Updated Well test Programme

Rigless Welltest NLW-GT-02-S1

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Revision no.	Date	Summary of changes
1.0	17-8-2017	Initial version
2.0	17-10-2017	Initial version submitted to SodM
3.0	20-01-2018	Final version submitted to SodM
4.0	20-04-2018	Updated for rigless welltest. Made specific for NLW-GT-02-S1 Lower Cretaceous production test only. Included Well Examiner comments.
4.1	22-05-2018	Included final well schematic and trajectory data.

Introductory Note

Revision Wireline logging and well testing NLW-GT-02-S1
In the original drilling programme of NLW-GT-02, the casing logs and production tests were planned with the drilling rig. After evaluation of the NLW-GT-01 well test, it was decided to perform these jobs for the second well after the rig demobilisation.

This revision document includes inputs from the two documents below and changes regarding the rigless activity.

- Well test and stimulation programme_v3, dated 20-01-2018
- Drilling program NLW-GT-02 Lower cretaceous_v2.1, dated 05-03-2018

Additionally, the following documents have been updated and are attached with this document:

- Project Specific Health and Safety plan
- Fire Fighting and rescue plan

The planned start date is May 28th 2018, duration is estimated at 7 days.

Contents

1 Introduction

This work plan describes the operational steps required to execute a production test. This will be done after rig down and demobilisation of the T-207 drilling rig. A work platform in combination with crane will be used for installation and retrieval of the ESP. An exemption for well control equipment is requested and should be in place for executing this programme.

A summary of the work sequence is given below.

1. Mobilise and unload work platform.
2. Remove blind flange and TWCV from wellhead NLW-GT-01.
3. Install pressure gauge in NLW-GT-01.
4. Remove X-mas tree NLW-GT-02-S1.
5. Rig up work platform over NLW-GT-02-S1.
6. Retrieve tubing hanger.
7. R/U wireline unit.
8. Perform cased hole logging in NLW-GT-02-S1.
9. R/D wireline unit.
10. R/U slickline unit.
11. Run downhole P/T gauges.
12. P/U ESP motor and connect to slickline.
13. Assemble ESP.
14. RIH ESP on 8 5/8” tubing to 780 m, meanwhile rig up welltest equipment.
15. Make cable splice, install penetrator in tubing hanger and land in wellhead.
16. Remove work platform.
17. Install X mas tree.
18. Install flowline and pressure test same.
19. Perform welltest.
20. Build-up period, meanwhile rig down welltest equipment.
21. POOH ESP.
22. Retrieve P/T gauges.
23. Take downhole fluid samples at reservoir level.
24. Install tubing hanger (TWCV pre-installed).
25. N/D work platform.
26. Install X-mas tree and pressure test same.
27. Remove TWCV.
28. End of operations.

2 Objectives

The objectives can be divided in technical and operational objectives:

Technical:

- Successfully obtain cement and casing integrity logs (USIT – CBL-VDL).
- Perform wellbore cleanout and production test to determine:
  - Productivity of the well .
  - Reservoir parameters (permeability, kH, skin, and temperature gradient).
  - Location of boundaries (faults)
  - Gas water ratio
  - Composition of water and gas.
  - Bubble point.

Operational:

- No accidents, no incidents, no harm to people.
- Minimum damage to the environment.

2.1 *Depth Reference*

Unless specified otherwise all depths are relative to ground level. Ground level is 0.9 m below NAP. Elevation of work platform = 4.95 m above GL (to be confirmed after installation).

2.2 *Well Data*

Table 1. Generic well data NLW-GT-02-S1

Well name	Naaldwijk – GT-02-S1
Type of well	Geothermal exploration
Concession	Naaldwijk 2II, De Lier IV & Naaldwijk 3
Acronym	NLW-GT-02-S1
Surface Location	Naaldwijk
Municipality	Westland
Deviation	J-shape
Operator	Trias Westland B.V.
Grid Coordinate System	Rijkdriehoeksmeting / Netherlands New
Surface coordinates	X: 76.154 (RD) Y: 445.230m (RD)
Well Total Depth	2671 m AH BGL / 2516 m TVD BGL
Expected reservoir pressure	245 bar - 1.06 s.g. PP @ 2359m TVD NAP = top Delft Sandstone
Max. Expected closed in WHP	0 bar (well is not self flowing, static fluid level is below surface.
Expected top reservoir temperature	86°C, geothermal gradient: 0,0313˚C/m @ 2359m TVD BRT assuming 12˚C surface temperature.

2.3 *Trajectory*

The actual trajectory can be found in the attachment. As per plan the trajectory is tangent at 12 – 13° angle from 425 m MDBRT up to 790 m MDBRT and should therefore provide a straight interval for the ESP.

Refer to attachment 6.4 for actual surveys and trajectory plot.

3 HSE & Organisation

3.1 *General HSE*

Health, Safety and Environment are of the utmost importance during all phases of operations. All personnel must ensure that they are fully conversant with the relevant HSE regulations.

The following documents have been prepared and distributed among all participant companies:

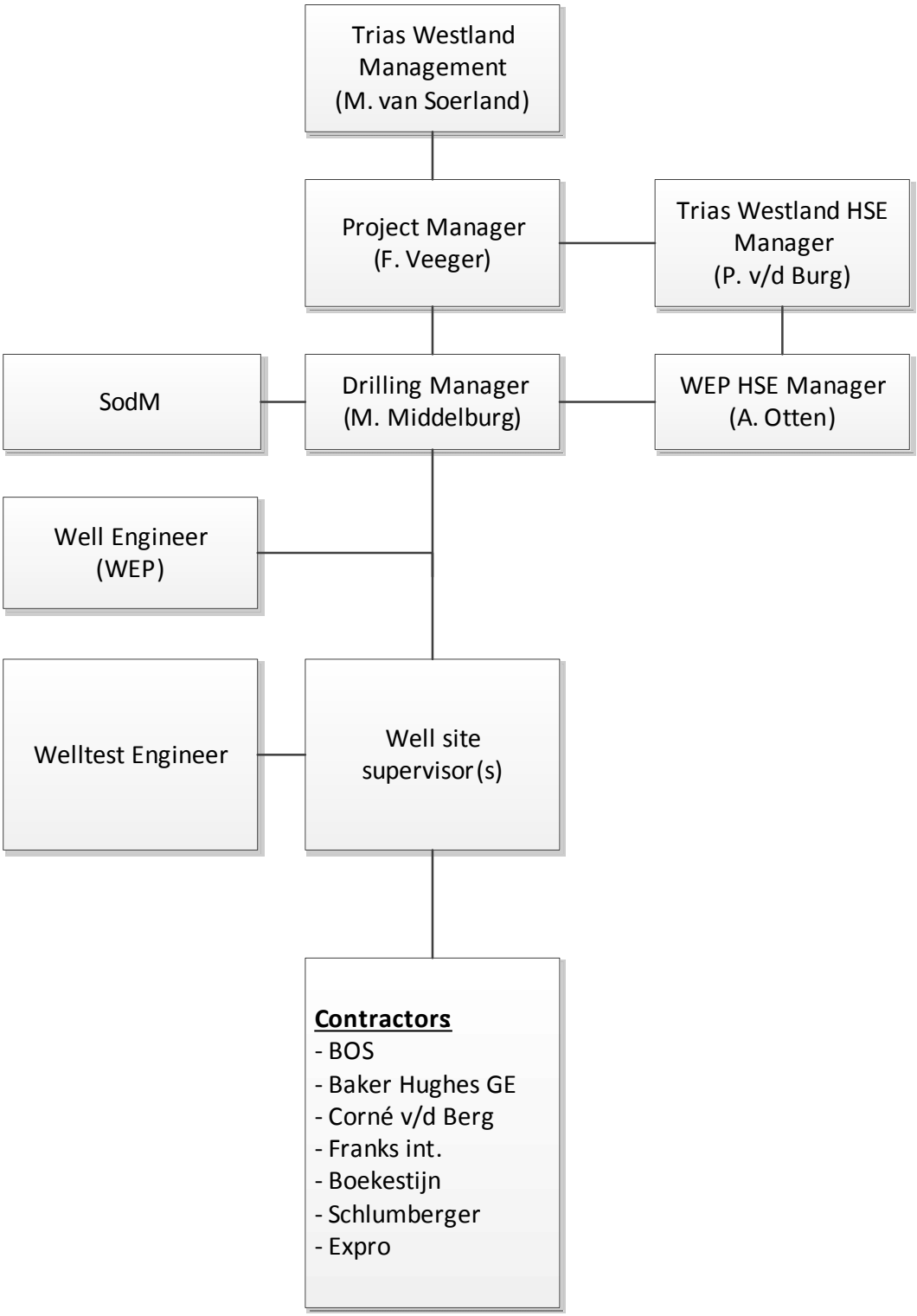
- Project-Specific Safety & Health Plan
- Fire Fighting & Rescue plan

A pre-shift Safety Meeting will be held at the beginning of every shift to brief the crew taking charge of the applicable work to be done. Well site Supervisors will keep a Shift Handover report to brief and record any abnormalities.

Pre-job safety meetings (PJSM) will be held to discuss specific jobs *ad hoc* and minutes of the meeting and participants involved recorded. Job safety analysis (JSA) will be used to aid focus of the PJSM.

Safety drills (fire and evacuation) will be held regularly and alternately with all personnel working on location.

3.2 *Organogram*



3.3 *Service Providers*

Table 2. Overview of service contractors

Service	Company
Work platform & tubular running services	Franks International
Crane Services	Boekestijn
Onsite Supervision & office support	Well Engineering Partners
Well test engineer	Trias Westland
E-line logging	Schlumberger
Slickline services	Expro
Wellhead/ XMT Installation	Hartmann Valves & Wellheads
Well Test equipment	Bakker Oilfield Supply
ESP installation	Baker Hughes GE
General services	Corné v/d Berg

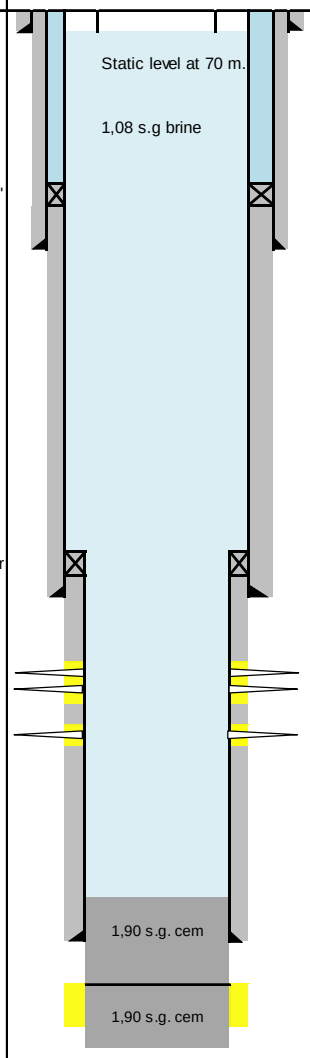
4 Current well status

4.1 *NLW-GT-01*

Actual status:

- Filled with 1.07 s.g. formation water.
- Static fluid level at 70 m below ground level.
- Tubing hanger with X-over and 1x 8 5/8" joint below.
- TWCV installed.
- 7 1/16" 5K Blind flange on top of tubing head adapter.

Nr.	Item Description Injection well All depths from GL *GL =0,9m below NAP*	Depth m tvd	Depth m ah	Hole ID in	Pipe OD in	Collar OD in (nom)	Pipe ID in	Pipe ID in (drift)
1	30" 0,5" WT S355 Conductor	124	124	35,433	30,000	welded	29,000	29,000
	20" x 16" liner hanger & packer X/O to 13 5/8"		1091,7	Top of liner (100 m liner lap)				
2	20" 133# NT95DE ERW BTC Casing	1149	1234,7	24,00	20,000	21,000	18,730	18,542
		1190	1288,7	section TD				
	13 5/8" x 9 5/8" Liner Hanger + Packer		2309,3	Top of liner				
3	13 5/8" 88.2# L80 VAM21Liner + tie-back	2159	2417,7	17,500	13,625	14,699	12,375	12,250
		2196	2460,7	section TD				
		Perforation interval 1: 2595 - 2688 m MD						
		Perforation interval 2: 2728 m MD - 2743 m MD						
			4008,7	Top of cement				
4	9 5/8" 53,5# L80 VAM21 Liner	3763	4113,2	12,25"	9,625	10,542	8,535	8,500
			4195,7	2nd stage cement plug				
				1st stage cment plug				
		4012	4437,7	TD 8 1/2" open hole.				



* not in scale

Figure 1. Well schematic NLW-GT-01 - Actual status

4.2 *NLW-GT-02-S1*

Actual status:

- Filled with 1.07 s.g. formation water.
- Static fluid level below ground level (not available at time of writing this document)
- Tubing hanger with X-over and 1x 8 5/8" joint below. No TWCV installed.
- X-mas tree installed (2x 7 1/16" 5K ball valves).

Nr.	Item Description Production well All depths from GL *GL - NAP: -0,9 (NAP is 0,9 m above GL)*	Wellhead and Xmastree **NLW-GT-02-S1**	Depth m tvd	Depth m ah	Hole ID in	Pipe OD in	Collar OD in (nom)	Pipe ID in	Pipe ID in (drift)
1	30" 0,5" WT S355 Conductor		125	125	35,433	30,000	welded	29,000	29,000
	20" x 16" liner hanger & packer X/O to 13 5/8"		967	983	Top of liner				
2	20" 133# NT95DE ERW BTC Casing		1076	1093	24,00	20,000	21,000	18,730	18,542
			1080	1097	section TD				
	13 5/8" x 9 5/8" Liner Hanger + Packer		2245	2316	Top of liner (50 m liner lap)				
3	13 5/8" 88.2# L80 VAM21 Liner + Tie back		2287	2366	17,5"	13,625	14,699	12,375	12,250
			2295	2376	section TD				
			2356	2451	Top Screens				
			2359	2455	Top Delft Sandstone				
			2444	2569	Bottom Screens				
4	9 5/8" 53,5# L80 VAM21 WWS		2490	2633	12,25"	9,625	10,542	8,535	8,500
			2516	2671	TD				
*Not in scale.									

Figure 2. Well schematic NLW-GT-02-S1

5 Sequence of Operations

5.1 *Installation of pressure gauge in NLW-GT-01*

A pressure sensor will be installed at 100 m depth to measure possible pressure interference while testing NLW-GT-02-S1.

Step by step operations:

1. Check and bleed-off pressure from 2 1/16" side outlets valves and bleed-off valve on top of blind flange.
2. Remove 7 1/16" 5K blind flange.
3. Remove TWCV from hanger.
4. Hang-off pressure sensors at 100 m below ground level.
5. Connect wire to TWCV and install same in tubing hanger.
    a. TWCV has a lifting eye installed at the bottom for connecting the wire.
6. Install X-mas tree valves.
7. Pressure test X-mas tree valves against TWCV to 25 bar / 5 min and 100 bar / 10 min.

5.2 *Rig up and cased hole logging (NLW-GT-02-S1)*

Objective of this phase is to open the well by removing the x-mas tree and tubing hanger and obtain logging data of the cement bond behind the 13 5/8" liner and casing ID and wall thickness of both 13 5/8" liner and tie-back string. Furthermore the work platform will be installed over the well to be ready for ESP installation.

Step by step operations:

1. Check and bleed-off pressure from 2 1/6" side outlets valves and 7 1/16" X-mas tree.
2. Remove X-mas tree and tubing head adapter.
3. Rig up work platform and TRS equipment.
4. P/U 7" VAMTOP landing joint and screw into hanger.
5. Undo tie-down bolts.
6. Pull hanger free using jacks. (string and hanger weight = approx. 2 ton).
7. Pick-up tubing hanger and lay down using crane.
    a. Inspect thread of pup joint below hanger.
    b. Prepare hanger for reinstallation, make sure new seals are available.
8. R/U Schlumberger E-line.
9. Prepare USIT + CBL – VDL toolstring.
10. Log 13 5/8" cemented liner in cement + casing mode.
11. Log 13 5/8" tie-back liner in casing mode.
12. L/D wire tools and rig down Schlumberger E-line.

5.3 *Installation of ESP*

A rental ESP will be run on 8 5/8" 32# L80 Polseal tubing to 780 m BGL. The ESP has a X-over + 2m 8 5/8" Polseal pupjoint pre-installed for easier handling. Pressure and temperature (P/T) will be recorded approx. 25m above the 9 5/8" liner hanger top during the production test. Gauges are run on slickline and connected below the lower ESP motor.

Step by step operations:

1. R/U Expro Slickline
2. Prepare toolstring with 2x Pressure and temperature gauges
    a. Sampling rate of gauges: 1 sec.
3. RIH P/T gauges to 25 m above 9 5/8" liner top.
4. Pull back gauges by planned ESP depth (plan = 780 m BGL).
5. Hang off slickline using wireline clamp.
6. Cut slickline and make up rope socket with 15/16 NPT sucker rod connection.
7. P/U ESP motor and connect slickline to bullnose (15/16" NPT Sucker rod connection)
8. Assemble ESP as per Baker Hughes GE instructions.
    a. 2x Motor
    b. Seal
    c. ESP with X-over and 2m 8 5/8" pup joint pre-installed.
9. RIH ESP on 8 5/8" tubing as per running tally.
    a. Take care of ESP cable while running in, especially when couplings passing the master bushings.
    b. Make up torque of 8 5/8" 32# L80 Polseal:

Minimum (ft*lbs)	Optimum (ft*lbs)	Maximum (ft*lbs)
8460	9400	10340

10. P/U tubing hanger with 7" VAMTOP landing joint.
    a. Penetrator with pig tale should be installed.
11. Measure ESP cable length and cut same.
12. Make splice between ESP cable and pig tale.
13. Land tubing hanger in wellhead.
14. Secure tie-down bolts.
15. Remove 7" landing joint.
16. Install TWCV in hanger.
17. Move work platform
18. Install X-mas tree
    a. Tubing head adapter
    b. 7 1/16" 5k master valves (one block)
19. Pressure test X-mas tree against TWCV to 25 / 5 min and 100 bar / 10 min.
20. Remove TWCV.
21. Install 7 1/16" 5K flange x 6" WECO on X-mas tree.
22. Rig up welltest equipment as per P&ID in attachment I.
23. Pressure test HP flow lines to 60 bar.
24. Leak test low pressure flow lines with fresh water.

5.4 *Production test*

A production test will be conducted to test the reservoir performance of the Delft Sandstone and upper sand layer of the Alblasserdam reservoir. Reservoir fluid will be produced with an Electric Submersible pump (ESP). The produced fluid will be separated at surface in a degasser. The liquid phase will be stored in a basin and the gas phases will be flared.

The deliverables of the production test are:

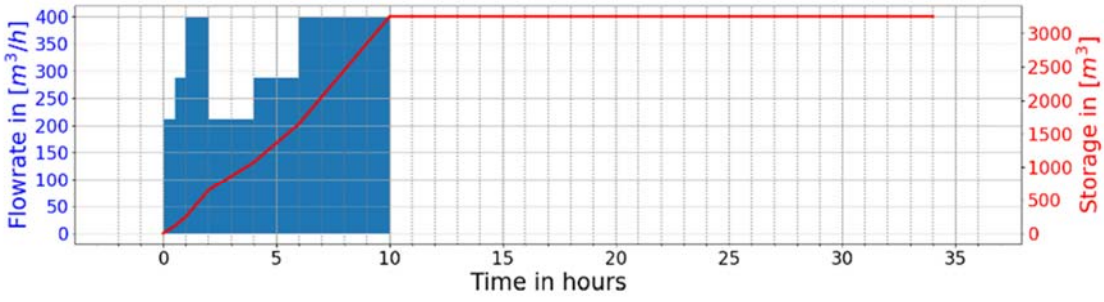
Reservoir Parameters:
- Permeability reservoir
- Skin factor
- Indication nearby flow barriers <300m

Production Parameters:
- Determine Gas-Water Ratio
- Determine Bubble point
- Determine composition reservoir fluids
- Determine composition stock-tank fluids

Clean-out:
- Clean wellbore
- Clean near-wellbore

5.4.1 Step by step operations:

1. Hold pre-job safety meeting before start of welltest.
2. Start ESP, check for correction direction of rotation.
3. Perform production test as per scheme below:
    a. A-annulus open and connected to gas separator.
    b. B-annulus is closed, pressure to be monitored and bled-off when pressure reaches 50bar.



	Phase 1	Phase 2	Phase 3	Phase 4	Phase 5	Phase 6	Phase 7
Time [h]	0.5	0.5	1.0	2.0	2.0	4.0	24.0
Flow-rate [m^3/h]	212.0	288.0	400.0	212.0	288.0	400.0	0.0

4. Stop ESP at end of phase 6 and allow pressure to stabilise 30 min before closing in the well on tubing and A-annulus.

5. Close in well on 2x 7 1/16" master valves and A-annulus sideoutlets for 24 hours build-up.
    a. Leave power connected to ESP to record ESP gauge data.
6. Rig down and demobilise welltest equipment during 24 hrs pressure build-up.

5.4.2 Measurements

The following measurements will be done during the production test:

Sensor	Data acquisition		Operating-Window	Resp. Party	Comments
	Electr	Manual			
P-gauge A- annulus	x	x	0 – 100 bar	BOS	
P-gauge B- Annulus		x	0 – 60 bar	Hartmann	Incl. bleed-off valve.
P-gauge tubing head pressure	x	x	0 – 100 bar	BOS	
2x Flow meter	x			BOS	
Gas flow meter	x	x		BOS	
Gas sensor (H2S, LEL, BTEX)		x		BOS	
PH meter		x		BOS	Used to analyze PH of returns
Downhole Pressure & Temperature gauge.	x		0 – 1100 bar 0 – 177 °C	Expro	Memory gauge run on slickline and supported below ESP. Sampling rate 1/sec)
Intake Temperature	x	x	0-150°C	BHGE	Also logged in BOS system
Intake Pressure	x	x	1-345 bar	BHGE	Also logged in BOS system
Output Frequency VSD	x		30-60Hz	BHGE	
Output Current VSD	x		0-1800A	BHGE	
Output Voltage VSD	x		0-400V	BHGE	
Motor Temperature	x		0-260°C	BHGE	

5.4.3 Well control during production test

During the production test the well is completed with the X-mas tree in a similar way as during the production phase. The X-mas tree consisting out of a lower and upper actuated master valve is installed. The upper valve is hydraulically operated and can therefore automatically shut in the well in case of an emergency. An ESP emergency shut down device (ESD) is present on location.

5.4.4 Gas handling

Gas will be separated from the formation water in the degassing tank which is operated at a minimum of 5 bar pressure. The gas is guided through a gasflow meter to the flare stack and burned. Expected GWR

ratio is between 1-1.5 Nm^3/m^3. The maximum gas flow is 600 Nm3/h. This corresponds to the maximum flow rates and high GWR.

5.4.5 LSA

LSA measurements will be performed on all equipment coming in and going out of location. In case there is LSA contamination on location, equipment will be contained and handled together with a LSA expert, level 3.

5.5 *Retrieve ESP and downhole sampling.*

The objective is to retrieve the ESP and downhole P/T gauges. Downhole sample will be taken at reservoir level to determine composition of formation water and bubble point.

1. Bleed-off pressure from A-annulus (13 5/8" x 8 5/8") and below X-mas tree via choke as per Baker Hughes GE procedure.
2. N/D X-mas tree and tubing head adapter flange.
3. Install work platform and r/u TRS equipment.
4. Install 7" landing joint.
5. Undo tie-down bolts.
6. Pull hanger free using jacks.
7. Lay down tubing hanger and landing joint.
    a. Inspect thread of pup joint below hanger.
    b. Prepare hanger for reinstallation, make sure new seals are available.
8. POOH ESP on 8 5/8" tubing.
    a. Install casing protectors on 8 5/8" tubing and prepare for transport to inspection company.
9. Disassemble ESP and lay down same.
10. R/U Expro slickline.
11. Retrieve slickline and P/T gauges.
12. M/U downhole sampling toolstring.
13. RIH to reservoir level (mid screens).
14. Take downhole sample 1 meter above top WWS and POOH to surface.
15. Transfer fluid sample in transfer bottle and send to laboratory.
16. R/D and demobilise Expro wireline.

5.6 *Suspension of wells*

5.6.1 NLW-GT-02-S1

1. Install tubing hanger with one joint 8 5/8" tubing below.
2. Secure tie-down bolts.
3. Remove and lay down 7" landing joint.
4. Install TWCV.
5. Rig down and demobilise work platform and TRS equipment.
6. Install X-mas tree
    a. Tubing head adapter
    b. 7 1/16" 5k master valves (one block)
7. Pressure test X-mas tree against TWCV to 25 / 5 min and 100 bar / 10 min.
8. Remove TWCV.
9. Install 90° Elbow.

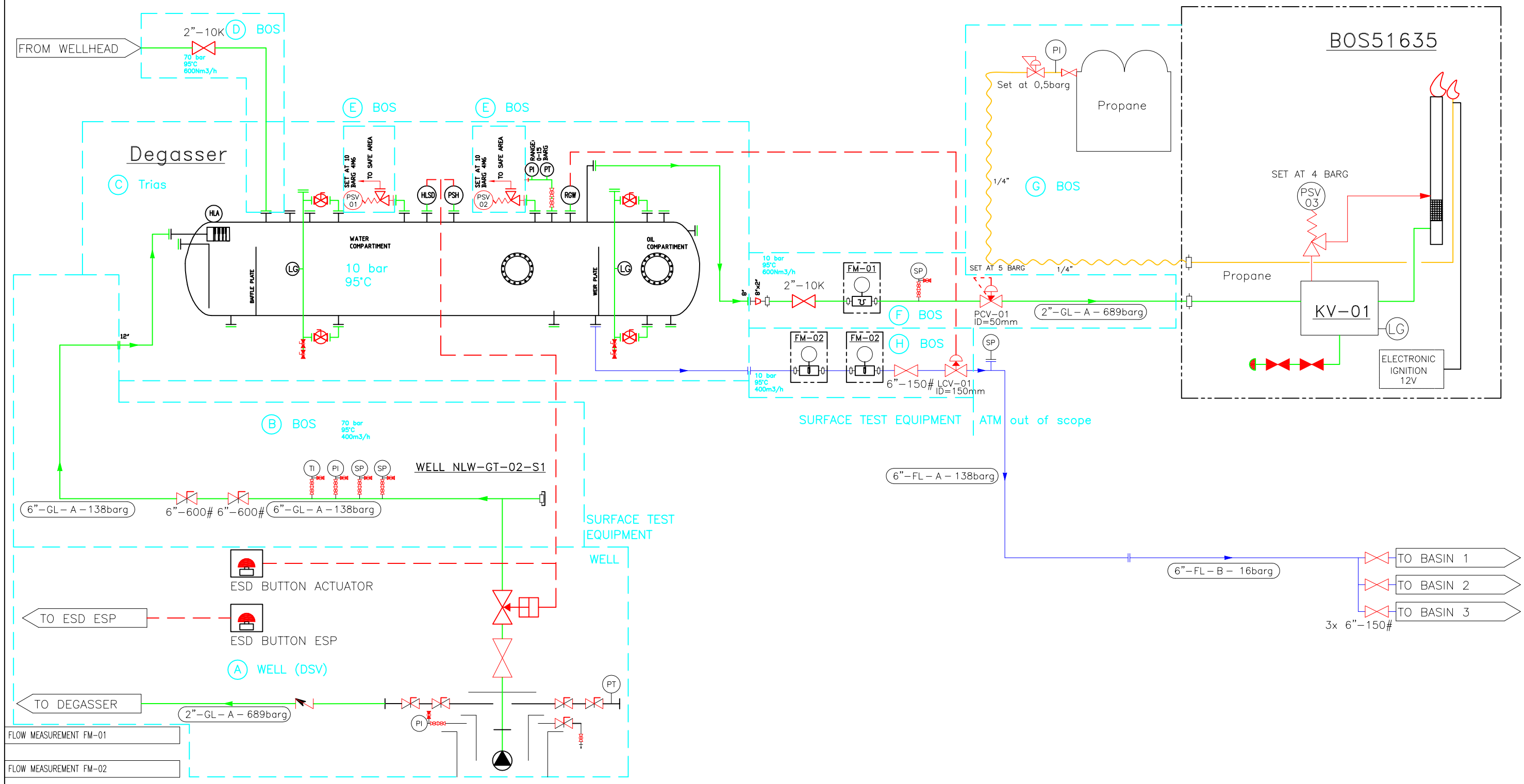
5.6.2 NLW-GT-01 well suspension

Only action to be taken is removing the TWCV and pressure sensors. The X-mas tree is already fully pressure tested during previous steps.

1. Check and bleed-off pressure from 2 1/16" side outlets.
2. Open master valves.
3. Remove TWCV and pressure sensors.
4. Close master valves.
5. Install 90° Elbow.
6. End of operations.

6 Attachments

6.1 *P&ID production test.*



Skid mounted flare		BOS51635
CAPACITY	m^3/ d	50.000
DESIGN PRESS.	barg	4
DESIGN TEMP.	°C	–20/ 100
SIZE PIPE	id x tt mm	97.1 x 6700
TOTAL HEIGHT	m	8
Knock–out Vessel KV–01		
VOLUME	m^3	0.165
DESIGN PRESS.	barg	16.3
DESIGN TEMP.	°C	–20/ 100
PSV–03 NR.–TAG–ORIFICE		150111–10669782–36mm

Trias Westland		Degasser
TYPE		VESSEL
VOLUME	m^3	60.3
DESIGN PRESS.	barg	25
DESIGN TEMP.	°C	–20 / 155
SIZE	id x tt mm	2500x12000
SERVICE		NON SOUR

SGS	SAFETY GUARDING SYSTEM	V	VALVE
ESD	EMERGENCY SHUTDOWN VALVE	EP	EROSION PROBE
PRC	PRESSURE READER CONTROLLER	CI	CHEMICAL INJECTION
PC	PRESSURE CONTROLLER	FI	FLOW INDICATOR
PCV	PRESSURE CONTROL VALVE	FR	FLOW RECORDER
PSE	RUPTURE DISC	HLA	HIGH LEVEL ALARM
PSH	PRESSURE SWITCH HIGH	HLSD	HIGH LEVEL SHUTDOWN
PSL	PRESSURE SWITCH LOW	LIC	LEVEL INDICATOR CONTROLLER
PSV	PRESSURE SAFETY VALVE	LC	LEVEL CONTROLLER
RO	RESTRICTION ORIFICE	LCV	LEVEL CONTROL VALVE
SP	SAMPLE POINT	LG	LEVEL GAUGE
TI	TEMPERATURE INDICATOR	LLSD	LOW LEVEL SHUTDOWN
TCV	TEMPERATURE CONTROL VALVE	PI	PRESSURE INDICATOR
TIC	TEMPERATURE INDICATOR CONTROLLER	PT	PRESSURE TRANSMITTER
RGW	RADAR GUIDED WAVE	LLA	LOW LEVEL ALARM
MARK	DESCRIPTION	MARK	DESCRIPTION

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	EMERGENCY SHUT DOWN VALVE HYDRAULIC		
SET AT … BARG	PRESSURE SAFETY VALVE		REDUCE
	HYDRAULIC LINE		FLEXIBLE HOSE
	FLANGE CONNECTION		PRESS. CONTROL VALVE PNEUM.
	GATE VALVE PNEUM.		WECO CONNECTION
	GATE VALVE MANUAL		BLEEDER
	ADJUSTABLE CHOKE		AIR SUPPLY
	FIXED CHOKE		BLIND FLANGE
	NORMALLY CLOSED VALVE		END CAP
	VALVE		END CLOSURE, QUICK RELEASE
	VALVE OPEN/CLOSED		GATE VALVE MANUAL
	CONTROL VALVE OPEN		GLOBE VALVE MANUAL
	CONTROL VALVE CLOSE		BUTTERFLY VALVE
	THREE WAY VALVE		BALL VALVE MANUAL
	NON RETURN VALVE		PLUG VALVE MANUAL
	STUDDED BLOCK		

MARK	DESCRIPTION
WL	WATER LINE
VL	VENT LINE
SL	STEAM LINE
OL	OIL LINE
GL	GASLINE
FL	FLUID LINE
CL	COFLEXIP
AL	AIR LINE
B	HOSES
A	HARD PIPING
FL	FLUID ID
3"	LINE ID
3"–FL–A–(B)	

CH–02	75 mm			
CH–01	75 mm	PSV–03	4 BAR	Skid mounted flare BOS51635
LCV–01	150 mm	PSV–02	10 BAR	Trias Degasser
PCV–01	100 mm	PSH	9 BAR	Trias Degasser
		PSV–01	10 BAR	Trias Degasser
MARK	ID	MARK	SETTINGS	LOCATION
CHOKE ID		SAFETY SYSTEM SETTINGS		

ISSUE REV.	DATE	DESCRIPTION	DWN BY	CHK'D BY
D				
C				
B				
A				
0	17–04–'18	ORIGINAL	JB	

BAKKER OILFIELD SUPPLY COEVORDEN BV.

TITLE: PEFS NLW–GT–02 PRD T.

ADM. No. BOS

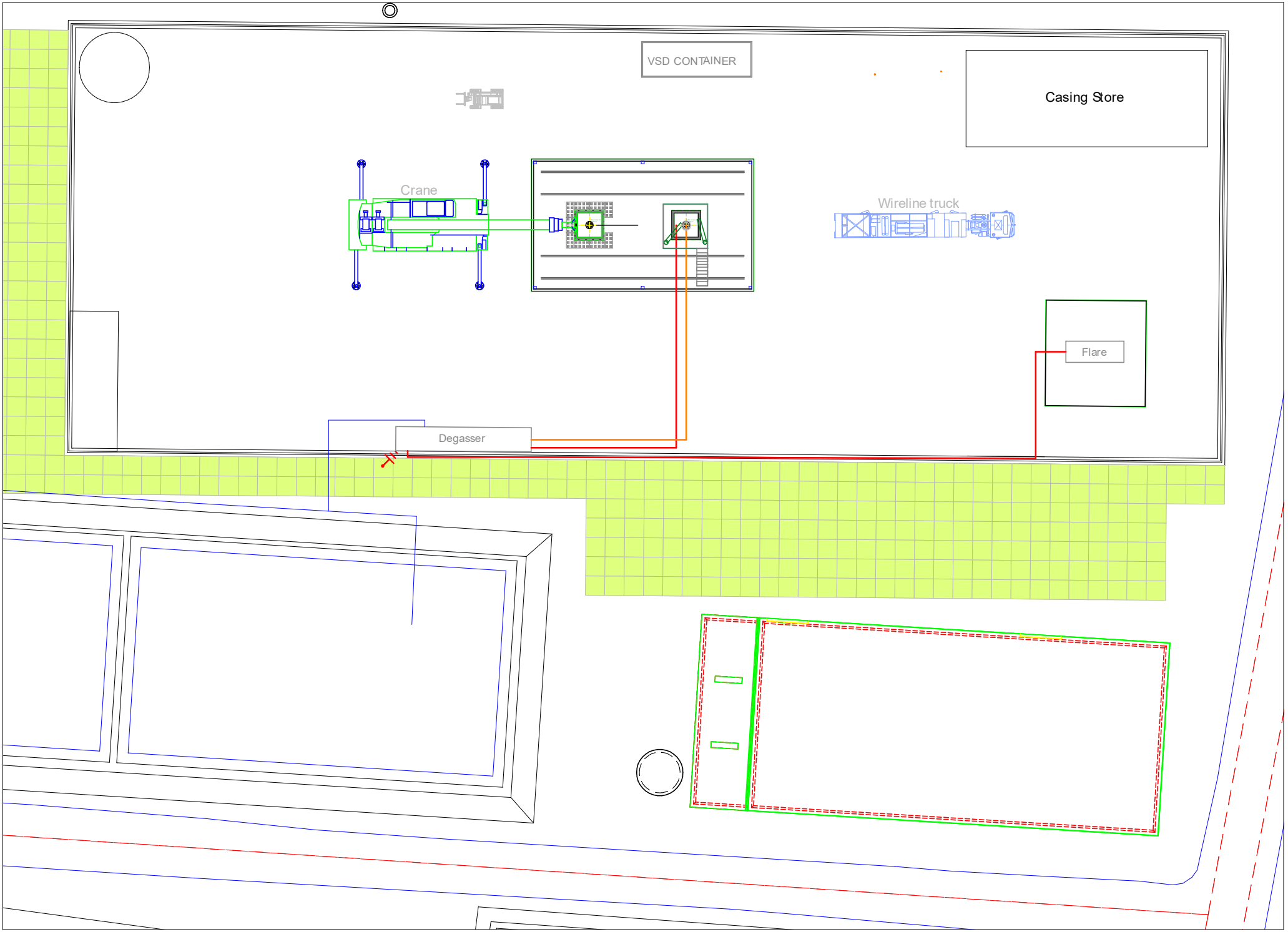
EQUIPMENT No.

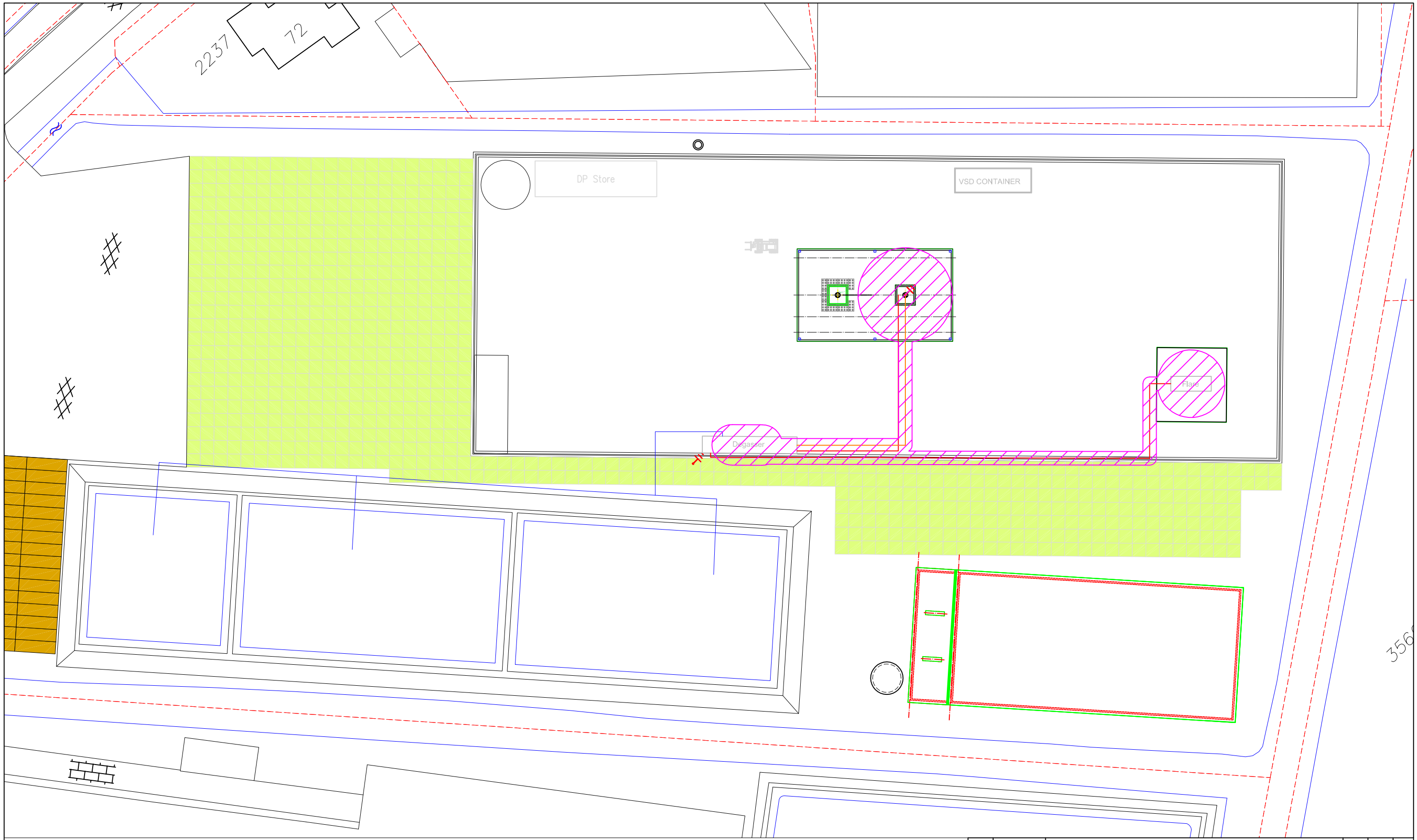
SCALE:

DRAWING No. 5313_001 RS41-10 REV. 0

SHEET 1 OF. 3

6.2 *Location Layout including welltest equipment*


VSD CONTAINER
Casing Store
Crane
Wireline truck
Flare
Degasser



Zone 2

D					
C					
B					
A					
0	17-04-'18	ORIGINAL	JB		
ISSUE REV.	DATE	DESCRIPTION	DWN BY	CHK'D BY	

BAKKER OILFIELD SUPPLY COEVORDEN BV.

TITLE: HAZARD NLW-GT-01 PRD T.

ADM. No. BOS

EQUIPMENT No.

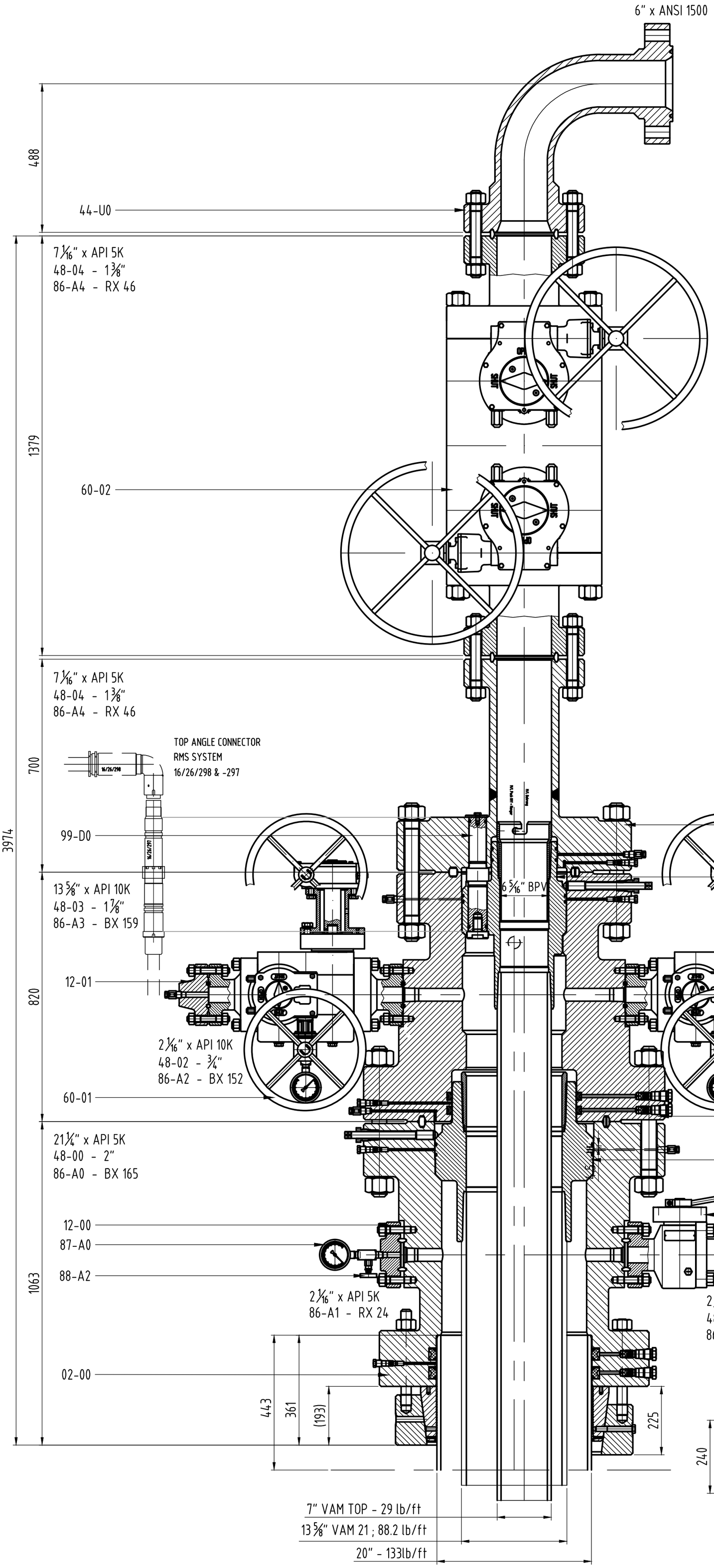
SCALE:

DRAWING No. 5298 002 RS41-10 REV. 0

SHEET 2 OF. 3

6.3 *Wellhead & X-mas tree drawing NLW-GT-01 & NLW-GT-02-S1*

See separate page



HARTMANN VALVES & WELLHEADS

	Date	Name
Prep.	14.08.2017	AB
Appr.	14.08.2017	BT

origin 108938
replaced by -
raw material -

Final Drawing
019928

Geothermal Wellhead and Xmas Tree

Trias Westland B.V. - Rigsite Naaldwijk

019928-0 | A2 | 1/1 | weight - | Scale: 1:10

Index	Revision	Date	Name
/	-	-	-

6.4 *Survey listing NLW-GT-02-S1*

Schlumberger

NLW-GT-02-S1 Def Survey Survey Geodetic Report

TRIAS WESTLAND

(Def Survey)

Report Date:	May 18, 2018 - 10:49 AM	**Survey / DLS Computation:**	Minimum Curvature / Lubinski
Client:		**Vertical Section Azimuth:**	107.442 ° (Grid North)
Field:	Naaldwijk (Trias Westland)	**Vertical Section Origin:**	0.000 m, 0.000 m
Structure / Slot:	NLW-GT-02 / NLW-GT-02	**TVD Reference Datum:**	Unknown
Well:	NLW-GT-02	**TVD Reference Elevation:**	8.420 m above NAP
Borehole:	NLW-GT-02-S1	**Seabed / Ground Elevation:**	0.900 m below NAP
UWI / API#:	Unknown / Unknown	**Magnetic Declination:**	1.102 °
Survey Name:	NLW-GT-02-S1 Def Survey	**Total Gravity Field Strength:**	1000.5836mgn (9.80665 Based)
Survey Date:	April 03, 2018	**Gravity Model:**	GARM
Tort / AHD / DDI / ERD Ratio:	84.567 ° / 730.906 m / 5.333 / 0.289	**Total Magnetic Field Strength:**	49039.641 nT
Coordinate Reference System:	Amersfoort * OGP-Nld / RD Dutch Onshore	**Magnetic Dip Angle:**	67.069 °
Location Lat / Long:	N 51° 59' 26.96188", E 4° 14' 22.35732"	**Declination Date:**	February 04, 2018
Location Grid N/E Y/X:	N 445230.000 m, E 76154.000 m	**Magnetic Declination Model:**	HDGM 2017
CRS Grid Convergence Angle:	-0.9056 °	**North Reference:**	Grid North
Grid Scale Factor:	0,99994799	**Grid Convergence Used:**	-0.9056 °
Version / Patch:	2.10.254.0	**Total Corr Mag North->Grid North:**	2.0078 °
		Local Coord Referenced To:	Structure Reference Point

Comments	MD (m)	Incl (°)	Azim Grid (°)	TVD (m)	TVDSS (m)	VSEC (m)	NS (m)	EW (m)	DLS (°/30m)	Northing (m)	Easting (m)	Latitude (N/S ° ' ")	Longitude (E/W ° ' ")
Tie-In	0,00	0,00	0,00	0,00	-8,42	0,00	0,00	0,00	N/A	445230,00	76154,00	N 51 59 26.96	E 4 14 22.36
GL	9,32	0,00	0,00	9,32	0,90	0,00	0,00	0,00	0,00	445230,00	76154,00	N 51 59 26.96	E 4 14 22.36
Conductor interference	143,59	2,13	43,05	143,56	135,14	1,08	1,82	1,70	0,48	445231,82	76155,70	N 51 59 27.02	E 4 14 22.45
DMAG	171,48	2,43	60,83	171,43	163,01	1,71	2,49	2,57	0,82	445232,49	76156,57	N 51 59 27.04	E 4 14 22.49
DMAG	200,72	4,05	79,42	200,62	192,20	3,05	2,98	4,13	1,96	445232,98	76158,13	N 51 59 27.06	E 4 14 22.57
DMAG	228,81	5,71	88,57	228,61	220,19	5,24	3,20	6,50	1,95	445233,20	76160,50	N 51 59 27.07	E 4 14 22.70
Fish Interference	256,86	7,22	88,59	256,48	248,06	8,23	3,28	9,66	1,61	445233,28	76163,66	N 51 59 27.07	E 4 14 22.86
Fish Interference	284,90	6,54	86,73	284,32	275,90	11,39	3,41	13,02	0,77	445233,41	76167,01	N 51 59 27.08	E 4 14 23.04
Fish Interference	312,51	7,69	90,35	311,71	303,29	14,63	3,49	16,43	1,34	445233,49	76170,43	N 51 59 27.08	E 4 14 23.22
Fish Interference	340,21	8,35	88,51	339,14	330,72	18,30	3,53	20,30	0,77	445233,53	76174,30	N 51 59 27.09	E 4 14 23.42
DMAG	368,61	9,23	88,49	367,21	358,79	22,41	3,64	24,63	0,93	445233,64	76178,63	N 51 59 27.09	E 4 14 23.65
DMAG	396,44	10,38	94,74	394,63	386,21	26,97	3,50	29,36	1,69	445233,50	76183,36	N 51 59 27.09	E 4 14 23.89
DMAG	424,21	12,96	99,87	421,83	413,41	32,50	2,76	34,93	3,00	445232,76	76188,93	N 51 59 27.07	E 4 14 24.19
DMAG	451,76	12,67	105,98	448,69	440,27	38,58	1,39	40,88	1,51	445231,39	76194,87	N 51 59 27.03	E 4 14 24.50
DMAG	480,28	11,94	107,66	476,56	468,14	44,66	-0,36	46,69	0,86	445229,64	76200,69	N 51 59 26.97	E 4 14 24.80
DMAG	508,01	13,16	109,74	503,62	495,20	50,68	-2,30	52,40	1,41	445227,70	76206,40	N 51 59 26.91	E 4 14 25.11
DMAG	536,29	14,17	112,19	531,10	522,68	57,34	-4,69	58,63	1,23	445225,31	76212,63	N 51 59 26.84	E 4 14 25.43
DMAG	564,31	13,91	113,38	558,29	549,87	64,11	-7,32	64,90	0,42	445222,68	76218,90	N 51 59 26.76	E 4 14 25.76
DMAG	592,18	13,35	112,05	585,37	576,95	70,65	-9,86	70,96	0,69	445220,14	76224,95	N 51 59 26.68	E 4 14 26.08
DMAG	620,05	13,22	112,05	612,50	604,08	77,04	-12,27	76,89	0,14	445217,73	76230,89	N 51 59 26.60	E 4 14 26.40
DMAG	647,70	13,00	112,85	639,42	631,00	83,28	-14,66	82,69	0,31	445215,34	76236,69	N 51 59 26.53	E 4 14 26.70
DMAG	675,87	12,87	114,06	666,88	658,46	89,55	-17,17	88,47	0,32	445212,83	76242,47	N 51 59 26.45	E 4 14 27.01
DMAG	703,90	12,21	116,00	694,24	685,82	95,59	-19,74	93,99	0,84	445210,26	76247,98	N 51 59 26.37	E 4 14 27.30
DMAG	731,75	12,74	114,18	721,43	713,01	101,55	-22,29	99,44	0,71	445207,71	76253,43	N 51 59 26.29	E 4 14 27.59
DMAG	759,59	13,16	114,62	748,57	740,15	107,74	-24,87	105,12	0,46	445205,13	76259,11	N 51 59 26.21	E 4 14 27.89
DMAG	787,98	12,93	114,75	776,22	767,80	114,10	-27,54	110,94	0,25	445202,46	76264,94	N 51 59 26.13	E 4 14 28.19
DMAG	815,95	11,86	114,15	803,54	795,12	120,06	-30,03	116,41	1,16	445199,97	76270,40	N 51 59 26.05	E 4 14 28.48
DMAG	843,88	11,35	114,64	830,90	822,48	125,63	-32,35	121,52	0,56	445197,65	76275,52	N 51 59 25.98	E 4 14 28.75
DMAG	871,83	11,35	114,42	858,30	849,88	131,09	-34,63	126,53	0,05	445195,37	76280,52	N 51 59 25.91	E 4 14 29.02
DMAG	899,31	11,26	114,67	885,25	876,83	136,44	-36,87	131,43	0,11	445193,13	76285,42	N 51 59 25.84	E 4 14 29.28
DMAG	927,06	11,07	115,71	912,47	904,05	141,76	-39,16	136,29	0,30	445190,84	76290,28	N 51 59 25.76	E 4 14 29.53
DMAG	955,25	10,73	115,25	940,16	931,74	147,04	-41,45	141,10	0,37	445188,55	76295,09	N 51 59 25.69	E 4 14 29.79
DMAG	983,37	10,05	119,06	967,82	959,40	152,04	-43,76	145,61	1,03	445186,24	76299,61	N 51 59 25.62	E 4 14 30.02
DMAG	1011,38	9,28	117,91	995,43	987,01	156,65	-46,01	149,75	0,85	445184,00	76303,74	N 51 59 25.55	E 4 14 30.24
DMAG	1038,94	8,90	120,58	1022,64	1014,22	160,91	-48,13	153,55	0,62	445181,87	76307,54	N 51 59 25.48	E 4 14 30.44
DMAG	1067,19	8,20	121,84	1050,58	1042,16	164,99	-50,30	157,14	0,77	445179,70	76311,13	N 51 59 25.41	E 4 14 30.63
DMAG	1087,46	8,01	119,22	1070,64	1062,22	167,77	-51,76	159,60	0,61	445178,25	76313,59	N 51 59 25.37	E 4 14 30.76
Shoe Interference	1111,90	7,85	120,24	1094,85	1086,43	171,07	-53,43	162,53	0,26	445176,57	76316,52	N 51 59 25.32	E 4 14 30.92
DMAG	1139,92	7,52	120,73	1122,62	1114,20	174,72	-55,33	165,76	0,36	445174,67	76319,75	N 51 59 25.26	E 4 14 31.09
DMAG	1167,90	7,17	121,80	1150,37	1141,95	178,19	-57,18	168,81	0,40	445172,82	76322,81	N 51 59 25.20	E 4 14 31.25
DMAG	1195,69	6,81	122,12	1177,95	1169,53	181,47	-58,97	171,68	0,39	445171,03	76325,67	N 51 59 25.14	E 4 14 31.40
DMAG	1223,97	6,52	122,42	1206,04	1197,62	184,64	-60,73	174,46	0,31	445169,28	76328,45	N 51 59 25.09	E 4 14 31.55
DMAG	1251,62	6,39	121,56	1233,52	1225,10	187,65	-62,37	177,10	0,18	445167,63	76331,09	N 51 59 25.03	E 4 14 31.69
DMAG	1279,60	8,06	120,24	1261,27	1252,85	191,07	-64,18	180,12	1,80	445165,83	76334,11	N 51 59 24.98	E 4 14 31.85
DMAG	1307,40	11,15	117,59	1288,68	1280,26	195,62	-66,40	184,18	3,37	445163,60	76338,17	N 51 59 24.91	E 4 14 32.06
DMAG	1336,11	13,30	117,28	1316,74	1308,32	201,61	-69,20	189,58	2,25	445160,80	76343,57	N 51 59 24.82	E 4 14 32.35
DMAG	1363,50	13,32	117,59	1343,39	1334,97	207,82	-72,11	195,18	0,08	445157,89	76349,17	N 51 59 24.73	E 4 14 32.65
MWD Surveys:	1391,19	12,90	117,05	1370,36	1361,94	214,00	-74,99	200,76	0,47	445155,01	76354,75	N 51 59 24.64	E 4 14 32.94
	1419,25	13,05	115,10	1397,70	1389,28	220,23	-77,76	206,41	0,49	445152,24	76360,40	N 51 59 24.55	E 4 14 33.24
	1447,01	12,97	110,28	1424,75	1416,33	226,45	-80,17	212,18	1,18	445149,83	76366,16	N 51 59 24.48	E 4 14 33.54
	1474,91	12,95	105,31	1451,94	1443,52	232,70	-82,08	218,13	1,20	445147,92	76372,12	N 51 59 24.42	E 4 14 33.86
	1503,47	13,10	101,61	1479,77	1471,35	239,12	-83,58	224,38	0,89	445146,43	76378,37	N 51 59 24.37	E 4 14 34.19
	1531,37	13,21	102,86	1506,94	1498,52	245,44	-84,92	230,59	0,33	445145,08	76384,58	N 51 59 24.33	E 4 14 34.51
	1559,39	13,28	104,61	1534,21	1525,79	251,85	-86,45	236,83	0,44	445143,56	76390,81	N 51 59 24.29	E 4 14 34.84
	1587,32	13,31	105,25	1561,39	1552,97	258,26	-88,10	243,03	0,16	445141,90	76397,02	N 51 59 24.24	E 4 14 35.17
	1615,16	12,95	107,24	1588,50	1580,08	264,59	-89,87	249,10	0,62	445140,14	76403,09	N 51 59 24.18	E 4 14 35.49
	1643,29	12,58	108,43	1615,94	1607,52	270,80	-91,77	255,02	0,48	445138,23	76409,01	N 51 59 24.12	E 4 14 35.80
	1671,20	12,65	107,90	1643,18	1634,76	276,90	-93,67	260,81	0,15	445136,33	76414,80	N 51 59 24.06	E 4 14 36.10
	1698,86	12,73	106,04	1670,16	1661,74	282,97	-95,44	266,62	0,45	445134,56	76420,61	N 51 59 24.01	E 4 14 36.41
	1726,79	12,69	104,12	1697,41	1688,99	289,11	-97,04	272,55	0,46	445132,96	76426,54	N 51 59 23.96	E 4 14 36.72
	1754,74	12,86	103,51	1724,66	1716,24	295,28	-98,52	278,56	0,23	445131,49	76432,54	N 51 59 23.92	E 4 14 37.04
	1782,10	12,95	103,08	1751,33	1742,91	301,37	-99,92	284,50	0,14	445130,08	76438,49	N 51 59 23.87	E 4 14 37.35
	1810,59	13,14	102,82	1779,09	1770,67	307,78	-101,37	290,77	0,21	445128,64	76444,75	N 51 59 23.83	E 4 14 37.68
	1838,33	13,43	102,20	1806,09	1797,67	314,13	-102,75	296,99	0,35	445127,26	76450,98	N 51 59 23.79	E 4 14 38.01
	1866,03	13,67	101,56	1833,01	1824,59	320,59	-104,08	303,34	0,31	445125,92	76457,33	N 51 59 23.75	E 4 14 38.34
	1893,92	14,38	102,20	1860,07	1851,65	327,32	-105,47	309,96	0,78	445124,53	76463,94	N 51 59 23.71	E 4 14 38.69
	1922,13	15,12	102,12	1887,35	1878,93	334,47	-106,99	316,98	0,79	445123,02	76470,96	N 51 59 23.66	E 4 14 39.06
	1950,02	16,08	102,76	1914,22	1905,80	341,94	-108,60	324,30	1,05	445121,40	76478,29	N 51 59 23.61	E 4 14 39.44
	1978,32	17,55	103,47	1941,30	1932,88	350,11	-110,46	332,27	1,57	445119,54	76486,26	N 51 59 23.56	E 4 14 39.86
	2006,20	18,68	102,74	1967,80	1959,38	358,75	-112,43	340,72	1,24	445117,58	76494,70	N 51 59 23.50	E 4 14 40.31
	2034,38	20,29	103,21	1994,37	1985,95	368,12	-114,54	349,88	1,72	445115,47	76503,86	N 51 59 23.43	E 4 14 40.79
	2062,02	21,66	103,09	2020,18	2011,76	377,99	-116,79	359,51	1,49	445113,22	76513,49	N 51 59 23.37	E 4 14 41.29
	2089,76	23,20	102,00	2045,82	2037,40	388,53	-119,08	369,84	1,73	445110,92	76523,82	N 51 59 23.30	E 4 14 41.84
	2117,60	25,10	101,08	2071,22	2062,80	399,86	-121,36	381,00	2,09	445108,65	76534,98	N 51 59 23.23	E 4 14 42.42
	2145,69	26,97	100,94	2096,46	2088,04	412,11	-123,71	393,10	2,00	445106,29	76547,08	N 51 59 23.16	E 4 14 43.06
	2173,22	28,89	99,89	2120,78	2112,36	424,91	-126,04	405,79	2,16	445103,97	76559,77	N 51 59 23.09	E 4 14 43.73
	2180,65	28,94	100,02	2127,28	2118,86	428,47	-126,66	409,32	0,32	445103,34	76563,30	N 51 59 23.07	E 4 14 43.91
	2208,98	27,98	101,72	2152,19	2143,77	441,88	-129,20	422,58	1,33	445100,80	76576,56	N 51 59 23.00	E 4 14 44.61
	2237,13	27,66	104,70	2177,09	2168,67	454,98	-132,20	435,37	1,52	445097,80	76589,35	N 51 59 22.91	E 4 14 45.28
	2265,10	27,95	105,63	2201,83	2193,41	468,01	-135,62	447,96	0,56	445094,39	76601,94	N 51 59 22.80	E 4 14 45.95
	2293,40	29,20	107,16	2226,68	2218,26	481,55	-139,44	460,94	1,54	445090,57	76614,92	N 51 59 22.69	E 4 14 46.63
	2321,69	30,90	107,82	2251,17	2242,75	495,71	-143,70	474,45	1,84	445086,31	76628,43	N 51 59 22.55	E 4 14 47.34
	2349,60	32,45	108,47	2274,92	2266,50	510,37	-148,27	488,38	1,71	445081,74	76642,35	N 51 59 22.41	E 4 14 48.07
	2373,38	33,86	108,86	2294,83	2286,41	523,37	-152,43	500,70	1,80	445077,58	76654,67	N 51 59 22.29	E 4 14 48.72
	2393,10	34,70	109,11	2311,12	2302,70	534,47	-156,04	511,20	1,30	445073,97	76665,18	N 51 59 22.17	E 4 14 49.28
	2421,41	36,12	107,81	2334,19	2325,77	550,87	-161,23	526,76	1,70	445068,77	76680,74	N 51 59 22.01	E 4 14 50.10

Comments	MD (m)	Incl (°)	Azim Grid (°)	TVD (m)	TVDSS (m)	VSEC (m)	NS (m)	EW (m)	DLS (°/30m)	Northing (m)	Easting (m)	Latitude (N/S ° ' ")	Longitude (E/W ° ' ")
	2449,50	37,50	107,27	2356,68	2348,26	567,70	-166,30	542,81	1,51	445063,70	76696,78	N 51 59 21.86	E 4 14 50.94
	2477,29	39,17	106,42	2378,48	2370,06	584,94	-171,30	559,31	1,89	445058,71	76713,28	N 51 59 21.70	E 4 14 51.81
	2504,99	40,37	107,06	2399,77	2391,35	602,65	-176,40	576,28	1,37	445053,61	76730,25	N 51 59 21.55	E 4 14 52.70
	2533,26	41,87	107,85	2421,07	2412,65	621,24	-181,98	594,01	1,68	445048,03	76747,98	N 51 59 21.38	E 4 14 53.64
	2561,64	43,89	108,05	2441,86	2433,44	640,55	-187,93	612,38	2,14	445042,08	76766,35	N 51 59 21.19	E 4 14 54.61
	2589,24	45,26	107,83	2461,52	2453,10	659,92	-193,90	630,81	1,50	445036,11	76784,78	N 51 59 21.01	E 4 14 55.58
	2616,70	45,11	107,81	2480,88	2472,46	679,40	-199,86	649,35	0,16	445030,15	76803,32	N 51 59 20.83	E 4 14 56.55
	2644,39	45,07	107,60	2500,43	2492,01	699,01	-205,82	668,04	0,17	445024,19	76822,00	N 51 59 20.64	E 4 14 57.54
	2668,00	45,00	107,91	2517,11	2508,69	715,72	-210,92	683,94	0,29	445019,09	76837,91	N 51 59 20.49	E 4 14 58.37
Proj. to well TD	2680,00	45,00	108,05	2525,60	2517,18	724,20	-213,54	692,02	0,25	445016,47	76845,98	N 51 59 20.41	E 4 14 58.80

Survey Type: Def Survey

Survey Error Model: ISCWSA Rev 0 *** 3-D 95.000% Confidence 2.7955 sigma

Survey Program:

Description	Part	MD From (m)	MD To (m)	EOU Freq (m)	Hole Size (in)	Casing Diameter (in)	Survey Tool Type	Borehole / Survey
	1	0,000	9,320	Act Stns	30,000	30,000	SLB_MWD+SAG-Depth Only	NLW-GT-02-S1 / NLW-GT-02-S1 Def Survey
	1	9,320	137,000	1/30.000	30,000	30,000	SLB_MWD+SAG	NLW-GT-02-S1 / NLW-GT-02-S1 Def Survey
	1	137,000	137,000	Act Stns	30,000	30,000	SLB_MWD+SAG	NLW-GT-02-S1 / NLW-GT-02-S1 Def Survey
	1	137,000	1102,000	Act Stns	24,000	20,000	SLB_MWD+SAG	NLW-GT-02-S1 / NLW-GT-02-S1 Def Survey
	1	1102,000	2376,000	Act Stns	17,500	13,625	SLB_MWD+SAG	NLW-GT-02-S1 / NLW-GT-02-S1 Def Survey
	1	2376,000	2680,000	Act Stns	12,250	12,250	SLB_MWD+SAG	NLW-GT-02-S1 / NLW-GT-02-S1 Def Survey

Schlumberger

Borehole:	Well:	Field:	Structure:
NLW-GT-02-S1	NLW-GT-02	Naaldwijk (Trias Westland)	NLW-GT-02

Gravity & Magnetic Parameters	Surface Location Amersfoort * OGP-Nld / RD Dutch Onshore	Miscellaneous
Model: HDGM 2017 Dip: 67.069° Date: 04-Feb-2018	Lat: N 51 59 26.96 Northing: 445230m Grid Conv: -0.9056°	Slot: NLW-GT-02 TVD Ref: Unknown(8.42m above NAP)
MagDec: 1.102° FS: 49039.641nT Gravity FS: 1000.584mgn (9.80665 Based)	Lon: E 4 14 22.36 Easting: 76154m Scale Fact: 0.99994799	Plan: NLW-GT-02-S1 Def Survey