

New Entry Sustainable Farming Project
Building the Leopold Center GAP-Certifiable Vegetable Wash Station:
Notes and Modifications - October 2011

Thanks to funding from a *Food Safety and Liability for Small Farmers* grant provided by the Northeast Center for Risk Management Education and the USDA National Institute of Food and Agriculture under Award Number 2010-49200-06201, the New Entry Sustainable Farming Project was able to build a Good Agricultural Practices (GAP) compliant vegetable wash station at one of their incubator farm sites in Dracut, MA. The original wash station design was developed by the Leopold Center for Sustainable Agriculture at Iowa State University and complete construction and design plans can be found online at http://www.leopold.iastate.edu/cool_tools/wash_stations1.

A number of modifications were made to the original Leopold Center design for three principle reasons: 1) to use more readily available and/or less expensive materials, 2) to better fit the scale of the small operations that will be using the station, and 3) to attempt to improve the structural integrity of the station components, especially the roof.



Figure 1. The completed wash station

Modifications

Hand wash sink: The 14.5 gallon plastic utility sink that was locally available was the same width as the sink used by the Leopold Center, but the length and depth were slightly different. Be sure to measure the sink dimensions before constructing the frame. Furthermore, a proper faucet was installed on the hand wash sink in place of the hanging overhead line for user convenience. There is a “Y” splitter at the beginning of the overhead water line that is used to provide water to the faucet via a shortened and mended hose (figure 2).



Figure 2. Hand Wash Sink Water Supply

Blue tub vegetable wash sinks: Because of the high cost of a deep stainless steel sink and the unavailability of a comparable sink made of food-grade plastic, two of the shallow blue tub



Figure 3. Blue tub drainage

sinks were incorporated into the design instead of just one. As a result, the length of the larger drying rack was extended to make use of the extra space under the roof. As with the hand washing sink, the dimensions of the 55-gallon drum used for the vegetable tubs was slightly wider than the frame dimensions provided by the Leopold Center. Be sure to measure the drum width after cutting it to the desired dimensions before constructing the frame. Finally, a drain hole was drilled onto the bottom of the tub using a 2" hole saw instead of using the bung hole as a drain. This was done in order to allow more water to drain out of the tub without having to install it at an angle. The 2" hole was cut through the 2"x6" support piece and through the tub. After cutting the 2" hole, a 3" hole was cut just through the 2"x6" support to provide more room for the drain plumbing (figure 3).

Drying Racks: As mentioned above, the length of the larger drying rack was extended to 94.75" to fill the additional space left by replacing the stainless steel sinks with a second blue tub sink. The adjusted length also reflects a change in the design of the drying rack legs. Instead of just two pairs of legs, one at each end of the rack, an additional 3.5" was left at the end closest to the blue tub sink frame and screwed directly into that frame (see figure 1). The same approach was taken with the smaller drying rack, leaving 3.5" at each end to screw directly into the hand washing sink



Figure 4. Small drying rack legs

frame and the other blue tub sink frame (figure 4). Furthermore, the plastic lumber and mesh designated for use as portable harvest trays in the Leopold Center design was incorporated directly into the design of the drying racks. This was done for two reasons. First, the portable racks seemed prone to breaking through the bottom if they were going to be used for heavy root vegetables. Second, there was some concern that the portable trays would be taken away from the site to the separate distribution location, thus leaving

the wash station users with no choice but to place produce directly on the wood frame drying rack (a violation of GAP food safety standards). Three 2"x6" pieces of plastic lumber were screwed directly to the top of the drying rack frames. The black PVC mesh was then stretched over the plastic lumber and attached to the original drying rack frame with $\frac{3}{4}$ " fence staples. Two final 2"x6" pieces of plastic lumber were then attached to the sides of the frame to create a lip and prevent produce from rolling off the racks (figure 5).



Figure 5. Large drying rack with plastic lumber and PVC mesh top

Overhead plumbing: Instead of using poly tubing, New Entry opted to use $\frac{3}{4}$ " schedule 40 PVC for the overhead water line. Threaded male adaptors were attached to the bottom of the two "tees" to provide an attachment point for the shortened and mended garden hoses (figure 6). Also, the PVC supply line was extended down the 4x4 roof support post closest to the hydrant to prevent running a hose up to the line. The female end of the supply hose was threaded into a "Y" splitter, one side of which was then screwed directly into the $\frac{3}{4}$ " PVC female threaded elbow with the other side available to supply the water for the hand washing sink (figure 7).



Figure 7. PVC tee with threaded male adaptor



Figure 6. "Y" splitter on supply line

Drainage plumbing: 1.5" female threaded couplers were attached to the bottom of each of



Figure 8. Hand washing sink drain pipes

the three drains. A 1.5" PVC coupler was then attached to the female threaded coupler to provide a female end for the longer 1.5" PVC drain spout. For the hand washing sink, the 1.5" drain spout was attached to a 1.5" to 2" expander coupler before joining a 2" elbow since there were no 1.5" to 2" elbows available locally (figure 8). The 1.5"x2"x2" "tees" used to attach the 1.5" drain spouts from the two blue tub sinks to the main drain line were offset at a 45 degree angle, requiring the use of 1.5" 45 degree angled couplers to tie into the "tees" (figure 9). Standard 2" bathtub drains were used in place of the bungholes for drainage, as discussed above in the "blue tub vegetable wash sinks" section (figure 10). The additional 2" 45 degree couplers and 2" elbow were used to extend the drain line beyond the roof structure. No backflow prevention is needed, since the supply line and drain line are not connected.



Figure 9. Wash tub drain pipes



Figure 10. Wash tub drain

Roofing Material: The original Leopold Center design calls for using 4 12-foot pieces of roof tin to complete the roof. New Entry instead purchased 9, 8-foot pieces then cut them in half with heavy duty tin snips, creating 18 4-foot pieces cut in half. These pieces were then attached to the trusses with the corrugation running vertically to facilitate water runoff. This modification added about 2 feet of covered area lengthwise and about 1.5 feet to the covered width of the structure (figure 11).



Figure 11. Roof tin layout

Roof supports: Six-inch by 36-inch sono tubes were used to provide a form for pouring one 50-pound bag of Quickrete fence post mix for each of the three 4x4 roof supports to



increase the structural integrity of the roof. After installation, there was still excessive play on the roof. This led to the addition of 2, 2x4 supports that screw into the roof trusses at each end of the structure and are buried about 3 inches deep in the ground (figure 12). Extra 45 degree cut 2"x4" pieces were attached to the bottom of the two outermost 4x4 posts and buried 4"-5" underground for additional stabilization (figure 13). The middle 4x4 post was reinforced with 2, 3-foot long 2"x4" pieces screwed to either side of the post and buried about 3" underground.

Figure 12. Corner roof supports



Figure 13. Roof post base support

Roof Trusses: The two roof trusses were modified to accommodate the change in roofing material. Two additional rafter beam sets were added to each truss to provide surface area for securing the roof tin. Each set of rafter beams was also attached to a 2"x4" cross piece just beneath the crest for increased stability (figure 14). The rectangular base frame was similarly reinforced with 45 degree cut 2"x4" joists at each of the corners (figure 15).



Figure 14. Rafter cross piece



Figure 15. Roof base corner joist

Notes

The wash station design seems appropriate for a small vegetable farm harvesting up to approximately 100 units of crop. For farms operating at a larger scale, the size of the vegetable wash tubs and drying racks will likely become prohibitively small. The design could be modified to incorporate larger GAP-certifiable wash tubs, such as the 150 gallon stock tanks produced by Rubbermaid, but doing so would require significant modification to all of the wash station components.

Achieving effective drainage on the blue vegetable wash tubs also remains a challenge. While the modifications documented above seem to be a significant improvement from the original design, a small bit of water (about ¼ cup) still does not drain because of the slightly elevated lip of the bath tub drain. It might be possible to create a beveled rim around the 2" hole created with the hole saw that would allow the drain to be slightly recessed. Poor drainage would also be an issue if using larger stock tanks in place of the converted 55-gallon drums as the bungholes are slightly elevated and require being tipped to fully drain.

Another possible modification that could be appropriate for some operations is to change the order of the wash station components so that the two vegetable wash tubs are side-by-side. Ordering the tubs this way would make double soaking of greens much easier.

Each of the roof trusses was constructed entirely on the ground prior to installation. Once completed, each truss was secured to the fork-lift attachment on the front of a 65 horsepower tractor and lifted into place. Installing the trusses this way saved a bit of heavy lifting, but was ultimately more dangerous both to the trusses and those installing the truss than getting four able-bodied individuals to hoist them into place on the 4x4 roof supports.

Finally, it may be both more structurally sound and aesthetically pleasing to place 4x4 roof supports at each of the four corners. It would be necessary to keep the two center supports unchanged as to not disrupt access to the central wash station components. Such a change would require a slight redesign of the trusses, but would be fairly easy to implement.

Pricing information for all labor, tools, and materials is included below.

For more information on Good Agricultural Practices food safety standards, please visit <http://extension.umass.edu/nutrition/index.php/programs/food-safety/programs/good-agricultural-practices>.

For more information on the New Entry Sustainable Farming Project, please visit <http://nesfp.nutrition.tufts.edu/>.

For questions regarding the construction of the wash station, please contact Ethan Grundberg, New Entry's Incubator Farm and Technical Assistance Coordinator, at egrundberg@comteam.org or 978-654-6745.

**GAP Certifiable Wash Station
 New Entry Sustainable Farming Project - Costs of Leopold Center Design
 Ogonowski Memorial Fields, Dracut, MA**

Labor Hours Estimates	Hours	Unit Price	Price
Material Purchasing	5	\$10.00	\$50.00
Land clearing and leveling	2	\$10.00	\$20.00
Sink, basin, and table construct	32	\$10.00	\$320.00
Roof frame construct	12	\$10.00	\$120.00
Roof post install	5	\$10.00	\$50.00
Roof and panel install	16	\$10.00	\$160.00
Plumbing	8	\$10.00	\$80.00
Subtotal	80		\$800.00

Tools	Quantity	Unit Price	Price
10" Compound Miter Saw	1	\$186.00	\$186.00
7.25" Circular Saw	1	\$119.00	\$119.00
Reciprocating Saw	1	\$99.00	\$99.00
Tin Snips	1	\$10.97	\$10.97
Hammer	1	\$6.96	\$6.96
Cordless drill	1	\$199.00	\$199.00
25' Tape Measure	1	\$8.88	\$8.88
Carpenter Square	1	\$6.96	\$6.96
PVC ratcheting cutter	1	\$12.98	\$12.98
Irwin 6" minibar clamps (2 pack)	1	\$19.97	\$19.97
1/8" drill bit	2	\$2.99	\$5.98
2" hole saw	1	\$13.97	\$13.97
3" hole saw	1	\$22.99	\$22.99
Caulk gun	1	\$7.49	\$7.49
Level	1	\$9.98	\$9.98
Putty Knife	1	\$5.49	\$5.49
Shovel	1	\$9.97	\$9.97
Post-Hole digger	1	\$18.49	\$18.49
9' Ladder	1	\$109.00	\$109.00
Subtotal			\$873.08

Pressure Treated Lumber	Quantity	Unit Price	Price
2"x4"x8'	19	\$2.79	\$53.01
2"x4"x10'	2	\$3.97	\$7.94
2"x4"x12'	20	\$4.97	\$99.40

2"x6"x10'	3	\$5.97	\$17.91
2"x2"x8'	1	\$2.97	\$2.97
2"x8"x8'	1	\$6.97	\$6.97
4"x4"x12'	3	\$12.97	\$38.91
Subtotal			\$227.11

Composite (Plastic) Lumber	Quantity	Unit Price	Price
5/4"x6"x12'	6	\$25.97	\$155.82
Subtotal			\$155.82

Roofing Materials	Quantity	Unit Price	Price
36"x8' Green Shelterguard Tin	9	\$25.78	\$232.02
10'6" Shelterguard Ridegecap	3	\$27.38	\$82.14
TEKS 2" drill point roofing screws (50 ct)	2	\$9.68	\$19.36
Subtotal			\$333.52

Plumbing Materials	Quantity	Unit Price	Price
3/4" PVC SxS coupler	3	\$0.49	\$1.47
3/4" PVC male adapter SxMPT	2	\$0.59	\$1.18
3/4" PVC T SxSxS	2	\$0.79	\$1.58
3/4" PVC Elbow SxS	1	\$0.49	\$0.49
3/4" PVC Elbow SxFPT	1	\$0.65	\$0.65
3/4" 10' SCH 40 PVC	4	\$1.97	\$7.88
3/4" 2-hole EMT strap (3 pack)	2	\$0.99	\$1.98
3/4" PVC End cap	1	\$0.32	\$0.32
3/4" Female Hose End Mender	3	\$2.29	\$6.87
3/4" Male Hose End Mender	3	\$1.99	\$5.97
3/4" Y Hose splitter	1	\$2.29	\$2.29
PVC Glue and Primer	1	\$7.51	\$7.51
15' Garden Hose	1	\$7.97	\$7.97
Spray nozzles	2	\$3.97	\$7.94
2" PVC coupler SxS	2	\$0.99	\$1.98
2" PVC 45 Deg Elbow SxS	2	\$1.49	\$2.98
2" 10' SCH 40 PVC	3	\$5.96	\$17.88
2" PVC Elbow SxS	1	\$1.02	\$1.02
2"x2"x1.5" PVC T SxSxS	2	\$4.17	\$8.34
2"x1.5" PVC reducer SxS	1	\$1.37	\$1.37
1.5" 10' SCH 40 PVC	1	\$4.51	\$4.51
1.5" PVC 45 Deg Elbow SxS	2	\$1.31	\$2.62

1.5" PVC Cleanout Adapter SPGxFPT	3	\$1.40	\$4.20
1.5" PVC Coupler SxS	3	\$0.64	\$1.92
8 oz Thread Sealer	1	\$9.99	\$9.99
Teflon tape .5"x260"	1	\$1.05	\$1.05
14 oz Plumber's putty	1	\$2.05	\$2.05
Subtotal			\$114.01

Sink Materials	Quantity	Unit Price	Price
55 gallon food grade drum	1	\$15.00	\$15.00
14.5 gallon drop in utility sink	1	\$58.00	\$58.00
Faucet	1	\$12.12	\$12.12
Kwik fit basket strainer	1	\$9.96	\$9.96
Bath drain w/strainer	2	\$3.47	\$6.94
Universal tub stopper (1.5")	2	\$4.47	\$8.94
Subtotal			\$110.96

Fasteners	Quantity	Unit Price	Price
2.5" Nails	6#	\$1.99	\$11.94
2.5" Galvanized deck screws	3#	\$3.99	\$11.97
25 ct Exterior Saber Screws	3	\$6.49	\$19.47
1-5/8" Exterior Screws	1#	\$8.47	\$8.47
3.5" 16d Nails	1#	\$4.24	\$4.24
3.5" Screws	1#	\$7.98	\$7.98
Subtotal			\$64.07

Miscellaneous	Quantity	Unit Price	Price
3'x15' Black PVC hardware net	1	\$16.44	\$16.44
Sono tubes (8"x48")	3	\$5.17	\$15.51
50 # Quickrete fence post mix	3	\$4.98	\$14.94
3/4" 4'x8' Plywood	1	\$19.25	\$19.25
10 oz Heavy Duty Liquid Nails	1	\$3.29	\$3.29
General Finishes Salad Bowl Finish	1	\$16.99	\$16.99
Subtotal			\$86.42

Total			\$2,764.99
Total w/o labor			\$1,964.99
Total w/o tools			\$1,891.91
Total w/o tools and labor			\$1,091.91

