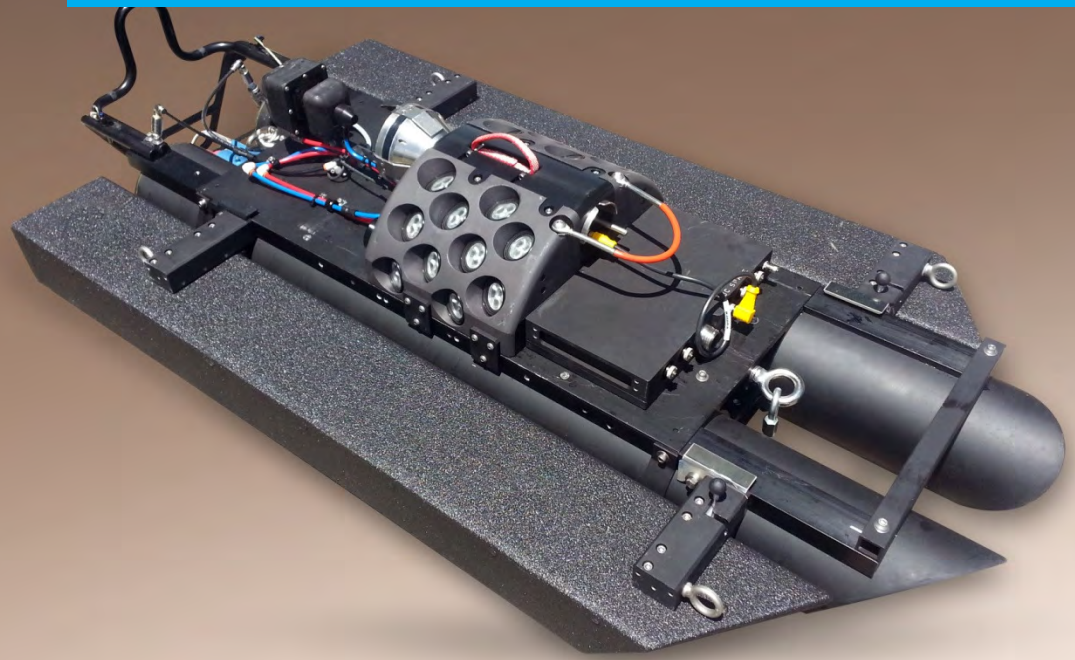
2D & 3D Mapping



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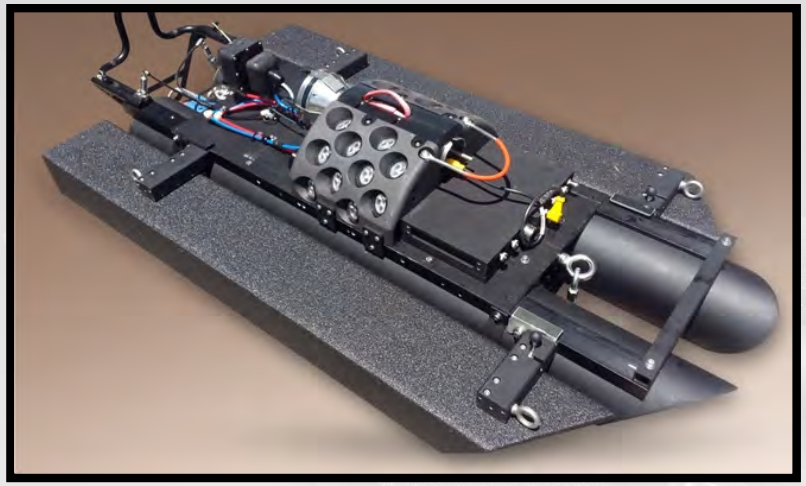
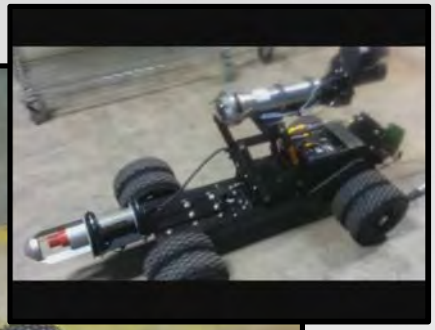
What is 2D Profiling?

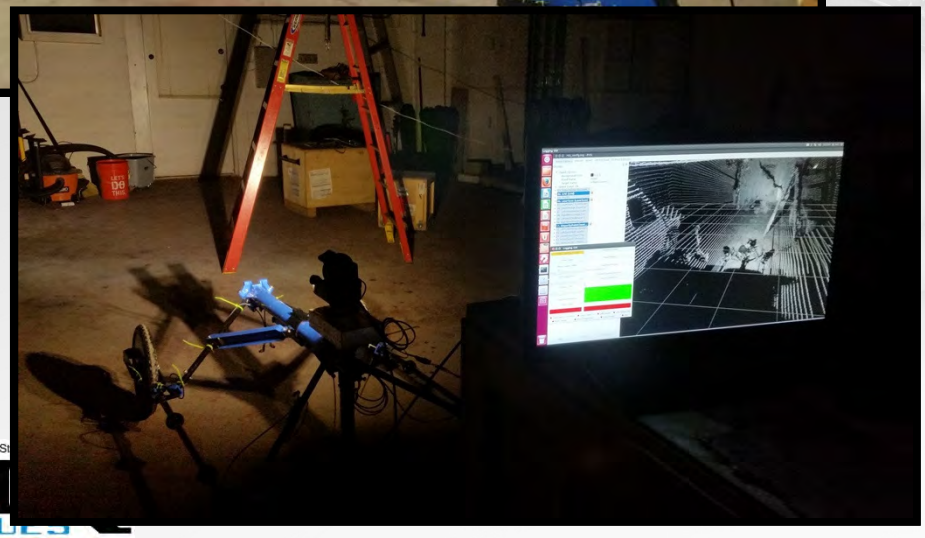
- Profiling systems – 2D
- Non-stable Prone to error

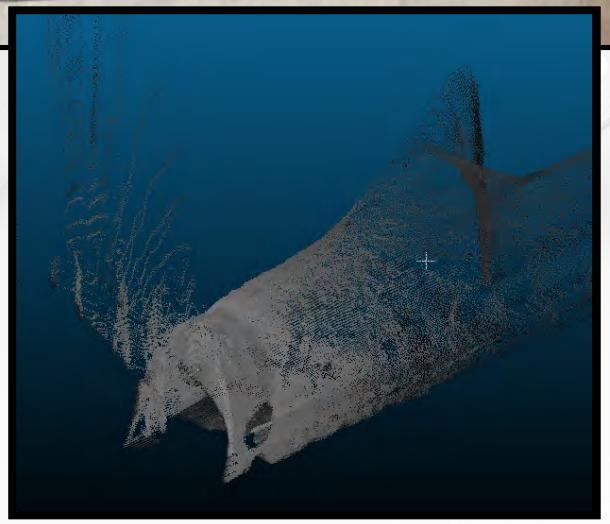


What is 3D LIDAR?

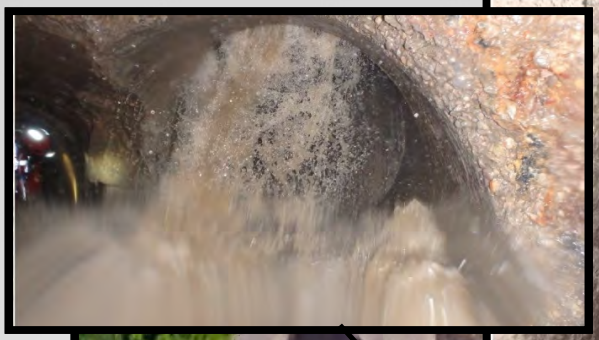
- Forward Looking – 3D
- Stable – accurate x-section

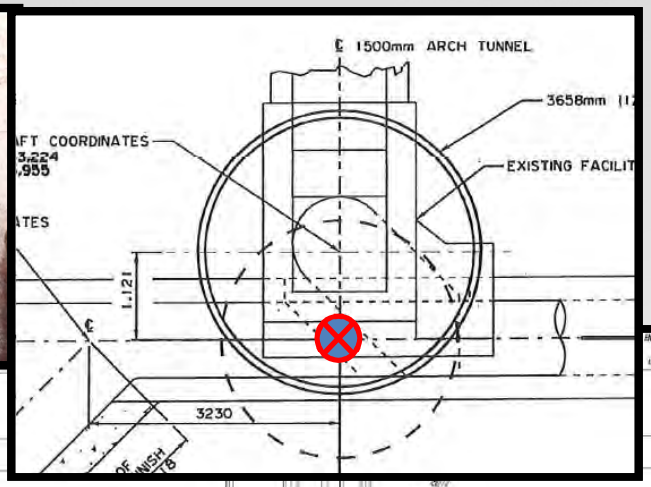


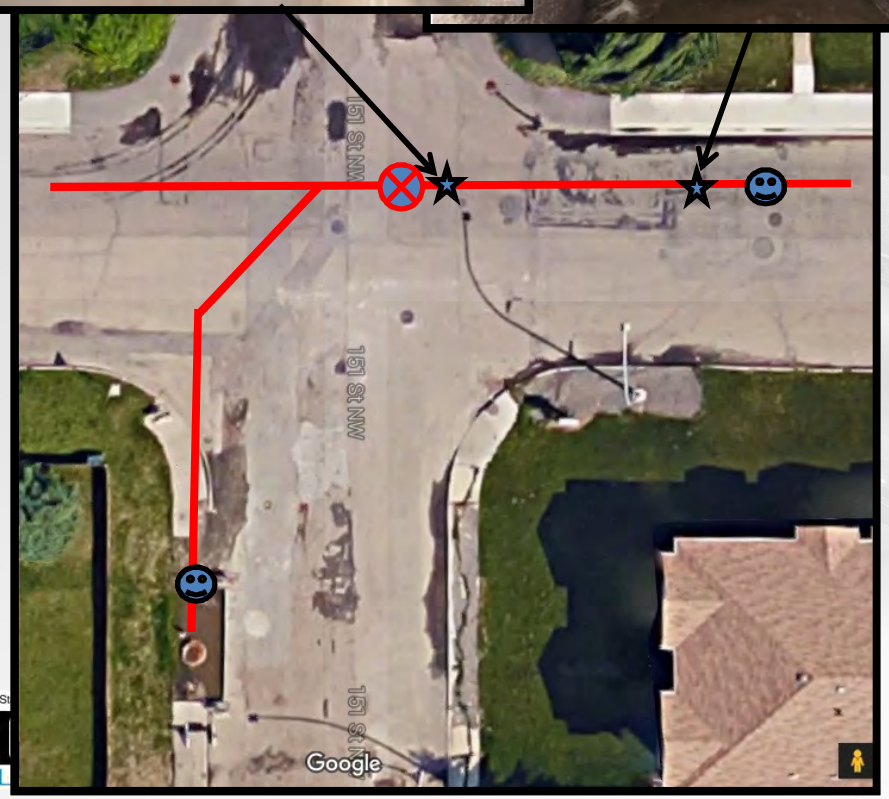


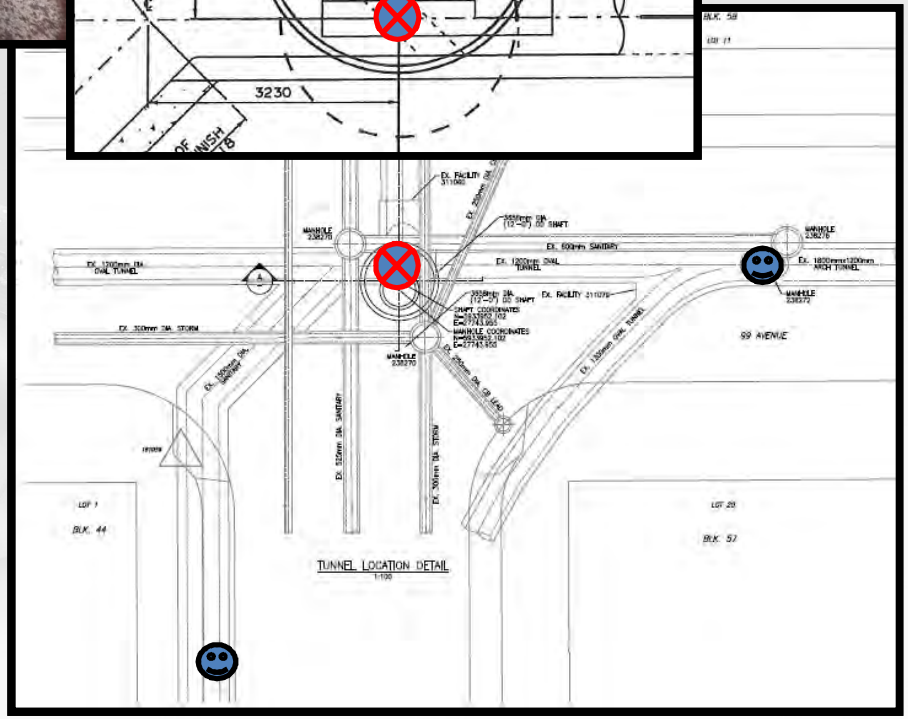


Application – Drill Location & Rehab



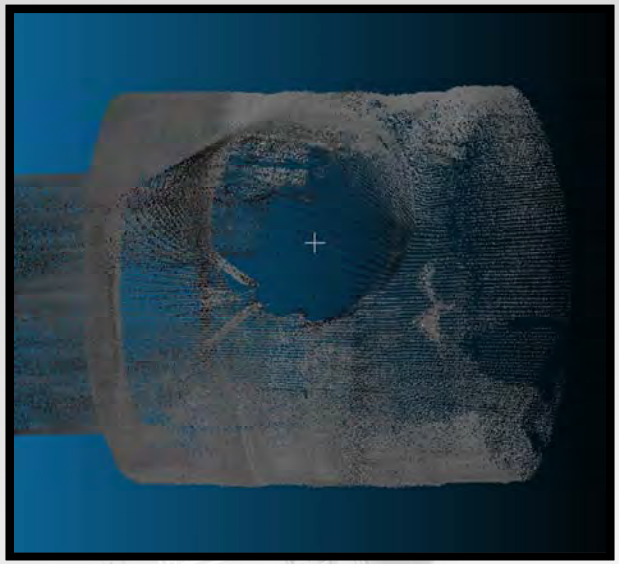


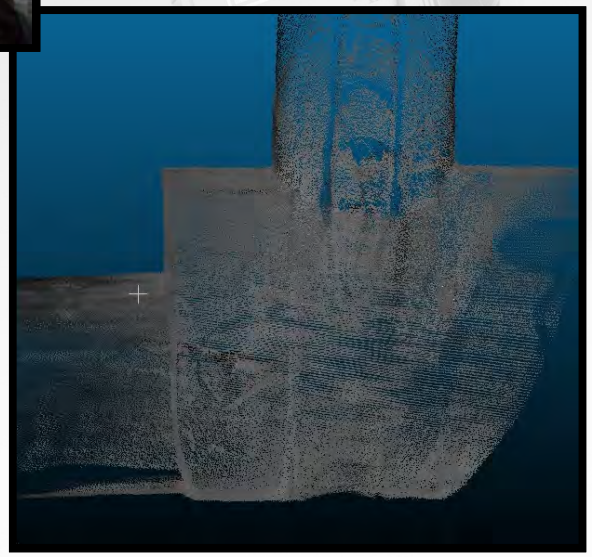




Deployment – MH Data

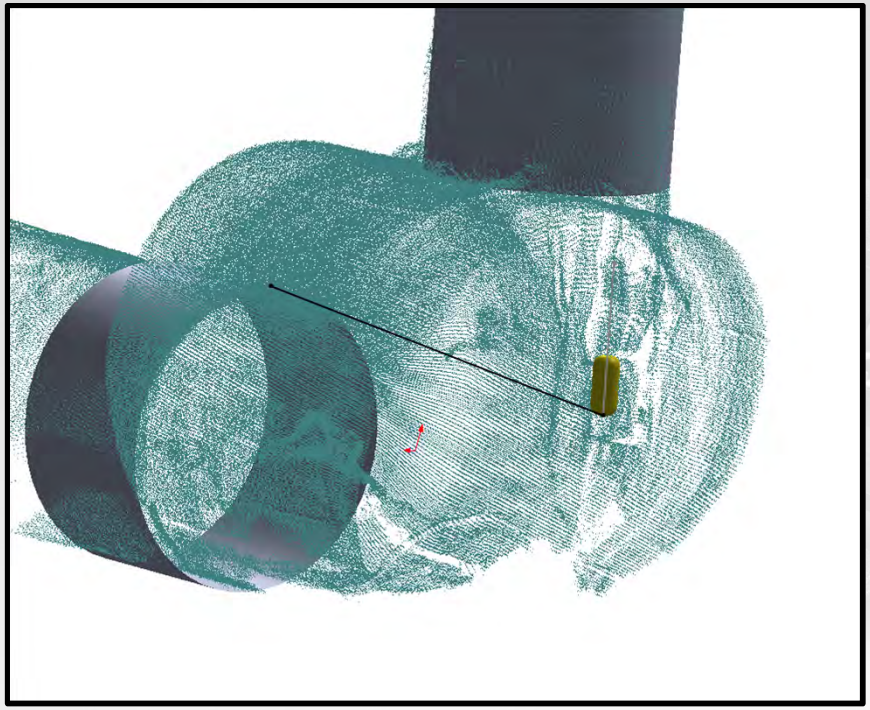
- Begin model construction

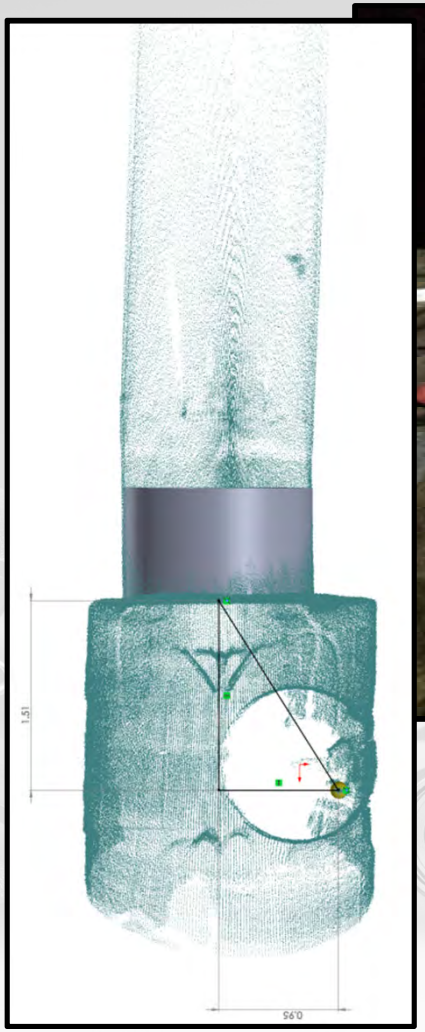


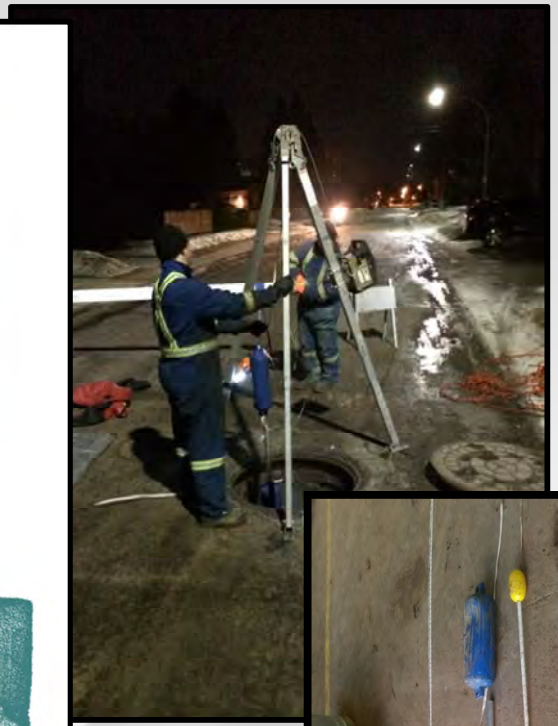


Offset MH – Plumb Line

- GPS Coordinate Transfer







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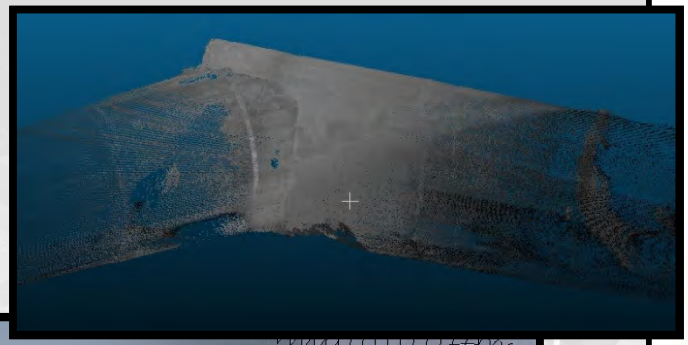
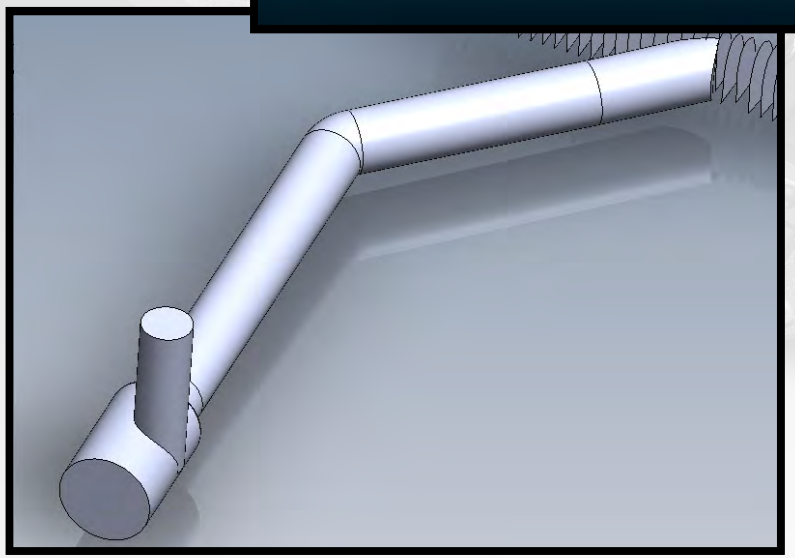
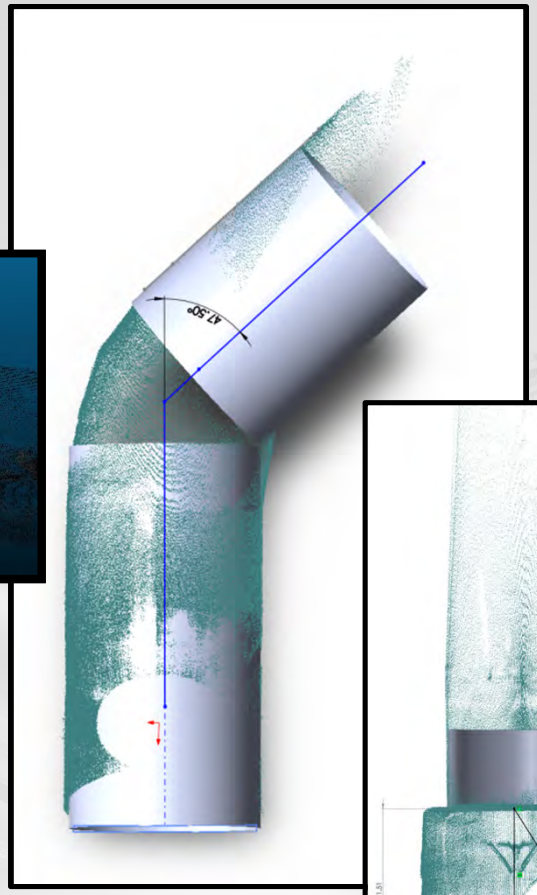
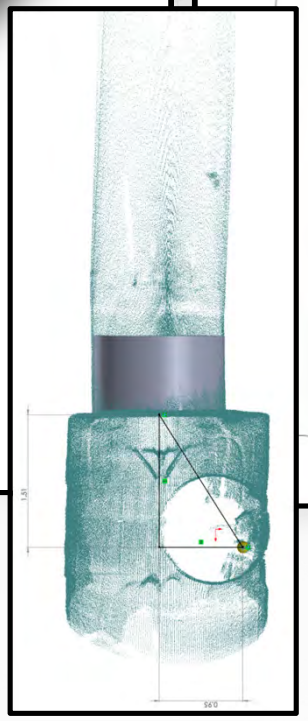
N-S By-Pass Pipe - Bend Analysis

- Import point clouds into CAD
- Define pipe wall and CL
- Measure angles
- Update 3D model



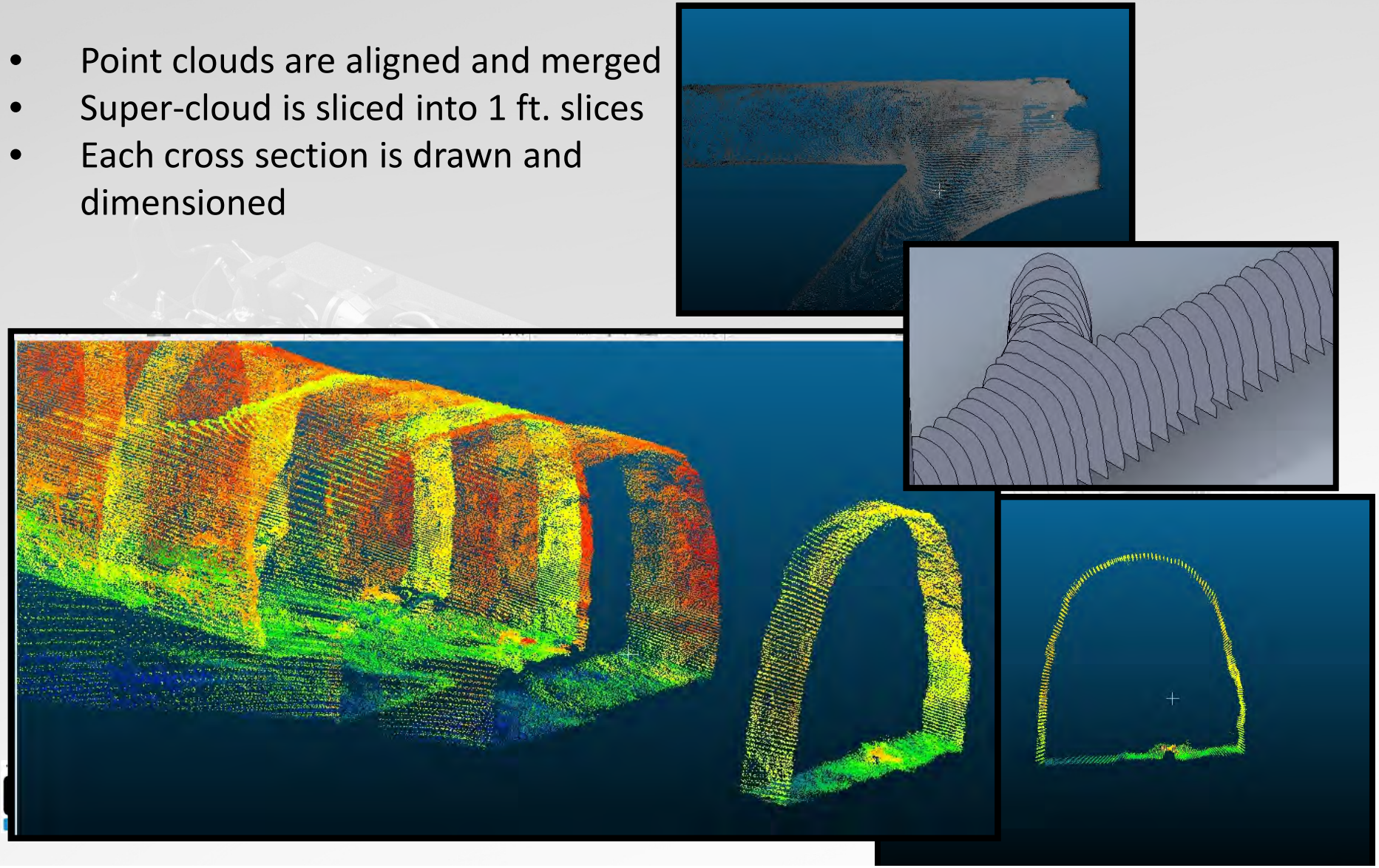




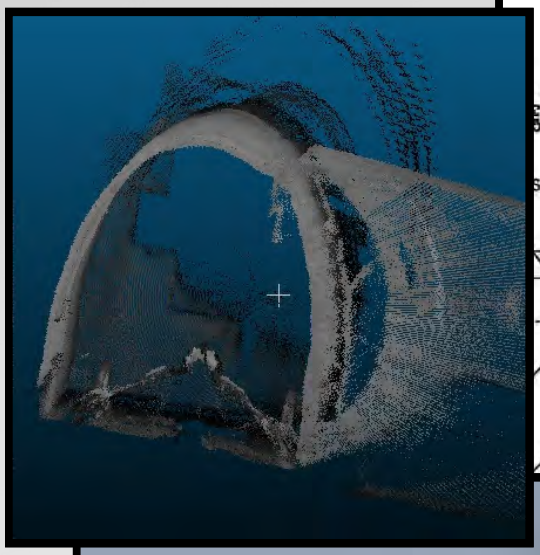


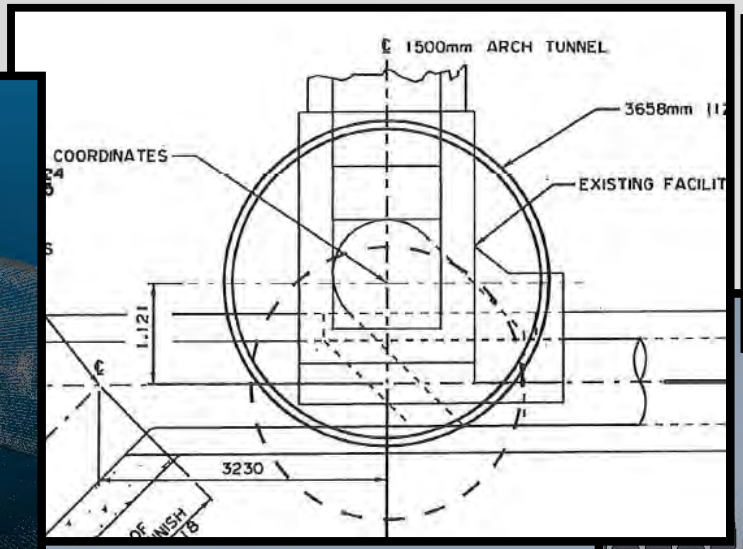
E-W Tunnel Cross-Sections

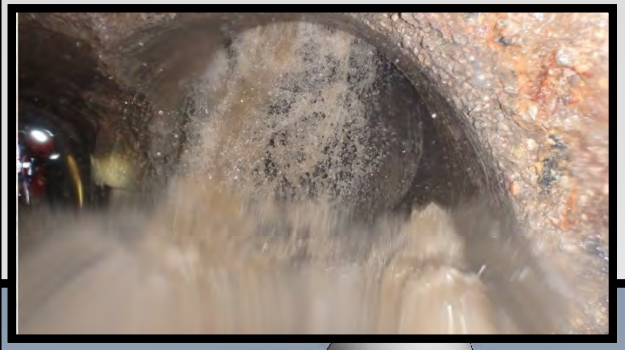
- Point clouds are aligned and merged
- Super-cloud is sliced into 1 ft. slices
- Each cross section is drawn and dimensioned

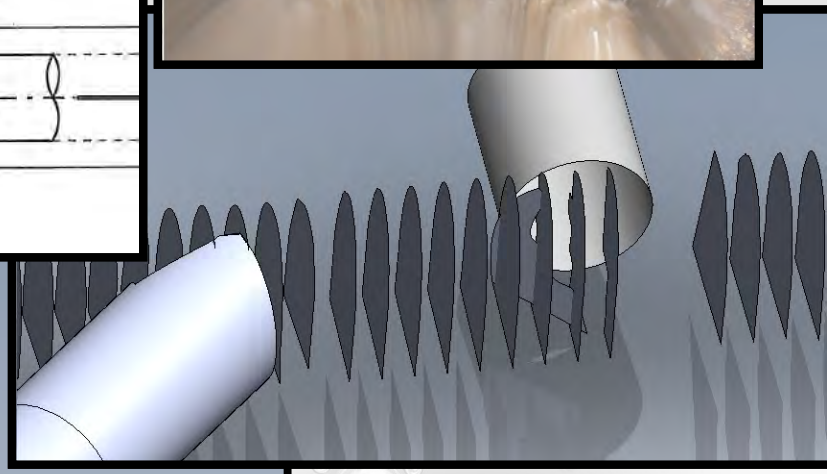


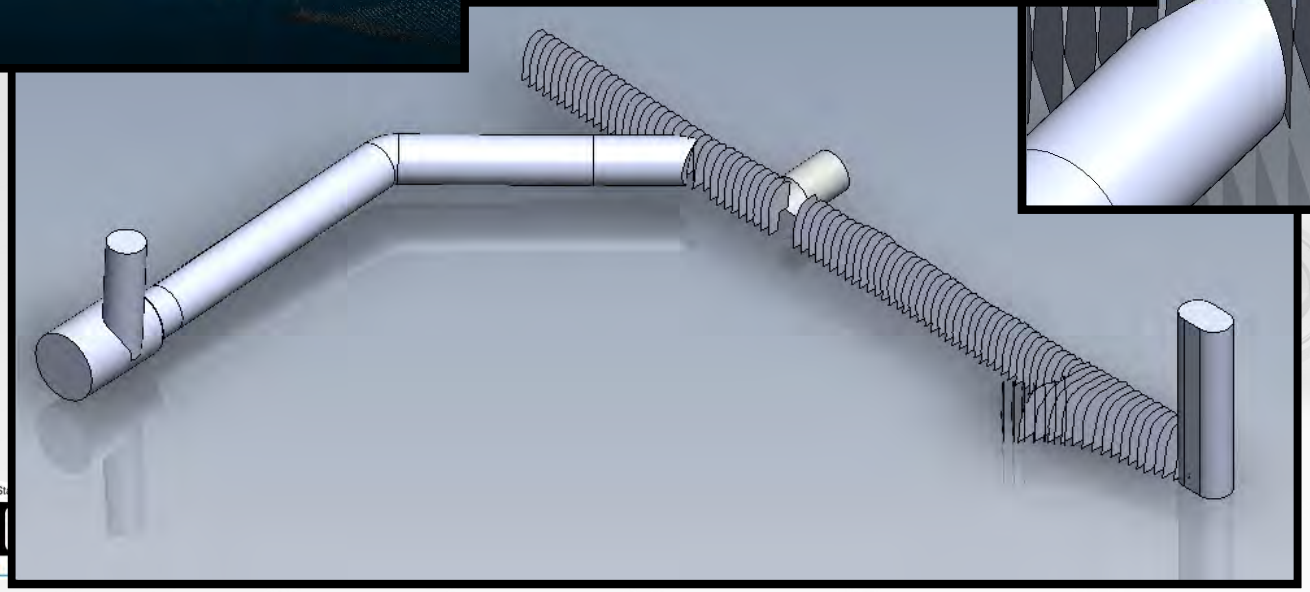
Tie the Pipe and Tunnel Together



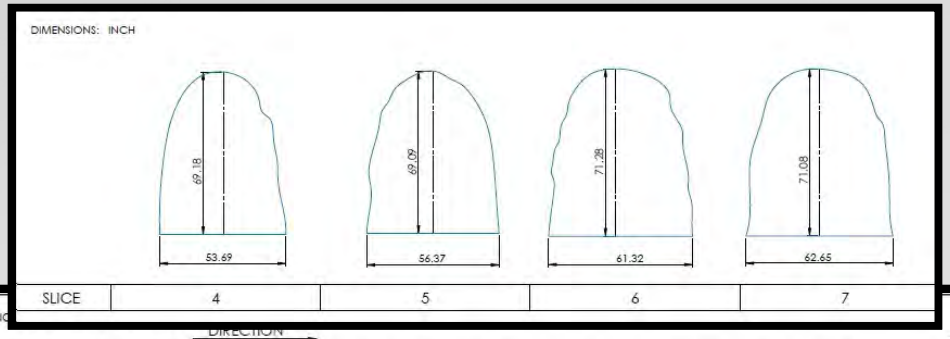


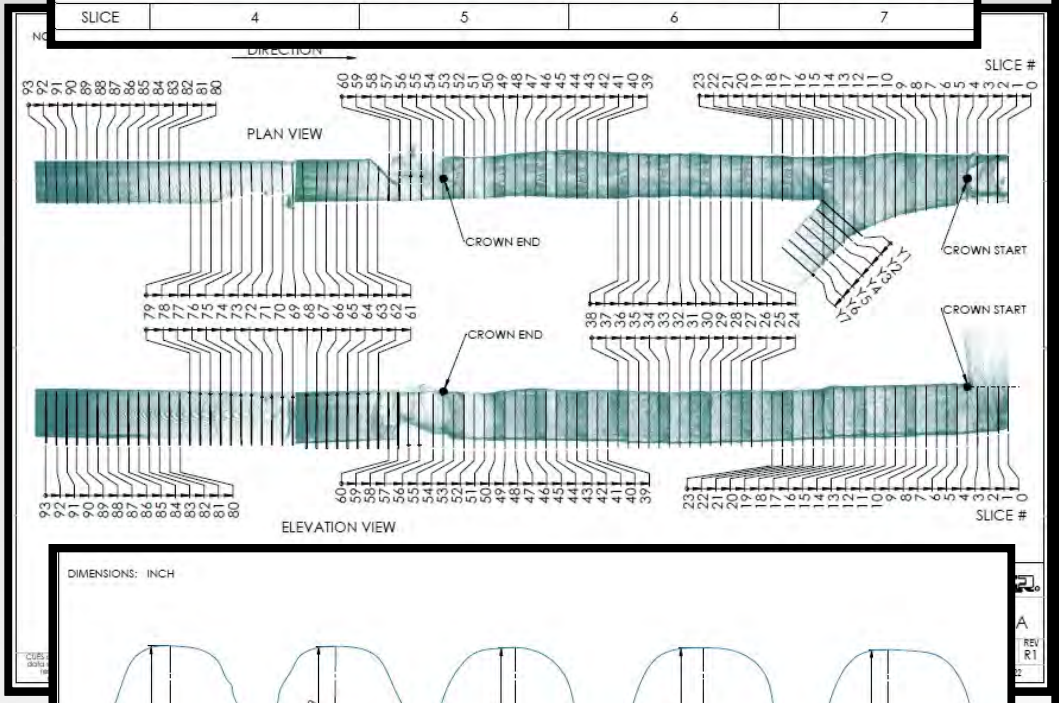


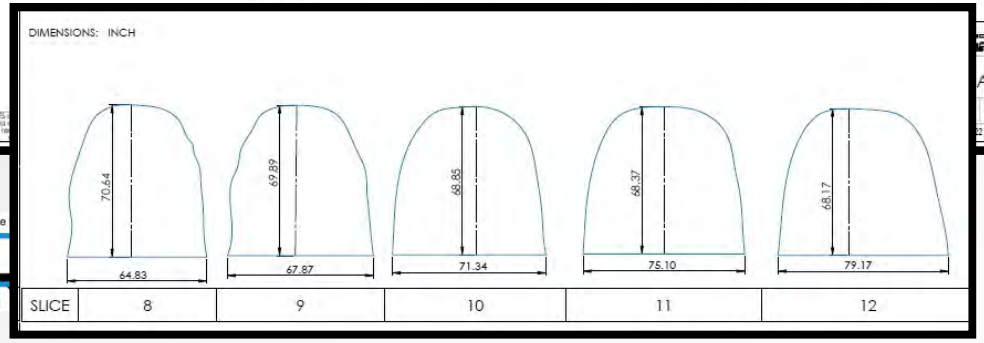


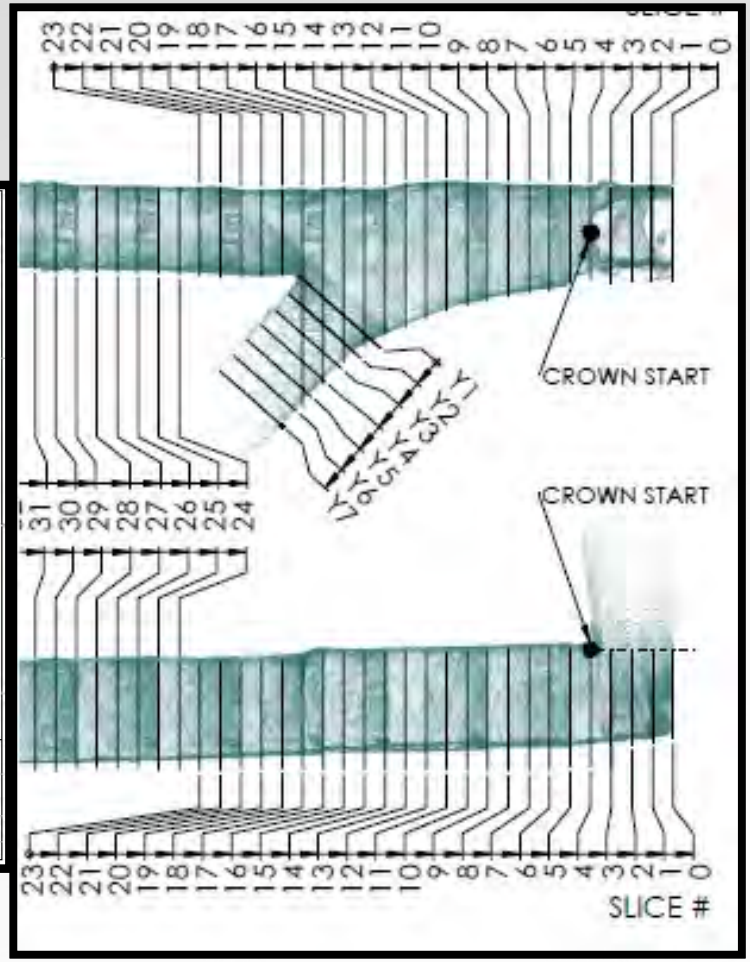


Deliverable - Cross Sections









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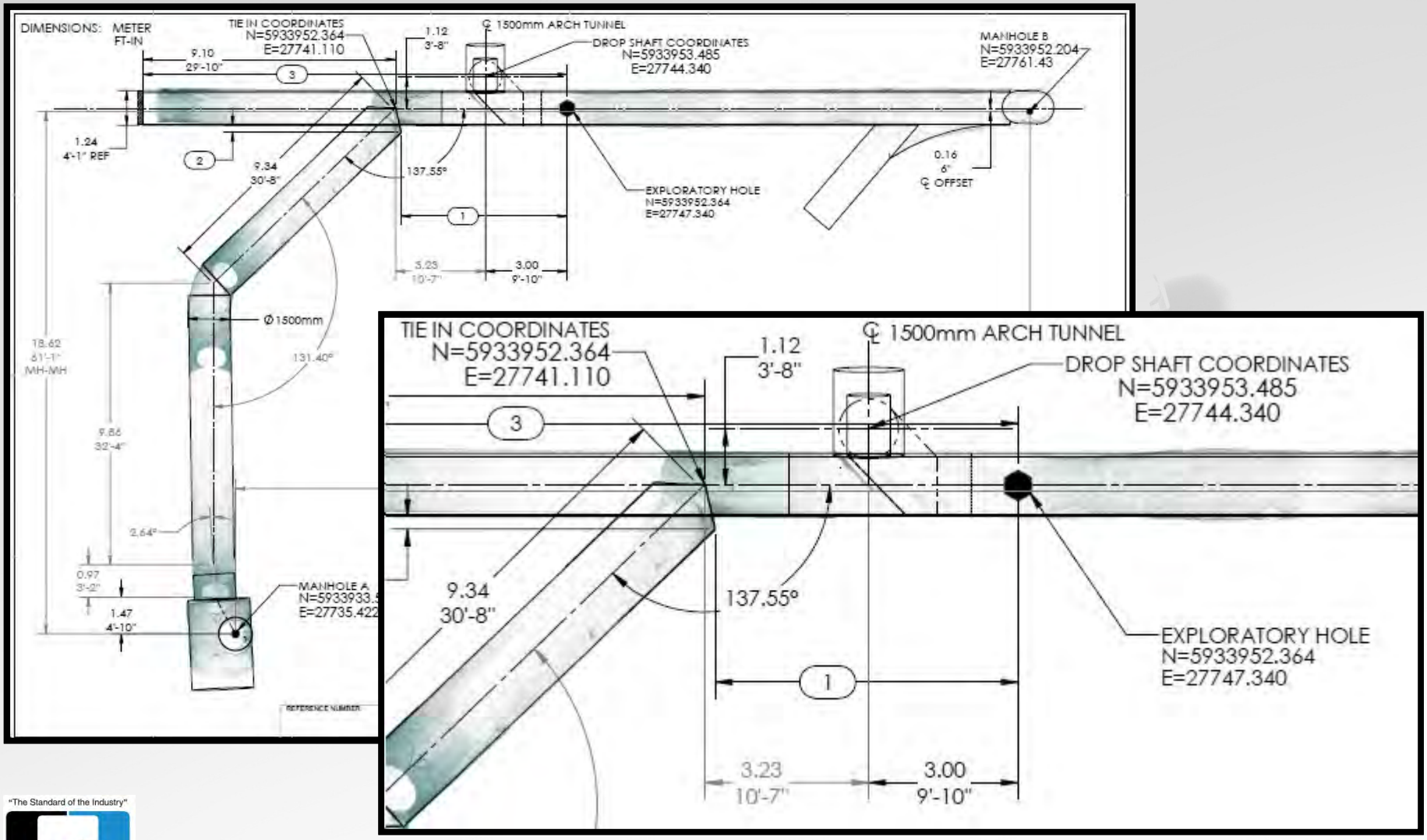
Deliverable – Access Shaft Dig Coords.



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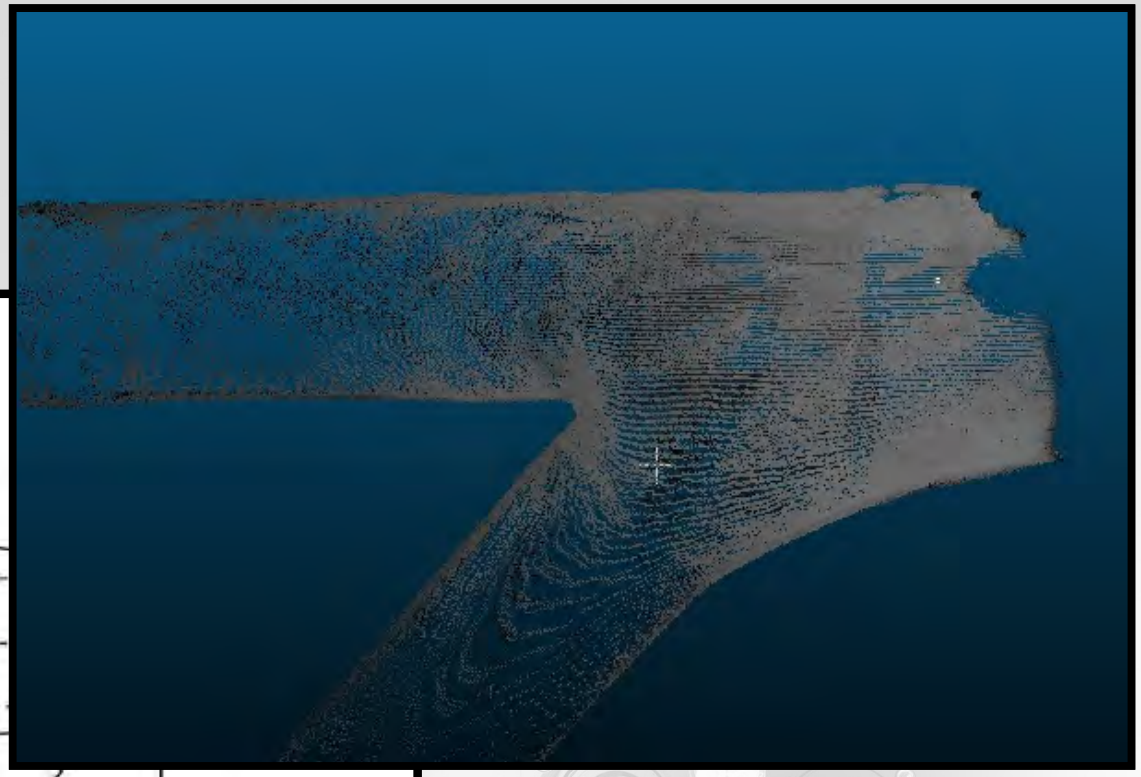
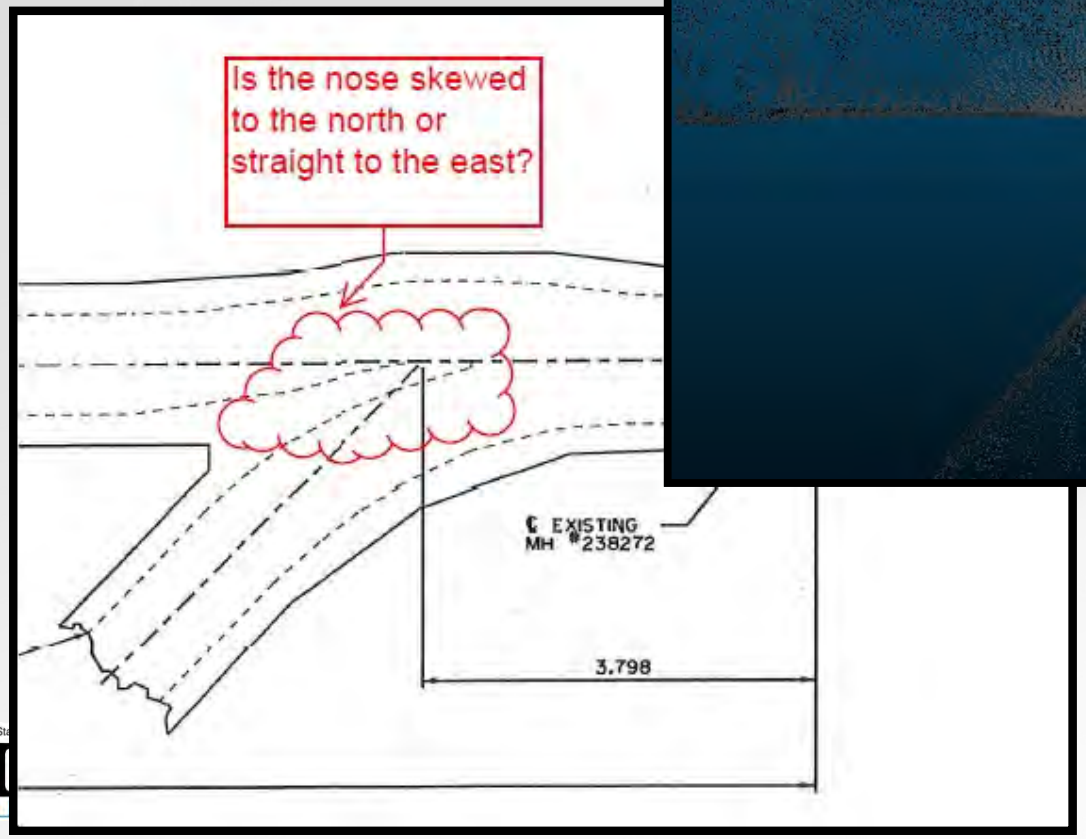
Results - Y 'nose' not there

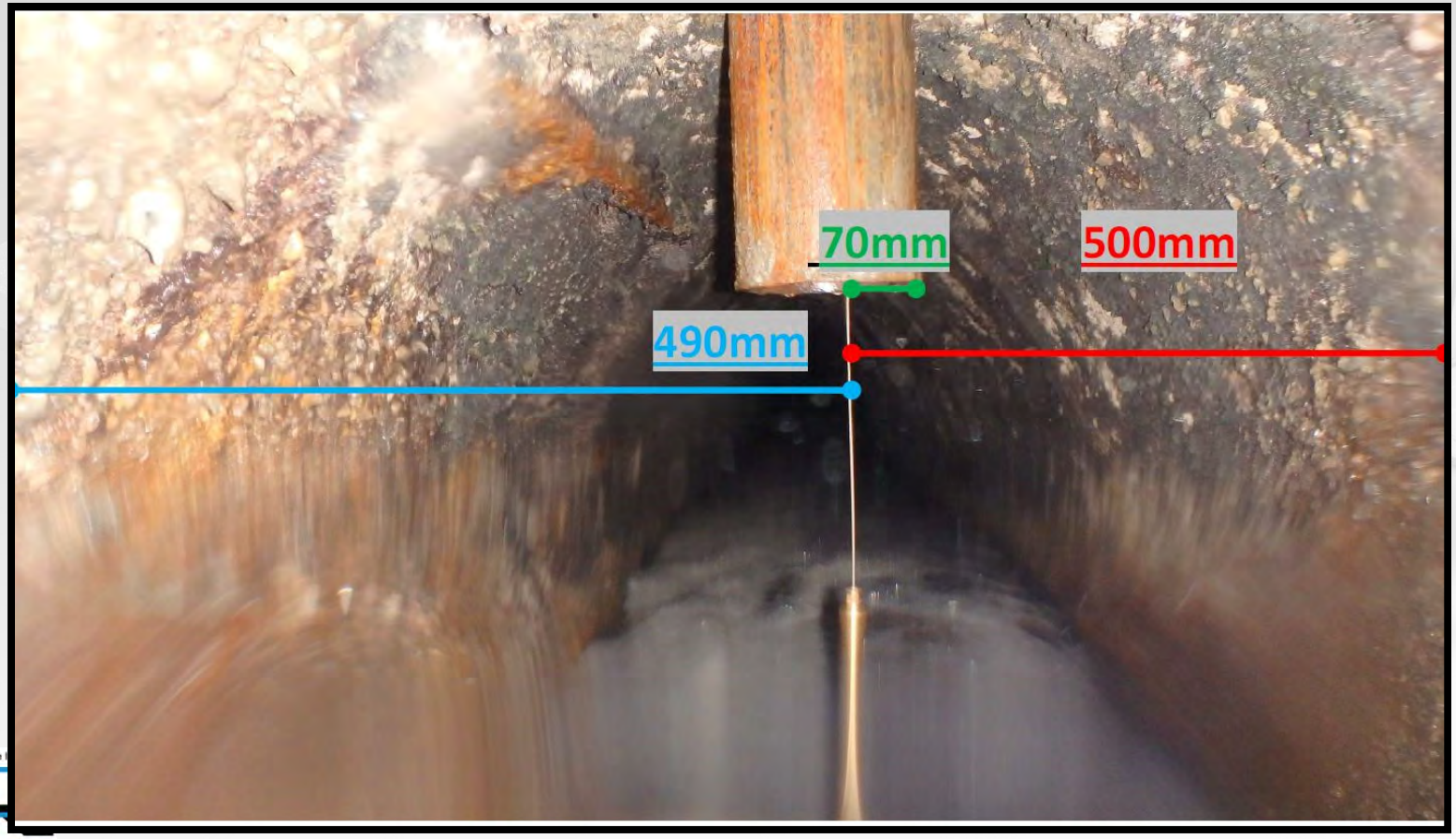
- As built of Y
- Pipe jacking concerns





Results – Exploratory Hole for Shaft

- String line to South wall – 500mm
- String line to North wall – 490 mm



In-Pipe 3D Accurate Mapping Probe (AMP) Technology

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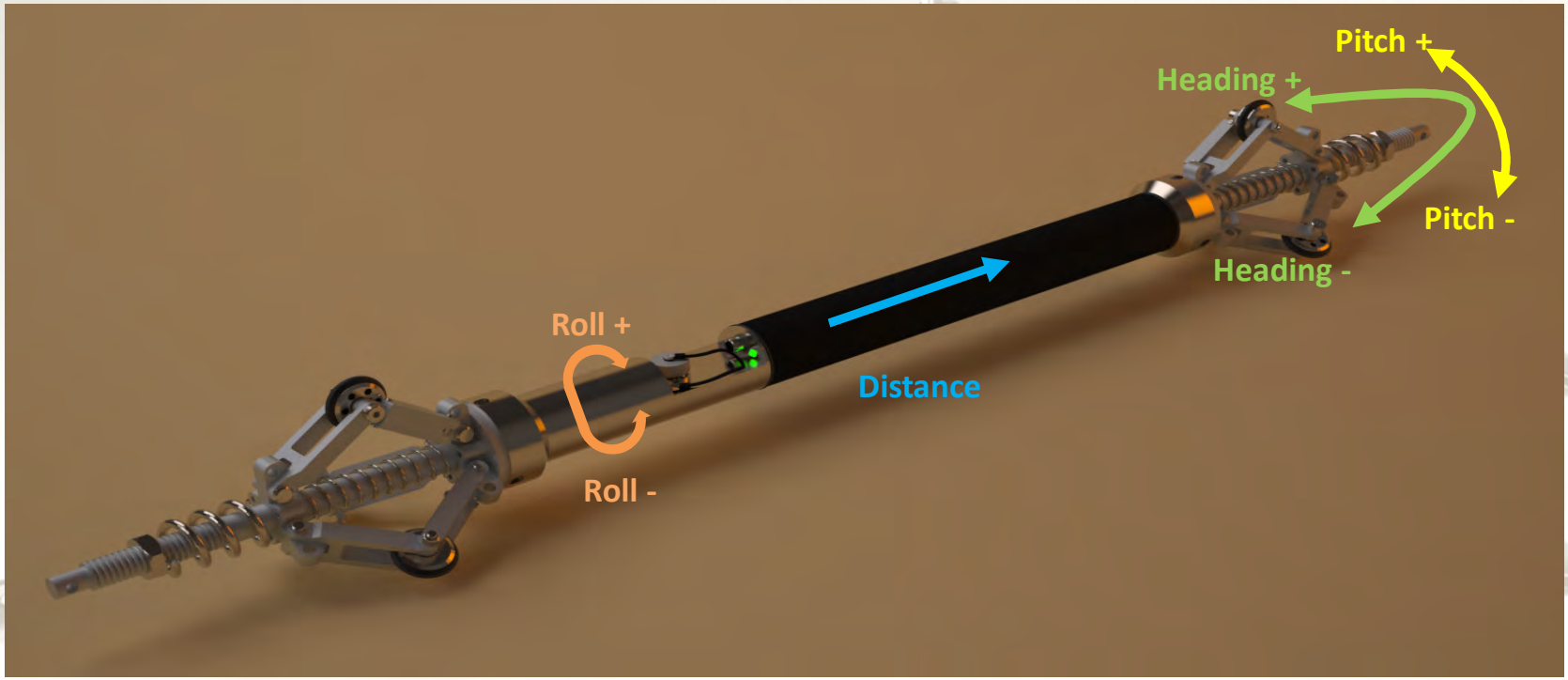
AMP Gyroscopic 3D Mapping

- Collects 100 positional measurements/sec in all 3 axes
- Simultaneously collects linear distance & velocity measurements



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Advantages of AMP Gyroscopic Mapping

- Accurate information for use in As-Built drawings
- Gyro data easily uploads into Auto CAD and GIS Platforms
- Map utilities not available to conventional survey (e.g. river crossings, deep utilities, HDD lines)
- Integration of exact positional location with CCTV- identified anomalies allows for accurate, cost-effective spot repairs
- Not subject to soil type, adjacent utilities, equipment depth limitations
- Locates and quantifies defects such as pipe sags, misaligned joints, horizontal and vertical design affects
- Provides pipeline center-line 3D geometry:
  - Bending radius
  - Line and Arc Segmentation
- Able to map under water

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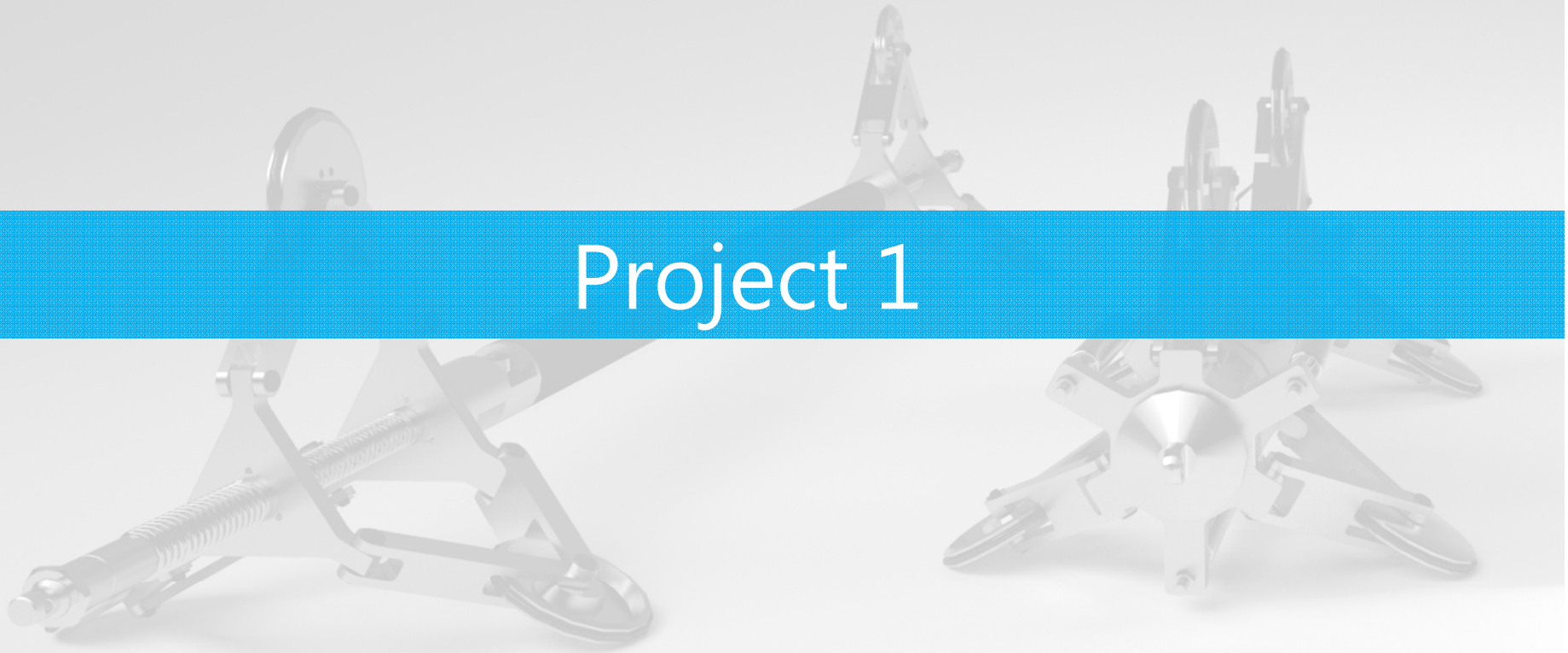
Project 1



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Project – Middletown, CT

Google Earth

Plan & Profile

Bend Radius

Project Photo

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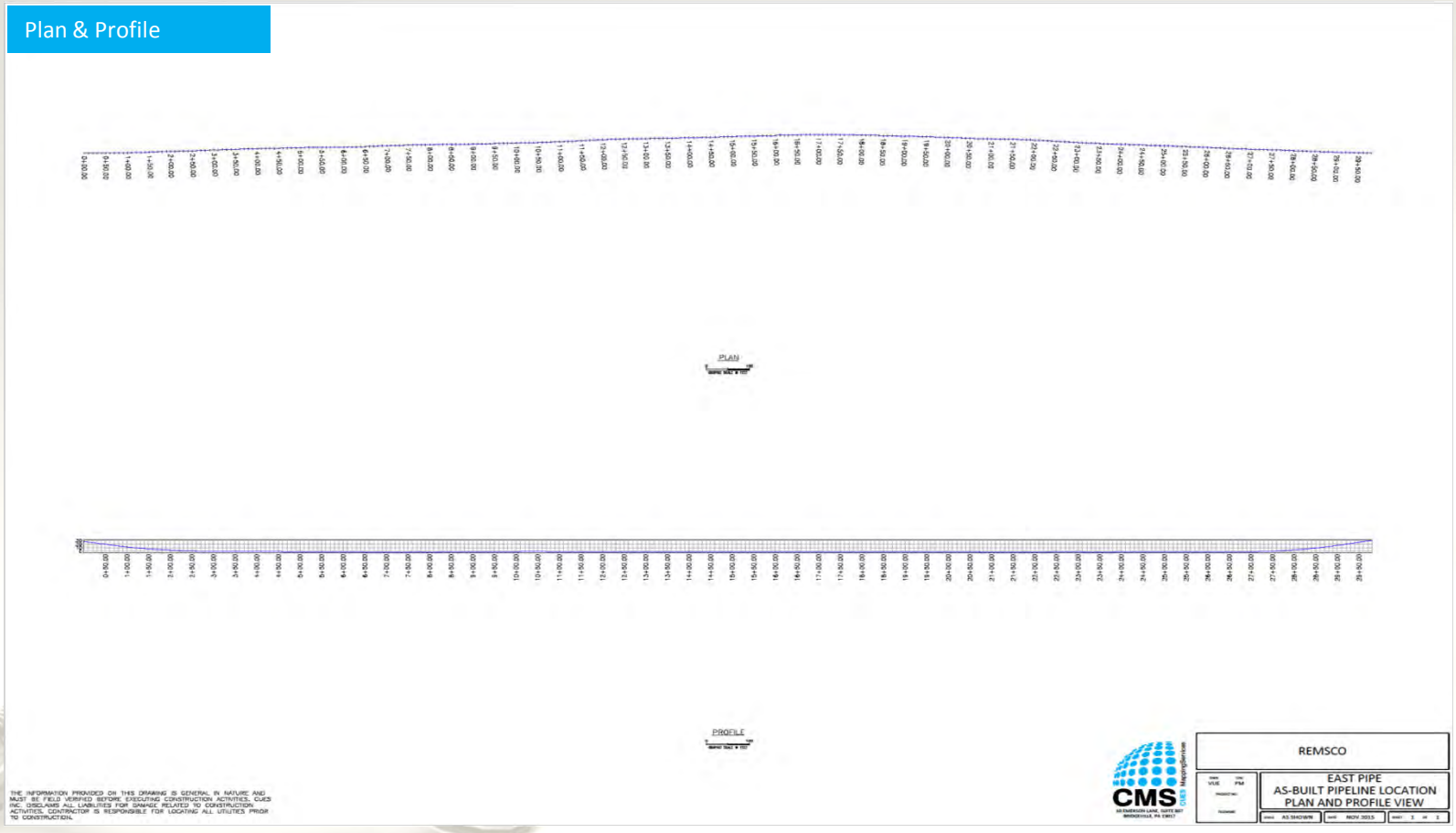

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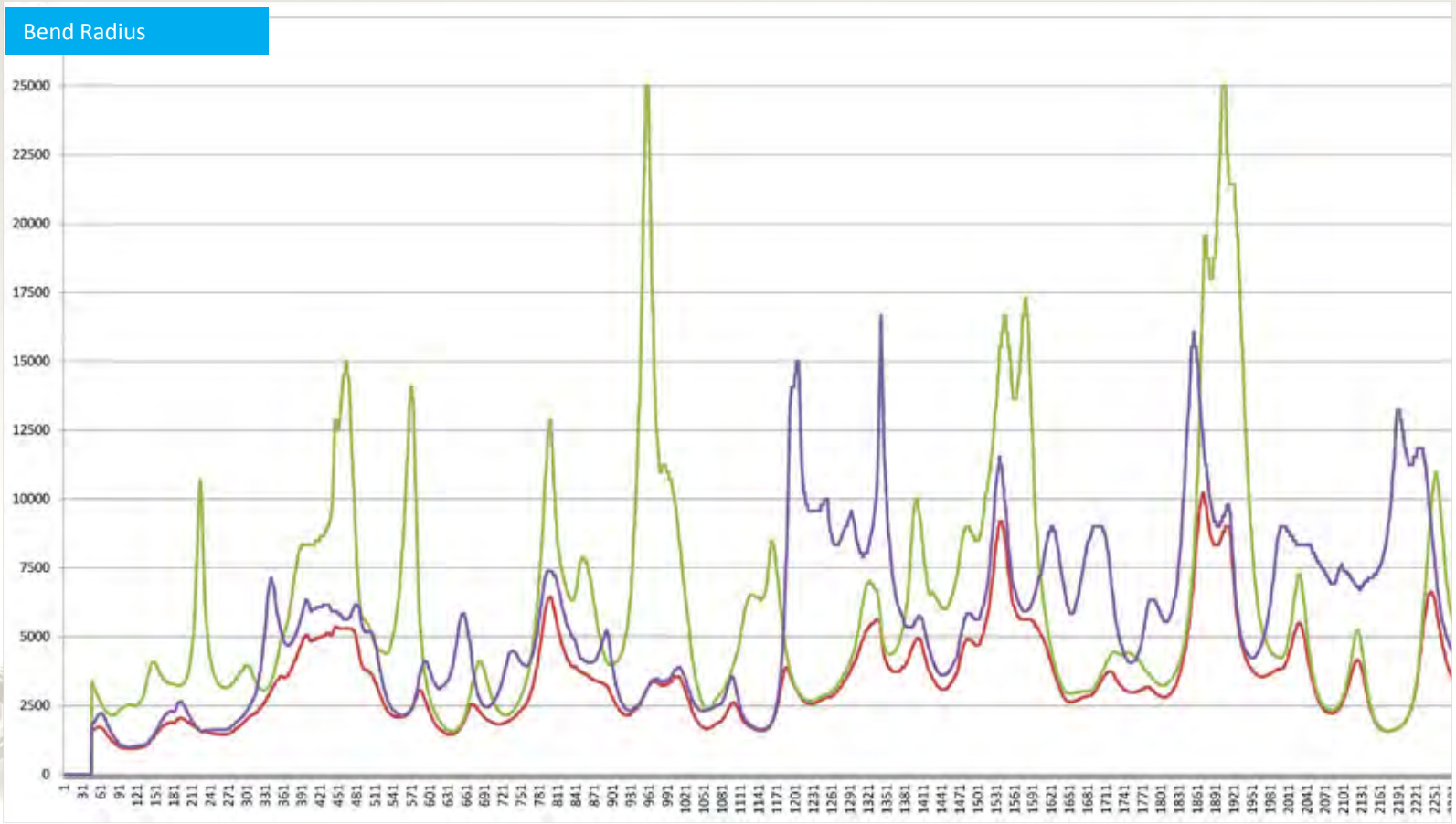
Project Photo



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Bend Radius

Project Photo

Project photo

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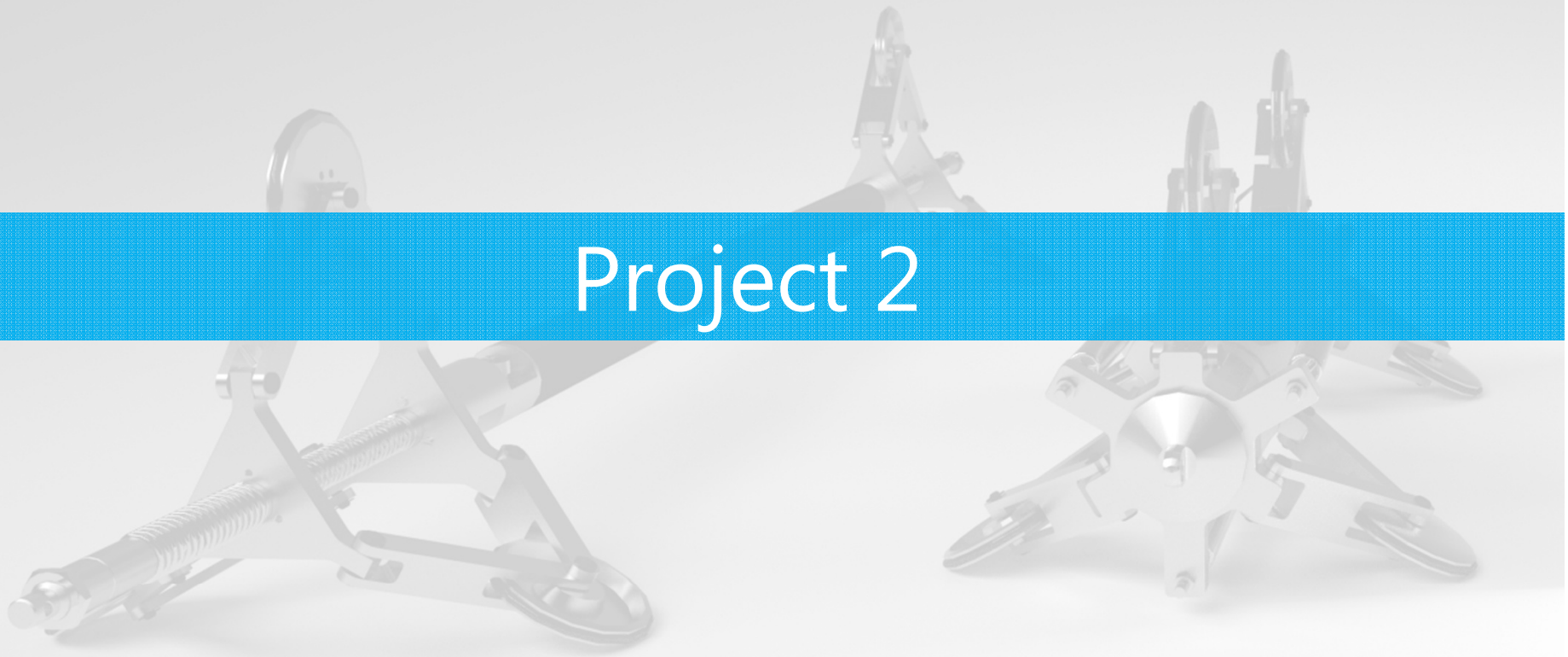
Project 2



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Project – Cherry Hill, CO

Google Earth

AutoCAD

Inclination

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Google Earth

AutoCAD

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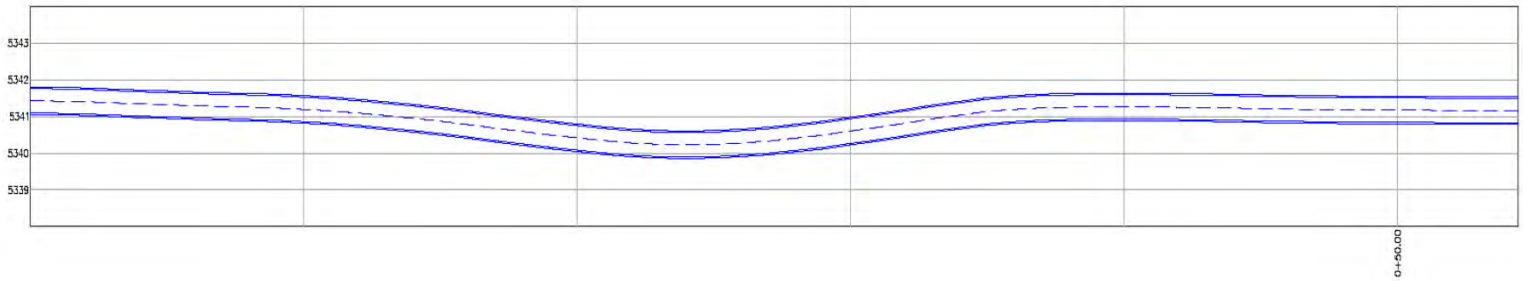
AutoCAD Profile



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Project – Cherry Hill, CO

Google Earth

AutoCAD

Inclination

Inclination Report

Point Number	X	Y	Z	Station	Horiz Distance Between Points (ft)	Elevation Change Between Points (ft)	Segment Slope	Segment Grade (%)
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11	3148601.180	1661374.160	5341.190	10.0018	0.9992	-0.0400	-0.0400	-4.00
12	3148600.260	1661373.760	5341.150	11.0050	1.0032	-0.0400	-0.0399	-3.99
13	3148599.340	1661373.370	5341.090	12.0043	0.9992	-0.0600	-0.0600	-6.00
14	3148598.420	1661372.990	5341.020	12.9997	0.9954	-0.0700	-0.0703	-7.03
15	3148597.490	1661372.630	5340.950	13.9969	0.9972	-0.0700	-0.0702	-7.02
16	3148596.560	1661372.270	5340.870	14.9941	0.9972	-0.0800	-0.0802	-8.02
17	3148595.620	1661371.930	5340.780	15.9937	0.9996	-0.0900	-0.0900	-9.00
18	3148594.690	1661371.570	5340.680	16.9910	0.9972	-0.1000	-0.1003	-10.03
19	3148593.760	1661371.210	5340.590	17.9882	0.9972	-0.0900	-0.0902	-9.02
20	3148592.840	1661370.860	5340.500	18.9726	0.9843	-0.0900	-0.0914	-9.14
21	3148591.910	1661370.500	5340.420	19.9698	0.9972	-0.0800	-0.0802	-8.02
22	3148590.980	1661370.130	5340.340	20.9707	1.0009	-0.0800	-0.0799	-7.99
23	3148590.050	1661369.760	5340.280	21.9716	1.0009	-0.0600	-0.0599	-5.99
24	3148589.120	1661369.390	5340.240	22.9725	1.0009	-0.0400	-0.0400	-4.00
25	3148588.200	1661369.020	5340.230	23.9641	0.9916	-0.0100	-0.0101	-1.01
26	3148587.270	1661368.640	5340.240	24.9688	1.0046	0.0100	0.0100	1.00
27	3148586.340	1661368.260	5340.280	25.9734	1.0046	0.0400	0.0398	3.98
28	3148585.430	1661367.870	5340.330	26.9635	0.9901	0.0500	0.0505	5.05
29	3148584.510	1661367.480	5340.410	27.9627	0.9992	0.0800	0.0801	8.01
30	3148583.600	1661367.090	5340.490	28.9528	0.9901	0.0800	0.0808	8.08
31	3148582.680	1661366.690	5340.600	29.9560	1.0032	0.1100	0.1096	10.96
32	3148581.770	1661366.290	5340.700	30.9500	0.9940	0.1000	0.1006	10.06
33	3148580.860	1661365.890	5340.810	31.9440	0.9940	0.1100	0.1107	11.07
34	3148579.950	1661365.490	5340.930	32.9380	0.9940	0.1200	0.1207	12.07
35	3148579.040	1661365.080	5341.030	33.9361	0.9981	0.1000	0.1002	10.02
36	3148578.140	1661364.680	5341.130	34.9210	0.9849	0.1000	0.1015	10.15
37	3148577.220	1661364.280	5341.190	35.9242	1.0032	0.0600	0.0598	5.98
38	3148576.300	1661363.890	5341.230	36.9235	0.9992	0.0400	0.0400	4.00

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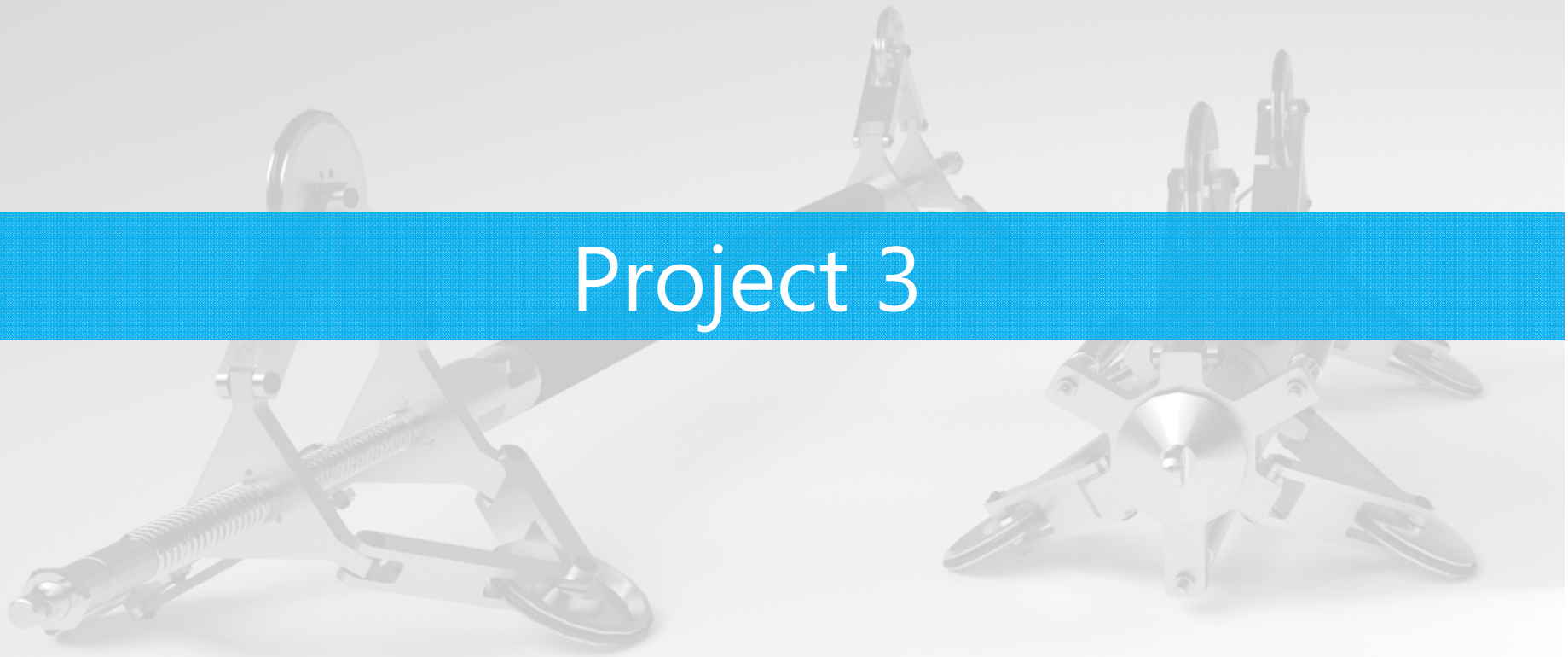
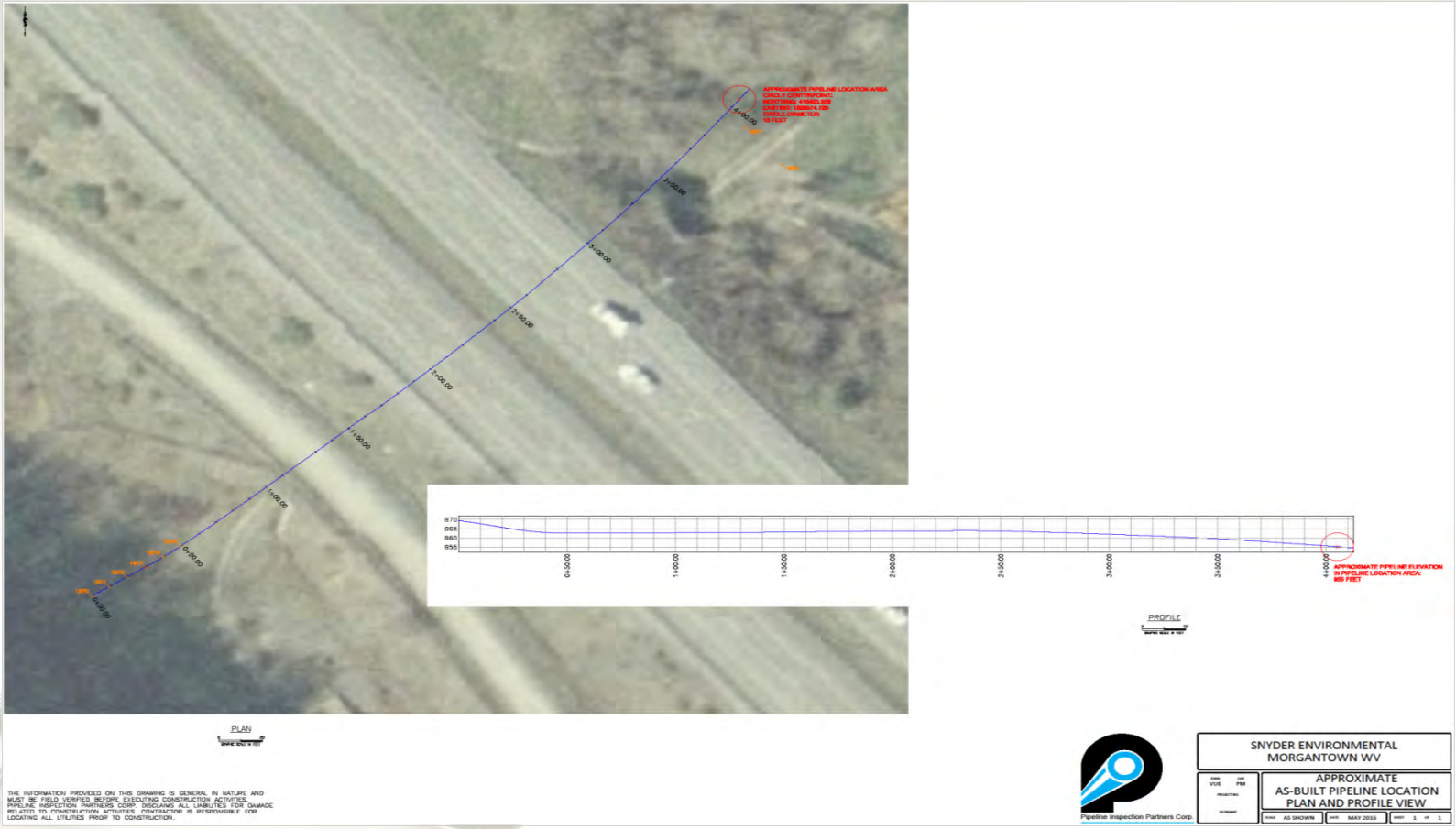
Project 3



Project – Morgantown, WV

Plan & Profile

Project Photo



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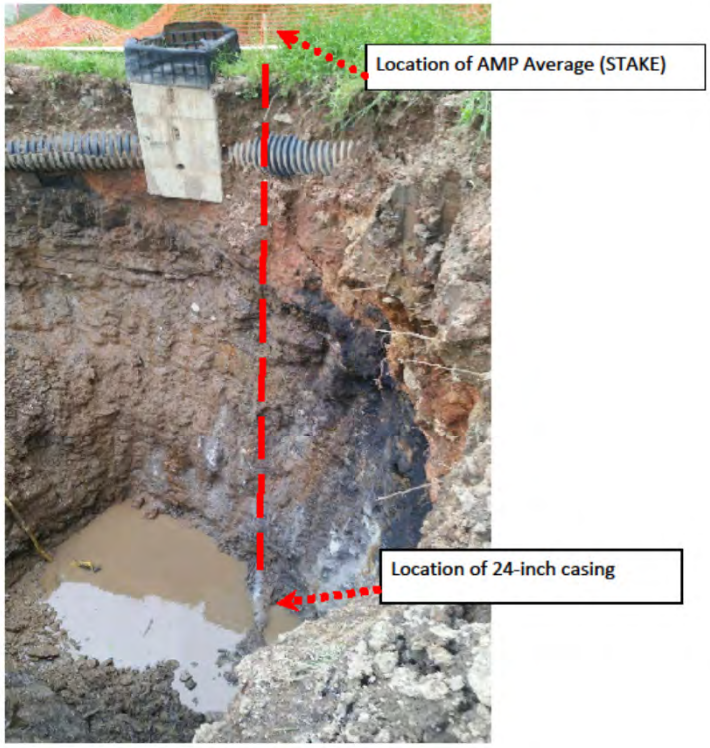
Project – Morgantown, WV

Plan & Profile

Project Photo

Project photo



Note:

Location of steel casing was within 1-ft of demarcated average.

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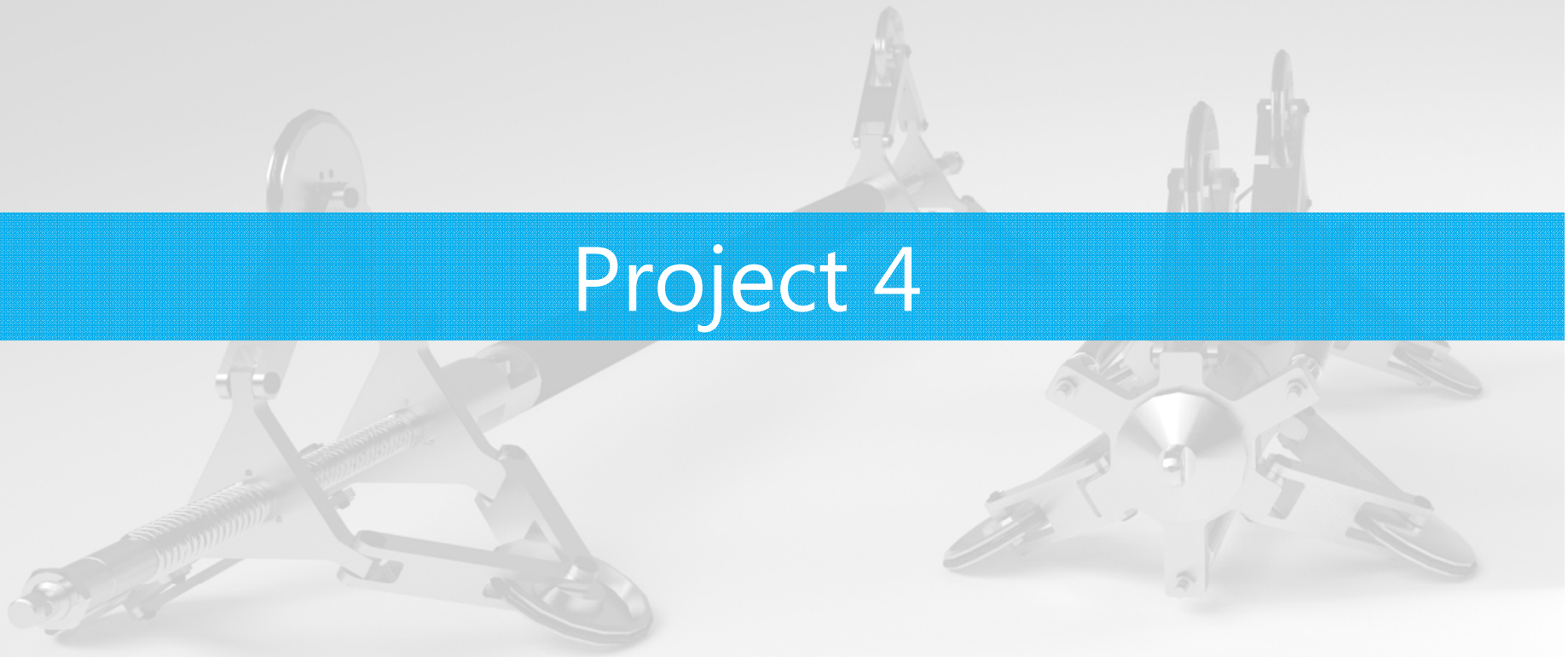
Project 4



Project – Freehold, NJ

Google Earth

Plan & Profile

Inclination

Google Earth photo

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Project – Freehold, NJ

Google Earth

Plan & Profile

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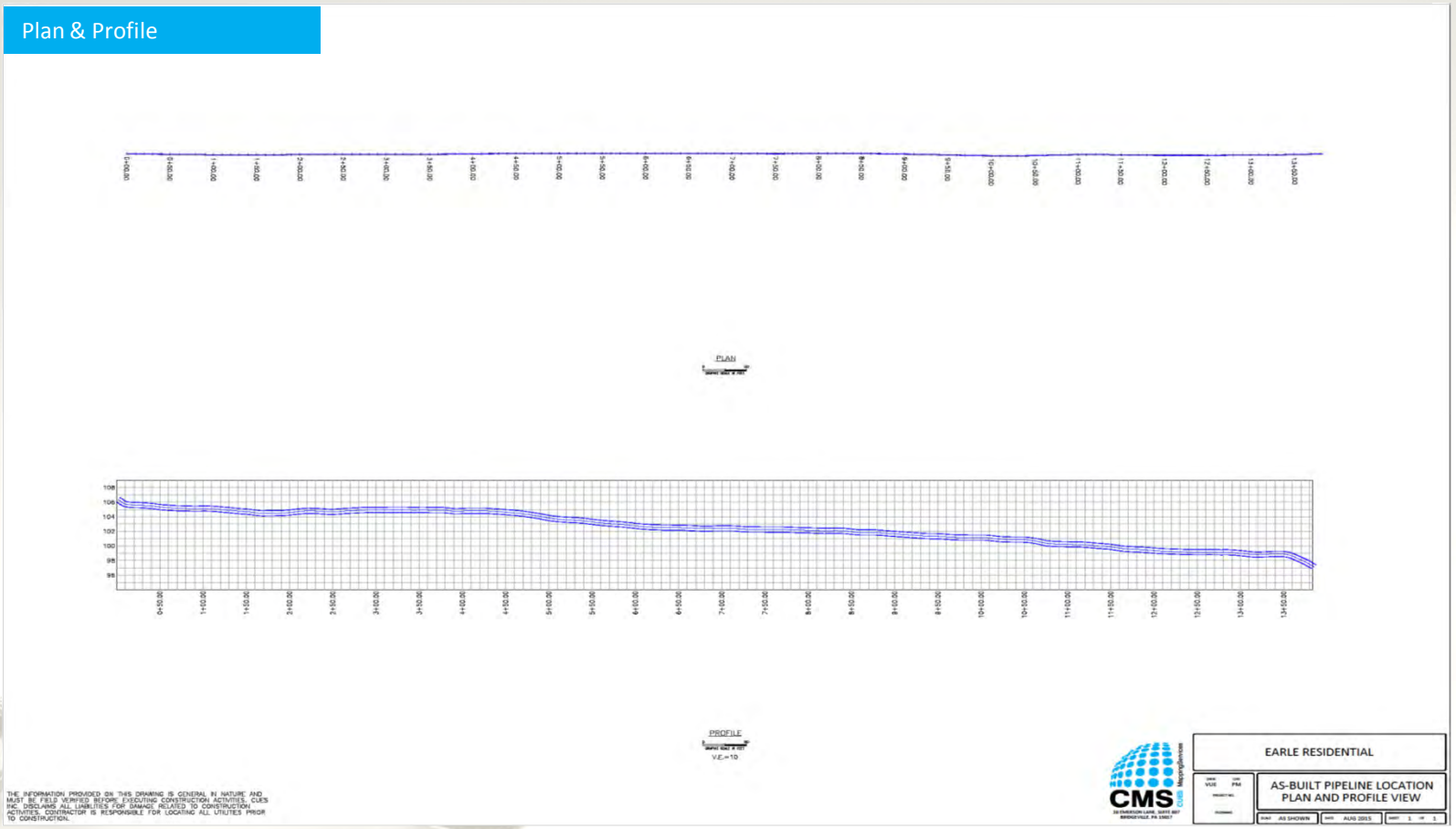

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Project – Freehold, NJ

Google Earth

Plan & Profile

Inclination

Inclination Report

Point Number	X	Y	Z	Station	Horiz Distance Between Points (ft)	Elevation Change Between Points (ft)	Segment Slope	Segment Grade (%)
1	553374.840	494631.580	106.000	0.0000	0.0000	0.0000	0.0000	0.00
2	553376.120	494632.780	105.890	1.7545	1.7545	-0.1100	-0.0627	-6.27
3	553376.300	494632.940	105.870	1.9954	0.2408	-0.0200	-0.0830	-8.30
4	553377.020	494633.630	105.760	2.9926	0.9972	-0.1100	-0.1103	-11.03
5	553377.740	494634.310	105.680	3.9830	0.9904	-0.0800	-0.0808	-8.08
6	553378.460	494635.000	105.610	4.9802	0.9972	-0.0700	-0.0702	-7.02
7	553379.190	494635.690	105.540	5.9847	1.0045	-0.0700	-0.0697	-6.97
8	553379.920	494636.370	105.480	6.9824	0.9976	-0.0600	-0.0601	-6.01
9	553380.640	494637.060	105.430	7.9796	0.9972	-0.0500	-0.0501	-5.01
10	553381.360	494637.750	105.390	8.9768	0.9972	-0.0400	-0.0401	-4.01
11	553382.090	494638.440	105.360	9.9813	1.0045	-0.0300	-0.0299	-2.99
12	553382.810	494639.130	105.330	10.9786	0.9972	-0.0300	-0.0301	-3.01
13	553383.540	494639.820	105.310	11.9831	1.0045	-0.0200	-0.0199	-1.99
14	553384.260	494640.510	105.290	12.9803	0.9972	-0.0200	-0.0201	-2.01
15	553384.980	494641.200	105.280	13.9776	0.9972	-0.0100	-0.0100	-1.00
16	553385.700	494641.890	105.270	14.9748	0.9972	-0.0100	-0.0100	-1.00
17	553386.420	494642.580	105.260	15.9721	0.9972	-0.0100	-0.0100	-1.00
18	553387.150	494643.270	105.250	16.9765	1.0045	-0.0100	-0.0100	-1.00
19	553387.870	494643.970	105.240	17.9807	1.0042	-0.0100	-0.0100	-1.00
20	553388.600	494644.660	105.240	18.9852	1.0045	0.0000	0.0000	0.00
21	553389.320	494645.350	105.230	19.9825	0.9972	-0.0100	-0.0100	-1.00
22	553390.040	494646.040	105.230	20.9797	0.9972	0.0000	0.0000	0.00
23	553390.760	494646.730	105.230	21.9770	0.9972	0.0000	0.0000	0.00
24	553391.490	494647.420	105.220	22.9815	1.0045	-0.0100	-0.0100	-1.00
25	553392.210	494648.110	105.220	23.9787	0.9972	0.0000	0.0000	0.00
26	553392.930	494648.800	105.220	24.9759	0.9972	0.0000	0.0000	0.00
27	553393.660	494649.490	105.210	25.9804	1.0045	-0.0100	-0.0100	-1.00
28	553394.380	494650.180	105.210	26.9777	0.9972	0.0000	0.0000	0.00
29	553395.110	494650.870	105.200	27.9822	1.0045	-0.0100	-0.0100	-1.00
30	553395.830	494651.550	105.200	28.9725	0.9904	0.0000	0.0000	0.00

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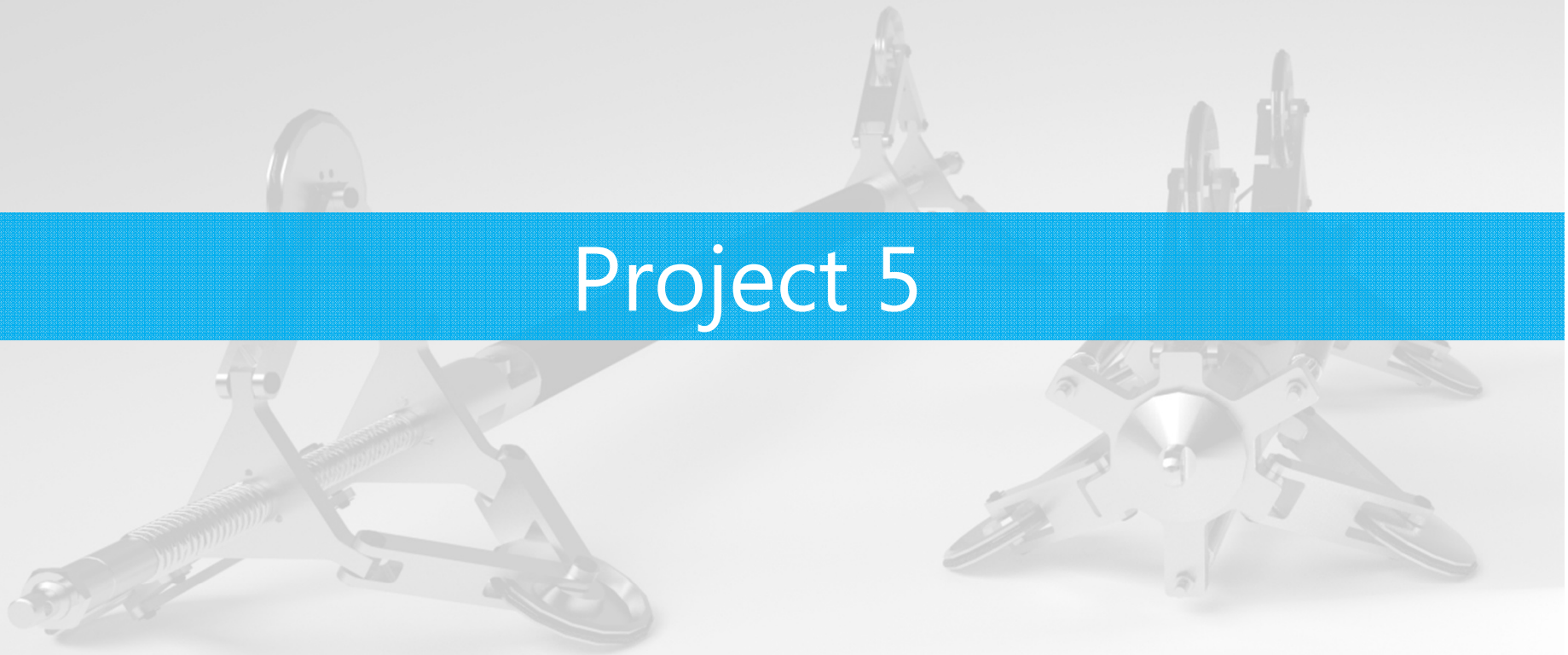

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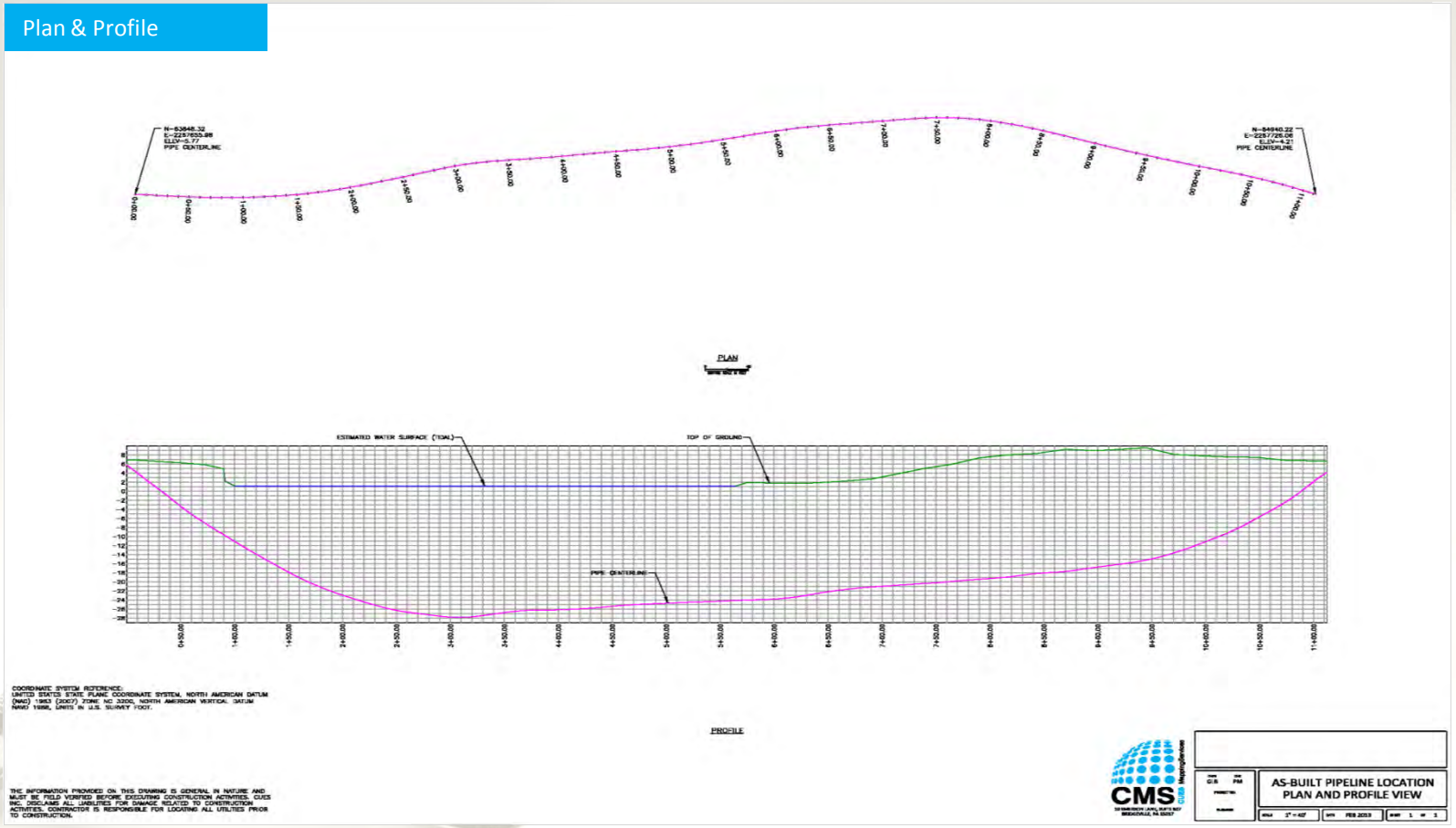

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