

Chapter 3. Mixing and Loading Pad

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The mixing and loading pad is the main operational area of the pesticide and fertilizer storage facility. The mixing and loading pad is where application equipment or tender vehicles are parked when spray solutions are transferred to or from the batch mixing equipment, tender vehicle, and pesticide or fertilizer storage area. Soil, surface water, and groundwater can be contaminated in areas where pesticides and fertilizers are mixed and loaded into application equipment if this pad is not designed to intercept and retain the spilled products. Curbed and/or ramped concrete slabs (or their equivalent) are used to provide secondary containment at mixing and loading facilities. Worker safety and state and federal regulations must be taken into account in facility design.

Functions that occur on a mixing and loading pad include:

- Transferring and handling pesticides and fertilizers.
- Mixing batches of pesticide and fertilizer solutions.
- Loading application equipment.
- Unloading transport vehicles.
- Unloading and cleaning out application equipment.
- External washing of application equipment (Not recommended).

The mixing and loading pad is designed to catch leaks and spills that occur from:

- Small daily accidental spills or overflows from application equipment.
- Drips or leaks from plumbing and application equipment.
- Drips from detaching plumbing connections.
- Accidental spills from storage containers.

Mixing and Loading Pad Design

The size and dimensions of the mixing and loading pad depend on the functions performed on the pad and on the type and size of application equipment that will be parked on the pad. To catch any splashed water or boom sprays, design these pads to extend at least 5 feet beyond each end of the extended booms of application equipment. Consider the space needed for workers to get around and between pieces of equipment easily.

A mixing and loading pad can be considered a secondary containment structure for bulk pesticides, bulk fertilizer, and rinsate storage tanks. It must meet the largest storage capacity to meet either a secondary containment capacity or a mixing and loading pad capacity. Multiple product storage and uses of a single area (such as a mixing loading pad) can create management problems. Mixtures of fertilizer, pesticide, and rinsate and other possible wastes may be more difficult to use or dispose of properly.

Figure 3.1 shows a mixing and loading facility. The mixing and loading pad is sized for the application equipment used. The mixing and loading pad floor has a variable slope that increases uniformly from a level perimeter edge (highest elevation) to the shallow sump (lowest elevation).

The centerline valley has a constant slope toward the sump. Sloped access ramps from the edge of the mixing and loading pad are used to ensure that water from the surrounding watershed does not enter the pad. The entire pad could be roofed to prevent precipitation from entering.

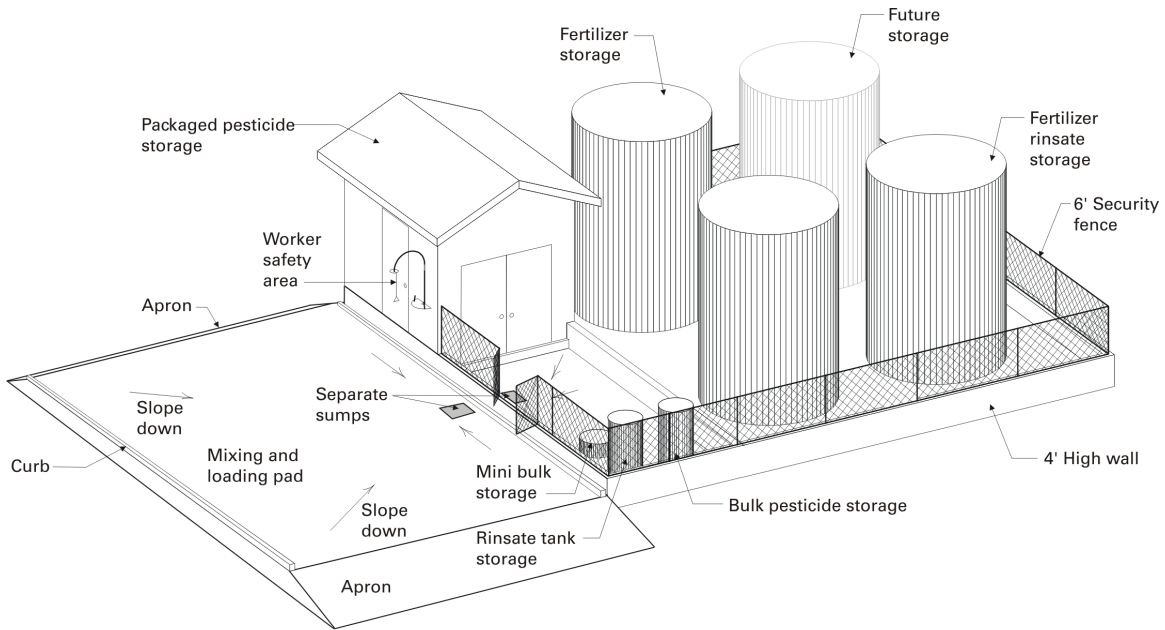


Figure 3.1. Plan view of mixing and loading facility.

The layout of mixing and loading pads can improve operational efficiency and worker safety while reducing environmental contamination risks. The capacity of the mixing and loading pad is designed to hold a minimum of 1000 gallons or 125 percent of the largest container if the largest container is 800 gallons or less. A curbed and sloped reinforced concrete slab is used to form an impervious barrier between the pesticide and fertilizer handling area and the soil below. Install sloping approach ramps (aprons) at vehicle entrances to minimize dust and trash accumulation on the mixing and loading pad. This also prevents surface water from the surrounding area from flowing onto the mixing and loading pad.

Slope the mixing and loading pad to drain liquid to a shallow sump. The sump is designed to temporarily hold rinsate for easy recovery and transfer to storage tanks (located within the secondary containment). If properly filtered and managed, liquid rinsate recovered from the sump may be reused in subsequent spray solutions.

Rinsate management

In most cases, rinsate liquid is recovered from the sump or depression on a routine basis after a loading or when a release occurs. Liquid level alarms may be installed to alert the operator when liquid enters a shallow sump. A pump must be available to transfer the liquid from the shallow sump into a rinsate storage tank located within the secondary containment. The rinsate storage tank must have a minimum available capacity of 200 gallons.

Pesticide and/or fertilizer contaminated precipitation is a major concern when using unroofed mixing and loading pads. The large volumes of contaminated water (rinsate) can be a major management problem. The rinsate is usually collected and stored until it can be used as makeup

water in subsequent spray solutions. To minimize the management problems associated with potentially large volumes of contaminated precipitation (rinsate) that can be used in an appropriate manner, roofed mixing and loading facilities are recommended. The challenge for most managers is to keep the contaminated water from becoming a hazardous waste that requires the use of expensive disposal options compared to handling the contaminated water as a rinsate. Surrounding and roofing these areas with a building will keep precipitation from entering the mixing and loading pads and provide security. When a building is integrated into the design, the building loads must be accounted for in the overall design. Information in this document assumes the concrete floor and walls are independent of the building shell and therefore does not account for additional loadings from an attached building shell or other possible loadings from the use of the building. Security fencing should be installed around all mixing and loading pads if there is no building shell in the design.

Mixing equipment area

The pesticide mixing area is usually placed adjacent to the mixing and loading pad. If desired it can be designed as a separate area providing its own separate secondary containment area. Batch mixing tanks, temporary pesticide container storage, pesticide transfer pumps, and plumbing are usually placed in the mixing area. Additional mixing system components like pesticide metering tanks, punch/drain/rinse/crush units, rinsing vacuum probes, and equipment for holding, rinsing, and draining pesticide containers, can also be placed in this area to provide an efficient, safe mixing system.

Bulk fertilizer unloading pad

Large liquid fertilizer storage outlets may need a separate pad for receiving bulk truck shipments while the primary mixing and loading pad is in use, Figure 1.5 (from Chapter 1). A concrete slab with level side curbs and floors that slope to a shallow trough at the center (6-9 inches deep), which drains to a small, shallow sump can provide the required containment volume. Locate it along one side of the bulk fertilizer secondary containment structure. The maximum required capacity for this pad is 1,000 gallons.

Sumps

A sump is a liquid tight recessed area or combination of recessed areas that serve as a collection point for liquids from a mixing and loading pad or a secondary containment structure. Figure 3.2 shows the two common shapes of sumps, and Table 3.1 shows the dimensions that meet the following criteria:

- Maximum capacity of less than 50 gallons for all interconnected areas.
- Maximum depth of less than 24 inches below the surrounding secondary containment surface.
- Maximum depth no greater than the shortest horizontal dimension.

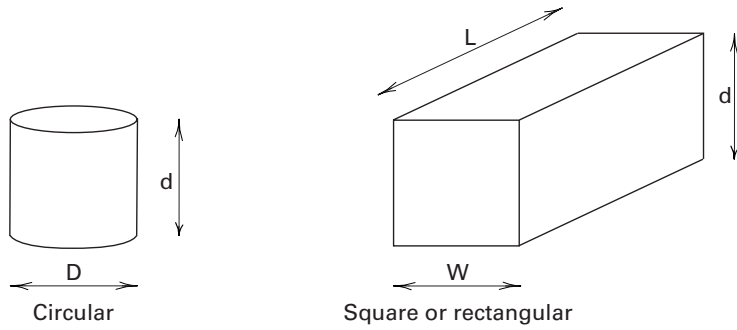


Figure 3.2. Sump definition for capacity and design dimensions.
 Note: $d \leq 24"$.

Table 3.1. Rectangular and circular sumps.

a. Rectangular sump capacity					b. Circular sump capacity			
Width (W) inches	Length (L) inches	Depth (d) inches	Volume (V)		Diameter (D) inches	Depth (d) inches	Volume (V)	
			cubic inches	gallons			cubic inches	gallons
12	40	24	11520	49.9	24	24	10857	47.0
12	36	24	10368	44.9	18	24	6107	26.4
12	24	24	6912	29.9	12	24	2714	11.8
12	12	24	3456	15.0	28	18	11084	48.0
9	71	18	11502	49.8	24	18	8143	35.3
9	60	18	9720	42.1	18	18	4580	19.8
9	48	18	7776	33.7	12	18	2036	8.8
9	36	18	5832	25.2	9	18	1145	5.0
9	24	18	3888	16.8	35	12	11545	50.0
9	12	18	1944	8.4	24	12	5429	23.5
9	9	18	1458	6.3	18	12	3054	13.2
6	160	12	11520	49.9	12	12	1357	5.9
6	72	12	5184	22.4	6	12	339	1.5
6	48	12	3456	15.0	49	6	11314	49.0
6	36	12	2592	11.2	36	6	6107	26.4
6	24	12	1728	7.5	24	6	2714	11.8
6	12	12	864	3.7	18	6	1527	6.6
6	6	12	432	1.9	12	6	679	2.9
3	642	6	11556	50.0	6	6	170	0.7
3	360	6	6480	28.1	3	6	42	0.2
3	180	6	3240	14.0	V < 50 gallons d < 24 inches d < 2 * D One gallon equals 231 cubic inches.			
3	96	6	1728	7.5				
3	72	6	1296	5.6				
3	60	6	1080	4.7				
3	48	6	864	3.7				
3	36	6	648	2.8				
3	24	6	432	1.9				
3	12	6	216	0.9				
3	3	6	54	0.2				
V < 50 gallons d < 24 inches d < 2 * W One gallon equals 231 cubic inches.								

Sumps are not intended to hold liquid for long periods. Rinsate collected in the sump is to be recovered immediately and transferred to a storage tank within a secondary containment structure. The regulatory requirements are to recover and transfer all discharges, spills, and/or rinsate to storage within a secondary containment upon discovery.

The sump is usually covered with an open structural grate for safety; a dust cover over the grate minimizes dust and debris blowing in. The sump grates and covers should support vehicle wheel loading. Sumps must be pumped out as necessary to prevent fluid from flooding the mixing and loading pad and subsequently being tracked off the pad by vehicle tires.

Soil and debris in sumps create a serious disposal problem of potentially hazardous waste. The sump should be cleaned out daily especially during the application season. It is more difficult to use contaminated solids like dirt, rock, and debris as a rinsate and apply the materials to a target crop in an appropriate way. The problem of pesticide-contaminated solids reinforces the value of enclosing the mixing and loading pads within a building shell to reduce solid hazardous waste problems resulting from blowing soil and debris.

Sumps constructed of concrete must be made placed in a continuous pour with the floor of the mixing and loading pad. The concrete thickness of the sump must be equal to or greater than the design thickness of the floor slab of the mixing and loading pad adjacent to it. Penetrations in the sides or bottom of a sump, including gravity drains, are not allowed. Several sump designs can be used in mixing and loading pads. A single sump is the simplest design.

Each secondary containment area or mixing and loading pad should have a separate sump placed monolithically in the floor slab of the system. Figure 3.3 shows how the secondary containment sump would be separated from the mixing and loading sump by the secondary containment wall and the mixing and loading pad curb.

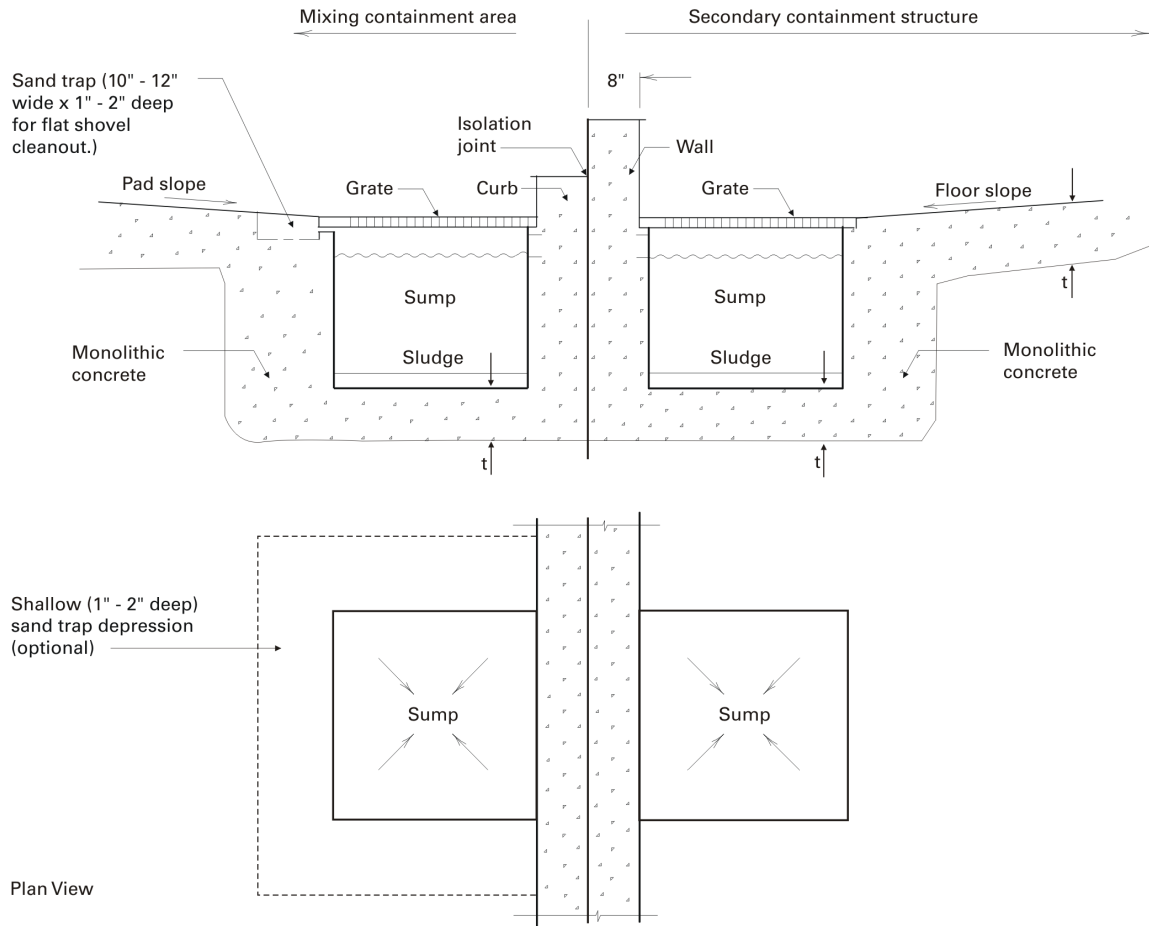


Figure 3.3. Separate sumps for mixing and loading pad and secondary containment structure.
See Table 3.1 to size sumps

Center sump designs slope the concrete floor to the middle of the mixing and loading pad as shown in Figure 3.4. Portable pumps or suction hoses are placed in the depression to recover liquid. This design keeps the application equipment level for accurate gauging of tank volumes from visible markings on the tank. Table 3.2. shows rectangular and circular depression dimensions.

Table 3.2. Rectangular and circular depression dimensions.

a. Rectangular depression capacity					b. Circular depression capacity			
Width W inches	Length L inches	Depth d inches	Volume V		Diameter D inches	Depth d inches	Volume (V)	
			cubic inches	gallons			cubic inches	gallons
12	16	6	1152	5.0	15	6	1060	4.6
12	12	6	864	3.7	12	6	679	2.9
8	36	4	1152	5.0	19	4	1134	4.9
8	30	4	960	4.2	18	4	1018	4.4
8	24	4	768	3.3	12	4	452	2.0
8	18	4	576	2.5	8	4	201	0.9
8	12	4	384	1.7	22	3	1140	4.9
8	8	4	256	1.1	18	3	763	3.3
6	64	3	1152	5.0	12	3	339	1.5
6	48	3	864	3.7	6	3	85	0.4
6	36	3	648	2.8				
6	24	3	432	1.9				
6	18	3	324	1.4				
6	12	3	216	0.9				
6	6	3	108	0.5				

V < 5 gallons
d < 6 inches
d < W/2
W < L

One gallon equals 231 cubic inches.

A pipe chase (placed monolithically) within the mixing and loading pad floor may be necessary to place plumbing and electrical conduit out of the way of vehicle and foot traffic, Figure 3.5. For example, it may be necessary to provide a pipe chase between a center sump and the secondary containment structure housing the storage tank where liquid is pumped automatically from the sump. This would prevent plumbing from lying on the floor surface and being damaged by vehicle traffic or becoming a trip hazard for workers. The pipe chase is considered part of the sump capacity requirements. Table 3.3 shows the possible dimensions of pipe chases that would meet the sump definition.

Table 3.3. Pipe chase dimension meeting sump or depression definitions.

Width (W) inches	Length (L) feet	Depth (d) inches	Volume (V)	
			cubic inches	gallons
Pipe Chase Design			Sump Capacity	
3	106	3	11448	49.6
6	53	3	11448	49.6
12	26	3	11232	48.6
18	17	3	11016	47.7
4	60	4	11520	49.9
8	30	4	11520	49.9
12	20	4	11520	49.9
18	13	4	11232	48.6
3	53	6	11448	49.6
6	26	6	11232	48.6
12	13	6	11232	48.6
18	8	6	10368	44.9
24	6	6	10368	44.9

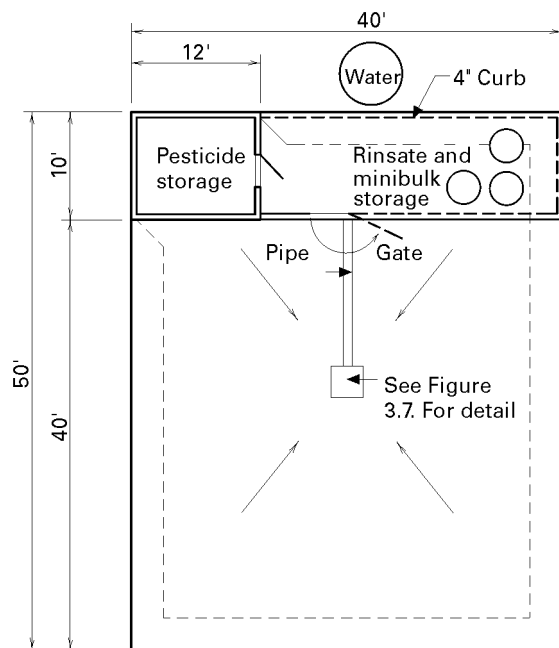


Figure 3.4. Center sump for mixing and loading facility.

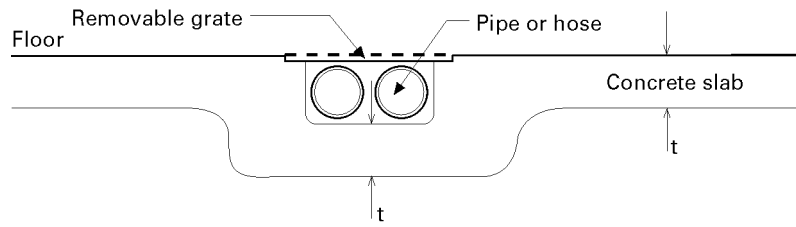


Figure 3.5. Pipe chase in concrete floor.

Side sump designs slope the floor to one side, most likely the side adjacent to the minibulk storage secondary containment area or mixing area as shown in Figure 3.6. The application equipment may be tilted and not read accurately from visual tank markings. It may be advantageous with the side sump design to provide automatic pumping of the sump to a rinsate storage tank. The side sump design also provides plumbing that will not be in the way of vehicle and foot traffic.

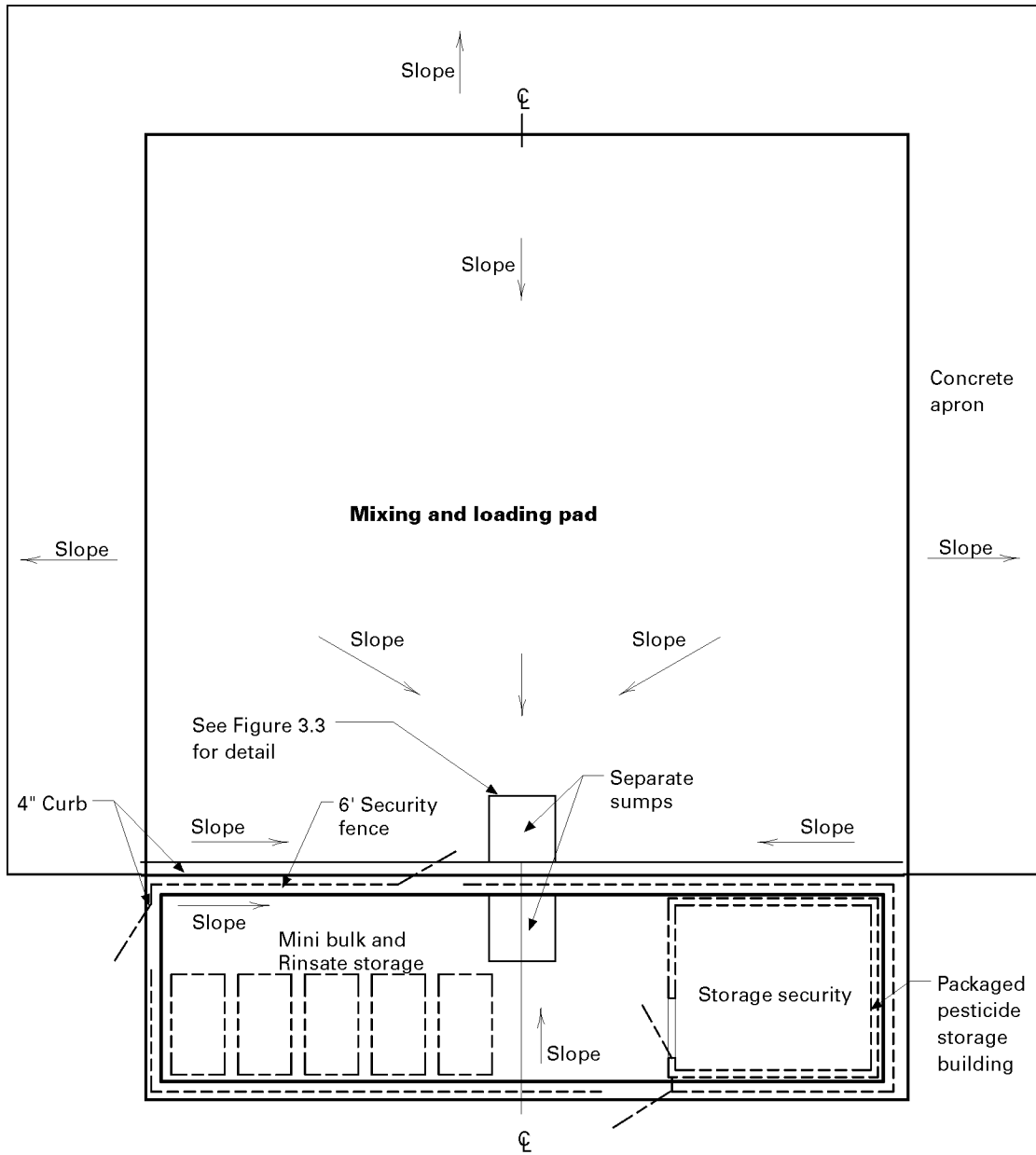


Figure 3.6. Example of side sump design in a mixing and loading pad.

One option to protect plumbing from a center sump or depression would be to build elevated ramp grates that would cover the plumbing and be placed on the floor surface as shown in Figure 3.7. The grates could be removable to allow the pad to be cleaned.

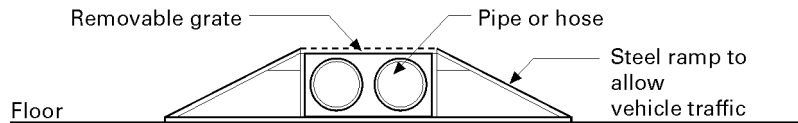


Figure 3.7. Elevated ramp with grates.

To reduce sludge (contaminated soil, rock, and debris) problems in mixing and loading pad sumps where applicator vehicles are washed, some facilities place two prefabricated stainless steel containers in series within a concrete sump, Figure 3.8.

Placing two containers in series within a sump allows segregation of rinsate and contaminated solids (Sludge). The first container acts as a sediment trap or settling basin where larger solids settle out before the liquids overflow into the second container. This design allows easy removal of the containers when they need to be cleaned out or decontaminated. As the water level rises in the first container, it is decanted off and enters into the second container. The pump or suction hose is placed in the second container. This water is filtered and transferred into rinsate storage within the secondary containment structure.

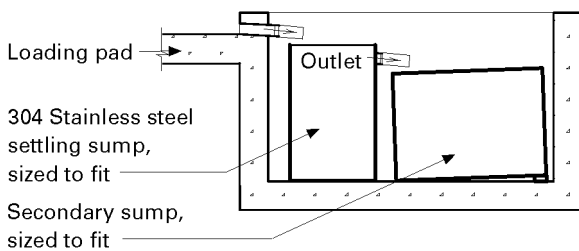
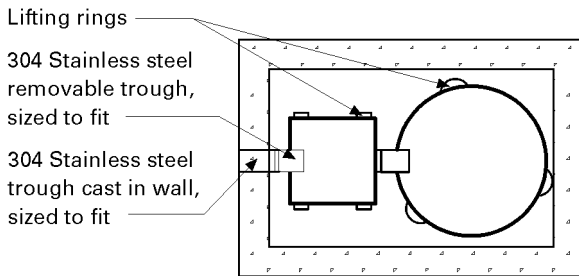


Figure 3.8. Removable stainless steel containers in series within concrete sump. Volume of sump must be less than 50 gallons.

Pumps and Plumbing Connections in Secondary Containment

In bulk handling systems, it is recommended to install transfer pumps, valves, and plumbing connections inside a stainless steel pan, Figure 3.9, or other chemical resistant drip pan or tub. If a seal in a pump, or a plumbing connection, or valve leaks, only the pan becomes contaminated and requires cleanup. Mount the pump motor base above the containment wall height or higher to prevent the pump from becoming submerged in the event of a release that could damage motor windings and/or create a serious electrocution hazard for workers. A disadvantage of elevating pumps is that higher levels of liquid are needed in tanks to prime pumps and/or not all of the product in a storage tank can be removed.

Drips also occur when switching hose connections to and from valves or manifolds. Use dry-break hose connectors to minimize drips during hose changes. Install shutoff valves and unions on each side of pumps so they can be easily drained for minimum leakage and removed for repairs.

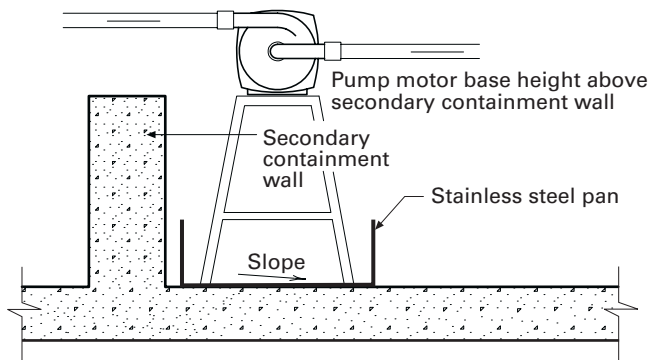


Figure 3.9. Separate pump secondary containment within larger secondary containment.