State of Hawai‘i
DEPARTMENT OF LABOR AND INDUSTRIAL RELATIONS
Princess Ruth Ke‘elikolani Building
830 Punchbowl Street
Honolulu, Hawai‘i 96813

September 17, 2018
WAGE RATE SCHEDULE BULLETIN NO. 493

This schedule of wage rates contained herein is recognized by the Director of Labor and Industrial Relations to be prevailing on public construction work for the purposes of Chapter 104, Hawai‘i Revised Statutes. The schedule of wage rates determines the applicable wage determination for each classification and does not impose any staffing requirements for any classification. The schedule of wage rates is applicable only to those laborers and mechanics employed at the site of work.

As required by law, future wage rates for laborers and mechanics are incorporated into this bulletin based on available information and are subject to change. Whenever the Director determines that the prevailing wage has increased as shown in the wage rate schedule, the contractor must increase the wages accordingly during the performance of the contract. For addenda or additional wage rate schedules, please consult the Internet at http://labor.hawaii.gov/rs.

The Apprentice Schedule is available on the Internet or upon request from the Research and Statistics Office. Pursuant to Section 12-22-6 (1), Hawai‘i Administrative Rules, the Apprentice Schedule is applicable only to apprentices who are parties to apprenticeship agreements registered with or recognized by the Department of Labor and Industrial Relations.

Questions on the schedule should be referred to the Research and Statistics Office at (808) 586-9005.

The next regular schedule will be issued on or about February 15, 2019.

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Director

STATE OF HAWAI‘I
DAVID Y. IGE, Governor

DEPARTMENT OF LABOR AND INDUSTRIAL RELATIONS
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In cooperation with:
WAGE STANDARDS DIVISION
PAMELA MARTIN, Administrator

Classification	Current			2018			2019			2020			Remarks See Pg 6-8
	Prevailing Wage Total	Basic Hourly Rate	Fringe Hourly Rate	Prevailing Wage Total	Basic Hourly Rate	Fringe Hourly Rate	Prevailing Wage Total	Basic Hourly Rate	Fringe Hourly Rate	Prevailing Wage Total	Basic Hourly Rate	Fringe Hourly Rate	
* **ASPHALT PAVING GROUP:**	**9/17/18**												
Asphalt Concrete Material Transfer	$76.24	$42.92	$33.32	-	-	-	-	-	-	-	-	-	13
Asphalt Raker	$75.28	$41.96	$33.32	-	-	-	-	-	-	-	-	-	13
Asphalt Spreader Operator	$76.76	$43.44	$33.32	-	-	-	-	-	-	-	-	-	13
Laborer, Hand Roller	$72.51	$39.19	$33.32	-	-	-	-	-	-	-	-	-	13
Roller Operator (5 tons and under)	$75.01	$41.69	$33.32	-	-	-	-	-	-	-	-	-	13
Roller Operator (over 5 tons)	$76.44	$43.12	$33.32	-	-	-	-	-	-	-	-	-	13
Screed Person	$76.24	$42.92	$33.32	-	-	-	-	-	-	-	-	-	13
EQUIPMENT OPERATOR:													
Combination Loader/Backhoe (over 3/4 cu. yd.)	$75.28	$41.96	$33.32	-	-	-	-	-	-	-	-	-	13
Combination Loader/Backhoe (up to 3/4 cu. yd.)	$74.30	$40.98	$33.32	-	-	-	-	-	-	-	-	-	13
Concrete saws and/or Grinder (self-propelled unit on streets, highways, airports and canals)	$76.24	$42.92	$33.32	-	-	-	-	-	-	-	-	-	13
Grader, Soil Stabilizer, Cold Planer	$77.07	$43.75	$33.32	-	-	-	-	-	-	-	-	-	13
Loader (2-1/2 cu. yds. and under)	$76.24	$42.92	$33.32	-	-	-	-	-	-	-	-	-	13
Loader (over 2-1/2 cu. yds. to and including 5 cu. yds.)	$76.56	$43.24	$33.32	-	-	-	-	-	-	-	-	-	13
TRUCK DRIVER:													
Assistant to Engineer	$75.01	$41.69	$33.32	-	-	-	-	-	-	-	-	-	13
Oil Tanker (double), Hot Liquid Asphalt Tanker	$76.56	$43.24	$33.32	-	-	-	-	-	-	-	-	-	13
Semi-Trailer, Semi-Dump, Asphalt Distributor	$76.24	$42.92	$33.32	-	-	-	-	-	-	-	-	-	13
Slip-in or Pup	$76.56	$43.24	$33.32	-	-	-	-	-	-	-	-	-	13
Single or Rock Cans Tandem Dump Truck (8 cu. yds. & under, water level)	$75.28	$41.96	$33.32	-	-	-	-	-	-	-	-	-	13
Single or Rock Cans Tandem Dump Truck (over 8 cu. yds., water level)	$75.59	$42.27	$33.32	-	-	-	-	-	-	-	-	-	13
Tractor Trailer (hauling equipment)	$76.67	$43.35	$33.32	-	-	-	-	-	-	-	-	-	13
Utility, Flatbed	$75.01	$41.69	$33.32	-	-	-	-	-	-	-	-	-	13
* **BOILERMAKER (Note: 2 increases in 2018)**	**9/17/18**			**10/1/18**									
	$66.08	$36.36	$29.72	$67.08	$36.36	$30.72	-	-	-	-	-	-	13
* **CARPENTER:**	**9/17/18**												
Carpenter; Patent Scaffold Erector (14 feet and over); Piledriver; Pneumatic Nailer	$71.20	$49.45	$21.75	-	-	-	-	-	-	-	-	-	1,13
Millwright	$71.45	$49.70	$21.75	-	-	-	-	-	-	-	-	-	1,13
Power Saw Operator (2 h.p. & above)	$71.35	$49.60	$21.75	-	-	-	-	-	-	-	-	-	1,13
* **CEMENT FINISHER:**	**9/17/18**												
Cement Finisher; Curb Setter; Precast Panel Setter; Manhole Builder	$69.43	$39.80	$29.63	-	-	-	-	-	-	-	-	-	2,13
Trowel Machine Operator	$69.58	$39.95	$29.63	-	-	-	-	-	-	-	-	-	2,13
CHAIN-LINK FENCE ERECTOR	**10/2/17**			**10/1/18**									
	$36.55	$22.60	$13.95	$38.75	$24.00	$14.75	-	-	-	-	-	-	10,13
* **CHLORINATOR**	**9/17/18**												
	$32.79	$29.63	$3.16	-	-	-	-	-	-	-	-	-	

Classification	Current			2018			2019			2020			Remarks See Pg 6-8
	Prevailing Wage Total	Basic Hourly Rate	Fringe Hourly Rate	Prevailing Wage Total	Basic Hourly Rate	Fringe Hourly Rate	Prevailing Wage Total	Basic Hourly Rate	Fringe Hourly Rate	Prevailing Wage Total	Basic Hourly Rate	Fringe Hourly Rate	
* **DIVER:**	**9/17/18**												
Diver (Aqua Lung) (Scuba) - Up to a depth of 30 feet	$89.39	$56.63	$32.76	-	-	-	-	-	-	-	-	-	13
Diver (Aqua Lung) (Scuba) - Over a depth of 30 feet	$98.76	$66.00	$32.76	-	-	-	-	-	-	-	-	-	13
Stand-By Diver (Aqua Lung) (Scuba)	$80.01	$47.25	$32.76	-	-	-	-	-	-	-	-	-	13
Diver (Other than Aqua Lung)	$98.76	$66.00	$32.76	-	-	-	-	-	-	-	-	-	3,13
Stand-By Diver (Other than Aqua Lung)	$80.01	$47.25	$32.76	-	-	-	-	-	-	-	-	-	3,13
Tender (Other than Aqua Lung)	$76.98	$44.22	$32.76	-	-	-	-	-	-	-	-	-	13
* **DRAPERY INSTALLER**	**9/17/18**												
	$19.02	$16.50	$2.52	-	-	-	-	-	-	-	-	-	
* **DRYWALL INSTALLER**	**9/17/18**												
	$71.45	$49.70	$21.75	-	-	-	-	-	-	-	-	-	13
DRYWALL TAPERS/FINISHERS	**2/19/18**												1/1/1900
	$68.25	$42.10	$26.15	-	-	-	-	-	-	-	-	-	
ELECTRICIAN (Note: 2 increases for 2019)	**8/26/18**						**2/17/19**			**2/23/20**			
Cable Splicer (inside/outside)	$83.98	$54.78	$29.20	-	-	-	$84.67	$55.33	$29.34	$86.17	$56.43	$29.74	4,13
Ground Worker (outside)	$61.83	$37.35	$24.48	-	-	-	$62.30	$37.73	$24.57	$63.36	$38.48	$24.88	4,13
Heavy Equipment Operator (outside)	$71.31	$44.82	$26.49	-	-	-	$71.90	$45.27	$26.63	$73.13	$46.17	$26.96	4,13
Line Installer (outside); Wire Installer (inside)	$77.65	$49.80	$27.85	-	-	-	$78.28	$50.30	$27.98	$79.66	$51.30	$28.36	4,13
							8/25/19						
Cable Splicer (inside/outside)	-	-	-	-	-	-	$85.48	$55.88	$29.60	-	-	-	4,13
Ground Worker (outside)	-	-	-	-	-	-	$62.87	$38.10	$24.77	-	-	-	4,13
Heavy Equipment Operator (outside)	-	-	-	-	-	-	$72.56	$45.72	$26.84	-	-	-	4,13
Line Installer (outside); Wire Installer (inside)	-	-	-	-	-	-	$79.01	$50.80	$28.21	-	-	-	4,13
* **Telecommunication Worker**	**9/17/18**												
Licensed Technician	$43.30	$30.94	$12.36	-	-	-	-	-	-	-	-	-	13
Technician I / Splicer	$41.50	$29.39	$12.11	-	-	-	-	-	-	-	-	-	13
ELEVATOR CONSTRUCTOR MECHANIC	**2/19/18**												
	$90.005	$57.36	$32.645	-	-	-	-	-	-	-	-	-	13
* **EQUIPMENT OPERATOR:**	**9/17/18**												
Group 1	$74.70	$41.94	$32.76	-	-	-	-	-	-	-	-	-	5,13
Group 2	$74.81	$42.05	$32.76	-	-	-	-	-	-	-	-	-	5,13
Group 3	$74.98	$42.22	$32.76	-	-	-	-	-	-	-	-	-	5,13
Group 4	$75.25	$42.49	$32.76	-	-	-	-	-	-	-	-	-	5,13
Group 5	$75.56	$42.80	$32.76	-	-	-	-	-	-	-	-	-	5,13
Group 6	$76.21	$43.45	$32.76	-	-	-	-	-	-	-	-	-	5,13
Group 7	$76.53	$43.77	$32.76	-	-	-	-	-	-	-	-	-	5,13
Group 8	$76.64	$43.88	$32.76	-	-	-	-	-	-	-	-	-	5,13
Group 9	$76.75	$43.99	$32.76	-	-	-	-	-	-	-	-	-	5,13
Group 9A	$76.98	$44.22	$32.76	-	-	-	-	-	-	-	-	-	5,13
Group 10	$77.04	$44.28	$32.76	-	-	-	-	-	-	-	-	-	5,13
Group 10A	$77.19	$44.43	$32.76	-	-	-	-	-	-	-	-	-	5,13
Group 11	$77.34	$44.58	$32.76	-	-	-	-	-	-	-	-	-	5,13
Group 12	$77.70	$44.94	$32.76	-	-	-	-	-	-	-	-	-	5,13
Group 12A	$78.06	$45.30	$32.76	-	-	-	-	-	-	-	-	-	5,13

Classification	Current			2018			2019			2020			Remarks See Pg 6-8
	Prevailing Wage Total	Basic Hourly Rate	Fringe Hourly Rate	Prevailing Wage Total	Basic Hourly Rate	Fringe Hourly Rate	Prevailing Wage Total	Basic Hourly Rate	Fringe Hourly Rate	Prevailing Wage Total	Basic Hourly Rate	Fringe Hourly Rate	
FENCE ERECTOR (CHAIN-LINK TYPE)													
See Chain-Link Fence Erector	-	-	-	-	-	-	-	-	-	-	-	-	
FLOOR LAYER (CARPET, LINOLEUM & SOFT TILE)	**3/4/18**												
	$63.47	$34.15	$29.32	-	-	-	-	-	-	-	-	-	13
* **GLAZIER**	**9/17/18**												
	$69.78	$38.00	$31.78	-	-	-	-	-	-	-	-	-	6,13
* **HELICOPTER WORK:**	**9/17/18**												
Airborne Hoist Operator	$78.56	$45.80	$32.76	-	-	-	-	-	-	-	-	-	13
Co-Pilot	$78.70	$45.94	$32.76	-	-	-	-	-	-	-	-	-	13
Pilot	$78.87	$46.11	$32.76	-	-	-	-	-	-	-	-	-	13
INSULATOR	**9/2/18**						**9/1/19**			**8/30/20**			
	$65.10	$40.40	$24.70	-	-	-	$65.90	$40.90	$25.00	$67.30	$41.90	$25.40	7,12,13
* **IRONWORKER:**	**9/17/18**						**9/1/19**			**9/1/20**			
Reinforcing, Structural	$73.80	$40.25	$33.55	-	-	-	$76.02	$41.50	$34.52	$76.02	$41.50	$34.52	8,12,13
LABORER:	**9/3/18**												
Driller	$58.66	$38.40	$20.26	-	-	-	-	-	-	-	-	-	1,13
Gunite Operator or Shotcrete Operator	$58.16	$37.90	$20.26	-	-	-	-	-	-	-	-	-	1,13
High Scaler (Working Suspended)	$58.16	$37.90	$20.26	-	-	-	-	-	-	-	-	-	13
Laborer I	$57.66	$37.40	$20.26	-	-	-	-	-	-	-	-	-	1,13
Laborer II	$55.06	$34.80	$20.26	-	-	-	-	-	-	-	-	-	1,13
Light/Final Clean-up (Janitorial) Laborer	$44.92	$28.80	$16.12	-	-	-	-	-	-	-	-	-	1,13
Mason Tender/Hod Carrier	$58.16	$37.90	$20.26	-	-	-	-	-	-	-	-	-	1,13
Powder Blaster	$58.66	$38.40	$20.26	-	-	-	-	-	-	-	-	-	1,13
Window Washer (Outside) (On bosun's chair, cable-suspended scaffold or work platform)	$57.16	$36.90	$20.26	-	-	-	-	-	-	-	-	-	13
LANDSCAPER:	**9/3/18**						**9/2/19**						
Landscape & Irrigation Laborer A	$38.18	$25.50	$12.68	-	-	-	$39.60	$26.15	$13.45	-	-	-	
Landscape & Irrigation Laborer B	$39.08	$26.40	$12.68	-	-	-	$40.60	$27.15	$13.45	-	-	-	
Landscape & Irrigation Maintenance Laborer	$33.78	$21.10	$12.68	-	-	-	$35.00	$21.55	$13.45	-	-	-	
* **LATHER**	**9/17/18**												
	$71.45	$49.70	$21.75	-	-	-	-	-	-	-	-	-	13
MASON; Bricklayer;	**9/18/17**												
Cement Blocklayer; Stone Mason; Precast Sill Setter	$68.23	$39.76	$28.47	-	-	-	-	-	-	-	-	-	2,13
Pointer-Caulker-Weatherproofer	$68.48	$40.01	$28.47	-	-	-	-	-	-	-	-	-	2,13
* **PAINTER: (Note: 2 increases for 2019 & 2010)**	**1/1/18**						**1/1/19**			**1/1/20**			
Painter; Spray Painter; Sandblaster or Waterblaster; Thermoplastic Striper; Paper Hanger	$66.21	$37.35	$28.86	-	-	-	$67.74	$38.35	$29.39	$68.44	$38.80	$29.64	
							7/1/19			**7/1/20**			
Painter; Spray Painter; Sandblaster or Waterblaster Thermoplastic Striper; Paper Hanger	-	-	-	-	-	-	$68.44	$38.80	$29.64	$68.44	$38.80	$29.64	

Classification	Current			2018			2019			2020			Remarks See Pg 6-8
	Prevailing Wage Total	Basic Hourly Rate	Fringe Hourly Rate	Prevailing Wage Total	Basic Hourly Rate	Fringe Hourly Rate	Prevailing Wage Total	Basic Hourly Rate	Fringe Hourly Rate	Prevailing Wage Total	Basic Hourly Rate	Fringe Hourly Rate	
* **PLASTERER:**	**9/17/18**												
	$70.97	$41.34	$29.63	-	-	-	-	-	-	-	-	-	2,13
PLUMBER: (Note: 2 increases for 2019 & 2020)	**7/1/18**						**1/6/19**			**1/5/20**			
Plumber; Pipefitter; Refrigeration Fitter; Heating & Air Conditioning Fitter; Sprinkler Fitter; Steamfitter	$68.87	$42.85	$26.02	-	-	-	$69.59	$43.35	$26.24	$71.06	$44.35	$26.71	9,13
							7/7/19			**7/5/20**			
Plumber; Pipefitter; Refrigeration Fitter; Heating & Air Conditioning Fitter; Sprinkler Fitter; Steamfitter	-	-	-	-	-	-	$70.34	$43.85	$26.49	$71.81	$44.85	$26.96	9.13
ROOFER:	**9/2/18**						**9/1/19**			**9/7/20**			
Shingle, Tile, Built-up Roofing	$58.60	$40.50	$18.10	-	-	-	$59.35	$41.15	$18.20	$60.10	$41.80	$18.30	12
Coal Tar Pitch	$99.10	$81.00	$18.10	-	-	-	$100.50	$82.30	$18.20	$101.90	$83.60	$18.30	
SANDBLASTER OR WATERBLASTER:													
Use wages of craft to which sand or water blasting is incidental.													
SHEETMETAL WORKER: (Note: 2 increases in 2019)	**9/2/18**						**3/3/19**						
	$69.99	$42.55	$27.44	-	-	-	$70.66	$42.85	$27.81	-	-	-	13
							9/1/19						
				-	-	-	$71.23	$43.13	$28.10	-	-	-	13
* **TERMITE TREATER**	**9/17/18**												
	$16.39	$14.00	$2.39	-	-	-	-	-	-	-	-	-	
TERRAZZO:	**9/3/18**												
Terrazzo Setter	$70.52	$41.70	$28.82	-	-	-	-	-	-	-	-	-	2,13
Terrazzo Base Grinder	$68.71	$39.89	$28.82	-	-	-	-	-	-	-	-	-	2,13
Certified Terrazzo Floor Grinder and Tender	$67.16	$38.34	$28.82	-	-	-	-	-	-	-	-	-	2,13
Terrazzo Floor Grinder	$64.16	$35.34	$28.82	-	-	-	-	-	-	-	-	-	2,13
TILE SETTER:	**9/3/18**												
Ceramic Hard Tile; Marble Setter	$70.52	$41.70	$28.82	-	-	-	-	-	-	-	-	-	2,13
Certified Ceramic Tile & Marble Helper	$67.16	$38.34	$28.82	-	-	-	-	-	-	-	-	-	2,13
* **TRUCK DRIVER:**	**9/17/18**												
Concrete Mixer	$40.34	$37.50	$2.84	-	-	-	-	-	-	-	-	-	
Concrete Mixer/Booster	$48.05	$34.53	$13.52	-	-	-	-	-	-	-	-	-	
Dump Truck, 8 cu. yds. & under (water level); Water Truck (up to & including 2,000 gallons)	$75.25	$42.49	$32.76	-	-	-	-	-	-	-	-	-	13
Flatbed, Utility, etc.	$74.98	$42.22	$32.76	-	-	-	-	-	-	-	-	-	13
End Dump, Unlicensed (Euclid, Mack, Caterpillar, or similar); Tractor Trailer (hauling equipment)	$76.64	$43.88	$32.76	-	-	-	-	-	-	-	-	-	13
Semi-Trailer, Rock Cans, or Semi-Dump	$76.21	$43.45	$32.76	-	-	-	-	-	-	-	-	-	13
Slip-in or Pup	$76.53	$43.77	$32.76	-	-	-	-	-	-	-	-	-	13
Tandem Dump Truck, over 8 cu. yds. (water level); Water Truck (over 2,000 gallons)	$75.56	$42.80	$32.76	-	-	-	-	-	-	-	-	-	13

Classification	Current			2018			2019			2020			
	Prevailing Wage Total	Basic Hourly Rate	Fringe Hourly Rate	Prevailing Wage Total	Basic Hourly Rate	Fringe Hourly Rate	Prevailing Wage Total	Basic Hourly Rate	Fringe Hourly Rate	Prevailing Wage Total	Basic Hourly Rate	Fringe Hourly Rate	Remarks See Pg 6-8
UNDERGROUND LABORER:	**9/3/18**												
Worker in a raise, shaft, or tunnel.													
Group 1	$58.26	$38.00	$20.26	-	-	-	-	-	-	-	-	-	13
Group 2	$59.76	$39.50	$20.26	-	-	-	-	-	-	-	-	-	13
Group 3	$60.26	$40.00	$20.26	-	-	-	-	-	-	-	-	-	13
Group 4	$61.26	$41.00	$20.26	-	-	-	-	-	-	-	-	-	13
Group 5	$61.51	$41.25	$20.26	-	-	-	-	-	-	-	-	-	13
Group 6	$61.61	$41.35	$20.26	-	-	-	-	-	-	-	-	-	13
Group 7	$61.86	$41.60	$20.26	-	-	-	-	-	-	-	-	-	13
Group 8	$62.31	$42.05	$20.26	-	-	-	-	-	-	-	-	-	13
* **WATER FRONT CONSTRUCTION (DREDGING):**	**9/17/18**												
CLAMSHELL OR DIPPER DREDGES:													
Clamshell or Dipper Operator	$77.70	$44.94	$32.76	-	-	-	-	-	-	-	-	-	11,13
Mechanic; Welder; Watch Engineer	$77.04	$44.28	$32.76	-	-	-	-	-	-	-	-	-	13
Deckmate; Bargemate	$76.64	$43.88	$32.76	-	-	-	-	-	-	-	-	-	13
Fire Person; Oiler; Deckhand; Barge Worker	$74.98	$42.22	$32.76	-	-	-	-	-	-	-	-	-	13
HYDRAULIC SUCTION DREDGES:													
Lever Operator	$77.34	$44.58	$32.76	-	-	-	-	-	-	-	-	-	13
Mechanic; Welder	$77.04	$44.28	$32.76	-	-	-	-	-	-	-	-	-	13
Watch Engineer (steam or electric)	$77.19	$44.43	$32.76	-	-	-	-	-	-	-	-	-	13
Dozer Operator	$76.98	$44.22	$32.76	-	-	-	-	-	-	-	-	-	13
Deckmate	$76.64	$43.88	$32.76	-	-	-	-	-	-	-	-	-	13
Winch Operator (stern winch on dredge)	$76.53	$43.77	$32.76	-	-	-	-	-	-	-	-	-	13
Fire Person; Oiler; Deckhand (can operate anchor scow under direction of deckmate); Levee Operator	$74.98	$42.22	$32.76	-	-	-	-	-	-	-	-	-	13
DERRICKS:													
Operator: Derrick, Piledriver, Crane	$77.70	$44.94	$32.76	-	-	-	-	-	-	-	-	-	13
Deckmate; Saurman Type Dragline (up to & including 5 yds.)	$76.64	$43.88	$32.76	-	-	-	-	-	-	-	-	-	13
Saurman Type Dragline (over 5 cu. yds.)	$77.04	$44.28	$32.76	-	-	-	-	-	-	-	-	-	13
Fire Person; Oiler; Deckhand	$74.98	$42.22	$32.76	-	-	-	-	-	-	-	-	-	13
BOAT OPERATORS:													
Master Boat Operator	$77.34	$44.58	$32.76	-	-	-	-	-	-	-	-	-	13
Boat Operator	$77.19	$44.43	$32.76	-	-	-	-	-	-	-	-	-	13
Boat Deckhand	$74.98	$42.22	$32.76	-	-	-	-	-	-	-	-	-	13
* **WATER WELL DRILLER:**	**9/17/18**												
Water Well Driller	$46.21	$31.00	$15.21	-	-	-	-	-	-	-	-	-	
Water Well Driller Helper	$31.69	$18.00	$13.69	-	-	-	-	-	-	-	-	-	
WELDER:													
Use wages of craft to which welding is incidental, except for Chain-Link Fence Erector. See remark.													10

Comments: Overtime must be paid at one and one-half times the basic hourly rate plus the hourly cost of required fringe benefits.

*** Indicates a wage, fringe benefit, remark, or title change from the previous bulletin.**

REMARKS:

1. Carpenter, Laborer (excluding High Scaler, Window Washer): $.50 per hour shall be added to the regular straight-time rate for height pay for each hour while working from a bosun's chair and/or from a cable-suspended scaffold or work platform which is free swinging (not attached to building) for each hour worked on said rig.

2. Cement Finisher, Mason, Plasterer, Terrazzo, Tile Setter: $1.00 per hour shall be added to the regular straight-time rate for height pay for each hour while working from a bosun's chair and/or from a cable-suspended scaffold or work platform which is free swinging (not attached to building) for each hour worked on said rig.

3. Diver (Other than Aqua Lung), Stand-By Diver (Other than Aqua Lung):

   A. On any dive exceeding 50 feet, the diver shall, in addition, be paid the following amount of "depth money":

50 feet to 100 feet	$1.50 per foot in excess of 50 feet
100 feet to 150 feet	$100.00 plus $2.00 per foot in excess of 100 feet
150 feet to 200 feet	$200.00 plus $3.00 per foot in excess of 150 feet

   B. When it is necessary for a Diver to enter any pipe, tunnel or other enclosure, the said Diver shall, in addition to the hourly rate, receive a premium in accordance with the following schedule for distance traveled from the entrance of the pipe, tunnel or other enclosure:

      1) When able to stand erect, but in which there is no vertical ascent:

5 feet to 50 feet	$5.00 per day
50 feet to 100 feet	$7.50 per day
100 feet to 150 feet	$12.50 per day
Greater than 150 feet	The premium shall be increased an additional $7.50 for each succeeding 50 feet.

      2) When unable to stand erect and in which there is no vertical ascent:

5 feet to 50 feet	$5.00 per day
50 feet to 100 feet	$7.50 per day
100 feet to 150 feet	$12.50 per day
150 feet to 200 feet	$36.75 per day
200 feet to 300 feet	$1.00 per foot
300 feet to 450 feet	$1.50 per foot
450 feet to 600 feet	$2.50 per foot

4. Electrician:

   A. One and one-half times the straight-time rate while working in a tunnel under construction; under water with aqualung equipment; in a completed tunnel which has only one entrance or exit providing access to safety and where no other personnel are working; or in an underground structure having no access to safety or where no other personnel are working.

   B. Double the straight-time rate shall be paid for the following types of hazardous work regardless if fall prevention devices are used:

      1) While working from poles, trusses, stacks, towers, tanks, bosun's chairs, swinging or rolling scaffolds, supporting structures, and open platforms, over 70 feet from the ground where the employee is subject to a free fall; provided, however, that when work is performed on stacks, towers or permanent platforms where the employees are on a firm footing within an enclosure, a hazardous condition does not exist regardless of height;
      2) While working outside of a railing or enclosure, or temporary platforms extending outside of a building, or from scaffolding or ladder within an enclosure where an employee's footing is within one foot of the top of such railing, and the employee is subject to a free fall of over 70 feet;
      3) Working on buildings while leaning over the railing or edge of the building, and is subject to a free fall of 70 feet; or
      4) Two hours minimum hazardous pay per day shall be paid while climbing to a stack, tower or permanent platform which exceeds 70 feet from the ground but where the employee is on a firm footing within an enclosure.

   C. Five percent per hour shall be added to the hourly wage for height pay while working above 9,000 feet elevation.

REMARKS:

5. Equipment Operator:

A. Operators and Assistants to Engineer (climbing a boom) of cranes (under 50 tons) with booms of eighty feet or more (including jib) or of cranes (under 50 tons) with leads of one hundred feet or more, shall receive additional premium according to the following schedule:

	Per Hour
Booms of 80 feet up to, or leads of 100 feet up to, but not including 130 feet	$0.50
Booms and/or leads of 130 feet up to, but not including 180 feet	$0.75
Booms and/or leads of 180 feet up to and including 250 feet	$1.15
Booms and/or leads over 250 feet	$1.50

Operators and Assistants to Engineer (climbing a boom) of cranes (50 tons and over) with booms of 180 feet or more (including jib) shall receive additional premium according to the following schedule:

	Per Hour
Booms of 180 feet up to and including 250 feet	$1.25
Booms over 250 feet	$1.75

Note: The boom shall be measured from the center of the heel pin to the center of the boom or jib point sheave.

B. $1.25 per hour shall be added to the hourly wage while operating a rig suspended by ropes or cables or to perform work on a Yo-Yo Cat.

C. In a raise or shaft, a premium of $.40 per hour will be paid in addition to the regular straight time wage.
A raise is defined to be an underground excavation (lined or unlined) whose length exceeds its width and the inclination of the grade from the excavation is greater than 20 degrees from the horizontal.
A shaft is defined to be an excavation (lined or unlined) made from the surface of the earth, generally vertical in nature, but may decline up to 75 degrees from the vertical, and whose depth is greater than 15 feet and its largest horizontal dimension. Includes an underground silo.

D. In a tunnel, a premium of $.30 per hour will be paid in addition to the regular straight time wages.
A tunnel is defined to be an underground excavation (lined or unlined) whose length exceeds its width and the inclination of the grade from the excavation is no greater than 20 degrees from the horizontal.

6. Glazier: $1.00 per hour shall be added to the hourly wage for height pay for exterior glazing work performed in a walking/working surface with an unprotected side or edge 10 feet or more above a lower level which requires protection from fall hazards by guardrail systems, safety net systems, personal fall arrest systems, position devise systems, fall restraint systems, perimeter safety cables or controlled decking zones.

7. Insulator: Six percent per hour shall be added to the hourly wage for hazardous pay while working from a boatswain chair, staging or free standing scaffolding erected from the ground up or mezzanine floor subject to a free fall and skyclimber suspended from a permanent structure and when working above 40 feet.

8. Ironworker: $.50 per hour shall be added to the hourly wage while working in tunnels or coffer dams. $1.00 per hour shall be added to the hourly wage while working under or covered with water (submerged), or on the summits of Mauna Kea, Mauna Loa or Haleakala.

9. Plumber: One and one-half times the straight-time rate for height pay while working from OSHA approved trusses, stacks, towers, tanks, bosun's chair, swinging or rolling scaffolding, supporting structures or on open platforms where the employee is subject to a direct fall of 40 feet or more. Provided, however, that when said work is performed where the employee is on a firm footing within an enclosure, a hazardous condition does not exist regardless of height. $1.00 per hour shall be added to the straight-time rate while working with flame cutting or any type of welding equipment on any galvanized material or product for at least an hour.

10. Chain-Link Fence Erector: $1.00 per hour shall be added to the hourly wage while performing welding services.

11. Water Front Construction: Clamshell or Dipper Operator: $.50 per hour shall be added to the straight-time rate while working with boom (including jib) over 130 feet.

12. Possible wage/fringe option increases:
Insulator: Effective WRS: 9/1/19 - $0.25; 8/30/20 - $0.25
Ironworker: Effective WRS 9/1/19 - $0.27
Roofer: Effective 9/1/19 - $0.75; 9/7/20 - $0.80

REMARKS:

13. Overtime/Holiday must be paid at one and one-half times the basic hourly rate, plus the hourly cost of required fringe, with the following exceptions:

A. ***Two times*** *the basic hourly rate, plus the hourly cost of required fringe.*

Asphalt Paving: Sunday, New Year's Day, Martin Luther King Day, Presidents' Day, Memorial Day, Kamehameha Day, Fourth of July, Labor Day, Veterans' Day, Thanksgiving Day and Christmas Day.

Boilermaker: Sunday, New Year's Day, President's Day, Memorial Day, Kamehameha Day, July 4th, Labor Day, Veteran's Day, Thanksgiving Day and Christmas Day.

Diver: Sunday, New Year's Day, Martin Luther King Day, Presidents' Day, Memorial Day, Kamehameha Day, Fourth of July, Labor Day, Veterans' Day, Thanksgiving Day and Christmas Day.

Electrician: Sunday, New Year's Day, Presidents' Day, Memorial Day, Kamehameha Day, Fourth of July, Labor Day, Thanksgiving Day and Christmas Day.

Elevator Constructor: Saturday, Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day and Christmas Day.

Equipment Operator: Sunday, New Year's Day, Martin Luther King Day, Presidents' Day, Memorial Day, Kamehameha Day, Fourth of July, Labor Day, Veterans' Day, Thanksgiving Day and Christmas Day.

Floor Layer: Labor Day.

Glazier: Sunday.

Helicopter Worker: Sunday, New Year's Day, Martin Luther King Day, Presidents' Day, Memorial Day, Kamehameha Day, Fourth of July, Labor Day, Veterans' Day, Thanksgiving Day and Christmas Day.

Ironworker: Sunday, New Year's Day, Presidents' Day, Memorial Day, Kamehameha Day, Fourth of July, Labor Day, Veteran's Day, Thanksgiving Day and Christmas Day.

Plumber: Sunday, New Year's Day, Martin Luther King Jr. Day, President's Day, Memorial Day, Kamehameha Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day and Christmas Day.

Sheetmetal Worker: Sunday, New Year's Day, Martin Luther King Day, President's Day, Memorial Day, Kamehameha Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day and Christmas Day.

Telecommunication: Sunday, New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day.

Truck Driver, except Concrete Mixer & Concrete Mixer/Booster: Sunday, New Year's Day, Martin Luther King Day, Presidents' Day, Memorial Day, Kamehameha Day, Fourth of July, Labor Day, Veterans' Day, Thanksgiving Day and Christmas Day.

Water Front Construction (Dredging): Sunday, New Year's Day, Martin Luther King Day, Presidents' Day, Memorial Day, Kamehameha Day, Fourth of July, Labor Day, Veterans' Day, Thanksgiving Day and Christmas Day.

B. ***Three times*** *the basic hourly wage, plus the hourly cost of required fringe* ***on Labor Day.***

Carpenter
Cement Finisher
Chain Link Fence Erector
Drywall Installer
Insulator
Laborer
Lather
Mason
Plasterer
Terrazzo
Tile Setter
Underground Laborer

APPRENTICE SCHEDULE BULLETIN NO. 493 September 17, 2018

Rates are applicable only to apprentices who are parties to agreements registered with the Department of Labor and where the journeyworker to apprentice ratio is met.

Apprentice Classifications	Interval Hrs	BASIC HOURLY RATE 1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	FRINGE BENEFIT HOURLY RATE Total	Remarks See Pg 8-9
* BOILERMAKER	1000	$25.45	$27.27	$29.08	$30.90	$32.72	$34.54					$29.72	10
(Effective 10/1/18)													
* BOILERMAKER	1000	$25.45	$27.27	$29.08	$30.90	$32.72	$34.54					$30.72	10
* CARPENTER													
Indentured Prior to 9/1/02	1000	$19.78										$12.62	1,10
"	1000		$22.25	$24.73	$29.67	$34.62	$39.56	$44.51	$46.98			$21.45	1,10
Indentured After 9/1/02	1000	$19.78										$8.62	1,10
"	1000		$22.25									$12.75	1,10
"	1000			$24.73	$29.67							$15.25	1,10
"	1000					$34.62	$39.56					$17.25	1,10
"	1000							$44.51	$46.98			$19.25	1,10
* CEMENT FINISHER													
Indentured Prior to 9/1/03	1000	$19.90										$10.07	2,10
"	1000		$21.89	$23.88	$27.86	$29.85	$31.84	$33.83	$35.82			$29.63	2,10
Indentured On or After 9/1/03	1000	$19.90	$21.89	$23.88	$27.86	$29.85	$31.84	$33.83	$35.82			$16.23	2,10
* CONSTRUCTION EQUIPMENT OPERATOR													
Indentured On or After 9/1/02	1000	$22.11										$9.00	3,10
"	1000		$24.32									$19.93	3,10
"	1000			$26.53								$20.92	3,10
"	1000				$30.95							$22.91	3,10
"	1000					$35.38						$24.89	3,10
"	1000						$39.80					$26.88	3,10
* DRYWALL INSTALLER													
Indentured Prior to 9/1/02	1000	$19.88										$12.62	10
"	1000		$22.37	$24.85	$29.82	$34.79	$39.76	$44.73	$47.22			$21.75	10
Indentured After 9/1/02	1000	$19.88										$8.62	10
"	1000		$22.37									$12.75	10
"	1000			$24.85	$29.82							$15.25	10
"	1000					$34.79	$39.76					$17.25	10
"	1000							$44.73	$47.22			$19.25	10

APPRENTICE SCHEDULE BULLETIN NO. 493 September 17, 2018

Rates are applicable only to apprentices who are parties to agreements registered with the Department of Labor and where the journeyworker to apprentice ratio is met.

Apprentice Classifications	Interval Hrs	BASIC HOURLY RATE 1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	FRINGE BENEFIT HOURLY RATE Total	Remarks See Pg 8-9
DRYWALL TAPERS/FINISHERS	1000	$16.84	$18.94	$21.05	$23.15	$25.26						$9.90	
	1000						$27.36					$10.40	
	1000							$31.57	$35.78			$13.90	
ELECTRICIAN (WIRE & LINE INSTALLER)	1000	$17.43										$9.62	10
" "	1000		$19.92									$9.96	10
" "	1000			$22.41								$16.53	4,10
" "	1000				$24.90							$17.55	4,10
" "	1000					$27.39						$18.58	4,10
" "	1000						$29.88					$19.62	4,10
" "	1000							$32.37				$20.64	4,10
" "	1000								$34.86			$21.68	4,10
" "	1000									$39.84		$23.73	4,10
" "	1000										$44.82	$25.78	4,10
(Effective 2/17/19)													
* ELECTRICIAN (WIRE & LINE INSTALLER)													
" "	1000	$17.61										$9.65	10
" "	1000		$20.12									$9.98	10
" "	1000			$22.64								$16.58	4,10
" "	1000				$25.15							$17.61	4,10
" "	1000					$27.67						$18.65	4,10
" "	1000						$30.18					$19.69	4,10
" "	1000							$32.70				$20.73	4,10
" "	1000								$35.21			$21.76	4,10
" "	1000									$40.24		$23.84	4,10
" "	1000										$45.27	$25.92	4,10
ELEVATOR CONSTRUCTOR	850	$28.68										-	10
"	850		$31.55									$32.645	10
"	1700			$37.28	$40.15	$45.89						$32.645	10
FLOOR LAYER													
Indentured after 2/27/94	1000	$15.37	$17.08									$19.32	10
" "	1000			$18.78	$20.49							$24.32	10
" "	1000					$22.20	$23.91	$27.32	$30.74			$29.32	10

APPRENTICE SCHEDULE BULLETIN NO. 493 September 17, 2018

Rates are applicable only to apprentices who are parties to agreements registered with the Department of Labor and where the journeyworker to apprentice ratio is met.

Apprentice Classifications	Interval Hrs	BASIC HOURLY RATE 1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	FRINGE BENEFIT HOURLY RATE Total	Remarks See Pg 8-9
* GLAZIER													
Indentured On or After 7/1/99	1000	$17.10										$29.14	5,10
"	1000		$19.00									$29.38	5,10
"	1000			$20.90								$29.62	5,10
"	1000				$22.80							$29.86	5,10
"	1000					$26.60						$30.34	5,10
"	1000						$28.50					$30.58	5,10
"	1000							$30.40				$30.82	5,10
"	1000								$32.30			$31.06	5,10
"	1000									$34.20		$31.30	5,10
"	1000										$36.10	$31.54	5,10
* HEAVY DUTY REPAIRER & WELDER													
Indentured on or after 9/1/02	1000	$22.11										$9.00	3,10
"	1000		$24.32									$19.93	3,10
"	1000			$26.53								$20.92	3,10
"	1000				$30.95							$22.91	3,10
"	1000					$35.38						$24.89	3,10
"	1000						$37.59					$25.90	3,10
"	1000							$39.80				$26.88	3,10
"	1000								$42.01			$27.89	3,10
INSULATOR													
Indentured After 5/3/95	2000	$20.20										$7.80	6,10
"	2000		$20.20									$18.21	6,10
"	2000			$24.24								$18.55	6,10
"	2000				$28.28							$18.90	6,10
"	2000					$32.32						$19.24	6,10
* IRONWORKER (REINFORCING & STRUCTURAL)													
Indentured After 10/31/93	1000	$20.13										$27.63	7,10
"	1000		$22.14									$28.22	7,10
"	1000			$24.15								$28.81	7,10
"	1000				$28.18							$29.99	7,10
"	1000					$32.20						$31.18	7,10
"	1000						$36.23					$32.37	7,10

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Apprentice Classifications	Interval Hrs	BASIC HOURLY RATE 1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	FRINGE BENEFIT HOURLY RATE Total	Remarks See Pg 8-9
LABORER I													
CONSTRUCTION CRAFT													
Indentured On or After 9/3/02	1000	$18.70										$8.10	1,10
"	1000		$22.44	$26.18	$29.92							$14.90	1,10
HAZARDOUS WASTE MATERIAL TECHNICIAN													
"	1000	$18.70										$6.70	1,10
"	1000		$22.44	$26.18	$29.92							$13.00	1,10
LANDSCAPER	1000	$16.58										$6.70	
"	1000		$17.85	$19.13	$20.40							$10.43	
MASON													
BRICKLAYER													
Indentured prior to 9/1/03	1000	$19.88										$9.12	2,10
	1000		$21.87	$23.86	$27.83	$29.82	$31.81	$33.80	$35.78			$28.47	2,10
Indentured On or After 9/1/03	1000	$19.88	$21.87	$23.86	$27.83	$29.82	$31.81	$33.80	$35.78			$15.87	2,10
STONE MASON													
Indentured On or After 9/1/03	1000	$21.87	$23.86	$25.84	$27.83	$29.82	$31.81	$33.80	$35.78			$15.87	2,10
POINTER-CAULKER-WEATHERPROOFER													
Indentured On or After 9/1/03	1000	$20.01	$22.01	$24.01	$28.01	$32.01	$36.01					$15.87	2,10
PAINTER	1000	$16.81										$9.25	
"	1000		$18.68	$20.54	$22.41	$24.28						$12.75	
"	1000						$26.15					$13.75	
"	1000							$28.01	$31.75			$14.50	
(Effective 1/1/19)													
* PAINTER	1000	$17.26										$9.25	
"	1000		$19.18	$21.09	$23.01	$24.93						$12.75	
"	1000						$26.85					$13.75	
"	1000							$28.76	$32.60			$14.50	
* PAVING EQUIPMENT OPERATOR	1000	$23.61										$9.00	10
"	1000		$30.04									$20.37	10
"	1000			$34.34								$23.49	10
"	1000				$38.63							$27.63	10

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Apprentice Classifications	Interval Hrs	BASIC HOURLY RATE 1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	FRINGE BENEFIT HOURLY RATE Total	Remarks See Pg 8-9
* PLASTERER													
Indentured On or After 9/1/03	1000	$16.54	$18.60	$20.67	$22.74	$24.80	$28.94	$33.07	$37.21			$16.23	2,10
PLUMBER:													
PLUMBER; FIRE SPRINKLER FITTER; REFRIGERATION													
AIR CONDITIONING; STEAMFITTER-WELDER													
Indentured On or After 9/2/85	1000	$17.23										$6.94	8,10
"	1000		$17.23									$6.99	8,10
"	1000			$20.35								$9.97	8,10
"	1000				$20.35							$9.97	8,10
"	1000					$23.57						$10.70	8,10
"	1000						$23.57					$10.70	8,10
"	1000							$27.85				$11.61	8,10
"	1000								$27.85			$11.61	8,10
"	1000									$32.14		$12.27	8,10
"	1000										$32.14	$12.27	8,10
(Effective 1/6/19)													
* PLUMBER:													
PLUMBER; FIRE SPRINKLER FITTER; REFRIGERATION													
AIR CONDITIONING; STEAMFITTER-WELDER													
Indentured On or After 9/2/85	1000	$17.43										$7.94	8,10
"	1000		$17.43									$7.99	8,10
"	1000			$20.59								$10.97	8,10
"	1000				$20.59							$10.97	8,10
"	1000					$23.84						$11.70	8,10
"	1000						$23.84					$11.70	8,10
"	1000							$28.18				$12.61	8,10
"	1000								$28.18			$12.61	8,10
"	1000									$32.51		$13.27	8,10
"	1000										$32.51	$13.27	8,10

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Apprentice Classifications	Interval Hrs	BASIC HOURLY RATE 1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	FRINGE BENEFIT HOURLY RATE Total	Remarks See Pg 8-9
ROOFER													
Indentured Prior to 11/1/98	1000	$18.23	$20.25	$24.30								$13.85	9
"	1000				$28.35	$32.40	$36.45	$38.48				$18.10	
Indentured On or After 11/1/98 and Prior to 11/4/12	1000	$18.23	$20.25	$24.30								$13.85	9
"	1000				$28.35	$32.40	$34.43	$36.45	$38.48			$18.10	
Indentured On or After 11/4/12	2000	$18.23	$24.30									$13.85	9
"	2000			$32.40	$36.45							$18.10	9
SHEETMETAL WORKER													
"	1000	$17.02										$12.20	10
"	1000		$19.15									$12.40	10
"	1000			$21.28								$22.09	10
"	1000				$23.40							$22.63	10
"	1000					$25.53						$23.15	10
"	1000						$27.66					$23.69	10
"	1000							$29.79				$24.23	10
"	1000								$31.91			$24.77	10
"	1000									$34.04		$25.30	10
"	1000										$36.17	$25.83	10
(Effective 3/3/19)													
* SHEETMETAL WORKER													
"	1000	$17.14										$12.32	10
"	1000		$19.28									$12.53	10
"	1000			$21.43								$22.40	10
"	1000				$23.57							$22.94	10
"	1000					$25.71						$23.48	10
"	1000						$27.85					$24.03	10
"	1000							$30.00				$24.56	10
"	1000								$32.14			$25.11	10
"	1000									$34.28		$25.65	10
"	1000										$36.42	$26.19	10

APPRENTICE SCHEDULE BULLETIN NO. 493 September 17, 2018

Rates are applicable only to apprentices who are parties to agreements registered with the Department of Labor and where the journeyworker to apprentice ratio is met.

Apprentice Classifications	Interval Hrs	BASIC HOURLY RATE 1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th	FRINGE BENEFIT HOURLY RATE Total	Remarks See Pg 8-9
* TELECOMMUNICATION WORKER	1000	$17.63										$10.10	10
(TECHNICIAN I / SPLICER)	1000		$19.10									$10.35	10
" "	1000			$20.57								$10.60	10
" "	1000				$22.04							$10.84	10
" "	1000					$23.51						$11.10	10
" "	1000						$26.45					$11.60	10
TILE SETTER													
CERAMIC & HARD TILE													
Indentured Prior to 9/1/03	1000	$20.85										$9.57	2,10
"	1000		$22.94	$25.02	$29.19	$31.28	$33.36	$35.45	$37.53			$28.82	2,10
Indentured On or After 9/1/03	1000	$20.85	$22.94	$25.02	$29.19	$31.28	$33.36	$35.45	$37.53			$16.27	2,10

*** Indicates a wage, fringe benefit, remark, or title change from the previous bulletin.**

REMARKS:

1. Carpenter, Construction Craft Laborer: $.50 per hour shall be added to the regular straight-time rate for height pay for each hour while working from a bosun's chair and/or from a cable-suspended scaffold or work platform which is free swinging (not attached to building) for each hour worked on said rig.

2. Cement Finisher, Mason, Plasterer, Tile Setter: $1.00 per hour shall be added to the regular straight-time rate for height pay for each hour while working from a bosun's chair and/or from a cable-suspended scaffold or work platform which is free swinging (not attached to building) for each hour worked on said rig.

3. Construction Equipment Operator, Heavy Duty Repairer & Welder: $1.25 per hour shall be added to the hourly wage while operating a rig suspended by ropes or cables or to perform work on a Yo-Yo Cat.

4. Electrician:
   A. One and one-half times the straight-time rate while working in a tunnel under construction; under water with aqualung equipment; in a completed tunnel which has only one entrance or exit providing access to safety and where no other personnel are working; or in an underground structure having no access to safety or where no other personnel are working.
   B. Double the straight-time rate shall be paid for the following types of hazardous work regardless if fall prevention devices are used:
      1) While working from poles, trusses, stacks, towers, tanks, bosun's chairs, swinging or rolling scaffolds, supporting structures, and open platforms, over 70 feet from the ground where the employee is subject to a free fall; provided, however, that when work is performed on stacks, towers or permanent platforms where the employees are on a firm footing within an enclosure, a hazardous condition does not exist regardless of height;
      2) While working outside of a railing or enclosure, or temporary platforms extending outside of a building, or from scaffolding or ladder within an enclosure where an employee's footing is within one foot of the top of such railing, and the employee is subject to a free fall of over 70 feet;
      3) Working on buildings while leaning over the railing or edge of the building, and is subject to a free fall of 70 feet; or
      4) Two hours minimum hazardous pay per day shall be paid while climbing to a stack, tower or permanent platform which exceeds 70 feet from the ground but where the employee is on a firm footing within an enclosure.
   C. Five percent per hour shall be added to the hourly wage for height pay while working above 9,000 feet elevation.

5. Glazier: $1.00 per hour shall be added to the hourly wage for height pay for exterior glazing work performed in a walking/working surface with an unprotected side or edge 10 feet or more above a lower level which requires protection from fall hazards by guardrail systems, safety net systems, personal fall arrest systems, position devise systems, fall restraint systems, perimeter safety cables or controlled decking zones.

6. Insulator: Six percent per hour shall be added to the hourly wage for hazardous pay while working from a boatswain chair, staging or free standing scaffolding erected from ground up or mezzanine floor subject to a free fall and skyclimber suspended from a permanent structure and when working above 40 feet.

7. Ironworker: $.50 per hour shall be added to the hourly wage while working in tunnels or coffer dams. $1.00 per hour shall be added to the hourly wage while working under or covered with water (submerged), or on the summits of Mauna Kea, Mauna Loa or Haleakala.

8. Plumber: One and one-half times the straight-time rate for height pay while working from OSHA approved trusses, stacks, towers, tanks, bosun's chair, swinging or rolling scaffolding, supporting structures or on open platforms where the employee is subject to a direct fall of 40 feet or more. Provided, however, that when said work is performed where the employee is on a firm footing within an enclosure, a hazardous condition does not exist regardless of height. $1.00 per hour shall be added to the straight-time rate while working with flame cutting or any type of welding equipment on any galvanized material or product for at least an hour.

9. Roofer: When an apprentice has accumulated 2500 hours, $4.25 will be added to his/her pension/annuity plan.
   The apprenticeship program for apprentices indentured on or after November 4, 2012, consists of four steps with 2,000 hours for each step.

REMARKS:

10. Overtime/Holiday must be paid at one and one-half times the basic hourly rate, plus the hourly cost of required fringe, with the following exceptions:

A. ***Two times*** *the basic hourly rate, plus the hourly cost of required fringe.*

Boilermaker: Sunday, New Year's Day, Presidents' Day, Memorial Day, Kamehameha Day, July 4th, Labor Day, Veteran's Day, Thanksgiving Day and Christmas Day.

Construction Equipment Operator: Sunday, New Year's Day, Martin Luther King Day, Presidents' Day, Memorial Day, Kamehameha Day, Fourth of July, Labor Day, Veterans' Day, Thanksgiving Day and Christmas Day.

Electrician: Sunday, New Year's Day, Presidents' Day, Memorial Day, Kamehameha Day, Fourth of July, Labor Day, Thanksgiving Day and Christmas Day.

Elevator Constructor: Saturday, Sunday, New Year's Day, Memorial Day, Independence Day, Labor Day, Veterans' Day, Thanksgiving Day and Christmas Day.

Floor Layer: Labor Day.

Glazier: Sunday.

Heavy Duty Repairer & Welder: Sunday, New Year's Day, Martin Luther King Day, Presidents' Day, Memorial Day, Kamehameha Day, Fourth of July, Labor Day, Veterans' Day, Thanksgiving Day and Christmas Day.

Ironworker: Sunday, New Year's Day, Presidents' Day, Memorial Day, Kamehameha Day, Fourth of July, Labor Day, Veteran's Day, Thanksgiving Day and Christmas Day.

Paving Equipment Operator: Sunday, New Year's Day, Martin Luther King Day, Presidents' Day, Memorial Day, Kamehameha Day, Fourth of July, Labor Day, Veterans' Day, Thanksgiving Day and Christmas Day.

Plumber: Sunday, New Year's Day, Martin Luther King Jr. Day, President's Day, Memorial Day, Kamehameha Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day and Christmas Day.

Sheetmetal Worker: Sunday, New Year's Day, Martin Luther King Day, President's Day, Memorial Day, Kamehameha Day, Independence Day, Labor Day, Veteran's Day, Thanksgiving Day and Christmas Day.

Telecommunication Worker: Sunday, New Year's Day, Presidents' Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day and Christmas Day.

B. ***Three times*** *the basic hourly wage, plus the hourly cost of required fringe* ***on Labor Day.***

Carpenter
Cement Finisher
Drywall Installer
Insulator
Construction Craft Laborer
Mason
Plasterer
Tile Setter

STATE OF HAWAII
DEPARTMENT OF LABOR AND INDUSTRIAL RELATIONS

List of Construction Trades in Registered Apprenticeship Programs

Apprenticeship programs for the following construction trades were approved and registered by the State Department of Labor and Industrial Relations in accordance with Chapter 372, Hawaii Revised Statutes, and Title 12, Chapter 30, Hawaii Administrative Rules. Union and non-union programs are listed separately. The minimum requirements are not exclusive as a program sponsor may add other requirements in their selection procedures.

Trade	Sponsor	Union	Non-Union	Date of Approval/ Registration	No. of Hours of On-the-Job Training	Minimum Requirements	Contact Information
Boilermaker	**Western States Area Joint Apprenticeship Committee** **(International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmith, Forgers, and Helpers and Subordinate, Lodge No. 627, AFL-CIO, and the Western States Joint Apprenticeship Committee, and Association of Boilermaker Employers)**	**x**		**03/18/1991**	**6,000**	• **At least 18 years old** • **High school graduate or GED equivalent**	Coordinator Address: PO Box 1612 Page, Arizona 86040 Phone: (928)645-0277 Website: **http://www/westermstatesjac/org/** *No training staff currently based in Hawaii
Bricklayer-Mason	**Joint Apprenticeship Committee for Bricklayer-Mason** **(Masonry Contractors Association of Hawaii and Other Signatory Employers and Local 1 of Hawaii of the Bricklayers and Allied Craftsmen International Union, AFL-CIO)**	**x**		**02/10/1964**	**8,000**	• **At least 16 years old** • **High school graduate or GED equivalent** • **Physically able to perform duties of the trade**	Director of Training or Training Coordinator Address: Hawaii Masons & Plasterers Training 1188 Sand Island Parkway Honolulu, HI 96819 Phone: (808) 848-0565 Fax: (808) 847-7068 Website: http://www.bacweb.org

Trade	Sponsor	Union	Non-Union	Date of Approval/ Registration	No. of Hours of On-the-Job Training	Minimum Requirements	Contact Information
Carpenter	**Carpenters Joint Apprenticeship Committee *aka* Hawaii Carpenters Apprenticeship and Training Program** **(General Contractors Association of Hawaii and Building Industry Labor Association and Other Signatory Contractors and the United Brotherhood of Carpenters and Joiners of America, Local 745 AFL-CIO)**	**x**		**04/01/1964**	**8,000**	• **At least 17 years old** • **High school diploma or equivalent education, or equivalent work experience** • **Pass basic math test** • **Complete questionnaire** • **Able to lift 75 lbs.**	Director of Training Address: 1311 Houghtailing Street Room 201 Honolulu, HI 96817 Phone: (808) 848-0794 Ext. 5 Fax: (808) 841-5961 (808) 841-0300 Website: http://www.carpenters.org/
Carpenter	**Associated Builders and Contractors Apprenticeship Committee**		**x**	**02/08/1990**	**8,000**	• **At least 18 years old** • **High school diploma or GED** • **Full-time employee of a member company for a period of not less than six continuous weeks** • **Legally able to work** • **Physically able to perform duties of the trade**	Director of Training Address: 1375 Dillingham Blvd. Suite 200 Honolulu, HI 96817 Phone: (808) 845-4887 Fax: (808) 847-7876 Website: http://www.abchawaii.org/
Cement Finisher	**Joint Apprenticeship Committee for Cement Finishers** **(Operative Plasterers and Cement Finishers International Association, Local 630, AFL-CIO, and Local 1 of the International Union of Bricklayers and Allied Craftsmen, AFL-CIO)**	**x**		**04/01/1961**	**8,000**	• **At least 16 years old** • **Physically able to perform duties of the trade**	Director of Training or Training Coordinator Address: Hawaii Masons & Plasterers Training 1188 Sand Island Parkway Honolulu, HI 96819 Phone: (808) 848-0565 Fax: (808) 847-7068 Website: http://www.opcmia.org/ http://www.bacweb.org

Trade	Sponsor	Union	Non-Union	Date of Approval/ Registration	No. of Hours of On-the-Job Training	Minimum Requirements	Contact Information
Construction Craft Laborer	**Hawaii Laborers' Joint Apprenticeship Committee** **(International Union of North America, Local 368, and Signatory Contractors Association)**	**x**		**02/11/2000**	**4,000**	• **At least 18 years old** • **High school diploma or GED** • **Driver's license** • **Successfully complete Pre-Construction Apprentice Evaluation Course**	Director of Training Address: 96-138 Farrington Hwy. Pearl City, HI 96782 Phone: (808) 455-7979 Fax: (808) 456-8689 Website: http://www.liuna.org/
Construction Equipment Operator	**Hawaii Joint Apprenticeship Committee for Operating Engineers** **(General Contractors Labor Association and the Building Industry Labor Association and International Union of Operating Engineers, Local Union #3, AFL-CIO)**	**x**		**11/14/1967**	**6,000**	• **At least 18 years old** • **High school diploma or GED or C-based test** • **Physically able to perform duties of the trade** • **School transcripts** • **Driver's license** • **Current State DOT PUC physical** • **Pass industry or general knowledge test** • **Have reliable transportation**	State Administrator Address: P.O. Box 428 Kahuku, HI 96731-0428 Phone: (808) 232-2001 Fax: (808) 232-2217 Website: http://oe3.org/training/
Drywall, Acoustic and Lather Installer	**Carpenters Joint Apprenticeship Committee *aka* Hawaii Carpenters Apprenticeship and Training Program** **(General Contractors Association of Hawaii and Building Industry Labor Association and Other Signatory Contractors and the United Brotherhood of Carpenters and Joiners of America, Local 745, AFL-CIO)**	**x**		**04/06/1988**	**8,000**	• **At least 17 years old** • **High school diploma or GED** • **Complete questionnaire** • **Pass basic math test** • **Able to lift 100 lbs.**	Director of Training Address: 1311 Houghtailing Street Room 201 Honolulu, HI 96817 Phone: (808) 848-0794 Ext. 5 Fax: (808) 848-5961 (808) 841-0300 Website: http://www.carpenters.org/

Trade	Sponsor	Union	Non-Union	Date of Approval/ Registration	No. of Hours of On-the-Job Training	Minimum Requirements	Contact Information
Electrical Wireperson	**PECA-HEW Joint Apprenticeship Committee** **(Pacific Electrical Contractors Association and the Hawaii Electrical Workers Division of Laborers International, Local 368)**	**x**		**11/20/1991**	**10,000**	• **At least 18 years old** • **High school diploma or GED** • **Pass color code test** • **Pass aptitude test** • **Transcript of high school or post high school courses** • **Pass one-year high school Algebra 1 (not pre-Algebra) or higher** • **Valid driver's license**	Training Coordinator Address: 1617 Palama Street Honolulu, HI 96817 Phone: (808) 841-5877 Ext 234 Fax: (808) 847-7829 Website: N/A
Electrician	**Associated Builders and Contractors Apprenticeship Committee**		**x**	**02/08/1990**	**10,000**	• **At least 18 years old** • **High school diploma or GED** • **Full-time employee of a member company for a period of not less than six continuous weeks** • **Legally able to work** • **Physically able to perform duties of the trade** • **Pass eye examination for color blindness** • **Completed one-year high school algebra (not pre-algebra)**	Director of Training Address: 1375 Dillingham Blvd. Suite 200 Honolulu, HI 96817 Phone: (808) 845-4887 Fax: (808) 847-7876 Website: http://www.abchawaii.org/
(Electrician) Wireperson	**Hawaii Electricians Joint Apprenticeship Committee** **(International Brotherhood of Electrical Workers (IBEW) Local 1186, AFL-CIO, and Signatory Employers)**	**x**		**04/08/1947**	**10,000**	• **At least 18 years old** • **High school diploma or GED** • **Complete the National Joint Apprenticeship and Training Committee Math Course or one-year high school Algebra 1** • **Transcript of high school or post high school**	Apprenticeship or Training Coordinator Address: 1935 Hau Street Room 301 Honolulu, HI 96819 Phone: (808) 847-0629 Fax: (808) 843-8818 Website: http://www.njatc.org/

Trade	Sponsor	Union	Non-Union	Date of Approval/ Registration	No. of Hours of On-the-Job Training	Minimum Requirements	Contact Information
						courses • Pass industry aptitude test to qualify for oral interview • Application fee (non-refundable)	
Elevator Constructor	International Union of Elevator Constructors Local 126 Joint Apprenticeship Committee (International Union of Elevator Constructors, Local 126 and Signatory Employers)	x		03/27/2003	6,800	• At least 18 years old • High school diploma or GED • School transcripts • Pass aptitude test (math, reading) • Pass medical exam • Physically able to perform duties of the trade	Business Representative Address: 707 Alakea Street Room 314 Honolulu, HI 96813 Phone: (808) 536-8653 Fax: (808) 537-3779 Website: http://iuec.org/
Fire Sprinkler Fitter	Honolulu Joint Apprenticeship and Training Committee for the Plumbing and Pipefitting Industry *aka* JATC of UA Plumbers and Fitters, Local 675, AFL-CIO, and PAMCAH (Plumbing and Mechanical Contractors Association of Hawaii and United Association of Plumbers and Pipefitters Local 675, AFL-CIO)	x		10/19/1992	10,000	• At least 17 years old • High school diploma or GED • School transcripts • Pass placement evaluation with minimum score of 70% • Driver's license	Training Coordinator Address: 720 Iwilei Road, Suite 222 Honolulu, HI 96817 Phone: (808) 456-0585 Fax: (808) 456-7131 Website: http://www.ua.org/
Floor Layer	Joint Apprenticeship and Training Committee for Floor Layers (Hawaii Floor Covering Association and Carpet, Linoleum, and Soft Tile Union Local 1926, AFL-CIO)	x		02/17/1966	8,000	• At least 18 years old • Driver's license • Distinguish colors • High school diploma or equivalent • Physically able to perform duties	Training Coordinator Address: 2240 Young Street Honolulu, HI 96826 Phone: (808) 942-3988 Fax: (808) 946-6667 Website: http://www.iupat.org/
Glazier	Joint Apprenticeship Committee for Glaziers, Architectural Metal and Glassworkers Industry *aka* Glaziers, Architectural Metal and Glassworkers JATC (Glass/Metal Contractors Association of Hawaii and	x		04/01/2001	10,000	• At least 18 years old • High school diploma or GED • Driver's license • Physically able to perform duties of the trade	Training Coordinator Address: 2240 Young Street Honolulu, HI 96826 Phone: (808) 942-3988 Fax: (808) 946-6667 Website: http://www.iupat.org/

Trade	Sponsor	Union	Non-Union	Date of Approval/ Registration	No. of Hours of On-the-Job Training	Minimum Requirements	Contact Information
	Other Signatory Contractors and the Glaziers, Architectural Metal and Glassworkers Union Local 1889, AFL-CIO)						
Hazardous Waste Material Technician	**Hawaii Laborers; Union Local 368**	**x**		**9/19/2017**	**4000**	• **At least 18 years old** • **High School Diploma or GED** • **Possess a Valid Driver's License** • **Pass a Pre-Evaluation course** • **Physical abilities to perform duties of the trade**	96-138 Farrington Highway Pearl City, Hawaii 96782 Phone (808) 455-7979
Heat and Frost Insulator	**Honolulu Joint Apprenticeship Committee for the Heat and Frost Asbestos Insulator Trade** **(Heat and Frost Insulators and Asbestos Workers, Local 132, and Signatory Participating Employers)**	**x**		**07/23/1971**	**10,000**	• **At least 18 years old** • **High school diploma or GED** • **Physically able to perform duties of the trade**	Training Coordinator Address: 1019 Lauia Street Bay #4 Kapolei, HI 96707 Phone: (808) 521-6405 Fax: (808) 523-9861 Website: http://www.insulators.org/
Heavy Duty Repairman and Welder	**Hawaii Joint Apprenticeship Committee for Operating Engineers** **(General Contractors Labor Association and the Building Industry Labor Association and International Union of Operating Engineers, Local Union #3, AFL-CIO)**	**x**		**11/14/1967**	**8,000**	• **At least 18 years old** • **High school diploma or GED or C-based test** • **Physically able to perform duties of the trade** • **School transcripts** • **Driver's license** • **Current State DOT PUC physical** • **Ranked on general knowledge and hands on test** • **Have reliable transportation**	State Administrator Address: P.O. Box 428 Kahuku, HI 96731-0428 Phone: (808) 232-2001 Fax: (808) 232-2217 Website: http://oe3.org/training/
Ironworker Shop Fabricator / Welder	**Hawaii Shopmen's Local 803 Joint Apprenticeship and Training Committee** **(International Association of Bridge,**	**x**		**12/31/1963**	**8,000**	• **At least 18 years old** • **High school diploma or GED** • **Physically able to perform duties of the trade**	Training Coordinator Address: 94-497 Ukee Street Waipahu, HI 96797 Phone: (808) 671-4344

Trade	Sponsor	Union	Non-Union	Date of Approval/ Registration	No. of Hours of On-the-Job Training	Minimum Requirements	Contact Information
	Structural and Ornamental Ironworkers, Local 803, AFL-CIO, and Participating Employers)					• **Must be sponsored by employer who is signatory to the Shopmen's Local 803 collective bargaining agreement**	Fax: (808) 676-1144 Website: http://www.ironworkers.org/
Ironworker (Reinforcing)	**Joint Apprenticeship Committee for Ironworker (Reinforcing) *aka* Ironworkers Joint Apprenticeship Committee (Reinforcing)** **(International Association of Bridge, Structural and Ornamental Ironworkers, Local 625, AFL-CIO and Participating Employers)**	**x**		**06/26/1953**	**6,000**	• **At least 16 years old** • **Physically able to perform duties of the trade**	Training Coordinator Address: 94-497 Ukee Street Waipahu, HI 96797 Phone: (808) 671-8225 Fax: (808) 676-1144 Website: http://www.ironworkers.org/

Trade	Sponsor	Union	Non-Union	Date of Approval/ Registration	No. of Hours of On-the-Job Training	Minimum Requirements	Contact Information
Ironworker (Structural)	**Joint Apprenticeship Committee for Ironworker (Structural) *aka* Ironworkers Joint Apprenticeship Committee (Structural)** **(International Association of Bridge, Structural and Ornamental Ironworkers, Local 625, AFL-CIO and Participating Employers)**	**x**		**03/01/1961**	**6,000**	• **At least 16 years old** • **Physically able to perform duties of the trade**	Training Coordinator Address: 94-497 Ukee Street Waipahu, HI 96797 Phone: (808) 671-8225 Fax: (808) 676-1144 Website: http://www.ironworkers.org/
Landscape and Irrigation Laborer	**Hawaii Laborers Union Local 368**	**x**		**03/30/2016**	**4,000**	• **At least 18 years old** • **High school diploma or GED or 10th grade education** • **Valid driver's license** • **Complete and pass the Pre-Landscape and Irrigation Apprentice Evaluation Course**	Director of Training Address: 96-138 Farrington Hwy. Pearl City, HI 96782 Phone: (808) 455-7979 Fax: (808) 456-8689 Website: http://www.liuna.org/
Painter	**Joint Apprenticeship and Training Committee for Painters** **(Painting and Decorating Contractors of Hawaii (PDCA) and the International Union of Painters and Allied Trades (IUPAT) Local 1791, AFL-CIO)**	**x**		**09/01/1961**	**8,000**	• **At least 18 years old** • **High school diploma or GED** • **Driver's license** • **Physically able to perform the duties of the trade** • **Pass color code vision test** • **Pass entry level test of math and vocabulary**	Training Coordinator Address: 2240 Young Street Honolulu, HI 96826 Phone: (808) 947-6606 Fax: (808) 942-0195 Websites: http://www.dc50.org/ http://www.iupat.org/
Painter	**Associated Builders and Contractors Apprenticeship Committee**		**x**	**05/02/1990**	**8,000**	• **At least 18 years old** • **Full-time employee of a member company for a period of not less than six continuous weeks** • **Legally able to work** • **Physically able to perform duties of the trade** • **Pass physical examination if required by Committee**	Director of Training Address: 1375 Dillingham Blvd. Suite 200 Honolulu, HI 96817 Phone: (808) 845-4887 Fax: (808) 847-7876 Website: http://www.abchawaii.org/

Trade	Sponsor	Union	Non-Union	Date of Approval/ Registration	No. of Hours of On-the-Job Training	Minimum Requirements	Contact Information
Painter	**Color Dynamics, Inc.**		**x**	**12/01/1989**	**8,000**	• **At least 16 years old** • **Physically fit to perform duties of the trade** • **Must not be color blind**	President Address: 816 Gulick Avenue Honolulu, HI 96819 Phone: (808) 848-7000 Fax: (808) 842-0800 Website: http://www.colordynamics.com
Painter	**Kawika's Painting**		**x**	**10/01/1984**	**8,000**	• **At least 16 years old** • **Physically fit to perform duties of the trade** • **Must not be color blind**	President Address: 2147 Eluwene Street Honolulu, HI 96819 Phone: (808) 848-0003 Fax: (808) 842-1908 Website: http://www.kawikaspainting.com
Paving Equipment Operator	**Hawaii Joint Apprenticeship Committee for Operating Engineers** **(General Contractors Labor Association and the Building Industry Labor Association and International Union of Operating Engineers, Local Union #3, AFL-CIO)**	**x**		**04/29/2010**	**4,000**	• **At least 18 years old** • **High school diploma or GED or C-based test** • **Physically able to perform duties of the trade** • **School transcripts** • **Driver's license showing address in HI** • **Current State DOT PUC physical** • **Ranked on general knowledge and hands on test** • **Have reliable transportation**	State Administrator Address: P.O. Box 428 Kahuku, HI 96731-0428 Phone: (808) 232-2001 Fax: (808) 232-2217 Website: http://oe3.org/training/
Plasterer	**Joint Apprenticeship Committee for Plasterers** **(Pacific Bureau for Lathing and Plastering and the Operative Plasterers and Cement Finishers Association of the U.S. and**	**x**		**06/30/1959**	**8,000**	• **At least 16 years old** • **Physically able to perform duties of the trade**	Director of Training or Training Coordinator Address: Hawaii Masons & Plasterers Training 1188 Sand Island Parkway Honolulu, HI 96819

Trade	Sponsor	Union	Non-Union	Date of Approval/ Registration	No. of Hours of On-the-Job Training	Minimum Requirements	Contact Information
	Canada, Local 630, AFL-CIO)						Phone: (808) 848-0565 Fax: (808) 847-7068 Website: http://www.opcmia.org/ http://www.bacweb.org
Plumber	Honolulu Joint Apprenticeship and Training Committee for the Plumbing and Pipefitting Industry *aka* JATC of UA Plumbers and Fitters, Local 675, AFL-CIO, and PAMCAH (Plumbing and Mechanical Contractors Association of Hawaii and United Association of Plumbers and Pipefitters Local 675, AFL-CIO)	x		11/14/1952	10,000	• At least 17 years old • High school diploma or GED • School transcripts • Pass placement evaluation with a minimum score of 70% • Driver's license	Training Coordinator Address: 720 Iwilei Road, Suite 222 Honolulu, HI 96817 Phone: (808) 456-0585 Fax: (808) 456-7131 Website: http://www.ua.org/
Plumber	Associated Builders and Contractors Apprenticeship Committee		x	02/02/1999	10,000	• At least 18 years old • Full-time employee of a member company for a period of not less than six continuous weeks • Legally able to work • Physically able to perform duties of the trade • Pass physical examination if required by Committee	Director of Training Address: 1375 Dillingham Blvd. Suite 200 Honolulu, HI 96817 Phone: (808) 845-4887 Fax: (808) 847-7876 Website: http://www.abchawaii.org/
Pointer-Caulker-Weatherproofer	Joint Apprenticeship Committee for Pointer-Caulker-Weatherproofer (Pointing, Caulking and Weatherproofing Contractors and the International Union of Bricklayers and Allied Crafts, Local 1, AFL-CIO)	x		08/23/1995	6,000	• At least 16 years old • High school graduate or GED equivalent • Physically able to perform duties of the trade	Director of Training or Training Coordinator Address: Hawaii Masons & Plasterers Training 1188 Sand Island Parkway Honolulu, HI 96819

Trade	Sponsor	Union	Non-Union	Date of Approval/ Registration	No. of Hours of On-the-Job Training	Minimum Requirements	Contact Information
							Phone: (808) 848-0565 Fax: (808) 847-7068 Website: http://www.bacweb.org
Refrigeration Air-Conditioning	**Honolulu Joint Apprenticeship and Training Committee for the Plumbing and Pipefitting Industry *aka* JATC of UA Plumbers and Fitters, Local 675, AFL-CIO, and PAMCAH** **(Plumbing and Mechanical Contractors Association of Hawaii and United Association of Plumbers and Pipefitters Local 675, AFL-CIO)**	**x**		**09/04/1962**	**10,000**	• **At least 17 years old** • **High school diploma or GED** • **School transcripts** • **Pass placement evaluation with a minimum score of 70%** • **Driver's license**	Training Coordinator Address: 720 Iwilei Road, Suite 222 Honolulu, HI 96817 Phone: (808) 456-0585 Fax: (808) 456-7131 Website: http://www.ua.org/
Roofer	**Joint Apprenticeship and Training Committee for Roofers** **(United Union of Roofers, Waterproofers and Allied Workers, AFL-CIO, Local 221, and All Participating Employers)**	**x**		**01/13/1968**	**8,000**	• **At least 16 years old** • **High school diploma or GED** • **Driver's license** • **Physically able to perform duties of the trade** • **Able to lift 100 lbs.**	Training Director Address: 2045 Kamehameha IV Rd. Room 203 Honolulu, HI 96819 Phone: (808) 847-5757 Fax: (808) 848-8707 Website: http://www.unionroofers.com

Trade	Sponsor	Union	Non-Union	Date of Approval/ Registration	No. of Hours of On-the-Job Training	Minimum Requirements	Contact Information
Roofer	**Associated Builders and Contractors Apprenticeship Committee**		**x**	**01/09/1996**	**7,000**	• **At least 18 years old** • **Full-time employee of a member company for a period of not less than six continuous weeks** • **Legally able to work** • **Physically able to perform duties of the trade** • **Pass physical examination if required by Committee**	Director of Training Address: 1375 Dillingham Blvd. Suite 200 Honolulu, HI 96817 Phone: (808) 845-4887 Fax: (808) 847-7876 Website: http://www.abchawaii.org/
Sheet Metal Worker	**Hawaii Joint Apprenticeship Committee for the Sheet Metal Industry** **(Sheet Metal Contractor's Association and Sheet Metal Workers' International Association, Local 293)**	**x**		**01/02/1958**	**10,000**	• **At least 18 years old** • **High school diploma or GED** • **Complete industry test** • **Driver's license** • **Physically able to perform work**	Apprenticeship Coordinator Address: 1405 North King Street Room 403 Honolulu, HI 96817 Phone: (808) 841-6106 Fax: (808) 841-1842 Website: http://www.smwia.org/
Steamfitter/ Welder	**Honolulu Joint Apprenticeship and Training Committee for the Plumbing and Pipefitting Industry *aka* JATC of UA Plumbers and Fitters, Local 675, AFL-CIO, and PAMCAH** **(Plumbing and Mechanical Contractors Association of Hawaii and United Association of Plumbers and Pipefitters Local 675, AFL-CIO)**	**x**		**02/05/2002**	**10,000**	• **At least 17 years old** • **High school diploma or GED** • **School transcripts** • **Pass placement evaluation with a minimum score of 70%** • **Driver's license**	Training Coordinator Address: 720 Iwilei Road, Suite 222 Honolulu, HI 96817 Phone: (808) 456-0585 Fax: (808) 456-7131 Website: http://www.ua.org/
Stone Mason	**Joint Apprenticeship Committee for Stone Mason Industry** **(Masonry Contractors Association of Hawaii and Local 1 of Hawaii of the Bricklayers and Allied Craftsmen International Union, AFL-CIO, and Other Signatory Employers)**	**x**		**02/10/1964**	**8,000**	• **At least 16 years old** • **High school graduate or GED equivalent** • **Physically able to perform duties of the trade**	Director of Training or Training Coordinator Address: Hawaii Masons & Plasterers Training 1188 Sand Island Parkway Honolulu, HI 96819

Trade	Sponsor	Union	Non-Union	Date of Approval/ Registration	No. of Hours of On-the-Job Training	Minimum Requirements	Contact Information
							Phone: (808) 848-0565 Fax: (808) 847-7068 Website: http://www.bacweb.org
Taper	**Joint Apprenticeship Committee for Tapers** **(Gypsum Drywall Contractors Association of Hawaii and the International Brotherhood of Painters and Allied Trades Tapers Local Union 1944, AFL-CIO)**	**x**		**09/01/1967**	**8,000**	• **At least 18 years old** • **Physically able to perform duties of the trade** • **Driver's license** • **High school diploma or equivalent**	Training Coordinator Address: 2240 Young Street Honolulu, HI 96826 Phone: (808) 941-0991 Fax: (808) 946-6623 Website: http://www.dc50.org/
Telecommunication / CATV Installer Technician	**Hawaii Electricians Joint Apprenticeship Committee** **aka** **Joint Apprenticeship Committee for Telecommunications** **(International Brotherhood of Electrical Workers Local Union 1186, AFL-CIO, and Signatory Employers)**	**x**		**09/16/1998**	**6,000**	• **At least 18 years old** • **High school diploma or GED** • **Complete the National Joint Apprenticeship and Training Committee Math Course or one-year high school Algebra 1** • **Transcript of high school or post high school courses** • **Pass industry aptitude test to qualify for oral interview** • **Application fee (non-refundable)**	Apprenticeship or Training Coordinator Address: 1935 Hau Street Room 301 Honolulu, HI 96819 Phone: (808) 847-0629 Fax: (808) 843-8818 Website: http://www.njatc.org/
Tile Setter	**Joint Apprenticeship Committee for Tile Setters** **(Tile, Marble and Terrazo Contractors Association of Hawaii and Local 1 of Hawaii of the Bricklayers, and Allied Craftsmen International Union of America, AFL-CIO)**	**x**		**06/24/1958**	**8,000**	• **At least 16 years old** • **High school graduate or GED equivalent** • **Physically able to perform duties of the trade**	Director of Training or Training Coordinator Address: Hawaii Masons & Plasterers Training 1188 Sand Island Parkway Honolulu, HI 96819 Phone: (808) 848-0565 Fax: (808) 847-7068 Website: http://www.bacweb.org

Trade	Sponsor	Union	Non-Union	Date of Approval/ Registration	No. of Hours of On-the-Job Training	Minimum Requirements	Contact Information
Truck Operator and Driver	**Hawaii Joint Apprenticeship Committee for Operating Engineers** **(General Contractors Labor Association and the Building Industry Labor Association and International Union of Operating Engineers, Local Union #3, AFL-CIO)**	**x**		**03/01/91**	**2,000**	• **At least 18 years old** • **High school diploma or GED or C-based test** • **Physically able to perform duties of the trade** • **School transcripts** • **Driver's license** • **Current State DOT PUC physical** • **Ranked on general knowledge and hands on test** • **Have reliable transportation**	State Administrator Address: P.O. Box 428 Kahuku, HI 96731-0428 Phone: (808) 232-2001 Fax: (808) 232-2217 Website: http://oe3.org/training/

Years 2018 and 2019

Holidays to be observed by the

HAWAII STATE GOVERNMENT

www.dhrd.hawaii.gov

Website where State Holiday Schedule posted

Year 2018 HAWAII STATE HOLIDAYS

(Hawaii Rev. Statutes, Sec. 8-1)	Day Observed in 2018	Official Date Designated in Statute/Constitution
New Year's Day	Jan. 1 Monday	The first day in January
Dr. Martin Luther King, Jr. Day	Jan. 15 Monday	The third Monday in January
Presidents' Day	Feb. 19 Monday	The third Monday in February
Prince Jonah Kuhio Kalanianaole Day	Mar. 26 Monday	The twenty-sixth day in March
Good Friday	Mar. 30 Friday	The Friday preceding Easter Sunday
Memorial Day	May 28 Monday	The last Monday in May
King Kamehameha I Day	June 11 Monday	The eleventh day in June
Independence Day	July 4 Wednesday	The fourth day in July
Statehood Day	Aug. 17 Friday	The third Friday in August
Labor Day	Sept. 3 Monday	The first Monday in September
General Election Day	Nov. 6 Tuesday	The first Tuesday in Nov. following the first Monday of even-numbered years. *(Hawaii State Constitution, Article 2 – Section 8)*
Veterans' Day	Nov. 12 Monday	The eleventh day in November
Thanksgiving	Nov. 22 Thursday	The fourth Thursday in November
Christmas	Dec. 25 Tuesday	The twenty-fifth day in December

Year 2019 HAWAII STATE HOLIDAYS

(Hawaii Rev. Statutes, Sec. 8-1)	Day Observed in 2019	Official Date Designated in Statute/Constitution
New Year's Day	Jan. 1 Tuesday	The first day in January
Dr. Martin Luther King, Jr. Day	Jan. 21 Monday	The third Monday in January
Presidents' Day	Feb. 18 Monday	The third Monday in February
Prince Jonah Kuhio Kalanianaole Day	Mar. 26 Tuesday	The twenty-sixth day in March
Good Friday	April 19 Friday	The Friday preceding Easter Sunday
Memorial Day	May 27 Monday	The last Monday in May
King Kamehameha I Day	June 11 Tuesday	The eleventh day in June
Independence Day	July 4 Thursday	The fourth day in July
Statehood Day	Aug. 16 Friday	The third Friday in August
Labor Day	Sept. 2 Monday	The first Monday in September
Veterans' Day	Nov. 11 Monday	The eleventh day in November
Thanksgiving	Nov. 28 Thursday	The fourth Thursday in November
Christmas	Dec. 25 Wednesday	The twenty-fifth day in December

FOOTNOTES: For use solely by State government agencies. Federal government and local banking holidays may differ. For State agencies that operate on other than Monday-Friday 7:45 AM to 4:30 PM schedules, also refer to appropriate collective bargaining agreements. Created by the Department of Human Resources Development 8/31/2017; subject to change.

GEOTECHNICAL ENGINEERING EXPLORATION
HONOKAIA NON-POTABLE WATER SYSTEM
DEPARTMENT OF HAWAIIAN HOME LANDS
HAMAKUA DISTRICT, ISLAND OF HAWAII

W.O. 7053-00 FEBRUARY 25, 2015

Prepared for

AKINAKA & ASSOCIATES, LTD.

CLAYTON S. MIMURA
LICENSED PROFESSIONAL ENGINEER
No. 4176-C
HAWAII, U.S.A.

THIS WORK WAS PREPARED BY
ME OR UNDER MY SUPERVISION.

SIGNATURE

4-30-16
EXPIRATION DATE
OF THE LICENSE

GEOLABS, INC.
Geotechnical Engineering and Drilling Services
2006 Kalihi Street • Honolulu, HI 96819

Hawaii • California

GEOLABS, INC.

Geotechnical Engineering and Drilling Services

February 25, 2015
W.O. 7053-00

Mr. Charles L. Jury, P.E.
Akinaka & Associates, Ltd.
3375 Koapaka Street, Suite B-206
Honolulu, HI 96819

Dear **Mr. Jury:**

Geolabs, Inc. is pleased to submit our report entitled "Geotechnical Engineering Exploration, Honokaia Non-Potable Water System, Department of Hawaiian Home Lands, Hamakua District, Island of Hawaii" prepared for the design of the project.

Our work was performed in general accordance with the scope of services outlined in our fee proposal dated March 21, 2014.

Please note that the soil samples recovered during our field exploration (remaining after testing) will be stored for a period of two months from the date of this report. The samples will be discarded after that date unless arrangements are made for a longer sample storage period. Please contact our office for alternative sample storage requirements, if appropriate.

Detailed discussion and specific design recommendations are contained in the body of this report. If there is any point that is not clear, please contact our office.

Very truly yours,

GEOLABS, INC.

Clayton S. Mimura, P.E.
President

CSM:AJF:mj

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Hawaii • California

GEOTECHNICAL ENGINEERING EXPLORATION

HONOKAIA NON-POTABLE WATER SYSTEM

DEPARTMENT OF HAWAIIAN HOME LANDS

HAMAKUA DISTRICT, ISLAND OF HAWAII

W.O. 7053-00 FEBRUARY 25, 2015

TABLE OF CONTENTS

GEOTECHNICAL ENGINEERING EXPLORATION

HONOKAIA NON-POTABLE WATER SYSTEM

DEPARTMENT OF HAWAIIAN HOME LANDS

HAMAKUA DISTRICT, ISLAND OF HAWAII

W.O. 7053-00 FEBRUARY 25, 2015

SUMMARY OF FINDINGS AND RECOMMENDATIONS

Our field exploration at the Lower Tank Site generally encountered a surface layer of volcanic ash that graded with depth to weathered basalt rock formation while our field exploration at the Upper Tank Site generally encountered medium dense granular fill materials ranging in thickness from about 2.5 to 8 feet overlying ash soil and weathered basalt rock formation. We did not encounter groundwater in the excavated test pits at the time of our field exploration.

In general, volcanic ash soils typically are relatively soft and will compress when subjected to structural and vehicular loads. Consequently, volcanic ash soils generally have poor structural characteristics with respect to foundation and pavement support. In addition, ash soils have thixotropic properties (i.e., they temporarily lose strength when remolded or are subjected to vibrations, such as seismic events). Therefore, to the extent practicable, the surface ash soils should be over-excavated and removed from structural areas to basalt rock formation and replaced with compacted structural fill materials.

Based on the anticipated structural loads and the subsurface conditions encountered, we believe shallow foundations consisting of spread and/or continuous footings may be used to support the proposed new water tank structures. We recommend over-excavating the volcanic ash soils at the Lower Tank Site to the underlying basalt formation and replacing with well-compacted structural fill. Similarly, we recommend over-excavating the existing fill materials encountered at the Upper Tank Site a minimum depth of 3 feet below water tank foundations and replacing with well-compacted structural fill materials. In addition, this over-excavation and replacement with well-compacted structural fill materials should extend a lateral distance of at least 3 feet beyond the perimeter of the water tank foundations.

Structural fill materials should consist of well-graded granular materials generally less than 6 inches in maximum dimension with sufficient fines to prevent the occurrence of voids in the compacted mass. The existing granular fill materials encountered at the Upper Tank Site may be re-used as a source of structural fill materials, provided that they are free of vegetation, deleterious materials, and rock fragments greater than 6 inches in maximum dimension. Excavated ash soils should not be re-used as structural fill materials. The structural fill materials should be compacted to a minimum of 95 percent relative compaction.

Based on our experience in the vicinity of the project site, cavities and/or voids may be present in the hard basaltic lava flows. To reduce the potential for loss of foundation support resulting from the collapse of cavities below foundations, a cavity probing and grouting program is generally implemented for new foundations during construction. However, the weathered basalt encountered below the Lower Tank site consisted primarily of clinker, which does not contain cavities or lava tubes. Therefore, it is our opinion that probing and grouting may be omitted.

Conventional earthwork and construction methods may be used for the proposed project grading. Based on the anticipated grading and our field exploration, excavation for this project will generally consist of excavations for foundation construction and infrastructure installation. Some of the excavations may encounter boulders and involve cuts into the underlying basalt formation. It is anticipated that most of the material may be excavated with normal heavy excavation equipment. However, deep excavations and excavations into basalt formations may require the use of hoerams or trenching machines. We recommend encouraging contractors bidding on this project to examine the site conditions and soil data to make their own interpretation.

The text of this report should be referred to for detailed discussions and specific geotechnical recommendations.

END OF SUMMARY OF FINDINGS AND RECOMMENDATIONS

SECTION 1. GENERAL

This report presents the results of our geotechnical engineering exploration performed for the *Honokaia Non-Potable Water System* project in the Hamakua District of the Island of Hawaii. The project location and general vicinity are shown on the Project Location Map, Plate 1.

This report summarizes the findings and geotechnical recommendations resulting from our field exploration, laboratory testing, and engineering analyses. These findings and geotechnical recommendations are intended for the design of water tank foundations, site grading, pavements, and utilities only. The findings and recommendations presented herein are subject to the limitations noted at the end of this report.

1.1 Project Considerations

The proposed Honokaia Non-Potable Water System project is to the south of the Old Mamalahoa Highway, between Honokaa and Waimea, in the Hamakua District of the Island of Hawaii. We understand the project involves constructing a non-potable water system consisting of underground water lines and two non-potable steel water tanks with capacities of about 40,500 and 45,000-gallons for the Department of Hawaiian Home Lands (DHHL) Honokaia Pastoral Lots.

Based on the information provided, the proposed 40,500 and 45,000-gallon water tanks will be located off the eastern side of Alanui Honokaia Road on Lots 4 and 5, respectively. We understand the 40,500-gallon water tank proposed for Lot 4 is being referred to as the Lower Tank Site, while the 45,000-gallon water tank proposed for Lot 5 is referred to as the Upper Tank Site. Details of the water tank foundations were not available at the time this report was prepared; however, it is anticipated that the water tanks will be supported by spread or continuous concrete foundations.

A grading plan was not provided at the time this report was prepared; however, it is anticipated that minimal grading will be required to achieve the design project site elevations and will generally consist of excavations for foundation construction.

1.2 Purpose and Scope

The purpose of our exploration was to obtain an overview of the surface and subsurface conditions to develop an idealized soil/rock data set to formulate geotechnical engineering recommendations for design of the project. The work was performed in general accordance with our fee proposal dated March 21, 2014. The scope of work for this exploration included the following tasks and work efforts:

1. Research and review of available in-house soils and geologic information for the project site and its vicinity.

2. Mobilization and demobilization of a Case 590L Super backhoe and operator to the project site and back.

3. Excavation and sampling of four test pits extending to depths of about 8 to 11 feet below the existing ground surface. Two bulk samples were collected for laboratory testing.

4. Coordination of the field exploration and logging of the test pits by our field engineer.

5. Laboratory testing of selected soil samples obtained during the field exploration as an aid in classifying the materials and evaluating their engineering properties.

6. Analyses of the field and laboratory data to formulate geotechnical recommendations for the design of the project.

7. Preparation of this report summarizing our work and presenting our findings and geotechnical recommendations.

8. Coordination of our overall work on the project by our project engineer.

9. Quality assurance of our work and client/design team consultation by our principal engineer.

10. Miscellaneous work efforts such as drafting, word processing, and clerical support.

Detailed descriptions of our field exploration methodology and the Logs of Test Pits are presented in Appendix A. Results of the laboratory tests performed on selected soil samples are presented in Appendix B.

END OF GENERAL

SECTION 2. SITE CHARACTERIZATION

2.1 Regional Geology

The Island of Hawaii is the largest island in the Hawaiian Archipelago and covers an area of approximately 4,000 square miles. The island was formed by the activity of five shield volcanoes, which include the following: Kohala (long extinct), Mauna Kea (activity during recent geologic time), Hualalai (last erupted in 1801 – 1803), and Mauna Loa and Kilauea (both still active).

The project site is situated on the northern flank of Mauna Kea near its contact with the southeastern flank of Kohala. The project site appears to be underlain by basaltic lava flows of the Laupahoehoe Volcanic Series of Mauna Kea, which were deposited during the Pleistocene Epoch (Stearns and Macdonald, 1946).

The project region consists of Laupahoehoe Volcanic Series that is typically composed of basaltic lava flows mantled by a relatively thin layer of palagonitized ash (locally referred to as Pahala Ash). This ash soil is typified by very high in-situ moisture contents and is generally thixotropic in nature (i.e., the soil loses shear strength when remolded) due to transient increases in soil pore pressure.

The lava formation at the site and in the vicinity appears to be of both a`a and pahoehoe basalt type flows, which are typical of the flank flows that originate from vents along the rift zones of Mauna Kea. The a`a form seems to be predominant at the site.

A`a lava is typically characterized by a porous, rough, and irregular flow surface resembling a jagged accumulation of rock fragments, cobbles, and boulders. Typically, a more dense and layered lava rock material is contained within the lava flow core. Pahoehoe lava is characterized by a smooth, rope-like or billowy surface and an internal structure of vesicular (porous) rock. Cavities are commonly encountered in pahoehoe lavas. Cavities are formed when the lavas are still in a molten state and represent both lava tubes (intra-flow cavities) and blisters and pockets (inter-flow cavities). Lava tubes are formed when molten lava drains from the cooling flow, leaving a hollow tube-like structure that may extend for a large longitudinal distance along the flow. Blisters and pockets (inter-flow cavities) are generally smaller in horizontal extent.

2.2 Site Description

The project site is located to the south of the Old Mamalahoa Highway, between Honokaa and Waimea, in the Hamakua District of the Island of Hawaii. The site is generally open pastureland that is traversed by a series of fence lines.

The Lower and Upper Tank Sites are located on Lots 4 and 5, respectively, and are bounded by Alanui Honokaia Road to the west and pasture on all other sides. At the time of our field exploration, an existing water tank was located at the Upper Tank Site in generally the same location as the new proposed water tank. The existing water tank was roughly 15 feet in diameter and about 3.5 feet high.

The ground surfaces at both tank site locations were covered by lush grasses up to about 12 inches high. The surface soils generally consist of brown to orangish brown clayey silts, which appear to be volcanic ash. The terrain around both tank sites is generally rolling, reflects the original surfaces of the basalt lava flows, and generally slopes down towards the north. The existing ground surface at both tank sites are generally flat; however, the upper tank site is at the top of an approximately 10-foot high embankment with a slope inclination of about two horizontal to one vertical (2H:1V). This embankment appears to be fill that may have been placed during construction of the adjacent roadway.

Based on the topographic survey map provided, the site elevations at the Upper and Lower Tank Sites range from approximately +3,335 feet to +3,253 feet Mean Sea Level (MSL), respectively.

2.3 Subsurface Conditions

Our field exploration consisted of excavating and sampling four test pits, designated as Test Pit Nos. 1 through 4, extending to depths ranging from about 8 to 11 feet below the existing ground surface. In addition, two bulk samples of the near-surface soils, designated as Bulk-1 and Bulk-2, were obtained to evaluate the pavement support characteristics of the near-surface soils. The approximate test pit and bulk sample locations are shown on the Site Plan, Plate 2.

The test pits at the Lower Tank Site generally encountered a surface layer of volcanic ash that graded with depth to weathered basalt rock formation. The ash soil encountered ranged from about 3.5 to 4 feet thick and generally consisted of medium stiff clayey silt. The ash soil was overlying highly weathered basalt rock formation that was generally medium hard and could be excavated by the backhoe. Hard basalt rock was encountered at a depth of about 7 feet in Test Pit No. 4.

The test pits at the Upper Tank Site encountered medium dense granular fill materials overlying ash soil and weathered basalt rock formation. The fill materials encountered ranged in thickness from about 2.5 to 8 feet and generally consisted of silty/sandy basalt gravel with cobbles and boulders up to about 2 feet in maximum dimension. The fill materials encountered were overlying a layer of ash soil, roughly 3.5 feet thick, and highly weathered basalt rock formation. The exception was Test Pit No. 1 in which medium stiff ash soil was still encountered at the termination depth of 11 feet below the existing ground surface.

Voids were not encountered in our field exploration, although lava tubes and cavities are commonly encountered in basalt formations. Therefore, the presence of lava tubes and/or cavities should be anticipated and should be expected at the project site.

We did not encounter groundwater in the test pits at the time of our field exploration. However, groundwater levels may change due to seasonal precipitation, surface water runoff, and other factors.

Detailed descriptions of our field exploration methodology and the Logs of Test Pits are presented in Appendix A. Results of the laboratory tests performed on selected soil samples are presented in Appendix B.

2.4 Seismic Design Considerations

Based on the International Building Code (2006 Edition), the project site may be subject to seismic activity, and seismic design considerations will need to be addressed. The following sections provide discussions on the seismicity and soil profile type for seismic design at the project site.

2.4.1 Earthquakes and Seismicity

In general, earthquakes that occur throughout the world are caused by shifts in the tectonic plates. In contrast, earthquake activity in Hawaii is linked primarily to volcanic activity. Therefore, earthquake activity in Hawaii generally occurs before or during volcanic eruptions. In addition, earthquakes may result from the underground movement of magma that comes close to the surface but does not erupt. The Island of Hawaii experiences thousands of earthquakes each year, but most are so small that they can only be detected by sensitive instruments. However, some of the earthquakes are strong enough to be felt, and a few cause minor to moderate damage.

In general, earthquakes associated with volcanic activity are most common on the Island of Hawaii. Earthquakes that are directly associated with the movement of magma are concentrated beneath the active Kilauea and Mauna Loa Volcanoes on the Island of Hawaii. Because the majority of earthquakes in Hawaii (over 90 percent) are related to volcanic activity, the risk of seismic activity and degree of ground shaking diminishes with increased distance from the Island of Hawaii. The Island of Hawaii has experienced numerous earthquakes greater than Magnitude 6 (M6+). Based on information obtained from the United States Geological Survey (USGS) Bulletin 2006, the following is a list of destructive earthquakes that occurred on the Island of Hawaii since 1868.

DATE	LOCATION	MAGNITUDE
March 28, 1868	South Hawaii	7.0
April 2, 1868	South Hawaii	7.9
October 5, 1929	Hualalai	6.5
August 21, 1951	Kona	6.9
April 26, 1973	North Hilo	6.2
November 29, 1975	Kalapana	7.2
November 16, 1983	Kaoiki	6.7
June 25, 1989	Kalapana	6.2
October 15, 2006	Kiholo Bay/Hawi	6.7 / 6.0

Several of the significant earthquakes on the Island of Hawaii have occurred in the past 160 years, including three earthquakes greater than Magnitude 7.0. Therefore, it may be concluded that the project area could experience moderate to severe earthquakes and associated ground shaking, depending on the earthquake origin.

2.4.2 Soil Profile Type for Seismic Design

Based on the subsurface materials anticipated at the project site and the geologic setting of the area, we anticipate the project site may be classified from a seismic analysis standpoint as being a "Very Dense Soil and Soft Rock Profile". Therefore, we believe the seismic design of the project may be designed based on a Site Class C soil profile based on the International Building Code (Table No. 1613.5.2), 2006 Edition.

When seismic waves propagate through a soil profile, most of the times the seismic shear waves get intensified and amplified (or attenuated) depending on the thickness and properties of the soils. Based on a Site Class C soil profile, the following seismic design parameters were estimated and may be used for the seismic analysis of the project site.

SEISMIC DESIGN PARAMETERS	
Parameter	**Value**
Mapped MCE Spectral Response Acceleration, S_S =	1.278g
Mapped MCE Spectral Response Acceleration, S_1 =	0.477g
Site Class =	"C"
Site Coefficient, F_a =	1.000
Site Coefficient, F_v =	1.323
Adjusted MCE Spectral Response Acceleration, S_{MS} =	1.278g
Adjusted MCE Spectral Response Acceleration, S_{M1} =	0.631g
Design Spectral Response Acceleration, S_{DS} =	0.852g
Design Spectral Response Acceleration, S_{D1} =	0.420g
Peak Bedrock Acceleration, PBA (Site Class B) =	0.341g
Peak Ground Acceleration, PGA (Site Class C) =	0.341g

END OF SITE CHARACTERIZATION

SECTION 3. DISCUSSION AND RECOMMENDATIONS

Our field exploration at the Lower Tank Site generally encountered a surface layer of volcanic ash that graded with depth to weathered basalt rock formation while our field exploration at the Upper Tank Site encountered medium dense granular fill materials ranging in thickness from about 2.5 to 8 feet overlying ash soil and weathered basalt rock formation. We did not encounter groundwater in the excavated test pits at the time of our field exploration.

In general, we believe that the primary geotechnical considerations for the project design include the following:

- Volcanic ash soils beneath foundations
- Existing, uncontrolled fill of varying thickness beneath foundations

Volcanic ash soils, which are relatively soft and will compress when subjected to structural and vehicular loads, generally have poor structural characteristics with respect to foundation and pavement support. In addition, ash soils have thixotropic properties (i.e., they temporarily lose strength when remolded or are subjected to vibrations, such as seismic events). Therefore, to the extent practicable, the surface ash soils should be over-excavated and removed from structural areas to basalt rock formation and replaced with compacted structural fill materials.

Surface ash soil ranging from about 3.5 to 4 feet thick was generally encountered during our field exploration at the Lower Tank Site. These volcanic ash soils should be over-excavated to the underlying basalt formation and replaced with well-compacted structural fill. In addition, this over-excavation and replacement with well-compacted structural fill materials should extend a lateral distance of at least 3 feet beyond the perimeter of the water tank foundations. Structural fill materials should consist of well-graded granular materials generally less than 6 inches in maximum size compacted to a minimum of 95 percent relative compaction.

Our field exploration at the Upper Tank Site generally encountered existing fill materials ranging from about 2.5 to 8 feet thick overlying ash soil and weathered basalt rock formation. The fill materials encountered generally consisted of silty/sandy basalt

gravel with cobbles and boulders up to about 2 feet in maximum dimension. Based on the observed consistency and varying thickness of the fill materials encountered, we recommend over-excavating the existing fill materials a minimum depth of 3 feet below water tank foundations and replacing with structural fill materials compacted to a minimum of 95 percent relative compaction. In addition, this over-excavation and replacement with compacted structural fill materials should extend a lateral distance of at least 3 feet beyond the perimeter of the water tank foundations. The removed existing fill materials may be re-used as a source of structural fill materials, provided that they are free of vegetation, deleterious materials, and rock fragments greater than 6 inches in maximum dimension.

Based on our experience in the vicinity of the project site, cavities and/or voids may be present in the hard basaltic lava flows. To reduce the potential for loss of foundation support resulting from the collapse of cavities below foundations, a cavity probing and grouting program is generally implemented for new foundations during construction. However, the weathered basalt encountered below the Lower Tank site consisted primarily of clinker, which does not contain cavities or lava tubes. Therefore, it is our opinion that probing and grouting may be omitted. Due to the thickness of existing fill materials and the observed depth to basalt formation, the cavity probing and grouting program may also be omitted for the Upper Tank Site.

We anticipate that asphaltic concrete pavements will be used for the water tank access roads at the project site. Due to the poor pavement support characteristics of the volcanic ash soils at the project site, we recommend removing the ash soil a minimum depth of 2 feet below pavement subgrades or to basalt rock formation and replacing with structural fill materials compacted to a minimum of 95 percent relative compaction.

Conventional earthwork and construction methods may be used for the proposed project grading. Based on the anticipated grading and our field exploration, excavation for this project will generally consist of excavations for foundation construction and infrastructure installation. Some of the excavations may encounter boulders and involve cuts into the underlying basalt formation. It is anticipated that most of the material may be excavated with normal heavy excavation equipment. However, deep excavations and

excavations into basalt formations may require the use of hoerams or trenching machines. We recommend encouraging contractors bidding on this project to examine the site conditions and soil data to make their own interpretation.

Detailed discussion of these items and our geotechnical engineering design recommendations are presented in the following sections.

3.1 Water Tank Foundations

Based on the anticipated structural loads and the subsurface conditions encountered, we believe shallow foundations consisting of spread and/or continuous footings may be used to support the proposed new water tank structures. As previously mentioned above, we recommend over-excavating the volcanic ash soils at the Lower Tank Site to the underlying basalt formation and replacing with well-compacted structural fill. In addition, this over-excavation and replacement with well-compacted structural fill materials should extend a lateral distance of at least 3 feet beyond the perimeter of the water tank foundations. The structural fill materials should consist of well-graded granular materials generally less than 6 inches in maximum size compacted to a minimum of 95 percent relative compaction.

Similarly, we recommend over-excavating the existing fill materials encountered at the Upper Tank Site a minimum depth of 3 feet below water tank foundations and replacing with well-compacted structural fill materials. This over-excavation and replacement with well-compacted fill materials should also extend a lateral distance of at least 3 feet beyond the perimeter of the water tank foundations.

We recommend using an allowable bearing pressure of up to 4,000 pounds per square foot (psf) for design of footings bearing on structural fill. This bearing value is for supporting dead-plus-live loads and may be increased by one-third (1/3) for transient loads, such as those caused by wind or seismic forces.

In general, footings should be embedded a minimum of 18 inches below the lowest adjacent grade. Footings constructed near the tops of slopes or on slopes should be embedded deep enough such that the horizontal distance measured from the outside edge (at the base of the footing) to the face of the slope is no less than 8 feet.

In addition, foundations next to other foundations, utility trenches, easements or other retaining walls should be embedded below a 45-degree imaginary plane extending upward from the bottom edge of the structure or utility trench, or the footings should be extended to a depth as deep as the inverts of the utility lines. This requirement is necessary to avoid surcharging adjacent below-grade structures with additional structural loads and to reduce the potential for appreciable foundation settlement.

Soft and/or loose materials encountered at the bottom of footing excavations should be over-excavated until dense materials are exposed in the footing excavation. The over-excavation should be backfilled with structural fill materials moisture-conditioned to above the optimum moisture content and compacted to a minimum of 95 percent relative compaction. Alternatively, the bottom of the footing may be extended down to bear directly on the underlying competent material.

If the foundations are designed and constructed in strict accordance with our recommendations, we estimate the total settlements of the foundations to be less than 1 inch. Differential settlements between adjacent footings supported on similar materials may be on the order of about 0.5 inches or less.

Lateral loads acting on the structure may be resisted by friction developed between the bottom of the foundation and the bearing soil and by passive earth pressure acting against the near-vertical faces of the foundation system. A coefficient of friction of 0.45 may be used for footings bearing on structural fill materials or on-site materials. Resistance due to passive earth pressure may be estimated using an equivalent fluid pressure of 450 pounds per square foot per foot of depth (pcf) assuming the soils around the footings are well compacted. The passive pressure resistance in the upper 12 inches of the soil should be neglected unless covered by pavements or slabs.

A Geolabs representative should observe the footing excavations prior to the placement of reinforcing steel and concrete to confirm the foundation bearing conditions and the required embedment depths.

3.2 Site Grading

Based on the existing topography and the proposed finished grades for the water tanks, we anticipate that site grading work for the proposed construction will consist of cuts and fills on the order of about 3 to 4 feet deep for foundation construction. The following grading items are addressed in the succeeding subsections:

- Site Preparation
- Volcanic Ash Soils
- Fill Materials
- Fill Placement and Compaction Requirements
- Excavation

A Geolabs representative should monitor the site grading operations to observe whether undesirable materials are encountered during the excavation and scarification process and to confirm whether the exposed soil conditions are similar to those encountered in our field exploration.

3.2.1 Site Preparation

As previously mentioned, the project site is generally underlain by basalt lava flows covered with volcanic ash soils at the ground surface. The volcanic ash soils, which are relatively soft and will compress when subjected to structural and vehicular loads, generally have poor structural characteristics with respect to foundation and pavement support. In addition, ash soils have thixotropic properties (i.e., they temporarily lose strength when remolded or are subjected to vibrations, such as seismic events). Therefore, to the extent practicable, site grading should be designed to remove the surface ash soils from structural areas.

At the on-set of earthwork, areas within the contract grading limits should be cleared and grubbed thoroughly. As previously mentioned, we recommend removing the surface volcanic ash soils encountered at the Lower Tank Site to expose the underlying basalt rock formation. Similarly, the existing fill materials encountered at the Upper Tank Site should be removed below the bottom of the tank foundations a minimum of 3 feet and replaced with well-compacted structural

fill materials. Over-excavations at both tank sites should extend a minimum lateral distance of at least 3 feet beyond the perimeter of the water tank foundations.

Vegetation, debris, deleterious materials, and other unsuitable materials should be removed and disposed properly off-site to reduce the potential for contaminating the excavated materials to be used as fill materials. Volcanic ash soils may be stockpiled and reused as a source of general fill materials in landscape areas.

Prior to filling, we recommend proof-rolling the cut subgrades with a minimum 10-ton (static weight) vibratory drum roller for a minimum of eight passes to help detect near-surface soft spots. The vibratory drum roller should also be operated at a speed of about 300 feet per minute. The proof-rolling operations should be performed in the presence of a Geolabs representative.

Yielding or loose areas disclosed during the proof-rolling operations should be over-excavated and backfilled with compacted fill materials. The depth of over-excavation should be extended until dense underlying materials are exposed and should be evaluated in the field by a Geolabs representative. Contract documents should include additive and deductive unit prices for over-excavation of the soft areas and backfilling with compacted fill to account for variations in the over-excavation and backfill quantities.

3.2.2 Volcanic Ash Soils

As previously mentioned, the surface volcanic ash soils at the site, locally referred to as Pahala Ash, consist of soft friable clayey silts generally extending to depths of about 3.5 to 4 feet below the existing ground surface at the Lower Tank Site. Ash soils were also encountered in our test pits at the Upper Tank Site but were overlain by existing fill materials ranging from about 2.5 to 8 feet thick.

The volcanic ash is characterized as having very high in-situ moisture contents and is highly compressible. Due to the soft consistency and high moisture contents, our experience in the past with similar material suggests that the contractor will have a difficult time when working with these volcanic ash soils during the earthwork operation.

Volcanic ash soils in the existing ground may be left in place provided that there are no structures, pavements, slabs, and other improvements on top. Volcanic ash soils under water tank foundations and pavement areas should be removed and replaced in accordance with the recommendations presented in the “Water Tank Foundations” and “Pavement Design” sections herein.

Since the volcanic ash soils also exhibit thixotropic properties (i.e., they temporarily lose strength when remolded or are subjected to vibrations, such as seismic events or vehicle loading), we recommend completely removing volcanic ash soils at the Lower Tank Site and removing a minimum depth of 2 feet below pavement subgrades or to basalt rock formation. The volcanic ash soils removed should be replaced with structural fill materials compacted to a minimum of 95 percent relative compaction.

3.2.3 Fill Materials

In general, fill materials required should consist of structural fill materials. Structural fill materials should consist of well-graded granular materials generally less than 6 inches in maximum dimension with sufficient fines to prevent the occurrence of voids in the compacted mass. The existing granular fill materials encountered at the Upper Tank Site may be re-used as a source of structural fill materials, provided that they are free of vegetation, deleterious materials, and rock fragments greater than 6 inches in maximum dimension. Excavated ash soils should not be re-used as structural fill materials.

The maximum particle size of the fills and backfills should be limited to a maximum of 3 inches for fills and backfills to be placed in confined locations. Confined locations are defined as areas where the compaction equipment is limited in size to less than 2 tons in static weight. In addition, if the contractor elects to use smaller-sized compaction equipment (less than 2 tons in static weight), the maximum particle size of the fill and backfill materials should be limited to 3 inches in dimension.

Aggregate base course materials required for pavement sections should consist of crushed basaltic aggregates and should conform to Subsection 703.06 of the Hawaii Standard Specifications for Road and Bridge Construction (2005).

Imported fill materials (where required) should be free of organics and deleterious materials and should be suitable for the intended use. In addition, imported fill materials should be observed and/or tested by Geolabs prior to being transported to the site for the intended use.

3.2.4 Fill Placement and Compaction Requirements

Structural fill materials should be placed in level lifts not exceeding 12 inches in loose thickness, moisture-conditioned to above the optimum moisture, and compacted to at least 95 percent relative compaction. Relative compaction refers to the in-place dry density of soil expressed as a percentage of the maximum dry density of the same soil established in accordance with ASTM D1557. Optimum moisture is the water content (percentage by weight) corresponding to the maximum dry density. Compaction should be accomplished by sheepsfoot rollers, vibratory rollers, or other types of acceptable compaction equipment.

Conventional compaction testing is generally not practical in fills composed of rocks, boulders, and/or cobbles. Instead, a testing program to evaluate the number of passes by a compactor needed to achieve the desired level of compaction should be conducted at the start of the grading phase of the project under the observation of a Geolabs representative. Based on this testing program, the number of passes then may be used as the field criterion for adequate compaction. For preliminary estimating purposes, compaction may be accomplished by using a large vibratory drum roller having a static weight of at least 10 tons traveling at a speed of about 300 feet per minute (3½ miles per hour). The roller should pass over the fill surface at least eight times for structural fill.

3.2.5 Excavation

Based on the anticipated grading and our field exploration, excavation for this project will generally consist of excavations for foundation construction and

infrastructure installation. Some of the excavations may encounter boulders and involve cuts into the underlying basalt formation. It is anticipated that most of the material may be excavated with normal heavy excavation equipment. However, deep excavations and excavations into basalt formations may require the use of hoerams or trenching machines.

The above discussions regarding the rippability of the surface materials are based on our visual observation of the existing basalt formation and field and laboratory data from the test pits. Contractors should be encouraged to examine the site conditions and the subsurface data to make their own reasonable and prudent interpretation.

3.3 Pavement Design

We anticipate that asphaltic concrete pavements will be used for the water tank access roads at the project site. In general, we anticipate that the vehicle loading for the proposed roadways would primarily consist of passenger vehicles and light trucks. Therefore, we have assumed generally light to medium traffic loading conditions for pavement design purposes. We have further assumed that there will be a minimum of 2 feet of compacted structural fill material or basalt rock formation below the road subgrade level. On this basis, we recommend using the following preliminary pavement design for the project.

Flexible Pavement Section

2.0-Inch Asphaltic Concrete
6.0-Inch Aggregate Base Course (95 Percent Relative Compaction)
8.0-Inch Total Pavement Thickness on Moist Compacted Subgrade

To confirm that the above design section is adequate, CBR tests and/or field observations should be performed on the actual subgrade soils during construction. The aggregate base course should consist of crushed basaltic aggregate compacted to a minimum of 95 percent relative compaction. The subgrade soils should be thoroughly moistened and kept moist until covered by the pavement structural section. We recommend performing CBR and density tests on the actual subgrade soils encountered during pavement construction to confirm the adequacy of the above

section. The recommended section also assumes that adequate drainage will be provided for the paved areas.

Aggregate base course materials required for pavement sections should consist of crushed basaltic aggregates and should conform to Subsection 703.06 of the Hawaii Standard Specifications for Road and Bridge Construction (2005).

In general, paved areas should be sloped, and drainage gradients should be maintained to carry surface water off the pavements. Surface water ponding should not be allowed on the site during or after construction. To reduce the potential for migration of excessive landscape water into the pavement section in areas where concrete curbs are used to isolate landscaping in or adjacent to the pavement areas, we recommend that the curbs extend a minimum of 2 inches into the subgrade soil.

3.4 Underground Utility Lines

We envision that new underground utility lines will be required for the project development. It is anticipated that most of the trenches for the utility lines will be excavated in the volcanic ash, clinker, compacted fill, or the hard basalt rock. In general, good construction practices should be utilized for the installation and backfilling of the trenches for the new utilities. The contractor should determine the method and equipment to be used for trench excavation, subject to practical limits and safety considerations. In addition, the excavations should comply with the applicable federal, state, and local safety requirements. The contractor should be responsible for trench shoring design and installation.

In general, we recommend providing a granular bedding layer consisting of 6 inches of open-graded gravel (ASTM C33, No. 67 gradation) for uniform support below the pipes. Free-draining granular materials, such as open-graded gravel (ASTM C33, No. 67 gradation), should be used for the initial trench backfill up to about 12 inches above the pipes. It is critical to use this free-draining material to reduce the potential for formation of voids below the haunches of pipes and to provide adequate support for the sides of the pipes. Improper backfill material around the pipes and

improper placement of the backfill could result in backfill settlement and damage to the pipes.

As an alternative, the granular bedding and the initial trench backfill (up to about 12 inches above the tops of the pipes) may consist of 1-inch minus, well-graded granular materials (aggregate base course). Where these materials are used, the granular bedding and the initial trench backfill should be moisture-conditioned and compacted to not less than 90 percent relative compaction.

The upper portion of the trench backfill, from a level of 12 inches above the pipes to the top of the subgrade or finished grade, should consist of well-graded granular materials less than 6 inches in maximum size. The trench backfill should be moisture-conditioned to above the optimum moisture, placed in about 8-inch loose lifts, and mechanically compacted to at least 90 percent relative compaction. Where trenches are located in paved areas, the upper 3 feet of the trench backfill below the pavement grade should be compacted to not less than 95 percent relative compaction.

Because basalt formation was encountered in the test pits, trench excavation for the utility line installation will likely involve excavation in the basalt formation and will require hard ripping or the use of hoerams. The contractor must exercise care to avoid over-ripping of the basalt formation, which would disrupt the structure of the rock formation and would result in a potential loss of bearing strength for foundations of the vicinity.

3.5 Drainage

Finished grades outside the new structures should be sloped to shed water away from the slabs and foundations and to reduce the potential for ponding around the structure. Excessive landscape watering near the slabs and foundations also should be avoided. Planters next to foundations should be avoided or have concrete bottoms and drains to reduce the potential for excessive water infiltration into the subsurface.

These drainage requirements are essential for the proper performance of the above foundation recommendations because ponded water could cause subsurface soil saturation and subsequent heaving or loss of strength. The foundation excavations

should be properly backfilled against the walls or slab edges immediately after setting of the concrete to reduce the potential for excessive water infiltration into the subsurface. Drainage swales should be provided as soon as possible and should be maintained to drain surface water runoff away from the slabs and foundations.

3.6 Design Review

Preliminary and final drawings and specifications for the project should be forwarded to Geolabs for review and written comments prior to bid solicitation for construction. This review is necessary to evaluate conformance of the plans and specifications with the intent of the foundation and earthwork recommendations provided herein. If this review is not made, Geolabs cannot be responsible for misinterpretation of our recommendations.

3.7 Post-Design Services/Services During Construction

Geolabs should be retained to provide geotechnical engineering services during construction. The critical items of construction monitoring that require "Special Inspection" include the following:

- Observation of subgrade preparation
- Observation of fill and backfill placement
- Observation of the shallow foundation excavations

A Geolabs representative also should monitor other aspects of earthwork construction to observe compliance with the design concepts, specifications, or recommendations and to expedite suggestions for design changes that may be required in the event that subsurface conditions differ from those anticipated at the time this report was prepared. Geolabs should be accorded the opportunity to provide geotechnical engineering services during construction to confirm our assumptions in providing the recommendations presented herein.

If the actual exposed subsurface conditions encountered during construction differ from those assumed or considered herein, Geolabs should be contacted to review and/or revise the geotechnical recommendations presented herein.

END OF DISCUSSION AND RECOMMENDATIONS

SECTION 4. LIMITATIONS

The analyses and recommendations submitted herein are based in part upon information obtained from the test pits and bulk samples. Variations of the subsurface conditions between and beyond the test pits and bulk samples may occur, and the nature and extent of these variations may not become evident until construction is underway. If variations then appear evident, it will be necessary to re-evaluate the recommendations presented herein.

The test pit and bulk sample locations indicated herein are approximate, having been estimated by taping from visible features shown on the Topographic Survey Map transmitted by Akinaka & Associats, Ltd. on January 13, 2015. Elevations of the test pits were estimated from contours and spot elevations on the same plan. The test pit locations and elevations should be considered accurate only to the degree implied by the methods used.

The stratification breaks shown on the graphic representations of the test pits depict the approximate boundaries between soil types and, as such, may denote a gradual transition. We did not encounter groundwater in the test pits at the time of our field exploration. However, it must be noted that fluctuation may occur due to variation in seasonal rainfall, and other factors. These data have been reviewed and interpretations made in the formulation of this report.

This report has been prepared for the exclusive use of Akinaka & Associates, Ltd. and their project consultants for specific application to the design of the *Honokaia Non-Potable Water System* project in accordance with generally accepted geotechnical engineering principles and practices. No warranty is expressed or implied.

This report has been prepared solely for the purpose of assisting the design engineers in the design of the proposed project. Therefore, this report may not contain sufficient data, or the proper information, to serve as a basis for detailed construction cost estimates.

The owner/client should be aware that unanticipated soil and/or rock conditions are commonly encountered. Unforeseen subsurface conditions, such as soft deposits, hard layers, cavities, or perched groundwater, may occur in localized areas and may require additional probing or corrections in the field (which may result in construction delays) to attain a properly constructed project. Therefore, a sufficient contingency fund is recommended to accommodate these possible extra costs.

This geotechnical engineering exploration conducted at the project site was not intended to investigate the potential for presence of hazardous materials existing at the site. It should be noted that the equipment, techniques, and personnel used to conduct a geo-environmental exploration differ substantially from those applied in geotechnical engineering.

END OF LIMITATIONS

CLOSURE

The following plates and appendices are attached and complete this report:

-ΩΩΩΩΩΩΩΩΩ-

Respectfully submitted,

GEOLABS, INC.

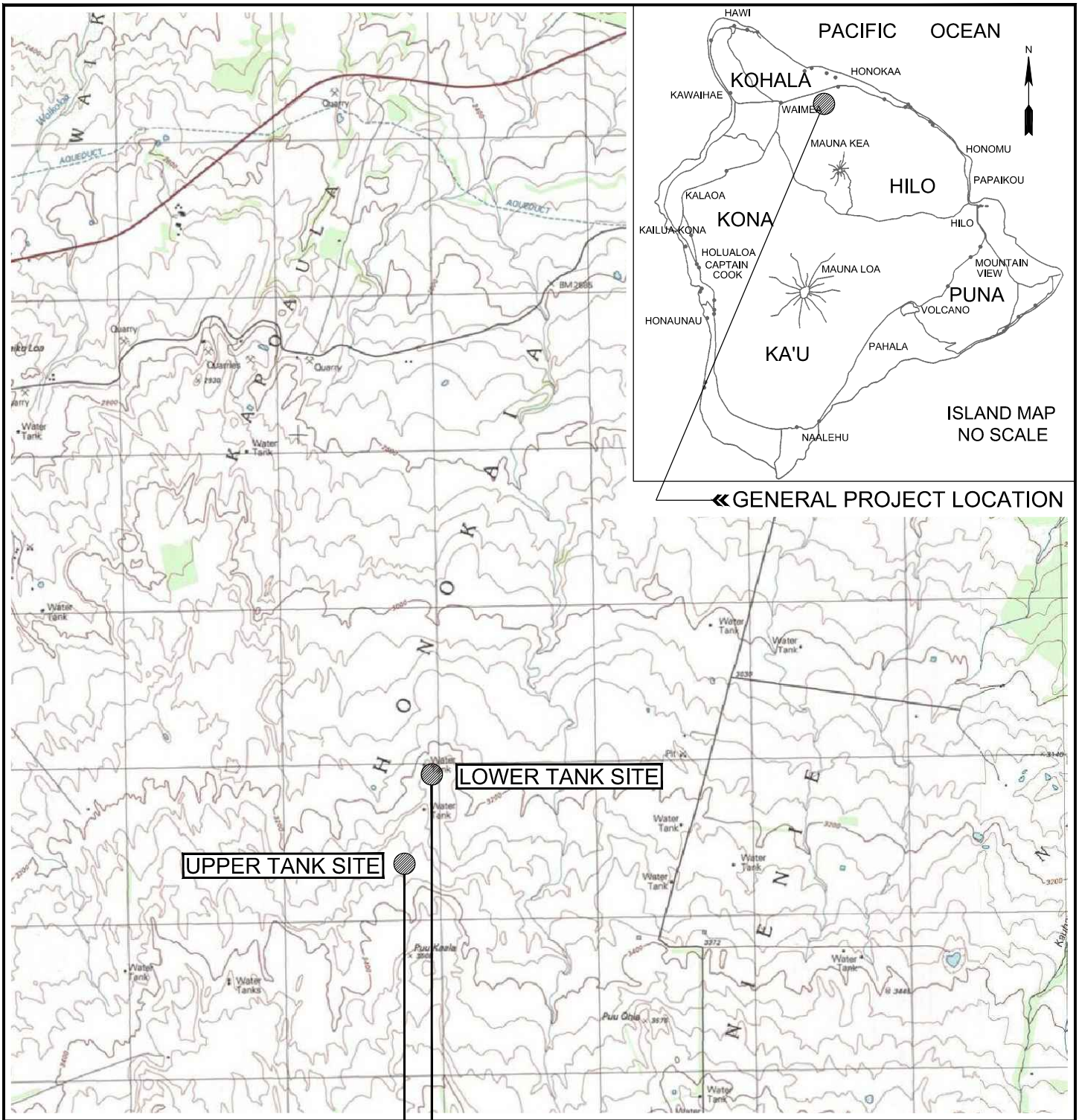
By _____
Andrew J. Felkel, P.E.
Project Engineer

By _____
Clayton S. Mimura, P.E.
President

CSM:AJF:mj

h:\7000Series\7053-00.ajf1

PLATES



PROJECT LOCATION MAP

HONOKAIA NON-POTABLE WATER SYSTEM
DEPARTMENT OF HAWAIIAN HOME LANDS
HAMAKUA DISTRICT, ISLAND OF HAWAII

3000 0 3000 FT.

GRAPHIC SCALE

N

REFERENCE: MAP CREATED WITH TOPO!® ©2010 NATIONAL GEOGRAPHIC; ©2007 TELE ATLAS, REL. 1/2007.

GEOLABS, INC.

Geotechnical Engineering

DATE	DRAWN BY	PLATE
JANUARY 2015	KHN	1
SCALE	W.O.	
1" = 3,000'	7053-00	

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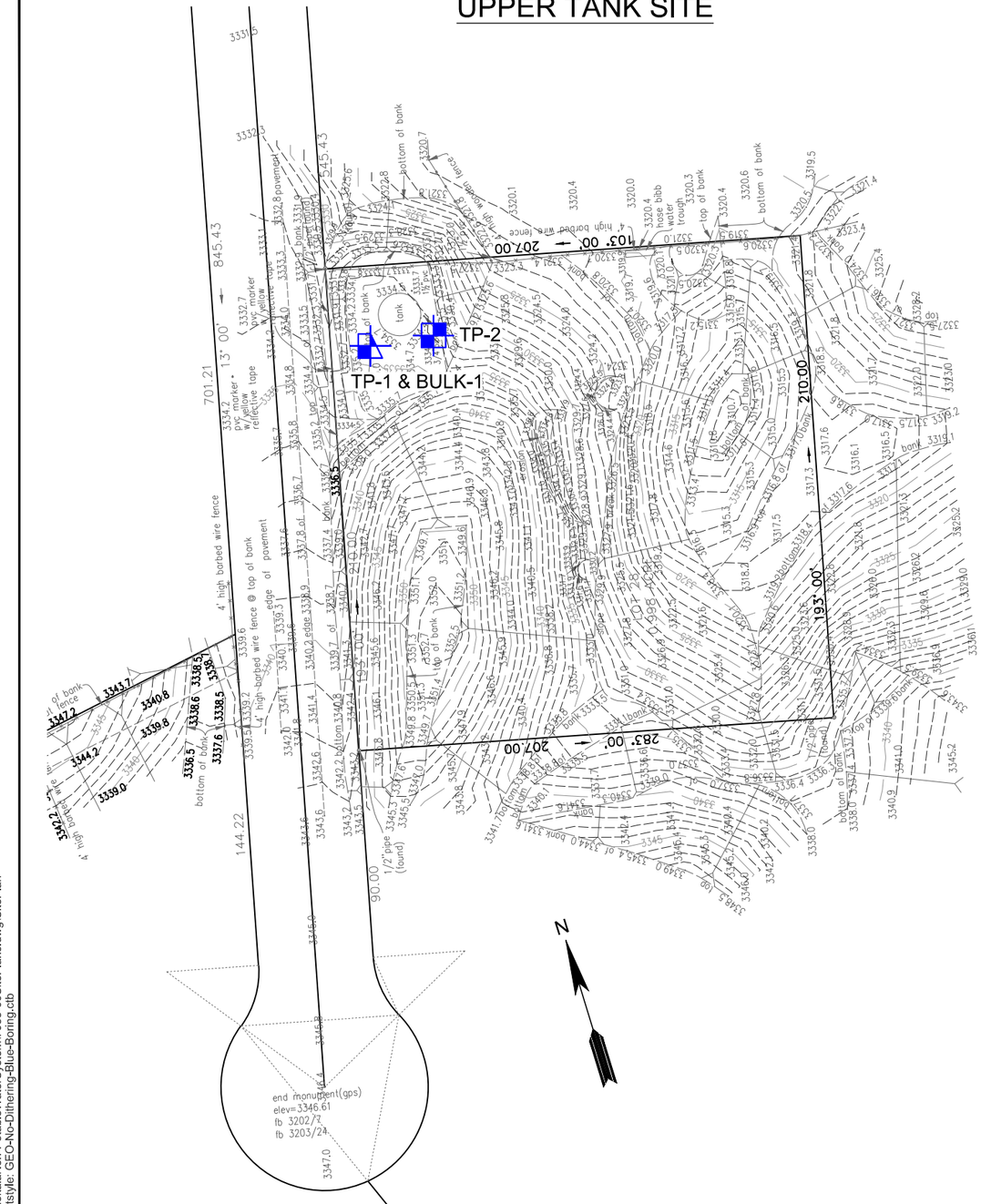
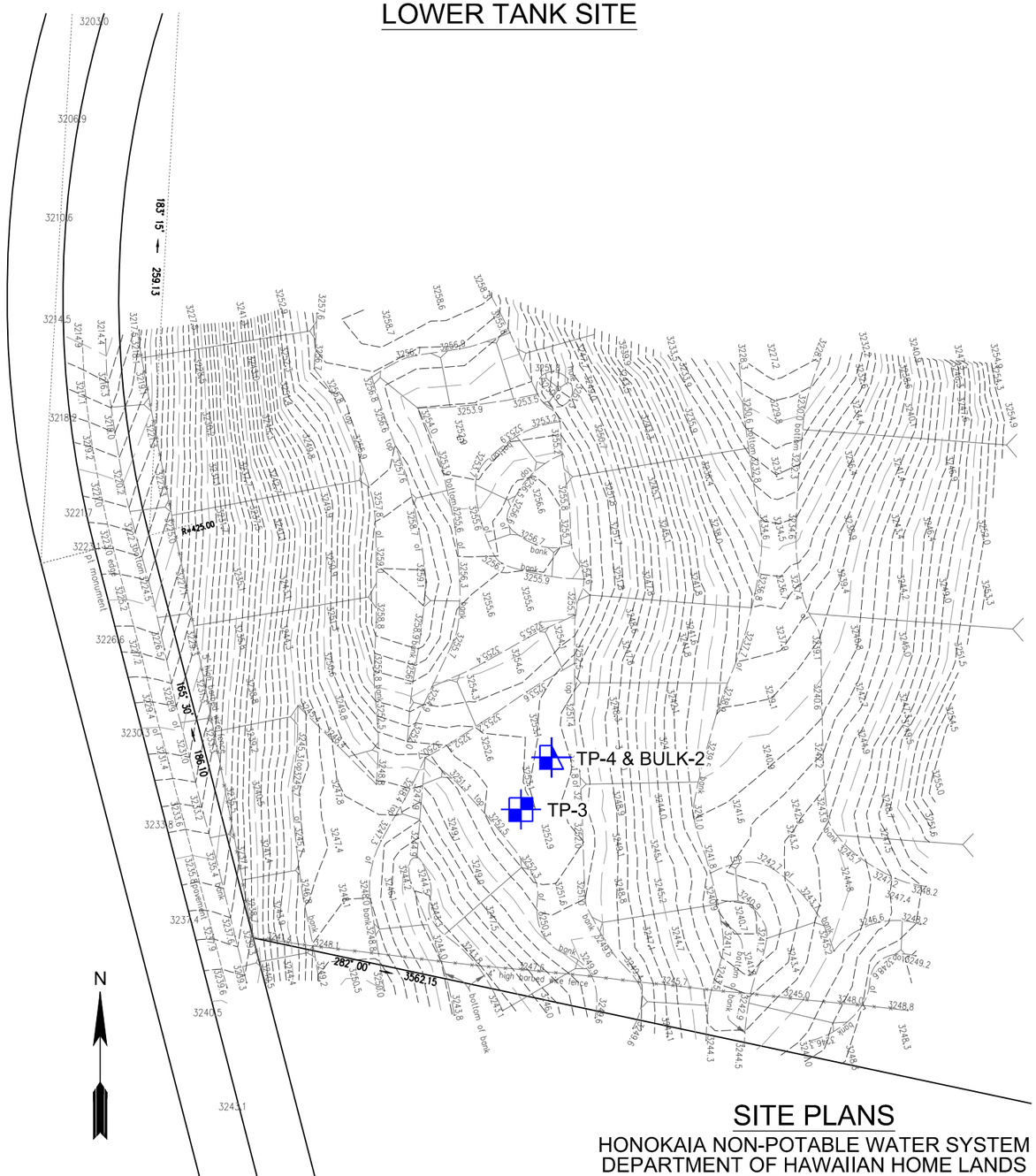
File: T:\Drafting\Working\7053-00HonokaiaNon-PotableWaterSystem\7053-00PLM.dwg\PLM
Plotter: GEO-DWG-TO-PDF.pc3 Plotstyle: GEO-No-Dithering.ctb

UPPER TANK SITE



LOWER TANK SITE



LEGEND:

- APPROXIMATE TEST PIT LOCATION
- APPROXIMATE BULK SAMPLE LOCATION

REFERENCE: TOPOGRAPHIC SURVEY MAP TRANSMITTED BY AKINAKA & ASSOCIATE, LTD. ON JANUARY 13, 2015.

0 20 40 60 120 180 FT.

GRAPHIC SCALE

SITE PLANS

HONOKAIA NON-POTABLE WATER SYSTEM
DEPARTMENT OF HAWAIIAN HOME LANDS
HAMAKUA DISTRICT, ISLAND OF HAWAII

GEOLABS, INC.
Geotechnical Engineering

DATE	DRAWN BY	PLATE
JANUARY 2015	KHN	2
SCALE	W.O.	
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Plotter: GEO-DWG-TO-PDF.pc3 Plotstyle: GEO-No-DitheringBlue-Boring.ctb

APPENDIX A

APPENDIX A

Field Exploration

We explored the subsurface conditions at the project site by excavating and sampling four test pits, designated as Test Pit Nos. 1 through 4, extending to depths ranging from about 8 to 11 feet below the existing ground surface. In addition, two bulk samples of the near-surface soils, designated as Bulk-1 and Bulk-2, were obtained to evaluate the pavement support characteristics of the near-surface soils. The approximate test pit and bulk sample locations are shown on the Site Plan, Plate 2. The test pits were excavated using a Case 590L Super backhoe equipped with 24-inch wide digging bucket.

Our engineer classified the materials encountered in the test pits by visual and textural examination in the field in general accordance with ASTM D2488, Standard Practice for Description and Identification of Soils, and monitored the excavation operations on a near-continuous (full-time) basis. These classifications were further reviewed visually and by testing in the laboratory. Soils were classified in general accordance with ASTM D2487, Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System). The Logs of Test Pits are presented on Plates A-1 through A-4.

Pocket penetrometer tests were performed on selected cohesive soil samples in the field. The pocket penetrometer test provides an indication of the unconfined compressive strength of the sample. Pocket penetrometer test results are summarized on the Logs of Test Pits at the appropriate sample depths.

LOGS OF TEST PITS

Honokaia Non-Potable Water System
Department of Hawaiian Home Lands
Hamakua District, Island of Hawaii

Test Pit No.	Depth Below Surface (feet)	Description
TP-1 Approx. Elev. +3,335 feet MSL	0 – 8.0	Brown **SILTY GRAVEL (GM)** with some sand, cobbles, and boulders up to approx. 2 feet in max. dimension, medium dense, very moist (fill) (MC=30.4% at 2 feet) (MC=44.7% at 6 feet)
	8.0 – 11	Orangish brown **CLAYEY SILT (MH)**, medium stiff, very moist (ash soil) (MC=142.2% at 9 feet) Test pit terminated at 11 feet on November 20, 2014 Groundwater was not encountered
TP-2 Approx. Elev. +3,334 feet MSL	0 – 2.5	Brown **SILTY GRAVEL (GM)** with some sand, cobbles, and boulders up to approx. 1.5 feet in max. dimension, medium dense, very moist (fill)
	2.5 – 6.0	Orangish brown **CLAYEY SILT (MH)**, soft to medium stiff, very moist (ash soil) (PP=1.0 tsf) (MC=191.7% at 4 feet)
	6.0 – 9.0	Yellowish gray **BASALT with CLINKERS**, highly weathered, medium hard (a'a) Test pit terminated at 9 feet on November 20, 2014 Groundwater was not encountered

LOGS OF TEST PITS

Honokaia Non-Potable Water System
Department of Hawaiian Home Lands
Hamakua District, Island of Hawaii

TP-3 Approx. Elev. +3,253 feet MSL	0 – 3.5	Brown **CLAYEY SILT (MH)**, soft to medium stiff, very moist (ash soil) (PP=1.0 tsf) (MC=201.4% at 2 feet) Grades to orangish brown at 2.5 feet (PP=1.25 tsf)
	3.5 – 8.0	Yellowish gray **BASALT with CLINKERS**, moderately to highly weathered, medium hard (a'a) (MC=41.1% at 6 feet) Test pit terminated at 8 feet on November 20, 2014 Groundwater was not encountered
TP-4 Approx. Elev. +3,253 feet MSL	0 – 4.0	Orangish brown **CLAYEY SILT (MH)**, very moist, soft to medium stiff (ash soil) (PP=0.75 tsf) (MC=184.2% at 2 feet)
	4.0 – 8.0	Yellowish gray **BASALT with CLINKERS**, highly weathered, medium hard (a'a) (MC=52.4% at 5.5 feet) Grades to hard at approx. 7 feet Test pit terminated at 8 feet on November 20, 2014 Groundwater was not encountered

APPENDIX B

A P P E N D I X B

Laboratory Tests

APPENDIX B

A P P E N D I X B

Laboratory Tests

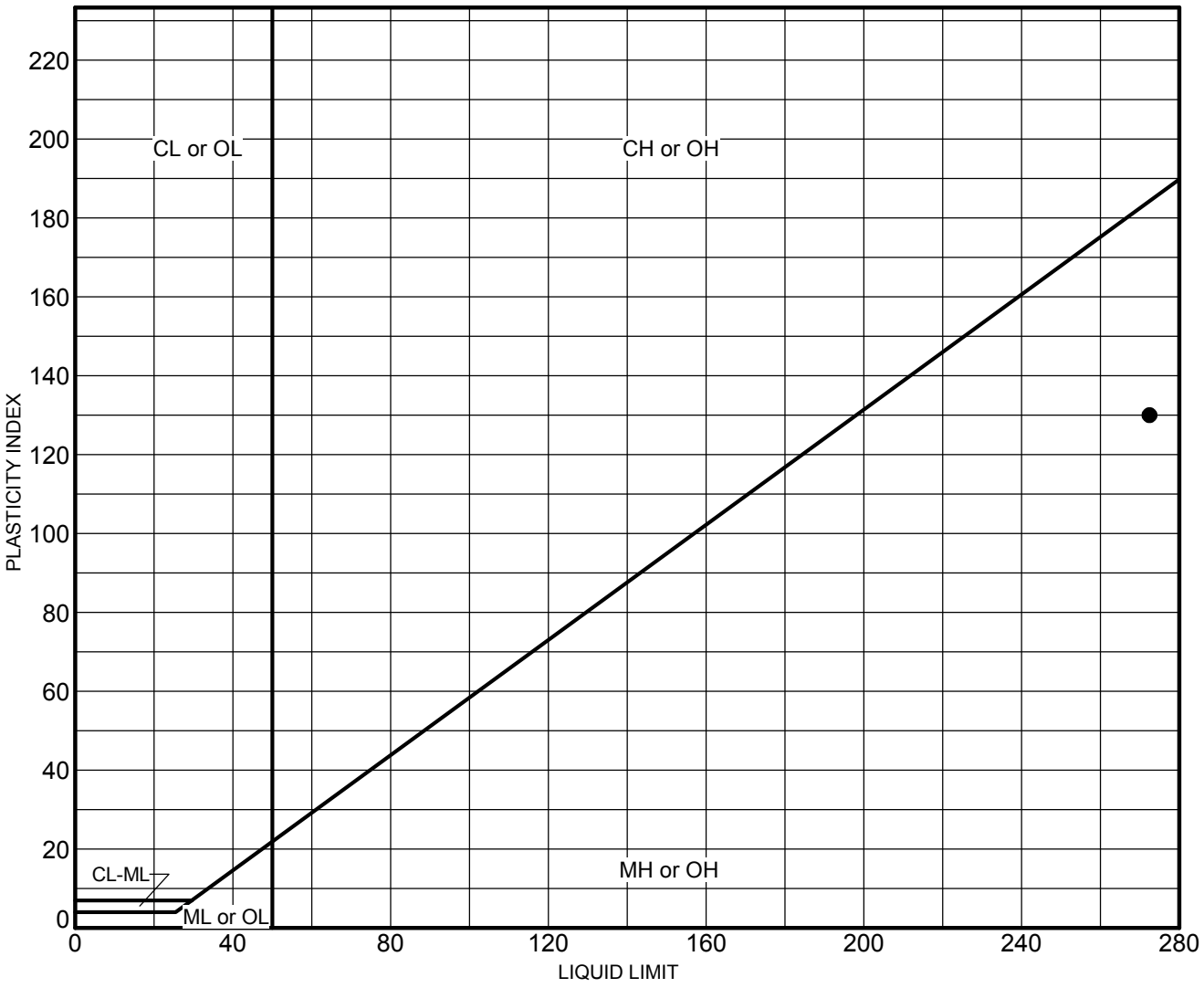
Moisture Content (ASTM D2216) were performed on selected samples as an aid in the classification and evaluation of soil properties.

One Atterberg Limits test (ASTM D4318) was performed on a selected soil sample to evaluate the liquid and plastic limits. Graphic presentation of the test results is provided on Plate B-1.

One Sieve Analysis test (ASTM C117 & C136) was performed on a selected soil sample to evaluate the gradation characteristics of the soil and to aid in soil classification. Graphic presentation of the grain size distribution is provided on Plate B-2.

One Modified Proctor compaction test (ASTM D1557 C) was performed on a bulk sample of the near-surface soils to evaluate the dry density and moisture content relationships. The test results are presented on Plate B-3.

Two laboratory California Bearing Ratio tests (ASTM D1883) were performed on bulk samples of the near-surface soils to evaluate the pavement support characteristics of the soils. The test results are presented on Plates B-4 and B-5.



	Sample	Depth (ft)	LL	PL	PI	Description
●	TP-3	1.5-2.5	272	142	130	Brown clayey silt (MH) w/ traces of roots

GEOLABS, INC.

GEOTECHNICAL ENGINEERING

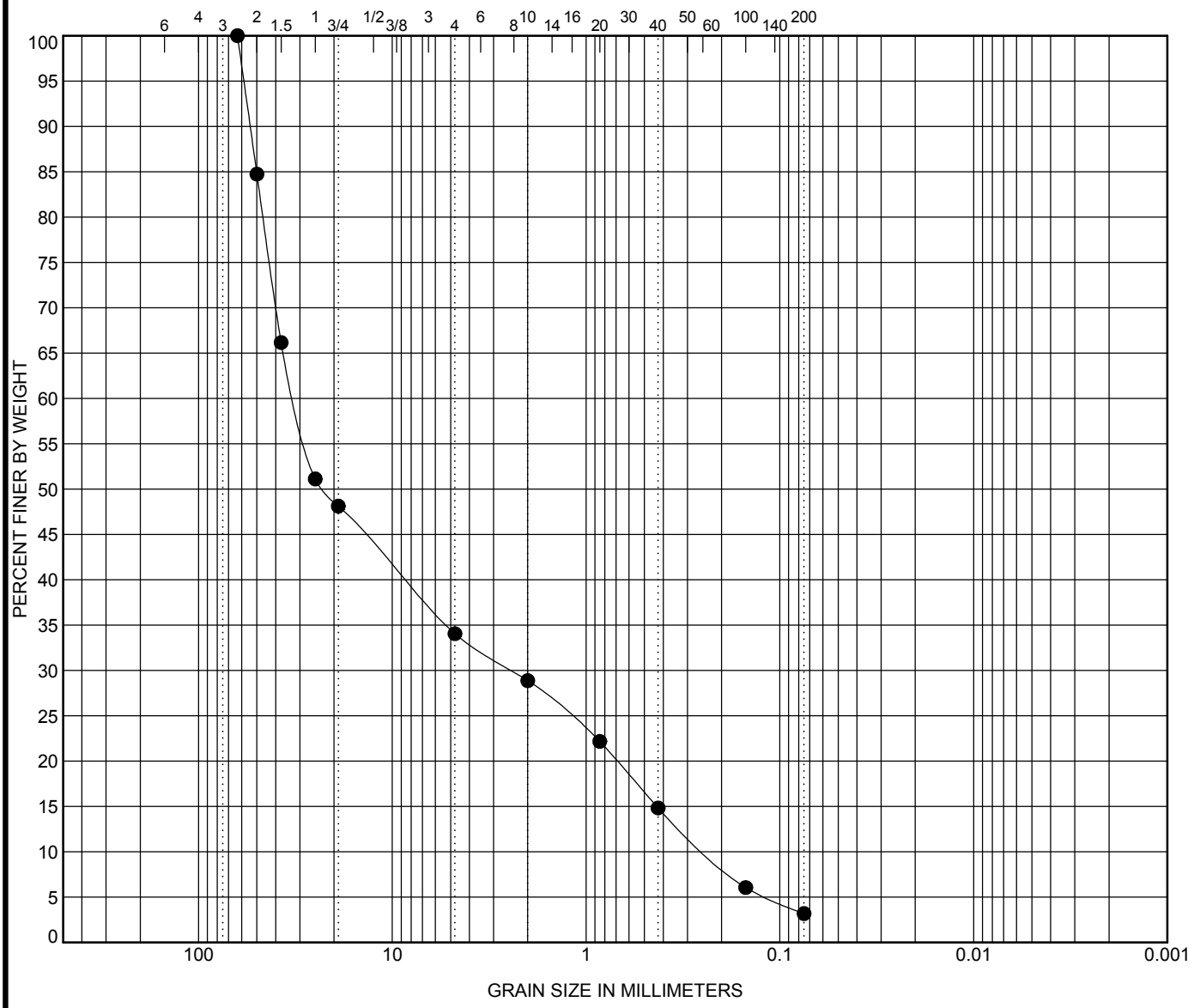
W.O. 7053-00

ATTERBERG LIMITS TEST RESULTS - ASTM D4318

HONOKAIA NON-POTABLE WATER SYSTEM
DEPARTMENT OF HAWAIIAN HOME LANDS
HAMAKUA DISTRICT, ISLAND OF HAWAII

Plate
B - 1

G ATTERBERG PI-200 LL-240 7053-00.GPJ GEOLABS.GDT 2/24/15



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	Sample	Depth (ft)	Description	LL	PL	PI	Cc	Cu
●	TP-1	1.0-2.0	Brown sandy gravel (GP) w/ traces of silt				0.8	132.5

	Sample	Depth (ft)	D100 (mm)	D60 (mm)	D30 (mm)	D10 (mm)	%Gravel	%Sand	%Fine
●	TP-1	1.0-2.0	63	31.766	2.417	0.24	66.0	30.9	3.2

GEOLABS, INC.
GEOTECHNICAL ENGINEERING

W.O. 7053-00

GRAIN SIZE DISTRIBUTION - ASTM C 117 & C 136

HONOKAIA NON-POTABLE WATER SYSTEM
DEPARTMENT OF HAWAIIAN HOME LANDS
HAMAKUA DISTRICT, ISLAND OF HAWAII

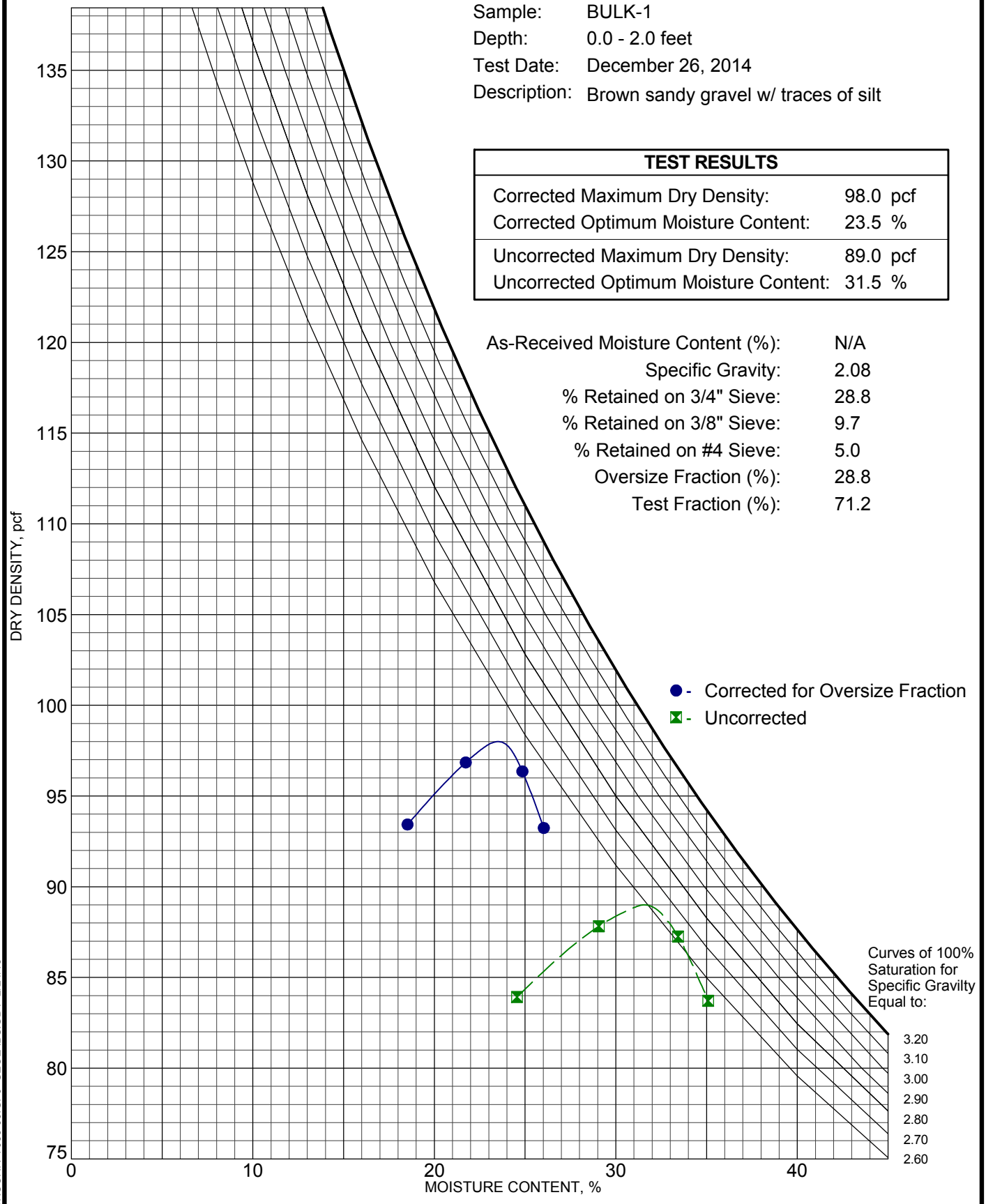
Plate
B - 2

G_GRAIN_SIZE_7053-00.GPJ_GEOLABS.GDT 2/24/15

Sample: BULK-1
Depth: 0.0 - 2.0 feet
Test Date: December 26, 2014
Description: Brown sandy gravel w/ traces of silt

TEST RESULTS	
Corrected Maximum Dry Density:	98.0 pcf
Corrected Optimum Moisture Content:	23.5 %
Uncorrected Maximum Dry Density:	89.0 pcf
Uncorrected Optimum Moisture Content:	31.5 %

As-Received Moisture Content (%):	N/A
Specific Gravity:	2.08
% Retained on 3/4" Sieve:	28.8
% Retained on 3/8" Sieve:	9.7
% Retained on #4 Sieve:	5.0
Oversize Fraction (%):	28.8
Test Fraction (%):	71.2



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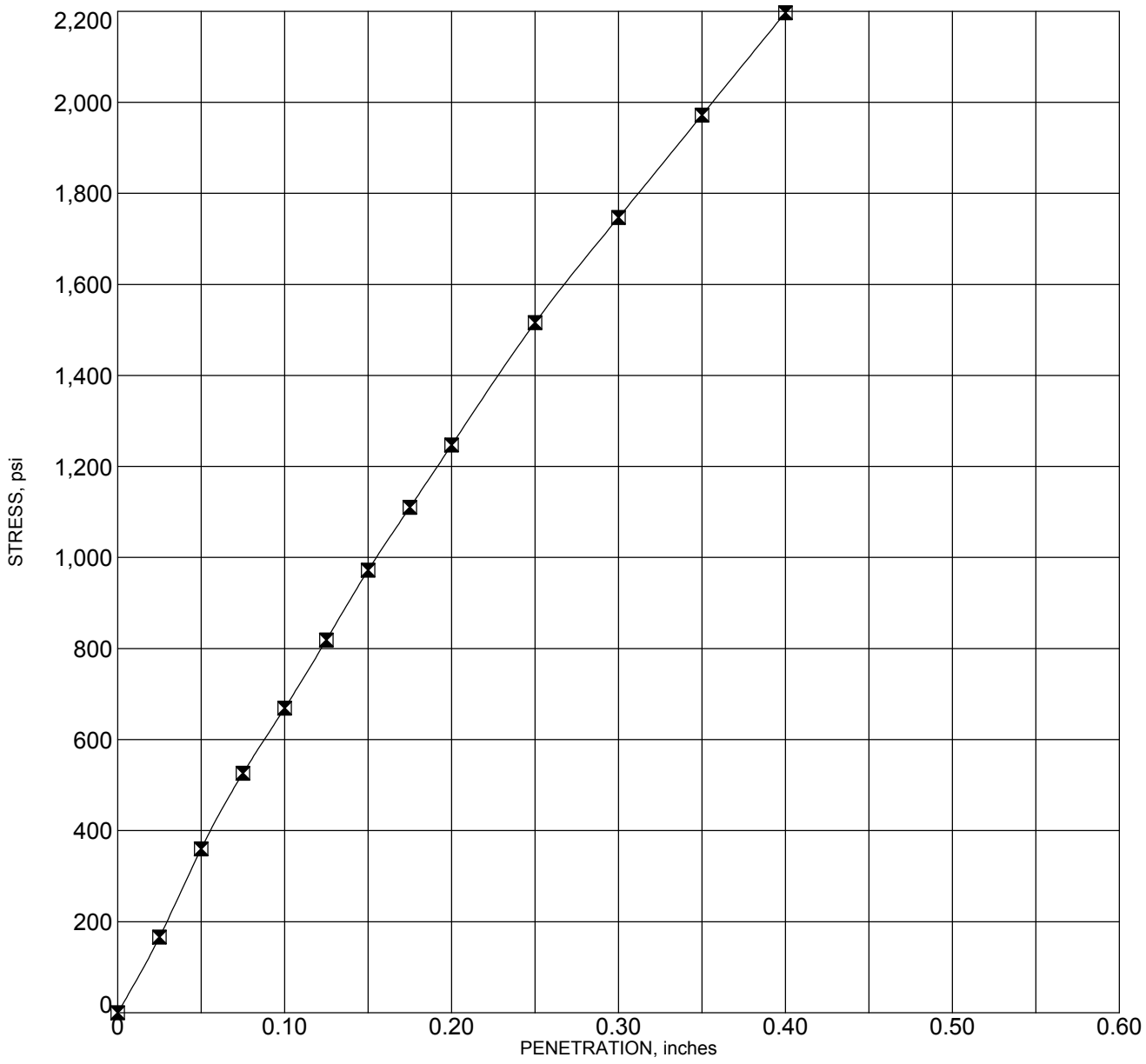
MOISTURE-DENSITY RELATIONSHIP - ASTM D1557 C

HONOKAIA NON-POTABLE WATER SYSTEM
DEPARTMENT OF HAWAIIAN HOME LANDS
HAMAKUA DISTRICT, ISLAND OF HAWAII

Plate
B - 3

G_COMPACTION_CORR&UNCORR_7053-00.GPJ_GEOLABS.GDT_2/24/15



Corr. CBR @ 0.1"	67.0
Corr. CBR @ 0.2"	83.1
Swell (%)	0.04

Sample: BULK-1
Depth: 0.0 - 2.0 feet
Description: Brown sandy gravel w/ traces of silt

Molding Dry Density (pcf)	96.3	Hammer Wt. (lbs)	10
Molding Moisture (%)	27.6	Hammer Drop (inches)	18
Days Soaked	4	No. of Blows	56
Aggregate	3/4 inch minus	No. of Layers	5

GEOLABS, INC.
GEOTECHNICAL ENGINEERING

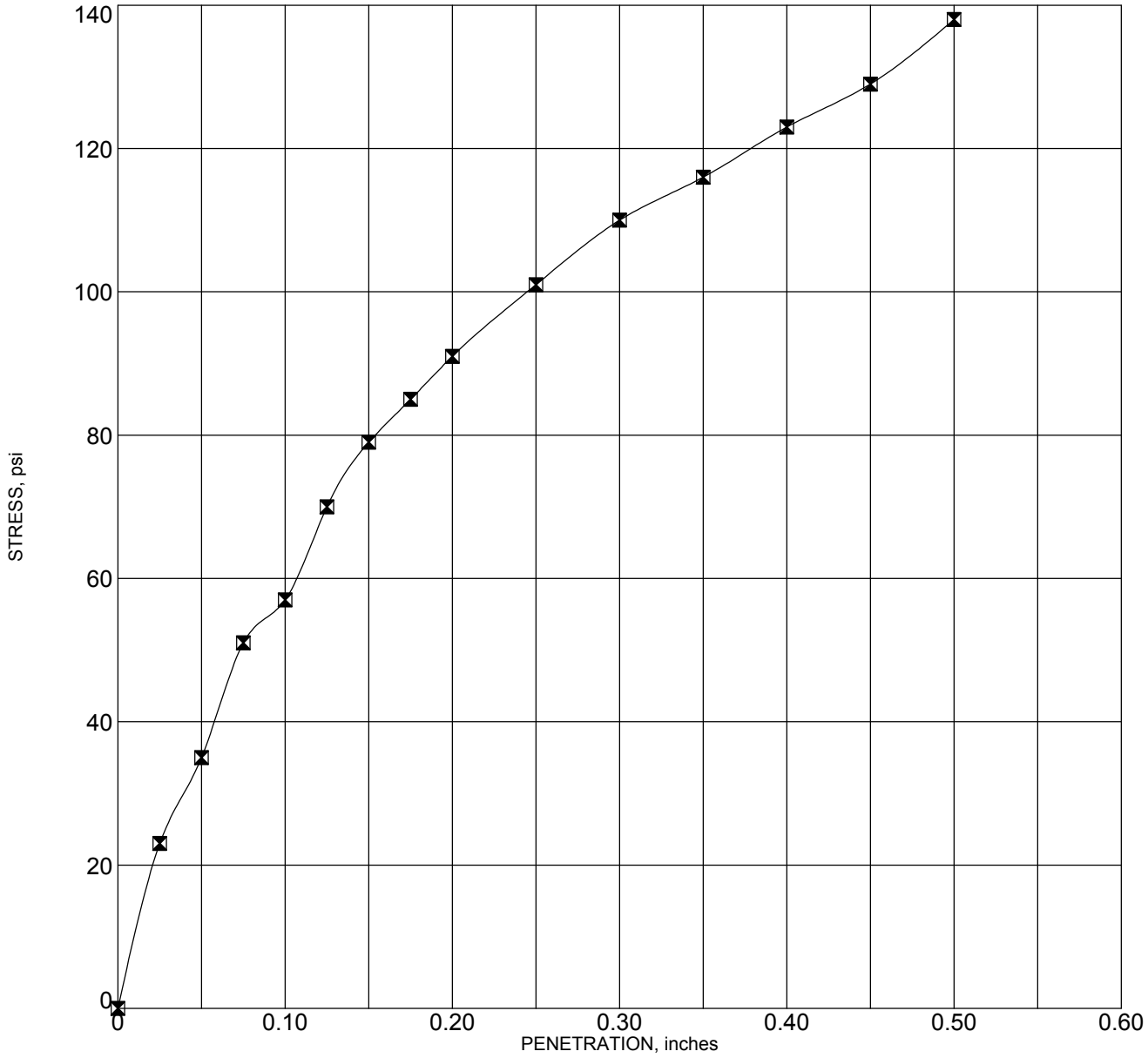
W.O. 7053-00

CALIFORNIA BEARING RATIO - ASTM D1883

HONOKAIA NON-POTABLE WATER SYSTEM
DEPARTMENT OF HAWAIIAN HOME LANDS
HAMAKUA DISTRICT, ISLAND OF HAWAII

Plate
B - 4

G_CBR_7053-00.GPJ GEOLABS.GDT 2/24/15



Corr. CBR @ 0.1"	5.7
Corr. CBR @ 0.2"	6.1
Swell (%)	0.17

Sample: BULK-2
Depth: 1.0 - 2.0 feet
Description: Brown clayey silt (MH) w/ traces of roots

Molding Dry Density (pcf)	29.8	Hammer Wt. (lbs)	10
Molding Moisture (%)	169.8	Hammer Drop (inches)	18
Days Soaked	4	No. of Blows	56
Aggregate	3/4 inch minus	No. of Layers	5

GEOLABS, INC.
GEOTECHNICAL ENGINEERING

W.O. 7053-00

CALIFORNIA BEARING RATIO - ASTM D1883

HONOKAIA NON-POTABLE WATER SYSTEM
DEPARTMENT OF HAWAIIAN HOME LANDS
HAMAKUA DISTRICT, ISLAND OF HAWAII

Plate
B - 5

G_CBR_7053-00.GPJ GEOLABS.GDT 2/24/15

SCAFCO Grain Systems Company
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Spokane, WA 99211-1215, USA

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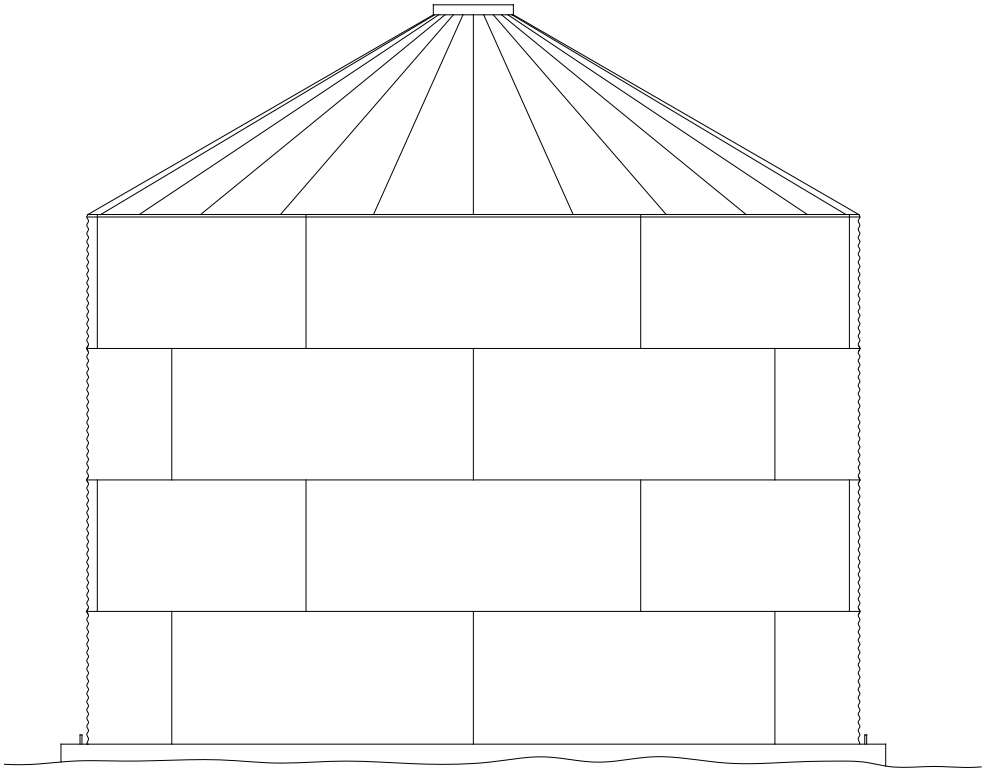
SCAFCO®
WATER STORAGE SYSTEMS

INSTALLATION INSTRUCTIONS



Congratulations on purchasing a quality SCAFCO Water Storage Tank! The SCAFCO Water Storage Tank is a unique and practical combination of corrugated galvanized steel wall sheets, a conical galvanized steel roof, a vinyl liner capable of retaining water, and a concrete foundation.

Proper design of a complete water storage system can only be insured by a local engineer skilled in the water supply field. Every tank purchaser should retain a local professional engineer and charge him with the responsibility for adequate design of the foundation, inlets, outlets, overflow pipes and controls.

The success of a SCAFCO Water Storage Tank depends upon proper erection and installation of the tank. The following instructions will be helpful to those individuals involved in tank installation.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

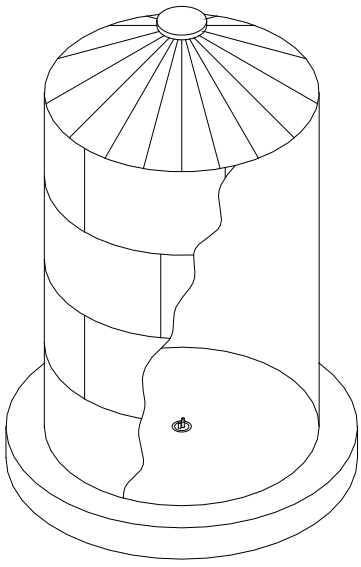
SNOW, WIND AND SEISMIC LOADS

The roof and sidewalls of SCAFCO Water Storage Tanks shall be designed to resist snow, wind and seismic loads as required by the 2006 International Building Code, and the local Regulatory Agency issuing building permits for new construction.

Minimum roof design live (snow) load is 20 psf, applied to the horizontal projection. Where required by climatic conditions or the local Regulatory Agency, roof design loads shall be increased to satisfy local requirements.

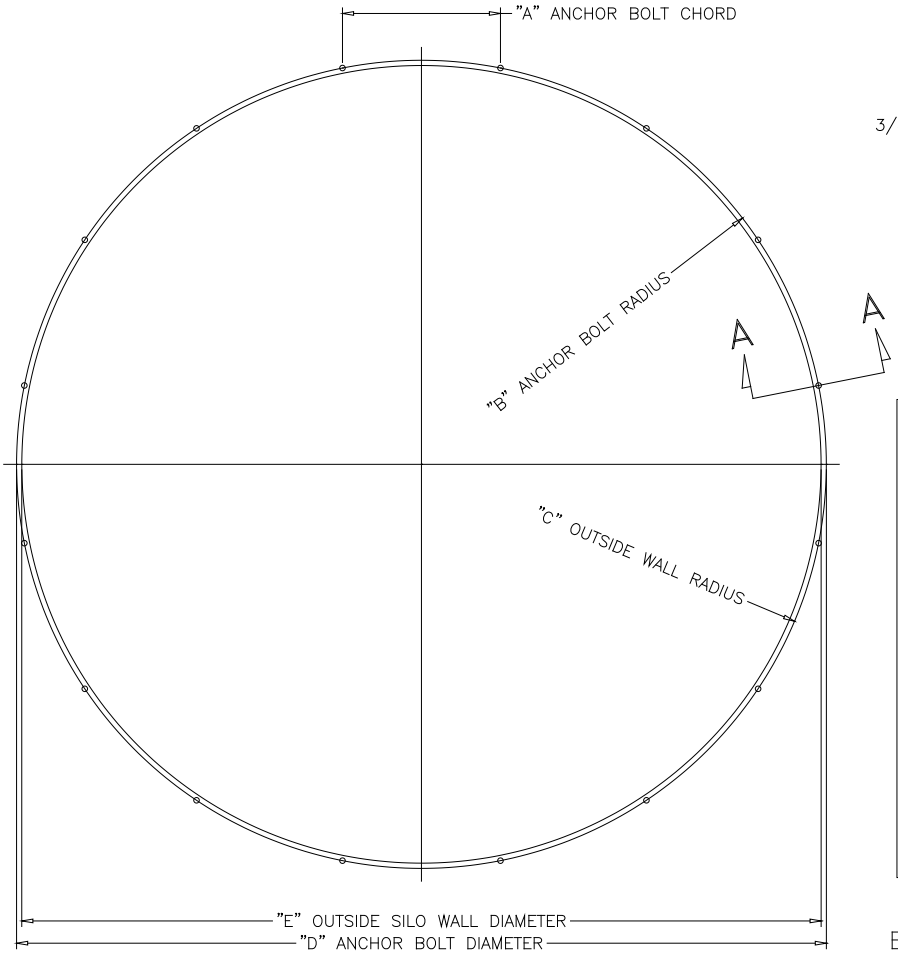
SCAFCO Water Storage Tanks are designed to resist wind pressures described in the 2006, International Building Code, Wind Exposure C.

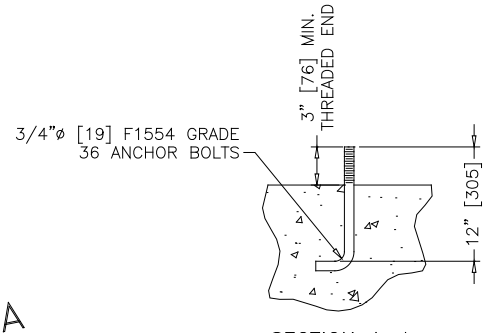
Standard SCAFCO Water Storage Tanks are designed for Seismic Design Category C, site class D per the 2006 International Building Code, AWWA D100-05, Section 13, and AWWA D103-97, Section 12. Upon engineer's design requirements, tank will be designed to resist additional seismic loads or those required by the local Regulatory Agency.



SCAFCO GRAIN SYSTEMS COMPANY

WATER STORAGE TANK FOUNDATION DETAILS





SECTION A–A
ANCHOR BOLT DETAIL

NOTE:

1. THIS DRAWING IS TYPICAL AND TO BE USED AS REFERENCE ONLY, **NOT** INTENDED FOR CONSTRUCTION.
2. ALL SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.
3. DESIGN OF THE FOUNDATION, REINFORCEMENT AND MATERIALS IS THE RESPONSIBILITY OF OTHERS.
4. THE FOUNDATION DESIGN SHALL BE BASED ON SITE SOILS AND OTHER LOCAL CONDITIONS.
5. THE ANCHOR BOLT EMBEDMENT END CONDITION AND EMBEDMENT DEPTH TO BE DETERMINED BY A CIVIL ENGINEER.
6. ANCHOR BOLTS MUST BE PLACED ACCURATELY TO MAINTAIN SILO ROUNDNESS. ANCHOR BOLT PLACEMENT MUST BE VERIFIED BY A LICENSED SURVEYOR OR OTHER QUALIFIED INDIVIDUAL TO ENSURE PLACEMENT IS CORRECT. FAILURE TO ENSURE PROPER ANCHOR BOLT PLACEMENT MAY CAUSE SILO DAMAGE.

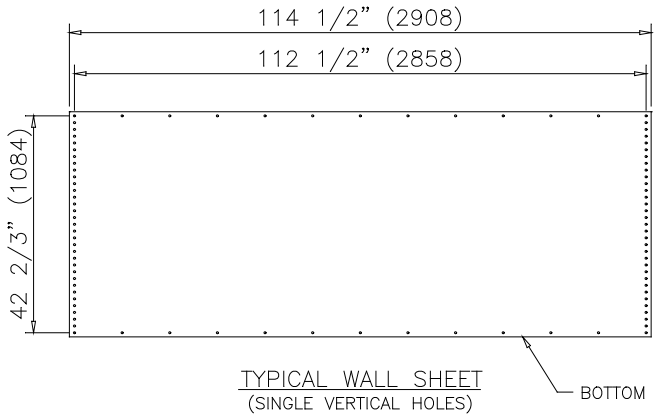
THIS DRAWING IS TYPICAL AND TO BE USED AS REFERENCE ONLY, **NOT** INTENDED FOR CONSTRUCTION

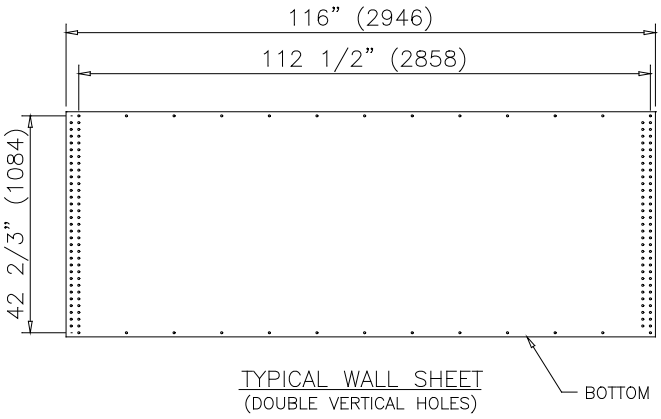
FOUNDATION DIMENSIONS

TANK DIAMETER	QTY OF ANCHOR BOLTS	A	A [MM]	B	B [MM]	C	C [MM]	D	D [MM]	E	E [MM]
6'	4	4'–5 11/16"	1364	3'–1 15/16"	964	3'–0 1/16"	916	6'–3 7/8"	1927	8'–11 3/8"	2727
9'	6	4'–7 7/8"	1419	4'–7 7/8"	1419	4'–6"	1372	9'–3 3/4"	2838	9'–3 3/4"	2838
12'	8	4'–8 7/16"	1434	6'–1 3/4"	1873	5'–11 7/8"	1826	12'–3 1/2"	3747	9'–4 7/8"	2867
15'	10	4'–8 5/8"	1438	7'–7 11/16"	2329	7'–5 13/16"	2281	15'–3 3/8"	4658	9'–5 1/4"	2877
18'	12	4'–8 3/4"	1441	9'–1 9/16"	2783	8'–11 11/16"	2735	18'–3 1/8"	5566	9'–5 1/2"	2883
21'	14	4'–8 3/4"	1441	10'–7 1/2"	3239	10'–5 5/8"	3191	21'–3"	6477	9'–5 1/2"	2883
24'	16	4'–8 3/4"	1441	12'–1 3/8"	3693	11'–11 1/2"	3645	24'–2 3/4"	7385	9'–5 1/2"	2883
27'	18	4'–8 11/16"	1440	13'–7 5/16"	4148	13'–5 7/16"	4101	27'–2 5/8"	8296	9'–5 3/8"	2880
30'	20	4'–8 11/16"	1440	15'–1 3/16"	4602	14'–11 5/16"	4555	30'–2 3/8"	9204	9'–5 3/8"	2880
33'	22	4'–8 11/16"	1440	16'–7 1/8"	5058	16'–5 1/4"	5010	33'–2 1/4"	10116	9'–5 3/8"	2880
36'	24	4'–8 5/8"	1438	18'–1"	5512	17'–11 1/8"	5464	36'–2"	11024	9'–5 1/4"	2877

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

WATER STORAGE TANK SPECIFICATIONS





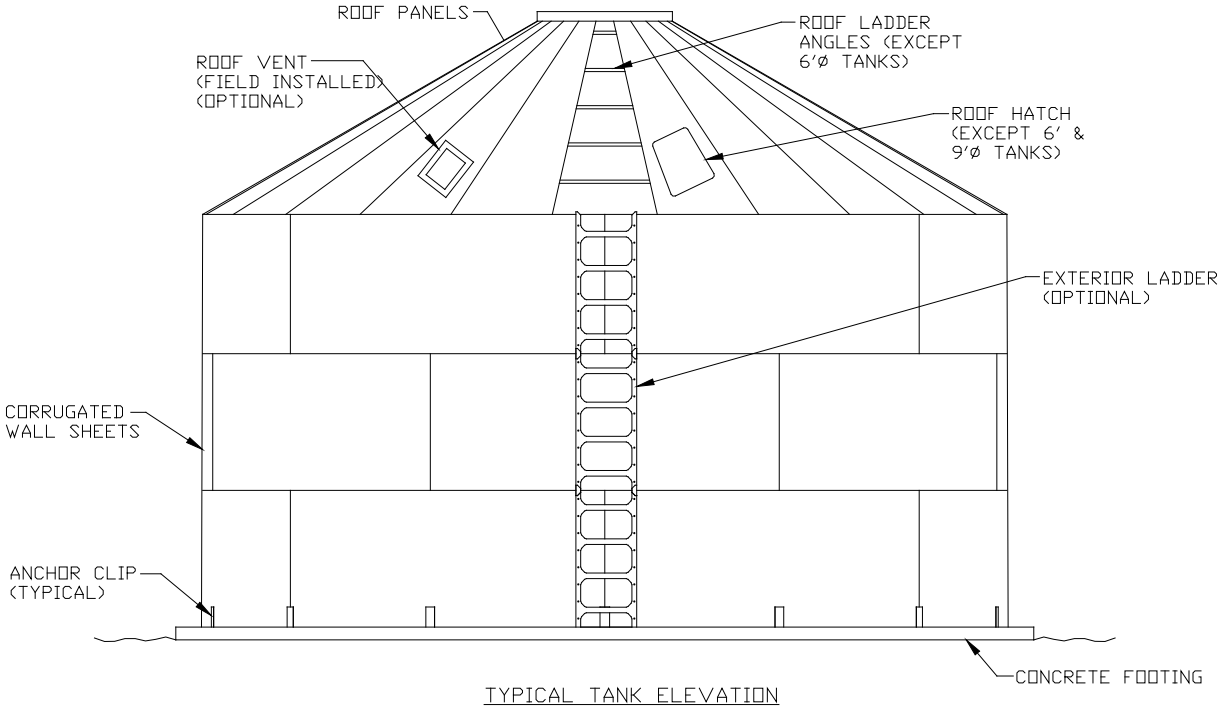
WALL SHEET GAUGE AND COLOR CODE			
GAUGE	COLOR	GAUGE	COLOR
20	BLACK	13	BROWN
18	UNPAINTED	12	ORANGE
17	RED	11	YELLOW
15	YELLOW	10	BLACK
14	GREEN	8	BLUE

TANK SPECIFICATIONS

1. All wall sheets to 17 Ga. conform to ASTM A-446, C, Fy = 50,000 P.S.I G-115 galvanized or better. All wall sheets 16 Ga. or thicker conform to ASTM A653 SQ, Grade 57.
2. Sheets standard corrugation 2 2/3" x 1/2". Sheets have 42 2/3" x 112 1/2" typical coverage.
3. All bolts are grade 8.2. Bolt meet or exceed Leland JS1000 specifications. Vertical seams are bolted at 1 1/3" on center. Horizontal seams are bolted at 9 3/8" on center.
4. Tank liner construction of 25 mil vinyl side and bottom, NSF approved for potable water.
5. Finished structure must be disinfected in accordance with AWWA standard D-105. Two or more successive sets of samples, taken at 24 hour intervals, shall indicate microbiologically satisfactory water before facility is placed in operation.

SCAFCO GRAIN SYSTEMS COMPANY

WATER STORAGE TANK SPECIFICATIONS

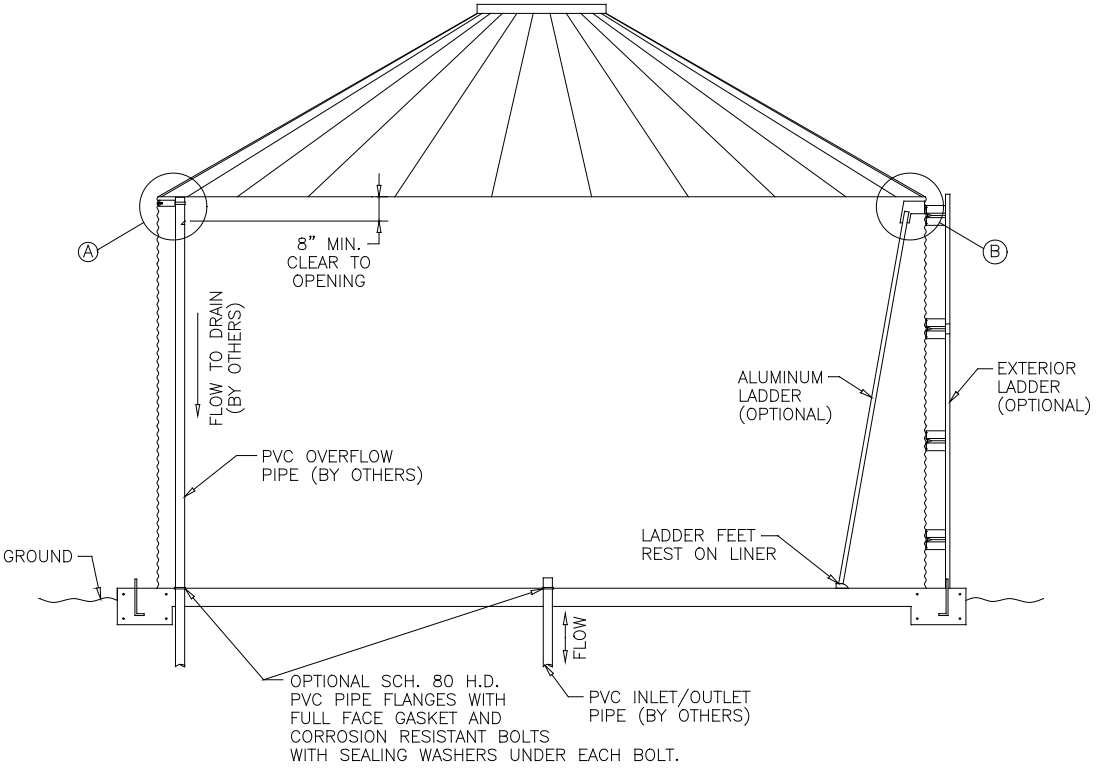


TYPICAL TANK ELEVATION

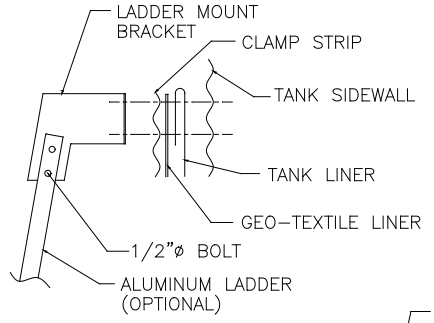
MODEL NO.	DIA.	EAVE HEIGHT	CAPACITY TO EAVE (GAL)	WALL SHEET GAUGES	MODEL NO.	DIA.	EAVE HEIGHT	CAPACITY TO EAVE (GAL)	WALL SHEET GAUGES
601	6'	3' 7"	600	20	2401	24'	3' 7"	10,700	20
602		7' 2"	1,400	20-20	2402		7' 2"	22,600	20-18
603		10' 9"	2,100	20-20-20	2403		10' 9"	34,500	20-18-17
604		14' 3"	2,900	20-20-20-20	2404		14' 3"	46,500	20-18-17-14
901	9'	3' 7"	1,500	20	2701	27'	3' 7"	13,500	20
902		7' 2"	3,100	20-20	2702		7' 2"	28,600	20-18
903		10' 9"	4,800	20-20-20	2703		10' 9"	43,700	20-18-15
904		14' 3"	6,500	20-20-20-20	2704		14' 3"	58,800	20-18-15-14
1201	12'	3' 7"	2,600	20	3001	30'	3' 7"	16,700	20
1202		7' 2"	5,600	20-20	3002		7' 2"	35,300	20-18
1203		10' 9"	8,600	20-20-18	3003		10' 9"	54,000	20-18-15
1204		14' 3"	11,600	20-20-18-18	3004		14' 3"	72,600	20-18-15-13
1501	15'	3' 7"	4,100	20	3301	33'	3' 7"	20,200	18
1502		7' 2"	8,800	20-20	3302		7' 2"	42,700	18-17
1503		10' 9"	13,500	20-20-18	3303		10' 9"	65,300	18-17-15
1504		14' 3"	18,100	20-20-18-17	3304		14' 3"	87,900	18-17-15-13
1801	18'	3' 7"	6,000	20	3601	36'	3' 7"	24,100	18
1802		7' 2"	12,700	20-20	3602		7' 2"	50,900	18-17
1803		10' 9"	19,400	20-20-18	3603		10' 9"	77,800	18-17-14
1804		14' 3"	26,100	20-20-18-17	3604		14' 3"	104,600	18-17-14-12
2101	21'	3' 7"	8,200	20					
2102		7' 2"	17,300	20-18					
2103		10' 9"	26,400	20-18-17					
2104		14' 3"	35,600	20-18-17-15					

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

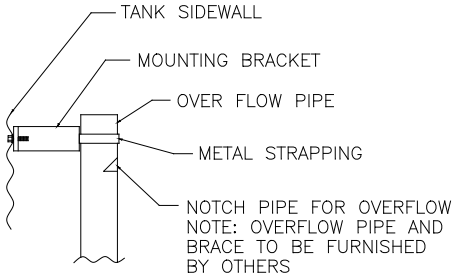
WATER STORAGE TANK SPECIFICATIONS



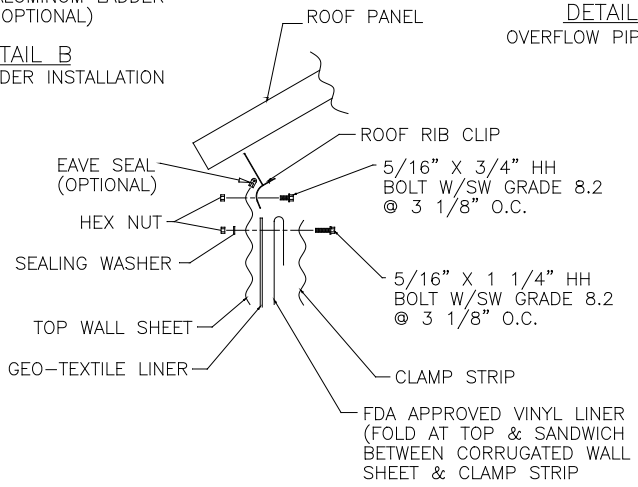
TYPICAL SECTION THROUGH TANK



DETAIL B
INTERIOR LADDER INSTALLATION

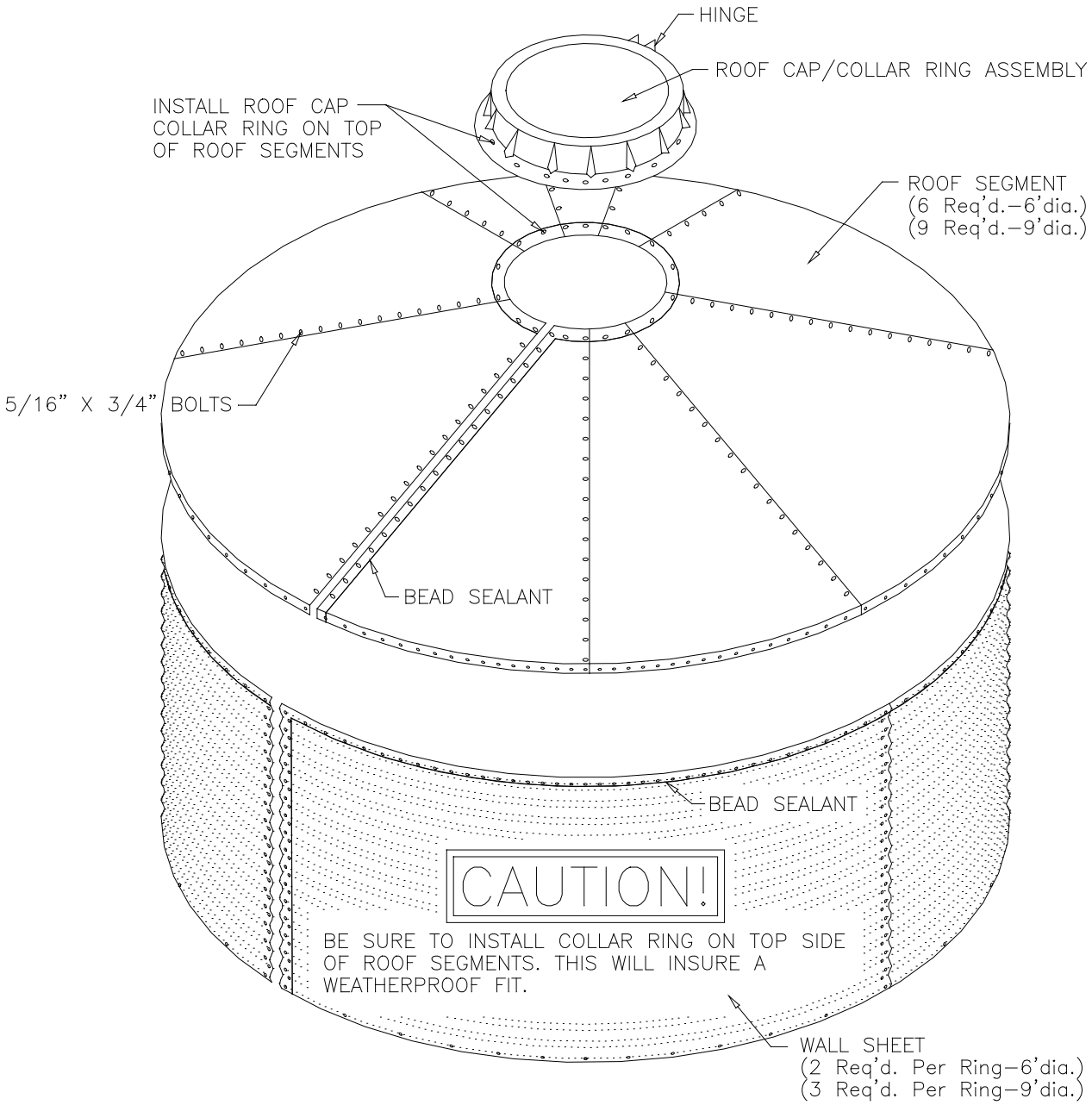


DETAIL A
OVERFLOW PIPE DETAIL



LINER INSTALLATION

ROOF ASSEMBLY
6’ & 9’ WATER STORAGE TANKS

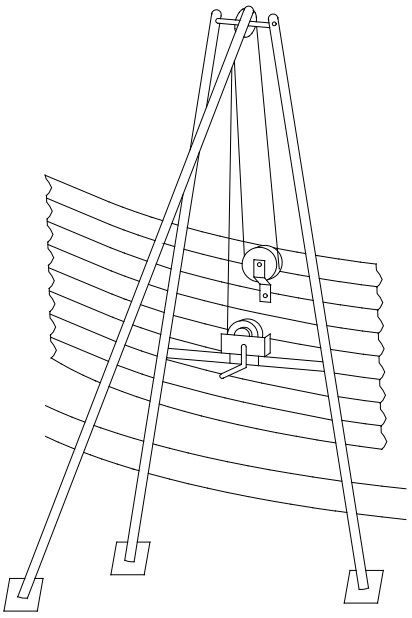


NOTES:

1. Roof segment sheets fit outside wall sheet ring.
2. Top sheets must overlap lower sheets.
3. Use bead sealant on all seams of roof assembly for weatherproofing.
4. For proper fitting roof, leave roof bolted loosely until roof collar ring has been installed, then tighten all roof and collar ring bolts.

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

ERECTION PROCEDURES

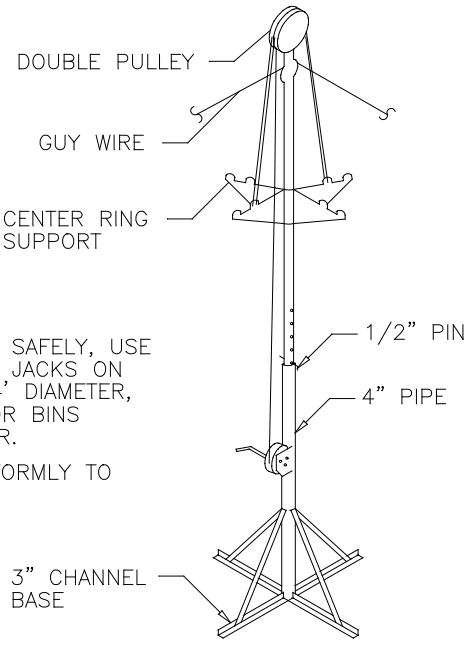


A—FRAME JACK WITH WINCH

5:1 GEAR RATIO WITH 5000 LB. LIFTING CAPACITY, 5/16" AIRCRAFT CABLE USED WITH WINCH.

SAFETY NOTES:

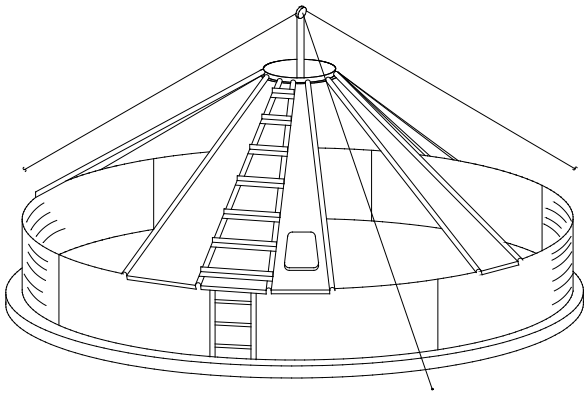
1. TO RAISE TANKS SAFELY, USE A MINIMUM OF 4 JACKS ON TANKS UP TO 24' DIAMETER, USE 6 JACKS FOR BINS 27'–36' DIAMETER.
2. LIFT TANKS UNIFORMLY TO AVOID TIPPING.



ROOF JACK CONSTRUCTION

INSTALLATION NOTES:

*HAND TIGHTEN ALL BOLTS.



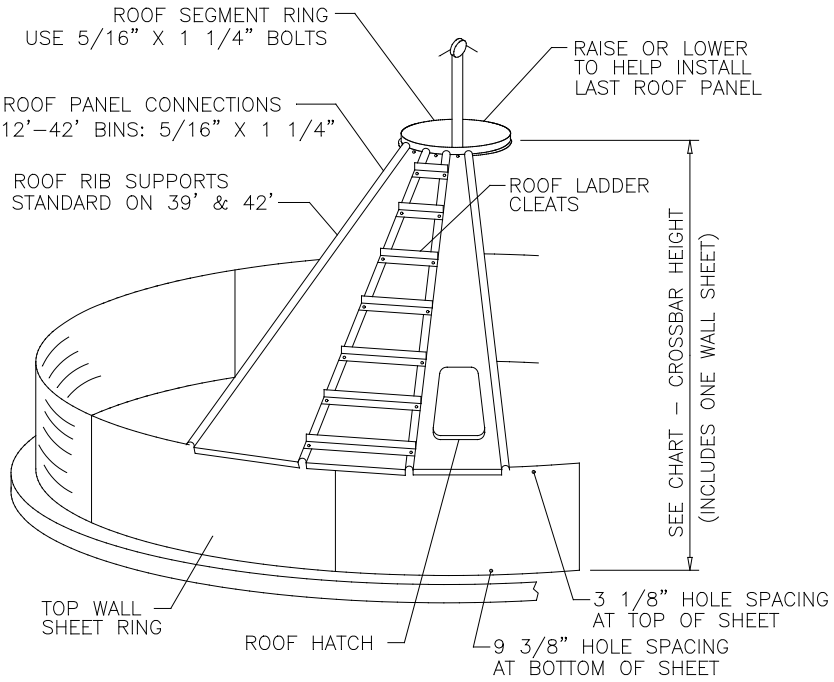
1. Place roof segment ring on center ring support.
2. Assemble top wall sheet ring. Make sure top holes are at 3 1/8" spacing. Holes at bottom of sheet will be at 9 3/8" spacing.
3. Position the roof hatch panel next to the desired sidewall ladder location & fasten to segment ring. Attach the roof center clip to roof panel and put the lower edge of panel on the wall sheet ring.
4. Continue with rest of roof panels by alternating around circumference of tanks until all panels are installed. Also attach center clips & rib clips to roof panels and wall sheets as you go. (39' & 42' tanks also add roof rib supports).
5. The last roof panel should be next to the roof hatch panel. Attach roof ladder cleats while bolting roof panels together. See next page for bolt size.

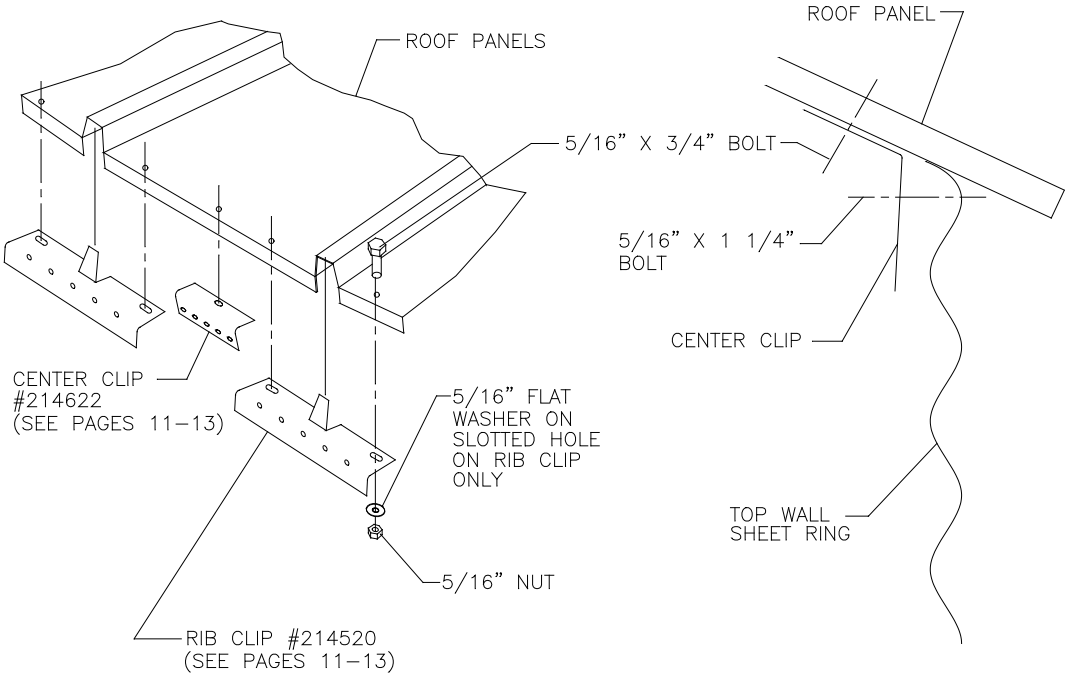
CAUTION: As last roof panel is installed, you may incur the following:
Too much space – Raise roof jack. This will close the gap.
Too little space – Lower the roof jack. This will lessen the slope & increase the space required.

6. Refer to next page for details on center clips, rib clips, and cleats.
7. With everything in place, tighten all roof bolts.

ROOF INSTALLATION DETAILS

TANK DIA.	CROSS BAR HEIGHT
12'	6'–7"
15'	7'–5"
18'	8'–4"
21'	9'–2"
24'	10'–0"
27'	10'–7"
30'	11'–5"
33'	12'–3"
36'	13'–2"
39'	14'–0"
42'	14'–10"

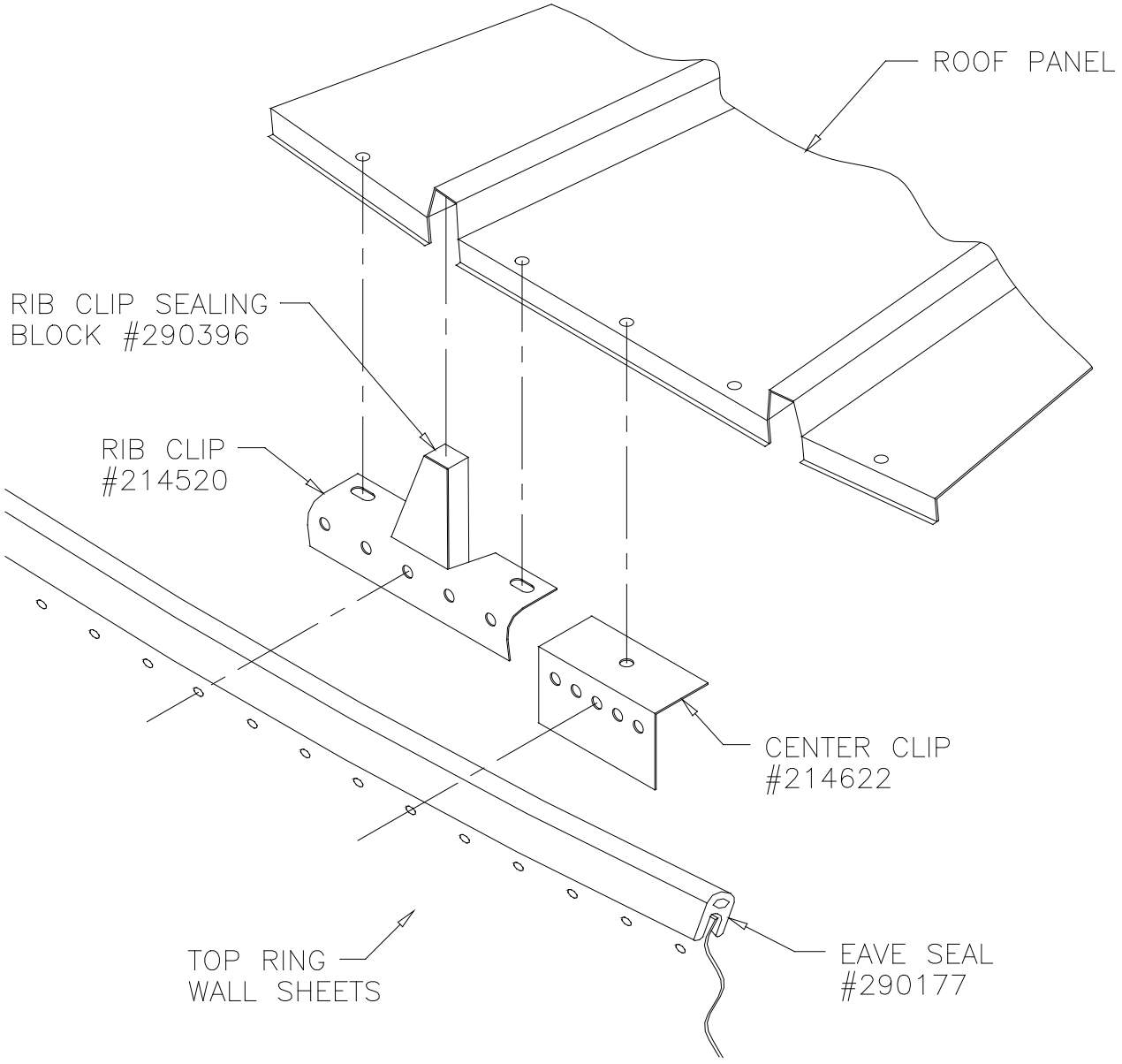




SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

RIB CLIP & EAVE SEAL INSTALLATION

(OPTIONAL PURCHASE)



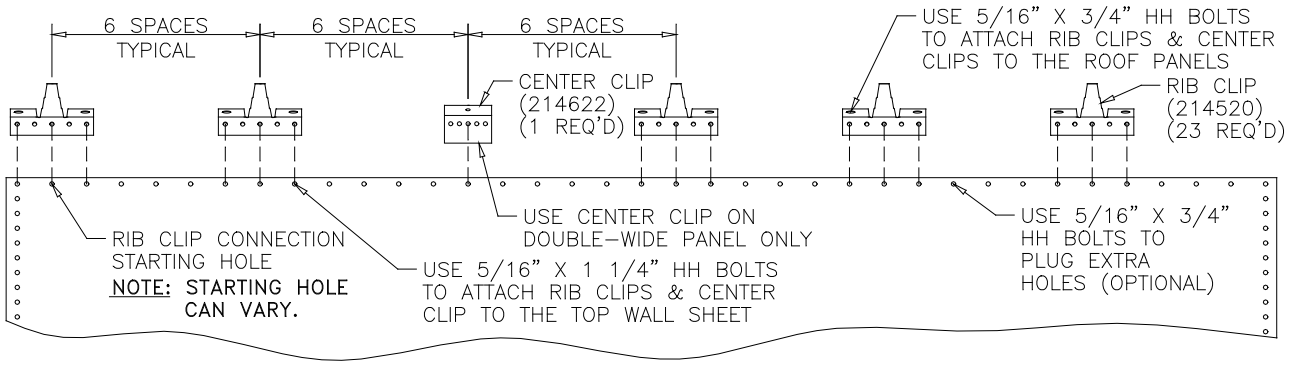
NOTES:

1. Install eave seal around top edge of wall sheets.
2. Glue rib clip sealing block to rib clip (1 per clip).
3. Bolt center clips and rib clips to wall sheets and roof panels as shown.
4. Fill all unused holes w/ 5/16" x ¾" bolts.

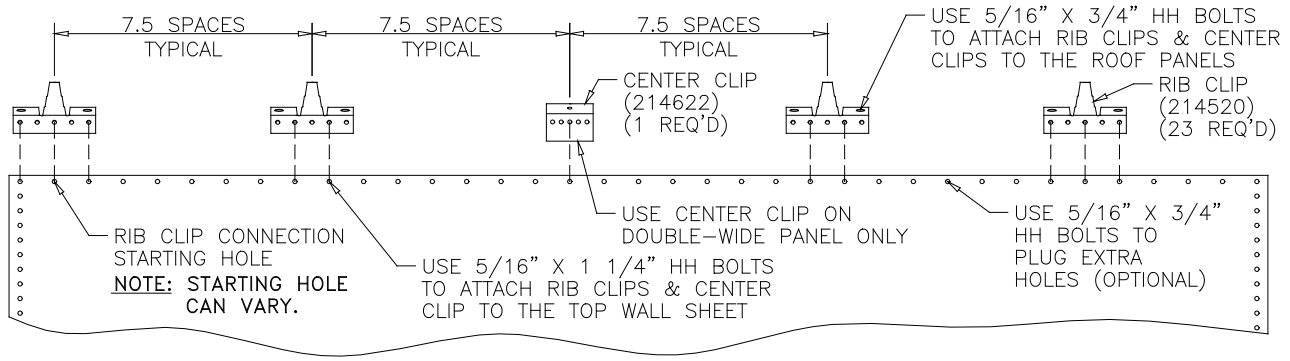
When installed properly, silo will have a weather tight seal.

STANDARD RIB & CENTER CLIP CONNECTIONS

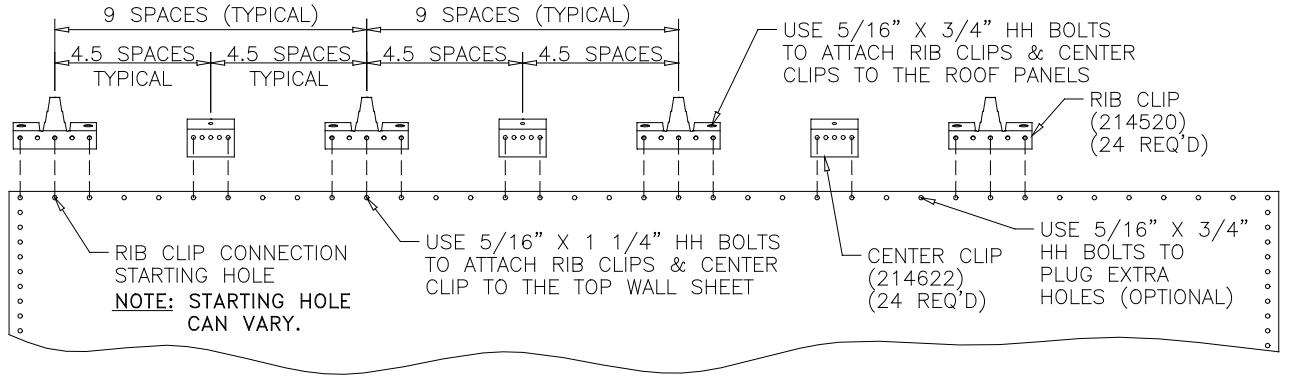
12' DIAMETER TANKS



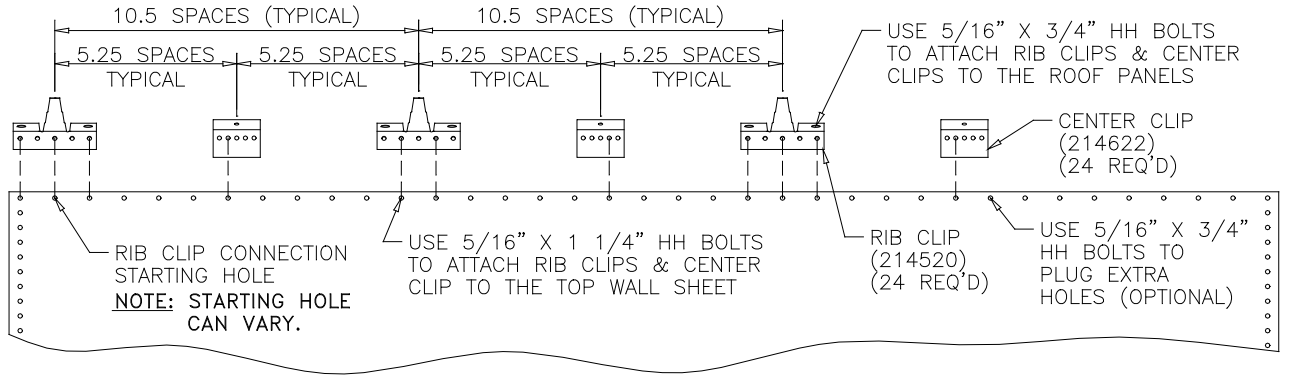
15' DIAMETER TANKS



18' DIAMETER TANKS



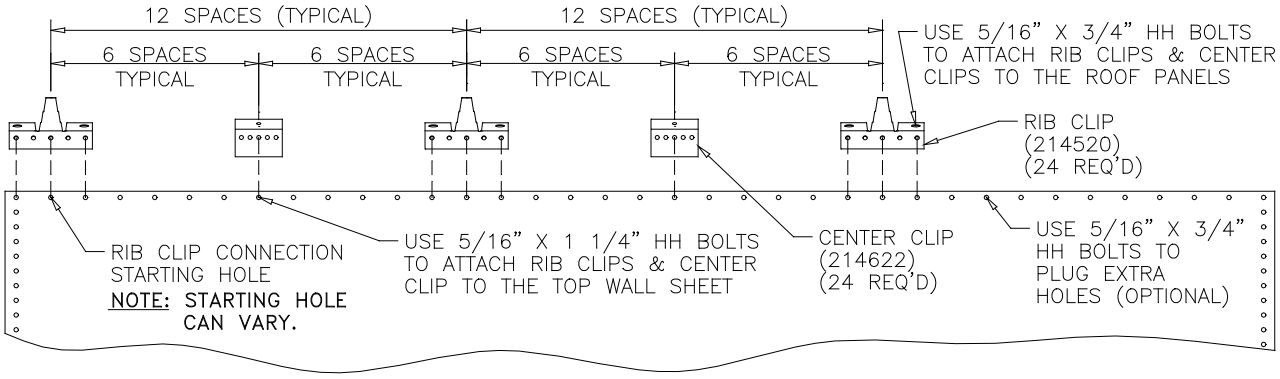
21' DIAMETER TANKS



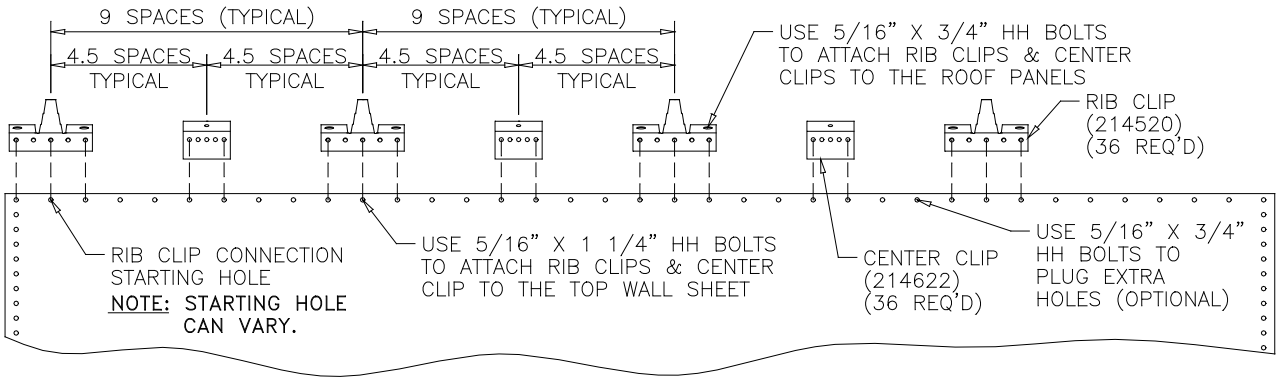
SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

STANDARD RIB & CENTER CLIP CONNECTIONS

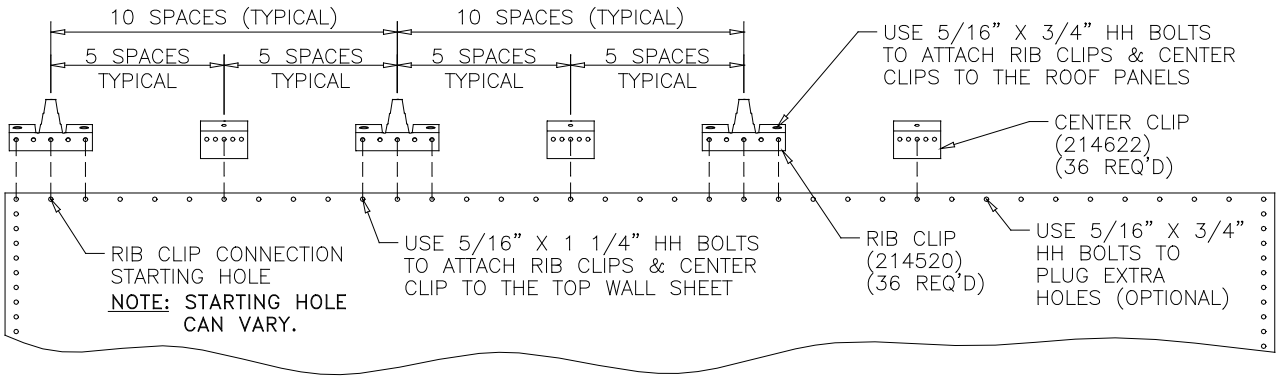
24' DIAMETER TANKS



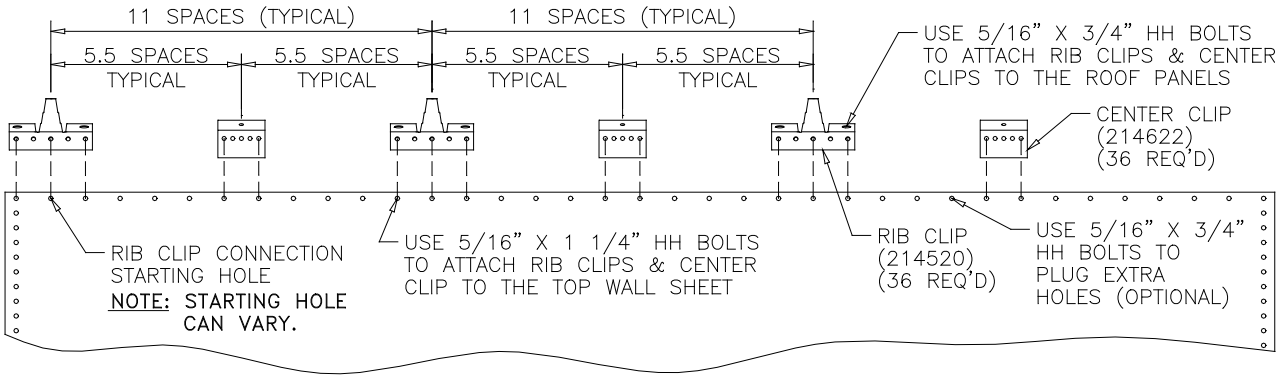
27' DIAMETER TANKS



30' DIAMETER TANKS

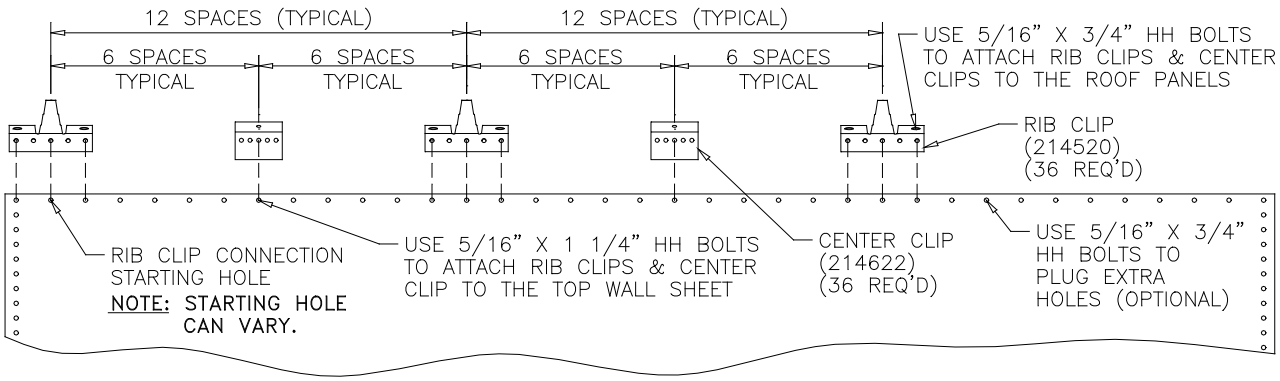


33' DIAMETER TANKS



STANDARD RIB & CENTER CLIP CONNECTIONS

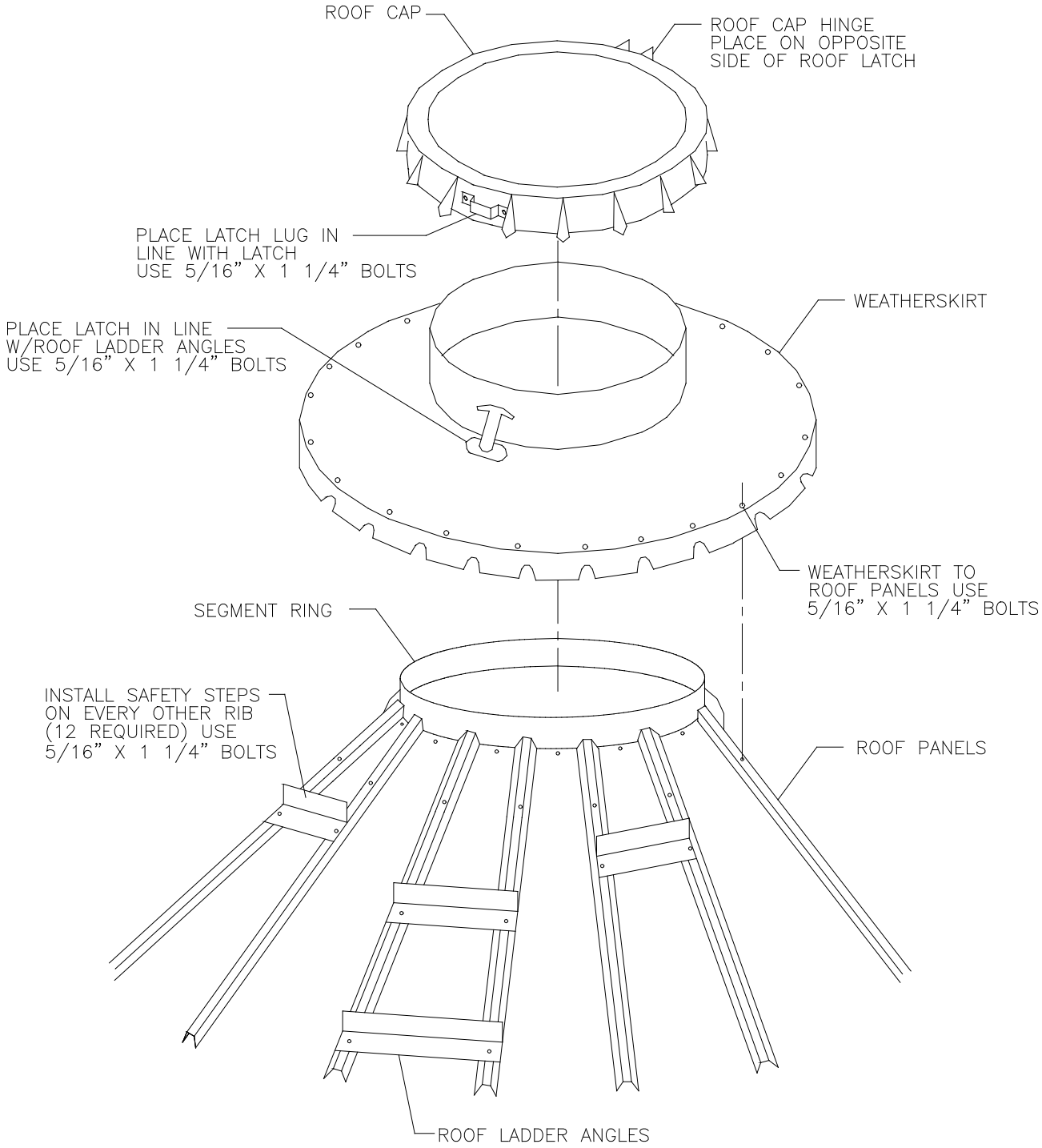
36’ DIAMETER TANKS



SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

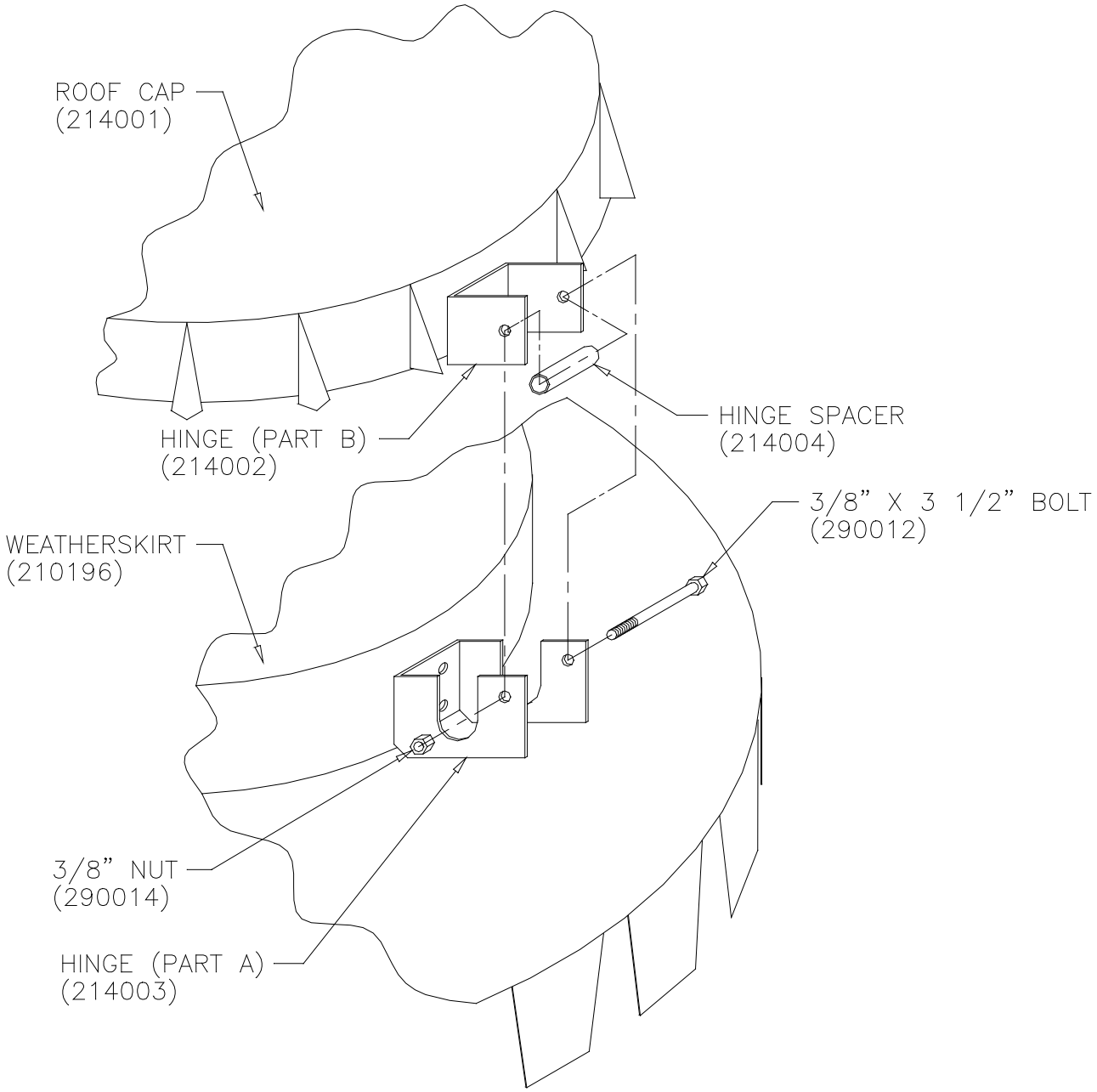
WEATHERSKIRT & CAP INSTALLATION

12’ – 24’ DIAMETER TANKS



ROOF CAP HINGE INSTALLATION

12’ – 24’ DIAMETER TANKS



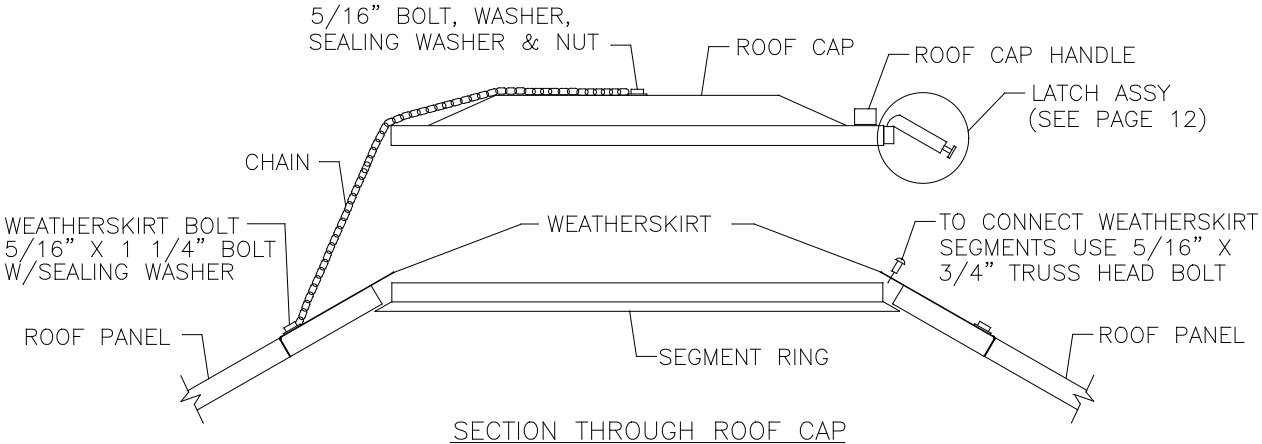
NOTES:

1. Connect hinge (part B) (214002) to roof cap (214001) using (2) 5/16” x 3/4” HH bolt (290001) & 5/16” Hex Nut (290010).
1. Connect hinge (part A) (214003) to weatherskirt (210196) using (4) 5/16” x 3/4” HH bolt (290001) & 5/16” Hex Nut (290010).
2. Assemble together using hinge spacer (214004) & 3/8” x 3 1/2” HH bolt (290012) & 3/8” Hex Nut (290014) as shown.

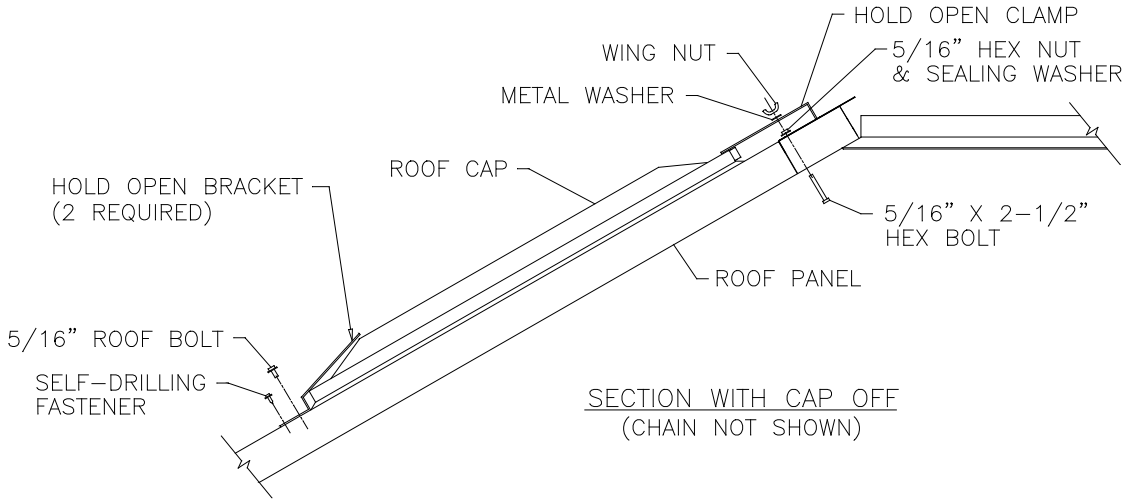
SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

ROOF CAP ASSEMBLY

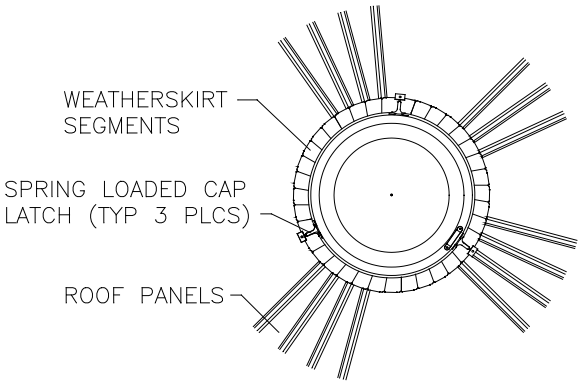
27’ – 36’ DIAMETER TANKS



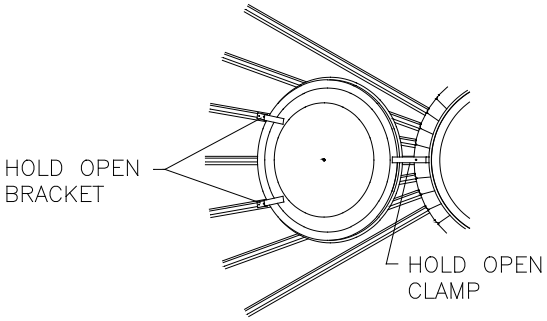
SECTION THROUGH ROOF CAP



SECTION WITH CAP OFF
(CHAIN NOT SHOWN)



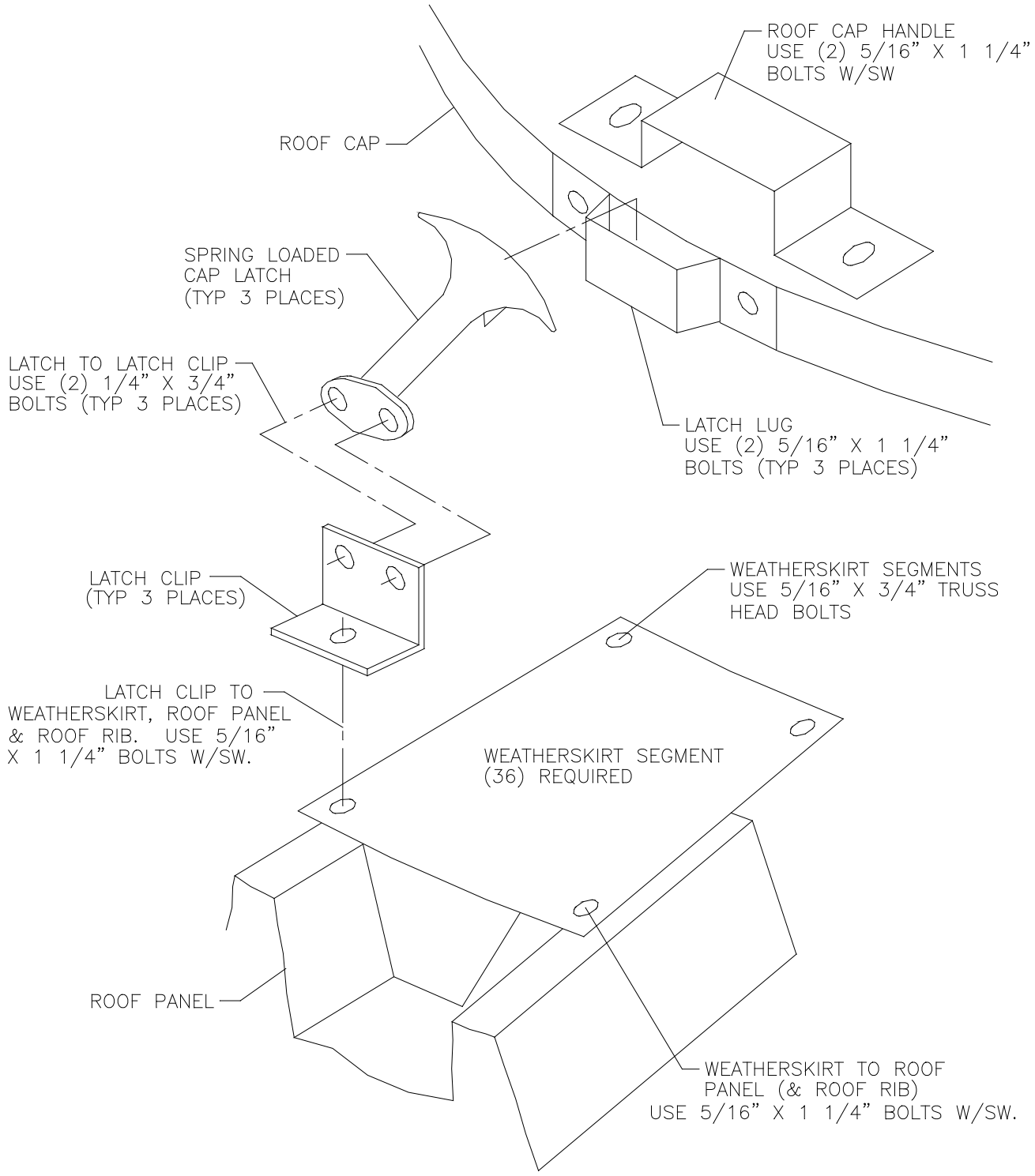
PLAN VIEW – CAP ON
(CHAIN NOT SHOWN)



PLAN VIEW – CAP OFF
(CHAIN NOT SHOWN)

ROOF CAP ASSEMBLY

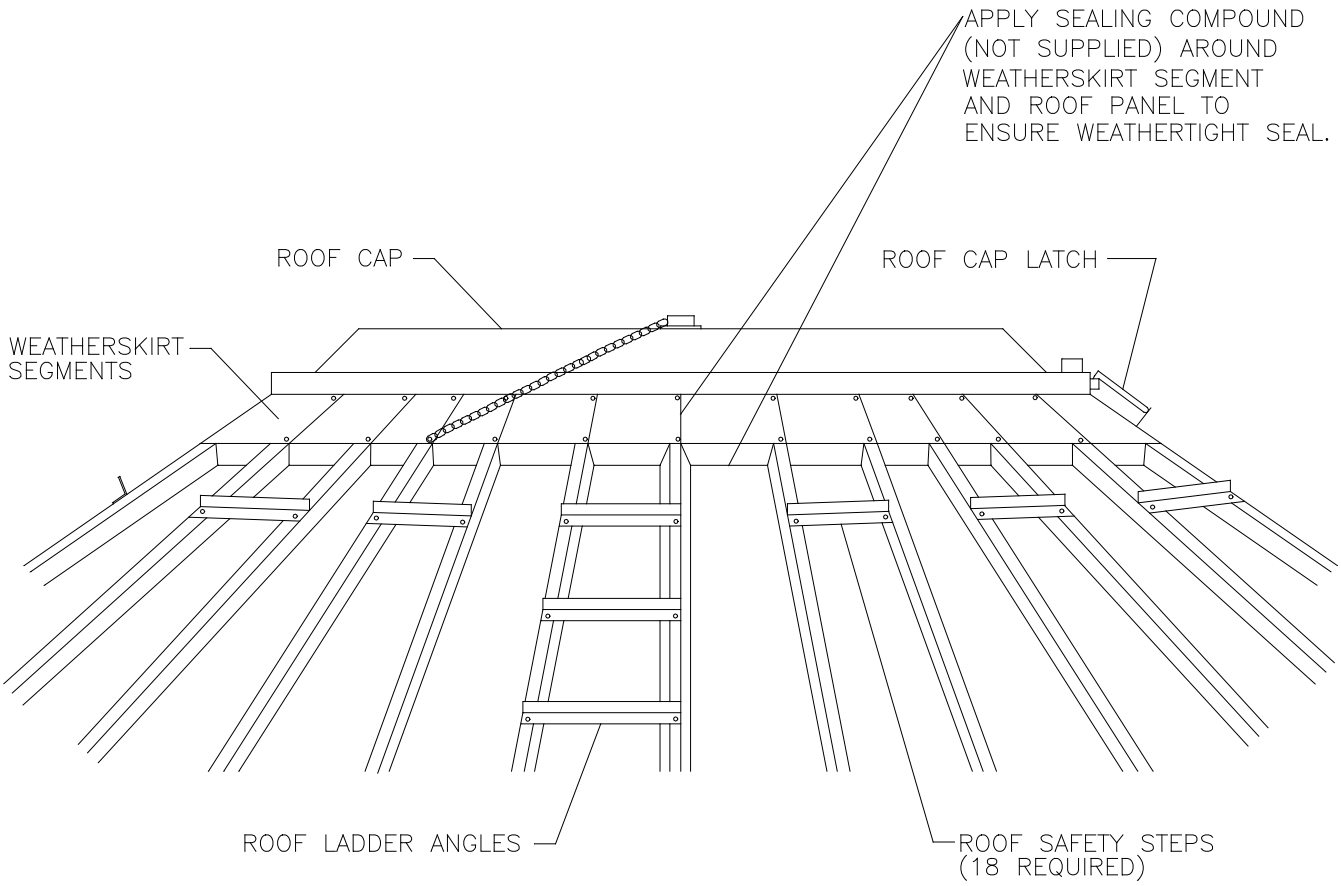
27’ – 36’ DIAMETER TANKS



SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

COMPLETE ROOF CAP ASSEMBLY

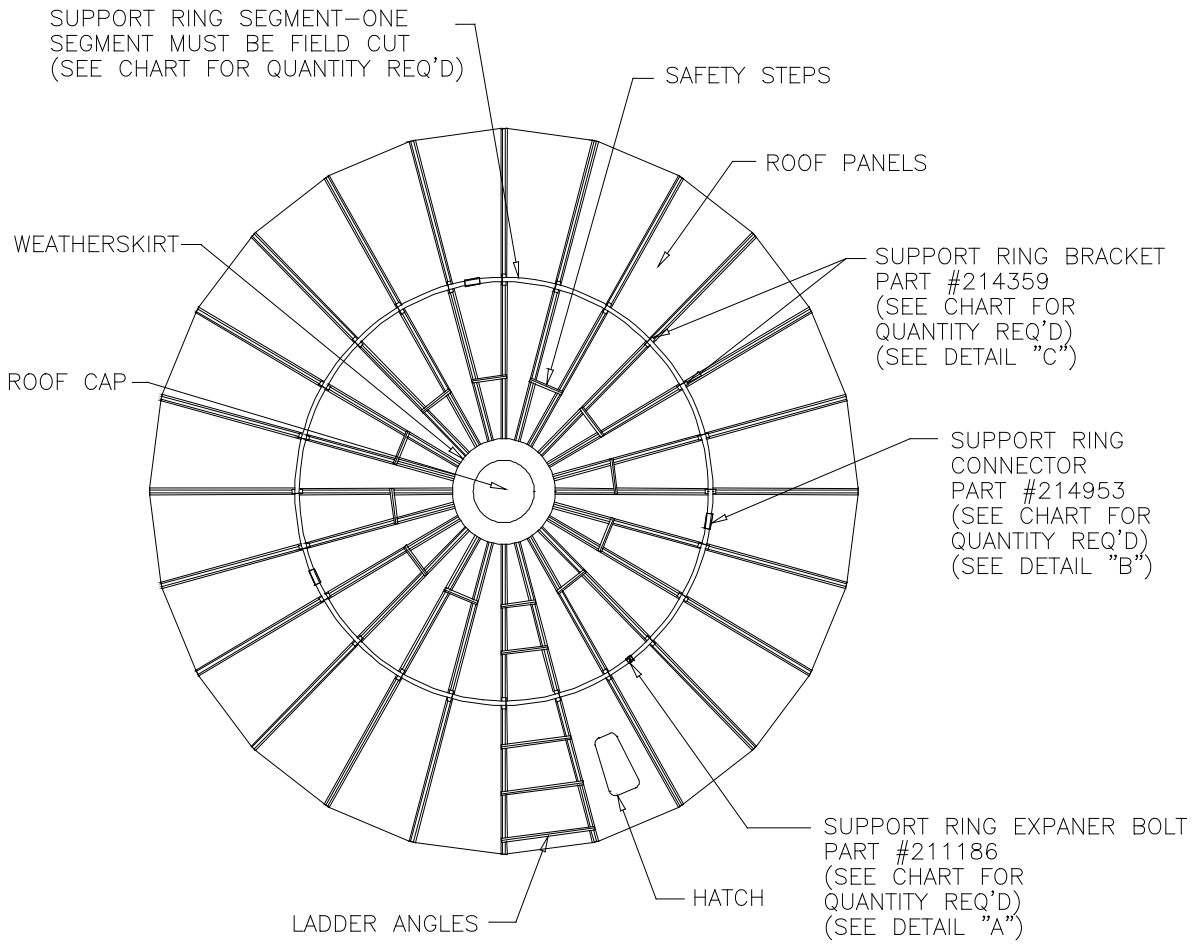
27’ – 36’ DIAMETER TANKS



ROOF SUPPORT RING INSTALLATION

STANDARD ON 39’ & 42’ TANKS ONLY

(Optional on other tank diameters)



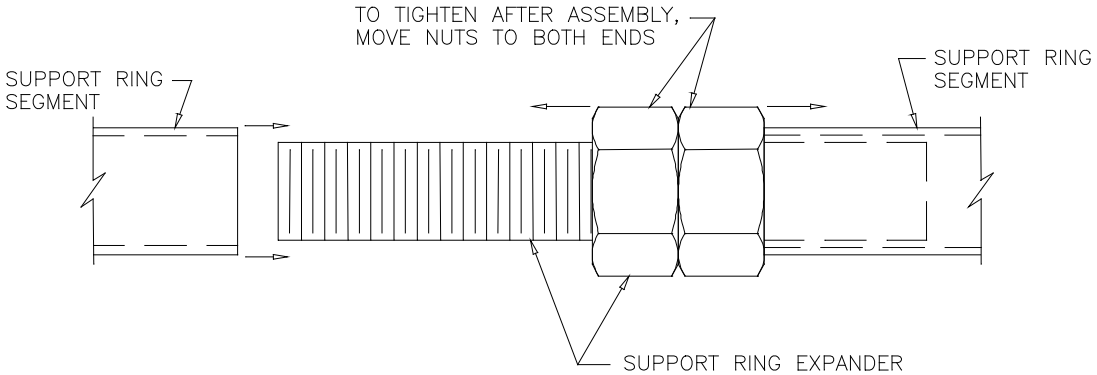
TOP VIEW

TANK SIZE	NUMBER OF RIB BRACKETS	NUMBER OF SEGMENTS	NUMBER OF EXPANSION BOLTS	*LOCATION OF SUPPORT RING BRACKET	NUMBER OF SUPPORT RING CONNECTORS	ROOF SUPPORT RING ASSEMBLY
42’	36	7	2	7	5	STANDARD
39’	36	6	1	7	5	STANDARD
36’	36	6	1	6	5	OPTIONAL
33’	36	6	1	5	5	OPTIONAL
30’	36	6	1	5	5	OPTIONAL
27’	36	5	1	4	4	OPTIONAL
24’	24	5	1	4	4	OPTIONAL
21’	24	4	1	4	3	OPTIONAL
18’	24	3	1	4	2	OPTIONAL

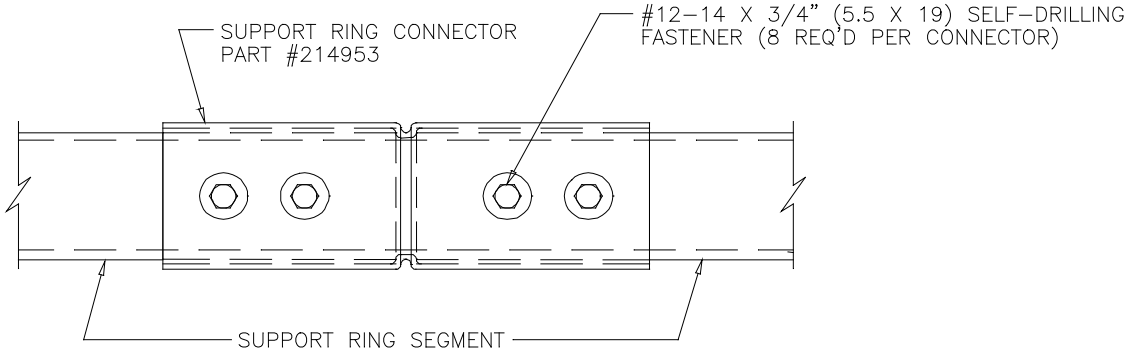
*NUMBER OF HOLES FROM BOTTOM OF ROOF SHEET

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

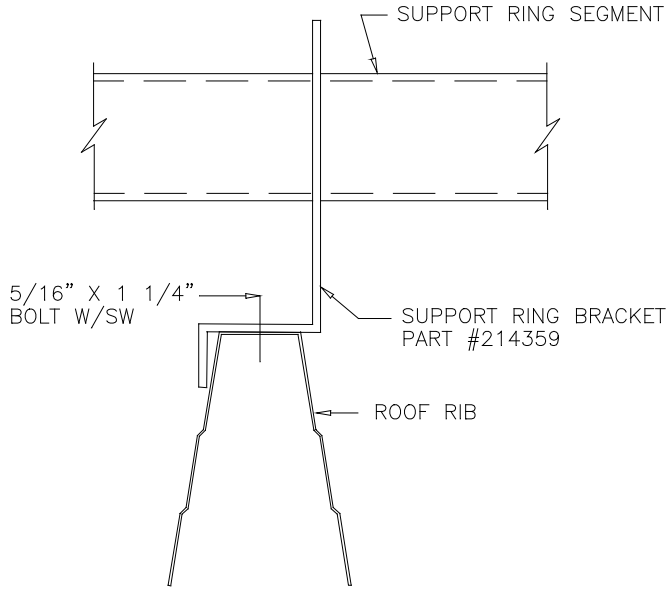
ROOF SUPPORT RING DETAILS



DETAIL 'A'
EXPANDER BOLT



DETAIL 'B'
RING CONNECTOR



DETAIL 'C'
SUPPORT RING BRACKET
TO ROOF CONNECTION

BOLT SCHEDULE

INSTRUCTIONS FOR BOLT PLACEMENT
ON WATER TANKS WITH ROOFS

Anchor Clips: (Refer To Page 22)

- Insert 3/8" diameter x 1" Button Head Bolt from inside the tank.
- Use 3/8" Metal-Backed Sealing Washer between the tank wall and bolt head.
- Fasten with 3/8" Hex Nut.

Clamp Strip to Top Wall Sheet: (Refer To Page 32)

- Insert 5/16" diameter x 1 1/4" Hex Head Bolt from inside the tank.
- Use 5/16 Metal-Backed Sealing Washer between wall sheet and Hex Nut.
- Fasten with 5/16" Hex Nut.

All Vertical Seams and All Other Horizontal Seams:

- Insert 5/16" diameter x 3/4" Truss Head Bolt from inside the tank.
- Fasten with 5/16" Hex Nut.

For Tanks with Wall Sheets 15 Gauge and Thicker (All Wall Sheet Bolts are 3/8")**:**

- Insert 3/8" diameter x 1" Button Head Bolt from inside the tank.
- Use 3/8" Metal-Backed Sealing Washer between the tank wall and bolt head.
- Fasten with 3/8" Hex Nut.

NOTE:
Upper wall sheet ring always overlaps the wall sheet ring below it.
IT IS NOT NECESSARY TO FIELD DRILL the bottom seam of the upper wall sheet to match the extra holes on the top seam of the wall sheets below.

Roof Panel Bolts: (Refer To Pages 7 & 9)

- Insert 5/16" diameter x 1 1/4" Hex Head Bolt from the top of the Roof Panel.
- Fasten with 5/16" Hex Nut.
- For **6' & 9' Dia.** Tanks use 5/16" x 3/4" Hex Head Bolt.
- Fasten with 5/16" Hex Nut.

Roof Center Clips and Rib Clips To Roof Panels: (Refer To Pages 9 - 13)

- Insert 5/16" diameter x 3/4" Hex Head Bolt from the top of the Roof Panel.
- Fasten with 5/16" Hex Nut.

Roof Center Clips and Rib Clips To Wall Sheets: (Refer To Pages 9 - 13)

- Insert 5/16" diameter x 1 1/4" Hex Head Bolt from outside the tank.
- Fasten with 5/16" Hex Nut.

Access Panel: (Refer To Page 24)

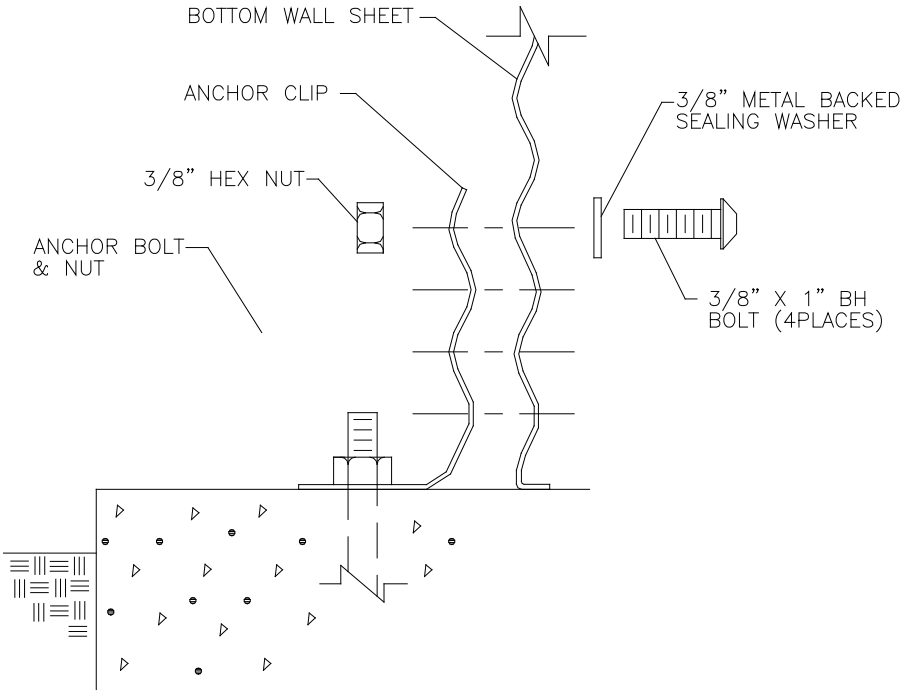
- Insert 3/8" diameter x 1 1/4" Button Head Bolt from inside tank.
- Place 3/8" Jam Nut between Wall Sheet and Access Panel.
- Places 3/8" Metal- Backed Sealing Washer on outside of Access Panel.
- Fasten with 3/8" Hex Nut.

DESCRIPTION	PART NUMBER
3/8" X 1" BUTTON HEAD BOLT GR. 8.2	290158
3/8" X 1 1/4" BUTTON HEAD BOLT GR. 8.2	290369
5/16" X 3/4" HEX HEAD BOLTS W/ SEALING WASHER GR. 8.2	290001
5/16" X 3/4" TRUSS HEAD BOLT W/ SEALING WASHER GR. 8.2	290410
5/16" X 1 1/4" HEX HEAD BOLT W/ SEALING WASHER GR. 8.2	290002
5/16" METAL-BACKED SEALING WASHER	290007
3/8" METAL-BACKED SEALING WASHER	290042
3/8" JAM NUT	290049

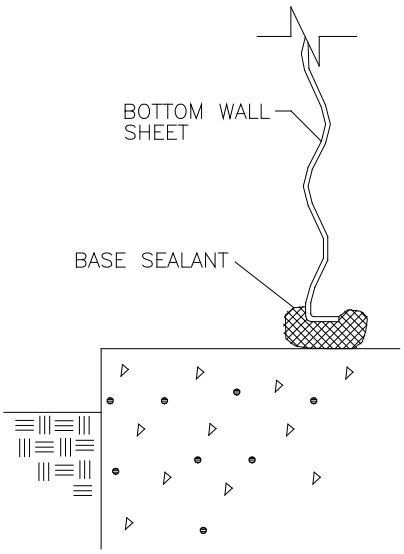
SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

ANCHORING AND SEALING INSTALLATION

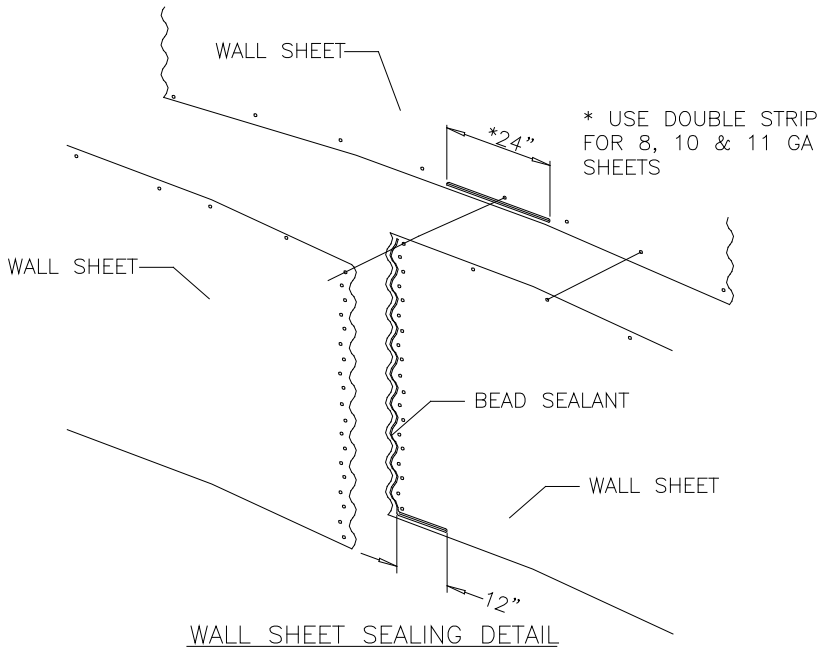
NOTE: THE BASE SEALANT PREVENTS OUTSIDE WATER FROM CREEPING INTO THE TANK DUE TO CAPILLARY ACTION



ANCHOR CLIP DETAIL

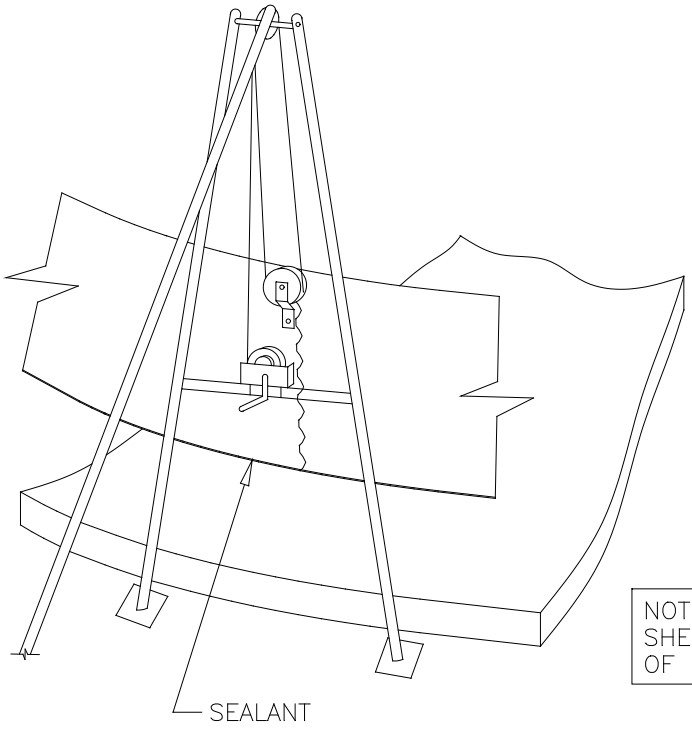


BASE SEALING DETAIL
(REFER TO PAGE 19)



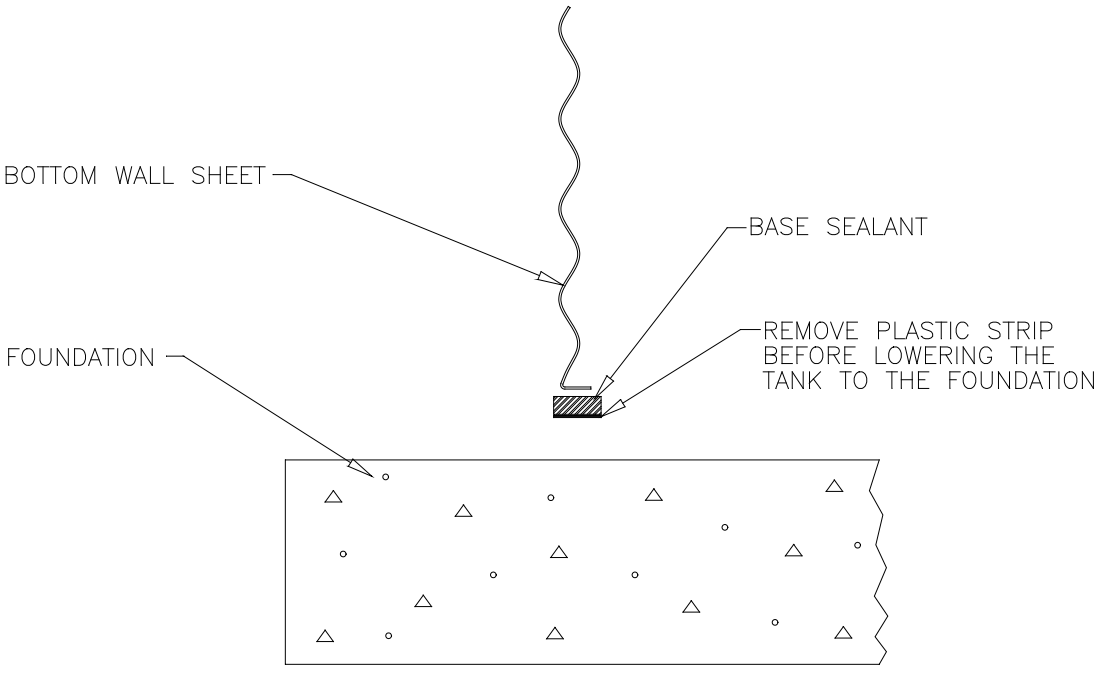
WALL SHEET SEALING DETAIL

BASE SEALANT APPLICATION



1. APPLY SEALANT ALONG LIP OF BOTTOM RING WHILE TANK IS STILL ON JACKS.
2. REMOVE PLASTIC STRIP OFF SEALANT.
3. LOWER TANK ONTO THE FOUNDATION. WHEN TANK IS LOWERED, SEALANT WILL DISTRIBUTE PROPERLY AND PROVIDE A SEAL BETWEEN THE TANK AND THE FOUNDATION.

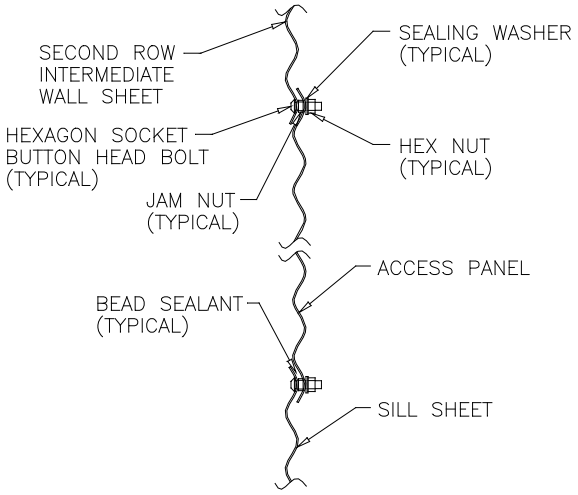
NOTE: CONCRETE AND BOTTOM WALL SHEET MUST BE CLEAN AND FREE OF WATER AND SOIL FOR PROPER SEAL.



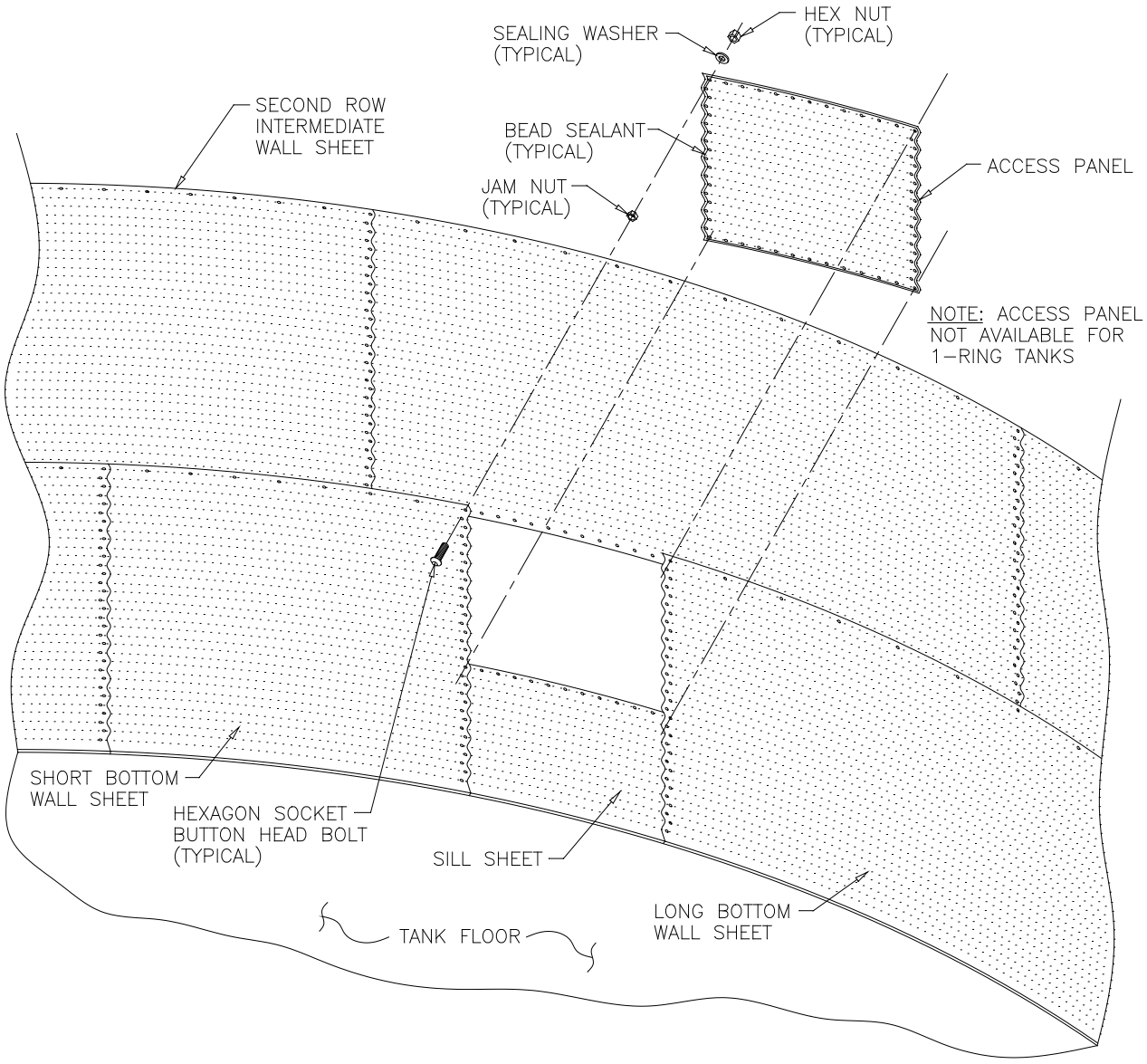
BASE SEALING DETAIL

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

ACCESS PANEL INSTALLATION



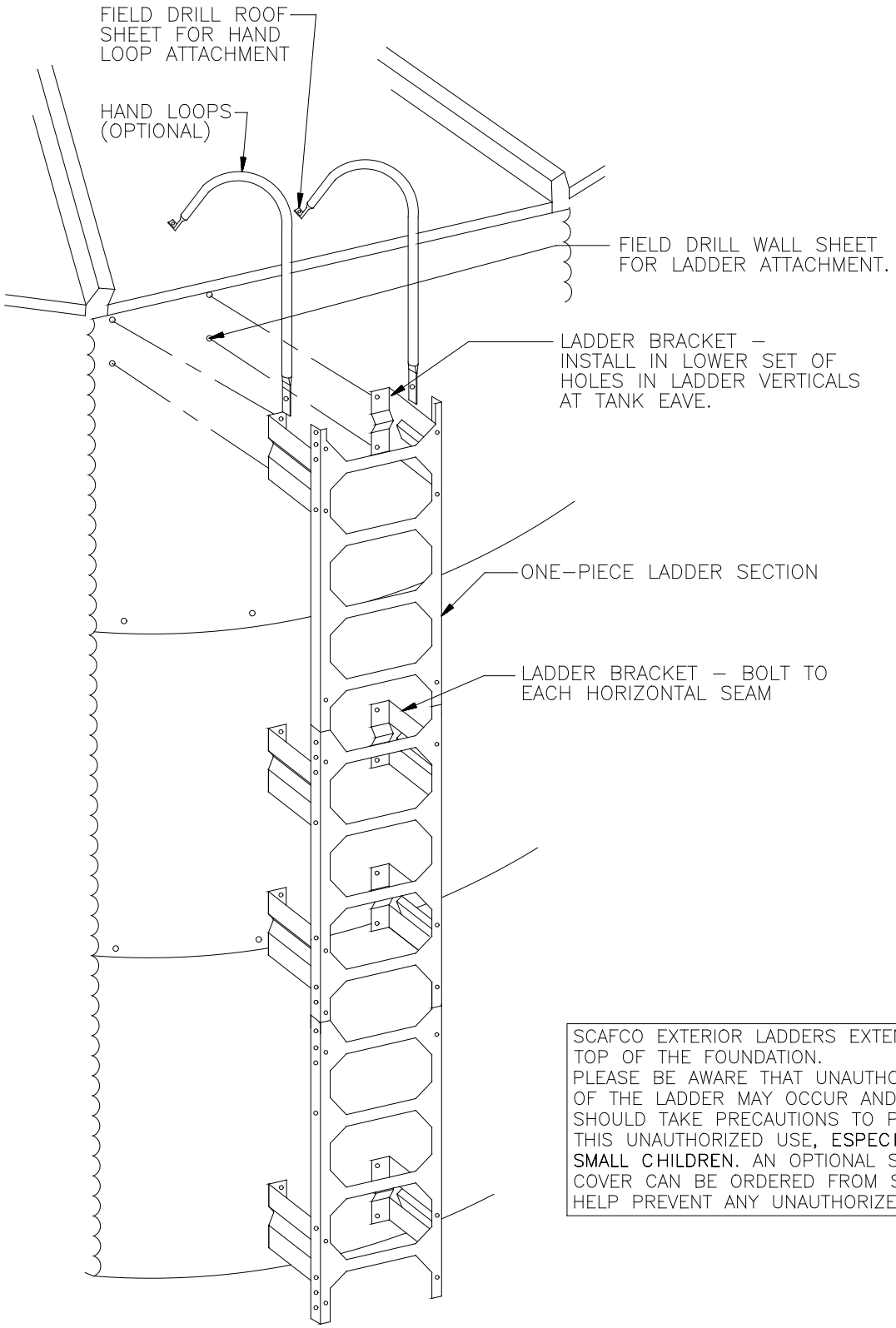
TYPICAL SECTION



SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

EXTERIOR LADDER INSTALLATION

SEE LADDER INSTALLATION BOOKLET (290164)
FOR LADDER INSTALLATION DETAILS



SCAFCO EXTERIOR LADDERS EXTEND TO THE TOP OF THE FOUNDATION.
PLEASE BE AWARE THAT UNAUTHORIZED USE OF THE LADDER MAY OCCUR AND OWNER SHOULD TAKE PRECAUTIONS TO PREVENT THIS UNAUTHORIZED USE, ESPECIALLY BY SMALL CHILDREN. AN OPTIONAL SECURITY COVER CAN BE ORDERED FROM SCAFCO TO HELP PREVENT ANY UNAUTHORIZED ACCESS.

FOUNDATION, INLETS, OUTLETS & OVERFLOWS

CONCRETE FOUNDATIONS

The concrete foundation provides structural support for the Water Storage Tank and its contents, transferring the imposed loads to the surrounding soil and underlying strata. In addition, the foundation can accommodate provisions for adequate drainage and sludge removal. See Figures 1 through 5 for recommendations. Foundation design must be done by a local engineer familiar with site conditions.

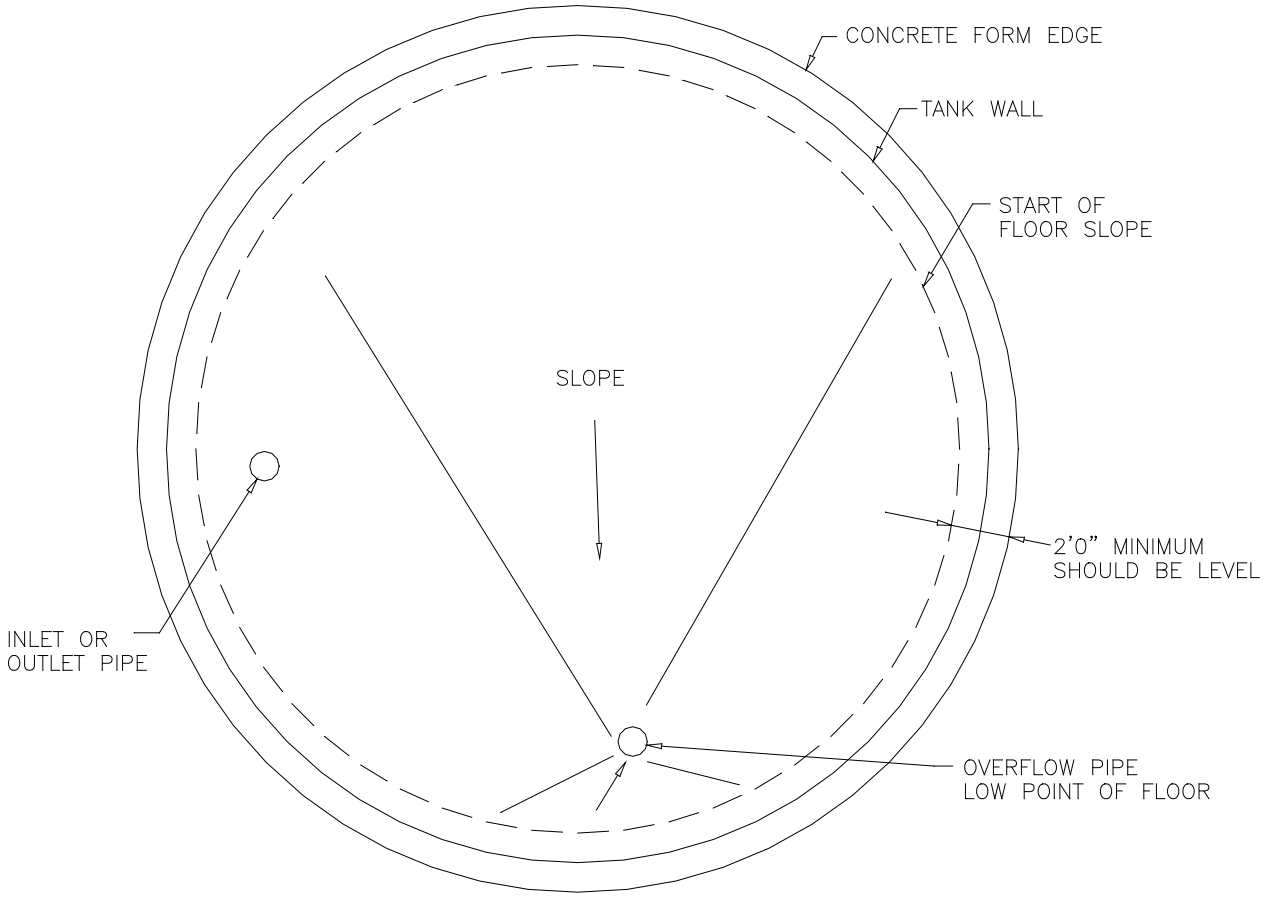


Figure 1: Concrete Floor and Foundation Profile. For removal of sludge and silt, a drain trough should terminate at the selected discharge pipe.

A CONCRETE FOUNDATION IS REQUIRED FOR AN APPROVED SCAFCO WATER STORAGE TANK. FOUNDATION DESIGN IS THE RESPONSIBILITY OF A LOCAL ENGINEER RETAINED BY TANK PURCHASER.

INSTALLING INLETS, OUTLETS & OVERFLOW PIPES

WATER INLET-OUTLET REQUIREMENTS

Every SCAFCO Water Storage Tank has mandatory inlet-outlet and overflow requirements. Each tank must be equipped with a water inlet-outlet pipe and an overflow pipe. Pipe sizes, connections and any controls should be designed by a local engineer retained by the tank purchaser.

Several drawings of recommended piping connections to the SCAFCO tank liner are shown in succeeding pages.

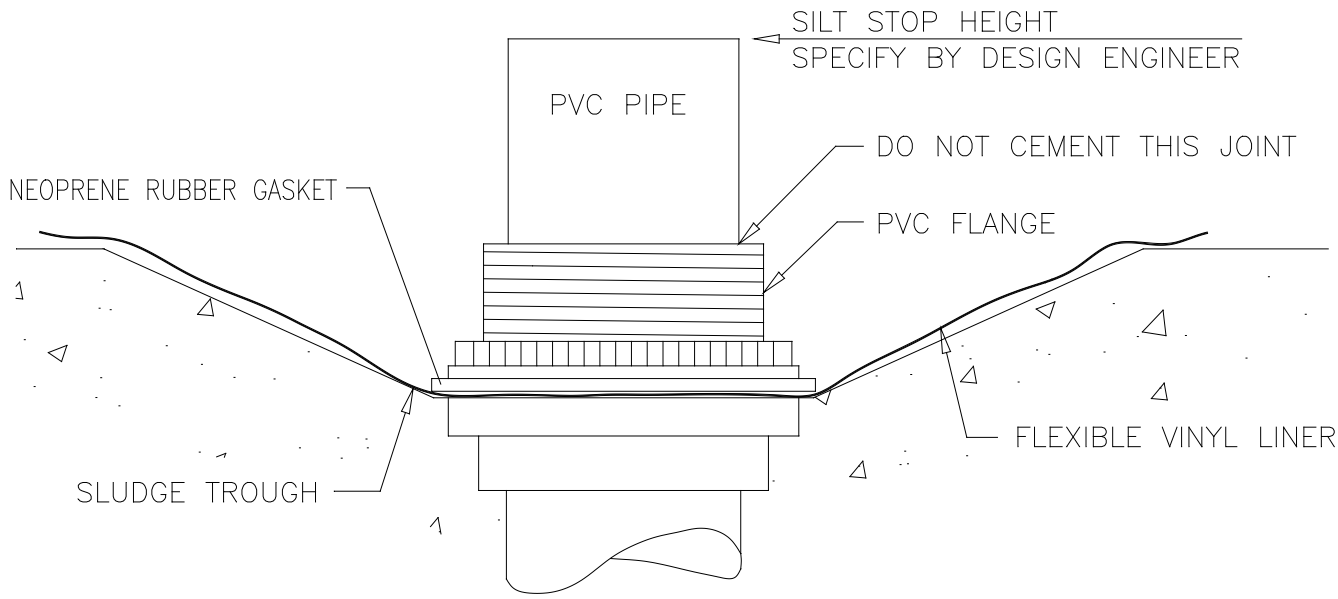
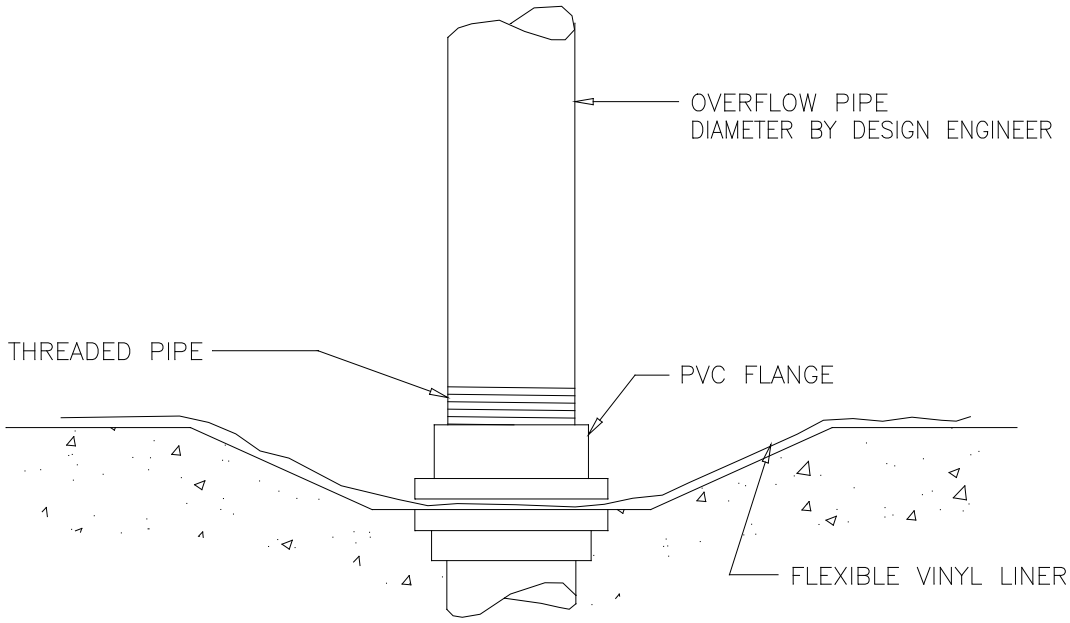


Figure 2: Discharge Outlet Details.
Silt and sludge may be removed through the discharge pipe by using a removable silt stop in the outlet flange.

A DISCHARGE OUTLET AND SILT STOP ARE REQUIRED.
DESIGN OF INLET-OUTLET IS RESPONSIBILITY OF PURCHASER'S ENGINEER.

WARNING: DO NOT LEAVE ANY PORTION OF FLEXIBLE LINER UNSUPPORTED AT FLANGE CONNECTION.



AN OVERFLOW PIPE IS REQUIRED.

Figure 3: Overflow Pipe Details.

By using an overflow pipe with a threaded joint at the floor line, silt and sludge can be removed through the overflow pipe. This eliminates sludge in the discharge system, removing the need to flush the discharge system.

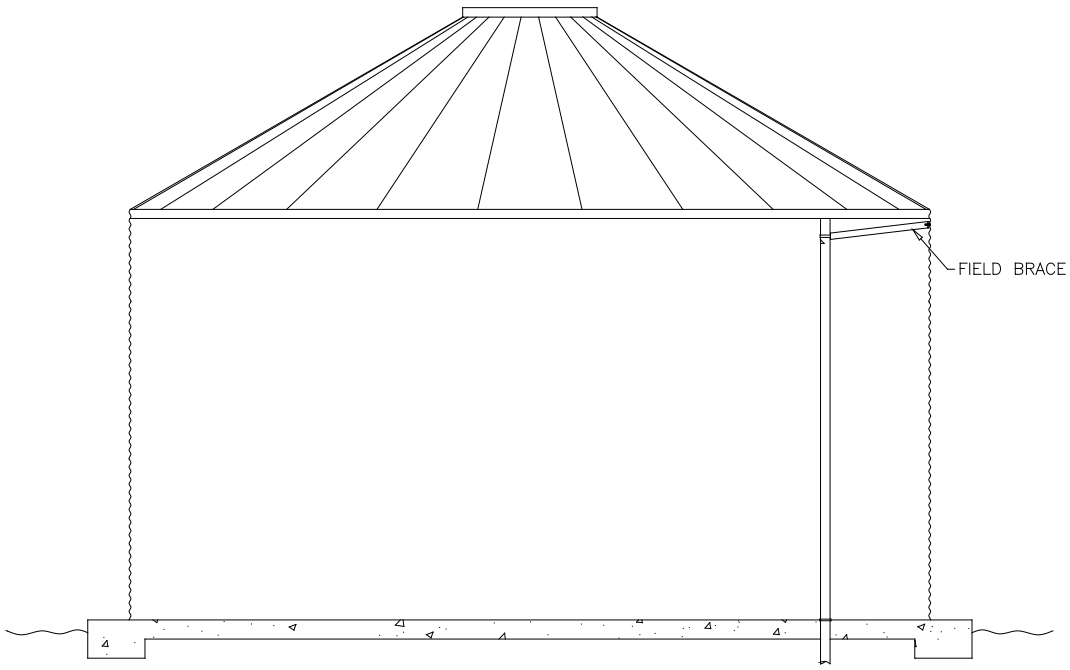


Figure 4: Locating Overflow Pipe.

Locate overflow pipe near wall of tank. Top of overflow pipe should be installed 4" below top of tank liner. Brace top of overflow pipe to tank wall at eave. Braces to be furnished by tank or liner installer. Braces must be attached on the tank wall **ABOVE** top of the liner.

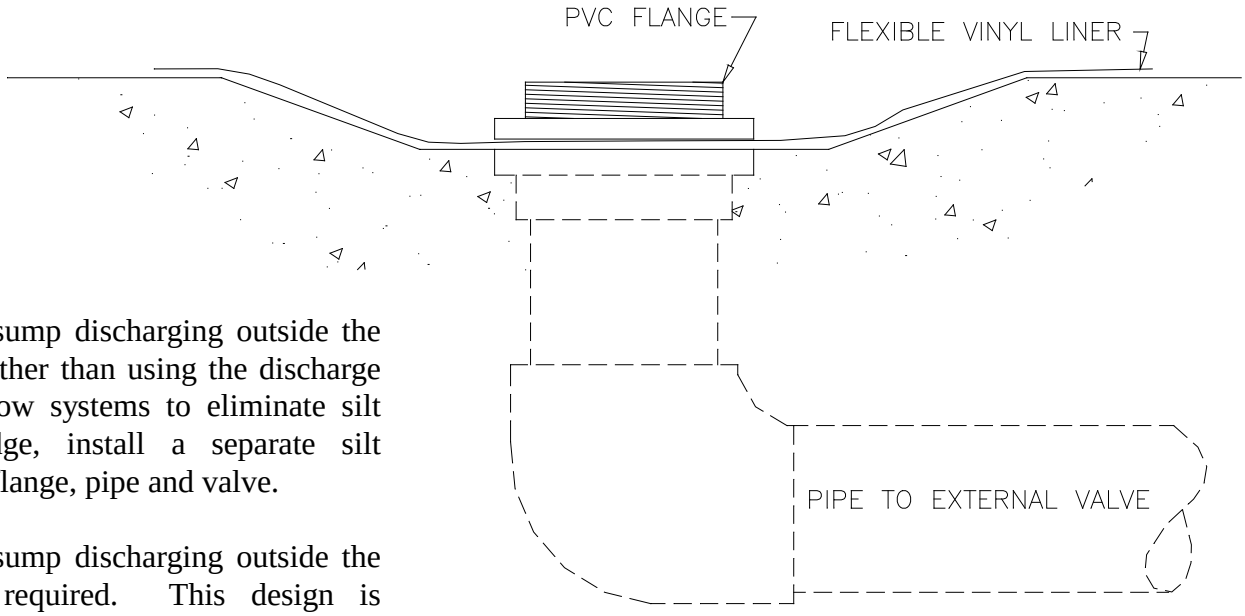


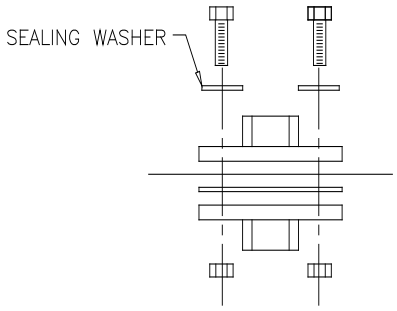
Figure 5:

A drain sump discharging outside the tank. Rather than using the discharge or overflow systems to eliminate silt and sludge, install a separate silt removal flange, pipe and valve.

A drain sump discharging outside the tank is required. This design is optional if the overflow pipe cannot be used for discharge.

INSTALLING INLETS AND OUTLETS

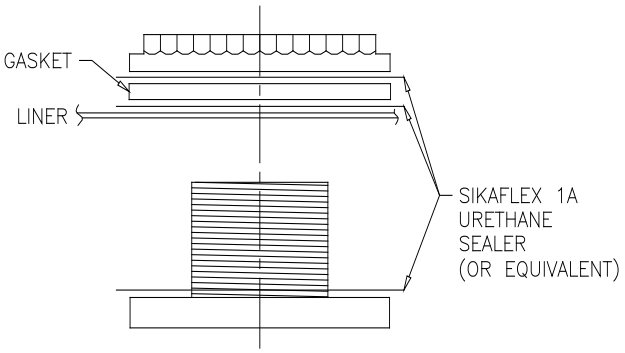
Inlets and outlets through the liner should be made through the tank bottom. Clamp the liner between two cast iron flanges or Schedule 80 plastic flanges or PVC tank adapters or use a prefabricated boot assembly included and located by the liner manufacturer (optional – call SCAFCO for pricing). Use a neoprene rubber gasket between top flange and liner.



BOLT–TOGETHER FLANGES

Seal both sides of liner to flange (and screw threads when applicable) with a waterproof elastometic sealant. Bolt flanges firmly together with stainless steel bolts, or screw PVC tank adapters together, being careful not to over tighten and damage flanges (tighten bolts alternately).

Cut opening through liner last on bolt-together flanges. Cut opening through liner first on screw type PVC tank adapters (opening should be slightly undersized).



PVC TANK ADAPTERS

WARNING: DO NOT LEAVE FLEXIBLE LINER UNSUPPORTED AT FLANGE CONNECTION.

TANK PREPARATION

1. Check interior wall for any sharp edges or protrusions that may damage tank. Sand or grind these areas. **SPECIAL REQUIREMENT:** Geotextile fabric, if supplied, must be installed on the wall and floor prior to liner installation.

2. Sweep concrete floor clean of all debris. Check for sharp objects or protrusions. Remove these by grinding.

FLOOR SURFACE

The vinyl liner is in direct contact with the floor finish. The concrete surface must be fine troweled without imperfections, sharp edges, debris or projections that could damage the liner. A cove fill of non-shrink grout shall be placed at the intersection of the wall and floor to provide a smooth backing for the liner. **See Figure 6.**

Install geotextile fabric on the concrete floor with adhesive prior to liner installation. This is especially helpful when the concrete finish is not smooth.

Design of the silt stop, sludge discharge, reinforced concrete foundation and liner protection must be determined by the purchaser's Design Engineer or other design professional.

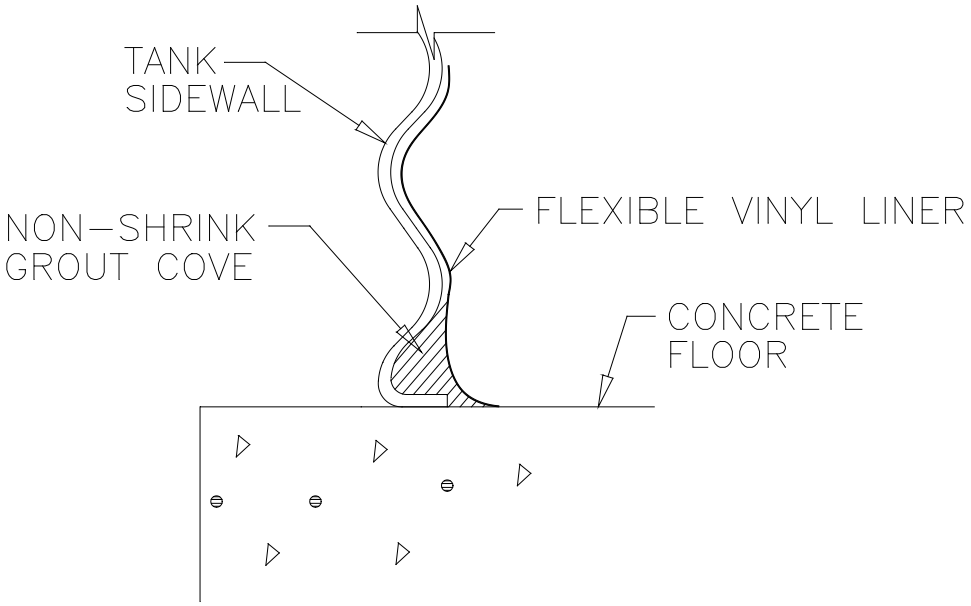


Figure 6: Tank Perimeter Preparation.
Provide an expanding grout cove around tank perimeter to reduce corner stress on flexible vinyl liner.

A COVE AT THE WALL TO FLOOR INTERSECTION IS REQUIRED.

INTERIOR WALL PAINT

It is recommended that the tank installer coat the interior walls of the SCAFCO Water Storage Tank prior to the installation of the geotextile fabric and flexible liner. It has been our experience that under certain circumstances white rust (corrosion of the zinc coating) may develop on the wall sheets due to moisture trapped between the geotextile fabric and galvanized wall sheet. The appearance of white rust (and subsequent degradation of the zinc coating) may range from light to excessive depending on actual conditions. Painting the interior walls will reduce the spread of white rust.

The following steps and materials are necessary to accomplish satisfactory coating of the interior walls prior to the application of the liner.

1. Apply a 60% phosphoric acid solution, diluted 1 to 3 with warm water, to the interior walls of the tank. This solution should be brushed on and allowed to dry. No rinse is required. Use Dubois Chemical Company "PREPARE" or equivalent product.
2. Apply a moisture cured urethane primer, minimum 2 mil thickness, to the interior tank walls. Primer should be applied on dry surface following etching accomplished in Step 1. Primer may be applied by brush or airless spray. Use Columbia Paint 07-440-PP Single Package Urethane Aluminum Primer or Sherwin-Williams paint.

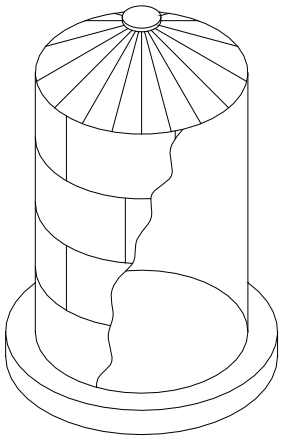
LINER INSTALLATION PRECAUTIONS

1. Do not open liner package with knife.

2. Avoid dropping tools or sharp instruments on liner.

3. **ALL PERSONNEL INVOLVED IN LINER INSTALLATION MUST DO SO IN BARE OR STOCKING FEET.**

4. SCAFCO tank liners are manufactured oversize so that there is plenty of slack. It is important, however, to see that no strains develop in the liner. To avoid strains, see that there is no shortage of liner material around the inside bottom perimeter.

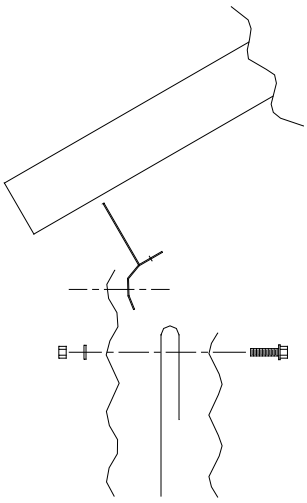


LINER INSTALLATION

1. Unfold the liner on the tank floor; stretch it out so the bottom is snug against the inside bottom perimeter. The bottom-to-wall of the liner circle should actually extend partially up the wall of the tank.

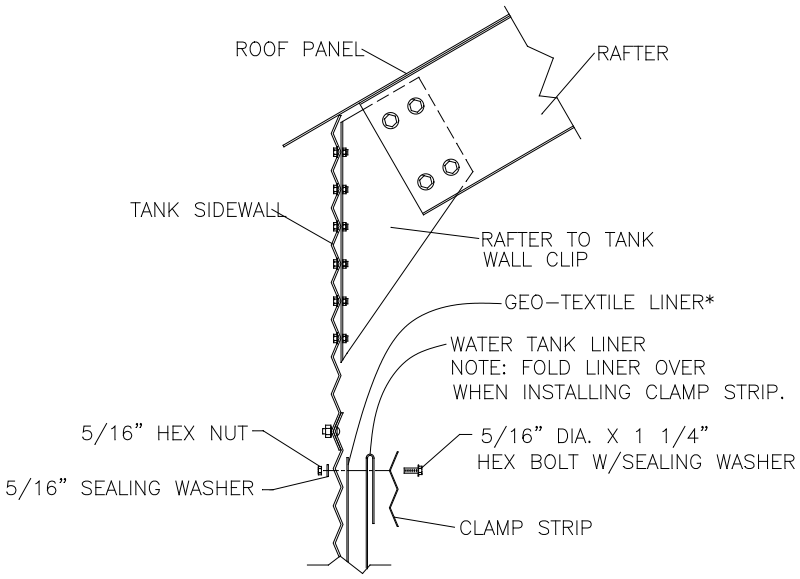
2. Raise the liner walls to the eave of the tank. Place the liner between the corrugated clamp strip and the outside walls. Use a sharp center punch to puncture the liner at each bolt hole in the clamp strip. Insert bolts around the upper perimeter of the tank.

3. Tighten all bolts. Make sure there is plenty of slack in walls to Reduce strain when tank is filled.



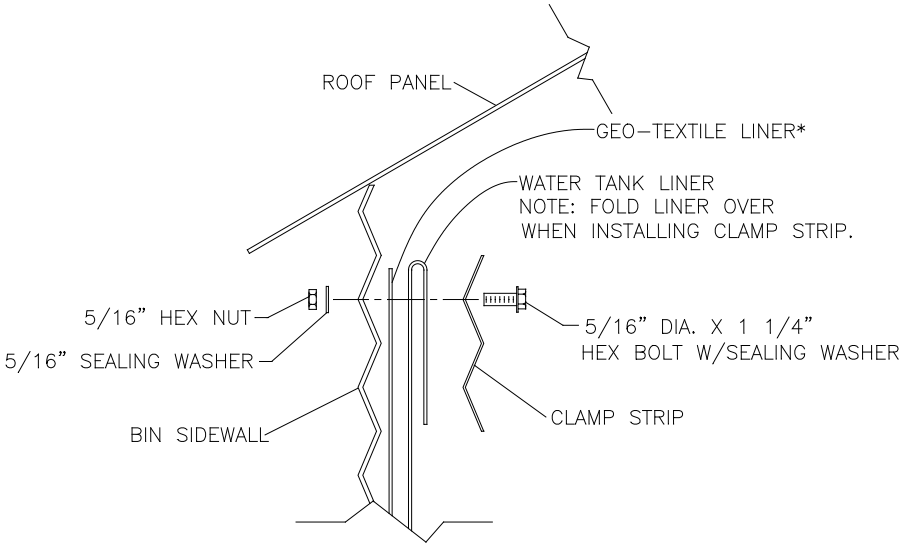
WARNING: DO NOT ALLOW LINER TO TWIST INSIDE TANK. TWISTING MAY CAUSE PREMATURE LINER FAILURE.

GEO-TEXTILE LINER INSTALLATION



RAFTER CLIP/CLAMP STRIP DETAIL
(FOR TANK WITH RAFTERS)

*ATTACH GEO–TEXTILE LINER TO THE SIDEWALL AND FLOOR. USE 1" (25) MAXIMUM OVERLAP. USE RUBBER CEMENT OR ADHESIVE COMPOUND. (NOT PROVIDED)



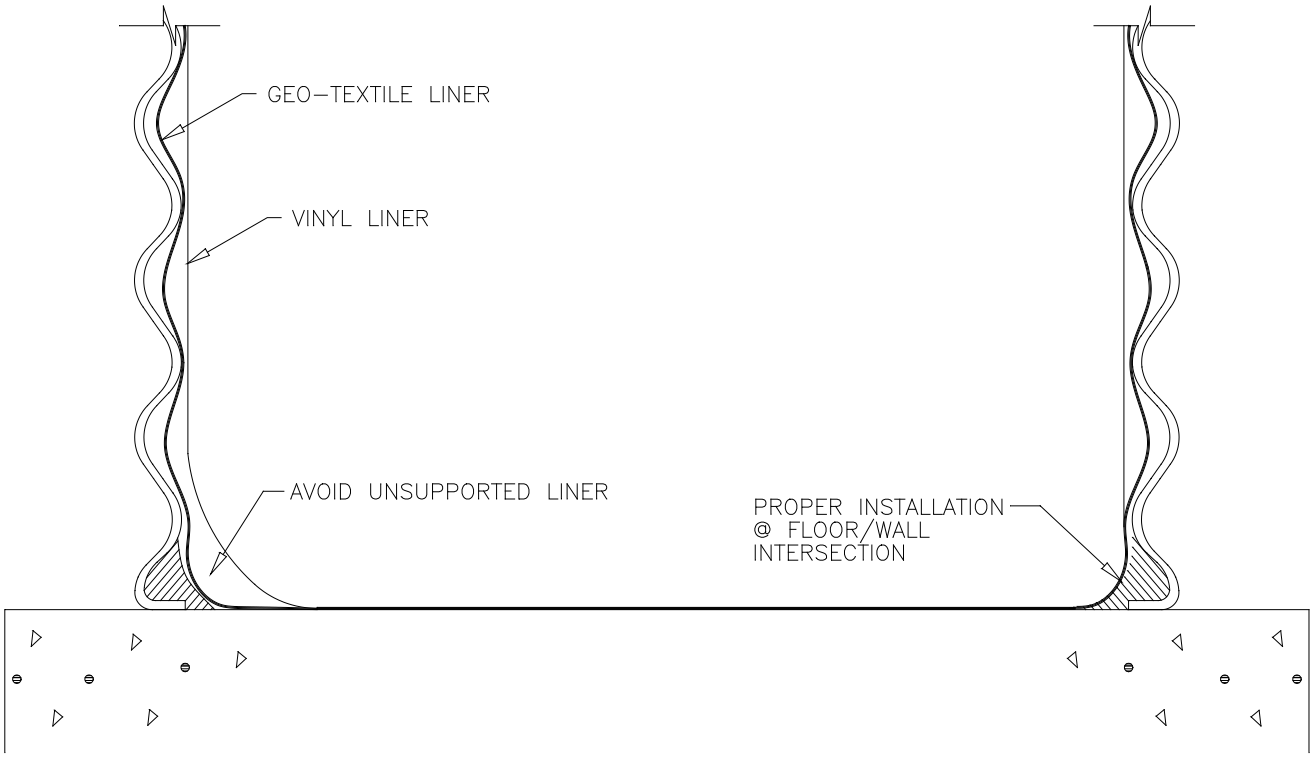
CLAMP STRIP DETAIL
(FOR TANK WITHOUT RAFTERS)

*ATTACH GEO–TEXTILE LINER TO THE SIDEWALL AND FLOOR. USE 1" (25) MAXIMUM OVERLAP. USE RUBBER CEMENT OR ADHESIVE COMPOUND. (NOT PROVIDED)

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

LINER

Just prior to filling the SCAFCO Water Storage Tank, the liner must be inspected to insure that the liner floor has been pulled up to the wall so that there will be no "bridging" at intersection of wall and floor.



Sloping floor may cause liner to creep away from the wall between the time of installation and filling of the tank.

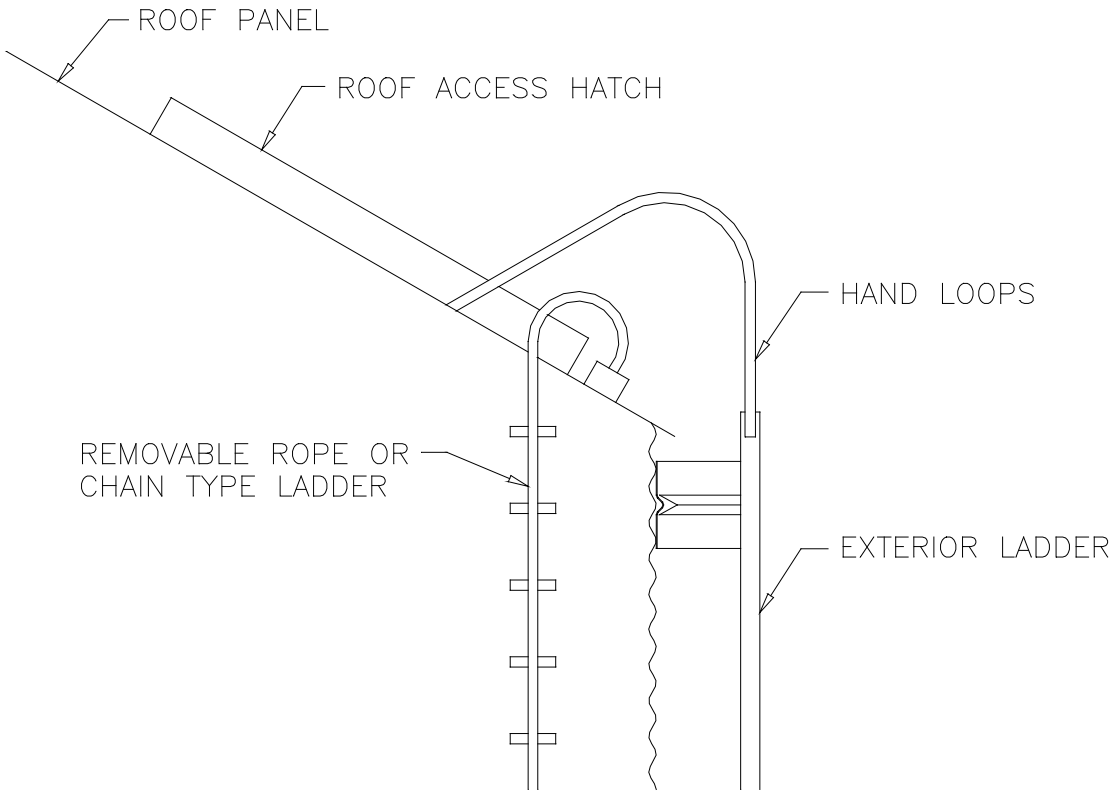
VINYL LINER PROTECTION

The vinyl liner is durable and will provide many years of service if installed and maintained properly. The liner will **NOT** withstand normal foot traffic during installation and routine cleaning. The following precautions are recommended when working inside a tank or walking on the liner.

1. Do not remove the liner from its carton until it is to be installed. Do not cut carton with a knife. Avoid dropping tools or sharp objects on the liner. Do not drag vinyl liner excessive distances over floor as the scrim will be exposed and lead to "weeping" type liner leaks.

2. All personnel installing and maintaining liner should do so in bare feet or thin stockings. In no case should personnel enter tank, beneath liner, or inside liner with shoes or boots on. Wearing shoes may introduce foreign matter which could perforate the flexible liner. In addition, personnel working in bare feet can feel foreign matter that may be remaining on the foundation before it can damage the liner.

3. Access to the tank interior through center hatch or additional access manhole may be made with an extension ladder with padded feet. Use of a rope ladder suspended from the hatch opening (**See Figure 7**) is highly recommended. Permanent interior ladders are not practical.



4. Periodic entry between the steel tank and liner, for the purpose of inspection, repair, or readjusting sand overlay, may be made through sidewall wall sheets.

5. A SCAFCO exterior ladder can be supplied (optional). Ladder extends to the top of the foundation.

TANK DISINFECTION

The finished SCAFCO Water Storage Tank must be disinfected by the purchaser or installer prior to use. Finished structure must be disinfected in accordance with AWWA D105, Method No. 3.

CHLORINATION METHOD 3

Water and chlorine shall be added to the storage facility in amount such that initially the solution will contain 50 mg/L available chlorine and will fill approximately 5% of the total storage volume, and this solution shall be held in the storage facility for a period of not less than 6 hours. The storage facility shall then be filled to the overflow level by flowing potable water into the highly chlorinated water, and shall be half-full for a period of not less than 24 hours. All highly chlorinated water shall then be purged from the drain piping. Then, subject to satisfactory bacteriological testing and acceptable aesthetic quality, the remaining water may be delivered to the distribution system.

4.3.1. Adding Chlorine. Chlorine shall be added to the storage facility by the method described in Section 4.1.1, Section 4.1.2, or Section 4.1.3. The actual volume of the 50 mg/L chlorine solution shall be such that after the solution is mixed with filling water and the storage facility is held full for 24 hours, there will be free chlorine residual of not less than 2 mg/L.

CARE OF VINYL LINER

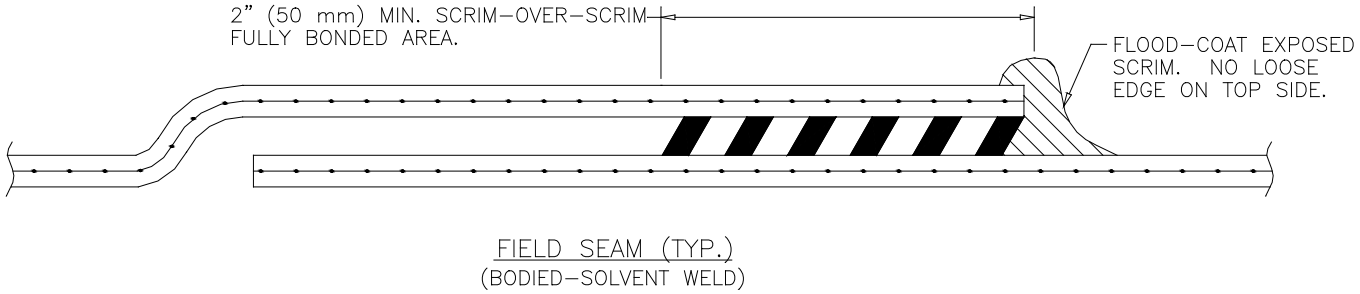
CLEANING THE VINYL LINER

The surface of the liner is relatively smooth and can be cleaned with a light brushing and pressure spray (water) washdown. The liner can easily accept sweeping, foot traffic and agitation necessary to remove any silt and sludge collected in the tank. Remember, all personnel entering tank must be in bare feet or thin stockings…no shoes or boots.

Sanitizing the liner with chlorine wash applied with spray equipment has no negative effects on the vinyl liner.

VINYL LINER REPAIR

In the event of a cut or damage to the liner, repair can be accomplished by chemically welding a new piece of vinyl over the affected area, using a large second ply over the first patch. This repair may be done to the inside or outside of the liner sheet. Proper repair instructions are provided in the patching kit. All repairs shall be accomplished by personnel in bare feet or stocking feet.



CONTROLS

Water level controls may be installed inside the tank. Control wires for these devices should exit the tank at the eave. Penetrations through the roof panels for control wires are not recommended unless proper sealing methods are used.

ICE FORMATION

Ice may form inside the tank in certain climatic conditions. Large quantities of ice forming around the top water level in a tank provides some potential for damage to the flexible liner.

If ice formation potential is substantial, the tank should be protected by some means of maintaining water movement – air spargers, small recycle pumps, or liquid level fluctuations – during the potential problem period.

When approved by a local engineer, insulation of the tank is a common method to avoid freezing damage.

Tank heating may present viable protection against ice formation. In the event that tank heating is chosen as the method to be used to prevent ice formation, follow the recommendations of the National Fire Protection Association Standard 22, Standard For Water Tanks For Private Fire Protection, Chapter 10.

WARNING: FAILURE TO ADEQUATELY PROTECT AGAINST ICE FORMATION INSIDE THE TANK SHALL VOID THE WARRANTY ON THE FLEXIBLE MEMBRANE LINER.

VENTING

A suitable roof vent shall be furnished. The vent or vents should be installed in the roof and shall have the capacity to pass air, so that at the maximum possible rate of the water, either entering or leaving the tank, excessive pressure will not be developed. **THE OVERFLOW PIPE SHALL NOT BE CONSIDERED A TANK VENT.**

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