noble MIDSTREAM PARTNERS

HYDROSTATIC DATA SHEET (C-8)

Project SGCI AFE/Work Order No. LA 16001

Pipeline DSU 53 (Name) (Location)

Testing Contractor Nitrogen Services

Pipe O.D. _____ Wall thickness. _____ Grade _____ MFG'R: Flexsteel

Test Fluid Water Additive NA

Test Location: DW ROW Section No. _____

Instrumentation: 50' from Segment (Location) (Type)

(Mfg'r) See Attached (S/N) (Date Calibrated)

Time	Pressure PSIG	Ambient Temp.
8:45	1031	33
9:00	1030	33
9:15	1029	33
9:30	1028	34
9:45	1027	34
10:00	1026	35
10:15	1025	38
10:30	1024	38
10:45	1024	37
11:00	1023	37
11:15	1023	38

Time	Pressure PSIG	Ambient Temp.
11:30	1022	45
11:45	1022	40
12:00	1021	38
12:15	1021	39
12:30	1020	39
12:45	1020	40
1:00	1019	39
1:15	1019	39
1:30	1018	39
1:45	1018	40
2:00	1018	40

Time	Pressure PSIG	Ambient Temp.
2:15	1017	40
2:30	1017	40
2:45	1016	42
3:00	1016	41
3:15	1015	41
3:30	1015	40
3:45	1015	39
4:00	1014	37
4:15	1014	35
4:30	1013	34
4:45	1013	33

Test Started 8:45 (Time) (AM)/PM 12-17-17 (Date) Test Ended 4:45 (Time) AM (PM) 12-17-17 (Date)

Remarks: _____

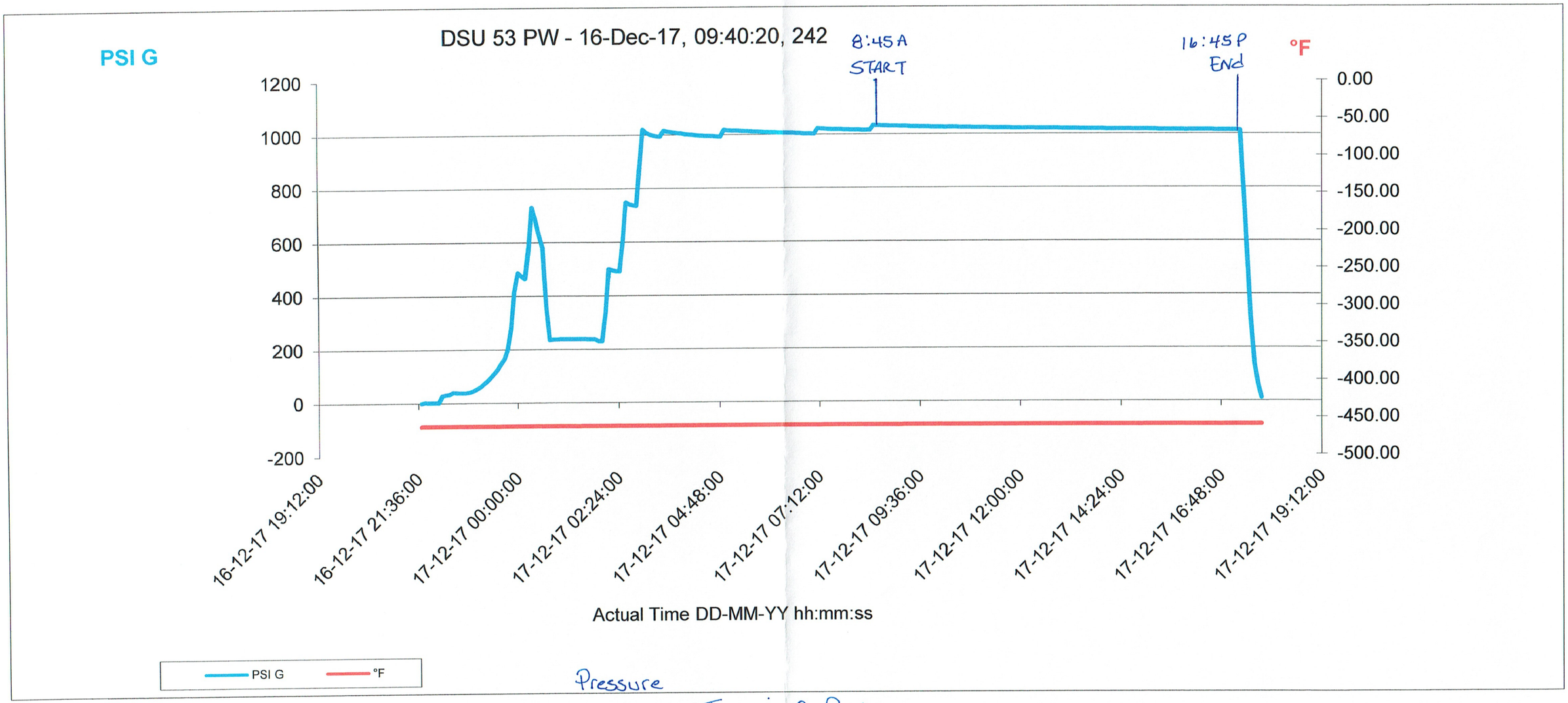
Weather: Cold, mostly cloudy w/ sunny patches in afternoon.

Testing Contractor's Representative Mike Spratlen (Name) Supervisor (Title) Mike Spratlen (Signature) 12-18-17 (Date)

Constr. Contractor's Representative Justin Peelee (Name) QA/QC (Title) Justin Peelee (Signature) 12-19-17 (Date)

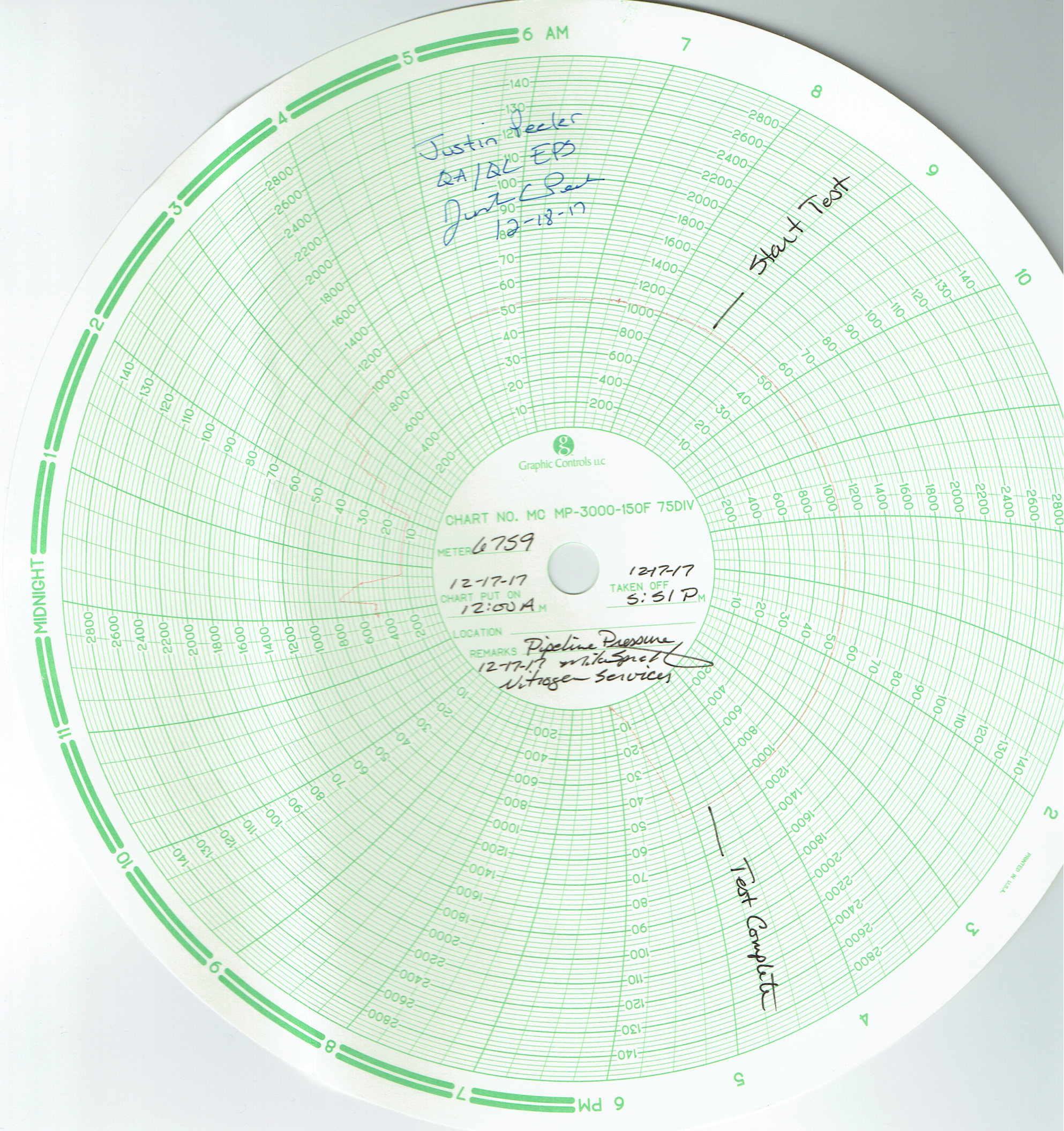
Company Representative Jason Knop (Name) Lead (Title) (Signature) 12-18-17 (Date)

Construction Superintendent Jake Owens (Name) Super (Title) (Signature) 12-18-17 (Date)



Pressure

Justin C Peeler
QA/QC EPS
Justin C Peeler 12-18-17


Graphic Controls LLC
CHART NO. MC MP-3000-150F 75DIV
METER 6759
12-17-17
CHART PUT ON 12:00 AM
12-17-17
TAKEN OFF 5:51 PM
LOCATION
REMARKS Pipeline Pressure 12-17-17 with Spectrum Nitrogen Services
Justin Peeler
QA/QC EPS
12-18-17
Start Test
Test Complete
6 AM
MIDNIGHT
6 PM


Justin Peeler
QA/QC EQPS
Justin Peeler 12-17-17
Graphic Controls LLC
CHART NO. MC MP-3000-150F 75DIV
METER 7108
12-17-17
TAKEN OFF 5:50 PM
12-10-17
CHART PUT ON 10:45 PM
LOCATION
REMARKS Pipe Temp
12-17-17 with Spratt Nitrogen Services
6 AM
7
8
9
10
11
NOON
MIDNIGHT

CHARTS ltd.

GAS MEASUREMENT

CALIBRATION CERTIFICATE

Date:	4/21/2017
DueDate:	4/21/2018

Customer:	NITROGEN SERVICES LLC
Model:	BULLFROG12"
SERIAL:	6759

This is to cerify that this instrument has been inspected and tested against Additel Digital Guage ADT GP30K, Serial#218141D0025 Calibrated (11-12-16). Reference Standard Serial#11-218 Certified with Dead Weight Model#KY250 Traceability#1500132804 Traceable to NIST. Calibrated in accordance with ISO9000 Quality Standards

This instrument is cerified to be accurate within +/- 1% of nominal value

Input Type/ Range: 3000# **Color: Red**
Pen Number: 1

Ascending		Descending	
Applied:	Reading	Applied:	Reading:
0	0	2990	3000
599	600	2395	2400
1503	1500	1497	1500
2395	2400	599	600
2990	3000	0	0

Input Type/ Range: 150F **Color: Green**
Pen Number: 2

Ascending		Descending	
Applied:	Reading:	Applied:	Reading;
0	0	150	150
32	32	32	32
150	150	0	0

Input Type/Range: **Color:**
Pen Number:

Ascending		Descending	
Appiled:	Reading:	Applied:	Reading:

P.O. BOX 2983 2031 TRADE DR.
MIDLAND, TX 79706
(432) 697-7801 (432) 520-3564Fax

Technician: Luzanna, Lopez

Charts ltd.

GAS MEASUREMENT

CALIBRATION CERTIFICATE

Date:	8/30/2017
DueDate:	8/30/2018

Customer:	Nitrogen Services
Model:	Clp 12"
Serial:	7108

This is to cerify that this instrument has been inspected and tested against Additel Digital Guage ADT GP20K, Serial#21817080004 Calibrated (6/16/17). Reference Standard Serial#11-218 Certified Traceable to NIST. Calibrated in accordance with ISO9000 Quality Standards

This instrument is cerified to be accurate within +/- 1% of nominal value

Input Type/ Range: 3000# **Color:** red
Pen Number: 1

Ascending Applied:	Reading	Descending Applied:	Reading:
0	0	3013	3000
595	600	2399	2400
1503	1500	1496	1500
2405	2400	597	600
3013	3000	0	0

Input Type/ Range: 0-150F **Color:** Green
Pen Number: 2

Ascending Applied:	Reading:	Descending Applied:	Reading:
0	0	150	150
32	32	32	32
150	150	0	0

Input Type/Range: **Color:**
Pen Number:

		Descending	
Appiled:	Reading:	Applied:	Reading:

P.O. BOX 2983 2031 TRADE DR.
MIDLAND, TX 79706
(432) 697-7801 (432) 520-3564Fax

Technician: Susanna Lopez

APEX INSTRUMENTS
7200 E. Dry Creek Rd, STE C-102, Centennial, CO 80112
Ph. 303-804-0667 Cal.Lab@Apex-Instruments.com

Calibration Certificate

Certificate Number: 172959

Customer:
Cross Country Pipeline Supply
Aurora, CO

Manufacturer:	Crystal Engineering	***Calibration Date:***	10/27/2017
Model Number:	nVision RTD100	***Due Date:***	10/27/2018
Serial Number:	794748	***As Found:***	In Tolerance
Description:	Temperature Module (RTD)	***As Left:***	As Found
Procedure:	CRY_R_RTD100p	***Temperature:***	72 F
Calibrated To:	Manufacturer's Specifications	***Humidity:***	30 %
Technician:	Austin Molyneux		

Tolerance Specs:
Range: 0 to 400 ohms ; -328 to 1562 degF (PT100 0.00385)

Resistance 0 to 100% of FS: +/- (0.015% of Rdg + 0.02 ohms)
Class B Probe Temperature Deviation: +/- (0.3 + 0.005*T) degC

Technician Notes:

As Left Userspan: 1.00000
R0: 100.000

Approved Signatory:

Apex Instruments certifies that the instrument listed above meets the specifications of the manufacturer at the completion of its calibration. Standards used are traceable to the National Institute of Standards and Technology (NIST), or have been derived from accepted values, natural physical constants, or through the use of the ratio method of self-calibration techniques.

Methods used are in accordance with the procedure listed above. This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

This certificate does not guarantee the continued performance of the instrument listed above. Any modifications or services performed hereafter may void this certificate.

Standards Used

Description	Model Number	Serial Number	Calibration Date	Due Date	ID
Digital Multimeter, 8 1/2 Digit	3458A	2823A11060	2/17/2017	2/17/2018	APX00012
Reference Thermometer Readout / PRT	1502A / 5628-12-D	B64070 / 3526	7/17/2017	7/17/2018	APX00014
Reference Thermometer Readout / PRT	1502A / 5628-12-D	B0B641 / 3780	5/11/2017	5/11/2018	APX00015
Decade Resistor	1433-28	E1-17295164	7/26/2017	7/26/2018	APX02856

APEX INSTRUMENTS
7200 E. Dry Creek Rd, STE C-102, Centennial, CO 80112
Ph. 303-804-0667 Cal.Lab@Apex-Instruments.com

Calibration Certificate

Certificate Number: 172960

Customer:
Cross Country Pipeline Supply
Aurora, CO

Manufacturer:	Crystal Engineering	***Calibration Date:***	10/27/2017
Model Number:	nVision 10,000 psi	***Due Date:***	10/27/2018
Serial Number:	791916	***As Found:***	In Tolerance
Description:	Pressure Module	***As Left:***	In Tolerance
Procedure:	CRY_P_nVPM	***Temperature:***	72 F
Calibrated To:	Manufacturer's Specifications	***Humidity:***	30 %
Technician:	Austin Molyneux		

Tolerance Specs:
0 to 30% of FS: +/- 0.015% of FS
30% to 110% of FS: +/- 0.05% of Rdg

Technician Notes:

As Left Userspan: 0.99982

Approved Signatory: Austin Molyneux

Apex Instruments certifies that the instrument listed above meets the specifications of the manufacturer at the completion of its calibration. Standards used are traceable to the National Institute of Standards and Technology (NIST), or have been derived from accepted values, natural physical constants, or through the use of the ratio method of self-calibration techniques.

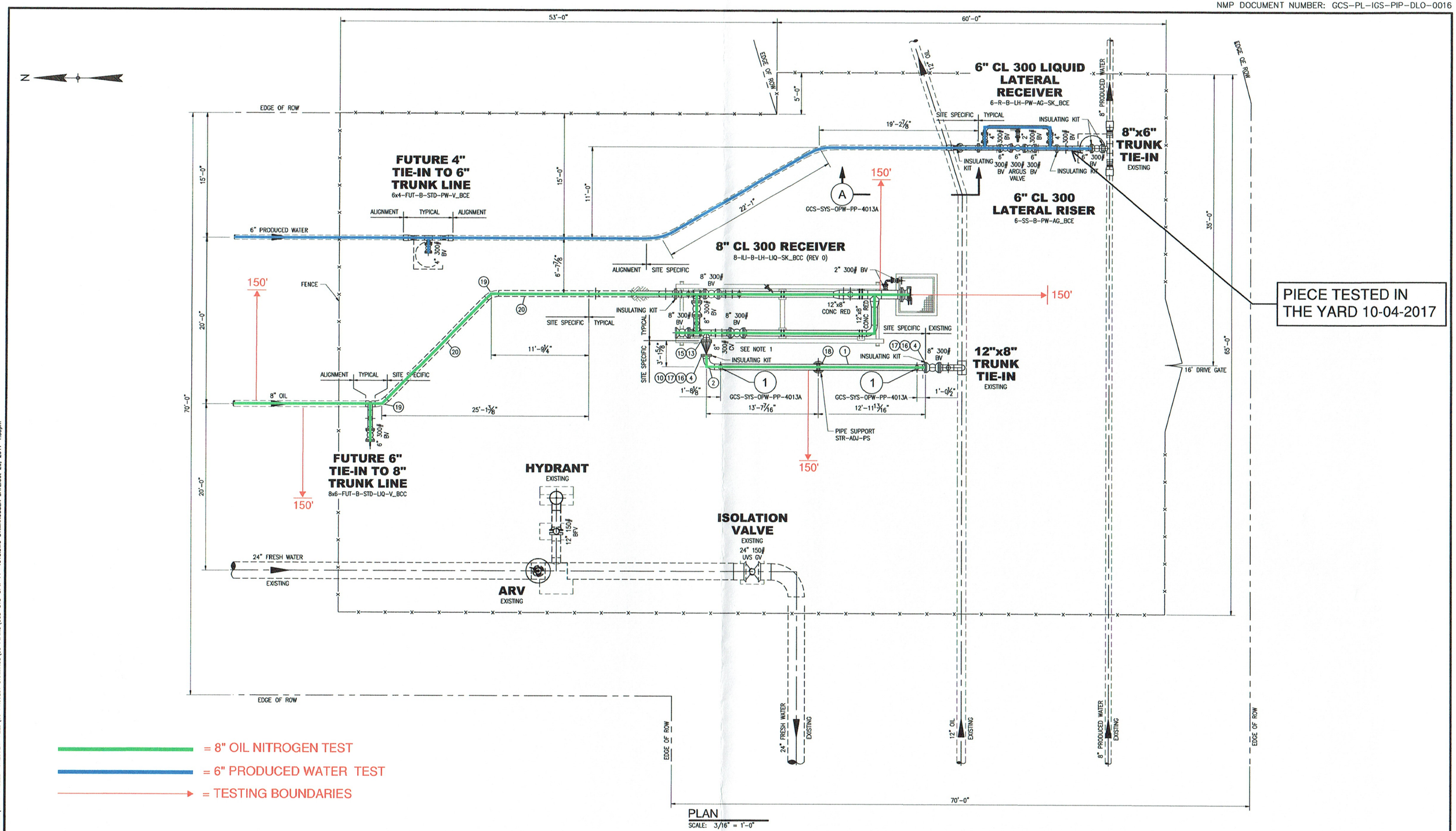
Methods used are in accordance with the procedure listed above. This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

This certificate does not guarantee the continued performance of the instrument listed above. Any modifications or services performed hereafter may void this certificate.

Standards Used

Description	Model Number	Serial Number	Calibration Date	Due Date	ID
Electronic Deadweight Tester	RPM4-E-DWT A100M/A10M	1709	11/2/2016	11/2/2017	APX00024

APX03433



PLAN
SCALE: 3/16" = 1'-0"

NOTES:
1. BALL VALVE TO BE OMITTED FROM RECEIVER TYPICAL 8-ILI-B-RH-LIQ-SK_BCC.

REFERENCE DRAWINGS	
GCS-SYS-OPW-PP-4013A	SECTIONS, ISO & BOM
STR-ADJ-PS	ADJUSTABLE PIPE SUPPORT DETAILS
6-R-B-LH-PW-AG-SK_BCE	6" CL 300 LH LIQUID LATERAL RECEIVER
6-SS-B-PW-AG_BCE	6" CL 300 LIQUID LATERAL RISER
12X8-FUT-B-STD-LIQ-V_BCE	8" CL 300 LIQUID STANDARD TIE-IN TO 12" LIQUID TRUNK LINE
8X6-FUT-B-STD-PW-V_BCE	6" CL 300 LIQUID STANDARD TIE-IN TO 8" LIQUID TRUNK LINE
8-ILI-B-LH-LIQ-SK_BCC (REV 0)	8" CL 300 LH LIQUID LAUNCHER & RECEIVER
DWG NO.	TITLE

REVISIONS								
REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE	APR BY	APR DATE
4	ISSUED FOR CONSTRUCTION – REVISED PER AS-BUILT LOCATIONS	MAK	20-OCT-2017	DAN	20-OCT-2017	–	–
3	RE-ISSUED FOR CONSTRUCTION – BOM REVISIONS	RLC	26-JUN-2017	DAN	26-JUN-2017	–	–
2	ISSUED FOR CONSTRUCTION – CHANGED ILI TO LH	CLJ	17-MAR-2017	DAN	17-MAR-2017	–	–
1	ISSUED FOR CONSTRUCTION	CLJ	28-FEB-2017	DAN	28-FEB-2017	–	–
0	ISSUED FOR CONSTRUCTION	CLJ	16-DEC-2016	DAN	16-DEC-2016	–	–

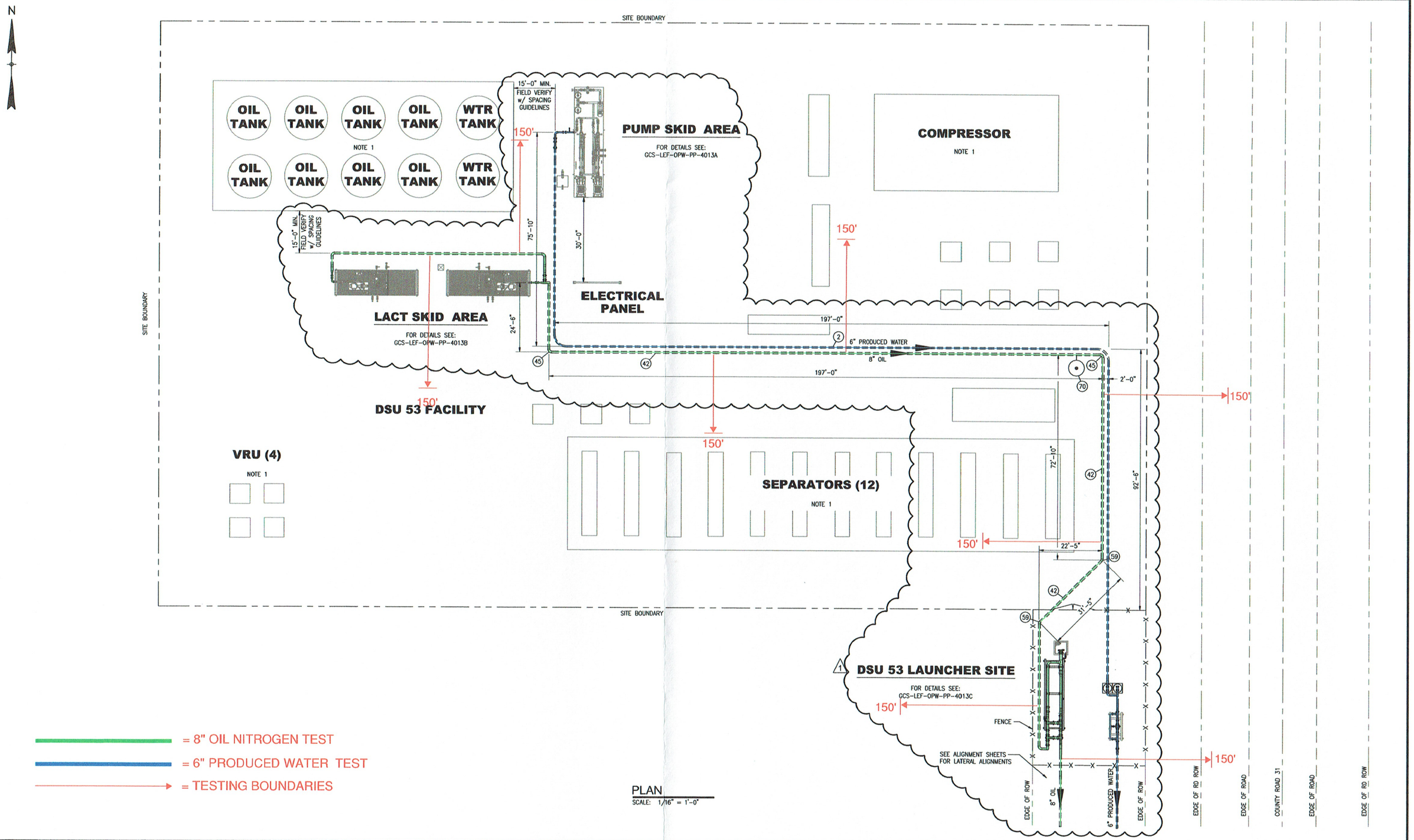
APPROVALS	SIGNATURE	DATE
DRAWN		
CHECKED		
APPROVED		

noble MIDSTREAM PARTNERS

PST

GREELEY CRESCENT SYSTEM
SYNERGY MIDSTREAM INFRASTRUCTURE
DSU 53 TIE-IN SITE
PLOT PLAN

SCALE:	DRAWING NO.	REV.
AS NOTED	GCS-SYS-OPW-PP-4013	4



PLAN
SCALE: 1/16" = 1'-0"

NOTES:
1. EQUIPMENT AND LOCATIONS BY OTHERS

REFERENCE DRAWINGS	
61169-AL-DSU53-PW-001, 002	DSU 53 6" PROPOSED PRODUCED WATER PIPELINE
61169-AL-DSU53-OT-001, 002	DSU 53 8" PROPOSED OIL PIPELINE
GCS-LEF-OPW-PP-4013C	DSU 53 FACILITY – LAUNCHER SITE DETAILED PLAN, SECTIONS & BOM
GCS-LEF-OPW-PP-4013B	DSU 53 FACILITY – LACT SKID AREA DETAILED PLAN, SECTIONS & BOM
GCS-LEF-OPW-PP-4013A	DSU 53 FACILITY – PUMP SKID AREA DETAILED PLAN, SECTION, DETAIL & BOM
DWG NO.	TITLE

REVISIONS								
REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE	APR BY	APR DATE
1	ISSUED FOR CONSTRUCTION – SITE CHANGES	MAK	19-OCT-2017	DAN	19-OCT-2017	–	–
0	ISSUED FOR CONSTRUCTION	PGA	20-JUL-2017	DAN	20-JUL-2017	–	–

APPROVALS	SIGNATURE	DATE
DRAWN		
CHECKED		
APPROVED		

noble MIDSTREAM PARTNERS

GREELEY CRESCENT SYSTEM
SYNERGY MIDSTREAM INFRASTRUCTURE
DSU 53 FACILITY
PLOT PLAN

SCALE:	DRAWING NO.	REV.
AS NOTED	GCS-LEF-OPW-PP-4013	1

noble MIDSTREAM PARTNERS

Greeley Crescent Gathering Project

DSU 53 Lateral – 6" PW Pipeline (CL 300)

Hydrostatic Pressure Test Procedure

1	7/18/2017	LZT	Issued for Review	DAN	
REV	DATE	BY	DESCRIPTION	CHKD	APPVD

Noble Midstream Partners, LLC

Hydrostatic Pressure Test Procedure

Doc. No. N/A

TABLE OF CONTENTS

1 EXECUTIVE SUMMARY

This procedure and the accompanying site-specific Hydrostatic Test Plan define the minimum requirements for the hydrostatic pressure testing of the **Greeley Crescent DSU 53 Lateral – 6" PW** pipeline. The piping and components to be tested using this procedure meet or exceed the pressure requirements of the ASME Class 300 flange rating for Type 2.2 materials between -20 °F and 100 °F.

The hydrostatic pressure test has been analyzed for acceptable practices per applicable codes.

2 PRE-TEST CONSIDERATIONS

The pressure test shall comply with American Petroleum Institute's "Pressure Testing of Steel Pipelines for the Transportation of Gas, Petroleum Gas, Hazardous Liquids, Highly Volatile Liquids or Carbon Dioxide." *(API RP 1110)* Chapter 6 of API's handbook provides general guidelines for pressure test implementation of steel pipe. In addition, testing will be in accordance with *ASME B31.4, ASME B16.5, 49 CFR Part 195, and the FlexSteel Technical Manual.*

2.1 TEST PRESSURE

The **6" DSU 53 Lateral** pipeline shall be tested at a minimum test pressure of 125% the internal pressure rating and a maximum test pressure of 150% the internal design pressure rounded to the next higher 25 psig increment. The upper and lower bounds of the test pressures are derived from *ASME B16.5* and *ASME B31.4 / 49 CFR Part 195* respectively.

The **Greeley Crescent DSU 53 Lateral** internal design pressure is **720 PSIG**, limited by the flange rating.

The **Greeley Crescent DSU 53 Lateral** final hydrostatic test pressure shall be **1,000 PSIG** or **1,016 PSIG**, at the point of filling, depending on where the operator chooses to fill the pipeline. See the table in **Section 3.4** for the two possible locations.

The minimum pipeline test pressure shall be **940 PSIG** and the maximum test pressure shall be **1,100 PSIG**.

Table 1: Upper and Lower Bound Test Pressures

ASME Flange Class	Pipeline Wall Thickness (in)	Design Pressure – DP (psig)	Pipe Pressure Rating – PR (psig)	Minimum Test Pressure 125% PR (psig)	Maximum Test Pressure 150% DP (psig)
300	0.665	720	750	940	1,100

2.2 TEST DURATION

The hydrostatic test pressure shall be maintained for **8 hours** after final test pressure has stabilized, and the pipe has been conditioned properly in the field. With pipe conditioning, accounted for, the test commonly takes **16 – 20 hours**. This is dependent, however on how well the pipe responds to the conditioning procedure **(times up to 24 hours may be required)**.

The test pressure shall be considered stabilized after **5 minutes** without fluctuation.

2.3 SAFETY PRECAUTIONS

This safety information is in addition to the safety information in other sections of this document.

Always take precautions to eliminate hazards to persons near lines being tested. For the entire duration of the procedure, including filling, initial pressurization, time at test pressure, and depressurization, only persons conducting the test or inspecting the system should be allowed near the section under test. These persons should be fully informed of the hazards of field pressure testing. All other persons should be kept a safe distance away. The test section must be supervised at all times. Failure may result in sudden, violent, uncontrolled, and dangerous movement of system piping, or components, or parts of components.

2.4 TEST EQUIPMENT AND MATERIALS

Pressure test equipment shall be selected to meet the hydrostatic test conditions and shall be in working order. The measurement equipment shall be designed for the pressures expected during the pressure test.

2.4.1 FILL PUMP

The pump used to fill the line shall be a high-volume pump which provides adequate pressure to overcome static head and maintains sufficient velocity to move pigs, spheres, and any debris in the pipeline.

The fill pump or associated discharge piping shall be equipped with a flow measurement device capable of maintaining a specified fill rate.

2.4.2 SUPPLY WATER FILTER

The pump discharge piping shall be equipped with an in-line filter capable of capturing debris greater than **100 µm**.

2.4.3 PRESSURIZATION PUMP

The pressurization pump shall be a variable speed, positive displacement pump that pressurizes the line to the specified test pressure. The pump shall have a known volume per stroke and shall be equipped with a stroke counter.

A constant-speed pump with a variable flowrate control may be used in lieu of the above pump if the liquid test medium injected into the pipeline is measured during pressurization.

2.4.4 Calibration Devices

2.4.4.1 Pressure Calibration Device

A deadweight tester or an equivalent pressure sensing device that is capable of measuring in increments of less than or equal to one (1) psig shall be used. The device shall have a certificate of calibration that is not more than one year old at the start of testing.

2.4.4.2 Temperature Calibration Device

A certified thermometer shall be provided. The device shall have a certificate of calibration that is not more than one year old at the start of testing.

2.4.5 Recording Devices

2.4.5.1 Pressure Recording

This procedure refers to the recording device used during the test duration as a chart recorder. A digital recorder may be used in lieu of the more traditional chart recorder.

Pressure recording equipment shall be provided and qualified as follows:

- A continuous-recording pressure measurement device that provides a permanent record of pressure versus time. This device should be calibrated immediately before each use with the deadweight tester.
- Electronic pressure/temperature monitoring and recording systems that assist in the analysis of test data. Such systems can be used in lieu of the components listed above provided that the individual pressure sensors included in the systems have a level of sensitivity and can be field calibrated in a manner similar to those instruments listed above.

2.4.5.2 Temperature Recording

Temperature recording equipment shall be provided and qualified as follows:

- A test medium temperature sensing and display instrument that is properly calibrated to a range suitable for anticipated test temperatures. Temperature instrument accuracy should be within 1 °F of actual temperature. Temperature instrument sensitivity should be within 0.1 °F.
- A continuous-recording temperature measurement device that provides a permanent record of test medium temperature versus time. This device should be calibrated immediately before each use with a certified thermometer.
- An ambient temperature sensing and display instrument that is properly calibrated to a range suitable for anticipated ambient temperatures. Temperature instrument accuracy should be within 1 °F of actual temperature. Temperature instrument sensitivity should be within 0.1 °F.
- A continuous-recording temperature measurement device that provides a permanent record of ambient temperature versus time. This device should be calibrated immediately before each use with a certified thermometer.

2.4.6 SAFETY RELIEF VALVE

The hydrostatic test fill pump and pressurization pump or associated discharge piping shall be equipped with a pressure relief valve. The pressure relief valve shall be set to relieve at **1,100 PSIG**.

2.5 QUALIFICATION OF CONTRACTOR AND OPERATOR PRESONNEL

Qualifications of contractor and operator personnel for conducting pressure tests will be based on certification requirements by *49 CFR Part 195*, Code, or Noble standards and procedures.

Noble personnel and contractors involved with designing, planning, conducting, or approval of a pressure test should be qualified by both training and experience. Noble is responsible for establishing these qualifications. The following factors to determine qualifications are recommended per *API RP 1110*:

- Performance of applicable calculations and interpretation of test data and results.
- Knowledge of code requirements and regulations.
- Qualification requirements of governing authority to conduct or witness testing.
- Governmental or operator requirements to certify test results.
- Familiarity with equipment and pressure test set-up.
- Familiarity with test procedures.

2.6 PERMIT TO WORK

Prior to commencing work, work permits shall be obtained. At a minimum, the below documents shall be submitted:

- Operator Qualification records for each person performing tasks.
- Test equipment certifications.
- Water source.
- Biocide injection plan. (If Applicable)
- Biocide Safety Data Sheets (SDS). (If Applicable)
- Leak monitoring plan.
- Depressurization plan.
- Water disposal plan.
- Drying plan (If Applicable).

3 TEST PROCEDURE

As part of the work permit, a hydrostatic test plan for each section of pipe shall be developed and submitted to the appointed Noble representative prior to commencing work. The test plan shall, at a minimum, address the requirements specified in this procedure.

3.1 SOURCE WATER

The quality and source of the test water shall be determined prior to the permitting process.

Non-potable water shall be treated with biocide prior to entering the pipeline. The SDS sheets and injection rate for the Biocide shall be submitted and approved by a Noble representative prior to work permit issuance. **Note: Biocide treatment may not always be required.**

Water shall be filtered prior to entering the pipeline. The maximum allowable particle size is **100 µm**.

3.2 EQUIPMENT INSTALLATION

If possible, excavated segments shall be backfilled prior to the initial pressurization.

Temporary piping shall be properly anchored and adequately secured from movement. Pipe couplings shall have safety devices or restraints to limit movement due to unexpected piping separation.

A flow meter shall be placed in the line to monitor and maintain the planned design rate of fill.

The sensor on each temperature recording device shall be installed so that it is in contact with the pipeline at a point where it has normal cover. Additionally, it shall be at a distance far enough from the injection point so that the effects of the exposed piping and make-up injection(s) on temperature is minimized. The backfill around the temperature recording device sensor shall be tamped.

Insulation, if appropriate, shall be used on the capillary lines to the temperature recorder and the temperature recorder should be installed in an insulated box. Large centrifugal pumps and storage tanks will affect the temperature of the test medium.

NOTE: According to the *FlexSteel Commissioning Field Notes*, FlexSteel recommends that the vent valves on all end fittings be removed during the hydrostatic test and replaced thereafter.

3.3 LINE FILL

Calculated line fill water volume: **255 US Oil Barrels**

All temporary piping and test heads shall be adequately secured before the line fill process is started.

If pigs or spheres are used in the filling process, they shall be equipped with trackers for monitoring location and speed during the line fill process.

NOTE: Only polyurethane pigs are allowed to be used with FlexSteel. *(FlexSteel Commissioning Field Notes)*

The fill pump shall be sized for the pigs to travel at a speed that will maintain a seal with the pipeline. This will reduce the risk of introducing air behind the pigs. A travel speed of 2 – 3 mph shall be maintained. The line fill flow rate for the **6" Greeley Crescent DSU 53 Lateral** pipeline must be **260 – 390 GPM (6 – 9 BPM)** in order to maintain the pig velocity in the 2 – 3 mph range.

High velocities may cause excessive wearing of the pigs and may cause the displaced air to mix with the test medium. As pigs travel down the line and down a slope, unless backpressure is applied during the line fill, the weight of the column of fluid could cause the pig to travel faster than the specified speed and introduce air behind the pig.

Air shall be bled during the filling process to minimize the time for line pressure stabilization. The total amount of residual air shall be less than 0.2% of the volume of the test section.

If it is determined that air is trapped in the pipeline, vents or traps at high elevation points may be installed in order to bleed the air from the pipeline. Any equipment added to the pipeline shall be removed after the pipeline has been dewatered.

The temperature, pressure, and flow rate of the test medium during line fill shall be recorded. All applicable conditions shall be monitored to prevent over-pressurization during line fill.

3.4 INITIAL PRESSURIZATION

A pipe maintained at high pressure is potentially dangerous. Established safety guidelines in accordance with the work permit shall be followed at all times.

The amount of water required to increase the pressure from the initial fill to the final test pressure shall be calculated prior to the pressure test and made available to test personnel.

The initial pressurization of the segment of pipe to be tested begins once the segment is full of fluid and the appropriate measures have been taken to bleed all air.

Personnel conducting the test shall maintain continuous surveillance over the operation to ensure that it is carefully controlled. Test personnel should be located at a safe distance from the test section.

Pipe connections shall be periodically checked for leaks during the pressurization process.

The flowrate shall be monitored and logged for the preparation of a pressure-volume plot.

A pressure-volume plot shall be initiated at the start of the pressurization process and continue until the test pressure is reached. The lower end of the pressure-volume plot can be used to determine the total amount of residual air in the test section. The upper end of the pressure-volume plot can be used to determine if any pipe in the test segment may have reached its elastic limit.

The **Greeley Crescent DSU 53 Lateral PW** pipeline is **8,349 feet** of **6.93" OD 0.665" w.t.** FlexSteel pipe. It will be pressurized to either of the following hydrostatic test pressures at the corresponding location:

DSU 53 Pump Skid Area	**1,000 psig**
DSU 53 Tie-In Site	**1,016 psig**

Pressurization up to 25% of the final test pressure shall occur at a rate of **10 PSIG/MIN**.

Once 25% of the final test pressure is reached, the pressure must be allowed to stabilize for a minimum of **15 minutes**. The pressure shall be considered stabilized after **5 minutes** without fluctuation.

This process should be repeated for pressurizing the pipe to 50% of the final test pressure. Once the pressure has stabilized for **15 minutes**, the pipe should be pressurized to 75% of the final test pressure at a rate of **10 PSIG/MIN**. Now, the pressure should be allowed to stabilize for 1 hour.

After the pressure has stabilized to 75% of the final test pressure, pressurization at a rate of **5 PSIG/MIN** shall be used to complete the pressurization process up to the final test pressure. The final test pressure shall be considered stabilized after **5 minutes** without fluctuation.

When the final test pressure is reached and has stabilized, pressurization shall cease, the pipe blocked in, and all valves and connections to the line shall be inspected for leakage.

3.5 PIPE CONDITIONING

FlexSteel must be conditioned prior to commencing a "hold" or test period. This is for the purpose of allowing the polymer liner in the FlexSteel to creep to bed into the tensile elements in the FlexSteel. *(FlexSteel Technical Manual)*

After the test pressure has stabilized in the Initial Pressurization phase, the pipe should be blocked in. Then, the pressure drop in the pipe should be monitored and recorded continuously, or at least every fifteen (15) minutes for 1 hour. After that, the pipe should be re-pressurized to the test pressure, blocked in, and have its pressure monitored and recorded continuously, or at least every fifteen (15) minutes for 1 hour. *(FlexSteel Technical Manual)*

The two recorded pressure drops should be compared. If the rate of pressure drop is smaller for the second run, the pipe is conditioning and not leaking. *(FlexSteel Technical Manual)*

However, if the pressure drop rate does not decrease, there is a possibility that leak exists in the pressure boundary system. These leaks are usually in the test equipment or flanges rather than the pipe. If this occurs, testing should continue for two (2) additional cycles to verify that the pressure drop rate is still not changing. If the pressure drop rate remains constant, or increases, the test fittings and flange connections should be checked for leakage. Following this, if there is still no decline in the rate of pressure drop, the pipe is leaking. A leak in the pipe is rare, and if it occurs, it could result from a faulty end fitting or end fitting installation. Thus, the end fittings should be carefully inspected and/or replaced to determine if the leak occurred at an end fitting. *(FlexSteel Technical Manual)*

If the rate of pressure drop did decrease without any issues, the cycle of pressurizing to the test pressure, blocking the pipe in, and monitoring and recording the test pressure for an hour should continue a few more times to get more data and demonstrate that the rate of pressure drop is decreasing with each cycle. If an issue arises, then the steps mentioned above to determine if a leak is present should be followed.

Otherwise, the anticipated 24-hour test pressure drop shall be calculated. That is, in a hypothetical 24-hour test, the anticipated pressure drop shall be calculated assuming the most recent pressure drop rate is maintained. If the predicted pressure is less than the Lower-Bound Test pressure (see the Site-Specific Hydrostatic Test Plan), then more conditioning cycles are needed. After each cycle, the predicted pressure drop shall be calculated for a 24-hour test to see if the pressure will always stay above the Lower-Bound Test Pressure. Once this has been confirmed, the pipe has been properly conditioned. The pipe should be re-pressurized to the test pressure, blocked in, and The Test Period shall start. *(FlexSteel Technical Manual)*

NOTE: The conditioning process can take several hours (8 – 12). It may be the case that the pipe needs to be pressurized up to the final test pressure a few times to finalize the conditioning before being blocked in and starting the test period. Also, it is recommended that all personnel be at least 50 feet away from the pipe during the pressure test. *(FlexSteel Commissioning Field Notes)*

3.6 THE TEST PERIOD

The Test Period shall begin after the temperature of the test medium, pipe temperature, and ground temperature have stabilized. When this stabilization process is complete, the pressurization pump should be isolated from the test section.

After inspecting for leakage, test personnel shall verify that the specified test pressure is being maintained.

Pressure and temperature shall be continuously monitored during the test. Data shall be recorded every half hour throughout the duration of the test.

The maximum allowable range of pressure fluctuation during the pressure test is defined by the **"Upper Bound Test Pressure"** and **"Lower Bound Test Pressure"** as shown in the **site-specific Hydrostatic Test Plan**, which is supplemental to this Hydrostatic Test Procedure. Any pressure excursions outside of these limits shall be reported to the Noble representative for further analysis.

Weather changes, such as the development of rain or clouds, which could affect the pressure and temperature of the pipe and test medium shall be documented on the test log.

The volume of any added or subtracted test medium shall be documented on the test log as well as its temperature and pressure at that time and be accounted for in the assessment of the results of the pressure test. For any pressure test of piping that cannot be 100% visually checked for leaks, it is mandatory that the volume of any test medium added or removed be accounted for to determine if the pressure test has been completed without evidence of leakage.

3.7 SEARCHING FOR LEAKS

Prior to commencing work, the method(s) for locating leaks or failures shall be approved by the Noble representative. The operator may choose to fly, drive and/or walk the pipeline right-of-way to visually check for evidence of leaks during the pressure test. The operator should develop contingency plans for locating large and small leaks in areas of difficult terrain or in the event of inclement weather.

Acceptable methods for finding leaks during a pressure test are listed as follows:

- Sectioning or segmenting the pipeline and monitoring the pressure of each section. Closing mainline block valves will isolate the pipeline into smaller segments. Freeze plugs may also be used to isolate sections of the pipeline for evaluation.
- Acoustical monitoring equipment may be employed to narrow the search area.
- Odorants or tracers introduced into the test medium during the filling process will allow the operator to detect leaks with sensing equipment.

3.8 PRESSURE TEST FAILURES

All leaks and test failures shall be reported to the Noble representative immediately.

Any pipeline leaks or failures shall be documented in the test report.

If a rupture or a substantial leak occurs, the test shall be stopped and the pipeline depressurized. The cause of failure shall be understood, test procedures shall be reevaluated, and approval from the Noble representative shall be obtained before proceeding with repairs and starting a new hydrostatic test.

Pipe, valves, fittings, and test components that fail during a pressure test shall be investigated to determine the cause of failure and to minimize the possibility of a recurrence.

Pipe or other failed components shall be preserved for further examination and failure analysis.

If a small leak occurs, the pressure should be reduced to 80% of the final test pressure while locating the leak. After repairs are completed and authorization from the Noble representative has been obtained, the test can be restarted per the initial pressurization steps above.

Pressure excursions outside of the **Maximum and Minimum Test Pressures** as defined in **Section 2.1** of this procedure are considered test failures.

3.9 DEPRESSURIZATION, DISPLACEMENT, AND DISPOSAL OF TEST WATER

Prior to commencing work, a depressurization, displacement, and disposal plan shall be submitted to and approved by the Noble representative.

Depressurization activities shall not commence without authorization from the Noble representative. Once authorization is received, depressurization should commence at a rate of **10 PSIG/MIN** in increments of 25% of the final test pressure. The pressure should be allowed to stabilize for **15 minutes** between increments.

Displacement and disposal activities shall not commence prior to Noble engineering acceptance of the hydrostatic test results.

A disposal plan for the test medium must be developed and the Noble representative shall review and approve the disposal plan.

Pigs or spheres used in the dewatering process shall be equipped with trackers for monitoring location and speed during the dewatering process.

The travel speed for the dewatering pigs shall be maintained at **2 – 3 MPH**.

3.10 DRYING OPERATIONS

If the pipeline will not be placed into service within seven (7) days of dewatering, drying operations are required.

Prior to commencing work, a drying plan shall be submitted to and approved by the Noble representative.

Drying shall be accomplished by sweeping the pipeline with nitrogen.

Upon completion of the nitrogen sweep, a **5 PSIG** nitrogen blanket shall be maintained on the pipeline until commissioning.

4 RECORDS

After the hydrostatic test has been completed, the following records shall be submitted as part of the Final Test Report, which must be retained as long as the pipeline is in use.

- Pressure / Volume Plot
- Pressure Recording Chart / Plot
- Calibration Records
  - Deadweight Tester
  - Chart Recorder
  - Temperature Recorders
  - Certified Thermometer
- 49 CFR Part 195 Operator Qualifications
  - Operator
  - Person responsible for making the test
  - Test company used, if any
- Hydrostatic Test Log, including:
  - Date and time of the test
  - Minimum test pressure
  - Test medium
  - Description of the pipeline tested and the test apparatus
- Leak Reports
- Failure Reports
- Site-specific hydrostatic test plan including:
  - Elevation profile of the pipeline
  - Locations of test sites over the entire length of the pipeline

- Temperature Chart / Plot

5 REFERENCES

1) API RP1110 "Recommended Practice for the Pressure Testing of Steel Pipelines for the Transportation of Gas, Petroleum Gas, Hazardous Liquids, Highly Volatile Liquids, or Carbon Dioxide"
2) ASME B31.4 "Pipeline Transportation Systems for Liquids and Slurries"
3) ASME B16.5 "Pipe Flanges and Flanged Fittings"
4) 49 CFR Part 195 "Transportation of Hazardous Liquids by Pipeline"
5) "FlexSteel Technical Manual"
6) "FlexSteel Commissioning Field Notes"
7) Site Specific Hydrostatic Test Plan

Greeley Crescent DSU 53 Lateral - 6 in PW Pipeline Hydrostatic Pressure Test Plan

Start Test Location Target Parameters
- **Target Pressure:** 1,000 psig
- **Upper Bound Pressure:** 1,025 psig
- **Lower Bound Pressure:** 975 psig

End Test Location Target Parameters
- **Target Pressure:** 1,016 psig
- **Upper Bound Pressure:** 1,041 psig
- **Lower Bound Pressure:** 991 psig

Design Note:
The test conditions detailed in this exhibit shall be performed and verified in order for the system to be rated for the internal design pressure of 750 psig. This test is designed to comply with hydrostatic testing standards outlined in API RP 1110, ASME B31.4, ASME B16.5, and 49 CFR Part 195.

Pipe Spec: 6.93 in OD, 0.665 in w.t., FlexSteel
Minimum Flange or Valve ANSI Rating: CL300 (720 psig)
Approximate Line Length: 8,349 feet
Water Volume: 255 US Oil Barrels