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TECHNICAL MEMORANDUM

DATE:	October 7, 2016
TO:	Cascade Natural Gas Corporation
FROM:	Parametrix
SUBJECT:	Summary of Field Testing and Test Results for 8" Bremerton Transmission Line #2
CC:	Cascade Natural Gas Corporation: Jeremy Ogden, Renie Sorensen Parametrix: Rebecca Cushman, Margaret Spence, Mallory Miller, Amanda Thom, Josh Ahmann, Theresa Nagle, Mike Hall
PROJECT NUMBER:	557-2402-014/03/0303
PROJECT NAME:	CNGC Asset Management

INTRODUCTION

Cascade Natural Gas Corporation (CNGC) is required to determine Maximum Allowable Operating Pressure (MAOP) for all of its high-pressure pipelines for which some form of essential data necessary to confirm MAOP is missing. To accomplish this, CNGC contracted Parametrix, Das-Co, and ABI Services to determine sample quantities, identify sample locations, and conduct *in-situ* testing of the pipelines. The tests used the Automated Ball Indentation® (ABI®) technique to measure yield strength and tensile strength and verify pipe grade.

The purpose of this technical memorandum is to summarize testing completed for 8" Bremerton Transmission Line #2, which is located south of Kitsap Lake in the City of Bremerton and Kitsap County, Washington (Figure 1). This pipeline includes two separate portions of original line that did not have adequate information to confirm MAOP. Figure 1 shows the location of 8" Bremerton Transmission Line #2 and the portions of the pipeline that were tested. Testing of the pipeline was completed July 18-20, 2016.

Parametrix prepared a detailed technical memorandum in January 2016 that described the statistical approach used to determine homogenous sampling "lots" of pipe, calculate statistically based sample quantities, and identify locations of *in-situ* testing for pipelines (Parametrix 2016a). Sample quantities were calculated following Section II-D of Appendix B in 49 CFR Part 192 using pipeline lengths estimated from geographic information system (GIS) files provided by CNGC. Sampling lots and random sample locations were determined following approaches described in American Society of Mechanical Engineers (ASME) Center for Research and Technology Development (CRTD) Volume 91 (CRTD-Vol. 91), *Application Guide for Determining the Yield Strength of In-Service Pipe by Hardness Evaluation* (Clark and Amend 2009).

For 8" Bremerton Transmission Line #2, pipe lengths in both portions of the original line were assumed to be homogeneous (Parametrix 2016a) and grouped into a single sampling lot for sample quantity calculation (Figure 1). For the pipeline sampling lot, total length was calculated from the GIS data provided by CNGC. Based on the GIS-estimated total length of 2,789 feet and a nominal pipe length of 40 feet, the portions of pipeline to be tested were estimated to contain approximately 70 pipe lengths. Based on 49 CFR Part 192, the minimum sample quantity for 70 pipe lengths is 14 (one set of tests per 5 pipe lengths).

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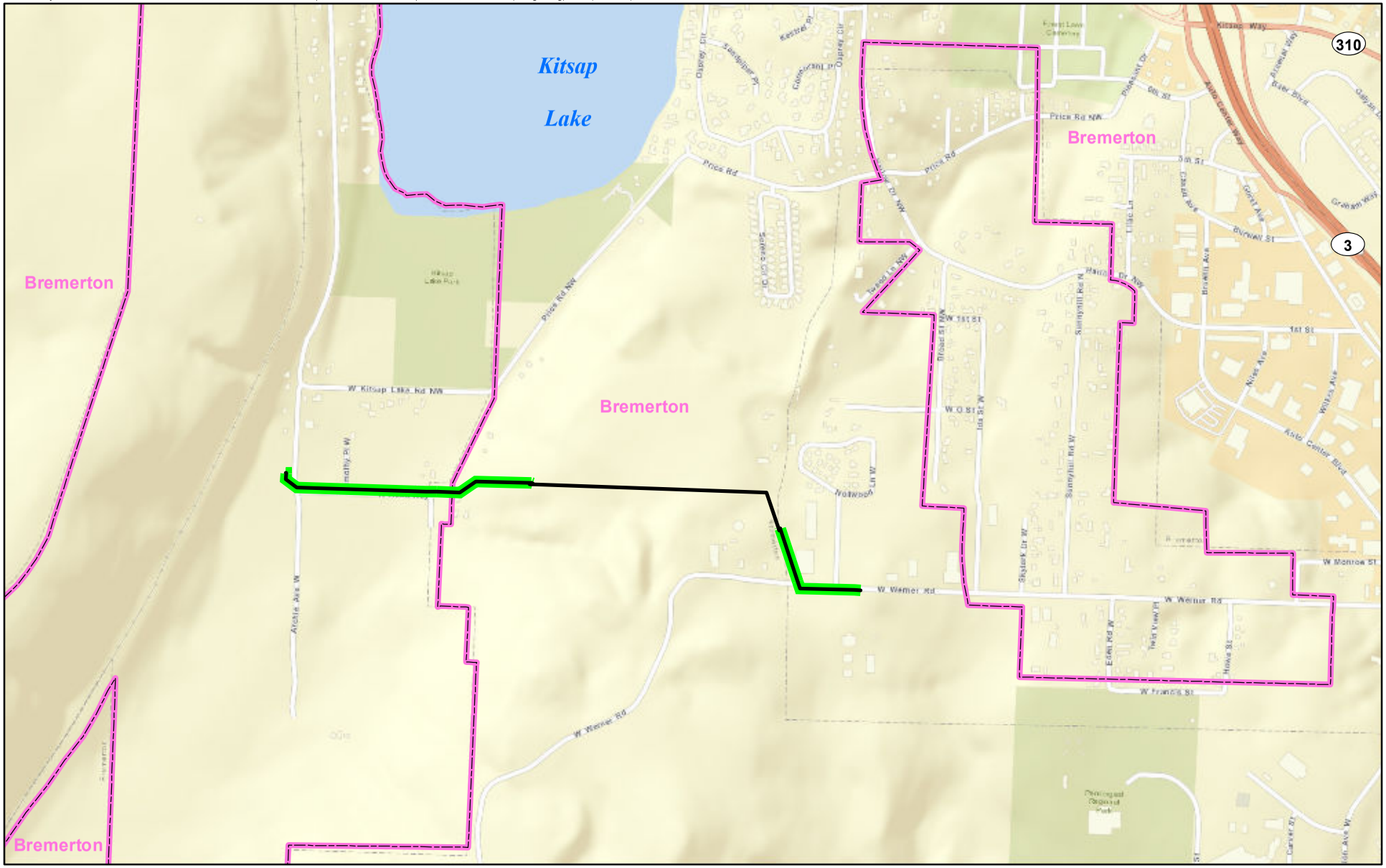

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Parametrix
ENGINEERING . PLANNING . ENVIRONMENTAL SCIENCES

0 500 1,000 1,500 Feet

Pipeline Location
Testing Required
Bremerton City Limit

FIGURE 1
VICINITY MAP FOR 8" BREMERTON TRANSMISSION LINE #2

CNGC ASSET MANAGEMENT

The remainder of this technical memorandum summarizes the testing completed for 8" Bremerton Transmission Line #2:

- Identification and screening of randomly selected sample locations
- Preparation and coordination between contractors prior to testing
- Testing procedures and conditions
- Results of tests conducted at sample locations

SAMPLE LOCATION IDENTIFICATION AND SCREENING

Generation of the sampling lot and random selection of pipe lengths for testing 8" Bremerton Transmission Line #2 was implemented in an Excel spreadsheet (Appendix A). The sampling lot was created by generating a list of sequential pipe lengths based on the total original pipeline length and the 40-foot nominal pipe length used to estimate sample quantity. A random sample from the approximately 70 pipe lengths was then created by generating a uniform random number using Excel's rand() function for each pipe length and sorting the list of pipe lengths based on the random numbers assigned (smallest to largest). The top 14 pipe lengths in the sorted list (those with the lowest random numbers) were then selected as the initial random sample for testing (Appendix A).

On-the ground sample locations were identified from the sequential list of pipe lengths generated in the Excel spreadsheet using GIS. Pipe length midpoints were estimated as a distance along the pipeline by multiplying each pipe length's sequential number by 40' then subtracting 20'. For example, the location of the middle of the fifth pipe length along a pipeline is approximately 180' ([5 x 40'] - 20') from the beginning of the pipeline. Using linear referencing in GIS, a route was created along the pipeline's primary orientation (west to east) from the portions of pipeline to be tested. The distances calculated for the individual pipe lengths were applied to the route to identify on-the-ground sample locations. On-the-ground sample locations identified for 8" Bremerton Transmission Line #2 are shown in maps provided in Appendix B.

The on-the-ground sample locations generated in GIS were screened to identify randomly selected sample locations that were not feasible for testing due to conditions such as the presence of restrictions or limitations to direct access (e.g., water crossings, casings, rocky terrain, topography, high water table, local permitting issues). Because all pipe lengths were included in the randomization process described above, pipe lengths listed below those included in the original random sample of 14 pipe lengths provided a sequential list of randomly selected alternate sample locations. Sampling feasibility was initially evaluated through a desktop review of as-built drawings, aerial imagery, and GIS-based data (e.g., major highways, wetlands, water bodies and courses, jurisdictions). Sample locations were also field-reviewed prior to testing to ensure access and testing feasibility.

Two sample locations were eliminated during the desktop review process due their proximity to a freshwater forested/shrub wetland. According to the National Wetland Inventory (USFWS 2013), one of the points was located in the wetland (sample order #14), and the other was located within approximately 50 feet of the wetland (sample order #3). The next two sample locations in the sorted list (sample order #s 15 and 16) were added as alternates. Final pre-field sample locations are shown in Appendix B.

TESTING PREPARATION AND COORDINATION

A team of three contractors completed testing of 8" Bremerton Transmission Line #2:

- Parametrix was responsible for overall coordination of pipeline testing, desktop and field screening of sample locations, coordination with regional CNGC staff, coordination with property owners and jurisdictions, acquisition of required permits for excavation and testing, and observation of testing at each location.
- Das-Co was responsible for excavation of each location (including scheduling 811 for utility line location and implementing safety precautions such as use of a shoring box as necessary) and preparation of the pipe length (i.e., removing the external pipe coating) prior to testing. Following testing, Das-Co was responsible for re-wrap of the pipe length, backfill of the test hole, and restoration of the sample location. Das-Co was also responsible for completing CNGC's 625 form for each test location, including recording wall thickness measurements.
- ABI Services was responsible for testing each sample location and reporting those results to Parametrix and CNGC.

Parametrix and Das-Co staff reviewed the sample locations in the field on May 4, 2016, to familiarize themselves with each site and evaluate access and excavation feasibility. Sample locations were identified from the GIS-generated on-the-ground coordinates using an IPad Air and Trimble R1 handheld global positioning system (GPS) receiver. During this reconnaissance, Das-Co located the pipeline and measured pipeline depth at each sample location. Parametrix also personally contacted those property owners or businesses located on properties with sample locations that were present and informed them of the general purpose of the testing and anticipated schedule. Parametrix returned on July 6, 2016, to mark sample locations using laths. Pre-excavation photos were also taken to document the pre-test condition at each location.

All sample locations were determined to be feasible for testing, although some locations were adjusted to address pipeline location and/or access issues. Locations for sample order #s 5, 7, 9, and 10 were shifted from the GIS-generated coordinates to the actual pipeline. On the west side of the pipeline, sample order #1 was shifted to the east to avoid a driveway, sample order #4 was shifted south so that it was outside the valve station at that location, and sample order #8 was shifted west to avoid a creek.

Sample locations along the pipeline fell into one of two jurisdictions: City of Bremerton or Kitsap County. Three of the points in the City of Bremerton were within a road right-of-way (sample order #s 9, 12, and 13), and therefore required a Right of Way Permit issued by the City. Parametrix worked with the Bremerton District of CNGC to submit the permit and get it approved. All other sample locations were located on private property in one of the two jurisdictions, which required notification for the property owner, but no formal permitting process (Appendix C).

The 11 sample locations outside of road right-of-way were located on properties owned by five different private entities, one of which was CNGC. The other four property owners were contacted by phone to notify them of the testing, including anticipated dates (Appendix C). If requested, additional information (e.g., a map of sample locations) was provided via email. Parametrix coordinated with CNGC's Bremerton District regarding testing of all sample locations.

TESTING SUMMARY

All three contractors conducted their work under contractor-specific health and safety plans (ABI Services 2016a, Das-Co 2014, Parametrix 2016b). Parametrix field staff also completed CNGC's on-line gas safety training modules. Das-Co and ABI Services are certified to work on gas pipelines. Additionally, Das-Co prepared traffic control plans for the three sample locations within a road right-of-way (sample order #s 9, 12, and 13), as well as an additional sample location in a driveway that is heavily used by large vehicles (e.g., dump trucks) to access local businesses, including Port Orchard Sand and Gravel (sample order #5).

Testing of the 14 sample locations for 8" Bremerton Transmission Line #2 was initiated on Monday, July 18, and completed Wednesday, July 20, 2016. Weather conditions were warm (50-80 °F) and overcast on Monday, warm and mostly to partly cloudy on Tuesday, and warm and overcast to clear on Wednesday. Parametrix observed ABI® testing at each sample location and recorded field observations electronically using an iPad Air. Coordinates for the actual test locations were collected by placing the GPS receiver on the pipe where the testing was to occur. Generally, coordinates were captured with sub-meter accuracy, although accuracy at each test site varied depending on GPS satellite reception, which can be affected by tree or cloud cover, as well as the depth of the pipe in the excavated hole.

ABI Services tested the 14 sample locations using the Stress-Strain Microprobe®, SSM-Mobile System. Prior to arriving at the first sample location on July 18, ABI Services performed a weekly bump test on a piece of reference material (metal of known specification) (ABI Services 2016b). The test results were within ABI Services' test specifications. Each morning, ABI Services completed a daily sensor check prior to testing at the first sample location (ABI Services 2016b). The test result for each sensor check was within ABI Services' specifications. At each sample location, ABI Services prepared the test site, mounted the testing unit on the pipe, and performed a sensor check to verify calibration (ABI Services 2016b). Once sensor calibration was verified, ABI Services then performed a set of five individual ABI® tests at a single location on the pipe. After each ABI® test, the test equipment was moved slightly within the test location (ABI Services 2016b).

There were no access issues for excavation and testing at the 14 sample locations. However, for two sets of adjacent adjusted sample locations (sample order #s 1 and 8 and sample order #s 7 and 10), the initial excavation exposed both pipe lengths at their seam. In each instance, ABI Services tested the two pipe lengths on either side of the seam weld. The location of sample order #4 was shifted farther south to avoid a guywire conflict with the excavation equipment.

CNGC Bremerton District Crew Lead, Kendall Youngblood, was also present during testing of sample order #13 on July 18 and sample order #6 on July 20. A representative from the UTC (Dennis Ritter) was present to observe testing of sample order #s 7 and 10 on July 18 and sample order #6 on July 20.

Appendices D through F include Parametrix field data, ABI Services' combined test report, and CNGC 625 forms completed by Das-Co, respectively. The field data in Appendix D also include information regarding site visits observed by Parametrix field staff from CNGC staff, UTC staff, or other governmental representatives. In addition to ABI Services' combined test report, Appendix E contains ABI Services' field testing procedures and sensor calibration certificates.

TEST RESULTS SUMMARY

Test results reported by ABI Services include yield strength (YS), strength coefficient, strain hardening coefficient, engineering ultimate tensile strength (UTS), calculated uniform ductility, ratio of YS to UTS, and fracture toughness. Based on these results and specifications in American Petroleum Institute (API) Specification 5L

(45th edition, July 1, 2013), ABI Services assigned a grade qualification for each pipe length tested. Table 1, below, summarizes YS, UTS, ratio of YS to UTS, and grade qualification, as well as average wall thickness measured by Das-Co. ABI Services' summary report for the entire pipeline is provided in Appendix E. Individual wall thickness measurements taken by Das-Co for each sample location are reported in the 625 forms provided in Appendix F.

Table 1. ABI® Test Results for 8" Bremerton Transmission Line #2

Pipe Length ID[1]	Sample Order[1]	ABI Test ID	Test Date	YS (ksi)		Engineering UTS (ksi)		Ratio of YS to UTS		Grade Qualification	Average Wall Thickness (inches)[2]
				Avg.	Std. Dev.	Avg.	Std. Dev.	Avg.	Std. Dev.		
13	8BT2-1	8BT2-1	7/18/16	54.2	0.64	76.9	1.30	0.70	0.011	X52	0.181
38	8BT2-2	8BT2-2	7/19/16	46.9	0.67	71.0	1.53	0.66	0.016	X42	0.181
1	8BT2-4	8BT2-4	7/20/16	49.6	3.13	80.3	1.88	0.62	0.034	X46	0.187
57	8BT2-5	8BT2-5	7/20/16	54.9	1.85	77.6	2.41	0.71	0.028	X52	0.188
3	8BT2-6	8BT2-6	7/20/16	58.6	0.63	81.8	2.51	0.72	0.023	X56	0.186
50	8BT2-7	8BT2-7	7/18/16	49.8	1.74	75.1	1.13	0.66	0.022	X46	0.188
15	8BT2-8	8BT2-8	7/18/16	52.9	1.74	77.4	1.30	0.68	0.013	X46	0.181
60	8BT2-9	8BT2-9	7/19/16	50.0	1.34	73.1	1.37	0.69	0.015	X46	0.181
51	8BT2-10	8BT2-10	7/18/16	49.7	1.68	72.7	1.75	0.68	0.025	X46	0.181
41	8BT2-11	8BT2-11	7/19/16	48.1	1.83	73.6	2.64	0.65	0.008	X42	0.180
63	8BT2-12	8BT2-12	7/19/16	46.0	1.02	68.6	1.36	0.67	0.018	X42	0.188
65	8BT2-13	8BT2-13	7/18/16	48.5	0.57	72.5	0.99	0.67	0.007	X46	0.182
44	8BT2-15	8BT2-15	7/19/16	48.1	1.00	71.9	1.12	0.67	0.020	X46	0.180
47	8BT2-16	8BT2-16	7/18/16	50.1	1.07	75.3	1.34	0.67	0.015	X46	0.180
			Minimum	46.0		68.6		0.62			0.180
			Maximum	58.6		81.8		0.72			0.188
			Average	50.5		74.8		0.68			0.183
			80% of Average YS.	40.4							

[1] Sample order values were used to identify sample locations in the field and record field observation and test data. Consequently, the prefix "8BT2-" included as part of the pipe length ID in Parametrix's sampling approach technical memorandum (2016a) was instead used with the sample order number to be consistent with the test IDs assigned in the field by ABI Services.

[2] Average of three or four thickness measurements.

Avg. = average of 5 test results per pipe length.

Std. Dev. = standard deviation of 5 test results per pipe length.

ksi = kilopounds per square inch.

For 8" Bremerton Transmission Line #2, average YS ranged from 46.0 to 58.6 ksi, average UTS ranged from 68.6 to 81.8 ksi, and the average ratio of YS to UTS ranged from 0.62 to 0.72. Pipe grade qualification ranged from X42 to X56, with 3 of the 14 tested pipe lengths qualified as X42. Average wall thickness ranged from 0.180 to 0.188 inches. Maps of the test locations, with pipe grade qualifications and average wall thicknesses, are provided in Appendix B.

Regulations at 49 CFR §192.107, Yield Strength (S) for Steel Pipe, specify how yield strength is to be determined for pipe with unknown specification or tensile properties: the lower of (1) 80 percent of the average yield strength determined by tensile tests, and (2) the lowest yield strength determined by tensile tests. Eighty percent

of the average YS from the 14 tests is 40.4, while the lowest YS determined by the ABI® tests is 46.0 (Table 1). Based on these calculations, the YS determined for 8" Bremerton Transmission Line #2 is 40.4 ksi.

Appendix G provides a description of the GIS data set created for this pipeline. The data set includes the original line as provided by CNGC, actual sample locations, and summary test results (averages, standard deviations, and grade qualifications).

REFERENCES

ABI Services. 2016a. Health, Environment & Safety Manual. Prepared by ABI Services, LLC, Oak Ridge, TN. January 2016.

ABI Services. 2016b. Field Testing Procedure for Performing the Automated Ball Indentation® (ABI®) Test. Prepared by ABI Services, LLC, Oak Ridge, TN.

Clark, E. B. and W. E. Amend. 2009. Applications Guide for Determining the Yield Strength of In-Service Pipe by Hardness Evaluation. Final Report. American Society of Mechanical Engineers Center for Research and Technology Development Volume 91. New York.

Das-Co. Health and Safety Manual. August 2014.

Parametrix. 2016a. Proposed Statistical Sampling Approach and Implementation for In-situ Testing of Existing Natural Gas Transmission Lines to Determine Maximum Allowable Operating Pressure. Technical Memorandum prepared for Cascade Natural Gas Corporation. Parametrix, Inc., Seattle. WA. January 8, 2016.

Parametrix. 2016b. Asset Management Project Health and Safety Plan. Prepared for Cascade Natural Gas Corporation. Prepared by Parametrix, Seattle, WA. July 2016.

U.S. Fish and Wildlife Service. 2013. National Wetland Inventory. Available via ArcGIS Online at http://utility.arcgis.com/usrsvcs/rest/services/1676a62091154e0dbc015db0421ff8dd/MapServer. Last modified November 14, 2013.

Appendix A
Candidate Sample Locations with Randomization, Selection, and Screening Results

Bremerton District
8" Bremerton Transmission Line #2 (pipe lengths in original line)

Approx. Length (feet)	Approx. Number of 40' Lengths	Number of Tests per 49 CFR 192
2,789	69.7	14

Each pipe length was assigned a random number. The pipe lengths were then sorted from smallest to largest based on the random numbers assigned. The first 14 sorted pipe lengths constitute a random sample. Any of the first 14 pipe lengths not accessible for sampling based on desktop or field review were replaced with alternate pipe lengths from those remaining in the ordered list in the order shown. Pipe lengths in red font were selected for testing.

Pipeline distances are oriented west to east.

Pipe Lengths

SAMPLE 14 OF APPROX. 70 PIPE LENGTHS

Pipe Length ID	Distance Along Pipeline (at approx. center)	Rand() Value	Sample Order	Sampled?
13	500	0.001131	8BT2-1	Yes
38	1500	0.018648	8BT2-2	Yes
17	660	0.030580	8BT2-3	No - Close proximity to a wetland
1	20	0.050504	8BT2-4	Yes
57	2260	0.052415	8BT2-5	Yes
3	100	0.074266	8BT2-6	Yes
50	1980	0.075234	8BT2-7	Yes
15	580	0.076400	8BT2-8	Yes
60	2380	0.078210	8BT2-9	Yes
51	2020	0.103898	8BT2-10	Yes
41	1620	0.112228	8BT2-11	Yes
63	2500	0.140145	8BT2-12	Yes
65	2580	0.153514	8BT2-13	Yes
20	780	0.203588	8BT2-14	No - In a wetland
44	1740	0.227981	8BT2-15	Yes - Alternate
47	1860	0.236585	8BT2-16	Yes - Alternate
70	2780	0.240759	8BT2-17	
33	1300	0.247604	8BT2-18	
16	620	0.291920	8BT2-19	
39	1540	0.296265	8BT2-20	
27	1060	0.319962	8BT2-21	
69	2740	0.344800	8BT2-22	
8	300	0.356146	8BT2-23	
5	180	0.365842	8BT2-24	
10	380	0.369907	8BT2-25	
61	2420	0.375783	8BT2-26	
66	2620	0.379276	8BT2-27	
18	700	0.385264	8BT2-28	
56	2220	0.392610	8BT2-29	
24	940	0.398390	8BT2-30	
53	2100	0.421691	8BT2-31	
54	2140	0.430985	8BT2-32	
58	2300	0.455624	8BT2-33	
67	2660	0.478211	8BT2-34	
9	340	0.483133	8BT2-35	
42	1660	0.486623	8BT2-36	
19	740	0.525694	8BT2-37	
48	1900	0.535304	8BT2-38	
28	1100	0.535861	8BT2-39	
23	900	0.547953	8BT2-40	
49	1940	0.552676	8BT2-41	
6	220	0.589115	8BT2-42	
40	1580	0.605852	8BT2-43	
31	1220	0.606120	8BT2-44	
21	820	0.606792	8BT2-45	
12	460	0.607290	8BT2-46	
64	2540	0.613627	8BT2-47	
37	1460	0.617585	8BT2-48	
2	60	0.652676	8BT2-49	
11	420	0.658006	8BT2-50	

Bremerton District
8" Bremerton Transmission Line #2 (pipe lengths in original line)

Approx. Length (feet)	Approx. Number of 40' Lengths	Number of Tests per 49 CFR 192
2,789	69.7	14

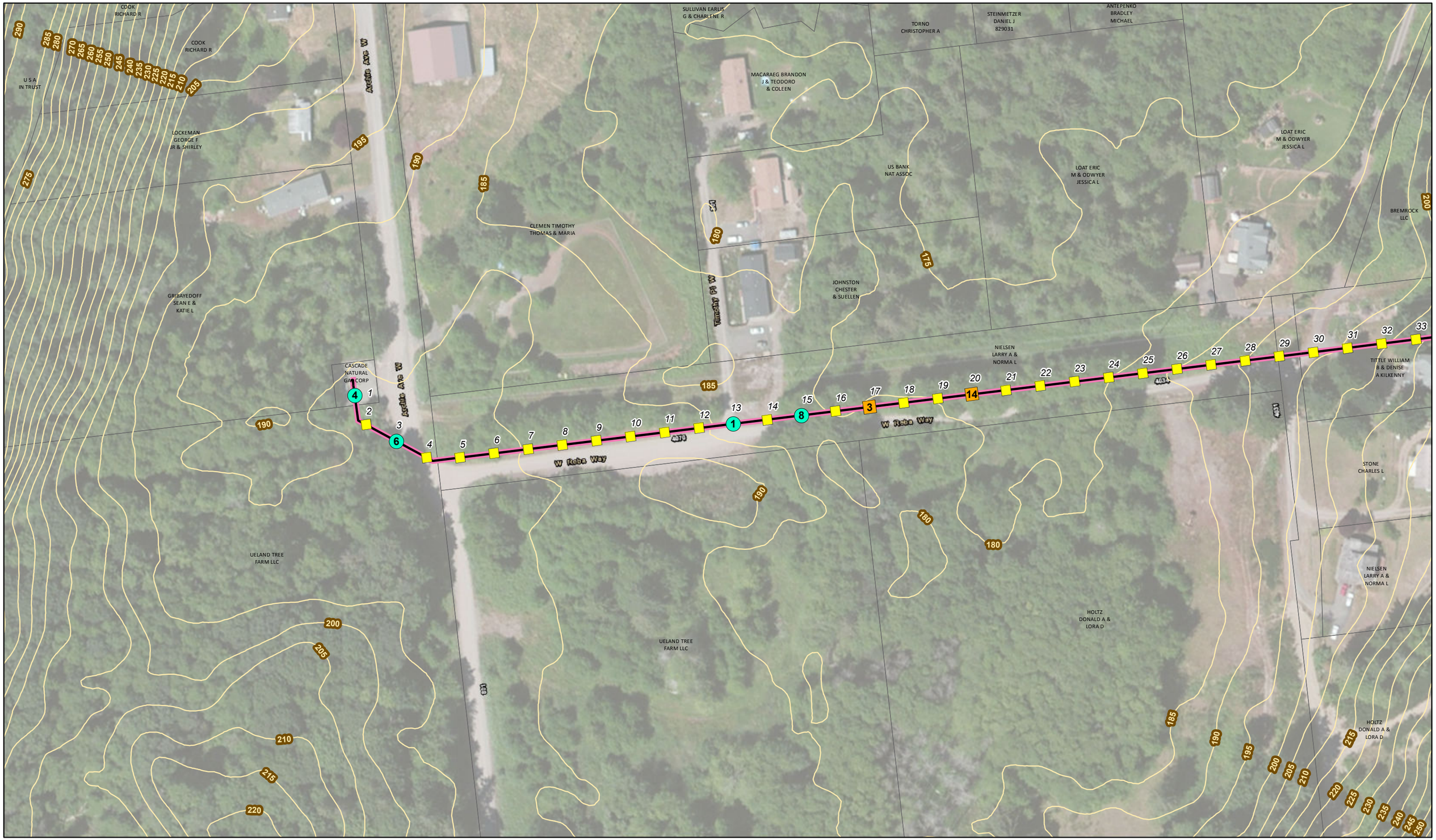
Pipe Lengths

SAMPLE 14 OF APPROX. 70 PIPE LENGTHS

Pipe Length ID	Distance Along Pipeline (at approx. center)	Rand() Value	Sample Order	Sampled?
4	140	0.663219	8BT2-51	
32	1260	0.663462	8BT2-52	
36	1420	0.670823	8BT2-53	
35	1380	0.681847	8BT2-54	
43	1700	0.713649	8BT2-55	
55	2180	0.713779	8BT2-56	
22	860	0.742132	8BT2-57	
30	1180	0.751494	8BT2-58	
59	2340	0.753670	8BT2-59	
34	1340	0.756873	8BT2-60	
7	260	0.767212	8BT2-61	
25	980	0.795898	8BT2-62	
14	540	0.798871	8BT2-63	
46	1820	0.809466	8BT2-64	
52	2060	0.817119	8BT2-65	
62	2460	0.825809	8BT2-66	
29	1140	0.832629	8BT2-67	
45	1780	0.886590	8BT2-68	
26	1020	0.926065	8BT2-69	
68	2700	0.949870	8BT2-70	

Appendix B

Candidate Sample Location and Field Test Location Maps



0 50 100 200 Feet

1 inch = 100 feet

Data obtained from Cascade Natural Gas Corp.

Source: Puget Sound LiDAR Consortium, Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

Pipeline
- Testing Not Required
- Testing Required

- Planned Test Location (Order #)
- Alternative Test Location
- Dropped Test Location (Order #)
- 51 Pipe Length ID

8" BREMERTON TRANSMISSION LINE #2
PIPE SAMPLING LOT AND PIPE LENGTHS
RANDOMLY SELECTED FOR ABI TESTING

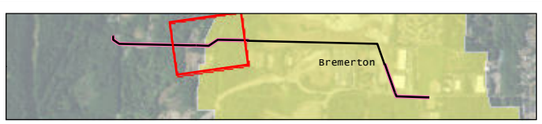
CNGC ASSET MANAGEMENT

0 50 100 200 Feet

1 inch = 100 feet

Source: Puget Sound LiDAR Consortium, Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

Data obtained from Cascade Natural Gas Corp.

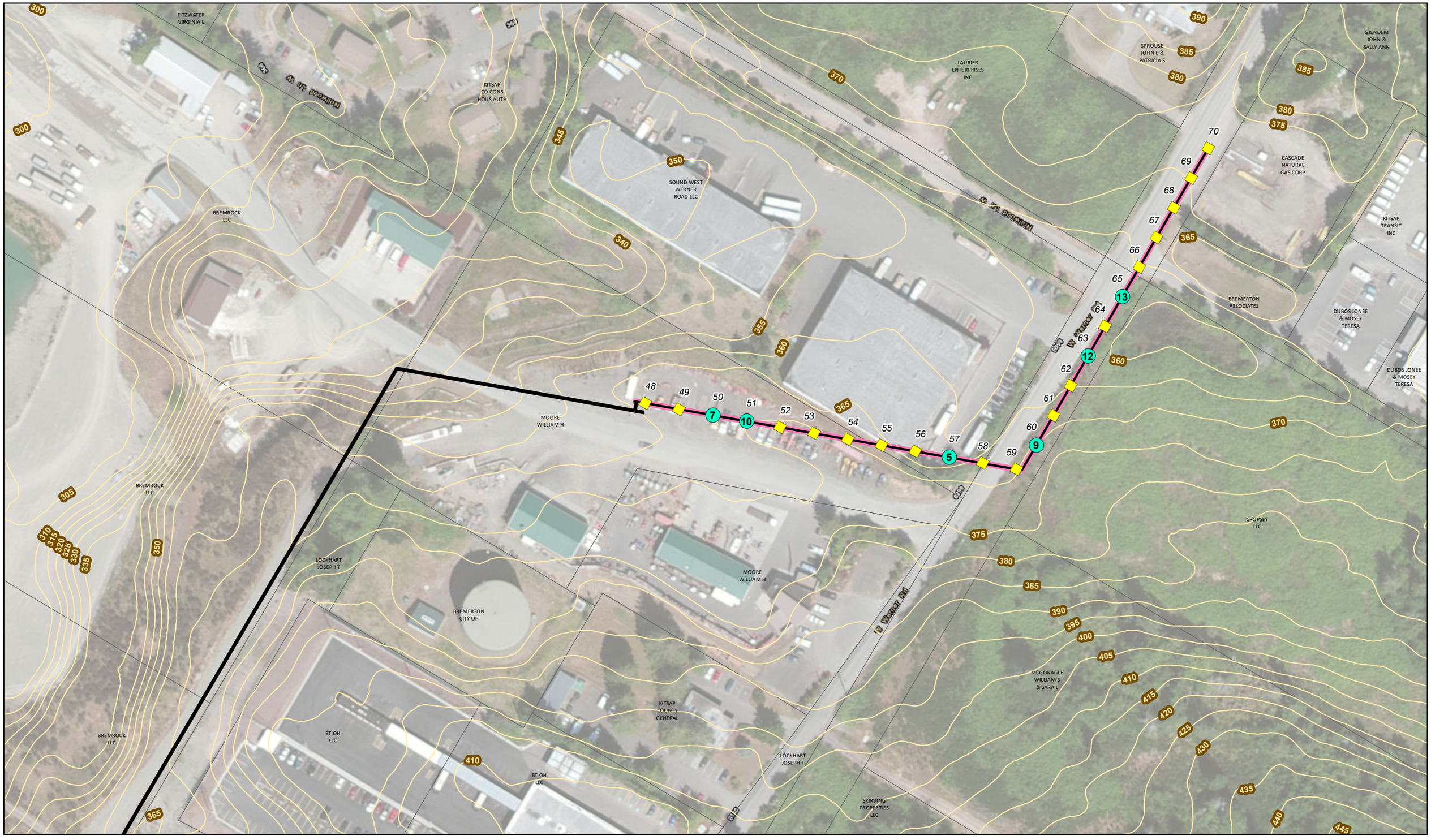


Pipeline
- Testing Not Required
- Testing Required

- Planned Test Location (Order #)
- Alternative Test Location
- Dropped Test Location (Order #)
- 51 Pipe Length ID

8" BREMERTON TRANSMISSION LINE #2
PIPE SAMPLING LOT AND PIPE LENGTHS
RANDOMLY SELECTED FOR ABI TESTING

CNGC ASSET MANAGEMENT



0 50 100 200 Feet

1 inch = 100 feet

Data obtained from Cascade Natural Gas Corp.

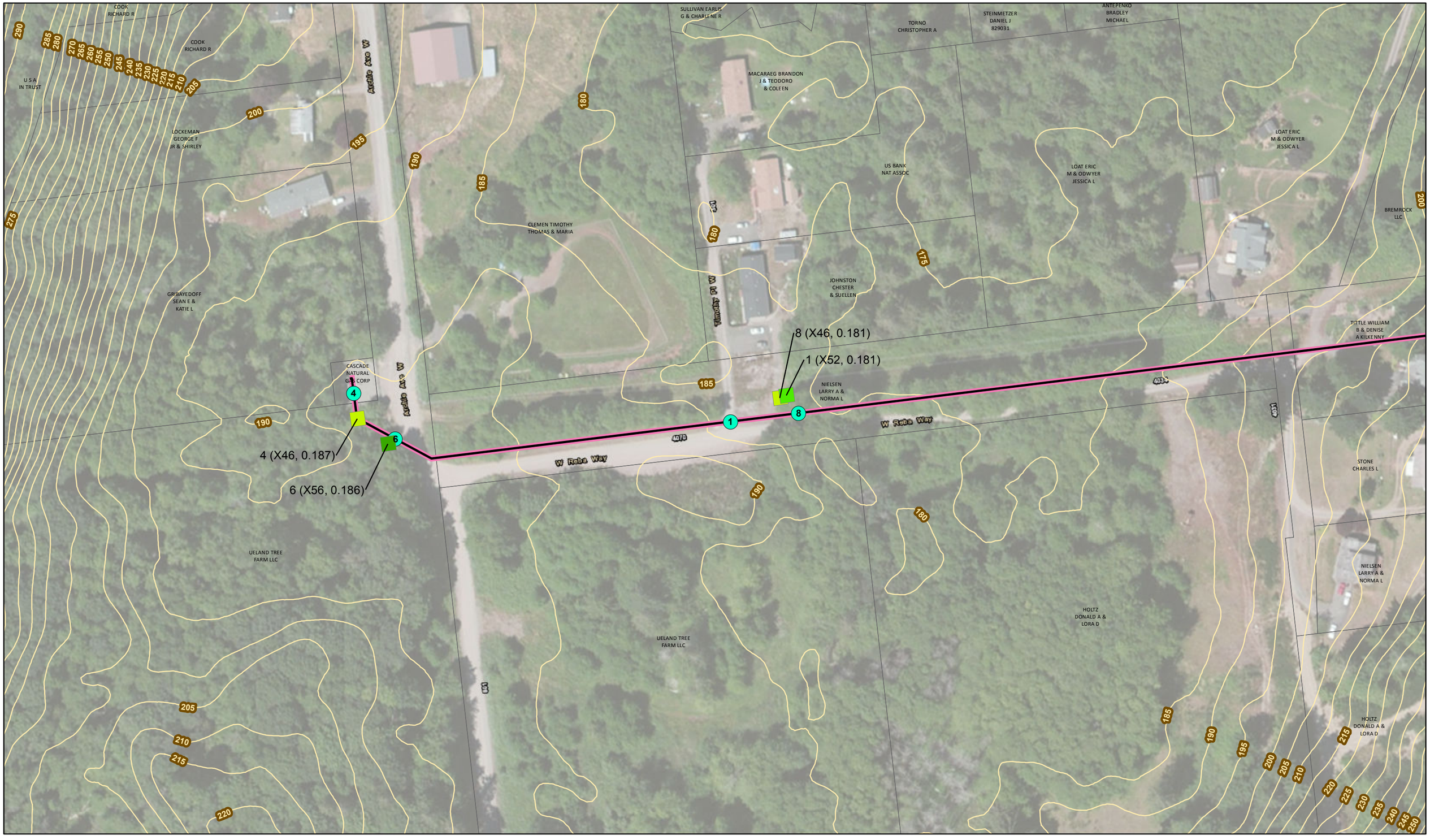
Source: Puget Sound LiDAR Consortium, Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

Pipeline
- Testing Not Required
- Testing Required

- Planned Test Location (Order #)
- Alternative Test Location
- Dropped Test Location (Order #)
- *51* Pipe Length ID

8" BREMERTON TRANSMISSION LINE #2
PIPE SAMPLING LOT AND PIPE LENGTHS
RANDOMLY SELECTED FOR ABI TESTING

CNGC ASSET MANAGEMENT



0 50 100 200 Feet

1 inch = 100 feet

Data obtained from Cascade Natural Gas Corp.

Source: Puget Sound LiDAR Consortium, Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

Pipeline
- Testing Not Required
- Testing Required
- Planned Test Location (Order #)

In-field Test Location (Order #)
- Grade X46
- Grade X52
- Grade X56

8" BREMERTON TRANSMISSION LINE #2
ABI TEST LOCATIONS AND RESULTS

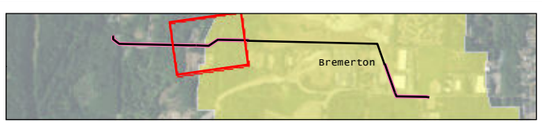
CNGC ASSET MANAGEMENT

0 50 100 200 Feet

1 inch = 100 feet

Data obtained from Cascade Natural Gas Corp.

Source: Puget Sound LiDAR Consortium, Esri, Digitalglobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

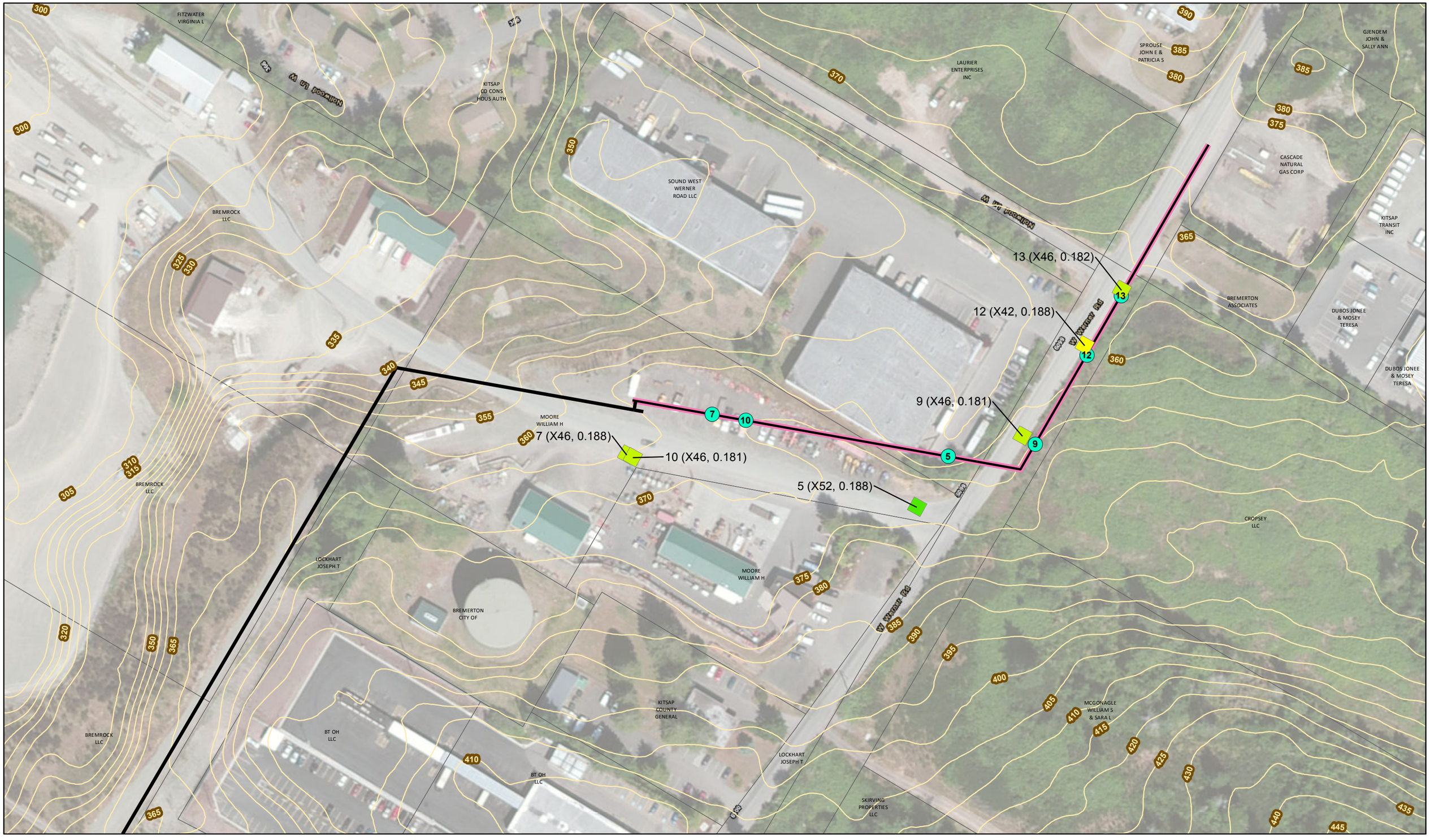


Pipeline
- Testing Not Required
- Testing Required
- Planned Test Location (Order #)

In-field Test Location (Order #)
- Grade X42
- Grade X46
- Grade X52

8" BREMERTON TRANSMISSION LINE #2
ABI TEST LOCATIONS AND RESULTS

CNGC ASSET MANAGEMENT



0 50 100 200 Feet

1 inch = 100 feet

Data obtained from Cascade Natural Gas Corp.

Source: Puget Sound LiDAR Consortium, Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community.

Pipeline
- Testing Not Required
- Testing Required
- Planned Test Location (Order #)

In-field Test Location (Order #)
- Grade X42
- Grade X46
- Grade X52

8" BREMERTON TRANSMISSION LINE #2
ABI TEST LOCATIONS AND RESULTS

Appendix C
Testing Preparation and Coordination

Summary of Landowner and Permit Coordination
8" Bremerton Transmission Line #2

SAMPLE ORDER	PIPE ID	PARCEL ID	OWNER	SITE ADDRESS	JURISDICTION	TYPE	PERMIT APP	TRAFFIC CONTROL PLANS	SUBMITTED	APPROVED	OWNER COORDINATION	PROP OWNER PHONE	COMMENTS
1	13	1156132	LARRY & NORMA NIELSEN	4002 W Reba Way Bremerton, WA 98312	KITSAP	PRIVATE	-	-	-		Chester Johnston theoldone1990@gmail.com 360-689-5210 5/4/2016 AThom	360-689-5210	
2	38	1155977	BREMROCK LLC	PO Box 181 Port Orchard, WA 98366	BREMERTON	PRIVATE	-	-	-		Dean or Debbie. mlh sent e-mail 7/5/2016 Athom	360-479-4626 deanm@gravelpits.com	Please call 2 weeks ahead and talk to Dean or Debbie.
4	1	1156082	CASCADE NATURAL GAS	267 ARCHIE AVE W	KITSAP	PRIVATE	-	-	-			n/a	
5	57	1155522	William Moore	In	BREMERTON	PRIVATE	-	-	-		Business: Cynthia Louden (360)621-2241 clouden@pacifictech.info 5/4/2016 AThom	360-377-3863	Lile Moving and Storage
6	3	1156108	UELAND TREE FARM LLC	267 ARCHIE AVE W (EST)	KITSAP	PRIVATE	-	-	-		mauren.wa@gmail.com (Mark) TN 5/18/16. mlh sent e-mail 7/5/16.	253-307-5900	Email 2 weeks prior to work, Mark Mauren, COO found on company website
7	50	2302982	WILLIAM MOORE	7000 WERNER RD (EST)	BREMERTON	PRIVATE	-	-	-		Manager Dan Ne/Chuck Peterson (360)536-4922 Athom 5/4/2016	206-436-5200	VECA Electric and Technologies
8	15	1156132	LARRY & NORMA NIELSEN	NO ADDRESS FOUND	KITSAP	PRIVATE	-	-	-		Chester Johnston theoldone1990@gmail.com 360-689-5210 5/4/2016 AThom	360-689-5210	
9	60	Existing ROW	Existing ROW	NO ADDRESS FOUND	BREMERTON	ROW	Complete; Submitted to Bremerton CNGC 6/13/2016	Yes, Complete	6/13/2016	6/20/2016		n/a	
10	51	2302982	WILLIAM MOORE	7000 WERNER RD (EST)	BREMERTON	PRIVATE	-	-	-		Manager Dan Ne/Chuck Peterson (360)536-4922 Athom 5/4/2016	206-436-5200	
11	41	1155977	BREMROCK LLC	PO Box 181 Port Orchard, WA 98366	BREMERTON	PRIVATE	-	-	-		Please call 2 weeks ahead and talk to Dean or Debbie. mlh sent e-mail 7/5/2016	360-479-4626 deanm@gravelpits.com	
12	63	Existing ROW	Existing ROW	NO ADDRESS FOUND	BREMERTON	ROW	Complete; Submitted to Bremerton CNGC 6/13/2016	Yes, Complete	6/13/2016	6/20/2016		n/a	
13	65	Existing ROW	Existing ROW	NO ADDRESS FOUND	BREMERTON	ROW	Complete; Submitted to Bremerton CNGC 6/13/2016	Yes, Complete	6/13/2016	6/20/2016		n/a	
15	44	1155977	BREMROCK LLC	PO Box 181 Port Orchard, WA 98366	BREMERTON	PRIVATE	-	-	-		Dean or Debbie. mlh sent e-mail 7/5/2016	360-479-4626 deanm@gravelpits.com	Please call 2 weeks ahead and talk to Dean or Debbie.
16	47	1155977	BREMROCK LLC	PO Box 181 Port Orchard, WA 98366	BREMERTON	PRIVATE	-	-	-		Dean or Debbie. mlh sent e-mail 7/5	360-479-4626 deanm@gravelpits.com	(phone number originally provided was out of service) Please call 2 weeks ahead and talk to Dean or Debbie.

Owner contacted

Appendix D
Parametrix Field Observation Data

ABI Testing Field Observations **CNGC Asset Management**
Parametrix, Inc. **557-2402-014**

Pipeline Segment: 8" Bremerton Transmission Line #2 **Sample Order #:** 1 **Type:** Pipe **ID:** 13

Date: 7/18/2016 **Day of the Week**: Monday **Arrival Time:** 7:00 **Departure Time:** 11:35

Parametrix Observer(s): Rebecca Cushman Amanda Thom

Parcel ID: R201156132200 **Longitude:** 47.55983066 **Latitude:** -122.70896632

Weather: Warm (50-80F) Overcast **Windy?** No **Precip?**

Vegetation Condition: Weeds and blackberry bushes

Soil Condition: Clay **Comments:** NA

Site Access: Drive/walk up

Site Condition: Dry

Das-Co **On site?** Yes **Name:** Greg Sigman

Activities: Expose pipe remove wrap pump water

TCP Required? No **TCP in Place:** No

Groundwater Present? Yes **Depth (inches):** 6 **Dewatering Equipment:** Yes

ABI Services **Test Technician:** Kenneth W. Warner

Test Start Time: 10:45 **Test End Time:** 11:20 **ABIS Test ID:** 8BT2-1-1through 5 **Number of Tests:** 5

Daily Sensor Check: Yes **Test Result:** Good

Weekly Verification Test: Yes **Test Result:** See bump test 7/18/2016

Comments on Test Process: NA

Preliminary Test Results: Y 52.9, SD 1.7; T 77.4, SD 1.3

CNGC, UTC, Others

CNGC on Site: No **Name(s):** NA

Activities: NA

UTC Activities:

Photos

Photo 1 Caption: Pre-test

Photo 2 Caption: ABI testing

Photo 3 Caption: ABI test complete

Photo 4 Caption: ABI test complete

Pipeline Segment: 8" Bremerton Transmission Line #2 **Sample Order #:** 1 **Type:** Pipe **ID:** 13

Test Location Photo:

ABI Testing Field Observations **CNGC Asset Management**
Parametrix, Inc. **557-2402-014**

Pipeline Segment: 8" Bremerton Transmission Line #2 **Sample Order #:** 2 **Type:** Pipe **ID:** 38

Date: 7/19/2016 **Day of the Week**: Tuesday **Arrival Time:** 10:06 **Departure Time:** 10:45

Parametrix Observer(s): Mallory Wilde Rebecca Cushman

Parcel ID: R201155977200 **Longitude:** 47.56005164 **Latitude:** -122.70528075

Weather: Warm (50-80F) Mostly Cloudy **Windy?** No **Precip?**

Vegetation Condition: Scotch room, blackberries, salal, weeds

Soil Condition: Sand **Comments:** Gravel

Site Access: Walk up hill

Site Condition: Dry

Das-Co **On site?** Yes **Name:** Other

Activities: NA

TCP Required? No **TCP in Place:** No

Groundwater Present? No **Depth (inches):** 0 **Dewatering Equipment:** No

---

ABI Services **Test Technician:** Kenneth W. Warner

Test Start Time: 10:11 **Test End Time:** 10:37 **ABIS Test ID:** 8BT2-2-1 through 5 **Number of Tests:** 5

Daily Sensor Check: Yes **Test Result:** Good

Weekly Verification Test: Yes **Test Result:** See bump test 7/18/2016

Comments on Test Process: NA

Preliminary Test Results: Y 46.9, SD 0.7; T 71.0, SD 1.5

CNGC, UTC, Others

CNGC on Site: No **Name(s):** NA

Activities: NA

UTC Activities:

Photos

Photo 1 Caption: Site vicinity

Photo 2 Caption: Closeup

Photo 3 Caption: ABI testing

Photo 4 Caption: Post test site excavation

Pipeline Segment: 8" Bremerton Transmission Line #2 **Sample Order #:** 2 **Type:** Pipe **ID:** 38

Test Location Photo:

ABI Testing Field Observations **CNGC Asset Management**
Parametrix, Inc. **557-2402-014**

Pipeline Segment: 8" Bremerton Transmission Line #2 **Sample Order #:** 4 **Type:** Pipe **ID:** 1

Date: 7/20/2016 **Day of the Week**: Wednesday **Arrival Time:** 8:00 **Departure Time:** 9:37

Parametrix Observer(s): Mallory Miller Rebecca Cushman

Parcel ID: R201156108200 **Longitude:** 47.55991843 **Latitude:** -122.71099406

Weather: Warm (50-80F) Overcast **Windy?** No **Precip?**

Vegetation Condition: Blackberry bushes and weeds

Soil Condition: Sand **Comments:** Clay present at trench bottom

Site Access: Walked in

Site Condition: NA

Das-Co **On site?** Yes **Name:** Calvin Naillonn

Activities: Exposed pipe and removed wrap

TCP Required? No **TCP in Place:** No

Groundwater Present? Yes **Depth (inches):** 2 **Dewatering Equipment:** No

ABI Services **Test Technician:** Kenneth W. Warner

Test Start Time: 8:45 **Test End Time:** 9:30 **ABIS Test ID:** 8BT2-4-1 through 5 **Number of Tests:** 5

Daily Sensor Check: Yes **Test Result:** Good

Weekly Verification Test: Yes **Test Result:** See bump test 7/18/2016

Comments on Test Process: 12:00 Seam weld and some pitting made test challenging

Preliminary Test Results: Y 49.6, SD 3.1; T 80.3, SD 1.9

CNGC, UTC, Others

CNGC on Site: No **Name(s):** NA

Activities: NA

UTC Activities:

Photos

Photo 1 Caption: Site vicinity

Photo 2 Caption: Pre-test

Photo 3 Caption: ABI testing

Photo 4 Caption: ABI test complete

Pipeline Segment: 8" Bremerton Transmission Line #2 **Sample Order #:** 4 **Type:** Pipe **ID:** 1

Test Location Photo:

ABI Testing Field Observations **CNGC Asset Management**
Parametrix, Inc. **557-2402-014**

Pipeline Segment: 8" Bremerton Transmission Line #2 **Sample Order #:** 5 **Type:** Pipe **ID:** 57

Date: 7/20/2016 **Day of the Week**: Wednesday **Arrival Time:** 9:50 **Departure Time:** 10:45

Parametrix Observer(s): Mallory Miller Rebecca Cushman

Parcel ID: R202302982200 **Longitude:** 47.55833176 **Latitude:** -122.69619139

Weather: Warm (50-80F) Clear **Windy?** No **Precip?**

Vegetation Condition: In pavement

Soil Condition: Sand **Comments:** Gravel

Site Access: Drove up to site

Site Condition: Sample in driveway to Port Orchard Sand and Gravel

Das-Co **On site?** Yes **Name:** Other

Activities: Expose pipe and remove wrap on pipe

TCP Required? Yes **TCP in Place:** Yes

Groundwater Present? No **Depth (inches):** 0 **Dewatering Equipment:** No

ABI Services **Test Technician:** Kenneth W. Warner

Test Start Time: 10:15 **Test End Time:** 10:35 **ABIS Test ID:** 8BT2-5-1 through 5 **Number of Tests:** 5

Daily Sensor Check: Yes **Test Result:** Good

Weekly Verification Test: Yes **Test Result:** See bump test 7/18/2016

Comments on Test Process: NA

Preliminary Test Results: Y 54.9, SD 1.9; T 77.6, SD 2.4

CNGC, UTC, Others

CNGC on Site: No **Name(s):** NA

Activities: NA

UTC Activities:

Photos

Photo 1 Caption: Site vicinity

Photo 2 Caption: Pre-test

Photo 3 Caption: ABI testing

Photo 4 Caption: ABI test complete

Pipeline Segment: 8" Bremerton Transmission Line #2 **Sample Order #:** 5 **Type:** Pipe **ID:** 57

Test Location Photo:

ABI Testing Field Observations **CNGC Asset Management**
Parametrix, Inc. **557-2402-014**

Pipeline Segment: 8" Bremerton Transmission Line #2 **Sample Order #:** 6 **Type:** Pipe **ID:** 3

Date: 7/20/2016 **Day of the Week**: Wednesday **Arrival Time:** 12:59 **Departure Time:** 14:20

Parametrix Observer(s): Margaret Spence Mallory Miller

Parcel ID: R201156108200 **Longitude:** 47.55982726 **Latitude:** -122.71086522

Weather: Warm (50-80F) Partly Cloudy **Windy?** No **Precip?**

Vegetation Condition: Brushy access road

Soil Condition: Sand **Comments:** Gravel and clay in bottom

Site Access: Adjacent to gravel road. No issues.

Site Condition: Adjacent to access gate

Das-Co **On site?** Yes **Name:** Calvin Naillonn

Activities: Excavate and remove coating

TCP Required? No **TCP in Place:** No

Groundwater Present? Yes **Depth (inches):** 2 **Dewatering Equipment:** No

ABI Services **Test Technician:** Kenneth W. Warner

Test Start Time: 13:19 **Test End Time:** 13:35 **ABIS Test ID:** 8BT2-6-1 through 5 **Number of Tests:** 5

Daily Sensor Check: Yes **Test Result:** Good

Weekly Verification Test: Yes **Test Result:** See bump test 7/18/2016

Comments on Test Process: No issues

Preliminary Test Results: Y 58.6, SD 0.6; T 81.8, SD 2.5

CNGC, UTC, Others

CNGC on Site: Yes **Name(s):** Kendell Youngblood

Activities: @ 13:30. Talk to utc rep. Talked with dasco (Mike) about brem site backfill/restoration. Asked for copy of email summarizing utc contact. Left 14:10

UTC Activities:

Photos

Photo 1 Caption: Site vicinity

Photo 2 Caption: Pre-test

Photo 3 Caption: ABI testing

Photo 4 Caption: ABI Test complete

Pipeline Segment: 8" Bremerton Transmission Line #2 **Sample Order #:** 6 **Type:** Pipe **ID:** 3

Test Location Photo:

ABI Testing Field Observations **CNGC Asset Management**
Parametrix, Inc. **557-2402-014**

Pipeline Segment: 8" Bremerton Transmission Line #2 **Sample Order #:** 7 **Type:** Pipe **ID:** 50

Date: 7/18/2016 **Day of the Week**: Monday **Arrival Time:** 12:20 **Departure Time:** 13:30

Parametrix Observer(s): Dallas Dimock Rebecca Cushman

Parcel ID: R202302982200 **Longitude:** 47.55921693 **Latitude:** -122.69667356

Weather: Warm (50-80F) Overcast **Windy?** Yes **Precip?**

Vegetation Condition: None.

Soil Condition: Sand **Comments:** NA

Site Access: NA

Site Condition: NA

Das-Co **On site?** No **Name:**

Activities: Excavation and shore box placement

TCP Required? No **TCP in Place:** No

Groundwater Present? No **Depth (inches):** 0 **Dewatering Equipment:** No

---

ABI Services **Test Technician:** Kenneth W. Warner

Test Start Time: 12:43 **Test End Time:** 13:00 **ABIS Test ID:** 8BT2-7-1 through 5 **Number of Tests:** 5

Daily Sensor Check: Yes **Test Result:** Good

Weekly Verification Test: Yes **Test Result:** See bump test 7/18/2016

Comments on Test Process: NA

Preliminary Test Results: Y 49.8, SD 1.7; T 75.1, SD 1.1

CNGC, UTC, Others

CNGC on Site: No **Name(s):** NA

Activities: NA

UTC Activities:

Photos

Photo 1 Caption: Pre-test

Photo 2 Caption: Site vicinity

Photo 3 Caption: ABI testing

Photo 4 Caption: ABI test complete

Pipeline Segment: 8" Bremerton Transmission Line #2 **Sample Order #:** 7 **Type:** Pipe **ID:** 50

Test Location Photo:

ABI Testing Field Observations **CNGC Asset Management**
Parametrix, Inc. **557-2402-014**

Pipeline Segment: 8" Bremerton Transmission Line #2 **Sample Order #:** 8 **Type:** Pipe **ID:** 15

Date: 7/18/2016 **Day of the Week**: Monday **Arrival Time:** 7:00 **Departure Time:** 11:20

Parametrix Observer(s): Rebecca Cushman Amanda Thom

Parcel ID: R201156132200 **Longitude:** 47.55982543 **Latitude:** -122.70899822

Weather: Warm (50-80F) Overcast **Windy?** No **Precip?**

Vegetation Condition: Weeds blackberry bushes

Soil Condition: Clay **Comments:** Clay at bottom.

Site Access: Drive up

Site Condition: Dry hole exposed

Das-Co

On site? Yes **Name:** Greg Sigman

Activities: Dewater, expose pipe, measure pipe wall thickness

TCP Required? No **TCP in Place:** No

Groundwater Present? Yes **Depth (inches):** 6 **Dewatering Equipment:** Yes

ABI Services

Test Technician: Kenneth W. Warner

Test Start Time: 10:15 **Test End Time:** 10:40 **ABIS Test ID:** 8BT2-8-1 through 5 **Number of Tests:** 5

Daily Sensor Check: Yes **Test Result:** Good

Weekly Verification Test: Yes **Test Result:** See bump test 7/18/2016

Comments on Test Process: NA

Preliminary Test Results: Y 52.9

CNGC, UTC, Others

CNGC on Site: No **Name(s):** NA

Activities: NA

UTC Activities:

Photos

Photo 1 Caption: Pre-test

Photo 2 Caption: To 8 and 1. Weld present

Photo 3 Caption: ABI testing

Photo 4 Caption: ABI test complete

Pipeline Segment: 8" Bremerton Transmission Line #2 **Sample Order #:** 8 **Type:** Pipe **ID:** 15

Test Location Photo:

ABI Testing Field Observations **CNGC Asset Management**
Parametrix, Inc. **557-2402-014**

Pipeline Segment: 8" Bremerton Transmission Line #2 **Sample Order #:** 9 **Type:** Pipe **ID:** 60

Date: 7/19/2016 **Day of the Week**: Tuesday **Arrival Time:** 13:12 **Departure Time:** 14:00

Parametrix Observer(s): Rebecca Cushman Mallory Wilde

Parcel ID: R20ROW1340200 **Longitude:** 47.55815576 **Latitude:** -122.69564906

Weather: Warm (50-80F) Mostly Cloudy **Windy?** No **Precip?**

Vegetation Condition: Pavement

Soil Condition: Sand **Comments:** Gravel

Site Access: Drive up

Site Condition: Dry

Das-Co **On site?** No **Name:**

Activities: NA

TCP Required? Yes **TCP in Place:** Yes

Groundwater Present? No **Depth (inches):** 0 **Dewatering Equipment:** No

---

ABI Services **Test Technician:** Kenneth W. Warner

Test Start Time: 13:20 **Test End Time:** 13:55 **ABIS Test ID:** 8BT2-9-1 through 5 **Number of Tests:** 5

Daily Sensor Check: Yes **Test Result:** Good

Weekly Verification Test: Yes **Test Result:** See bump test 7/18/2016

Comments on Test Process: NA

Preliminary Test Results: Y 50.0, SD 1.3; T 73.1, SD 1.4

CNGC, UTC, Others

CNGC on Site: No **Name(s):** NA

Activities: NA

UTC Activities:

Photos

Photo 1 Caption: Site vicinity

Photo 2 Caption: Pre-test

Photo 3 Caption: ABI testing

Photo 4 Caption: NA

Pipeline Segment: 8" Bremerton Transmission Line #2 **Sample Order #:** 9 **Type:** Pipe **ID:** 60

Test Location Photo:

ABI Testing Field Observations **CNGC Asset Management**
Parametrix, Inc. **557-2402-014**

Pipeline Segment: 8" Bremerton Transmission Line #2 **Sample Order #:** 10 **Type:** Pipe **ID:** 51

Date: 7/18/2016 **Day of the Week**: Monday **Arrival Time:** 12:20 **Departure Time:** 13:30

Parametrix Observer(s): Dallas Dimock Rebecca Cushman

Parcel ID: R202302982200 **Longitude:** 47.55919659 **Latitude:** -122.69666939

Weather: Warm (50-80F) Overcast **Windy?** Yes **Precip?**

Vegetation Condition: None. Gravel

Soil Condition: Sand **Comments:** NA

Site Access: NA

Site Condition: NA

Das-Co **On site?** No **Name:** Greg Sigman

Activities: Excavation and shore box placement

TCP Required? No **TCP in Place:** No

Groundwater Present? No **Depth (inches):** 0 **Dewatering Equipment:** No

---

ABI Services **Test Technician:** Kenneth W. Warner

Test Start Time: 13:05 **Test End Time:** 13:25 **ABIS Test ID:** 8BT2-10-1 through 5 **Number of Tests:** 5

Daily Sensor Check: Yes **Test Result:** Good

Weekly Verification Test: Yes **Test Result:** See bump test 7/18/2016

Comments on Test Process: NA

Preliminary Test Results: Y 49.7, SD 1.7; T 72.7, SD 1.8

CNGC, UTC, Others

CNGC on Site: No **Name(s):** NA

Activities: NA

UTC Activities:

Photos

Photo 1 Caption: Pre-test

Photo 2 Caption: Site vicinity

Photo 3 Caption: ABI testing

Photo 4 Caption: ABI test complete

Pipeline Segment: 8" Bremerton Transmission Line #2 **Sample Order #:** 10 **Type:** Pipe **ID:** 51

Test Location Photo:

ABI Testing Field Observations **CNGC Asset Management**
Parametrix, Inc. **557-2402-014**

Pipeline Segment: 8" Bremerton Transmission Line #2 **Sample Order #:** 11 **Type:** Pipe **ID:** 41

Date: 7/19/2016 **Day of the Week**: Tuesday **Arrival Time:** 9:15 **Departure Time:** 10:00

Parametrix Observer(s): Mallory Wilde Rebecca Cushman

Parcel ID: R201155977200 **Longitude:** 47.56007476 **Latitude:** -122.70479756

Weather: Warm (50-80F) Mostly Cloudy **Windy?** No **Precip?**

Vegetation Condition: Scotch broom, salal, blackberry

Soil Condition: Sand **Comments:** Gravel

Site Access: Walk up hill

Site Condition: Dry

Das-Co

On site? Yes **Name:** Other

Activities: NA

TCP Required? No **TCP in Place:** No

Groundwater Present? No **Depth (inches):** 0 **Dewatering Equipment:** No

ABI Services

Test Technician: Kenneth W. Warner

Test Start Time: 9:25 **Test End Time:** 9:55 **ABIS Test ID:** 8BT2-11-1 through 5 **Number of Tests:** 5

Daily Sensor Check: Yes **Test Result:** Good

Weekly Verification Test: Yes **Test Result:** See bump test 7/18/2016

Comments on Test Process: NA

Preliminary Test Results: Y 48.1, SD 1.8; T 73.6, SD 2.6

CNGC, UTC, Others

CNGC on Site: No **Name(s):** NA

Activities: NA

UTC Activities:

Photos

Photo 1 Caption: Site vicinity

Photo 2 Caption: Closeup

Photo 3 Caption: ABI testing

Photo 4 Caption: ABI test complete

Pipeline Segment: 8" Bremerton Transmission Line #2 **Sample Order #:** 11 **Type:** Pipe **ID:** 41

Test Location Photo:

ABI Testing Field Observations **CNGC Asset Management**
Parametrix, Inc. **557-2402-014**

Pipeline Segment: 8" Bremerton Transmission Line #2 **Sample Order #:** 12 **Type:** Pipe **ID:** 63

Date: 7/19/2016 **Day of the Week**: Tuesday **Arrival Time:** 11:19 **Departure Time:** 12:10

Parametrix Observer(s): Mallory Wilde Rebecca Cushman

Parcel ID: R20ROW1340200 **Longitude:** 47.55813059 **Latitude:** -122.69513139

Weather: Warm (50-80F) Partly Cloudy **Windy?** No **Precip?**

Vegetation Condition: None. In street

Soil Condition: Gravel **Comments:** Clay

Site Access: In street

Site Condition: Dry.

Das-Co **On site?** Yes **Name:** Calvin Naillonn

Activities: NA

TCP Required? Yes **TCP in Place:** Yes

Groundwater Present? No **Depth (inches):** 0 **Dewatering Equipment:** No

ABI Services **Test Technician:** Kenneth W. Warner

Test Start Time: 11:25 **Test End Time:** 12:05 **ABIS Test ID:** 8BT2-12-1 through 5 **Number of Tests:** 5

Daily Sensor Check: Yes **Test Result:** Good

Weekly Verification Test: Yes **Test Result:** See bump test 7/18/2016

Comments on Test Process: NA

Preliminary Test Results: Y 46.0, SD 1.0; T 68.6, SD 1.4

CNGC, UTC, Others

CNGC on Site: No **Name(s):** NA

Activities: NA

UTC Activities:

Photos

Photo 1 Caption: Site vicinity

Photo 2 Caption: Closeup

Photo 3 Caption: ABI testing

Photo 4 Caption: Post test vicinity

Pipeline Segment: 8" Bremerton Transmission Line #2 **Sample Order #:** 12 **Type:** Pipe **ID:** 63

Test Location Photo:

ABI Testing Field Observations **CNGC Asset Management**
Parametrix, Inc. **557-2402-014**

Pipeline Segment: 8" Bremerton Transmission Line #2 **Sample Order #:** 13 **Type:** Pipe **ID:** 65

Date: 7/18/2016 **Day of the Week**: Monday **Arrival Time:** 15:00 **Departure Time:** 16:00

Parametrix Observer(s): Dallas Dimock Rebecca Cushman

Parcel ID: R20ROW1340200 **Longitude:** 47.55811793 **Latitude:** -122.69481739

Weather: Warm (50-80F) Overcast **Windy?** No **Precip?**

Vegetation Condition: None. Test point is in road

Soil Condition: Sand **Comments:** NA

Site Access: NA

Site Condition: NA

Das-Co

On site? No **Name:**

Activities: Excavate and place shore box

TCP Required? Yes **TCP in Place:** Yes

Groundwater Present? No **Depth (inches):** 0 **Dewatering Equipment:** No

ABI Services

Test Technician: Kenneth W. Warner

Test Start Time: 15:20 **Test End Time:** 15:40 **ABIS Test ID:** 8BT2-13-1 through 5 **Number of Tests:** 5

Daily Sensor Check: Yes **Test Result:** Good

Weekly Verification Test: Yes **Test Result:** See bump test 7/18/2016

Comments on Test Process: NA

Preliminary Test Results: Y 48.5, SD 0.6; T 72.5, SD 1.0

CNGC, UTC, Others

CNGC on Site: Yes **Name(s):** Kendell Youngblood

Activities: Observing the testing. Asking how the visit with Dennis from the UTC went. Asked what info we are taking down in our field form. Asked Wayne about the testing procedure.

UTC Activities:

Photos

Photo 1 Caption: Site vicinity

Photo 2 Caption: Pre-test

Photo 3 Caption: ABI testing

Photo 4 Caption: ABI test complete

Pipeline Segment: 8" Bremerton Transmission Line #2 **Sample Order #:** 13 **Type:** Pipe **ID:** 65

Test Location Photo:

ABI Testing Field Observations **CNGC Asset Management**
Parametrix, Inc. **557-2402-014**

Pipeline Segment: 8" Bremerton Transmission Line #2 **Sample Order #:** 15 **Type:** Pipe **ID:** 44

Date: 7/19/2016 **Day of the Week**: Tuesday **Arrival Time:** 7:00 **Departure Time:** 8:45

Parametrix Observer(s): Rebecca Cushman Mallory Wilde

Parcel ID: R201155977200 **Longitude:** 47.56005426 **Latitude:** -122.70433739

Weather: Warm (50-80F) Mostly Cloudy **Windy?** No **Precip?**

Vegetation Condition: Scotch room, weeds, blackberry bushes

Soil Condition: Sand **Comments:** NA

Site Access: Walk down hill to site

Site Condition: Dry

Das-Co **On site?** Yes **Name:** Other

Activities: Remove wrap

TCP Required? No **TCP in Place:** No

Groundwater Present? No **Depth (inches):** 0 **Dewatering Equipment:** No

ABI Services **Test Technician:** Kenneth W. Warner

Test Start Time: 8:15 **Test End Time:** 8:39 **ABIS Test ID:** 8BT2-15-1 through 5 **Number of Tests:** 5

Daily Sensor Check: Yes **Test Result:** Good

Weekly Verification Test: Yes **Test Result:** See bump test 7/18/2016

Comments on Test Process: NA

Preliminary Test Results: Y 48.1, SD 1.0; T 71.9, SD 1.1

CNGC, UTC, Others

CNGC on Site: No **Name(s):** NA

Activities: NA

UTC Activities:

Photos

Photo 1 Caption: Pre-test

Photo 2 Caption: Closeup

Photo 3 Caption: ABI testing

Photo 4 Caption: ABI test complete

Pipeline Segment: 8" Bremerton Transmission Line #2 **Sample Order #:** 15 **Type:** Pipe **ID:** 44

Test Location Photo:

ABI Testing Field Observations **CNGC Asset Management**
Parametrix, Inc. **557-2402-014**

Pipeline Segment: 8" Bremerton Transmission Line #2 **Sample Order #:** 16 **Type:** Pipe **ID:** 47

Date: 7/18/2016 **Day of the Week**: Monday **Arrival Time:** 16:05 **Departure Time:** 16:55

Parametrix Observer(s): Amanda Thom Rebecca Cushman

Parcel ID: R201155977200 **Longitude:** 47.56004843 **Latitude:** -122.70386673

Weather: Warm (50-80F) Overcast **Windy?** No **Precip?**

Vegetation Condition: Scotch broom, weeds, blackberry bushes

Soil Condition: Sand **Comments:** NA

Site Access: Drive from equipment yard to top of hill

Site Condition: Dry

Das-Co **On site?** No **Name:**

Activities: NA

TCP Required? No **TCP in Place:** No

Groundwater Present? No **Depth (inches):** 0 **Dewatering Equipment:** No

ABI Services **Test Technician:** Kenneth W. Warner

Test Start Time: 16:15 **Test End Time:** 16:47 **ABIS Test ID:** 8BT2-16-1 through 5 **Number of Tests:** 5

Daily Sensor Check: Yes **Test Result:** Good

Weekly Verification Test: Yes **Test Result:** See bump test 7/18/2016

Comments on Test Process: NA

Preliminary Test Results: Y 50.1, SD 1.1; T 75.3, SD 1.3

CNGC, UTC, Others

CNGC on Site: No **Name(s):** NA

Activities: NA

UTC Activities:

Photos

Photo 1 Caption: Site vicinity looking NE

Photo 2 Caption: Pre-test

Photo 3 Caption: ABI testing

Photo 4 Caption: ABI test complete

Pipeline Segment: 8" Bremerton Transmission Line #2 **Sample Order #:** 16 **Type:** Pipe **ID:** 47

Test Location Photo:

ABI Testing Field Observations **CNGC Asset Management**
Parametrix, Inc. **557-2402-014**

Pipeline Segment: 8" Bremerton Transmission Line #2 **Sample Order #:** 0 **Type:** Bump **ID:** 0

Date: 7/18/2016 **Day of the Week**: Monday **Arrival Time:** 8:00 **Departure Time:**

Parametrix Observer(s): Rebecca Cushman

Parcel ID: R201156132200 **Longitude:** 47.55966837 **Latitude:** -122.70972935

Weather: Warm (50-80F) Overcast **Windy?** No **Precip?**

Vegetation Condition: N/A

Soil Condition: N/A **Comments:** NA

Site Access: Back of truck

Site Condition: N/A

Das-Co

On site? No **Name:**

Activities:

TCP Required? No **TCP in Place:** No

Groundwater Present? No **Depth (inches):** 0 **Dewatering Equipment:** No

ABI Services

Test Technician: Kenneth W. Warner

Test Start Time: **Test End Time:** **ABIS Test ID:** Bump **Number of Tests:** 0

Daily Sensor Check: Yes **Test Result:** Good

Weekly Verification Test: Yes **Test Result:** Bump Test

Comments on Test Process: NA

Preliminary Test Results: 1018 steel plate: Yield 49.0 KSI, Tensile 65.8 KSI

CNGC, UTC, Others

CNGC on Site: No **Name(s):** NA

Activities:

UTC Activities:

Photos

Photo 1 Caption: Bump test

Photo 2 Caption: NA

Photo 3 Caption: NA

Photo 4 Caption: NA

Pipeline Segment: 8" Bremerton Transmission Line #2 **Sample Order #:** 0 **Type:** Bump **ID:** 0

Test Location Photo:

Appendix E
ABI Services Test Reports

Table of Contents

ABI Services, LLC
253 Midway Ln
Oak Ridge, TN 37830 USA
T: 1.865.483.5756 | F: 1.865.483.5860
abiservices-usa.com | info@abiservices-usa.com

Cascade Natural Gas Company
A Subsidiary of MDU Resources Group, Inc.
8113 Grandridge Blvd, Kennewick, WA 99336
Attention: Jeremy Ogden

July 27, 2016
SOW # CNGC-1601
Prepared by: Fahmy Haggag

REPORT # ABIS/CNGC/BREMERTON07272016

In-Situ Measurements of Tensile and Fracture Toughness Properties of Pipelines near Bremerton, WA, Using the *Automated Ball Indentation® (ABI®)* Technique

SUMMARY

The goal of this project was to measure nondestructively the tensile and fracture toughness properties at 14 locations on 8" pipeline joints near Bremerton, WA. The *ABI®* technique was used to conduct five *ABI®* tests on the base metal at each of the 14 pipe joints. The details of the *ABI* test results are provided in this report with detailed tabulation and overlay graphs of test data and results.

Based on the *ABI*-measured average yield strength (YS) minus one standard deviation and the *ABI*-measured ultimate tensile strength (UTS) minus one standard deviation the test locations qualify as the following grades according to the minimum YS and UTS values specified in the API 5L Specification, 45th Ed, July 1, 2013.

Test Location # 8BT2-1	Grade X52
Test Location # 8BT2-2	Grade X42
Test Location # 8BT2-4	Grade X46
Test Location # 8BT2-5	Grade X52
Test Location # 8BT2-6	Grade X56
Test Location # 8BT2-7	Grade X46
Test Location # 8BT2-8	Grade X46
Test Location # 8BT2-9	Grade X46
Test Location # 8BT2-10	Grade X46
Test Location # 8BT2-11	Grade X42
Test Location # 8BT2-12	Grade X42
Test Location # 8BT2-13	Grade X46
Test Location # 8BT2-15	Grade X46
Test Location # 8BT2-16	Grade X46

Note: These grade values represent only the joints tested. The MAOP of the entire line is based on the joint/bend/fitting with the lowest grade (lowest SMYS for that particular grade).

**Stress Strain Microprobe®, SSM™, Automated Ball Indentation®*, and *ABI®* are the property of Fahmy Haggag and are used with permission.

TEST PROCEDURE

The background of the *Stress-Strain Microprobe®* (SSM) system and its *Automated Ball Indentation®* (*ABI®*) test techniques are given in Appendix A. The details of ATC's standard test methods for measuring tensile and fracture toughness properties are given in Appendices B and C, respectively.

The ***ABI* test is a direct measurement mechanical test** that is considered nondestructive because it does not remove any material and only leaves a shallow/smooth spherical depression (i.e., no sharp edges or stress-concentration sites). Furthermore, the *ABI* test leaves a compressive residual stress that retards crack initiation. Each *ABI* test is very similar to a single shot peen, albeit slightly larger. The *Automated Ball Indentation® (ABI®)* test technique was invented and developed by Fahmy Haggag of Advanced Technology Corporation (ATC) in 1989 and is used by all of ABIS' *Stress-Strain Microprobe® (SSM™)* systems.

Multiple *ABI®* tests were conducted on the base metal at each test location. All tests were performed using a 0.030-inch (0.762-mm) diameter tungsten carbide indenter at an indenter speed of 0.0008-in/s (0.02 mm/s).

The *ABI*-measured yield strength (σ_y) in ksi units is calculated from Equation 11 given in Table 1 of Appendix B and is shown again below:

$$\sigma_y = \beta_m * A + B$$

The yield strength slope (β_m) and offset (B) for pipeline steels are 0.376 and -32.5 ksi, respectively (PRCI Report L52280, April 2007).

The minimum yield strength (YS) and ultimate tensile strength (UTS) values specified in the API 5L Specification for the pipeline grades (given below in Table 1) are used in the grade determination of the pipe sections based on the test results obtained from multiple in-situ *ABI®* tests conducted on each joint.

RESULTS

The tensile and fracture toughness properties were determined from each *ABI®* test. Summaries of the *ABI*-measured properties in English units are given in Tables 2-15 (with average and standard deviation values for each test location).

Overlay graphs of indentation force-depth data, true-stress versus true-plastic-strain curves, and yield strength calculation plots of the multiple *ABI* tests conducted at each of the pipe test locations are shown in Figures 1 through 14. Photos of site locations are shown in Figures 15 through 26.

Table 1 Requirements for Tensile Test Results for PSL 1 pipe specified in the API 5L Specification, 45th Ed, July 1, 2013

Pipe Grade	Yield Strength Minimum		Tensile Strength Minimum	
	PSI	MPa	PSI	MPa
A25	25,400	175	45,000	310
A	30,500	210	48,600	335
B	35,500	245	60,200	415
X42	42,100	290	60,200	415
X46	46,400	320	63,100	435
X52	52,200	360	66,700	460
X56	56,600	390	71,100	490
X60	60,200	415	75,400	520
X65	65,300	450	77,600	535
X70	70,300	485	82,700	570

Table 2: Summary of *ABI* Test Results for Location 8BT2-1

Select Files | Test Data Only | English Units | Exit

ABI-Measured Tensile & Fracture Toughness Summary

Print | Output File

Test Name	Yield Strength (A,β) [ksi]	Strength Coefficient (K) [ksi]	Strain Hardening Exponent (n)	Engineering UTS [ksi]	Calculated Uniform Ductility [%]	Ratio Yield to UTS	Fracture Toughness (ksi*in^0.5)
8BT2-1-1	53.8	112.4	0.118	77.6	13.9	0.69	185.0
8BT2-1-2	53.8	111.4	0.117	77.1	13.9	0.70	186.1
8BT2-1-3	55.3	113.0	0.115	78.6	11.1	0.70	186.9
8BT2-1-4	54.2	107.8	0.111	75.6	11.0	0.72	184.6
8BT2-1-5	53.9	108.0	0.112	75.6	11.1	0.71	184.3
Average	54.2	110.5	0.115	76.9	12.2	0.70	185.4
Std.Dev.	0.64	2.46	0.0030	1.30	1.55	0.011	1.09

Table 3: Summary of *ABI* Test Results for Location 8BT2-2

Select Files | Test Data Only | English Units | Exit

ABI-Measured Tensile & Fracture Toughness Summary

Print | Output File

Test Name	Yield Strength (A,β) [ksi]	Strength Coefficient (K) [ksi]	Strain Hardening Exponent (n)	Engineering UTS [ksi]	Calculated Uniform Ductility [%]	Ratio Yield to UTS	Fracture Toughness (ksi*in^0.5)
8BT2-2-1	46.2	106.0	0.133	70.9	14.1	0.65	178.5
8BT2-2-2	46.7	107.1	0.133	71.8	14.2	0.65	179.7
8BT2-2-3	48.0	108.2	0.130	72.8	14.1	0.66	180.6
8BT2-2-4	47.1	100.5	0.122	68.7	14.1	0.69	176.3
8BT2-2-5	46.7	104.8	0.129	70.6	14.1	0.66	180.1
Average	46.9	105.3	0.129	71.0	14.1	0.66	179.0
Std.Dev.	0.67	2.98	0.0045	1.53	0.04	0.016	1.72

Table 4: Summary of *ABI* Test Results for Location 8BT2-4

Select Files | Test Data Only | English Units | Exit

ABI-Measured Tensile & Fracture Toughness Summary

Print | Output File

Test Name	Yield Strength (A,β) [ksi]	Strength Coefficient (K) [ksi]	Strain Hardening Exponent (n)	Engineering UTS [ksi]	Calculated Uniform Ductility [%]	Ratio Yield to UTS	Fracture Toughness (ksi*in^0.5)
8BT2-4-1	47.5	119.2	0.147	77.6	13.8	0.61	180.8
8BT2-4-2	47.3	123.6	0.152	79.7	13.7	0.59	183.0
8BT2-4-3	53.1	119.2	0.130	80.3	13.8	0.66	185.2
8BT2-4-4	52.9	123.9	0.135	82.5	13.7	0.64	187.0
8BT2-4-5	47.1	127.9	0.158	81.6	13.8	0.58	185.1
Average	49.6	122.8	0.144	80.3	13.8	0.62	184.2
Std.Dev.	3.13	3.67	0.0117	1.88	0.05	0.034	2.38

Table 5: Summary of *ABI* Test Results for Location 8BT2-5

Select Files | Test Data Only | English Units | Exit

ABI-Measured Tensile & Fracture Toughness Summary

Print | Output File

Test Name	Yield Strength (A,β) [ksi]	Strength Coefficient (K) [ksi]	Strain Hardening Exponent (n)	Engineering UTS [ksi]	Calculated Uniform Ductility [%]	Ratio Yield to UTS	Fracture Toughness (ksi*in^0.5)
8BT2-5-1	54.7	104.9	0.106	74.4	10.8	0.74	181.7
8BT2-5-2	55.0	109.3	0.111	76.6	10.9	0.72	184.7
8BT2-5-3	57.1	111.9	0.109	78.9	10.9	0.72	186.3
8BT2-5-4	55.5	117.4	0.120	80.8	13.9	0.69	187.8
8BT2-5-5	52.0	113.9	0.125	77.4	14.0	0.67	185.7
Average	54.9	111.5	0.114	77.6	12.1	0.71	185.2
Std.Dev.	1.85	4.72	0.0080	2.41	1.69	0.028	2.28

Table 6: Summary of *ABI* Test Results for Location 8BT2-6

Select Files | Test Data Only | English Units | Exit

ABI-Measured Tensile & Fracture Toughness Summary

Print | Output File

Test Name	Yield Strength (A,β) [ksi]	Strength Coefficient (K) [ksi]	Strain Hardening Exponent (n)	Engineering UTS [ksi]	Calculated Uniform Ductility [%]	Ratio Yield to UTS	Fracture Toughness (ksi*in^0.5)
8BT2-6-1	59.2	117.6	0.110	82.6	11.0	0.72	189.0
8BT2-6-2	59.3	109.1	0.099	78.6	10.6	0.75	186.0
8BT2-6-3	58.3	119.7	0.115	83.1	13.8	0.70	189.1
8BT2-6-4	57.8	113.5	0.109	79.9	10.8	0.72	185.6
8BT2-6-5	58.5	122.6	0.118	84.8	13.8	0.69	192.5
Average	58.6	116.5	0.110	81.8	12.0	0.72	188.4
Std.Dev.	0.63	5.30	0.0073	2.51	1.65	0.023	2.80

Table 7: Summary of *ABI* Test Results for Location 8BT2-7

Select Files | Test Data Only | English Units | Exit

ABI-Measured Tensile & Fracture Toughness Summary

Print | Output File

Test Name	Yield Strength (A,β) [ksi]	Strength Coefficient (K) [ksi]	Strain Hardening Exponent (n)	Engineering UTS [ksi]	Calculated Uniform Ductility [%]	Ratio Yield to UTS	Fracture Toughness (ksi*in^0.5)
8BT2-7-1	49.0	111.7	0.132	75.0	14.0	0.65	183.2
8BT2-7-2	50.1	115.0	0.133	77.0	14.0	0.65	183.4
8BT2-7-3	47.3	111.7	0.137	74.2	14.1	0.64	181.3
8BT2-7-4	51.3	109.7	0.122	75.0	13.9	0.68	180.6
8BT2-7-5	51.5	108.0	0.119	74.3	14.0	0.69	181.2
Average	49.8	111.2	0.129	75.1	14.0	0.66	181.9
Std.Dev.	1.74	2.62	0.0077	1.13	0.07	0.022	1.27

Table 8: Summary of *ABI* Test Results for Location 8BT2-8

Select Files | Test Data Only | English Units | Exit

ABI-Measured Tensile & Fracture Toughness Summary

Print | Output File

Test Name	Yield Strength (A,β) [ksi]	Strength Coefficient (K) [ksi]	Strain Hardening Exponent (n)	Engineering UTS [ksi]	Calculated Uniform Ductility [%]	Ratio Yield to UTS	Fracture Toughness (ksi*in^0.5)
8BT2-8-1	52.5	112.4	0.122	76.9	14.0	0.68	183.2
8BT2-8-2	51.2	111.6	0.125	76.0	14.0	0.67	182.1
8BT2-8-3	51.5	112.4	0.125	76.5	13.9	0.67	184.3
8BT2-8-4	53.8	114.4	0.121	78.5	13.9	0.69	187.2
8BT2-8-5	55.4	113.9	0.116	79.0	13.8	0.70	185.8
Average	52.9	112.9	0.122	77.4	13.9	0.68	184.5
Std.Dev.	1.74	1.17	0.0037	1.30	0.08	0.013	2.03

Table 9: Summary of *ABI* Test Results for Location 8BT2-9

Select Files | Test Data Only | English Units | Exit

ABI-Measured Tensile & Fracture Toughness Summary

Print | Output File

Test Name	Yield Strength (A,β) [ksi]	Strength Coefficient (K) [ksi]	Strain Hardening Exponent (n)	Engineering UTS [ksi]	Calculated Uniform Ductility [%]	Ratio Yield to UTS	Fracture Toughness (ksi*in^0.5)
8BT2-9-1	49.4	109.6	0.127	74.2	14.0	0.67	181.3
8BT2-9-2	51.7	106.7	0.117	73.9	14.0	0.70	182.8
8BT2-9-3	51.2	105.4	0.116	73.0	14.0	0.70	180.5
8BT2-9-4	48.6	103.4	0.122	70.8	14.0	0.69	179.0
8BT2-9-5	49.3	108.6	0.127	73.7	14.0	0.67	180.6
Average	50.0	106.7	0.122	73.1	14.0	0.69	180.8
Std.Dev.	1.34	2.48	0.0053	1.37	0.00	0.015	1.38

Table 10: Summary of *ABI* Test Results for Location 8BT2-10

Select Files | Test Data Only | English Units | Exit

ABI-Measured Tensile & Fracture Toughness Summary

Print | Output File

Test Name	Yield Strength (A,β) [ksi]	Strength Coefficient (K) [ksi]	Strain Hardening Exponent (n)	Engineering UTS [ksi]	Calculated Uniform Ductility [%]	Ratio Yield to UTS	Fracture Toughness (ksi*in^0.5)
8BT2-10-1	49.1	103.2	0.120	71.0	14.1	0.69	178.4
8BT2-10-2	50.3	104.6	0.118	72.2	14.0	0.70	179.8
8BT2-10-3	49.1	103.7	0.120	71.3	14.0	0.69	179.1
8BT2-10-4	47.7	112.2	0.136	74.6	14.0	0.64	182.2
8BT2-10-5	52.2	107.8	0.117	74.6	13.9	0.70	182.1
Average	49.7	106.3	0.122	72.7	14.0	0.68	180.3
Std.Dev.	1.68	3.75	0.0078	1.75	0.07	0.025	1.74

Table 11: Summary of *ABI* Test Results for Location 8BT2-11

Select Files | Test Data Only | English Units | Exit

ABI-Measured Tensile & Fracture Toughness Summary

Print | Output File

Test Name	Yield Strength (A,β) [ksi]	Strength Coefficient (K) [ksi]	Strain Hardening Exponent (n)	Engineering UTS [ksi]	Calculated Uniform Ductility [%]	Ratio Yield to UTS	Fracture Toughness (ksi*in^0.5)
8BT2-11-1	46.3	106.0	0.133	70.9	14.0	0.65	177.1
8BT2-11-2	48.6	112.0	0.134	74.9	13.9	0.65	182.7
8BT2-11-3	47.0	105.5	0.131	71.0	14.0	0.66	177.2
8BT2-11-4	47.6	111.9	0.137	74.4	14.0	0.64	181.2
8BT2-11-5	51.0	113.9	0.128	77.0	14.0	0.66	185.4
Average	48.1	109.9	0.133	73.6	14.0	0.65	180.7
Std.Dev.	1.83	3.84	0.0034	2.64	0.04	0.008	3.59

Table 12: Summary of *ABI* Test Results for Location 8BT2-12

Select Files | Test Data Only | English Units | Exit

ABI-Measured Tensile & Fracture Toughness Summary

Print | Output File

Test Name	Yield Strength (A,β) [ksi]	Strength Coefficient (K) [ksi]	Strain Hardening Exponent (n)	Engineering UTS [ksi]	Calculated Uniform Ductility [%]	Ratio Yield to UTS	Fracture Toughness (ksi*in^0.5)
8BT2-12-1	46.4	104.3	0.130	70.3	14.0	0.66	178.3
8BT2-12-2	44.5	100.9	0.132	67.7	14.1	0.66	175.9
8BT2-12-3	45.8	99.1	0.125	67.5	14.1	0.68	175.3
8BT2-12-4	47.3	97.8	0.118	67.6	14.1	0.70	176.4
8BT2-12-5	46.0	103.7	0.130	69.8	14.1	0.66	177.2
Average	46.0	101.2	0.127	68.6	14.1	0.67	176.6
Std.Dev.	1.02	2.82	0.0057	1.36	0.04	0.018	1.17

Table 13: Summary of *ABI* Test Results for Location 8BT2-13

Select Files | Test Data Only | English Units | Exit

ABI-Measured Tensile & Fracture Toughness Summary

Print | Output File

Test Name	Yield Strength (A,β) [ksi]	Strength Coefficient (K) [ksi]	Strain Hardening Exponent (n)	Engineering UTS [ksi]	Calculated Uniform Ductility [%]	Ratio Yield to UTS	Fracture Toughness (ksi*in^0.5)
8BT2-13-1	48.4	109.3	0.130	73.6	14.1	0.66	182.5
8BT2-13-2	49.0	108.7	0.128	73.6	14.1	0.67	182.7
8BT2-13-3	48.3	106.1	0.126	72.0	14.1	0.67	180.6
8BT2-13-4	49.1	104.7	0.122	71.7	14.1	0.68	179.2
8BT2-13-5	47.7	106.0	0.128	71.7	14.1	0.67	181.2
Average	48.5	107.0	0.127	72.5	14.1	0.67	181.2
Std.Dev.	0.57	1.95	0.0030	0.99	0.00	0.007	1.44

Table 14: Summary of *ABI* Test Results for Location 8BT2-15

Select Files | Test Data Only | English Units | Exit

ABI-Measured Tensile & Fracture Toughness Summary

Print | Output File

Test Name	Yield Strength (A,β) [ksi]	Strength Coefficient (K) [ksi]	Strain Hardening Exponent (n)	Engineering UTS [ksi]	Calculated Uniform Ductility [%]	Ratio Yield to UTS	Fracture Toughness (ksi*in^0.5)
8BT2-15-1	46.9	105.9	0.131	71.2	14.0	0.66	177.0
8BT2-15-2	47.3	110.9	0.136	73.8	14.0	0.64	181.0
8BT2-15-3	49.3	104.7	0.121	71.8	14.0	0.69	177.8
8BT2-15-4	48.7	104.5	0.123	71.4	14.0	0.68	177.5
8BT2-15-5	48.4	104.2	0.124	71.1	14.0	0.68	177.4
Average	48.1	106.0	0.127	71.9	14.0	0.67	178.1
Std.Dev.	1.00	2.79	0.0063	1.12	0.00	0.020	1.62

Table 15: Summary of *ABI* Test Results for Location 8BT2-16

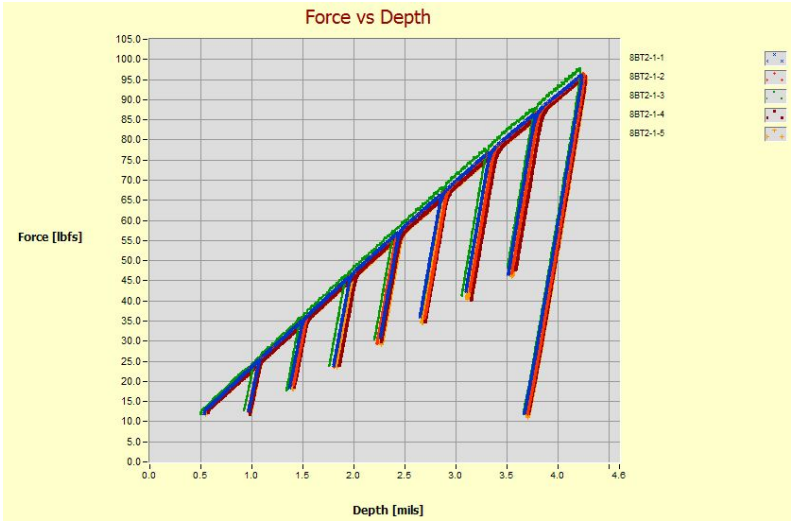
Select Files | Test Data Only | English Units | Exit

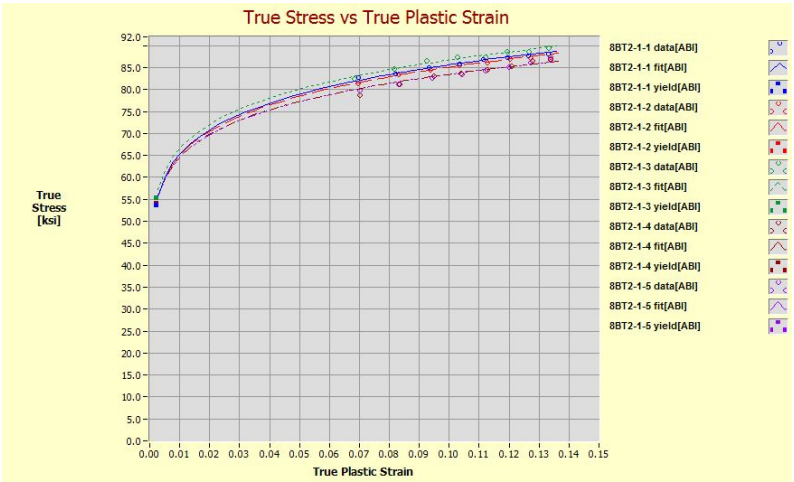
ABI-Measured Tensile & Fracture Toughness Summary

Print | Output File

Test Name	Yield Strength (A,β) [ksi]	Strength Coefficient (K) [ksi]	Strain Hardening Exponent (n)	Engineering UTS [ksi]	Calculated Uniform Ductility [%]	Ratio Yield to UTS	Fracture Toughness (ksi*in^0.5)
8BT2-16-1	48.4	110.5	0.133	74.0	13.9	0.65	178.3
8BT2-16-2	49.8	114.2	0.133	76.5	13.9	0.65	183.1
8BT2-16-3	51.3	113.6	0.128	76.9	13.8	0.67	182.3
8BT2-16-4	50.4	109.7	0.125	74.6	13.8	0.68	178.8
8BT2-16-5	50.4	109.0	0.124	74.3	13.8	0.68	179.7
Average	50.1	111.4	0.129	75.3	13.8	0.67	180.4
Std.Dev.	1.07	2.35	0.0043	1.34	0.05	0.015	2.14

Fig. 1: Overlays of *ABI* force-depth data, true-stress versus true-plastic-strain curves, and yield strength calculation plots for Location 8BT2-1





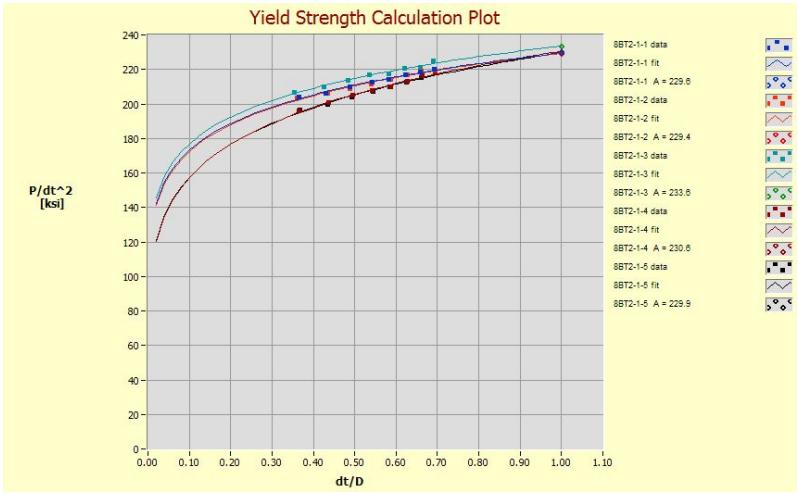
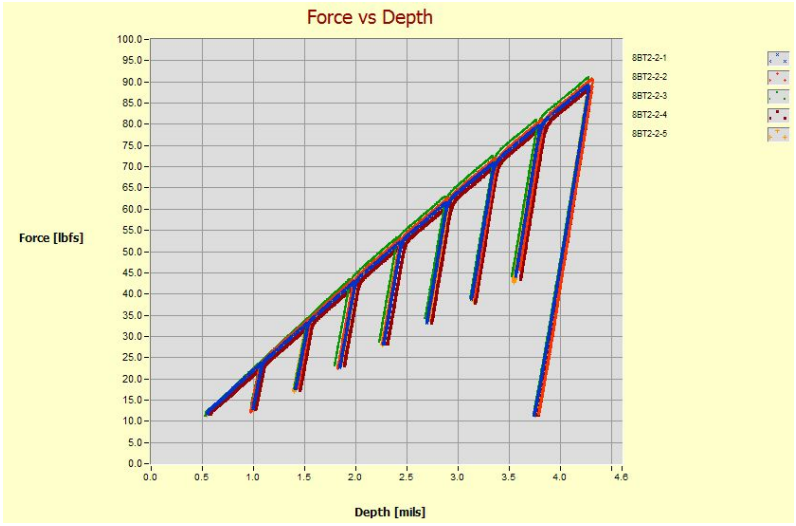
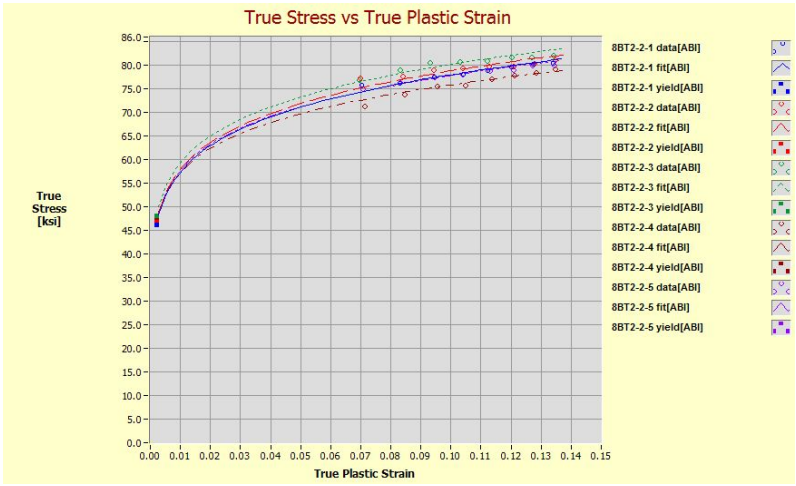


Fig. 2: Overlays of *ABI* force-depth data, true-stress versus true-plastic-strain curves, and yield strength calculation plots for Location 8BT2-2





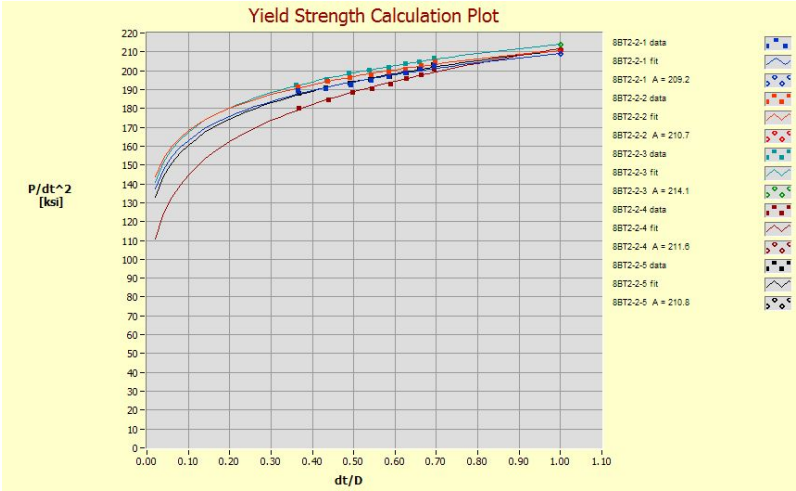
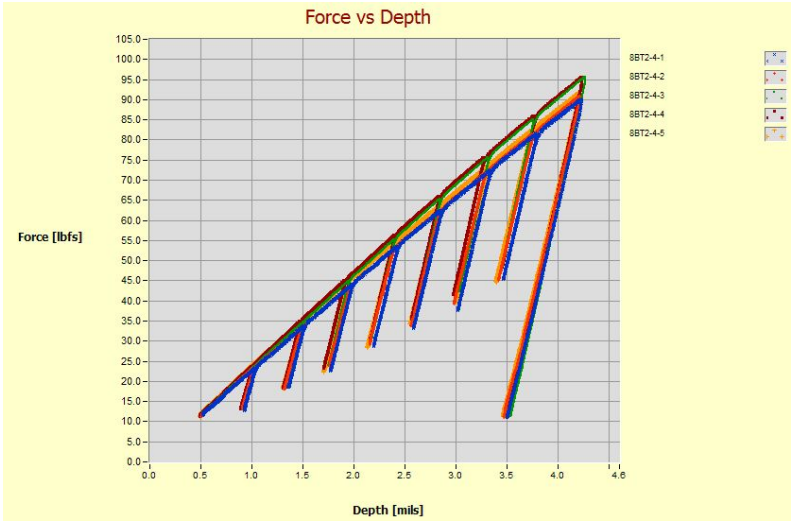
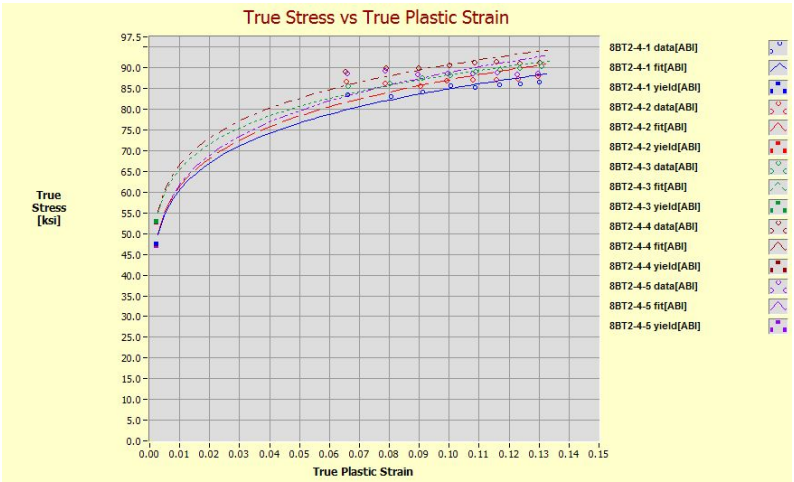


Fig. 3: Overlays of *ABI* force-depth data, true-stress versus true-plastic-strain curves, and yield strength calculation plots for Location 8BT2-4





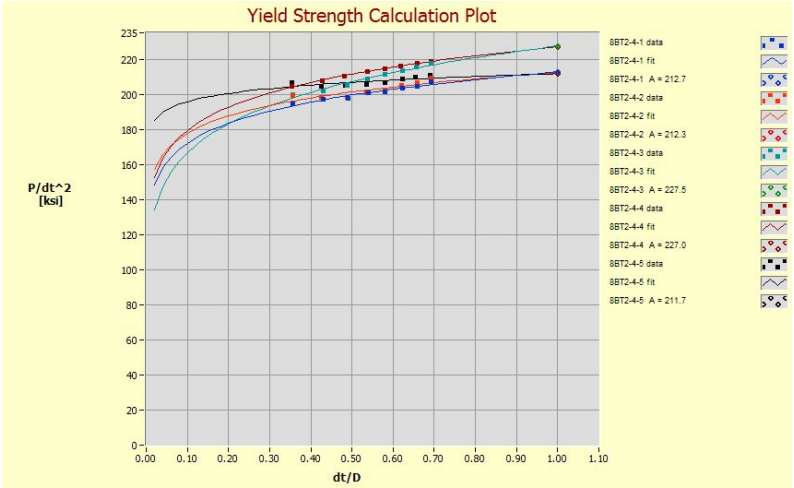
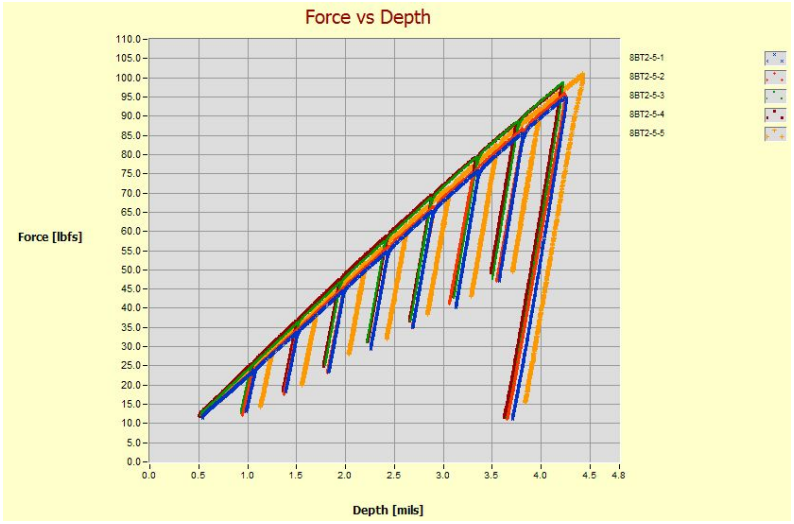
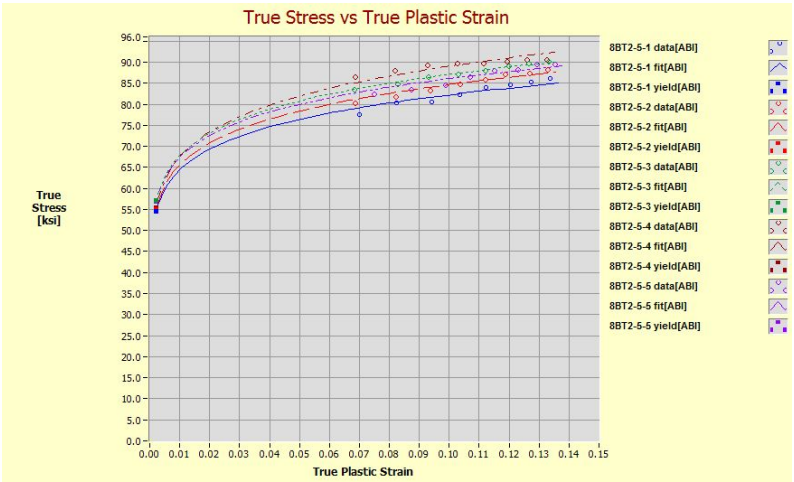


Fig. 4: Overlays of *ABI* force-depth data, true-stress versus true-plastic-strain curves, and yield strength calculation plots for Location 8BT2-5





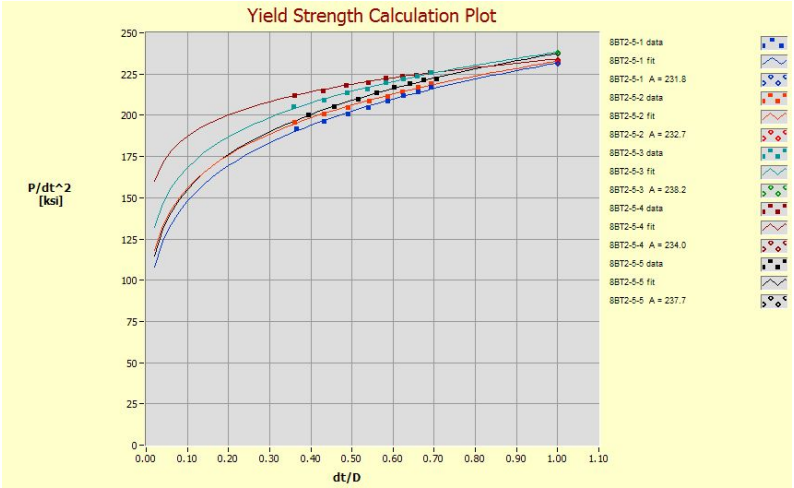
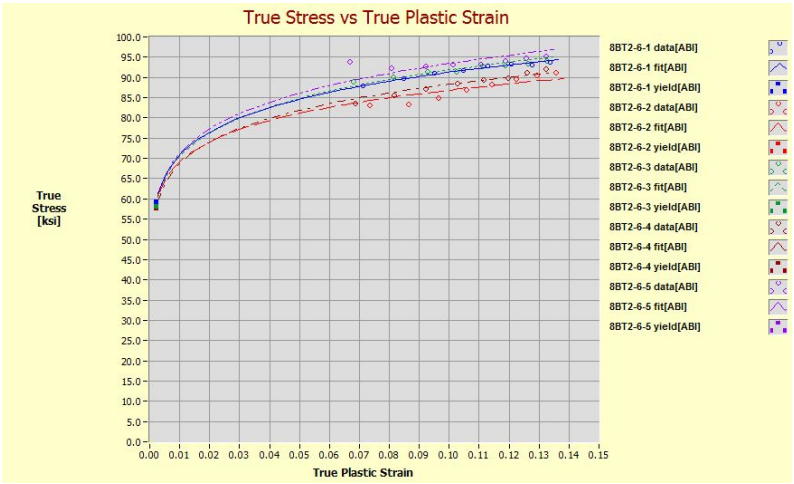


Fig. 5: Overlays of *ABI* force-depth data, true-stress versus true-plastic-strain curves, and yield strength calculation plots for Location 8BT2-6



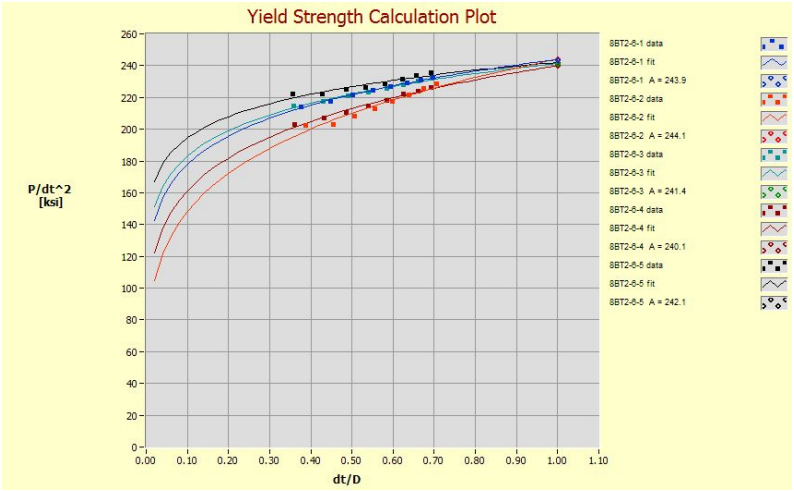
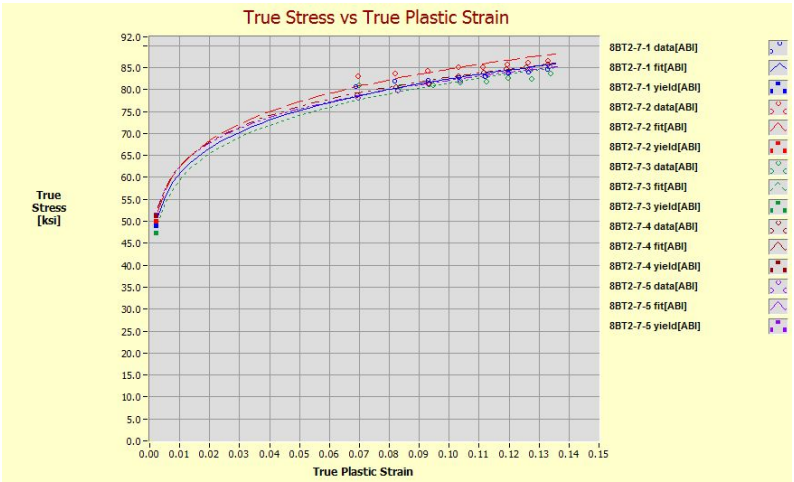


Fig. 6: Overlays of *ABI* force-depth data, true-stress versus true-plastic-strain curves, and yield strength calculation plots for Location 8BT2-7



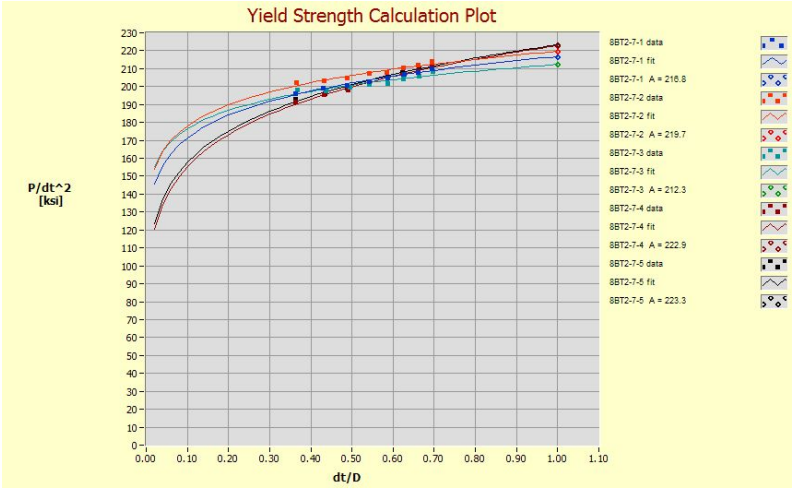
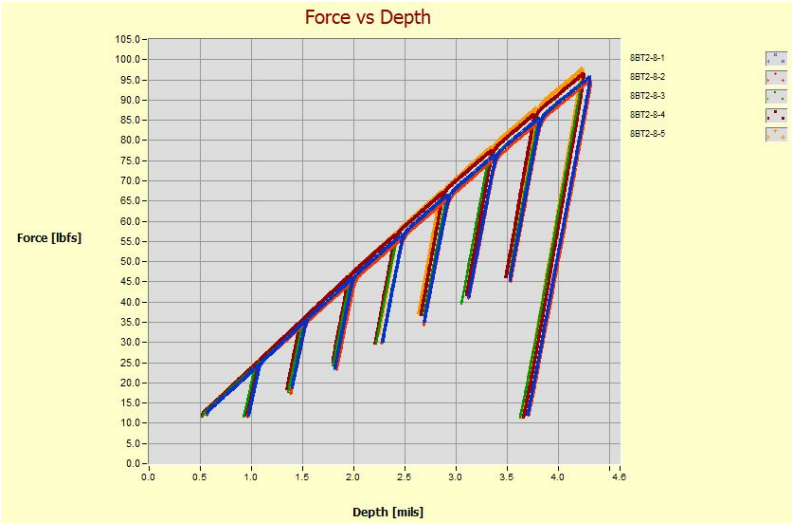
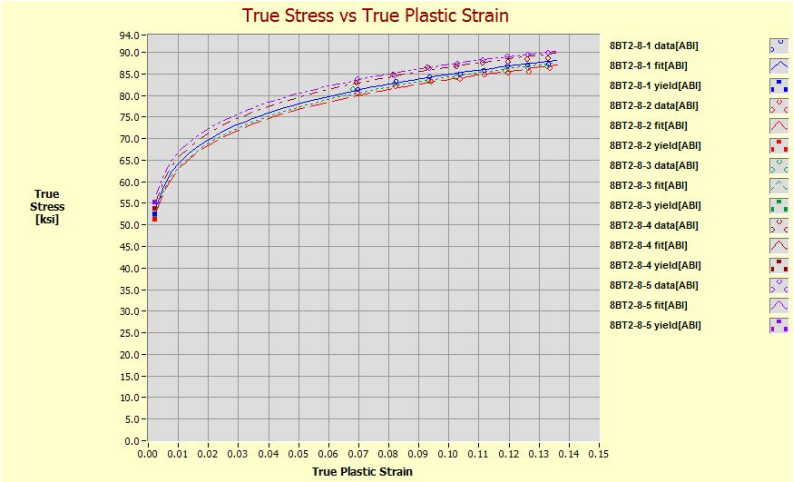


Fig. 7: Overlays of *ABI* force-depth data, true-stress versus true-plastic-strain curves, and yield strength calculation plots for Location 8BT2-8





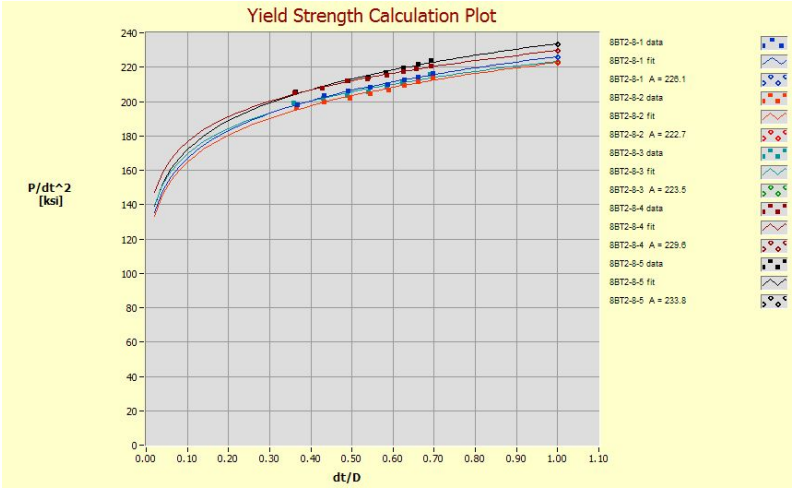
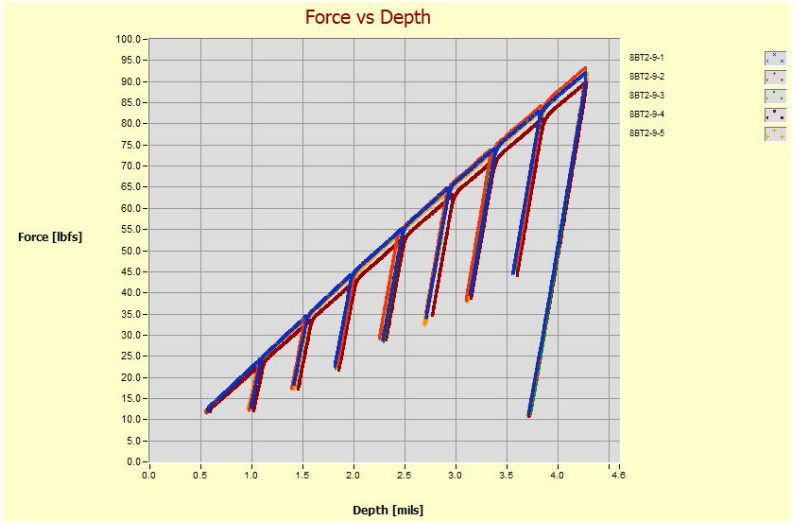
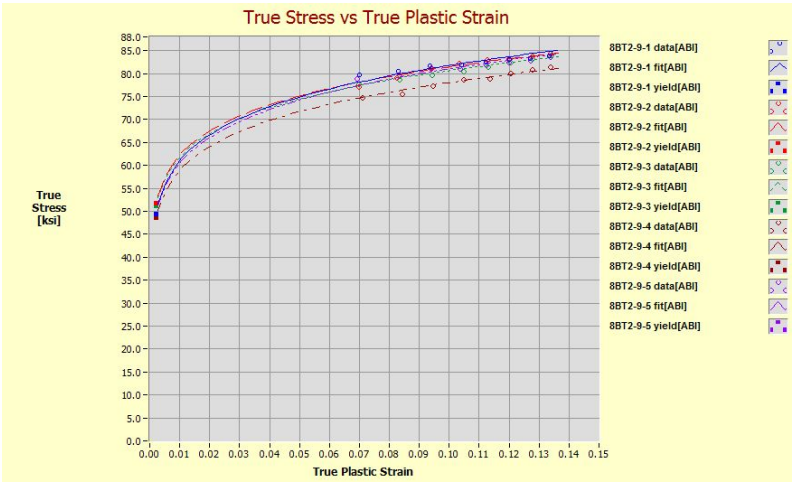


Fig. 8: Overlays of *ABI* force-depth data, true-stress versus true-plastic-strain curves, and yield strength calculation plots for Location 8BT2-9





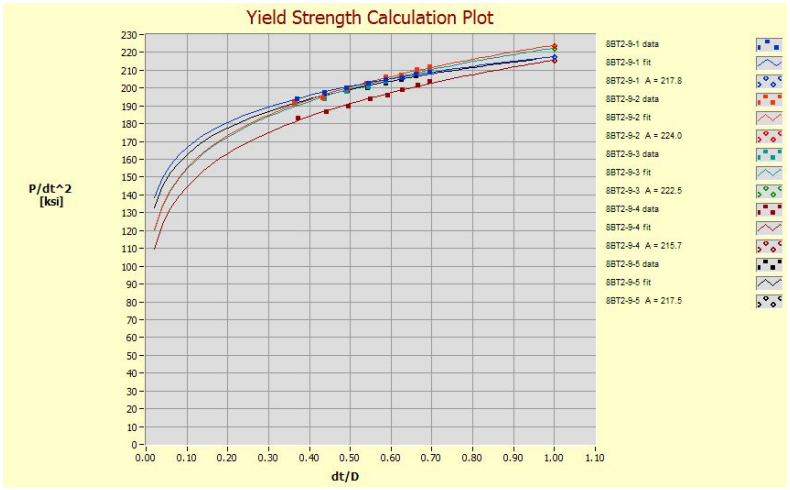
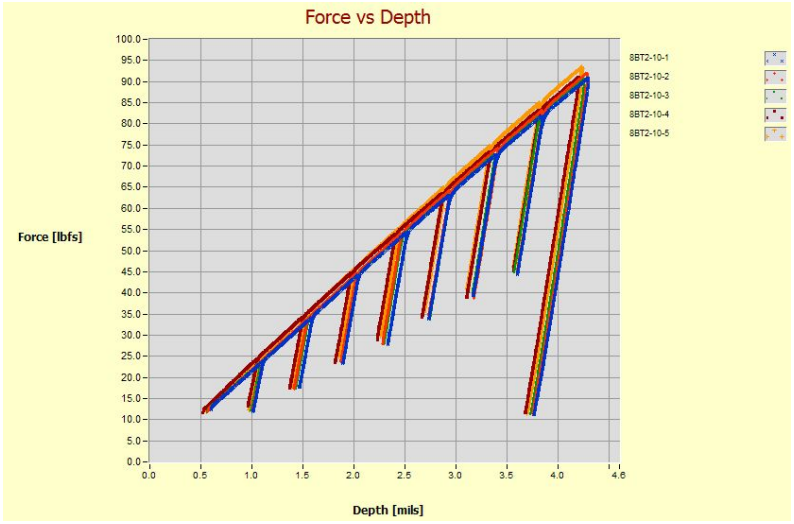
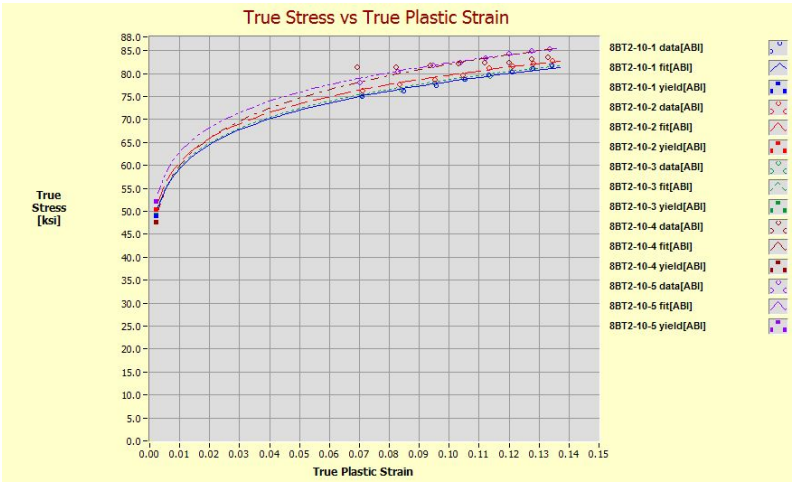


Fig. 9: Overlays of *ABI* force-depth data, true-stress versus true-plastic-strain curves, and yield strength calculation plots for Location 8BT2-10





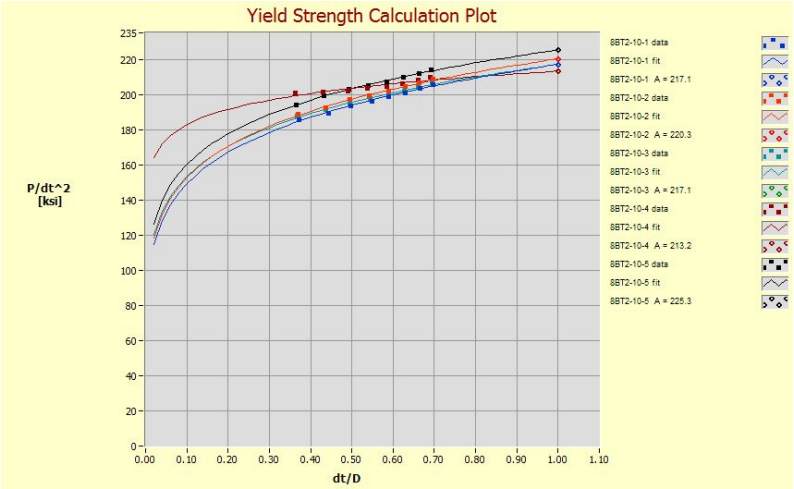
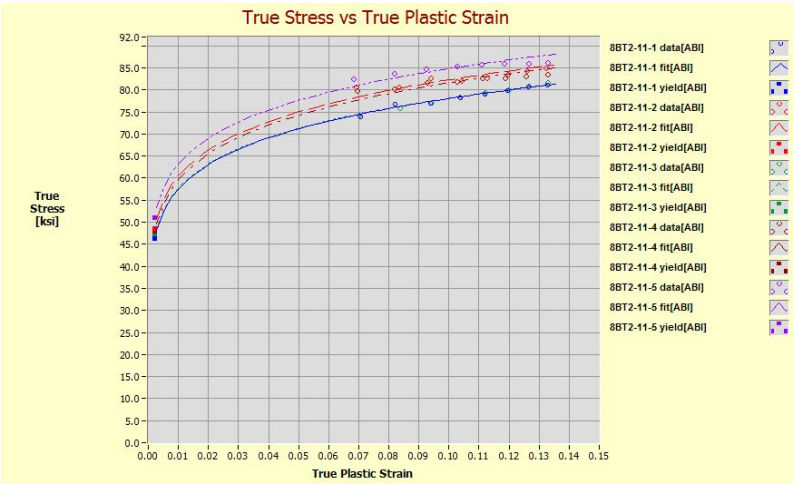


Fig. 10: Overlays of *ABI* force-depth data, true-stress versus true-plastic-strain curves, and yield strength calculation plots for Location 8BT2-11



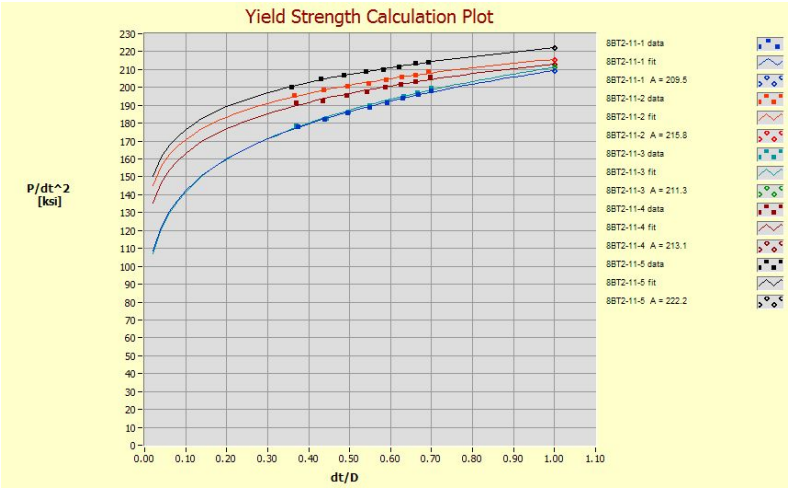
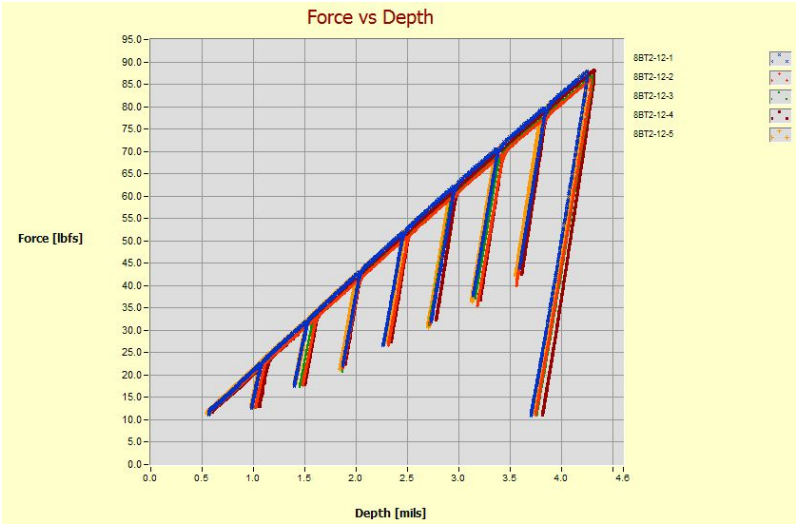
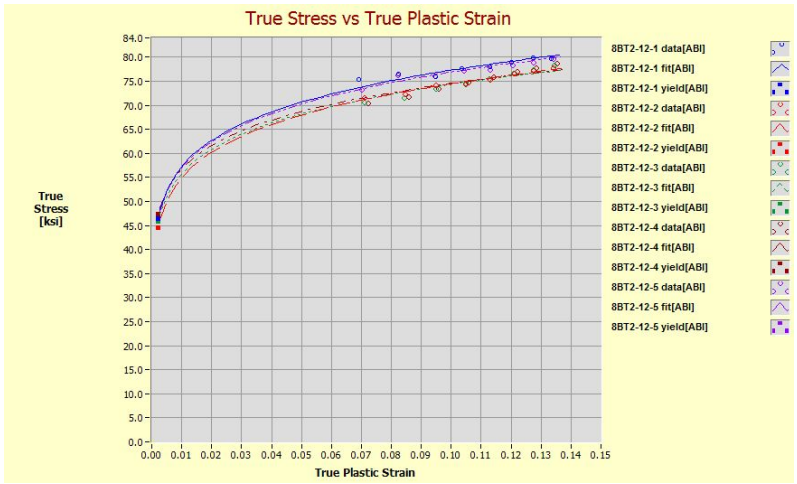


Fig. 11: Overlays of *ABI* force-depth data, true-stress versus true-plastic-strain curves, and yield strength calculation plots for Location 8BT2-12





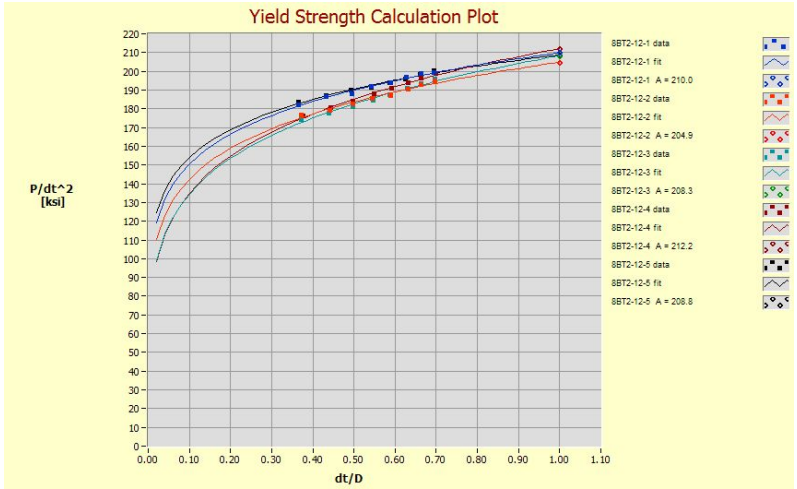
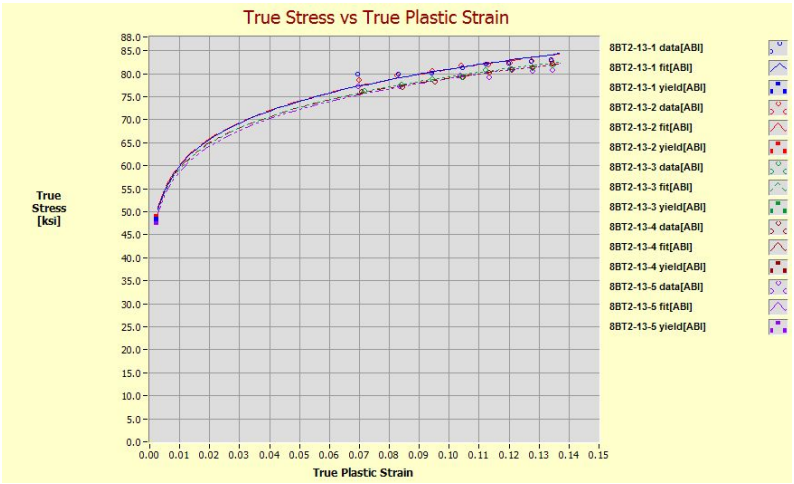


Fig. 12: Overlays of *ABI* force-depth data, true-stress versus true-plastic-strain curves, and yield strength calculation plots for Location 8BT2-13



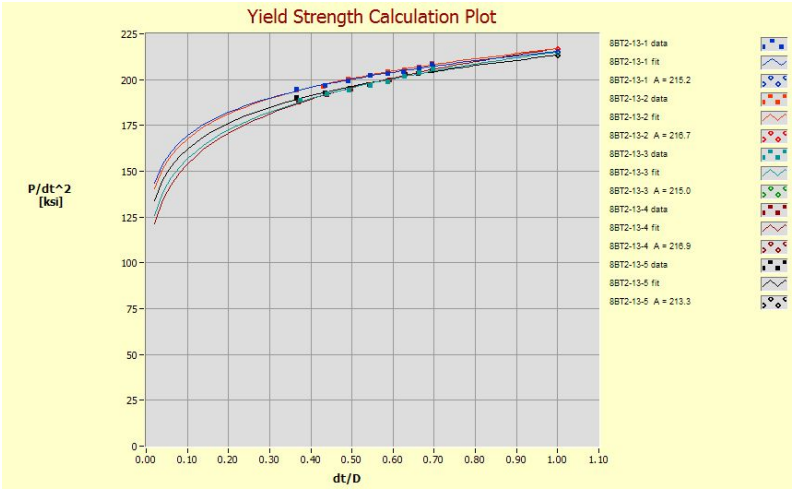
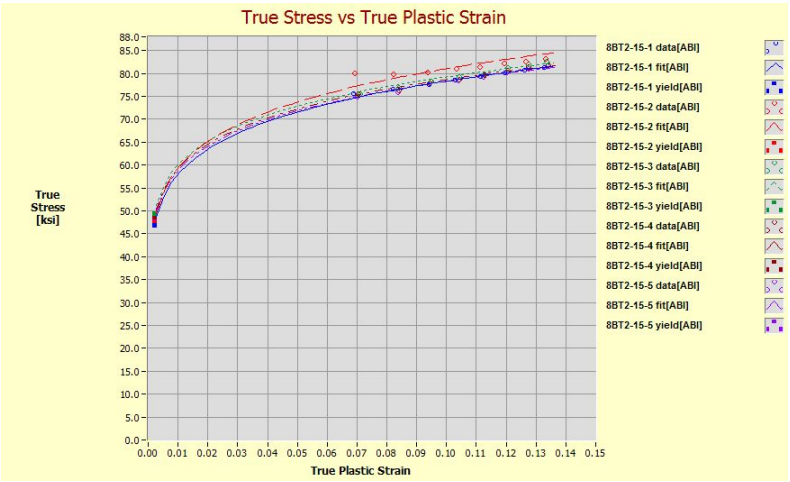


Fig. 13: Overlays of *ABI* force-depth data, true-stress versus true-plastic-strain curves, and yield strength calculation plots for Location 8BT2-15



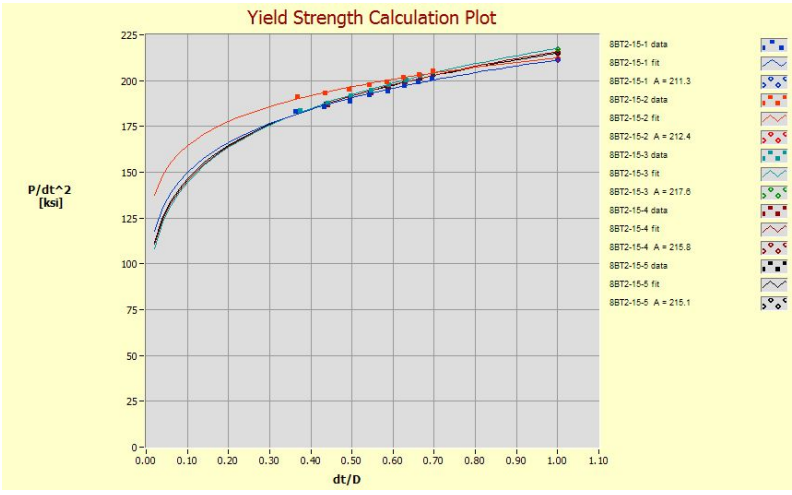
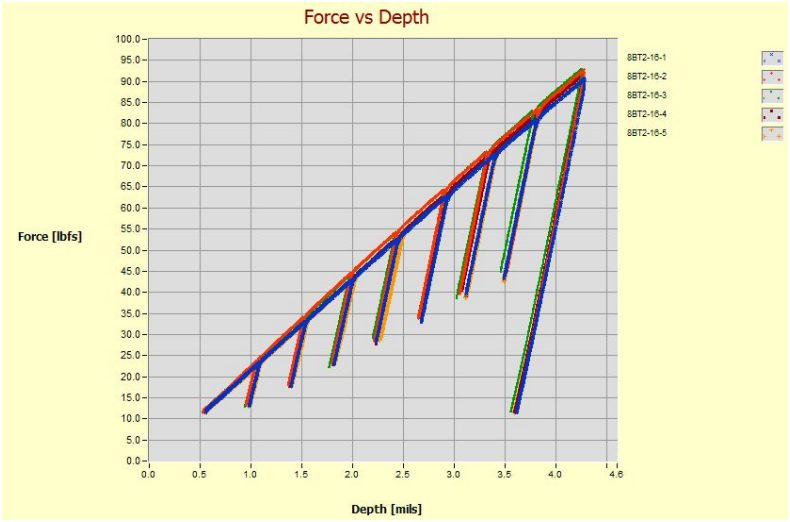
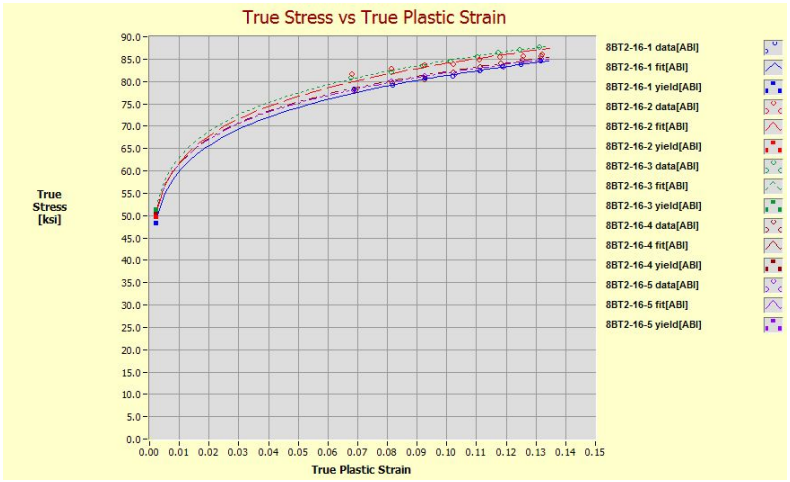


Fig. 14: Overlays of *ABI* force-depth data, true-stress versus true-plastic-strain curves, and yield strength calculation plots for Location 8BT2-16





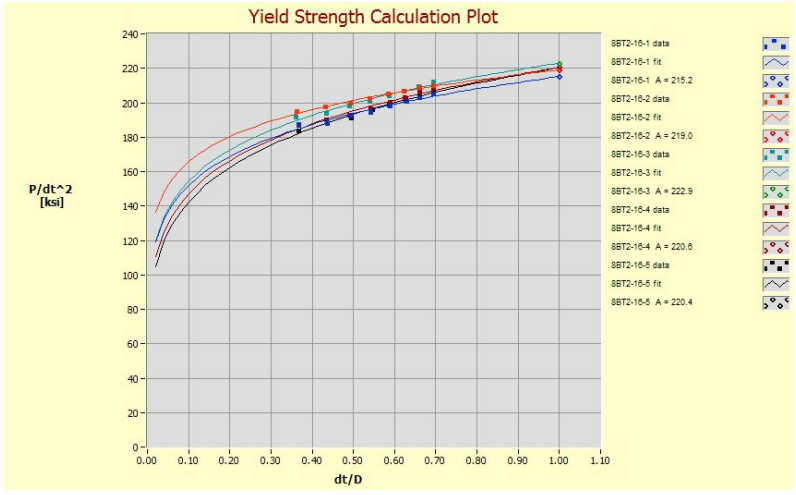


Fig. 15 Photos from Locations 8BT2-1 and 8BT2-8

Fig. 16 Photo from Location 8BT2-2

Fig. 17 Photos from Location 8BT2-4

Fig. 18 Photos from Location 8BT2-5

Fig. 19 Photos from Location 8BT2-6

Fig. 20 Photos from Locations 8BT2-7 and 8BT2-10

Fig. 21 Photo from Location 8BT2-9

Fig. 22 Photos from Location 8BT2-11

Fig. 23 Photos from Location 8BT2-12

Fig. 24 Photos from Location 8BT2-13

Fig. 25 Photos from Location 8BT2-15

Fig. 26 Photos from Location 8BT2-16

Field Testing Procedure

for Performing the

Automated Ball Indentation® (ABI®) Test

2016

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Introduction

This guide is designed to lead you through the steps to performing an ABI test on structures and components in the field.

Surface Prep and SSM System Attachment

1. Inspect the work area before proceeding. Safety is everyone's responsibility.

Make sure excavations and trenches are safe and that sufficient ingress and egress is available, Figs 1-3. If testing over water or at heights over four feet, ensure scaffolding, hoists, or other lifting methods are safe and inspected, Fig. 4. Use the proper personal protection equipment for each situation.

Fig.1 Reinforced trench with cut steps

Fig. 2 Reinforced trench with ladder

Fig. 3 Muddy trench with pallet for safe footing

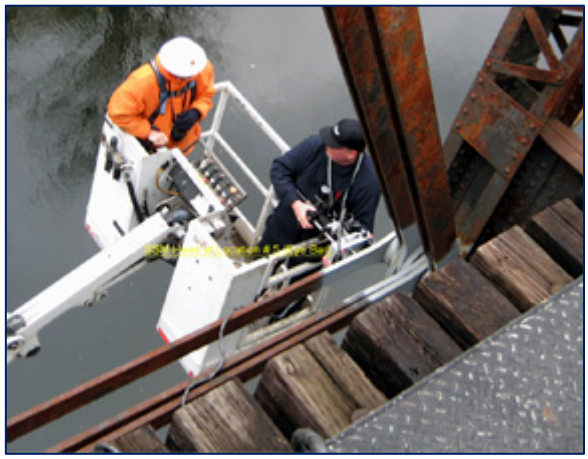

Fig. 4 Testing over water

2. The pipeline operator or contractor is responsible for removing coatings and paint from surface and sand/bead blasting an area larger than 14” x 5”, Figs 5 and 6.

Fig. 5 Sand blasting pipe

Fig. 6 Pipe after sand blasting

3. Each ABI test location requires an area that is 14” long by 5” wide, (356mm x 127mm) in the longitudinal direction of the pipeline. ABIS personnel will clean the foot print area with 120 grit sanding disc and spot polish the test area with 220 grit sanding disc, Figs. 7 and 8.

Fig. 7 ABIS personnel performing final polishing with handheld grinder/polisher

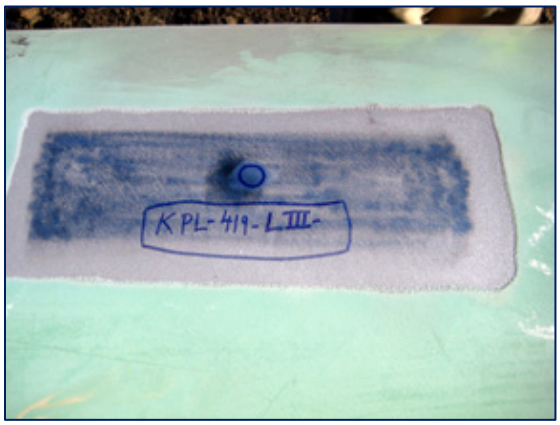

Fig. 8 Test locations with coating removed, SSM footprint area ground smooth, and test location polished

4. Carefully attach SSM system to structure making sure magnet mount is fully engaged and that the system is parallel to the test surface. For pipelines, diameter guide plates are available for positioning, Fig. 9.

Fig. 9 Pipeline testing in the 12 o'clock position

Fig. 10 Testing pipeline elbow (curved surface)

Fig. 11 Use straps for irregular shaped pipe sections,bends,or short sections

5. Perform three to five valid ABI tests at each test location, moving the test head to a new position at least three diameters away for each test.

Pre-Testing Checks

A. Perform Program and Hardware verifications before testing at the beginning of the day or if the hardware setup has changed.

1. Attach system cables, move Battery Connect/Disconnect Switch to “Connect”, turn on system power Fig. 12
2. Start computer and run SSM-Mobile Program. Run ABI test module (Fig. 13). Click on the “**ABI**” icon and the “***MAIN MENU***” screen appears as shown in Fig. 14.
3. Verify the inclusion of the SSM Mobile Serial Number with the Serial Number and cable length of each sensor (load cell and LVDT) in the “Hardware Setup”, Fig. 15. Select the calibration files of the actual load cell and LVDT mounted on the SSM’s load-frame.

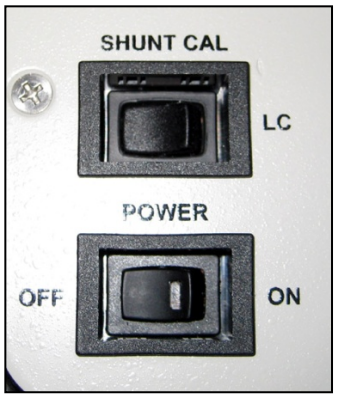

Fig. 12 SSM-Mobile Electronics cabinet, Battery Connect/Disconnect Switch, Power and Shunt Cal switches

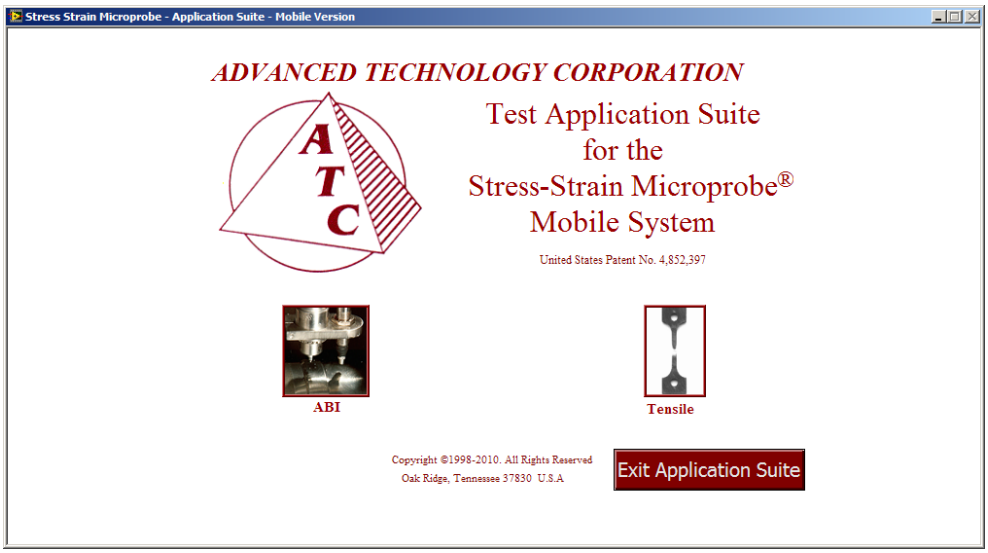

Fig. 13 SSM-Mobile Software application page

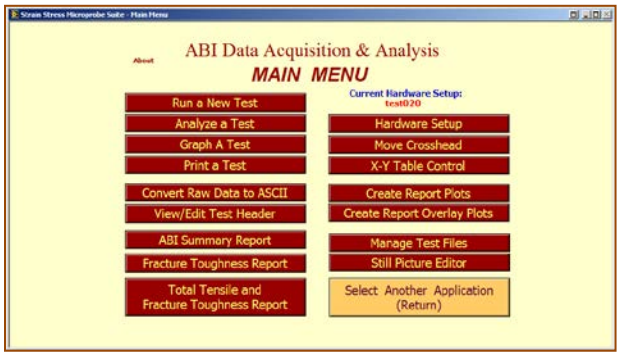

Fig. 14 Main Menu

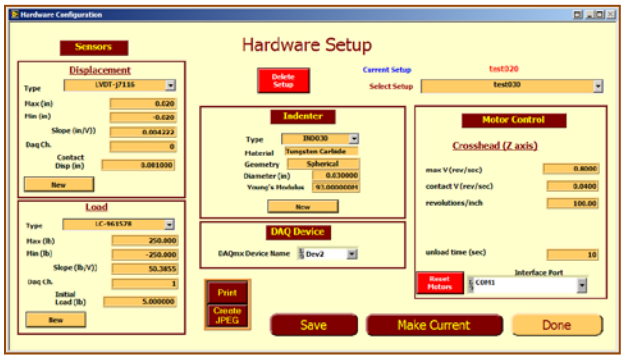

Fig. 15 Hardware Setup

Field testing will always be performed using a 30-mil ground-tip indenter and a 250-lb load cell. The Select Setup should be set to “ABI-030G”.
Verify the Com Port is correct. The pull down menu shows the available ports. If there are more than one, the one associated with the USB port should be used.
Verify the DAQ device. The pull down menu shows the available devices. Verify the Setup matches the device installed.
4. Verify the load cell, LVDT, and motor are working properly. See the “Local Mode” display on Fig. 16.
5. Carefully move the LVDT tip and observe the display. LVDT reading should be within ± 20 mil range. The LVDT position is normally adjusted with the initial depth reading at -12 to -8 mil range when a small load (5-10 lb) is applied. After adjusting the LVDT, move to a new location to conduct the ABI test.
6. Verify the load cell calibration by pushing the “SHUNT CAL” Switch on the front of the cabinet. Each load cell has its own calibration calculated from the certificate provided with each load cell. The Current Reading must be within 0.1 lb from the load cell calibration certificate. The calibration value and the serial number of every load cell are printed on a label affixed to the load cell.
6. Hit “Return” to get out of the “Local Mode’.
8. When prompted to “Do you want to unload the specimen?” choose “Yes”.

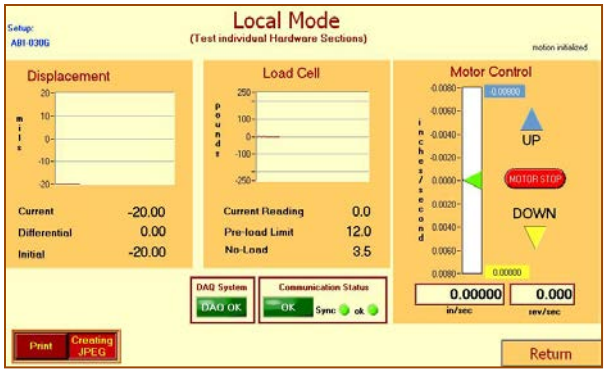

Fig. 16 Move Crosshead

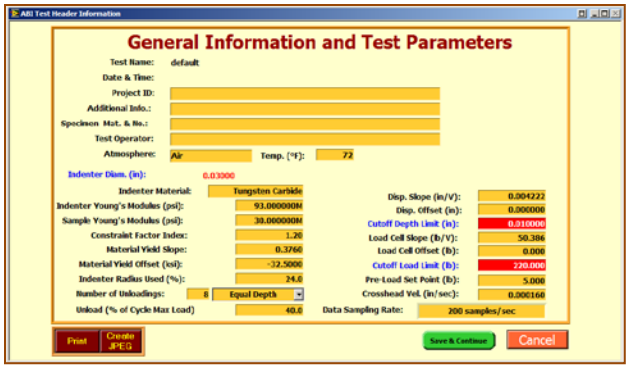

Fig. 17 General information and test parameters

B. Perform an ABI Test on reference material and compare with previous tests on same reference material to verify system operation once per week or after shipping the system to the field.

Perform an ABI Test

1. Choose the “ABI” module from the start up screen, Fig. 13:
2. From the *MAIN MENU*, Choose “Run a New Test” Fig. 14.
3. Type a test name indicating customer designated test name and test number, Fig 18. After the first test, the program will auto-fill the name of the previous test. You can only edit or change the test name at this time. The name cannot be changed once it is saved. Click OK.

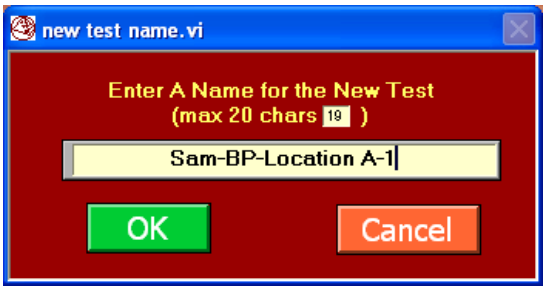

Fig. 18 Notice that the name has a maximum of 20 characters

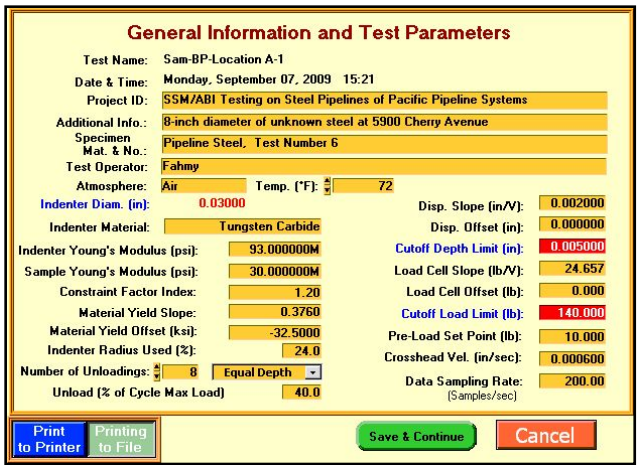

Fig. 19 General information and test parameters

4. The General Information and Test Parameters screen allows you to edit the test parameters.
   Enter/Edit the information fields:
   Project ID, Additional Info, Specimen Mat. & No, Test Operator, Atmosphere, and Temp.

   Verify/Edit test and analysis parameters:
   Material Yield Slope: 0.376 (Pipeline)
   Material Yield Offset: -32.5000 (Pipeline)
   Indenter Radius Used %: 24.0 (this can be from 0.20 to a maximum of 0.40)
   Number of Unloadings: 8 (must be more than 5 but less than 15)
   Cutoff Load Limit ((lb): 140 or no more than 250 (load cell capacity limit)
   Crosshead Vel. (in/sec): 0.0006 in/sec (it can be from 0.0004 to 0.0008)
   Pre-load Set Point (lb): 10.000 (Pipeline). This can be between 5-20 lb.
   Data Sample Rate: 100 to 200 samples/second

Hit **“SAVE and CONTINUE”** and the “Local Mode” screen will appear (Fig. 20).

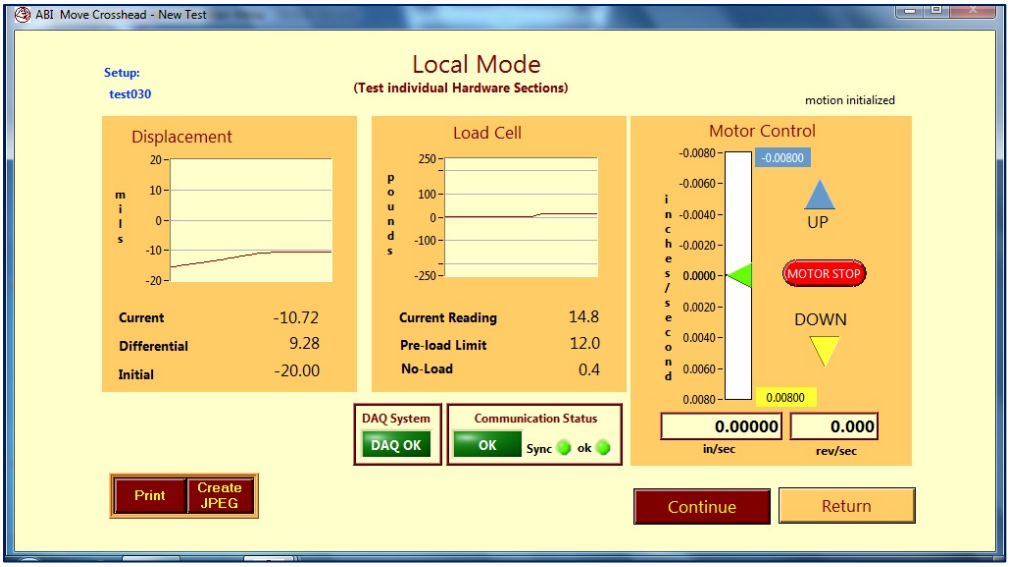

Fig. 20 Move Crosshead under "Run a New Test" to apply a preload and then continue the test

5. Move indenter with the Motor Control to apply the preload. The software will automatically slow the motor when the LVDT contacts the reference surface and reads a difference of 0.001 in (or a current reading of -19 mils) in order to avoid a large load overshoot. You can also slow it manually by clicking on a slower speed on the indicator bar before the LVDT contacts the surface.
6. When the pre-load limit is reached, the "Continue" button appears. Hit "**CONTINUE"** to complete the ABI test.
You can save a screen capture of the screen by clicking "Print to File" before clicking "Return"
7. After the test is completed, hit "**RETURN"** and the indenter is fully unloaded, Fig. 21.
During the test, real-time graphical and digital displays are shown as in Fig. 21.
Note: During the real-time testing display if any unusual graph appears or if the magnet de-couples, abort the ABI test with the red "STOP" button. The test will stop and the indenter will raise to unload the test surface.

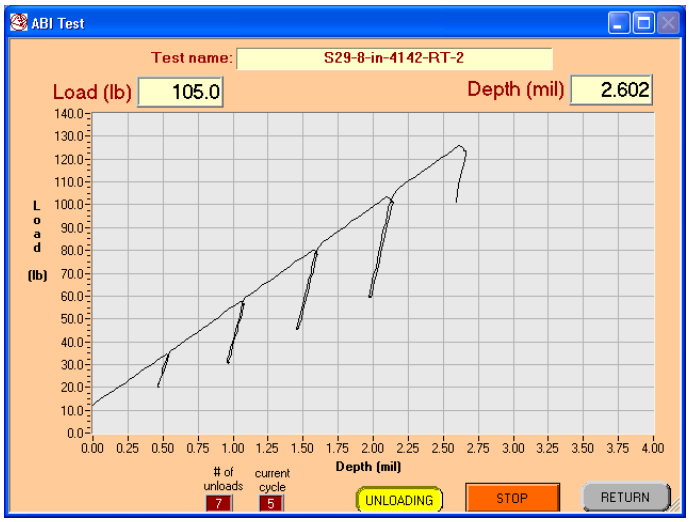

Fig. 21 Real time display of ABI test

Backup all test files at the end of the day or during an extended break.

ABI Services, LLC
253 Midway Ln
Oak Ridge, TN 37830 USA
T: 1.865.483.5756 | F: 1.865.483.5860
abiservices-usa.com | info@abiservices-usa.com

ANNUAL LOAD CELL CALIBRATION

Date	**Original Calibration Date**	**Manufacturer**
June 30, 2016	June 3, 2003	Sensotec
Model	**Serial Number**	**Capacity**
41/0571-02	961578	250 lb
Shunt Cal Factor MV/V	**Calibration Factor MV/V**	**SSM Shunt Cal Value**
1.485	2.984	124.4 ±0.2
SSM System Number	**Cable Length**	
201004	10 ft	
Shunt Value Reading 1	124.4	
Shunt Value Reading 2	124.3	

Certified by: Fahmy M. Haggag
Fahmy Haggag, Chief Engineer

SENSOTEC
2080 ARLINGATE LANE COLUMBUS, OHIO 43228 (614) 850 - 5000
INTERNET URL http://www.sensotec.com

CERTIFICATE OF CALIBRATION

MODEL: 41/0571-02
ORDER CODE: AL111CN
SERIAL NUMBER: 961578-
CALIBRATION DATE: Jun 03/2003
INPUT RESISTANCE: 388.Ω
OUTPUT RESISTANCE: 352.Ω
LEAKAGE: ∞

WIRING CODE

CAPACITY: 250 LBS TENSION
CALIBRATED AT: 250 LBS
EXCITATION: 10.0 VDC
CALIBRATION FACTOR: 2.984 MV/V
SHUNT RESISTOR: 59kΩ
SHUNT CAL FACTOR: 1.485 MV/V

$\frac{1.485}{2.984} \times 250 = 124.4$

SENSOTEC

UNAMP#2,4-COND,6-PIN	
PIN	DESIGNATION
A	(+)EXCITATION
B	(+)EXCITATION
C	(-)EXCITATION
D	(-)EXCITATION
E	(-)OUTPUT
F	(+)OUTPUT

001-0333-02

Accepted and Certified by: Michael A Stanley

Date Printed: 6/4/2003

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ANNUAL LOAD CELL CALIBRATION

Date	**Original Calibration Date**	**Manufacturer**
June 30, 2016	February 6, 2012	Honeywell/Sensotec
Model	**Serial Number**	**Capacity**
41/0571-02	1374130	250 lb
Shunt Cal Factor mV/V	**Calibration Factor mV/V**	**SSM Shunt Cal Value**
1.1014	3.004	91.7 ±0.2
SSM System Number	**Cable Length**	
201004	10 ft	
Shunt Value Reading 1	91.8	
Shunt Value Reading 2	91.7	

Certified by: Fahmy M. Haggag
Fahmy Haggag, Chief Engineer

Honeywell

2080 Arlingate Lane
Columbus, Ohio 43228 U.S.A.
Phone: 614-850-5000
Toll free: 800-848-6564
Fax: 614-850-1111
www.honeywell.com/sensotec
sensotec.service@honeywell.com

CERTIFICATE OF CALIBRATION

Product Identification

Product Type:	LOAD	Customer Name:	N/A
Model:	41	Customer PO:	N/A
Serial No.*:	1374130	Order Code:	AL111CN,1A,2U,6A,15A
Part No.:	060-0571-02	Instrument Serial No.:	N/A

* A letter at the end of the serial number indicates the associated bridge.

Product Specifications

Capacity:	250lbs	Excitation:	10.0 Vdc
Calibrated At:	250.00lbs	Amplifier Output:	N/A
Direction / Type:	Tension	Electrical Leakage:	∞ MegΩ

Wiring Code

UNAMP#2,4-COND,6-PIN

PIN	DESIGNATION
A	(+)EXCITATION
B	(+)EXCITATION
C	(-)EXCITATION
D	(-)EXCITATION
E	(-)OUTPUT
F	(+)OUTPUT

001-0333-02

1.1014 / 3.0041 X250 = 91.66

This unit has been calibrated using standards whose accuracies are traceable to the National Institute of Standards and Technology (NIST). Units are calibrated based upon ANSI/NCSL Z540 on equipment whose accuracies are within a 4:1 ratio unless otherwise indicated. Reported values may be scaled due to limitations of test equipment such as dead weight increments or local barometric pressure. This certificate of calibration shall not be reproduced in any form, except in full, without the expressed written consent of Honeywell. If you have any questions concerning this certificate of calibration, please call our service department at (614) 850-5000.

Derek W. Drabenstadt, Quality Manager

PRINT DATE: 2/6/2012

Certificate No

1374130--001

Document No. 086-1000-09

Calibration Data

Input Resistance: 351 Ω
Output Resistance: 261 Ω
Calibration Factor: 3.0041mV/V
Operator(s): Steve Escoffier
Calibration Date: 02/04/2012
Calibration Procedure: 072-LC75-10, Rev C, Date 04/20/2011

% Capacity	Load (lbs)	Raw (mV/V)	Normalized (mV/V)
0	0.00	0.0108	0.0000
50	125.00	1.5134	1.5026
100	250.00	3.0145	3.0037
50	125.00	1.5143	1.5035
0	0.00	0.0113	0.0005

$\frac{1.1014}{3.0041} \times 250 = 91.66$

Shunt Calibration Data

Line No.	Shunt Resistor	Shunt Sense	Zero	Shunt Zero	Shunt Cal	Shunt Cal. Capacity
1	59kΩ	N/A	N/A	N/A	1.1014 mV/V	N/A

Calibration Standards

NIST Traceable #	Inst. ID#	Description	Model	Cal Date	Date Due
4591694	100635	DEADWEIGHT TEST STAND	1000 LBS.	10/28/2010	10/28/2013
5108348	100859	DIGITAL MULTIMETER	34401A	05/05/2011	05/05/2012
5106590	7241228	DECADE RESISTOR	0-10M OHMS	05/04/2011	05/04/2012

Environmental Data

Temperature: 74 °F
Humidity: 18 %RH
Pressure: 14.41 psiA

Certificate No
1374130--001

ABI Services, LLC
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Oak Ridge, TN 37830 USA
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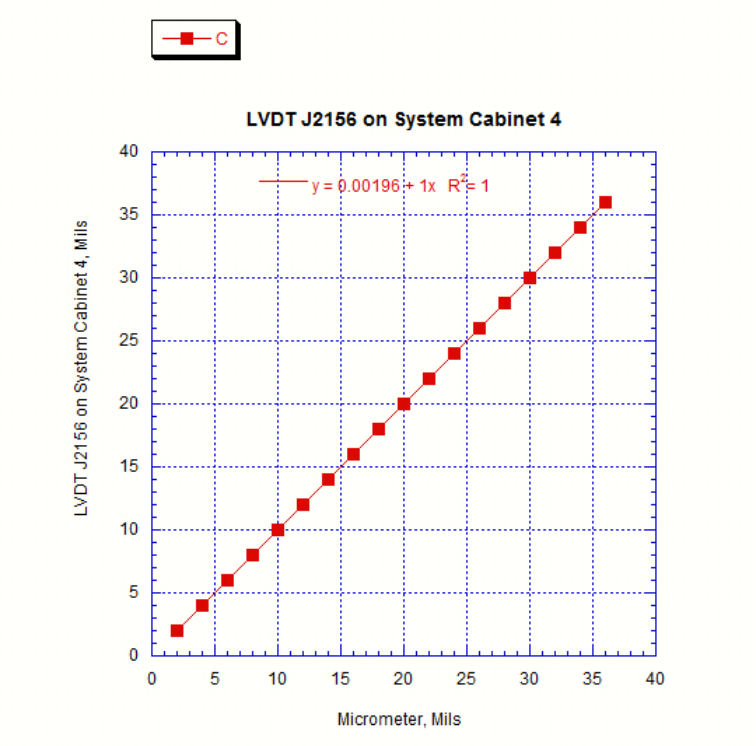
abiservices-usa.com | info@abiservices-usa.com

ANNUAL LVDT CALIBRATION

Date	Original Calibration Date	Manufacturer
June 30, 2016	October 30, 2002	Schaevitz Sensors
Model	**Serial Number**	**Capacity**
LBB-315-PA-020	J2156	±0.0200”
SSM System Number	**Cable Length**	
201004	10 ft	



Certified by: Fahmy M. Haggag

Fahmy Haggag, Chief Engineer

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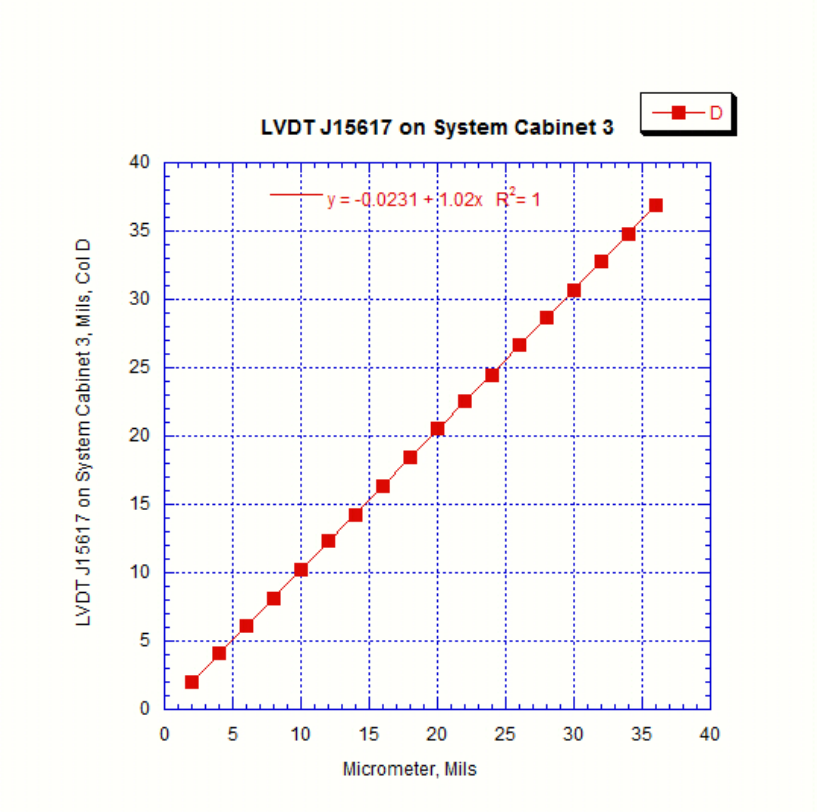
ANNUAL LVDT CALIBRATION

Date	Original Calibration Date	Manufacturer
June 30, 2016	April 15, 2010	Schaevitz Sensors
Model	**Serial Number**	**Capacity**
LBB-315-TA-020	J15617	±0.0200”
SSM System Number	**Cable Length**	
201003	10 ft	



Certified by: Fahmy M. Haggag

Fahmy Haggag, Chief Engineer

Appendix F
Das-Co 625 Forms

Table of Contents

CASCADE NATURAL GAS CORPORATION

INTEGRITY MANAGEMENT DIG REPORT

PRESSURE CLASS	■ TRANSMISSION	☐ HIGH PRESSURE (>60 psig)	☐ INTERMEDIATE (<=60 psig)
IDENTIFICATION	☐ ABOVE GROUND FACILITY ■ BELOW GROUND PIPE EXPOSURE	FACILITY IDENTIFICATION (REG STATION, VALVE #, METER STATION/ETC.)	
DATE OF ASSESSEMENT	7-18-16	HP LINE NAME AND NUMBER	8" BREMERTON TRANS LINE #2
DISTRICT	Bremerton	TOWN	Bremerton
LOCATION	ADDRESS / CROSS STREETS Reba Way & Timothy Place		
REASON FOR ASSESSEMENT	☐ OBSERVING THIRD PARTY DIG	☐ CNG CONSTRUCTION PROJECT	■ INTEGRITY ASSESSMENT-DIRECT EXAMINATION ☐ OTHER -EXPLAIN IN COMMENTS
LOCATE No. (if applicable)	Brem TP8 & TP1	ARRIVAL TIME	COMPLETED TIME

PIPE EXAMINATION DETAILS

COLLECT AS MUCH DATA AS POSSIBLE. DESCRIBE REASON IF DATA IS NOT AVAILABLE.

PIPE MATERIAL	■ STEEL ☐ PE ☐ OTHER:_____	PIPE DIAMETER	8 INCHES	MEASURED DEPTH OF COVER (if applicable)	60 INCHES	LENGTH OF PIPE EXPOSED	3 FEET
STEEL FACTORY APPLIED COATING	■ COAL TAR ☐ BARE	☐ X-TRU ☐ FIBER WRAP	☐ FBE ☐ OTHER:_____	☐ N/A			
STEEL FIELD APPLIED COATING	☐ ROYSTON GREENLINE ☐ POLYGARD RD-6 ☐ FIELD APPLIED EPOXY ☐ FIELD APPLIED MASTIC	■ TRENTON #1 (BELOW GROUND) ☐ TRENTON #2A (ABOVE GROUND) ☐ FIBER WRAP ☐ SHRINKSLEEVE		☐ N/A ☐ OTHER _____			
STEEL COATING CONDITION	DESCRIBE ALL COATING DEFECTS AND POSSIBLE CAUSE. SKETCH LOCATIONS AND DESCRIBE REPAIRS.	**FOUND:** ■ GOOD ☐ FAIR ☐ POOR ☐ N/A **LEFT:** ■ GOOD ☐ FAIR ☐ POOR ☐ N/A					

PIPE MATERIAL EXAMINATION DETAILS

IF PIPE MATERIAL IS EXPOSED, COMPLETE THE FOLLOWING

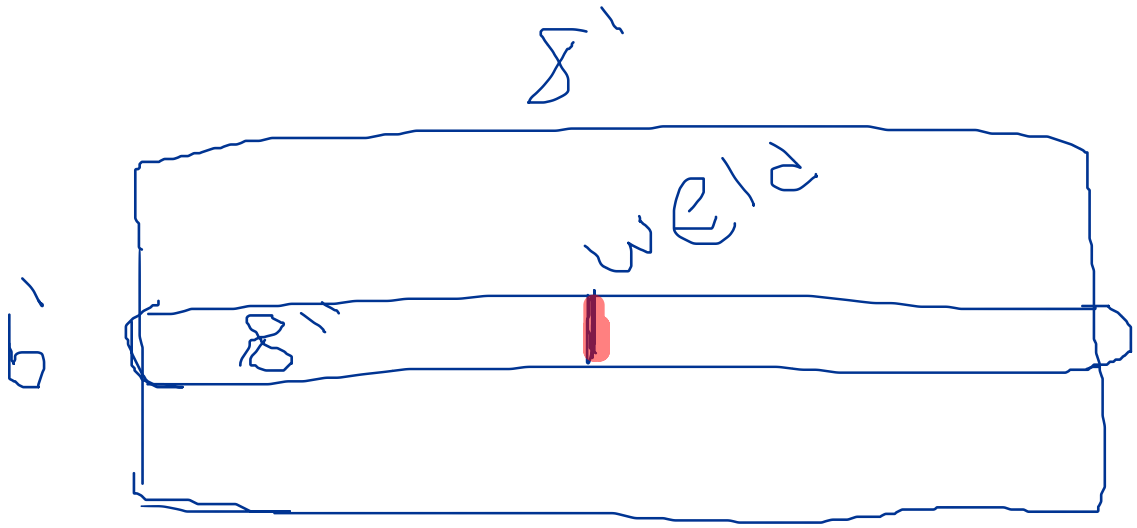
EXTERNAL PIPE CONDITION	IF PIPE CONDITION IS OTHER THAN GOOD, REPORT TO CORROSION CONTROL AND ENGINEERING WHEN APPLICABLE; SKETCH LOCATIONS.	
	FOUND: ■ GOOD ☐ FAIR ☐ POOR PITTING: ☐ YES ■ NO SCALING: ☐ YES ☐ NO GOUGING: ☐ YES ☐ NO SCRATCHING: ☐ YES ☐ NO	**LEFT**: ■ GOOD ☐ FAIR ☐ POOR PITTING: ☐ YES ■ NO SCALING: ☐ YES ☐ NO GOUGING: ☐ YES ☐ NO SCRATCHING: ☐ YES ☐ NO

INTERNAL PIPE CONDITION	☐ GOOD ☐ FAIR ☐ POOR ■ N/A	INTERNAL PIPE LIQUIDS	☐ DRY ☐ WET ■ N/A	SKETCH LOCATION OF CUT AND DESCRIBE INTERNAL CONDITIONS FOUND IF INTERNAL PIPE CONDITION IS OTHER THAN GOOD OR N/A AND REPORT TO CORROSION AND ENGINEERING.
WELD APPEARANCE	HOW MANY WELDS EXPOSED: 1			SKETCH LOCATION OF ALL WELDS; DESCRIBE WELDS THAT DO NOT APPEAR ACCEPTABLE.
CATHODIC PROTECTION	PIPE TO SOIL POTENTIAL (VOLTS), INDICATE POLARITY	#8 -1.9 / #1 -1.9		IF READING IS MORE POSITIVE THAN –0.90V, CONTACT CORROSION CONTROL

IF PIPE WALL LOSS, DENTS, OR IMPACT DAMAGE IS FOUND OR SUSPECTED, CONTACT ENGINEERING FOR INSTRUCTIONS.

CASCADE NATURAL GAS CORPORATION
INTEGRITY MANAGEMENT DIG REPORT

SKETCH PIPE LOCATION, AND NEARBY AREA. INDICATE SIZE OF EXCAVATION. GIVE DISTANCES TO NEARBY LANDMARKS. IDENTIFY LOCATION OF ANOMOLIES (CORROSION, PITTING, POOR WELDS, UNEXPECTED FITTINGS, ETC.)



COMMENTS/DESCRIPTION OF EXAMINATION INCLUDING ANY INFORMATION THAT MIGHT AID EVALUATION OF SYSTEM QUALITY. EXPLAIN UNUSUAL CONDITIONS AND DESCRIBE THE CONDITION FOUND AS NECESSARY

Wall Thickness TP#8 .181, .181, .180, .182 / TP#1 .181, .182, .181, .180

SPECIAL NOTE: ADDING FITTINGS OR COMPONENTS, REPAIRS, REPLACEMENTS, REINFORCEMENTS, AND REROUTES OF HP LINE AND TRANSMISSION LINES MUST BE RECORDED BY AS BUILT AND SUBMITTED TO ENGINEERING FOR INCLUSION INTO THE PERMANENT RECORDS. RECORD AS-BUILTS AS DIRECTED BY DISTRICT MANAGEMENT AND DISTRIBUTION CLERK.

REPORTED BY	DATE
Bruno	7-18-16

DISTRICT OPERATIONS MANAGER/DISTRICT MANAGER	DATE

CASCADE NATURAL GAS CORPORATION
INTEGRITY MANAGEMENT DIG REPORT

ANOMOLY EXAMINATION DETAILS

IF WALL LOSS, DENTS, OR IMPACT DAMAGE SUSPECTED – IDENTIFY LOCATION, AREA, PIT DEPTH, MAX PIT DEPTH, AND TYPE OF ALL WALL LOSS OR ANOMOLIES WITH DETAILED SKETCHES. FOR GENERAL CORROSION, MULTIPLE MEASUREMENTS OF PIT DEPTH AND REMAINING WALL ARE NEEDED (TOPOGRAPHY MAP)

SOIL TYPE (IF KNOWN)		SOIL RESISTIVITY (if applicable)	OHM-CM	MINIMUM UT PIPE WALL THICKNESS	INCHES
MAX PIT DEPTH DISCOVERED (INCHES)		GPS REFERENCE POINT (IF KNOWN)			

BOTTOM							
3:00							
TOP							
9:00							
BOTTOM							

SPECIFY LONGITUDINAL PIPE LENGTH OF ANOMOLY IN INCHES

EXAM PERFORMED BY	DESIGNATED REPRESENTATIVE	DATE

ENGINEERING REVIEW

REFER TO CP755 FOR ENGINEERING REVIEW REQUIREMENTS AND APPROPRIATE WORKFLOW

☐	ANOMOLIES WERE FOUND ACCEPTABLE PER ASME B31G – REMAINING STRENGTH GUIDELINES (ATTACH CALCULATIONS)
☐	ACCEPTABLE REINFORCEMENT FITTINGS INSTALLED – DETAILS SHOWN ON AS-BUILT WORK ORDER_____
☐	PIPE WAS REMOVED – DETAILS SHOWN ON AS-BUILT - WORK ORDER _____
☐	NO ACTION NECESSARY
☐	OTHER: (WRITE IN OR ATTACH)

	ENGINEER	DATE

CASCADE NATURAL GAS CORPORATION

INTEGRITY MANAGEMENT DIG REPORT

PRESSURE CLASS	☑ TRANSMISSION	☐ HIGH PRESSURE (>60 psig)	☐ INTERMEDIATE (<=60 psig)
IDENTIFICATION	☐ ABOVE GROUND FACILITY ☑ BELOW GROUND PIPE EXPOSURE	FACILITY IDENTIFICATION (REG STATION, VALVE #, METER STATION/ETC.)	
DATE OF ASSESSEMENT	7/18/16	HP LINE NAME AND NUMBER	8" BREMERTON TRANS LINE #2
DISTRICT	Bremerton	TOWN	Bremerton
LOCATION	ADDRESS / CROSS STREETS Bottom of Hill		
REASON FOR ASSESSEMENT	☐ OBSERVING THIRD PARTY DIG	☐ CNG CONSTRUCTION PROJECT	☑ INTEGRITY ASSESSMENT-DIRECT EXAMINATION ☐ OTHER -EXPLAIN IN COMMENTS

LOCATE No. (if applicable)	Tp#2	ARRIVAL TIME	10:30	COMPLETED TIME	11:15

PIPE EXAMINATION DETAILS

COLLECT AS MUCH DATA AS POSSIBLE. DESCRIBE REASON IF DATA IS NOT AVAILABLE.

PIPE MATERIAL	☑ STEEL ☐ PE ☐ OTHER:_____	PIPE DIAMETER	8 INCHES	MEASURED DEPTH OF COVER (if applicable)	60 INCHES	LENGTH OF PIPE EXPOSED	3 FEET

STEEL FACTORY APPLIED COATING	☑ COAL TAR ☐ BARE	☐ X-TRU ☐ FIBER WRAP	☐ FBE ☐ OTHER:_____	☐ N/A
STEEL FIELD APPLIED COATING	☐ ROYSTON GREENLINE ☐ POLYGARD RD-6 ☐ FIELD APPLIED EPOXY ☐ FIELD APPLIED MASTIC	☑ TRENTON #1 (BELOW GROUND) ☐ TRENTON #2A (ABOVE GROUND) ☐ FIBER WRAP ☐ SHRINKSLEEVE	☐ N/A ☐ OTHER _____	
STEEL COATING CONDITION	DESCRIBE ALL COATING DEFECTS AND POSSIBLE CAUSE. SKETCH LOCATIONS AND DESCRIBE REPAIRS.	**FOUND:** ☑ GOOD ☐ FAIR ☐ POOR ☐ N/A **LEFT:** ☑ GOOD ☐ FAIR ☐ POOR ☐ N/A		

PIPE MATERIAL EXAMINATION DETAILS

IF PIPE MATERIAL IS EXPOSED, COMPLETE THE FOLLOWING

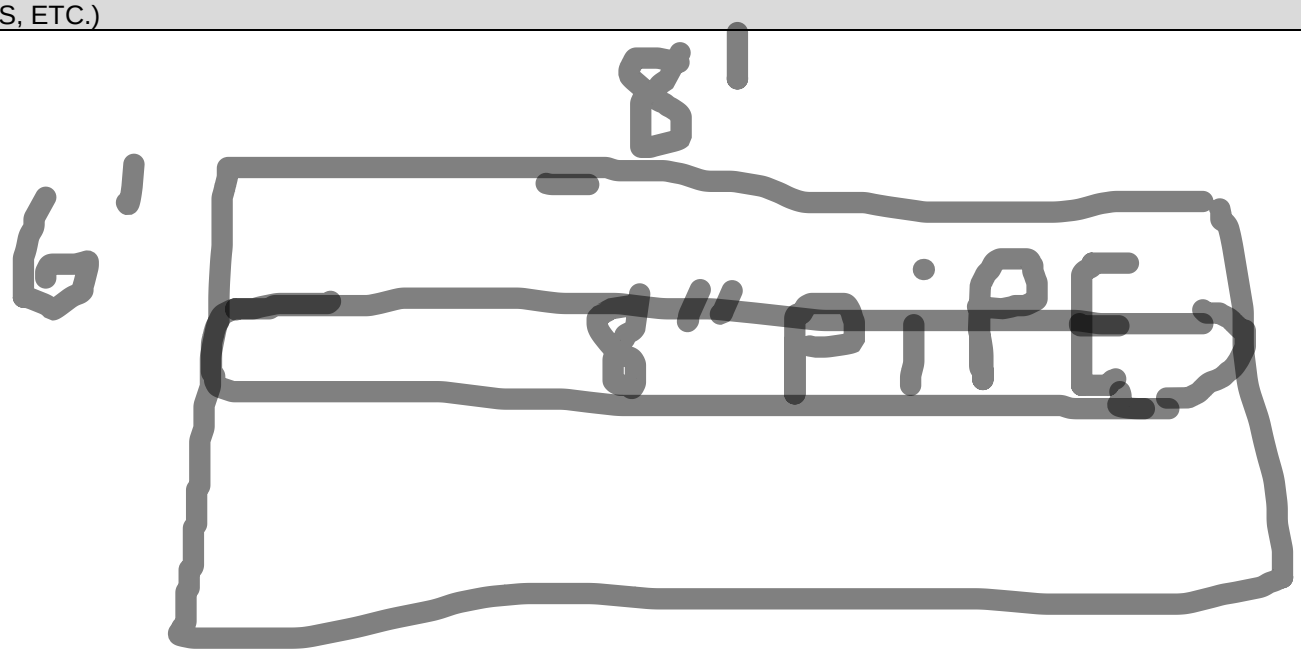
EXTERNAL PIPE CONDITION	IF PIPE CONDITION IS OTHER THAN GOOD, REPORT TO CORROSION CONTROL AND ENGINEERING WHEN APPLICABLE; SKETCH LOCATIONS.	
	FOUND: ☑ GOOD ☐ FAIR ☐ POOR PITTING: ☐ YES ☑ NO SCALING: ☐ YES ☑ NO GOUGING: ☐ YES ☑ NO SCRATCHING: ☐ YES ☑ NO	**LEFT**: ☑ GOOD ☐ FAIR ☐ POOR PITTING: ☐ YES ☑ NO SCALING: ☐ YES ☑ NO GOUGING: ☐ YES ☑ NO SCRATCHING: ☐ YES ☑ NO

INTERNAL PIPE CONDITION	☐ GOOD ☐ FAIR ☐ POOR ☑ N/A	INTERNAL PIPE LIQUIDS	☐ DRY ☐ WET ☑ N/A	SKETCH LOCATION OF CUT AND DESCRIBE INTERNAL CONDITIONS FOUND IF INTERNAL PIPE CONDITION IS OTHER THAN GOOD OR N/A AND REPORT TO CORROSION AND ENGINEERING.
WELD APPEARANCE	HOW MANY WELDS EXPOSED: 0			SKETCH LOCATION OF ALL WELDS; DESCRIBE WELDS THAT DO NOT APPEAR ACCEPTABLE.
CATHODIC PROTECTION	PIPE TO SOIL POTENTIAL (VOLTS), INDICATE POLARITY	-1.5		IF READING IS MORE POSITIVE THAN –0.90V, CONTACT CORROSION CONTROL

IF PIPE WALL LOSS, DENTS, OR IMPACT DAMAGE IS FOUND OR SUSPECTED, CONTACT ENGINEERING FOR INSTRUCTIONS.

CASCADE NATURAL GAS CORPORATION
INTEGRITY MANAGEMENT DIG REPORT

SKETCH PIPE LOCATION, AND NEARBY AREA. INDICATE SIZE OF EXCAVATION. GIVE DISTANCES TO NEARBY LANDMARKS. IDENTIFY LOCATION OF ANOMOLIES (CORROSION, PITTING, POOR WELDS, UNEXPECTED FITTINGS, ETC.)



COMMENTS/DESCRIPTION OF EXAMINATION INCLUDING ANY INFORMATION THAT MIGHT AID EVALUATION OF SYSTEM QUALITY. EXPLAIN UNUSUAL CONDITIONS AND DESCRIBE THE CONDITION FOUND AS NECESSARY

Wall Thickness .181 .181 .181 .181

SPECIAL NOTE: ADDING FITTINGS OR COMPONENTS, REPAIRS, REPLACEMENTS, REINFORCEMENTS, AND REROUTES OF HP LINE AND TRANSMISSION LINES MUST BE RECORDED BY AS BUILT AND SUBMITTED TO ENGINEERING FOR INCLUSION INTO THE PERMANENT RECORDS. RECORD AS-BUILTS AS DIRECTED BY DISTRICT MANAGEMENT AND DISTRIBUTION CLERK.

REPORTED BY	DATE
Jason	7/19/16

DISTRICT OPERATIONS MANAGER/DISTRICT MANAGER	DATE

CASCADE NATURAL GAS CORPORATION
INTEGRITY MANAGEMENT DIG REPORT

ANOMOLY EXAMINATION DETAILS

IF WALL LOSS, DENTS, OR IMPACT DAMAGE SUSPECTED – IDENTIFY LOCATION, AREA, PIT DEPTH, MAX PIT DEPTH, AND TYPE OF ALL WALL LOSS OR ANOMOLIES WITH DETAILED SKETCHES. FOR GENERAL CORROSION, MULTIPLE MEASUREMENTS OF PIT DEPTH AND REMAINING WALL ARE NEEDED (TOPOGRAPHY MAP)

SOIL TYPE (IF KNOWN)		SOIL RESISTIVITY (if applicable)	OHM-CM	MINIMUM UT PIPE WALL THICKNESS	INCHES
MAX PIT DEPTH DISCOVERED (INCHES)		GPS REFERENCE POINT (IF KNOWN)			

BOTTOM							
3:00							
TOP							
9:00							
BOTTOM							

SPECIFY LONGITUDINAL PIPE LENGTH OF ANOMOLY IN INCHES

EXAM PERFORMED BY	DESIGNATED REPRESENTATIVE	DATE

ENGINEERING REVIEW

REFER TO CP755 FOR ENGINEERING REVIEW REQUIREMENTS AND APPROPRIATE WORKFLOW

☐	ANOMOLIES WERE FOUND ACCEPTABLE PER ASME B31G – REMAINING STRENGTH GUIDELINES (ATTACH CALCULATIONS)
☐	ACCEPTABLE REINFORCEMENT FITTINGS INSTALLED – DETAILS SHOWN ON AS-BUILT WORK ORDER_____
☐	PIPE WAS REMOVED – DETAILS SHOWN ON AS-BUILT - WORK ORDER _____
☐	NO ACTION NECESSARY
☐	OTHER: (WRITE IN OR ATTACH)

	ENGINEER	DATE

CASCADE NATURAL GAS CORPORATION

INTEGRITY MANAGEMENT DIG REPORT

PRESSURE CLASS	☑ TRANSMISSION	☐ HIGH PRESSURE (>60 psig)	☐ INTERMEDIATE (<=60 psig)
IDENTIFICATION	☐ ABOVE GROUND FACILITY ☑ BELOW GROUND PIPE EXPOSURE	FACILITY IDENTIFICATION (REG STATION, VALVE #, METER STATION/ETC.)	
DATE OF ASSESSEMENT	7-20-16	HP LINE NAME AND NUMBER	8" BREMERTON TRANS LINE #2
DISTRICT	Bremerton	TOWN	Bremerton
LOCATION	ADDRESS / CROSS STREETS Archie Way & Reba		
REASON FOR ASSESSEMENT	☐ OBSERVING THIRD PARTY DIG	☐ CNG CONSTRUCTION PROJECT	☑ INTEGRITY ASSESSMENT-DIRECT EXAMINATION ☐ OTHER -EXPLAIN IN COMMENTS

LOCATE No. (if applicable)	Tp 4	ARRIVAL TIME	7:00 am	COMPLETED TIME	11:00 am

PIPE EXAMINATION DETAILS

COLLECT AS MUCH DATA AS POSSIBLE. DESCRIBE REASON IF DATA IS NOT AVAILABLE.

PIPE MATERIAL	☑ STEEL ☐ PE ☐ OTHER:_____	PIPE DIAMETER	8 INCHES	MEASURED DEPTH OF COVER (if applicable)	48 INCHES	LENGTH OF PIPE EXPOSED	3 FEET

STEEL FACTORY APPLIED COATING	☑ COAL TAR ☐ BARE	☐ X-TRU ☐ FIBER WRAP	☐ FBE ☐ OTHER:_____	☐ N/A
STEEL FIELD APPLIED COATING	☐ ROYSTON GREENLINE ☐ POLYGARD RD-6 ☐ FIELD APPLIED EPOXY ☐ FIELD APPLIED MASTIC	☑ TRENTON #1 (BELOW GROUND) ☐ TRENTON #2A (ABOVE GROUND) ☐ FIBER WRAP ☐ SHRINKSLEEVE	☐ N/A ☐ OTHER _____	
STEEL COATING CONDITION	DESCRIBE ALL COATING DEFECTS AND POSSIBLE CAUSE. SKETCH LOCATIONS AND DESCRIBE REPAIRS.	**FOUND:** ☑ GOOD ☐ FAIR ☐ POOR ☐ N/A **LEFT:** ☑ GOOD ☐ FAIR ☐ POOR ☐ N/A		

PIPE MATERIAL EXAMINATION DETAILS

IF PIPE MATERIAL IS EXPOSED, COMPLETE THE FOLLOWING

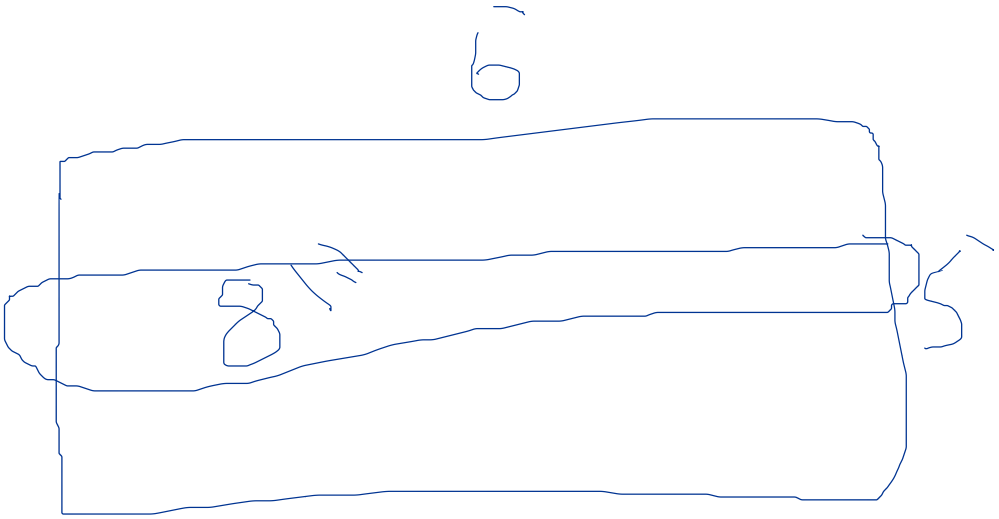
EXTERNAL PIPE CONDITION	IF PIPE CONDITION IS OTHER THAN GOOD, REPORT TO CORROSION CONTROL AND ENGINEERING WHEN APPLICABLE; SKETCH LOCATIONS.	
	FOUND: ☑ GOOD ☐ FAIR ☐ POOR PITTING: ☐ YES ☑ NO SCALING: ☐ YES ☑ NO GOUGING: ☐ YES ☑ NO SCRATCHING: ☐ YES ☑ NO	**LEFT**: ☑ GOOD ☐ FAIR ☐ POOR PITTING: ☐ YES ☑ NO SCALING: ☐ YES ☑ NO GOUGING: ☐ YES ☑ NO SCRATCHING: ☐ YES ☑ NO

INTERNAL PIPE CONDITION	☐ GOOD ☐ FAIR ☐ POOR ☑ N/A	INTERNAL PIPE LIQUIDS	☐ DRY ☐ WET ☑ N/A	SKETCH LOCATION OF CUT AND DESCRIBE INTERNAL CONDITIONS FOUND IF INTERNAL PIPE CONDITION IS OTHER THAN GOOD OR N/A AND REPORT TO CORROSION AND ENGINEERING.
WELD APPEARANCE	HOW MANY WELDS EXPOSED: 0			SKETCH LOCATION OF ALL WELDS; DESCRIBE WELDS THAT DO NOT APPEAR ACCEPTABLE.
CATHODIC PROTECTION	PIPE TO SOIL POTENTIAL (VOLTS), INDICATE POLARITY	-1.8		IF READING IS MORE POSITIVE THAN –0.90V, CONTACT CORROSION CONTROL

IF PIPE WALL LOSS, DENTS, OR IMPACT DAMAGE IS FOUND OR SUSPECTED, CONTACT ENGINEERING FOR INSTRUCTIONS.

CASCADE NATURAL GAS CORPORATION
INTEGRITY MANAGEMENT DIG REPORT

SKETCH PIPE LOCATION, AND NEARBY AREA. INDICATE SIZE OF EXCAVATION. GIVE DISTANCES TO NEARBY LANDMARKS. IDENTIFY LOCATION OF ANOMOLIES (CORROSION, PITTING, POOR WELDS, UNEXPECTED FITTINGS, ETC.)



COMMENTS/DESCRIPTION OF EXAMINATION INCLUDING ANY INFORMATION THAT MIGHT AID EVALUATION OF SYSTEM QUALITY. EXPLAIN UNUSUAL CONDITIONS AND DESCRIBE THE CONDITION FOUND AS NECESSARY

Half cell -1.8. Ut.188 .188 .185 .185

SPECIAL NOTE: ADDING FITTINGS OR COMPONENTS, REPAIRS, REPLACEMENTS, REINFORCEMENTS, AND REROUTES OF HP LINE AND TRANSMISSION LINES MUST BE RECORDED BY AS BUILT AND SUBMITTED TO ENGINEERING FOR INCLUSION INTO THE PERMANENT RECORDS. RECORD AS-BUILTS AS DIRECTED BY DISTRICT MANAGEMENT AND DISTRIBUTION CLERK.

REPORTED BY	DATE
Jason	7/20/16

DISTRICT OPERATIONS MANAGER/DISTRICT MANAGER	DATE

CASCADE NATURAL GAS CORPORATION
INTEGRITY MANAGEMENT DIG REPORT

ANOMOLY EXAMINATION DETAILS

IF WALL LOSS, DENTS, OR IMPACT DAMAGE SUSPECTED – IDENTIFY LOCATION, AREA, PIT DEPTH, MAX PIT DEPTH, AND TYPE OF ALL WALL LOSS OR ANOMOLIES WITH DETAILED SKETCHES. FOR GENERAL CORROSION, MULTIPLE MEASUREMENTS OF PIT DEPTH AND REMAINING WALL ARE NEEDED (TOPOGRAPHY MAP)

SOIL TYPE (IF KNOWN)		SOIL RESISTIVITY (if applicable)	OHM-CM	MINIMUM UT PIPE WALL THICKNESS	INCHES
MAX PIT DEPTH DISCOVERED (INCHES)		GPS REFERENCE POINT (IF KNOWN)			

BOTTOM							
3:00							
TOP							
9:00							
BOTTOM							

SPECIFY LONGITUDINAL PIPE LENGTH OF ANOMOLY IN INCHES

EXAM PERFORMED BY	DESIGNATED REPRESENTATIVE	DATE

ENGINEERING REVIEW

REFER TO CP755 FOR ENGINEERING REVIEW REQUIREMENTS AND APPROPRIATE WORKFLOW

☐	ANOMOLIES WERE FOUND ACCEPTABLE PER ASME B31G – REMAINING STRENGTH GUIDELINES (ATTACH CALCULATIONS)
☐	ACCEPTABLE REINFORCEMENT FITTINGS INSTALLED – DETAILS SHOWN ON AS-BUILT WORK ORDER_____
☐	PIPE WAS REMOVED – DETAILS SHOWN ON AS-BUILT - WORK ORDER _____
☐	NO ACTION NECESSARY
☐	OTHER: (WRITE IN OR ATTACH)

	ENGINEER	DATE

CASCADE NATURAL GAS CORPORATION

INTEGRITY MANAGEMENT DIG REPORT

PRESSURE CLASS	☑ TRANSMISSION	☐ HIGH PRESSURE (>60 psig)	☐ INTERMEDIATE (<=60 psig)
IDENTIFICATION	☐ ABOVE GROUND FACILITY ☑ BELOW GROUND PIPE EXPOSURE	FACILITY IDENTIFICATION (REG STATION, VALVE #, METER STATION/ETC.)	
DATE OF ASSESSEMENT	7/20/16	HP LINE NAME AND NUMBER	8" BREMERTON TRANS LINE #2
DISTRICT	Bremerton	TOWN	Bremerton
LOCATION	ADDRESS / CROSS STREETS Driveway on Waren Rd		
REASON FOR ASSESSEMENT	☐ OBSERVING THIRD PARTY DIG	☐ CNG CONSTRUCTION PROJECT	☑ INTEGRITY ASSESSMENT-DIRECT EXAMINATION ☐ OTHER -EXPLAIN IN COMMENTS

LOCATE No. (if applicable)	Brem TP5	ARRIVAL TIME		COMPLETED TIME	1:00pm

PIPE EXAMINATION DETAILS

COLLECT AS MUCH DATA AS POSSIBLE. DESCRIBE REASON IF DATA IS NOT AVAILABLE.

PIPE MATERIAL	☑ STEEL ☐ PE ☐ OTHER:_____	PIPE DIAMETER	8 INCHES	MEASURED DEPTH OF COVER (if applicable)	60 INCHES	LENGTH OF PIPE EXPOSED	3 FEET

STEEL FACTORY APPLIED COATING	☑ COAL TAR ☐ BARE	☐ X-TRU ☐ FIBER WRAP	☐ FBE ☐ OTHER:_____	☐ N/A
STEEL FIELD APPLIED COATING	☐ ROYSTON GREENLINE ☐ POLYGARD RD-6 ☐ FIELD APPLIED EPOXY ☐ FIELD APPLIED MASTIC	☑ TRENTON #1 (BELOW GROUND) ☐ TRENTON #2A (ABOVE GROUND) ☐ FIBER WRAP ☐ SHRINKSLEEVE	☐ N/A ☐ OTHER _____	
STEEL COATING CONDITION	DESCRIBE ALL COATING DEFECTS AND POSSIBLE CAUSE. SKETCH LOCATIONS AND DESCRIBE REPAIRS.	**FOUND:** ☑ GOOD ☐ FAIR ☐ POOR ☐ N/A **LEFT:** ☑ GOOD ☐ FAIR ☐ POOR ☐ N/A		

PIPE MATERIAL EXAMINATION DETAILS

IF PIPE MATERIAL IS EXPOSED, COMPLETE THE FOLLOWING

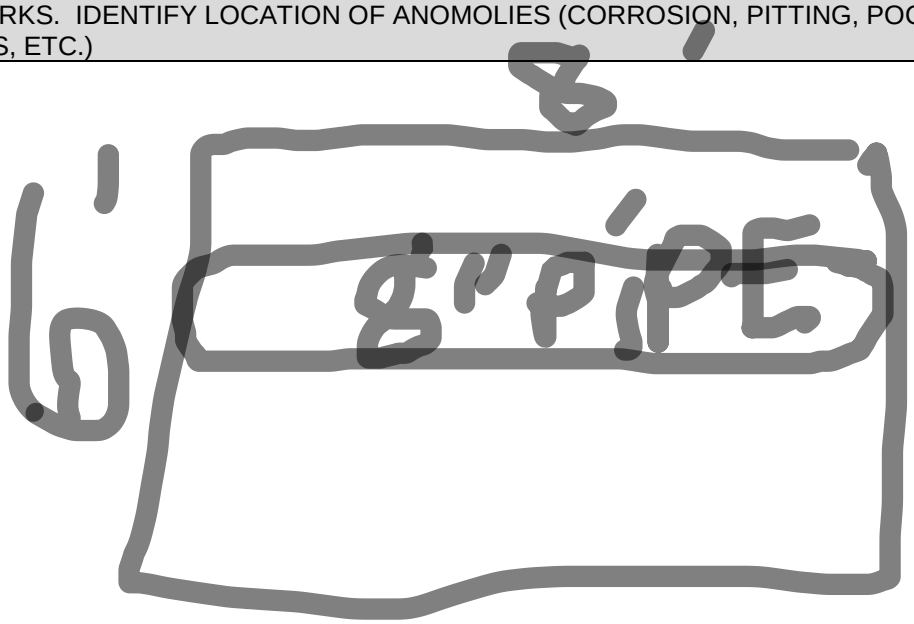
EXTERNAL PIPE CONDITION	IF PIPE CONDITION IS OTHER THAN GOOD, REPORT TO CORROSION CONTROL AND ENGINEERING WHEN APPLICABLE; SKETCH LOCATIONS.	
	FOUND: ☑ GOOD ☐ FAIR ☐ POOR PITTING: ☐ YES ☑ NO SCALING: ☐ YES ☑ NO GOUGING: ☐ YES ☑ NO SCRATCHING: ☐ YES ☑ NO	**LEFT**: ☑ GOOD ☐ FAIR ☐ POOR PITTING: ☐ YES ☑ NO SCALING: ☐ YES ☑ NO GOUGING: ☐ YES ☑ NO SCRATCHING: ☐ YES ☑ NO

INTERNAL PIPE CONDITION	☐ GOOD ☐ FAIR ☐ POOR ☑ N/A	INTERNAL PIPE LIQUIDS	☐ DRY ☐ WET ☑ N/A	SKETCH LOCATION OF CUT AND DESCRIBE INTERNAL CONDITIONS FOUND IF INTERNAL PIPE CONDITION IS OTHER THAN GOOD OR N/A AND REPORT TO CORROSION AND ENGINEERING.
WELD APPEARANCE	HOW MANY WELDS EXPOSED: 0			SKETCH LOCATION OF ALL WELDS; DESCRIBE WELDS THAT DO NOT APPEAR ACCEPTABLE.
CATHODIC PROTECTION	PIPE TO SOIL POTENTIAL (VOLTS), INDICATE POLARITY	-1.5		IF READING IS MORE POSITIVE THAN –0.90V, CONTACT CORROSION CONTROL

IF PIPE WALL LOSS, DENTS, OR IMPACT DAMAGE IS FOUND OR SUSPECTED, CONTACT ENGINEERING FOR INSTRUCTIONS.

CASCADE NATURAL GAS CORPORATION
INTEGRITY MANAGEMENT DIG REPORT

SKETCH PIPE LOCATION, AND NEARBY AREA. INDICATE SIZE OF EXCAVATION. GIVE DISTANCES TO NEARBY LANDMARKS. IDENTIFY LOCATION OF ANOMOLIES (CORROSION, PITTING, POOR WELDS, UNEXPECTED FITTINGS, ETC.)



COMMENTS/DESCRIPTION OF EXAMINATION INCLUDING ANY INFORMATION THAT MIGHT AID EVALUATION OF SYSTEM QUALITY. EXPLAIN UNUSUAL CONDITIONS AND DESCRIBE THE CONDITION FOUND AS NECESSARY

Wall thickness .187 .187 .189 .187

SPECIAL NOTE: ADDING FITTINGS OR COMPONENTS, REPAIRS, REPLACEMENTS, REINFORCEMENTS, AND REROUTES OF HP LINE AND TRANSMISSION LINES MUST BE RECORDED BY AS BUILT AND SUBMITTED TO ENGINEERING FOR INCLUSION INTO THE PERMANENT RECORDS. RECORD AS-BUILTS AS DIRECTED BY DISTRICT MANAGEMENT AND DISTRIBUTION CLERK.

REPORTED BY	DATE
Jason	7/20/16

DISTRICT OPERATIONS MANAGER/DISTRICT MANAGER	DATE

CASCADE NATURAL GAS CORPORATION
INTEGRITY MANAGEMENT DIG REPORT

ANOMOLY EXAMINATION DETAILS

IF WALL LOSS, DENTS, OR IMPACT DAMAGE SUSPECTED – IDENTIFY LOCATION, AREA, PIT DEPTH, MAX PIT DEPTH, AND TYPE OF ALL WALL LOSS OR ANOMOLIES WITH DETAILED SKETCHES. FOR GENERAL CORROSION, MULTIPLE MEASUREMENTS OF PIT DEPTH AND REMAINING WALL ARE NEEDED (TOPOGRAPHY MAP)

SOIL TYPE (IF KNOWN)		SOIL RESISTIVITY (if applicable)	OHM-CM	MINIMUM UT PIPE WALL THICKNESS	INCHES
MAX PIT DEPTH DISCOVERED (INCHES)		GPS REFERENCE POINT (IF KNOWN)			

BOTTOM							
3:00							
TOP							
9:00							
BOTTOM							

SPECIFY LONGITUDINAL PIPE LENGTH OF ANOMOLY IN INCHES

EXAM PERFORMED BY	DESIGNATED REPRESENTATIVE	DATE

ENGINEERING REVIEW

REFER TO CP755 FOR ENGINEERING REVIEW REQUIREMENTS AND APPROPRIATE WORKFLOW

☐	ANOMOLIES WERE FOUND ACCEPTABLE PER ASME B31G – REMAINING STRENGTH GUIDELINES (ATTACH CALCULATIONS)
☐	ACCEPTABLE REINFORCEMENT FITTINGS INSTALLED – DETAILS SHOWN ON AS-BUILT WORK ORDER_____
☐	PIPE WAS REMOVED – DETAILS SHOWN ON AS-BUILT - WORK ORDER _____
☐	NO ACTION NECESSARY
☐	OTHER: (WRITE IN OR ATTACH)

	ENGINEER	DATE

CASCADE NATURAL GAS CORPORATION

INTEGRITY MANAGEMENT DIG REPORT

PRESSURE CLASS	☒ TRANSMISSION	☐ HIGH PRESSURE (>60 psig)	☐ INTERMEDIATE (<=60 psig)
IDENTIFICATION	☐ ABOVE GROUND FACILITY ☒ BELOW GROUND PIPE EXPOSURE	FACILITY IDENTIFICATION (REG STATION, VALVE #, METER STATION/ETC.)	
DATE OF ASSESSEMENT	7-20-16	HP LINE NAME AND NUMBER	8" BREMERTON TRANS LINE #2
DISTRICT	Bremerton	TOWN	Bremerton
LOCATION	ADDRESS / CROSS STREETS Archie Way & Reba		
REASON FOR ASSESSEMENT	☐ OBSERVING THIRD PARTY DIG	☐ CNG CONSTRUCTION PROJECT	☒ INTEGRITY ASSESSMENT-DIRECT EXAMINATION ☐ OTHER -EXPLAIN IN COMMENTS

LOCATE No. (if applicable)	Tp6	ARRIVAL TIME	11:00	COMPLETED TIME	5:00pm

PIPE EXAMINATION DETAILS

COLLECT AS MUCH DATA AS POSSIBLE. DESCRIBE REASON IF DATA IS NOT AVAILABLE.

PIPE MATERIAL	☒ STEEL ☐ PE ☐ OTHER:_____	PIPE DIAMETER	8 INCHES	MEASURED DEPTH OF COVER (if applicable)	102 INCHES	LENGTH OF PIPE EXPOSED	3 FEET

STEEL FACTORY APPLIED COATING	☒ COAL TAR ☐ BARE	☐ X-TRU ☐ FIBER WRAP	☐ FBE ☐ OTHER:_____	☐ N/A
STEEL FIELD APPLIED COATING	☐ ROYSTON GREENLINE ☐ POLYGARD RD-6 ☐ FIELD APPLIED EPOXY ☐ FIELD APPLIED MASTIC	☒ TRENTON #1 (BELOW GROUND) ☐ TRENTON #2A (ABOVE GROUND) ☐ FIBER WRAP ☐ SHRINKSLEEVE	☐ N/A ☐ OTHER _____	
STEEL COATING CONDITION	DESCRIBE ALL COATING DEFECTS AND POSSIBLE CAUSE. SKETCH LOCATIONS AND DESCRIBE REPAIRS.	**FOUND:** ☒ GOOD ☐ FAIR ☐ POOR ☐ N/A **LEFT:** ☒ GOOD ☐ FAIR ☐ POOR ☐ N/A		

PIPE MATERIAL EXAMINATION DETAILS

IF PIPE MATERIAL IS EXPOSED, COMPLETE THE FOLLOWING

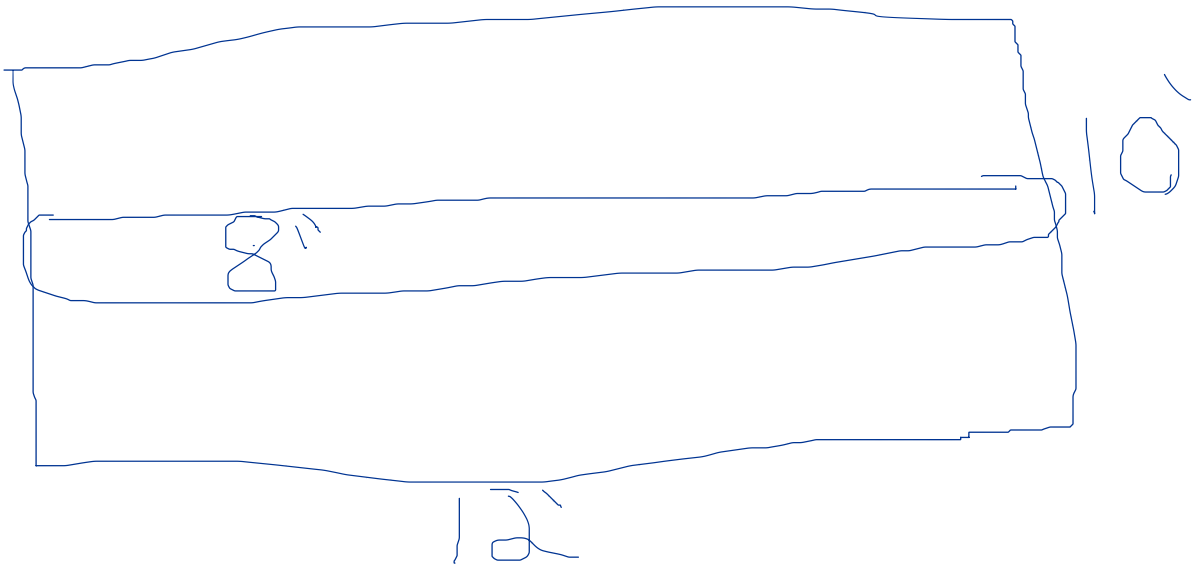
EXTERNAL PIPE CONDITION	IF PIPE CONDITION IS OTHER THAN GOOD, REPORT TO CORROSION CONTROL AND ENGINEERING WHEN APPLICABLE; SKETCH LOCATIONS.	
	FOUND: ☒ GOOD ☐ FAIR ☐ POOR PITTING: ☐ YES ☒ NO SCALING: ☐ YES ☒ NO GOUGING: ☐ YES ☒ NO SCRATCHING: ☐ YES ☒ NO	**LEFT**: ☒ GOOD ☐ FAIR ☐ POOR PITTING: ☐ YES ☒ NO SCALING: ☐ YES ☒ NO GOUGING: ☐ YES ☒ NO SCRATCHING: ☐ YES ☒ NO

INTERNAL PIPE CONDITION	☐ GOOD ☐ FAIR ☐ POOR ☒ N/A	INTERNAL PIPE LIQUIDS	☐ DRY ☐ WET ☒ N/A	SKETCH LOCATION OF CUT AND DESCRIBE INTERNAL CONDITIONS FOUND IF INTERNAL PIPE CONDITION IS OTHER THAN GOOD OR N/A AND REPORT TO CORROSION AND ENGINEERING.
WELD APPEARANCE	HOW MANY WELDS EXPOSED: O			SKETCH LOCATION OF ALL WELDS; DESCRIBE WELDS THAT DO NOT APPEAR ACCEPTABLE.
CATHODIC PROTECTION	PIPE TO SOIL POTENTIAL (VOLTS), INDICATE POLARITY	-1.5		IF READING IS MORE POSITIVE THAN –0.90V, CONTACT CORROSION CONTROL

IF PIPE WALL LOSS, DENTS, OR IMPACT DAMAGE IS FOUND OR SUSPECTED, CONTACT ENGINEERING FOR INSTRUCTIONS.

CASCADE NATURAL GAS CORPORATION
INTEGRITY MANAGEMENT DIG REPORT

SKETCH PIPE LOCATION, AND NEARBY AREA. INDICATE SIZE OF EXCAVATION. GIVE DISTANCES TO NEARBY LANDMARKS. IDENTIFY LOCATION OF ANOMOLIES (CORROSION, PITTING, POOR WELDS, UNEXPECTED FITTINGS, ETC.)



COMMENTS/DESCRIPTION OF EXAMINATION INCLUDING ANY INFORMATION THAT MIGHT AID EVALUATION OF SYSTEM QUALITY. EXPLAIN UNUSUAL CONDITIONS AND DESCRIBE THE CONDITION FOUND AS NECESSARY

Half cell -1.5 Ut .188 .188 .185 .182

SPECIAL NOTE: ADDING FITTINGS OR COMPONENTS, REPAIRS, REPLACEMENTS, REINFORCEMENTS, AND REROUTES OF HP LINE AND TRANSMISSION LINES MUST BE RECORDED BY AS BUILT AND SUBMITTED TO ENGINEERING FOR INCLUSION INTO THE PERMANENT RECORDS. RECORD AS-BUILTS AS DIRECTED BY DISTRICT MANAGEMENT AND DISTRIBUTION CLERK.

REPORTED BY	DATE
Bruno	7-20-16

DISTRICT OPERATIONS MANAGER/DISTRICT MANAGER	DATE

CASCADE NATURAL GAS CORPORATION
INTEGRITY MANAGEMENT DIG REPORT

ANOMOLY EXAMINATION DETAILS

IF WALL LOSS, DENTS, OR IMPACT DAMAGE SUSPECTED – IDENTIFY LOCATION, AREA, PIT DEPTH, MAX PIT DEPTH, AND TYPE OF ALL WALL LOSS OR ANOMOLIES WITH DETAILED SKETCHES. FOR GENERAL CORROSION, MULTIPLE MEASUREMENTS OF PIT DEPTH AND REMAINING WALL ARE NEEDED (TOPOGRAPHY MAP)

SOIL TYPE (IF KNOWN)		SOIL RESISTIVITY (if applicable)	OHM-CM	MINIMUM UT PIPE WALL THICKNESS	INCHES
MAX PIT DEPTH DISCOVERED (INCHES)		GPS REFERENCE POINT (IF KNOWN)			

BOTTOM							
3:00							
TOP							
9:00							
BOTTOM							

SPECIFY LONGITUDINAL PIPE LENGTH OF ANOMOLY IN INCHES

EXAM PERFORMED BY	DESIGNATED REPRESENTATIVE	DATE

ENGINEERING REVIEW

REFER TO CP755 FOR ENGINEERING REVIEW REQUIREMENTS AND APPROPRIATE WORKFLOW

☐	ANOMOLIES WERE FOUND ACCEPTABLE PER ASME B31G – REMAINING STRENGTH GUIDELINES (ATTACH CALCULATIONS)
☐	ACCEPTABLE REINFORCEMENT FITTINGS INSTALLED – DETAILS SHOWN ON AS-BUILT WORK ORDER_____
☐	PIPE WAS REMOVED – DETAILS SHOWN ON AS-BUILT - WORK ORDER _____
☐	NO ACTION NECESSARY
☐	OTHER: (WRITE IN OR ATTACH)

	ENGINEER	DATE

CASCADE NATURAL GAS CORPORATION

INTEGRITY MANAGEMENT DIG REPORT

PRESSURE CLASS	☑ TRANSMISSION	☐ HIGH PRESSURE (>60 psig)	☐ INTERMEDIATE (<=60 psig)
IDENTIFICATION	☐ ABOVE GROUND FACILITY ☑ BELOW GROUND PIPE EXPOSURE	FACILITY IDENTIFICATION (REG STATION, VALVE #, METER STATION/ETC.)	
DATE OF ASSESSEMENT	7/20/16	HP LINE NAME AND NUMBER	8" BREMERTON TRANS LINE #2
DISTRICT		TOWN	Bremerton
LOCATION	ADDRESS / CROSS STREETS Warner Road		
REASON FOR ASSESSEMENT	☐ OBSERVING THIRD PARTY DIG	☐ CNG CONSTRUCTION PROJECT	☑ INTEGRITY ASSESSMENT-DIRECT EXAMINATION ☐ OTHER -EXPLAIN IN COMMENTS
LOCATE No. (if applicable)	Bremerton TP#7 & 10	ARRIVAL TIME	COMPLETED TIME

PIPE EXAMINATION DETAILS

COLLECT AS MUCH DATA AS POSSIBLE. DESCRIBE REASON IF DATA IS NOT AVAILABLE.

PIPE MATERIAL	☑ STEEL ☐ PE ☐ OTHER:_____	PIPE DIAMETER	8 INCHES	MEASURED DEPTH OF COVER (if applicable)	96 INCHES	LENGTH OF PIPE EXPOSED	6 FEET
STEEL FACTORY APPLIED COATING	☑ COAL TAR ☐ BARE	☐ X-TRU ☐ FIBER WRAP	☐ FBE ☐ OTHER:_____	☐ N/A			
STEEL FIELD APPLIED COATING	☐ ROYSTON GREENLINE ☐ POLYGARD RD-6 ☐ FIELD APPLIED EPOXY ☐ FIELD APPLIED MASTIC	☑ TRENTON #1 (BELOW GROUND) ☐ TRENTON #2A (ABOVE GROUND) ☐ FIBER WRAP ☐ SHRINKSLEEVE		☐ N/A ☐ OTHER _____			
STEEL COATING CONDITION	DESCRIBE ALL COATING DEFECTS AND POSSIBLE CAUSE. SKETCH LOCATIONS AND DESCRIBE REPAIRS.	**FOUND:** ☐ GOOD ☑ FAIR ☐ POOR ☐ N/A **LEFT:** ☑ GOOD ☐ FAIR ☐ POOR ☐ N/A					

PIPE MATERIAL EXAMINATION DETAILS

IF PIPE MATERIAL IS EXPOSED, COMPLETE THE FOLLOWING

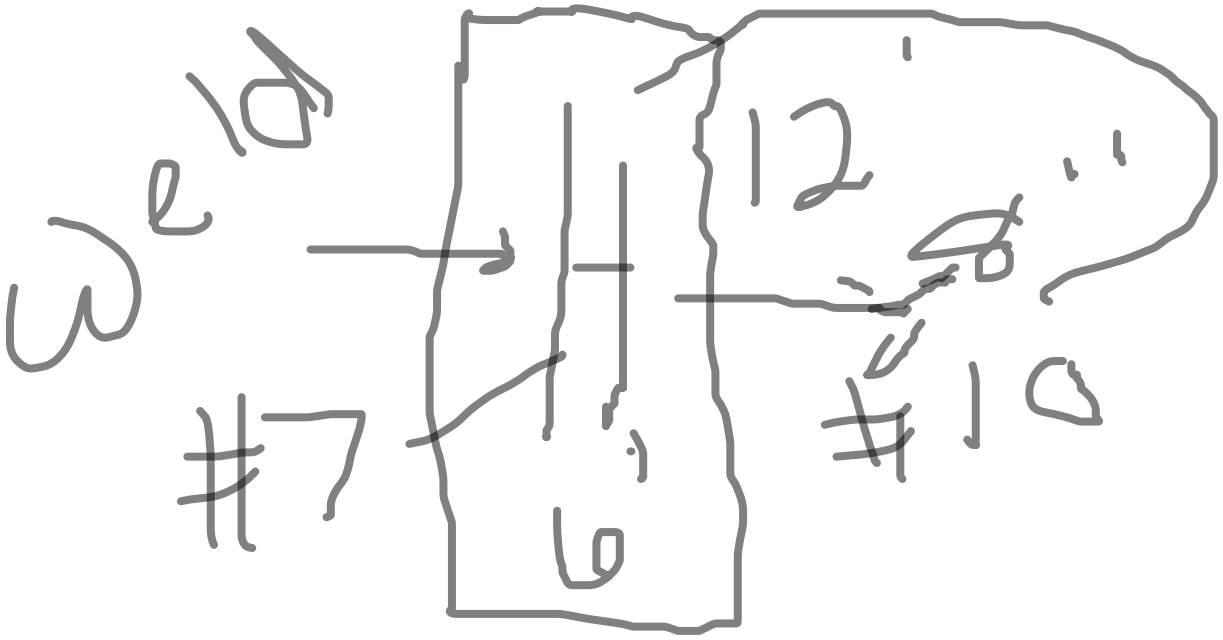
EXTERNAL PIPE CONDITION	IF PIPE CONDITION IS OTHER THAN GOOD, REPORT TO CORROSION CONTROL AND ENGINEERING WHEN APPLICABLE; SKETCH LOCATIONS.	
	FOUND: ☑ GOOD ☐ FAIR ☐ POOR PITTING: ☐ YES ☑ NO SCALING: ☐ YES ☑ NO GOUGING: ☐ YES ☑ NO SCRATCHING: ☐ YES ☑ NO	**LEFT**: ☑ GOOD ☐ FAIR ☐ POOR PITTING: ☐ YES ☑ NO SCALING: ☐ YES ☑ NO GOUGING: ☐ YES ☑ NO SCRATCHING: ☐ YES ☑ NO

INTERNAL PIPE CONDITION	☐ GOOD ☐ FAIR ☐ POOR ☑ N/A	INTERNAL PIPE LIQUIDS	☐ DRY ☐ WET ☑ N/A	SKETCH LOCATION OF CUT AND DESCRIBE INTERNAL CONDITIONS FOUND IF INTERNAL PIPE CONDITION IS OTHER THAN GOOD OR N/A AND REPORT TO CORROSION AND ENGINEERING.
WELD APPEARANCE	HOW MANY WELDS EXPOSED: 1			SKETCH LOCATION OF ALL WELDS; DESCRIBE WELDS THAT DO NOT APPEAR ACCEPTABLE.
CATHODIC PROTECTION	PIPE TO SOIL POTENTIAL (VOLTS), INDICATE POLARITY	Tp7 -1.6, tp 10 -1.5		IF READING IS MORE POSITIVE THAN –0.90V, CONTACT CORROSION CONTROL

IF PIPE WALL LOSS, DENTS, OR IMPACT DAMAGE IS FOUND OR SUSPECTED, CONTACT ENGINEERING FOR INSTRUCTIONS.

CASCADE NATURAL GAS CORPORATION
INTEGRITY MANAGEMENT DIG REPORT

SKETCH PIPE LOCATION, AND NEARBY AREA. INDICATE SIZE OF EXCAVATION. GIVE DISTANCES TO NEARBY LANDMARKS. IDENTIFY LOCATION OF ANOMOLIES (CORROSION, PITTING, POOR WELDS, UNEXPECTED FITTINGS, ETC.)



COMMENTS/DESCRIPTION OF EXAMINATION INCLUDING ANY INFORMATION THAT MIGHT AID EVALUATION OF SYSTEM QUALITY. EXPLAIN UNUSUAL CONDITIONS AND DESCRIBE THE CONDITION FOUND AS NECESSARY

Tp10 UT .182,.181,.181, tp 7 UT .187,.187,.189

SPECIAL NOTE: ADDING FITTINGS OR COMPONENTS, REPAIRS, REPLACEMENTS, REINFORCEMENTS, AND REROUTES OF HP LINE AND TRANSMISSION LINES MUST BE RECORDED BY AS BUILT AND SUBMITTED TO ENGINEERING FOR INCLUSION INTO THE PERMANENT RECORDS. RECORD AS-BUILTS AS DIRECTED BY DISTRICT MANAGEMENT AND DISTRIBUTION CLERK.

REPORTED BY	DATE
Bruno	7/20/16

DISTRICT OPERATIONS MANAGER/DISTRICT MANAGER	DATE

CASCADE NATURAL GAS CORPORATION
INTEGRITY MANAGEMENT DIG REPORT

ANOMOLY EXAMINATION DETAILS

IF WALL LOSS, DENTS, OR IMPACT DAMAGE SUSPECTED – IDENTIFY LOCATION, AREA, PIT DEPTH, MAX PIT DEPTH, AND TYPE OF ALL WALL LOSS OR ANOMOLIES WITH DETAILED SKETCHES. FOR GENERAL CORROSION, MULTIPLE MEASUREMENTS OF PIT DEPTH AND REMAINING WALL ARE NEEDED (TOPOGRAPHY MAP)

SOIL TYPE (IF KNOWN)		SOIL RESISTIVITY (if applicable)	OHM-CM	MINIMUM UT PIPE WALL THICKNESS	INCHES
MAX PIT DEPTH DISCOVERED (INCHES)		GPS REFERENCE POINT (IF KNOWN)			

BOTTOM							
3:00							
TOP							
9:00							
BOTTOM							

SPECIFY LONGITUDINAL PIPE LENGTH OF ANOMOLY IN INCHES

EXAM PERFORMED BY	DESIGNATED REPRESENTATIVE	DATE

ENGINEERING REVIEW

REFER TO CP755 FOR ENGINEERING REVIEW REQUIREMENTS AND APPROPRIATE WORKFLOW

☐	ANOMOLIES WERE FOUND ACCEPTABLE PER ASME B31G – REMAINING STRENGTH GUIDELINES (ATTACH CALCULATIONS)
☐	ACCEPTABLE REINFORCEMENT FITTINGS INSTALLED – DETAILS SHOWN ON AS-BUILT WORK ORDER_____
☐	PIPE WAS REMOVED – DETAILS SHOWN ON AS-BUILT - WORK ORDER _____
☐	NO ACTION NECESSARY
☐	OTHER: (WRITE IN OR ATTACH)

	ENGINEER	DATE

CASCADE NATURAL GAS CORPORATION

INTEGRITY MANAGEMENT DIG REPORT

PRESSURE CLASS	☑ TRANSMISSION	☐ HIGH PRESSURE (>60 psig)	☐ INTERMEDIATE (<=60 psig)
IDENTIFICATION	☐ ABOVE GROUND FACILITY ☑ BELOW GROUND PIPE EXPOSURE	FACILITY IDENTIFICATION (REG STATION, VALVE #, METER STATION/ETC.)	
DATE OF ASSESSEMENT	7/19/16	HP LINE NAME AND NUMBER	8" BREMERTON TRANS LINE #2
DISTRICT	Bremerton	TOWN	Bremerton
LOCATION	ADDRESS / CROSS STREETS Werner Rd & west of Nollwood		
REASON FOR ASSESSEMENT	☐ OBSERVING THIRD PARTY DIG	☐ CNG CONSTRUCTION PROJECT	☑ INTEGRITY ASSESSMENT-DIRECT EXAMINATION ☐ OTHER -EXPLAIN IN COMMENTS

LOCATE No. (if applicable)	Tp#9	ARRIVAL TIME	2:15	COMPLETED TIME	5:45

PIPE EXAMINATION DETAILS

COLLECT AS MUCH DATA AS POSSIBLE. DESCRIBE REASON IF DATA IS NOT AVAILABLE.

PIPE MATERIAL	☑ STEEL ☐ PE ☐ OTHER:_____	PIPE DIAMETER	8 INCHES	MEASURED DEPTH OF COVER (if applicable)	60 INCHES	LENGTH OF PIPE EXPOSED	3 FEET

STEEL FACTORY APPLIED COATING	☑ COAL TAR ☐ BARE	☐ X-TRU ☐ FIBER WRAP	☐ FBE ☐ OTHER:_____	☐ N/A
STEEL FIELD APPLIED COATING	☐ ROYSTON GREENLINE ☐ POLYGARD RD-6 ☐ FIELD APPLIED EPOXY ☐ FIELD APPLIED MASTIC	☑ TRENTON #1 (BELOW GROUND) ☐ TRENTON #2A (ABOVE GROUND) ☐ FIBER WRAP ☐ SHRINKSLEEVE	☐ N/A ☐ OTHER _____	
STEEL COATING CONDITION	DESCRIBE ALL COATING DEFECTS AND POSSIBLE CAUSE. SKETCH LOCATIONS AND DESCRIBE REPAIRS.	**FOUND:** ☑ GOOD ☐ FAIR ☐ POOR ☐ N/A **LEFT:** ☑ GOOD ☐ FAIR ☐ POOR ☐ N/A		

PIPE MATERIAL EXAMINATION DETAILS

IF PIPE MATERIAL IS EXPOSED, COMPLETE THE FOLLOWING

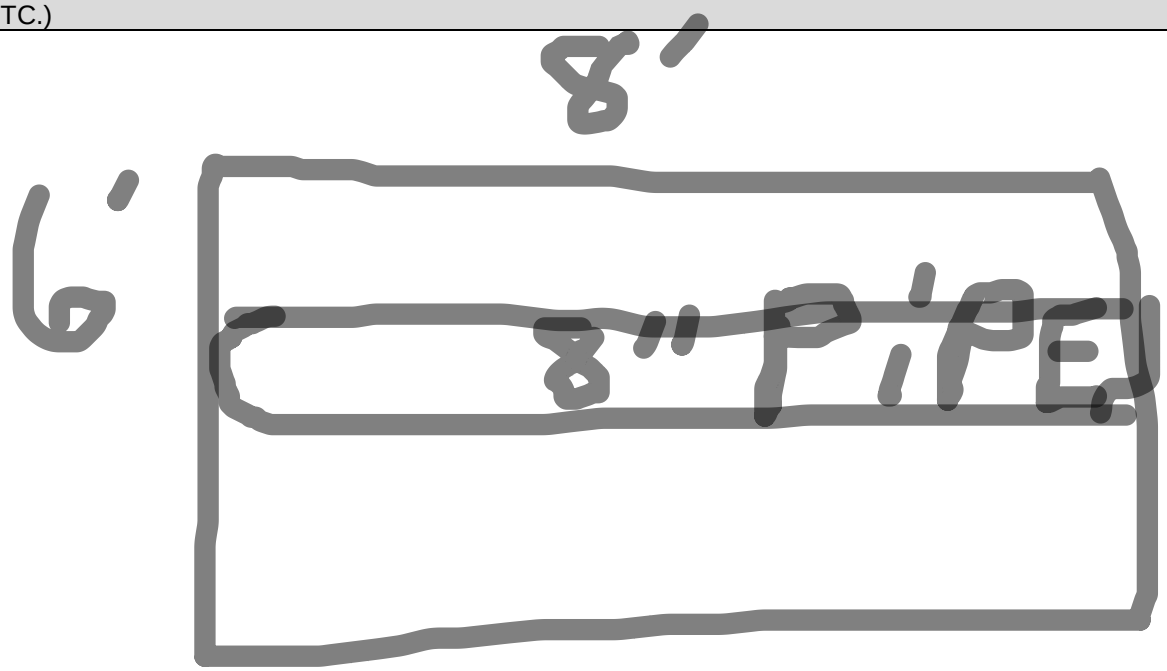
EXTERNAL PIPE CONDITION	IF PIPE CONDITION IS OTHER THAN GOOD, REPORT TO CORROSION CONTROL AND ENGINEERING WHEN APPLICABLE; SKETCH LOCATIONS.	
	FOUND: ☑ GOOD ☐ FAIR ☐ POOR PITTING: ☐ YES ☑ NO SCALING: ☐ YES ☑ NO GOUGING: ☐ YES ☑ NO SCRATCHING: ☐ YES ☑ NO	**LEFT**: ☑ GOOD ☐ FAIR ☐ POOR PITTING: ☐ YES ☑ NO SCALING: ☐ YES ☑ NO GOUGING: ☐ YES ☑ NO SCRATCHING: ☐ YES ☑ NO

INTERNAL PIPE CONDITION	☐ GOOD ☐ FAIR ☐ POOR ☑ N/A	INTERNAL PIPE LIQUIDS	☐ DRY ☐ WET ☑ N/A	SKETCH LOCATION OF CUT AND DESCRIBE INTERNAL CONDITIONS FOUND IF INTERNAL PIPE CONDITION IS OTHER THAN GOOD OR N/A AND REPORT TO CORROSION AND ENGINEERING.
WELD APPEARANCE	HOW MANY WELDS EXPOSED: 0			SKETCH LOCATION OF ALL WELDS; DESCRIBE WELDS THAT DO NOT APPEAR ACCEPTABLE.
CATHODIC PROTECTION	PIPE TO SOIL POTENTIAL (VOLTS), INDICATE POLARITY	-1.6		IF READING IS MORE POSITIVE THAN –0.90V, CONTACT CORROSION CONTROL

IF PIPE WALL LOSS, DENTS, OR IMPACT DAMAGE IS FOUND OR SUSPECTED, CONTACT ENGINEERING FOR INSTRUCTIONS.

CASCADE NATURAL GAS CORPORATION
INTEGRITY MANAGEMENT DIG REPORT

SKETCH PIPE LOCATION, AND NEARBY AREA. INDICATE SIZE OF EXCAVATION. GIVE DISTANCES TO NEARBY LANDMARKS. IDENTIFY LOCATION OF ANOMOLIES (CORROSION, PITTING, POOR WELDS, UNEXPECTED FITTINGS, ETC.)



COMMENTS/DESCRIPTION OF EXAMINATION INCLUDING ANY INFORMATION THAT MIGHT AID EVALUATION OF SYSTEM QUALITY. EXPLAIN UNUSUAL CONDITIONS AND DESCRIBE THE CONDITION FOUND AS NECESSARY

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SPECIAL NOTE: ADDING FITTINGS OR COMPONENTS, REPAIRS, REPLACEMENTS, REINFORCEMENTS, AND REROUTES OF HP LINE AND TRANSMISSION LINES MUST BE RECORDED BY AS BUILT AND SUBMITTED TO ENGINEERING FOR INCLUSION INTO THE PERMANENT RECORDS. RECORD AS-BUILTS AS DIRECTED BY DISTRICT MANAGEMENT AND DISTRIBUTION CLERK.

REPORTED BY	DATE
Jason	7/19/16

DISTRICT OPERATIONS MANAGER/DISTRICT MANAGER	DATE

CASCADE NATURAL GAS CORPORATION
INTEGRITY MANAGEMENT DIG REPORT

ANOMOLY EXAMINATION DETAILS

IF WALL LOSS, DENTS, OR IMPACT DAMAGE SUSPECTED – IDENTIFY LOCATION, AREA, PIT DEPTH, MAX PIT DEPTH, AND TYPE OF ALL WALL LOSS OR ANOMOLIES WITH DETAILED SKETCHES. FOR GENERAL CORROSION, MULTIPLE MEASUREMENTS OF PIT DEPTH AND REMAINING WALL ARE NEEDED (TOPOGRAPHY MAP)

SOIL TYPE (IF KNOWN)		SOIL RESISTIVITY (if applicable)	OHM-CM	MINIMUM UT PIPE WALL THICKNESS	INCHES
MAX PIT DEPTH DISCOVERED (INCHES)		GPS REFERENCE POINT (IF KNOWN)			

BOTTOM							
3:00							
TOP							
9:00							
BOTTOM							

SPECIFY LONGITUDINAL PIPE LENGTH OF ANOMOLY IN INCHES

EXAM PERFORMED BY	DESIGNATED REPRESENTATIVE	DATE

ENGINEERING REVIEW

REFER TO CP755 FOR ENGINEERING REVIEW REQUIREMENTS AND APPROPRIATE WORKFLOW

☐	ANOMOLIES WERE FOUND ACCEPTABLE PER ASME B31G – REMAINING STRENGTH GUIDELINES (ATTACH CALCULATIONS)
☐	ACCEPTABLE REINFORCEMENT FITTINGS INSTALLED – DETAILS SHOWN ON AS-BUILT WORK ORDER_____
☐	PIPE WAS REMOVED – DETAILS SHOWN ON AS-BUILT - WORK ORDER _____
☐	NO ACTION NECESSARY
☐	OTHER: (WRITE IN OR ATTACH)

	ENGINEER	DATE

CASCADE NATURAL GAS CORPORATION

INTEGRITY MANAGEMENT DIG REPORT

PRESSURE CLASS	☑ TRANSMISSION	☐ HIGH PRESSURE (>60 psig)	☐ INTERMEDIATE (<=60 psig)
IDENTIFICATION	☐ ABOVE GROUND FACILITY ☑ BELOW GROUND PIPE EXPOSURE	FACILITY IDENTIFICATION (REG STATION, VALVE #, METER STATION/ETC.)	
DATE OF ASSESSEMENT	7/19/16	HP LINE NAME AND NUMBER	8" BREMERTON TRANS LINE #2
DISTRICT	Bremerton	TOWN	Bremerton
LOCATION	ADDRESS / CROSS STREETS Mid Hill		
REASON FOR ASSESSEMENT	☐ OBSERVING THIRD PARTY DIG	☐ CNG CONSTRUCTION PROJECT	☑ INTEGRITY ASSESSMENT-DIRECT EXAMINATION ☐ OTHER -EXPLAIN IN COMMENTS

LOCATE No. (if applicable)	Tp11	ARRIVAL TIME	9:00	COMPLETED TIME	10:30

PIPE EXAMINATION DETAILS

COLLECT AS MUCH DATA AS POSSIBLE. DESCRIBE REASON IF DATA IS NOT AVAILABLE.

PIPE MATERIAL	☑ STEEL ☐ PE ☐ OTHER:_____	PIPE DIAMETER	8 INCHES	MEASURED DEPTH OF COVER (if applicable)	60 INCHES	LENGTH OF PIPE EXPOSED	3 FEET

STEEL FACTORY APPLIED COATING	☑ COAL TAR ☐ BARE	☐ X-TRU ☐ FIBER WRAP	☐ FBE ☐ OTHER:_____	☐ N/A
STEEL FIELD APPLIED COATING	☐ ROYSTON GREENLINE ☐ POLYGARD RD-6 ☐ FIELD APPLIED EPOXY ☐ FIELD APPLIED MASTIC	☑ TRENTON #1 (BELOW GROUND) ☐ TRENTON #2A (ABOVE GROUND) ☐ FIBER WRAP ☐ SHRINKSLEEVE	☐ N/A ☐ OTHER _____	
STEEL COATING CONDITION	DESCRIBE ALL COATING DEFECTS AND POSSIBLE CAUSE. SKETCH LOCATIONS AND DESCRIBE REPAIRS.	**FOUND:** ☑ GOOD ☐ FAIR ☐ POOR ☐ N/A **LEFT:** ☑ GOOD ☐ FAIR ☐ POOR ☐ N/A		

PIPE MATERIAL EXAMINATION DETAILS

IF PIPE MATERIAL IS EXPOSED, COMPLETE THE FOLLOWING

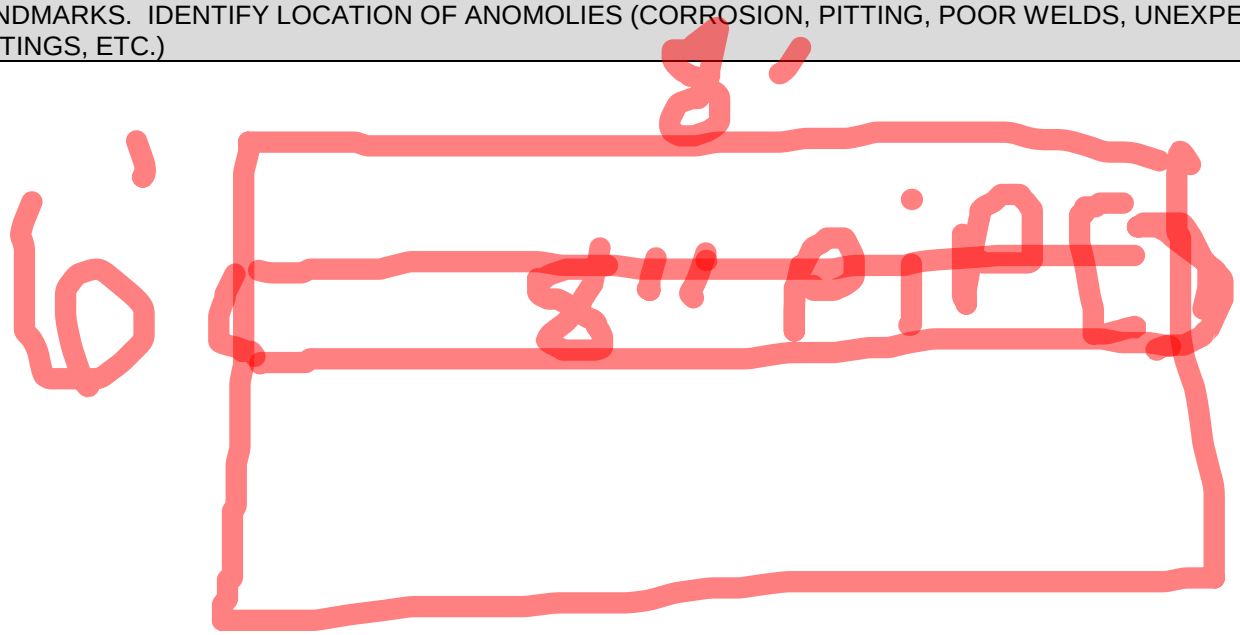
EXTERNAL PIPE CONDITION	IF PIPE CONDITION IS OTHER THAN GOOD, REPORT TO CORROSION CONTROL AND ENGINEERING WHEN APPLICABLE; SKETCH LOCATIONS.	
	FOUND: ☑ GOOD ☐ FAIR ☐ POOR PITTING: ☐ YES ☑ NO SCALING: ☐ YES ☑ NO GOUGING: ☐ YES ☑ NO SCRATCHING: ☐ YES ☑ NO	**LEFT**: ☑ GOOD ☐ FAIR ☐ POOR PITTING: ☐ YES ☑ NO SCALING: ☐ YES ☑ NO GOUGING: ☐ YES ☑ NO SCRATCHING: ☐ YES ☑ NO

INTERNAL PIPE CONDITION	☐ GOOD ☐ FAIR ☐ POOR ☑ N/A	INTERNAL PIPE LIQUIDS	☐ DRY ☐ WET ☑ N/A	SKETCH LOCATION OF CUT AND DESCRIBE INTERNAL CONDITIONS FOUND IF INTERNAL PIPE CONDITION IS OTHER THAN GOOD OR N/A AND REPORT TO CORROSION AND ENGINEERING.
WELD APPEARANCE	HOW MANY WELDS EXPOSED: 0			SKETCH LOCATION OF ALL WELDS; DESCRIBE WELDS THAT DO NOT APPEAR ACCEPTABLE.
CATHODIC PROTECTION	PIPE TO SOIL POTENTIAL (VOLTS), INDICATE POLARITY	-1.1		IF READING IS MORE POSITIVE THAN –0.90V, CONTACT CORROSION CONTROL

IF PIPE WALL LOSS, DENTS, OR IMPACT DAMAGE IS FOUND OR SUSPECTED, CONTACT ENGINEERING FOR INSTRUCTIONS.

CASCADE NATURAL GAS CORPORATION
INTEGRITY MANAGEMENT DIG REPORT

SKETCH PIPE LOCATION, AND NEARBY AREA. INDICATE SIZE OF EXCAVATION. GIVE DISTANCES TO NEARBY LANDMARKS. IDENTIFY LOCATION OF ANOMOLIES (CORROSION, PITTING, POOR WELDS, UNEXPECTED FITTINGS, ETC.)



COMMENTS/DESCRIPTION OF EXAMINATION INCLUDING ANY INFORMATION THAT MIGHT AID EVALUATION OF SYSTEM QUALITY. EXPLAIN UNUSUAL CONDITIONS AND DESCRIBE THE CONDITION FOUND AS NECESSARY

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SPECIAL NOTE: ADDING FITTINGS OR COMPONENTS, REPAIRS, REPLACEMENTS, REINFORCEMENTS, AND REROUTES OF HP LINE AND TRANSMISSION LINES MUST BE RECORDED BY AS BUILT AND SUBMITTED TO ENGINEERING FOR INCLUSION INTO THE PERMANENT RECORDS. RECORD AS-BUILTS AS DIRECTED BY DISTRICT MANAGEMENT AND DISTRIBUTION CLERK.

REPORTED BY	DATE
Jason	7/19/16

DISTRICT OPERATIONS MANAGER/DISTRICT MANAGER	DATE

CASCADE NATURAL GAS CORPORATION
INTEGRITY MANAGEMENT DIG REPORT

ANOMOLY EXAMINATION DETAILS

IF WALL LOSS, DENTS, OR IMPACT DAMAGE SUSPECTED – IDENTIFY LOCATION, AREA, PIT DEPTH, MAX PIT DEPTH, AND TYPE OF ALL WALL LOSS OR ANOMOLIES WITH DETAILED SKETCHES. FOR GENERAL CORROSION, MULTIPLE MEASUREMENTS OF PIT DEPTH AND REMAINING WALL ARE NEEDED (TOPOGRAPHY MAP)

SOIL TYPE (IF KNOWN)		SOIL RESISTIVITY (if applicable)	OHM-CM	MINIMUM UT PIPE WALL THICKNESS	INCHES
MAX PIT DEPTH DISCOVERED (INCHES)		GPS REFERENCE POINT (IF KNOWN)			

BOTTOM							
3:00							
TOP							
9:00							
BOTTOM							

SPECIFY LONGITUDINAL PIPE LENGTH OF ANOMOLY IN INCHES

EXAM PERFORMED BY	DESIGNATED REPRESENTATIVE	DATE

ENGINEERING REVIEW

REFER TO CP755 FOR ENGINEERING REVIEW REQUIREMENTS AND APPROPRIATE WORKFLOW

☐	ANOMOLIES WERE FOUND ACCEPTABLE PER ASME B31G – REMAINING STRENGTH GUIDELINES (ATTACH CALCULATIONS)
☐	ACCEPTABLE REINFORCEMENT FITTINGS INSTALLED – DETAILS SHOWN ON AS-BUILT WORK ORDER_____
☐	PIPE WAS REMOVED – DETAILS SHOWN ON AS-BUILT - WORK ORDER _____
☐	NO ACTION NECESSARY
☐	OTHER: (WRITE IN OR ATTACH)

	ENGINEER	DATE

CASCADE NATURAL GAS CORPORATION

INTEGRITY MANAGEMENT DIG REPORT

PRESSURE CLASS	■ TRANSMISSION	☐ HIGH PRESSURE (>60 psig)	☐ INTERMEDIATE (<=60 psig)
IDENTIFICATION	☐ ABOVE GROUND FACILITY ■ BELOW GROUND PIPE EXPOSURE	FACILITY IDENTIFICATION (REG STATION, VALVE #, METER STATION/ETC.)	Brem TP12
DATE OF ASSESSEMENT	7/19/16	HP LINE NAME AND NUMBER	8" BREMERTON TRANS LINE #2
DISTRICT		TOWN	Bremerton
LOCATION	ADDRESS / CROSS STREETS Warner rd & W of Nollwood		
REASON FOR ASSESSEMENT	☐ OBSERVING THIRD PARTY DIG	☐ CNG CONSTRUCTION PROJECT	■ INTEGRITY ASSESSMENT-DIRECT EXAMINATION ☐ OTHER -EXPLAIN IN COMMENTS
LOCATE No. (if applicable)	Tp12	ARRIVAL TIME: 7	COMPLETED TIME: 9:45

PIPE EXAMINATION DETAILS

COLLECT AS MUCH DATA AS POSSIBLE. DESCRIBE REASON IF DATA IS NOT AVAILABLE.

PIPE MATERIAL	■ STEEL ☐ PE ☐ OTHER:_____	PIPE DIAMETER	8 INCHES	MEASURED DEPTH OF COVER (if applicable)	48 INCHES	LENGTH OF PIPE EXPOSED	3 FEET
STEEL FACTORY APPLIED COATING	■ COAL TAR ☐ BARE	☐ X-TRU ☐ FIBER WRAP	☐ FBE ☐ OTHER:_____	☐ N/A			
STEEL FIELD APPLIED COATING	☐ ROYSTON GREENLINE ☐ POLYGARD RD-6 ☐ FIELD APPLIED EPOXY ☐ FIELD APPLIED MASTIC	■ TRENTON #1 (BELOW GROUND) ☐ TRENTON #2A (ABOVE GROUND) ☐ FIBER WRAP ☐ SHRINKSLEEVE	☐ N/A ☐ OTHER _____				
STEEL COATING CONDITION	DESCRIBE ALL COATING DEFECTS AND POSSIBLE CAUSE. SKETCH LOCATIONS AND DESCRIBE REPAIRS.	**FOUND:** ■ GOOD ☐ FAIR ☐ POOR ☐ N/A **LEFT:** ■ GOOD ☐ FAIR ☐ POOR ☐ N/A					

PIPE MATERIAL EXAMINATION DETAILS

IF PIPE MATERIAL IS EXPOSED, COMPLETE THE FOLLOWING

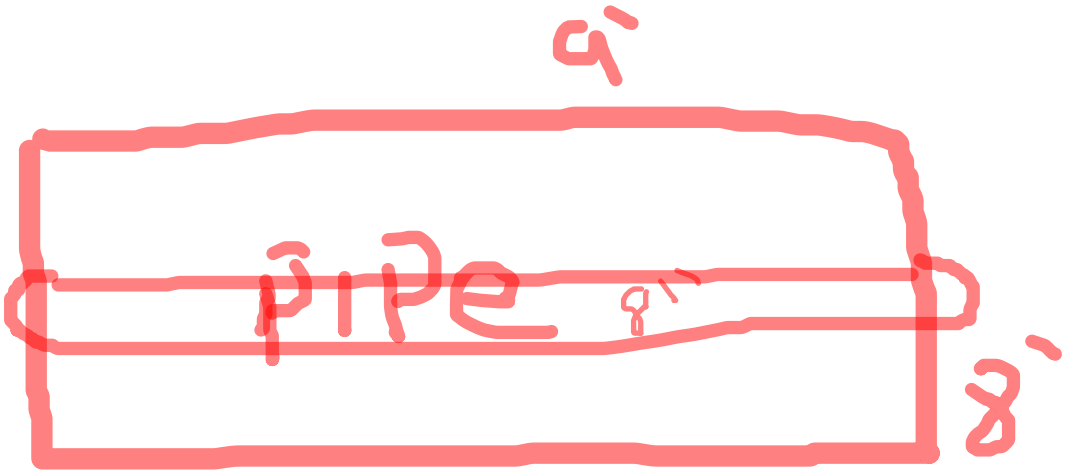
EXTERNAL PIPE CONDITION	IF PIPE CONDITION IS OTHER THAN GOOD, REPORT TO CORROSION CONTROL AND ENGINEERING WHEN APPLICABLE; SKETCH LOCATIONS.	
	FOUND: ■ GOOD ☐ FAIR ☐ POOR PITTING: ☐ YES ■ NO SCALING: ☐ YES ☐ NO GOUGING: ☐ YES ☐ NO SCRATCHING: ☐ YES ☐ NO	**LEFT**: ☐ GOOD ☐ FAIR ☐ POOR PITTING: ☐ YES ■ NO SCALING: ☐ YES ☐ NO GOUGING: ☐ YES ☐ NO SCRATCHING: ☐ YES ☐ NO

INTERNAL PIPE CONDITION	☐ GOOD ☐ FAIR ☐ POOR ■ N/A	INTERNAL PIPE LIQUIDS	☐ DRY ☐ WET ■ N/A	SKETCH LOCATION OF CUT AND DESCRIBE INTERNAL CONDITIONS FOUND IF INTERNAL PIPE CONDITION IS OTHER THAN GOOD OR N/A AND REPORT TO CORROSION AND ENGINEERING.
WELD APPEARANCE	HOW MANY WELDS EXPOSED: 0			SKETCH LOCATION OF ALL WELDS; DESCRIBE WELDS THAT DO NOT APPEAR ACCEPTABLE.
CATHODIC PROTECTION	PIPE TO SOIL POTENTIAL (VOLTS), INDICATE POLARITY	-1.8		IF READING IS MORE POSITIVE THAN –0.90V, CONTACT CORROSION CONTROL

IF PIPE WALL LOSS, DENTS, OR IMPACT DAMAGE IS FOUND OR SUSPECTED, CONTACT ENGINEERING FOR INSTRUCTIONS.

CASCADE NATURAL GAS CORPORATION
INTEGRITY MANAGEMENT DIG REPORT

SKETCH PIPE LOCATION, AND NEARBY AREA. INDICATE SIZE OF EXCAVATION. GIVE DISTANCES TO NEARBY LANDMARKS. IDENTIFY LOCATION OF ANOMOLIES (CORROSION, PITTING, POOR WELDS, UNEXPECTED FITTINGS, ETC.)



COMMENTS/DESCRIPTION OF EXAMINATION INCLUDING ANY INFORMATION THAT MIGHT AID EVALUATION OF SYSTEM QUALITY. EXPLAIN UNUSUAL CONDITIONS AND DESCRIBE THE CONDITION FOUND AS NECESSARY

Half cell -1.6. UV.188 .188 .188 .187

SPECIAL NOTE: ADDING FITTINGS OR COMPONENTS, REPAIRS, REPLACEMENTS, REINFORCEMENTS, AND REROUTES OF HP LINE AND TRANSMISSION LINES MUST BE RECORDED BY AS BUILT AND SUBMITTED TO ENGINEERING FOR INCLUSION INTO THE PERMANENT RECORDS. RECORD AS-BUILTS AS DIRECTED BY DISTRICT MANAGEMENT AND DISTRIBUTION CLERK.

REPORTED BY	DATE
Bruno	7-19-16

DISTRICT OPERATIONS MANAGER/DISTRICT MANAGER	DATE

CASCADE NATURAL GAS CORPORATION
INTEGRITY MANAGEMENT DIG REPORT

ANOMOLY EXAMINATION DETAILS

IF WALL LOSS, DENTS, OR IMPACT DAMAGE SUSPECTED – IDENTIFY LOCATION, AREA, PIT DEPTH, MAX PIT DEPTH, AND TYPE OF ALL WALL LOSS OR ANOMOLIES WITH DETAILED SKETCHES. FOR GENERAL CORROSION, MULTIPLE MEASUREMENTS OF PIT DEPTH AND REMAINING WALL ARE NEEDED (TOPOGRAPHY MAP)

SOIL TYPE (IF KNOWN)		SOIL RESISTIVITY (if applicable)	OHM-CM	MINIMUM UT PIPE WALL THICKNESS	INCHES
MAX PIT DEPTH DISCOVERED (INCHES)		GPS REFERENCE POINT (IF KNOWN)			

BOTTOM							
3:00							
TOP							
9:00							
BOTTOM							

SPECIFY LONGITUDINAL PIPE LENGTH OF ANOMOLY IN INCHES

EXAM PERFORMED BY	DESIGNATED REPRESENTATIVE	DATE

ENGINEERING REVIEW

REFER TO CP755 FOR ENGINEERING REVIEW REQUIREMENTS AND APPROPRIATE WORKFLOW

☐	ANOMOLIES WERE FOUND ACCEPTABLE PER ASME B31G – REMAINING STRENGTH GUIDELINES (ATTACH CALCULATIONS)
☐	ACCEPTABLE REINFORCEMENT FITTINGS INSTALLED – DETAILS SHOWN ON AS-BUILT WORK ORDER_____
☐	PIPE WAS REMOVED – DETAILS SHOWN ON AS-BUILT - WORK ORDER _____
☐	NO ACTION NECESSARY
☐	OTHER: (WRITE IN OR ATTACH)

	ENGINEER	DATE

CASCADE NATURAL GAS CORPORATION

INTEGRITY MANAGEMENT DIG REPORT

PRESSURE CLASS	☑ TRANSMISSION	☐ HIGH PRESSURE (>60 psig)	☐ INTERMEDIATE (<=60 psig)
IDENTIFICATION	☐ ABOVE GROUND FACILITY ☑ BELOW GROUND PIPE EXPOSURE	FACILITY IDENTIFICATION (REG STATION, VALVE #, METER STATION/ETC.)	
DATE OF ASSESSEMENT	7/18/16	HP LINE NAME AND NUMBER	8" BREMERTON TRANS LINE #2
DISTRICT	Bremerton	TOWN	Bremerton
LOCATION	ADDRESS / CROSS STREETS Werner Rd & Nollwood		
REASON FOR ASSESSEMENT	☐ OBSERVING THIRD PARTY DIG	☐ CNG CONSTRUCTION PROJECT	☑ INTEGRITY ASSESSMENT-DIRECT EXAMINATION ☐ OTHER -EXPLAIN IN COMMENTS

LOCATE No. (if applicable)	Tp#13	ARRIVAL TIME	5:00	COMPLETED TIME	5:45

PIPE EXAMINATION DETAILS

COLLECT AS MUCH DATA AS POSSIBLE. DESCRIBE REASON IF DATA IS NOT AVAILABLE.

PIPE MATERIAL	☑ STEEL ☐ PE ☐ OTHER:_____	PIPE DIAMETER	8" INCHES	MEASURED DEPTH OF COVER (if applicable)	5' INCHES	LENGTH OF PIPE EXPOSED	FEET

STEEL FACTORY APPLIED COATING	☑ COAL TAR ☐ BARE	☐ X-TRU ☐ FIBER WRAP	☐ FBE ☐ OTHER:_____	☐ N/A
STEEL FIELD APPLIED COATING	☐ ROYSTON GREENLINE ☐ POLYGARD RD-6 ☐ FIELD APPLIED EPOXY ☐ FIELD APPLIED MASTIC	☑ TRENTON #1 (BELOW GROUND) ☐ TRENTON #2A (ABOVE GROUND) ☐ FIBER WRAP ☐ SHRINKSLEEVE	☐ N/A ☐ OTHER _____	
STEEL COATING CONDITION	DESCRIBE ALL COATING DEFECTS AND POSSIBLE CAUSE. SKETCH LOCATIONS AND DESCRIBE REPAIRS.	**FOUND:** ☑ GOOD ☐ FAIR ☐ POOR ☐ N/A **LEFT:** ☑ GOOD ☐ FAIR ☐ POOR ☐ N/A		

PIPE MATERIAL EXAMINATION DETAILS

IF PIPE MATERIAL IS EXPOSED, COMPLETE THE FOLLOWING

EXTERNAL PIPE CONDITION	IF PIPE CONDITION IS OTHER THAN GOOD, REPORT TO CORROSION CONTROL AND ENGINEERING WHEN APPLICABLE; SKETCH LOCATIONS.	
	FOUND: ☑ GOOD ☐ FAIR ☐ POOR PITTING: ☐ YES ☑ NO SCALING: ☐ YES ☑ NO GOUGING: ☐ YES ☑ NO SCRATCHING: ☐ YES ☑ NO	**LEFT**: ☑ GOOD ☐ FAIR ☐ POOR PITTING: ☐ YES ☑ NO SCALING: ☐ YES ☑ NO GOUGING: ☐ YES ☑ NO SCRATCHING: ☐ YES ☑ NO

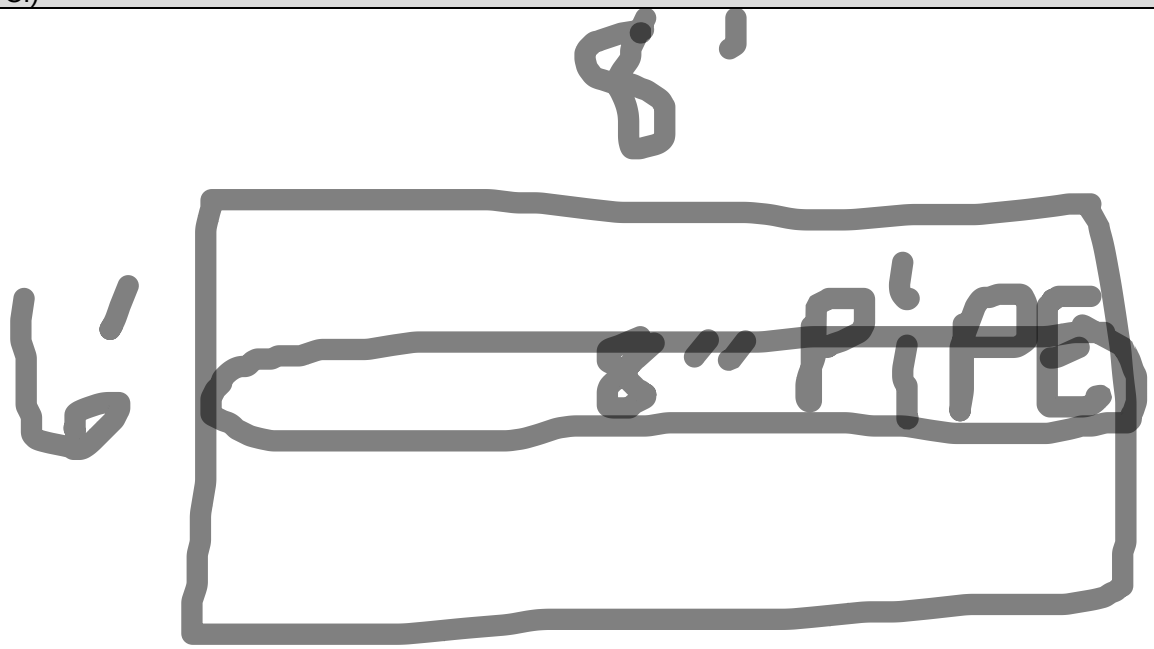
INTERNAL PIPE CONDITION	☐ GOOD ☐ FAIR ☐ POOR ☑ N/A	INTERNAL PIPE LIQUIDS	☐ DRY ☐ WET ☑ N/A	SKETCH LOCATION OF CUT AND DESCRIBE INTERNAL CONDITIONS FOUND IF INTERNAL PIPE CONDITION IS OTHER THAN GOOD OR N/A AND REPORT TO CORROSION AND ENGINEERING.
WELD APPEARANCE	HOW MANY WELDS EXPOSED: 0			SKETCH LOCATION OF ALL WELDS; DESCRIBE WELDS THAT DO NOT APPEAR ACCEPTABLE.
CATHODIC PROTECTION	PIPE TO SOIL POTENTIAL (VOLTS), INDICATE POLARITY	-1.5		IF READING IS MORE POSITIVE THAN –0.90V, CONTACT CORROSION CONTROL

IF PIPE WALL LOSS, DENTS, OR IMPACT DAMAGE IS FOUND OR SUSPECTED, CONTACT ENGINEERING FOR INSTRUCTIONS.

CASCADE NATURAL GAS CORPORATION

INTEGRITY MANAGEMENT DIG REPORT

SKETCH PIPE LOCATION, AND NEARBY AREA. INDICATE SIZE OF EXCAVATION. GIVE DISTANCES TO NEARBY LANDMARKS. IDENTIFY LOCATION OF ANOMOLIES (CORROSION, PITTING, POOR WELDS, UNEXPECTED FITTINGS, ETC.)



COMMENTS/DESCRIPTION OF EXAMINATION INCLUDING ANY INFORMATION THAT MIGHT AID EVALUATION OF SYSTEM QUALITY. EXPLAIN UNUSUAL CONDITIONS AND DESCRIBE THE CONDITION FOUND AS NECESSARY

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SPECIAL NOTE: ADDING FITTINGS OR COMPONENTS, REPAIRS, REPLACEMENTS, REINFORCEMENTS, AND REROUTES OF HP LINE AND TRANSMISSION LINES MUST BE RECORDED BY AS BUILT AND SUBMITTED TO ENGINEERING FOR INCLUSION INTO THE PERMANENT RECORDS. RECORD AS-BUILTS AS DIRECTED BY DISTRICT MANAGEMENT AND DISTRIBUTION CLERK.

REPORTED BY	DATE
Jason	7/18/16

DISTRICT OPERATIONS MANAGER/DISTRICT MANAGER	DATE

CASCADE NATURAL GAS CORPORATION
INTEGRITY MANAGEMENT DIG REPORT

ANOMOLY EXAMINATION DETAILS

IF WALL LOSS, DENTS, OR IMPACT DAMAGE SUSPECTED – IDENTIFY LOCATION, AREA, PIT DEPTH, MAX PIT DEPTH, AND TYPE OF ALL WALL LOSS OR ANOMOLIES WITH DETAILED SKETCHES. FOR GENERAL CORROSION, MULTIPLE MEASUREMENTS OF PIT DEPTH AND REMAINING WALL ARE NEEDED (TOPOGRAPHY MAP)

SOIL TYPE (IF KNOWN)		SOIL RESISTIVITY (if applicable)	OHM-CM	MINIMUM UT PIPE WALL THICKNESS	INCHES
MAX PIT DEPTH DISCOVERED (INCHES)		GPS REFERENCE POINT (IF KNOWN)			

BOTTOM							
3:00							
TOP							
9:00							
BOTTOM							

SPECIFY LONGITUDINAL PIPE LENGTH OF ANOMOLY IN INCHES

EXAM PERFORMED BY	DESIGNATED REPRESENTATIVE	DATE

ENGINEERING REVIEW

REFER TO CP755 FOR ENGINEERING REVIEW REQUIREMENTS AND APPROPRIATE WORKFLOW

☐	ANOMOLIES WERE FOUND ACCEPTABLE PER ASME B31G – REMAINING STRENGTH GUIDELINES (ATTACH CALCULATIONS)
☐	ACCEPTABLE REINFORCEMENT FITTINGS INSTALLED – DETAILS SHOWN ON AS-BUILT WORK ORDER_____
☐	PIPE WAS REMOVED – DETAILS SHOWN ON AS-BUILT - WORK ORDER _____
☐	NO ACTION NECESSARY
☐	OTHER: (WRITE IN OR ATTACH)

	ENGINEER	DATE

CASCADE NATURAL GAS CORPORATION

INTEGRITY MANAGEMENT DIG REPORT

PRESSURE CLASS	☑ TRANSMISSION	☐ HIGH PRESSURE (>60 psig)	☐ INTERMEDIATE (<=60 psig)
IDENTIFICATION	☐ ABOVE GROUND FACILITY ☑ BELOW GROUND PIPE EXPOSURE	FACILITY IDENTIFICATION (REG STATION, VALVE #, METER STATION/ETC.)	
DATE OF ASSESSEMENT	7/19/16	HP LINE NAME AND NUMBER	8" BREMERTON TRANS LINE #2
DISTRICT	Bremerton	TOWN	Bremerton
LOCATION	ADDRESS / CROSS STREETS Mid Hill		
REASON FOR ASSESSEMENT	☐ OBSERVING THIRD PARTY DIG	☐ CNG CONSTRUCTION PROJECT	☑ INTEGRITY ASSESSMENT-DIRECT EXAMINATION ☐ OTHER -EXPLAIN IN COMMENTS

LOCATE No. (if applicable)	Tp#15	ARRIVAL TIME	6:30	COMPLETED TIME	9:00

PIPE EXAMINATION DETAILS

COLLECT AS MUCH DATA AS POSSIBLE. DESCRIBE REASON IF DATA IS NOT AVAILABLE.

PIPE MATERIAL	☑ STEEL ☐ PE ☐ OTHER:_____	PIPE DIAMETER	8 INCHES	MEASURED DEPTH OF COVER (if applicable)	60 INCHES	LENGTH OF PIPE EXPOSED	3 FEET

STEEL FACTORY APPLIED COATING	☑ COAL TAR ☐ BARE	☐ X-TRU ☐ FIBER WRAP	☐ FBE ☐ OTHER:_____	☐ N/A
STEEL FIELD APPLIED COATING	☐ ROYSTON GREENLINE ☐ POLYGARD RD-6 ☐ FIELD APPLIED EPOXY ☐ FIELD APPLIED MASTIC	☑ TRENTON #1 (BELOW GROUND) ☐ TRENTON #2A (ABOVE GROUND) ☐ FIBER WRAP ☐ SHRINKSLEEVE	☐ N/A ☐ OTHER _____	
STEEL COATING CONDITION	DESCRIBE ALL COATING DEFECTS AND POSSIBLE CAUSE. SKETCH LOCATIONS AND DESCRIBE REPAIRS.	**FOUND:** ☑ GOOD ☐ FAIR ☐ POOR ☐ N/A **LEFT:** ☑ GOOD ☐ FAIR ☐ POOR ☐ N/A		

PIPE MATERIAL EXAMINATION DETAILS

IF PIPE MATERIAL IS EXPOSED, COMPLETE THE FOLLOWING

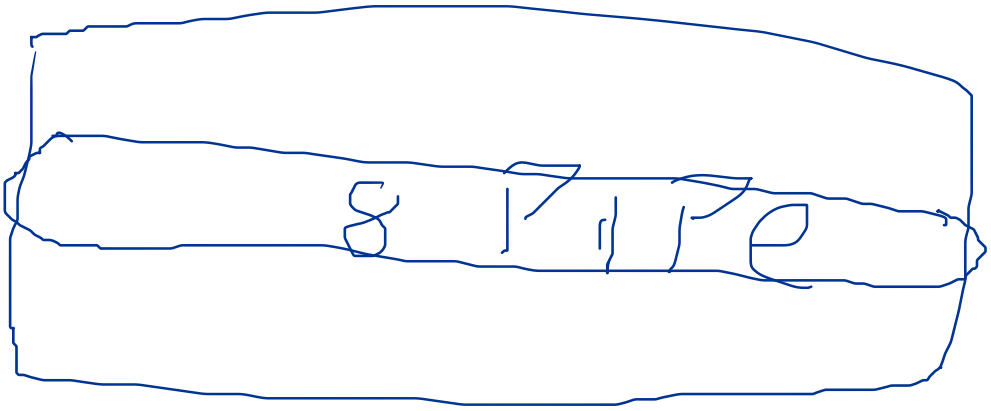
EXTERNAL PIPE CONDITION	IF PIPE CONDITION IS OTHER THAN GOOD, REPORT TO CORROSION CONTROL AND ENGINEERING WHEN APPLICABLE; SKETCH LOCATIONS.	
	FOUND: ☑ GOOD ☐ FAIR ☐ POOR PITTING: ☐ YES ☑ NO SCALING: ☐ YES ☑ NO GOUGING: ☐ YES ☑ NO SCRATCHING: ☐ YES ☑ NO	**LEFT**: ☑ GOOD ☐ FAIR ☐ POOR PITTING: ☐ YES ☑ NO SCALING: ☐ YES ☑ NO GOUGING: ☐ YES ☑ NO SCRATCHING: ☐ YES ☑ NO

INTERNAL PIPE CONDITION	☐ GOOD ☐ FAIR ☐ POOR ☑ N/A	INTERNAL PIPE LIQUIDS	☐ DRY ☐ WET ☑ N/A	SKETCH LOCATION OF CUT AND DESCRIBE INTERNAL CONDITIONS FOUND IF INTERNAL PIPE CONDITION IS OTHER THAN GOOD OR N/A AND REPORT TO CORROSION AND ENGINEERING.
WELD APPEARANCE	HOW MANY WELDS EXPOSED: 0			SKETCH LOCATION OF ALL WELDS; DESCRIBE WELDS THAT DO NOT APPEAR ACCEPTABLE.
CATHODIC PROTECTION	PIPE TO SOIL POTENTIAL (VOLTS), INDICATE POLARITY	-1.0		IF READING IS MORE POSITIVE THAN –0.90V, CONTACT CORROSION CONTROL

IF PIPE WALL LOSS, DENTS, OR IMPACT DAMAGE IS FOUND OR SUSPECTED, CONTACT ENGINEERING FOR INSTRUCTIONS.

CASCADE NATURAL GAS CORPORATION
INTEGRITY MANAGEMENT DIG REPORT

SKETCH PIPE LOCATION, AND NEARBY AREA. INDICATE SIZE OF EXCAVATION. GIVE DISTANCES TO NEARBY LANDMARKS. IDENTIFY LOCATION OF ANOMOLIES (CORROSION, PITTING, POOR WELDS, UNEXPECTED FITTINGS, ETC.)



COMMENTS/DESCRIPTION OF EXAMINATION INCLUDING ANY INFORMATION THAT MIGHT AID EVALUATION OF SYSTEM QUALITY. EXPLAIN UNUSUAL CONDITIONS AND DESCRIBE THE CONDITION FOUND AS NECESSARY

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SPECIAL NOTE: ADDING FITTINGS OR COMPONENTS, REPAIRS, REPLACEMENTS, REINFORCEMENTS, AND REROUTES OF HP LINE AND TRANSMISSION LINES MUST BE RECORDED BY AS BUILT AND SUBMITTED TO ENGINEERING FOR INCLUSION INTO THE PERMANENT RECORDS. RECORD AS-BUILTS AS DIRECTED BY DISTRICT MANAGEMENT AND DISTRIBUTION CLERK.

REPORTED BY	DATE
Jason	7/19/16

DISTRICT OPERATIONS MANAGER/DISTRICT MANAGER	DATE

CASCADE NATURAL GAS CORPORATION
INTEGRITY MANAGEMENT DIG REPORT

ANOMOLY EXAMINATION DETAILS

IF WALL LOSS, DENTS, OR IMPACT DAMAGE SUSPECTED – IDENTIFY LOCATION, AREA, PIT DEPTH, MAX PIT DEPTH, AND TYPE OF ALL WALL LOSS OR ANOMOLIES WITH DETAILED SKETCHES. FOR GENERAL CORROSION, MULTIPLE MEASUREMENTS OF PIT DEPTH AND REMAINING WALL ARE NEEDED (TOPOGRAPHY MAP)

SOIL TYPE (IF KNOWN)		SOIL RESISTIVITY (if applicable)	OHM-CM	MINIMUM UT PIPE WALL THICKNESS	INCHES
MAX PIT DEPTH DISCOVERED (INCHES)		GPS REFERENCE POINT (IF KNOWN)			

BOTTOM							
3:00							
TOP							
9:00							
BOTTOM							

SPECIFY LONGITUDINAL PIPE LENGTH OF ANOMOLY IN INCHES

EXAM PERFORMED BY	DESIGNATED REPRESENTATIVE	DATE

ENGINEERING REVIEW

REFER TO CP755 FOR ENGINEERING REVIEW REQUIREMENTS AND APPROPRIATE WORKFLOW

☐	ANOMOLIES WERE FOUND ACCEPTABLE PER ASME B31G – REMAINING STRENGTH GUIDELINES (ATTACH CALCULATIONS)
☐	ACCEPTABLE REINFORCEMENT FITTINGS INSTALLED – DETAILS SHOWN ON AS-BUILT WORK ORDER_____
☐	PIPE WAS REMOVED – DETAILS SHOWN ON AS-BUILT - WORK ORDER _____
☐	NO ACTION NECESSARY
☐	OTHER: (WRITE IN OR ATTACH)

	ENGINEER	DATE

CASCADE NATURAL GAS CORPORATION

INTEGRITY MANAGEMENT DIG REPORT

PRESSURE CLASS	☒ TRANSMISSION	☐ HIGH PRESSURE (>60 psig)	☐ INTERMEDIATE (<=60 psig)
IDENTIFICATION	☐ ABOVE GROUND FACILITY ☒ BELOW GROUND PIPE EXPOSURE	FACILITY IDENTIFICATION (REG STATION, VALVE #, METER STATION/ETC.)	
DATE OF ASSESSEMENT	7/18/16	HP LINE NAME AND NUMBER	8" BREMERTON TRANS LINE #2
DISTRICT	Bremerton	TOWN	Bremerton
LOCATION	ADDRESS / CROSS STREETS Top of Hill		
REASON FOR ASSESSEMENT	☐ OBSERVING THIRD PARTY DIG	☐ CNG CONSTRUCTION PROJECT	☒ INTEGRITY ASSESSMENT-DIRECT EXAMINATION ☐ OTHER -EXPLAIN IN COMMENTS
LOCATE No. (if applicable)	Tp#16	ARRIVAL TIME: 7:00 pm	COMPLETED TIME: 7:30

PIPE EXAMINATION DETAILS

COLLECT AS MUCH DATA AS POSSIBLE. DESCRIBE REASON IF DATA IS NOT AVAILABLE.

PIPE MATERIAL	☒ STEEL ☐ PE ☐ OTHER:_____	PIPE DIAMETER	8 INCHES	MEASURED DEPTH OF COVER (if applicable)	60 INCHES	LENGTH OF PIPE EXPOSED	3 FEET
STEEL FACTORY APPLIED COATING	☒ COAL TAR ☐ BARE	☐ X-TRU ☐ FIBER WRAP	☐ FBE ☐ OTHER:_____	☐ N/A			
STEEL FIELD APPLIED COATING	☐ ROYSTON GREENLINE ☐ POLYGARD RD-6 ☐ FIELD APPLIED EPOXY ☐ FIELD APPLIED MASTIC	☒ TRENTON #1 (BELOW GROUND) ☐ TRENTON #2A (ABOVE GROUND) ☐ FIBER WRAP ☐ SHRINKSLEEVE		☐ N/A ☐ OTHER _____			
STEEL COATING CONDITION	DESCRIBE ALL COATING DEFECTS AND POSSIBLE CAUSE. SKETCH LOCATIONS AND DESCRIBE REPAIRS.	**FOUND:** ☒ GOOD ☐ FAIR ☐ POOR ☐ N/A **LEFT:** ☒ GOOD ☐ FAIR ☐ POOR ☐ N/A					

PIPE MATERIAL EXAMINATION DETAILS

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INTERNAL PIPE CONDITION	☐ GOOD ☐ FAIR ☐ POOR ☒ N/A	INTERNAL PIPE LIQUIDS	☐ DRY ☐ WET ☒ N/A	SKETCH LOCATION OF CUT AND DESCRIBE INTERNAL CONDITIONS FOUND IF INTERNAL PIPE CONDITION IS OTHER THAN GOOD OR N/A AND REPORT TO CORROSION AND ENGINEERING.
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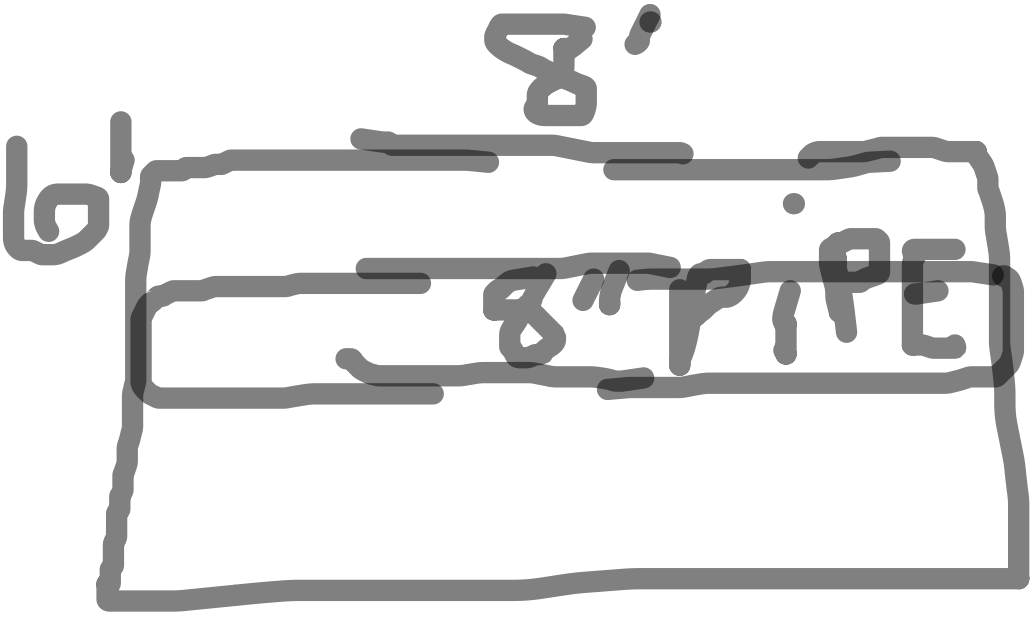
IF PIPE WALL LOSS, DENTS, OR IMPACT DAMAGE IS FOUND OR SUSPECTED, CONTACT ENGINEERING FOR INSTRUCTIONS.

CASCADE NATURAL GAS CORPORATION
INTEGRITY MANAGEMENT DIG REPORT

SKETCH PIPE LOCATION, AND NEARBY AREA. INDICATE SIZE OF EXCAVATION. GIVE DISTANCES TO NEARBY LANDMARKS. IDENTIFY LOCATION OF ANOMOLIES (CORROSION, PITTING, POOR WELDS, UNEXPECTED FITTINGS, ETC.)



COMMENTS/DESCRIPTION OF EXAMINATION INCLUDING ANY INFORMATION THAT MIGHT AID EVALUATION OF SYSTEM QUALITY. EXPLAIN UNUSUAL CONDITIONS AND DESCRIBE THE CONDITION FOUND AS NECESSARY

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SPECIAL NOTE: ADDING FITTINGS OR COMPONENTS, REPAIRS, REPLACEMENTS, REINFORCEMENTS, AND REROUTES OF HP LINE AND TRANSMISSION LINES MUST BE RECORDED BY AS BUILT AND SUBMITTED TO ENGINEERING FOR INCLUSION INTO THE PERMANENT RECORDS. RECORD AS-BUILTS AS DIRECTED BY DISTRICT MANAGEMENT AND DISTRIBUTION CLERK.

REPORTED BY	DATE
Jason	7/18/19

DISTRICT OPERATIONS MANAGER/DISTRICT MANAGER	DATE

CASCADE NATURAL GAS CORPORATION
INTEGRITY MANAGEMENT DIG REPORT

ANOMOLY EXAMINATION DETAILS

IF WALL LOSS, DENTS, OR IMPACT DAMAGE SUSPECTED – IDENTIFY LOCATION, AREA, PIT DEPTH, MAX PIT DEPTH, AND TYPE OF ALL WALL LOSS OR ANOMOLIES WITH DETAILED SKETCHES. FOR GENERAL CORROSION, MULTIPLE MEASUREMENTS OF PIT DEPTH AND REMAINING WALL ARE NEEDED (TOPOGRAPHY MAP)

SOIL TYPE (IF KNOWN)		SOIL RESISTIVITY (if applicable)	OHM-CM	MINIMUM UT PIPE WALL THICKNESS	INCHES
MAX PIT DEPTH DISCOVERED (INCHES)		GPS REFERENCE POINT (IF KNOWN)			

BOTTOM							
3:00							
TOP							
9:00							
BOTTOM							

SPECIFY LONGITUDINAL PIPE LENGTH OF ANOMOLY IN INCHES

EXAM PERFORMED BY	DESIGNATED REPRESENTATIVE	DATE

ENGINEERING REVIEW

REFER TO CP755 FOR ENGINEERING REVIEW REQUIREMENTS AND APPROPRIATE WORKFLOW

☐	ANOMOLIES WERE FOUND ACCEPTABLE PER ASME B31G – REMAINING STRENGTH GUIDELINES (ATTACH CALCULATIONS)
☐	ACCEPTABLE REINFORCEMENT FITTINGS INSTALLED – DETAILS SHOWN ON AS-BUILT WORK ORDER_____
☐	PIPE WAS REMOVED – DETAILS SHOWN ON AS-BUILT - WORK ORDER _____
☐	NO ACTION NECESSARY
☐	OTHER: (WRITE IN OR ATTACH)

	ENGINEER	DATE

Appendix G
GIS Delivery Data Set Documentation

8" Bremerton Transmission Line #2 -- GIS Data Description

NAME	Bremerton 8" Pipeline
FEATURE CLASS NAME	Bremerton_8inch_Pipeline
SOURCE	Original shapefile provided by CNGC, then modified by PMX to implement candidate sample location methodology.

CNGC-ORIGIN FIELDS

FIELD	DESCRIPTION
FID	
Shape	
OBJECTID	
ENABLED	
CREATIONUS	
DATECREATE	
DATEMODIFI	
LASTUSER	
COMMENTS	
LEGACYID	
GASTRACEWE	
SUBTYPECD	
INSTALLMET	
WORKORDERI	
PIPESIZE	
MATERIAL	
MANUFACTUR	
LENGTHSOUR	
MEASUREDLE	
DATEINSTAL	
WALLTHICKN	
COATING	
REPLACEMEN	
LASTLEAKSU	
DRIVEABLEL	
PRESSURECL	
AUTHORIZAT	
JOINTRENC	
OPERATINGP	
DESIGNPRES	
DESIGNPR_1	
DESIGNPR_2	
PIPETESTDA	
PIPETESTDU	
PIPETESTPR	
PIPETESTTY	
GASPRESSUR	
ORIGINALCO	
CRITIALLI	
LEGACYMAPN	
HYPERLINK	
DOCUMENTTY	
SMYS	
OWNER	
T3_SOURCEF	
PIPEPARTNU	
PIPELOTNUM	
PIPCONDIT	
GLOBALID	

8" Bremerton Transmission Line #2 -- GIS Data Description

NAME	Bremerton 8" Pipeline
FEATURE CLASS NAME	Bremerton_8inch_Pipeline
SOURCE	Original shapefile provided by CNGC, then modified by PMX to implement candidate sample location methodology.

CNGC-ORIGIN FIELDS

FIELD	DESCRIPTION
MAOP	
PIPELINENA	
SHAPE_LEN	*May have been re-calculated by PMX*

PMX-ORIGIN FIELDS

FIELD	DESCRIPTION
Sample	0 = do not sample; 1 = sample
Segment	sampling lot # (when more than one sampling lot identified for a pipeline)
ArcOrder	arc sequence (for linear referencing)

8" Bremerton Transmission Line #2 -- GIS Data Description

NAME	Bremerton 8" Sample Points (Pooled)
FEATURE CLASS NAME	Bremerton_8inch_Random_Sample_Locations_Pool
SOURCE	Potential sample locations every 40' along arcs comprising a sampling lot of pipeline. Generated using linear referencing from approximate pipe length centers calculated in Excel

PMX-ORIGIN FIELDS

FIELD	DESCRIPTION
OBJECTID	Internal GIS field
SHAPE	Internal GIS field
DISTANCE	Location of sample point along the pipeline in feet
RAND_VAL	Random value generated for determining primary and secondary samples
SAMPE_ID	ID generated for determining primary and secondary samples
RevisedSample	Delineation of primary or secondary sample location (1-2 = Primary and 3-4 = Secondary)
GlobalID	Internal GIS field
GIS_LAT	Latitude (Mercator 3.1)
GIS_LONG	Longitude (Mercator 3.1)
PMX_ORDER	PMX Sample Order Number
ROUTE	CNGC Pipeline

8" Bremerton Transmission Line #2 -- GIS Data Description

NAME	Bremerton 8" Sample Points (Collected)
FEATURE CLASS NAME	Bremerton_8inch_Random_Sample_Locations_Collected
SOURCE	Testing locations collected in the field using ESRI GPS Collector App for iOS and a Trimble R1 sub-meter receiver

PMX-ORIGIN FIELDS

FIELD	DESCRIPTION
OBJECTID	Internal GIS field
SHAPE	Internal GIS field
GIS_LAT	Latitude
GIS_LONG	Longitude
ABI_TEST_ID	ABI unique testing ID
PMX_ORDER	PMX Sample Order Number (Use to join to Field Notes table)
ROUTE	CNGC Pipeline

8" Bremerton Transmission Line #2 -- GIS Data Description

NAME	Bremerton 8" Sample Point Field Notes
FEATURE TABLE NAME	Bremerton_8inch_Random_Sample_Locations_Collected_Field_Notes
SOURCE	Field Notes collected in the field during testing using ESRI GPS Collector App for iOS. This table can be joined to the Bremerton 8" Sample Points Collected Feature Class

PMX-ORIGIN FIELDS

FIELD	DESCRIPTION
OBJECTID	Internal GIS field
PIPELINE SEGMENT	CNGC Pipeline
PIPELINE LENGTH	Pipe length ID (sequentially numbered from start of pipeline segment)
PMX_ORDER	PMX Sample Order Number (Use to join to Field Notes table)
SAMPLE_TYPE	Delineates sample type between Elbow / Fitting / Pipe
OBSERVATION_DATE	Test date
DAY_WEEK	Day of the week the test occurred
ARRIVAL	PMX arrival time
DEPARTURE TIME	PMX departure time
PMX_OBSERVER_1	PMX observer
PMX_OBSERVER_2	PMX observer
PARCEL_ID	Parcel ID number from county parcel dataset.
GIS_LONG	Longitude (Mercator 3.1)
GIS_LAT	Latitude (Mercator 3.1)
WEATHER_TEMP	Temperature range at the time of the test
WEATHER_CONDITION	Conditions at the time of the test
WEATHER_WIND	Wind conditions at the time of the test
WEATHER_PRECIP	Precipitation conditions at the time of the test
VEGETATION_CONDITION	Vegetation around the test location
SOIL_CONDITION	Soil condition around the site
SOIL_CONDITION_OTHER	Soil condition comments
COMMENT_SITE_ACCESS	Comments regarding access to site
COMMENT_SITE_CONDITION	Comments regarding the condition of the site at the time of the test.
DASCO_ON_SITE	Dasco present at the site (yes/no)
DASCO_OBSERVER	Dasco observer present at the site
DASCO_ACTIVITIES	Dasco activities at the site
TCP_REQUIRED	Traffic control plan required at the site during testing (yes/no)
TCP_IN_PLACE	Traffic control plan in place at the site during testing (yes/no)
GROUNDWATER_PRESENT	Groundwater present during the test (yes/no)
GROUNDWATER_DEPTH	Groundwater depth (feet) during the test
DEWATERING_EQUIP	Dewatering equipment used during the test
ABI_TESTER	ABI tester conducting the test
TEST_START_TIME	Test start time (24 hour clock)
TEST_END_TIME	Test end time (24 hour clock)
ABI_TEST_ID	ABI unique test ID
ABI_NUMBER_OF_TEST	Number of tests completed by ABI
ABI_DAILY_CENSOR_CHECK	Daily sensor check completed (yes/no)
ABI_DAILY_CENSOR_CHECK_RESULTS	Daily sensor check results
ABI_WEEKLY_VERIFICATION	Weekly verification test completed by ABI (yes/no)
ABI_WEEKLY_VERIFICATION_RESULTS	Weekly verification test results
COMMENT_TEST_PROCESS	A description of the test conducted
COMMENT_TEST_RESULTS	Abbreviated test results
CNG_ON_SITE	CNGC representative on site during the test (yes/no)
CNG_OBSERVER	CNGC observer present during the test
CNG_ACTIVITIES	CNGC activities during the test
UTC_NAMENOTES	Names of UTC staff present during testing and notes describing their activities
PICTURE_1_CAPTION	Caption describing attached Photo 1
PICTURE_2_CAPTION	Caption describing attached Photo 2
PICTURE_3_CAPTION	Caption describing attached Photo 3
PICTURE_4_CAPTION	Caption describing attached Photo 4

8" Bremerton Transmission Line #2 -- GIS Data Description

NAME	Bremerton 8" Sample Points (Collected) Attachments
FEATURE TABLE NAME	Bremerton_8inch_Random_Sample_Locations_Collected_ATTACH
SOURCE	Photo and field form attachments. Attachments can be viewed in ArcGIS Desktop or in the Attachments folder included with this deliverable.

PMX-ORIGIN FIELDS

FIELD	DESCRIPTION
ATTACHMENTID	Internal GIS field
REL_GLOBALID	Internal GIS field
CONTENT_TYPE	Describes the attachment type (image/jpeg or application/pdf)
ATT_NAME	Attachment name
DATA_SIZE	File size in bytes
DATA	Data field (as blob)
GLOBALID	Internal GIS field
ABI_TEST_ID	ABI unique test ID

8" Bremerton Transmission Line #2 -- GIS Data Description

NAME	Bremerton 8" ABI Test Results
FEATURE TABLE NAME	Bremerton_8inch_ABI_Test_Results
SOURCE	ABI test data extracted from software used to process data collected by testing equipment (average and standard deviation of 5 individual tests for each test location)

PMX-ORIGIN FIELDS

FIELD	DESCRIPTION
Pipeline_Segment	Name of pipeline segment being tested
PMX_Order	PMX Sample Order Number (Use to join to collected and pooled sample points)
PipeID	Pipe length ID (sequentially numbered from start of pipeline segment)
ABI_Test	ABI test ID
Test_Date	Date of ABI test
YS_ksi_Avg	Average yield strength (ksi)
YS_ksi_StdDev	Standard deviation yield strength (ksi)
SC_ksi_Avg	Average strength coefficient (ksi)
SC_ksi_StdDev	Standard deviation strength coefficient (ksi)
SHE_Avg	Average strain hardening exponent
SHE_StdDev	Standard deviation strain hardening exponent
EngUTS_ksi_Avg	Average engineering ultimate tensile strength (ksi)
EngUTS_ksi_StdDev	Standard deviation engineering ultimate tensile strength (ksi)
CalcUD_pct_Avg	Average calculated uniform ductility (%)
CalcUD_pct_StdDev	Standard deviation calculated uniform ductility (%)
YS2UTS_Avg	Average ratio of yield strength to UTS
YS2UTS_StdDev	Standard deviation ratio of yield strength to UTS
FT_Avg	Average fracture toughness (ksi * in ^ 0.5)
FT_StdDev	Standard deviation fracture toughness (ksi * in ^ 0.5)
Grade_Qual	Grade qualification
WT_Avg	Average wall thickness (measured by Das-Co)
WT_StdDev	Standard deviation wall thickness (measured by Das-Co)