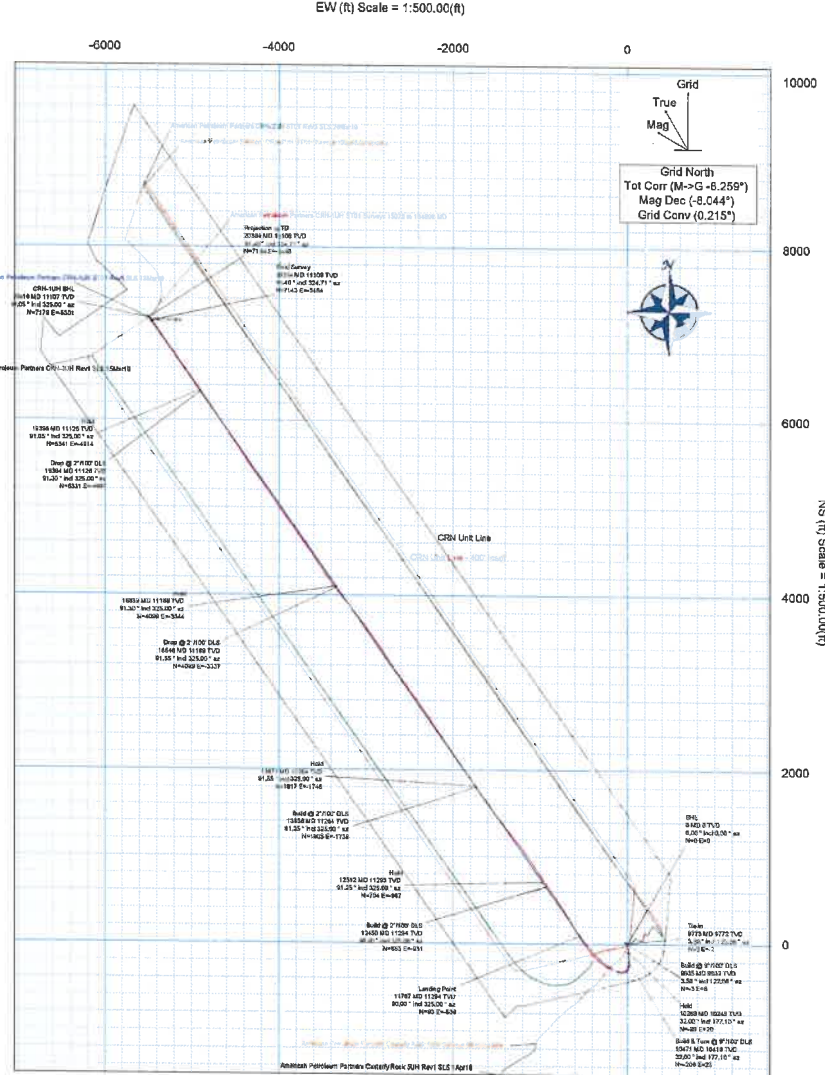


Borehole: ST01		Well: CRN-1UH		Field: WV Marshall County (NAD 83 UTM Zone 17N)		Structure: H&P 471	
Gravity & Magnetic Parameters			Surface Location			Miscellaneous	
Model: HDGM 2019	Dip: 67.078°	Date: 13-Mar-2019	Let: N 39 57 58.05	NAD83 UTM Zone 17N, US Feet	Grid Conv: 0.2149°	Slot: CRN-1UH	TVD Ref: KB(1363.53R above MSL)
MagDec: -8.044°	PS: 52472.637N	Gravity FG: 989.337mgals (9.80665 Based)	Lon: W 80 39 55.35	Northing: 14514675.54RUS	Scale Fact: 0.99991006	Plan: American Petroleum Partners CRN-1UH 8701 Surveys 1507N to 1649R MD	

Seq	Survey	Tool Code	Velocity (ft/s)	Depth (ft)	Gravity (mgals)	Let (N)	Lon (W)	Alt (ft)	Temp (F)	Pressure (psi)	Flow (gpm)	Flow (bbl/d)	Compass	Compass
1	CRN-1UH	Open	30	30	0	25	198.425	1.251	1.25					
2	NAL_HSG-M307-OT-Open	Open	30	30	25	25	1507	4.716	2.423					
3	NAL_HSG-M307-OT	Open	30	30	1967	9773	4019	6.213	4.701					
4	NAL_HSG-M307-SLS	Open	30	30	4775	20349	34277	8.528						

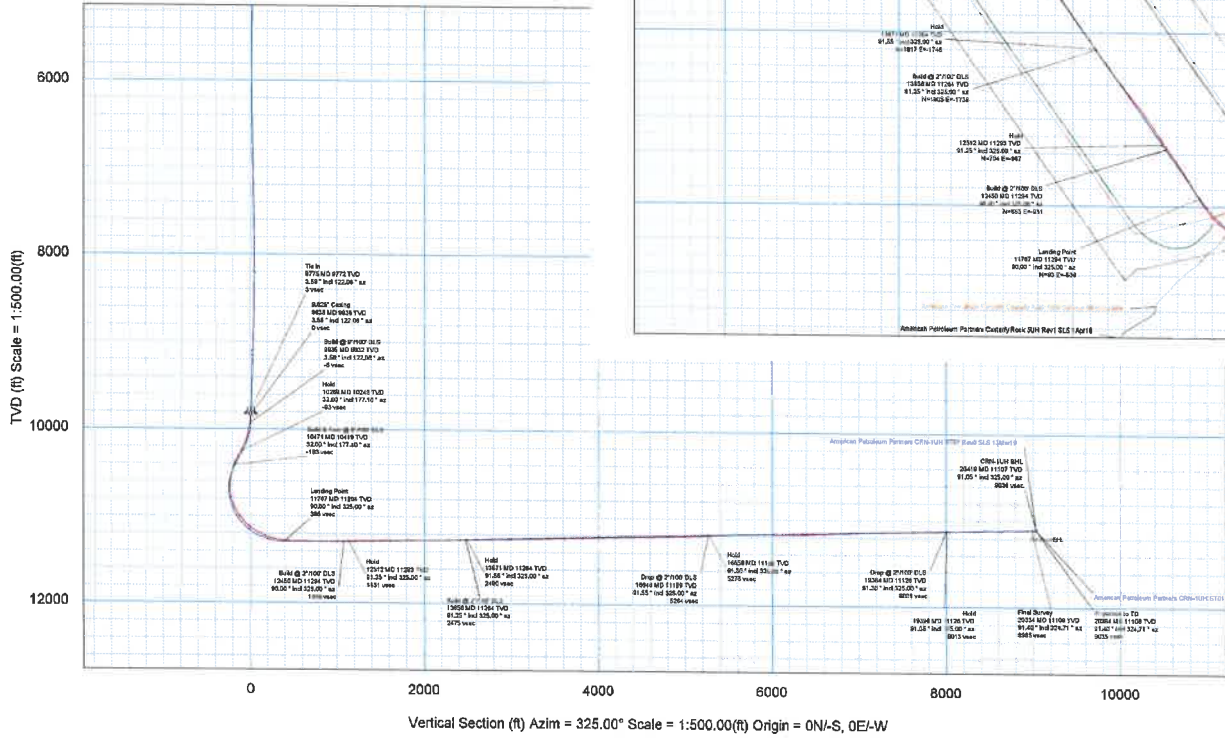
Point	MD	BHCL	ASMA	TVD	VEIC	N(Y90)	E(Y90)	DLG
Top	1987.00	0.58	284.47	1908.27	-2.27	-5.75	-4.80	
Final Survey	2034.00	81.40	324.71	1102.64	8265.10	7143.14	-5483.21	0.01
Projection to TD	2034.00	81.40	324.71	1102.22	8253.16	7183.94	-5482.83	0.00

Surface Location									
Northing: 14514675.54RUS		Easting: 1734176.08RUS		Latitude: N 39 57 58.05		Longitude: W 80 39 55.35		Vibe Azimuth: 325.00	
Target Description	Shape	Dimension	Latitude	Longitude	Northing	Easting	TVD	V-Vec	Local Coord
CRN-1UH Line - 800' Broad	Polyline	N/A	38 57 58.05	W 80 39 55.35	14514675.54	1734176.08	1365.33	0.00	0.00
CRN-1UH Line	Polyline	N/A	38 57 58.05	W 80 39 55.35	14514675.54	1734176.08	1365.33	0.00	0.00
CRN-1UH BHL	Point	N/A	38 58 18.26	W 80 41 5.67	1453185.82	1728676.76	1107.38	8035.82	179.00 -5500.85



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Survey	Start Date	End Date	Scale	Units
CRN-1UH BHL	1507N	1649R	1:500	ft
CRN-1UH Line	1507N	1649R	1:500	ft
CRN-1UH Line - 800' Broad	1507N	1649R	1:500	ft

CONTROLLED

Plan No: H&P 8701 Surveys 1507N to 1649R MD

Issued By: [Signature]

Date: 07-Sep-2018

Scale: 1:500

Units: ft

American Petroleum Partners CRN-1UH ST01 Surveys 1507ft to 16489ft MD Survey Geodetic Report (Def Survey)

Report Date: May 07, 2019 - 10:09 AM
Client: American Petroleum Partners
Field: WV Marshall County (NAD 83 UTM Zone 17N)
Structure / Slot: American Petroleum Partners CRN Prod / CRN-1UH
Well: CRN-1UH
Borehole: ST01
UWI / API#: Unknown / Unknown
Survey Name: American Petroleum Partners CRN-1UH ST01 Surveys 1507ft to 16489ft MD
Survey Date: March 13, 2019
Tort / AHD / DDI / ERD Ratio: 314.354 * 79658.854 ft / 6.748 / 0.873
Coordinate Reference System: NAD83 UTM Zone 17N, US Feet
Location Lat / Long: N 39° 57' 59.05269", W 80° 39' 55.34532"
Location Grid N/E Y/X: N 14514675.544 RJUS, E 174175.084 RJUS
CRS Grid Convergence Angle: 0.2149°
Grid Scale Factor: 0.99681005
Version / Patch: 2.10.753.0
Survey / DLS Computation: Minimum Curvature / Lubinski
Vertical Section Azimuth: 325.000° (Grid North)
Vertical Section Origin: 0.000 R, 0.000 ft
TVD Reference Datum: 1293.530 R above MSL
TVD Reference Elevation: 1338.530 R above MSL
Magnetic Declination: -8.044°
Total Gravity Field Strength: 999.3372mgm (g.80655 Based)
Gravity Model: GARM
Total Magnetic Field Strength: 52472.837 nT
Magnetic Dip Angle: 67.079°
Declination Date: March 13, 2019
Magnetic Declination Model: HDGM 2019
Grid North: 0.2149°
Total Corr Mag North-Grid North: -8.2593°
Local Coord Referenced To: Well Head

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Table with columns: Comments, MD (ft), Incl (°), Azim Grid (°), TVD (ft), TVDSS (ft), VSECC (ft), NS (ft), EW (ft), DLS (ft), TF (ft), BR (ft), TR (ft), Northing (ft), Easting (ft), Latitude (°), Longitude (°), Directional (°), and Density Index. The table contains multiple rows of survey data points.

Comments	MD	Incl	Asim Grid	TVD	TVSS	VSEC	NS	EW	DLS	TF	BR	TR	Northing	Easting	Latitude	Longitude	Directional
	(ft)	(%)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	Difficulty Index
	8657.00	0.88	164.38	8655.02	7291.49	34.85	28.00	-23.81	0.32	159.82M	0.32	3.95	14514701.59	1734151.29	39.86647515	-80.66545828	3.81
8752.00	1.24	158.82	8750.00	7386.47	31.42	24.51	-23.26	0.23	151.43M	0.17	-0.02	14514700.05	1734151.84	39.86647105	-80.66545334	3.82	
8762.00	1.51	143.48	8760.00	7460.46	33.58	22.85	-22.42	0.22	139.48M	0.20	-0.67	14514698.38	1734152.07	39.86646647	-80.66545430	3.83	
8930.00	1.33	159.48	8930.96	7575.45	29.48	21.50	-21.54	0.22	162.38M	0.13	8.47	14514698.44	1734153.55	39.86648113	-80.66545028	3.84	
9030.00	1.72	162.13	9033.93	7670.40	27.04	18.50	-20.71	0.40	165.14M	0.19	2.78	14514698.04	1734154.33	39.86648248	-80.66544735	3.85	
9130.00	1.64	165.41	9127.89	7784.36	24.43	15.83	-19.84	0.13	168.88M	0.03	3.49	14514691.39	1734155.15	39.86644725	-80.66544494	3.85	
9225.00	1.96	168.80	9222.84	7858.31	21.64	12.67	-19.23	0.34	159.42M	0.34	1.46	14514688.50	1734155.86	39.86649329	-80.66544213	3.87	
9319.00	2.24	159.42	9318.78	7953.25	18.37	9.66	-18.22	0.41	130.82M	0.30	-0.16	14514688.17	1734156.37	39.86649326	-80.66543936	3.88	
9414.00	1.88	130.82	9411.72	8048.19	15.08	6.93	-16.40	1.13	108.72M	0.40	-30.11	14514682.47	1734158.89	39.86642271	-80.66543306	3.89	
9509.00	2.25	142.14	9506.87	8143.14	12.46	5.13	-13.86	0.80	99.86M	0.19	-25.37	14514681.05	1734161.23	39.86641676	-80.66543036	3.91	
9604.00	1.98	99.06	9601.82	8238.05	10.00	4.77	-10.62	0.63	102.81M	0.58	-7.22	14514680.31	1734164.47	39.86641673	-80.66541153	3.93	
9699.00	2.83	102.81	9696.52	8332.99	6.87	3.91	-6.39	1.70	122.06M	0.68	3.11	14514678.45	1734168.89	39.86641432	-80.66539645	3.94	
9793.00	3.58	122.06	9772.40	8406.87	3.24	2.22	-2.49	1.68	115.82M	0.57	25.33	14514677.76	1734172.60	39.86640684	-80.66538255	3.96	
9892.00	4.25	115.82	9886.12	8525.89	-3.91	-1.61	4.51	0.88	143.31M	0.86	5.33	14514673.93	1734179.59	39.86638605	-80.66537573	3.99	
9923.00	6.74	143.31	9919.98	8556.45	-6.73	-3.57	8.63	1.17	147.24M	0.93	8.68	14514671.98	1734181.71	39.86638368	-80.66536968	4.03	
10018.00	14.84	167.24	10013.27	8648.74	-23.80	-19.94	12.68	9.57	30.98R	8.53	25.19	14514665.61	1734187.74	39.86636968	-80.66535979	4.13	
10113.00	20.35	178.35	10103.80	8740.27	-48.99	-43.32	18.41	1.32L	5.83	9.59	9.59	14514627.25	1734191.48	39.86627072	-80.66531582	4.23	
10208.00	27.63	175.99	10190.54	8827.01	-82.02	-86.83	19.00	7.66	6.21	7.86	7.86	14514624.17	1734191.48	39.86627072	-80.66531582	4.23	
10300.00	33.47	177.53	10271.86	8908.35	-122.01	-133.81	21.61	5.21	101.58R	5.15	1.64	14514541.79	1734196.89	39.86624271	-80.66531211	4.43	
10397.00	38.29	182.29	10352.15	8986.82	-164.17	-184.80	22.59	1.57	155.97R	-0.28	2.89	14514491.02	1734197.66	39.86598555	-80.66529558	4.50	
10492.00	23.63	189.85	10436.06	9072.53	-198.41	-228.77	19.20	10.15	154.62R	-0.20	10.07	14514466.86	1734194.28	39.86577532	-80.66530828	4.60	
10587.00	19.01	196.77	10524.55	9161.02	-221.50	-262.37	11.47	5.53	100.31R	-0.88	7.28	14514413.28	1734186.55	39.86568131	-80.66532828	4.65	
10681.00	22.30	222.30	10515.51	9248.98	-234.39	-288.54	-3.43	6.87	88.14R	-4.29	27.24	14514381.12	1734171.66	39.86561910	-80.66539680	4.72	
10776.00	24.91	247.79	10507.23	9338.20	-259.74	-313.53	8.11	5.53	81.24R	2.37	26.75	14514366.52	1734144.93	39.86561811	-80.66545343	4.78	
10871.00	24.49	269.24	10790.33	9428.80	-219.00	-313.59	-86.04	8.31	81.24R	2.37	16.45	14514362.07	1734144.93	39.86561811	-80.66545343	4.78	
10966.00	28.45	282.02	10875.42	9511.83	-191.33	-309.14	7.28	3.72R	1.21	15.75	14.55	14514365.53	1734067.22	39.86565633	-80.66576281	4.90	
11061.00	34.83	290.13	10856.30	9592.77	-162.48	-295.07	-155.59	8.08	34.02R	6.72	8.54	14514360.59	1734016.58	39.86559270	-80.66593270	4.96	
11156.00	41.59	1103.93	10967.40	9677.40	-102.34	-271.48	-209.29	8.52	40.17R	5.01	0.38	14514484.17	1733985.88	39.86560544	-80.66612388	5.02	
11250.00	46.55	304.32	11057.33	9733.80	-41.77	-237.49	-266.34	9.32	33.79R	7.40	6.01	14514435.15	1733908.54	39.86563805	-80.66623767	5.05	
11345.00	58.25	311.52	11099.29	9791.76	30.11	-191.13	-325.46	10.38	35.74R	8.11	7.58	14514484.49	1733968.76	39.86568221	-80.66629374	5.15	
11440.00	64.07	317.64	11202.58	9839.03	111.07	-133.25	-363.94	9.94	33.08R	9.23	6.44	14514542.34	1733791.29	39.86604919	-80.66674522	5.22	
11535.00	70.95	322.32	11238.60	9875.37	196.43	-440.26	-685.27	27.87R	7.24	4.83	4.83	14514609.53	1733734.96	39.86622577	-80.66694525	5.28	
11630.00	77.11	328.64	11284.75	9901.22	286.73	7.03	-483.34	7.38	27.35R	8.55	3.53	14514662.57	1733681.93	39.86642790	-80.66713564	5.34	
11724.00	83.88	339.88	11330.81	9927.21	382.22	85.75	-534.92	11.72R	7.91	6.80	6.80	14514761.26	1733631.38	39.86664551	-80.66731033	5.40	
11818.00	69.61	330.18	11285.65	9923.12	478.70	-591.87	-614.04	9.40L	1.36	1.36	1.36	14514642.82	1733583.35	39.86668925	-80.66748375	5.44	
11914.00	69.50	328.82	11287.23	9923.86	571.41	248.21	-640.32	1.65	165.24R	-0.12	-1.64	14514624.65	1733536.01	39.86679420	-80.66767878	5.48	
12008.00	68.21	328.96	11289.27	9925.74	665.19	329.59	-689.02	1.42	83.46L	-1.37	0.36	14515005.00	1733486.33	39.86731534	-80.66827454	5.51	
12103.00	68.71	324.64	11291.82	9928.29	760.08	405.03	-753.01	0.54	50.33R	0.88	-4.55	14515004.41	1733434.37	39.86753395	-80.66837078	5.55	
12198.00	69.19	328.82	11291.82	9928.29	855.01	488.44	-808.17	5.17	90L	2.72	4.40	14515163.78	1733382.59	39.86772393	-80.66849668	5.59	
12293.00	69.23	323.72	11289.68	9928.15	949.33	567.40	-845.83	5.37	71.03R	0.00	-5.07	14515242.72	1733328.59	39.86798975	-80.66869373	5.63	
12387.00	61.63	324.71	11287.29	9923.29	1043.69	643.83	-900.78	1.11	92.17R	0.36	10.50	14515318.92	1733274.65	39.86817857	-80.66885785	5.66	
12482.00	61.57	328.28	11284.63	9921.10	1138.85	720.76	-964.57	1.65	147.26L	-0.06	1.65	14515397.14	1733220.65	39.86836193	-80.66907663	5.68	
12577.00	61.12	325.99	11282.80	9918.87	1333.80	800.74	-1007.49	0.58	128.88R	-0.47	0.81	14515475.97	1733167.99	39.86851995	-80.66928730	5.71	
12672.00	60.84	326.34	11281.78	9917.25	1427.77	878.64	-1050.38	0.47	73.81L	0.26	0.83	14515554.84	1733115.12	39.86862207	-80.66945304	5.73	
12767.00	60.89	326.17	11279.34	9915.81	1423.73	968.83	-1113.15	0.55	85.59L	0.06	-0.18	14515633.78	1733062.37	39.86904643	-80.66963225	5.76	
12861.00	60.95	325.39	11277.83	9914.30	1517.71	1038.34	-1165.00	0.87	95.21L	-0.29	0.37	14515711.49	1733009.54	39.86920031	-80.66981890	5.78	
12956.00	60.67	322.33	11276.49	9912.98	1612.67	1113.05	-1222.02	3.23	77L	-0.29	-3.22	14515788.15	1732953.55	39.86947144	-80.66997163	5.80	
13051.00	60.73	322.07	11275.33	9911.80	1707.55	1186.10	-1289.24	1.62	85.17R	-0.27	-1.62	14515883.19	1732895.35	39.86967807	-80.67019235	5.82	
13146.00	60.17	322.64	11274.58	9911.05	1802.45	1263.32	-1338.28	1.64	84.91R	0.59	-0.59	14515938.88	1732837.72	39.86983855	-80.67037137	5.85	
13241.00	60.28	321.10	11274.21	9910.28	1887.30	1338.05	-1396.91	1.83	94.00L	0.12	-1.62	14516013.07	1732778.72	39.87000087	-80.67053652	5.87	
13336.00	60.17	322.45	11273.84	9910.31	1992.15	1412.68	-1455.69	1.44	83.69R	-0.12	1.43	14516087.67	1732718.97	39.87029234	-80.67074523	5.89	
13430.00	60.50	325.45	11273.29	9909.76	2066.12	1488.86	-1510.99	3.20	92.56L	0.35	1.18	14516163.64	1732664.68	39.87050551	-80.67097467	5.91	
13525.00	61.23	324.64	11272.85	9908.42	2176.11	1566.53	-1565.41	1.07	72.59R	0.29	-0.85	14516241.49	1732612.99	39.87071977	-80.67109371	5.93	
13620.00	61.12	325.48	11272.85	9908.33	2261.05	1644.41	-1619.77	0.58	102.14L	0.69	0.69	14516319.31					

Comments	MD (ft)	Incl °	Azim Grid °	TVD (ft)	TVDSS (ft)	VSEC (ft)	NS (ft)	EW (ft)	DLS (ft)	TF °	BR (ft)	TR (ft)	Northing (ft)	Easting (ft)	Latitude °	Longitude °	Directional Difficulty Index
	20254.00	91.28	325.38	11111.32	9747.79	8905.22	7077.59	-5411.93	0.85	80.97L	0.59	0.61	14521750.35	17287389.27	39.98586630	-80.68481329	6.74
Final Survey	20334.00	91.40	324.71	11109.44	9745.91	8985.19	7143.14	-5483.75	0.85	HS	0.14	-0.84	14521815.58	1728713.47	39.98606658	-80.68477598	6.74
Projection to TD	20384.00	91.40	324.71	11108.22	9744.89	9035.18	7183.94	-5492.63	0.00		0.00	0.00	14521856.66	1728684.61	39.98617698	-80.68487851	6.75

Survey Type: Def Survey

Survey Error Model: ISCWSA Rev 0 *** 3-D 95.000% Confidence 2.7855 sigma
 Survey Program:

Description	Part	MD From (ft)	MD To (ft)	EOU Freq (ft)	Hole Size (in)	Casing Diameter (in)	Survey Tool Type	Borehole / Survey
	1	0.000	25.000	1/98.425	30.000	30.000	NAL_NSG+MSHOT-Depth Only	Original Borehole / American Petroleum Partners CRN-1UH Surveys 0ft to 2291.05ft MD
	1	25.000	25.000	Act Slts	30.000	30.000	NAL_NSG+MSHOT-Depth Only	Original Borehole / American Petroleum Partners CRN-1UH Surveys 0ft to 2291.05ft MD
	1	25.000	1507.000	Act Slts	30.000	30.000	NAL_NSG+MSHOT	Original Borehole / American Petroleum Partners CRN-1UH ST01 / American Petroleum Partners CRN-1UH ST01 Surveys
	1	1507.000	9775.000	Act Slts	30.000	30.000	NAL_MWD-NON_SLB	ST01 / American Petroleum Partners CRN-1UH ST01 Surveys
	1	8775.000	20384.000	Act Slts	30.000	30.000	NAL_MWD_1_0_DEG	ST01 / American Petroleum Partners CRN-1UH ST01 Surveys

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