APPENDIX B

MW-25 BORING/WELL CONSTRUCTION LOG AND MP CASING CONSTRUCTION DETAILS

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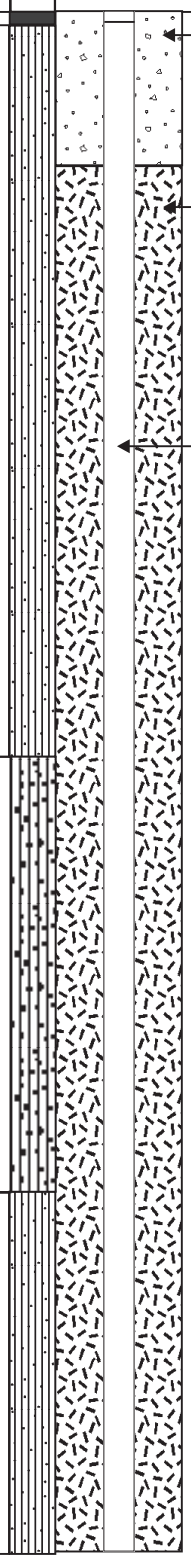
NASA/JPL BORING LOG AND WELL CONSTRUCTION – JPL-MW-25

Borehole Location: JPL-MW-25 Project Location: NASA Jet Propulsion Lab Project #: G486048 Geologist: D. Conner Drilling Contractor: WDC Exploration & Wells Driller: Alberto Vega Reviewed by: David Clexton R.G. #7350	Sampler Type: Grab Sample from Shaker Screen Boring Diameter: 12 1/4” Drilling Method: Mud Rotary Drill Rig: Speedstar 50K Hammer Type: Casing Hammer Date: 09/20/04 - 09/24/04 Total Depth: 815’ bgs	Coordinates (NAD 83/NAVD 88) Surface Elevation: Borehole Abandoned: Yes No X Method: N/A	Northing: 1,882,639.52 Easting: 6,514,027.89 Monitoring Device Installed: Yes X No Type: Westbay Multi-Port Monitoring System

Depth (feet bgs)	USCS symbols	Sample description	Comments
0		Asphalt Surface (4 inches thick).	
5	SM	Silty SAND: reddish brown, dry, medium dense, fine- to medium-grained SAND, some coarse-grained SAND, some gravel, some granitic cobbles.	
10		As above.	
15		As above.	
20		As above.	
25		75% medium-grained, 25% fine-grained, trace coarse-grained SAND.	
30	GM	COBBLES with SAND: 70% medium-grained SAND, 30% coarse-grained SAND, trace silt, 29-46’ bgs (cobbles).	Moderate rig chatter.
35		60% medium-grained, some coarse-grained SAND, fine gravel up to 10mm long, trace silt.	Heavy rig chatter.
40		80% coarse-grained SAND, 20% fine-grained SAND subangular to angular, grains up to 5mm long, trace silt.	
45	SM	Silty SAND: coarse- to medium-grained SAND; angular to angular, some cobbles.	Decrease in rig chatter.
50		Fine- to medium-grained SAND, some coarse-grained.	Low rig chatter; easier drilling.
55		As above.	
60		Occassional cobbles.	Increase in rig chatter (59 - 61’ bgs).



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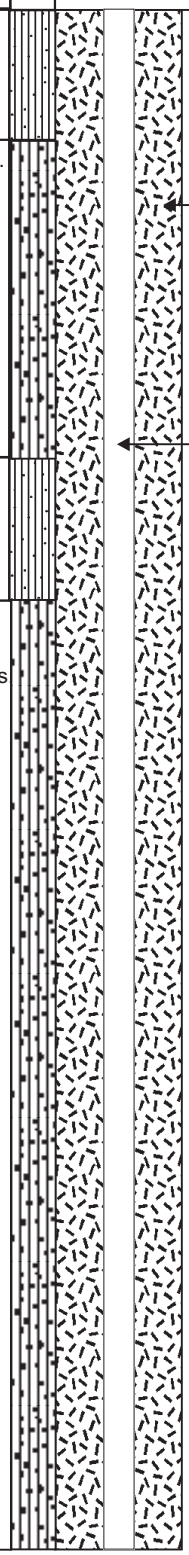
Depth (feet bgs)	USCS symbols	Sample description	Comments
60	SM	Silty SAND: coarse- to medium-grained SAND; angular to subangular, some cobbles.	Low rig chatter and easier drilling (61 - 66' bgs).
		Some fine-grained SAND, trace gravel.	
65	GM	COBBLES with Silty SAND: fine- to medium-grained, some coarse-grained SAND, some gravel.	Increased rig chatter at 66' bgs.
70		Some gravel and cobbles.	
75		70% coarse-grained SAND, 20% medium-grained, 10% fine-grained, angular to subangular, some cobbles and gravel.	Heavy rig chatter.
80	SM	Silty SAND: 60% fine- to medium-grained SAND, some coarse-grained.	Viscosity: 41seconds Weight: 8.9 lbs/ft^3 Sand: 0.8%
85	GM	Gravel with Silty SAND: coarse-grained SAND, some fine-to medium-grained SAND, angular to subangular.	Moderate rig chatter.
		60% medium-to coarse-grained SAND, some gravel.	Increase in rig chatter at 86' bgs
90		As above.	
95		70% medium- to coarse-grained SAND, 30% fine-grained SAND and some silt.	
100		Gravel up to 15mm long.	Moderate rig chatter.
105		As above.	
110		As above.	Increased rig chatter.
115		As above.	
120			



Well Completion

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Depth (feet bgs)	USCS symbols	Sample description	Comments	Lithology	Well Completion
120	GM	COBBLES with Silty SAND: 80% medium- to coarse-grained SAND, 20% fine-grained SAND.	Moderate to moderately heavy rig chatter.		
125		As above.			Bentonite Seal: 1:1 granular bentonite to sand mixture 3 - 335’ bgs
130		Gravel and sparse cobbles.	Less rig chatter.		
		Gravelly SAND: 60% coarse-grained SAND, 40% fine- to medium-grained SAND.			
135	SM	Silty SAND: fine- to medium-grained SAND, some coarse-grained SAND, well graded, some grains 5-6mm long.			4” Diameter Low-Carbon Steel Casing 0 - 355’ bgs
140		As above.			
145		60% medium- to coarse-grained SAND, 40% fine-grained SAND; angular to subangular.			
150		As above.	Low to moderate rig chatter.		
155		As above.			
160		75% medium- to coarse-grained SAND, 25% fine-grained SAND, well graded.			
	GM	COBBLES with Silty SAND: 80% medium- to coarse-grained SAND, 20% fine-grained SAND.	Increase in rig chatter and rig shaking.		
165		As above.			
170		COBBLES and BOULDERS; cuttings: 70% fine-grained SAND, 30% coarse-grained SAND.	Heavy rig chatter, drill bit advancing slowly through rock.		
175		60% coarse-grained SAND, 40% fine- to medium-grained SAND, angular to subangular.			
180					

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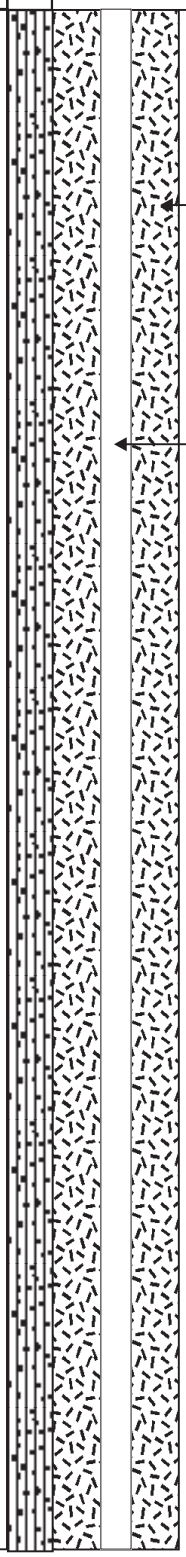
Depth (feet bgs)	USCS symbols	Sample description	Comments
180	GM	COBBLES and BOULDERS: 60% coarse-grained SAND, 40% fine- to medium-grained SAND; angular to subangular.	
185		As above.	
			Increased rig chatter (187’bgs).
190		As above.	
195		As above.	
200		As above.	Attempted split spoon sample (300lb. slide hammer), 100 blows, no recovery.
205		As above.	
210		As above.	
215		As above.	
220		As above.	
225		As above.	
230		As above.	
235		Less cobbles.	
240			



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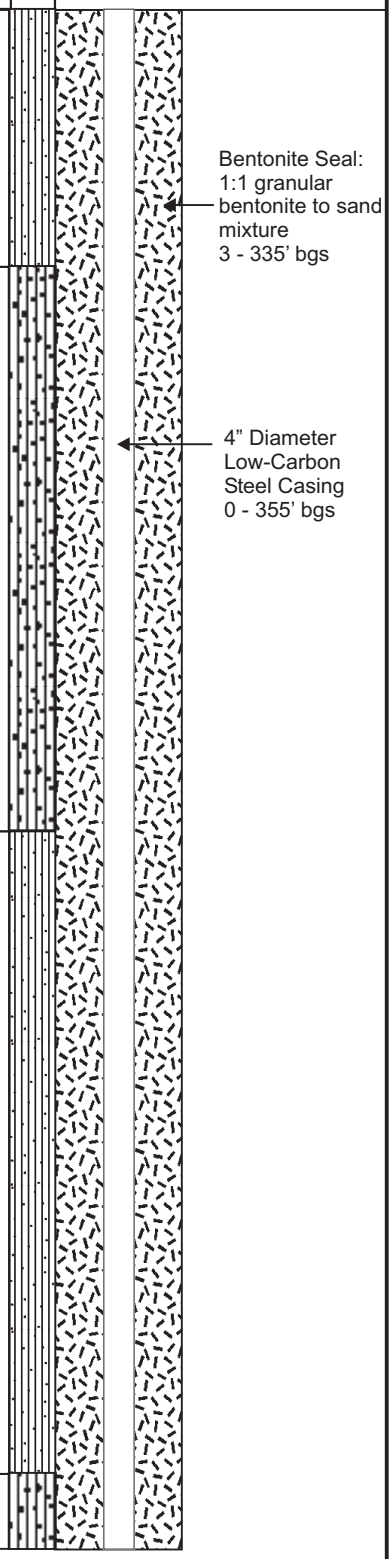
Depth (feet bgs)	USCS symbols	Sample description	Comments
240	SM	Silty SAND: fine- to medium-grained; angular to subangular, some sporadic COBBLES.	
245		As above.	
250	GM	COBBLES with silty SAND: 70% medium to coarse-grained SAND, 30% fine-grained SAND; angular to subangular.	Moderate rig chatter.
255		80% medium- to coarse-grained SAND and fine gravel, 20% fine-grained SAND.	
260		60% coarse-grained SAND, 30% fine gravel, 10% fine-grained SAND; angular to subangular gravel.	
265		As above.	
270		As above.	Moderate rig chatter.
275	SM	Silty SAND: 70% coarse-grained SAND, 30% fine- to medium-grained SAND, angular to subangular, no gravel.	Low to moderate rig chatter.
280		As above.	
285		As above.	
290		Trace fine gravel.	
295		As above.	Attempted split spoon sample (300lb. slide hammer), 100 blows, 2” recovery.
300	GM	COBBLES with Silty SAND: 70% coarse-grained SAND, 30% fine- to medium-grained SAND; angular to subangular, trace gravel. Increase in cobbles.	



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Depth (feet bgs)	USCS symbols	Sample description	Comments	Lithology	Well Completion
300	GM	COBBLES with Silty SAND: 70% coarse-grained SAND, 30% fine- to medium-grained SAND; angular to subangular, trace gravel. Increase in cobbles.	Driller says it’s very rocky, drill bit binding.		
305		As above.			Bentonite Seal: 1:1 granular bentonite to sand mixture 3 - 335’ bgs
310		As above.			
315		As above. Decrease in cobbles.			4” Diameter Low-Carbon Steel Casing 0 - 355’ bgs
320		Increase in cobbles.	Drill bit binding, rig chatter.		
325		As above.			
330	SM	Gravelly SAND: tan to reddish brown, 70% medium- to coarse-grained SAND, 30% fine-grained SAND; angular to subangular, trace fine gravel.	Easier drilling.		
335		As above.			Filter Pack: Lonestar No. 2/16 sand: 335 - 368’ bgs
340	GM	COBBLES with Silty SAND: tan to reddish brown, 70% medium- to coarse-grained SAND, 30% fine-grained SAND; angular to subangular.			
345		Increase in cobbles.			
350		As above.	Some bit binding.		
355		Trace gravel.			Well Screen #1: 355 - 365’ bgs, 4” Diameter 0.010-inch slot, wire-wrapped stainless-steel screen
360					

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Depth (feet bgs)	USCS symbols	Sample description	Comments	Lithology	Well Completion
360	GM	COBBLES with Silty SAND: 70% medium- to coarse-grained SAND, 30% fine-grained SAND; angular to subangular, trace gravel.	Bit binding.		Well Screen #1: 355 - 365’ bgs, 4” Diameter 0.010-inch slot, wire-wrapped stainless-steel screen
365		As above.	Viscosity: 40 seconds. Weight: 9.0lbs/ft^3 SAND: 0.75%		Filter Pack: Lonestar No. 2/16 sand: 335 - 368’ bgs
370		As above.			
375		60% coarse-grained SAND, 40% fine- to medium-grained SAND; angular.	Cuttings are finer grained than above due to the bit grinding through dense material. Driller comments that material is competent.		4” Diameter Low-Carbon Steel Casing 365 - 420’ bgs
380		70% coarse-grained SAND, 30% fine- to medium-grained SAND; angular to subangular, well graded.			Bentonite Seal: 1:1 granular bentonite to sand mixture 368 - 407’ bgs
385		As above.			
390		As above.			
395		As above.			
	SM	Silty SAND: 70% medium- to coarse-grained SAND, 30% fine-grained SAND.			
400					
405		Gravels (406 - 414’ bgs).			
410		As above.	Moderate rig chatter. Driller says hard material.		Filter Pack: Lonestar No. 2/16 sand: 407 - 435’
415		As above.			
420					

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Depth (feet bgs)	USCS symbols	Sample description	Comments	Lithology	Well Completion
420	SM	Silty SAND: 70% medium- to coarse-grained SAND, 30% fine-grained SAND.			Filter Pack: Lonestar No. 2/16sand: 407 - 435’ bgs
425	SM/ GM	Silty SAND with COBBLES: 60% medium- to coarse-grained SAND, 20% fine-grained SAND, 20% COBBLES.			Well Screen #2: 420 - 430’ bgs, 4” Diameter 0.010-inch slot, wire-wrapped stainless-steel screen
430		As above.			
435		As above.			4” Diameter Low-Carbon Steel Casing 435 - 500’ bgs
440	SM	Silty SAND: tan with some reddish orange grains, 70% medium- to coarse-grained; angular to subangular, well graded, some grains up to 2-3mm in length..			Bentonite Seal: 1:1 granular bentonite to sand mixture 435 - 490’ bgs
445		As above.	Viscosity: 39 seconds. Weight: 9.4 lbs/ft^3. SAND: 1.5%		
450	SM/ GM	Silty SAND with COBBLES: 60% medium- to coarse-grained SAND, 20% fine-grained SAND, 20% COBBLES.			
455					
460	SM	Silty SAND: tan with red-orange and gray, 60% medium-grained SAND, 30% fine-grained SAND 10% coarse-grained, maximum size <2mm.			
465		Finer grained than above, trace grains 2mm in length.			
470		Tan, 50% medium grained SAND, 40% fine-grained SAND, 10% coarse-grained SAND, moderately graded.	Viscosity: 40 seconds Weight: 9lbs/ft^3 Sand: 1%		
475		As above.	Low rig chatter, softer material, no cobbles and higher rotational speed of drilling rod and bit.		
480					

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Depth (feet bgs)	USCS symbols	Sample description	Comments	Lithology	Well Completion
480	ML	Sandy SILT: orange brown, damp, medium dense, some fine-grained SAND, trace medium and trace coarse-grained SAND (logged from split-spoon sample).			Bentonite Seal: 1:1 granular bentonite to sand mixture 435 - 490’ bgs
485		As above.			4” Diameter Low-Carbon Steel Casing 435 - 500’ bgs
490		As above.	Attempted split spoon sample (300 lb. Slide hammer), 100 blows, 6” recovery.		Filter Pack: Lonestar No. 2/16 sand: 490 - 518’ bgs
495		As above.			
	GM	COBBLES with Silty SAND: 70% medium- to coarse-grained SAND, 30% fine-grained SAND; angular to subangular, trace gravel.			
500		As above.			Well Screen #3: 500 - 510’ bgs, 4” Diameter 0.010-inch slot, wire-wrapped stainless-steel screen
505		As above.			
510	SM	Silty SAND: fine- to medium-grained SAND; angular to subangular, some coarse (up to 2-3mm).			
515	GM	COBBLES with Silty SAND: 70% medium- to coarse-grained SAND, 30% fine-grained SAND; angular to subangular, trace gravel, grains up to 3mm, moderately graded			
520	SM	Silty SAND: fine- to medium-grained SAND, some coarse (up to 2-3mm); angular to subangular.			Bentonite Seal: 1:1 granular bentonite to sand mixture 518 - 617’ bgs
525		As above.			4” Diameter Low-Carbon Steel Casing 510 - 630’ bgs
530		As above.			
535	GM	COBBLES with Silty SAND: 70% medium- to coarse-grained SAND, 30% fine-grained SAND; angular to subangular, trace gravel, grains up to 3mm, moderately graded			
540					

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Depth (feet bgs)	USCS symbols	Sample description	Comments
540	GM	COBBLES with Silty SAND: 70% medium- to coarse-grained SAND, 30% fine-grained SAND; angular to subangular, trace gravel.	
545		As above.	
550	GM/SM	Poorly graded SAND with silt and gravel: 75% fine- to coarse-grained SAND, 15% COBBLES, 10% silt.	Increase in rig chatter.
555		As above.	New shaker screen.
		As above.	
560	SM	Silty SAND: tan brown, fine- to medium-grained SAND, some coarse-grained up to 1mm in size; angular to subangular, moderately graded.	
565		As above.	
570		As above.	
575		Increase in coarse-grained SAND and medium-grained SAND.	
580	GM	COBBLES with Silty SAND: 70% medium- to coarse-grained SAND, 30% fine-grained SAND; angular to subangular, trace gravel.	
585		As above.	
590		As above.	
595		As above.	
600			

Lithology

Well Completion

Bentonite Seal: 1:1 granular bentonite to sand mixture 518 - 617’ bgs

4” Diameter Low-Carbon Steel Casing 510 - 630’ bgs

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Depth (feet bgs)	USCS symbols	Sample description	Comments	Lithology	Well Completion
600	SM	Silty SAND: tan brown, medium- to coarse-grained SAND, with some fine-grained SAND; angular to subangular, moderately graded.			
605		As above.	Rig chatter. Viscosity: 41 seconds Weight: 9.1lbs/ft^3 Sand: 1%		Bentonite Seal: 1:1 granular bentonite to sand mixture 518 - 617’ bgs
610		As above.			4” Diameter Low-Carbon Steel Casing 510 - 630’ bgs
615		Poorly graded SAND.			
620		As above.			Filter Pack: Lonestar No. 2/16 sand: 617 - 643’ bgs
625		As above.			
630		As above.			Well Screen #4: 630 - 640’ bgs, 4” Diameter 0.010-inch slot, wire-wrapped stainless-steel screen
635		As above.	Attempt split spoon sample (300lb. slide hammer), 100 blows, no recovery.		
640		Increase in coarse-grained SAND.			
645		As above.	Rig chatter (648 - 650’).		Bentonite Seal: 1:1 granular bentonite to sand mixture 643 - 707’ bgs
650		Fine- to medium-grained SAND; subangular, some cobbles, moderate grading.			4” Diameter Low-Carbon Steel Casing 640 - 710’ bgs
655		As above.			
660					

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Depth (feet bgs)	USCS symbols	Sample description	Comments	Lithology	Well Completion
660	GM	COBBLES with Silty SAND: 70% medium- to coarse-grained SAND, 30% fine-grained SAND; angular to subangular, trace gravel.			
665		As above.			Bentonite Seal: 1:1 granular bentonite to sand mixture 643 - 707’ bgs
670		As above.			
675	SM	Silty SAND: fine- to medium-grained, some cobbles (2-3mm), moderately graded, subangular.			4” Diameter Low-Carbon Steel Casing 640 - 710’ bgs
680		As above.			
685		As above.	Viscosity: 39 seconds Weight: 9.2lbs/ft^3 Sand: 1%		
690		As above.			
695		As above.			
700	GM	COBBLES with Silty SAND: 60% fine to medium-grained, 40% coarse-grained SAND; angular to subangular, up to 4 mm in length, some silt.			
705		As above.			
710		As above.	Heavy rig chatter.		Filter Pack: Lonestar No. 2/16 sand: 707 - 724’ bgs Well Screen #5: 710 - 720’ bgs, 4” Diameter 0.010-inch slot, wire-wrapped stainless-steel screen
715		As above.			
720					

JPL-MW-25.CDR

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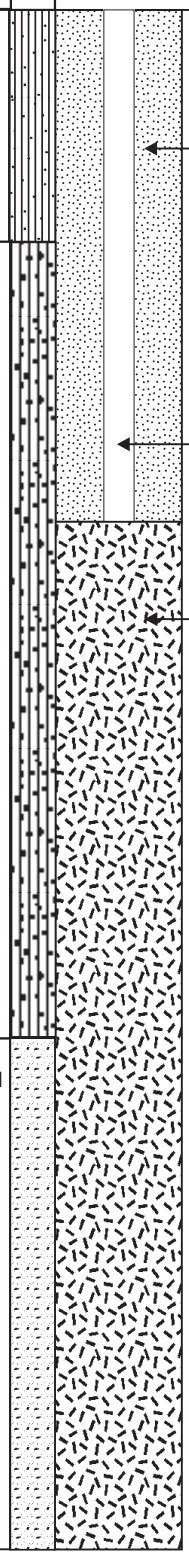
NASA/JPL BORING LOG AND WELL CONSTRUCTION – JPL-MW-25

Borehole Location: JPL-MW-25 Project Location: NASA Jet Propulsion Lab Project #: G486048 Geologist: D. Conner Drilling Contractor: WDC Exploration & Wells Driller: Alberto Vega Reviewed by: David Clexton R.G. #7350	Sampler Type: Grab Sample from Shaker Screen Boring Diameter: 12 1/4” Drilling Method: Mud Rotary Drill Rig: Speedstar 50K Hammer Type: Casing Hammer Date: 09/20/04 - 09/24/04 Total Depth: 815’ bgs	Coordinates (NAD 83/NAVD 88) Surface Elevation: Borehole Abandoned: Yes No X Method: N/A	Northing: 1,882,639.52 Easting: 6,514,027.89 Monitoring Device Installed: Yes X No Type: Westbay Multi-Port Monitoring System

Depth (feet bgs)	USCS symbols	Sample description	Comments
720	SM	Silty SAND: 50% fine- to medium-grained, 50% coarse-grained SAND; angular to subangular, grains up to 4 mm in length.	Increase in rig chatter (722’).
725		As above.	
730	GM	SAND with COBBLES: 70% fine- to medium-grained, 30% coarse-grained.	Heavy rig chatter (COBBLES), and bit binding. Very hard (competent)
735		As above.	
740		As above.	Increased rig chatter (741’). More competent (742’).
745		As above.	
750		As above.	
755		As above.	
760		BEDROCK: buff to tannish pink, medium- to coarse-grained SAND; angular, some granodiorite grains (light colored with biotite).	Decrease in rig chatter and bit binding, consistent rotational speed and pressure indicating bedrock.
765		As above.	
770		As above.	
775		Possible fractured and weathered BEDROCK.	Easier drilling (775 - 780’) possibly due to fractured or weathered zone in bedrock.
780			



JPL-MW-25.CDR

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NASA/JPL BORING LOG AND WELL CONSTRUCTION – JPL-MW-25

Borehole Location: JPL-MW-25 Project Location: NASA Jet Propulsion Lab Project #: G486048 Geologist: D. Conner Drilling Contractor: WDC Exploration & Wells Driller: Alberto Vega Reviewed by: David Clexton R.G. #7350	Sampler Type: Grab Sample from Shaker Screen Boring Diameter: 12 1/4” Drilling Method: Mud Rotary Drill Rig: Speedstar 50K Hammer Type: Casing Hammer Date: 09/20/04 - 09/24/04 Total Depth: 815’ bgs	Coordinates (NAD 83/NAVD 88) Northing: 1,882,639.52 Surface Elevation: Easting: 6,514,027.89 Borehole Abandoned: Yes No X Method: N/A	Monitoring Device Installed: Yes X No Type: Westbay Multi-Port Monitoring System

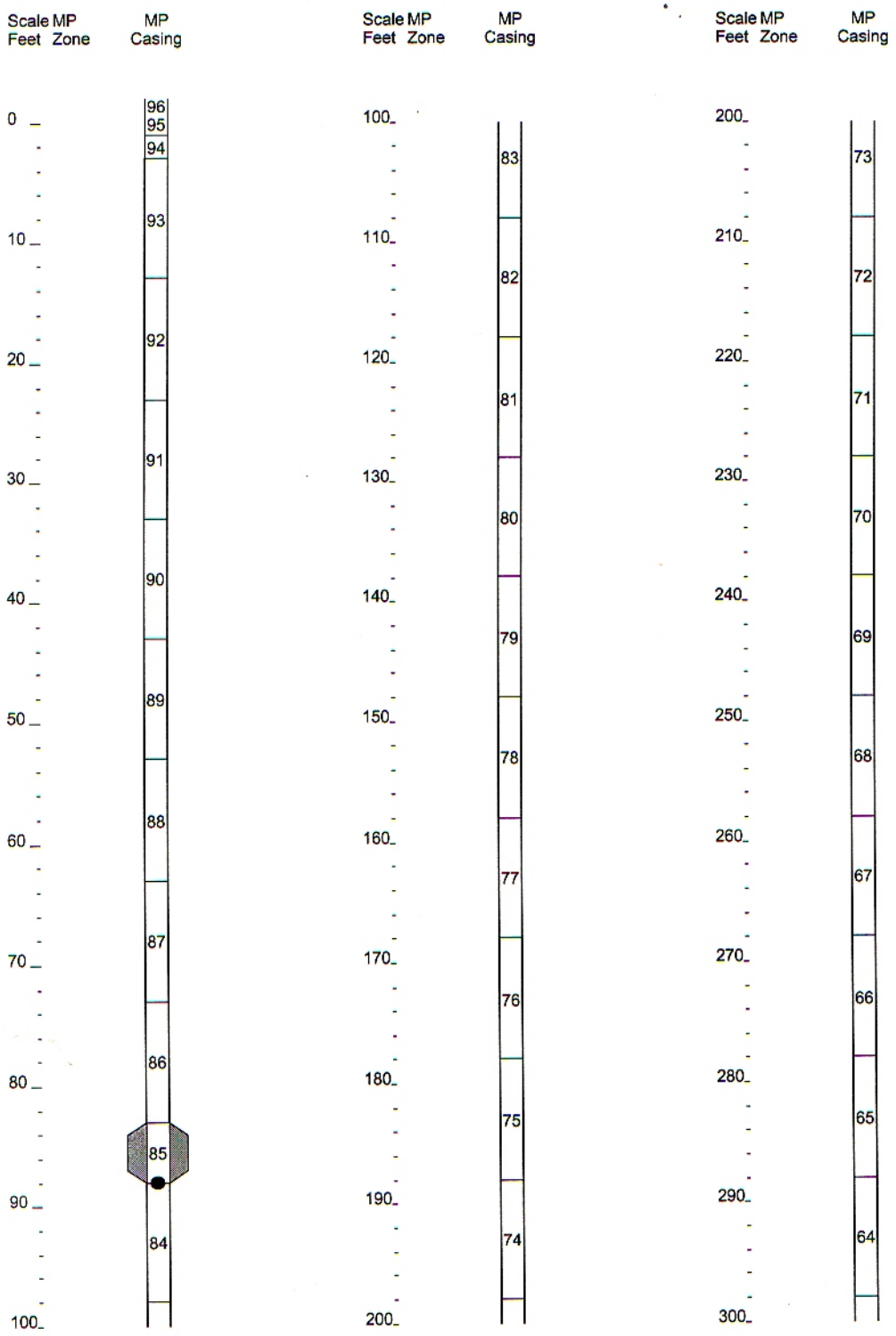
Depth (feet bgs)	USCS symbols	Sample description	Comments	Lithology	Well Completion
780		BEDROCK: buff to tannish pink, medium- to coarse-grained SAND, angular, some granodiorite grains (light colored with biotite).	Rig chatter and bouncing (782’) indicating possibly fractured bedrock.		Bentonite Seal: 1:1 granular bentonite to sand mixture 740 - 815’ bgs
785		As above.			
790		As above.			
795		As above.	Drill rod and bit rotating at constant speed, slower advancement.		
800		As above.			
805		As above.			
810		As above.			
815		As above.			

T.D.: 815’ bgs.

JPL-MW-25.CDR

Summary Casing Log
WDC

Job No: WB650
Well: MW-25



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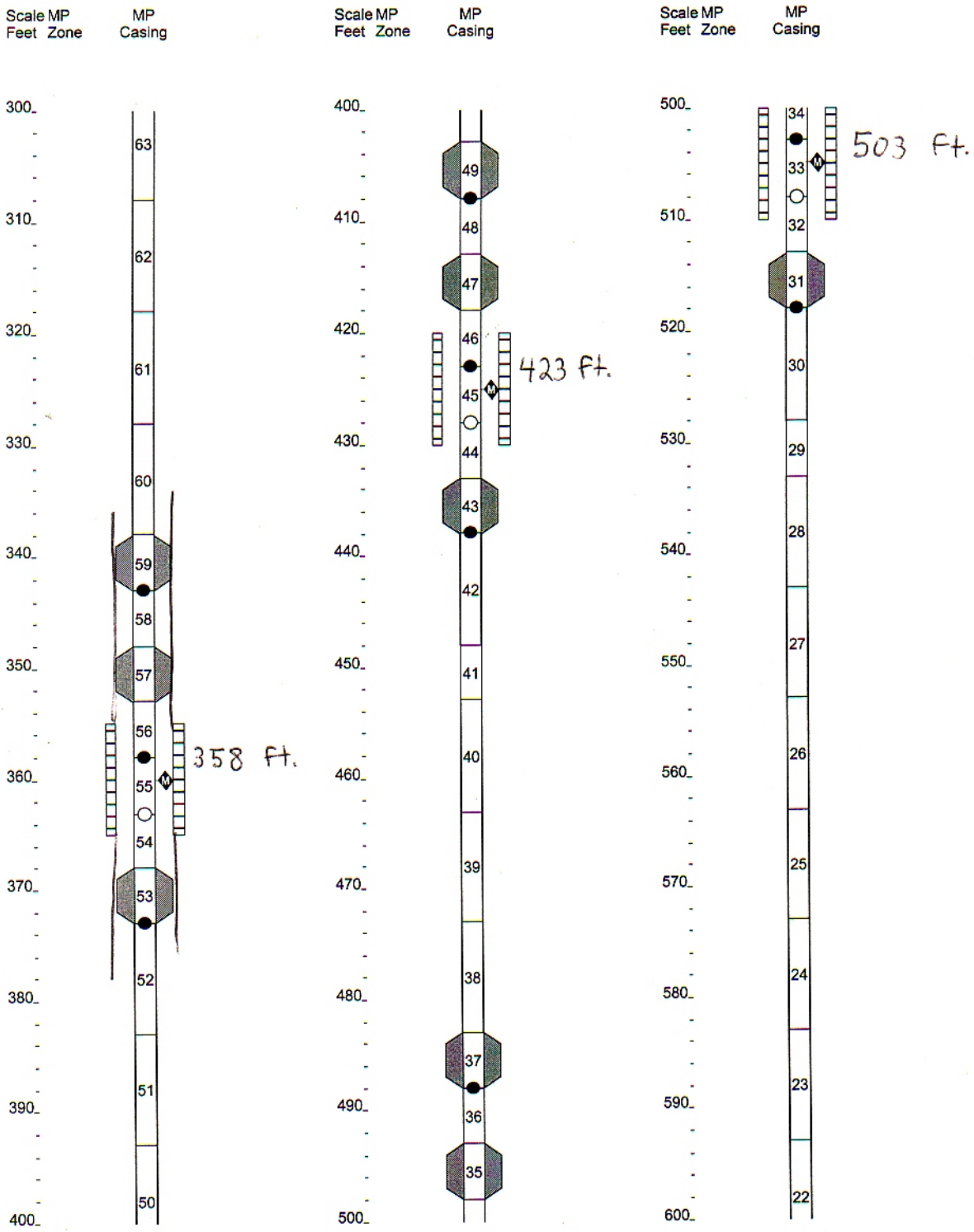
Summary Casing Log
WDC

Job No: WB650
Well: MW-25



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Summary Casing Log
WDC

Job No: WB650
Well: MW-25