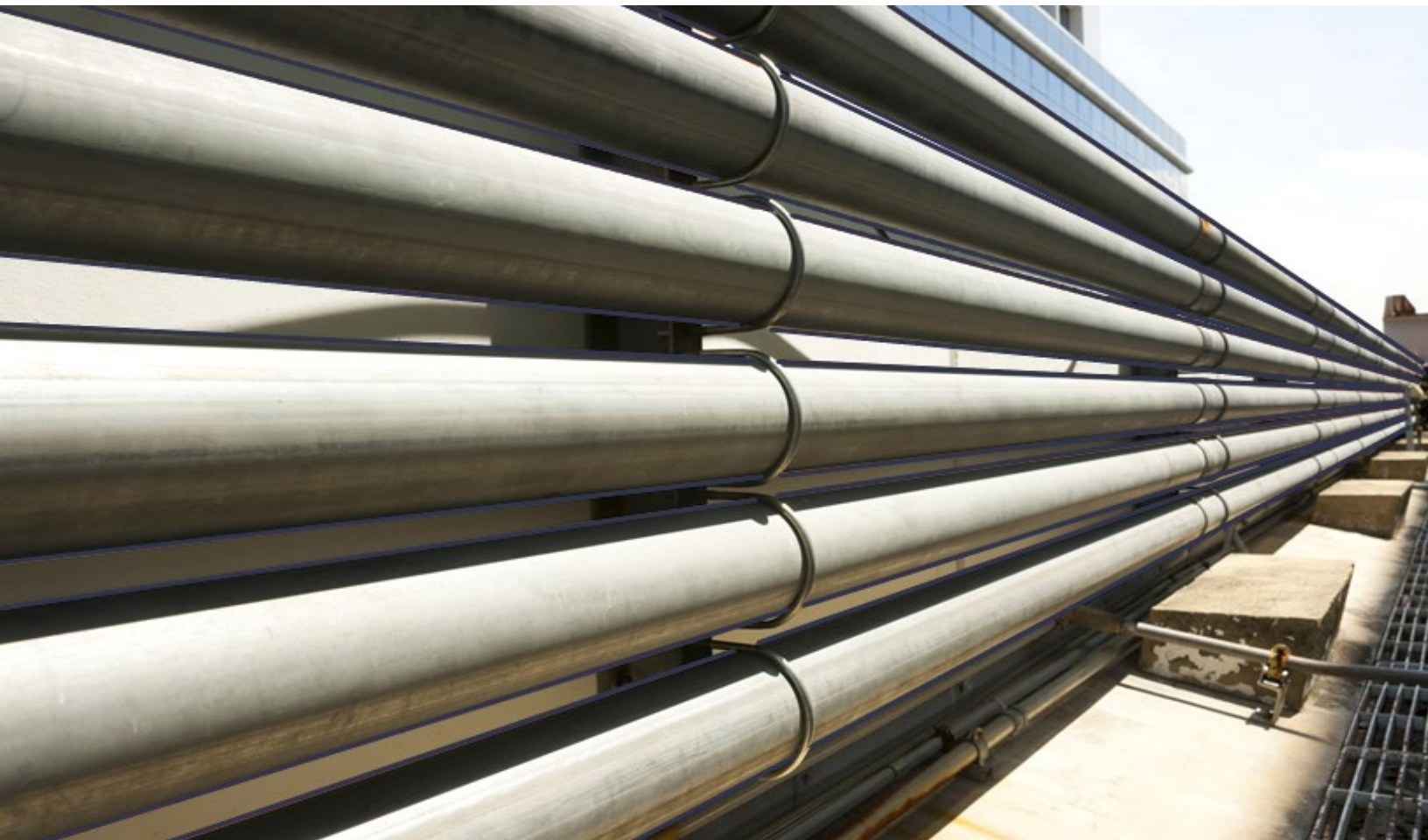


2023 Operational Reliability Assessment of the Longhorn Pipeline System

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March 26, 2025



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Final Report

2023 Operational Reliability Assessment of the Longhorn Pipeline System

to

Magellan Pipeline Company

on

March 26, 2025

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EXECUTIVE SUMMARY

This report presents the annual Operational Reliability Assessment (ORA) of the Longhorn Pipeline System for the 2023 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 the results of the SIP elements to evaluate the condition of Longhorn assets. In addition, recommendations are provided to preserve the long-term integrity and mitigate areas of potential concern.

Kiefner reviewed data collected and generated from inspections and pipeline system operation from the SIP. See Section 1.3 ORA Interaction with the SIP for areas where data is collected and generated. The goal of the SIP is to manage and preserve the integrity of the seven potential threats to pipeline integrity: Pressure-Cycle-Induced Fatigue, Corrosion, Laminations and Hydrogen Blisters, Earth Movement and Water Forces, Third-Party Damage (TPD), Stress-Corrosion Cracking (SCC), and Threats to Facilities Other than Line Pipe.

In 2023, Magellan continued performing in-line inspection (ILI) investigation digs to remediate and validate metal loss features; performed atmospheric maintenance for the Longhorn Pipeline System, see Table 22 for repair information; inspected 13 tanks, five in Crane and eight in El Paso, see Table 23 for inspection summary; and conducted depth-of-cover (DOC) surveys for eight water crossings. These surveys were documented in Magellan's Outside Forces Database and assessed per Magellan's River Crossing Program. Details of the surveys are in Section 2.4.4 Waterway Inspections and Depth-of-Cover Program.

2023 Data Analysis/Review:

- Pressure-cycle-induced fatigue – Crane to Texon and Cartman to Kimble crude oil segments have suggested reassessment dates of August and September 2027.
- Internal corrosion coupons show low corrosion rates (≤ 0.17 mpy).
- Semi-annual test point surveys are completed in tier II and III areas. An annual CIS is completed in tier III areas. According to the 2023 CIS results, there are 49 areas listed in Table 19, where the pipe segments either do not meet a minimum of 100 mV of cathodic polarization or have a polarized potential of -850 mV. Magellan performed a follow-up survey in March and April 2024 that cleared all exceptions from the 2023 CIS.
- AC pipe-to-soil voltages were collected during the CIS. Table 21 summarizes the areas with elevated AC voltages; the highest reading was 8.362 V at KOCKS RECT LOC C-929. This AC voltage level should not cause personnel safety issues.
- Kiefner compared the ID reductions identified from the 2023 electronic geometry pig (EGP) assessments between Texon to Warda and Buckhorn to Satsuma to laminations reported by the 2009/10 UT assessments. Eleven dents and 53 geometric anomalies (GMA) were present on the same joint as a lamination reported from the 2009/10 UT assessments. One GMA on the Cartman to Kimble segment correlated directly to a UT assessment lamination. Based on the 2023 maintenance reports, no laminations were found during in-ditch inspections.

- Earth movement:
 - The overall movement rates at the Akron, Melde, Breen, McCarty, Negyev, and Oates faults remain slow, over 100 years¹ to reach the allowable displacement. The observed short-term movement rates at these faults show relatively minor oscillations near their baseline, suggesting that semi-annual monitoring is adequate to assess the need for any intervention, if necessary.
 - The Hockley Fault, as indicated in previous surveys, displays the highest rate of movement and necessitates continuous monitoring. However, semi-annual monitoring should be adequate, considering the mitigation efforts undertaken on this fault in 2018.
- The Longhorn 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 January, October, November, and December of 2023. In this instance, Magellan began and completed patrols following event cessation within 72 hours.
- One incident investigation was conducted on the Longhorn Pipeline; it was classified as third-party damage and was not reportable to PHMSA. Magellan formally documented and investigated the incident.
- Facilities data indicate that pump stations and terminal facilities have been properly maintained and operated and have had no adverse impact on public safety.
- 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 and safety or cause environmental harm.

Kiefner recommends that Magellan continue monitoring for lamination anomalies with ILI tools and continue to conduct inspections per 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.

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.

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.

<i>Accident</i>	An undesired event that results in harm to people or property damage.
<i>AC</i>	Alternating Current
<i>API</i>	American Petroleum Institute
<i>ASME</i>	American Society of Mechanical Engineers
<i>Bbl</i>	Barrels
<i>bpd</i>	Barrels per day
<i>CFR</i>	Code of Federal Regulations
<i>CGR</i>	Corrosion growth rate
<i>CIS</i>	Close interval survey
<i>CMP</i>	Corrosion Management Plan
<i>CP</i>	Cathodic Protection – A method of protection against galvanic corrosion of a buried or submerged pipeline through the application of protective electric currents.
<i>Def</i>	Deformation
<i>Defect</i>	An imperfection of a type or magnitude exceeding acceptable criteria. Definition based on API Publication 570 – Piping Inspection Code. (Also see anomaly).
<i>Dent</i>	An ID Reduction greater than or equal to 2% of the pipe diameter
<i>DOC</i>	Depth-of-cover
<i>DOT</i>	Department of Transportation
<i>EA</i>	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: <ul style="list-style-type: none">• Categorical Exclusion Determination (CATEX)• Environmental Assessment/Finding of No Significant Impact• Environmental Impact Statement (EIS)
<i>EFW</i>	Electric-flash weld is a type of EW that uses electric induction to generate weld heat.

<i>EGP</i>	Electronic geometry pig
<i>Encroachments</i>	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.
<i>EPA</i>	Environmental Protection Agency
<i>ERW</i>	An electric-resistance weld is a type of electric welding that uses electric-resistance to generate weld heat.
<i>EW</i>	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. 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.
<i>Existing Pipeline</i>	The Environmental Assessment (EA) defines it as 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.
<i>External Corrosion</i>	Deterioration of the pipe due to an electrochemical reaction between the pipe material and the environment outside the pipe
<i>FEA</i>	Finite element analysis
<i>GMA</i>	Geometric Anomaly – An ID Reduction of less than 2% of the pipe diameter
<i>HCA</i>	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: <ul style="list-style-type: none">• Commercially navigable waterway• High population area• Other populated area• Unusually sensitive area (USA)
<i>Hydrostatic Test</i>	An integrity verification test that pressurizes the pipeline with water is called a hydro test or hydrostatic pressure test.
<i>ID</i>	Inside nominal diameter of line pipe
<i>ID Reduction</i>	A deformation of pipe diameter detected by the ILI tool
<i>ILI</i>	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.

<i>ILI Final Report</i>	ILI vendor report that provides the operator with a comprehensive interpretation of the data from an ILI.
<i>Incident</i>	<p>An event defined in the LMP's Incident Investigation Program includes accidents, near-miss cases, repairs, and/or any combination thereof. Incidents are divided into three categories: major, significant, and minor.</p> <p>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.</p>
<i>Internal Corrosion</i>	Deterioration of the pipe due to an electrochemical reaction between the pipe material and the environment outside the pipe
<i>J-1 Valve</i>	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; the actual junction is at MP 9 (2 miles from the J-1 Valve).
<i>Jct</i>	Junction
<i>Kiefner</i>	Kiefner and Associates, Inc.
<i>Leak Detection System</i>	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: <ul style="list-style-type: none">• 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: <ul style="list-style-type: none">• 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
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	<p>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 is obtained from Hazard / Near-miss cards, incident investigations, aerial patrol reports, maintenance reports, and ROW inspection reports.</p> <p>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.</p>
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 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	Pipeline and Hazardous Materials Safety Administration – a federal agency within the DOT with safety jurisdiction over interstate pipelines.
PMI	Positive Material Identification
PMI Field Services	A process and procedure developed by T. D. Williamson to determine tensile strength, yield strength, and chemical composition of pipes in the field. The process includes mobile automated ball indentation 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 loss is measured in terms of both the likelihood of occurrence of the incident and the 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: <ul style="list-style-type: none"> • 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 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.

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

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

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2023 Operational Reliability Assessment of the Longhorn Pipeline System

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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 2023 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. In September 2023, Magellan was purchased by ONEOK, but Magellan continues the system integrity activities and SIP. A 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 include 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 implementing an 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. Magellan continues with this agreement.

The LMP stipulates the ORA's specific and general requirements. 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 2023 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 focus on:

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

³SCC 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.

1.4 Longhorn Pipeline System Description

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

The Eastern portion of the Longhorn system transports crude oil through an 18" 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" pipe from Satsuma Station to East Houston Terminal and 9 miles of 20" pipe from East Houston Terminal to 9th Street Junction. The crude system contains the Existing Pipeline (as named in the original EA) built in 1949 and 1950, with some replacements and extensions in Houston.

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" pipe from Crane Station to the El Paso Terminal and 29 miles of 8" 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 systems were 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 increased from 92,180 bpd to 136,600 bpd from Crane to El Paso. The 8" Crane to Odessa segment is now inactive. Figure 4 provides 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	373.6	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

System	Station	Type	Milepost	Tier	MOP (psig)
Refined Product	Odessa ⁴	Meter	29.3	I	1440
	Crane	Pump	457.5	II	1440
	Cottonwood	Valve	576.3	I	1440
	El Paso	Terminal	694.4	I	1440
	8" Chevron	Meter	9.4	I	2160
	8" Kinder Morgan Flush Line	Meter	9.4	I	1440
	8" Strauss	Meter	9.4	I	1440
	12" Kinder Morgan	Meter	9.4	I	1440

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

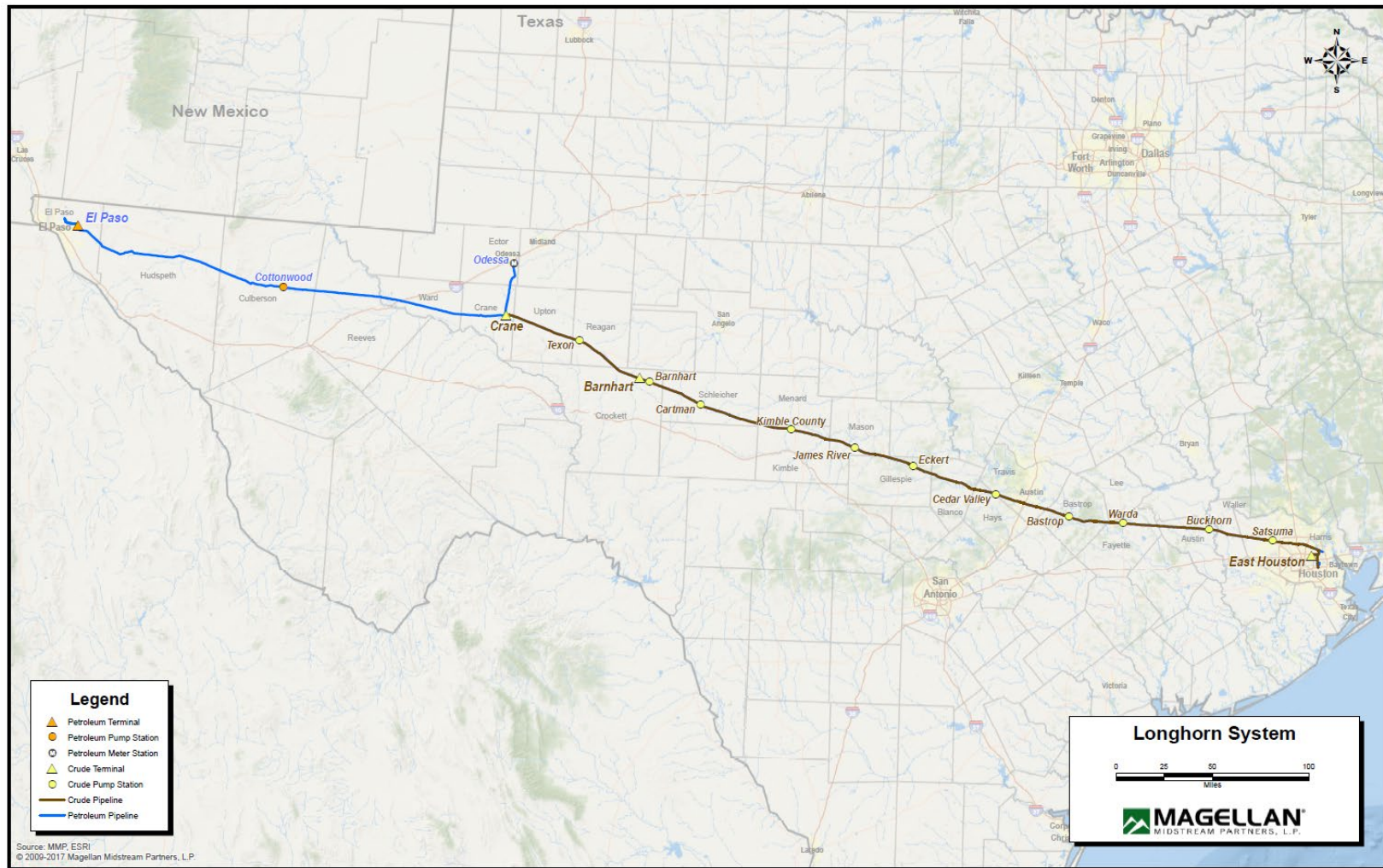


Figure 1. Longhorn System Map (2023)



Figure 2. Longhorn System Map showing Tier Level (2023)

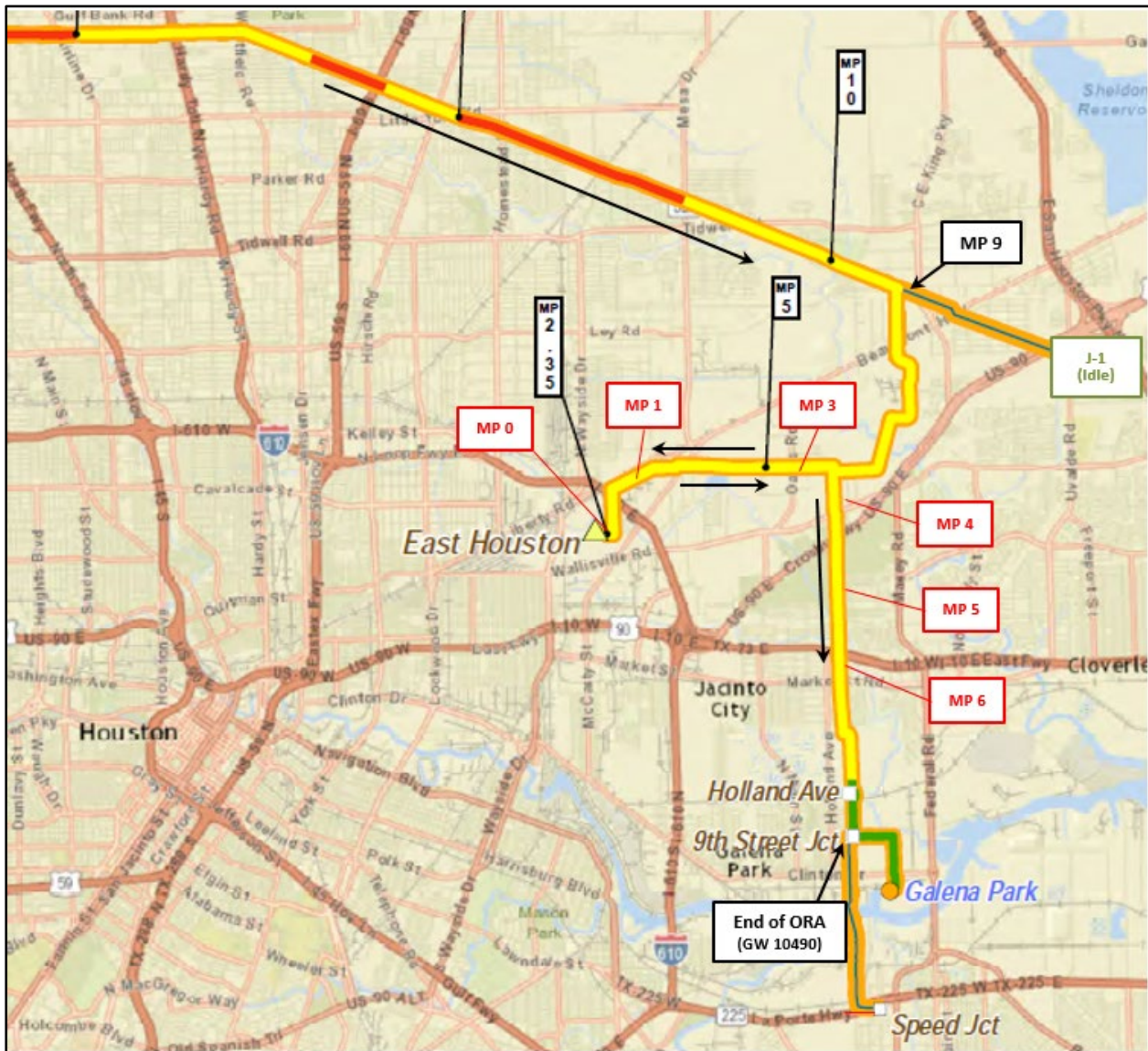


Figure 3. Map of Longhorn System within the Houston Area (2023)

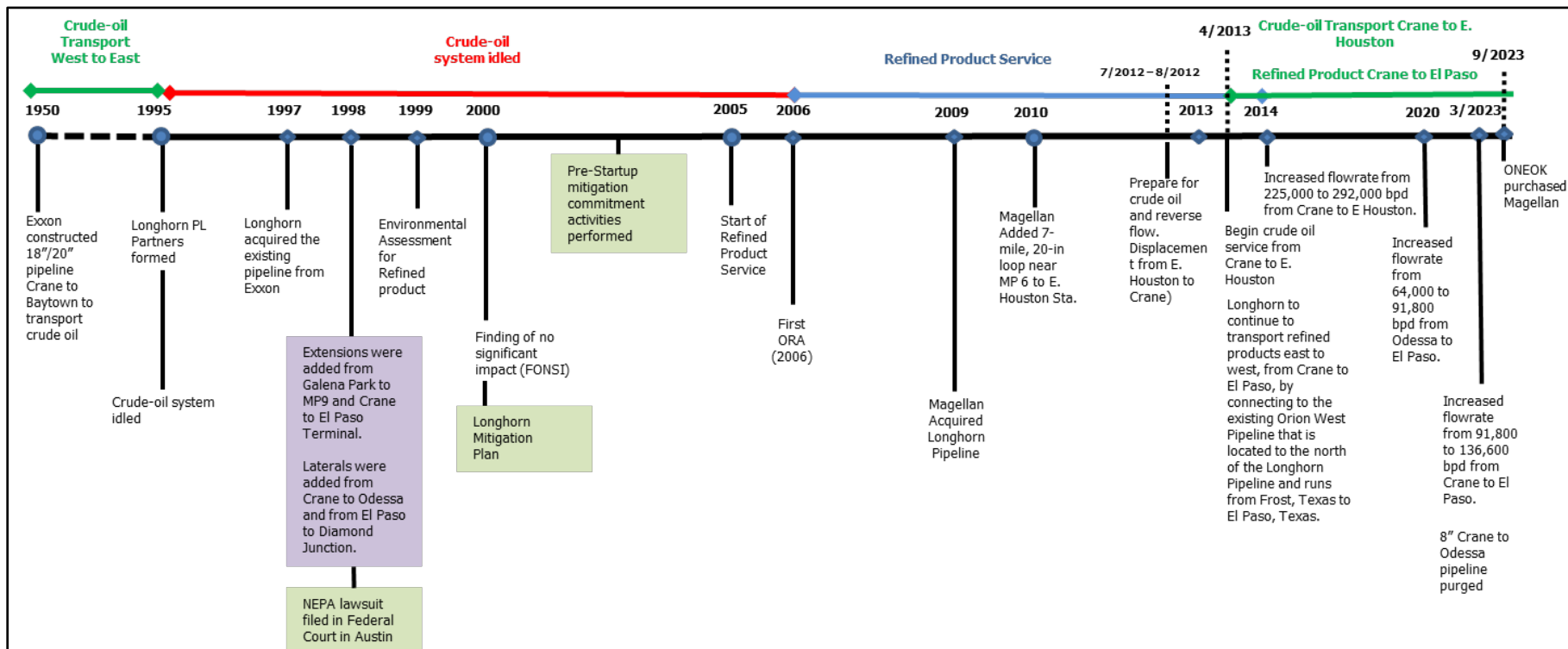


Figure 4. Timeline of the Longhorn Pipeline System

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 operating the pipeline and its associated assets. The LMP and SIP help to 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 11 pipeline segments assessed, with final reports received in 2023. The Crane to Texon segment was assessed in late 2023, with the final report received in 2024. The following ILI assessment tool was used for the 2023 EGP assessment: T.D. Williamson's (TDW) Deformation tool. The TDW magnetic flux leakage (MFL) and deformation tools assessed the following segments: Crane to Texon, Crane to Cottonwood, and 8" El Paso to Strauss. NDT Global's Ultrasonic Wall Thickness tool (EVO 1.0 Ump/Ump+) and Ultrasonic Crack tool (UCx) assessed the Crane to Texon segment in 2023. Refer to Table 2 for a list of assessments performed in 2023 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.

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Table 2. Longhorn System ILI Assessments

Buckhorn to Satsuma	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	Crane to Cottonwood	8" El Paso to Strauss
68.0 to 34.1	141.8 to 112.9	181.6 to 141.8	227.9 to 181.6	260.2 to 227.9	295.2 to 260.2	344.3 to 295.2	373.4 to 344.3	416.6 to 373.4	457.5 to 416.6	457.5 to 576.3	0 to 9.4
Corrosion											
									UT*	MFL	MFL
									27-Sep-23	5/5/2023	9/18/2023
Pressure Cycle Induce Fatigue											
									UCD*		
									13-Dec-23		
Laminations & Hydrogen Blisters											
									UT*		
									27-Sep-23		
Third-Party Damage											
Deformation	Deformation	Deformation	Deformation	Deformation	Deformation	Deformation	Deformation	Deformation	Deformation*	Deformation	Deformation
12-Jan-23	6-Jan-23	6-Jan-23	24-Jan-23	28-Mar-23	11-Jul-23	25-Jul-23	31-May-23	25-Apr-23	27-Sep-23	17-Mar-23	18-Sept-23

*Assessments were performed in 2023, and the final reports were received in 2024. Analysis to be part of the 2024 ORA Report.

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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 line segments 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 modern, post-1970 pipes. 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 may have grown 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 crack of a given size to resist tearing at a particular value of applied tensile stress. Toughness in pipeline steel has been found to correspond reasonably well to the value of "upper-shelf" energy as determined utilizing standard Charpy V-notch (CVN) impact tests. As noted in Reference [1], the full-size CVN energy levels 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 maximum operating pressure (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 2023 analysis, Magellan supplied the 2023 operational pressure data for the crude oil pipeline system from Crane Station to 9th Street Junction 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 2023 pressure readings were recorded at

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).

one-minute intervals from January 1, 2023, to December 31, 2023. Kiefner added the 2023 pressure data to all available data from previous years to create an operational pressure history for each segment. The cumulative pressure data used in each analysis depended on the consecutive years that Magellan provided pressure data to Kiefner in the same time interval and the date of the ILI run for the ultrasound crack detection (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 (~3.5 to 5.5)
Threshold Defects, Crane to E. Houston (Crude)	All since UCD ILI run (~3.5 to 5.5)
Threshold Defects, E. Houston to 9th St. Jct. (Crude)	8.5
Threshold Defects, Odessa to Crane (Product)	5.0
Threshold Defects, Crane to El Paso (Product)	10.0

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 reduce computation time. Then, Paris' law is applied to simulate crack growth. Kiefner's rainflow-counting process complies with ASTM E1049-85 guidelines.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 Existing Pipeline segments built around 1950 from Crane Station to the East Houston Terminal have been inspected using 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, and tool tolerance was added (0.3" for length and 0.036" for depth).

Threshold Defects

In addition to the known ILI features, hypothetical flaws based on the ILI detection thresholds and API 5L manufacturing standards 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

⁶ ASTM, "Standard Practices for Cycle Counting in Fatigue Analysis", E 1049, Annual Book of Standards, 2002.

run, Kiefner used the inspection standards for API 5L line pipe in 1998⁷, where the pipe was inspected ultrasonically using a calibration standard 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.

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. To be conservative, Kiefner used the location of each pipe joint with similar attributes (grade, wall thickness, and other attributes) closest to the pump discharge. Calculating fatigue life at points further downstream is unnecessary as they will have a longer fatigue life (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' law⁹, shown below:

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

Kiefner's Pipelife software uses Paris' law to estimate the crack growth for a given flaw, using the rainflow-counted pressure cycles to calculate the change in stress intensity (da/dN is the increment of crack growth per load cycle, ΔK is the change of 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]). Crack growth is iteratively calculated until failure (burst pressure less than or equal to MOP). Based on the supplied historical pressure data, the cumulative pressure cycles at failure are 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 as 45% of the shortest predicted remaining life, corresponding to a safety factor of 2.22 as specified in the ORAPM and per the LMP.

⁷ API 5L, "Specification for Line Pipe," 41st Edition. April 1, 1995.

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.

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 been established through large numbers of laboratory tests published in the Fitness-for-Service (FFS) API Standard 579-1/ASME FFS-1.¹¹

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

The refined product segments' earliest reassessment due date was May 3, 2090, indicating that cyclic fatigue is an unlikely failure mode based on known defect data. Kiefner used the API 5L manufacturing inspection thresholds since Magellan has not run a UCD ILI tool on them.

For the Existing Pipeline crude oil segments, Crane to Texon had the earliest reassessment due date of August 20, 2027. Kiefner conducted all crude oil analyses using UCD ILI data except for East Houston to 9th Street Junction, which used API 5L manufacturing inspection thresholds (Magellan has not inspected this line segment with an ILI crack detection tool).

The results for the crude pipeline segment remained relatively consistent with the 2022 assessment performed by Kiefner, suggesting that pressure cycling for this pipeline has not changed significantly since 2022. Table 5 compares the current 2023 fatigue assessment results with previous assessments.

Table 4. Reassessment Due Date Before 2030

Pipeline Segment	OD (inch)	WT (inch)	Yield Stress (psi)	ILI Feature ID	ILI Log Distance (feet)	Re-assessment Interval (years)	Re-assessment Due Date	ILI Date
Crane to Texon	18	0.246	52,000	3585104	14,093.27	8.8	08/20/2027	10/19/2018
Crane to Texon	18	0.285	65,000	3585075	7,662.83	8.9	08/31/2027	10/19/2018
Cartman to Kimble	18	0.266	45,000	5956790	9,149.70	7.1	09/16/2027	08/25/2020
Crane to Texon	18	0.246	52,000	3585267	55,459.22	10.0	10/09/2028	10/19/2018
Crane to Texon	18	0.256	52,000	3585349	84,065.97	10.3	02/01/2029	10/19/2018
Crane to Texon	18	0.256	52,000	3585090	11,653.29	10.6	06/07/2029	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	2018 Report	2019 Report	2020 Report	2021 Report	2022 Report	2023 Report
East Houston to 9 th Street	03/15/2195	03/23/2170	08/04/2173	02/10/2033	11/27/2128	03/26/2223
Satsuma to East Houston	09/07/2034	04/03/2084*	03/03/2045*	03/29/2046*	04/07/2048*	03/03/2048*
Buckhorn to Satsuma	10/17/2034	05/05/2034	11/27/2046*	08/09/2047*	08/05/2048*	11/29/2048*
Warda to Buckhorn	09/19/2030	03/06/2030	03/22/2039*	01/10/2041*	06/04/2043*	07/23/2043*
Bastrop to Warda	10/06/2024	08/09/2024	08/10/2035*	05/12/2054*	02/02/2036*	12/21/2035*
Cedar Valley to Bastrop	03/08/2044	08/08/2043	06/11/2053*	07/14/2054*	12/22/2052*	10/06/2052*
Eckert to Cedar Valley	10/07/2032	09/12/2031	04/04/2042*	09/17/2044*	02/18/2047*	10/17/2047*
James River to Eckert	03/28/2025	04/30/2025	02/20/2043*	08/16/2042*	05/07/2043*	03/10/2044*
Kimble to James River	09/06/2027	10/28/2027	01/16/2028	10/23/2047*	02/11/2047*	12/27/2044*
Cartman to Kimble	05/20/2024	07/04/2024	11/13/2040*	02/21/2041*	08/28/2027*	09/16/2027*
Barnhart to Cartman	12/01/2036	10/22/2037	01/31/2039*	09/27/2038*	11/13/2038*	06/26/2038*
Texon to Barnhart	12/25/2022	12/28/2022	06/24/2037*	06/27/2040*	08/13/2030*	09/20/2030*
Crane to Texon	01/28/2023	08/07/2025*	06/29/2024*	12/21/2026*	04/05/2027*	08/20/2027*
Crane to El Paso	01/04/2498	01/04/2498	03/25/2233	03/25/2233	03/25/2233	03/26/2223
Odessa to Crane	N/A	N/A	N/A	04/08/2084	09/27/2093	05/03/2090

*Based on ILI indications 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 2023, two pipeline segments were assessed using MFL and electronic geometry pigs (EGP) technology. One pipeline segment was assessed using Ultrasonic Wall Thickness, Ultrasonic Crack, and EGP. Nine pipeline segments were addressed using EGP only. Refer to Table 2 for a list of assessments performed in 2023 by pipeline segment. Magellan performed seven ILI anomaly investigations in 2023. Kiefner’s review of the ILI 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 2023 assessment in Table 2. The general results for all of the reviewed 2023 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. Items to note:

- 8" El Paso to Strauss:
 - TDW notes that one DEF sensor was out of tolerance between 169,500 ft absolute distance and the end of the assessment. The probability of identification (POI) and detection (POD) are not affected, but the sizing accuracy may be impacted.
- Cartman to Kimble:
 - TDW notes that one DEF sensor was intermittently out of tolerance between 6,910 ft absolute distance and the end of the assessment and had approximately 3,969 ft of data loss. TDW checked all dents and GMAs reported on the line segment, and none of the features interacted with the intermittent sensor. POI and POD are not affected, but the sizing accuracy may be impacted.
- Buckhorn to Satsuma:
 - TDW notes one area of debris from 35,045.92 to 35,085.23 ft absolute distance.

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 2023 are listed in Table 2. An overall ILI reassessment schedule can be found in Section 4, Table 36 for the crude system and Table 37 for the refined system. The next crude system assessment for corrosion is in 2024 for the following segments: Warda to Buckhorn, Satsuma to E. Houston, and E. Houston to Speed Junction. The next refined system assessment for corrosion is in 2026 for the Odessa to Crane segment.

A run-to-run comparison was performed to determine external and internal corrosion growth rates (CGRs) for the ILI assessments performed and received in 2023. The two segments reviewed: 8" El Paso to Strauss and Crane to Cottonwood. No pipe replacements were noted on either segment between the two assessments. The matched results from the run-to-run comparison are shown in Table 6. CGRs were calculated for both pipeline segments and are shown in Table 7. 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			
Crane to Cottonwood	8,864	101	8,965	18,770	47.8
8" El Paso to Strauss	60	2	62	95	65.3

Table 7. Corrosion Growth Rate Results

Segment	Upper Bound CGR (mpy)		
	EXT ML	INT ML	EXT/INT ML Mismatches
Crane to Cottonwood	3.10	2.77	3.42
8" El Paso to Strauss	6.96	4.03	N/A

External corrosion growth along a pipeline should be expected to have the potential for variability along the pipeline length due to differences in cathodic protection, coating conditions, pipe age, and environment. Internal corrosion growth should also be expected to vary along the length of the pipeline due to elevation changes, potential liquid along the inside, 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 and Figure 6 provide ML frequency histograms for the Crane to Cottonwood and 8" El Paso to Strauss segments, respectively.

- Figure 5 shows histograms for the Crane to Cottonwood segment's external and internal ML features. Both assessments (2018 and 2023) had a 10% WT depth threshold and used a 6t x 6t interaction rule. Figure 5 indicates the 2023 ILI assessment reports more metal loss features than the 2018 ILI assessment. All reported ML features from both assessments had reported depth $\leq 39\%$ WT. The 2018 assessment reported 18,635 internal (10-36% WT) and 135 external metal loss features (10-18% WT). The 2023 assessment reported 21,611 internal (10-39% WT) and 195 external metal loss features (10-24% WT).
- Figure 6 shows histograms for the 8" El Paso to Strauss segment's external and internal ML features. Both assessments (2018 and 2023) had a 10% WT depth threshold and used a 6t x 6t interaction rule. Figure 6 shows similar ML feature counts between the two ILI assessments. The 2018 assessment reported 39 internal and 58 external metal loss features. The 2023 assessment reported 36 internal and 59 external metal loss features. All ML features from both assessments had reported depths $\leq 39\%$ WT.

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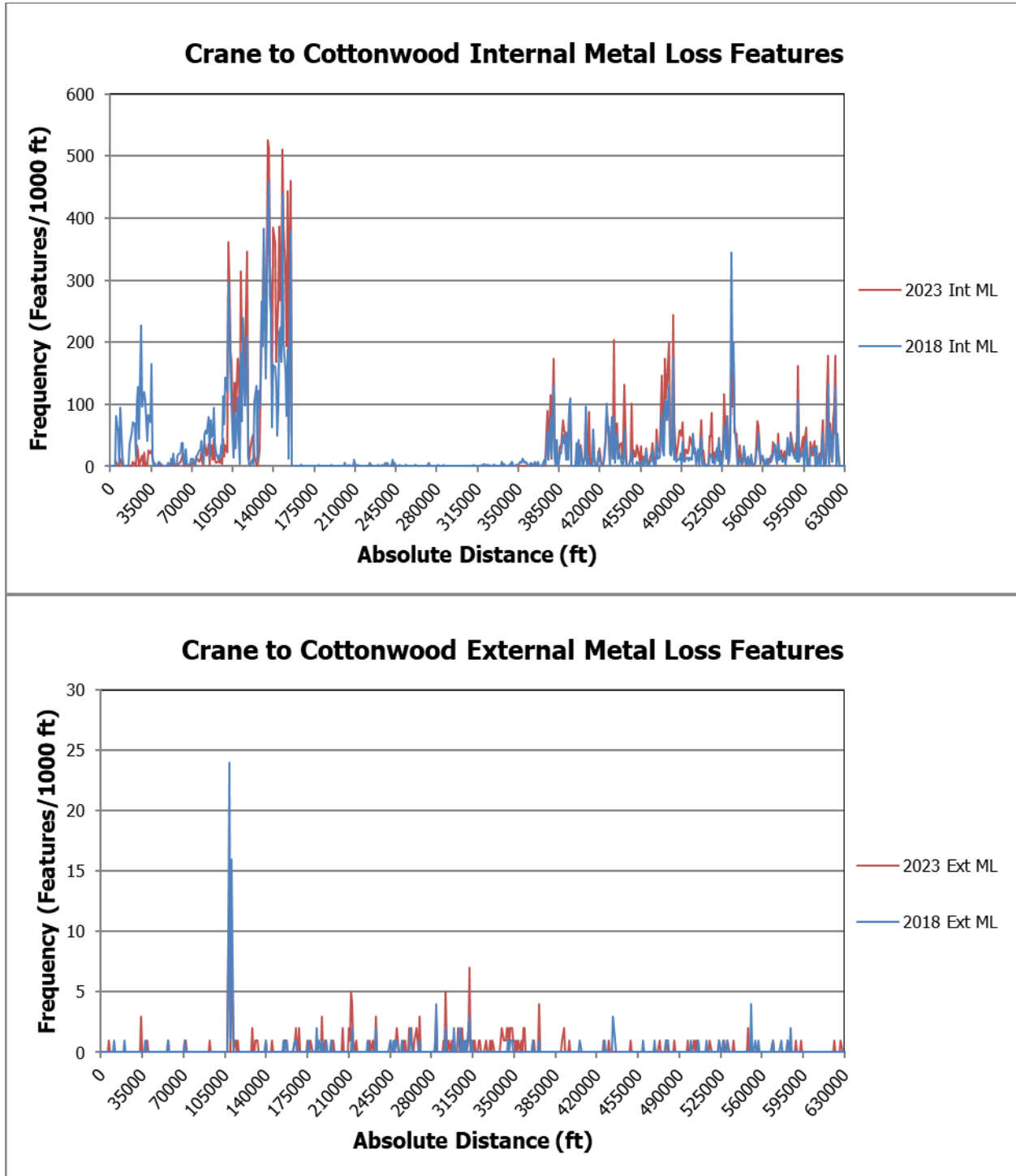


Figure 5. Crane to Cottonwood ML Frequency by Linear Distance Along the Pipeline (2018 MFL vs 2023 MFL)

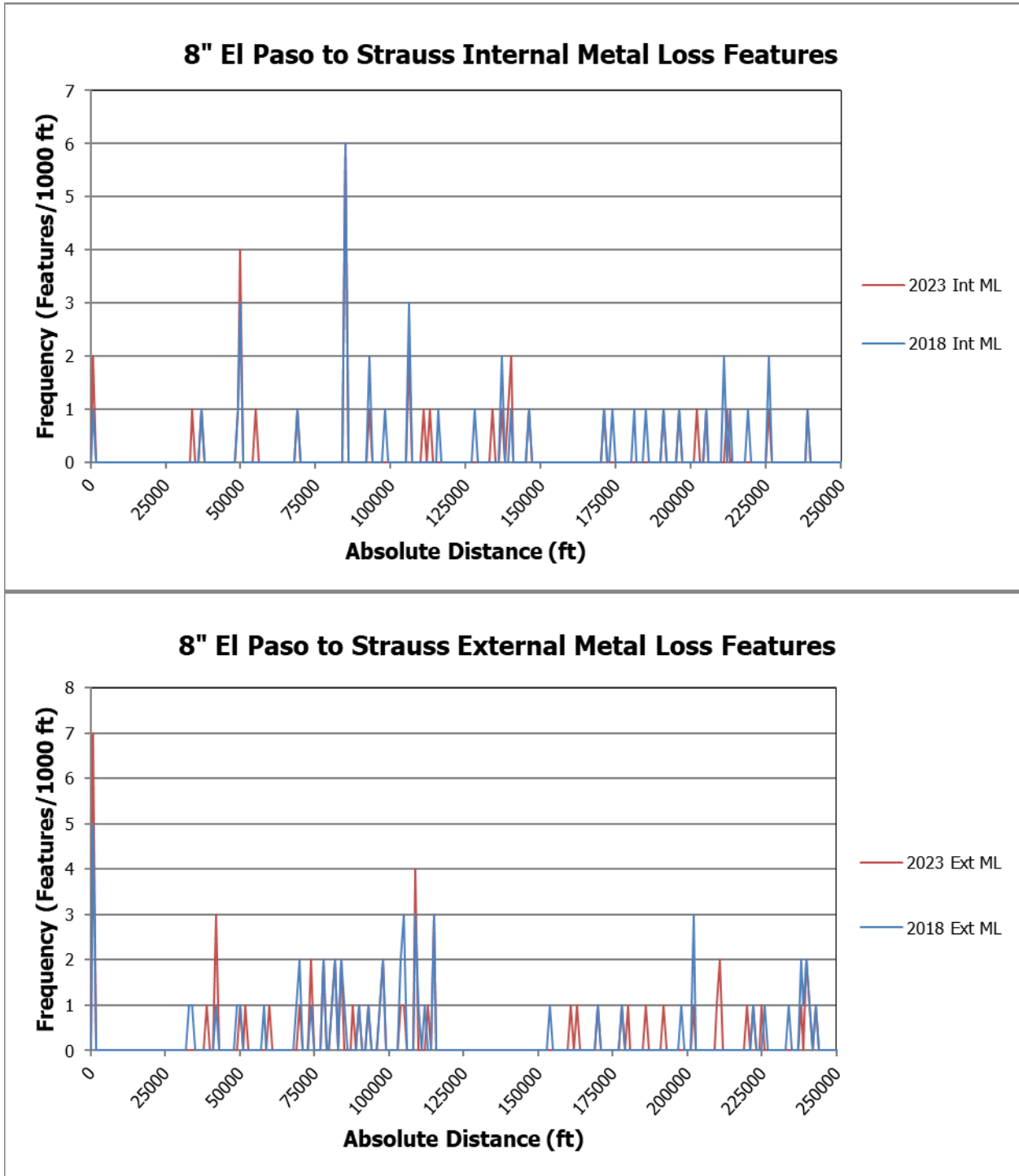


Figure 6. 8" El Paso to Strauss ML Frequency by Linear Distance Along the Pipeline (2018 MFL vs 2023 MFL)

2.2.2 Girth Weld Anomaly Assessment

Kiefner assessed and reviewed girth weld anomalies (GWA) reported by the LH Crane to Cottonwood 18" 2023 MFL pipeline listing. This assessment aims to determine whether these anomalies are fit for continued safe service. GWA assessments were completed by evaluating the potential for failure due to the circumferential extent of the features subjected to longitudinal stress. The GWAs were assumed to be subject to internal pressure loading and external bending loads and located at maximum bending stress.

The Miller Solution was used to evaluate the GW's plastic collapse strength or longitudinal stress capacity with the anomalies. Research performed by the pipeline industry and the Pipeline Research Council International (PRCI) has shown that the Miller Solution, as modified by Want et al., gives an appropriate expression for determining the load for blunt-tip flaws such as metal-loss corrosion.^{12;13;14;15} This approach has been validated by many years of practical application, detailed numerical analysis, and comparison to full-scale fracture tests.

Although other assessment techniques for axial loads on circumferential flaws have been developed and used, Kiefner's review of the various techniques indicated the Miller analysis to be suitable. In addition, the Miller Solution, as modified by Wang et al., has been incorporated into the CSA Z662-2015 standard.¹⁶

An allowable longitudinal stress limit of 80% of the specified minimum yield strength (SMYS) is the criterion for critical displacement to account for fault movement due to seismic activity. Therefore, an applied stress level of 80% SMYS has been considered as the worst-case scenario based on the maximum allowable value for FFS. 80% SMYS represents a safety factor (SF) of 1.25 relative to SMYS for a defect-free pipe. A feature (GW anomaly) with a safety factor of 1.25 or greater is considered safe and acceptable. The safety factor is defined as:

$$SF = \frac{\sigma_F}{\sigma_L}$$

SF = Safety factor

σ_F = Predicted failure stress of assumed anomaly using the Miller solution, psi

σ_L = Longitudinal stress from MOP and assumed bending stresses, psi

Table 8 summarizes the reported GW anomaly number, circumferential length, predicted failure stress, applied longitudinal stress, and safety factors along the crude pipeline. The safety factors are greater than 1.25, indicating that the GW anomaly reported by 2023 ILI runs is considered safe and acceptable for continued service.

¹² Rosenfeld, M. J., "Serviceability of Corroded Girth Welds", PRCI Catalog Number L51742 (May 31, 1996).

¹³ Wang, Y. Y., Swatzel, J. F., Horsley, D., and Glover, A., "Girth Weld Criteria from the Perspective of Code Revisions in North America", *Proceedings of IPC'02, 4th International Pipeline Conference*, Calgary, Alberta, Canada (September 29-October 3, 2002).

¹⁴ Wang, Y.-Y., and Liu, M., "A Comprehensive Update in the Evaluation of Pipeline Weld Defects", draft report to DOT/PRCI, US DOT Agreement No. DTRS56-03-T0008, PRCI Contract No. PR-276-04503, November 2004, Appendix D.

¹⁵ Wang, Y.Y., Liu, M., Horsley, D., and Bauman, G., "A Tiered Approach to Girth Weld Defect Acceptance Criteria for Stress-Based Design of Pipelines", IPC2006-10491, Proc. of 6th International Pipeline Conference, Sept. 25-29, 2006, Calgary, AB, Canada.

¹⁶ Canadian Standards Association, CSA-Z662-2015, "Oil and Gas Pipeline Systems" (2015).

Table 8. GW Anomaly Summary of Crane to Cottonwood

Segment	Reported GW Anomalies	Circ. Length (inch)	Predicted Failure Stress (psi)	Applied Stress (psi)	Safety Factor
Crane-Cottonwood	1	2.40	56,642	19,736	2.87

2.2.3 Maintenance Reports and In-Ditch Evaluations

In 2023, Magellan performed seven in-ditch ILI assessments corresponding to ILI assessments (2022 MFL/EGP and 2023 EGP). Anomaly investigations included nondestructive evaluation (NDE) reports with detailed investigation results. Table 9 provides a breakdown, per pipeline segment, of where the in-ditch assessments occurred (high consequence area (HCA), segment, and tier). The total number of ILI anomalies addressed per pipeline segment in 2023 is listed in Table 10. 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 PMI¹⁷ tests to be completed at 50% of the ILI anomaly investigation locations that do not have material documentation. In 2023, Magellan performed seven ILI anomaly investigations. Only one site met the PMI requirement. Magellan performed PMI testing at the one investigation location, satisfying PMI requirements. Since the start of PMI testing in 2014, Magellan has performed PMI testing at 395 dig locations. Table 11 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 segment. 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 five-mile span would require five PMI tests in succession. The final summary is shown in Table 12.

¹⁷ 2012 Longhorn Pipeline Reversal EA (Reference [6]).

Table 9. ILI Anomaly Investigation Digs per Maintenance Reports Completed in 2023

	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	8/5/22								1/24/23	1/6/20										
Maintenance Report	Yes	No	No	No	No	No	No	No	Yes	Yes	No	No	No	No	No	No	No	No	No	No
Tier I	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tier II	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Tier III	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Total Digs	5	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
HCA	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0
Non-HCA	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 10. Reported ILI Anomalies Excavated per 2023 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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Internal ML	34	34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Internal ML at Girth Weld	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mill Anomaly w/ML	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Crack-like feature at Seam Weld	0	0	0	0	0	0	0	0	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	1	1	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	0	0	0	1	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	36	35	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0

Table 11. Positive Material Identification Testing Activity

	Pipeline Segment	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Total
Refined System*	8" El Paso to Chevron	0	0	0	0	0	0	0	0	0	0	0
	8" Crane to Odessa	0	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	0
	18" Cottonwood to El Paso	0	0	0	0	0	0	0	0	0	0	0
	18" Crane to Cottonwood	0	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	0	31
	18" Texon to Barnhart	0	0	8	3	0	0	2	18	13	0	44
	18" Barnhart to Cartman	0	0	11	0	0	0	0	14	2	0	27
	18" Cartman to Kimble	0	0	12	0	0	0	0	21	1	0	34
	18" Kimble to James River	0	0	5	0	0	0	0	9	3	0	17
	18" James River to Eckert	0	1	3	0	0	0	0	24	0	0	28
	18" Eckert to Cedar Valley	1	0	6	7	0	0	15	6	0	1	36
	18" Cedar Valley to Bastrop	0	0	20	6	0	0	35	7	0	0	68
	18" Bastrop to Warda	0	1	3	4	0	0	34	6	0	0	48
	18" Warda to Buckhorn	0	2	0	14	0	0	18	0	0	0	34
	18" Buckhorn to Satsuma	0	0	0	8	0	0	8	0	0	0	16
	20" Satsuma to E. Houston	0	4	0	0	0	3	4	1	0	0	12
	20" E. Houston to 9 th Street Junction*	0	0	0	0	0	0	0	0	0	0	0
Total PMI Tests Performed		1	9	75	42	4	18	116	110	19	1	395
Segments without available Material Documentation		2	18	141	64	7	31	232	195	37	1	728
Percentage Addressed (%) (Requirement of 50%)		50	50	53	65	57	58	50	56	51	100	54

*Per the EA, the refined system and the 20" East Houston to 9th Street Junction segments do not require PMI testing.

Table 12. 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	7.0	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 2023 EGP assessments correlated with the 2023 dig results for the following segments: Eckert to Cedar Valley and Cedar Valley to Bastrop. The Cottonwood to El Paso segment correlated to the 2022 MFL/EGP assessment. Dig results were provided through in-ditch ILI anomaly investigation maintenance and NDE reports. ILI anomaly investigations resulted in nine individually correlated metal loss features and two individually correlated ID reduction features. Table 13 shows the correlation between the ILI anomaly investigation data for metal loss and ID reduction features. No crack-like features were targeted in 2023.

Table 13. 2023 ILI Field Investigation Correlations

Pipeline Segment	INT ML to INT ML	Dent to Dent	Geometric Anomaly to Geometric Anomaly	Total Data Correlations
8-in El Paso to Chevron	0	0	0	0
8-in Odessa to Crane	0	0	0	0
12-in El Paso to Kinder Morgan	0	0	0	0
18-in Cottonwood to El Paso	9	1	0	10
18-in Crane to Cottonwood	0	0	0	0
18-in Crane to Texon	0	0	0	0
18-in Texon to Barnhart	0	0	0	0
18-in Barnhart to Cartman	0	0	0	0
18-in Cartman to Kimble	0	0	0	0
18-in Kimble to James River	0	0	0	0
18-in James River to Eckert	0	0	0	0
18-in Eckert to Cedar Valley	0	0	1	1
18-in Cedar Valley to Bastrop	0	0	0	0
18-in Bastrop to Warda	0	0	0	0
18-in Warda to Buckhorn	0	0	0	0
18-in Buckhorn to Satsuma	0	0	0	0
18-in Satsuma to E. Houston	0	0	0	0
18-in E. Houston to Speed Jct	0	0	0	0
Total	9	1	1	11

2.2.4 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 $\geq 2.0\%$ of the pipe diameter are classified as dents, and ID reductions $< 2.0\%$ are classified as GMAs.

The 2023 EGP assessments reported 1055 ID reductions (117 dents and 938 GMAs) with depths ranging from 1.0% to 4.6% OD. As noted in the ILI pipeline listings, 13 ID reductions (nine dents and four GMAs) are indicated as possibly repaired. One hundred and eight dents and 934 GMAs constitute the remaining 1042 ID reductions. The ILI assessments reported no dents or GMAs associated with metal loss, girth welds, or seam welds.

Two hundred and fifty-two ID reductions are reported in an HCA, with eight noted as possibly repaired and one noted as previously repaired. 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. Six segments did not have ID reductions reported in an HCA: 8" El Paso to Strauss, Crane to Cottonwood, Texon to Barnhart, Barnhart to Cartman, Cartman to Kimble, and Buckhorn to Satsuma. 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 HCAs¹⁸

Segment	Quantity	Quantity Noted as Repaired	Peak Depth (% OD)*	Comment
Kimble to James River	80	0	3.7~	<ul style="list-style-type: none"> • 12 Dents (2.1 - 3.7% OD) • 68 GMAs (1.0 - 1.9% OD)
James River to Eckert	33	0	2.7	<ul style="list-style-type: none"> • One Dent (2.7% OD) • 32 GMAs (1.0 - 1.8% OD)
Eckert to Cedar Valley	126	8	4.2~	<ul style="list-style-type: none"> • 25 Dents (2.0 - 4.2% OD) <ul style="list-style-type: none"> ○ Five noted as possibly repaired (2.2 - 3.3% OD) • 101 GMAs (1.0 - 1.9% OD) <ul style="list-style-type: none"> ○ Three noted as possibly repaired (1.1 - 1.9% OD)
Cedar Valley to Bastrop	10	1	2.4	<ul style="list-style-type: none"> • 1 Dent (3.1% OD) noted as previously repaired • 2 Dents (2.2 & 2.4% OD) • 7 GMAs (1.0 - 1.8% OD)
Bastrop to Warda	3	0	1.4	<ul style="list-style-type: none"> • 3 GMAs (1.1 - 1.4% OD)
Total	252	9		

*Peak depth is the deepest unmitigated ID Reduction in an HCA for that pipeline segment.

~Feature is located on the bottom 1/3 of the pipe.

2.2.5 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 2023 EGP assessments with laminations reported from the 2009/2010 UT assessment. Eleven dents and 53 GMAs reported from the 2023 EGP assessments were present on the same joint with lamination(s) reported from the

¹⁸ 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.

2009/2010 UT assessments (Table 15). The one GMA on the Cartman to Kimble segment correlated directly to the UT assessment laminations. Two joints (one on the Kimble to James River segment and one on the Eckert to Cedar Valley segment) have previous repairs. No correlations of features were reported on associated joints on the Cedar Valley to Bastrop and Bastrop to Warda segments. The 2023 EGP assessment on the Cedar Valley to Bastrop segment reported a 'wrinkle' on Joint 37800. The 2010 UT assessment reported an 'Intermittent Lamination' on this associated joint.

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Table 15. ID Reductions Correlating with Laminations¹⁹ (page 1 of 3)

Segment	Quantity			Peak Depth (% OD)	Joints from the 2023 Assessment	Comment
	Joint(s)	Dent(s)	GMA(s)			
Crane to Texon	1	-	2	1.4	43100	<ul style="list-style-type: none"> • 2023 joint: 43100 reported two GMAs; 2010 UT assessment reported three 'Intermittent Laminations' on the associated joint.
Texon to Barnhart	1	1	-	2.0~	4730	<ul style="list-style-type: none"> • 2023 joint: 4730 reported a Dent; 2010 UT assessment reported five 'Intermittent Laminations' on the associated joint.
Barnhart to Cartman	3	1	2	2.6~	14040, 25760, and 26460	<ul style="list-style-type: none"> • 2023 joint: 14040 reported a GMA; 2010 UT assessment reported a lamination on the associated joint. • 2023 joint: 25760 reported a GMA; 2010 UT assessment reported two 'Intermittent Laminations' on the associated joint. • 2023 joint: 26460 reported a Dent; 2010 UT assessment reported a correlating dent and three 'Intermittent Laminations' on the associated joint.
Cartman to Kimble	17	1	17	2.3~	4430, 14610, 21360, 23680, 24520, 26240, 27190, 31760, 43300, 46370, 46460, 46840, 49790, 50150, 53640, 59930, and 66710	<ul style="list-style-type: none"> • 2023 joint: 4430, 14610, 21360, 26240, 27190, 46370, 49790, 50150, and 59930 reported a GMA; 2010 UT assessment reported one 'Intermittent Lamination' on the associated joint. • 2023 joint: 23680 and 46840 reported a GMA; 2010 UT assessment reported two 'Intermittent Laminations' on the associated joint. • 2023 joint: 24520 reported two GMAs; 2010 UT assessment reported two 'Intermittent Laminations' on the associated joint. • 2023 joint: 31760 reported a Dent; 2010 UT assessment reported two 'Intermittent Laminations' on the associated joint. • 2023 joint: 43300 and 46460 reported a GMA; 2010 UT assessment reported a lamination and four 'Intermittent Laminations' on the associated joint; one inclusion field was also reported on the same joint. • 2023 joint: 53640 reported a GMA; 2010 UT assessment reported a lamination and three 'Intermittent Laminations' on the associated joint; one inclusion field was also reported on the same joint. • 2023 joint: 66710 reported a GMA; 2010 UT assessment reported a lamination and three 'Intermittent Laminations' on the associated joint.

[^] Feature was found to correlate to the 2010 UT assessment.

~Largest unmitigated Dent or GMA.

¹⁹ Features may not be directly correlating (i.e., overlapping area), but were identified in this table if reported on the same joint.
Kiefner and Associates, Inc.

Table 15 (continued). ID Reductions Correlating with Laminations²⁰ (pg 2 of 3)

Segment	Quantity			Peak Depth (% OD)	Joints from the 2023 Assessment	Comment
	Joint(s)	Dent(s)	GMA(s)			
Kimble to James River	10	1	10	1.4~	7590, 8330, 21520, 24130, 29830, 30670*, 36510, 37880, 39450, and 45300	<ul style="list-style-type: none"> • 2023 joint: 7590 reported a GMA; 2010 UT assessment reported one lamination and two 'Intermittent Laminations' on the associated joint. • 2023 joint: 8330, 37880, 39450, and 45300 reported a GMA; 2010 UT assessment reported one 'Intermittent Lamination' on the associated joint. • 2023 joint: 21520 reported a GMA; 2010 UT assessment reported two laminations and two 'Intermittent Laminations' on the associated joint. • 2023 joint: 24130 reported a GMA; 2010 UT assessment reported two laminations and one 'Intermittent Lamination' on the associated joint. • 2023 joint: 29830 reported a GMA; 2010 UT assessment reported three 'Intermittent Laminations' on the associated joint. • 2023 joint: 30670 reported one Dent and one GMA; 2010 UT assessment reported one lamination and one 'Intermittent Lamination' on the associated joint. • 2023 joint: 36510 reported a GMA; 2010 UT assessment reported one lamination on the associated joint.
James River to Eckert	8	3	6	2.4~	3200, 17900, 19670, 27530, 28280, 36610, 41080, and 42070	<ul style="list-style-type: none"> • 2023 joint: 3200 and 41080 reported a Dent; 2010 UT assessment reported one "Intermittent Lamination" on the associated joint, and one inclusion on the whole joint was also reported on the joint. • 2023 joint: 17900 reported a Dent; 2010 UT assessment reported three laminations on the associated joint. • 2023 joint: 19670 reported a GMA; 2010 UT assessment reported one lamination and three 'Intermittent Laminations' on the associated joint. • 2023 joint: 27530 reported a Dent; 2010 UT assessment reported one 'Intermittent Lamination' on the associated joint. • 2023 joint: 28280 reported a GMA; 2010 UT assessment reported one lamination on the associated joint. • 2023 joint: 36610 reported a GMA; 2010 UT assessment reported six laminations, one 'Intermittent Lamination,' and one inclusion on the associated joint. • 2023 joint: 42070 reported two GMAs; 2010 UT assessment reported one lamination on the associated joint.

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

²⁰ Features may not be directly correlating (i.e., overlapping area), but were identified in this table if reported on the same joint.
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Table 15 (continued). ID Reductions Correlating with Laminations²¹ (pg 3 of 3)

Segment	Quantity			Peak Depth (% OD)	Joints from the 2023 Assessment	Comment
	Joint(s)	Dent(s)	GMA(s)			
Eckert to Cedar Valley	19	4	15	3.3~	2520, 9490, 10800, 16390, 16420, 18630, 18830, 21350, 25980*, 28130, 28180, 30490, 30710, 31860, 33870, 38030, 38160, 40110, and 40190	<ul style="list-style-type: none"> • 2023 joint: 2520, 9490, 16390, 16420, and 25980 reported a GMA; 2010 UT assessment reported one lamination on the associated joint. • 2023 joint: 10800, 18630, 18830, 21350, 28180, and 40110 reported a GMA; 2010 UT assessment reported one 'Intermittent Lamination' on the associated joint. • 2023 joint: 28130 reported a GMA; 2010 UT assessment reported two laminations and one 'Intermittent Lamination' on the associated joint. • 2023 joint: 30490 reported a Dent; 2010 UT assessment reported two laminations and two 'Intermittent Lamination' on the associated joint. • 2023 joint: 30710 reported a Dent; 2010 UT assessment reported one 'Intermittent Lamination' on the associated joint. • 2023 joint: 31860 and 38160 reported a GMA; 2010 UT assessment reported two 'Intermittent Laminations' on the associated joint. • 2023 joint: 33870 reported a Dent; 2010 UT assessment reported four laminations and two 'Intermittent Laminations' on the associated joint. • 2023 joint: 38030 reported a Dent; 2010 UT assessment reported a correlated dent and one lamination on the associated joint. • 2023 joint: 40190 reported a GMA; 2010 UT assessment reported three 'Intermittent Laminations' on the associated joint.
Buckhorn to Satsuma	1	-	1	1.1~	14880	<ul style="list-style-type: none"> • 2023 joint: 14880 reported a GMA; 2009 UT assessment reported one 'Intermittent Lamination' that correlates to the 2023 reported GMA.
Total	60	11	53			

*Feature has been repaired or addressed.

~Largest unmitigated Dent or GMA.

²¹ Features may not be directly correlating (i.e., overlapping area), but were identified in this table if reported on the same joint.
Kiefner and Associates, Inc.

A review of the 2023 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 assessments in 2023. 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 2024 for two segments: Satsuma to E. Houston and E. Houston to Speed Junction, see Table 36.

2.3 Corrosion Management Plan

The LMP entails an extensive corrosion management plan (CMP) to control the extent of corrosion. The 2023 CMP considered the following items: the 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 the 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 Crane to Cottonwood and El Paso to 8" Strauss segments, assessed by MFL in 2023. The POE calculations incorporated the ILI tool specifications (TDW MFL) and utilized a CGR of five mpy for external ML and one mpy for internal ML over a five-year range. Three metal loss features on the Crane to Cottonwood segment had a calculated POE value of $10E^{-7}$; see Table 16. No metal loss features on the El Paso to 8" Strauss segment had a calculated POE value of $10E^{-7}$ or greater.

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

Pipeline Segment	Absolute Distance (feet)	Predicted Depth (% WT)	Predicted Length (inch)	POE	POE Type
Crane to Cottonwood	200468.4	39	0.69	2.58 E-07	Depth
Crane to Cottonwood	101761.0	25	22.53	1.68 E-07	Pressure
Crane to Cottonwood	366228.0	16	2.44	1.01 E-07	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 December 8, 2022, and December 29, 2023. The Longhorn system's coupon testing days were from 59 to 155 days. Magellan achieved three evaluation times in 2023 for all crude and refined line locations. One coupon from the 18" Cedar Valley Station was lost in the line. Two coupons from the 8" Odessa to Crane segment were lost in the line. The coupon testing results for the remaining coupons observed corrosion rates ranging from no corrosion to the maximum of 0.17 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 lines, 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	Pasadena	Speed Jct Manifold from E Houston (6643)	AB5415	12/9/2022	4/11/2023	123	0.04
20	Pasadena	Speed Jct Manifold from E Houston (6643)	AB8561	4/11/2023	8/14/2023	125	0.05
20	Pasadena	Speed Jct Manifold from E Houston (6643)	AB8398	8/14/2023	12/8/2023	116	0.00
20	E. Houston	East Houston ML (6645)	N3703	12/14/2022	4/14/2023	121	0.02
20	E. Houston	East Houston ML (6645)	N3771	4/14/2023	8/15/2023	123	0.03
20	E. Houston	East Houston ML (6645)	N3800	8/15/2023	12/12/2023	119	0.00
18	Austin	18" Satsuma Station (6645)	AB5425	12/15/2022	4/14/2023	120	0.02
18	Austin	18" Satsuma Station (6645)	AB8564	4/14/2023	8/14/2023	122	0.05
18	Austin	18" Satsuma Station (6645)	AB8401	8/14/2023	12/19/2023	127	0.02
18	Austin	18" Cedar Valley Station (6645)	AB5417	12/15/2022	4/14/2023	133	0.06
18	Austin	18" Cedar Valley Station (6645)	AB8563	4/27/2023	8/28/2023	123	0.03
18	Austin	18" Cedar Valley Station (6645)	AB8400	8/14/2023	12/19/2023	123	Lost
18	Austin	18" Cartman Station (6645)	AB5416	12/20/2022	4/4/2023	105	0.02
18	Austin	18" Cartman Station (6645)	AB8562	4/4/2023	9/6/2023	155	0.00
18	Austin	18" Cartman Station (6645)	AB8399	10/20/2023	12/18/2023	59*	0.03
24	Crane	24" Tank Manifold	N3700	12/15/2022	4/13/2023	119	0.17
24	Crane	24" Tank Manifold	N3768	4/13/2023	8/16/2023	125	0.04
24	Crane	24" Tank Manifold	N3793	8/16/2023	12/25/2023	131	0.04

*Note: Short exposure days due to coupon holder repair.

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)	AB5412	1/3/2023	4/14/2023	101	0.00
12	El Paso	KM 12" (6651)	AB8559	4/14/2023	8/15/2023	123	0.00
12	El Paso	KM 12" (6651)	AB8646	8/15/2023	12/19/2023	126	0.00
8	El Paso	KM 8" flush (6652)	AB5413	1/13/2022	4/14/2023	101	0.00
8	El Paso	KM 8" flush (6652)	AB8558	4/14/2023	8/15/2023	123	0.00
8	El Paso	KM 8" flush (6652)	AB8393	8/15/2023	12/19/2023	126	0.00
8	Santa Teresa	Strauss 8" (6653)	AB5419	1/3/2023	4/13/2023	100	0.00
8	Santa Teresa	Strauss 8" (6653)	AB8565	4/13/2023	8/15/2023	124	0.00
8	Santa Teresa	Strauss 8" (6653)	AB8571	8/15/2023	12/19/2023	126	0.00
8	Crane	8" Odessa to Crane (6648)	N3701	12/15/2022	4/13/2023	119	Lost
8	Crane	8" Odessa to Crane (6648)	N3769	4/13/2023	8/16/2023	125	0.00
8	Crane	8" Odessa to Crane (6648)	N3794	8/16/2023	12/29/2023	135	Lost
18	El Paso	18" ML (6645)	N0010	12/20/2022	4/14/2023	115	0.00
18	El Paso	18" ML (6645)	N0013	4/14/2023	8/15/2023	123	0.00
18	El Paso	18" ML (6645)	N0015	8/15/2023	12/19/2023	126	0.00
8	El Paso	Plains-8" (6650)	N0011	12/20/2022	4/14/2023	115	0.01
8	El Paso	Plains-8" (6650)	N0014	4/14/2023	8/15/2023	123	0.00
8	El Paso	Plains-8" (6650)	N0016	8/15/2023	12/19/2023	126	0.00
12	El Paso	KM 12" (6651)	AB5412	1/3/2023	4/14/2023	101	0.00
12	El Paso	KM 12" (6651)	AB8559	4/14/2023	8/15/2023	123	0.00
12	El Paso	KM 12" (6651)	AB8646	8/15/2023	12/19/2023	126	0.00

2.3.3 Cathodic Protection System

The rectifier surveys, test point surveys, foreign bonds, and CIS were reviewed to evaluate the effectiveness of the current CP systems for the Longhorn pipeline system. Kiefner reviewed the following documents:

- 2024 PHMSA Audit Report
- Rectifier Maintenance Report
- Test Point Exceptions (Current Year) Selectable
- 6645 E. Houston – Crane Int-Depol Executive Summary – summarizes the 2023 CIS data for the crude pipeline from E. Houston to Crane, including all the Tier II and III areas.
- 6645 Interrupted Executive Summary Post Exception Repair – summarizes the 2023 CIS data for the petroleum pipeline from Crane to El Paso, including Tier I areas.

The rectifiers were inspected monthly in 2023, including the inspection date, as-found voltage and current, and as-left voltage and current, referring to the “2024 PHMSA Audit Report.”

Test point surveys were conducted throughout the Longhorn system in 2023, referring to the “2024 PHMSA Audit Report.” Annual surveys are being conducted in Tier I areas, and semi-annual surveys are being conducted in Tier II and Tier III areas per LMP 32.

A CIS for the crude pipeline from E. Houston to Crane (MP 2.367 to 457.544) was performed from October 2022 to February 2023 and received by Magellan in April 2023, referring to “6645 E. Houston – Crane Int-Depol Executive Summary.” This CIS survey covers 980 test stations, 111 casings, 135 rectifiers, 46 bonds, and 231 foreign line crossings. The CIS areas that did not meet any criteria are summarized in Table 19. Annual close-interval pipe-to-soil potential 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 the Association for Materials Protection and Performance (AMPP) SP0169-2013, ASME, and API recommended practices where applicable.

AMPP, formerly known as NACE International, has established criteria that are 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 decay of polarization 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 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 2023 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. Magellan performed a follow-up survey in March and April 2024 that cleared all exceptions from the 2023 CIS.

The 2023 CIS data also indicates that some pipe sections had the “instant off” readings slightly more electronegative than -1250 mV with respect to a CSE reference electrode, meaning the CP system may overprotect these pipe sections. Such areas are summarized in “6645 E. Houston - Crane Int-Depol Executive Summary” and “6645 Interrupted Executive Summary Post Exception Repair.” Over-cathodic protection may deteriorate pipe coatings due to electrical osmosis and hydrogen reactions weaken 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 from E. Houston to Crane (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				
1	9488+52	9488+77	25	179.707	179.712	30.23837496	-97.99114536	30.23837890	-97.99119910	-1.705	-0.502	-0.420	0.082
2	9490+24	9490+51	27	179.739	179.745	30.23841755	-97.99163179	30.23842803	-97.99173772	-1.718	-0.542	-0.447	0.095
3	9549+38	9549+41	3	180.859	180.860	30.23944191	-98.01029208	30.23944191	-98.01029208	-1.632	-0.464	-0.382	0.082
4	9612+23	9612+35	12	182.050	182.052	30.24312346	-98.02941568	30.24312686	-98.02946473	-1.290	-0.429	-0.349	0.080
5	9615+58	9615+61	3	182.113	182.114	30.24331426	-98.03040074	30.24331426	-98.03040074	-1.142	-0.458	-0.359	0.099
6	9615+63	9615+66	3	182.114	182.115	30.24331712	-98.03041504	30.24331712	-98.03041504	-1.147	-0.458	-0.359	0.099
7	9615+99	9616+02	3	182.121	182.122	30.24333572	-98.03052521	30.24333620	-98.03053284	-1.143	-0.445	-0.348	0.097
8	9625+25	9625+30	5	182.296	182.297	30.24396397	-98.03327824	30.24396529	-98.03328528	-1.359	-0.415	-0.316	0.099
9	9625+62	9625+87	25	182.303	182.308	30.24397786	-98.03337097	30.24398151	-98.03343743	-1.376	-0.422	-0.331	0.091
10	9626+19	9626+47	28	182.314	182.320	30.24399492	-98.03351745	30.24401212	-98.03359755	-1.392	-0.419	-0.326	0.093
11	9629+60	9629+68	8	182.379	182.380	30.24425697	-98.03451995	30.24425697	-98.03453825	-1.412	-0.435	-0.349	0.086
12	9632+65	9632+68	3	182.437	182.437	30.24462837	-98.03527797	30.24462837	-98.03527797	-1.389	-0.438	-0.340	0.098
13	9632+98	9633+03	5	182.443	182.444	30.24467649	-98.03535585	30.24468336	-98.03536911	-1.376	-0.438	-0.339	0.099
14	9633+10	9633+13	3	182.445	182.446	30.24469224	-98.03538972	30.24469520	-98.03539659	-1.376	-0.438	-0.339	0.099
15	9640+61	9640+64	3	182.587	182.588	30.24556977	-98.03736346	30.24557339	-98.03737033	-1.384	-0.423	-0.346	0.077
16	9640+69	9640+74	5	182.589	182.590	30.24558063	-98.03738407	30.24558425	-98.03739094	-1.384	-0.446	-0.347	0.099
17	9641+47	9641+50	3	182.604	182.604	30.24568208	-98.03759045	30.24568558	-98.03759766	-1.385	-0.446	-0.348	0.098
18	9645+61	9645+64	3	182.682	182.683	30.24618296	-98.03864675	30.24618296	-98.03864675	-1.425	-0.454	-0.355	0.099
19	9648+31	9648+33	2	182.733	182.734	30.24656143	-98.03947601	30.24656448	-98.03948440	-1.449	-0.446	-0.349	0.097
20	9648+40	9648+62	22	182.735	182.739	30.24657363	-98.03950957	30.24659803	-98.03957669	-1.455	-0.448	-0.370	0.078
21	9648+95	9648+97	2	182.745	182.746	30.24663238	-98.03967058	30.24663505	-98.03967783	-1.463	-0.452	-0.353	0.099
22	9649+02	9649+05	3	182.747	182.747	30.24664039	-98.03969233	30.24664039	-98.03969233	-1.481	-0.452	-0.353	0.099
23	9650+34	9650+37	3	182.772	182.772	30.24681314	-98.04002463	30.24681664	-98.04003143	-1.479	-0.448	-0.351	0.097
24	9651+01	9651+18	17	182.784	182.788	30.24689227	-98.04020691	30.24690818	-98.04025921	-1.486	-0.452	-0.363	0.089
25	9651+40	9651+47	7	182.792	182.793	30.24693392	-98.04034255	30.24694023	-98.04035759	-1.490	-0.461	-0.366	0.095
26	9651+71	9651+82	11	182.798	182.800	30.24697110	-98.04040907	30.24698482	-98.04043195	-1.493	-0.456	-0.363	0.093

**Table 19 (continued). CIS Areas not Meeting Any Criteria from E. Houston to Crane
(pg 2 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				
27	9653+98	9654+03	5	182.841	182.841	30.24725680	-98.04098357	30.24726023	-98.04099158	-1.503	-0.459	-0.361	0.098
28	9654+40	9654+48	8	182.848	182.850	30.24729896	-98.04108691	30.24730670	-98.04110635	-1.499	-0.455	-0.361	0.094
29	9656+56	9656+72	16	182.889	182.892	30.24754617	-98.04166028	30.24756495	-98.04170276	-1.521	-0.461	-0.374	0.087
30	9656+85	9656+95	10	182.895	182.897	30.24760857	-98.04179078	30.24763890	-98.04185144	-1.521	-0.468	-0.375	0.093
31	9657+09	9657+21	12	182.899	182.902	30.24769956	-98.04197276	30.24774000	-98.04205364	-1.526	-0.471	-0.376	0.095
32	9657+26	9657+50	24	182.903	182.907	30.24776022	-98.04209408	30.24775199	-98.04205930	-1.526	-0.467	-0.379	0.088
33	9657+84	9658+16	32	182.914	182.920	30.24772952	-98.04198749	30.24778938	-98.04211426	-1.538	-0.451	-0.360	0.091
34	9659+63	9659+70	7	182.948	182.949	30.24796106	-98.04251862	30.24797108	-98.04254151	-1.534	-0.476	-0.380	0.096
35	9659+78	9659+80	2	182.950	182.951	30.24798110	-98.04256440	30.24798444	-98.04257203	-1.531	-0.476	-0.379	0.097
36	9661+69	9661+79	10	182.987	182.988	30.24823850	-98.04308980	30.24824690	-98.04310963	-1.518	-0.488	-0.401	0.087
37	9661+89	9661+93	4	182.990	182.991	30.24825810	-98.04313607	30.24826370	-98.04314929	-1.512	-0.491	-0.393	0.098
38	9661+98	9662+28	30	182.992	182.998	30.24826930	-98.04316251	30.24830742	-98.04323733	-1.509	-0.486	-0.403	0.083
39	9662+35	9662+65	30	182.999	183.005	30.24831858	-98.04325794	30.24835797	-98.04333496	-1.508	-0.489	-0.409	0.080
40	9663+49	9663+57	8	183.021	183.022	30.24845824	-98.04356160	30.24846910	-98.04358221	-1.477	-0.486	-0.392	0.094
41	9667+24	9667+45	21	183.092	183.096	30.24894707	-98.04462048	30.24896894	-98.04467556	-1.428	-0.476	-0.398	0.078
42	9964+48	9964+73	25	188.721	188.726	30.26938057	-98.13513184	30.26938820	-98.13521576	-1.796	-0.446	-0.391	0.055
43	9965+29	9965+32	3	188.737	188.737	30.26941490	-98.13539124	30.26941109	-98.13540649	-1.834	-0.497	-0.402	0.095
44	9965+55	9965+83	28	188.741	188.747	30.26941872	-98.13547516	30.26943398	-98.13556671	-1.817	-0.439	-0.436	0.003
45	9966+14	9966+39	25	188.753	188.757	30.26947021	-98.13610077	30.26947212	-98.13610077	-1.848	-0.478	-0.390	0.088
46	9966+70	9967+23	53	188.763	188.773	30.26947594	-98.13610077	30.26948357	-98.13610840	-1.922	-0.429	-0.382	0.047
47	11281+01	11281+13	12	213.655	213.658	30.36659432	-98.52788925	30.36662102	-98.52793121	-1.156	-0.534	-0.441	0.093
48	17014+80	17014+99	19	322.250	322.254	30.74863243	-100.27194977	30.74864388	-100.27200317	-5.893	-0.250	-0.213	0.037
49	17019+59	17020+22	63	322.341	322.353	30.74892235	-100.27334595	30.74897385	-100.27354431	-5.825	-0.206	-0.163	0.043

2.3.4 AC Potential Survey

The pipe-to-soil AC voltage survey was conducted when the 2023 CIS was performed for the pipeline ROW Segment 6645. Table 20 shows the area of AC voltage greater than 5 V from the pipeline segments from E. Houston to Crane. The maximum AC voltage of 8.362 V was found at KOCKS RECT LOC C-929. Table 21 shows the area of AC voltage greater than 5 V from the pipeline segments from Crane to El Paso. An elevated AC voltage of 9.236 V was found at HOMESTEAD VALVE.

The AC voltages were remeasured at the locations where the elevated AC voltages were when the rectifier was off. The remeasured AC voltages are less than 1 V when the rectifier is off, as shown in "Magellan's Comments" in Table 20 and Table 21. Theoretically, the pipe-to-soil AC voltages should be independent of the rectifier's functioning status because it outputs direct current.

The AC density was also measured at some locations with elevated AC voltages, as shown in "Magellan's Comments" in Table 20 and Table 21. The measured AC densities are less than 30 A/m² (2.8A/ft²). According to AMPP SP0169-2013, the level of measured AC densities should not cause AC-induced corrosion. It is recommended that the AC densities at these locations be monitored.

Table 20. Areas of AC Voltage Greater than 5 V from E. Houston to Crane

Date	Stationing	MP	Location Description	AC potential (V)	Magellan's Comments
10/20/2022	8992+01	170.295	BRODIE LANE WSD	5.180	RMU at location monitoring current densities. 3.49 A/m ² last read
01/26/2023	13511+03	255.893	Salt Branch Rect Loc	5.256	AC PS taken when rectifier cycling off <1 VAC
01/28/2023	14121+58	267.455	Mill Creek Rd ESD	5.733	AC PS taken when rectifier cycling off <1 VAC
01/28/2023	16329+71	309.281	TL FENCE	6.233	11.816 A/m ²
01/28/2023	16384+58	310.316	TL FENCE @ RECTIFIER 310	7.521	AC PS taken when rectifier cycling off <1 VAC
01/30/2023	16935+51	320.774	TL FENCE	5.535	13.85 A/m ²
01/30/2023	16985+04	321.687	E. HG FT MCKAVETT STA	6.508	AC PS taken when rectifier cycling off 1.19 VAC
01/30/2023	16986+35	321.741	RECT LOCN. 322 FT McKavett	5.644	AC PS taken when rectifier cycling off <1 VAC
01/30/2023	16986+63	321.751	MP 321.751 Test station, Line marker FT MCKAVETT STN RECT LOCN	5.897	AC PS taken when rectifier cycling off <1 VAC
01/30/2023	17000+89	322.120	West of Ft. McKavett Station under power lines	7.237	0.3A/m ² on direct coupon measurement
01/30/2023	17012+87	322.219	FENCE WEST OF CPPL STATION	6.139	12.1 A/m ²
6/2/2023	19833+36	375.600	RECT LOCN. 375	6.035	AC PS taken when rectifier cycling off <1 VAC
6/2/2023	20480+85	387.861	MP 387.88	5.663	12.78 A/m ²
6/2/2023	20517+15	388.583	TL PASTURE (PHILLIPS 42)	6.231	12.98 A/m ²
7/2/2023	20962+34	397.001	KOCKS RECT LOC C-929	8.362	AC PS taken when rectifier cycling off <1 VAC

Table 21. Areas of AC Voltage Greater than 5 V from Crane to El Paso

Date	Stationing	MP	Location Description	AC potential (V)	Magellan's Comments
01/15/2024	36420+60	689.908	HOMESTEAD VALVE	9.236	13.89 A/m ²

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2.3.5 Atmospheric Inspections

Following annual atmospheric inspections, Magellan monitors the condition of above-grade appurtenances, including station piping, tanks, valve settings, and exposed piping. Table 22 summarizes the repair numbers and repair dates for the Longhorn Pipeline System.

Table 22. Atmospheric Maintenance Summary

Segment Name	Repair Found Date	Repair Corrected Date	Repair Numbers
Satsuma – East Houston 20"	9/2/2023	12/31/2024	14
Buckhorn – Satsuma 18"	9/2/2023	10/25/2024	8
Warda – Buckhorn 18"	5/18/2023	5/1/2024	6
Bastrop – Warda 18"	5/20/2023	6/1/2024	9
Cedar Valley - Bastrop 18"	3/24/2023	5/31/2024	16
Eckert - Cedar Valley 18"	5/4/2023	5/31/2024	28
James River – Eckert 18"	5/18/2023	10/1/2024	17
Kimble – James River 18"	2/24/2023	10/19/2023	2
Texon – Barnhart 18"	12/6/2023	6/30/2024	1
Eckert Station	5/18/2023	5/31/2024	7
Satsuma Station	9/2/2023	8/2/2024	6
Warda Station	4/5/2023	5/31/2024	1
Bastrop Station	4/11/2023	5/31/2024	1
James River Station	5/18/2023	5/31/2024	5
Buckhorn Station	10/2/2023	9/2/2024	4
Cedar Valley Station	5/17/2023	5/31/2024	7
El Paso Station	12/22/2023	12/1/2024	16
Crane Station	9/29/2023	9/1/2024	2

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2.3.6 Tank Inspections

Magellan inspected 13 tanks in 2023; Table 23 lists the tanks inspected, the inspection type, the date, and key comments.

Table 23. Tank Inspection Summary

Tank #	Tank Location	Product	Inspection type	Inspection Date	Comments
51	Crane	Crude Oil	External API-653	03-28-2023	No items requiring immediate corrective action were noted
52	Crane	Crude Oil	External API-653	03-28-2023	No items requiring immediate corrective action were noted
53	Crane	Crude Oil	External API-653	03-28-2023	No items requiring immediate corrective action were noted
55	Crane	Crude Oil	External API-653	03-28-2023	No items requiring immediate corrective action were noted
55	Crane	Crude Oil	Internal API-653	Pre-Repair 07-26-2023; Post Repair 10-04-2023	<p>Piping and Appurtenances: The level gauge should be serviced to ensure proper operation. The weld spacing of Shell Nozzle K to Nozzle L did not meet API standards.</p> <p>Floating Roof: The fabric, secondary seal, column well, gauge pole, radar pole, and gauge funnel seals should be replaced. The pressure/vacuum vent should be serviced to ensure proper operation.</p> <p>Bottom: The bottom coating should be repaired or replaced. Burrs and corroded areas should be repaired and/or patched.</p>
56	Crane	Crude Oil	Internal API-653	Pre-Repair 02-22-2023; Post Repair 06-13-2023	<p>Floating Roof: The primary seal, secondary seal, column well, gauge pole, anti-rotation, and gauge funnel seals should be replaced. The pressure/vacuum vent should be serviced to ensure proper operation.</p> <p>Bottom: The bottom coating should be repaired or replaced, and damaged areas should be repaired and/or patched.</p>
8	El Paso	Transmix	External API-653	03-28-2023	No items requiring immediate corrective action were noted
16	El Paso	Gasoline	External API-653	03-09-2023	Fixed Roof: Exposed wires should be removed.
18	El Paso	Ethanol	External API-653	03-09-2023	No items requiring immediate corrective action were noted
20	El Paso	Gasoline	External API-653	03-08-2023	No items requiring immediate corrective action were noted
21	El Paso	Unleaded Gasoline	External API-653	03-08-2023	No items requiring immediate corrective action were noted
22	El Paso	Diesel	External API-653	03-08-2023	No items requiring immediate corrective action were noted
23	El Paso	Gasoline	External API-653	03-08-2023	No items requiring immediate corrective action were noted
191-50	El Paso	Transmix	External API-653	03-09-2023	No items requiring immediate corrective action were noted

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 19.5 years were compared to evaluate any integrity threats on the Longhorn Pipeline System. In addition, waterway inspections and periodic depth-of-cover (DOC) 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.²²

²² "Study of Aseismic Faults and Regional Subsidence along Longhorn Partners Pipeline", IT Corporation, June 14, 2000.

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 24 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 25 summarizes the available geologic data for Akron, Melde, Breen, and Hockley faults.

Table 24. Approximate Location Information for each Fault Benchmark²³

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		

Table 25. 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

²³ From Geosyntec Semi-Annual Fault Displacement Monitoring Report for 2nd half of 2022.

version of ASME B31.4²⁴ 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 26 presents the resulting allowable displacement at each fault.

2.4.3 Fault Movements

Fault displacement is 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 readings²⁵ have been taken at approximately 6-month intervals. Figure 7 shows a plot of the vertical displacements over time.

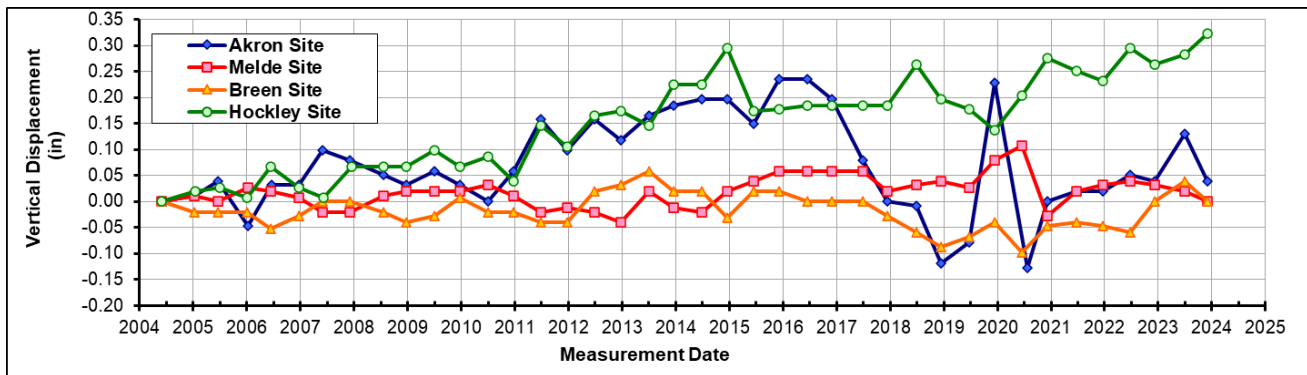


Figure 7. Fault Displacement over 19.5-Year Monitoring Period at Akron, Melde, Breen, and Hockley Faults

²⁴ 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.

²⁵ Geosyntec Semi-Annual Fault Displacement Monitoring Reports. The last report is for the 2nd half of 2022.

The benchmark recordings have shown the Akron fault's multiple backward and rebound movements since 2017. However, no significant movement has been shown since 2021. Based on the 2023 readings, this fault experienced a relatively small amount of movement oscillating near its baseline displacement.

Data collected at Melde fault since the benchmarks were installed in 2004 shows slow progressive movement, as verified by the 38th and 39th resurveys²⁶ in 2023. The recent resurveys indicate movement above the average historical rate for the Breen and Hockley faults, 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, 27 readings have been taken between December 2012 and December 2022, as shown in Figure 8.

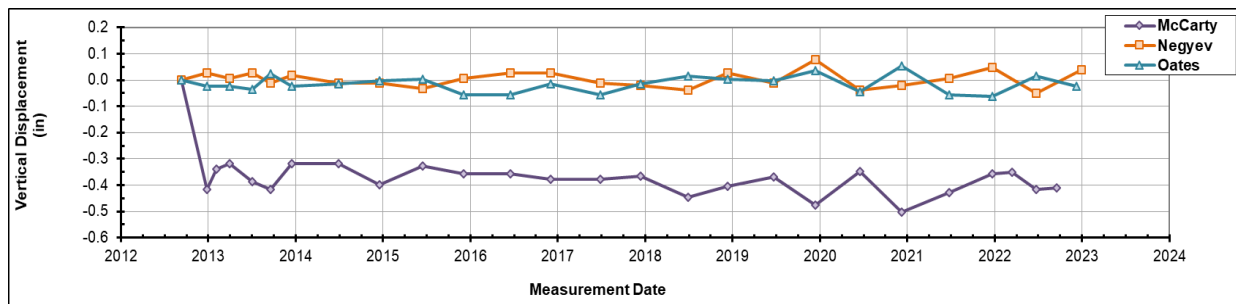


Figure 8. Fault Displacement over 11.5-Year Monitoring Period at McCarty, Negyev, and Oates Faults

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 after the initial jump. This jump could indicate the benchmark is equilibrating with its environment after installation or due to a measurement error in 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. The McCarty, Negyev, and Oates fault movements are slightly above the average historical rate.

Table 26 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 monitoring period.

²⁶ Geosyntec – First and second-half Semi-Annual Fault Displacement Monitoring Reports.

- 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 26) 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 26. 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	0.026	0.006	>1000	163	689
Melde	4.13	0.002	0.017	0.004	>1000	248	>1000
Breen	1.50	0.001	0.040	0.004	>1000	38	372
Hockley ⁱ	1.25	0.014	0.034	0.021	87	36	61
McCarty	0.95	0.004	0.009	0.013	265	102	75
Negyev	2.65	0.000	0.006	0.009	>1000	413	280
Oates	2.65	0.000	0.013	0.008	>1000	203	315

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 four 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 fault has shown a slower rate of movement and oscillation in the past four years compared to previous years. The Breen fault's short-term rate of movement is larger than in previous years. However, the overall movements of the faults still suggest continuous semi-annual monitoring. The shortest calculated time to reach allowable displacement at the Hockley fault is 36 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.

From December 2020 to December 2022, resurveys indicated significant activity in the McCarty fault. Based on the movement trends observed in 2021 & 2022 and considering the small allowable displacement at the pipeline crossing this fault, it was estimated that the allowable displacement would be reached in 18 years. As a result, Magellan requested quarterly monitoring of the McCarty fault during 2022. However, during the 2023 surveys, it was discovered that the fault's movement had slowed sufficiently to allow the surveys to be reset to a 6-month cycle.

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 2005²⁷, 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 26. Actual measurements over the past 19.5 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 an overly conservative estimation of fault movement rates.

2.4.4 Waterway Inspections and Depth-of-Cover Program

Since 2015, Magellan has conducted waterway surveys by measuring the DOC of the pipeline at water crossings. Once a water crossing has been surveyed, it is categorized and entered into Magellan's Waterway Crossing Program. Magellan's Outside Forces Database will calculate the Risk Score based on the River Risk Model Scoring Rubric. Some of the factors²⁸ playing a 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, historical or ongoing channel migration, flood history, and potential for scour from upstream river obstructions. The risk score is also valued based on the presence of HCAs, stream order, and ordinary high-water width of a river crossing. Generally, the higher the total risk score, the more perceived risk the crossing represents. Once ranked, Magellan assesses each crossing and determines whether it needs mitigation, rainfall monitoring, or is placed within the re-inspection pool.

Table 27 summarizes the findings of the third-party inspections completed in 2023. Based on the findings of these surveys, no mitigation measures are planned by Magellan. All crossings listed in Table 27 will be placed in the pool of reinspection candidates to be assessed for a follow-up survey.

²⁷ 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.

²⁸ Based on Magellan's Procedure Number: 7.05-ADM-043.

Table 27. Summary of Water Crossing Inspections in 2023

River Name	Route Name	Survey Comments
Unnamed Creek #10783	Satsuma-Buckhorn	There was 3' of exposure with a max DOC of 4". The coating is in good condition, and no debris was present.
Unnamed Creek #10505 (Piney Creek)	Warda-Bastrop	Exposed throughout the entire width of the channel with the mid 1/3 section being suspended. The coating is in fair condition. No debris was present. The west and east banks show recent signs of erosion.
Pin Oak Creek	Warda-Bastrop	No exposure. Minimum DOC of 3'-5". Signs of erosion are noted. Debris was present.
Antelope Gulch	Cottonwood-El Paso	No exposure. Minimum DOC of 4'-3". Recent signs of erosion are noted.
Cottonwood Creek #7698 (Reeves County)	Crane-Cottonwood	No exposure. Minimum DOC of 5'-6". The west and east banks show significant recent erosion, with deep rills.
Cottonwood Creek #7735 (Culberson County)	Crane-Cottonwood	8' of exposure with max DOC of 1'-4". The coating is in good condition. Recent erosion on both banks.
Cummins Creek	Buckhorn-Warda	No exposure. Minimum DOC of 1'-6". Downstream of tributary confluence and near constant woody debris
East Mill Creek	Buckhorn-Warda	No exposure. Minimum DOC of 1'-7". Signs of significant recent erosion on both banks. Downstream flow constriction and near-constant woody debris

In February 2023, a third-party inspection company conducted a DOC survey on the Satsuma-Buckhorn segment crossing Unnamed Creek #10783 near a river bend in Austin County, Texas. The inspection revealed the pipeline is exposed for 3 feet along the 16-foot width of the waterway, which is expected to increase local scour rates. The coating on the exposed section of the pipeline is in good condition, with a maximum DOC of 4 inches at the east bank water's edge. Trails from livestock accessing the waterway have caused additional bank erosion and soil disturbance near the pipeline. No debris is present. At the writing of this report, the Unnamed Creek #10783 crossing does not trigger any immediate mitigation action for Magellan. It will be placed into the pool of reinspection candidates to be assessed for a follow-up survey.

Two water crossings on the Warda-Bastrop segment were surveyed on the same date. One crossing at Unnamed Creek #10505 (Piney Creek) in Fayette County, Texas, was found exposed across the channel width, with two 4-foot-long exposed segments and an additional 4-foot suspension between them, conditions that likely induced higher scour rates. The coating is in fair condition, and both banks show recent erosion upstream and downstream. At the writing of this report, the Piney Creek crossing does not trigger any immediate mitigation action for Magellan. It will be placed into the pool of reinspection candidates to be assessed for a follow-up survey.

The other survey on the Warda-Bastrop segment crosses Pin Oak Creek in Bastrop County, Texas. The survey showed a minimum DOC of 2 inches at the toe of the west bank and a maximum DOC of 3 feet and 5 inches at the east bank's edge. Erosion is visible on both banks, and comparisons with 2016, 2017, and 2023 data indicate significant bank material loss. A large tree was noted downstream on the survey date. At the writing of this report, the Pin Oak Creek crossing does not trigger any immediate mitigation action for Magellan. It will be placed into the pool of reinspection candidates to be assessed for a follow-up survey.

A DOC survey was performed on the Cottonwood-El Paso segment at Antelope Gulch in Hudspeth County, Texas, showing a minimum DOC of 4 feet and 3 inches at the channel center and a maximum DOC of 4 feet and 11 inches at the west bank edge. No surface water was

observed, though recent erosion was visible on both banks. No nearby stream gauges were available for flood monitoring.

The Crane-Cottonwood segment crossing at Cottonwood Creek #7698 in Reeves County, Texas, showed similar conditions to Antelope Gulch, with a minimum DOC of 5 feet and 6 inches at the west bank and a maximum DOC of 6 feet and 6 inches at the channel center. The proposed USGS 08433000 stream gauge is unlikely to represent local conditions accurately. The east and west banks show significant recent erosion, with deep rills from groundwater sapping extending to the channel bottom, and historic imagery indicates ongoing riling, bar formation, and tire tracks, worsening bank erosion at the crossing.

Another Crane-Cottonwood segment crossing at Cottonwood Creek #7735 in Culberson County, Texas, has an exposed 8-foot segment with a maximum DOC of 1 foot and 4 inches near the east bank. The coating is in good condition, but recent erosion on both banks, exacerbated by vehicle crossings, likely increases local scour, and historic imagery shows ongoing gully erosion. The USGS 08433000 stream gauge is also not recommended for this crossing. At the writing of this report, the Cottonwood Creek crossing does not trigger any immediate mitigation action for Magellan. It will be placed into the pool of reinspection candidates to be assessed for a follow-up survey.

A survey of the Buckhorn-Warda segment crossing at Cummins Creek in Fayette County, Texas, reported a shallow DOC ranging from 1 foot and 6 inches to a maximum of 2 feet and 9 inches, with recent significant erosion on both banks, although cover along the channel bottom has increased since 2021. The channel bed is armored with partially silted-in stabilization bags, and the pipeline is located near agricultural activity and persistent woody debris.

Another Buckhorn-Warda segment crossing at East Mill Creek in Austin County, Texas, measured a DOC from 1 foot and 7 inches to 3 feet and 5 inches near the east bank, with significant recent erosion on both banks. The pipeline crosses at a cut bank prone to high erosion rates and is located about 71 feet downstream of a bridge with support piers in the waterway. Historic imagery shows tortuous meanders and persistent woody debris around the crossing. At the writing of this report, the East Mill Creek crossing does not trigger any immediate mitigation action for Magellan. It will be placed into the pool of reinspection candidates to be assessed for a follow-up survey.

As a preventive measure, all streams should be monitored using stream gauges that provide raw data for hydrographs, which record discharge and stage height. These records can be utilized to statistically extrapolate return periods for floods of a given magnitude. Each return period has an associated calculated velocity and depth, which can then be used to assess scour for that specific return period. The pipeline becomes exposed if the scour depth for a given flood return period exceeds DOC. For a given crossing, the annual probability that the maximum allowable unsupported span length (MAUSL) is likely to be exceeded can be calculated. It is highly recommended that Magellan integrate these considerations into their River Risk Model if they have not done so already.

Special attention must be given to pipes that are exposed or likely to become exposed soon. Once a pipeline is exposed, it is subject to impacts from the force of the water itself or debris

such as ice, boulders, trees, or vehicles. These exposed pipelines also need to be checked for bending stress from water, debris, and suspension and potential failure due to vortex-induced vibration (VIV) and fatigue. The MAUSL can serve as a limit state beyond which the pipe may be damaged by bending strain or VIV. The MAUSL can be estimated at the screening stage using simple calculations based on pipe characteristics and water velocity. Kiefner recommends Magellan incorporate these considerations into their River Risk Model if they have yet to do so. A "Natural Event Response Procedure" in the system provides a method for upfront planning, communication, monitoring, and establishing safeguards for natural events, such as flooding.

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 2023 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 exceptions.

There was one Longhorn system incident in 2023. The incident occurred on August 28, 2023, near El Paso, Texas, affecting the 8" Kinder Morgan (KM) flush line. A third-party contractor working on a relocation project for a different operator was excavating around four Magellan pipelines in the El Paso area. The third-party contractor used a hydro-vac to identify the pipeline, the back of the excavator bucket to crumb the soil on top of the pipeline, and probe rods placed between the pipelines to help guide the equipment operator. Magellan's Excavation Safety Procedures allow for soil crumbs to be removed from the top of the pipeline up to 12 inches maximum above the line and for probe rods to be offset a minimum of one foot from the pipeline. The third-party contractor was working between the 12" KM and 8" KM flush lines. Both lines were exposed, and probe rods were placed directly against the pipeline (not meeting Magellan's Excavation Safety Procedures). The equipment operator was sloping the North side of the excavation, which caused dirt to cover the 8" KM flush line and fill in the gap between the 12" and 8" lines. Using the teeth of the bucket, the equipment operator removed soil between the two lines. When the contractor completed the excavation by hand digging, they noticed that the 8" KM flush line had a 27" scrape across the top of the pipeline. This incident was not DOT reportable and was formally documented and investigated by Magellan. Following Magellan's incident investigation report, corrective actions to requalify operational qualifications for observation of excavation activities, measure clearance, and backfilling were implemented on an individual basis. This incident falls under Section 2.5.1 Third-Party Damage.

An ILI tool should be run if three or more one-call violations occur on any 25-mile pipeline segment within 12 months. This threshold was not met in 2023. 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 2023 on 10 sections from Crane 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 2024. 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 36 in Section 4 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 ILI tools and maintenance activities, are also part of this assessment.

Kiefner received a complete log of aerial patrol and ground patrol reports for 2023. 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 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 2023 Third-Party Damage Annual Assessment, Kiefner concluded:

- There was one physical hit to the pipeline in 2023.
- There were no ROW near-misses in 2023.
- There were two one-call violations in 2023.
- There was an increase of approximately 21% in aerial patrol observations from 2022 to 2023.
- There were two unauthorized encroachments recorded.
- One-call frequency increased by approximately 25% from 2022 to 2023.

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 laterals from El Paso Terminal to Diamond Junction (9.4 miles each). 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 two and one-half 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 aerial patrol ROW surveillance mileage, Magellan must perform 64,560 miles for the Galena Park to MP 528 segment and 8,153 miles from MP 528 to 694. Magellan must perform a minimum of 156 miles in the Edwards Aquifer area for ground patrol.

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 28 shows the 2023 cumulative miles of patrols for these three areas listed by month.

Table 28. 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	11,716	11,109	13,824	14,390	14,372	15,712	16,368	16,368	14,075	12,451	10,124	11,383	161,891
Tier I: Aerial Patrol (once/week, not to exceed 12 days)													
303: MP 528 to 694	1,052	1,315	1,052	1,052	1,315	1,052	789	1,315	1,052	1,315	1,052	1,052	13,413
Ground Patrol (once/week)													
Edwards Aquifer: MP 170.5 to 173.3	44	44	55	44	44	55	44	55	44	44	55	44	572

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 two unauthorized ROW encroachments.

2.5.3 One-Call Ticket Analysis

In 2023, there were 9,480 one-call tickets, of which 33% of the required “field locates” were potential ROW encroachments. Two one-call violations occurred in 2023; 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 2,652 (28.0%) of the one-call tickets, while Travis County (Austin) accounted for 2,821 (29.8%) of the one-call tickets. Thus, 57.8% of the one-call notifications on the pipeline occurred in these large metropolitan areas. The data shows these two areas present the greatest potential for third-party damage. The Crane area has the next highest number of one-calls, with 2,116 tickets (22.3%).

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, face-to-face liaison meetings, meetings with emergency response agencies and 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.

Magellan's website is a communication tool to inform the public about pipeline safety, damage prevention, emergency preparedness, and mitigation measures. It also posts information about Magellan's operations, including the annual self-audit report and the results of the annual ORA.

As part of a new effort in 2023, the School Pipeline Safety Partnership is a collaborative effort involving the Pipeline Association for Public Awareness, the Danielle Dawn Smalley Foundation, diligent operators, and conscientious school officials nationwide dedicated to school pipeline safety. The program is on a four-year cycle with 34 identified high-consequence area schools within 1000 feet of transmission lines. This program provides school administrators with a customized webpage for each school, a customized mailer, and a web meeting with school administrators and the operator. The program's materials and web meetings covered maps, line size, product in the line, evacuation distance, identifying markers, leak detection, contacting 811, color code charts, and overall pipeline safety.

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 are also considered encroachment.

The SIP includes provisions for surveillance to prevent and minimize the effects of unannounced or unauthorized ROW encroachments. Aerial patrols, one-call tickets, or encroachment agreements are typically used to identify encroachments. In 2023, there were 23 authorized encroachments and two unauthorized encroachments. When properly followed by the encroaching party, the encroachment procedures have effectively prevented TPD to the pipeline. 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 they are DOT-reportable or not.²⁹ Magellan had zero PHMSA reportable releases in 2023. To continue and improve the overall effectiveness of the incident investigation program, Magellan should

²⁹ DOT-Reportable Requirement. A "PHMSA (or DOT) reportable incident" is a failure in a pipeline system in which there is a release of a product resulting in explosion or fire, volume exceeding five gallons (five barrels from a pipeline maintenance activity), death of any person, personal injury necessitating hospitalization, or estimated property damage exceeding \$50,000.

continue to record all relevant data on incident reports, including a detailed description of the incident, root cause, and contributing factors.

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. Magellan's IMP also includes activities to assess and improve the program's performance. The primary goal of IMP is Mission Zero, which eliminates preventable incidents through evaluation, risk analysis, inspection, and maintenance of pipeline systems as described in the SIP.

In alignment with Mission Zero, Magellan selected Enablon for a pilot program at the Odessa location in 2023. Enablon, a third-party software, is an upgraded Incident Management system that tracks incidents and near-misses. The pilot program was put on hold during 2023 due to the ONEOK acquisition.

In 2023, Magellan continued to focus on entering and tracking near misses. 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, facility integrity processes, and facility maintenance program reporting.

2.7 Incorrect Operations Mitigation Program

In addition to Magellan's investigation program, they also implemented 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" are described as incorrect operation or maintenance procedures or a failure of pipeline operator personnel to follow procedures correctly. In 2023, there were two one-calls and one third-party damage incident. The incident was not DOT reportable, but Magellan formally documented and investigated it.

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, which 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. 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 2023.

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 nine facilities, as shown in Table 29.

Table 29. Facility Safety Inspections received in 2023

Facility	Inspection Date
Cartman Station	8/16/2023
Kimble Station	8/16/2023
James River Station	8/17/2023
Eckert Station	8/17/2023
Cedar Valley Station	9/21/2023
Bastrop Station	9/21/2023
Warda Station	9/20/2023
Buckhorn Station	9/20/2023
Satsuma Station	9/19/2023

Facility Risk Assessments (FRA) continued throughout 2023. Assessments aim to minimize the number and size of potential releases. Magellan completed five FRAs in 2023, including Cedar Valley Pump Station, Crane Terminal, Eckert Pump Station, Cottonwood Pump Station, and James River Pump Station. Table 30 lists the five FRAs with their recommendations.

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Table 30. 2023 Facility Risk Assessment Summary

Facility	Recommendation
Cedar Valley Pump Station	<ul style="list-style-type: none"> • Installing tubing supports on tubing extending from the drain ports on ROV 4 and ROV 9. • Conducting a Facility Risk Assessment of Cedar Valley Pump Station within five years of the last assessment, not to exceed 68 months.
Crane Terminal	<ul style="list-style-type: none"> • Performing UT inspection on the low flow/no flow lines located at the LACT manifold. • Upgrading insulation on Units 3, 4, and 5 seal pots and drain lines. • Investigating a solution to movement on tank line supports for Tank 51, 53, 55, and 56. • Conducting a Facility Risk Assessment of Crane Crude Terminal within five years of the last assessment, not to exceed 68 months.
Eckert Pump Station	<ul style="list-style-type: none"> • Investigating the installation of pipe support on a pipe extending from the launch trap. • Replacing the undersized pipe supports. • Conducting a Facility Risk Assessment of Eckert Pump Station within five years of the last assessment, not to exceed 68 months.
Cottonwood/Valve Site	<ul style="list-style-type: none"> • Changing the facility type from a Pump Station to a Valve Site. • Conducting a Limited Scope Facility Risk Assessment of Cottonwood Pump Station within five years of the last assessment, not to exceed 68 months.
James River Pump Station	<ul style="list-style-type: none"> • Installing tubing supports on tubing extending from the drain ports on ROV 2 and ROV 4. • Conducting a Facility Risk Assessment of James River Pump Station within five years of the last assessment, not to exceed 68 months.

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 74 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 2023, 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 there are 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 and
- 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. Magellan's Scenario-Based Risk Mitigation Analysis program aims to identify preventive measures and/or modifications that can be recommended to reduce the risks to the environment and the population in the event of a product release. The results of the Key Risk Area Identification and Assessment Program 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 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 plans to replace the existing leak detection system in the Edwards Aquifer area over the next two to five years with a new, more reliable leak detection cable manufactured by Naftosense.

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 pipeline's integrity. This integration aids in the identification of preventive and mitigation measures to protect areas along the pipeline.

The LMP risk management plan commits to maintaining pipeline-related failure rates at or below a probability level of 1 in 10,000 (0.0001) per mile-year. Per the self-audit report, the scenario-based risk mitigation analysis (SBRMA) for the 2023 operating year was performed in 2024. The results show that none of the pipeline segments exceeded the risk threshold. Therefore, no additional mitigation measures were required or recommended.

Magellan's Facility Integrity Management Program (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 five FRAs in 2023.

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 2024 with information from operations in 2023. 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 2023, Magellan had 47 MOCRs on the Longhorn Pipeline System; 13 of the 47 were determined to have some impact on the LMP. Per the Self-Audit Report, all 13 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
- 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 and safety or cause environmental harm. Magellan provides educational outreach programs to schools through the School Pipeline Safety Partnership. The program is on a four-year cycle with 34 identified HCA schools within 1000 feet of transmission lines. Table 31 provides a history of educational and outreach meetings. 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, no metal loss features met POE dig requirements from the 2023 ILI runs. Regarding failure measures, there were two one-call violations, one physical hit to the pipeline (associated with third-party damage), and no DOT-reportable incidents.

Table 31. Educational and Outreach Meetings

EVENT	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Emergency Responder / Excavator Meetings	14	12	11	11	11	11	11	11	11	25	30	30	16	16	24	25	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	17
TOTAL	28	18	25	21	17	22	20	22	17	30	36	36	24	38	75	46	43	42	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 2023 TPD Annual Assessment for details.

\A new school program, School Pipeline Safety Partnership, started in 2023.

3 OVERALL SIP PERFORMANCE MEASURES

The LMP describes the philosophy of the SIP. Through 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 2023 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 32 summarizes the SIP Activity Measures from 2005 through 2023. 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, 156 miles are needed for the Edwards Aquifer area. This metric is compared to the previous 12-month period. Magellan met this commitment in 2023.
- 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 shows Magellan’s consistent effort 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. This decline will not indicate any failure on Magellan's part. 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 Magellan's effort to educate the public regarding pipeline safety and to prevent TPD. 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 32. System Integrity Plan Activity Measures

Year	Measure		
	<i>Miles of pipelines inspected by aerial and ground survey (73,296 mi required)</i>	<i>No. of warning or ROW identification signs installed, replaced, or repaired</i>	<i>No. of outreach or training meetings to educate and train the public and third parties about pipeline safety</i>
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
2023	175,876	622	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 33 provides a summary of the deterioration measures from 2006 through 2023. In 2023, there were:

- There are no immediate conditions as defined by the SIP and 49 CFR 195.452.
- No ILI-reported metal loss features met POE evaluation dig requirements in 2023.
- 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. POE calculations should continue to be performed.

Table 33. 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
2023	0	0	0	0	N/A	0

*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 34. Response times, volumes, and costs are for DOT-reportable leaks. Service interruptions, both scheduled and unscheduled, that were reported during 2023 are shown in Table 35.

Table 34. System Integrity Plan Failure Measures

Measure	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	
Number of leaks (DOT-reportable)	2	0	1	3	0	1	2	0	2	2	0	0	3	1	0	1	0	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	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	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	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	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	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	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	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	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	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	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	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	2	
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	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	0	
Number of service interruptions	115	165	155	74	16*	17	9	8	15	15	11	8	13	114	141	43	132	180	127	

Table 35. Service Interruptions per Month for 2023³⁰

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Total
No./Month	14	12	5	10	12	16	15	15	11	7	7	3	127

³⁰ Service interruptions include both scheduled and unscheduled interruptions.
Kiefner and Associates, Inc.

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 to 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 additional information. One ILI tool technology may satisfy multiple inspection requirements for a pipe segment. The tools Magellan has committed to use have multiple capabilities.

Table 36 and Table 37 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 36 and Table 37 as it is currently addressed using surface surveys rather than ILI technology. The 2017 Longhorn ORA Final Report completes a listing of all ILI assessments on the crude and refined pipeline systems.

Table 36. 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	
	Date of Tool Run	2-Oct-14	1-Oct-14	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	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	
	Tool													UT
	Date of Tool Run													27-Sep-23
	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	
	Tool													UCD
	Date of Tool Run													13-Dec-23
	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
	Tool													UT
	Date of Tool Run													27-Sep-23
	Third-Party Damage													
	Tool	Def.		Def.	Def.	Def.	Def.	Def.	Def.	Def.	Def.	Def.	Def.	
	Date of Tool Run	28-Aug-19		14-Jan-20	5-Nov-19	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	
Tool			Def.		Def.	Def.	Def.	Def.	Def.	Def.	Def.	Def.	Def.	
Date of Tool Run			12-Jan-23		6-Jan-23	6-Jan-23	24-Jan-23	28-Mar-23	11-Jul-23	25-Jul-23	31-May-23	25-Apr-23	27-Sep-23	
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	27-Sep-28	
Pressure-Cycle Induced Fatigue	2223	2048	2048	2043	2035	2052	2047	2044	2044	2027	2038	2030	20-Aug-27	
Third-Party Damage*	28-Aug-24	6-Jul-24	12-Jan-26	15-Feb-25	6-Jan-26	6-Jan-26	24-Jan-26	28-Mar-26	11-Jul-26	25-Jul-26	31-May-26	25-Apr-26	27-Sep-26	

†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 37. 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
	Tool	MFL					MFL	
	Date of Tool Run	5-May-23					18-Sep-23	
	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	
Tool	Deformation					Deformation		
Date of Tool Run	5-May-23					18-Sep-23		
Next Required Assessment								
Corrosion	5-May-28	5-Aug-27	8-Sep-26	2-Jun-27	1-Jun-27	18-Sep-28	25-Jun-27	
Pressure-Cycle Induced Fatigue	2233	2233	2090	Not susceptible~	Not susceptible~	Not susceptible~	Not susceptible~	
Third-Party Damage	5-May-28	1-Jul-27	8-Sep-26	2-Jun-27	1-Jun-27	18-Sep-28	25-Jun-27	

~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, HCAs, and meet the LMP requirements. The pipeline from 9th Street Junction to El Paso, including the four laterals connecting El Paso to Diamond Junction and the lateral from Odessa to Crane, is under DOT jurisdiction.

The HCA rule states that an operator must establish five-year intervals, not exceeding 68 months, to continually assess 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. 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 year intervals. The HCA requirement will continue to be integrated into the ILI requirements as additional tool runs are completed to ensure the required five-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 to the new pipeline is lower because the pipeline is buried at least 30 inches deep.

4.3 Pipe Replacement Schedule

There were no pipe replacements in 2023.

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 Tank Inspections

Kiefner's review of Aboveground Storage Tanks noted areas for improvement when performing external In-Service, internal Out-of-Service, and routine ultrasonic thickness inspections. Three tank inspection procedures were received and reviewed: 7.10-ADM-005 - API 653 Out-of-Service Inspection procedure, 7.10-ADM-006 - API 653 In-Service Inspection procedure, and 7.10-ADM-009 - Monthly External Tank Inspection Procedure.

Suggested updates to the current inspection report forms include:

- Inspection reports should reference either procedures 7.10-ADM-005 - API 653 Out-of-Service Inspection procedure or 7.10-ADM-006 - API 653 In-Service Inspection procedure.
- Include the required date of the next inspection per the requirements of API 653.

Items to consider for improvement of tank inspection review reports:

- Ensure internal resources are trained to review and approve the inspection reports.
- Consider the use of a third-party inspection company.
- Consider performing a gap assessment of the tank inspection program.
- A final review should be conducted by an API 653 authorized inspector (AI).

6 REFERENCES

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4. Kiefner, J. F., & Mitchell, J. L. (2006, January 19). *Charpy V-notch impact data for six samples of seam-weld material from the Longhorn Pipeline* (Final Report 06-6). Kiefner and Associates, Inc.
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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 identified by the Surge Pressure Analysis as 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; a concrete barrier will protect the pipe. 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 the 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 the 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, as indicated by the 1995 in-line inspection, and determine the 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-1 (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 that 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 that 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 pipeline areas 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.	In Tier II and III areas, an inspection shall be performed no more than three years after system startup at intervals established by the ORA.	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 equals 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 three months of startup and thereafter at intervals established by the ORA.	Corrosion, Outside Force Damage, and Previous Defects
12	Following the use of sizing and (where appropriate) geometry tools, Longhorn shall 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 five 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 three 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-1 (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, including 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 six 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 that 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 (Longhorn shall resolve the right-of-way encroachments 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-1 (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: (a) Stress-corrosion cracking potential. (b) Scour, erosion, and flood potential. (c) Seismic activity. (d) Ground movement, subsidence, and aseismic faulting. (e) Landslide potential. (f) Soil stress.	Prior to startup / Completed	Outside Force Damage, Corrosion, and Material Defects
			Outside Force Damage and Corrosion
			Outside Force Damage
			Outside Force Damage
			Outside Force Damage
			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, based on 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 so 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-1 (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 largely superseded 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, which is characterized by a travel time 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 documentation) that secondary containment was installed during construction, under and around all storage and relief tanks, per 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-1 (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 near pipeline stream crossings to determine the presence of gasoline constituents. See Mitigation Appendix, Item 29.	Evaluate the program's effectiveness for two years after startup 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 can 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 can 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 (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 on listed species or habitat

Table A-1 (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 the 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 include information about the status of mitigation commitment implementation, the character of interim developments 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, the 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. 2023 ORA Data List (pg. 1 of 2)

Topics	Data / Notes
1. Pipeline and Facilities	<ul style="list-style-type: none"> • Alignment Sheets <ul style="list-style-type: none"> – 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 <ul style="list-style-type: none"> – Bastrop Station (9/2023) – Buckhorn Station (9/2023) – Cartman Station (8/2023) – Cedar Valley Station (9/2023) – Eckert Station (8/2023) – James River Station (8/2023) – Kimble Station (8/2023) – Satsuma Station (9/2023) – Warda Station (9/2023)
2. Flow and Pressure Data	<ul style="list-style-type: none"> • Monthly spreadsheet of flow and pressures • Service Interruptions
3. ILI & Anomaly Investigation Reports	<ul style="list-style-type: none"> • Deformation Reports: <ul style="list-style-type: none"> – Texon to Barnhart – Barnhart to Cartman – Cartman to Kimble – Kimble to James River – James River to Eckert – Eckert to Cedar Valley – Cedar Valley to Bastrop – Bastrop to Warda – Buckhorn to Satsuma • MFL and Deformation Reports: <ul style="list-style-type: none"> – Crane to Texon – Crane to Cottonwood – 8" El Paso to Strauss • Tool specifications
4. Hydrostatic Testing Reports	<ul style="list-style-type: none"> • No hydrostatic tests were performed in 2023.
5. Corrosion Management Surveys & Reports	<ul style="list-style-type: none"> • Cathodic Protection Data <ul style="list-style-type: none"> – Rectifier Inspection Reports – Rectifier Maintenance Reports – Test Point Exception Reports – CIS Reports • Coupon Data • Atmospheric Inspection Reports • Tank inspections performed in 2023: <ul style="list-style-type: none"> – Crane Tanks: 51, 52, 53, 55, and 56 – El Paso Tanks: 8, 16, 18, 20, 21, 22, 23, and 191-50

Table B-1 (continued). 2023 ORA Data List (pg. 2 of 2)

Topics	Data / Notes
6. Earth Movement & Water Forces	<ul style="list-style-type: none"> • Fault monitoring (semi-annual reports) • Depth of cover surveys <ul style="list-style-type: none"> – Antelope Gulch (Cottonwood to El Paso segment) – Cottonwood Creek (Crane to Cottonwood segment) – Cummins Creek (Buckhorn to Warda segment) – East Mill Creek (Buckhorn to Warda segment) – Pin Oak Creek (Warda to Bastrop segment) – Piney Creek (Warda to Bastrop segment) – Unnamed Creek (Satsuma to Buckhorn segment) • Master River Inspections Spreadsheet • Flood monitoring (daily)
7. Maintenance and Inspection Reports	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • CMS Year-End Task Report • Preventive Maintenance Summary • Scorecards • Annual Asset Integrity Summary for 2023 • 2023 Annual Commitment Implementation Status Report • 2023 Annual Self-Audit
9. One-Call Violations and Third-Party Damage Prevention Data	<ul style="list-style-type: none"> • Third-Party Damage Report • One-call list • Encroachments • Patrol Data • Website Visits • Damage Prevention Training (2023 Public Awareness Summary Report)
10. Incident, Root Cause, and Metallurgical Failure Analysis Reports	<ul style="list-style-type: none"> • Incident Data and Incident Investigation Reports
11. Other SIP / Risk Assessment Studies, Evaluations, and other Program Data	<ul style="list-style-type: none"> • Process Hazard Analyses – None performed in 2023.
12. Leak Detection	<ul style="list-style-type: none"> • Pipeline Leak Monitoring (PLM) Records • Description of System(s)
13. Integrity Management Plan (IMP) & Related Procedures	<ul style="list-style-type: none"> • 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 2023.

B.2.2 PHMSA Notices

Pipeline Safety: Safety of Gas Transmission Pipelines: Repair Criteria, Integrity Management Improvements, Cathodic Protection, Management of Change and Other Related Amendments: Technical Corrections; Response to Petitions for Reconsideration, April 24, 2023.

These rules were issued by PHMSA containing technical corrections to the final rule titled "Safety of Gas Transmission Pipelines: Repair Criteria, Integrity Management Improvements, Cathodic Protection, Management of Change, and Other Related Amendments."

Pipeline Safety: Gas Pipeline Leak Detection and Repair, May 18, 2023.

PHMSA published this document with proposed regulatory amendments for: Part 192 - stronger leak survey and patrol requirements on regulated gas pipelines; stronger requirements on grading leaks and repair criteria for mandatory repairs; blowdown emission requirements; requirements for pressure relief devices, configuration and maintenance; clarification on investigation failures; and expanded reporting requirements.

- June 30, 2023 – PHMSA extended comment period for stakeholders.

Hazardous Materials: Harmonization with International Standards, May 30, 2023.

PHMSA published this document to amend the Hazardous Materials Regulations to align with international regulations and standards.

Hazardous Materials: Modernizing Regulations to Improve Safety and Efficiency, July 5, 2023.

PHMSA is asking for feedback from stakeholders on consideration for modernizing the Hazardous Materials Regulations to improve efficiencies and maintain high levels/improve safety.

- September 21, 2023 – PHMSA extended comment period for stakeholders

Pipeline Safety: Requirement of Valve Installation and Minimum Rupture Detection Standards: Technical Corrections, August 1, 2023.

PHMSA published this document to provide corrections to the final rule "Pipeline Safety: Requirement of Valve Installation and Minimum Rupture Detection Standards" for certain gas, hazardous liquid, and carbon dioxide pipelines. Also codifies results of the judicial review.

Pipeline Safety: Safety of Gas Distribution Pipelines and Other Pipeline Safety Initiatives, September 7, 2023.

PHMSA issued this notice of proposed rulemaking to:

- Require operators of gas distribution pipelines to update the following: distribution integrity management programs (DIMP), emergency response plans, maintenance and operation manuals, and other safety practices.
- Issue notice of proposing to codify the use of its State Inspection Calculation tool.
- Other safety initiatives for all part 192 regulated pipelines: update emergency response plans and inspection requirements.

B.2.3 DOT Regulations

Section §192.179 Transmission Line Valves, August 1, 2023.

Updated wording in items (e) and (f).

Section §192.319 Installation of Pipe in a Ditch, April 24, 2023.

Added new items (d) through (g).

Section §192.4661 External Corrosion Control – Protective Coating.

Updated wording in item (a)(4). Added new items (f) through (i).

Section §192.465 External Corrosion Control: Monitoring.

Updated §192.465 from 'External Corrosion Control: Monitoring' to 'External Corrosion Control: Monitoring and Remediation.' Updated wording in item (d). Added new item (f).

Section §192.473 External Corrosion Control: Interference Currents, August 24, 2023.

Added new item (c).

Section §192.478 Internal Corrosion Control: Onshore Transmission Monitoring and Mitigation. New Section.

Section §192.613 Continuing Surveillance.

Added new item (c).

Section §192.634 Transmission Lines: Onshore Valve Shut-off for Rupture Mitigation, August 1, 2023.

Removed item (c).

Section §192.636 Transmission Lines: Response to a Rupture; Capabilities of Rupture-Mitigation Valves (RMVs) or Alternative Equivalent Technologies, August 1, 2023.

Added new item (h).

Section §192.711 Transmission Lines: General Requirements for Repair Procedures.

Updated wording for item (b)(1)(i) and added new item (b)(1)(ii).

Section §192.712 Analysis of Predicted Failure Pressure.

Updated §192.712 from 'Analysis of Predicted Failure Pressure' to 'Analysis of Predicted Failure Pressure and Critical Strain Level.' Added new items (b)(1), (b)(2), (c), and (h).

Section §192.714 Transmission Lines: Repair Criteria for Onshore Transmission Pipelines, April 24, 2023. New Section.**Section §192.917 How does an Operator Identify Potential Threats to Pipeline Integrity and Use the Threat Identification in its Integrity Program?**

Updated wording in items (a), (a)(2), (a)(3), (a)(4), and (b). Added new items (b)(1) through (b)(4). Updated wording in item (c) and added new items (c)(1) through (c)(5). Updated wording in item (d).

B.2.4 Literature Reviewed

See References.

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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. The fatigue reassessment results are in order of the earliest reassessment interval.

To limit the calculation time, a simulation cap of 500 years was imposed. 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 calculated as 45% of the estimated time to failure (remaining life).

Table C-1. Pressure-Cycle-Induced Fatigue Cracking Analysis of Threshold Defects on Refined Product Segments

Pipeline Segment	Assessment Location	OD (inch)	Wall Thickness (inch)	Yield Strength (ksi)	Elevation (feet)	Year of Installation	Threshold Flaw Depth (inch)	Threshold Anomaly Depth at API 5L Detection Threshold (% WT)	Reassessment Interval (years)	Reassessment Due Date
Odessa to Crane	1516+94	8.625	0.188	60	2,847	1998	0.019	10	92.3	05/03/2090
Odessa to Crane	1526+10	8.625	0.250	60	2,857	1998	0.025	10	191.7	09/12/2189
Odessa to Crane	1483+32	8.625	0.250	46	2,863	1998	0.025	10	207.0	01/20/2205
Odessa to Crane	1413+58	8.625	0.250	42	2,853	1998	0.025	10	225.2	03/26/2223
Odessa to Crane	1517+42	8.625	0.277	60	2,848	1998	0.028	10	225.2	03/26/2223
Odessa to Crane	1544+74	8.625	0.322	35	2,863	1998	0.032	10	225.2	03/26/2223
Odessa to Crane	1544+68	8.625	0.322	52	2,864	1998	0.032	10	225.2	03/26/2223
Odessa to Crane	1544+20	8.625	0.322	42	2,862	1998	0.032	10	225.2	03/26/2223
Odessa to Crane	1521+51	8.625	0.277	35	2,855	1998	0.028	10	225.2	03/26/2223
Crane to Cottonwood	30429+00	18	0.281	65	3,843	1998	0.028	10	225.2	03/26/2223
Crane to Cottonwood	30430+16	18	0.375	52	3,841	2008	0.038	10	225.2	03/25/2233
Crane to Cottonwood	30429+60	18	0.375	65	3,840	2008	0.038	10	225.2	03/25/2233
Crane to Cottonwood	27879+57	18	0.500	52	2,621	2008	0.050	10	225.2	03/25/2233
Cottonwood to El Paso	36664+58	18	0.281	65	4,022	1998	0.028	10	225.2	03/26/2223
Cottonwood to El Paso	36665+05	18	0.375	52	4,022	1998	0.038	10	225.2	03/26/2223
Cottonwood to El Paso	36642+98	18	0.375	65	4,017	1998	0.038	10	225.2	03/26/2223

Table C-2. Pressure-Cycle-Induced Fatigue Cracking Analysis of 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 ILLI Detection Threshold (% WT)	Reassessment Interval (years)	Reassessment Due Date
Crane to Texon	24062+95	18	0.250	52	2,525	1953	0.040	16	50.6	06/02/2069
Texon to Barnhart	21999+54	18	0.250	52	2,675	1953	0.040	16	57.4	09/23/2077
Bastrop to Warda	7483+48	18	0.281	45	395	1950	0.040	14	62.9	12/24/2082
Cartman to Kimble	18168+81	18	0.281	45	2,445	1950	0.040	14	64.8	06/08/2085
Cartman to Kimble	18173+61	18	0.281	65	2,445	1950	0.040	14	68.1	09/13/2088
James River to Eckert	13733+47	18	0.281	45	1,705	1950	0.040	14	68.1	04/23/2088
Crane to Texon	24157+75	18	0.281	65	2,524	1998	0.040	14	78.9	08/27/2097
Cartman to Kimble	17883+21	18	0.281	52	2,399	1950	0.040	14	86.0	08/19/2106
Bastrop to Warda	7157+10	18	0.281	65	348	1950	0.040	14	93.3	06/02/2113
Kimble to James River	14758+39	18	0.219	52	1,669	1967	0.040	18	96.0	11/04/2116
Cartman to Kimble	18174+51	18	0.312	45	2,445	1950	0.040	13	100.1	10/05/2120
James River to Eckert	13371+07	18	0.281	65	1,649	2013	0.040	14	105.4	08/15/2125
Barnhart to Cartman	19716+78	18	0.281	65	2,605	2013	0.040	14	108.5	12/04/2128
Kimble to James River	15584+59	18	0.281	45	2,223	1950	0.040	14	128.7	07/13/2149
James River to Eckert	13585+57	18	0.312	60	1,777	1950	0.040	13	128.9	02/01/2149
Warda to Buckhorn	5702+41	18	0.281	45	380	1950	0.040	14	130.4	04/15/2150
Eckert to Cedar Valey	12033+42	18	0.281	45	1,736	1950	0.040	14	130.4	08/12/2150
Buckhorn to Satsuma	3587+47	18	0.281	45	171	1950	0.040	14	140.4	04/11/2160
Warda to Buckhorn	5961+54	18	0.312	45	359	1950	0.040	13	151.0	10/31/2170
Barnhart to Cartman	19726+03	18	0.312	45	2,603	1950	0.040	13	158.9	05/15/2179
Barnhart to Cartman	19262+28	18	0.281	45	2,533	1950	0.040	14	161.9	05/17/2182
Barnhart to Cartman	19717+38	18	0.312	52	2,605	1998	0.040	13	163.1	07/13/2183
Cedar Valey to Bastrop	8965+58	18	0.281	45	790	1950	0.040	14	180.4	05/29/2200
Texon to Barnhart	21388+14	18	0.281	65	2,664	1998	0.040	14	182.9	04/21/2203
Kimble to James River	15260+29	18	0.281	65	2,123	2013	0.040	14	195.9	08/30/2216
Bastrop to Warda	6789+27	18	0.312	45	470	1950	0.040	13	197.9	12/11/2217
Cartman to Kimble	18178+76	18	0.375	35	2,446	2004	0.040	11	201.4	02/03/2222
Eckert to Cedar Valey	12029+82	18	0.312	45	1,744	1950	0.040	13	201.7	12/02/2221
Crane to Texon	22422+53	18	0.281	46	2,664	1995	0.040	14	212.2	01/05/2231
James River to Eckert	13735+06	18	0.375	35	1,712	1950	0.040	11	213.6	10/17/2233
Crane to Texon	24158+24	18	0.375	35	2,524	1998	0.040	11	225.2	01/11/2244
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
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

Table C-2 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of 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)	Reassessment Interval (years)	Reassessment Due Date
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 Valey	12035+40	18	0.375	52	1,728	2006	0.040	11	225.2	05/25/2245
Eckert to Cedar Valey	11998+62	18	0.375	65	1,822	2012	0.040	11	225.2	05/25/2245
Eckert to Cedar Valey	11499+12	18	0.281	45	1,648	2012	0.040	14	225.2	05/25/2245
Eckert to Cedar Valey	11439+42	18	0.500	35	1,705	2012	0.040	8	225.2	05/25/2245
Eckert to Cedar Valey	11389+62	18	0.385	65	1,585	2000	0.040	10	225.2	05/25/2245
Eckert to Cedar Valey	10508+23	18	0.375	35	996	2012	0.040	11	225.2	05/25/2245
Cedar Valey to Bastrop	9590+73	18	0.375	65	1,032	2002	0.040	11	225.2	04/09/2245
Cedar Valey to Bastrop	9561+68	18	0.385	65	973	2002	0.040	10	225.2	04/09/2245
Cedar Valey to Bastrop	9099+68	18	0.375	52	865	2002	0.040	11	225.2	04/09/2245
Cedar Valey to Bastrop	8896+16	18	0.312	45	708	1950	0.040	13	225.2	04/09/2245
Cedar Valey to Bastrop	8430+98	18	0.281	65	553	2013	0.040	14	225.2	04/09/2245
Cedar Valey to Bastrop	7828+82	18	0.500	65	503	2012	0.040	8	225.2	04/09/2245

Table C-2 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of 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)	Reassessment Interval (years)	Reassessment Due Date
Bastrop to Warda	7360+80	18	0.375	35	394	2002	0.040	11	225.2	04/20/2245
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	0.500	42	150	1950	0.040	8	225.2	02/26/2245
Buckhorn to Satsuma	3386+91	18	0.500	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	1800+22	20	0.312	35	126	1947	0.040	13	225.2	11/07/2244
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
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
Satsuma to E Houston	381+01	20	0.344	52	30	1998	0.040	12	225.2	11/07/2244

Table C-2 (continued). Pressure-Cycle-Induced Fatigue Cracking Analysis of 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)	Reassessment Interval (years)	Reassessment Due Date
E Houston to Speed Junction	403+64	20	0.500	42	0	2011	0.050	10	225.2	03/25/2236
E Houston to Speed Junction	363+98	20	0.500	52	5	1998	0.050	10	225.2	03/26/2223
E Houston to Speed Junction	235+10	20	0.344	52	18	1998	0.034	10	225.2	03/26/2223
E Houston to Speed Junction	188+83	20	0.312	52	17	1998	0.031	10	225.2	03/26/2223
E Houston to Speed Junction	187+12	20	0.375	60	19	2013	0.038	10	225.2	03/26/2238
E Houston to Speed Junction	0+14	20	0.375	52	37	2010	0.038	10	225.2	03/26/2235
E Houston to Speed Junction	0+02	20	0.375	35	37	2010	0.038	10	225.2	03/26/2235
E Houston to Speed Junction	403+64	20	0.500	42	0	2011	0.050	10	225.2	03/25/2236

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APPENDIX D – CRACK DETECTION ILI ANOMALY FATIGUE EVALUATION RESULTS

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

To limit the calculation time, a simulation cap of 500 years was imposed. 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 calculated as 45% of the estimated time to failure (remaining life).

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**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)**

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
3585104	14,093.27	18	0.246	52,000	3.53	0.052	8.8	08/19/2027
3585075	7,662.83	18	0.285	65,000	3.77	0.086	8.9	08/31/2027
3585267	55,459.22	18	0.246	52,000	4.83	0.052	10.0	10/08/2028
3585090	11,653.29	18	0.256	52,000	7.53	0.038	10.6	06/06/2029
3585764	211,360.59	18	0.246	52,000	2.94	0.071	11.2	01/03/2030
3585634	166,032.26	18	0.256	52,000	7.77	0.054	11.3	02/19/2030
3585175	25,118.56	18	0.256	52,000	3.77	0.054	11.7	06/24/2030
3585714	187,391.92	18	0.256	52,000	4.00	0.072	11.8	08/19/2030
3585105	14,097.52	18	0.246	52,000	4.12	0.039	12.3	01/21/2031
3585471	114,831.85	18	0.256	52,000	2.94	0.084	12.3	02/02/2031
3585087	10,922.59	18	0.246	52,000	6.00	0.032	12.4	03/20/2031
3585681	181,745.48	18	0.250	52,000	3.30	0.073	12.6	05/13/2031
3585145	19,030.71	18	0.256	52,000	8.94	0.033	13.2	01/07/2032
3585735	198,111.78	18	0.256	52,000	5.06	0.059	13.8	08/06/2032
3585269	58,699.22	18	0.256	52,000	3.77	0.059	13.9	08/25/2032
3585134	17,310.46	18	0.256	52,000	3.77	0.046	13.9	09/07/2032
3585281	61,999.89	18	0.256	52,000	2.94	0.067	14.8	07/20/2033
3585442	107,138.68	18	0.256	52,000	8.24	0.046	15.2	01/08/2034
3585606	162,919.20	18	0.246	52,000	1.88	0.091	15.3	02/01/2034
3585454	109,735.65	18	0.246	52,000	3.53	0.059	15.7	07/04/2034
3585138	18,270.46	18	0.256	52,000	2.47	0.054	15.8	08/04/2034
3585320	75,900.76	18	0.246	52,000	3.65	0.052	16.1	11/30/2034
3585303	69,057.10	18	0.246	52,000	2.59	0.059	16.9	09/30/2035
3585136	17,311.47	18	0.256	52,000	4.00	0.038	17.4	03/12/2036
3585227	43,812.30	18	0.246	52,000	2.35	0.052	17.8	08/06/2036
3585111	14,457.15	18	0.246	52,000	3.53	0.032	17.8	08/24/2036
3585457	110,504.38	18	0.256	52,000	1.30	0.118	18.3	02/09/2037
3585231	44,583.71	18	0.256	52,000	2.83	0.054	18.5	04/23/2037
3585579	154,698.71	18	0.256	52,000	4.24	0.059	19.4	03/12/2038
3585176	25,479.69	18	0.246	52,000	2.59	0.039	19.5	04/11/2038
3585268	56,922.38	18	0.256	52,000	1.65	0.079	19.7	06/15/2038
3585737	199,890.88	18	0.256	52,000	6.12	0.046	19.7	06/27/2038
3585149	19,631.42	18	0.246	52,000	1.77	0.047	20.1	11/11/2038
3585651	174,727.67	18	0.256	52,000	4.71	0.054	20.4	02/25/2039
3585112	15,058.48	18	0.256	52,000	2.94	0.038	20.7	06/24/2039
3585493	121,277.52	18	0.246	52,000	3.53	0.052	21.2	12/18/2039
3585193	33,110.83	18	0.246	52,000	1.41	0.059	21.3	02/22/2040
3585717	188,714.99	18	0.246	52,000	3.30	0.052	21.8	07/25/2040
3585089	11,580.35	18	0.246	52,000	1.06	0.059	21.8	08/02/2040
3585195	33,943.93	18	0.246	52,000	2.47	0.039	22.0	10/31/2040
3585121	15,610.53	18	0.256	52,000	5.89	0.026	22.7	06/29/2041
3585726	191,181.19	18	0.256	52,000	3.18	0.059	23.2	01/12/2042
3585150	19,889.74	18	0.246	52,000	0.94	0.066	23.3	01/26/2042
3585216	41,929.89	18	0.246	52,000	1.41	0.059	23.4	03/10/2042
3585255	51,720.49	18	0.246	52,000	1.06	0.079	23.4	03/15/2042
3585755	207,202.88	18	0.246	52,000	1.41	0.079	23.8	08/13/2042
3585570	150,308.19	18	0.256	52,000	1.88	0.084	24.2	01/17/2043

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)

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
3585698	183,138.54	18	0.246	52,000	2.00	0.066	24.4	02/27/2043
3585308	70,926.08	18	0.246	52,000	2.24	0.052	24.4	03/12/2043
3585282	62,012.79	18	0.256	52,000	1.41	0.079	24.6	05/14/2043
3585132	17,305.83	18	0.256	52,000	2.35	0.038	24.6	06/06/2043
3585288	62,595.18	18	0.246	52,000	1.30	0.071	24.6	06/06/2043
3585133	17,306.30	18	0.256	52,000	5.06	0.026	24.7	06/22/2043
3585356	86,297.56	18	0.246	52,000	1.18	0.086	24.8	08/04/2043
3585697	183,128.39	18	0.246	52,000	1.53	0.079	24.8	08/25/2043
3585122	15,682.46	18	0.246	52,000	2.12	0.032	24.9	08/29/2043
3585605	162,911.35	18	0.246	52,000	1.30	0.091	25.0	10/05/2043
3585543	139,883.31	18	0.246	52,000	3.77	0.047	25.1	11/24/2043
3585767	213,030.38	18	0.256	52,000	6.00	0.038	25.5	04/02/2044
3585446	108,166.46	18	0.246	52,000	4.59	0.039	25.7	07/06/2044
3585103	14,086.10	18	0.246	52,000	2.47	0.027	25.8	08/05/2044
3585110	14,449.98	18	0.246	52,000	1.06	0.052	25.8	08/10/2044
3585119	15,472.67	18	0.246	52,000	1.06	0.052	26.1	11/28/2044
3585733	194,390.12	18	0.246	52,000	2.12	0.059	26.2	12/22/2044
3585221	42,813.92	18	0.246	52,000	3.06	0.032	26.5	04/16/2045
3585289	62,906.39	18	0.256	52,000	1.53	0.072	26.5	04/27/2045
3585599	162,087.12	18	0.256	52,000	1.88	0.079	26.8	08/11/2045
3585696	182,485.00	18	0.246	52,000	4.47	0.039	27.3	01/29/2046
3585135	17,310.97	18	0.256	52,000	2.47	0.033	27.6	05/25/2046
3585533	134,968.96	18	0.246	52,000	2.24	0.059	27.6	05/25/2046
3585313	72,683.92	18	0.256	52,000	1.77	0.067	27.6	05/30/2046
3585295	63,571.36	18	0.256	52,000	2.24	0.054	27.7	06/25/2046
3585094	12,789.46	18	0.256	52,000	2.24	0.033	27.9	09/12/2046
3585525	132,704.65	18	0.246	52,000	1.65	0.071	28.2	12/16/2046
3585607	163,742.78	18	0.246	52,000	1.41	0.079	28.8	08/23/2047
3585083	10,862.43	18	0.256	52,000	0.94	0.059	29.8	08/23/2048
3585158	20,747.14	18	0.246	52,000	0.82	0.059	29.9	09/16/2048
3585098	13,317.64	18	0.256	52,000	1.65	0.038	30.1	11/16/2048
3585129	16,216.52	18	0.256	52,000	3.18	0.026	30.1	11/30/2048
3585350	84,937.46	18	0.256	52,000	1.77	0.067	30.4	03/28/2049
3585210	38,410.10	18	0.256	52,000	1.30	0.059	30.8	07/22/2049
3585265	54,463.44	18	0.246	52,000	0.82	0.079	30.9	09/03/2049
3585099	13,690.44	18	0.246	52,000	0.82	0.052	31.3	01/29/2050
3585574	152,968.50	18	0.256	52,000	1.65	0.079	31.5	04/16/2050
3585521	131,687.65	18	0.256	52,000	1.30	0.092	31.6	05/30/2050
3585713	186,891.46	18	0.246	52,000	2.59	0.047	31.8	08/12/2050
3585542	138,744.20	18	0.256	52,000	8.47	0.033	32.4	03/18/2051
3585185	31,078.14	18	0.256	52,000	0.94	0.067	32.9	08/28/2051
3585354	85,948.87	18	0.256	52,000	4.12	0.038	33.1	11/25/2051
3585126	15,971.71	18	0.256	52,000	1.18	0.046	33.5	04/02/2052
3585310	71,542.24	18	0.256	52,000	1.30	0.072	33.5	04/24/2052
3585148	19,561.94	18	0.256	52,000	1.88	0.033	33.6	05/27/2052
3585163	23,089.10	18	0.256	52,000	2.00	0.033	33.6	06/04/2052
3585491	121,182.69	18	0.246	52,000	1.18	0.079	33.7	06/28/2052

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)

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
3585309	71,277.99	18	0.246	52,000	1.30	0.059	33.7	07/14/2052
3585100	13,914.25	18	0.256	52,000	1.65	0.033	34.2	01/14/2053
3585120	15,610.08	18	0.256	52,000	1.41	0.038	34.3	02/05/2053
3585091	12,086.71	18	0.256	52,000	2.24	0.026	34.4	03/24/2053
3585246	48,999.60	18	0.256	52,000	2.35	0.038	34.4	03/27/2053
3585088	11,363.30	18	0.256	52,000	1.30	0.038	34.7	06/25/2053
3585754	205,263.48	18	0.256	52,000	2.83	0.046	34.8	08/19/2053
3585123	15,829.92	18	0.256	52,000	1.65	0.033	35.0	10/17/2053
3585151	20,042.49	18	0.256	52,000	1.77	0.033	35.1	12/08/2053
3585551	143,598.30	18	0.246	52,000	1.77	0.059	35.4	03/05/2054
3585399	99,608.06	18	0.246	52,000	1.30	0.066	35.4	03/18/2054
3585554	143,911.77	18	0.246	52,000	7.30	0.027	36.1	12/05/2054
3585637	166,990.71	18	0.246	52,000	1.41	0.066	36.8	08/03/2055
3585258	54,067.94	18	0.246	52,000	1.30	0.047	36.9	08/28/2055
3585531	133,851.53	18	0.256	52,000	2.47	0.054	37.2	01/05/2056
3585640	169,518.23	18	0.256	52,000	1.77	0.067	37.3	01/22/2056
3585673	177,504.02	18	0.256	52,000	2.35	0.054	37.6	05/31/2056
3585249	50,308.79	18	0.256	52,000	1.18	0.059	37.7	06/13/2056
3585609	163,928.41	18	0.246	52,000	3.06	0.039	37.8	08/13/2056
3585774	214,513.11	18	0.246	52,000	3.06	0.032	37.9	09/10/2056
3585160	22,321.78	18	0.256	52,000	1.06	0.046	38.8	08/03/2057
3585183	29,209.41	18	0.256	52,000	0.94	0.054	39.8	08/11/2058
3585109	14,439.32	18	0.246	52,000	1.18	0.027	40.1	12/03/2058
3585363	87,314.62	18	0.246	52,000	2.12	0.039	40.3	02/07/2059
3585676	179,276.19	18	0.256	52,000	1.88	0.059	40.4	03/05/2059
3585131	17,151.82	18	0.246	52,000	0.82	0.039	40.5	04/06/2059
3585311	72,055.85	18	0.256	52,000	1.06	0.072	40.7	06/27/2059
3585567	149,703.24	18	0.256	52,000	1.65	0.067	41.0	11/01/2059
3585106	14,195.50	18	0.256	52,000	1.06	0.038	41.0	11/03/2059
3585238	48,552.21	18	0.256	52,000	1.41	0.046	41.2	12/16/2059
3585635	166,253.75	18	0.246	52,000	2.71	0.039	41.2	12/27/2059
3585560	146,328.10	18	0.256	52,000	2.24	0.054	41.4	03/24/2060
3585736	198,998.82	18	0.246	52,000	2.24	0.039	41.5	04/22/2060
3585250	50,361.55	18	0.256	52,000	0.82	0.072	41.6	05/15/2060
3585649	174,405.43	18	0.256	52,000	1.53	0.067	42.2	01/01/2061
3585162	23,085.72	18	0.256	52,000	0.94	0.046	42.7	06/19/2061
3585275	59,433.24	18	0.256	52,000	2.47	0.033	42.9	08/26/2061
3585124	15,844.51	18	0.256	52,000	1.18	0.033	43.3	02/15/2062
3585128	16,165.66	18	0.256	52,000	1.18	0.033	43.4	03/27/2062
3585214	40,443.05	18	0.246	52,000	1.65	0.027	43.5	04/01/2062
3585127	16,015.05	18	0.256	52,000	0.82	0.046	43.5	04/03/2062
3585304	69,156.16	18	0.246	52,000	2.12	0.032	43.5	04/07/2062
3585276	59,961.03	18	0.256	52,000	1.53	0.046	43.5	04/13/2062
3585762	210,980.94	18	0.246	52,000	1.30	0.052	43.7	06/25/2062
3585196	33,948.07	18	0.246	52,000	0.94	0.039	44.1	12/12/2062
3585283	62,350.16	18	0.256	52,000	2.00	0.038	44.2	01/13/2063
3585371	89,195.39	18	0.246	52,000	1.88	0.039	44.2	01/15/2063

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)

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
3585376	91,306.49	18	0.246	52,000	3.53	0.027	44.3	01/29/2063
3585306	69,599.87	18	0.256	52,000	2.71	0.033	44.7	07/13/2063
3585548	142,400.53	18	0.246	52,000	1.06	0.071	45.0	10/07/2063
3585186	31,082.77	18	0.256	52,000	0.82	0.054	45.2	12/18/2063
3585184	30,285.31	18	0.256	52,000	1.41	0.033	45.3	01/19/2064
3585580	154,699.60	18	0.256	52,000	1.77	0.059	45.3	01/30/2064
3585317	74,855.00	18	0.246	52,000	2.12	0.032	45.5	04/13/2064
3585187	31,105.22	18	0.256	52,000	1.41	0.033	45.6	06/02/2064
3585321	76,938.30	18	0.256	52,000	1.41	0.054	46.0	10/20/2064
3585386	94,473.12	18	0.246	52,000	1.30	0.052	46.3	01/27/2065
3585652	174,747.42	18	0.256	52,000	2.35	0.046	46.5	04/17/2065
3585211	39,131.36	18	0.256	52,000	1.30	0.038	46.8	08/07/2065
3585137	18,205.83	18	0.246	52,000	0.82	0.032	47.1	11/22/2065
3585287	62,462.87	18	0.246	52,000	2.12	0.027	47.3	01/19/2066
3585761	210,642.17	18	0.246	52,000	1.18	0.052	47.3	02/12/2066
3585591	159,177.50	18	0.246	52,000	1.77	0.047	47.3	02/20/2066
3585408	100,598.32	18	0.256	52,000	2.71	0.038	47.5	04/23/2066
3585488	119,843.31	18	0.246	52,000	1.65	0.047	47.6	05/13/2066
3585744	202,204.32	18	0.246	52,000	1.06	0.059	47.6	06/01/2066
3585286	62,445.19	18	0.256	52,000	1.41	0.046	47.7	06/14/2066
3585298	65,522.41	18	0.256	52,000	1.18	0.054	48.1	11/23/2066
3585527	133,426.65	18	0.246	52,000	1.06	0.066	48.4	03/17/2067
3585509	125,823.56	18	0.246	52,000	0.94	0.071	48.5	05/04/2067
3585336	82,780.98	18	0.246	52,000	2.12	0.032	48.7	07/13/2067
3585550	142,948.36	18	0.256	52,000	3.18	0.038	48.8	08/08/2067
3585529	133,654.04	18	0.256	52,000	1.06	0.079	48.9	08/31/2067
3585346	83,365.64	18	0.256	52,000	2.24	0.038	48.9	09/28/2067
3585751	204,218.89	18	0.256	52,000	1.30	0.059	49.5	04/22/2068
3585647	172,955.60	18	0.256	52,000	1.53	0.059	49.6	05/23/2068
3585235	46,765.75	18	0.246	52,000	0.94	0.039	50.4	03/12/2069
3585594	160,038.28	18	0.246	52,000	0.82	0.079	50.4	03/18/2069
3585541	138,288.85	18	0.256	52,000	1.77	0.054	50.4	03/19/2069
3585280	61,991.15	18	0.256	52,000	0.82	0.067	50.6	06/10/2069
3585467	113,606.33	18	0.256	52,000	3.41	0.033	51.1	11/30/2069
3585197	33,953.00	18	0.246	52,000	0.94	0.032	51.2	12/16/2069
3585141	18,365.62	18	0.256	52,000	0.94	0.033	51.4	03/10/2070
3585391	96,136.38	18	0.246	52,000	1.30	0.047	51.7	06/20/2070
3585466	113,374.06	18	0.256	52,000	1.18	0.067	51.8	08/10/2070
3585387	94,673.87	18	0.246	52,000	0.82	0.066	52.1	11/29/2070
3585377	91,307.19	18	0.246	52,000	1.53	0.039	52.4	03/23/2071
3585319	75,515.25	18	0.246	52,000	0.94	0.052	52.7	07/19/2071
3585510	125,834.74	18	0.246	52,000	0.94	0.066	52.8	08/01/2071
3585198	34,569.09	18	0.256	52,000	1.18	0.033	53.1	11/11/2071
3585290	63,009.42	18	0.246	52,000	1.41	0.032	53.4	03/02/2072
3585301	68,360.21	18	0.246	52,000	1.18	0.039	53.4	03/23/2072
3585763	211,293.36	18	0.256	52,000	1.53	0.046	53.5	04/19/2072
3585236	48,402.47	18	0.256	52,000	0.82	0.054	53.8	08/19/2072

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)

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
3585563	148,862.47	18	0.236	52,000	1.77	0.033	54.0	10/23/2072
3585728	191,905.34	18	0.256	52,000	1.77	0.046	54.2	01/01/2073
3585496	122,873.76	18	0.246	52,000	3.18	0.027	54.4	03/10/2073
3585547	141,070.91	18	0.246	52,000	3.41	0.027	54.5	05/01/2073
3585498	122,874.76	18	0.246	52,000	1.77	0.039	54.9	09/12/2073
3585444	107,528.68	18	0.256	52,000	1.41	0.054	55.0	10/11/2073
3585514	127,794.84	18	0.246	52,000	1.41	0.047	55.1	11/10/2073
3585312	72,196.25	18	0.256	52,000	2.94	0.026	55.4	02/25/2074
3585768	213,611.41	18	0.246	52,000	1.06	0.047	55.4	02/26/2074
3585389	94,841.52	18	0.246	52,000	1.18	0.047	55.4	03/16/2074
3585390	94,842.17	18	0.246	52,000	1.18	0.047	55.4	03/16/2074
3585314	72,793.24	18	0.256	52,000	2.94	0.026	55.5	04/27/2074
3585219	42,248.62	18	0.246	52,000	0.94	0.032	55.8	07/22/2074
3585750	203,658.02	18	0.256	52,000	2.00	0.038	55.9	09/18/2074
3585420	103,791.09	18	0.256	52,000	0.82	0.079	56.0	10/15/2074
3585489	119,876.57	18	0.246	52,000	1.18	0.052	56.0	11/03/2074
3585212	39,808.42	18	0.246	52,000	1.06	0.027	56.2	12/18/2074
3585234	46,461.19	18	0.256	52,000	1.30	0.033	56.4	03/11/2075
3585549	142,404.48	18	0.246	52,000	1.41	0.047	56.9	08/31/2075
3585712	185,902.35	18	0.246	52,000	0.82	0.066	56.9	09/08/2075
3585270	58,715.64	18	0.256	52,000	1.30	0.038	57.1	11/06/2075
3585293	63,270.77	18	0.246	52,000	0.82	0.047	57.4	03/25/2076
3585291	63,060.36	18	0.256	52,000	2.35	0.026	57.6	05/07/2076
3585559	145,349.60	18	0.256	52,000	1.88	0.046	57.6	05/22/2076
3585177	26,384.51	18	0.256	52,000	1.18	0.026	57.6	05/27/2076
3585324	77,979.69	18	0.256	52,000	0.82	0.067	58.2	01/14/2077
3585388	94,678.51	18	0.246	52,000	0.82	0.059	58.8	07/24/2077
3585677	179,339.84	18	0.246	52,000	0.94	0.059	58.8	08/16/2077
3585573	152,951.35	18	0.256	52,000	3.06	0.033	58.9	09/02/2077
3585079	10,464.40	18	0.256	52,000	0.82	0.026	59.3	02/11/2078
3585565	149,226.71	18	0.246	52,000	1.18	0.052	59.5	04/26/2078
3585192	32,905.81	18	0.256	52,000	0.82	0.038	59.6	05/29/2078
3585215	40,443.41	18	0.246	52,000	0.82	0.032	59.6	06/07/2078
3585409	100,650.91	18	0.256	52,000	0.94	0.067	59.8	07/19/2078
3585266	55,089.84	18	0.246	52,000	0.82	0.039	60.0	10/28/2078
3585739	200,952.13	18	0.256	52,000	1.18	0.054	60.2	01/01/2079
3585473	116,224.40	18	0.246	52,000	1.06	0.052	60.6	05/18/2079
3585194	33,897.27	18	0.256	52,000	0.94	0.033	60.7	06/17/2079
3585603	162,304.13	18	0.256	52,000	1.06	0.067	60.9	09/14/2079
3585157	20,456.75	18	0.256	52,000	0.94	0.026	61.4	03/13/2080
3585328	79,413.50	18	0.256	52,000	1.53	0.038	61.7	07/14/2080
3585711	185,793.41	18	0.256	52,000	2.47	0.033	61.8	07/29/2080
3585470	114,802.19	18	0.256	52,000	4.00	0.026	62.1	11/15/2080
3585364	87,896.29	18	0.256	52,000	1.06	0.054	62.2	12/18/2080
3585443	107,299.84	18	0.256	52,000	1.06	0.059	63.1	11/23/2081
3585213	40,350.73	18	0.256	52,000	1.30	0.026	63.1	11/30/2081
3585518	129,188.44	18	0.256	52,000	1.30	0.054	63.5	05/02/2082

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)

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
3585351	85,663.93	18	0.256	52,000	1.53	0.038	64.0	10/25/2082
3585385	94,028.17	18	0.246	52,000	1.18	0.039	64.4	03/05/2083
3585294	63,560.63	18	0.256	52,000	0.94	0.046	64.7	06/29/2083
3585715	187,404.33	18	0.256	52,000	1.18	0.054	64.9	08/28/2083
3585596	160,694.54	18	0.256	52,000	1.30	0.054	65.1	11/10/2083
3585553	143,909.28	18	0.246	52,000	1.88	0.032	66.5	04/24/2085
3585407	100,451.89	18	0.256	52,000	1.65	0.038	66.6	05/24/2085
3585404	100,339.07	18	0.256	52,000	0.82	0.067	67.0	10/12/2085
3585674	178,519.57	18	0.246	52,000	1.06	0.047	67.4	03/22/2086
3585524	132,609.10	18	0.246	52,000	2.24	0.027	67.7	06/22/2086
3585370	89,107.10	18	0.256	52,000	0.94	0.054	68.5	05/02/2087
3585419	103,721.07	18	0.256	52,000	0.94	0.059	68.6	05/21/2087
3585675	178,874.02	18	0.246	52,000	1.65	0.032	68.8	07/24/2087
3585775	214,608.82	18	0.246	52,000	0.94	0.039	69.1	12/08/2087
3585610	164,039.49	18	0.246	52,000	0.94	0.052	70.1	11/17/2088
3585245	48,952.54	18	0.256	52,000	0.94	0.033	70.7	07/11/2089
3585566	149,689.46	18	0.256	52,000	1.18	0.054	70.9	09/19/2089
3585469	114,799.96	18	0.256	52,000	2.00	0.033	71.2	01/08/2090
3585254	50,832.46	18	0.256	52,000	0.94	0.033	72.1	11/18/2090
3585530	133,738.71	18	0.256	52,000	2.12	0.033	72.4	02/28/2091
3585592	159,827.54	18	0.246	52,000	1.53	0.032	75.6	06/12/2094
3585414	102,474.87	18	0.246	52,000	0.82	0.047	75.7	07/08/2094
3585638	167,653.88	18	0.256	52,000	0.94	0.059	75.9	09/16/2094
3585495	121,811.55	18	0.246	52,000	1.41	0.032	76.3	01/27/2095
3585725	190,157.94	18	0.256	52,000	0.94	0.054	76.3	02/11/2095
3585724	190,036.63	18	0.256	52,000	0.94	0.054	76.4	03/03/2095
3585613	165,184.73	18	0.246	52,000	0.94	0.047	76.6	05/22/2095
3585237	48,416.44	18	0.256	52,000	0.82	0.033	76.6	06/05/2095
3585557	144,852.18	18	0.256	52,000	2.94	0.026	76.7	07/18/2095
3585748	202,851.21	18	0.256	52,000	2.12	0.026	76.8	08/06/2095
3585540	138,109.90	18	0.256	52,000	0.94	0.059	76.8	08/11/2095
3585680	181,617.25	18	0.256	52,000	1.18	0.046	76.9	09/01/2095
3585299	66,921.02	18	0.246	52,000	0.82	0.032	77.4	03/29/2096
3585577	153,768.98	18	0.246	52,000	0.94	0.047	77.7	06/28/2096
3585400	99,671.57	18	0.246	52,000	0.94	0.039	77.8	07/21/2096
3585753	204,644.14	18	0.256	52,000	0.82	0.054	78.0	10/09/2096
3585752	204,629.60	18	0.256	52,000	2.00	0.026	78.3	02/22/2097
3585277	59,986.42	18	0.256	52,000	0.82	0.038	78.4	03/23/2097
3585732	193,987.15	18	0.256	52,000	1.06	0.046	78.5	05/02/2097
3585558	144,857.35	18	0.256	52,000	1.88	0.033	79.1	12/06/2097
3585485	119,218.10	18	0.256	52,000	1.41	0.038	79.8	08/01/2098
3585279	60,889.67	18	0.256	52,000	0.94	0.033	79.9	09/10/2098
3585568	149,891.37	18	0.256	52,000	1.53	0.038	80.3	02/08/2099
3585305	69,302.83	18	0.256	52,000	1.41	0.026	80.4	03/30/2099
3585727	191,713.40	18	0.246	52,000	1.18	0.032	80.7	07/03/2099
3585499	122,875.57	18	0.246	52,000	1.30	0.032	81.1	12/04/2099
3585392	96,205.48	18	0.246	52,000	1.06	0.032	81.7	06/17/2100

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)

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
3585734	196,817.84	18	0.256	52,000	0.82	0.054	81.7	07/17/2100
3585776	214,731.57	18	0.256	52,000	1.18	0.033	82.2	12/21/2100
3585331	81,035.03	18	0.256	52,000	0.82	0.046	83.1	11/28/2101
3585552	143,776.01	18	0.246	52,000	1.30	0.032	84.5	04/14/2103
3585670	175,910.37	18	0.256	52,000	1.06	0.046	84.7	07/10/2103
3585505	125,225.28	18	0.256	52,000	1.06	0.046	85.4	03/19/2104
3585381	92,545.53	18	0.256	52,000	1.06	0.038	85.6	05/30/2104
3585278	60,193.00	18	0.256	52,000	0.82	0.033	86.3	01/24/2105
3585641	169,597.00	18	0.256	52,000	1.06	0.046	86.3	02/10/2105
3585372	89,487.54	18	0.256	52,000	1.18	0.033	86.6	05/11/2105
3585758	207,779.58	18	0.256	52,000	0.82	0.046	86.6	05/17/2105
3585597	162,024.10	18	0.256	52,000	1.06	0.046	87.8	08/19/2106
3585642	169,698.66	18	0.256	52,000	1.53	0.033	88.0	10/25/2106
3585380	92,458.97	18	0.256	52,000	0.82	0.046	88.6	06/02/2107
3585561	146,331.01	18	0.256	52,000	1.06	0.046	88.6	06/11/2107
3585593	159,987.29	18	0.246	52,000	0.94	0.039	88.8	08/18/2107
3585535	135,039.59	18	0.246	52,000	1.41	0.027	89.0	10/15/2107
3585765	211,364.99	18	0.246	52,000	0.82	0.032	89.5	04/12/2108
3585572	152,306.74	18	0.256	52,000	1.30	0.038	89.8	08/15/2108
3585307	70,640.07	18	0.256	52,000	1.18	0.026	89.8	08/24/2108
3585468	114,320.14	18	0.256	52,000	0.94	0.046	89.9	09/02/2108
3585760	210,470.65	18	0.246	52,000	0.82	0.032	90.2	12/16/2108
3585555	144,052.68	18	0.246	52,000	1.41	0.027	90.3	02/19/2109
3585472	115,798.61	18	0.256	52,000	0.94	0.046	90.4	03/27/2109
3585588	158,875.46	18	0.256	52,000	2.12	0.026	90.8	08/03/2109
3585253	50,734.97	18	0.256	52,000	0.82	0.026	90.8	08/21/2109
3585427	104,773.06	18	0.256	52,000	1.06	0.038	91.3	02/08/2110
3585395	97,428.00	18	0.246	52,000	1.06	0.027	91.8	07/30/2110
3585643	171,155.61	18	0.246	52,000	1.30	0.027	92.4	03/12/2111
3585413	102,071.75	18	0.256	52,000	0.82	0.046	93.6	05/21/2112
3585648	174,072.75	18	0.246	52,000	0.82	0.039	94.4	03/25/2113
3585384	93,189.45	18	0.246	52,000	0.82	0.032	94.4	03/29/2113
3585528	133,535.54	18	0.246	52,000	1.06	0.032	94.6	05/20/2113
3585678	180,937.80	18	0.256	52,000	1.77	0.026	94.7	07/03/2113
3585329	80,805.17	18	0.256	52,000	0.82	0.038	94.7	07/05/2113
3585705	184,362.83	18	0.256	52,000	1.06	0.038	95.3	01/24/2114
3585749	203,327.03	18	0.256	52,000	1.06	0.033	95.5	04/28/2114
3585532	134,968.44	18	0.246	52,000	0.82	0.039	96.7	06/24/2115
3585608	163,919.68	18	0.246	52,000	0.82	0.039	97.0	10/17/2115
3585465	112,663.56	18	0.246	52,000	1.06	0.027	98.5	04/16/2117
3585600	162,090.03	18	0.256	52,000	1.30	0.033	99.4	03/12/2118
3585759	208,000.81	18	0.256	52,000	0.94	0.033	99.6	06/11/2118
3585360	87,254.13	18	0.246	52,000	0.82	0.027	100.2	01/13/2119
3585587	158,708.68	18	0.246	52,000	1.18	0.027	100.2	01/14/2119
3585653	174,839.99	18	0.256	52,000	0.82	0.046	102.1	11/25/2120
3585571	151,122.71	18	0.256	52,000	1.06	0.038	102.8	08/13/2121
3585740	201,536.23	18	0.256	52,000	0.82	0.038	103.0	10/31/2121

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)

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
3585773	214,273.77	18	0.256	52,000	0.82	0.033	103.3	01/31/2122
3585330	80,806.76	18	0.256	52,000	0.82	0.033	103.9	09/26/2122
3585581	154,700.23	18	0.256	52,000	1.65	0.026	104.5	05/01/2123
3585585	156,057.62	18	0.256	52,000	0.82	0.046	106.2	01/05/2125
3585500	122,929.43	18	0.256	52,000	0.94	0.038	106.6	06/05/2125
3585490	120,284.33	18	0.256	52,000	1.41	0.026	107.8	08/12/2126
3585423	104,648.04	18	0.256	52,000	0.82	0.038	108.0	10/31/2126
3585511	125,845.93	18	0.246	52,000	0.82	0.032	108.7	07/09/2127
3585671	176,010.91	18	0.256	52,000	1.06	0.033	108.8	08/20/2127
3585327	78,027.86	18	0.256	52,000	0.94	0.026	108.9	09/03/2127
3585494	121,283.53	18	0.246	52,000	0.94	0.027	109.2	12/17/2127
3585440	106,256.83	18	0.256	52,000	0.94	0.033	109.7	07/14/2128
3585589	158,877.39	18	0.256	52,000	0.94	0.038	110.5	05/07/2129
3585590	158,879.51	18	0.256	52,000	0.94	0.038	110.5	05/08/2129
3585586	158,191.90	18	0.256	52,000	0.94	0.038	110.7	06/21/2129
3585595	160,548.72	18	0.246	52,000	0.82	0.032	112.1	11/19/2130
3585539	137,994.87	18	0.246	52,000	0.94	0.027	114.1	11/11/2132
3585520	131,014.10	18	0.256	52,000	1.30	0.026	116.6	05/30/2135
3585650	174,503.09	18	0.256	52,000	0.82	0.038	116.7	07/10/2135
3585519	129,895.05	18	0.256	52,000	0.82	0.038	118.2	12/28/2136
3585598	162,054.49	18	0.256	52,000	0.94	0.033	121.4	03/16/2140
3585355	86,290.71	18	0.256	52,000	0.82	0.026	123.8	08/10/2142
3585546	140,636.54	18	0.246	52,000	0.82	0.027	124.1	11/20/2142
3585569	150,225.60	18	0.256	52,000	1.18	0.026	126.3	02/05/2145
3585742	201,934.55	18	0.256	52,000	0.82	0.026	130.8	07/26/2149
3585526	133,231.49	18	0.256	52,000	0.82	0.033	131.1	11/15/2149
3585672	176,011.26	18	0.256	52,000	0.94	0.026	136.9	08/31/2155
3585564	149,104.63	18	0.256	52,000	0.94	0.026	143.3	02/22/2162
3585503	124,623.36	18	0.256	52,000	0.82	0.026	148.9	09/09/2167
3585562	148,446.20	18	0.256	52,000	0.82	0.026	154.8	08/08/2173

**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)**

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
5944990	14,539.19	18	0.246	52,000	4.13	0.052	10.4	09/20/2030
5944822	1,750.00	18	0.246	52,000	2.95	0.052	11.9	04/13/2032
5945238	35,239.67	18	0.246	52,000	4.37	0.052	12.4	10/19/2032
5945202	30,497.45	18	0.256	52,000	5.20	0.054	12.6	01/04/2033
5944795	1,557.34	18	0.246	52,000	1.89	0.059	14.7	02/09/2035
5944873	8,840.97	18	0.256	52,000	2.83	0.054	16.2	08/10/2036
5944872	8,508.39	18	0.246	52,000	2.24	0.052	16.4	09/24/2036
5944901	11,538.01	18	0.246	52,000	2.60	0.047	17.1	06/28/2037
5944908	12,169.86	18	0.246	52,000	2.48	0.047	17.9	04/17/2038
5945219	32,567.06	18	0.256	52,000	2.24	0.067	18.9	03/22/2039
5945028	18,290.97	18	0.246	52,000	1.42	0.066	19.9	04/18/2040
5944907	12,168.06	18	0.246	52,000	1.18	0.066	22.1	06/06/2042
5945239	35,266.00	18	0.246	52,000	1.54	0.066	22.2	08/12/2042
5944792	1,411.24	18	0.246	52,000	1.18	0.059	22.5	11/11/2042
5945003	16,609.03	18	0.256	52,000	1.54	0.067	22.9	04/05/2043
5945026	18,087.51	18	0.246	52,000	1.18	0.066	23.5	12/01/2043
5945191	27,115.99	18	0.246	52,000	1.54	0.059	23.7	01/15/2044
5945031	18,805.48	18	0.246	52,000	1.18	0.066	23.7	02/10/2044
5944865	7,201.36	18	0.256	52,000	1.30	0.067	24.1	06/06/2044
5945223	32,660.01	18	0.246	52,000	2.24	0.047	24.3	09/15/2044
5945218	32,421.14	18	0.256	52,000	2.24	0.054	25.7	01/13/2046
5944904	11,776.07	18	0.246	52,000	1.54	0.047	26.2	07/09/2046
5945388	56,977.88	18	0.246	52,000	2.72	0.047	26.6	12/22/2046
5945038	19,986.99	18	0.246	52,000	1.42	0.052	27.5	11/09/2047
5945378	55,793.84	18	0.246	52,000	1.77	0.059	27.9	04/17/2048
5945338	49,998.40	18	0.256	52,000	1.77	0.067	28.5	11/12/2048
5945002	16,608.83	18	0.256	52,000	1.18	0.067	29.1	06/08/2049

**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)**

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
5945184	26,011.38	18	0.246	52,000	1.18	0.059	29.4	10/14/2049
5945250	37,880.24	18	0.256	52,000	1.77	0.059	29.7	01/12/2050
5945269	39,069.72	18	0.246	52,000	1.30	0.059	31.2	08/01/2051
5945221	32,589.85	18	0.256	52,000	1.77	0.054	31.3	08/31/2051
5944992	15,037.07	18	0.246	52,000	0.95	0.059	31.5	11/25/2051
5945068	23,416.84	18	0.256	52,000	1.54	0.054	31.8	03/01/2052
5944989	14,529.41	18	0.246	52,000	1.18	0.047	33.0	04/29/2053
5947113	105,789.21	18	0.305	45,000	5.43	0.079	34.1	06/20/2054
5945190	27,115.79	18	0.246	52,000	2.95	0.027	34.2	08/01/2054
5945200	30,314.91	18	0.256	52,000	1.54	0.054	34.3	09/10/2054
5945311	44,597.29	18	0.246	52,000	1.06	0.066	34.6	12/14/2054
5945224	32,812.13	18	0.246	52,000	1.06	0.059	34.7	01/18/2055
5945343	51,229.67	18	0.246	52,000	1.30	0.059	35.4	10/09/2055
5947799	173,315.87	18	0.305	45,000	6.85	0.079	36.0	05/30/2056
5945249	37,613.45	18	0.256	52,000	1.18	0.067	36.4	10/15/2056
5945013	17,320.12	18	0.256	52,000	0.83	0.072	37.0	05/11/2057
5944894	10,912.09	18	0.256	52,000	1.06	0.054	37.3	08/15/2057
5945337	49,997.20	18	0.256	52,000	1.18	0.072	37.8	02/28/2058
5945296	41,707.07	18	0.246	52,000	1.06	0.059	38.2	08/06/2058
5944825	1,765.00	18	0.246	52,000	0.95	0.039	38.8	03/19/2059
5944875	8,921.75	18	0.246	52,000	1.65	0.027	38.9	03/24/2059
5945215	31,996.33	18	0.256	52,000	1.65	0.046	38.9	04/25/2059
5945410	57,911.16	18	0.246	52,000	1.06	0.066	39.1	07/03/2059
5945069	23,583.60	18	0.246	52,000	1.06	0.047	39.3	09/17/2059
5944993	15,070.50	18	0.246	52,000	0.83	0.052	39.8	03/16/2060
5945227	33,151.49	18	0.246	52,000	1.18	0.047	40.5	10/29/2060
5945030	18,729.31	18	0.256	52,000	0.83	0.067	40.5	11/22/2060
5945279	40,104.20	18	0.246	52,000	0.95	0.059	41.4	10/01/2061
5944994	15,113.20	18	0.246	52,000	1.06	0.039	41.5	11/08/2061
5944816	1,568.92	18	0.246	52,000	0.83	0.039	42.5	11/03/2062
5947320	125,683.86	18	0.305	52,000	4.96	0.079	43.3	09/01/2063
5945301	42,673.01	18	0.246	52,000	1.06	0.052	44.3	08/17/2064
5945814	72,594.70	18	0.305	45,000	4.25	0.067	44.5	10/27/2064
5945406	57,655.89	18	0.246	52,000	1.06	0.059	44.5	10/28/2064
5945316	46,186.22	18	0.256	52,000	0.95	0.072	44.7	01/24/2065
5945417	58,541.46	18	0.256	52,000	1.06	0.072	45.0	05/11/2065
5945629	66,353.51	18	0.305	45,000	5.31	0.058	46.4	10/11/2066
5945519	60,929.05	18	0.246	52,000	0.83	0.071	46.5	11/02/2066
5945212	31,600.66	18	0.256	52,000	0.83	0.067	46.5	11/10/2066
5947117	106,052.37	18	0.305	45,000	16.06	0.052	47.3	09/10/2067
5945081	59,045.07	18	0.246	52,000	0.83	0.066	49.3	09/17/2069
5948920	220,977.06	18	0.315	45,000	8.62	0.066	49.7	01/25/2070
5945315	46,184.42	18	0.256	52,000	0.83	0.072	50.4	10/07/2070
5945651	67,105.69	18	0.305	45,000	3.31	0.067	51.8	02/17/2072
5945034	19,286.59	18	0.246	52,000	0.83	0.039	51.8	03/02/2072
5945637	66,544.29	18	0.315	45,000	14.17	0.047	53.0	06/02/2073
5945371	55,106.10	18	0.256	52,000	1.06	0.059	54.1	06/29/2074

**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)**

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
5948990	223,357.17	18	0.315	45,000	4.37	0.079	54.7	01/13/2075
5945303	43,094.47	18	0.256	52,000	1.54	0.038	55.0	05/10/2075
5947179	112,757.34	18	0.305	45,000	4.84	0.067	55.5	10/30/2075
5945336	49,996.70	18	0.256	52,000	0.83	0.067	56.2	07/31/2076
5945424	58,915.09	18	0.246	52,000	1.06	0.047	56.5	11/09/2076
5945340	50,403.46	18	0.256	52,000	0.95	0.059	57.0	05/23/2077
5947617	149,390.94	18	0.305	45,000	5.90	0.067	57.2	07/12/2077
5945044	21,598.63	18	0.256	52,000	0.83	0.046	57.6	12/11/2077
5945211	31,599.86	18	0.256	52,000	1.18	0.038	57.7	01/16/2078
5945214	31,876.64	18	0.256	52,000	0.95	0.046	58.5	11/07/2078
5945188	26,610.41	18	0.256	52,000	1.06	0.038	58.6	12/23/2078
5945370	54,966.28	18	0.256	52,000	1.30	0.046	58.7	02/06/2079
5945386	56,746.31	18	0.246	52,000	0.83	0.052	61.5	11/21/2081
5947490	181,759.27	18	0.305	45,000	8.86	0.058	62.2	07/19/2082
5945199	30,205.28	18	0.256	52,000	0.83	0.046	63.3	08/21/2083
5945043	21,061.77	18	0.246	52,000	0.83	0.027	66.7	02/12/2087
5946128	88,328.34	18	0.305	45,000	4.01	0.058	67.3	09/11/2087
5946096	86,080.09	18	0.305	45,000	3.78	0.058	69.0	05/31/2089
5945335	49,972.55	18	0.256	52,000	0.95	0.046	70.4	10/23/2090
5947747	167,256.38	18	0.315	45,000	6.38	0.066	71.2	08/03/2091
5948498	217,622.06	18	0.295	45,000	16.06	0.038	72.8	03/04/2093
5947703	162,964.70	18	0.305	45,000	4.37	0.067	73.2	07/13/2093
5945306	43,868.94	18	0.256	52,000	0.83	0.046	73.3	09/12/2093
5947805	173,567.76	18	0.315	45,000	2.95	0.091	74.4	10/01/2094
5947625	150,316.60	18	0.315	45,000	4.37	0.072	75.9	04/18/2096
5947743	167,149.96	18	0.315	45,000	5.55	0.066	77.8	02/26/2098
5945220	32,585.65	18	0.256	52,000	0.83	0.033	81.1	06/28/2101
5947504	136,351.61	18	0.315	45,000	3.66	0.072	83.5	11/16/2103
5945086	59,709.76	18	0.256	52,000	0.83	0.046	84.9	04/04/2105
5945839	73,722.73	18	0.315	45,000	2.83	0.060	87.0	05/25/2107
5947664	155,836.23	18	0.305	45,000	6.38	0.052	88.6	12/17/2108
5945820	73,063.20	18	0.315	45,000	1.77	0.079	89.3	08/21/2109
5946028	79,511.16	18	0.315	45,000	1.89	0.079	89.5	12/01/2109
5945317	46,196.80	18	0.256	52,000	0.83	0.033	93.8	02/21/2114
5947744	167,151.46	18	0.315	45,000	3.07	0.072	104.7	02/06/2125
5946138	88,730.88	18	0.305	45,000	1.54	0.073	105.6	12/06/2125
5947776	168,995.03	18	0.315	45,000	4.49	0.060	105.9	03/29/2126
5946465	94,082.85	18	0.305	45,000	1.77	0.067	108.2	07/19/2128
5948826	209,828.43	18	0.315	45,000	2.60	0.072	108.4	09/27/2128
5947395	130,976.74	18	0.315	52,000	2.60	0.072	111.1	06/24/2131
5946140	88,854.19	18	0.305	45,000	1.18	0.085	111.1	07/04/2131
5947080	102,749.07	18	0.305	45,000	2.60	0.052	116.8	03/17/2137
5945815	72,595.80	18	0.305	45,000	1.54	0.058	117.7	01/09/2138
5947673	158,089.38	18	0.305	45,000	2.01	0.073	121.9	04/08/2142
5946846	121,714.54	18	0.315	45,000	10.86	0.038	122.3	09/13/2142
5945838	73,639.67	18	0.325	45,000	4.72	0.039	126.7	02/09/2147
5947426	133,814.48	18	0.305	45,000	2.48	0.058	127.5	11/03/2147

**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)**

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
5946027	79,510.96	18	0.315	45,000	1.77	0.060	128.9	04/21/2149
5946164	90,046.13	18	0.305	45,000	2.24	0.046	133.2	07/21/2153
5947091	103,900.56	18	0.305	45,000	2.60	0.046	134.8	03/19/2155
5947908	184,622.63	18	0.305	45,000	4.01	0.046	135.1	06/12/2155
5947903	184,108.88	18	0.305	45,000	3.07	0.052	136.3	09/03/2156
5947178	112,700.52	18	0.315	45,000	2.72	0.054	139.3	08/18/2159
5947114	105,818.99	18	0.305	45,000	4.61	0.034	140.1	07/07/2160
5946179	91,964.89	18	0.295	45,000	1.54	0.047	142.0	05/12/2162
5948828	210,125.75	18	0.315	45,000	1.65	0.079	142.2	08/15/2162
5945955	76,730.15	18	0.315	45,000	1.30	0.066	143.2	07/29/2163
5946030	79,971.16	18	0.315	45,000	3.07	0.038	144.4	10/03/2164
5946847	121,879.96	18	0.305	45,000	0.95	0.098	147.7	01/28/2168
5947484	180,937.46	18	0.315	45,000	2.01	0.072	148.4	09/23/2168
5947358	128,965.21	18	0.315	52,000	3.66	0.047	149.1	07/01/2169
5947950	188,379.74	18	0.315	45,000	2.24	0.066	149.6	12/23/2169
5947594	146,774.22	18	0.305	45,000	3.07	0.046	153.1	06/26/2173
5947508	136,686.98	18	0.315	45,000	2.83	0.054	153.7	01/30/2174
5947026	99,962.32	18	0.305	45,000	2.01	0.046	153.9	04/06/2174
5948847	212,786.35	18	0.305	45,000	1.77	0.058	157.7	02/06/2178
5948967	223,025.35	18	0.315	45,000	1.89	0.060	159.1	07/03/2179
5947745	167,152.76	18	0.315	45,000	6.85	0.038	162.6	12/08/2182
5947162	110,502.31	18	0.295	45,000	1.54	0.047	162.8	03/22/2183
5946107	87,221.18	18	0.305	45,000	1.54	0.046	165.7	01/31/2186
5945650	67,088.53	18	0.305	45,000	1.65	0.034	167.8	03/04/2188
5947446	135,671.22	18	0.305	45,000	2.95	0.040	174.0	04/28/2194
5947103	104,993.85	18	0.305	45,000	2.13	0.040	175.2	08/06/2195
5946129	88,351.33	18	0.305	45,000	1.06	0.058	176.4	10/09/2196
5946102	86,809.12	18	0.305	45,000	1.65	0.040	177.0	05/31/2197
5946117	87,601.26	18	0.305	45,000	1.18	0.052	178.5	12/03/2198
5945715	69,230.13	18	0.305	45,000	1.89	0.027	182.0	05/16/2202
5946833	120,132.38	18	0.315	45,000	1.65	0.060	182.7	01/31/2203
5947665	156,036.85	18	0.305	45,000	2.36	0.046	184.0	05/01/2204
5945811	72,276.13	18	0.315	45,000	1.30	0.047	184.0	05/11/2204
5946003	77,304.93	18	0.315	45,000	1.18	0.054	185.7	02/08/2206
5945879	74,398.50	18	0.305	45,000	1.06	0.046	187.7	02/13/2208
5947583	144,718.27	18	0.315	45,000	2.13	0.054	191.9	04/24/2212
5947276	124,848.07	18	0.305	52,000	3.07	0.034	192.3	09/14/2212
5947780	170,353.89	18	0.305	45,000	2.83	0.040	193.5	11/20/2213
5946007	77,354.98	18	0.305	45,000	0.95	0.046	208.2	07/23/2228
5947589	145,756.59	18	0.305	45,000	1.77	0.046	214.5	11/11/2234
5947217	115,146.49	18	0.305	45,000	1.06	0.058	214.7	02/12/2235
5945589	65,105.26	18	0.344	45,000	1.18	0.065	216.2	08/03/2236
5945662	67,553.09	18	0.315	45,000	0.95	0.047	217.3	08/28/2237
5947447	135,783.49	18	0.315	45,000	1.42	0.060	220.5	11/24/2240
5945964	76,998.01	18	0.305	45,000	1.18	0.034	220.8	02/24/2241
5948829	210,128.25	18	0.315	45,000	1.06	0.072	223.6	12/25/2243
5945581	64,818.70	18	0.335	45,000	0.83	0.047	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. 5 of 6)**

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
5945582	64,857.12	18	0.335	45,000	0.95	0.040	225.2	08/07/2245
5945584	64,884.62	18	0.344	45,000	0.83	0.034	225.2	08/07/2245
5945598	65,523.79	18	0.335	45,000	0.83	0.040	225.2	08/07/2245
5945636	66,541.00	18	0.315	45,000	0.83	0.032	225.2	08/07/2245
5946006	77,347.09	18	0.305	45,000	1.18	0.027	225.2	08/07/2245
5946077	83,985.87	18	0.305	45,000	1.06	0.034	225.2	08/07/2245
5946089	85,173.07	18	0.315	45,000	0.95	0.047	225.2	08/07/2245
5946114	87,532.84	18	0.315	45,000	0.83	0.025	225.2	08/07/2245
5946115	87,536.41	18	0.315	45,000	1.06	0.038	225.2	08/07/2245
5946130	88,366.12	18	0.315	45,000	0.83	0.032	225.2	08/07/2245
5947093	104,054.30	18	0.315	45,000	1.06	0.047	225.2	08/07/2245
5947094	104,059.60	18	0.315	45,000	1.77	0.038	225.2	08/07/2245
5947130	106,668.55	18	0.315	45,000	1.06	0.038	225.2	08/07/2245
5947140	107,538.92	18	0.305	45,000	1.18	0.040	225.2	08/07/2245
5947213	114,959.30	18	0.315	45,000	0.95	0.054	225.2	08/07/2245
5947219	115,325.45	18	0.315	45,000	1.89	0.025	225.2	08/07/2245
5947225	116,133.32	18	0.315	45,000	1.18	0.038	225.2	08/07/2245
5946840	121,248.06	18	0.315	45,000	0.95	0.047	225.2	08/07/2245
5946858	122,822.81	18	0.315	45,000	1.18	0.032	225.2	08/07/2245
5946869	123,492.17	18	0.305	45,000	0.83	0.027	225.2	08/07/2245
5947398	131,351.87	18	0.315	45,000	1.42	0.054	225.2	08/07/2245
5947422	133,207.57	18	0.315	45,000	0.95	0.038	225.2	08/07/2245
5947427	133,840.16	18	0.305	45,000	1.18	0.034	225.2	08/07/2245
5947439	134,450.80	18	0.315	45,000	1.42	0.054	225.2	08/07/2245
5947440	134,764.26	18	0.315	45,000	1.42	0.025	225.2	08/07/2245
5947448	135,921.14	18	0.315	45,000	1.30	0.038	225.2	08/07/2245
5947518	136,976.37	18	0.315	45,000	2.01	0.032	225.2	08/07/2245
5947521	137,165.19	18	0.315	45,000	1.06	0.038	225.2	08/07/2245
5947527	137,632.51	18	0.315	45,000	1.89	0.038	225.2	08/07/2245
5947528	138,387.98	18	0.315	45,000	1.54	0.032	225.2	08/07/2245
5947532	138,746.55	18	0.315	45,000	1.06	0.054	225.2	08/07/2245
5947549	140,062.17	18	0.295	45,000	0.83	0.053	225.2	08/07/2245
5947570	142,438.24	18	0.305	45,000	1.06	0.052	225.2	08/07/2245
5947573	142,866.11	18	0.305	45,000	0.95	0.052	225.2	08/07/2245
5947596	147,182.16	18	0.315	45,000	0.83	0.047	225.2	08/07/2245
5947675	158,290.54	18	0.315	45,000	1.18	0.054	225.2	08/07/2245
5947690	160,575.22	18	0.315	45,000	1.06	0.060	225.2	08/07/2245
5947734	165,346.90	18	0.305	45,000	1.06	0.027	225.2	08/07/2245
5947737	165,905.20	18	0.315	45,000	1.54	0.060	225.2	08/07/2245
5947746	167,174.79	18	0.315	45,000	1.30	0.032	225.2	08/07/2245
5947779	170,351.91	18	0.305	45,000	0.83	0.040	225.2	08/07/2245
5947790	171,836.27	18	0.315	45,000	0.95	0.025	225.2	08/07/2245
5947800	173,337.96	18	0.305	45,000	1.06	0.027	225.2	08/07/2245
5947803	173,557.85	18	0.315	45,000	1.06	0.060	225.2	08/07/2245
5947804	173,566.46	18	0.315	45,000	0.95	0.066	225.2	08/07/2245
5947806	173,572.86	18	0.315	45,000	1.30	0.038	225.2	08/07/2245
5947807	173,577.87	18	0.315	45,000	1.42	0.047	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)**

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
5947810	173,702.95	18	0.315	45,000	1.65	0.038	225.2	08/07/2245
5947896	183,843.00	18	0.315	45,000	0.95	0.025	225.2	08/07/2245
5947900	184,024.16	18	0.305	45,000	1.06	0.040	225.2	08/07/2245
5947953	188,718.33	18	0.315	45,000	0.83	0.038	225.2	08/07/2245
5947979	192,692.01	18	0.305	45,000	0.83	0.027	225.2	08/07/2245
5948244	197,336.87	18	0.315	45,000	2.83	0.038	225.2	08/07/2245
5948796	206,521.08	18	0.315	45,000	1.06	0.047	225.2	08/07/2245
5948802	207,322.87	18	0.315	45,000	0.83	0.085	225.2	08/07/2245
5948805	207,807.94	18	0.315	45,000	1.89	0.032	225.2	08/07/2245
5948809	208,011.30	18	0.315	45,000	0.83	0.047	225.2	08/07/2245
5948884	216,857.08	18	0.315	45,000	0.95	0.047	225.2	08/07/2245
5948500	217,697.57	18	0.305	45,000	1.30	0.040	225.2	08/07/2245
5948899	219,097.35	18	0.315	45,000	0.83	0.038	225.2	08/07/2245
5948909	219,577.80	18	0.315	45,000	1.18	0.047	225.2	08/07/2245
5948910	219,579.60	18	0.315	45,000	0.83	0.032	225.2	08/07/2245
5949021	225,103.57	18	0.315	45,000	1.42	0.032	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)**

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
5954509	148,421.84	18	0.266	45,000	5.91	0.059	18.0	06/26/2038
5953499	91,924.49	18	0.276	45,000	4.73	0.066	22.9	05/17/2043
5953807	125,252.23	18	0.266	45,000	3.43	0.067	24.9	05/12/2045
5952630	13,015.78	18	0.315	45,000	5.55	0.066	27.6	01/30/2048
5954572	151,831.62	18	0.285	45,000	4.73	0.066	28.4	10/26/2048
5952827	31,851.43	18	0.315	45,000	5.08	0.072	29.6	02/06/2050
5953944	104,944.05	18	0.276	45,000	2.95	0.072	32.2	09/05/2052
5953119	69,575.35	18	0.276	45,000	9.92	0.039	35.4	10/28/2055
5953126	70,096.24	18	0.266	45,000	4.61	0.040	40.0	06/29/2060
5952716	20,397.82	18	0.315	45,000	2.95	0.072	41.6	01/07/2062
5954480	143,714.65	18	0.266	45,000	2.36	0.059	42.2	08/23/2062
5954574	152,075.21	18	0.276	45,000	2.95	0.058	42.5	12/06/2062
5952011	5,416.32	18	0.305	45,000	4.37	0.046	43.1	07/06/2063
5952923	44,481.57	18	0.315	45,000	4.02	0.066	46.8	03/24/2067
5952816	30,153.58	18	0.315	45,000	2.48	0.079	46.9	04/27/2067
5954227	120,170.64	18	0.276	65,000	9.81	0.039	47.9	05/08/2068
5952747	22,430.57	18	0.315	45,000	6.50	0.047	48.4	11/17/2068
5953255	79,362.95	18	0.276	45,000	2.48	0.058	48.6	01/14/2069
5951846	2,895.03	18	0.315	45,000	2.95	0.054	52.0	06/13/2072
5954504	147,896.54	18	0.276	45,000	1.42	0.080	54.0	06/08/2074
5954256	122,837.02	18	0.276	45,000	2.84	0.052	55.5	12/29/2075
5954184	115,814.83	18	0.276	45,000	1.89	0.066	57.1	07/06/2077
5952874	37,066.90	18	0.315	45,000	2.84	0.066	57.3	10/08/2077
5953028	59,562.42	18	0.276	45,000	1.42	0.066	58.4	10/27/2078
5953480	90,257.63	18	0.266	45,000	2.36	0.045	58.7	03/10/2079

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

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
5953191	76,362.70	18	0.276	45,000	2.25	0.052	58.9	05/14/2079
5954153	115,280.00	18	0.266	45,000	2.48	0.045	59.8	04/15/2080
5954573	151,918.59	18	0.276	45,000	1.42	0.072	60.9	05/03/2081
5952633	13,489.45	18	0.315	45,000	1.65	0.072	63.0	06/22/2083
5952636	13,512.73	18	0.315	45,000	1.65	0.072	63.0	06/27/2083
5953186	76,263.94	18	0.285	45,000	4.14	0.040	66.0	06/12/2086
5953254	79,357.98	18	0.276	45,000	1.89	0.052	68.5	12/19/2088
5954503	147,570.45	18	0.276	45,000	1.89	0.052	71.1	07/12/2091
5952410	7,845.82	18	0.315	45,000	2.36	0.047	72.5	12/24/2092
5952901	39,959.37	18	0.305	45,000	2.01	0.058	75.4	11/01/2095
5952634	13,490.15	18	0.315	45,000	1.65	0.060	77.3	10/02/2097
5953095	67,300.32	18	0.276	45,000	1.30	0.052	84.5	11/29/2104
5953256	79,364.43	18	0.276	45,000	1.65	0.047	84.9	05/25/2105
5954241	121,742.03	18	0.276	45,000	1.89	0.047	85.8	03/30/2106
5952178	7,301.75	18	0.305	45,000	0.83	0.073	87.3	10/03/2107
5952864	36,192.91	18	0.315	45,000	4.14	0.038	88.5	12/15/2108
5952697	18,848.50	18	0.315	45,000	1.65	0.054	90.8	04/04/2111
5954214	116,066.01	18	0.276	45,000	1.65	0.047	94.2	09/13/2114
5953051	61,737.33	18	0.276	45,000	1.54	0.039	95.0	06/07/2115
5952649	15,142.50	18	0.295	45,000	1.06	0.047	95.2	08/23/2115
5952696	18,797.14	18	0.305	45,000	2.25	0.034	96.0	07/03/2116
5953939	104,813.18	18	0.266	45,000	1.42	0.040	99.1	08/02/2119
5953477	90,142.54	18	0.276	45,000	1.42	0.047	99.5	12/13/2119
5952710	19,780.44	18	0.305	45,000	1.65	0.040	100.9	05/08/2121
5953029	59,642.62	18	0.276	45,000	1.06	0.047	102.4	10/31/2122
5952890	39,412.10	18	0.305	45,000	1.18	0.058	110.8	03/19/2131
5952692	18,254.31	18	0.315	45,000	1.42	0.047	111.3	10/19/2131
5952750	22,508.88	18	0.305	45,000	1.06	0.052	111.6	01/28/2132
5953050	61,579.02	18	0.276	45,000	0.95	0.047	112.7	03/02/2133
5953062	63,055.52	18	0.276	45,000	1.18	0.039	113.4	10/28/2133
5953547	96,122.28	18	0.276	45,000	1.54	0.039	114.0	06/09/2134
5952715	20,393.82	18	0.315	45,000	1.06	0.060	114.4	10/26/2134
5952729	21,535.97	18	0.315	45,000	0.95	0.066	116.0	06/22/2136
5952885	39,033.33	18	0.315	45,000	1.30	0.060	117.4	11/10/2137
5953278	81,992.83	18	0.276	45,000	1.06	0.047	117.6	01/19/2138
5952884	39,030.53	18	0.315	45,000	1.06	0.066	124.9	05/08/2145
5952905	40,977.03	18	0.315	45,000	1.06	0.066	127.2	08/15/2147
5952651	15,527.99	18	0.295	45,000	0.95	0.032	131.4	11/16/2151
5952888	39,406.52	18	0.305	45,000	1.18	0.046	134.2	09/07/2154
5952810	28,928.94	18	0.315	45,000	1.06	0.054	135.7	02/17/2156
5952667	16,783.90	18	0.305	45,000	0.83	0.046	137.3	10/22/2157
5953377	82,610.98	18	0.276	45,000	1.54	0.028	137.7	02/14/2158
5952691	18,245.24	18	0.315	45,000	1.30	0.038	138.1	08/04/2158
5953277	81,698.96	18	0.276	45,000	1.18	0.033	141.6	01/04/2162
5952912	41,913.25	18	0.315	45,000	1.18	0.054	141.9	05/12/2162
5952887	39,178.32	18	0.315	45,000	1.65	0.038	146.4	10/26/2166
5952635	13,494.04	18	0.315	45,000	1.30	0.032	147.5	12/29/2167

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

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
5953931	104,471.12	18	0.266	45,000	1.06	0.027	156.4	11/21/2176
5952866	36,257.24	18	0.315	45,000	1.06	0.047	159.3	10/10/2179
5952795	27,040.90	18	0.305	45,000	1.18	0.027	165.4	11/05/2185
5952889	39,409.31	18	0.305	45,000	0.95	0.040	170.7	03/15/2191
5952917	42,956.35	18	0.305	45,000	1.42	0.027	174.0	06/13/2194
5952596	12,007.03	18	0.315	45,000	1.06	0.025	181.4	11/26/2201
5952924	44,483.57	18	0.315	45,000	1.18	0.038	186.5	12/28/2206
5952892	39,599.03	18	0.305	45,000	0.83	0.034	204.1	07/16/2224

**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)**

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
5956790	9,149.70	18.000	0.266	45,000	9.55	0.045	7.1	09/16/2027
5958589	73,460.16	18.000	0.266	45,000	9.66	0.045	12.4	01/10/2033
5958360	60,388.78	18.000	0.266	45,000	4.36	0.059	12.5	02/19/2033
5956679	1,069.84	18.000	0.276	45,000	3.77	0.047	15.1	10/07/2035
5957278	49,850.29	18.000	0.276	45,000	7.31	0.047	15.5	03/01/2036
5957984	18,124.00	18.000	0.276	45,000	7.42	0.039	16.2	10/30/2036
5959198	116,568.54	18.000	0.266	45,000	14.49	0.040	16.7	05/10/2037
5956723	1,534.69	18.000	0.276	45,000	2.24	0.058	16.9	07/21/2037
5956767	6,068.09	18.000	0.276	45,000	3.42	0.047	16.9	07/30/2037
5956834	12,180.77	18.000	0.276	45,000	3.54	0.047	17.5	02/28/2038
5958023	19,007.45	18.000	0.276	45,000	1.89	0.066	19.3	12/17/2039
5959040	106,587.14	18.000	0.276	45,000	5.66	0.058	19.7	04/22/2040
5959105	110,186.38	18.000	0.276	45,000	5.77	0.058	20.2	11/11/2040
5956747	4,008.59	18.000	0.266	45,000	3.54	0.032	20.8	06/15/2041
5956828	11,850.54	18.000	0.276	45,000	4.01	0.039	20.8	06/25/2041
5957937	15,635.85	18.000	0.276	45,000	4.24	0.039	20.9	07/08/2041
5957956	16,482.33	18.000	0.276	45,000	4.24	0.039	21.0	08/19/2041
5957754	8,365.43	18.000	0.276	45,000	5.07	0.033	21.6	04/01/2042
5958960	98,750.23	18.000	0.266	45,000	8.60	0.040	21.8	06/15/2042
5956765	5,975.20	18.000	0.276	45,000	7.54	0.028	22.2	11/17/2042
5958595	74,445.87	18.000	0.266	45,000	6.01	0.040	22.3	12/27/2042
5957760	8,634.40	18.000	0.276	45,000	4.71	0.033	22.4	01/06/2043
5958579	72,541.63	18.000	0.276	45,000	4.24	0.052	22.4	01/10/2043
5958867	93,800.59	18.000	0.266	45,000	5.54	0.045	22.5	02/10/2043
5958570	71,678.66	18.000	0.266	45,000	2.95	0.053	22.7	05/03/2043
5956724	1,539.90	18.000	0.276	45,000	2.12	0.047	22.7	05/09/2043
5958389	62,505.54	18.000	0.276	45,000	4.60	0.047	23.2	10/31/2043
5958751	84,285.80	18.000	0.276	45,000	3.65	0.058	23.3	12/30/2043
5958332	59,573.72	18.000	0.276	45,000	3.42	0.052	23.4	01/24/2044
5958900	95,748.40	18.000	0.276	45,000	5.19	0.052	23.6	03/27/2044
5958361	60,440.64	18.000	0.266	45,000	1.77	0.067	23.6	04/18/2044
5956962	31,258.97	18.000	0.276	45,000	2.83	0.047	24.1	10/12/2044
5957743	7,321.30	18.000	0.276	45,000	5.89	0.028	24.5	03/06/2045

**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)**

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
5959080	108,433.37	18.000	0.276	45,000	7.78	0.047	24.6	04/11/2045
5958733	82,953.90	18.000	0.266	45,000	10.37	0.032	24.9	07/29/2045
5956842	12,378.69	18.000	0.285	45,000	3.77	0.040	25.0	08/19/2045
5957161	41,720.81	18.000	0.266	45,000	4.83	0.032	25.0	08/31/2045
5958785	86,580.00	18.000	0.276	45,000	10.13	0.039	25.0	09/12/2045
5958140	44,297.81	18.000	0.285	45,000	6.36	0.040	25.5	02/18/2046
5958366	61,306.29	18.000	0.276	45,000	3.77	0.047	26.0	08/11/2046
5958760	84,750.19	18.000	0.276	45,000	5.07	0.047	26.4	01/04/2047
5959149	113,245.87	18.000	0.266	45,000	5.30	0.045	27.0	08/20/2047
5958330	59,314.35	18.000	0.276	45,000	5.54	0.039	27.0	08/31/2047
5958148	44,770.28	18.000	0.266	45,000	2.24	0.045	27.1	09/25/2047
5958331	59,552.35	18.000	0.276	45,000	8.25	0.033	27.9	07/27/2048
5960771	242,491.54	18.000	0.266	45,000	5.77	0.059	28.8	05/27/2049
5958392	62,653.96	18.000	0.276	45,000	8.13	0.033	28.8	06/02/2049
5958592	73,738.39	18.000	0.276	45,000	6.25	0.039	28.9	07/22/2049
5958058	21,151.15	18.000	0.276	45,000	1.89	0.047	29.6	03/20/2050
5958714	81,958.30	18.000	0.276	45,000	10.61	0.033	30.1	10/10/2050
5959044	107,211.17	18.000	0.266	45,000	2.95	0.053	30.2	11/06/2050
5957283	50,069.67	18.000	0.276	45,000	2.12	0.052	30.8	06/26/2051
5959853	150,217.73	18.000	0.315	45,000	9.31	0.072	31.1	09/26/2051
5958501	68,295.71	18.000	0.266	45,000	3.06	0.040	31.2	11/20/2051
5956721	1,508.58	18.000	0.276	45,000	2.83	0.028	31.5	03/01/2052
5958498	67,979.27	18.000	0.276	45,000	4.24	0.039	33.1	09/30/2053
5957836	13,089.42	18.000	0.276	45,000	1.41	0.047	33.7	05/25/2054
5956720	1,328.34	18.000	0.276	45,000	1.89	0.033	33.9	07/02/2054
5959612	131,218.08	18.000	0.305	45,000	17.09	0.052	33.9	07/14/2054
5956958	30,977.88	18.000	0.276	45,000	4.24	0.028	34.3	12/17/2054
5958371	61,598.25	18.000	0.276	45,000	5.07	0.033	34.7	05/04/2055
5958399	63,566.27	18.000	0.276	45,000	2.12	0.052	34.9	07/19/2055
5958541	70,267.57	18.000	0.276	45,000	4.01	0.039	35.0	08/10/2055
5958428	64,688.38	18.000	0.276	45,000	2.48	0.047	35.9	07/13/2056
5958743	83,651.85	18.000	0.276	45,000	4.71	0.039	35.9	07/16/2056
5956722	1,522.39	18.000	0.276	45,000	1.65	0.033	36.6	04/18/2057
5958971	99,267.95	18.000	0.276	45,000	2.83	0.052	37.7	05/10/2058
5956837	12,261.72	18.000	0.266	45,000	1.41	0.032	37.9	07/03/2058
5960766	242,053.42	18.000	0.276	45,000	7.90	0.052	38.4	01/01/2059
5956863	22,451.24	18.000	0.276	45,000	2.12	0.033	38.4	01/12/2059
5956907	24,946.89	18.000	0.266	45,000	1.18	0.040	40.5	02/10/2061
5958763	84,881.92	18.000	0.276	45,000	3.77	0.039	40.8	06/16/2061
5958786	87,120.99	18.000	0.266	45,000	2.00	0.045	42.6	04/01/2063
5956678	1,051.15	18.000	0.276	45,000	1.53	0.028	43.2	10/27/2063
5958635	77,272.44	18.000	0.266	45,000	1.41	0.053	43.3	12/14/2063
5958523	69,686.65	18.000	0.276	45,000	5.66	0.028	43.3	12/23/2063
5958549	70,796.46	18.000	0.266	45,000	2.59	0.032	44.7	05/15/2065
5958753	84,325.83	18.000	0.276	45,000	4.36	0.033	45.0	09/06/2065
5958179	45,767.03	18.000	0.276	45,000	1.77	0.039	45.9	08/03/2066
5958738	83,426.96	18.000	0.276	45,000	6.36	0.028	46.6	03/22/2067

**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)**

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
5959154	113,985.92	18.000	0.266	45,000	2.36	0.045	47.5	02/14/2068
5959602	129,912.44	18.000	0.315	45,000	7.31	0.060	47.5	02/27/2068
5958892	95,315.89	18.000	0.276	45,000	4.71	0.033	47.9	07/08/2068
5958583	73,166.58	18.000	0.276	45,000	4.71	0.028	48.0	08/17/2068
5960174	183,776.54	18.000	0.315	45,000	6.95	0.072	48.0	09/07/2068
5956853	21,868.86	18.000	0.276	45,000	1.41	0.033	48.3	12/26/2068
5958945	98,031.73	18.000	0.266	45,000	4.95	0.027	48.8	05/31/2069
5958675	79,916.33	18.000	0.266	45,000	1.53	0.045	48.8	06/17/2069
5957657	170,411.77	18.000	0.305	45,000	8.96	0.058	48.9	07/02/2069
5958447	65,480.93	18.000	0.276	45,000	2.12	0.039	49.0	09/08/2069
5956768	6,145.41	18.000	0.276	45,000	1.06	0.033	49.8	06/22/2070
5958617	76,454.23	18.000	0.276	45,000	2.95	0.033	51.6	03/14/2072
5956973	31,890.70	18.000	0.266	45,000	1.30	0.027	53.3	12/28/2073
5960346	202,018.66	18.000	0.315	45,000	9.19	0.066	53.5	03/08/2074
5959628	132,229.17	18.000	0.315	45,000	6.01	0.060	53.9	07/17/2074
5960303	196,774.49	18.000	0.315	45,000	8.72	0.066	54.0	08/10/2074
5960032	163,827.32	18.000	0.315	45,000	9.19	0.060	54.0	09/10/2074
5958185	46,085.12	18.000	0.276	45,000	2.12	0.028	54.1	09/24/2074
5959854	150,229.95	18.000	0.315	45,000	7.54	0.060	54.2	10/27/2074
5958429	64,690.28	18.000	0.276	45,000	1.77	0.039	54.7	05/08/2075
5958661	78,981.71	18.000	0.276	45,000	2.12	0.039	55.0	09/03/2075
5959049	107,405.94	18.000	0.276	45,000	6.60	0.028	55.8	06/27/2076
5959387	123,786.60	18.000	0.305	45,000	8.13	0.046	55.9	07/29/2076
5959196	116,564.13	18.000	0.266	45,000	2.36	0.040	56.0	09/01/2076
5959153	113,887.91	18.000	0.266	45,000	2.24	0.040	56.4	01/08/2077
5960548	223,268.64	18.000	0.276	45,000	6.25	0.047	56.4	01/31/2077
5957618	147,847.56	18.000	0.305	45,000	12.49	0.046	56.7	05/04/2077
5956936	26,363.87	18.000	0.276	45,000	1.41	0.028	56.8	06/13/2077
5959039	106,561.26	18.000	0.276	45,000	2.83	0.039	57.4	01/29/2078
5958631	77,103.57	18.000	0.276	45,000	2.24	0.033	60.2	11/18/2080
5957149	41,128.33	18.000	0.276	45,000	1.30	0.033	60.2	11/23/2080
5960559	224,153.81	18.000	0.276	45,000	5.54	0.047	60.4	01/04/2081
5960692	234,653.00	18.000	0.276	45,000	4.24	0.052	60.4	01/19/2081
5958478	67,013.18	18.000	0.266	45,000	1.65	0.027	63.7	05/06/2084
5958580	72,696.15	18.000	0.276	45,000	2.48	0.028	63.8	05/29/2084
5958293	56,818.44	18.000	0.266	45,000	1.41	0.027	63.9	07/22/2084
5959894	153,153.58	18.000	0.315	45,000	4.48	0.066	64.2	11/20/2084
5957191	43,259.03	18.000	0.276	45,000	1.41	0.028	65.5	03/11/2086
5959193	116,368.70	18.000	0.266	45,000	2.59	0.032	65.7	05/26/2086
5958899	95,654.29	18.000	0.266	45,000	1.41	0.040	66.1	10/10/2086
5959389	123,812.90	18.000	0.305	45,000	5.54	0.046	66.2	11/17/2086
5959203	116,860.43	18.000	0.276	45,000	1.65	0.052	66.5	02/21/2087
5959200	116,723.16	18.000	0.266	45,000	3.42	0.027	67.3	12/06/2087
5958756	84,551.96	18.000	0.266	45,000	1.89	0.027	69.0	09/02/2089
5957219	46,598.94	18.000	0.276	45,000	0.94	0.039	69.2	11/21/2089
5958188	46,202.50	18.000	0.266	45,000	0.83	0.032	70.8	06/23/2091
5960001	162,120.36	18.000	0.305	45,000	8.72	0.046	72.4	01/16/2093

**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)**

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
5959170	115,276.90	18.000	0.276	45,000	0.94	0.072	74.4	01/29/2095
5958870	94,765.83	18.000	0.276	45,000	2.59	0.028	75.1	09/16/2095
5958632	77,113.56	18.000	0.276	45,000	1.53	0.033	75.2	10/21/2095
5958762	84,842.07	18.000	0.266	45,000	1.30	0.032	75.5	02/19/2096
5960740	238,839.87	18.000	0.266	45,000	6.60	0.032	77.0	09/09/2097
5960507	218,846.47	18.000	0.266	45,000	2.24	0.053	77.0	09/12/2097
5957235	47,301.04	18.000	0.276	45,000	0.94	0.033	77.2	11/08/2097
5958716	82,069.52	18.000	0.276	45,000	1.53	0.033	77.9	08/02/2098
5960308	196,799.66	18.000	0.315	45,000	2.59	0.091	78.5	02/15/2099
5959052	107,531.26	18.000	0.285	45,000	4.95	0.026	78.6	04/18/2099
5960661	231,668.88	18.000	0.276	45,000	6.01	0.039	78.9	08/03/2099
5959048	107,374.77	18.000	0.276	45,000	2.83	0.028	78.9	08/03/2099
5960563	224,291.27	18.000	0.266	45,000	6.13	0.032	79.4	01/23/2100
5959758	139,159.35	18.000	0.315	45,000	6.36	0.047	80.5	02/18/2101
5960739	238,815.04	18.000	0.266	45,000	3.42	0.040	81.8	06/05/2102
5960000	162,108.16	18.000	0.305	45,000	2.71	0.067	81.9	07/12/2102
5960299	196,337.96	18.000	0.315	45,000	3.18	0.079	82.3	12/07/2102
5959018	104,429.99	18.000	0.276	45,000	1.89	0.033	82.7	05/14/2103
5960745	239,204.11	18.000	0.276	45,000	5.30	0.039	83.0	08/16/2103
5959909	153,350.73	18.000	0.305	45,000	2.48	0.067	83.0	09/08/2103
5959648	133,557.70	18.000	0.315	45,000	12.84	0.038	83.4	01/23/2104
5958597	74,763.38	18.000	0.276	45,000	1.53	0.028	83.6	04/05/2104
5957216	44,259.21	18.000	0.285	45,000	1.06	0.031	83.9	07/25/2104
5957429	119,671.17	18.000	0.315	45,000	4.24	0.047	84.0	08/17/2104
5960047	165,030.81	18.000	0.315	45,000	4.24	0.060	85.1	09/29/2105
5957415	102,649.49	18.000	0.276	45,000	2.24	0.028	85.6	04/12/2106
5957610	147,504.13	18.000	0.305	45,000	7.31	0.040	86.0	08/15/2106
5959834	149,516.05	18.000	0.315	45,000	4.36	0.054	87.8	06/20/2108
5959611	131,090.40	18.000	0.315	45,000	2.83	0.060	88.0	08/10/2108
5957546	146,781.19	18.000	0.305	45,000	6.72	0.040	88.4	01/09/2109
5959816	148,049.61	18.000	0.305	45,000	6.60	0.040	89.7	05/08/2110
5958853	92,609.09	18.000	0.276	45,000	1.18	0.039	90.0	08/14/2110
5959124	111,627.74	18.000	0.276	45,000	1.77	0.033	91.6	03/14/2112
5960101	176,343.20	18.000	0.305	45,000	4.24	0.052	93.7	05/10/2114
5957673	172,131.38	18.000	0.305	45,000	2.48	0.067	94.3	12/28/2114
5958891	95,310.49	18.000	0.276	45,000	1.65	0.028	95.2	11/05/2115
5957509	144,106.08	18.000	0.315	45,000	2.12	0.072	95.5	03/08/2116
5958959	98,737.94	18.000	0.266	45,000	1.06	0.032	95.8	05/30/2116
5960075	173,191.69	18.000	0.305	45,000	8.60	0.040	97.1	09/30/2117
5960424	208,982.29	18.000	0.315	45,000	3.77	0.066	98.5	02/27/2119
5957539	146,435.49	18.000	0.315	45,000	8.96	0.038	101.6	04/10/2122
5960547	222,974.49	18.000	0.285	45,000	4.71	0.040	101.7	05/25/2122
5959856	150,535.64	18.000	0.305	45,000	8.48	0.034	102.5	03/14/2123
5957543	146,674.95	18.000	0.305	45,000	7.78	0.034	102.8	06/17/2123
5958333	59,574.32	18.000	0.276	45,000	0.83	0.028	103.6	03/15/2124
5959843	149,767.53	18.000	0.315	45,000	4.36	0.047	103.9	07/29/2124
5958737	83,403.73	18.000	0.285	45,000	1.65	0.026	104.6	04/16/2125

**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)**

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
5960395	205,706.06	18.000	0.315	45,000	4.24	0.060	105.0	08/22/2125
5957622	166,825.48	18.000	0.315	45,000	13.08	0.038	105.7	04/28/2126
5958388	62,473.71	18.000	0.276	45,000	0.83	0.028	106.0	08/19/2126
5960721	236,829.51	18.000	0.276	45,000	4.71	0.033	106.4	01/16/2127
5959951	156,649.20	18.000	0.315	45,000	2.36	0.066	107.9	07/13/2128
5959050	107,413.06	18.000	0.276	45,000	1.53	0.028	108.5	02/15/2129
5959726	137,816.03	18.000	0.305	45,000	1.53	0.067	109.4	01/22/2130
5959368	123,469.80	18.000	0.305	45,000	1.89	0.052	109.5	02/07/2130
5960510	219,446.35	18.000	0.276	45,000	3.06	0.039	111.4	02/05/2132
5960774	242,760.97	18.000	0.266	45,000	4.36	0.027	111.7	05/19/2132
5957544	146,700.74	18.000	0.305	45,000	3.77	0.040	113.6	03/19/2134
5957489	122,452.86	18.000	0.305	45,000	3.54	0.034	114.8	06/09/2135
5960015	163,081.99	18.000	0.305	45,000	2.71	0.052	115.0	08/26/2135
5958509	68,719.99	18.000	0.285	45,000	1.06	0.026	116.6	03/30/2137
5960209	187,712.79	18.000	0.315	45,000	4.12	0.054	117.2	11/08/2137
5959685	134,818.35	18.000	0.315	45,000	8.01	0.032	118.7	04/27/2139
5960922	252,664.21	18.000	0.276	45,000	2.59	0.039	119.2	11/10/2139
5959614	131,541.73	18.000	0.305	45,000	3.77	0.034	119.3	12/03/2139
5959572	128,161.93	18.000	0.315	45,000	6.13	0.032	121.7	04/24/2142
5959716	137,109.86	18.000	0.305	45,000	4.01	0.034	121.9	07/08/2142
5959295	118,376.24	18.000	0.315	45,000	1.53	0.060	124.4	01/09/2145
5960268	190,955.11	18.000	0.315	45,000	11.43	0.038	126.3	12/23/2146
5959962	157,694.77	18.000	0.315	45,000	2.71	0.054	126.7	05/07/2147
5957503	143,944.94	18.000	0.315	45,000	1.65	0.066	129.6	03/31/2150
5960187	185,138.24	18.000	0.305	45,000	4.83	0.040	131.1	09/15/2151
5960300	196,339.76	18.000	0.315	45,000	2.48	0.066	131.3	12/24/2151
5959600	129,820.64	18.000	0.315	45,000	2.24	0.047	132.6	03/15/2153
5960006	162,580.73	18.000	0.315	45,000	11.08	0.032	133.7	05/21/2154
5960577	225,178.36	18.000	0.285	45,000	4.60	0.031	135.1	09/22/2155
5959306	118,915.66	18.000	0.305	45,000	2.36	0.034	135.6	03/31/2156
5960615	228,685.17	18.000	0.276	45,000	1.41	0.052	138.8	06/11/2159
5960752	240,443.55	18.000	0.276	45,000	2.12	0.039	139.6	04/20/2160
5960058	166,243.39	18.000	0.315	45,000	1.30	0.085	140.5	02/27/2161
5957724	198,702.04	18.000	0.315	45,000	3.30	0.054	140.7	05/26/2161
5959715	136,963.34	18.000	0.315	45,000	4.71	0.032	142.3	12/30/2162
5960751	240,425.99	18.000	0.276	45,000	2.00	0.039	144.7	05/18/2165
5960043	164,765.30	18.000	0.315	45,000	4.60	0.038	146.6	04/09/2167
5960219	188,149.49	18.000	0.305	45,000	2.95	0.046	146.6	04/11/2167
5960765	242,007.37	18.000	0.276	45,000	1.30	0.052	146.6	04/13/2167
5959304	118,830.49	18.000	0.315	45,000	1.65	0.047	147.0	08/20/2167
5959788	141,654.62	18.000	0.305	45,000	1.30	0.058	147.3	11/29/2167
5957477	121,456.70	18.000	0.305	45,000	2.83	0.027	147.7	04/28/2168
5959525	126,928.88	18.000	0.315	45,000	1.53	0.054	147.8	06/17/2168
5960309	196,806.16	18.000	0.315	45,000	2.48	0.060	148.9	08/02/2169
5959836	149,645.04	18.000	0.315	45,000	5.19	0.032	150.2	11/19/2170
5957669	171,512.43	18.000	0.315	45,000	2.00	0.060	151.2	11/16/2171
5960811	244,739.98	18.000	0.295	45,000	4.71	0.032	152.7	04/24/2173

**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)**

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
5959850	150,150.91	18.000	0.315	45,000	3.30	0.038	153.4	02/03/2174
5959852	150,210.83	18.000	0.315	45,000	3.30	0.038	153.5	03/01/2174
5960365	203,676.20	18.000	0.305	45,000	6.25	0.034	154.6	03/18/2175
5959837	149,645.74	18.000	0.315	45,000	1.53	0.060	157.6	04/08/2178
5959629	132,261.28	18.000	0.305	45,000	1.18	0.052	161.9	07/25/2182
5960295	193,208.37	18.000	0.305	45,000	2.12	0.052	162.5	02/08/2183
5960029	163,345.37	18.000	0.305	45,000	3.18	0.034	163.8	05/31/2184
5960085	174,204.73	18.000	0.305	45,000	2.71	0.040	163.8	07/01/2184
5959877	152,116.81	18.000	0.315	45,000	0.83	0.098	164.3	12/01/2184
5960403	206,475.62	18.000	0.315	45,000	2.71	0.054	164.5	03/06/2185
5959792	141,706.33	18.000	0.315	45,000	1.53	0.054	165.1	10/01/2185
5960051	165,381.08	18.000	0.315	45,000	5.42	0.032	166.1	09/18/2186
5959585	128,592.96	18.000	0.305	45,000	2.48	0.027	166.3	11/26/2186
5960576	225,175.67	18.000	0.285	45,000	4.24	0.026	167.3	12/20/2187
5959919	153,617.86	18.000	0.305	45,000	3.65	0.027	169.9	07/02/2190
5959554	127,723.86	18.000	0.305	45,000	1.41	0.040	171.2	11/19/2191
5960503	218,537.71	18.000	0.276	45,000	1.89	0.033	171.5	02/18/2192
5960540	222,658.56	18.000	0.276	45,000	1.89	0.033	171.8	06/08/2192
5959849	150,149.01	18.000	0.315	45,000	3.65	0.032	172.4	01/18/2193
5959777	140,053.57	18.000	0.315	45,000	1.65	0.047	173.4	01/05/2194
5960376	204,567.71	18.000	0.305	45,000	3.18	0.040	173.7	05/25/2194
5960667	232,558.35	18.000	0.276	45,000	1.53	0.039	174.0	09/04/2194
5960045	164,876.07	18.000	0.305	45,000	1.77	0.046	174.5	03/07/2195
5960502	218,531.52	18.000	0.276	45,000	2.36	0.028	174.8	05/27/2195
5959712	136,747.36	18.000	0.295	45,000	1.89	0.027	176.3	12/30/2196
5960370	203,995.42	18.000	0.315	45,000	4.83	0.038	176.7	05/06/2197
5959742	138,704.37	18.000	0.315	45,000	2.83	0.032	177.9	08/04/2198
5959583	128,567.08	18.000	0.305	45,000	2.12	0.027	178.7	04/29/2199
5959782	140,952.35	18.000	0.305	45,000	1.53	0.040	179.7	05/10/2200
5960002	162,175.42	18.000	0.315	45,000	2.00	0.047	180.5	02/12/2201
5957648	169,191.27	18.000	0.315	45,000	4.60	0.032	180.6	03/17/2201
5960744	239,203.71	18.000	0.276	45,000	2.12	0.028	184.6	04/15/2205
5957524	145,548.91	18.000	0.315	45,000	1.18	0.060	185.8	06/16/2206
5959800	143,082.99	18.000	0.315	45,000	4.12	0.025	186.5	02/15/2207
5957668	171,402.32	18.000	0.315	45,000	1.30	0.066	188.7	05/26/2209
5959789	141,658.11	18.000	0.305	45,000	1.41	0.040	189.6	04/17/2210
5959630	132,568.95	18.000	0.305	45,000	0.94	0.052	189.8	06/19/2210
5960738	238,814.74	18.000	0.266	45,000	0.94	0.040	191.9	08/02/2212
5957647	169,182.06	18.000	0.315	45,000	1.41	0.060	192.3	12/02/2212
5959670	134,043.11	18.000	0.305	45,000	1.53	0.034	193.3	11/30/2213
5960034	163,935.76	18.000	0.315	45,000	3.54	0.032	193.8	06/16/2214
5960201	186,588.10	18.000	0.315	45,000	1.89	0.054	194.8	06/19/2215
5959793	141,710.93	18.000	0.315	45,000	0.94	0.066	195.7	05/05/2216
5960666	232,446.46	18.000	0.276	45,000	1.53	0.033	196.0	08/28/2216
5959851	150,203.72	18.000	0.315	45,000	2.71	0.032	197.0	09/12/2217
5957645	168,826.78	18.000	0.315	45,000	3.65	0.032	197.2	10/31/2217
5960180	184,115.97	18.000	0.315	45,000	3.06	0.038	200.5	03/07/2221

**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)**

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
5957650	169,798.47	18.000	0.305	45,000	3.06	0.027	203.6	04/13/2224
5960374	204,388.69	18.000	0.325	45,000	3.30	0.046	204.4	02/05/2225
5960379	204,842.24	18.000	0.305	45,000	1.89	0.046	206.4	01/31/2227
5959819	148,247.64	18.000	0.315	45,000	2.36	0.032	208.0	09/07/2228
5959995	161,598.14	18.000	0.305	45,000	1.30	0.046	208.4	01/29/2229
5960178	184,047.10	18.000	0.315	45,000	1.65	0.054	210.0	08/20/2230
5960113	178,006.70	18.000	0.315	45,000	1.18	0.066	212.2	11/08/2232
5959847	150,001.95	18.000	0.305	45,000	1.30	0.040	212.4	01/31/2233
5959663	133,861.79	18.000	0.315	45,000	2.48	0.025	213.0	08/25/2233
5960446	211,919.43	18.000	0.315	45,000	2.24	0.047	215.6	03/16/2236
5959838	149,646.84	18.000	0.315	45,000	1.30	0.047	216.9	07/22/2237
5957490	122,467.04	18.000	0.305	45,000	1.06	0.034	217.0	08/10/2237
5959682	134,666.12	18.000	0.315	45,000	1.41	0.038	217.7	05/09/2238
5957663	171,370.02	18.000	0.315	45,000	2.24	0.038	217.9	07/09/2238
5960425	209,163.98	18.000	0.305	45,000	4.12	0.027	218.4	01/19/2239
5957708	195,337.69	18.000	0.315	45,000	2.00	0.047	218.8	06/17/2239
5959797	142,477.83	18.000	0.315	45,000	1.53	0.038	219.5	02/14/2240
5959802	143,198.97	18.000	0.315	45,000	1.18	0.047	220.8	06/03/2241
5960081	173,668.28	18.000	0.305	45,000	2.00	0.034	221.3	12/06/2241
5957615	147,701.76	18.000	0.305	45,000	1.18	0.040	222.3	12/18/2242
5960200	186,569.50	18.000	0.315	45,000	6.01	0.025	223.4	01/28/2244
5960264	190,874.36	18.000	0.315	45,000	3.65	0.032	224.6	03/28/2245
5957434	119,789.12	18.000	0.315	45,000	0.83	0.038	225.2	11/17/2245
5957492	122,523.82	18.000	0.315	45,000	1.06	0.032	225.2	11/17/2245
5959601	129,823.35	18.000	0.315	45,000	1.53	0.025	225.2	11/17/2245
5959652	133,713.09	18.000	0.315	45,000	0.94	0.032	225.2	11/17/2245
5959674	134,269.62	18.000	0.305	45,000	0.94	0.034	225.2	11/17/2245
5959723	137,487.15	18.000	0.315	45,000	1.06	0.032	225.2	11/17/2245
5959790	141,681.49	18.000	0.305	45,000	0.94	0.040	225.2	11/17/2245
5957619	147,868.70	18.000	0.315	45,000	0.83	0.054	225.2	11/17/2245
5959857	150,548.18	18.000	0.305	45,000	1.30	0.034	225.2	11/17/2245
5959910	153,351.03	18.000	0.305	45,000	0.94	0.046	225.2	11/17/2245
5959926	154,284.53	18.000	0.315	45,000	0.94	0.038	225.2	11/17/2245
5959957	157,389.14	18.000	0.315	45,000	2.71	0.025	225.2	11/17/2245
5959976	159,225.56	18.000	0.315	45,000	0.83	0.047	225.2	11/17/2245
5960027	163,295.52	18.000	0.315	45,000	0.83	0.047	225.2	11/17/2245
5960028	163,296.12	18.000	0.315	45,000	1.06	0.032	225.2	11/17/2245
5960048	165,122.08	18.000	0.315	45,000	0.94	0.025	225.2	11/17/2245
5957641	168,387.79	18.000	0.315	45,000	1.18	0.032	225.2	11/17/2245
5957656	170,356.30	18.000	0.315	45,000	0.94	0.047	225.2	11/17/2245
5957661	171,167.50	18.000	0.305	45,000	0.83	0.027	225.2	11/17/2245
5957662	171,369.52	18.000	0.315	45,000	0.83	0.060	225.2	11/17/2245
5957664	171,378.52	18.000	0.315	45,000	0.94	0.054	225.2	11/17/2245
5957665	171,378.92	18.000	0.315	45,000	1.30	0.047	225.2	11/17/2245
5957666	171,379.72	18.000	0.315	45,000	1.06	0.047	225.2	11/17/2245
5957667	171,391.42	18.000	0.315	45,000	1.77	0.038	225.2	11/17/2245
5957670	172,000.11	18.000	0.315	45,000	2.59	0.025	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)**

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
5957671	172,042.72	18.000	0.325	45,000	0.94	0.059	225.2	11/17/2245
5957672	172,071.15	18.000	0.325	45,000	0.83	0.059	225.2	11/17/2245
5960095	175,592.17	18.000	0.315	45,000	0.94	0.060	225.2	11/17/2245
5960099	176,163.17	18.000	0.305	45,000	1.89	0.027	225.2	11/17/2245
5960100	176,205.02	18.000	0.315	45,000	0.83	0.047	225.2	11/17/2245
5960139	179,892.66	18.000	0.315	45,000	1.30	0.054	225.2	11/17/2245
5960148	181,034.02	18.000	0.315	45,000	2.24	0.025	225.2	11/17/2245
5960183	184,427.15	18.000	0.315	45,000	0.83	0.025	225.2	11/17/2245
5960188	185,314.99	18.000	0.315	45,000	0.94	0.032	225.2	11/17/2245
5960195	186,003.18	18.000	0.315	45,000	2.71	0.025	225.2	11/17/2245
5960199	186,569.30	18.000	0.315	45,000	1.65	0.038	225.2	11/17/2245
5960202	186,595.10	18.000	0.315	45,000	3.89	0.025	225.2	11/17/2245
5960210	187,716.89	18.000	0.315	45,000	5.07	0.025	225.2	11/17/2245
5960214	187,831.35	18.000	0.305	45,000	0.83	0.027	225.2	11/17/2245
5960220	188,158.78	18.000	0.305	45,000	1.65	0.027	225.2	11/17/2245
5960225	188,693.81	18.000	0.315	45,000	0.83	0.038	225.2	11/17/2245
5960236	189,515.81	18.000	0.315	45,000	0.94	0.032	225.2	11/17/2245
5960237	189,520.72	18.000	0.315	45,000	1.30	0.047	225.2	11/17/2245
5960238	189,522.92	18.000	0.315	45,000	1.06	0.072	225.2	11/17/2245
5960243	189,606.28	18.000	0.315	45,000	2.24	0.032	225.2	11/17/2245
5960246	189,765.19	18.000	0.315	45,000	0.94	0.032	225.2	11/17/2245
5960255	190,357.47	18.000	0.325	45,000	9.07	0.026	225.2	11/17/2245
5960282	191,950.61	18.000	0.305	45,000	0.94	0.027	225.2	11/17/2245
5960283	191,975.71	18.000	0.305	45,000	0.83	0.027	225.2	11/17/2245
5957701	195,022.23	18.000	0.315	45,000	1.06	0.038	225.2	11/17/2245
5957702	195,216.44	18.000	0.305	45,000	2.36	0.034	225.2	11/17/2245
5957711	195,949.31	18.000	0.305	45,000	1.41	0.040	225.2	11/17/2245
5960298	196,337.16	18.000	0.315	45,000	1.06	0.054	225.2	11/17/2245
5960301	196,340.06	18.000	0.315	45,000	1.18	0.047	225.2	11/17/2245
5960302	196,340.76	18.000	0.315	45,000	3.06	0.025	225.2	11/17/2245
5960304	196,778.58	18.000	0.315	45,000	1.41	0.047	225.2	11/17/2245
5960307	196,795.67	18.000	0.315	45,000	0.94	0.066	225.2	11/17/2245
5957727	199,021.31	18.000	0.305	45,000	1.89	0.027	225.2	11/17/2245
5960366	203,950.83	18.000	0.315	45,000	1.30	0.025	225.2	11/17/2245
5960369	203,992.17	18.000	0.315	45,000	1.53	0.032	225.2	11/17/2245
5960371	204,186.90	18.000	0.315	45,000	1.41	0.025	225.2	11/17/2245
5960375	204,528.50	18.000	0.305	45,000	2.12	0.034	225.2	11/17/2245
5960393	205,633.82	18.000	0.315	45,000	2.59	0.025	225.2	11/17/2245
5960394	205,675.65	18.000	0.315	45,000	2.71	0.032	225.2	11/17/2245
5960409	207,213.90	18.000	0.315	45,000	1.18	0.047	225.2	11/17/2245
5960436	211,389.32	18.000	0.315	45,000	1.18	0.032	225.2	11/17/2245
5960455	213,562.73	18.000	0.315	45,000	3.89	0.025	225.2	11/17/2245
5960490	216,818.70	18.000	0.285	45,000	0.83	0.046	225.2	11/17/2245
5960499	218,270.19	18.000	0.276	45,000	0.94	0.033	225.2	11/17/2245
5960509	219,367.66	18.000	0.266	45,000	0.83	0.032	225.2	11/17/2245
5960545	222,860.57	18.000	0.276	45,000	1.06	0.028	225.2	11/17/2245
5960549	223,487.85	18.000	0.276	45,000	0.94	0.039	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)**

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
5960657	231,191.79	18.000	0.276	45,000	1.06	0.028	225.2	11/17/2245
5960660	231,628.44	18.000	0.276	45,000	1.18	0.033	225.2	11/17/2245
5960858	248,150.68	18.000	0.276	45,000	0.94	0.033	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)**

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
5961204	10,695.23	18	0.266	45,000	2.36	0.067	24.2	12/27/2044
5961465	24,409.00	18	0.285	45,000	4.37	0.060	30.8	07/31/2051
5961073	2,872.82	18	0.276	45,000	4.14	0.039	39.7	07/10/2060
5961831	60,313.17	18	0.276	45,000	6.26	0.047	43.3	02/23/2064
5961036	422.49	18	0.276	45,000	2.13	0.047	45.5	04/07/2066
5961273	16,586.32	18	0.266	45,000	2.60	0.040	46.7	07/14/2067
5961668	40,243.67	18	0.276	45,000	2.48	0.058	49.5	04/26/2070
5961473	26,222.91	18	0.276	45,000	2.72	0.047	52.1	11/14/2072
5961466	24,663.31	18	0.276	45,000	3.78	0.039	52.6	06/02/2073
5961476	26,862.50	18	0.276	45,000	3.66	0.039	54.8	08/10/2075
5963219	151,114.02	18	0.276	45,000	2.72	0.066	55.0	10/24/2075
5961146	6,548.89	18	0.276	45,000	2.36	0.033	64.5	04/02/2085
5961791	57,586.20	18	0.285	45,000	4.37	0.046	65.7	06/18/2086
5961076	3,446.14	18	0.276	45,000	1.18	0.052	66.4	03/29/2087
5961745	46,555.97	18	0.276	45,000	2.13	0.052	67.4	03/31/2088
5961454	23,221.81	18	0.276	45,000	1.77	0.047	69.2	01/14/2090
5961054	1,697.87	18	0.266	45,000	1.06	0.040	71.6	05/20/2092
5962815	121,832.93	18	0.276	45,000	3.78	0.047	76.1	12/08/2096
5961989	66,984.04	18	0.276	45,000	1.77	0.058	83.1	11/23/2103
5963624	172,965.97	18	0.285	45,000	4.61	0.040	83.4	03/05/2104
5961877	63,624.54	18	0.276	45,000	1.65	0.058	85.6	06/14/2106
5962875	129,859.51	18	0.276	45,000	4.73	0.039	87.1	11/09/2107
5962964	117,535.40	18	0.276	45,000	7.45	0.033	87.1	12/11/2107
5961835	61,170.50	18	0.276	45,000	2.13	0.047	87.4	03/22/2108
5962987	118,264.16	18	0.266	45,000	2.84	0.040	90.5	04/23/2111
5963223	151,292.37	18	0.276	45,000	1.54	0.066	91.9	09/03/2112
5961833	60,359.26	18	0.276	45,000	5.20	0.028	93.3	02/11/2114
5961245	13,414.04	18	0.266	45,000	1.30	0.027	95.7	07/04/2116
5962310	100,239.22	18	0.266	45,000	1.54	0.053	98.1	11/14/2118
5961457	23,538.52	18	0.276	45,000	1.06	0.047	99.1	11/20/2119
5963509	168,815.30	18	0.266	45,000	1.89	0.040	99.8	08/07/2120
5961044	993.98	18	0.276	45,000	0.95	0.033	103.3	01/29/2124
5961448	22,237.55	18	0.276	45,000	1.42	0.033	104.9	08/31/2125
5963688	176,299.47	18	0.285	45,000	2.84	0.040	107.4	03/11/2128
5961215	12,051.18	18	0.266	45,000	0.83	0.032	109.4	03/29/2130
5961370	50,901.16	18	0.276	45,000	1.89	0.033	118.8	08/14/2139
5961343	20,973.33	18	0.266	45,000	0.83	0.032	122.4	03/18/2143
5961200	10,535.20	18	0.285	45,000	1.42	0.026	123.8	08/14/2144

**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)**

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
5961397	53,675.16	18	0.276	45,000	1.18	0.047	124.1	11/17/2144
5963689	176,306.95	18	0.285	45,000	2.13	0.040	127.8	08/11/2148
5962956	117,240.68	18	0.276	45,000	2.72	0.033	136.8	08/02/2157
5961199	10,499.35	18	0.285	45,000	0.95	0.031	138.5	04/13/2159
5963613	172,574.76	18	0.276	45,000	1.54	0.039	139.0	10/28/2159
5963042	167,126.33	18	0.266	45,000	1.42	0.032	144.8	08/12/2165
5962216	79,052.72	18	0.276	45,000	1.54	0.039	144.8	08/25/2165
5961387	52,558.93	18	0.285	45,000	0.95	0.051	157.2	12/27/2177
5962853	125,733.59	18	0.276	45,000	2.72	0.028	160.2	01/10/2181
5961876	63,434.07	18	0.276	45,000	1.18	0.033	175.0	10/13/2195
5963467	165,385.92	18	0.276	45,000	1.06	0.039	180.6	05/31/2201
5962816	121,913.48	18	0.285	45,000	1.54	0.040	192.6	05/21/2213
5962817	121,917.06	18	0.285	45,000	1.06	0.046	220.4	03/09/2241
5961790	57,582.71	18	0.285	45,000	0.83	0.026	225.2	01/12/2246
5962946	116,299.49	18	0.276	45,000	0.83	0.039	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)**

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
4568160	35,346.62	18	0.266	45,000	3.54	0.040	24.0	03/10/2044
4569519	84,670.13	18	0.266	45,000	3.90	0.053	24.3	07/07/2044
4569334	71,054.89	18	0.266	45,000	4.72	0.045	24.5	09/14/2044
4569086	75,685.86	18	0.266	45,000	6.26	0.040	26.5	08/31/2046
4568151	35,150.87	18	0.266	45,000	4.37	0.032	28.0	02/22/2048
4568464	44,237.58	18	0.266	45,000	5.20	0.032	28.4	08/21/2048
4567911	24,176.82	18	0.266	45,000	3.31	0.032	28.7	11/29/2048
4568323	38,112.73	18	0.266	45,000	2.72	0.040	29.2	05/05/2049
4568161	35,349.53	18	0.266	45,000	1.65	0.053	29.8	12/14/2049
4569561	87,134.26	18	0.266	45,000	5.79	0.040	30.6	10/09/2050
4568860	73,783.33	18	0.266	45,000	14.17	0.027	30.8	12/25/2050
4567489	3,938.15	18	0.266	45,000	1.89	0.032	31.4	08/22/2051
4567897	22,677.30	18	0.266	45,000	3.54	0.027	32.3	07/08/2052
4567484	3,425.66	18	0.266	45,000	1.77	0.032	32.5	09/19/2052
4568475	45,064.97	18	0.266	45,000	5.67	0.027	33.7	11/21/2053
4568232	36,362.16	18	0.266	45,000	4.13	0.027	34.6	10/15/2054
4568684	53,838.42	18	0.285	45,000	4.61	0.040	37.1	04/16/2057
4568685	53,840.71	18	0.285	45,000	2.72	0.051	37.4	07/25/2057
4569926	105,959.99	18	0.266	45,000	5.55	0.040	37.6	10/19/2057
4568346	39,155.14	18	0.266	45,000	3.54	0.027	38.4	08/05/2058
4568748	55,772.96	18	0.266	45,000	3.19	0.032	40.1	04/16/2060
4569138	77,690.70	18	0.266	45,000	5.08	0.032	40.8	12/29/2060
4568338	38,764.50	18	0.266	45,000	2.24	0.032	41.3	07/03/2061
4568001	30,231.72	18	0.256	45,000	1.30	0.033	42.2	05/27/2062
4571465	159,709.10	18	0.266	45,000	3.66	0.053	43.5	09/14/2063
4567735	12,883.10	18	0.266	45,000	1.18	0.032	46.3	06/10/2066

**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)**

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
4568750	55,818.46	18	0.266	45,000	2.36	0.032	47.4	08/08/2067
4571437	159,039.15	18	0.266	45,000	6.38	0.040	47.9	01/23/2068
4571001	140,763.37	18	0.266	45,000	5.43	0.040	48.9	01/28/2069
4569509	83,950.74	18	0.266	45,000	2.48	0.040	49.6	11/02/2069
4570138	115,240.75	18	0.266	45,000	6.73	0.032	50.5	08/30/2070
4569552	86,516.12	18	0.266	45,000	3.78	0.032	50.7	11/11/2070
4569267	68,503.66	18	0.285	45,000	2.72	0.046	50.9	01/23/2071
4567769	15,914.01	18	0.266	45,000	1.06	0.032	51.1	04/01/2071
4571325	158,028.91	18	0.256	45,000	2.83	0.046	51.7	11/09/2071
4570859	141,598.18	18	0.266	45,000	8.86	0.032	52.2	05/23/2072
4567963	27,121.92	18	0.266	45,000	0.95	0.040	53.7	11/15/2073
4568657	52,708.76	18	0.266	45,000	2.24	0.027	54.4	07/18/2074
4567892	22,435.41	18	0.266	45,000	1.30	0.027	54.4	08/07/2074
4569924	105,959.31	18	0.266	45,000	4.49	0.032	56.3	06/26/2076
4569275	68,756.16	18	0.285	45,000	4.84	0.031	56.7	11/17/2076
4570465	130,190.57	18	0.266	45,000	2.95	0.045	56.7	11/24/2076
4569233	67,469.51	18	0.285	45,000	4.61	0.031	56.7	12/07/2076
4567737	13,121.98	18	0.266	45,000	0.83	0.032	57.7	11/30/2077
4569337	71,093.31	18	0.266	45,000	1.65	0.040	58.0	03/28/2078
4569471	80,899.73	18	0.266	45,000	1.89	0.040	58.2	06/01/2078
4569857	101,008.50	18	0.266	45,000	3.66	0.032	59.0	03/26/2079
4569137	77,686.59	18	0.266	45,000	3.31	0.027	59.6	11/03/2079
4569958	107,556.37	18	0.285	45,000	5.20	0.040	60.5	09/03/2080
4569527	85,161.17	18	0.266	45,000	3.66	0.027	60.6	10/02/2080
4569696	92,702.26	18	0.266	45,000	2.95	0.032	61.2	05/25/2081
4570469	130,426.23	18	0.266	45,000	8.86	0.027	62.0	03/21/2082
4569508	83,947.50	18	0.266	45,000	3.31	0.027	62.6	10/17/2082
4569550	86,422.84	18	0.266	45,000	2.48	0.032	63.5	08/30/2083
4569559	86,847.95	18	0.266	45,000	2.48	0.032	63.8	01/15/2084
4568932	62,322.63	18	0.266	45,000	2.01	0.027	64.0	03/17/2084
4569518	84,666.89	18	0.266	45,000	2.24	0.032	66.1	03/31/2086
4569718	93,835.82	18	0.266	45,000	2.60	0.032	66.5	09/03/2086
4570280	121,631.55	18	0.266	45,000	4.02	0.032	67.3	07/12/2087
4569444	80,263.33	18	0.266	45,000	2.60	0.027	68.2	06/08/2088
4570272	120,270.47	18	0.285	45,000	3.54	0.046	69.5	08/29/2089
4568984	64,291.68	18	0.266	45,000	1.65	0.027	72.9	02/12/2093
4570709	135,967.02	18	0.266	45,000	4.13	0.032	73.0	03/04/2093
4569861	101,645.03	18	0.266	45,000	3.19	0.027	75.4	08/13/2095
4571461	159,436.82	18	0.266	45,000	4.72	0.032	75.9	01/24/2096
4571721	168,561.38	18	0.266	45,000	4.84	0.032	76.3	06/13/2096
4570445	129,157.53	18	0.266	45,000	3.43	0.032	77.1	04/16/2097
4569136	77,597.98	18	0.266	45,000	1.89	0.027	79.2	05/14/2099
4571077	151,948.70	18	0.266	45,000	6.50	0.027	79.2	06/06/2099
4569586	88,970.29	18	0.266	45,000	1.77	0.032	79.3	07/04/2099
4569918	105,397.02	18	0.266	45,000	3.07	0.027	79.9	02/10/2100
4571009	141,081.99	18	0.266	45,000	3.66	0.032	80.0	02/27/2100
4569082	75,607.52	18	0.285	45,000	2.72	0.031	80.0	03/14/2100

**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)**

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
4569193	66,117.99	18	0.266	45,000	1.18	0.032	80.5	09/01/2100
4569513	84,358.27	18	0.266	45,000	2.01	0.027	80.9	02/08/2101
4570232	126,989.72	18	0.266	45,000	4.25	0.027	82.2	05/14/2102
4567682	47,946.28	18	0.266	45,000	0.83	0.032	82.5	09/07/2102
4568840	73,515.19	18	0.295	45,000	1.30	0.059	84.7	11/28/2104
4568950	62,960.95	18	0.285	45,000	2.36	0.026	85.8	01/05/2106
4569504	83,577.55	18	0.266	45,000	1.77	0.027	85.9	02/15/2106
4569407	72,923.84	18	0.266	45,000	1.18	0.032	88.2	05/14/2108
4569401	72,618.66	18	0.285	45,000	2.72	0.026	91.1	05/04/2111
4571081	152,294.59	18	0.266	45,000	2.13	0.040	92.6	10/28/2112
4569937	106,567.31	18	0.285	45,000	2.36	0.040	92.8	12/20/2112
4571098	152,924.00	18	0.266	45,000	0.95	0.072	95.1	03/31/2115
4570254	127,934.25	18	0.266	45,000	3.07	0.027	95.5	09/03/2115
4570115	113,616.73	18	0.266	45,000	1.42	0.040	95.6	11/03/2115
4569879	102,480.63	18	0.266	45,000	2.01	0.027	96.3	06/20/2116
4570259	128,252.29	18	0.266	45,000	1.30	0.045	101.6	10/04/2121
4571229	156,379.58	18	0.266	45,000	3.54	0.027	102.9	01/17/2123
4569964	108,425.37	18	0.266	45,000	1.54	0.032	104.2	06/10/2124
4570862	141,625.33	18	0.266	45,000	2.24	0.032	104.9	01/18/2125
4570512	131,849.35	18	0.285	45,000	4.13	0.031	105.5	09/12/2125
4571423	158,941.71	18	0.266	45,000	3.19	0.027	109.1	05/05/2129
4571057	150,481.41	18	0.266	45,000	2.24	0.032	109.6	10/10/2129
4569501	83,320.27	18	0.266	45,000	0.95	0.032	109.6	11/02/2129
4570466	130,236.08	18	0.266	45,000	1.77	0.032	112.6	10/10/2132
4569632	91,480.39	18	0.266	45,000	0.95	0.032	118.9	01/22/2139
4569307	70,442.96	18	0.285	45,000	1.18	0.026	133.7	11/30/2153
4570830	139,094.38	18	0.266	45,000	1.77	0.027	135.8	12/25/2155
4570835	139,213.57	18	0.266	45,000	1.77	0.027	135.9	01/25/2156
4571060	150,773.18	18	0.266	45,000	1.54	0.032	137.3	07/01/2157
4571024	148,078.88	18	0.266	45,000	1.77	0.027	141.0	03/01/2161
4571041	149,052.55	18	0.285	45,000	3.19	0.026	153.8	12/15/2173
4569959	107,595.66	18	0.285	45,000	1.77	0.026	155.0	03/05/2175
4570429	128,838.83	18	0.266	45,000	1.18	0.027	159.5	08/30/2179
4570511	131,848.05	18	0.285	45,000	2.13	0.026	169.1	05/01/2189
4570279	121,629.77	18	0.266	45,000	0.95	0.027	171.8	01/08/2192
4570468	130,387.76	18	0.266	45,000	0.95	0.027	182.5	09/16/2202
4570281	121,634.35	18	0.266	45,000	0.83	0.027	185.5	09/13/2205
4569582	88,528.85	18	0.285	45,000	0.83	0.026	192.9	02/03/2213
4570708	135,955.44	18	0.266	45,000	0.83	0.027	203.8	01/12/2224
4571042	149,053.52	18	0.285	45,000	0.95	0.026	225.2	06/03/2245

**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)**

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
4536340	38,219.00	18	0.295	45,000	8.51	0.059	27.6	10/17/2047
4535712	16,008.45	18	0.285	45,000	6.26	0.051	28.1	04/21/2048
4535858	20,050.95	18	0.295	45,000	6.26	0.059	28.2	05/12/2048
4535736	16,887.28	18	0.285	45,000	8.62	0.046	29.1	04/15/2049
4535820	34,669.29	18	0.285	45,000	4.96	0.060	29.5	08/31/2049
4535737	17,125.07	18	0.285	45,000	5.79	0.051	29.6	10/20/2049
4535589	10,552.58	18	0.305	45,000	7.21	0.058	31.8	12/05/2051
4535863	20,997.24	18	0.295	45,000	23.86	0.038	35.0	03/16/2055
4536818	56,832.78	18	0.295	45,000	4.25	0.071	38.2	05/30/2058
4535259	913.81	18	0.295	45,000	9.69	0.038	38.4	08/13/2058
4535690	14,933.80	18	0.305	45,000	10.63	0.046	40.7	11/20/2060
4535698	15,292.81	18	0.305	45,000	4.84	0.058	40.8	12/15/2060
4539118	123,275.44	18	0.305	45,000	11.34	0.067	41.7	11/14/2061
4535746	17,537.71	18	0.285	45,000	6.26	0.040	42.5	09/13/2062
4535677	14,696.72	18	0.305	45,000	9.10	0.046	43.2	05/04/2063
4535756	17,923.55	18	0.295	45,000	11.46	0.038	43.6	10/05/2063
4535883	22,550.72	18	0.295	45,000	29.18	0.032	45.1	04/03/2065
4535974	28,374.89	18	0.285	45,000	6.97	0.040	45.4	07/26/2065
4539986	193,294.98	18	0.295	45,000	12.17	0.059	45.7	11/06/2065
4536899	54,373.85	18	0.295	45,000	9.92	0.047	47.1	03/25/2067
4535692	14,975.39	18	0.285	45,000	3.43	0.046	48.2	04/27/2068
4535745	17,504.19	18	0.305	45,000	12.76	0.040	49.1	04/02/2069
4535884	22,553.90	18	0.295	45,000	4.84	0.047	49.1	04/19/2069
4539335	132,060.90	18	0.295	45,000	7.56	0.065	49.6	10/06/2069
4538435	88,290.24	18	0.295	45,000	6.38	0.059	52.3	06/24/2072
4538145	82,885.71	18	0.295	45,000	11.46	0.047	55.9	01/26/2076
4536639	52,405.04	18	0.295	45,000	4.73	0.053	56.5	09/16/2076
4535914	25,196.82	18	0.295	45,000	2.36	0.065	56.6	10/04/2076
4536325	37,554.70	18	0.295	45,000	9.45	0.038	57.1	04/23/2077
4535652	13,934.51	18	0.295	45,000	5.20	0.038	57.5	08/23/2077
4535771	18,400.77	18	0.305	45,000	8.15	0.040	58.1	04/20/2078
4535774	18,468.13	18	0.295	45,000	5.20	0.038	60.2	05/16/2080
4535289	2,892.30	18	0.295	45,000	5.43	0.032	60.7	11/10/2080
4535590	10,631.17	18	0.305	45,000	3.31	0.052	61.0	03/13/2081
4535494	6,232.38	18	0.295	45,000	3.78	0.038	61.2	05/19/2081
4535897	24,461.16	18	0.295	45,000	5.79	0.038	61.3	06/24/2081
4535626	12,020.25	18	0.305	45,000	6.14	0.040	62.5	08/24/2082
4535606	11,026.74	18	0.295	45,000	7.21	0.032	63.5	09/03/2083
4538446	89,070.90	18	0.295	45,000	6.50	0.053	63.5	09/13/2083
4538349	95,559.32	18	0.295	45,000	6.97	0.053	64.1	04/23/2084
4535628	12,332.26	18	0.295	45,000	12.64	0.027	65.5	08/17/2085
4535575	10,393.97	18	0.285	45,000	2.48	0.040	67.7	11/16/2087
4536885	54,056.87	18	0.295	45,000	9.33	0.038	67.8	12/29/2087
4535829	19,537.44	18	0.305	45,000	5.43	0.040	68.6	10/13/2088
4538547	97,845.82	18	0.305	45,000	6.97	0.058	69.1	04/02/2089
4536233	49,812.67	18	0.305	45,000	3.66	0.058	70.0	03/11/2090
4536593	45,577.87	18	0.285	45,000	2.48	0.051	70.4	07/28/2090

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)

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
4535973	28,361.59	18	0.285	45,000	2.36	0.046	70.4	08/05/2090
4535666	14,559.10	18	0.295	45,000	9.22	0.027	71.0	03/10/2091
4535283	2,417.27	18	0.295	45,000	5.67	0.027	71.8	12/06/2091
4535898	24,463.35	18	0.295	45,000	4.02	0.038	72.4	07/28/2092
4536225	49,154.01	18	0.305	45,000	9.92	0.040	74.1	04/22/2094
4539159	126,207.94	18	0.285	45,000	5.67	0.051	75.1	03/25/2095
4537876	76,585.42	18	0.295	45,000	11.81	0.038	75.4	07/19/2095
4535889	23,384.60	18	0.285	45,000	1.65	0.051	75.9	01/29/2096
4538402	96,508.35	18	0.295	45,000	7.68	0.047	76.1	04/02/2096
4538559	98,081.27	18	0.305	45,000	14.41	0.046	76.6	09/27/2096
4536887	54,069.28	18	0.295	45,000	6.62	0.038	77.6	10/02/2097
4535932	25,971.26	18	0.295	45,000	5.43	0.032	77.7	11/03/2097
4535769	18,392.57	18	0.305	45,000	6.26	0.034	78.0	02/13/2098
4535695	15,090.62	18	0.285	45,000	2.01	0.040	78.0	03/05/2098
4535759	18,002.97	18	0.295	45,000	2.13	0.047	78.4	07/14/2098
4536223	49,059.98	18	0.305	45,000	8.27	0.040	78.9	01/29/2099
4536901	54,811.05	18	0.295	45,000	6.26	0.038	79.8	12/26/2099
4536456	41,774.98	18	0.295	45,000	7.44	0.032	80.4	07/18/2100
4535933	26,564.68	18	0.305	45,000	7.68	0.034	80.4	08/03/2100
4538486	90,307.73	18	0.295	45,000	6.14	0.047	80.6	09/21/2100
4536248	51,387.39	18	0.295	45,000	5.55	0.038	81.6	10/15/2101
4535764	18,211.08	18	0.295	45,000	6.38	0.027	81.9	02/12/2102
4536234	49,813.38	18	0.305	45,000	7.44	0.040	82.9	01/24/2103
4535824	34,813.50	18	0.295	45,000	1.18	0.080	83.1	04/16/2103
4536628	52,364.67	18	0.305	45,000	3.66	0.052	83.2	05/27/2103
4536886	54,066.76	18	0.295	45,000	2.13	0.059	88.1	04/06/2108
4537655	74,975.02	18	0.295	45,000	4.14	0.047	88.3	06/13/2108
4536884	54,055.70	18	0.295	45,000	8.15	0.032	88.4	08/11/2108
4536445	41,194.55	18	0.295	45,000	3.66	0.038	88.6	10/02/2108
4539172	127,034.74	18	0.305	45,000	8.98	0.052	89.6	10/15/2109
4539160	126,366.48	18	0.305	45,000	14.89	0.046	90.7	10/30/2110
4535968	28,254.22	18	0.305	45,000	5.43	0.034	90.8	12/27/2110
4536337	38,159.25	18	0.295	45,000	8.86	0.027	91.3	06/11/2111
4535279	2,258.09	18	0.295	45,000	2.13	0.032	92.0	02/28/2112
4536465	42,342.59	18	0.305	45,000	4.61	0.040	92.2	05/26/2112
4536495	43,517.48	18	0.285	45,000	2.36	0.040	93.2	05/23/2113
4538429	87,932.55	18	0.295	45,000	4.49	0.047	93.6	09/27/2113
4535865	22,139.76	18	0.305	45,000	1.65	0.058	93.9	02/12/2114
4538493	90,783.05	18	0.295	45,000	3.54	0.053	94.0	03/21/2114
4537018	70,124.13	18	0.305	45,000	8.62	0.040	94.0	03/22/2114
4536331	37,733.48	18	0.295	45,000	3.07	0.038	94.2	05/01/2114
4535934	26,802.28	18	0.305	45,000	2.13	0.052	94.3	07/05/2114
4539549	147,955.85	18	0.285	45,000	9.45	0.040	94.4	07/22/2114
4539906	186,737.11	18	0.295	45,000	5.79	0.053	94.9	01/09/2115
4536475	42,699.03	18	0.305	45,000	7.09	0.034	94.9	02/09/2115
4535773	18,467.29	18	0.295	45,000	4.14	0.027	95.1	04/10/2115
4539316	130,426.25	18	0.295	45,000	7.21	0.047	95.9	01/22/2116

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)

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
4539731	158,472.16	18	0.295	45,000	3.54	0.065	95.9	02/08/2116
4537441	70,916.05	18	0.305	45,000	8.15	0.040	96.3	06/28/2116
4536151	35,330.54	18	0.305	45,000	5.20	0.034	97.9	01/24/2118
4536932	55,048.14	18	0.295	45,000	6.14	0.032	98.3	06/12/2118
4537575	72,446.19	18	0.295	45,000	9.45	0.032	98.8	12/06/2118
4536232	49,810.90	18	0.305	45,000	8.03	0.034	99.3	07/10/2119
4538992	116,314.11	18	0.295	45,000	4.25	0.053	100.1	03/22/2120
4537656	74,975.68	18	0.295	45,000	3.31	0.047	101.1	04/15/2121
4538557	98,076.68	18	0.305	45,000	12.88	0.040	101.8	12/31/2121
4538848	106,132.65	18	0.295	45,000	9.81	0.038	101.9	01/30/2122
4536464	42,223.56	18	0.305	45,000	2.25	0.052	103.7	11/01/2123
4536224	49,146.53	18	0.305	45,000	15.24	0.027	104.5	09/10/2124
4537001	69,362.71	18	0.295	45,000	7.44	0.032	104.7	11/04/2124
4535887	23,007.07	18	0.305	45,000	2.01	0.046	104.8	12/13/2124
4538406	96,589.10	18	0.295	45,000	7.56	0.038	105.1	04/01/2125
4536226	49,163.51	18	0.305	45,000	14.77	0.027	105.3	06/03/2125
4538338	95,043.50	18	0.295	45,000	7.09	0.038	105.5	08/26/2125
4535767	18,318.83	18	0.305	45,000	4.37	0.027	106.6	10/05/2126
4537012	70,044.91	18	0.295	45,000	4.25	0.038	108.7	11/10/2128
4539792	178,271.82	18	0.295	45,000	6.50	0.047	109.6	10/06/2129
4536342	38,229.16	18	0.295	45,000	2.36	0.038	109.8	01/05/2130
4538432	88,218.97	18	0.295	45,000	3.43	0.047	110.1	04/03/2130
4535902	24,757.36	18	0.295	45,000	3.43	0.027	110.7	10/31/2130
4535651	13,924.11	18	0.295	45,000	1.89	0.032	112.2	05/18/2132
4536240	50,553.30	18	0.305	45,000	5.67	0.034	112.8	12/31/2132
4539331	131,188.84	18	0.295	45,000	3.90	0.053	113.6	10/04/2133
4539314	130,407.59	18	0.295	45,000	10.28	0.038	114.0	02/23/2134
4538984	115,799.02	18	0.305	45,000	4.96	0.052	114.6	09/30/2134
4539203	128,236.66	18	0.295	45,000	9.92	0.038	114.8	12/11/2134
4536752	55,445.80	18	0.295	45,000	7.21	0.027	114.9	01/19/2135
4539153	126,090.24	18	0.285	45,000	5.08	0.040	116.5	08/31/2136
4540004	195,053.32	18	0.285	45,000	3.19	0.051	117.0	03/07/2137
4538497	90,899.67	18	0.305	45,000	4.73	0.046	117.4	08/06/2137
4538597	134,505.70	18	0.295	45,000	2.25	0.071	117.9	01/11/2138
4535770	18,393.50	18	0.305	45,000	2.36	0.034	119.1	04/17/2139
4537578	72,762.72	18	0.305	45,000	8.27	0.034	119.6	10/08/2139
4539241	128,874.89	18	0.295	45,000	4.61	0.047	120.0	03/21/2140
4536246	51,110.73	18	0.305	45,000	3.31	0.040	120.1	03/24/2140
4535943	27,476.85	18	0.295	45,000	3.07	0.027	121.3	06/20/2141
4537522	78,931.55	18	0.295	45,000	3.78	0.038	123.2	05/30/2143
4535280	2,298.54	18	0.295	45,000	1.54	0.027	124.7	10/31/2144
4536230	49,376.51	18	0.305	45,000	2.95	0.040	125.3	06/17/2145
4536898	54,372.89	18	0.295	45,000	3.31	0.032	125.8	12/25/2145
4538153	83,150.80	18	0.295	45,000	3.90	0.038	125.8	01/04/2146
4538033	80,232.71	18	0.305	45,000	8.51	0.034	126.0	02/27/2146
4537583	73,223.78	18	0.295	45,000	4.73	0.032	126.8	12/12/2146
4539165	126,717.40	18	0.305	45,000	6.62	0.046	126.8	12/14/2146

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)

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
4535629	12,335.80	18	0.295	45,000	1.89	0.027	128.1	04/21/2148
4535821	34,669.95	18	0.285	45,000	2.13	0.026	128.5	09/11/2148
4538135	82,298.88	18	0.295	45,000	1.77	0.059	129.0	03/17/2149
4537263	62,751.12	18	0.295	45,000	3.66	0.032	129.8	12/24/2149
4537002	69,369.33	18	0.295	45,000	7.21	0.027	130.0	03/17/2150
4538849	106,143.75	18	0.295	45,000	8.98	0.032	131.2	05/17/2151
4536215	48,065.32	18	0.305	45,000	5.67	0.027	131.6	10/26/2151
4538502	91,336.53	18	0.285	45,000	7.44	0.026	131.7	11/12/2151
4538905	110,602.75	18	0.295	45,000	5.55	0.038	131.9	01/13/2152
4536496	43,529.69	18	0.305	45,000	2.36	0.040	132.4	07/25/2152
4536888	54,079.36	18	0.295	45,000	1.42	0.053	132.9	02/03/2153
4536444	40,920.92	18	0.295	45,000	1.77	0.038	133.3	06/25/2153
4538334	94,921.89	18	0.295	45,000	6.38	0.032	134.1	04/09/2154
4538146	82,889.05	18	0.295	45,000	4.96	0.032	134.8	12/16/2154
4536323	37,116.79	18	0.295	45,000	2.01	0.032	136.3	06/27/2156
4536460	41,944.75	18	0.305	45,000	1.77	0.046	136.6	09/27/2156
4538975	115,384.08	18	0.305	45,000	7.68	0.040	137.5	09/03/2157
4538073	81,112.97	18	0.305	45,000	4.14	0.040	138.2	05/30/2158
4538069	81,014.75	18	0.285	45,000	3.19	0.031	139.3	06/13/2159
4538768	102,817.88	18	0.305	45,000	10.75	0.034	140.9	01/21/2161
4536338	38,183.07	18	0.295	45,000	1.54	0.038	141.5	09/11/2161
4538567	98,359.26	18	0.295	45,000	2.13	0.053	143.0	02/22/2163
4538511	91,930.57	18	0.295	45,000	9.45	0.027	144.2	04/28/2164
4538288	86,946.45	18	0.295	45,000	8.15	0.027	144.4	08/15/2164
4538292	87,621.32	18	0.295	45,000	3.19	0.038	144.5	08/24/2164
4538152	83,135.76	18	0.295	45,000	1.77	0.053	145.4	07/23/2165
4538500	91,228.32	18	0.305	45,000	7.09	0.034	145.7	11/07/2165
4535734	16,721.96	18	0.305	45,000	2.01	0.027	145.7	11/08/2165
4536497	43,530.52	18	0.305	45,000	3.66	0.027	145.9	01/23/2166
4537217	60,095.85	18	0.295	45,000	2.13	0.038	146.5	08/31/2166
4538850	106,144.91	18	0.295	45,000	2.72	0.047	146.6	09/28/2166
4537267	63,145.51	18	0.295	45,000	2.84	0.032	147.0	03/18/2167
4536757	55,914.99	18	0.285	45,000	1.89	0.031	148.0	02/26/2168
4539977	192,622.95	18	0.295	45,000	3.54	0.047	148.4	07/24/2168
4537927	79,954.85	18	0.305	45,000	10.16	0.027	148.8	12/17/2168
4539041	119,487.40	18	0.295	45,000	4.61	0.038	150.0	03/02/2170
4539853	184,041.12	18	0.295	45,000	3.54	0.047	150.2	05/12/2170
4538061	80,469.23	18	0.285	45,000	3.90	0.026	150.2	05/24/2170
4539738	158,985.95	18	0.295	45,000	6.14	0.038	150.6	10/16/2170
4535622	11,425.35	18	0.305	45,000	1.89	0.027	151.1	03/29/2171
4536874	53,342.88	18	0.295	45,000	2.25	0.032	151.6	09/25/2171
4536341	38,220.16	18	0.295	45,000	0.95	0.053	151.7	11/22/2171
4538415	87,658.60	18	0.295	45,000	6.73	0.027	153.4	08/04/2173
4539132	123,922.12	18	0.285	45,000	4.96	0.031	153.8	01/03/2174
4536227	49,169.59	18	0.305	45,000	3.78	0.027	153.9	01/28/2174
4535961	27,992.40	18	0.295	45,000	1.42	0.032	154.0	03/10/2174
4539481	142,702.56	18	0.295	45,000	9.45	0.032	155.0	02/23/2175

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)

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
4536243	50,863.54	18	0.305	45,000	3.90	0.027	155.5	09/05/2175
4538298	93,093.04	18	0.305	45,000	3.90	0.040	156.2	05/18/2176
4536344	39,097.04	18	0.305	45,000	1.18	0.052	156.4	07/23/2176
4539823	180,564.90	18	0.295	45,000	9.45	0.032	158.9	02/09/2179
4538307	93,525.53	18	0.285	45,000	2.01	0.040	159.3	06/11/2179
4537003	69,409.36	18	0.295	45,000	3.78	0.027	161.0	03/02/2181
4538080	81,261.63	18	0.295	45,000	3.19	0.032	161.3	06/06/2181
4535730	16,642.62	18	0.285	45,000	0.95	0.026	164.0	02/25/2184
4538989	116,036.61	18	0.285	45,000	6.14	0.026	167.0	03/08/2187
4539360	133,022.24	18	0.295	45,000	6.62	0.032	167.0	03/17/2187
4536508	44,473.81	18	0.285	45,000	1.54	0.026	167.6	09/24/2187
4538330	94,855.26	18	0.295	45,000	5.79	0.027	168.7	11/02/2188
4538304	93,410.71	18	0.305	45,000	8.62	0.027	172.4	07/16/2192
4539732	158,472.92	18	0.295	45,000	7.32	0.032	172.4	08/11/2192
4537584	73,231.25	18	0.295	45,000	2.36	0.032	175.4	07/13/2195
4538496	90,853.29	18	0.315	45,000	2.36	0.054	176.0	03/03/2196
4538275	86,414.56	18	0.295	45,000	2.84	0.032	177.1	04/05/2197
4535697	15,170.82	18	0.305	45,000	1.06	0.034	178.6	10/01/2198
4538961	114,908.71	18	0.295	45,000	4.37	0.032	179.2	05/09/2199
4536237	50,053.31	18	0.285	45,000	0.83	0.046	179.9	01/14/2200
4540022	196,052.24	18	0.305	45,000	2.84	0.052	182.1	04/11/2202
4537250	62,513.69	18	0.295	45,000	2.48	0.027	182.5	08/18/2202
4536476	42,742.92	18	0.305	45,000	2.13	0.027	183.8	12/07/2203
4539768	162,869.27	18	0.305	45,000	5.43	0.040	184.4	07/12/2204
4535929	25,813.38	18	0.295	45,000	0.83	0.038	185.9	01/15/2206
4539480	142,701.90	18	0.295	45,000	3.66	0.038	185.9	01/24/2206
4535565	10,037.02	18	0.305	45,000	0.95	0.034	186.3	07/08/2206
4538935	113,657.70	18	0.295	45,000	3.90	0.032	186.8	12/11/2206
4538963	115,146.49	18	0.295	45,000	6.62	0.027	188.1	04/13/2208
4539315	130,425.72	18	0.295	45,000	4.61	0.032	188.9	01/30/2209
4538279	86,708.64	18	0.295	45,000	3.54	0.027	189.1	04/27/2209
4538991	116,302.02	18	0.295	45,000	2.84	0.038	189.6	10/10/2209
4539158	126,207.29	18	0.285	45,000	3.19	0.031	189.6	10/25/2209
4538932	113,519.62	18	0.295	45,000	6.14	0.027	190.5	09/05/2210
4539740	159,198.15	18	0.295	45,000	3.66	0.038	191.0	03/08/2211
4537218	60,212.62	18	0.295	45,000	1.65	0.032	192.2	05/13/2212
4538431	88,171.22	18	0.295	45,000	2.48	0.032	192.8	12/26/2212
4539202	128,234.40	18	0.295	45,000	7.44	0.027	194.3	06/15/2214
4539733	158,474.06	18	0.295	45,000	5.20	0.032	194.6	10/19/2214
4536173	35,973.94	18	0.305	45,000	1.30	0.034	194.8	12/31/2214
4536889	54,095.64	18	0.295	45,000	1.42	0.032	195.7	11/06/2215
4537238	61,959.29	18	0.295	45,000	1.30	0.038	198.2	06/03/2218
4536638	52,390.80	18	0.305	45,000	2.25	0.027	198.5	08/27/2218
4538136	82,300.61	18	0.295	45,000	1.30	0.047	199.4	07/26/2219
4537877	76,587.29	18	0.295	45,000	2.60	0.027	199.7	11/27/2219
4537652	74,895.87	18	0.295	45,000	2.48	0.027	201.3	06/15/2221
4538433	88,221.08	18	0.295	45,000	3.07	0.027	203.6	10/04/2223

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)

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
4539592	149,736.13	18	0.305	45,000	6.50	0.034	203.8	12/10/2223
4536324	37,239.90	18	0.295	45,000	1.18	0.027	205.2	05/11/2225
4539793	178,303.08	18	0.295	45,000	3.19	0.038	205.8	12/16/2225
4538906	110,639.41	18	0.295	45,000	4.61	0.027	206.3	06/12/2226
4538534	97,290.38	18	0.305	45,000	3.31	0.034	206.3	07/07/2226
4539795	178,419.15	18	0.295	45,000	4.49	0.032	207.2	05/02/2227
4540017	195,772.82	18	0.295	45,000	2.95	0.038	207.2	05/17/2227
4536339	38,197.71	18	0.295	45,000	0.83	0.038	207.2	05/20/2227
4536343	38,676.14	18	0.295	45,000	0.83	0.038	208.1	03/31/2228
4535905	24,798.17	18	0.295	45,000	0.95	0.027	208.7	11/16/2228
4538933	113,558.11	18	0.295	45,000	4.61	0.027	209.1	04/25/2229
4536276	52,249.00	18	0.295	45,000	0.83	0.047	209.4	08/11/2229
4536895	54,334.50	18	0.295	45,000	0.83	0.047	213.2	05/29/2233
4539334	131,943.08	18	0.295	45,000	3.54	0.032	213.4	07/20/2233
4538996	116,791.40	18	0.305	45,000	2.95	0.040	213.4	07/23/2233
4538492	90,781.67	18	0.295	45,000	2.13	0.032	213.4	08/06/2233
4538852	106,224.74	18	0.295	45,000	1.54	0.047	214.2	05/07/2234
4538985	115,838.52	18	0.285	45,000	3.07	0.026	215.6	09/27/2235
4540018	195,773.48	18	0.295	45,000	2.72	0.038	217.1	03/30/2237
4538434	88,248.22	18	0.295	45,000	0.95	0.059	217.8	12/06/2237
4539817	180,289.75	18	0.295	45,000	6.73	0.027	218.0	02/25/2238
4536637	52,381.82	18	0.305	45,000	1.18	0.040	219.1	04/20/2239
4540016	195,753.64	18	0.295	45,000	3.54	0.032	221.7	11/23/2241
4539535	147,162.67	18	0.285	45,000	2.72	0.031	222.0	03/05/2242
4536461	42,025.00	18	0.305	45,000	1.42	0.027	222.9	02/14/2243
4539609	150,516.73	18	0.305	45,000	9.69	0.027	224.2	05/08/2244
4536159	35,676.01	18	0.305	45,000	0.83	0.034	225.2	05/26/2245
4536160	35,678.07	18	0.305	45,000	1.18	0.027	225.2	05/26/2245
4536322	37,044.53	18	0.295	45,000	0.83	0.027	225.2	05/26/2245
4536411	39,838.18	18	0.305	45,000	0.95	0.034	225.2	05/26/2245
4536214	48,064.08	18	0.305	45,000	1.18	0.034	225.2	05/26/2245
4536231	49,429.22	18	0.305	45,000	0.95	0.040	225.2	05/26/2245
4536629	52,366.20	18	0.305	45,000	1.06	0.040	225.2	05/26/2245
4536636	52,381.05	18	0.305	45,000	0.95	0.034	225.2	05/26/2245
4537228	61,390.30	18	0.295	45,000	1.54	0.027	225.2	05/26/2245
4537262	62,750.31	18	0.295	45,000	1.06	0.032	225.2	05/26/2245
4536971	68,677.41	18	0.295	45,000	0.95	0.038	225.2	05/26/2245
4537007	69,555.42	18	0.295	45,000	0.95	0.027	225.2	05/26/2245
4537008	69,640.51	18	0.295	45,000	0.83	0.038	225.2	05/26/2245
4537449	71,929.22	18	0.305	45,000	0.95	0.040	225.2	05/26/2245
4537843	76,211.31	18	0.305	45,000	1.06	0.034	225.2	05/26/2245
4537505	78,548.27	18	0.295	45,000	1.06	0.027	225.2	05/26/2245
4538067	80,714.18	18	0.295	45,000	1.30	0.032	225.2	05/26/2245
4538071	81,058.31	18	0.295	45,000	1.30	0.038	225.2	05/26/2245
4538072	81,058.64	18	0.295	45,000	0.83	0.047	225.2	05/26/2245
4538416	87,663.97	18	0.295	45,000	1.18	0.038	225.2	05/26/2245
4538499	91,228.00	18	0.305	45,000	2.01	0.034	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)

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
4539592	149,736.13	18	0.305	45,000	6.50	0.034	203.8	12/10/2223
4536324	37,239.90	18	0.295	45,000	1.18	0.027	205.2	05/11/2225
4539793	178,303.08	18	0.295	45,000	3.19	0.038	205.8	12/16/2225
4538906	110,639.41	18	0.295	45,000	4.61	0.027	206.3	06/12/2226
4538534	97,290.38	18	0.305	45,000	3.31	0.034	206.3	07/07/2226
4539795	178,419.15	18	0.295	45,000	4.49	0.032	207.2	05/02/2227
4540017	195,772.82	18	0.295	45,000	2.95	0.038	207.2	05/17/2227
4536339	38,197.71	18	0.295	45,000	0.83	0.038	207.2	05/20/2227
4536343	38,676.14	18	0.295	45,000	0.83	0.038	208.1	03/31/2228
4535905	24,798.17	18	0.295	45,000	0.95	0.027	208.7	11/16/2228
4538933	113,558.11	18	0.295	45,000	4.61	0.027	209.1	04/25/2229
4536276	52,249.00	18	0.295	45,000	0.83	0.047	209.4	08/11/2229
4536895	54,334.50	18	0.295	45,000	0.83	0.047	213.2	05/29/2233
4539334	131,943.08	18	0.295	45,000	3.54	0.032	213.4	07/20/2233
4538996	116,791.40	18	0.305	45,000	2.95	0.040	213.4	07/23/2233
4538492	90,781.67	18	0.295	45,000	2.13	0.032	213.4	08/06/2233
4538852	106,224.74	18	0.295	45,000	1.54	0.047	214.2	05/07/2234
4538985	115,838.52	18	0.285	45,000	3.07	0.026	215.6	09/27/2235
4540018	195,773.48	18	0.295	45,000	2.72	0.038	217.1	03/30/2237
4538434	88,248.22	18	0.295	45,000	0.95	0.059	217.8	12/06/2237
4539817	180,289.75	18	0.295	45,000	6.73	0.027	218.0	02/25/2238
4536637	52,381.82	18	0.305	45,000	1.18	0.040	219.1	04/20/2239
4540016	195,753.64	18	0.295	45,000	3.54	0.032	221.7	11/23/2241
4539535	147,162.67	18	0.285	45,000	2.72	0.031	222.0	03/05/2242
4536461	42,025.00	18	0.305	45,000	1.42	0.027	222.9	02/14/2243
4539609	150,516.73	18	0.305	45,000	9.69	0.027	224.2	05/08/2244
4536159	35,676.01	18	0.305	45,000	0.83	0.034	225.2	05/26/2245
4536160	35,678.07	18	0.305	45,000	1.18	0.027	225.2	05/26/2245
4536322	37,044.53	18	0.295	45,000	0.83	0.027	225.2	05/26/2245
4536411	39,838.18	18	0.305	45,000	0.95	0.034	225.2	05/26/2245
4536214	48,064.08	18	0.305	45,000	1.18	0.034	225.2	05/26/2245
4536231	49,429.22	18	0.305	45,000	0.95	0.040	225.2	05/26/2245
4536629	52,366.20	18	0.305	45,000	1.06	0.040	225.2	05/26/2245
4536636	52,381.05	18	0.305	45,000	0.95	0.034	225.2	05/26/2245
4537228	61,390.30	18	0.295	45,000	1.54	0.027	225.2	05/26/2245
4537262	62,750.31	18	0.295	45,000	1.06	0.032	225.2	05/26/2245
4536971	68,677.41	18	0.295	45,000	0.95	0.038	225.2	05/26/2245
4537007	69,555.42	18	0.295	45,000	0.95	0.027	225.2	05/26/2245
4537008	69,640.51	18	0.295	45,000	0.83	0.038	225.2	05/26/2245
4537449	71,929.22	18	0.305	45,000	0.95	0.040	225.2	05/26/2245
4537843	76,211.31	18	0.305	45,000	1.06	0.034	225.2	05/26/2245
4537505	78,548.27	18	0.295	45,000	1.06	0.027	225.2	05/26/2245
4538067	80,714.18	18	0.295	45,000	1.30	0.032	225.2	05/26/2245
4538071	81,058.31	18	0.295	45,000	1.30	0.038	225.2	05/26/2245
4538072	81,058.64	18	0.295	45,000	0.83	0.047	225.2	05/26/2245
4538416	87,663.97	18	0.295	45,000	1.18	0.038	225.2	05/26/2245
4538499	91,228.00	18	0.305	45,000	2.01	0.034	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)

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
4539743	159,440.84	18	0.295	45,000	1.06	0.038	225.2	05/26/2245
4539755	161,014.80	18	0.295	45,000	1.42	0.038	225.2	05/26/2245
4539769	162,870.66	18	0.305	45,000	2.13	0.027	225.2	05/26/2245
4539398	166,518.07	18	0.354	65,000	2.25	0.085	225.2	05/26/2245
4539423	172,037.03	18	0.354	65,000	1.89	0.071	225.2	05/26/2245
4539477	177,271.35	18	0.295	45,000	1.42	0.053	225.2	05/26/2245
4539779	177,273.24	18	0.295	45,000	2.48	0.038	225.2	05/26/2245
4539788	177,829.01	18	0.295	45,000	2.01	0.027	225.2	05/26/2245
4539818	180,365.99	18	0.295	45,000	3.54	0.032	225.2	05/26/2245
4539821	180,445.40	18	0.295	45,000	2.60	0.038	225.2	05/26/2245
4539928	187,080.71	18	0.295	45,000	1.42	0.038	225.2	05/26/2245
4539959	191,007.28	18	0.305	45,000	1.30	0.040	225.2	05/26/2245
4539963	191,162.87	18	0.285	45,000	2.48	0.026	225.2	05/26/2245
4539964	191,358.37	18	0.285	45,000	1.42	0.040	225.2	05/26/2245
4539970	191,819.03	18	0.285	45,000	2.13	0.031	225.2	05/26/2245
4539984	193,215.50	18	0.295	45,000	3.07	0.032	225.2	05/26/2245
4539993	194,050.90	18	0.295	45,000	0.95	0.053	225.2	05/26/2245
4540007	195,338.27	18	0.285	45,000	0.83	0.026	225.2	05/26/2245
4540008	195,390.92	18	0.305	45,000	0.95	0.027	225.2	05/26/2245
4540009	195,397.95	18	0.305	45,000	1.89	0.040	225.2	05/26/2245
4540181	223,472.04	18	0.374	65,000	0.95	0.041	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)

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
4140089	175,341.68	18	0.256	45,000	7.10	0.038	32.7	10/06/2052
4134052	98,144.39	18	0.295	45,000	7.69	0.059	36.8	11/06/2056
4136362	131,578.35	18	0.256	45,000	4.14	0.046	38.2	03/13/2058
4140615	207,318.27	18	0.266	45,000	5.44	0.040	38.4	06/21/2058
4136379	131,617.01	18	0.256	45,000	8.52	0.033	39.2	03/22/2059
4140140	178,839.45	18	0.256	45,000	5.20	0.038	40.0	01/13/2060
4140643	208,765.31	18	0.266	45,000	4.73	0.040	41.1	02/16/2061
4139127	152,006.86	18	0.256	45,000	3.67	0.046	42.1	02/10/2062
4140210	184,668.29	18	0.256	45,000	6.27	0.033	42.6	08/09/2062
4139600	161,868.96	18	0.256	45,000	6.62	0.033	45.8	10/19/2065
4140147	180,007.74	18	0.256	45,000	3.79	0.038	48.5	07/27/2068
4133856	82,825.76	18	0.295	45,000	3.90	0.059	52.5	07/14/2072
4134209	111,487.38	18	0.295	45,000	9.58	0.047	54.3	04/21/2074
4134152	110,160.59	18	0.285	45,000	6.74	0.046	54.5	07/20/2074
4139391	155,477.04	18	0.256	45,000	3.55	0.038	55.3	05/18/2075
4133908	89,112.05	18	0.295	45,000	2.72	0.071	55.4	06/13/2075
4139128	152,019.12	18	0.256	45,000	3.55	0.038	55.8	11/10/2075
4140601	206,231.86	18	0.246	45,000	2.13	0.032	56.4	06/13/2076
4140050	173,318.21	18	0.256	45,000	7.69	0.026	57.0	02/02/2077
4140345	193,934.88	18	0.256	45,000	3.31	0.033	57.1	02/19/2077

**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)**

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
4140602	206,254.32	18	0.246	45,000	2.25	0.027	63.2	03/31/2083
4139279	153,293.06	18	0.256	45,000	3.79	0.033	63.8	11/22/2083
4139979	168,967.89	18	0.266	45,000	5.91	0.032	64.5	07/30/2084
4133518	65,328.33	18	0.295	45,000	5.32	0.038	69.4	06/20/2089
4137896	136,504.44	18	0.246	45,000	3.19	0.027	70.3	04/29/2090
4140051	173,319.03	18	0.256	45,000	2.13	0.038	73.5	07/22/2093
4138228	139,443.26	18	0.266	45,000	2.37	0.045	76.2	04/02/2096
4139521	159,611.39	18	0.256	45,000	4.38	0.026	77.2	04/06/2097
4133663	74,686.96	18	0.295	45,000	1.77	0.065	80.6	09/03/2100
4133934	92,109.02	18	0.295	45,000	6.03	0.038	81.5	07/10/2101
4137803	134,903.42	18	0.256	45,000	4.02	0.026	82.5	06/30/2102
4133783	80,245.19	18	0.295	45,000	4.61	0.038	84.2	03/24/2104
4133683	76,130.75	18	0.295	45,000	14.67	0.027	84.4	05/31/2104
4138093	138,818.01	18	0.266	45,000	3.31	0.032	90.4	06/23/2110
4133659	74,667.70	18	0.295	45,000	2.01	0.053	91.8	11/15/2111
4133863	83,667.19	18	0.295	45,000	4.02	0.038	92.5	07/11/2112
4137041	132,955.03	18	0.256	45,000	1.66	0.038	93.4	06/11/2113
4133857	82,877.35	18	0.295	45,000	2.60	0.047	93.9	11/29/2113
4133655	74,653.80	18	0.295	45,000	2.25	0.047	96.3	05/18/2116
4133692	77,639.61	18	0.285	45,000	5.44	0.026	96.6	09/01/2116
4133740	79,147.11	18	0.295	45,000	4.97	0.032	96.8	11/22/2116
4134268	115,407.07	18	0.295	45,000	9.58	0.032	97.1	02/24/2117
4133703	78,272.34	18	0.285	45,000	5.32	0.026	97.8	11/19/2117
4134229	113,209.67	18	0.295	45,000	8.16	0.032	101.2	03/30/2121
4133915	90,455.71	18	0.295	45,000	2.48	0.047	101.7	09/19/2121
4133707	78,641.19	18	0.295	45,000	3.08	0.038	101.8	10/20/2121
4140344	193,856.60	18	0.256	45,000	1.77	0.026	102.4	06/11/2122
4133599	70,421.25	18	0.295	45,000	0.95	0.080	105.6	08/29/2125
4137042	132,955.87	18	0.256	45,000	1.66	0.033	105.8	10/27/2125
4140568	204,574.92	18	0.246	45,000	0.95	0.027	107.2	04/12/2127
4134155	110,171.60	18	0.285	45,000	1.30	0.066	108.6	08/19/2128
4138686	143,547.24	18	0.266	45,000	2.37	0.032	109.0	01/05/2129
4139039	148,670.60	18	0.256	45,000	1.30	0.038	110.9	12/23/2130
4133913	90,284.64	18	0.295	45,000	4.26	0.032	111.9	12/02/2131
4134180	110,478.08	18	0.295	45,000	5.80	0.032	112.4	05/28/2132
4139434	155,909.08	18	0.266	45,000	2.84	0.027	112.9	11/30/2132
4140116	176,996.04	18	0.256	45,000	1.30	0.033	113.4	06/10/2133
4134153	110,170.01	18	0.285	45,000	3.90	0.031	113.4	06/26/2133
4133282	39,149.23	18	0.354	65,000	3.08	0.060	113.5	07/20/2133
4138212	139,423.94	18	0.266	45,000	1.54	0.040	117.0	01/21/2137
4136066	129,414.60	18	0.256	45,000	1.89	0.026	118.2	03/23/2138
4136102	130,256.57	18	0.256	45,000	1.89	0.026	118.4	06/30/2138
4134210	111,526.89	18	0.305	45,000	7.69	0.034	118.6	09/04/2138
4137747	134,567.67	18	0.256	45,000	0.95	0.046	119.2	04/11/2139
4138201	139,413.35	18	0.266	45,000	2.01	0.032	119.5	07/15/2139
4133311	41,970.43	18	0.374	65,000	4.73	0.060	121.0	01/14/2141
4134136	108,651.74	18	0.305	45,000	3.08	0.046	123.3	04/23/2143

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)

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
4138229	139,443.67	18	0.266	45,000	1.42	0.040	123.5	07/31/2143
4139928	166,831.74	18	0.256	45,000	1.66	0.026	123.8	11/22/2143
4133880	86,373.49	18	0.295	45,000	4.85	0.027	124.9	11/24/2144
4134072	100,758.27	18	0.295	45,000	2.84	0.038	124.9	12/02/2144
4137908	137,355.37	18	0.266	45,000	2.37	0.027	126.5	07/28/2146
4137612	134,187.90	18	0.256	45,000	1.07	0.038	126.7	09/27/2146
4133920	90,879.85	18	0.295	45,000	4.97	0.027	127.4	06/10/2147
4137613	134,191.79	18	0.256	45,000	1.66	0.026	129.2	03/13/2149
4136328	131,498.35	18	0.256	45,000	0.83	0.046	130.1	03/10/2150
4133603	70,975.48	18	0.295	45,000	1.18	0.053	130.3	05/02/2150
4133869	85,246.43	18	0.295	45,000	2.84	0.032	131.0	01/11/2151
4137398	133,683.24	18	0.256	45,000	1.18	0.033	131.3	05/11/2151
4137622	134,209.27	18	0.256	45,000	1.18	0.033	131.5	07/08/2151
4133906	89,048.26	18	0.295	45,000	4.26	0.027	132.9	12/07/2152
4139972	168,135.83	18	0.256	45,000	1.07	0.033	134.1	02/23/2154
4133855	82,825.30	18	0.295	45,000	2.01	0.038	134.7	10/07/2154
4136072	129,592.77	18	0.256	45,000	0.95	0.038	135.3	05/14/2155
4140143	179,454.43	18	0.256	45,000	0.95	0.033	137.0	01/30/2157
4133660	74,677.80	18	0.295	45,000	1.30	0.047	138.9	11/27/2158
4133902	88,593.64	18	0.295	45,000	2.60	0.032	139.5	08/06/2159
4133667	75,070.10	18	0.295	45,000	2.84	0.027	140.7	09/12/2160
4134134	108,571.81	18	0.305	45,000	4.38	0.034	142.9	11/29/2162
4134141	109,229.55	18	0.295	45,000	3.19	0.032	143.6	08/17/2163
4133602	70,973.61	18	0.295	45,000	1.89	0.032	143.6	09/09/2163
4134154	110,171.07	18	0.285	45,000	3.31	0.026	144.7	10/05/2164
4133310	41,969.75	18	0.374	65,000	3.31	0.060	148.1	02/15/2168
4135983	129,128.63	18	0.256	45,000	0.95	0.033	149.3	04/25/2169
4133661	74,684.69	18	0.295	45,000	2.37	0.027	152.4	06/25/2172
4133890	87,661.60	18	0.295	45,000	2.96	0.027	152.8	10/29/2172
4134255	114,727.32	18	0.295	45,000	2.96	0.032	152.8	10/31/2172
4140071	174,327.35	18	0.256	45,000	0.83	0.033	152.9	12/29/2172
4133922	91,198.20	18	0.295	45,000	3.08	0.027	153.6	08/15/2173
4134051	98,138.47	18	0.295	45,000	1.07	0.059	158.8	11/21/2178
4133923	91,215.11	18	0.295	45,000	1.66	0.038	159.8	10/23/2179
4133657	74,656.76	18	0.295	45,000	2.13	0.027	160.2	04/08/2180
4139556	160,957.20	18	0.256	45,000	0.83	0.033	160.5	07/15/2180
4134253	114,510.38	18	0.295	45,000	3.79	0.027	161.6	08/13/2181
4134256	114,727.80	18	0.295	45,000	3.79	0.027	161.7	10/16/2181
4133656	74,654.67	18	0.295	45,000	1.30	0.038	162.9	12/02/2182
4134075	101,320.16	18	0.295	45,000	2.25	0.032	164.5	07/15/2184
4133504	64,355.81	18	0.295	45,000	1.30	0.032	166.8	10/28/2186
4134206	111,329.54	18	0.295	45,000	1.18	0.053	172.4	06/09/2192
4133919	90,819.07	18	0.295	45,000	2.37	0.027	172.4	06/14/2192
4134147	109,783.64	18	0.305	45,000	4.26	0.027	173.4	06/28/2193
4139011	147,242.59	18	0.266	45,000	1.30	0.027	174.3	05/18/2194
4138226	139,441.70	18	0.266	45,000	0.83	0.040	177.3	04/29/2197
4134069	100,013.30	18	0.295	45,000	1.54	0.038	177.9	11/26/2197

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)

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
4133976	93,225.29	18	0.295	45,000	1.07	0.047	183.2	03/15/2203
4139433	155,906.43	18	0.266	45,000	0.95	0.032	184.4	05/25/2204
4139536	160,602.78	18	0.256	45,000	0.83	0.026	186.4	05/28/2206
4133867	84,532.01	18	0.295	45,000	1.18	0.038	187.9	12/04/2207
4134211	112,071.38	18	0.295	45,000	1.89	0.032	190.7	10/06/2210
4134049	98,044.86	18	0.295	45,000	2.13	0.027	192.0	01/17/2212
4138221	139,434.99	18	0.266	45,000	1.07	0.027	195.0	02/02/2215
4134112	105,112.48	18	0.295	45,000	0.95	0.053	197.4	05/26/2217
4133852	82,457.56	18	0.295	45,000	1.54	0.027	201.1	03/12/2221
4134056	98,285.49	18	0.305	45,000	1.89	0.034	203.6	09/06/2223
4138225	139,441.25	18	0.266	45,000	0.83	0.032	204.0	01/12/2224
4140127	177,958.62	18	0.266	45,000	0.83	0.027	204.2	03/17/2224
4139432	155,902.30	18	0.266	45,000	0.95	0.027	204.6	08/23/2224
4133780	80,083.14	18	0.295	45,000	0.95	0.038	208.0	01/15/2228
4134073	100,758.70	18	0.295	45,000	0.95	0.047	209.3	05/21/2229
4133516	65,052.20	18	0.295	45,000	0.83	0.032	218.3	05/15/2238
4133658	74,660.20	18	0.295	45,000	0.95	0.032	219.0	02/03/2239
4133662	74,685.99	18	0.295	45,000	0.95	0.032	219.1	02/19/2239
4133312	42,290.31	18	0.374	65,000	2.72	0.026	225.2	04/10/2245
4133358	52,313.19	18	0.354	65,000	0.83	0.039	225.2	04/10/2245
4133838	81,983.96	18	0.305	45,000	0.83	0.027	225.2	04/10/2245
4133866	83,776.01	18	0.295	45,000	0.95	0.027	225.2	04/10/2245
4133917	90,631.78	18	0.295	45,000	1.30	0.027	225.2	04/10/2245
4133924	91,216.09	18	0.295	45,000	0.83	0.038	225.2	04/10/2245
4133932	91,867.28	18	0.295	45,000	1.30	0.027	225.2	04/10/2245
4133952	93,029.89	18	0.354	65,000	0.83	0.025	225.2	04/10/2245
4133953	93,030.38	18	0.354	65,000	1.66	0.032	225.2	04/10/2245
4133960	93,093.48	18	0.354	65,000	0.95	0.053	225.2	04/10/2245
4133961	93,098.32	18	0.354	65,000	0.83	0.039	225.2	04/10/2245
4133985	94,040.75	18	0.295	45,000	0.95	0.027	225.2	04/10/2245
4134043	97,059.01	18	0.295	45,000	0.95	0.032	225.2	04/10/2245
4134055	98,285.05	18	0.305	45,000	1.66	0.027	225.2	04/10/2245
4134068	100,013.03	18	0.295	45,000	1.30	0.027	225.2	04/10/2245
4134070	100,395.89	18	0.295	45,000	1.07	0.032	225.2	04/10/2245
4134447	122,495.65	18	0.295	45,000	0.95	0.038	225.2	04/10/2245

**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)**

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
4143341	64,580.13	18	0.256	45,000	4.14	0.046	15.9	12/21/2035
4142052	1,150.00	18	0.266	45,000	2.49	0.040	19.0	02/07/2039
4142545	35,634.30	18	0.256	65,000	2.60	0.046	19.9	12/04/2039
4142211	11,758.67	18	0.256	45,000	2.01	0.038	20.6	09/17/2040
4142520	33,678.24	18	0.256	65,000	4.38	0.033	20.9	12/19/2040
4145142	103,434.50	18	0.246	45,000	3.91	0.039	22.5	07/28/2042
4142449	28,759.83	18	0.256	45,000	2.84	0.033	22.6	08/30/2042
4143368	66,888.76	18	0.256	45,000	3.91	0.038	22.6	08/20/2042
4143032	50,854.21	18	0.256	45,000	3.91	0.033	23.3	05/24/2043
4145456	123,234.98	18	0.256	45,000	6.39	0.038	24.1	03/21/2044
4142144	6,437.83	18	0.246	45,000	1.30	0.032	24.7	10/21/2044
4142258	12,885.36	18	0.285	45,000	2.37	0.051	24.9	12/17/2044
4142298	15,181.17	18	0.256	45,000	2.84	0.026	25.2	03/25/2045
4142264	13,177.28	18	0.256	45,000	1.54	0.038	25.3	05/10/2045
4144270	82,678.91	18	0.256	45,000	4.02	0.038	25.4	07/05/2045
4142212	11,760.16	18	0.256	45,000	1.78	0.033	25.6	09/15/2045
4145177	106,595.08	18	0.256	45,000	6.98	0.033	25.7	10/18/2045
4142208	11,662.12	18	0.256	45,000	2.49	0.026	26.1	02/24/2046
4142079	1,509.30	18	0.266	45,000	1.30	0.045	26.8	11/07/2046
4144820	90,139.32	18	0.256	45,000	9.59	0.026	26.8	11/01/2046
4142623	40,325.34	18	0.256	45,000	2.60	0.033	26.9	12/13/2046
4141957	403.19	18	0.266	45,000	1.89	0.032	27.7	10/22/2047
4142261	12,946.46	18	0.256	45,000	2.25	0.026	27.9	12/05/2047
4142146	6,523.75	18	0.266	45,000	1.54	0.040	28.1	02/22/2048
4144132	75,907.08	18	0.256	45,000	3.20	0.038	28.3	05/05/2048
4145168	106,141.76	18	0.256	45,000	4.50	0.038	28.4	06/26/2048
4145824	140,045.00	18	0.256	45,000	3.91	0.046	28.5	07/25/2048
4145140	103,072.59	18	0.246	45,000	2.13	0.047	29.0	01/24/2049
4145677	133,179.13	18	0.256	45,000	5.33	0.038	29.5	08/04/2049
4145175	106,517.19	18	0.256	45,000	5.80	0.033	29.6	08/24/2049
4145151	104,176.65	18	0.256	45,000	2.25	0.054	29.7	10/12/2049
4145079	99,149.17	18	0.256	45,000	2.13	0.054	29.9	12/21/2049
4141960	461.62	18	0.266	45,000	1.66	0.032	30.1	02/16/2050
4145273	115,770.21	18	0.256	45,000	4.50	0.038	30.1	02/18/2050
4142051	1,148.61	18	0.266	45,000	1.66	0.032	30.3	05/04/2050
4144819	90,137.32	18	0.256	45,000	4.62	0.033	30.7	09/24/2050
4142301	15,197.56	18	0.256	45,000	1.89	0.026	31.3	05/16/2051
4145842	141,983.37	18	0.256	45,000	2.25	0.059	31.7	10/19/2051
4145306	117,324.08	18	0.256	45,000	2.25	0.054	32.2	04/20/2052
4145457	123,274.25	18	0.256	45,000	4.38	0.038	32.3	05/10/2052
4145154	104,397.09	18	0.256	45,000	2.01	0.054	32.9	12/12/2052
4145262	115,038.97	18	0.256	45,000	2.13	0.054	33.3	05/30/2053
4145181	106,837.63	18	0.266	45,000	1.89	0.067	33.4	06/21/2053
4145213	107,675.02	18	0.256	45,000	4.85	0.033	33.4	07/06/2053
4143367	66,887.10	18	0.256	45,000	1.18	0.059	34.3	06/01/2054
4144913	94,490.93	18	0.256	45,000	1.78	0.054	34.3	05/25/2054
4142521	33,686.33	18	0.256	65,000	1.78	0.033	35.2	04/09/2055

**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)**

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
4143052	52,765.61	18	0.256	45,000	1.66	0.038	35.6	09/20/2055
4144159	76,629.70	18	0.256	45,000	2.25	0.038	36.1	03/01/2056
4144773	89,608.40	18	0.266	45,000	2.13	0.053	36.2	04/04/2056
4145169	106,177.64	18	0.256	45,000	4.02	0.033	36.9	01/06/2057
4146600	149,532.52	18	0.256	45,000	2.84	0.046	37.4	06/16/2057
4141965	692.13	18	0.266	45,000	1.42	0.027	37.5	07/14/2057
4144158	76,624.34	18	0.256	45,000	2.13	0.038	37.5	07/21/2057
4145795	138,482.29	18	0.256	45,000	2.13	0.054	37.6	09/06/2057
4145134	102,183.26	18	0.266	45,000	2.25	0.053	37.7	09/24/2057
4142436	27,101.35	18	0.256	45,000	1.54	0.026	39.7	09/21/2059
4145138	102,935.50	18	0.266	45,000	3.43	0.040	40.2	03/30/2060
4145289	116,882.84	18	0.256	45,000	3.91	0.033	40.3	05/01/2060
4142426	25,391.78	18	0.256	45,000	1.07	0.033	40.9	12/09/2060
4144823	90,246.43	18	0.256	45,000	2.25	0.038	41.0	01/27/2061
4145258	114,855.92	18	0.256	45,000	1.66	0.054	41.6	09/11/2061
4142453	29,002.98	18	0.256	45,000	1.07	0.033	42.4	06/04/2062
4145182	106,959.58	18	0.256	45,000	2.49	0.038	42.8	10/29/2062
4145363	119,762.47	18	0.256	45,000	1.66	0.054	42.8	11/25/2062
4145678	133,183.74	18	0.256	45,000	4.02	0.033	43.3	06/02/2063
4145358	119,403.19	18	0.256	45,000	2.01	0.046	43.8	11/18/2063
4146647	150,757.11	18	0.256	45,000	4.26	0.033	43.9	12/28/2063
4145155	104,703.85	18	0.256	45,000	2.96	0.033	44.0	01/09/2064
4145236	111,617.67	18	0.256	45,000	3.20	0.033	44.0	01/20/2064
4145417	121,949.83	18	0.256	45,000	2.72	0.038	44.0	01/29/2064
4144822	90,245.91	18	0.256	45,000	2.01	0.038	44.2	04/24/2064
4145416	121,734.48	18	0.256	45,000	1.42	0.059	44.6	08/20/2064
4144847	91,292.38	18	0.256	45,000	1.54	0.046	45.1	02/15/2065
4144643	88,644.69	18	0.256	45,000	1.89	0.038	45.5	02/04/2121
4144818	90,136.52	18	0.256	45,000	2.37	0.033	45.8	11/01/2065
4145465	124,242.87	18	0.256	45,000	2.60	0.038	46.2	04/26/2066
4145521	128,532.60	18	0.256	45,000	2.01	0.046	46.4	06/12/2066
4144476	87,120.21	18	0.256	45,000	1.78	0.038	47.3	05/26/2067
4144914	94,491.29	18	0.256	45,000	1.89	0.038	47.5	07/13/2067
4145355	119,052.37	18	0.256	45,000	2.37	0.038	47.6	09/01/2067
4142517	33,283.48	18	0.256	65,000	1.42	0.026	48.1	03/09/2068
4144131	75,886.60	18	0.256	45,000	1.18	0.046	48.2	04/06/2068
4145375	120,137.32	18	0.256	45,000	1.42	0.054	49.0	01/21/2069
4143340	64,579.66	18	0.256	45,000	1.42	0.033	49.9	12/28/2069
4145162	105,472.48	18	0.256	45,000	3.79	0.026	50.3	05/15/2070
4144817	90,135.94	18	0.256	45,000	2.96	0.026	51.1	03/20/2071
4145301	117,217.43	18	0.256	45,000	4.26	0.026	51.1	03/09/2071
4144852	91,685.38	18	0.256	45,000	2.96	0.026	51.7	09/29/2071
4143036	51,538.31	18	0.256	45,000	1.07	0.033	53.0	01/18/2073
4145164	105,550.16	18	0.256	45,000	1.78	0.038	53.6	09/19/2073
4143349	64,706.32	18	0.256	45,000	1.07	0.038	54.2	03/31/2074
4144458	86,291.83	18	0.256	45,000	1.42	0.038	54.3	05/03/2074
4145410	121,622.95	18	0.256	45,000	2.01	0.038	54.3	05/06/2074

**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)**

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
4142544	35,538.54	18	0.256	65,000	1.18	0.026	54.4	06/26/2074
4142159	7,782.71	18	0.266	45,000	0.83	0.027	55.2	03/24/2075
4145573	129,275.48	18	0.266	45,000	4.14	0.032	55.5	08/03/2075
4144677	89,348.26	18	0.256	45,000	0.95	0.054	55.8	10/28/2075
4143339	64,579.37	18	0.256	45,000	0.83	0.046	56.2	04/18/2076
4145088	99,874.04	18	0.256	45,000	2.72	0.026	56.6	08/26/2076
4146243	144,841.64	18	0.256	45,000	1.66	0.046	57.1	03/19/2077
4143184	59,476.79	18	0.256	45,000	1.07	0.033	57.5	08/12/2077
4145475	124,796.02	18	0.256	45,000	1.89	0.038	57.8	11/26/2077
4145147	103,994.37	18	0.256	45,000	1.54	0.038	58.6	09/12/2078
4145343	117,934.78	18	0.256	45,000	2.13	0.033	58.7	09/29/2078
4145120	101,612.01	18	0.256	45,000	1.18	0.046	58.9	12/15/2078
4145179	106,749.16	18	0.256	45,000	1.66	0.033	64.2	04/24/2084
4145184	107,019.97	18	0.266	45,000	1.78	0.040	64.3	05/14/2084
4145399	121,120.06	18	0.256	45,000	1.78	0.033	67.0	01/18/2087
4144039	73,008.70	18	0.256	45,000	1.30	0.026	68.7	10/02/2088
4145747	135,350.72	18	0.256	45,000	1.89	0.033	69.4	07/08/2089
4144842	90,903.50	18	0.256	45,000	1.18	0.033	71.5	08/02/2091
4145400	121,128.07	18	0.256	45,000	1.30	0.038	72.9	01/06/2093
4145396	121,056.86	18	0.256	45,000	1.54	0.033	73.3	05/25/2093
4144214	78,983.48	18	0.266	45,000	1.66	0.027	74.0	02/01/2094
4143358	65,953.01	18	0.256	45,000	0.95	0.026	76.8	11/09/2096
4146651	150,799.06	18	0.256	45,000	1.42	0.038	77.1	02/21/2097
4145793	138,392.76	18	0.256	45,000	1.30	0.038	79.4	06/22/2099
4145774	137,601.22	18	0.256	45,000	1.54	0.033	79.7	09/30/2099
4145338	117,804.33	18	0.256	45,000	1.78	0.026	80.6	09/12/2100
4144237	80,170.72	18	0.256	45,000	0.83	0.033	81.1	03/15/2101
4145512	127,954.90	18	0.256	45,000	0.95	0.046	82.2	04/18/2102
4143369	67,164.96	18	0.256	45,000	0.83	0.026	84.0	01/21/2104
4145746	135,314.06	18	0.256	45,000	1.18	0.038	84.2	03/23/2104
4145345	118,099.87	18	0.256	45,000	0.83	0.046	85.6	08/30/2105
4145173	106,492.94	18	0.256	45,000	1.30	0.026	89.5	07/11/2109
4145832	140,905.81	18	0.256	45,000	1.78	0.026	90.4	07/08/2110
4144201	78,518.70	18	0.266	45,000	0.95	0.032	91.1	02/22/2111
4146526	147,274.11	18	0.256	45,000	1.78	0.026	91.4	07/02/2111
4145470	124,619.47	18	0.256	45,000	1.07	0.033	95.4	07/02/2115
4144808	89,962.20	18	0.256	45,000	0.95	0.026	96.1	03/16/2116
4145732	134,354.36	18	0.256	45,000	0.95	0.038	97.2	04/18/2117
4146636	150,586.74	18	0.256	45,000	0.83	0.046	97.2	04/26/2117
4145316	117,412.99	18	0.256	45,000	0.95	0.033	98.3	05/11/2118
4145174	106,516.36	18	0.256	45,000	1.07	0.026	100.4	06/16/2120
4145572	129,272.89	18	0.266	45,000	0.95	0.045	102.5	07/15/2122
4146577	149,100.24	18	0.266	45,000	1.42	0.032	107.8	11/12/2127
4145208	107,488.05	18	0.256	45,000	0.83	0.026	117.1	03/21/2137
4146548	147,631.61	18	0.256	45,000	0.83	0.033	121.6	08/29/2141
4146602	149,640.21	18	0.256	45,000	0.83	0.033	121.9	12/05/2141
4145157	104,859.54	18	0.266	45,000	0.83	0.032	122.3	05/30/2142

**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)**

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
4145735	134,588.36	18	0.266	45,000	0.83	0.027	159.8	11/13/2179
4142574	37,313.62	18	0.364	45,000	1.18	0.047	182.4	06/26/2202

**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)**

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
4071460	11,753.70	18	0.276	45,000	4.37	0.047	23.7	07/23/2043
4072982	94,214.35	18	0.276	45,000	4.01	0.072	29.4	04/06/2049
4073471	149,588.83	18	0.276	45,000	6.02	0.072	30.3	03/11/2050
4071559	18,491.61	18	0.276	45,000	1.77	0.066	32.3	03/09/2052
4072178	48,851.85	18	0.276	45,000	3.30	0.058	32.8	08/24/2052
4072180	49,927.89	18	0.276	45,000	5.31	0.047	32.9	10/03/2052
4071825	29,311.75	18	0.276	45,000	2.36	0.058	34.1	12/17/2053
4072372	65,384.02	18	0.276	45,000	4.84	0.052	34.3	02/20/2054
4072625	88,052.00	18	0.276	45,000	3.19	0.072	34.8	08/13/2054
4071325	8,692.20	18	0.276	45,000	2.36	0.047	34.8	08/16/2054
4071558	18,491.26	18	0.276	45,000	1.53	0.066	36.8	08/08/2056
4072269	55,992.94	18	0.276	45,000	3.89	0.052	37.0	11/20/2056
4071553	18,024.36	18	0.276	45,000	2.12	0.052	37.1	11/25/2056
4071552	18,021.38	18	0.276	45,000	4.48	0.033	39.6	06/11/2059
4072040	39,625.08	18	0.276	45,000	2.83	0.052	39.8	09/09/2059
4071304	7,992.82	18	0.276	45,000	1.53	0.052	42.2	01/15/2062
4073051	102,234.09	18	0.276	45,000	4.72	0.058	43.0	10/25/2062
4071206	837.50	18	0.276	45,000	2.60	0.033	43.1	12/19/2062
4072155	47,613.12	18	0.276	45,000	2.71	0.052	44.5	05/07/2064
4071276	6,691.27	18	0.276	45,000	2.71	0.033	44.7	07/26/2064
4071269	5,984.11	18	0.276	45,000	2.01	0.039	45.9	10/11/2065
4071277	6,809.96	18	0.276	45,000	3.42	0.028	46.8	09/05/2066
4071303	7,775.38	18	0.276	45,000	2.36	0.033	48.9	10/12/2068
4072398	70,209.21	18	0.276	45,000	2.60	0.058	49.3	03/03/2069
4071518	13,938.10	18	0.276	45,000	2.01	0.039	50.7	07/06/2070
4071919	35,718.48	18	0.276	45,000	2.95	0.039	52.5	05/02/2072
4071673	21,251.59	18	0.276	45,000	0.83	0.080	52.9	10/07/2072
4073031	99,047.49	18	0.276	45,000	4.25	0.052	53.0	11/18/2072
4073068	104,770.63	18	0.276	45,000	5.78	0.047	55.4	04/16/2075
4071818	28,969.34	18	0.276	45,000	2.01	0.039	60.3	02/12/2080
4073066	104,015.38	18	0.276	45,000	1.65	0.086	61.3	03/03/2081
4072988	96,359.49	18	0.276	45,000	4.25	0.047	61.8	09/08/2081
4071544	16,207.16	18	0.276	45,000	2.36	0.028	62.6	06/21/2082
4071511	13,602.80	18	0.276	45,000	1.65	0.033	64.6	05/29/2084
4073452	146,406.31	18	0.276	45,000	5.78	0.052	65.7	07/02/2085
4073015	98,032.44	18	0.276	45,000	2.60	0.058	66.7	07/16/2086
4073021	98,568.74	18	0.276	45,000	1.89	0.066	73.6	06/04/2093
4073446	145,831.39	18	0.276	45,000	19.11	0.033	76.3	03/04/2096

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)

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
4071551	18,020.92	18	0.276	45,000	1.65	0.028	77.1	12/05/2096
4071627	21,171.25	18	0.276	45,000	0.94	0.047	77.2	01/10/2097
4074664	234,215.80	18	0.276	45,000	3.42	0.058	77.3	03/08/2097
4072346	61,966.12	18	0.276	45,000	3.19	0.033	77.6	06/16/2097
4072543	81,910.99	18	0.276	45,000	4.72	0.033	78.8	08/12/2098
4073141	107,760.47	18	0.276	45,000	2.36	0.058	79.1	12/22/2098
4074578	228,013.09	18	0.276	45,000	5.55	0.047	81.7	07/22/2101
4071581	20,427.73	18	0.276	45,000	1.53	0.028	82.2	01/09/2102
4073368	138,037.11	18	0.276	45,000	3.54	0.052	87.2	01/25/2107
4072038	39,549.23	18	0.276	45,000	1.77	0.033	87.7	07/05/2107
4072371	65,328.21	18	0.276	45,000	3.66	0.028	89.5	05/07/2109
4071739	25,368.32	18	0.276	45,000	1.42	0.028	91.3	02/26/2111
4071842	29,881.84	18	0.276	45,000	1.42	0.028	96.0	10/25/2115
4072351	62,591.58	18	0.276	45,000	1.77	0.039	96.4	03/29/2116
4073850	153,395.51	18	0.276	45,000	7.79	0.039	96.9	09/26/2116
4072524	79,508.04	18	0.276	45,000	2.24	0.039	97.6	06/15/2117
4073363	137,667.43	18	0.276	45,000	2.01	0.066	99.8	08/15/2119
4074472	208,487.05	18	0.276	45,000	3.66	0.052	101.8	09/03/2121
4071882	33,621.98	18	0.276	45,000	0.94	0.039	103.5	05/01/2123
4072181	50,079.67	18	0.276	45,000	1.89	0.028	104.5	05/16/2124
4073029	99,040.88	18	0.276	45,000	2.01	0.047	106.4	04/05/2126
4073052	102,507.32	18	0.276	45,000	2.12	0.047	106.8	08/21/2126
4074195	178,263.75	18	0.276	45,000	12.51	0.033	107.2	02/03/2127
4073014	97,945.18	18	0.276	45,000	2.60	0.039	108.8	08/31/2128
4074659	233,499.03	18	0.276	45,000	1.65	0.072	109.4	04/09/2129
4073070	104,856.37	18	0.276	45,000	2.83	0.039	110.5	05/08/2130
4073369	138,109.44	18	0.276	45,000	4.84	0.039	110.9	10/08/2130
4073172	111,188.23	18	0.276	45,000	2.95	0.039	114.4	04/04/2134
4072243	54,161.31	18	0.276	45,000	1.18	0.039	114.8	08/16/2134
4073173	111,253.68	18	0.276	45,000	2.01	0.047	120.0	10/23/2139
4073841	153,003.09	18	0.276	45,000	4.96	0.039	121.6	05/27/2141
4072322	60,276.91	18	0.276	45,000	1.42	0.033	122.5	05/01/2142
4072062	41,400.84	18	0.276	45,000	0.83	0.039	126.1	11/30/2145
4072306	58,930.45	18	0.276	45,000	1.30	0.033	127.8	08/23/2147
4073447	145,836.09	18	0.276	45,000	10.62	0.028	128.7	07/26/2148
4074405	198,962.94	18	0.276	45,000	3.42	0.047	129.2	02/01/2149
4072316	59,409.53	18	0.276	45,000	1.06	0.039	130.0	10/31/2149
4074661	233,503.52	18	0.276	45,000	3.54	0.039	133.3	03/03/2153
4073418	144,254.53	18	0.276	45,000	8.85	0.028	136.7	07/06/2156
4072525	79,528.57	18	0.276	45,000	2.01	0.028	137.4	04/15/2157
4073075	104,982.22	18	0.276	45,000	2.48	0.033	138.9	09/27/2158
4072487	75,843.62	18	0.276	45,000	1.18	0.039	140.4	03/25/2160
4073034	99,591.67	18	0.276	45,000	2.95	0.028	140.7	07/09/2160
4072049	40,607.90	18	0.276	45,000	0.94	0.028	142.8	08/28/2162
4073982	167,381.68	18	0.276	45,000	2.24	0.052	146.5	04/28/2166
4073174	111,439.14	18	0.276	45,000	3.19	0.028	151.7	07/28/2171
4073964	165,006.41	18	0.276	45,000	3.54	0.039	154.3	03/01/2174

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)

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
4073442	145,739.79	18	0.276	45,000	2.95	0.039	154.9	10/02/2174
4073175	111,447.65	18	0.276	45,000	2.71	0.028	163.8	09/09/2183
4073288	125,510.37	18	0.276	45,000	1.53	0.047	164.5	05/09/2184
4073958	163,293.37	18	0.276	45,000	3.07	0.039	166.8	08/24/2186
4074240	182,083.65	18	0.276	45,000	2.12	0.047	182.7	07/28/2202
4073981	167,380.85	18	0.276	45,000	2.60	0.039	186.5	05/16/2206
4073862	154,266.05	18	0.276	45,000	2.36	0.039	187.3	02/11/2207
4074596	230,521.75	18	0.276	45,000	3.54	0.028	191.3	03/13/2211
4072544	81,921.59	18	0.276	45,000	1.06	0.028	199.9	10/11/2219
4073948	161,954.29	18	0.276	45,000	2.71	0.033	207.8	08/30/2227
4073338	135,128.33	18	0.276	45,000	0.94	0.058	213.8	09/08/2233
4074373	197,199.75	18	0.276	45,000	2.24	0.039	214.4	03/16/2234
4073358	137,159.35	18	0.276	45,000	0.94	0.058	215.6	06/21/2235
4073394	141,924.10	18	0.276	45,000	2.60	0.028	219.4	03/29/2239
4072639	89,855.47	18	0.276	45,000	0.83	0.028	225.2	01/29/2245
4073293	126,598.96	18	0.276	45,000	0.83	0.028	225.2	01/29/2245
4073339	135,129.98	18	0.276	45,000	1.53	0.033	225.2	01/29/2245
4073392	141,729.47	18	0.276	45,000	1.65	0.033	225.2	01/29/2245
4073455	146,616.76	18	0.276	45,000	0.83	0.028	225.2	01/29/2245
4073461	148,678.03	18	0.276	45,000	1.42	0.028	225.2	01/29/2245
4073943	160,777.62	18	0.276	45,000	0.83	0.052	225.2	01/29/2245
4073946	161,091.98	18	0.276	45,000	0.94	0.033	225.2	01/29/2245
4074236	181,687.31	18	0.276	45,000	0.94	0.033	225.2	01/29/2245
4074303	189,615.87	18	0.276	45,000	1.30	0.039	225.2	01/29/2245
4074469	207,100.17	18	0.276	45,000	1.06	0.047	225.2	01/29/2245
4074554	225,098.55	18	0.276	45,000	1.89	0.028	225.2	01/29/2245
4074660	233,499.35	18	0.276	45,000	0.83	0.047	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)

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
4083119	57,764.81	18	0.285	45,000	7.10	0.071	29.0	11/29/2048
4081985	7,422.56	18	0.285	45,000	6.39	0.046	35.5	06/16/2055
4082007	8,459.47	18	0.266	45,000	5.21	0.032	42.5	06/08/2062
4081980	6,874.69	18	0.285	45,000	5.21	0.040	46.6	06/25/2066
4082130	14,133.88	18	0.266	45,000	1.54	0.059	50.1	12/27/2069
4081978	6,836.10	18	0.285	45,000	7.93	0.031	53.7	08/17/2073
4082077	12,453.08	18	0.266	45,000	4.38	0.027	57.9	10/23/2077
4083014	48,071.13	18	0.266	45,000	2.25	0.059	59.9	10/12/2079
4082245	18,390.58	18	0.266	45,000	2.96	0.032	63.7	08/11/2083
4084436	141,291.09	18	0.285	45,000	6.27	0.080	65.0	12/11/2084
4082035	10,250.81	18	0.266	45,000	2.25	0.032	66.1	01/06/2086
4083183	63,123.76	18	0.266	45,000	6.15	0.040	66.6	07/16/2086
4082079	12,478.04	18	0.266	45,000	3.08	0.027	67.3	04/06/2087
4081979	6,836.93	18	0.285	45,000	4.02	0.031	67.9	10/31/2087

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)

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
4084633	165,225.97	18	0.256	45,000	4.14	0.067	69.1	01/25/2089
4083015	48,081.76	18	0.266	45,000	3.55	0.040	70.2	02/19/2090
4081854	2,193.76	18	0.285	45,000	2.13	0.040	71.0	12/13/2090
4082276	19,501.21	18	0.285	45,000	5.21	0.031	73.4	04/22/2093
4083525	88,230.40	18	0.266	45,000	6.51	0.045	76.3	03/27/2096
4082757	34,684.75	18	0.285	45,000	8.75	0.031	78.0	12/20/2097
4083011	47,698.57	18	0.266	45,000	4.38	0.032	81.0	11/21/2100
4082074	12,320.92	18	0.266	45,000	1.54	0.032	84.8	09/18/2104
4083361	75,970.42	18	0.256	45,000	3.67	0.038	87.9	10/24/2107
4082423	23,270.69	18	0.295	45,000	3.43	0.038	90.6	07/05/2110
4081984	7,305.81	18	0.266	45,000	1.42	0.027	93.3	03/16/2113
4082015	9,284.10	18	0.285	45,000	3.08	0.026	93.4	05/11/2113
4082078	12,454.11	18	0.266	45,000	1.30	0.032	93.7	08/29/2113
4084345	128,261.45	18	0.285	45,000	6.39	0.066	94.5	06/15/2114
4084291	121,530.20	18	0.285	45,000	7.93	0.060	94.8	09/25/2114
4082695	33,113.74	18	0.285	45,000	2.13	0.046	97.6	07/02/2117
4082959	44,910.35	18	0.295	45,000	2.60	0.053	102.7	08/19/2122
4083036	50,077.49	18	0.266	45,000	3.90	0.027	105.2	01/30/2125
4082892	40,658.98	18	0.285	45,000	4.26	0.031	108.0	12/23/2127
4082260	18,891.53	18	0.285	45,000	2.96	0.026	108.9	10/17/2128
4083964	105,224.00	18	0.266	45,000	6.39	0.040	117.7	08/13/2137
4082032	10,019.77	18	0.266	45,000	0.83	0.032	119.0	11/23/2138
4082878	39,795.42	18	0.295	45,000	4.50	0.032	120.4	05/10/2140
4081857	2,349.67	18	0.285	45,000	1.30	0.026	128.1	01/17/2148
4083728	101,556.69	18	0.266	45,000	4.73	0.040	129.4	04/25/2149
4083178	62,612.00	18	0.285	45,000	3.43	0.040	130.0	12/07/2149
4083164	61,665.61	18	0.285	45,000	3.31	0.040	130.8	09/19/2150
4082661	32,520.94	18	0.295	45,000	3.55	0.027	141.4	05/11/2161
4083190	63,399.76	18	0.285	45,000	2.37	0.046	142.9	11/03/2162
4084216	116,628.59	18	0.266	45,000	2.84	0.053	144.9	11/16/2164
4084398	137,735.90	18	0.266	45,000	2.84	0.059	151.5	06/18/2171
4082205	17,398.27	18	0.295	45,000	0.83	0.053	154.7	08/30/2174
4084503	150,394.08	18	0.266	45,000	5.21	0.045	155.2	02/15/2175
4083965	105,225.07	18	0.266	45,000	3.67	0.040	155.6	07/18/2175
4082599	29,141.61	18	0.285	45,000	0.83	0.051	159.1	01/05/2179
4083136	59,887.71	18	0.295	45,000	3.19	0.038	161.9	10/27/2181
4083338	74,597.12	18	0.266	45,000	3.31	0.027	162.5	06/20/2182
4083510	87,397.16	18	0.266	45,000	4.85	0.027	167.2	02/17/2187
4083625	96,343.54	18	0.266	45,000	1.18	0.067	178.4	05/10/2198
4084299	122,480.34	18	0.266	45,000	7.69	0.032	180.5	06/21/2200
4084659	168,570.21	18	0.266	45,000	5.32	0.040	181.6	07/10/2201
4084293	121,968.53	18	0.266	45,000	3.79	0.040	184.5	05/28/2204
4082617	30,487.61	18	0.295	45,000	0.95	0.047	185.3	04/02/2205
4083171	62,061.14	18	0.266	45,000	1.77	0.027	185.6	07/13/2205
4084660	168,610.95	18	0.285	45,000	5.32	0.051	186.4	05/04/2206
4083184	63,134.70	18	0.266	45,000	0.95	0.045	189.2	02/10/2209
4082932	43,216.48	18	0.285	45,000	1.89	0.026	191.2	03/07/2211

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)

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
4084594	161,543.81	18	0.266	45,000	3.67	0.045	191.7	09/05/2211
4084268	118,124.27	18	0.266	45,000	10.17	0.027	197.7	08/20/2217
4083037	50,091.13	18	0.295	45,000	2.96	0.027	197.8	09/23/2217
4084602	162,558.00	18	0.285	45,000	7.10	0.046	199.4	05/11/2219
4084434	141,133.53	18	0.285	45,000	4.50	0.051	202.4	05/10/2222
4083366	76,142.98	18	0.295	45,000	2.25	0.047	204.5	06/19/2224
4083010	47,696.96	18	0.266	45,000	0.83	0.032	205.7	08/15/2225
4082923	42,560.15	18	0.285	45,000	0.95	0.040	210.9	11/08/2230
4083098	55,700.74	18	0.295	45,000	3.08	0.027	211.5	06/15/2231
4084571	159,439.75	18	0.285	45,000	3.19	0.060	212.4	04/21/2232
4084644	166,658.25	18	0.266	45,000	3.08	0.045	212.6	07/06/2232
4083551	91,130.69	18	0.266	45,000	1.66	0.040	214.2	02/18/2234
4083505	87,038.21	18	0.285	45,000	1.42	0.060	217.8	09/17/2237
4083337	74,586.40	18	0.266	45,000	1.42	0.032	221.9	11/09/2241
4083371	76,328.51	18	0.295	45,000	3.67	0.032	225.0	12/12/2244
4082404	22,483.44	18	0.305	45,000	0.83	0.027	225.2	02/26/2245
4082891	40,656.54	18	0.285	45,000	0.83	0.026	225.2	02/26/2245
4082904	41,664.86	18	0.285	45,000	0.83	0.031	225.2	02/26/2245
4083097	55,661.93	18	0.295	45,000	2.25	0.027	225.2	02/26/2245
4083134	59,854.12	18	0.295	45,000	1.07	0.038	225.2	02/26/2245
4083135	59,875.43	18	0.295	45,000	1.07	0.027	225.2	02/26/2245
4083364	76,091.17	18	0.295	45,000	3.08	0.032	225.2	02/26/2245
4083365	76,131.39	18	0.295	45,000	2.25	0.027	225.2	02/26/2245
4083367	76,157.31	18	0.295	45,000	1.30	0.047	225.2	02/26/2245
4083477	84,630.80	18	0.295	45,000	0.95	0.032	225.2	02/26/2245
4083559	91,794.40	18	0.266	45,000	0.95	0.027	225.2	02/26/2245
4083795	102,771.93	18	0.285	45,000	1.42	0.031	225.2	02/26/2245
4083811	102,923.56	18	0.266	45,000	1.07	0.032	225.2	02/26/2245
4083899	104,713.39	18	0.285	45,000	2.84	0.046	225.2	02/26/2245
4083984	105,656.87	18	0.266	45,000	0.83	0.059	225.2	02/26/2245
4084100	108,455.43	18	0.266	45,000	2.96	0.027	225.2	02/26/2245
4084204	114,983.22	18	0.266	45,000	1.42	0.053	225.2	02/26/2245
4084215	116,469.43	18	0.285	45,000	1.30	0.040	225.2	02/26/2245
4084221	116,784.66	18	0.295	45,000	0.83	0.032	225.2	02/26/2245
4084237	116,897.51	18	0.266	45,000	1.77	0.040	225.2	02/26/2245
4084240	116,913.30	18	0.266	45,000	1.30	0.040	225.2	02/26/2245
4084289	121,217.13	18	0.285	45,000	2.01	0.046	225.2	02/26/2245
4084292	121,572.17	18	0.285	45,000	3.43	0.031	225.2	02/26/2245
4084295	122,088.13	18	0.266	45,000	1.07	0.027	225.2	02/26/2245
4084297	122,207.22	18	0.285	45,000	2.48	0.031	225.2	02/26/2245
4084309	124,366.94	18	0.266	45,000	2.13	0.032	225.2	02/26/2245
4084342	128,143.41	18	0.285	45,000	0.95	0.026	225.2	02/26/2245
4084343	128,163.07	18	0.285	45,000	4.73	0.026	225.2	02/26/2245
4084344	128,182.14	18	0.285	45,000	0.83	0.031	225.2	02/26/2245
4084347	129,270.10	18	0.285	45,000	1.30	0.026	225.2	02/26/2245
4084407	138,470.21	18	0.285	45,000	1.89	0.026	225.2	02/26/2245
4084415	139,019.14	18	0.285	45,000	3.08	0.040	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)

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
4084425	140,498.60	18	0.285	45,000	2.60	0.046	225.2	02/26/2245
4084426	140,537.56	18	0.285	45,000	4.61	0.031	225.2	02/26/2245
4084428	140,856.03	18	0.285	45,000	3.67	0.051	225.2	02/26/2245
4084435	141,252.33	18	0.285	45,000	4.97	0.040	225.2	02/26/2245
4084440	141,847.59	18	0.285	45,000	3.79	0.046	225.2	02/26/2245
4084441	141,886.56	18	0.285	45,000	0.83	0.031	225.2	02/26/2245
4084443	142,005.60	18	0.285	45,000	4.02	0.031	225.2	02/26/2245
4084476	147,059.61	18	0.285	45,000	1.66	0.026	225.2	02/26/2245
4084480	147,562.84	18	0.285	45,000	2.01	0.046	225.2	02/26/2245
4084482	148,156.03	18	0.285	45,000	7.69	0.040	225.2	02/26/2245
4084486	148,617.12	18	0.285	45,000	1.89	0.040	225.2	02/26/2245
4084490	148,948.35	18	0.285	45,000	2.01	0.031	225.2	02/26/2245
4084494	149,658.33	18	0.285	45,000	0.83	0.031	225.2	02/26/2245
4084495	149,660.00	18	0.285	45,000	0.95	0.040	225.2	02/26/2245
4084500	150,010.15	18	0.266	45,000	1.54	0.032	225.2	02/26/2245
4084501	150,169.08	18	0.266	45,000	3.79	0.032	225.2	02/26/2245
4084505	150,533.23	18	0.285	45,000	2.25	0.040	225.2	02/26/2245
4084507	150,963.16	18	0.266	45,000	2.01	0.032	225.2	02/26/2245
4084543	154,796.70	18	0.285	45,000	0.95	0.031	225.2	02/26/2245
4084588	161,066.75	18	0.295	45,000	1.89	0.038	225.2	02/26/2245
4084589	161,073.45	18	0.285	45,000	6.51	0.031	225.2	02/26/2245
4084600	162,171.77	18	0.266	45,000	3.55	0.027	225.2	02/26/2245
4084629	164,980.00	18	0.285	45,000	1.07	0.026	225.2	02/26/2245
4084631	165,027.96	18	0.266	45,000	0.83	0.027	225.2	02/26/2245
4084640	166,180.65	18	0.285	45,000	4.73	0.046	225.2	02/26/2245
4084641	166,326.05	18	0.266	45,000	5.56	0.027	225.2	02/26/2245
4084645	166,737.73	18	0.266	45,000	0.83	0.032	225.2	02/26/2245
4084663	168,729.40	18	0.285	45,000	0.83	0.026	225.2	02/26/2245
4084668	170,785.24	18	0.285	45,000	2.37	0.031	225.2	02/26/2245
4084672	171,116.67	18	0.285	45,000	1.18	0.105	225.2	02/26/2245
4084711	176,881.18	18	0.266	45,000	2.37	0.027	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)

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
4046942	12,025.16	20	0.305	35,000	5.08	0.079	28.5	03/03/2048
4045914	4,810.24	20	0.295	35,000	5.32	0.065	29.4	12/25/2048
4046106	7,041.73	20	0.305	35,000	2.84	0.085	40.6	04/09/2060
4047534	20,113.06	20	0.315	35,000	2.95	0.104	41.1	09/16/2060
4047130	16,763.33	20	0.305	35,000	4.37	0.073	42.1	09/21/2061
4046962	12,475.49	20	0.305	35,000	5.55	0.058	50.6	04/02/2070
4047104	15,659.93	20	0.305	35,000	2.24	0.092	52.7	05/08/2072
4048238	31,418.59	20	0.305	35,000	2.72	0.092	56.8	06/14/2076
4046375	8,868.78	20	0.295	35,000	2.24	0.071	57.1	10/01/2076

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)

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
4046117	7,124.12	20	0.295	35,000	7.80	0.038	62.0	08/22/2081
4047056	14,580.12	20	0.305	35,000	4.25	0.058	62.3	12/09/2081
4050291	85,846.38	20	0.315	35,000	5.20	0.110	64.1	09/26/2083
4045777	2,904.06	20	0.305	35,000	2.01	0.073	66.7	05/15/2086
4046873	11,541.49	20	0.305	35,000	2.48	0.067	72.3	12/18/2091
4047058	14,624.25	20	0.305	35,000	3.07	0.058	78.6	03/10/2098
4046871	11,509.50	20	0.305	35,000	2.72	0.058	81.5	02/08/2101
4045951	5,423.33	20	0.305	35,000	2.84	0.052	81.7	04/22/2101
4046379	8,999.89	20	0.295	35,000	2.72	0.047	83.7	05/11/2103
4048758	32,798.04	20	0.315	35,000	2.60	0.085	86.4	12/26/2105
4046357	8,744.66	20	0.305	35,000	2.60	0.052	91.7	05/02/2111
4046059	6,392.69	20	0.305	35,000	3.78	0.040	94.7	05/04/2114
4046161	7,628.51	20	0.295	35,000	1.54	0.059	96.3	12/14/2115
4050051	81,541.46	20	0.305	35,000	3.31	0.104	97.6	03/21/2117
4047040	14,229.50	20	0.305	35,000	2.72	0.052	97.7	05/11/2117
4048525	32,186.39	20	0.315	35,000	2.01	0.091	98.9	07/03/2118
4047136	16,773.21	20	0.305	35,000	1.89	0.067	99.2	10/16/2118
4047186	18,124.84	20	0.305	35,000	1.54	0.079	99.2	10/21/2118
4048853	35,177.56	20	0.315	35,000	6.14	0.054	99.6	03/13/2119
4048361	31,581.24	20	0.315	35,000	4.02	0.060	101.3	12/05/2120
4049435	55,922.98	20	0.305	35,000	2.84	0.085	101.7	04/20/2121
4046516	10,421.38	20	0.305	35,000	1.42	0.073	102.1	10/04/2121
4047031	14,114.97	20	0.315	35,000	1.89	0.072	103.5	02/27/2123
4047049	14,547.56	20	0.305	35,000	1.65	0.067	106.3	12/11/2125
4049828	70,920.73	20	0.305	35,000	6.50	0.067	107.9	06/26/2127
4049184	45,181.48	20	0.305	35,000	4.13	0.058	112.2	11/02/2131
4048438	31,658.33	20	0.315	35,000	2.48	0.072	113.1	09/26/2132
4046482	10,339.54	20	0.315	35,000	1.77	0.066	113.1	09/26/2132
4046582	10,708.26	20	0.295	35,000	4.84	0.027	113.7	04/19/2133
4046285	8,230.76	20	0.305	35,000	1.30	0.067	115.9	07/05/2135
4047691	25,488.41	20	0.305	35,000	2.36	0.058	116.0	07/30/2135
4049299	49,804.31	20	0.305	35,000	2.72	0.073	120.4	12/23/2139
4047107	15,784.65	20	0.295	35,000	3.54	0.032	120.7	05/07/2140
4045841	4,038.11	20	0.305	35,000	2.95	0.034	120.8	06/10/2140
4048998	39,804.31	20	0.315	35,000	1.89	0.091	121.3	12/21/2140
4046097	6,871.35	20	0.305	35,000	1.65	0.052	121.4	12/26/2140
4046963	12,546.50	20	0.305	35,000	1.89	0.052	122.0	07/31/2141
4046336	8,602.10	20	0.305	35,000	1.65	0.052	125.0	08/02/2144
4049541	59,558.00	20	0.295	35,000	1.65	0.097	126.7	04/28/2146
4049391	54,237.83	20	0.305	35,000	1.30	0.119	131.3	11/29/2150
4046107	7,085.72	20	0.295	35,000	1.30	0.047	133.0	09/02/2152
4047654	24,796.13	20	0.305	35,000	1.54	0.067	135.6	03/08/2155
4047041	14,236.33	20	0.305	35,000	2.48	0.040	136.3	11/17/2155
4045743	2,435.09	20	0.305	35,000	1.06	0.058	140.3	11/22/2159
4050517	91,111.66	20	0.295	35,000	8.74	0.059	143.6	03/06/2163
4046946	12,175.37	20	0.315	35,000	1.54	0.060	143.7	05/14/2163
4050290	85,844.82	20	0.315	35,000	3.19	0.104	143.9	07/18/2163

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)

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
4049809	70,102.78	20	0.295	35,000	4.37	0.059	144.0	08/04/2163
4046752	11,252.07	20	0.305	35,000	1.42	0.052	145.6	03/23/2165
4047154	17,199.79	20	0.305	35,000	1.06	0.073	146.0	08/30/2165
4050859	105,551.57	20	0.305	35,000	7.09	0.079	146.4	01/13/2166
4045962	5,578.13	20	0.295	35,000	2.13	0.027	147.7	05/09/2167
4048628	32,356.32	20	0.305	35,000	2.36	0.052	149.4	01/11/2169
4046039	6,271.76	20	0.295	35,000	1.65	0.032	151.6	04/10/2171
4047955	28,674.63	20	0.315	35,000	2.13	0.060	151.9	07/10/2171
4048173	31,249.68	20	0.315	35,000	2.60	0.054	155.9	07/12/2175
4047244	18,959.48	20	0.305	35,000	2.24	0.040	156.9	07/19/2176
4047128	16,759.44	20	0.305	35,000	1.06	0.067	157.5	02/01/2177
4047247	19,010.73	20	0.305	35,000	1.54	0.052	157.7	04/14/2177
4047990	28,857.09	20	0.315	35,000	2.01	0.060	159.0	08/11/2178
4048473	32,087.60	20	0.315	35,000	1.65	0.072	159.8	05/18/2179
4047758	28,327.14	20	0.305	35,000	1.89	0.052	161.6	03/24/2181
4046984	13,276.95	20	0.325	35,000	1.06	0.085	162.7	04/20/2182
4048792	33,847.54	20	0.305	35,000	3.43	0.040	162.8	05/31/2182
4050048	81,299.05	20	0.305	35,000	4.13	0.073	163.3	11/22/2182
4049254	47,843.31	20	0.295	35,000	2.01	0.059	164.2	11/07/2183
4048756	32,792.48	20	0.315	35,000	1.42	0.079	165.7	04/18/2185
4050603	94,499.24	20	0.305	35,000	7.56	0.067	165.8	05/28/2185
4049849	72,285.77	20	0.305	35,000	2.48	0.085	166.2	11/03/2185
4046451	10,240.48	20	0.315	35,000	1.06	0.066	167.8	05/28/2187
4048444	31,802.15	20	0.315	35,000	2.01	0.060	167.9	07/12/2187
4047129	16,763.18	20	0.305	35,000	1.30	0.052	170.1	10/08/2189
4047133	16,768.13	20	0.305	35,000	1.30	0.052	170.2	10/16/2189
4046342	8,640.71	20	0.295	35,000	1.18	0.038	170.6	03/19/2190
4046290	8,246.63	20	0.305	35,000	1.18	0.046	173.1	09/16/2192
4045739	2,378.24	20	0.305	35,000	1.42	0.034	173.8	06/13/2193
4047657	24,816.31	20	0.305	35,000	1.54	0.052	175.1	09/05/2194
4047134	16,769.41	20	0.305	35,000	1.42	0.046	177.8	06/18/2197
4048854	35,179.35	20	0.315	35,000	8.27	0.032	179.0	08/31/2198
4046872	11,509.87	20	0.305	35,000	1.18	0.046	183.0	08/18/2202
4050741	98,913.43	20	0.315	35,000	2.24	0.132	183.3	11/21/2202
4050278	85,259.81	20	0.305	35,000	7.56	0.058	183.6	04/07/2203
4048150	29,806.72	20	0.295	35,000	2.48	0.032	185.3	12/05/2204
4047673	25,052.44	20	0.305	35,000	1.42	0.052	185.8	05/30/2205
4047963	28,720.31	20	0.305	35,000	2.24	0.040	187.3	11/19/2206
4048006	29,005.75	20	0.305	35,000	4.61	0.027	189.4	12/27/2208
4048777	33,473.41	20	0.305	35,000	2.01	0.046	192.7	04/21/2212
4047696	25,824.50	20	0.305	35,000	1.18	0.058	194.9	06/30/2214
4045880	4,441.63	20	0.295	35,000	1.18	0.027	195.7	04/29/2215
4049417	55,080.47	20	0.305	35,000	1.77	0.073	195.8	06/05/2215
4049384	53,890.62	20	0.295	35,000	11.69	0.027	196.6	04/03/2216
4047131	16,764.57	20	0.305	35,000	1.42	0.040	198.3	12/13/2217
4045982	5,826.12	20	0.315	35,000	0.95	0.054	200.1	09/17/2219
4050531	91,620.32	20	0.305	35,000	2.24	0.104	202.3	12/01/2221

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)

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
4046338	8,611.27	20	0.305	35,000	1.30	0.034	202.8	05/26/2222
4047241	18,893.68	20	0.305	35,000	0.95	0.058	202.9	07/02/2222
4050783	101,285.66	20	0.305	35,000	2.95	0.098	203.9	07/30/2223
4046933	11,943.28	20	0.315	35,000	1.89	0.032	211.8	06/19/2231
4049345	50,968.05	20	0.305	35,000	2.01	0.058	213.7	04/26/2233
4049590	61,215.40	20	0.305	35,000	6.26	0.040	213.9	07/27/2233
4047994	28,866.85	20	0.315	35,000	3.43	0.032	215.4	01/23/2235
4048481	32,094.31	20	0.315	35,000	1.42	0.060	218.0	08/08/2237
4047149	17,127.16	20	0.315	35,000	0.95	0.060	223.9	07/22/2243
4046407	9,423.40	20	0.305	35,000	0.95	0.040	224.5	02/10/2244
4045999	5,995.35	20	0.305	35,000	1.06	0.027	225.2	11/07/2244
4046108	7,086.45	20	0.295	35,000	0.83	0.032	225.2	11/07/2244
4046284	8,221.57	20	0.305	35,000	0.83	0.040	225.2	11/07/2244
4046990	13,340.50	20	0.305	35,000	0.95	0.040	225.2	11/07/2244
4047050	14,548.66	20	0.305	35,000	1.06	0.027	225.2	11/07/2244
4047086	15,062.26	20	0.305	35,000	0.83	0.027	225.2	11/07/2244
4047478	20,067.65	20	0.315	35,000	1.18	0.038	225.2	11/07/2244
4047583	21,802.17	20	0.305	35,000	0.95	0.027	225.2	11/07/2244
4047644	24,331.69	20	0.315	35,000	3.43	0.025	225.2	11/07/2244
4047656	24,813.16	20	0.305	35,000	1.06	0.027	225.2	11/07/2244
4047672	24,969.69	20	0.305	35,000	1.18	0.027	225.2	11/07/2244
4047674	25,053.44	20	0.305	35,000	0.83	0.027	225.2	11/07/2244
4047688	25,439.62	20	0.295	35,000	1.30	0.027	225.2	11/07/2244
4047719	27,386.58	20	0.315	35,000	2.13	0.032	225.2	11/07/2244
4047724	27,600.06	20	0.305	35,000	1.65	0.034	225.2	11/07/2244
4047730	27,910.45	20	0.305	35,000	0.95	0.040	225.2	11/07/2244
4047942	28,628.99	20	0.315	35,000	1.30	0.038	225.2	11/07/2244
4047961	28,701.54	20	0.305	35,000	1.30	0.046	225.2	11/07/2244
4048148	29,780.87	20	0.295	35,000	1.06	0.032	225.2	11/07/2244
4048149	29,781.14	20	0.295	35,000	1.77	0.027	225.2	11/07/2244
4048153	29,994.48	20	0.295	35,000	0.95	0.047	225.2	11/07/2244
4048155	30,013.09	20	0.295	35,000	1.18	0.032	225.2	11/07/2244
4048172	31,165.74	20	0.305	35,000	0.95	0.040	225.2	11/07/2244
4048443	31,757.40	20	0.305	35,000	1.18	0.027	225.2	11/07/2244
4048504	32,167.40	20	0.315	35,000	1.54	0.032	225.2	11/07/2244
4048514	32,177.29	20	0.315	35,000	2.13	0.032	225.2	11/07/2244
4048757	32,794.81	20	0.315	35,000	0.95	0.047	225.2	11/07/2244
4048786	33,746.09	20	0.305	35,000	1.42	0.040	225.2	11/07/2244
4048877	35,685.31	20	0.315	35,000	1.06	0.047	225.2	11/07/2244
4048929	37,729.33	20	0.315	35,000	1.06	0.038	225.2	11/07/2244
4048980	39,187.75	20	0.315	35,000	0.95	0.032	225.2	11/07/2244
4048992	39,537.03	20	0.305	35,000	1.42	0.052	225.2	11/07/2244
4048999	39,831.79	20	0.315	35,000	1.89	0.047	225.2	11/07/2244
4049000	39,832.62	20	0.315	35,000	1.06	0.079	225.2	11/07/2244
4049002	40,302.30	20	0.315	35,000	1.42	0.025	225.2	11/07/2244
4049072	42,427.50	20	0.305	35,000	1.42	0.058	225.2	11/07/2244
4049315	50,643.06	20	0.305	35,000	2.48	0.034	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)

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
4049379	53,384.02	20	0.295	35,000	0.95	0.080	225.2	11/07/2244
4049383	53,831.48	20	0.305	35,000	0.83	0.034	225.2	11/07/2244
4049386	53,978.56	20	0.305	35,000	1.30	0.034	225.2	11/07/2244
4049388	54,077.64	20	0.315	35,000	2.24	0.038	225.2	11/07/2244
4049392	54,255.49	20	0.305	35,000	1.54	0.027	225.2	11/07/2244
4049397	54,625.98	20	0.315	35,000	2.82	0.032	225.2	11/07/2244
4049401	54,780.78	20	0.315	35,000	0.95	0.047	225.2	11/07/2244
4049407	54,817.29	20	0.305	35,000	1.18	0.027	225.2	11/07/2244
4049415	55,011.38	20	0.305	35,000	0.95	0.027	225.2	11/07/2244
4049429	55,808.05	20	0.305	35,000	1.06	0.040	225.2	11/07/2244
4049430	55,813.41	20	0.305	35,000	1.18	0.046	225.2	11/07/2244
4049436	55,991.57	20	0.295	35,000	1.30	0.053	225.2	11/07/2244
4049441	56,210.05	20	0.305	35,000	0.95	0.052	225.2	11/07/2244
4049454	57,117.61	20	0.315	35,000	0.83	0.047	225.2	11/07/2244
4049460	57,199.68	20	0.315	35,000	1.30	0.025	225.2	11/07/2244
4049461	57,225.44	20	0.305	35,000	1.42	0.067	225.2	11/07/2244
4049463	57,243.32	20	0.305	35,000	0.83	0.027	225.2	11/07/2244
4049481	57,570.75	20	0.305	35,000	0.95	0.067	225.2	11/07/2244
4049528	59,114.64	20	0.305	35,000	0.83	0.046	225.2	11/07/2244
4049529	59,115.25	20	0.305	35,000	1.18	0.058	225.2	11/07/2244
4049557	60,555.30	20	0.305	35,000	1.06	0.040	225.2	11/07/2244
4049559	60,557.17	20	0.305	35,000	1.54	0.073	225.2	11/07/2244
4049582	61,100.71	20	0.295	35,000	0.83	0.027	225.2	11/07/2244
4049591	61,216.83	20	0.305	35,000	3.19	0.027	225.2	11/07/2244
4049632	63,055.43	20	0.295	35,000	1.30	0.032	225.2	11/07/2244
4049666	64,186.43	20	0.305	35,000	1.65	0.034	225.2	11/07/2244
4049676	64,235.24	20	0.305	35,000	1.18	0.027	225.2	11/07/2244
4049683	64,536.75	20	0.295	35,000	1.42	0.053	225.2	11/07/2244
4049689	64,797.68	20	0.295	35,000	0.95	0.027	225.2	11/07/2244
4049695	65,275.58	20	0.315	35,000	1.18	0.054	225.2	11/07/2244
4049697	65,366.71	20	0.315	35,000	0.95	0.038	225.2	11/07/2244
4049698	65,377.11	20	0.315	35,000	2.72	0.054	225.2	11/07/2244
4049717	65,696.81	20	0.315	35,000	1.18	0.054	225.2	11/07/2244
4049738	66,886.28	20	0.305	35,000	3.07	0.027	225.2	11/07/2244
4049746	67,216.83	20	0.315	35,000	2.72	0.054	225.2	11/07/2244
4049755	67,768.55	20	0.305	35,000	1.54	0.027	225.2	11/07/2244
4049756	67,771.35	20	0.305	35,000	0.95	0.040	225.2	11/07/2244
4049805	69,997.84	20	0.295	35,000	1.65	0.032	225.2	11/07/2244
4049808	70,098.46	20	0.295	35,000	1.42	0.065	225.2	11/07/2244
4049810	70,103.33	20	0.295	35,000	3.54	0.047	225.2	11/07/2244
4049812	70,200.70	20	0.295	35,000	1.77	0.047	225.2	11/07/2244
4049829	70,954.74	20	0.295	35,000	1.06	0.027	225.2	11/07/2244
4049846	72,099.73	20	0.305	35,000	1.06	0.027	225.2	11/07/2244
4049874	73,622.73	20	0.305	35,000	1.30	0.092	225.2	11/07/2244
4049896	74,349.56	20	0.295	35,000	1.54	0.032	225.2	11/07/2244
4049898	74,554.03	20	0.315	35,000	1.30	0.038	225.2	11/07/2244
4049899	74,595.45	20	0.315	35,000	2.72	0.060	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)

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
4049900	74,651.19	20	0.295	35,000	2.60	0.032	225.2	11/07/2244
4049910	75,674.09	20	0.305	35,000	2.72	0.027	225.2	11/07/2244
4049919	76,911.83	20	0.305	35,000	0.83	0.058	225.2	11/07/2244
4049922	77,081.76	20	0.295	35,000	2.36	0.053	225.2	11/07/2244
4049930	78,059.22	20	0.305	35,000	0.95	0.040	225.2	11/07/2244
4049936	78,454.31	20	0.305	35,000	1.06	0.073	225.2	11/07/2244
4049938	78,497.70	20	0.295	35,000	0.95	0.047	225.2	11/07/2244
4049939	78,562.18	20	0.305	35,000	1.77	0.058	225.2	11/07/2244
4049941	78,677.91	20	0.315	35,000	1.65	0.060	225.2	11/07/2244
4049944	78,961.79	20	0.315	35,000	2.72	0.038	225.2	11/07/2244
4049951	79,156.13	20	0.295	35,000	5.20	0.047	225.2	11/07/2244
4049976	80,308.40	20	0.305	35,000	1.06	0.040	225.2	11/07/2244
4050015	80,682.60	20	0.305	35,000	0.83	0.034	225.2	11/07/2244
4050016	80,700.77	20	0.305	35,000	1.06	0.034	225.2	11/07/2244
4050047	81,083.35	20	0.315	35,000	0.95	0.066	225.2	11/07/2244
4050052	82,049.32	20	0.305	35,000	1.30	0.040	225.2	11/07/2244
4050053	82,120.78	20	0.315	35,000	1.65	0.025	225.2	11/07/2244
4050057	82,450.96	20	0.315	35,000	1.06	0.066	225.2	11/07/2244
4050067	82,696.19	20	0.295	35,000	1.06	0.032	225.2	11/07/2244
4050069	82,815.18	20	0.305	35,000	1.06	0.027	225.2	11/07/2244
4050105	83,249.80	20	0.305	35,000	3.54	0.052	225.2	11/07/2244
4050106	83,269.57	20	0.305	35,000	3.54	0.058	225.2	11/07/2244
4050108	83,283.36	20	0.295	35,000	1.18	0.091	225.2	11/07/2244
4050111	83,295.17	20	0.295	35,000	1.30	0.038	225.2	11/07/2244
4050118	83,655.41	20	0.295	35,000	3.19	0.059	225.2	11/07/2244
4050158	84,113.86	20	0.305	35,000	2.13	0.040	225.2	11/07/2244
4050159	84,114.31	20	0.305	35,000	1.42	0.027	225.2	11/07/2244
4050261	84,597.02	20	0.295	35,000	2.24	0.032	225.2	11/07/2244
4050275	85,099.19	20	0.305	35,000	2.48	0.027	225.2	11/07/2244
4050276	85,099.71	20	0.305	35,000	1.30	0.027	225.2	11/07/2244
4050285	85,751.93	20	0.305	35,000	1.30	0.058	225.2	11/07/2244
4050286	85,808.73	20	0.315	35,000	0.83	0.025	225.2	11/07/2244
4050287	85,817.28	20	0.315	35,000	0.95	0.032	225.2	11/07/2244
4050288	85,826.73	20	0.315	35,000	3.90	0.047	225.2	11/07/2244
4050289	85,827.42	20	0.315	35,000	1.18	0.047	225.2	11/07/2244
4050295	86,028.47	20	0.315	35,000	0.95	0.032	225.2	11/07/2244
4050311	86,871.12	20	0.305	35,000	0.83	0.073	225.2	11/07/2244
4050312	86,958.28	20	0.305	35,000	1.42	0.027	225.2	11/07/2244
4050330	87,181.60	20	0.305	35,000	1.06	0.052	225.2	11/07/2244
4050331	87,218.21	20	0.305	35,000	3.31	0.040	225.2	11/07/2244
4050461	89,396.39	20	0.295	35,000	3.07	0.053	225.2	11/07/2244
4050462	89,445.31	20	0.305	35,000	1.06	0.046	225.2	11/07/2244
4050481	90,196.17	20	0.305	35,000	1.42	0.052	225.2	11/07/2244
4050518	91,162.43	20	0.305	35,000	1.42	0.040	225.2	11/07/2244
4050532	91,620.77	20	0.305	35,000	0.95	0.052	225.2	11/07/2244
4050539	91,820.70	20	0.295	35,000	2.95	0.027	225.2	11/07/2244
4050540	91,821.45	20	0.295	35,000	0.83	0.038	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)

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
4050544	92,284.26	20	0.315	35,000	1.06	0.038	225.2	11/07/2244
4050558	92,807.07	20	0.295	35,000	2.95	0.038	225.2	11/07/2244
4050577	93,230.71	20	0.295	35,000	2.48	0.038	225.2	11/07/2244
4050590	94,130.04	20	0.305	35,000	2.01	0.052	225.2	11/07/2244
4050591	94,204.20	20	0.305	35,000	2.95	0.040	225.2	11/07/2244
4050598	94,471.56	20	0.305	35,000	2.13	0.027	225.2	11/07/2244
4050602	94,498.14	20	0.305	35,000	2.24	0.067	225.2	11/07/2244
4050611	94,850.53	20	0.305	35,000	2.36	0.067	225.2	11/07/2244
4050612	94,858.32	20	0.305	35,000	0.83	0.034	225.2	11/07/2244
4050614	94,865.84	20	0.305	35,000	1.06	0.040	225.2	11/07/2244
4050615	94,867.10	20	0.305	35,000	1.06	0.034	225.2	11/07/2244
4050634	95,269.11	20	0.315	35,000	0.95	0.066	225.2	11/07/2244
4050639	95,420.11	20	0.305	35,000	1.06	0.034	225.2	11/07/2244
4050658	96,159.80	20	0.315	35,000	2.24	0.047	225.2	11/07/2244
4050664	96,527.01	20	0.315	35,000	4.13	0.054	225.2	11/07/2244
4050665	96,549.97	20	0.315	35,000	1.54	0.038	225.2	11/07/2244
4050728	98,042.92	20	0.305	35,000	1.42	0.027	225.2	11/07/2244
4050735	98,646.06	20	0.315	35,000	2.13	0.047	225.2	11/07/2244
4050736	98,693.94	20	0.315	35,000	1.30	0.047	225.2	11/07/2244
4050742	98,926.55	20	0.315	35,000	2.36	0.060	225.2	11/07/2244
4050754	99,096.27	20	0.305	35,000	1.54	0.052	225.2	11/07/2244
4050761	99,971.38	20	0.305	35,000	2.24	0.073	225.2	11/07/2244
4050765	100,150.49	20	0.305	35,000	1.42	0.052	225.2	11/07/2244
4050767	100,220.45	20	0.305	35,000	2.36	0.052	225.2	11/07/2244
4050773	100,594.72	20	0.315	35,000	1.42	0.066	225.2	11/07/2244
4050776	100,930.50	20	0.305	35,000	3.54	0.058	225.2	11/07/2244
4050781	101,141.83	20	0.305	35,000	1.54	0.040	225.2	11/07/2244
4050789	101,399.17	20	0.315	35,000	2.60	0.047	225.2	11/07/2244
4050790	101,623.30	20	0.315	35,000	1.18	0.054	225.2	11/07/2244
4050797	102,652.80	20	0.305	35,000	4.49	0.040	225.2	11/07/2244
4050818	103,600.39	20	0.315	35,000	1.77	0.085	225.2	11/07/2244
4050830	103,780.61	20	0.315	35,000	6.97	0.060	225.2	11/07/2244
4050832	103,818.76	20	0.305	35,000	2.95	0.052	225.2	11/07/2244
4050853	105,128.38	20	0.305	35,000	1.06	0.034	225.2	11/07/2244
4050866	106,162.26	20	0.305	35,000	2.01	0.067	225.2	11/07/2244
4050869	106,193.76	20	0.315	35,000	1.18	0.038	225.2	11/07/2244
4050871	106,242.78	20	0.305	35,000	1.06	0.046	225.2	11/07/2244
4050875	106,392.63	20	0.295	35,000	1.06	0.038	225.2	11/07/2244
4050879	106,493.75	20	0.305	35,000	1.18	0.058	225.2	11/07/2244
4050880	106,529.01	20	0.305	35,000	1.77	0.034	225.2	11/07/2244
4050881	106,530.31	20	0.305	35,000	1.30	0.027	225.2	11/07/2244
4050883	106,639.11	20	0.305	35,000	0.95	0.034	225.2	11/07/2244
4050884	106,652.62	20	0.315	35,000	0.95	0.054	225.2	11/07/2244
4050896	107,837.21	20	0.305	35,000	4.73	0.034	225.2	11/07/2244
4050945	109,196.70	20	0.295	35,000	1.18	0.032	225.2	11/07/2244
4050954	109,273.63	20	0.315	35,000	1.30	0.066	225.2	11/07/2244
4050971	110,012.57	20	0.305	35,000	2.01	0.046	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)

ILI Feature ID	ILI Log Distance (feet)	OD (inch)	WT (inch)	YS (psi)	ILI Length (inch)	ILI Depth (inch)	Reassessment Interval (years)	Reassessment Due Date
4051007	111,535.44	20	0.305	35,000	4.37	0.067	225.2	11/07/2244
4051009	111,684.67	20	0.295	35,000	3.31	0.027	225.2	11/07/2244
4051011	111,701.25	20	0.295	35,000	3.78	0.047	225.2	11/07/2244
4051027	112,298.52	20	0.305	35,000	2.01	0.034	225.2	11/07/2244
4051028	112,384.69	20	0.315	35,000	1.06	0.032	225.2	11/07/2244
4051037	113,227.10	20	0.295	35,000	1.42	0.059	225.2	11/07/2244
4051038	113,240.41	20	0.295	35,000	0.83	0.038	225.2	11/07/2244
4051073	114,957.45	20	0.315	35,000	1.18	0.038	225.2	11/07/2244
4051081	115,166.25	20	0.315	35,000	1.89	0.054	225.2	11/07/2244
4051087	115,411.97	20	0.315	35,000	0.83	0.032	225.2	11/07/2244
4051090	115,556.12	20	0.315	35,000	1.30	0.032	225.2	11/07/2244
4051092	115,582.32	20	0.315	35,000	1.89	0.025	225.2	11/07/2244
4051107	116,092.67	20	0.315	35,000	0.83	0.025	225.2	11/07/2244
4051108	116,148.91	20	0.315	35,000	2.01	0.079	225.2	11/07/2244
4051124	116,463.14	20	0.305	35,000	0.83	0.040	225.2	11/07/2244
4051154	117,179.56	20	0.305	35,000	2.95	0.046	225.2	11/07/2244
4051155	117,180.04	20	0.305	35,000	2.72	0.058	225.2	11/07/2244
4051246	122,410.57	20	0.315	35,000	1.06	0.038	225.2	11/07/2244
4051252	122,900.06	20	0.315	35,000	2.48	0.047	225.2	11/07/2244
4051253	122,901.97	20	0.315	35,000	1.06	0.032	225.2	11/07/2244
4051257	123,236.54	20	0.305	35,000	1.42	0.034	225.2	11/07/2244
4051259	123,336.81	20	0.305	35,000	0.83	0.058	225.2	11/07/2244
4051260	123,411.71	20	0.305	35,000	1.30	0.067	225.2	11/07/2244
4051265	123,601.90	20	0.315	35,000	2.84	0.047	225.2	11/07/2244
4051278	124,226.92	20	0.305	35,000	1.42	0.046	225.2	11/07/2244
4051289	124,898.63	20	0.315	35,000	2.95	0.091	225.2	11/07/2244
4051291	124,925.18	20	0.305	35,000	1.77	0.052	225.2	11/07/2244
4051296	125,200.98	20	0.315	35,000	2.84	0.025	225.2	11/07/2244
4051300	125,307.71	20	0.315	35,000	3.43	0.072	225.2	11/07/2244
4051301	125,376.45	20	0.315	35,000	1.06	0.038	225.2	11/07/2244
4051305	125,938.06	20	0.305	35,000	1.06	0.067	225.2	11/07/2244
4051326	127,175.88	20	0.305	35,000	1.65	0.052	225.2	11/07/2244
4051353	127,923.27	20	0.315	35,000	2.60	0.054	225.2	11/07/2244
4051354	127,945.82	20	0.315	35,000	1.06	0.066	225.2	11/07/2244
4051355	127,956.29	20	0.315	35,000	1.30	0.038	225.2	11/07/2244
4051364	128,311.36	20	0.315	35,000	2.13	0.025	225.2	11/07/2244
4051378	128,785.85	20	0.295	35,000	1.65	0.065	225.2	11/07/2244
4051382	128,900.83	20	0.295	35,000	2.24	0.065	225.2	11/07/2244
4051386	129,212.65	20	0.305	35,000	5.20	0.052	225.2	11/07/2244
4051390	129,545.73	20	0.315	35,000	1.06	0.038	225.2	11/07/2244
4051391	129,650.49	20	0.315	35,000	1.30	0.072	225.2	11/07/2244
4051399	130,250.16	20	0.305	35,000	1.30	0.027	225.2	11/07/2244
4051401	130,350.59	20	0.315	35,000	1.65	0.025	225.2	11/07/2244
4051412	131,649.99	20	0.305	35,000	1.18	0.027	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. The standard distinguishes between results with and without field verification measurements. API 1163 Section 7 provides information on the ILI Vendor 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 pipeline being inspected. 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 with indications of significance reported by ILI. Typically, enough validation measurements are taken on the pipeline being inspected to confidently state whether the ILI tool is performing 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 performs within ILI specification. The number of validation measurements will typically be greater than or equal to five but will not be statistically significant enough to perform a Level 3 validation. If the ILI tool specification can be

rejected, then there is the option to progress to a Level 3 validation which may require 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, with 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.

Depending on the data analysis using the API 1163 decision chart process, tool performance can be rejected, accepted, or non-conclusive. If tool performance is deemed nonconclusive, 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 improve the current tool performance, accepting the determined tool performance and 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.

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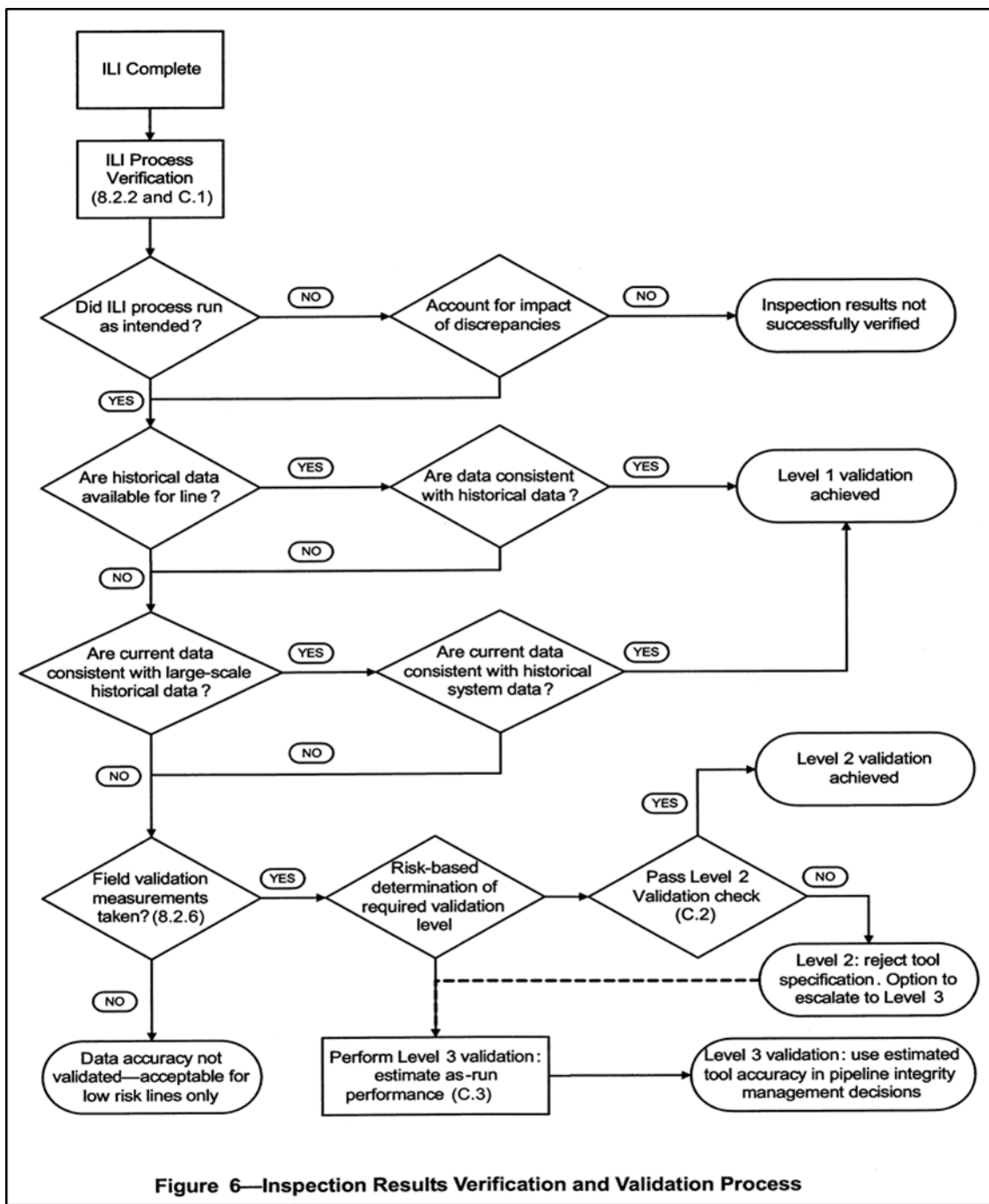


Figure E-1. Evaluation of System Results from API 1163 Section 8 Figure 6

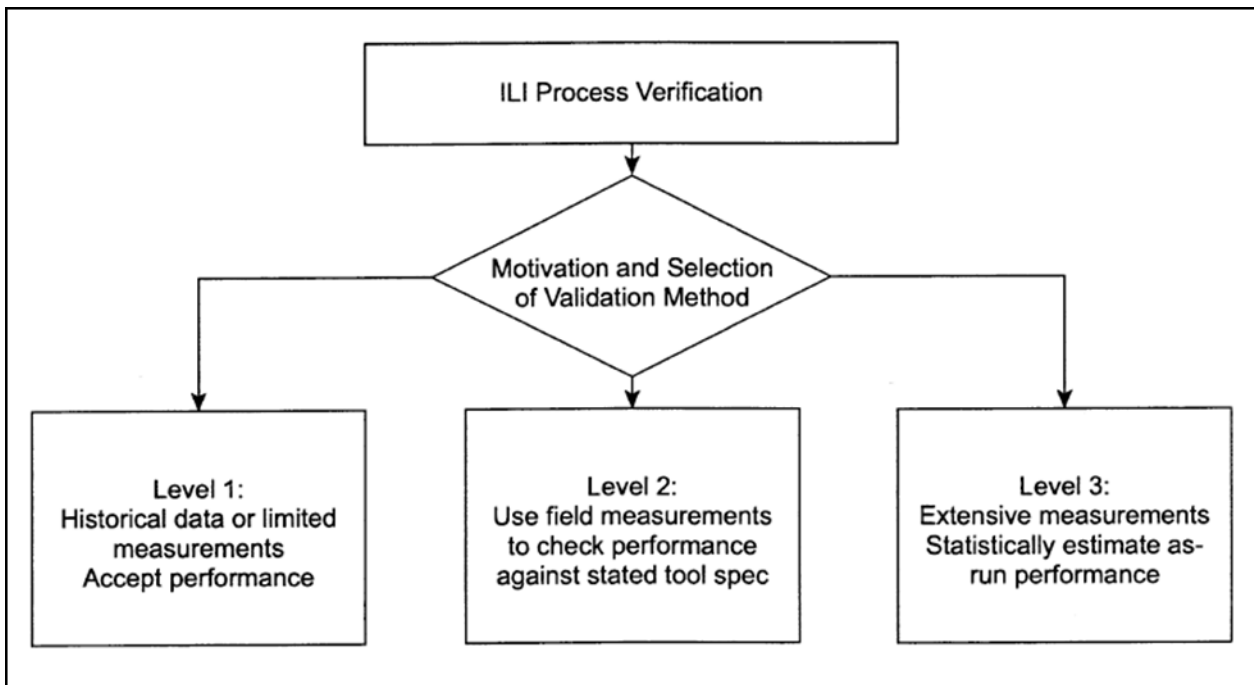


Figure E-2. Overview of Three Levels of Validation