



## Documentation of Calculations for Land Application of Irrigation Water, Process Wastewater, and Solid Manure; and for Plant Tissue Removal

### Irrigation water application

If average pump output is known and unit is **gallons per minute (gpm)**, then:

$$D(\text{water}) = \frac{(Q \div 449) \times T}{A}$$

where: D = **acre-inches** of water applied  
 Q = **gallons** per minute (flow rate)  
 T = **hours** of irrigation set time  
 A = **Acres** in irrigation set

If average output is known and unit is **cubic feet per second (cfs)**, then:

$$D(\text{water}) = \frac{\text{Flow rate (CFS)} \times T}{A}$$

### Process wastewater application

If flow meters are used:

measured total gallons applied = ending reading - starting reading

If average pump output is known and unit is **gallons per minute (gpm)**, then:

$$D(\text{pww}) = \frac{(Q \div 449) \times T}{A}$$

### Solid manure application

Tons applied = 
$$\frac{(\text{weight of full truck (lbs)} - \text{weight of empty truck (lbs)})}{2000 \text{ lbs/ton}}$$

Tons applied = 
$$\frac{(\text{volume of truck (cu ft)} \times \text{bulk density (lbs/cu ft)})}{2000 \text{ lbs/ton}}$$

### Plant tissue removed

Tons removed = 
$$\frac{\text{weight of full truck (lbs)} - \text{weight of empty truck (lbs)}}{2000 \text{ lbs/ton}}$$

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1 acre-inch	=	27154 gal
1 acre-inch	=	3630 cu ft
1 cu ft	=	1728 cu in
1 cu yd	=	27 cu ft

**Solid manure application (tons)**

S = (Weight of full truck - Weight of empty truck) ÷ 2000  
Truck weights in **lbs**

**OR** S = (Volume of truck x Bulk density of manure) ÷ 2000  
Truck volume in **cu ft**  
Bulk density in **lbs per cu ft**

**Plant tissue removed (lbs)**

P = (Weight of full truck - Weight of empty truck) ÷ 2000  
Truck weights in **lbs**

**Nutrient application & removal**

Nutrient application (**lbs**) per field (A) **A = A(water) + Total A(pww) + A(solid)**

A(water) = D(water) x L x 0.2268

D(water) = sum of all water applied to the crop in **ac-in**

A(pww) = D(pww) x L x 0.2268

Note: calculate for each application, using the most recent laboratory result

D(pww) = process wastewater applied to the crop in **ac-in**

Total A(pww) = Sum of all A(pww) for the crop

A(solid) = S x L x 0.002

Note: calculate for each application, using the most recent laboratory result

L = Laboratory result for nutrient from solid or liquid manure sample, in **ppm**

Nutrient application per acre (**lbs/ac**) **A(a) = A ÷ acres**

Nutrient removal (**lbs**) per field **R = P x L x 0.002**

L = Laboratory result for nutrient from plant tissue harvested, in **ppm**

Nutrient removal per acre (**lbs/ac**)

R(a) = R ÷ acres

1000 gallons = gallons of liquid applied/1000

Multiply by 0.2268 to convert nutrient content from ppm to lbs/acre-inch of liquid applied

Multiply by 0.008345 to convert TDS in water from ppm to lbs/1000 gallons of liquid applied

Multiply by 0.002 to convert nutrient content from ppm to lbs/ton

Conversion to ppm

Nitrate-N	=	Nitrate x 0.226
Ammonium-N	=	Ammonium x 0.7765
TKN	=	Organic-N* + Ammonium-N*
Total N	=	Organic-N* + Ammonium-N* + Nitrate-N*
Total P	=	P2O5 x 0.44
Total K	=	K2O x 0.83

\*Values must be expressed as nitrogen forms and in the same units

%	ppm
1	10,000
0.1	1,000
0.01	100
0.001	10
0.0001	1
1 Meq	ppm
Ca	20
Mg	12.2
Na	23
Cl	35.5