/2042
21834+03	2,573	18	0.256	52,000	1.84	0.103	22.8	02/23/2043
21819+19	2,574	18	0.246	52,000	1.48	0.102	23.4	10/16/2043
21728+63	2,582	18	0.246	52,000	1.84	0.095	23.6	12/23/2043
21811+98	2,576	18	0.246	52,000	1.48	0.102	23.7	01/11/2044
21927+98	2,568	18	0.256	52,000	1.60	0.103	23.9	03/22/2044
21673+15	2,606	18	0.246	52,000	2.54	0.083	24.2	08/02/2044
21675+54	2,606	18	0.256	52,000	2.54	0.090	25.5	11/14/2045
21882+48	2,575	18	0.246	52,000	1.84	0.083	26.0	05/19/2046
21429+48	2,607	18	0.246	52,000	3.02	0.083	26.6	12/16/2046
21800+13	2,576	18	0.246	52,000	1.72	0.088	27.3	09/03/2047
21441+31	2,626	18	0.246	52,000	2.07	0.095	27.9	04/08/2048
21499+37	2,648	18	0.256	52,000	2.07	0.103	28.5	11/14/2048
21834+04	2,573	18	0.256	52,000	1.48	0.103	28.9	03/22/2049

Table D-2 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Texon to Barnhart – ILI Date May 15, 2020 (pg. 2 of 6)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
21739+68	2,575	18	0.246	52,000	1.48	0.095	29.3	08/16/2049
21620+84	2,636	18	0.256	52,000	2.07	0.095	29.6	12/26/2049
21608+91	2,630	18	0.246	52,000	1.60	0.095	31.2	07/14/2051
21673+85	2,605	18	0.256	52,000	2.07	0.090	31.2	07/24/2051
21849+81	2,570	18	0.246	52,000	1.25	0.095	31.4	09/24/2051
21765+68	2,563	18	0.256	52,000	1.84	0.090	31.6	01/03/2052
21854+90	2,570	18	0.246	52,000	1.48	0.083	32.7	02/10/2053
21728+63	2,582	18	0.246	52,000	3.25	0.063	34.0	05/27/2054
20940+52	2,603	18	0.305	45,000	5.73	0.115	34.0	06/01/2054
21696+60	2,599	18	0.256	52,000	1.84	0.090	34.2	08/06/2054
21553+51	2,675	18	0.246	52,000	1.36	0.102	34.5	11/20/2054
21671+62	2,609	18	0.246	52,000	1.36	0.095	34.6	12/09/2054
21487+01	2,649	18	0.246	52,000	1.60	0.095	35.3	09/13/2055
20264+44	2,631	18	0.305	45,000	7.15	0.115	35.6	12/24/2055
21623+51	2,637	18	0.256	52,000	1.48	0.103	36.3	09/05/2056
21826+90	2,575	18	0.256	52,000	1.13	0.108	36.8	02/16/2057
21891+07	2,577	18	0.256	52,000	1.36	0.090	37.0	05/10/2057
21499+38	2,648	18	0.256	52,000	1.48	0.108	37.8	03/04/2058
21582+48	2,667	18	0.246	52,000	1.36	0.095	38.2	07/20/2058
21910+88	2,578	18	0.246	52,000	1.95	0.063	38.5	11/23/2058
21981+29	2,574	18	0.246	52,000	1.25	0.075	38.5	11/25/2058
21679+79	2,605	18	0.256	52,000	1.95	0.082	38.7	02/01/2059
21420+13	2,599	18	0.246	52,000	1.36	0.102	39.1	06/24/2059
21764+01	2,564	18	0.246	52,000	1.36	0.083	39.2	07/23/2059
21849+48	2,570	18	0.246	52,000	1.13	0.088	39.6	12/28/2059
21668+23	2,611	18	0.246	52,000	1.48	0.083	40.3	08/30/2060
21812+75	2,576	18	0.256	52,000	1.13	0.103	40.3	09/01/2060
21849+05	2,570	18	0.246	52,000	1.36	0.075	41.3	09/01/2061
21598+56	2,638	18	0.246	52,000	1.25	0.095	41.3	09/08/2061
21983+21	2,575	18	0.246	52,000	1.13	0.075	42.2	07/28/2062
20742+69	2,664	18	0.305	52,000	5.26	0.115	43.2	08/06/2063
21572+81	2,675	18	0.246	52,000	1.36	0.088	44.2	07/15/2064
21422+69	2,600	18	0.246	52,000	1.36	0.095	44.4	10/24/2064
21273+18	2,553	18	0.305	45,000	4.55	0.103	44.5	10/29/2064
21537+58	2,672	18	0.256	52,000	1.25	0.108	44.6	12/15/2064
21413+82	2,589	18	0.256	52,000	1.36	0.108	45.0	05/26/2065
21683+75	2,605	18	0.256	52,000	1.13	0.103	46.4	09/24/2066
21335+68	2,570	18	0.305	45,000	5.61	0.094	46.5	10/28/2066
21389+94	2,581	18	0.246	52,000	1.13	0.107	46.5	11/13/2066
20937+88	2,606	18	0.305	45,000	16.36	0.088	47.4	09/21/2067
19786+15	2,528	18	0.315	45,000	8.92	0.102	48.5	11/13/2068
21408+79	2,588	18	0.246	52,000	1.13	0.102	49.3	09/15/2069
21537+60	2,672	18	0.256	52,000	1.13	0.108	50.3	08/15/2070
21807+16	2,577	18	0.246	52,000	1.13	0.075	51.5	11/11/2071
21328+17	2,567	18	0.305	45,000	3.61	0.103	51.7	01/26/2072
21333+78	2,570	18	0.315	45,000	14.47	0.083	53.1	06/15/2073
19762+06	2,526	18	0.315	45,000	4.67	0.115	53.3	09/13/2073

Table D-2 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Texon to Barnhart – ILI Date May 15, 2020 (pg. 3 of 6)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
21448+20	2,637	18	0.256	52,000	1.36	0.095	54.1	06/24/2074
21568+58	2,675	18	0.256	52,000	1.84	0.074	54.8	03/14/2075
20871+29	2,655	18	0.305	45,000	5.14	0.103	55.4	10/15/2075
21499+38	2,648	18	0.256	52,000	1.13	0.103	56.2	07/24/2076
21410+08	2,589	18	0.246	52,000	1.36	0.083	56.5	11/03/2076
20504+01	2,616	18	0.305	45,000	6.20	0.103	56.8	03/07/2077
21495+30	2,653	18	0.256	52,000	1.25	0.095	57.0	04/30/2077
21783+94	2,570	18	0.256	52,000	1.13	0.082	57.3	09/08/2077
21683+76	2,605	18	0.256	52,000	1.48	0.074	57.5	11/07/2077
21680+99	2,605	18	0.256	52,000	1.25	0.082	58.2	08/11/2078
21733+69	2,579	18	0.256	52,000	1.36	0.074	58.4	09/25/2078
21449+60	2,638	18	0.256	52,000	1.60	0.082	58.7	01/14/2079
20179+80	2,597	18	0.305	45,000	9.16	0.094	61.3	09/05/2081
21431+79	2,610	18	0.246	52,000	1.13	0.088	61.5	11/09/2081
21697+70	2,598	18	0.256	52,000	1.13	0.082	63.0	05/20/2083
21789+32	2,574	18	0.246	52,000	1.13	0.063	66.4	10/16/2086
21115+52	2,587	18	0.305	45,000	4.31	0.094	67.4	10/15/2087
21138+23	2,613	18	0.305	45,000	4.08	0.094	69.1	06/20/2089
21499+62	2,648	18	0.256	52,000	1.25	0.082	70.4	10/14/2090
20325+08	2,640	18	0.315	45,000	6.68	0.102	70.4	10/23/2090
19820+10	2,538	18	0.295	45,000	16.36	0.074	71.1	07/07/2091
20368+09	2,622	18	0.305	45,000	4.67	0.103	72.4	10/15/2092
21560+81	2,674	18	0.256	52,000	1.13	0.082	73.1	06/29/2093
20261+92	2,631	18	0.315	45,000	3.25	0.127	73.5	11/13/2093
20494+75	2,609	18	0.315	45,000	4.67	0.108	75.4	10/24/2095
20326+14	2,640	18	0.315	45,000	5.85	0.102	77.0	04/29/2097
21673+89	2,605	18	0.256	52,000	1.13	0.069	80.9	03/22/2101
20635+89	2,624	18	0.315	45,000	3.96	0.108	83.2	08/11/2103
21402+14	2,585	18	0.256	52,000	1.13	0.082	84.9	03/26/2105
21261+87	2,549	18	0.315	45,000	3.13	0.096	87.1	06/13/2107
20439+50	2,604	18	0.305	45,000	6.68	0.088	87.9	04/27/2108
21268+48	2,553	18	0.315	45,000	2.07	0.115	89.3	08/27/2109
21204+14	2,582	18	0.315	45,000	2.19	0.115	89.5	11/16/2109
21537+47	2,672	18	0.256	52,000	1.13	0.069	93.6	01/07/2114
20326+13	2,640	18	0.315	45,000	3.37	0.108	103.6	12/30/2123
20307+69	2,637	18	0.315	45,000	4.79	0.096	104.6	01/04/2125
21111+46	2,574	18	0.305	45,000	1.84	0.109	105.6	01/08/2126
19898+67	2,534	18	0.315	45,000	2.90	0.108	106.2	07/18/2126
21057+86	2,570	18	0.305	45,000	2.07	0.103	108.3	09/03/2128
20689+66	2,623	18	0.315	52,000	2.90	0.108	110.8	03/17/2131
21110+22	2,572	18	0.305	45,000	1.48	0.121	111.3	08/30/2131
20970+98	2,588	18	0.305	45,000	2.90	0.088	117.0	04/29/2137
21273+17	2,553	18	0.305	45,000	1.84	0.094	117.7	02/10/2138
20416+95	2,600	18	0.305	45,000	2.31	0.109	120.9	04/04/2141
20782+38	2,651	18	0.315	45,000	11.16	0.074	122.2	07/27/2142
21262+70	2,549	18	0.325	45,000	5.02	0.075	126.8	03/17/2147
20661+16	2,596	18	0.305	45,000	2.78	0.094	127.1	07/05/2147

Table D-2 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Texon to Barnhart – ILI Date May 15, 2020 (pg. 4 of 6)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
21204+14	2,582	18	0.315	45,000	2.07	0.096	129.0	05/10/2149
20151+07	2,595	18	0.305	45,000	4.31	0.082	133.1	06/25/2153
21098+26	2,593	18	0.305	45,000	2.54	0.082	133.3	09/14/2153
20156+22	2,596	18	0.305	45,000	3.37	0.088	134.4	09/25/2154
20959+44	2,586	18	0.305	45,000	2.90	0.082	135.0	05/21/2155
20871+85	2,654	18	0.315	45,000	3.02	0.090	139.3	08/26/2159
19895+69	2,532	18	0.315	45,000	1.95	0.115	139.4	09/28/2159
20940+22	2,604	18	0.305	45,000	4.91	0.070	140.2	07/24/2160
21079+08	2,586	18	0.295	45,000	1.84	0.083	142.1	07/01/2162
21231+82	2,547	18	0.315	45,000	1.60	0.102	143.3	08/28/2163
21199+57	2,582	18	0.315	45,000	3.37	0.074	144.5	11/16/2164
20188+04	2,600	18	0.315	45,000	2.31	0.108	146.3	08/28/2166
20113+46	2,572	18	0.315	45,000	2.54	0.102	147.3	09/11/2167
20780+73	2,652	18	0.305	45,000	1.25	0.134	147.6	12/15/2167
20709+86	2,631	18	0.315	52,000	3.96	0.083	148.9	03/26/2169
20530+21	2,624	18	0.305	45,000	3.37	0.082	152.3	08/19/2172
20632+55	2,629	18	0.315	45,000	3.13	0.090	153.2	07/29/2173
20998+90	2,583	18	0.305	45,000	2.31	0.082	154.1	07/07/2174
19868+96	2,515	18	0.305	45,000	2.07	0.094	154.4	09/30/2174
19765+42	2,526	18	0.315	45,000	2.19	0.096	155.3	09/05/2175
20326+12	2,640	18	0.315	45,000	7.15	0.074	160.9	03/23/2181
20893+68	2,635	18	0.295	45,000	1.84	0.083	162.9	03/25/2183
21126+73	2,617	18	0.305	45,000	1.84	0.082	165.9	04/20/2186
21328+34	2,567	18	0.305	45,000	1.95	0.070	167.8	03/16/2188
20642+66	2,612	18	0.305	45,000	3.25	0.076	173.4	10/22/2193
20948+49	2,596	18	0.305	45,000	2.43	0.076	175.4	10/27/2195
21115+29	2,586	18	0.305	45,000	1.36	0.094	176.6	12/16/2196
21130+88	2,618	18	0.305	45,000	1.95	0.076	177.2	07/21/2197
21122+88	2,612	18	0.305	45,000	1.48	0.088	178.7	02/13/2199
21306+92	2,561	18	0.305	45,000	2.19	0.063	182.1	06/22/2202
20798+21	2,653	18	0.315	45,000	1.95	0.096	182.6	12/04/2202
20437+49	2,603	18	0.305	45,000	2.66	0.082	182.6	12/18/2202
21276+37	2,553	18	0.315	45,000	1.60	0.083	184.1	06/27/2204
21226+11	2,545	18	0.315	45,000	1.48	0.090	185.9	04/05/2206
21255+09	2,544	18	0.305	45,000	1.36	0.082	187.8	03/01/2208
20550+79	2,617	18	0.315	45,000	2.43	0.090	191.1	06/09/2211
20294+07	2,633	18	0.305	45,000	3.13	0.076	191.4	10/18/2211
20751+06	2,675	18	0.305	52,000	3.37	0.070	192.0	04/30/2212
21225+61	2,545	18	0.305	45,000	1.25	0.082	208.4	10/14/2228
20540+39	2,621	18	0.305	45,000	2.07	0.082	213.5	11/17/2233
20847+62	2,663	18	0.305	45,000	1.36	0.094	214.7	02/05/2235
21348+18	2,582	18	0.344	45,000	1.48	0.101	216.4	09/25/2236
21323+69	2,564	18	0.315	45,000	1.25	0.083	217.4	10/19/2237
19895+66	2,532	18	0.315	45,000	1.36	0.108	219.0	06/01/2239
20641+54	2,615	18	0.315	45,000	1.72	0.096	219.9	03/30/2240
21229+16	2,546	18	0.305	45,000	1.48	0.070	221.0	05/04/2241
20024+05	2,561	18	0.315	45,000	3.13	0.074	222.0	06/04/2242

Table D-2 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Texon to Barnhart – ILI Date May 15, 2020 (pg. 5 of 6)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
20338+59	2,631	18	0.315	45,000	1.84	0.096	223.4	09/26/2243
19744+42	2,503	18	0.315	45,000	1.72	0.068	225.2	08/07/2245
19800+31	2,532	18	0.315	45,000	1.13	0.068	225.2	08/07/2245
19800+33	2,532	18	0.315	45,000	1.48	0.083	225.2	08/07/2245
19805+19	2,534	18	0.315	45,000	1.13	0.074	225.2	08/07/2245
19819+34	2,538	18	0.305	45,000	1.60	0.076	225.2	08/07/2245
19827+83	2,538	18	0.315	45,000	1.25	0.083	225.2	08/07/2245
19916+93	2,545	18	0.315	45,000	1.13	0.083	225.2	08/07/2245
19918+98	2,546	18	0.315	45,000	2.19	0.068	225.2	08/07/2245
19923+86	2,550	18	0.315	45,000	1.13	0.121	225.2	08/07/2245
19931+93	2,553	18	0.315	45,000	1.36	0.083	225.2	08/07/2245
20070+26	2,567	18	0.305	45,000	1.13	0.063	225.2	08/07/2245
20110+07	2,574	18	0.315	45,000	1.13	0.074	225.2	08/07/2245
20157+07	2,595	18	0.305	45,000	1.36	0.076	225.2	08/07/2245
20158+89	2,596	18	0.315	45,000	1.25	0.061	225.2	08/07/2245
20260+56	2,631	18	0.315	45,000	1.95	0.074	225.2	08/07/2245
20261+81	2,631	18	0.315	45,000	1.72	0.083	225.2	08/07/2245
20261+86	2,631	18	0.315	45,000	1.60	0.074	225.2	08/07/2245
20261+93	2,631	18	0.315	45,000	1.25	0.102	225.2	08/07/2245
20262+02	2,631	18	0.315	45,000	1.36	0.096	225.2	08/07/2245
20264+22	2,631	18	0.305	45,000	1.36	0.063	225.2	08/07/2245
20279+23	2,634	18	0.315	45,000	1.25	0.061	225.2	08/07/2245
20294+09	2,633	18	0.305	45,000	1.13	0.076	225.2	08/07/2245
20325+90	2,640	18	0.315	45,000	1.60	0.068	225.2	08/07/2245
20344+16	2,627	18	0.305	45,000	1.36	0.063	225.2	08/07/2245
20392+06	2,629	18	0.315	45,000	1.36	0.096	225.2	08/07/2245
20414+93	2,606	18	0.315	45,000	1.48	0.090	225.2	08/07/2245
20526+13	2,627	18	0.315	45,000	1.13	0.083	225.2	08/07/2245
20569+33	2,610	18	0.305	45,000	1.25	0.088	225.2	08/07/2245
20573+75	2,610	18	0.305	45,000	1.36	0.088	225.2	08/07/2245
20598+35	2,602	18	0.295	45,000	1.13	0.089	225.2	08/07/2245
20611+97	2,621	18	0.315	45,000	1.36	0.090	225.2	08/07/2245
20615+60	2,626	18	0.315	45,000	1.84	0.068	225.2	08/07/2245
20623+13	2,632	18	0.315	45,000	2.19	0.074	225.2	08/07/2245
20627+79	2,631	18	0.315	45,000	1.36	0.074	225.2	08/07/2245
20629+67	2,631	18	0.315	45,000	2.31	0.068	225.2	08/07/2245
20640+17	2,617	18	0.315	45,000	1.60	0.074	225.2	08/07/2245
20651+68	2,594	18	0.315	45,000	1.72	0.061	225.2	08/07/2245
20654+80	2,596	18	0.315	45,000	1.72	0.090	225.2	08/07/2245
20660+91	2,596	18	0.305	45,000	1.48	0.070	225.2	08/07/2245
20667+27	2,595	18	0.315	45,000	1.25	0.074	225.2	08/07/2245
20685+90	2,616	18	0.315	45,000	1.72	0.090	225.2	08/07/2245
20764+62	2,672	18	0.305	45,000	1.13	0.063	225.2	08/07/2245
20771+31	2,663	18	0.315	45,000	1.48	0.068	225.2	08/07/2245
20787+06	2,650	18	0.315	45,000	1.25	0.083	225.2	08/07/2245
20837+86	2,664	18	0.315	45,000	1.48	0.074	225.2	08/07/2245
20845+85	2,663	18	0.315	45,000	2.19	0.061	225.2	08/07/2245

Table D-2 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Texon to Barnhart – ILI Date May 15, 2020 (pg. 6 of 6)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
20849+48	2,663	18	0.315	45,000	1.25	0.090	225.2	08/07/2245
20923+10	2,624	18	0.305	45,000	1.48	0.076	225.2	08/07/2245
20931+74	2,613	18	0.315	45,000	1.36	0.074	225.2	08/07/2245
20957+85	2,586	18	0.315	45,000	2.07	0.074	225.2	08/07/2245
20957+90	2,586	18	0.315	45,000	1.36	0.083	225.2	08/07/2245
21115+14	2,585	18	0.315	45,000	1.13	0.068	225.2	08/07/2245
21123+54	2,613	18	0.315	45,000	1.36	0.074	225.2	08/07/2245
21123+57	2,613	18	0.315	45,000	1.13	0.061	225.2	08/07/2245
21147+38	2,613	18	0.315	45,000	1.25	0.083	225.2	08/07/2245
21159+35	2,594	18	0.305	45,000	1.36	0.070	225.2	08/07/2245
21225+69	2,545	18	0.305	45,000	1.48	0.063	225.2	08/07/2245
21333+81	2,570	18	0.315	45,000	1.13	0.068	225.2	08/07/2245
21343+99	2,572	18	0.335	45,000	1.13	0.076	225.2	08/07/2245
21350+39	2,585	18	0.344	45,000	1.13	0.070	225.2	08/07/2245
21350+67	2,585	18	0.335	45,000	1.25	0.076	225.2	08/07/2245
21351+05	2,585	18	0.335	45,000	1.13	0.083	225.2	08/07/2245

Table D-3. Pressure Cycle Fatigue Analysis — ILI-Indicated Anomalies Barnhart to Cartman – ILI Date June 16, 2020 (pg. 1 of 3)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
18236+72	2,445	18	0.266	45,000	6.21	0.095	18.4	11/13/2038
18804+73	2,503	18	0.276	45,000	5.03	0.102	23.1	07/20/2043
18469+86	2,463	18	0.266	45,000	3.73	0.103	24.7	03/13/2045
19595+59	2,581	18	0.315	45,000	5.85	0.102	27.7	03/07/2048
18202+48	2,438	18	0.285	45,000	5.03	0.102	27.9	05/06/2048
19406+59	2,498	18	0.315	45,000	5.38	0.108	29.7	02/17/2050
18674+38	2,484	18	0.276	45,000	3.25	0.108	31.9	05/17/2052
19028+90	2,510	18	0.276	45,000	10.22	0.075	36.5	12/25/2056
19023+69	2,513	18	0.266	45,000	4.91	0.076	39.9	05/16/2060
18284+26	2,440	18	0.266	45,000	2.66	0.095	41.2	08/19/2061
18200+03	2,435	18	0.276	45,000	3.25	0.094	41.3	10/17/2061
19521+58	2,539	18	0.315	45,000	3.25	0.108	41.5	12/10/2061
19671+81	2,597	18	0.305	45,000	4.67	0.082	42.9	05/03/2063
19280+09	2,532	18	0.315	45,000	4.32	0.102	46.5	12/11/2066
19423+72	2,483	18	0.315	45,000	2.78	0.115	46.7	02/23/2067
18520+52	2,476	18	0.276	65,000	10.11	0.075	46.7	03/12/2067
18930+70	2,523	18	0.276	45,000	2.78	0.094	48.1	07/05/2068
19501+18	2,500	18	0.315	45,000	6.80	0.083	48.3	10/04/2068
19697+08	2,589	18	0.315	45,000	3.25	0.090	51.8	03/20/2072
18242+03	2,446	18	0.276	45,000	1.72	0.116	52.5	11/29/2072
18493+91	2,473	18	0.276	45,000	3.14	0.088	54.2	08/13/2074
18564+20	2,471	18	0.276	45,000	2.19	0.102	55.8	03/22/2076
19354+45	2,516	18	0.315	45,000	3.14	0.102	56.9	05/24/2077
18821+23	2,501	18	0.266	45,000	2.66	0.081	57.8	03/24/2078
19129+04	2,526	18	0.276	45,000	1.72	0.102	57.8	04/06/2078

Table D-3 (continued). Pressure Cycle Fatigue Analysis — ILI-Indicated Anomalies
Barnhart to Cartman – ILI Date June 16, 2020 (pg. 2 of 3)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
18960+78	2,508	18	0.276	45,000	2.55	0.088	58.2	08/22/2078
18569+57	2,467	18	0.266	45,000	2.78	0.081	58.4	11/17/2078
18201+61	2,437	18	0.276	45,000	1.72	0.108	59.0	06/24/2079
19590+85	2,579	18	0.315	45,000	1.95	0.108	62.7	02/16/2083
19590+62	2,579	18	0.315	45,000	1.95	0.108	62.7	02/21/2083
18961+78	2,508	18	0.285	45,000	4.44	0.076	65.1	07/15/2085
18930+75	2,523	18	0.276	45,000	2.19	0.088	67.5	12/18/2087
18245+32	2,446	18	0.276	45,000	2.19	0.088	68.8	03/28/2089
19647+45	2,595	18	0.315	45,000	2.66	0.083	72.1	07/18/2092
19325+64	2,511	18	0.305	45,000	2.31	0.094	74.7	03/10/2095
19590+85	2,579	18	0.315	45,000	1.95	0.096	76.8	04/08/2097
19051+68	2,506	18	0.276	45,000	1.60	0.088	83.3	10/02/2103
18504+81	2,479	18	0.276	45,000	2.19	0.083	83.3	10/13/2103
18930+69	2,523	18	0.276	45,000	1.95	0.083	83.5	12/28/2103
19652+91	2,597	18	0.305	45,000	1.13	0.109	86.6	02/06/2107
19363+15	2,517	18	0.315	45,000	4.44	0.074	87.6	01/19/2108
19537+14	2,560	18	0.315	45,000	1.95	0.090	90.1	07/17/2110
18561+68	2,470	18	0.276	45,000	1.95	0.083	91.6	01/25/2112
19107+30	2,514	18	0.276	45,000	1.84	0.075	93.6	02/05/2114
19574+32	2,564	18	0.295	45,000	1.36	0.083	94.4	11/06/2114
19537+65	2,560	18	0.305	45,000	2.55	0.070	95.3	09/24/2115
18675+68	2,485	18	0.266	45,000	1.72	0.076	96.6	01/30/2117
18822+37	2,501	18	0.276	45,000	1.72	0.083	97.5	12/02/2117
19527+77	2,544	18	0.305	45,000	1.95	0.076	100.0	06/28/2120
19128+23	2,526	18	0.276	45,000	1.36	0.083	100.9	05/29/2121
19331+09	2,510	18	0.305	45,000	1.48	0.094	109.5	12/28/2129
19543+11	2,558	18	0.315	45,000	1.72	0.083	110.3	10/22/2130
19500+39	2,501	18	0.305	45,000	1.36	0.088	110.6	01/21/2131
19108+89	2,513	18	0.276	45,000	1.25	0.083	111.1	07/11/2131
18763+41	2,497	18	0.276	45,000	1.84	0.075	111.2	09/08/2131
19094+11	2,509	18	0.276	45,000	1.48	0.075	111.6	02/05/2132
19521+62	2,539	18	0.315	45,000	1.36	0.096	113.3	10/22/2133
19510+15	2,511	18	0.315	45,000	1.25	0.102	114.9	05/29/2135
18904+35	2,507	18	0.276	45,000	1.36	0.083	115.3	09/26/2135
19334+87	2,509	18	0.315	45,000	1.60	0.096	116.1	07/20/2136
19334+90	2,509	18	0.315	45,000	1.36	0.102	123.5	12/16/2143
19315+42	2,514	18	0.315	45,000	1.36	0.102	125.6	02/02/2146
19570+46	2,562	18	0.295	45,000	1.25	0.068	130.2	08/29/2150
19331+15	2,510	18	0.305	45,000	1.48	0.082	132.6	01/24/2153
19436+06	2,521	18	0.315	45,000	1.36	0.090	134.3	10/01/2154
18898+07	2,503	18	0.276	45,000	1.84	0.064	134.8	04/15/2155
19557+88	2,559	18	0.305	45,000	1.13	0.082	136.0	07/03/2156
19543+20	2,558	18	0.315	45,000	1.60	0.074	136.8	04/11/2157
18907+34	2,510	18	0.276	45,000	1.48	0.069	138.6	01/10/2159
19305+98	2,520	18	0.315	45,000	1.48	0.090	140.2	08/12/2160
19333+42	2,509	18	0.315	45,000	1.95	0.074	144.6	01/05/2165
19590+81	2,579	18	0.315	45,000	1.60	0.068	146.1	08/09/2166

Table D-3 (continued). Pressure Cycle Fatigue Analysis — ILI-Indicated Anomalies
Barnhart to Cartman – ILI Date June 16, 2020 (pg. 3 of 3)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
18679+09	2,487	18	0.266	45,000	1.36	0.063	152.1	07/21/2172
19362+51	2,517	18	0.315	45,000	1.36	0.083	157.5	11/29/2177
19455+06	2,530	18	0.305	45,000	1.48	0.063	163.5	12/24/2183
19331+12	2,510	18	0.305	45,000	1.25	0.076	168.6	01/16/2189
19295+47	2,530	18	0.305	45,000	1.72	0.063	171.6	01/30/2192
19605+68	2,585	18	0.315	45,000	1.36	0.061	179.7	02/24/2200
19280+07	2,532	18	0.315	45,000	1.48	0.074	183.9	05/19/2204
19329+23	2,511	18	0.305	45,000	1.13	0.070	201.3	10/18/2221

Table D-4. Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies
Cartman to Kimble – ILI Date August 25, 2020 (pg. 1 of 9)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
18086+30	2,433	18	0.266	45,000	9.85	0.081	7.0	08/28/2027
17439+73	2,373	18	0.266	45,000	9.96	0.081	12.4	01/21/2033
17570+86	2,372	18	0.266	45,000	4.66	0.095	12.5	03/04/2033
18167+30	2,440	18	0.276	45,000	4.07	0.083	15.1	09/25/2035
17676+63	2,331	18	0.276	45,000	7.61	0.083	15.5	03/08/2036
17995+86	2,397	18	0.276	45,000	7.72	0.075	16.1	10/07/2036
17007+75	2,300	18	0.266	45,000	14.79	0.076	16.8	05/31/2037
18162+65	2,441	18	0.276	45,000	2.54	0.094	16.8	06/29/2037
18117+32	2,437	18	0.276	45,000	3.72	0.083	16.9	07/06/2037
18055+73	2,423	18	0.276	45,000	3.84	0.083	17.5	02/05/2038
17986+95	2,397	18	0.276	45,000	2.19	0.102	19.2	11/24/2039
17107+84	2,193	18	0.276	45,000	5.96	0.094	19.8	06/01/2040
17071+66	2,284	18	0.276	45,000	6.07	0.094	20.2	11/12/2040
18137+90	2,441	18	0.266	45,000	3.84	0.068	20.7	05/10/2041
18059+06	2,425	18	0.276	45,000	4.31	0.075	20.8	05/29/2041
18020+93	2,407	18	0.276	45,000	4.54	0.075	20.8	06/18/2041
18012+39	2,398	18	0.276	45,000	4.54	0.075	21.0	08/14/2041
18094+21	2,436	18	0.276	45,000	5.37	0.069	21.5	03/05/2042
17186+22	2,261	18	0.266	45,000	8.90	0.076	21.8	06/30/2042
18118+25	2,436	18	0.276	45,000	7.84	0.064	22.1	10/09/2042
18091+50	2,434	18	0.276	45,000	5.01	0.069	22.3	12/03/2042
17429+86	2,380	18	0.266	45,000	6.31	0.076	22.4	01/10/2043
17448+94	2,376	18	0.276	45,000	4.54	0.088	22.4	01/30/2043
17235+84	2,329	18	0.266	45,000	5.84	0.081	22.5	03/14/2043
18162+60	2,441	18	0.276	45,000	2.42	0.083	22.6	04/11/2043
17457+60	2,376	18	0.266	45,000	3.25	0.089	22.8	06/12/2043
17549+62	2,367	18	0.276	45,000	4.90	0.083	23.2	11/12/2043
17331+28	2,298	18	0.276	45,000	3.95	0.094	23.4	01/07/2044
17579+05	2,392	18	0.276	45,000	3.72	0.088	23.5	02/09/2044
17216+29	2,294	18	0.276	45,000	5.49	0.088	23.7	04/26/2044
17570+44	2,371	18	0.266	45,000	2.07	0.103	23.7	05/05/2044
17863+59	2,372	18	0.276	45,000	3.13	0.083	24.2	10/22/2044
18104+72	2,440	18	0.276	45,000	6.19	0.064	24.5	02/10/2045

Table D-4 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Cartman to Kimble – ILI Date August 25, 2020 (pg. 2 of 9)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
17089+28	2,235	18	0.276	45,000	8.08	0.083	24.7	04/27/2045
18053+73	2,424	18	0.285	45,000	4.07	0.076	24.9	07/15/2045
17344+61	2,310	18	0.266	45,000	10.67	0.068	25.0	08/27/2045
17758+57	2,344	18	0.266	45,000	5.13	0.068	25.0	08/28/2045
17308+30	2,271	18	0.276	45,000	10.43	0.075	25.1	10/06/2045
17732+39	2,314	18	0.285	45,000	6.66	0.076	25.5	03/01/2046
17561+65	2,355	18	0.276	45,000	4.07	0.083	26.0	09/11/2046
17326+63	2,300	18	0.276	45,000	5.37	0.083	26.4	01/16/2047
17041+00	2,235	18	0.266	45,000	5.60	0.081	27.1	09/27/2047
17581+64	2,396	18	0.276	45,000	5.84	0.075	27.1	10/08/2047
17727+59	2,313	18	0.266	45,000	2.54	0.081	27.1	10/16/2047
17579+26	2,392	18	0.276	45,000	8.55	0.069	28.0	08/18/2048
15743+26	2,220	18	0.266	45,000	6.07	0.095	28.0	08/21/2048
17548+37	2,369	18	0.276	45,000	8.43	0.069	28.9	07/05/2049
17436+94	2,377	18	0.276	45,000	6.55	0.075	29.0	08/29/2049
17965+34	2,405	18	0.276	45,000	2.19	0.083	29.5	02/25/2050
17354+59	2,289	18	0.276	45,000	10.91	0.069	30.3	11/30/2050
17101+57	2,194	18	0.266	45,000	3.25	0.089	30.4	12/31/2050
17674+64	2,325	18	0.276	45,000	2.42	0.088	30.9	07/07/2051
16670+45	2,224	18	0.315	45,000	9.61	0.108	31.0	08/22/2051
17491+53	2,327	18	0.266	45,000	3.36	0.076	31.3	12/26/2051
18162+91	2,441	18	0.276	45,000	3.13	0.064	31.4	01/21/2052
17494+70	2,318	18	0.276	45,000	4.54	0.075	33.2	11/17/2053
18046+56	2,426	18	0.276	45,000	1.71	0.083	33.7	05/02/2054
18164+71	2,441	18	0.276	45,000	2.19	0.069	33.7	05/14/2054
16860+89	2,278	18	0.305	45,000	17.39	0.088	33.9	07/05/2054
17866+41	2,377	18	0.276	45,000	4.54	0.064	34.3	12/08/2054
17558+73	2,356	18	0.276	45,000	5.37	0.069	34.8	06/13/2055
17539+15	2,365	18	0.276	45,000	2.42	0.088	35.0	08/21/2055
17471+74	2,347	18	0.276	45,000	4.31	0.075	35.1	09/18/2055
17527+72	2,376	18	0.276	45,000	2.78	0.083	36.0	08/11/2056
17337+62	2,290	18	0.276	45,000	5.01	0.075	36.0	08/18/2056
18162+77	2,441	18	0.276	45,000	1.95	0.069	36.5	03/07/2057
15747+65	2,210	18	0.276	45,000	8.20	0.088	37.3	11/26/2057
18054+91	2,423	18	0.266	45,000	1.71	0.068	37.8	06/02/2058
17181+05	2,279	18	0.276	45,000	3.13	0.088	37.9	07/18/2058
17952+25	2,419	18	0.276	45,000	2.42	0.069	38.3	12/23/2058
17927+07	2,418	18	0.266	45,000	1.48	0.076	40.4	01/26/2061
17325+31	2,298	18	0.276	45,000	4.07	0.075	41.0	08/20/2061
17302+94	2,267	18	0.266	45,000	2.30	0.081	42.8	05/26/2063
18167+49	2,440	18	0.276	45,000	1.83	0.064	43.0	08/29/2063
17401+55	2,348	18	0.266	45,000	1.71	0.089	43.4	01/27/2064
17477+56	2,342	18	0.276	45,000	5.96	0.064	43.4	01/27/2064
17466+44	2,364	18	0.266	45,000	2.89	0.068	44.9	07/04/2065
17330+88	2,299	18	0.276	45,000	4.66	0.069	45.2	11/03/2065
17717+58	2,323	18	0.276	45,000	2.07	0.075	46.0	08/26/2066
17339+87	2,289	18	0.276	45,000	6.66	0.064	46.7	05/19/2067

Table D-4 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Cartman to Kimble – ILI Date August 25, 2020 (pg. 3 of 9)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
16873+98	2,302	18	0.315	45,000	7.61	0.096	47.5	03/02/2068
17033+58	2,243	18	0.266	45,000	2.66	0.081	47.6	03/18/2068
16332+31	2,385	18	0.315	45,000	7.25	0.108	47.7	04/23/2068
17220+63	2,310	18	0.276	45,000	5.01	0.069	48.0	09/11/2068
17442+67	2,372	18	0.276	45,000	5.01	0.064	48.1	10/15/2068
17958+12	2,413	18	0.276	45,000	1.71	0.069	48.3	12/18/2068
16466+93	2,257	18	0.305	45,000	9.26	0.094	48.6	03/20/2069
17193+40	2,243	18	0.266	45,000	5.25	0.063	48.9	07/21/2069
17375+04	2,299	18	0.266	45,000	1.83	0.081	48.9	08/06/2069
17519+76	2,365	18	0.276	45,000	2.42	0.075	49.2	11/04/2069
18116+55	2,438	18	0.276	45,000	1.36	0.069	49.7	05/05/2070
17409+72	2,377	18	0.276	45,000	3.25	0.069	51.7	05/19/2072
16149+31	2,378	18	0.315	45,000	9.49	0.102	52.8	06/07/2073
17857+26	2,357	18	0.266	45,000	1.60	0.063	53.3	12/27/2073
16201+83	2,338	18	0.315	45,000	9.02	0.102	53.3	12/29/2073
16533+14	2,313	18	0.315	45,000	9.49	0.096	53.9	07/06/2074
16850+83	2,290	18	0.315	45,000	6.31	0.096	53.9	08/02/2074
16670+33	2,224	18	0.315	45,000	7.84	0.096	54.1	10/06/2074
17714+39	2,315	18	0.276	45,000	2.42	0.064	54.2	10/27/2074
17527+70	2,376	18	0.276	45,000	2.07	0.075	54.9	07/16/2075
15936+26	2,219	18	0.276	45,000	6.55	0.083	55.1	10/13/2075
17384+39	2,331	18	0.276	45,000	2.42	0.075	55.2	11/02/2075
16935+39	2,311	18	0.305	45,000	8.43	0.082	56.1	09/14/2076
17099+61	2,194	18	0.276	45,000	6.90	0.064	56.1	09/14/2076
17007+81	2,300	18	0.266	45,000	2.66	0.076	56.1	10/17/2076
17034+56	2,240	18	0.266	45,000	2.54	0.076	56.5	02/25/2077
16694+31	2,271	18	0.305	45,000	12.79	0.082	56.6	03/24/2077
17912+77	2,407	18	0.276	45,000	1.71	0.064	56.8	06/07/2077
17108+10	2,193	18	0.276	45,000	3.13	0.075	57.6	04/15/2078
15821+80	2,265	18	0.276	45,000	4.54	0.088	59.0	08/09/2079
15927+32	2,162	18	0.276	45,000	5.84	0.083	59.1	10/06/2079
17764+58	2,353	18	0.276	45,000	1.60	0.069	60.3	12/19/2080
17403+24	2,358	18	0.276	45,000	2.54	0.069	60.5	02/15/2081
17504+39	2,316	18	0.266	45,000	1.95	0.063	63.9	07/23/2084
17447+38	2,376	18	0.276	45,000	2.78	0.064	64.0	08/15/2084
17606+69	2,395	18	0.266	45,000	1.71	0.063	64.1	09/27/2084
16640+90	2,286	18	0.315	45,000	4.78	0.102	64.1	10/10/2084
17742+95	2,320	18	0.276	45,000	1.71	0.064	65.6	04/04/2086
17009+75	2,302	18	0.266	45,000	2.89	0.068	65.9	07/09/2086
17217+34	2,297	18	0.266	45,000	1.71	0.076	66.4	01/10/2087
16935+12	2,310	18	0.305	45,000	5.84	0.082	66.4	01/21/2087
17004+83	2,301	18	0.276	45,000	1.95	0.088	66.7	04/29/2087
17006+20	2,296	18	0.266	45,000	3.72	0.063	67.4	02/02/2088
17328+61	2,301	18	0.266	45,000	2.19	0.063	69.3	12/01/2089
17709+24	2,308	18	0.276	45,000	1.24	0.075	69.4	01/17/2090
17713+21	2,313	18	0.266	45,000	1.13	0.068	71.0	08/09/2091
16550+32	2,281	18	0.305	45,000	9.02	0.082	72.2	11/12/2092

Table D-4 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Cartman to Kimble – ILI Date August 25, 2020 (pg. 4 of 9)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
17020+67	2,267	18	0.276	45,000	1.24	0.108	74.6	03/29/2095
15779+84	2,196	18	0.266	45,000	6.90	0.068	75.0	09/06/2095
17226+15	2,327	18	0.276	45,000	2.89	0.064	75.3	12/19/2095
17403+14	2,357	18	0.276	45,000	1.83	0.069	75.4	01/29/2096
15980+95	2,280	18	0.266	45,000	2.54	0.089	75.6	03/26/2096
17325+70	2,298	18	0.266	45,000	1.60	0.068	75.8	06/19/2096
15851+70	2,280	18	0.276	45,000	6.31	0.075	77.0	09/06/2097
17702+20	2,350	18	0.276	45,000	1.24	0.069	77.4	01/04/2098
16201+58	2,337	18	0.315	45,000	2.89	0.127	77.6	03/27/2098
15925+93	2,153	18	0.266	45,000	6.43	0.068	77.7	05/15/2098
17353+47	2,292	18	0.276	45,000	1.83	0.069	78.2	11/09/2098
17098+36	2,201	18	0.285	45,000	5.25	0.062	78.9	08/02/2099
17099+93	2,193	18	0.276	45,000	3.13	0.064	79.2	10/30/2099
15780+09	2,195	18	0.266	45,000	3.72	0.076	79.6	03/27/2100
16781+46	2,276	18	0.315	45,000	6.66	0.083	80.4	02/02/2101
15776+20	2,205	18	0.276	45,000	5.60	0.075	80.8	06/16/2101
16206+20	2,344	18	0.315	45,000	3.48	0.115	81.3	12/20/2101
16550+44	2,281	18	0.305	45,000	3.01	0.103	81.6	04/04/2102
16638+92	2,292	18	0.305	45,000	2.78	0.103	82.9	08/01/2103
17129+40	2,189	18	0.276	45,000	2.19	0.069	83.0	08/28/2103
16837+58	2,328	18	0.315	45,000	13.14	0.074	83.5	02/20/2104
17426+68	2,383	18	0.276	45,000	1.83	0.064	83.9	07/09/2104
17732+78	2,315	18	0.285	45,000	1.36	0.067	84.0	09/03/2104
16976+70	2,317	18	0.315	45,000	4.54	0.083	84.2	11/14/2104
16521+07	2,286	18	0.315	45,000	4.54	0.096	84.7	05/24/2105
16697+77	2,272	18	0.305	45,000	7.61	0.076	85.9	07/15/2106
17147+17	2,234	18	0.276	45,000	2.54	0.064	85.9	07/15/2106
16677+51	2,217	18	0.315	45,000	4.66	0.090	87.7	05/18/2108
16862+17	2,276	18	0.315	45,000	3.13	0.096	88.0	09/12/2108
16705+01	2,282	18	0.305	45,000	7.02	0.076	88.3	12/06/2108
16692+28	2,265	18	0.305	45,000	6.90	0.076	89.6	03/31/2110
17248+08	2,324	18	0.276	45,000	1.48	0.075	90.3	12/05/2110
17057+19	2,219	18	0.276	45,000	2.07	0.069	91.9	07/07/2112
16407+14	2,301	18	0.305	45,000	4.54	0.088	93.2	10/20/2113
16449+58	2,290	18	0.305	45,000	2.78	0.103	93.9	07/08/2114
16731+78	2,284	18	0.315	45,000	2.42	0.108	95.5	02/11/2116
17220+69	2,310	18	0.276	45,000	1.95	0.064	95.6	03/23/2116
17186+34	2,261	18	0.266	45,000	1.36	0.068	96.1	10/05/2116
16438+89	2,310	18	0.305	45,000	8.90	0.076	96.6	03/15/2117
16079+51	2,261	18	0.315	45,000	4.07	0.102	96.9	07/16/2117
15939+23	2,226	18	0.285	45,000	5.01	0.076	99.5	02/28/2120
16708+48	2,281	18	0.315	45,000	9.26	0.074	101.5	03/03/2122
16667+25	2,226	18	0.305	45,000	8.78	0.070	102.5	02/13/2123
16706+09	2,283	18	0.305	45,000	8.08	0.070	102.7	05/12/2123
16112+32	2,299	18	0.315	45,000	4.54	0.096	103.4	02/06/2124
15799+99	2,216	18	0.276	45,000	5.01	0.069	103.6	04/16/2124
16674+98	2,218	18	0.315	45,000	4.66	0.083	103.8	06/18/2124

Table D-4 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Cartman to Kimble – ILI Date August 25, 2020 (pg. 5 of 9)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
17579+04	2,392	18	0.276	45,000	1.13	0.064	103.8	06/24/2124
17340+10	2,289	18	0.285	45,000	1.95	0.062	105.0	09/03/2125
16503+06	2,326	18	0.315	45,000	13.38	0.074	105.3	12/22/2125
17549+95	2,368	18	0.276	45,000	1.13	0.064	106.3	12/23/2126
16605+67	2,284	18	0.315	45,000	2.66	0.102	107.7	04/21/2128
15740+56	2,219	18	0.266	45,000	4.66	0.063	108.7	04/29/2129
17099+54	2,194	18	0.276	45,000	1.83	0.064	108.9	07/19/2129
15974+91	2,263	18	0.276	45,000	3.36	0.075	109.2	11/03/2129
16795+01	2,328	18	0.305	45,000	1.83	0.103	109.4	01/17/2130
16938+56	2,324	18	0.305	45,000	2.19	0.088	109.7	05/01/2130
16705+83	2,283	18	0.305	45,000	4.07	0.076	113.4	02/03/2134
16540+62	2,310	18	0.305	45,000	3.01	0.088	114.6	04/19/2135
16948+76	2,351	18	0.305	45,000	3.84	0.070	115.1	10/12/2135
15641+30	2,163	18	0.276	45,000	2.89	0.075	115.5	02/29/2136
16292+67	2,394	18	0.315	45,000	4.42	0.090	116.2	11/15/2136
17487+26	2,336	18	0.285	45,000	1.36	0.062	117.0	08/30/2137
16825+18	2,337	18	0.315	45,000	8.31	0.068	118.7	05/16/2139
16857+66	2,277	18	0.305	45,000	4.07	0.070	119.5	02/23/2140
16891+56	2,339	18	0.315	45,000	6.43	0.068	121.8	06/24/2142
16802+30	2,326	18	0.305	45,000	4.31	0.070	121.9	07/11/2142
16989+67	2,325	18	0.315	45,000	1.83	0.096	124.7	04/28/2145
16260+10	2,378	18	0.315	45,000	11.73	0.074	125.1	10/03/2145
16595+09	2,302	18	0.315	45,000	3.01	0.090	126.5	02/17/2147
16733+39	2,284	18	0.315	45,000	1.95	0.102	129.6	03/27/2150
16206+18	2,344	18	0.315	45,000	2.78	0.102	129.9	07/14/2150
16318+61	2,408	18	0.305	45,000	5.13	0.076	130.1	09/28/2150
15916+99	2,173	18	0.285	45,000	4.90	0.067	132.1	10/03/2152
16874+90	2,303	18	0.315	45,000	2.54	0.083	132.8	05/28/2153
16545+66	2,289	18	0.315	45,000	11.38	0.068	133.4	01/04/2154
15881+65	2,242	18	0.276	45,000	1.71	0.088	135.6	04/01/2156
15763+77	2,203	18	0.276	45,000	2.42	0.075	135.9	07/25/2156
16984+25	2,310	18	0.305	45,000	2.66	0.070	136.0	08/27/2156
16182+55	2,299	18	0.315	45,000	3.60	0.090	139.0	08/10/2159
16508+91	2,307	18	0.315	45,000	1.60	0.121	140.0	08/26/2160
15763+95	2,204	18	0.276	45,000	2.30	0.075	140.9	07/07/2161
16803+78	2,330	18	0.315	45,000	5.01	0.068	142.4	01/13/2163
15748+11	2,209	18	0.276	45,000	1.60	0.088	142.6	04/13/2163
16288+27	2,385	18	0.305	45,000	3.25	0.082	145.3	12/19/2165
16523+73	2,291	18	0.315	45,000	4.90	0.074	146.1	10/03/2166
16201+52	2,337	18	0.315	45,000	2.78	0.096	147.2	10/25/2167
16756+30	2,243	18	0.305	45,000	1.60	0.094	147.2	11/18/2167
16985+11	2,310	18	0.315	45,000	1.95	0.083	147.3	12/20/2167
16958+76	2,323	18	0.305	45,000	3.13	0.063	148.1	09/30/2168
16903+89	2,324	18	0.315	45,000	1.83	0.090	148.2	10/24/2168
15720+68	2,144	18	0.295	45,000	5.01	0.068	148.4	01/14/2169
16676+21	2,217	18	0.315	45,000	5.49	0.068	150.1	09/15/2170
16455+82	2,268	18	0.315	45,000	2.30	0.096	150.5	02/21/2171

Table D-4 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Cartman to Kimble – ILI Date August 25, 2020 (pg. 6 of 9)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
16132+69	2,332	18	0.305	45,000	6.55	0.070	152.3	12/16/2172
16671+12	2,223	18	0.315	45,000	3.60	0.074	153.3	12/05/2173
16670+52	2,223	18	0.315	45,000	3.60	0.074	153.3	12/17/2173
16676+20	2,217	18	0.315	45,000	1.83	0.096	157.4	01/31/2178
16237+53	2,381	18	0.305	45,000	2.42	0.088	160.8	06/28/2181
16104+61	2,285	18	0.315	45,000	3.01	0.090	162.0	08/14/2182
16850+52	2,292	18	0.305	45,000	1.48	0.088	162.1	09/25/2182
16428+68	2,316	18	0.305	45,000	3.01	0.076	163.0	08/17/2183
16537+98	2,316	18	0.305	45,000	3.48	0.070	163.2	11/04/2183
15917+01	2,173	18	0.285	45,000	4.54	0.062	163.7	05/17/2184
16651+33	2,260	18	0.315	45,000	1.13	0.134	164.1	09/18/2184
16755+78	2,243	18	0.315	45,000	1.83	0.090	165.1	09/24/2185
16517+55	2,292	18	0.315	45,000	5.72	0.068	165.5	03/02/2186
16887+22	2,331	18	0.305	45,000	2.78	0.063	166.6	03/17/2187
15984+04	2,292	18	0.276	45,000	2.19	0.069	168.2	10/22/2188
15942+43	2,234	18	0.276	45,000	2.19	0.069	168.2	11/09/2188
16636+23	2,298	18	0.305	45,000	3.95	0.063	169.5	02/24/2190
15842+80	2,308	18	0.276	45,000	1.83	0.075	169.8	06/06/2190
16123+74	2,299	18	0.305	45,000	3.48	0.076	171.2	11/13/2191
15984+10	2,292	18	0.276	45,000	2.66	0.064	171.4	01/04/2192
16895+93	2,337	18	0.305	45,000	1.71	0.076	171.5	02/28/2192
16671+14	2,223	18	0.315	45,000	3.95	0.068	172.2	11/17/2192
16772+49	2,263	18	0.315	45,000	1.95	0.083	173.5	02/11/2194
16522+62	2,289	18	0.305	45,000	2.07	0.082	174.0	08/15/2194
16129+49	2,317	18	0.315	45,000	5.13	0.074	174.2	10/27/2194
16805+79	2,331	18	0.295	45,000	2.19	0.063	176.5	03/11/2197
16786+16	2,288	18	0.315	45,000	3.13	0.068	178.0	08/29/2198
16887+48	2,332	18	0.305	45,000	2.42	0.063	178.9	07/29/2199
15776+20	2,204	18	0.276	45,000	2.42	0.064	179.7	05/13/2200
16763+39	2,240	18	0.305	45,000	1.83	0.076	179.8	06/08/2200
16479+24	2,302	18	0.315	45,000	4.90	0.068	179.8	06/22/2200
16549+76	2,282	18	0.315	45,000	2.30	0.083	180.0	08/19/2200
16717+33	2,263	18	0.315	45,000	1.48	0.096	185.7	05/25/2206
16742+01	2,262	18	0.315	45,000	4.42	0.061	186.4	02/03/2207
15780+10	2,195	18	0.266	45,000	1.24	0.076	186.9	07/14/2207
16456+93	2,265	18	0.315	45,000	1.60	0.102	187.9	07/18/2208
16756+26	2,243	18	0.305	45,000	1.71	0.076	189.6	04/09/2210
16847+47	2,309	18	0.305	45,000	1.24	0.088	190.1	09/28/2210
15843+92	2,309	18	0.276	45,000	1.83	0.069	191.3	12/31/2211
16479+33	2,302	18	0.315	45,000	1.71	0.096	191.4	01/23/2212
16532+05	2,310	18	0.315	45,000	3.84	0.068	193.2	11/08/2213
16304+01	2,406	18	0.315	45,000	2.19	0.090	193.2	11/21/2213
16832+76	2,345	18	0.305	45,000	1.83	0.070	193.5	02/27/2214
16755+73	2,243	18	0.315	45,000	1.24	0.102	195.8	05/27/2216
16482+91	2,298	18	0.315	45,000	3.95	0.068	196.4	01/20/2217
16670+59	2,223	18	0.315	45,000	3.01	0.068	196.8	06/24/2217
16328+90	2,384	18	0.315	45,000	3.36	0.074	199.0	09/06/2219

Table D-4 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Cartman to Kimble – ILI Date August 25, 2020 (pg. 7 of 9)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
16125+54	2,306	18	0.325	45,000	3.60	0.082	201.4	01/05/2222
16473+11	2,284	18	0.305	45,000	3.36	0.063	202.8	06/28/2223
16120+98	2,295	18	0.305	45,000	2.19	0.082	203.4	01/30/2224
16690+27	2,255	18	0.315	45,000	2.66	0.068	207.9	07/09/2228
16555+60	2,292	18	0.305	45,000	1.60	0.082	207.9	07/10/2228
16329+59	2,384	18	0.315	45,000	1.95	0.090	208.4	02/03/2229
16390+39	2,323	18	0.315	45,000	1.48	0.102	210.9	07/24/2231
16050+12	2,288	18	0.315	45,000	2.54	0.083	211.9	07/06/2232
16672+62	2,221	18	0.305	45,000	1.60	0.076	212.2	11/17/2232
16834+66	2,340	18	0.315	45,000	2.78	0.061	213.2	10/27/2233
16077+69	2,261	18	0.305	45,000	4.42	0.063	214.8	06/27/2235
16216+20	2,340	18	0.315	45,000	2.30	0.083	216.4	01/07/2237
16676+19	2,217	18	0.315	45,000	1.60	0.083	216.7	04/30/2237
16457+25	2,265	18	0.315	45,000	2.54	0.074	216.9	07/07/2237
16948+62	2,351	18	0.305	45,000	1.36	0.070	217.5	03/12/2238
16826+55	2,340	18	0.315	45,000	1.71	0.074	217.9	07/26/2238
16748+05	2,250	18	0.315	45,000	1.83	0.074	219.4	01/23/2240
16434+09	2,314	18	0.305	45,000	2.30	0.070	220.2	10/21/2240
16740+85	2,265	18	0.315	45,000	1.48	0.083	220.7	05/07/2241
16304+19	2,406	18	0.315	45,000	6.31	0.061	221.6	04/18/2242
16695+78	2,273	18	0.305	45,000	1.48	0.076	222.1	10/11/2242
16260+93	2,378	18	0.315	45,000	3.95	0.068	222.5	02/11/2243
15852+11	2,277	18	0.276	45,000	1.48	0.069	223.1	09/17/2243
16274+46	2,369	18	0.315	45,000	1.36	0.108	223.6	04/20/2244
15686+46	2,183	18	0.276	45,000	1.24	0.069	225.2	11/17/2245
15856+48	2,251	18	0.276	45,000	1.36	0.064	225.2	11/17/2245
15934+04	2,207	18	0.276	45,000	1.24	0.075	225.2	11/17/2245
15940+38	2,228	18	0.276	45,000	1.36	0.064	225.2	11/17/2245
15975+70	2,265	18	0.266	45,000	1.13	0.068	225.2	11/17/2245
15986+71	2,288	18	0.276	45,000	1.24	0.069	225.2	11/17/2245
16001+21	2,273	18	0.285	45,000	1.13	0.082	225.2	11/17/2245
16033+72	2,286	18	0.315	45,000	4.19	0.061	225.2	11/17/2245
16055+43	2,287	18	0.315	45,000	1.48	0.068	225.2	11/17/2245
16097+23	2,245	18	0.315	45,000	1.48	0.083	225.2	11/17/2245
16112+62	2,297	18	0.315	45,000	3.01	0.068	225.2	11/17/2245
16113+04	2,296	18	0.315	45,000	2.89	0.061	225.2	11/17/2245
16124+13	2,300	18	0.305	45,000	2.42	0.070	225.2	11/17/2245
16127+57	2,312	18	0.315	45,000	1.71	0.061	225.2	11/17/2245
16129+52	2,317	18	0.315	45,000	1.83	0.068	225.2	11/17/2245
16129+94	2,318	18	0.315	45,000	1.60	0.061	225.2	11/17/2245
16179+36	2,308	18	0.305	45,000	2.19	0.063	225.2	11/17/2245
16201+62	2,337	18	0.315	45,000	1.24	0.102	225.2	11/17/2245
16201+79	2,338	18	0.315	45,000	1.71	0.083	225.2	11/17/2245
16206+17	2,344	18	0.315	45,000	3.36	0.061	225.2	11/17/2245
16206+18	2,344	18	0.315	45,000	1.48	0.083	225.2	11/17/2245
16206+21	2,344	18	0.315	45,000	1.36	0.090	225.2	11/17/2245
16210+10	2,347	18	0.305	45,000	1.71	0.076	225.2	11/17/2245

Table D-4 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Cartman to Kimble – ILI Date August 25, 2020 (pg. 8 of 9)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
16217+42	2,339	18	0.305	45,000	2.66	0.070	225.2	11/17/2245
16219+36	2,339	18	0.315	45,000	1.36	0.074	225.2	11/17/2245
16249+89	2,360	18	0.305	45,000	1.13	0.063	225.2	11/17/2245
16250+14	2,360	18	0.305	45,000	1.24	0.063	225.2	11/17/2245
16266+11	2,370	18	0.325	45,000	9.37	0.062	225.2	11/17/2245
16272+02	2,371	18	0.315	45,000	1.24	0.068	225.2	11/17/2245
16273+61	2,370	18	0.315	45,000	2.54	0.068	225.2	11/17/2245
16274+49	2,369	18	0.315	45,000	1.60	0.083	225.2	11/17/2245
16274+54	2,369	18	0.315	45,000	1.24	0.068	225.2	11/17/2245
16282+81	2,379	18	0.315	45,000	1.13	0.074	225.2	11/17/2245
16288+17	2,385	18	0.305	45,000	1.95	0.063	225.2	11/17/2245
16291+51	2,392	18	0.305	45,000	1.13	0.063	225.2	11/17/2245
16292+63	2,394	18	0.315	45,000	5.37	0.061	225.2	11/17/2245
16303+94	2,406	18	0.315	45,000	4.19	0.061	225.2	11/17/2245
16304+20	2,406	18	0.315	45,000	1.95	0.074	225.2	11/17/2245
16309+89	2,403	18	0.315	45,000	3.01	0.061	225.2	11/17/2245
16316+82	2,408	18	0.315	45,000	1.24	0.068	225.2	11/17/2245
16325+77	2,386	18	0.315	45,000	1.13	0.061	225.2	11/17/2245
16359+89	2,389	18	0.315	45,000	2.54	0.061	225.2	11/17/2245
16371+41	2,371	18	0.315	45,000	1.60	0.090	225.2	11/17/2245
16408+51	2,300	18	0.315	45,000	1.13	0.083	225.2	11/17/2245
16408+96	2,299	18	0.305	45,000	2.19	0.063	225.2	11/17/2245
16414+72	2,298	18	0.315	45,000	1.24	0.096	225.2	11/17/2245
16450+19	2,288	18	0.325	45,000	1.13	0.095	225.2	11/17/2245
16450+48	2,287	18	0.325	45,000	1.24	0.095	225.2	11/17/2245
16450+91	2,285	18	0.315	45,000	2.89	0.061	225.2	11/17/2245
16457+04	2,265	18	0.315	45,000	2.07	0.074	225.2	11/17/2245
16457+16	2,265	18	0.315	45,000	1.36	0.083	225.2	11/17/2245
16457+17	2,265	18	0.315	45,000	1.24	0.090	225.2	11/17/2245
16457+17	2,265	18	0.315	45,000	1.60	0.083	225.2	11/17/2245
16457+26	2,265	18	0.315	45,000	1.13	0.096	225.2	11/17/2245
16459+30	2,262	18	0.305	45,000	1.13	0.063	225.2	11/17/2245
16467+48	2,261	18	0.315	45,000	1.24	0.083	225.2	11/17/2245
16487+34	2,299	18	0.315	45,000	1.48	0.068	225.2	11/17/2245
16520+15	2,284	18	0.315	45,000	1.24	0.061	225.2	11/17/2245
16538+47	2,315	18	0.315	45,000	1.36	0.068	225.2	11/17/2245
16538+48	2,315	18	0.315	45,000	1.13	0.083	225.2	11/17/2245
16579+60	2,379	18	0.315	45,000	1.13	0.083	225.2	11/17/2245
16598+18	2,295	18	0.315	45,000	3.01	0.061	225.2	11/17/2245
16629+53	2,308	18	0.315	45,000	1.24	0.074	225.2	11/17/2245
16638+92	2,292	18	0.305	45,000	1.24	0.082	225.2	11/17/2245
16667+13	2,226	18	0.305	45,000	1.60	0.070	225.2	11/17/2245
16694+10	2,270	18	0.315	45,000	1.13	0.090	225.2	11/17/2245
16756+03	2,243	18	0.305	45,000	1.24	0.076	225.2	11/17/2245
16798+48	2,318	18	0.315	45,000	1.36	0.068	225.2	11/17/2245
16830+50	2,340	18	0.305	45,000	1.24	0.070	225.2	11/17/2245
16836+13	2,333	18	0.315	45,000	1.24	0.068	225.2	11/17/2245

Table D-4 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Cartman to Kimble – ILI Date August 25, 2020 (pg. 9 of 9)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
16874+87	2,303	18	0.315	45,000	1.83	0.061	225.2	11/17/2245
16948+05	2,351	18	0.315	45,000	1.36	0.068	225.2	11/17/2245
16975+48	2,316	18	0.315	45,000	1.13	0.074	225.2	11/17/2245

Table D-5. Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Kimble to James River – ILI Date October 20, 2020 (pg 1 of 2)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
15478+03	2,203	18	0.266	45,000	2.66	0.103	26.3	02/11/2047
15340+44	2,223	18	0.285	45,000	4.67	0.096	33.0	11/05/2053
15556+88	2,328	18	0.276	45,000	4.44	0.075	43.4	03/19/2064
14980+14	2,028	18	0.276	45,000	6.56	0.083	45.1	12/04/2065
15581+66	2,242	18	0.276	45,000	2.43	0.083	49.9	09/20/2070
15418+99	2,175	18	0.266	45,000	2.90	0.076	50.9	09/03/2071
15181+91	2,161	18	0.276	45,000	2.78	0.094	52.5	05/06/2073
14069+19	1,719	18	0.276	45,000	3.02	0.102	53.6	05/14/2074
15322+12	2,206	18	0.276	45,000	3.02	0.083	56.0	10/28/2076
15337+87	2,214	18	0.276	45,000	4.08	0.075	56.7	06/21/2077
15315+68	2,208	18	0.276	45,000	3.96	0.075	59.0	10/08/2079
15007+52	2,050	18	0.285	45,000	4.67	0.082	68.5	04/13/2089
15519+70	2,247	18	0.276	45,000	2.66	0.069	70.5	04/05/2091
15118+42	2,079	18	0.276	45,000	2.43	0.088	71.1	12/09/2091
15551+08	2,321	18	0.276	45,000	1.48	0.088	72.5	04/27/2093
15352+43	2,289	18	0.276	45,000	2.07	0.083	74.3	02/20/2095
14362+66	1,737	18	0.276	45,000	4.08	0.083	75.0	10/15/2095
15568+76	2,291	18	0.266	45,000	1.36	0.076	78.5	04/06/2099
13850+02	1,760	18	0.285	45,000	4.91	0.076	81.3	02/09/2102
14282+62	1,797	18	0.276	45,000	5.03	0.075	85.3	02/08/2106
14913+30	2,010	18	0.276	45,000	2.07	0.094	85.8	08/04/2106
14405+74	1,704	18	0.276	45,000	7.75	0.069	86.0	10/16/2106
14946+97	2,050	18	0.276	45,000	1.95	0.094	88.8	07/26/2109
14398+44	1,704	18	0.266	45,000	3.14	0.076	89.4	03/01/2110
14067+40	1,707	18	0.276	45,000	1.84	0.102	89.5	04/19/2110
14971+55	2,027	18	0.276	45,000	2.43	0.083	90.8	08/22/2111
14979+68	2,029	18	0.276	45,000	5.50	0.064	97.1	12/07/2117
13891+76	1,646	18	0.266	45,000	2.19	0.076	97.3	02/11/2118
14579+50	1,601	18	0.266	45,000	1.84	0.089	98.2	01/06/2119
15450+76	2,266	18	0.266	45,000	1.60	0.063	104.2	01/05/2125
13816+88	1,857	18	0.285	45,000	3.14	0.076	104.5	04/05/2125
15349+23	2,275	18	0.276	45,000	1.36	0.083	106.3	01/22/2127
15362+38	2,253	18	0.276	45,000	1.72	0.069	112.8	08/20/2133
15575+88	2,268	18	0.276	45,000	1.25	0.069	113.0	11/03/2133
15464+42	2,204	18	0.266	45,000	1.13	0.068	119.3	02/12/2140
13816+80	1,858	18	0.285	45,000	2.43	0.076	124.3	02/10/2145
15074+66	2,085	18	0.276	45,000	2.19	0.069	124.9	09/11/2145
15046+82	2,097	18	0.276	45,000	1.48	0.083	130.0	10/17/2150

Table D-5 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Kimble to James River – ILI Date October 20, 2020 (pg 2 of 2)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
15375+12	2,243	18	0.266	45,000	1.13	0.068	132.2	12/23/2152
15479+63	2,202	18	0.285	45,000	1.72	0.062	134.8	08/19/2155
14408+69	1,721	18	0.276	45,000	3.02	0.069	135.1	11/21/2155
13853+94	1,755	18	0.276	45,000	1.84	0.075	135.6	05/20/2156
13908+60	1,613	18	0.266	45,000	1.72	0.068	141.2	12/24/2161
14792+26	1,661	18	0.276	45,000	1.84	0.075	148.1	11/18/2168
15479+99	2,202	18	0.285	45,000	1.25	0.067	150.5	05/09/2171
14323+71	1,762	18	0.276	45,000	3.02	0.064	157.3	02/07/2178
15058+03	2,119	18	0.285	45,000	1.25	0.087	164.6	06/07/2185
13926+20	1,479	18	0.276	45,000	1.36	0.075	176.0	10/31/2196
14948+88	2,048	18	0.276	45,000	1.48	0.069	181.5	04/05/2202
14361+85	1,737	18	0.285	45,000	1.84	0.076	189.6	06/10/2210
14361+82	1,737	18	0.285	45,000	1.36	0.082	217.0	10/28/2237
14418+12	1,717	18	0.276	45,000	1.13	0.075	225.2	01/12/2246
15007+55	2,050	18	0.285	45,000	1.13	0.062	225.2	01/12/2246

Table D-6. Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies James River to Eckert – ILI Date March 11, 2020 (pg. 1 of 3)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
13381+10	1,630	18	0.266	45,000	3.84	0.076	23.2	05/07/2043
12885+69	1,562	18	0.266	45,000	4.20	0.089	23.9	01/23/2044
13021+94	1,672	18	0.266	45,000	5.02	0.081	24.0	03/24/2044
12975+73	1,725	18	0.266	45,000	6.56	0.076	25.7	12/02/2045
13383+06	1,636	18	0.266	45,000	4.67	0.068	26.9	01/29/2047
13291+08	1,661	18	0.266	45,000	5.50	0.068	27.5	08/22/2047
13493+35	1,697	18	0.266	45,000	3.61	0.068	27.5	09/24/2047
13353+07	1,589	18	0.266	45,000	3.02	0.076	28.1	04/12/2048
13381+07	1,630	18	0.266	45,000	1.95	0.089	28.8	01/13/2049
12994+88	1,766	18	0.266	45,000	14.47	0.063	29.4	08/20/2049
12861+12	1,582	18	0.266	45,000	6.09	0.076	29.8	12/25/2049
13695+53	1,644	18	0.266	45,000	2.19	0.068	30.0	03/14/2050
13508+59	1,672	18	0.266	45,000	3.84	0.063	30.7	11/25/2050
13700+68	1,656	18	0.266	45,000	2.07	0.068	31.1	04/09/2051
13282+73	1,641	18	0.266	45,000	5.97	0.063	32.2	05/19/2052
13370+81	1,562	18	0.266	45,000	4.43	0.063	32.9	02/04/2053
13195+13	1,456	18	0.285	45,000	4.91	0.076	35.9	02/02/2056
13195+11	1,456	18	0.285	45,000	3.02	0.087	36.5	09/13/2056
13342+56	1,619	18	0.266	45,000	3.84	0.063	36.6	10/13/2056
12672+49	1,664	18	0.266	45,000	5.85	0.076	36.7	11/28/2056
13175+65	1,493	18	0.266	45,000	3.49	0.068	38.8	12/28/2058
12955+75	1,702	18	0.266	45,000	5.38	0.068	39.7	12/08/2059
13346+51	1,610	18	0.266	45,000	2.54	0.068	39.9	02/02/2060
13431+83	1,693	18	0.256	45,000	1.60	0.069	41.0	02/25/2061
12134+99	1,571	18	0.266	45,000	3.96	0.089	42.8	01/01/2063
13605+79	1,688	18	0.266	45,000	1.48	0.068	44.3	06/28/2064

Table D-6 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies James River to Eckert – ILI Date March 11, 2020 (pg. 2 of 3)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
13175+13	1,496	18	0.266	45,000	2.66	0.068	46.0	03/09/2066
12141+65	1,589	18	0.266	45,000	6.68	0.076	46.6	10/25/2066
12324+44	1,599	18	0.266	45,000	5.73	0.076	47.7	11/30/2067
12893+00	1,564	18	0.266	45,000	2.78	0.076	48.4	08/20/2068
13575+73	1,702	18	0.266	45,000	1.36	0.068	49.0	03/26/2069
13047+44	1,607	18	0.285	45,000	3.02	0.082	49.1	04/10/2069
12579+56	1,678	18	0.266	45,000	7.03	0.068	49.3	06/27/2069
12867+31	1,578	18	0.266	45,000	4.08	0.068	49.3	07/12/2069
12151+72	1,561	18	0.256	45,000	3.13	0.082	50.7	11/11/2070
12316+07	1,593	18	0.266	45,000	9.16	0.068	51.0	02/28/2071
13463+37	1,733	18	0.266	45,000	1.25	0.076	51.4	07/30/2071
13510+91	1,680	18	0.266	45,000	1.60	0.063	51.8	12/23/2071
13206+51	1,448	18	0.266	45,000	2.54	0.063	52.2	06/07/2072
12672+53	1,664	18	0.266	45,000	4.79	0.068	55.0	03/27/2075
13603+39	1,690	18	0.266	45,000	1.13	0.068	55.2	05/20/2075
13057+98	1,556	18	0.285	45,000	4.91	0.067	55.9	02/13/2076
13044+90	1,620	18	0.285	45,000	5.14	0.067	55.9	02/18/2076
12430+28	1,611	18	0.266	45,000	3.25	0.081	56.0	03/20/2076
13021+55	1,676	18	0.266	45,000	1.95	0.076	56.6	10/10/2076
12923+46	1,629	18	0.266	45,000	2.19	0.076	56.8	12/20/2076
12955+80	1,702	18	0.266	45,000	3.61	0.063	57.5	09/14/2077
12722+31	1,579	18	0.266	45,000	3.96	0.068	57.7	11/13/2077
12880+77	1,576	18	0.266	45,000	3.96	0.063	58.4	08/06/2078
12656+53	1,708	18	0.285	45,000	5.50	0.076	59.1	04/09/2079
12427+94	1,595	18	0.266	45,000	9.16	0.063	59.8	12/12/2079
12805+23	1,581	18	0.266	45,000	3.25	0.068	59.8	01/04/2080
12893+03	1,564	18	0.266	45,000	3.61	0.063	60.4	07/20/2080
13109+57	1,472	18	0.266	45,000	2.31	0.063	61.6	10/08/2081
12868+24	1,575	18	0.266	45,000	2.78	0.068	61.9	02/09/2082
12863+87	1,584	18	0.266	45,000	2.78	0.068	62.3	06/18/2082
12885+72	1,562	18	0.266	45,000	2.54	0.068	64.5	08/22/2084
12793+99	1,587	18	0.266	45,000	2.90	0.068	64.9	02/05/2085
12515+50	1,623	18	0.266	45,000	4.32	0.068	65.8	01/06/2086
12929+84	1,620	18	0.266	45,000	2.90	0.063	65.8	01/10/2086
12529+16	1,688	18	0.285	45,000	3.84	0.082	67.4	08/19/2087
13089+92	1,513	18	0.266	45,000	1.95	0.063	70.4	08/03/2090
12372+52	1,582	18	0.266	45,000	4.43	0.068	71.4	07/19/2091
12715+87	1,587	18	0.266	45,000	3.49	0.063	73.0	03/02/2093
12137+70	1,572	18	0.266	45,000	5.02	0.068	74.0	03/19/2094
12046+84	1,617	18	0.266	45,000	5.14	0.068	74.2	05/04/2094
12440+59	1,631	18	0.266	45,000	3.73	0.068	75.4	07/27/2095
12212+51	1,592	18	0.266	45,000	6.80	0.063	76.3	07/11/2096
12956+68	1,696	18	0.266	45,000	2.19	0.063	76.5	09/13/2096
12678+15	1,645	18	0.266	45,000	3.37	0.063	77.3	07/12/2097
12842+62	1,582	18	0.266	45,000	2.07	0.068	77.5	08/29/2097
12888+92	1,570	18	0.266	45,000	2.31	0.063	78.2	05/06/2098
12321+24	1,600	18	0.266	45,000	3.96	0.068	78.2	05/24/2098

Table D-6 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies James River to Eckert – ILI Date March 11, 2020 (pg. 3 of 3)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
13071+56	1,578	18	0.266	45,000	1.48	0.068	78.3	07/10/2098
12976+52	1,727	18	0.285	45,000	3.02	0.067	78.8	01/04/2099
12462+18	1,656	18	0.266	45,000	4.55	0.063	79.5	09/13/2099
13253+93	1,533	18	0.266	45,000	1.13	0.068	79.7	11/09/2099
12997+42	1,768	18	0.295	45,000	1.60	0.095	82.6	10/23/2102
13103+16	1,484	18	0.285	45,000	2.66	0.062	82.9	01/19/2103
12896+62	1,578	18	0.266	45,000	2.07	0.063	83.2	05/19/2103
13003+31	1,765	18	0.266	45,000	1.48	0.068	85.9	02/03/2106
13006+50	1,754	18	0.285	45,000	3.02	0.062	88.0	03/08/2108
12208+93	1,614	18	0.266	45,000	2.43	0.076	90.3	07/15/2110
12666+46	1,684	18	0.285	45,000	2.66	0.076	90.8	12/21/2110
12202+65	1,666	18	0.266	45,000	1.25	0.108	92.4	07/17/2112
12452+71	1,626	18	0.266	45,000	3.37	0.063	92.5	09/03/2112
12707+42	1,598	18	0.266	45,000	2.31	0.063	93.2	06/08/2113
12595+88	1,642	18	0.266	45,000	1.72	0.076	93.5	09/05/2113
12168+17	1,546	18	0.266	45,000	3.84	0.063	99.3	07/13/2119
12449+55	1,612	18	0.266	45,000	1.60	0.081	100.0	03/09/2120
12647+93	1,684	18	0.266	45,000	1.84	0.068	101.8	01/12/2122
12315+80	1,592	18	0.266	45,000	2.54	0.068	102.7	11/14/2122
12413+75	1,597	18	0.285	45,000	4.43	0.067	104.7	11/06/2124
12142+62	1,587	18	0.266	45,000	3.49	0.063	105.4	07/21/2125
12899+32	1,577	18	0.266	45,000	1.25	0.068	106.7	11/17/2126
12227+19	1,617	18	0.266	45,000	2.54	0.068	107.2	06/01/2127
12429+84	1,608	18	0.266	45,000	2.07	0.068	110.3	06/17/2130
12817+56	1,590	18	0.266	45,000	1.25	0.068	115.8	12/16/2135
13028+04	1,659	18	0.285	45,000	1.48	0.062	129.7	11/04/2149
12341+24	1,599	18	0.266	45,000	2.07	0.063	131.9	01/24/2152
12340+05	1,599	18	0.266	45,000	2.07	0.063	132.0	02/26/2152
12224+27	1,617	18	0.266	45,000	1.84	0.068	133.9	02/15/2154
12251+14	1,503	18	0.266	45,000	2.07	0.063	136.8	12/25/2156
12241+38	1,565	18	0.285	45,000	3.49	0.062	149.0	03/29/2169
12656+20	1,708	18	0.285	45,000	2.07	0.062	150.7	11/28/2170
12443+76	1,621	18	0.266	45,000	1.48	0.063	155.2	05/22/2175
12413+77	1,597	18	0.285	45,000	2.43	0.062	164.3	06/10/2184
12515+52	1,623	18	0.266	45,000	1.25	0.063	166.8	12/16/2186
12428+32	1,597	18	0.266	45,000	1.25	0.063	177.0	03/19/2197
12515+47	1,623	18	0.266	45,000	1.13	0.063	180.3	06/21/2200
12847+03	1,580	18	0.285	45,000	1.13	0.062	187.2	05/13/2207
12372+64	1,581	18	0.266	45,000	1.13	0.063	198.0	03/01/2218

Table D-7. Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies
Eckert to Cedar Valley – ILI Date March 2, 2020 (pg. 1 of 8)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
11653+65	1,532	18	0.295	45,000	8.81	0.095	27.0	02/18/2047
11835+05	1,664	18	0.295	45,000	6.56	0.095	27.5	08/24/2047
11874+86	1,710	18	0.285	45,000	6.56	0.087	27.8	12/17/2047
11866+04	1,647	18	0.285	45,000	8.92	0.082	27.9	01/19/2048
11690+42	1,467	18	0.285	45,000	5.26	0.096	28.6	10/01/2048
11863+65	1,633	18	0.285	45,000	6.09	0.087	29.2	05/23/2049
11929+59	1,771	18	0.305	45,000	7.51	0.094	30.9	01/29/2051
11825+97	1,664	18	0.295	45,000	24.16	0.074	34.8	12/14/2054
11465+59	1,570	18	0.295	45,000	4.55	0.107	37.4	07/27/2057
12026+26	1,679	18	0.295	45,000	9.99	0.074	37.9	01/14/2058
11885+64	1,697	18	0.305	45,000	10.93	0.082	39.3	06/23/2059
11882+04	1,708	18	0.305	45,000	5.14	0.094	39.7	11/27/2059
11859+51	1,636	18	0.285	45,000	6.56	0.076	41.3	06/10/2061
10798+69	1,114	18	0.305	45,000	11.64	0.103	41.5	08/27/2061
11888+02	1,674	18	0.305	45,000	9.40	0.082	41.6	10/13/2061
11855+64	1,658	18	0.295	45,000	11.76	0.074	43.2	04/30/2063
11755+18	1,639	18	0.285	45,000	7.27	0.076	44.0	02/22/2064
11811+06	1,621	18	0.295	45,000	29.48	0.068	44.9	01/21/2065
10095+95	1,044	18	0.295	45,000	12.47	0.095	45.2	05/27/2065
11885+22	1,698	18	0.285	45,000	3.73	0.082	46.3	06/23/2066
11490+19	1,556	18	0.295	45,000	10.22	0.083	46.6	09/24/2066
11859+85	1,634	18	0.305	45,000	13.06	0.076	47.3	06/08/2067
11811+03	1,621	18	0.295	45,000	5.14	0.083	48.1	04/22/2068
10705+70	1,051	18	0.295	45,000	7.86	0.101	49.1	03/28/2069
11150+24	1,253	18	0.295	45,000	6.68	0.095	51.6	10/10/2071
11785+68	1,756	18	0.295	45,000	2.66	0.101	55.0	02/15/2075
11509+88	1,587	18	0.295	45,000	5.03	0.089	55.6	09/22/2075
11204+17	1,319	18	0.295	45,000	11.76	0.083	55.6	10/04/2075
11850+88	1,688	18	0.305	45,000	8.45	0.076	56.0	03/01/2076
11660+53	1,521	18	0.295	45,000	9.75	0.074	56.6	09/25/2076
11895+66	1,714	18	0.295	45,000	5.50	0.074	56.6	10/21/2076
11928+80	1,773	18	0.305	45,000	3.61	0.088	59.2	05/15/2079
11850+23	1,689	18	0.295	45,000	5.50	0.074	59.2	05/27/2079
12006+41	1,740	18	0.295	45,000	5.73	0.068	60.0	03/06/2080
11972+91	1,709	18	0.295	45,000	4.08	0.074	60.2	05/10/2080
11914+87	1,760	18	0.305	45,000	6.44	0.076	60.2	05/10/2080
11792+73	1,690	18	0.295	45,000	6.09	0.074	60.3	07/03/2080
11911+74	1,746	18	0.295	45,000	12.94	0.063	62.6	10/26/2082
11924+83	1,782	18	0.295	45,000	7.51	0.068	62.8	12/02/2082
11142+47	1,229	18	0.295	45,000	6.80	0.089	62.8	01/01/2083
11077+32	1,212	18	0.295	45,000	7.27	0.089	63.6	10/16/2083
11931+18	1,768	18	0.285	45,000	2.78	0.076	65.8	12/25/2085
11839+97	1,670	18	0.305	45,000	5.73	0.076	66.2	05/04/2086
11493+36	1,560	18	0.295	45,000	9.63	0.074	67.6	10/02/2087
11755+31	1,641	18	0.285	45,000	2.66	0.082	67.9	01/16/2088
11889+40	1,671	18	0.295	45,000	9.52	0.063	68.0	03/19/2088
11054+10	1,219	18	0.305	45,000	7.27	0.094	68.1	04/14/2088

Table D-7 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Eckert to Cedar Valley – ILI Date March 2, 2020 (pg. 2 of 8)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
11535+89	1,639	18	0.305	45,000	3.96	0.094	68.6	10/14/2088
12011+18	1,719	18	0.295	45,000	5.97	0.063	68.7	11/23/2088
11578+43	1,526	18	0.285	45,000	2.78	0.087	69.5	08/18/2089
11792+71	1,690	18	0.295	45,000	4.32	0.074	71.1	04/04/2091
11542+51	1,618	18	0.305	45,000	10.22	0.076	71.8	12/07/2091
11803+06	1,637	18	0.285	45,000	1.95	0.087	74.4	07/27/2094
11850+96	1,688	18	0.305	45,000	6.56	0.070	74.9	02/02/2095
11051+71	1,200	18	0.305	45,000	14.71	0.082	75.0	02/13/2095
10769+11	1,128	18	0.285	45,000	5.97	0.087	75.2	05/10/2095
11267+42	1,329	18	0.295	45,000	12.11	0.074	75.4	07/11/2095
11067+68	1,284	18	0.295	45,000	7.98	0.083	75.7	11/16/2095
11884+06	1,702	18	0.285	45,000	2.31	0.076	75.8	12/14/2095
11543+45	1,613	18	0.305	45,000	8.57	0.076	76.5	08/17/2096
11778+25	1,701	18	0.295	45,000	5.73	0.068	76.7	11/03/2096
11854+85	1,662	18	0.295	45,000	2.43	0.083	76.7	11/16/2096
11772+55	1,714	18	0.305	45,000	7.98	0.070	77.0	02/23/2097
11493+24	1,560	18	0.295	45,000	6.92	0.074	77.0	03/19/2097
11485+82	1,557	18	0.295	45,000	6.56	0.074	79.4	07/15/2099
11616+82	1,491	18	0.295	45,000	7.74	0.068	79.9	02/03/2100
11130+16	1,219	18	0.295	45,000	6.44	0.083	80.0	03/15/2100
11535+88	1,639	18	0.305	45,000	7.74	0.076	80.4	08/02/2100
11688+93	1,474	18	0.295	45,000	1.48	0.116	80.7	11/21/2100
11520+07	1,622	18	0.295	45,000	5.85	0.074	81.0	03/16/2101
11510+29	1,589	18	0.305	45,000	3.96	0.088	81.5	08/31/2101
11852+76	1,675	18	0.295	65,000	6.68	0.063	81.5	09/12/2101
11493+26	1,560	18	0.295	45,000	2.43	0.095	86.4	07/27/2106
11756+34	1,665	18	0.305	45,000	5.73	0.070	87.1	04/03/2107
11283+59	1,343	18	0.295	45,000	4.44	0.083	87.4	08/02/2107
11622+83	1,487	18	0.295	45,000	3.96	0.074	87.7	11/01/2107
11654+27	1,533	18	0.295	45,000	9.16	0.063	87.7	11/05/2107
11493+37	1,560	18	0.295	45,000	8.45	0.068	88.3	07/01/2108
10760+77	1,136	18	0.305	45,000	9.28	0.088	88.4	07/12/2108
10767+51	1,133	18	0.305	45,000	15.19	0.082	89.0	02/19/2109
11610+94	1,474	18	0.305	45,000	4.91	0.076	89.5	08/17/2109
12012+77	1,704	18	0.295	45,000	2.43	0.068	90.4	07/17/2110
11599+13	1,475	18	0.285	45,000	2.66	0.076	91.1	04/21/2111
11770+27	1,718	18	0.305	45,000	2.43	0.088	91.2	05/09/2111
11850+24	1,689	18	0.295	45,000	4.44	0.063	91.4	07/17/2111
11332+28	1,486	18	0.305	45,000	8.92	0.076	91.5	09/02/2111
11815+01	1,630	18	0.305	45,000	1.95	0.094	91.5	09/18/2111
11607+35	1,470	18	0.305	45,000	7.39	0.070	91.6	10/12/2111
11658+68	1,518	18	0.295	45,000	3.37	0.074	92.8	01/06/2113
11153+80	1,261	18	0.295	45,000	4.79	0.083	92.9	01/28/2113
11125+42	1,245	18	0.295	45,000	3.84	0.089	93.2	05/03/2113
10550+67	983	18	0.285	45,000	9.75	0.076	93.4	07/23/2113
11324+33	1,427	18	0.305	45,000	8.45	0.076	93.6	10/27/2113
11683+57	1,451	18	0.305	45,000	5.50	0.070	94.1	04/21/2114

Table D-7 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Eckert to Cedar Valley – ILI Date March 2, 2020 (pg. 3 of 8)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
10162+13	1,050	18	0.295	45,000	6.09	0.089	94.4	08/14/2114
10445+83	907	18	0.295	45,000	3.84	0.101	95.2	05/17/2115
10724+38	1,039	18	0.295	45,000	7.51	0.083	95.9	01/11/2116
11535+91	1,639	18	0.305	45,000	8.33	0.070	96.0	02/19/2116
11483+44	1,558	18	0.295	45,000	6.44	0.068	98.0	02/28/2118
11308+97	1,348	18	0.295	45,000	9.75	0.068	98.9	01/28/2119
11051+76	1,200	18	0.305	45,000	13.18	0.076	99.3	06/05/2119
10868+32	1,222	18	0.295	45,000	4.55	0.089	99.4	08/14/2119
11283+58	1,343	18	0.295	45,000	3.61	0.083	100.1	04/03/2120
11612+17	1,479	18	0.305	45,000	2.55	0.088	101.1	04/03/2121
11806+68	1,643	18	0.305	45,000	2.31	0.082	101.3	07/08/2121
10970+17	1,260	18	0.295	45,000	10.11	0.074	102.3	06/05/2122
11542+58	1,618	18	0.305	45,000	15.54	0.063	104.3	07/06/2124
11339+92	1,464	18	0.295	45,000	7.74	0.068	104.7	11/26/2124
11542+41	1,619	18	0.305	45,000	15.07	0.063	105.0	03/05/2125
11066+86	1,281	18	0.295	45,000	7.86	0.074	105.1	04/01/2125
11082+56	1,167	18	0.295	45,000	7.39	0.074	105.5	08/15/2125
11789+89	1,718	18	0.295	45,000	3.73	0.063	106.2	05/15/2126
11333+07	1,482	18	0.295	45,000	4.55	0.074	108.1	04/22/2128
11653+55	1,532	18	0.295	45,000	2.66	0.074	108.3	06/25/2128
11851+68	1,684	18	0.305	65,000	4.67	0.063	108.3	07/08/2128
11528+45	1,662	18	0.305	45,000	5.97	0.070	109.1	03/25/2129
11150+95	1,255	18	0.295	45,000	3.73	0.083	109.1	04/03/2129
10247+06	974	18	0.295	45,000	6.80	0.083	109.5	09/20/2129
11895+77	1,714	18	0.295	45,000	2.19	0.068	110.4	07/11/2130
11479+47	1,561	18	0.295	45,000	7.51	0.063	111.1	03/24/2131
10873+47	1,213	18	0.305	45,000	5.26	0.088	113.0	03/10/2133
10715+66	1,056	18	0.295	45,000	4.20	0.089	113.2	05/02/2133
10724+59	1,038	18	0.295	45,000	10.58	0.074	114.8	12/07/2134
11850+95	1,688	18	0.305	45,000	2.66	0.070	115.0	03/09/2135
11124+26	1,243	18	0.305	45,000	5.03	0.082	115.0	03/14/2135
10770+30	1,128	18	0.285	45,000	5.38	0.076	115.1	04/28/2135
10748+65	1,091	18	0.295	45,000	10.22	0.074	115.4	07/20/2135
11305+79	1,356	18	0.305	45,000	8.57	0.070	116.1	04/02/2136
10681+49	1,024	18	0.295	45,000	2.55	0.107	116.5	08/31/2136
11763+80	1,738	18	0.295	45,000	3.37	0.063	116.5	09/02/2136
11522+85	1,635	18	0.305	45,000	3.61	0.076	116.6	10/24/2136
10078+22	1,096	18	0.285	45,000	3.49	0.087	116.9	01/16/2137
10742+10	1,050	18	0.295	45,000	4.91	0.083	119.7	12/03/2139
12012+37	1,709	18	0.295	45,000	1.84	0.063	119.9	01/29/2140
11540+27	1,630	18	0.305	45,000	3.25	0.076	121.9	01/09/2142
11230+81	1,270	18	0.305	45,000	8.81	0.070	122.3	06/17/2142
11243+87	1,318	18	0.295	45,000	4.08	0.074	122.7	11/30/2142
11911+70	1,745	18	0.295	45,000	2.19	0.063	123.6	09/25/2143
11690+41	1,467	18	0.285	45,000	2.43	0.062	124.1	04/17/2144
10763+97	1,142	18	0.305	45,000	6.92	0.082	124.7	11/16/2144
11490+20	1,556	18	0.295	45,000	3.61	0.068	125.1	03/27/2145

Table D-7 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies
Eckert to Cedar Valley – ILI Date March 2, 2020 (pg. 4 of 8)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
11201+51	1,314	18	0.295	45,000	4.20	0.074	125.3	06/24/2145
11339+85	1,464	18	0.295	45,000	7.51	0.063	126.1	03/25/2146
11301+17	1,370	18	0.295	45,000	5.03	0.068	126.6	10/17/2146
11210+07	1,301	18	0.295	45,000	2.07	0.095	127.4	07/18/2147
11119+91	1,227	18	0.285	45,000	7.74	0.062	128.3	06/25/2148
11599+00	1,474	18	0.305	45,000	2.66	0.076	128.8	12/19/2148
11406+29	1,544	18	0.295	45,000	3.96	0.068	129.4	07/19/2149
11493+14	1,560	18	0.295	45,000	1.72	0.089	130.6	10/26/2150
11553+44	1,564	18	0.305	45,000	5.97	0.063	131.1	04/02/2151
11625+67	1,504	18	0.295	45,000	2.07	0.074	131.6	10/12/2151
10970+06	1,260	18	0.295	45,000	9.28	0.068	132.0	03/09/2152
10925+34	1,303	18	0.295	45,000	5.85	0.074	132.1	03/31/2152
11615+06	1,495	18	0.305	45,000	2.07	0.082	133.2	05/17/2153
11083+79	1,158	18	0.295	45,000	6.68	0.068	134.4	07/27/2154
11665+07	1,521	18	0.295	45,000	2.31	0.068	134.4	08/03/2154
10877+61	1,212	18	0.305	45,000	7.98	0.076	134.5	09/18/2154
11204+14	1,319	18	0.295	45,000	5.26	0.068	134.9	01/28/2155
11221+97	1,324	18	0.305	45,000	4.44	0.076	134.9	02/05/2155
11003+72	1,262	18	0.305	45,000	11.05	0.070	137.0	03/22/2157
11222+96	1,321	18	0.285	45,000	3.49	0.067	138.7	11/08/2158
11654+02	1,533	18	0.295	45,000	1.84	0.074	139.1	04/13/2159
11114+00	1,222	18	0.295	45,000	9.75	0.063	139.9	01/18/2160
11163+62	1,257	18	0.295	45,000	8.45	0.063	140.2	05/12/2160
11048+89	1,188	18	0.295	45,000	2.43	0.089	141.4	08/08/2161
11120+99	1,231	18	0.305	45,000	7.39	0.070	141.7	11/06/2161
11867+70	1,659	18	0.305	45,000	2.31	0.063	143.4	08/01/2163
11201+66	1,314	18	0.295	45,000	2.07	0.089	143.9	01/10/2164
11156+90	1,268	18	0.295	45,000	3.49	0.074	143.9	01/15/2164
11598+99	1,474	18	0.305	45,000	3.96	0.063	144.8	12/09/2164
11432+94	1,624	18	0.295	45,000	2.43	0.074	144.8	12/11/2164
10970+05	1,260	18	0.295	45,000	3.02	0.083	145.7	11/03/2165
11402+33	1,522	18	0.295	45,000	3.14	0.068	146.2	05/14/2166
11228+43	1,289	18	0.285	45,000	4.20	0.062	146.5	09/08/2166
11474+77	1,566	18	0.285	45,000	2.19	0.067	146.6	09/30/2166
11653+64	1,532	18	0.295	45,000	1.25	0.089	147.9	02/08/2168
10102+74	1,009	18	0.295	45,000	3.84	0.083	148.0	03/03/2168
11920+84	1,781	18	0.305	45,000	2.19	0.063	148.5	09/18/2168
11156+53	1,267	18	0.295	45,000	7.03	0.063	149.1	03/29/2169
11233+60	1,281	18	0.305	45,000	10.46	0.063	149.1	04/27/2169
10188+57	862	18	0.295	45,000	3.84	0.083	150.0	02/26/2170
10836+64	1,160	18	0.295	45,000	4.91	0.074	150.2	05/20/2170
11500+50	1,571	18	0.295	45,000	2.55	0.068	150.2	05/31/2170
11758+85	1,720	18	0.295	45,000	1.72	0.068	150.9	02/07/2171
10440+68	920	18	0.295	45,000	6.44	0.074	151.6	10/13/2171
11644+56	1,501	18	0.305	45,000	1.48	0.088	152.6	10/02/2172
11102+36	1,240	18	0.305	45,000	4.20	0.076	152.6	10/16/2172
11542+35	1,619	18	0.305	45,000	4.08	0.063	153.0	03/01/2173

Table D-7 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Eckert to Cedar Valley – ILI Date March 2, 2020 (pg. 5 of 8)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
10792+17	1,109	18	0.285	45,000	5.26	0.067	154.4	07/18/2174
11525+34	1,647	18	0.305	45,000	4.20	0.063	154.6	09/22/2174
11339+45	1,463	18	0.295	45,000	4.08	0.063	156.4	08/06/2176
10603+53	1,069	18	0.295	45,000	9.75	0.068	156.6	10/20/2176
11097+97	1,202	18	0.285	45,000	2.31	0.076	156.8	01/05/2177
11868+49	1,670	18	0.285	45,000	1.25	0.062	158.4	07/21/2178
10223+76	969	18	0.295	45,000	9.75	0.068	160.6	10/01/2180
11220+48	1,327	18	0.295	45,000	3.49	0.068	161.0	03/12/2181
11589+52	1,509	18	0.285	45,000	1.84	0.062	162.7	11/16/2182
10871+09	1,215	18	0.285	45,000	6.44	0.062	163.5	09/03/2183
11084+47	1,158	18	0.295	45,000	6.09	0.063	164.0	03/10/2184
10695+53	1,023	18	0.295	45,000	6.92	0.068	168.7	11/17/2188
11124+72	1,244	18	0.315	45,000	2.66	0.090	172.3	06/25/2192
11099+14	1,209	18	0.305	45,000	8.92	0.063	172.8	01/08/2193
11883+26	1,704	18	0.305	45,000	1.36	0.070	172.9	02/01/2193
10445+82	907	18	0.295	45,000	7.62	0.068	174.2	05/26/2194
11301+09	1,370	18	0.295	45,000	2.66	0.068	174.9	01/16/2195
11533+47	1,652	18	0.285	45,000	1.13	0.082	175.0	02/19/2195
11168+91	1,223	18	0.295	45,000	3.14	0.068	176.6	10/07/2196
11408+67	1,568	18	0.295	45,000	2.78	0.063	177.5	08/22/2197
11934+76	1,760	18	0.305	45,000	1.25	0.070	179.6	10/08/2199
10068+18	1,093	18	0.305	45,000	3.14	0.088	179.6	10/09/2199
10882+36	1,212	18	0.295	45,000	4.67	0.068	180.0	03/14/2200
11779+76	1,712	18	0.295	45,000	1.13	0.074	181.3	07/07/2201
10401+51	981	18	0.305	45,000	5.73	0.076	181.4	07/30/2201
11606+91	1,471	18	0.305	45,000	2.43	0.063	181.8	12/19/2201
10879+98	1,213	18	0.295	45,000	6.92	0.063	183.5	08/27/2203
11165+98	1,238	18	0.295	45,000	3.84	0.063	184.2	05/30/2204
10896+22	1,227	18	0.295	45,000	6.44	0.063	185.8	01/09/2206
10603+54	1,069	18	0.295	45,000	3.96	0.074	186.6	10/03/2206
10894+84	1,223	18	0.295	45,000	4.20	0.068	187.5	08/17/2207
11676+91	1,469	18	0.305	45,000	1.60	0.070	188.4	08/11/2208
10868+44	1,221	18	0.295	45,000	3.14	0.074	189.3	06/30/2209
10748+67	1,091	18	0.295	45,000	7.74	0.063	189.7	11/10/2209
10769+12	1,128	18	0.285	45,000	3.49	0.067	190.0	03/01/2210
10724+38	1,039	18	0.295	45,000	4.91	0.068	190.2	05/12/2210
11431+77	1,621	18	0.295	45,000	1.95	0.068	190.8	12/30/2210
10438+56	929	18	0.295	45,000	3.96	0.074	191.8	01/02/2212
11151+42	1,256	18	0.295	45,000	2.78	0.068	192.4	07/24/2212
11492+97	1,560	18	0.295	45,000	1.72	0.068	193.8	01/02/2214
11267+40	1,329	18	0.295	45,000	2.90	0.063	194.4	08/12/2214
11284+38	1,346	18	0.295	45,000	2.78	0.063	196.0	03/03/2216
11414+23	1,569	18	0.295	45,000	1.60	0.074	196.1	04/27/2216
10445+81	907	18	0.295	45,000	5.50	0.068	196.3	07/05/2216
11510+03	1,588	18	0.305	45,000	2.55	0.063	196.8	12/28/2216
11210+05	1,301	18	0.295	45,000	1.60	0.083	197.2	05/04/2217
11150+93	1,255	18	0.295	45,000	3.37	0.063	198.4	08/09/2218

Table D-7 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Eckert to Cedar Valley – ILI Date March 2, 2020 (pg. 6 of 8)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
11663+79	1,523	18	0.295	45,000	1.48	0.063	198.7	11/20/2218
10532+80	922	18	0.305	45,000	6.80	0.070	199.6	10/20/2219
11789+50	1,724	18	0.295	45,000	1.25	0.063	200.7	11/25/2220
10924+98	1,303	18	0.295	45,000	4.91	0.063	201.4	08/05/2221
11059+74	1,272	18	0.305	45,000	3.61	0.070	201.5	08/18/2221
11653+87	1,532	18	0.295	45,000	1.13	0.074	203.2	05/16/2223
11648+92	1,517	18	0.295	45,000	1.13	0.074	204.1	03/27/2224
10895+84	1,226	18	0.295	45,000	4.91	0.063	204.2	05/27/2224
11511+44	1,593	18	0.295	45,000	1.13	0.083	205.8	12/19/2225
10246+75	974	18	0.295	45,000	3.49	0.074	206.4	07/31/2226
10070+99	1,104	18	0.295	45,000	3.25	0.074	207.3	07/07/2227
10245+57	975	18	0.295	45,000	4.79	0.068	208.7	11/04/2228
11490+58	1,557	18	0.295	45,000	1.13	0.083	209.6	09/28/2229
10863+56	1,214	18	0.305	45,000	3.25	0.076	209.6	10/11/2229
10873+07	1,214	18	0.285	45,000	3.37	0.062	211.4	08/16/2231
10969+24	1,259	18	0.295	45,000	1.84	0.083	212.5	08/21/2232
11125+44	1,245	18	0.295	45,000	2.43	0.068	212.6	09/30/2232
10226+55	985	18	0.295	45,000	7.03	0.063	213.2	05/01/2233
11510+12	1,588	18	0.305	45,000	1.48	0.076	214.0	02/21/2234
11150+66	1,254	18	0.295	45,000	1.25	0.095	214.1	04/15/2234
10707+04	1,054	18	0.295	45,000	3.84	0.068	215.0	03/08/2235
10070+98	1,104	18	0.295	45,000	3.02	0.074	216.9	01/16/2237
11614+23	1,494	18	0.305	45,000	1.72	0.063	220.2	05/29/2240
11419+94	1,591	18	0.295	45,000	1.84	0.063	222.1	04/10/2242
10558+65	1,020	18	0.285	45,000	3.02	0.067	222.6	09/29/2242
10071+18	1,104	18	0.295	45,000	3.84	0.068	222.6	10/22/2242
11089+00	1,178	18	0.295	45,000	2.31	0.068	224.7	11/19/2244
11679+99	1,447	18	0.305	45,000	1.13	0.070	225.2	05/26/2245
11679+97	1,447	18	0.305	45,000	1.48	0.063	225.2	05/26/2245
11665+82	1,520	18	0.295	45,000	1.13	0.063	225.2	05/26/2245
11636+88	1,477	18	0.305	45,000	1.25	0.070	225.2	05/26/2245
11553+46	1,564	18	0.305	45,000	1.48	0.070	225.2	05/26/2245
11539+74	1,632	18	0.305	45,000	1.25	0.076	225.2	05/26/2245
11510+27	1,589	18	0.305	45,000	1.36	0.076	225.2	05/26/2245
11510+12	1,588	18	0.305	45,000	1.25	0.070	225.2	05/26/2245
11406+29	1,544	18	0.295	45,000	1.36	0.068	225.2	05/26/2245
11346+80	1,473	18	0.295	45,000	1.25	0.074	225.2	05/26/2245
11337+99	1,464	18	0.295	45,000	1.25	0.063	225.2	05/26/2245
11337+13	1,466	18	0.295	45,000	1.13	0.074	225.2	05/26/2245
11314+16	1,371	18	0.305	45,000	1.25	0.076	225.2	05/26/2245
11271+18	1,328	18	0.305	45,000	1.36	0.070	225.2	05/26/2245
11247+72	1,262	18	0.295	45,000	1.36	0.063	225.2	05/26/2245
11225+97	1,305	18	0.295	45,000	1.60	0.068	225.2	05/26/2245
11222+52	1,323	18	0.295	45,000	1.60	0.074	225.2	05/26/2245
11222+52	1,323	18	0.295	45,000	1.13	0.083	225.2	05/26/2245
11156+47	1,267	18	0.295	45,000	1.48	0.074	225.2	05/26/2245
11120+99	1,231	18	0.305	45,000	2.31	0.070	225.2	05/26/2245

Table D-7 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Eckert to Cedar Valley – ILI Date March 2, 2020 (pg. 7 of 8)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
11120+96	1,231	18	0.305	45,000	1.84	0.070	225.2	05/26/2245
11095+12	1,192	18	0.305	45,000	1.36	0.076	225.2	05/26/2245
11067+96	1,285	18	0.295	45,000	1.84	0.063	225.2	05/26/2245
11067+81	1,285	18	0.295	45,000	1.36	0.068	225.2	05/26/2245
11051+75	1,200	18	0.305	45,000	1.95	0.063	225.2	05/26/2245
11018+39	1,284	18	0.305	45,000	1.36	0.070	225.2	05/26/2245
11012+42	1,280	18	0.305	45,000	1.48	0.063	225.2	05/26/2245
11012+36	1,280	18	0.305	45,000	1.36	0.063	225.2	05/26/2245
11012+28	1,280	18	0.305	45,000	1.36	0.063	225.2	05/26/2245
10998+00	1,254	18	0.285	45,000	1.25	0.062	225.2	05/26/2245
10975+44	1,241	18	0.295	45,000	1.25	0.063	225.2	05/26/2245
10883+56	1,212	18	0.295	45,000	1.25	0.068	225.2	05/26/2245
10875+04	1,213	18	0.305	45,000	1.36	0.082	225.2	05/26/2245
10873+86	1,213	18	0.305	45,000	1.36	0.082	225.2	05/26/2245
10873+50	1,213	18	0.305	45,000	1.25	0.063	225.2	05/26/2245
10859+14	1,202	18	0.305	45,000	1.13	0.063	225.2	05/26/2245
10830+35	1,143	18	0.295	45,000	2.66	0.063	225.2	05/26/2245
10823+57	1,127	18	0.295	45,000	1.13	0.089	225.2	05/26/2245
10823+56	1,127	18	0.295	45,000	1.13	0.074	225.2	05/26/2245
10808+68	1,126	18	0.305	45,000	5.14	0.063	225.2	05/26/2245
10786+78	1,132	18	0.285	45,000	1.13	0.062	225.2	05/26/2245
10765+29	1,141	18	0.305	45,000	2.07	0.063	225.2	05/26/2245
10751+69	1,101	18	0.295	45,000	1.13	0.074	225.2	05/26/2245
10749+29	1,095	18	0.295	45,000	1.13	0.074	225.2	05/26/2245
10749+17	1,094	18	0.295	45,000	2.07	0.063	225.2	05/26/2245
10748+67	1,091	18	0.295	45,000	1.36	0.068	225.2	05/26/2245
10742+09	1,050	18	0.295	45,000	1.13	0.074	225.2	05/26/2245
10724+36	1,039	18	0.295	45,000	1.36	0.068	225.2	05/26/2245
10724+35	1,039	18	0.295	45,000	1.25	0.063	225.2	05/26/2245
10714+75	1,058	18	0.295	45,000	2.55	0.068	225.2	05/26/2245
10704+32	1,046	18	0.295	45,000	1.48	0.095	225.2	05/26/2245
10658+76	993	18	0.285	45,000	1.48	0.076	225.2	05/26/2245
10649+77	1,057	18	0.295	45,000	1.95	0.063	225.2	05/26/2245
10644+54	1,055	18	0.295	45,000	1.72	0.068	225.2	05/26/2245
10644+51	1,055	18	0.295	45,000	1.72	0.068	225.2	05/26/2245
10585+57	1,051	18	0.305	45,000	1.25	0.076	225.2	05/26/2245
10556+66	1,009	18	0.305	45,000	3.14	0.063	225.2	05/26/2245
10556+65	1,009	18	0.305	45,000	3.02	0.070	225.2	05/26/2245
10553+05	992	18	0.305	45,000	2.43	0.063	225.2	05/26/2245
10527+66	900	18	0.305	45,000	1.13	0.063	225.2	05/26/2245
10525+02	904	18	0.305	45,000	9.99	0.063	225.2	05/26/2245
10521+48	917	18	0.305	45,000	2.43	0.063	225.2	05/26/2245
10519+29	924	18	0.295	45,000	1.25	0.083	225.2	05/26/2245
10511+40	927	18	0.305	45,000	3.61	0.063	225.2	05/26/2245
10445+98	906	18	0.295	45,000	1.25	0.063	225.2	05/26/2245
10445+83	907	18	0.295	45,000	2.43	0.063	225.2	05/26/2245
10441+75	916	18	0.295	45,000	2.31	0.068	225.2	05/26/2245

Table D-7 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Eckert to Cedar Valley – ILI Date March 2, 2020 (pg. 8 of 8)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
10436+13	940	18	0.295	45,000	1.36	0.074	225.2	05/26/2245
10420+32	947	18	0.295	45,000	1.72	0.074	225.2	05/26/2245
10401+50	981	18	0.305	45,000	2.43	0.063	225.2	05/26/2245
10364+79	992	18	0.354	45,000	2.55	0.121	225.2	05/26/2245
10309+62	1,080	18	0.354	45,000	2.19	0.107	225.2	05/26/2245
10257+23	994	18	0.295	45,000	1.72	0.089	225.2	05/26/2245
10257+21	994	18	0.295	45,000	2.78	0.074	225.2	05/26/2245
10251+57	966	18	0.295	45,000	2.31	0.063	225.2	05/26/2245
10225+78	985	18	0.295	45,000	3.84	0.068	225.2	05/26/2245
10224+97	982	18	0.295	45,000	2.90	0.074	225.2	05/26/2245
10158+68	1,049	18	0.295	45,000	1.72	0.074	225.2	05/26/2245
10119+05	1,077	18	0.305	45,000	1.60	0.076	225.2	05/26/2245
10117+48	1,062	18	0.285	45,000	2.78	0.062	225.2	05/26/2245
10115+50	1,052	18	0.285	45,000	1.72	0.076	225.2	05/26/2245
10110+85	1,050	18	0.285	45,000	2.43	0.067	225.2	05/26/2245
10096+75	1,041	18	0.295	45,000	3.37	0.068	225.2	05/26/2245
10088+32	1,045	18	0.295	45,000	1.25	0.089	225.2	05/26/2245
10075+36	1,100	18	0.285	45,000	1.13	0.062	225.2	05/26/2245
10074+83	1,101	18	0.305	45,000	1.25	0.063	225.2	05/26/2245
10074+76	1,101	18	0.305	45,000	2.19	0.076	225.2	05/26/2245
9793+23	1,058	18	0.374	45,000	1.25	0.077	225.2	05/26/2245

Table D-8. Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Cedar Valley to Bastrop – ILI Date January 16, 2020 (pg. 1 of 4)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
7833+09	411	18	0.256	45,000	7.40	0.074	32.9	12/22/2052
8607+90	543	18	0.295	45,000	7.99	0.095	37.2	03/18/2057
7513+36	295	18	0.266	45,000	5.74	0.076	37.4	06/16/2057
8272+15	401	18	0.256	45,000	4.44	0.082	38.4	06/05/2058
8271+76	403	18	0.256	45,000	8.82	0.069	39.9	12/05/2059
7499+19	293	18	0.266	45,000	5.03	0.076	40.0	01/13/2060
7798+07	403	18	0.256	45,000	5.50	0.074	40.1	02/27/2060
8066+14	431	18	0.256	45,000	3.97	0.082	41.9	12/19/2061
7739+65	357	18	0.256	45,000	6.57	0.069	42.4	06/25/2062
7968+24	415	18	0.256	45,000	6.92	0.069	45.9	12/23/2065
7786+37	402	18	0.256	45,000	4.09	0.074	48.5	07/09/2068
8761+75	574	18	0.295	45,000	4.20	0.095	53.1	03/01/2073
8487+29	450	18	0.285	45,000	7.04	0.082	54.2	04/10/2074
7524+00	301	18	0.246	45,000	2.43	0.068	55.1	02/13/2075
8473+91	477	18	0.295	45,000	9.88	0.083	55.2	04/09/2075
7853+38	402	18	0.256	45,000	7.99	0.062	55.3	05/14/2075
8031+80	405	18	0.256	45,000	3.85	0.074	55.7	10/05/2075
8698+84	464	18	0.295	45,000	3.02	0.107	55.8	10/26/2075
8066+02	431	18	0.256	45,000	3.85	0.074	56.3	04/19/2076
7646+55	338	18	0.256	45,000	3.61	0.069	56.6	08/15/2076

Table D-8 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Cedar Valley to Bastrop – ILI Date January 16, 2020 (pg. 2 of 4)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
7523+78	301	18	0.246	45,000	2.55	0.063	61.9	11/28/2081
7897+02	435	18	0.266	45,000	6.21	0.068	63.7	09/24/2083
8053+41	424	18	0.256	45,000	4.09	0.069	64.1	02/16/2084
8223+31	507	18	0.246	45,000	3.49	0.063	70.5	08/03/2090
8937+33	680	18	0.295	45,000	5.62	0.074	71.1	02/04/2091
7853+37	402	18	0.256	45,000	2.43	0.074	73.4	06/09/2093
7990+77	395	18	0.256	45,000	4.68	0.062	75.5	07/01/2095
8194+18	456	18	0.266	45,000	2.67	0.081	76.5	08/01/2096
8239+18	497	18	0.256	45,000	4.32	0.062	81.4	06/20/2101
8843+36	574	18	0.295	45,000	2.07	0.101	81.6	08/18/2101
8669+22	449	18	0.295	45,000	6.33	0.074	83.3	05/18/2103
8828+83	577	18	0.295	45,000	14.97	0.063	83.8	10/20/2103
8787+38	566	18	0.295	45,000	4.91	0.074	86.1	02/07/2106
8200+37	483	18	0.266	45,000	3.61	0.068	90.3	04/19/2110
8843+56	575	18	0.295	45,000	2.31	0.089	93.1	02/08/2113
8258+50	430	18	0.256	45,000	1.96	0.074	94.4	06/11/2114
8753+37	570	18	0.295	45,000	4.32	0.074	94.5	07/31/2114
8761+23	573	18	0.295	45,000	2.90	0.083	95.4	06/25/2115
8813+53	542	18	0.285	45,000	5.74	0.062	96.6	08/23/2116
8843+70	576	18	0.295	45,000	2.55	0.083	97.8	11/15/2117
8807+11	544	18	0.285	45,000	5.62	0.062	97.9	12/14/2117
8798+28	547	18	0.295	45,000	5.27	0.068	99.4	06/05/2119
7647+33	339	18	0.256	45,000	2.07	0.062	99.6	08/18/2119
8434+39	471	18	0.295	45,000	9.88	0.068	99.7	09/12/2119
8685+49	446	18	0.295	45,000	2.78	0.083	103.4	06/03/2123
8803+37	545	18	0.295	45,000	3.38	0.074	103.8	10/31/2123
8456+55	453	18	0.295	45,000	8.46	0.068	103.8	10/31/2123
7540+25	306	18	0.246	45,000	1.25	0.063	104.8	10/27/2124
8886+54	609	18	0.295	45,000	1.25	0.116	105.9	12/12/2125
8258+49	430	18	0.256	45,000	1.96	0.069	106.6	09/01/2126
8151+95	480	18	0.266	45,000	2.67	0.068	108.5	07/03/2128
8487+18	449	18	0.285	45,000	1.60	0.102	109.0	12/29/2128
8027+52	397	18	0.266	45,000	3.14	0.063	110.8	10/27/2130
8099+49	467	18	0.256	45,000	1.60	0.074	111.5	07/27/2131
7816+52	401	18	0.256	45,000	1.60	0.069	112.6	09/01/2132
9199+29	812	18	0.354	65,000	3.38	0.096	114.6	08/10/2134
8687+17	447	18	0.295	45,000	4.56	0.068	114.7	09/11/2134
8484+09	455	18	0.295	45,000	6.10	0.068	115.2	03/13/2135
8487+19	449	18	0.285	45,000	4.20	0.067	115.8	11/15/2135
8194+37	454	18	0.266	45,000	1.84	0.076	116.6	09/06/2136
8293+91	386	18	0.256	45,000	2.19	0.062	117.4	06/29/2137
8285+44	391	18	0.256	45,000	2.19	0.062	117.7	09/13/2137
8473+51	478	18	0.305	45,000	7.99	0.070	117.9	12/27/2137
8194+47	453	18	0.266	45,000	2.31	0.068	119.3	04/27/2139
8242+51	463	18	0.256	45,000	1.25	0.082	119.3	05/02/2139
7918+48	432	18	0.256	45,000	1.96	0.062	121.2	03/12/2141
9171+04	812	18	0.374	65,000	5.03	0.096	121.6	08/26/2141

Table D-8 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Cedar Valley to Bastrop – ILI Date January 16, 2020 (pg. 3 of 4)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
8194+17	457	18	0.266	45,000	1.72	0.076	123.2	04/03/2143
8502+42	474	18	0.305	45,000	3.38	0.082	123.7	09/16/2143
8726+20	519	18	0.295	45,000	5.15	0.063	124.6	08/07/2144
8214+87	500	18	0.266	45,000	2.67	0.063	125.1	02/17/2145
8681+32	446	18	0.295	45,000	5.27	0.063	127.0	01/07/2147
8581+47	484	18	0.295	45,000	3.14	0.074	127.4	06/03/2147
8246+27	456	18	0.256	45,000	1.37	0.074	127.6	08/10/2147
8246+24	456	18	0.256	45,000	1.96	0.062	127.9	11/23/2147
8272+95	401	18	0.256	45,000	1.13	0.082	130.5	07/18/2150
8880+88	613	18	0.295	45,000	1.48	0.089	132.2	04/15/2152
8699+48	466	18	0.295	45,000	4.56	0.063	132.6	08/09/2152
8251+28	452	18	0.256	45,000	1.48	0.069	132.6	09/06/2152
8246+06	456	18	0.256	45,000	1.48	0.069	132.7	10/07/2152
7905+38	435	18	0.256	45,000	1.37	0.069	133.1	02/25/2153
8737+50	554	18	0.295	45,000	3.14	0.068	134.1	02/10/2154
7791+91	403	18	0.256	45,000	1.25	0.069	135.6	08/07/2155
8292+11	387	18	0.256	45,000	1.25	0.074	136.6	08/13/2156
8761+75	574	18	0.295	45,000	2.31	0.074	137.5	07/01/2157
8839+52	570	18	0.295	45,000	3.14	0.063	140.6	08/23/2160
8843+45	574	18	0.295	45,000	1.60	0.083	141.0	02/02/2161
8503+22	475	18	0.305	45,000	4.68	0.070	142.4	06/04/2162
8704+02	469	18	0.295	45,000	2.90	0.068	142.9	12/13/2162
8487+18	449	18	0.285	45,000	3.61	0.062	144.7	09/18/2164
8880+90	613	18	0.295	45,000	2.19	0.068	146.9	12/06/2166
8496+64	468	18	0.295	45,000	3.49	0.068	146.9	12/13/2166
9171+05	812	18	0.374	65,000	3.61	0.096	148.8	10/30/2168
8296+78	386	18	0.256	45,000	1.25	0.069	150.3	05/13/2170
7843+26	402	18	0.256	45,000	1.13	0.069	151.6	08/22/2171
8843+39	574	18	0.295	45,000	2.67	0.063	152.4	06/04/2172
8713+33	499	18	0.295	45,000	3.26	0.063	152.6	08/26/2172
8678+18	447	18	0.295	45,000	3.38	0.063	153.3	04/25/2173
8441+24	464	18	0.295	45,000	3.26	0.068	156.0	01/03/2176
7977+34	391	18	0.256	45,000	1.13	0.069	159.8	10/29/2179
8607+96	543	18	0.295	45,000	1.37	0.095	160.1	03/07/2180
8843+67	575	18	0.295	45,000	2.43	0.063	160.3	05/05/2180
8443+43	461	18	0.295	45,000	4.09	0.063	160.8	10/28/2180
8441+24	464	18	0.295	45,000	4.09	0.063	161.0	01/14/2181
8678+02	447	18	0.295	45,000	1.96	0.074	162.5	07/15/2182
8843+69	576	18	0.295	45,000	1.60	0.074	166.0	01/10/2186
8575+84	477	18	0.295	45,000	2.55	0.068	168.0	01/19/2188
8947+09	690	18	0.295	45,000	1.60	0.068	170.2	04/02/2190
8681+91	446	18	0.295	45,000	2.67	0.063	172.3	04/30/2192
8113+81	476	18	0.266	45,000	1.60	0.063	172.3	05/07/2192
8475+50	476	18	0.295	45,000	1.48	0.089	174.6	09/08/2194
8194+19	456	18	0.266	45,000	1.13	0.076	176.6	09/08/2196
8491+09	455	18	0.305	45,000	4.56	0.063	177.5	08/01/2197
8588+93	489	18	0.295	45,000	1.84	0.074	181.0	01/30/2201

Table D-8 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Cedar Valley to Bastrop – ILI Date January 16, 2020 (pg. 4 of 4)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
8027+55	397	18	0.266	45,000	1.25	0.068	182.4	06/08/2202
7980+87	391	18	0.256	45,000	1.13	0.062	183.1	02/21/2203
8658+24	445	18	0.295	45,000	1.37	0.083	185.2	03/27/2205
8744+68	569	18	0.295	45,000	1.48	0.074	191.6	08/22/2211
8608+93	535	18	0.295	45,000	2.43	0.063	192.0	01/20/2212
8194+26	455	18	0.266	45,000	1.37	0.063	192.9	12/09/2212
8468+02	473	18	0.295	45,000	2.19	0.068	194.6	08/17/2214
8537+87	552	18	0.295	45,000	1.25	0.089	199.2	03/29/2219
7806+88	404	18	0.266	45,000	1.13	0.063	199.6	08/27/2219
8027+59	397	18	0.266	45,000	1.25	0.063	201.2	03/15/2221
8765+40	564	18	0.295	45,000	1.84	0.063	201.5	07/16/2221
8194+20	456	18	0.266	45,000	1.13	0.068	203.3	05/18/2223
8606+44	550	18	0.305	45,000	2.19	0.070	204.1	03/07/2224
8788+99	565	18	0.295	45,000	1.25	0.074	211.2	03/31/2231
8581+47	484	18	0.295	45,000	1.25	0.083	211.8	10/27/2231
8940+10	693	18	0.295	45,000	1.13	0.068	222.1	02/20/2242
8843+63	575	18	0.295	45,000	1.25	0.068	222.9	11/24/2242
8843+37	574	18	0.295	45,000	1.25	0.068	222.9	12/27/2242
9167+84	815	18	0.374	65,000	3.02	0.062	225.2	04/09/2245
9067+64	724	18	0.354	65,000	1.13	0.075	225.2	04/09/2245
8770+11	555	18	0.305	45,000	1.13	0.063	225.2	04/09/2245
8752+28	571	18	0.295	45,000	1.25	0.063	225.2	04/09/2245
8683+76	446	18	0.295	45,000	1.60	0.063	225.2	04/09/2245
8678+01	447	18	0.295	45,000	1.13	0.074	225.2	04/09/2245
8671+60	449	18	0.295	45,000	1.60	0.063	225.2	04/09/2245
8660+16	424	18	0.354	65,000	1.96	0.068	225.2	04/09/2245
8660+16	424	18	0.354	65,000	1.13	0.061	225.2	04/09/2245
8659+54	422	18	0.354	65,000	1.25	0.089	225.2	04/09/2245
8659+49	422	18	0.354	65,000	1.13	0.075	225.2	04/09/2245
8650+22	444	18	0.295	45,000	1.25	0.063	225.2	04/09/2245
8619+12	495	18	0.295	45,000	1.25	0.068	225.2	04/09/2245
8606+44	550	18	0.305	45,000	1.96	0.063	225.2	04/09/2245
8588+93	489	18	0.295	45,000	1.60	0.063	225.2	04/09/2245
8585+10	486	18	0.295	45,000	1.37	0.068	225.2	04/09/2245
8363+31	432	18	0.295	45,000	1.25	0.074	225.2	04/09/2245

Table D-9. Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies
Bastrop to Warda – ILI Date January 27, 2020 (pg. 1 of 4)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
6835+22	244	18	0.256	45,000	4.44	0.082	16.0	02/02/2036
7471+93	294	18	0.266	45,000	2.79	0.076	18.5	07/27/2038
7125+72	250	18	0.256	65,000	2.90	0.082	19.7	09/22/2039
7365+39	307	18	0.256	45,000	2.31	0.074	20.5	07/19/2040
7145+34	259	18	0.256	65,000	4.68	0.069	20.8	11/21/2040
7194+49	258	18	0.256	45,000	3.14	0.069	22.5	07/16/2042
6812+08	243	18	0.256	45,000	4.21	0.074	22.9	12/03/2042
6445+54	268	18	0.246	45,000	4.21	0.075	23.1	02/17/2043
6973+04	251	18	0.256	45,000	4.21	0.069	23.4	06/04/2043
7418+82	322	18	0.246	45,000	1.60	0.068	24.3	05/08/2044
7331+25	284	18	0.256	45,000	3.14	0.062	24.4	06/22/2044
7354+10	292	18	0.285	45,000	2.67	0.087	24.6	08/15/2044
6246+87	302	18	0.256	45,000	6.69	0.074	24.9	12/29/2044
7351+19	303	18	0.256	45,000	1.84	0.074	25.0	01/22/2045
7366+36	307	18	0.256	45,000	2.79	0.062	25.3	05/07/2045
7365+37	307	18	0.256	45,000	2.08	0.069	25.3	05/25/2045
6653+39	224	18	0.256	45,000	4.32	0.074	25.9	12/19/2045
6578+83	373	18	0.256	45,000	9.89	0.062	26.3	04/29/2046
7468+31	323	18	0.266	45,000	1.60	0.081	26.3	05/08/2046
6413+88	251	18	0.256	45,000	7.28	0.069	26.4	06/04/2046
7078+67	272	18	0.256	45,000	2.90	0.069	26.9	12/09/2046
7353+49	296	18	0.256	45,000	2.55	0.062	27.0	02/03/2047
7479+43	306	18	0.266	45,000	2.19	0.068	27.1	02/27/2047
7417+96	323	18	0.266	45,000	1.84	0.076	27.4	06/17/2047
6720+52	327	18	0.256	45,000	3.50	0.074	28.7	10/26/2048
6078+41	305	18	0.256	45,000	4.21	0.082	28.9	12/25/2048
6449+16	260	18	0.246	45,000	2.43	0.083	29.0	02/06/2049
6418+40	260	18	0.256	45,000	4.80	0.074	29.2	04/19/2049
7478+84	308	18	0.266	45,000	1.96	0.068	29.3	05/25/2049
7471+94	293	18	0.266	45,000	1.96	0.068	29.5	07/26/2049
6438+09	267	18	0.256	45,000	2.55	0.090	29.8	11/14/2049
6488+48	234	18	0.256	45,000	2.43	0.090	30.0	02/03/2050
6414+66	254	18	0.256	45,000	6.10	0.069	30.2	04/22/2050
6147+08	311	18	0.256	45,000	5.63	0.074	30.5	07/12/2050
7331+08	283	18	0.256	45,000	2.19	0.062	30.5	07/13/2050
6321+82	226	18	0.256	45,000	4.80	0.074	31.0	01/31/2051
6578+85	373	18	0.256	45,000	4.92	0.069	31.2	03/26/2051
6059+29	300	18	0.256	45,000	2.55	0.095	32.1	02/23/2052
6306+14	237	18	0.256	45,000	2.55	0.090	32.4	07/02/2052
6435+88	265	18	0.256	45,000	2.31	0.090	33.1	02/19/2053
6246+48	301	18	0.256	45,000	4.68	0.074	33.3	05/13/2053
6411+45	257	18	0.266	45,000	2.19	0.103	33.5	07/28/2053
6329+19	223	18	0.256	45,000	2.43	0.090	33.6	08/22/2053
6403+08	273	18	0.256	45,000	5.15	0.069	34.2	04/24/2054
6812+10	243	18	0.256	45,000	1.48	0.095	34.3	05/06/2054
6535+13	313	18	0.256	45,000	2.08	0.090	34.3	05/16/2054
7145+26	259	18	0.256	65,000	2.08	0.069	35.0	01/27/2055

Table D-9 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Bastrop to Warda – ILI Date January 27, 2020 (pg. 2 of 4)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
6953+86	247	18	0.256	45,000	1.96	0.074	35.8	11/03/2055
7476+53	312	18	0.266	45,000	1.72	0.063	36.3	05/17/2056
6713+44	273	18	0.256	45,000	2.55	0.074	36.6	08/22/2056
6584+17	352	18	0.266	45,000	2.43	0.089	36.6	08/28/2056
6418+05	259	18	0.256	45,000	4.32	0.069	37.8	11/05/2057
5983+69	231	18	0.256	45,000	3.14	0.082	37.9	01/01/2058
6093+93	277	18	0.256	45,000	2.43	0.090	38.0	01/13/2058
6713+49	274	18	0.256	45,000	2.43	0.074	38.0	01/26/2058
6458+08	255	18	0.266	45,000	2.55	0.089	38.2	04/15/2058
7211+28	250	18	0.256	45,000	1.84	0.062	38.7	09/28/2058
7228+92	257	18	0.256	45,000	1.37	0.069	40.3	05/29/2060
6450+54	258	18	0.266	45,000	3.73	0.076	40.5	07/13/2060
6310+59	241	18	0.256	45,000	4.21	0.069	41.2	04/08/2061
6577+75	372	18	0.256	45,000	2.55	0.074	41.7	10/12/2061
6331+03	228	18	0.256	45,000	1.96	0.090	41.9	12/03/2061
7192+06	260	18	0.256	45,000	1.37	0.069	41.9	01/07/2062
6281+64	226	18	0.256	45,000	1.96	0.090	43.1	03/15/2063
6410+23	259	18	0.256	45,000	2.79	0.074	43.7	10/25/2063
6147+03	311	18	0.256	45,000	4.32	0.069	44.5	07/18/2064
6285+23	237	18	0.256	45,000	2.31	0.082	44.5	07/30/2064
6432+81	266	18	0.256	45,000	3.26	0.069	44.8	11/21/2064
6363+67	270	18	0.256	45,000	3.50	0.069	44.9	12/20/2064
5971+32	259	18	0.256	45,000	4.56	0.069	44.9	12/21/2064
6261+90	253	18	0.256	45,000	1.72	0.095	45.1	03/15/2065
6577+75	372	18	0.256	45,000	2.31	0.074	45.2	03/28/2065
6259+74	258	18	0.256	45,000	3.02	0.074	45.2	04/22/2065
6567+25	349	18	0.256	45,000	1.84	0.082	45.4	07/08/2065
6593+85	348	18	0.256	45,000	2.19	0.074	46.4	06/20/2066
6578+85	373	18	0.256	45,000	2.67	0.069	46.5	07/27/2066
7149+29	256	18	0.256	65,000	1.72	0.062	47.1	03/01/2067
6193+80	322	18	0.256	45,000	2.31	0.082	47.2	04/08/2067
6236+79	308	18	0.256	45,000	2.90	0.074	47.5	07/21/2067
6608+94	394	18	0.256	45,000	2.08	0.074	48.0	01/26/2068
6535+12	313	18	0.256	45,000	2.19	0.074	48.4	06/27/2068
6720+71	328	18	0.256	45,000	1.48	0.082	48.5	08/12/2068
6288+74	242	18	0.256	45,000	2.67	0.074	48.8	11/11/2068
6277+88	226	18	0.256	45,000	1.72	0.090	49.4	06/27/2069
6425+10	269	18	0.256	45,000	4.09	0.062	50.1	02/28/2070
6835+23	244	18	0.256	45,000	1.72	0.069	50.2	04/01/2070
6578+86	373	18	0.256	45,000	3.26	0.062	50.9	12/14/2070
6307+21	239	18	0.256	45,000	4.56	0.062	51.1	02/15/2071
6563+30	349	18	0.256	45,000	3.26	0.062	51.3	06/01/2071
6966+18	246	18	0.256	45,000	1.37	0.069	52.9	12/27/2072
7126+68	253	18	0.256	65,000	1.48	0.062	53.5	07/12/2073
7405+31	323	18	0.266	45,000	1.13	0.063	53.6	08/16/2073
6833+96	242	18	0.256	45,000	1.37	0.074	54.4	06/25/2074
6424+32	270	18	0.256	45,000	2.08	0.074	54.7	10/11/2074

Table D-9 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Bastrop to Warda – ILI Date January 27, 2020 (pg. 3 of 4)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
6617+13	310	18	0.256	45,000	1.72	0.074	55.1	03/03/2075
6263+01	258	18	0.256	45,000	2.31	0.074	55.7	10/09/2075
6586+78	340	18	0.256	45,000	1.25	0.090	55.8	11/14/2075
6835+23	244	18	0.256	45,000	1.13	0.082	56.1	03/18/2076
6186+35	331	18	0.266	45,000	4.44	0.068	56.2	04/02/2076
6481+22	233	18	0.256	45,000	3.02	0.062	56.5	07/21/2076
6886+45	286	18	0.256	45,000	1.37	0.069	57.5	08/14/2077
6031+11	279	18	0.256	45,000	1.96	0.082	58.0	01/21/2078
6231+26	293	18	0.256	45,000	2.19	0.074	59.3	05/29/2079
6463+80	253	18	0.256	45,000	1.48	0.082	59.7	10/20/2079
6439+91	269	18	0.256	45,000	1.84	0.074	59.8	10/31/2079
6299+99	243	18	0.256	45,000	2.43	0.069	59.9	01/04/2080
6409+63	260	18	0.266	45,000	2.08	0.076	64.8	11/18/2084
6412+34	255	18	0.256	45,000	1.96	0.069	65.4	06/07/2085
6268+05	227	18	0.256	45,000	2.08	0.069	68.3	05/21/2088
6748+88	303	18	0.256	45,000	1.60	0.062	68.3	05/27/2088
6125+24	310	18	0.256	45,000	2.19	0.069	71.1	03/20/2091
6571+15	342	18	0.256	45,000	1.48	0.069	72.6	09/04/2092
6690+39	233	18	0.266	45,000	1.96	0.063	73.5	08/02/2093
6267+97	228	18	0.256	45,000	1.60	0.074	74.7	10/20/2094
6268+68	215	18	0.256	45,000	1.84	0.069	74.8	11/22/2094
6821+47	243	18	0.256	45,000	1.25	0.062	76.0	01/14/2096
5970+89	258	18	0.256	45,000	1.72	0.074	78.7	10/19/2098
6301+30	240	18	0.256	45,000	2.08	0.062	80.8	11/05/2100
6102+74	269	18	0.256	45,000	1.84	0.069	81.4	06/27/2101
6094+83	277	18	0.256	45,000	1.60	0.074	81.5	07/17/2101
6678+76	228	18	0.256	45,000	1.13	0.069	81.8	11/20/2101
6809+32	243	18	0.256	45,000	1.13	0.062	83.2	04/28/2103
6199+59	312	18	0.256	45,000	1.25	0.082	83.4	07/06/2103
6125+59	310	18	0.256	45,000	1.48	0.074	86.3	05/28/2106
6298+32	244	18	0.256	45,000	1.13	0.082	86.7	10/20/2106
6414+90	255	18	0.256	45,000	1.60	0.062	89.7	10/08/2109
6069+92	309	18	0.256	45,000	2.08	0.062	90.7	09/25/2110
6694+95	237	18	0.266	45,000	1.25	0.068	91.2	04/20/2111
6006+53	251	18	0.256	45,000	2.08	0.062	91.5	07/30/2111
6580+61	369	18	0.256	45,000	1.25	0.062	95.8	11/26/2115
6233+02	301	18	0.256	45,000	1.37	0.069	97.2	04/01/2117
5973+04	255	18	0.256	45,000	1.13	0.082	98.5	07/22/2118
6135+25	278	18	0.256	45,000	1.25	0.074	99.4	06/07/2119
6305+25	239	18	0.256	45,000	1.25	0.069	100.0	01/26/2120
6414+67	254	18	0.256	45,000	1.37	0.062	100.5	07/17/2120
6186+38	331	18	0.266	45,000	1.25	0.081	104.2	04/25/2124
5988+07	213	18	0.266	45,000	1.72	0.068	109.0	02/13/2129
6404+95	271	18	0.256	45,000	1.13	0.062	117.4	07/08/2137
6431+25	267	18	0.266	45,000	1.13	0.068	123.4	07/03/2143
6002+92	237	18	0.256	45,000	1.13	0.069	123.7	10/10/2143

Table D-9 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Bastrop to Warda – ILI Date January 27, 2020 (pg. 4 of 4)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
6132+90	284	18	0.266	45,000	1.13	0.063	160.9	12/13/2180
7108+88	244	18	0.364	45,000	1.48	0.083	181.7	10/13/2201

Table D-10. Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Warda to Buckhorn – ILI Date November 7, 2019 (pg. 1 of 3)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
5844+01	331	18	0.276	45,000	4.67	0.083	23.6	06/04/2043
5018+76	431	18	0.276	45,000	4.31	0.108	29.1	12/12/2048
4464+86	335	18	0.276	45,000	6.32	0.108	29.9	09/19/2049
5776+42	374	18	0.276	45,000	2.07	0.102	32.6	06/30/2052
5472+17	481	18	0.276	45,000	3.60	0.094	32.9	10/09/2052
5461+55	451	18	0.276	45,000	5.61	0.083	32.9	10/12/2052
5668+47	413	18	0.276	45,000	2.66	0.094	34.2	01/30/2054
5080+54	397	18	0.276	45,000	3.49	0.108	34.5	05/01/2054
5874+66	308	18	0.276	45,000	2.66	0.083	34.7	07/14/2054
5307+23	448	18	0.276	45,000	5.14	0.088	34.8	09/04/2054
5776+42	374	18	0.276	45,000	1.83	0.102	37.1	12/22/2056
5781+10	373	18	0.276	45,000	2.42	0.088	37.5	05/04/2057
5401+22	494	18	0.276	45,000	4.19	0.088	37.5	05/23/2057
5781+13	373	18	0.276	45,000	4.78	0.069	39.9	10/08/2059
5566+17	524	18	0.276	45,000	3.13	0.088	40.4	03/23/2060
5881+58	326	18	0.276	45,000	1.83	0.088	42.8	08/07/2062
4938+66	436	18	0.276	45,000	5.02	0.094	42.9	09/28/2062
5952+41	343	18	0.276	45,000	2.90	0.069	43.2	02/03/2063
5894+47	320	18	0.276	45,000	3.01	0.069	44.9	09/21/2064
5484+39	501	18	0.276	45,000	3.01	0.088	45.1	12/12/2064
5901+47	305	18	0.276	45,000	2.31	0.075	45.6	05/31/2065
5893+29	321	18	0.276	45,000	3.72	0.064	46.3	02/19/2066
5883+73	328	18	0.276	45,000	2.66	0.069	49.1	12/24/2068
5258+91	392	18	0.276	45,000	2.90	0.094	49.4	03/14/2069
5822+06	371	18	0.276	45,000	2.31	0.075	50.3	02/20/2070
5605+17	479	18	0.276	45,000	3.25	0.075	52.0	11/06/2071
5748+89	369	18	0.276	45,000	1.13	0.116	52.9	09/30/2072
4970+51	378	18	0.276	45,000	4.55	0.088	53.8	09/03/2073
4913+29	380	18	0.276	45,000	6.08	0.083	55.2	01/30/2075
5671+85	414	18	0.276	45,000	2.31	0.075	59.9	10/11/2079
4920+84	386	18	0.276	45,000	1.95	0.122	60.8	09/02/2080
4997+35	404	18	0.276	45,000	4.55	0.083	61.6	07/01/2081
5799+32	371	18	0.276	45,000	2.66	0.064	62.1	12/30/2081
5825+43	371	18	0.276	45,000	1.95	0.069	65.0	10/31/2084
4496+72	367	18	0.276	45,000	6.08	0.088	66.3	02/27/2086
4980+64	399	18	0.276	45,000	2.90	0.094	66.5	05/01/2086
4975+29	390	18	0.276	45,000	2.19	0.102	73.9	10/17/2093
3618+43	173	18	0.276	45,000	3.72	0.094	74.4	04/15/2094

Table D-10 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Warda to Buckhorn – ILI Date November 7, 2019 (pg. 2 of 3)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
4502+47	343	18	0.276	45,000	19.41	0.069	76.4	03/24/2096
5781+14	373	18	0.276	45,000	1.95	0.064	76.7	07/30/2096
5749+69	362	18	0.276	45,000	1.24	0.083	77.5	05/13/2097
5341+46	442	18	0.276	45,000	3.49	0.069	78.1	12/13/2097
3680+61	175	18	0.276	45,000	5.85	0.083	78.5	05/23/2098
4883+39	347	18	0.276	45,000	2.66	0.094	79.0	10/26/2098
5141+78	395	18	0.276	45,000	5.02	0.069	79.2	01/09/2099
5757+09	352	18	0.276	45,000	1.83	0.064	81.7	07/14/2101
4580+52	340	18	0.276	45,000	3.84	0.088	87.9	10/08/2107
5566+95	522	18	0.276	45,000	2.07	0.069	88.1	12/15/2107
5307+79	446	18	0.276	45,000	3.96	0.064	88.5	05/13/2108
5707+85	394	18	0.276	45,000	1.72	0.064	90.6	06/09/2110
4426+77	287	18	0.276	45,000	8.09	0.075	94.7	07/26/2114
5662+83	399	18	0.276	45,000	1.72	0.064	95.4	03/20/2115
5335+20	457	18	0.276	45,000	2.07	0.075	95.8	09/01/2115
5165+83	375	18	0.276	45,000	2.54	0.075	96.9	10/17/2116
4584+22	323	18	0.276	45,000	2.31	0.102	99.7	07/20/2119
3875+95	262	18	0.276	45,000	3.96	0.088	100.1	12/07/2119
5625+88	435	18	0.276	45,000	1.24	0.075	103.5	05/20/2123
5460+05	447	18	0.276	45,000	2.19	0.064	103.8	09/13/2123
3625+65	165	18	0.276	45,000	1.95	0.108	105.1	12/03/2124
4970+57	378	18	0.276	45,000	2.31	0.083	106.0	11/06/2125
4177+99	212	18	0.276	45,000	12.81	0.069	106.2	01/29/2126
4935+93	421	18	0.276	45,000	2.42	0.083	106.8	08/08/2126
4981+51	396	18	0.276	45,000	2.90	0.075	107.7	07/28/2127
4579+80	341	18	0.276	45,000	5.14	0.075	109.1	12/08/2128
4912+43	380	18	0.276	45,000	3.13	0.075	109.4	04/04/2129
4849+11	354	18	0.276	45,000	3.25	0.075	113.1	12/18/2132
5419+55	479	18	0.276	45,000	1.48	0.075	114.3	03/07/2134
4430+69	304	18	0.276	45,000	5.26	0.075	119.1	12/29/2138
4848+46	353	18	0.276	45,000	2.31	0.083	119.4	04/20/2139
5358+36	473	18	0.276	45,000	1.72	0.069	122.9	09/23/2142
5547+87	490	18	0.276	45,000	1.13	0.075	125.3	03/07/2145
3971+26	267	18	0.276	45,000	3.72	0.083	125.7	07/08/2145
4502+43	343	18	0.276	45,000	10.92	0.064	125.7	07/09/2145
3625+61	165	18	0.276	45,000	3.84	0.075	127.1	11/30/2146
5371+83	485	18	0.276	45,000	1.60	0.069	128.4	03/30/2148
5367+04	474	18	0.276	45,000	1.36	0.075	129.7	07/04/2149
4518+26	364	18	0.276	45,000	9.15	0.064	133.7	07/06/2153
5165+62	375	18	0.276	45,000	2.31	0.064	136.2	01/07/2156
4965+07	400	18	0.276	45,000	3.25	0.064	139.1	12/14/2158
4911+17	380	18	0.276	45,000	2.78	0.069	139.2	01/25/2159
5202+50	340	18	0.276	45,000	1.48	0.075	139.6	06/26/2159
5556+04	521	18	0.276	45,000	1.24	0.064	142.5	05/04/2162
4288+24	208	18	0.276	45,000	2.54	0.088	146.5	04/23/2166
4846+61	347	18	0.276	45,000	3.49	0.064	149.6	06/26/2169
4311+63	251	18	0.276	45,000	3.84	0.075	151.0	10/24/2170

Table D-10 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Warda to Buckhorn – ILI Date November 7, 2019 (pg. 3 of 3)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
4503+39	341	18	0.276	45,000	3.25	0.075	152.3	03/10/2172
4846+52	347	18	0.276	45,000	3.01	0.064	161.9	10/11/2181
4328+40	273	18	0.276	45,000	3.37	0.075	163.3	03/13/2183
4705+84	268	18	0.276	45,000	1.83	0.083	164.1	12/24/2183
4139+84	291	18	0.276	45,000	2.42	0.083	179.3	02/21/2199
3655+52	160	18	0.276	45,000	3.84	0.064	182.1	12/27/2201
4288+25	208	18	0.276	45,000	2.90	0.075	182.4	03/17/2202
4418+06	310	18	0.276	45,000	2.66	0.075	184.2	01/04/2204
5141+68	395	18	0.276	45,000	1.36	0.064	198.9	10/02/2218
4341+50	283	18	0.276	45,000	3.01	0.069	206.6	06/13/2226
3988+90	293	18	0.276	45,000	2.54	0.075	207.4	03/26/2227
4609+61	363	18	0.276	45,000	1.24	0.094	213.6	06/10/2233
4589+30	299	18	0.276	45,000	1.24	0.094	215.3	03/15/2235
4541+60	329	18	0.276	45,000	2.90	0.064	215.7	07/21/2235
5062+57	379	18	0.276	45,000	1.13	0.064	225.2	01/29/2245
4694+95	312	18	0.276	45,000	1.13	0.064	225.2	01/29/2245
4609+60	363	18	0.276	45,000	1.83	0.069	225.2	01/29/2245
4543+55	332	18	0.276	45,000	1.95	0.069	225.2	01/29/2245
4494+61	371	18	0.276	45,000	1.13	0.064	225.2	01/29/2245
4473+98	363	18	0.276	45,000	1.72	0.064	225.2	01/29/2245
4353+02	312	18	0.276	45,000	1.13	0.088	225.2	01/29/2245
4349+95	313	18	0.276	45,000	1.24	0.069	225.2	01/29/2245
4143+80	288	18	0.276	45,000	1.24	0.069	225.2	01/29/2245
4064+66	280	18	0.276	45,000	1.60	0.075	225.2	01/29/2245
3889+84	287	18	0.276	45,000	1.36	0.083	225.2	01/29/2245
3709+78	183	18	0.276	45,000	2.19	0.064	225.2	01/29/2245
3625+65	165	18	0.276	45,000	1.13	0.083	225.2	01/29/2245

Table D-11. Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Buckhorn to Satsuma – ILI Date December 5, 2019 (pg. 1 of 4)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
3007+90	107	18	0.285	45,000	7.40	0.107	28.7	08/05/2048
3512+93	69	18	0.285	45,000	6.69	0.082	34.0	11/21/2053
3502+52	72	18	0.266	45,000	5.51	0.068	41.1	01/01/2061
3518+43	68	18	0.285	45,000	5.51	0.076	45.0	11/22/2064
3445+54	58	18	0.266	45,000	1.84	0.095	48.1	01/10/2068
3518+82	68	18	0.285	45,000	8.23	0.067	52.7	08/19/2072
3462+42	58	18	0.266	45,000	4.68	0.063	55.4	05/04/2075
3105+21	78	18	0.266	45,000	2.55	0.095	57.8	10/06/2077
3402+96	48	18	0.266	45,000	3.26	0.068	61.7	08/27/2081
2170+24	55	18	0.285	45,000	6.57	0.116	64.0	12/01/2083
3484+54	72	18	0.266	45,000	2.55	0.068	64.0	12/05/2083
3462+17	58	18	0.266	45,000	3.38	0.063	64.5	06/18/2084
2954+08	119	18	0.266	45,000	6.45	0.076	65.2	02/20/2085
3518+81	68	18	0.285	45,000	4.32	0.067	66.6	07/13/2086

Table D-11 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Buckhorn to Satsuma – ILI Date December 5, 2019 (pg. 2 of 4)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
1934+25	37	18	0.256	45,000	4.44	0.103	67.0	12/01/2086
3105+11	78	18	0.266	45,000	3.85	0.076	68.4	05/02/2088
3565+60	58	18	0.285	45,000	2.43	0.076	68.6	07/21/2088
3391+88	51	18	0.285	45,000	5.51	0.067	72.1	01/27/2092
2702+88	89	18	0.266	45,000	6.81	0.081	75.9	11/15/2095
3239+53	67	18	0.285	45,000	9.05	0.067	77.1	12/29/2096
3108+95	78	18	0.266	45,000	4.68	0.068	78.9	11/04/2098
3463+75	59	18	0.266	45,000	1.84	0.068	82.1	01/06/2102
2825+08	93	18	0.256	45,000	3.97	0.074	87.8	09/17/2107
3354+05	52	18	0.295	45,000	3.73	0.074	89.0	11/27/2108
3514+10	68	18	0.266	45,000	1.72	0.063	89.7	08/01/2109
3494+24	75	18	0.285	45,000	3.38	0.062	89.7	08/13/2109
3462+41	58	18	0.266	45,000	1.60	0.068	90.9	10/23/2110
2300+79	60	18	0.285	45,000	6.69	0.102	92.5	05/29/2112
2368+15	65	18	0.285	45,000	8.23	0.096	93.8	09/14/2113
3255+15	71	18	0.285	45,000	2.43	0.082	94.3	03/12/2114
3136+90	78	18	0.295	45,000	2.90	0.089	100.7	08/07/2120
3085+10	80	18	0.266	45,000	4.20	0.063	101.6	07/11/2121
3397+97	51	18	0.285	45,000	3.26	0.062	104.7	08/14/2124
3179+68	67	18	0.285	45,000	4.56	0.067	106.6	07/26/2126
3486+86	74	18	0.266	45,000	1.13	0.068	115.2	02/06/2135
2531+64	76	18	0.266	45,000	6.69	0.076	116.4	05/14/2136
3188+40	67	18	0.295	45,000	4.80	0.068	119.1	01/07/2139
3564+02	58	18	0.285	45,000	1.60	0.062	123.3	03/11/2143
2959+22	120	18	0.285	45,000	3.73	0.076	127.4	05/13/2147
2568+46	74	18	0.266	45,000	5.03	0.076	128.0	12/04/2147
2968+72	120	18	0.285	45,000	3.61	0.076	128.1	01/12/2148
3261+04	49	18	0.295	45,000	3.85	0.063	136.1	01/11/2156
2951+31	119	18	0.285	45,000	2.67	0.082	139.0	11/27/2158
2417+21	67	18	0.266	45,000	3.14	0.089	145.0	12/01/2164
2205+79	55	18	0.266	45,000	3.14	0.095	148.4	05/17/2168
3412+86	60	18	0.295	45,000	1.13	0.089	150.3	04/05/2170
2531+63	76	18	0.266	45,000	3.97	0.076	154.0	12/21/2173
2080+15	46	18	0.266	45,000	5.51	0.081	154.3	03/21/2174
3294+84	51	18	0.285	45,000	1.13	0.087	155.4	05/17/2175
2838+89	95	18	0.266	45,000	3.61	0.063	158.3	03/09/2178
2986+58	117	18	0.295	45,000	3.49	0.074	160.4	04/29/2180
2711+40	89	18	0.266	45,000	5.15	0.063	162.9	10/28/2182
2620+69	79	18	0.266	45,000	1.48	0.103	175.9	10/18/2195
1900+36	35	18	0.266	45,000	5.62	0.076	177.5	05/26/2197
2358+64	65	18	0.266	45,000	7.99	0.068	179.0	12/14/2198
3281+24	51	18	0.295	45,000	1.25	0.083	180.7	08/19/2200
2964+75	120	18	0.266	45,000	2.07	0.063	180.7	09/03/2200
2363+76	65	18	0.266	45,000	4.09	0.076	182.8	09/10/2202
1899+95	35	18	0.285	45,000	5.62	0.087	184.5	05/29/2204
3153+88	65	18	0.285	45,000	2.19	0.062	185.4	04/20/2205
2953+97	119	18	0.266	45,000	1.25	0.081	186.0	12/11/2205

Table D-11 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Buckhorn to Satsuma – ILI Date December 5, 2019 (pg. 3 of 4)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
1970+89	36	18	0.266	45,000	3.97	0.081	189.7	08/05/2209
3084+96	80	18	0.295	45,000	3.26	0.063	191.2	02/14/2211
1961+01	39	18	0.285	45,000	7.40	0.082	193.3	03/20/2213
2402+24	66	18	0.266	45,000	10.47	0.063	193.5	05/29/2213
3108+97	78	18	0.266	45,000	1.13	0.068	200.6	07/03/2220
2171+81	54	18	0.285	45,000	4.80	0.087	202.2	02/22/2222
2823+35	93	18	0.295	45,000	2.55	0.083	202.5	05/28/2222
3028+64	94	18	0.295	45,000	3.38	0.063	204.6	07/12/2224
3160+47	66	18	0.285	45,000	1.25	0.076	205.2	02/21/2225
1991+40	40	18	0.285	45,000	3.49	0.096	208.4	04/17/2228
1919+72	35	18	0.266	45,000	3.38	0.081	209.7	08/16/2229
2673+20	88	18	0.266	45,000	1.96	0.076	211.3	04/08/2231
2715+08	85	18	0.285	45,000	1.72	0.096	214.7	08/26/2234
2839+00	95	18	0.266	45,000	1.72	0.068	218.4	05/01/2238
2536+77	76	18	0.285	45,000	3.14	0.082	221.4	05/10/2241
2821+48	93	18	0.295	45,000	3.97	0.068	224.6	07/31/2244
3361+94	53	18	0.305	45,000	1.13	0.063	225.2	02/26/2245
3179+70	67	18	0.285	45,000	1.13	0.062	225.2	02/26/2245
3169+51	68	18	0.285	45,000	1.13	0.067	225.2	02/26/2245
3029+03	94	18	0.295	45,000	2.55	0.063	225.2	02/26/2245
2986+92	117	18	0.295	45,000	1.37	0.074	225.2	02/26/2245
2986+70	117	18	0.295	45,000	1.37	0.063	225.2	02/26/2245
2823+87	93	18	0.295	45,000	3.38	0.068	225.2	02/26/2245
2823+46	93	18	0.295	45,000	2.55	0.063	225.2	02/26/2245
2823+20	93	18	0.295	45,000	1.60	0.083	225.2	02/26/2245
2739+49	88	18	0.295	45,000	1.25	0.068	225.2	02/26/2245
2666+41	85	18	0.266	45,000	1.25	0.063	225.2	02/26/2245
2556+26	75	18	0.285	45,000	1.72	0.067	225.2	02/26/2245
2554+74	73	18	0.266	45,000	1.37	0.068	225.2	02/26/2245
2527+30	77	18	0.266	45,000	1.13	0.095	225.2	02/26/2245
2499+22	81	18	0.266	45,000	3.26	0.063	225.2	02/26/2245
2433+72	67	18	0.266	45,000	1.72	0.089	225.2	02/26/2245
2418+81	66	18	0.285	45,000	1.60	0.076	225.2	02/26/2245
2415+65	65	18	0.295	45,000	1.13	0.068	225.2	02/26/2245
2414+51	63	18	0.266	45,000	2.07	0.076	225.2	02/26/2245
2414+36	63	18	0.266	45,000	1.60	0.076	225.2	02/26/2245
2371+28	65	18	0.285	45,000	2.31	0.082	225.2	02/26/2245
2367+73	65	18	0.285	45,000	3.73	0.067	225.2	02/26/2245
2362+57	65	18	0.266	45,000	1.37	0.063	225.2	02/26/2245
2361+37	65	18	0.285	45,000	2.78	0.067	225.2	02/26/2245
2339+76	63	18	0.266	45,000	2.43	0.068	225.2	02/26/2245
2301+97	60	18	0.285	45,000	1.25	0.062	225.2	02/26/2245
2301+77	60	18	0.285	45,000	5.03	0.062	225.2	02/26/2245
2301+58	60	18	0.285	45,000	1.13	0.067	225.2	02/26/2245
2290+70	60	18	0.285	45,000	1.60	0.062	225.2	02/26/2245
2198+42	54	18	0.285	45,000	2.19	0.062	225.2	02/26/2245
2192+94	55	18	0.285	45,000	3.38	0.076	225.2	02/26/2245

Table D-11 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Buckhorn to Satsuma – ILI Date December 5, 2019 (pg. 4 of 4)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
2178+16	54	18	0.285	45,000	2.90	0.082	225.2	02/26/2245
2177+77	54	18	0.285	45,000	4.91	0.067	225.2	02/26/2245
2174+59	54	18	0.285	45,000	3.97	0.087	225.2	02/26/2245
2170+63	55	18	0.285	45,000	5.27	0.076	225.2	02/26/2245
2164+68	52	18	0.285	45,000	4.09	0.082	225.2	02/26/2245
2164+29	52	18	0.285	45,000	1.13	0.067	225.2	02/26/2245
2163+10	53	18	0.285	45,000	4.32	0.067	225.2	02/26/2245
2112+83	47	18	0.285	45,000	1.96	0.062	225.2	02/26/2245
2107+89	48	18	0.285	45,000	2.31	0.082	225.2	02/26/2245
2102+08	48	18	0.285	45,000	7.99	0.076	225.2	02/26/2245
2097+56	46	18	0.285	45,000	2.19	0.076	225.2	02/26/2245
2094+32	46	18	0.285	45,000	2.31	0.067	225.2	02/26/2245
2087+36	46	18	0.285	45,000	1.13	0.067	225.2	02/26/2245
2087+34	46	18	0.285	45,000	1.25	0.076	225.2	02/26/2245
2083+91	46	18	0.266	45,000	1.84	0.068	225.2	02/26/2245
2082+35	46	18	0.266	45,000	4.09	0.068	225.2	02/26/2245
2078+78	46	18	0.285	45,000	2.55	0.076	225.2	02/26/2245
2074+57	46	18	0.266	45,000	2.31	0.068	225.2	02/26/2245
2036+81	44	18	0.285	45,000	1.25	0.067	225.2	02/26/2245
1975+54	40	18	0.295	45,000	2.19	0.074	225.2	02/26/2245
1975+48	40	18	0.285	45,000	6.81	0.067	225.2	02/26/2245
1964+77	39	18	0.266	45,000	3.85	0.063	225.2	02/26/2245
1936+74	37	18	0.285	45,000	1.37	0.062	225.2	02/26/2245
1936+26	37	18	0.266	45,000	1.13	0.063	225.2	02/26/2245
1924+56	35	18	0.285	45,000	5.03	0.082	225.2	02/26/2245
1923+09	35	18	0.266	45,000	5.86	0.063	225.2	02/26/2245
1918+91	36	18	0.266	45,000	1.13	0.068	225.2	02/26/2245
1898+77	35	18	0.285	45,000	1.13	0.062	225.2	02/26/2245
1878+16	33	18	0.285	45,000	2.67	0.067	225.2	02/26/2245
1874+84	33	18	0.285	45,000	1.48	0.141	225.2	02/26/2245
1817+22	25	18	0.266	45,000	2.67	0.063	225.2	02/26/2245

Table D-12. Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Satsuma to East Houston – ILI Date August 16, 2019 (pg. 1 of 8)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
1679+53	116	20	0.305	35,000	5.38	0.115	28.6	04/07/2048
1752+00	123	20	0.295	35,000	5.62	0.101	29.4	01/06/2049
1729+58	119	20	0.305	35,000	3.14	0.121	40.7	05/02/2060
1598+51	111	20	0.315	35,000	3.25	0.140	41.2	11/12/2060
1632+14	112	20	0.305	35,000	4.67	0.109	42.3	11/19/2061
1675+02	116	20	0.305	35,000	5.85	0.094	50.8	06/16/2070
1643+16	111	20	0.305	35,000	2.54	0.128	53.0	08/23/2072
1485+41	105	20	0.305	35,000	3.02	0.128	57.0	08/10/2076
1711+20	117	20	0.295	35,000	2.54	0.107	57.4	01/09/2077

Table D-12 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Satsuma to East Houston – ILI Date August 16, 2019 (pg. 2 of 8)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
1728+75	118	20	0.295	35,000	8.10	0.074	62.2	10/31/2081
1653+96	112	20	0.305	35,000	4.55	0.094	62.6	03/15/2082
939+66	67	20	0.315	35,000	5.50	0.146	64.4	12/28/2083
1771+12	121	20	0.305	35,000	2.31	0.109	66.9	06/30/2086
1684+38	116	20	0.305	35,000	2.78	0.103	72.6	03/29/2092
1653+52	112	20	0.305	35,000	3.37	0.094	78.9	07/06/2098
1684+70	116	20	0.305	35,000	3.02	0.094	81.8	05/24/2101
1745+85	121	20	0.305	35,000	3.14	0.088	81.9	06/29/2101
1709+88	117	20	0.295	35,000	3.02	0.083	84.0	08/17/2103
1471+69	105	20	0.315	35,000	2.90	0.121	86.7	04/24/2106
1712+44	117	20	0.305	35,000	2.90	0.088	92.0	08/16/2111
1736+11	120	20	0.305	35,000	4.08	0.076	95.1	09/08/2114
1723+67	119	20	0.295	35,000	1.84	0.095	96.5	02/02/2116
982+92	70	20	0.305	35,000	3.61	0.140	98.0	08/19/2117
1657+46	113	20	0.305	35,000	3.02	0.088	98.1	09/25/2117
1477+77	106	20	0.315	35,000	2.31	0.127	99.3	12/14/2118
1618+48	113	20	0.305	35,000	1.84	0.115	99.4	01/05/2119
1632+04	112	20	0.305	35,000	2.19	0.103	99.6	03/30/2119
1447+79	105	20	0.315	35,000	6.44	0.090	100.1	09/24/2119
1483+79	106	20	0.315	35,000	4.32	0.096	101.8	06/03/2121
1239+99	87	20	0.305	35,000	3.14	0.121	102.1	10/02/2121
1695+61	115	20	0.305	35,000	1.72	0.109	102.3	12/05/2121
1658+61	114	20	0.315	35,000	2.19	0.108	103.9	07/27/2123
1654+28	113	20	0.305	35,000	1.95	0.103	107.0	08/23/2126
1089+63	79	20	0.305	35,000	6.80	0.103	108.5	02/05/2128
1347+08	87	20	0.305	35,000	4.43	0.094	113.1	09/26/2132
1696+43	116	20	0.315	35,000	2.07	0.102	113.7	05/01/2133
1483+02	106	20	0.315	35,000	2.78	0.108	113.7	05/07/2133
1692+74	117	20	0.295	35,000	5.14	0.063	114.1	09/29/2133
1717+61	118	20	0.305	35,000	1.60	0.103	116.2	10/23/2135
1544+58	109	20	0.305	35,000	2.66	0.094	116.6	03/19/2136
1301+14	88	20	0.305	35,000	3.02	0.109	121.1	09/07/2140
1641+92	112	20	0.295	35,000	3.84	0.068	121.3	12/17/2140
1759+74	124	20	0.305	35,000	3.25	0.070	121.3	12/21/2140
1731+29	118	20	0.305	35,000	1.95	0.088	122.0	08/20/2141
1401+21	99	20	0.315	35,000	2.19	0.127	122.1	09/11/2141
1674+30	115	20	0.305	35,000	2.19	0.088	122.5	01/30/2142
1713+88	117	20	0.305	35,000	1.95	0.088	125.7	04/13/2145
1203+57	87	20	0.295	35,000	1.95	0.133	127.9	06/26/2147
1256+98	89	20	0.305	35,000	1.60	0.155	132.0	08/08/2151
1729+13	118	20	0.295	35,000	1.60	0.083	133.5	02/05/2153
1551+52	108	20	0.305	35,000	1.84	0.103	135.9	06/24/2155
1657+39	113	20	0.305	35,000	2.78	0.076	137.0	08/01/2156
1775+82	123	20	0.305	35,000	1.36	0.094	141.0	08/18/2160
887+08	60	20	0.295	35,000	9.04	0.095	144.0	08/29/2163
1678+02	116	20	0.315	35,000	1.84	0.096	144.0	08/30/2163
939+67	67	20	0.315	35,000	3.49	0.140	144.6	04/02/2164

Table D-12 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Satsuma to East Houston – ILI Date August 16, 2019 (pg. 3 of 8)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
1097+90	79	20	0.295	35,000	4.67	0.095	144.8	06/21/2164
742+35	57	20	0.305	35,000	7.39	0.115	145.7	04/19/2165
1687+28	117	20	0.305	35,000	1.72	0.088	146.0	08/03/2165
1627+77	112	20	0.305	35,000	1.36	0.109	147.1	09/20/2166
1744+30	121	20	0.295	35,000	2.43	0.063	148.2	10/13/2167
1476+08	104	20	0.305	35,000	2.66	0.088	150.3	11/27/2169
1737+32	119	20	0.295	35,000	1.95	0.068	152.4	01/28/2172
1512+75	106	20	0.315	35,000	2.43	0.096	152.6	03/07/2172
1487+09	106	20	0.315	35,000	2.90	0.090	156.7	05/10/2176
1610+10	112	20	0.305	35,000	2.54	0.076	157.8	06/16/2177
1609+58	111	20	0.305	35,000	1.84	0.088	158.1	09/15/2177
1632+18	112	20	0.305	35,000	1.36	0.103	158.5	02/15/2178
1510+93	107	20	0.315	35,000	2.31	0.096	159.8	05/30/2179
1478+76	106	20	0.315	35,000	1.95	0.108	161.0	08/15/2180
1516+22	107	20	0.305	35,000	2.19	0.088	162.6	03/16/2182
1461+18	105	20	0.305	35,000	3.73	0.076	163.5	02/19/2183
1666+98	115	20	0.325	35,000	1.36	0.121	163.8	06/19/2183
985+35	71	20	0.305	35,000	4.43	0.109	164.3	12/05/2183
1320+67	88	20	0.295	35,000	2.31	0.095	165.2	10/29/2184
853+16	59	20	0.305	35,000	7.86	0.103	166.1	10/05/2185
1471+75	105	20	0.315	35,000	1.72	0.115	166.3	11/16/2185
1075+65	77	20	0.305	35,000	2.78	0.121	167.3	12/18/2186
1481+59	106	20	0.315	35,000	2.31	0.096	168.8	05/30/2188
1697+43	117	20	0.315	35,000	1.36	0.102	168.9	06/23/2188
1632+14	112	20	0.305	35,000	1.60	0.088	170.8	06/16/2190
1632+09	112	20	0.305	35,000	1.60	0.088	170.9	06/27/2190
1713+49	117	20	0.295	35,000	1.48	0.074	171.4	12/25/2190
1717+46	118	20	0.305	35,000	1.48	0.082	173.8	06/04/2193
1776+39	123	20	0.305	35,000	1.72	0.070	174.2	10/24/2193
1551+32	108	20	0.305	35,000	1.84	0.088	175.5	02/28/2195
1632+08	112	20	0.305	35,000	1.72	0.082	178.4	01/21/2198
1447+77	105	20	0.315	35,000	8.57	0.068	180.0	07/30/2199
808+97	63	20	0.315	35,000	2.54	0.168	183.7	04/26/2203
1684+70	116	20	0.305	35,000	1.48	0.082	183.9	07/06/2203
945+55	68	20	0.305	35,000	7.86	0.094	184.6	03/20/2204
1501+47	106	20	0.295	35,000	2.78	0.068	186.4	12/31/2205
1548+95	110	20	0.305	35,000	1.72	0.088	186.6	03/26/2206
1512+30	106	20	0.305	35,000	2.54	0.076	188.6	03/15/2208
1509+45	107	20	0.305	35,000	4.91	0.063	190.4	01/27/2210
1464+95	105	20	0.305	35,000	2.31	0.082	193.5	02/25/2213
1541+21	108	20	0.305	35,000	1.48	0.094	196.1	09/05/2215
1755+70	123	20	0.295	35,000	1.48	0.063	196.5	02/10/2216
1248+51	87	20	0.305	35,000	2.07	0.109	197.2	11/10/2216
1260+44	87	20	0.295	35,000	11.99	0.063	197.8	06/23/2217
1632+12	112	20	0.305	35,000	1.72	0.076	199.0	08/04/2218
1741+81	119	20	0.315	35,000	1.25	0.090	200.1	09/25/2219
1610+76	112	20	0.305	35,000	1.25	0.094	203.1	09/17/2222

Table D-12 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Satsuma to East Houston – ILI Date August 16, 2019 (pg. 4 of 8)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
881+98	60	20	0.305	35,000	2.54	0.140	203.4	01/18/2223
1713+79	117	20	0.305	35,000	1.60	0.070	203.5	02/02/2223
785+44	64	20	0.305	35,000	3.25	0.134	203.7	05/10/2223
1680+35	116	20	0.315	35,000	2.19	0.068	212.8	06/10/2232
1289+55	87	20	0.305	35,000	2.31	0.094	214.9	07/27/2234
1187+21	86	20	0.305	35,000	6.56	0.076	215.2	11/11/2234
1510+84	107	20	0.315	35,000	3.73	0.068	216.6	03/10/2236
1478+69	106	20	0.315	35,000	1.72	0.096	218.8	06/19/2238
1628+50	112	20	0.315	35,000	1.25	0.096	224.1	09/13/2243
1705+62	116	20	0.305	35,000	1.25	0.076	224.7	05/04/2244
1740+10	120	20	0.305	35,000	1.36	0.063	225.2	11/07/2244
1729+13	118	20	0.295	35,000	1.13	0.068	225.2	11/07/2244
1717+71	118	20	0.305	35,000	1.13	0.076	225.2	11/07/2244
1666+35	114	20	0.305	35,000	1.25	0.076	225.2	11/07/2244
1654+27	113	20	0.305	35,000	1.36	0.063	225.2	11/07/2244
1649+14	112	20	0.305	35,000	1.13	0.063	225.2	11/07/2244
1598+97	111	20	0.315	35,000	1.48	0.074	225.2	11/07/2244
1581+56	109	20	0.305	35,000	1.25	0.063	225.2	11/07/2244
1556+18	107	20	0.315	35,000	3.73	0.061	225.2	11/07/2244
1551+35	108	20	0.305	35,000	1.36	0.063	225.2	11/07/2244
1549+78	109	20	0.305	35,000	1.48	0.063	225.2	11/07/2244
1548+94	110	20	0.305	35,000	1.13	0.063	225.2	11/07/2244
1545+07	109	20	0.295	35,000	1.60	0.063	225.2	11/07/2244
1525+59	106	20	0.315	35,000	2.43	0.068	225.2	11/07/2244
1523+47	107	20	0.305	35,000	1.95	0.070	225.2	11/07/2244
1520+37	107	20	0.305	35,000	1.25	0.076	225.2	11/07/2244
1513+21	107	20	0.315	35,000	1.60	0.074	225.2	11/07/2244
1512+49	106	20	0.305	35,000	1.60	0.082	225.2	11/07/2244
1501+73	107	20	0.295	35,000	1.36	0.068	225.2	11/07/2244
1501+72	107	20	0.295	35,000	2.07	0.063	225.2	11/07/2244
1499+60	106	20	0.295	35,000	1.25	0.083	225.2	11/07/2244
1499+41	106	20	0.295	35,000	1.48	0.068	225.2	11/07/2244
1487+92	106	20	0.305	35,000	1.25	0.076	225.2	11/07/2244
1482+04	106	20	0.305	35,000	1.48	0.063	225.2	11/07/2244
1477+96	106	20	0.315	35,000	1.84	0.068	225.2	11/07/2244
1477+86	106	20	0.315	35,000	2.43	0.068	225.2	11/07/2244
1471+72	105	20	0.315	35,000	1.25	0.083	225.2	11/07/2244
1462+20	105	20	0.305	35,000	1.72	0.076	225.2	11/07/2244
1442+68	103	20	0.315	35,000	1.36	0.083	225.2	11/07/2244
1422+10	98	20	0.315	35,000	1.36	0.074	225.2	11/07/2244
1407+41	99	20	0.315	35,000	1.25	0.068	225.2	11/07/2244
1403+90	100	20	0.305	35,000	1.72	0.088	225.2	11/07/2244
1400+93	99	20	0.315	35,000	2.19	0.083	225.2	11/07/2244
1400+92	99	20	0.315	35,000	1.36	0.115	225.2	11/07/2244
1396+18	99	20	0.315	35,000	1.72	0.061	225.2	11/07/2244
1374+72	94	20	0.305	35,000	1.72	0.094	225.2	11/07/2244
1292+79	87	20	0.305	35,000	2.78	0.070	225.2	11/07/2244

Table D-12 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Satsuma to East Houston – ILI Date August 16, 2019 (pg. 5 of 8)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
1265+49	88	20	0.295	35,000	1.25	0.116	225.2	11/07/2244
1261+03	88	20	0.305	35,000	1.13	0.070	225.2	11/07/2244
1259+57	88	20	0.305	35,000	1.60	0.070	225.2	11/07/2244
1258+58	89	20	0.315	35,000	2.54	0.074	225.2	11/07/2244
1256+81	88	20	0.305	35,000	1.84	0.063	225.2	11/07/2244
1253+10	87	20	0.315	35,000	3.12	0.068	225.2	11/07/2244
1251+54	87	20	0.315	35,000	1.25	0.083	225.2	11/07/2244
1251+17	88	20	0.305	35,000	1.48	0.063	225.2	11/07/2244
1249+21	87	20	0.305	35,000	1.25	0.063	225.2	11/07/2244
1241+15	87	20	0.305	35,000	1.36	0.076	225.2	11/07/2244
1241+10	87	20	0.305	35,000	1.48	0.082	225.2	11/07/2244
1239+30	87	20	0.295	35,000	1.60	0.089	225.2	11/07/2244
1237+09	86	20	0.305	35,000	1.25	0.088	225.2	11/07/2244
1227+91	86	20	0.315	35,000	1.13	0.083	225.2	11/07/2244
1227+08	86	20	0.315	35,000	1.60	0.061	225.2	11/07/2244
1226+82	87	20	0.305	35,000	1.72	0.103	225.2	11/07/2244
1226+64	87	20	0.305	35,000	1.13	0.063	225.2	11/07/2244
1223+33	87	20	0.305	35,000	1.25	0.103	225.2	11/07/2244
1207+92	87	20	0.305	35,000	1.13	0.082	225.2	11/07/2244
1207+91	87	20	0.305	35,000	1.48	0.094	225.2	11/07/2244
1193+79	87	20	0.305	35,000	1.36	0.076	225.2	11/07/2244
1193+78	87	20	0.305	35,000	1.84	0.109	225.2	11/07/2244
1188+37	87	20	0.295	35,000	1.13	0.063	225.2	11/07/2244
1187+19	86	20	0.305	35,000	3.49	0.063	225.2	11/07/2244
1168+59	85	20	0.295	35,000	1.60	0.068	225.2	11/07/2244
1157+16	85	20	0.305	35,000	1.95	0.070	225.2	11/07/2244
1156+67	85	20	0.305	35,000	1.48	0.063	225.2	11/07/2244
1153+65	85	20	0.295	35,000	1.72	0.089	225.2	11/07/2244
1151+04	85	20	0.295	35,000	1.25	0.063	225.2	11/07/2244
1146+26	83	20	0.315	35,000	1.48	0.090	225.2	11/07/2244
1145+34	83	20	0.315	35,000	1.25	0.074	225.2	11/07/2244
1145+24	83	20	0.315	35,000	3.02	0.090	225.2	11/07/2244
1142+04	84	20	0.315	35,000	1.48	0.090	225.2	11/07/2244
1130+14	82	20	0.305	35,000	3.37	0.063	225.2	11/07/2244
1126+83	83	20	0.315	35,000	3.02	0.090	225.2	11/07/2244
1121+31	82	20	0.305	35,000	1.84	0.063	225.2	11/07/2244
1121+28	82	20	0.305	35,000	1.25	0.076	225.2	11/07/2244
1098+95	79	20	0.295	35,000	1.95	0.068	225.2	11/07/2244
1097+94	79	20	0.295	35,000	1.72	0.101	225.2	11/07/2244
1097+89	79	20	0.295	35,000	3.84	0.083	225.2	11/07/2244
1096+91	79	20	0.295	35,000	2.07	0.083	225.2	11/07/2244
1089+28	79	20	0.295	35,000	1.36	0.063	225.2	11/07/2244
1077+56	77	20	0.305	35,000	1.36	0.063	225.2	11/07/2244
1062+00	75	20	0.305	35,000	1.60	0.128	225.2	11/07/2244
1054+82	73	20	0.295	35,000	1.84	0.068	225.2	11/07/2244
1052+80	73	20	0.315	35,000	1.60	0.074	225.2	11/07/2244
1052+39	72	20	0.315	35,000	3.02	0.096	225.2	11/07/2244

Table D-12 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Satsuma to East Houston – ILI Date August 16, 2019 (pg. 6 of 8)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
1051+84	73	20	0.295	35,000	2.90	0.068	225.2	11/07/2244
1041+74	70	20	0.305	35,000	3.02	0.063	225.2	11/07/2244
1029+37	71	20	0.305	35,000	1.13	0.094	225.2	11/07/2244
1027+67	70	20	0.295	35,000	2.66	0.089	225.2	11/07/2244
1017+86	70	20	0.305	35,000	1.25	0.076	225.2	11/07/2244
1013+90	70	20	0.305	35,000	1.36	0.109	225.2	11/07/2244
1013+46	71	20	0.295	35,000	1.25	0.083	225.2	11/07/2244
1012+82	71	20	0.305	35,000	2.07	0.094	225.2	11/07/2244
1011+66	71	20	0.315	35,000	1.95	0.096	225.2	11/07/2244
1008+81	70	20	0.315	35,000	3.02	0.074	225.2	11/07/2244
1006+86	70	20	0.295	35,000	5.50	0.083	225.2	11/07/2244
995+31	70	20	0.305	35,000	1.36	0.076	225.2	11/07/2244
991+55	70	20	0.305	35,000	1.13	0.070	225.2	11/07/2244
991+37	71	20	0.305	35,000	1.36	0.070	225.2	11/07/2244
987+52	70	20	0.315	35,000	1.25	0.102	225.2	11/07/2244
977+81	70	20	0.305	35,000	1.60	0.076	225.2	11/07/2244
977+10	70	20	0.315	35,000	1.95	0.061	225.2	11/07/2244
973+78	69	20	0.315	35,000	1.36	0.102	225.2	11/07/2244
971+31	69	20	0.295	35,000	1.36	0.068	225.2	11/07/2244
970+12	69	20	0.305	35,000	1.36	0.063	225.2	11/07/2244
965+75	68	20	0.305	35,000	3.84	0.088	225.2	11/07/2244
965+55	68	20	0.305	35,000	3.84	0.094	225.2	11/07/2244
965+41	69	20	0.295	35,000	1.48	0.127	225.2	11/07/2244
965+29	69	20	0.295	35,000	1.60	0.074	225.2	11/07/2244
961+67	68	20	0.295	35,000	3.49	0.095	225.2	11/07/2244
957+07	68	20	0.305	35,000	2.43	0.076	225.2	11/07/2244
957+06	68	20	0.305	35,000	1.72	0.063	225.2	11/07/2244
952+21	68	20	0.295	35,000	2.54	0.068	225.2	11/07/2244
947+16	67	20	0.305	35,000	1.60	0.063	225.2	11/07/2244
947+16	67	20	0.305	35,000	2.78	0.063	225.2	11/07/2244
940+60	67	20	0.305	35,000	1.60	0.094	225.2	11/07/2244
940+03	67	20	0.315	35,000	1.13	0.061	225.2	11/07/2244
939+95	67	20	0.315	35,000	1.25	0.068	225.2	11/07/2244
939+85	67	20	0.315	35,000	1.48	0.083	225.2	11/07/2244
939+85	67	20	0.315	35,000	4.20	0.083	225.2	11/07/2244
937+83	67	20	0.315	35,000	1.25	0.068	225.2	11/07/2244
929+37	63	20	0.305	35,000	1.13	0.109	225.2	11/07/2244
928+50	63	20	0.305	35,000	1.72	0.063	225.2	11/07/2244
926+27	62	20	0.305	35,000	1.36	0.088	225.2	11/07/2244
925+91	61	20	0.305	35,000	3.61	0.076	225.2	11/07/2244
904+20	60	20	0.295	35,000	3.37	0.089	225.2	11/07/2244
903+71	61	20	0.305	35,000	1.36	0.082	225.2	11/07/2244
896+23	61	20	0.305	35,000	1.72	0.088	225.2	11/07/2244
886+57	60	20	0.305	35,000	1.72	0.076	225.2	11/07/2244
881+98	60	20	0.305	35,000	1.25	0.088	225.2	11/07/2244
879+98	60	20	0.295	35,000	3.25	0.063	225.2	11/07/2244
879+97	60	20	0.295	35,000	1.13	0.074	225.2	11/07/2244

Table D-12 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Satsuma to East Houston – ILI Date August 16, 2019 (pg. 7 of 8)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
875+34	61	20	0.315	35,000	1.36	0.074	225.2	11/07/2244
870+10	61	20	0.295	35,000	3.25	0.074	225.2	11/07/2244
865+86	60	20	0.295	35,000	2.78	0.074	225.2	11/07/2244
856+86	59	20	0.305	35,000	2.31	0.088	225.2	11/07/2244
856+11	59	20	0.305	35,000	3.25	0.076	225.2	11/07/2244
853+44	59	20	0.305	35,000	2.43	0.063	225.2	11/07/2244
853+17	59	20	0.305	35,000	2.54	0.103	225.2	11/07/2244
849+64	62	20	0.305	35,000	2.66	0.103	225.2	11/07/2244
849+57	62	20	0.305	35,000	1.13	0.070	225.2	11/07/2244
849+49	62	20	0.305	35,000	1.36	0.076	225.2	11/07/2244
849+48	62	20	0.305	35,000	1.36	0.070	225.2	11/07/2244
845+45	58	20	0.315	35,000	1.25	0.102	225.2	11/07/2244
843+94	59	20	0.305	35,000	1.36	0.070	225.2	11/07/2244
836+54	58	20	0.315	35,000	2.54	0.083	225.2	11/07/2244
832+86	57	20	0.315	35,000	4.43	0.090	225.2	11/07/2244
832+63	57	20	0.315	35,000	1.84	0.074	225.2	11/07/2244
817+69	60	20	0.305	35,000	1.72	0.063	225.2	11/07/2244
811+65	61	20	0.315	35,000	2.43	0.083	225.2	11/07/2244
811+17	61	20	0.315	35,000	1.60	0.083	225.2	11/07/2244
808+84	63	20	0.315	35,000	2.66	0.096	225.2	11/07/2244
807+14	62	20	0.305	35,000	1.84	0.088	225.2	11/07/2244
798+47	62	20	0.305	35,000	2.54	0.109	225.2	11/07/2244
796+69	64	20	0.305	35,000	1.72	0.088	225.2	11/07/2244
796+00	64	20	0.305	35,000	2.66	0.088	225.2	11/07/2244
792+29	65	20	0.315	35,000	1.72	0.102	225.2	11/07/2244
788+96	65	20	0.305	35,000	3.84	0.094	225.2	11/07/2244
786+87	64	20	0.305	35,000	1.84	0.076	225.2	11/07/2244
784+32	64	20	0.315	35,000	2.90	0.083	225.2	11/07/2244
782+10	65	20	0.315	35,000	1.48	0.090	225.2	11/07/2244
771+89	65	20	0.305	35,000	4.79	0.076	225.2	11/07/2244
762+34	63	20	0.315	35,000	2.07	0.121	225.2	11/07/2244
760+49	62	20	0.315	35,000	7.27	0.096	225.2	11/07/2244
760+10	62	20	0.305	35,000	3.25	0.088	225.2	11/07/2244
746+69	59	20	0.305	35,000	1.36	0.070	225.2	11/07/2244
736+10	53	20	0.305	35,000	2.31	0.103	225.2	11/07/2244
735+78	56	20	0.315	35,000	1.48	0.074	225.2	11/07/2244
735+28	53	20	0.305	35,000	1.36	0.082	225.2	11/07/2244
733+74	57	20	0.295	35,000	1.36	0.074	225.2	11/07/2244
732+71	57	20	0.305	35,000	1.48	0.094	225.2	11/07/2244
732+34	57	20	0.305	35,000	2.07	0.070	225.2	11/07/2244
732+33	57	20	0.305	35,000	1.60	0.063	225.2	11/07/2244
731+22	57	20	0.305	35,000	1.25	0.070	225.2	11/07/2244
731+09	57	20	0.315	35,000	1.25	0.090	225.2	11/07/2244
719+27	56	20	0.305	35,000	5.03	0.070	225.2	11/07/2244
705+71	54	20	0.295	35,000	1.48	0.068	225.2	11/07/2244
704+94	54	20	0.315	35,000	1.60	0.102	225.2	11/07/2244
697+57	52	20	0.305	35,000	2.31	0.082	225.2	11/07/2244

Table D-12 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of ILI-Indicated Anomalies Satsuma to East Houston – ILI Date August 16, 2019 (pg. 8 of 8)

Station Number	Elevation (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Re-assessment Interval (years)	Re-assessment Due Date
682+38	53	20	0.305	35,000	4.67	0.103	225.2	11/07/2244
680+89	52	20	0.295	35,000	3.61	0.063	225.2	11/07/2244
680+73	52	20	0.295	35,000	4.08	0.083	225.2	11/07/2244
674+77	53	20	0.305	35,000	2.31	0.070	225.2	11/07/2244
673+91	52	20	0.315	35,000	1.36	0.068	225.2	11/07/2244
665+51	52	20	0.295	35,000	1.72	0.095	225.2	11/07/2244
665+38	52	20	0.295	35,000	1.13	0.074	225.2	11/07/2244
648+16	51	20	0.315	35,000	1.48	0.074	225.2	11/07/2244
646+07	50	20	0.315	35,000	2.19	0.090	225.2	11/07/2244
643+60	50	20	0.315	35,000	1.13	0.068	225.2	11/07/2244
642+16	51	20	0.315	35,000	1.60	0.068	225.2	11/07/2244
641+90	50	20	0.315	35,000	2.19	0.061	225.2	11/07/2244
636+78	50	20	0.315	35,000	1.13	0.061	225.2	11/07/2244
636+21	49	20	0.315	35,000	2.31	0.115	225.2	11/07/2244
633+06	49	20	0.305	35,000	1.13	0.076	225.2	11/07/2244
625+81	48	20	0.305	35,000	3.25	0.082	225.2	11/07/2244
625+80	48	20	0.305	35,000	3.02	0.094	225.2	11/07/2244
573+12	43	20	0.315	35,000	1.36	0.074	225.2	11/07/2244
568+22	43	20	0.315	35,000	2.78	0.083	225.2	11/07/2244
568+21	43	20	0.315	35,000	1.36	0.068	225.2	11/07/2244
564+86	43	20	0.305	35,000	1.72	0.070	225.2	11/07/2244
563+85	43	20	0.305	35,000	1.13	0.094	225.2	11/07/2244
563+10	43	20	0.305	35,000	1.60	0.103	225.2	11/07/2244
561+20	43	20	0.315	35,000	3.14	0.083	225.2	11/07/2244
554+95	43	20	0.305	35,000	1.72	0.082	225.2	11/07/2244
548+22	42	20	0.315	35,000	3.25	0.127	225.2	11/07/2244
547+96	42	20	0.305	35,000	2.07	0.088	225.2	11/07/2244
545+20	42	20	0.315	35,000	3.14	0.061	225.2	11/07/2244
544+13	40	20	0.315	35,000	3.73	0.108	225.2	11/07/2244
543+44	41	20	0.315	35,000	1.36	0.074	225.2	11/07/2244
537+82	40	20	0.305	35,000	1.36	0.103	225.2	11/07/2244
525+43	20	20	0.305	35,000	1.95	0.088	225.2	11/07/2244
517+95	40	20	0.315	35,000	2.90	0.090	225.2	11/07/2244
517+73	40	20	0.315	35,000	1.36	0.102	225.2	11/07/2244
517+62	40	20	0.315	35,000	1.60	0.074	225.2	11/07/2244
514+07	41	20	0.315	35,000	2.43	0.061	225.2	11/07/2244
509+33	42	20	0.295	35,000	1.95	0.101	225.2	11/07/2244
508+18	41	20	0.295	35,000	2.54	0.101	225.2	11/07/2244
505+07	41	20	0.305	35,000	5.50	0.088	225.2	11/07/2244
501+75	40	20	0.315	35,000	1.36	0.074	225.2	11/07/2244
500+71	40	20	0.315	35,000	1.60	0.108	225.2	11/07/2244
494+73	41	20	0.305	35,000	1.60	0.063	225.2	11/07/2244
493+73	40	20	0.315	35,000	1.95	0.061	225.2	11/07/2244
480+77	39	20	0.305	35,000	1.48	0.063	225.2	11/07/2244

APPENDIX E – APPROACH TO API 1163 VERIFICATION

Approach to API 1163 Verification

API 1163 2nd Edition, April 2013, describes methods in Section 7 and Section 8 that can be applied to verify that the ILI tool was working as expected and that reported inspection results are within the performance specification for the inspected pipeline. Within the Standard, a distinction is made between results with and without field verification measurements. API 1163 Section 7 provides information about what the ILI Vendor provides regarding pre-, mid-, and post-inspection checks for proper tool runs. API 1163 Section 8 Figure 6 (Figure E-1 in this document) describes a process for validating ILI measurements using three levels of validation, shown in Figure E-2.

The three levels of validation all consist of the following steps:

- A process verification or quality control (§8.2.2 and Annex C.1)
- A comparison with historical data for the pipeline being inspected (§8.2.3)
- A comparison analysis of pipeline component records (§8.2.4)

The validation levels differ based on the risk of the pipeline segment and the amount of validation data.

Validation Level 1 (Annex C):

- A comparison with large-scale historic data for pipeline segments similar to the pipeline being inspected (§8.2.3)

Validation Level 1 only applies to pipelines with anomaly populations with a low risk of consequence or probability of failure. Typically, only a limited number or no validation measurements are taken on the inspected pipeline. A Level 1 validation assumes the ILI specified tool performance is neither proven nor disputed for the ILI run. This assumption means the validity of the ILI run cannot be rejected solely based on a Level 1 validation. A Level 2 or Level 3 validation is required before an ILI run can be rejected.

Validation Level 2 (Annex C):

- A comparison with field excavation results warranted by the reporting of significant indications (§8.2.6)

Validation Level 2 applies to pipelines with a lower risk of consequence or probability of failure that has indications of significance reported by ILI. Typically, enough validation measurements are taken on the inspected pipeline to confidently state whether the ILI tool performs worse than the ILI specification and possibly reject the ILI run. However, a Level 2 validation does not let one confidently state that the ILI tool is performing within ILI specifications. The number of validation measurements will typically be greater than or equal to five but not statistically significant to perform a Level 3 validation. If the ILI tool specification can be rejected, there is the option to progress to a Level 3 validation, requiring additional validation measurements.

Validation Level 3 (Annex C):

- A comparison with field excavation results warranted by the reporting of significant indications (§8.2.6)

Validation Level 3 applies to pipelines with a higher risk of consequence or probability of failure that has indications of significance reported by ILI. Typically, a statistically significant number of validation measurements are taken on the pipeline being inspected to confidently state an as-run tool performance.

The tool performance can be rejected, accepted, or non-conclusive, depending upon the data analysis using the API 1163 decision chart process. If tool performance is determined to be non-conclusive, it does not mean the inspection failed. Instead, an additional course of action may be required. Some actions to consider are: performing additional validation digs to gather more information to possibly improve the current tool performance, accepting the determined tool performance as-is, adjusting the depth accuracy applied to the reported ILI features, or having the ILI Vendor regrade the data. Figure E-1 shows API 1163 Section 8 Figure 6, which summarizes the system results evaluation process. For clarity of wording in the flow chart, "historical data" is taken to mean the data limited to the particular line, whereas "large-scale historical data" is taken to mean the data on this line, as well as any similar diameter lines with the same ILI tool type used for inspection.

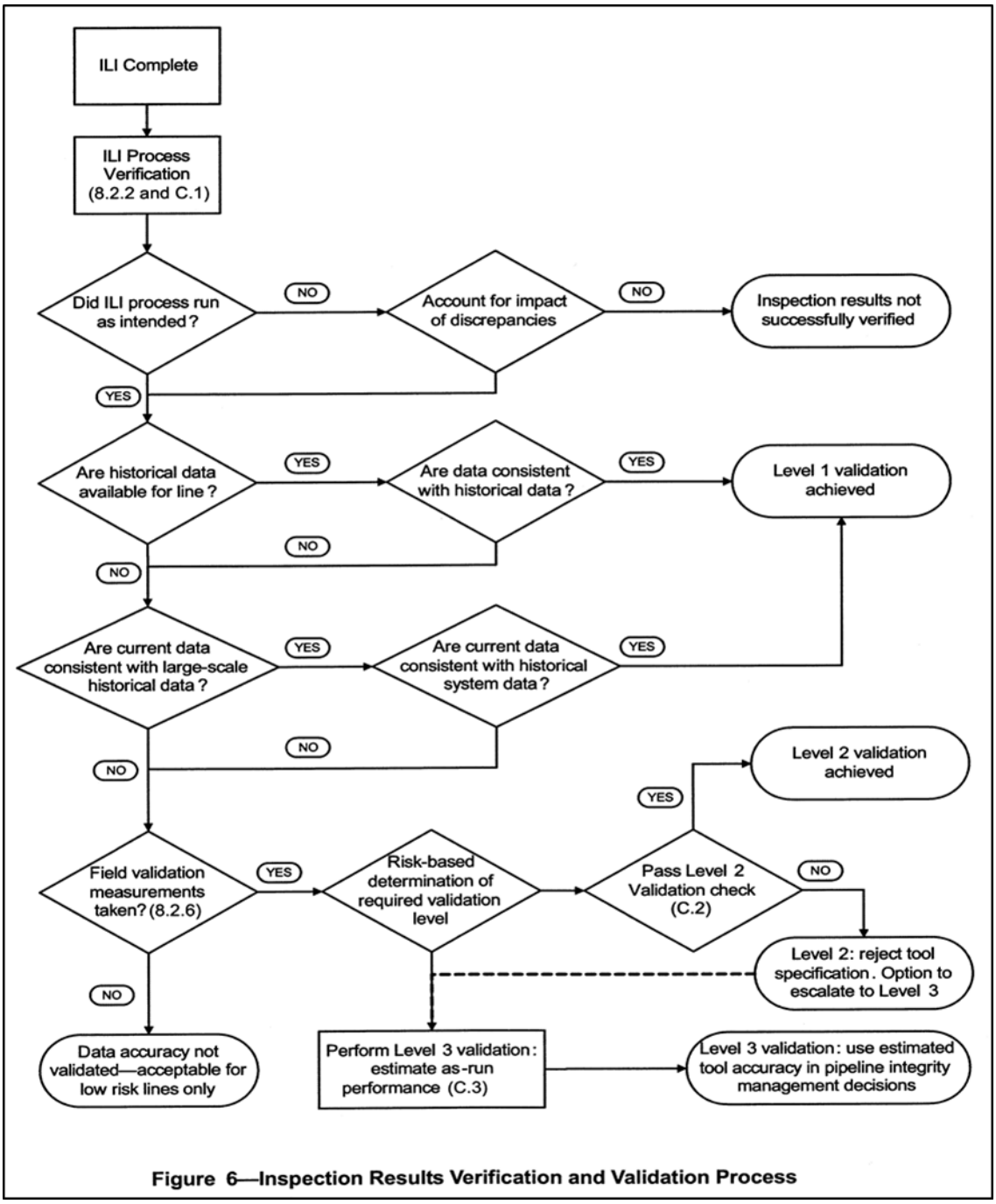

Figure 6—Inspection Results Verification and Validation Process

Figure E-1. Evaluation of System Results from API 1163 Section 8 Figure 6

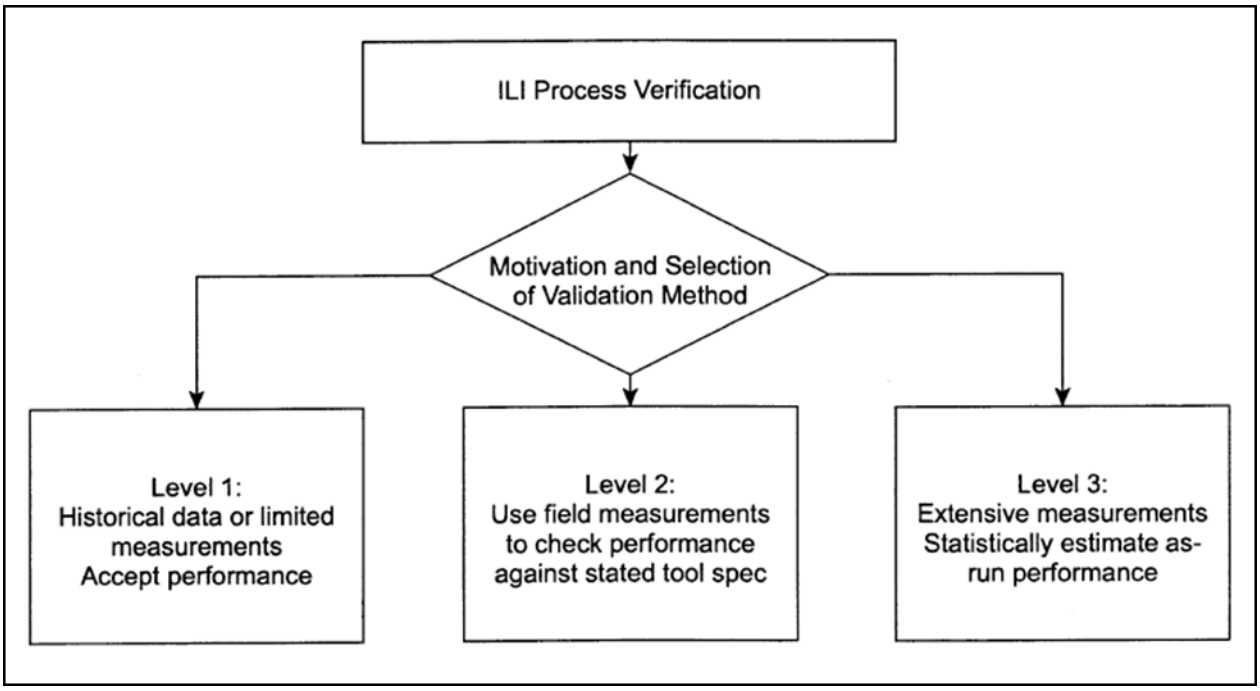

Figure E-2. Overview of Three Levels of Validation