Traditions and Historic Practices vs. Science: Shifting to a Risk-Based Model for Onsite

Out of Sight, Out of Mind
Methods of Sewage Disposal

- **By George E. Waring, Jr.**
- ***"It has hitherto been – and, in fact, it still is – the practice of the world to consider its wastes satisfactorily disposed of when they are hidden from sight."***

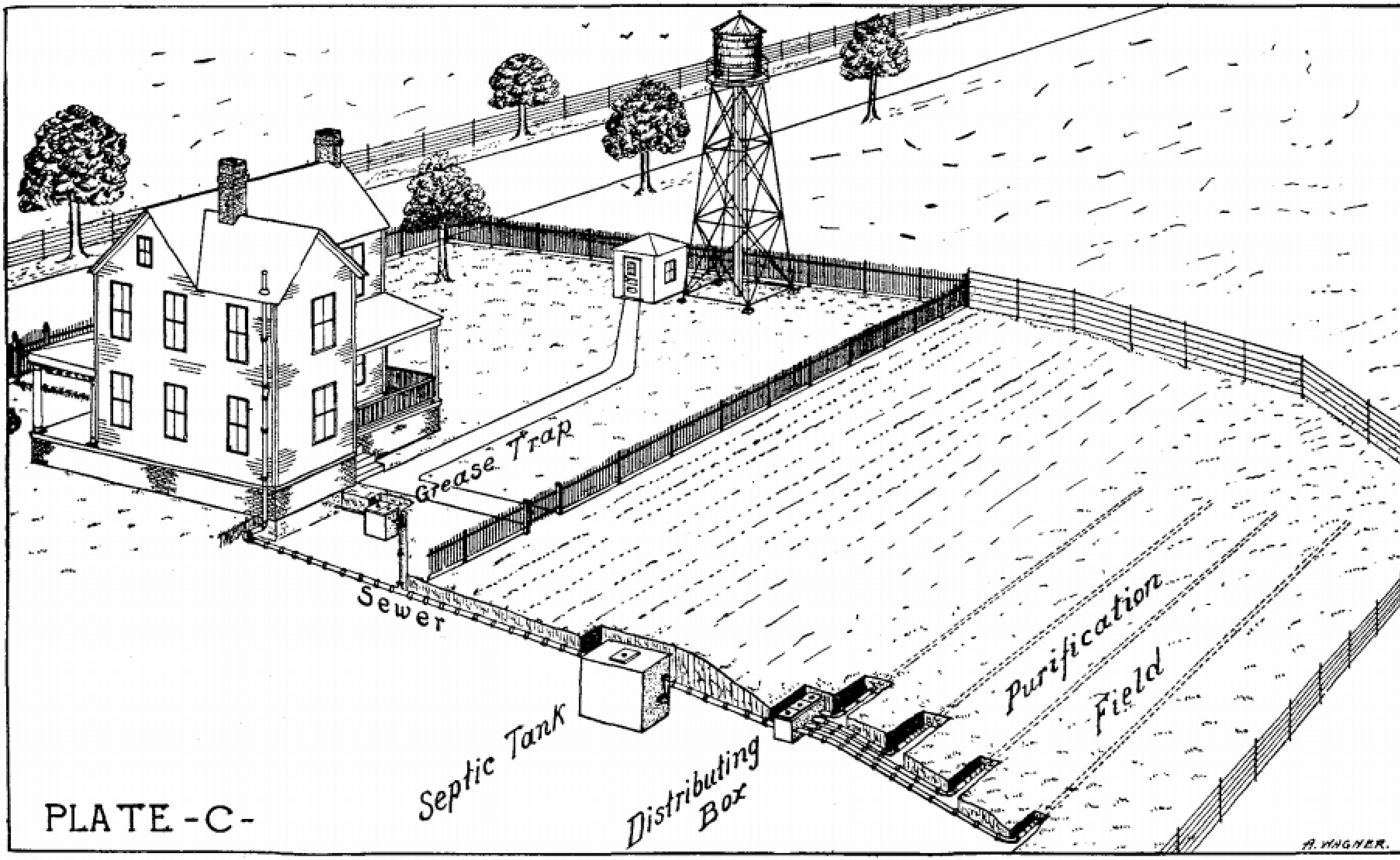
1894

What does it look like?

Septic System

- **1913**

USPHS, 1926


Grease Trap
Sewer
Septic Tank
Distributing Box
Purification Field
PLATE -C-
A. WAGNER.

Public Health & The Environment

USDA Sewage Disposal on the Farm & the Protection of Drinking Water

- **1896**

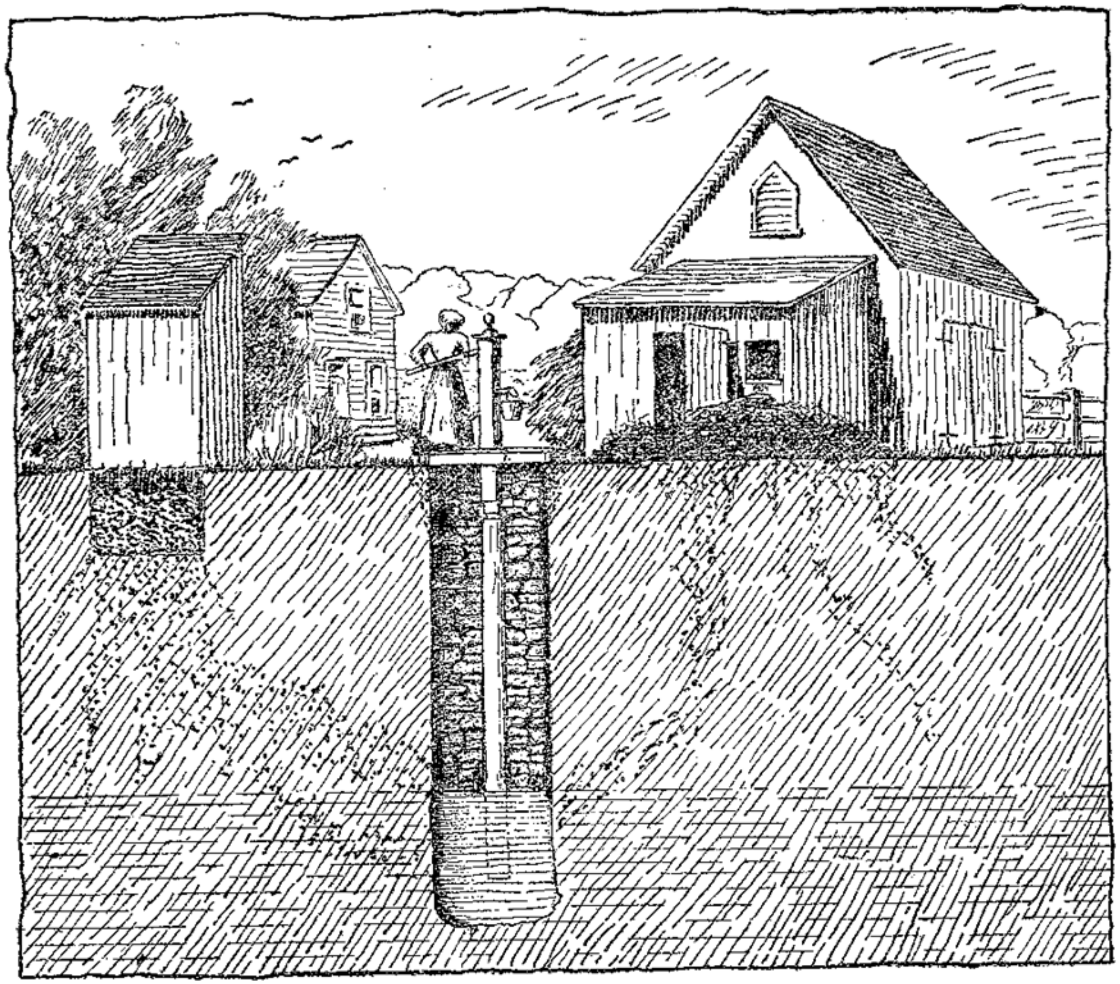


Fig. 1.—The shallow barnyard well, with privy vault and manure heaps near by. The water is likely to receive fluid from these at any time.

PA Septic Tanks for the Farm, 1927

Lawrence, MA Experiment Station

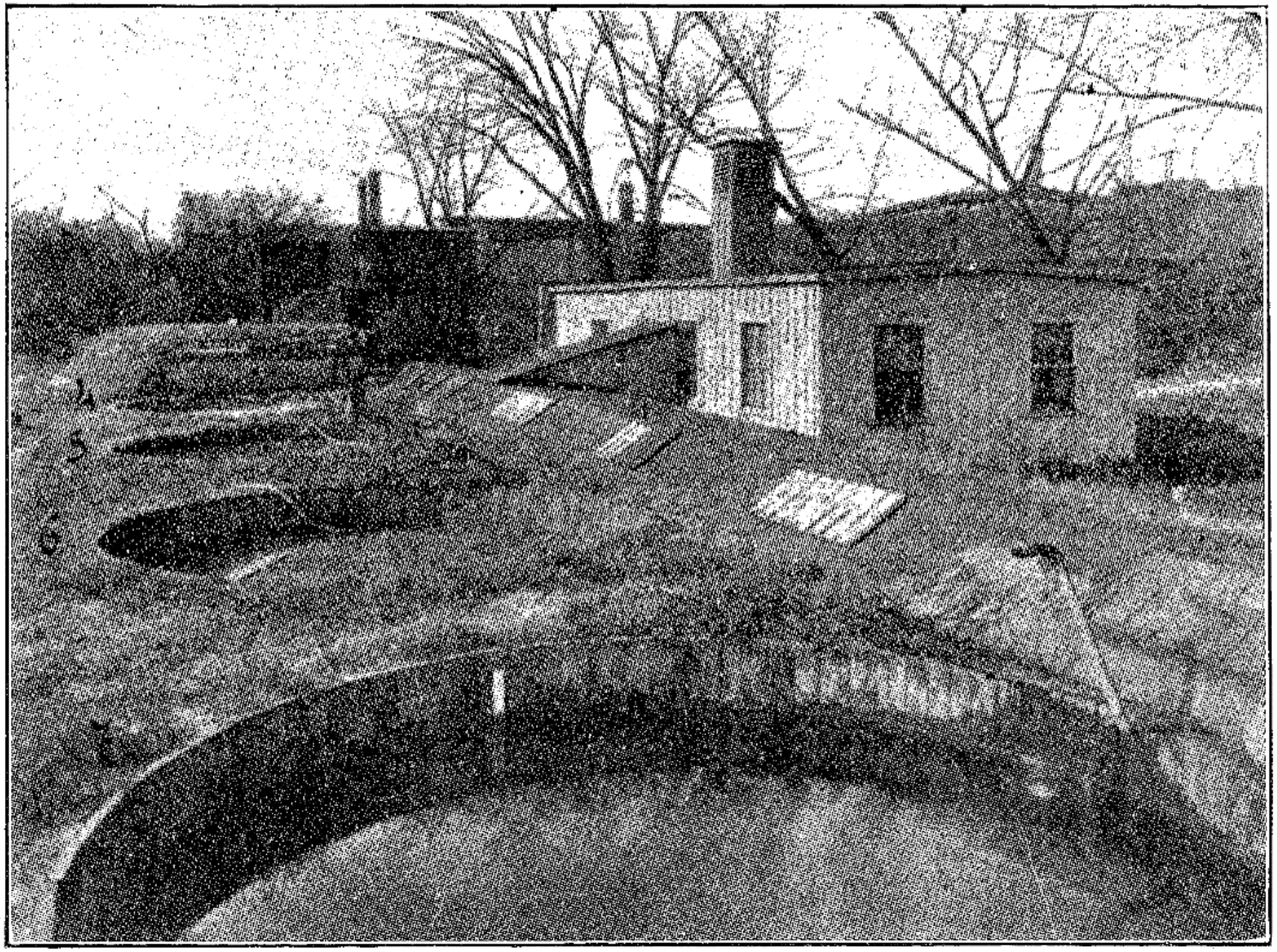


FIG. 64. Experimental Filters at the Lawrence Experiment Station (copied by permission from Henneking, 1909).

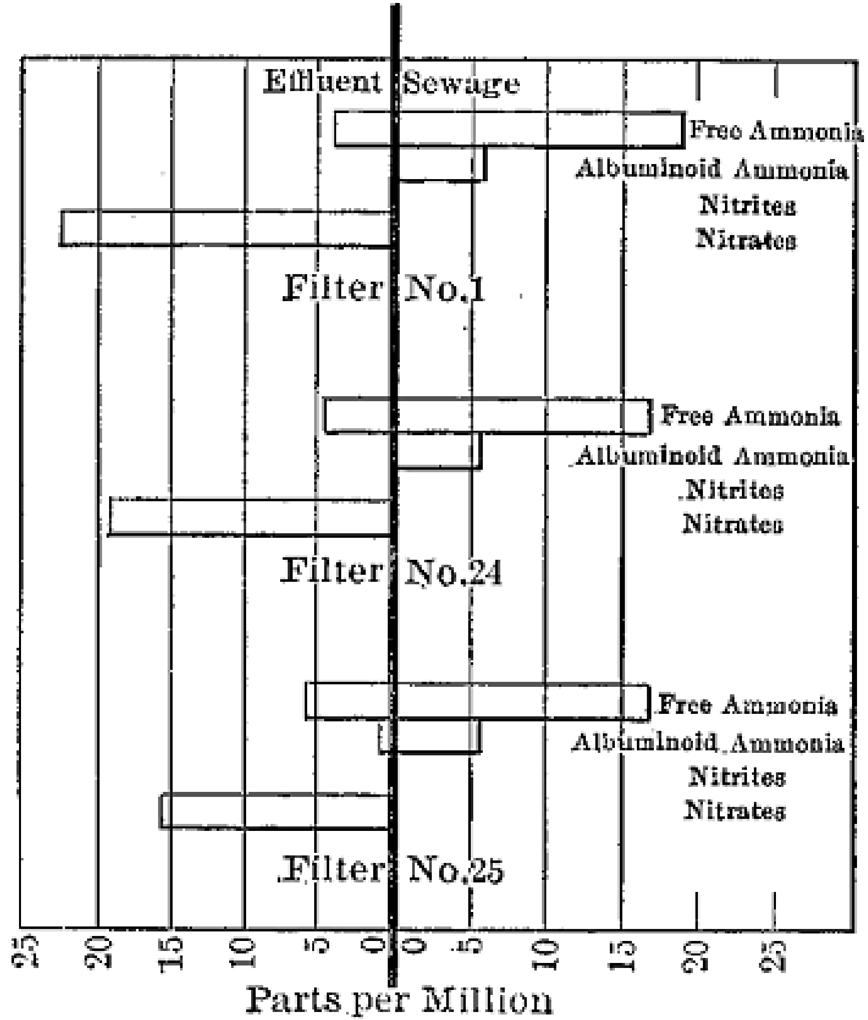
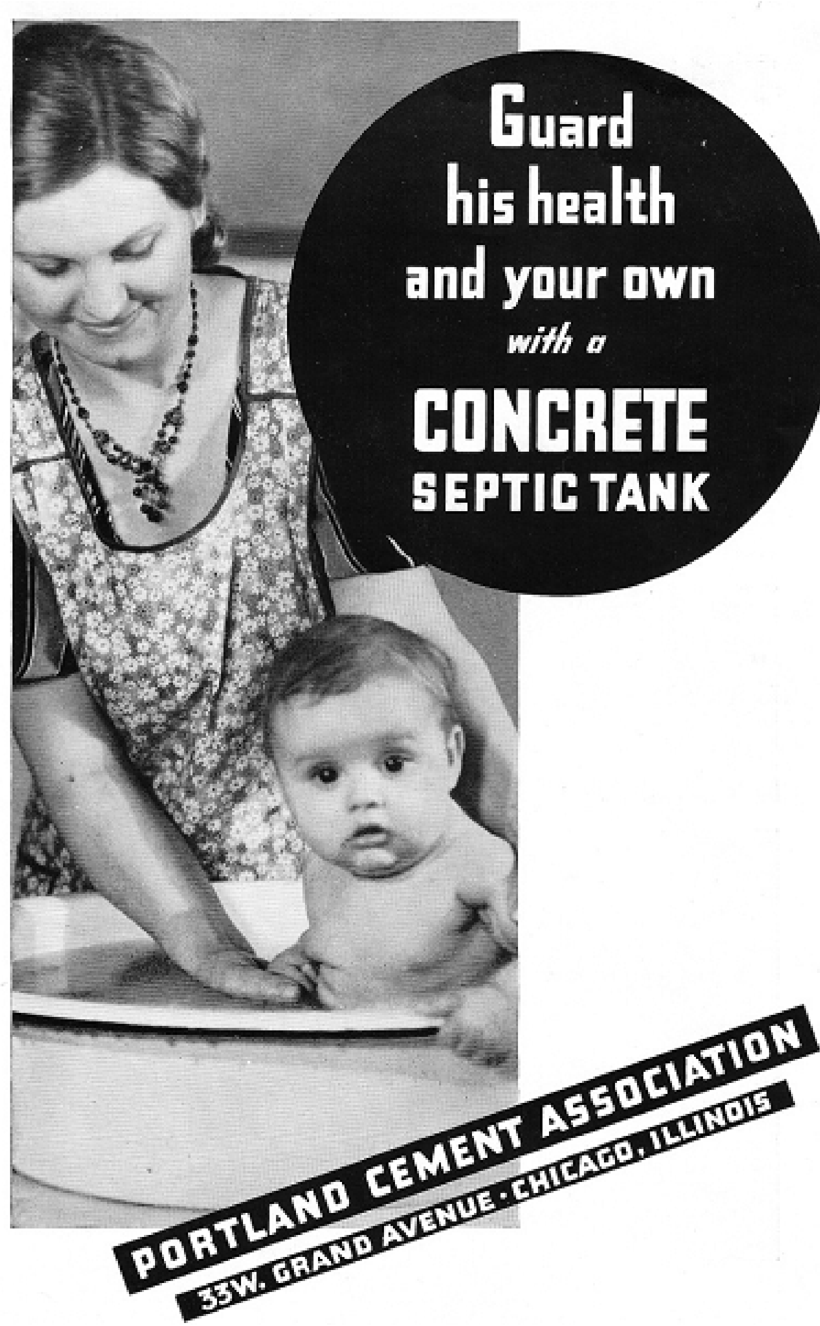


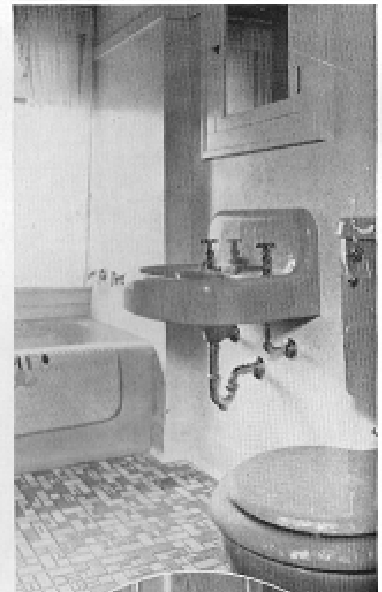
FIG. 65. Nitrogen changes in Intermittent Filtration at the Technology Experiment Station.

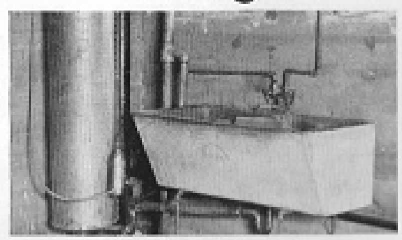
- **1937**


Guard
his health
and your own
with a
CONCRETE
SEPTIC TANK
PORTLAND CEMENT ASSOCIATION
33W. GRAND AVENUE · CHICAGO, ILLINOIS

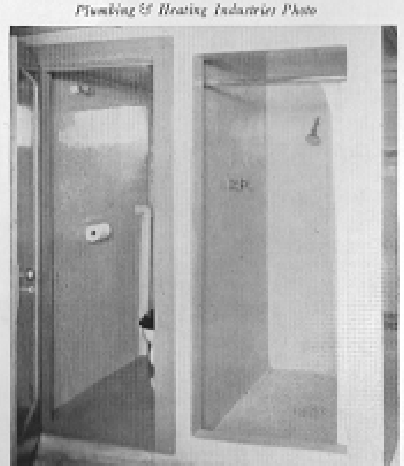
THE SEPTIC TANK....

BULWARK of safety

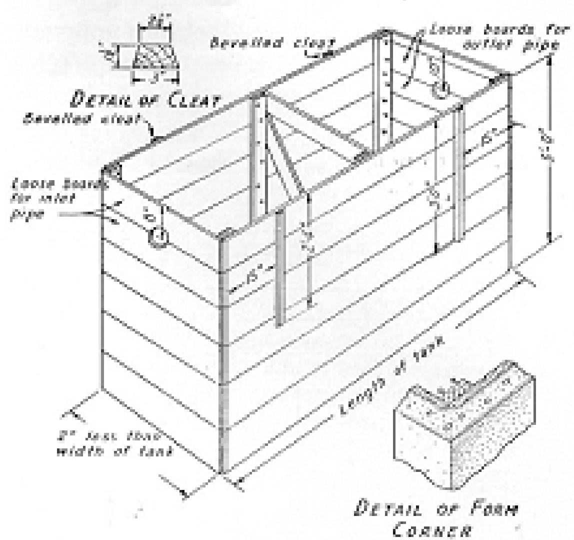




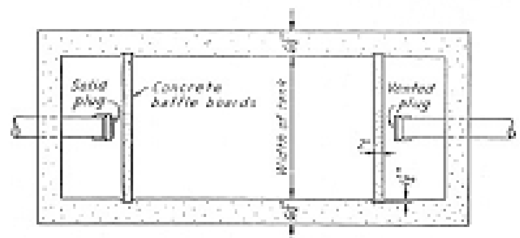
Plumbing & Heating Industries Photo



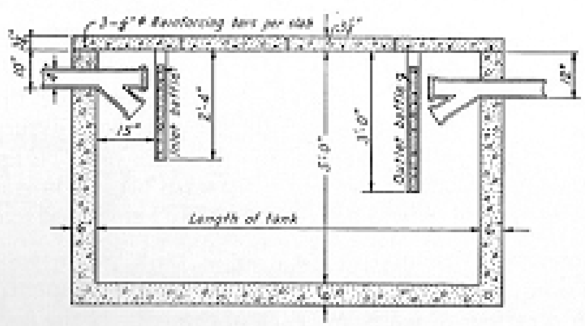
These are the conveniences which you may enjoy *in perfect safety*—when a septic tank guards the purity of your drinking and cooking water.



Inside form for single chamber septic tank.



Top view of tank.



Sectional view of tank.

- **1942**

SEWERAGE *and*
SEWAGE TREATMENT

By

W. A. HARDENBERGH

MEMBER, AMERICAN SOCIETY OF CIVIL ENGINEERS
COLONEL, SANITARY CORPS, U. S. ARMY

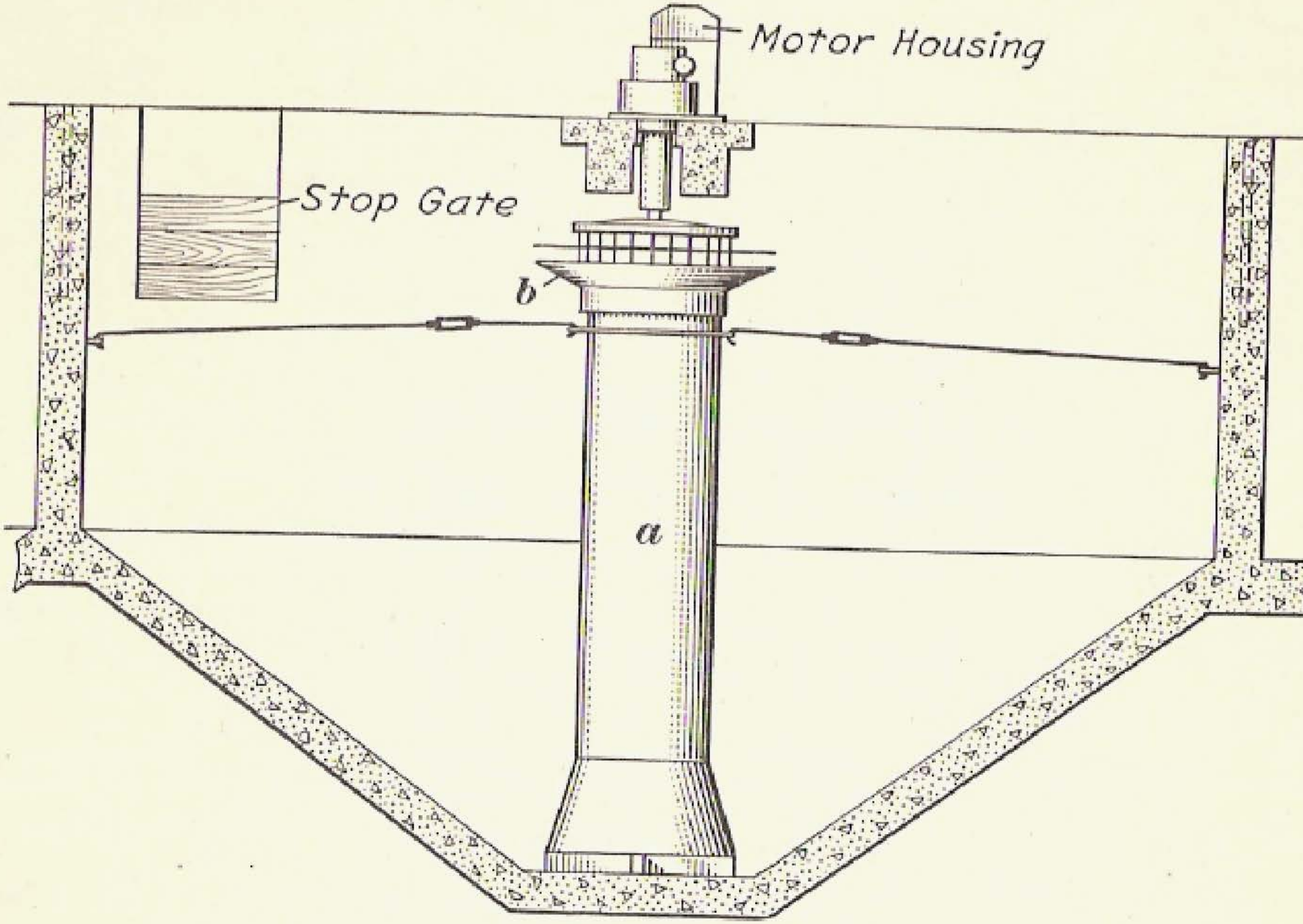
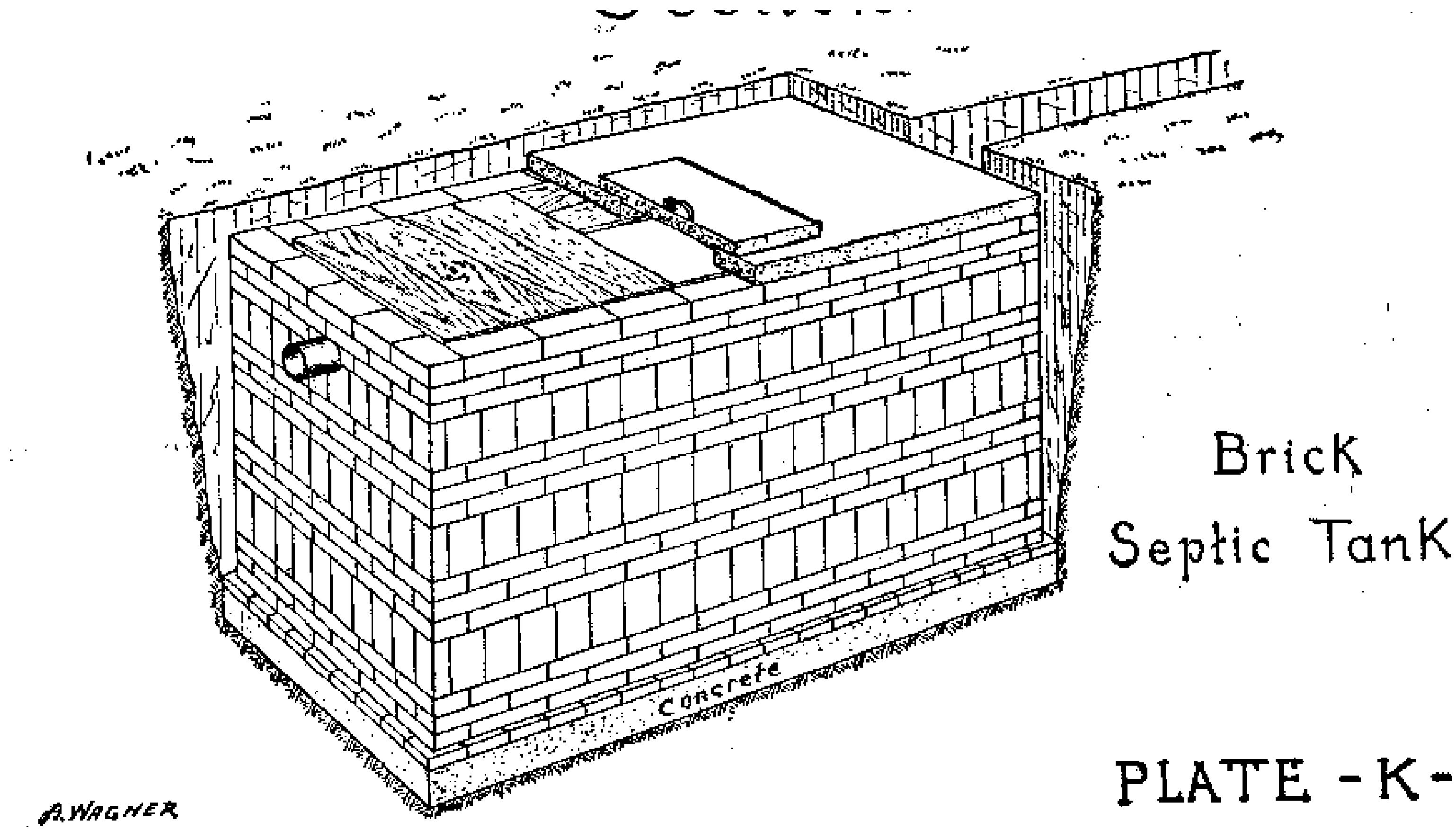


FIG. 117. MECHANICAL AERATOR.

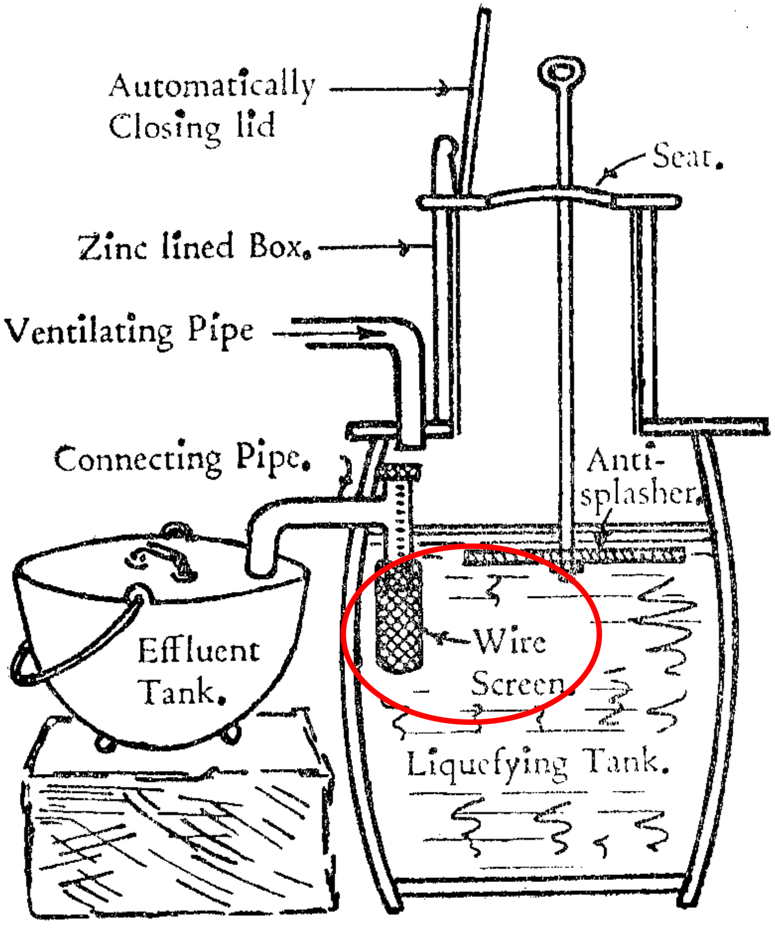
Watertight Tanks

- **1924 *Home Sewage Disposal* book**
- ***"To operate properly and to prevent pollution of the ground or the ground water, septic tanks should be water-tight. Any material is permissible, so long as it is durable and does not leak."***

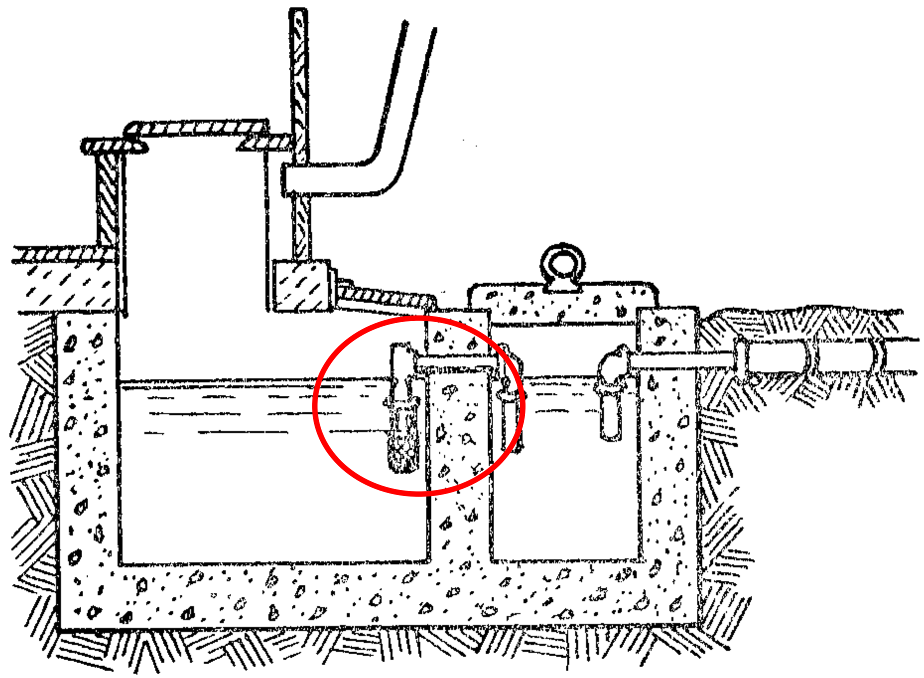
USPHS, 1926
Brick Septic Tank



USPH Bulletin No. 68, 1915
Effluent Filter



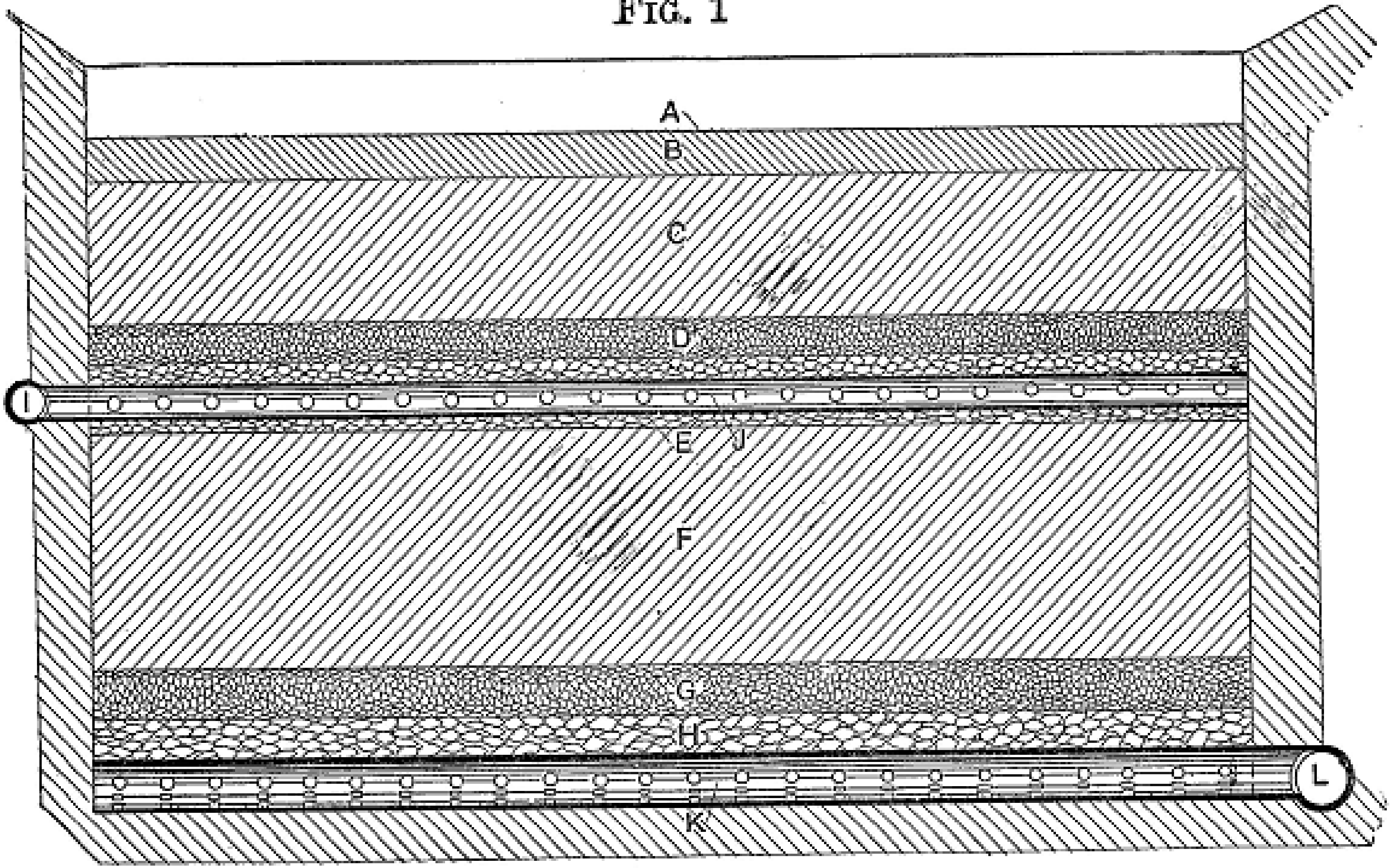
A.



B.

Lowcock Aerated Filter, 1894
Intermittent Filtration

FIG. 1



Hardenbergh, 1942
Intermittent Filtration, cont'd

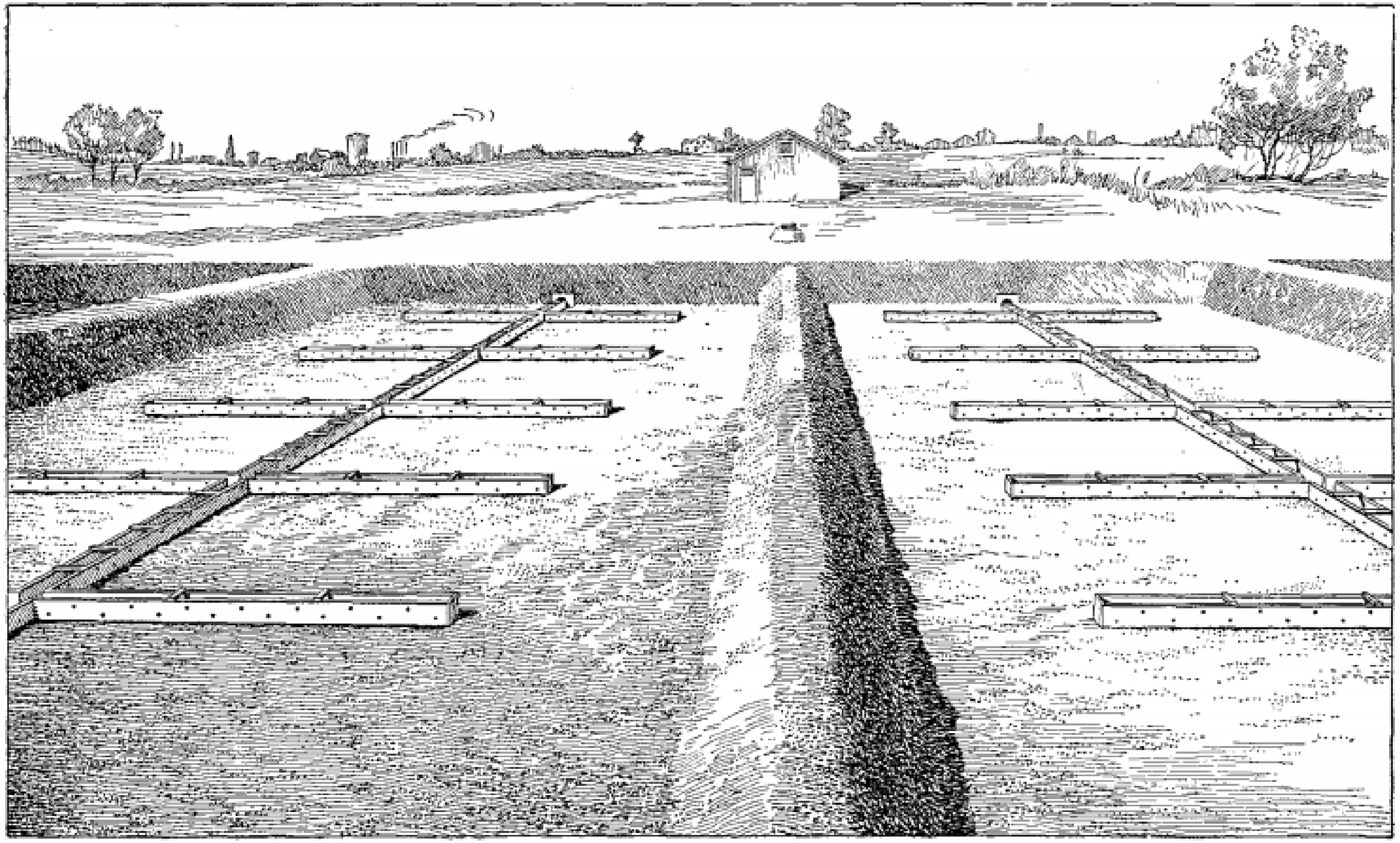
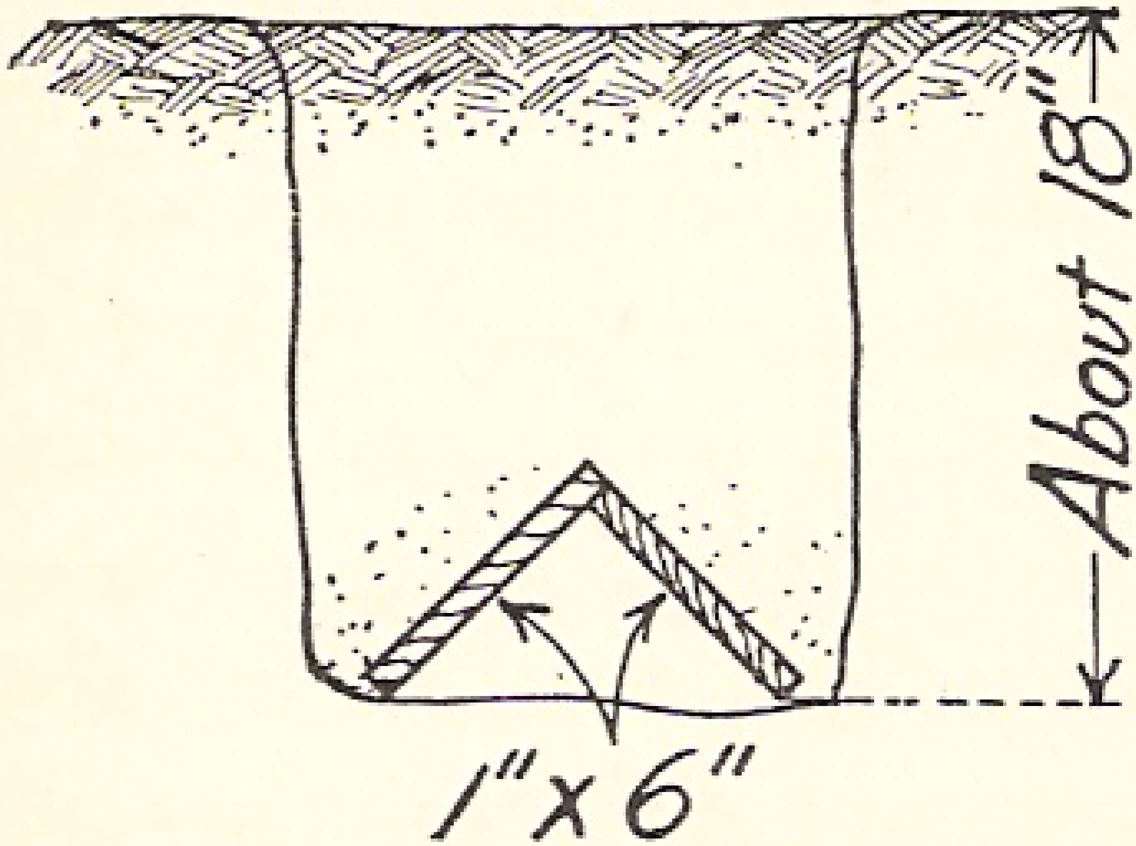


FIG. 133. DISTRIBUTION SYSTEM FOR INTERMITTENT SAND FILTRATION.

Hardenbergh, 1924
Early "Chamber"



Courtesy California State Board of Health.

FIG. 63.—A method of making sub-surface drains of boards.

CA Ag Extension, 1933 & 1948
Early “Chamber” & “Half-pipe”

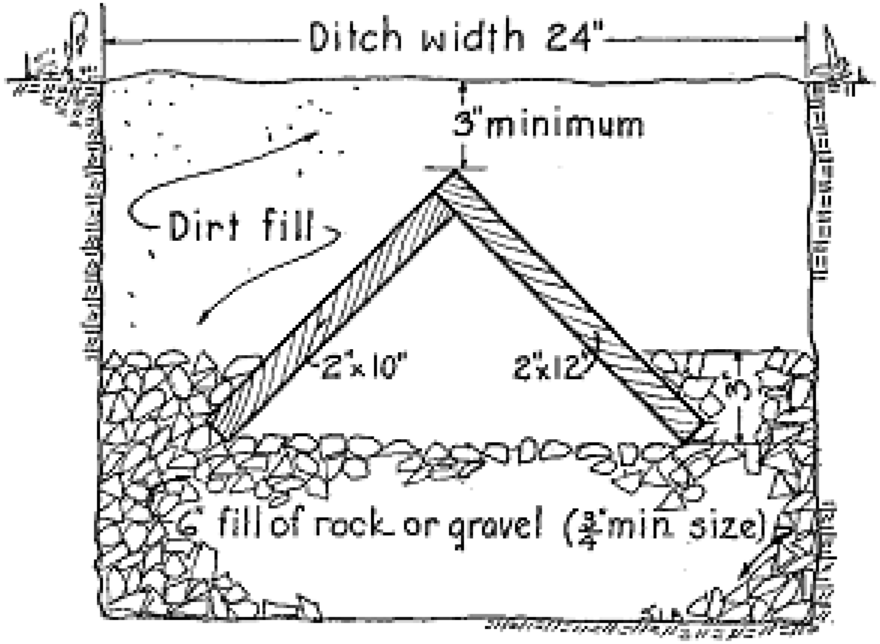


Fig. 14.—Cross section of V-trough drain line.

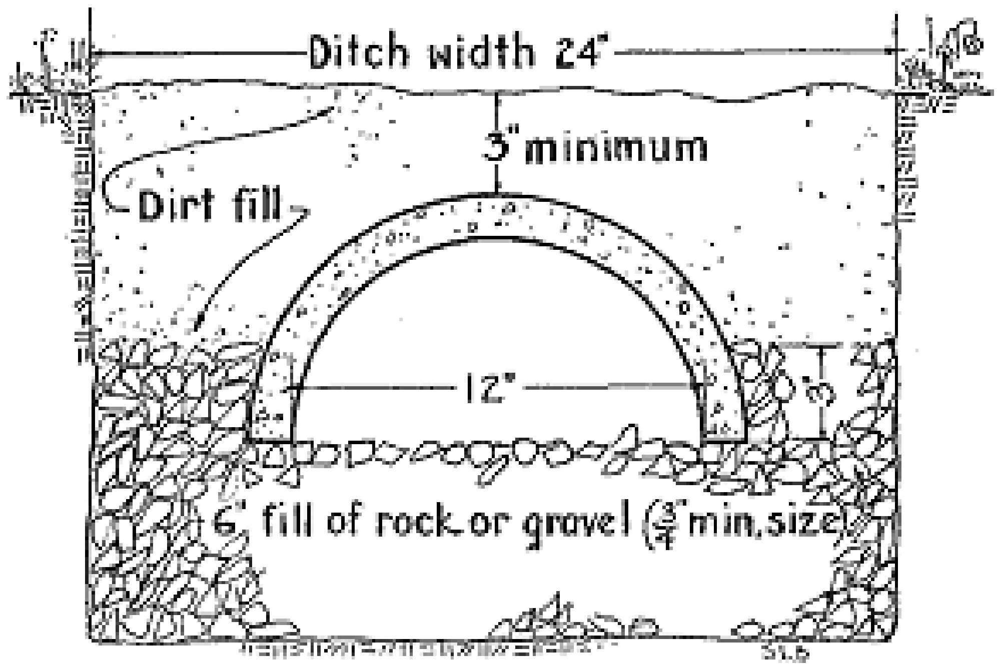


Fig. 16.—Cross section of half-section pipe drain line.

1929
Operation & Maintenance

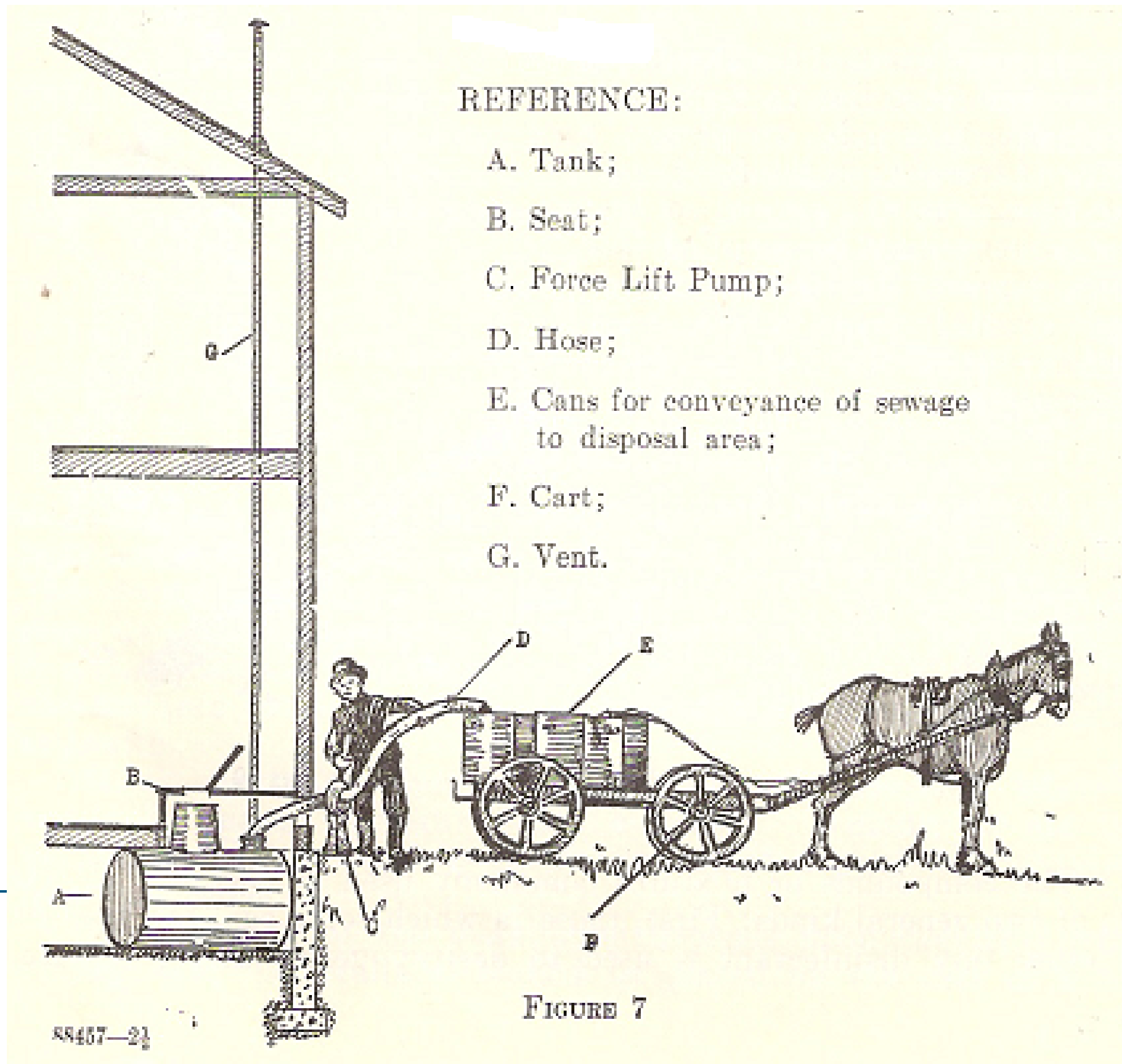


Figure 7

Resource Capture & Reuse

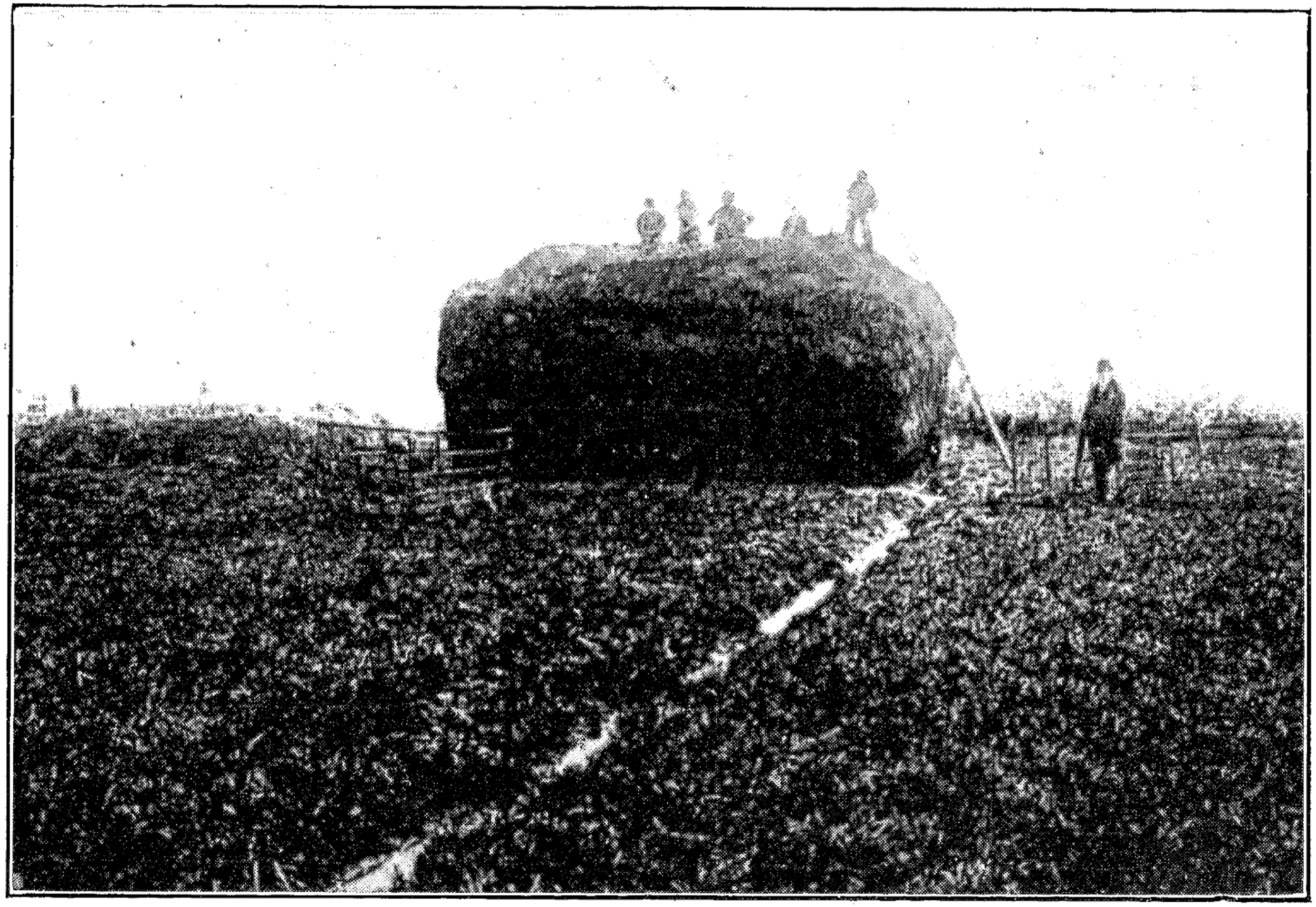


FIG. 60. Getting in the Hay Crop on an English Sewage Farm.

Resource Capture & Reuse, cont'd

FIG. 62. Cornfield on the Pasadena Sewage Farm.

Resource Capture & Reuse, cont'd

FIG. 63. Walnuts on the Pasadena Sewage Farm.

Risk & Regulations

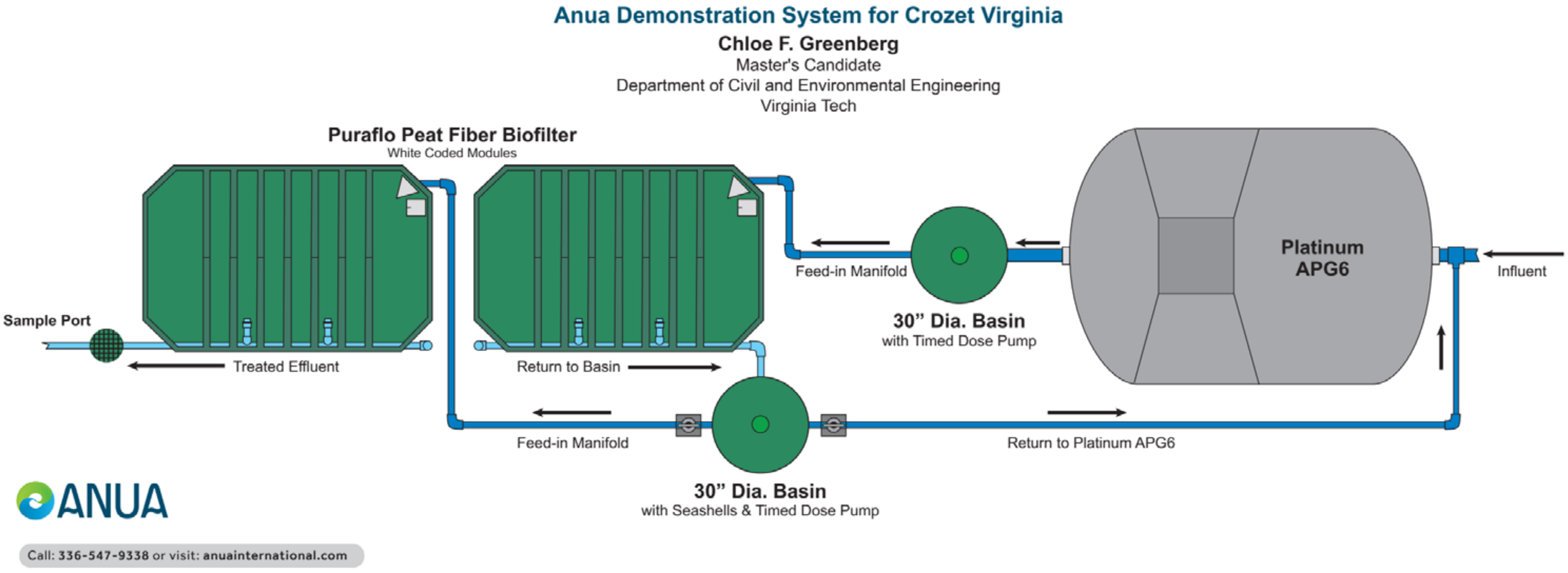
- Address in design
- Verify at start-up
- Operation
  - Measure
  - Adjust
  - Report
- Correct

Regulations: What Do We Need to Address Risk?

- Plumbing → UPC
- Electrical → NEC
- Septic Tanks → IAPMO & ASTM
- Treatment Systems → NSF/ANSI
- Bioreactor optimization →
- Soil dispersal →
- Water reuse →
- Do states need to generally approve products?

Regulations: What Do We Need to Address Risk?

- **Staged Treatment**



Risk Discussion:
Critical Parameters

- **What should we address in design?**

Risk Discussion:
Critical Parameters

- **What should we verify at start-up?**

Risk Discussion:
Critical Parameters

- What should we measure and report?

Risk Discussion:
Critical Parameters

- **How do we address <u>correction</u>?**

Risk Discussion:
Critical Parameters

- **How do we address <u>correction</u>?**

Operation & Enforcement

- Addressing Risk
  - Fail-safe mechanism
    - Power loss
    - Post filtration/physical barrier

Operation & Enforcement

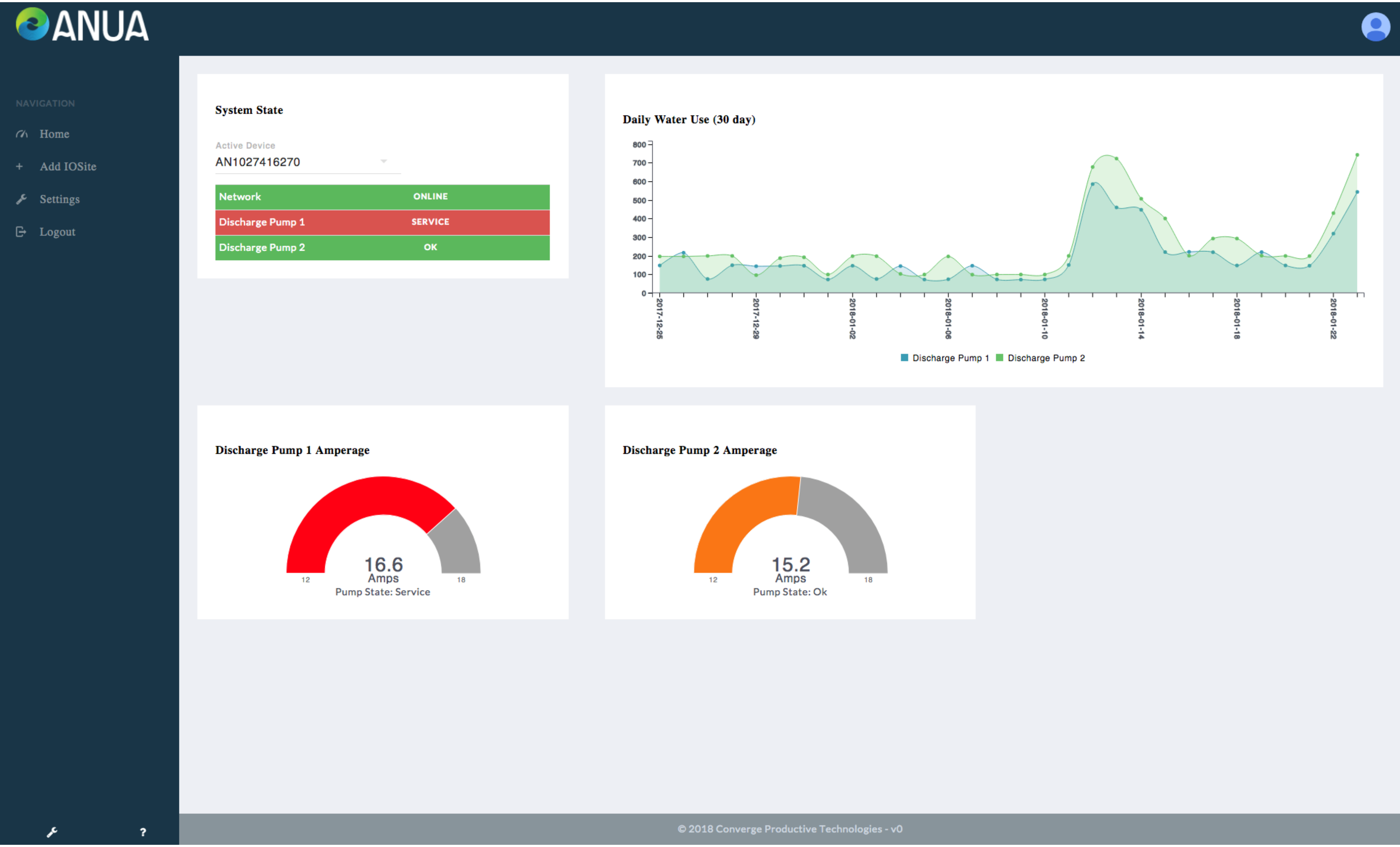
- Addressing Risk
  - Flow surge control mechanism w/ alarm
    - Volume
    - Rate

Operation & Enforcement

Risk Level	Impact	Suggested maintenance frequency
High	Break of electromechanical component that impacts directly system treatment performance – Risk of discharging partially or untreated effluent	2 to 4 times a year
Low	Simple electromechanical not allowing treatment by-pass - impacts conveyance of water without impacting system treatment performance – No discharge of partially or untreated effluent	Once a year to once every 2 years
	Passive system that doesn't involved electromechanical components	

Finding Balance - Verification

- Remote monitoring
  - Internet connected
  - Tracks water use
  - Catches motor issues
  - Uses any mobile device


ANUA
NAVIGATION
Home
Add IOSite
Settings
Logout
System State
Active Device
AN1027416270
Network ONLINE
Discharge Pump 1 SERVICE
Discharge Pump 2 OK
Daily Water Use (30 day)
800
700
600
500
400
300
200
100
0
2017-12-25
2017-12-29
2018-01-02
2018-01-06
2018-01-10
2018-01-14
2018-01-18
2018-01-22
Discharge Pump 1
Discharge Pump 2
Discharge Pump 1 Amperage
16.6
Amps
12
18
Pump State: Service
Discharge Pump 2 Amperage
15.2
Amps
12
18
Pump State: Ok
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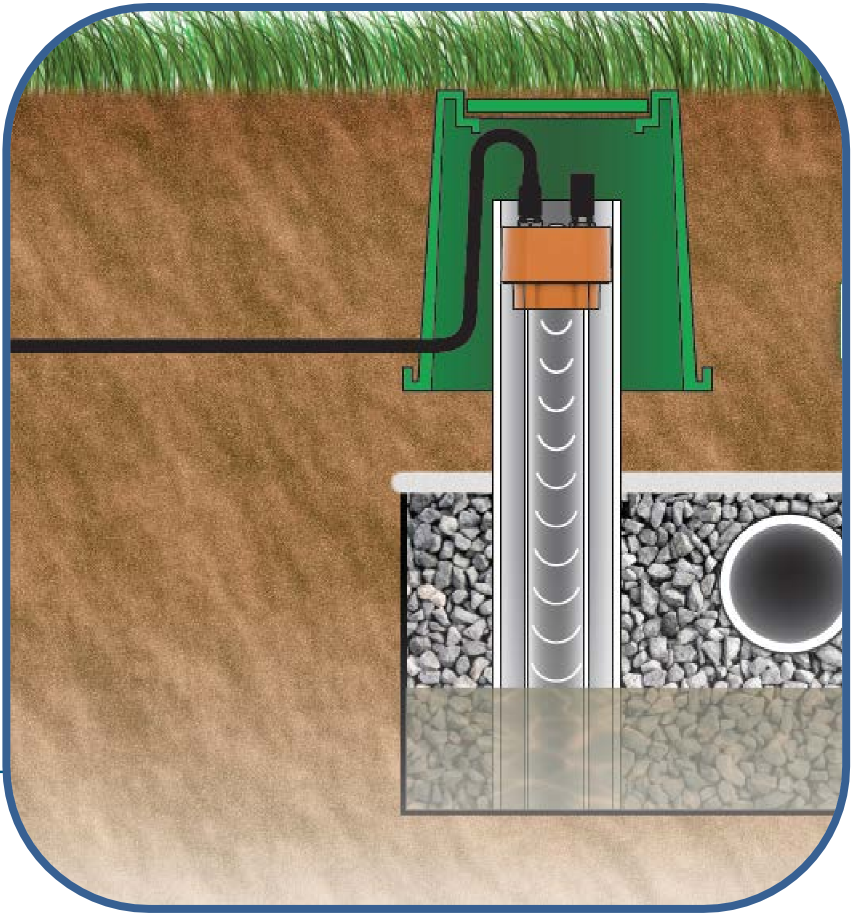
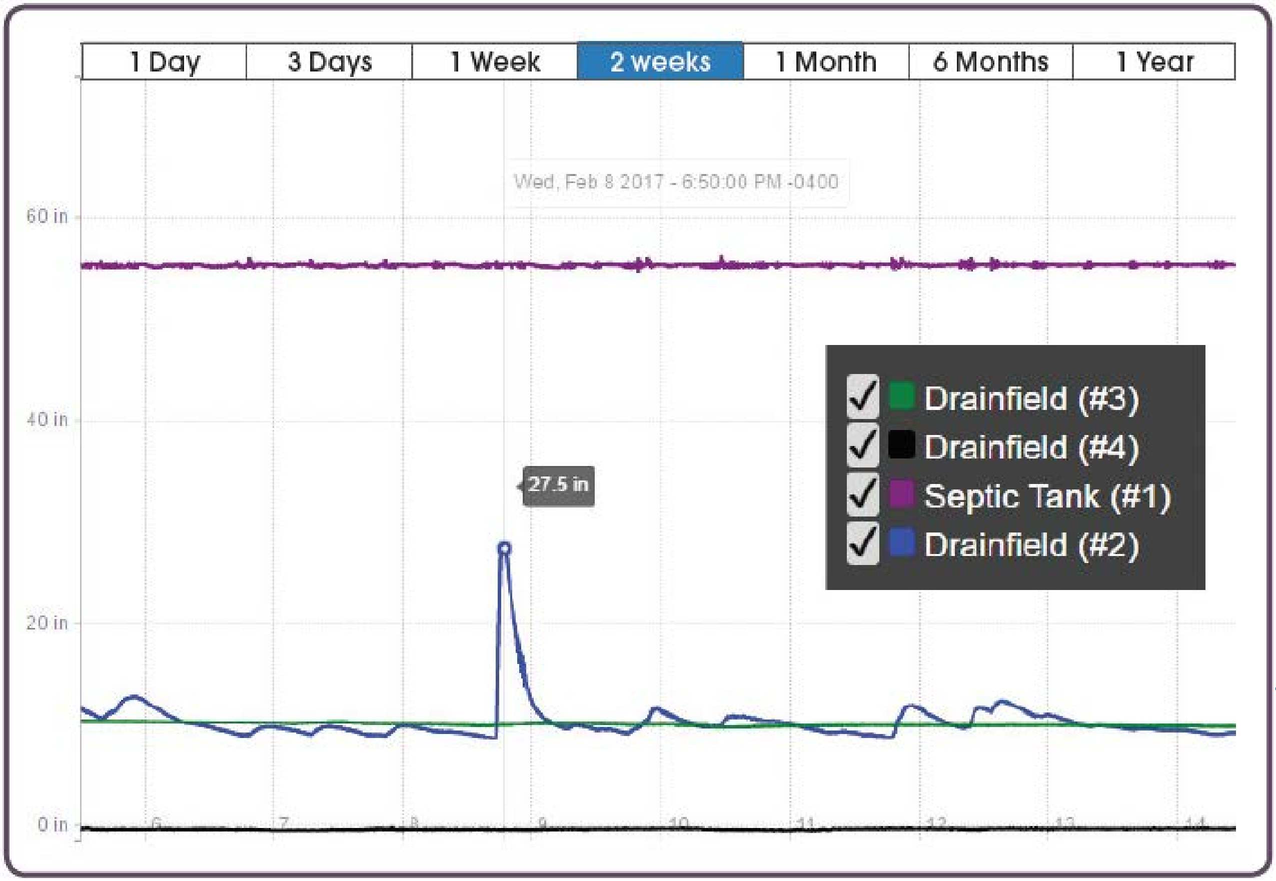
Finding Balance

- **Ultrasonic drainfield sensor**



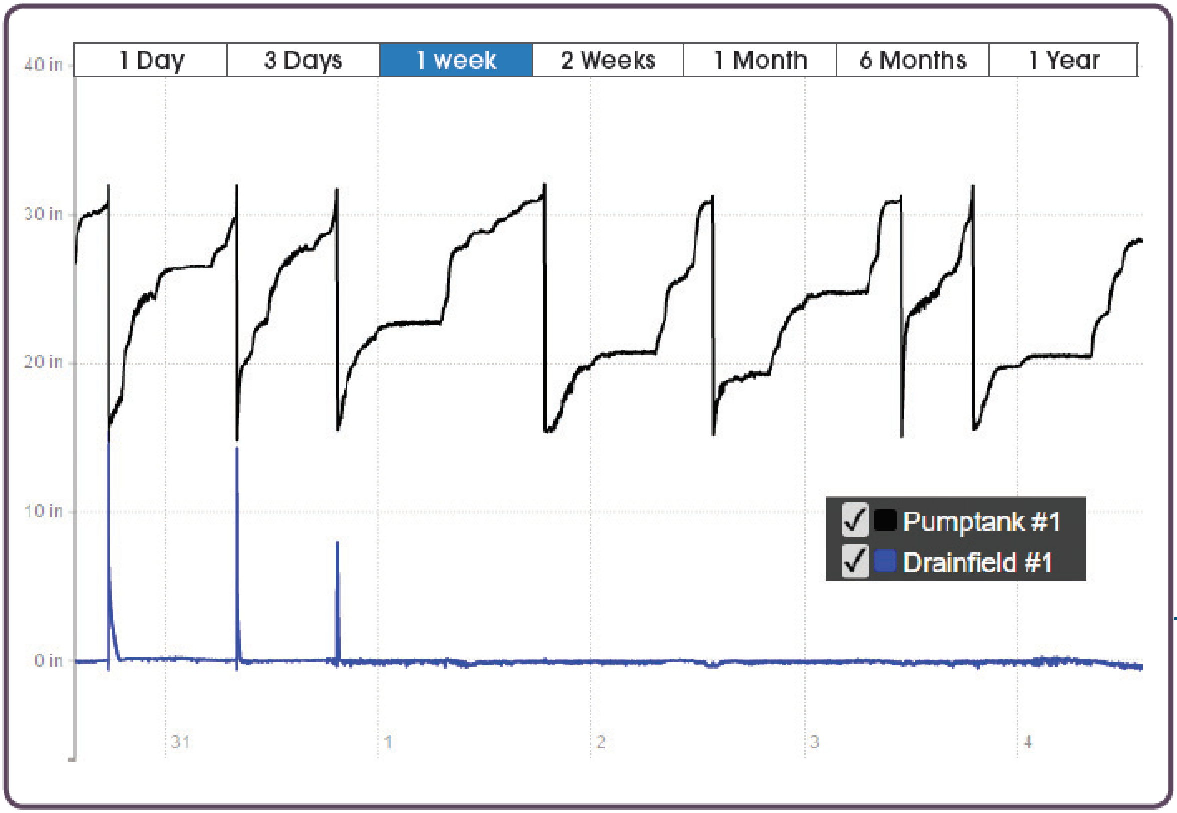
Finding Balance
Septic Sitter Example

- **Excessive ponding in portions from snowmelt or rain**



Finding Balance
Septic Sitter Example

- Pump tank with dosed drainfield
- Overloaded drainfield started recovering after dosing regimes changes



Contact

Colin Bishop, REHS, RS
928.433.3220
colin.bishop@anuainternational.com