Pump Sizing and Selection
Effluent Pump Training

PASEO / PSMA
February 2, 2026

Sign Up For the Barnes Alliance Program to receive more Training!

CRANE
PUMPS & SYSTEMS

Leaning Objectives

- Practical, field-ready framework for sizing and selecting effluent pumps for a wide range of decentralized wastewater applications, including pressure distribution, timed dosing, drip dispersal, and ATU/pretreatment discharges.

- Participants will learn how to interpret pump curves, calculate system head, match pump performance to system requirements, and evaluate common installation variables that affect pump reliability and lifecycle cost.

- The class blends hydraulic theory with real-world field experience – highlighting troubleshooting tips, common mistakes, regulatory considerations, and best practices for achieving uniform distribution and long-term system performance.

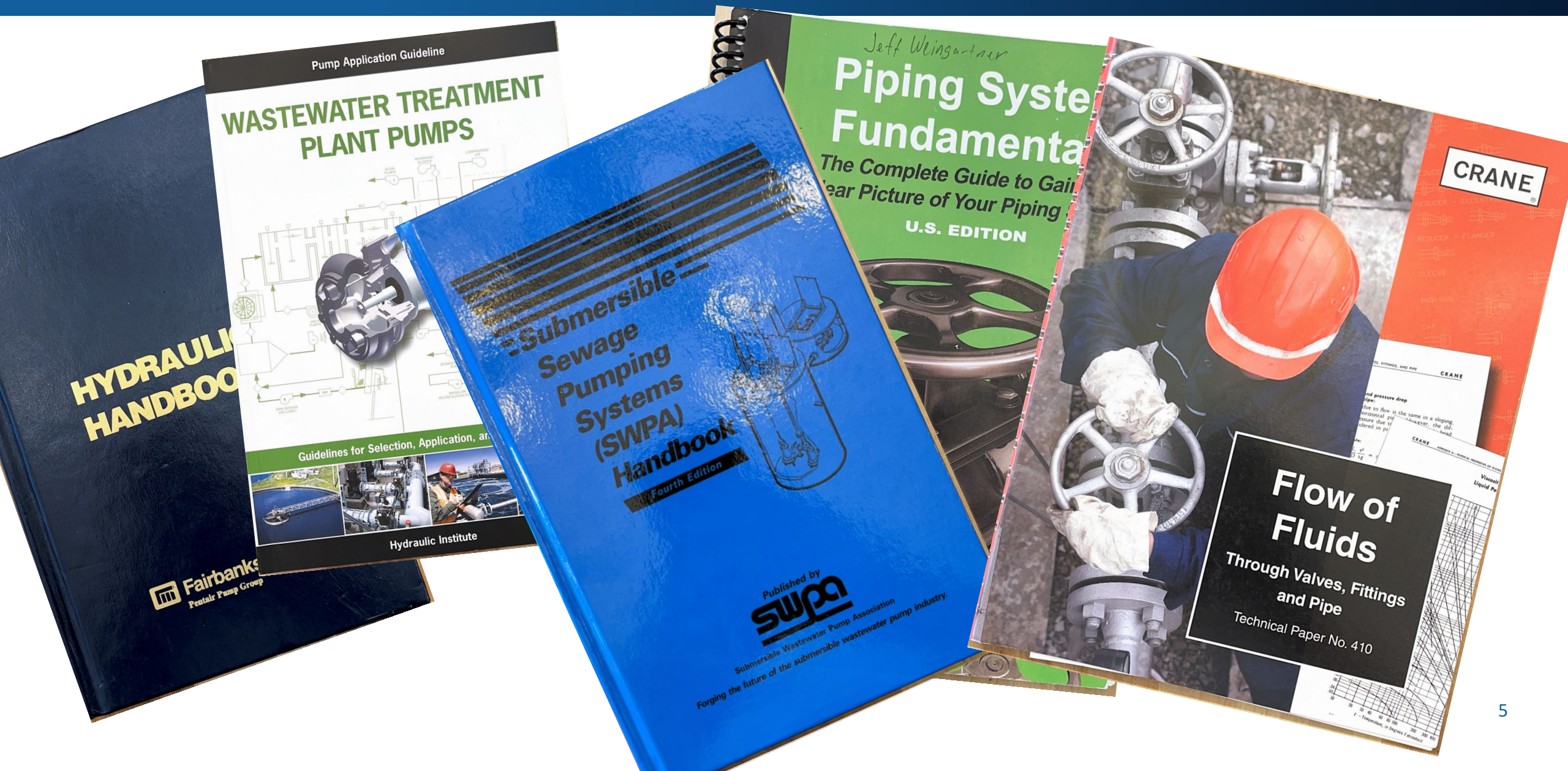
Leaning Objectives

1. Understanding Pumps and Pump Curves
2. Differences between Sump, Sewage, Effluent, and Grinders
3. Pump Selection Using Pump Curves
4. How to Size Your Pump
5. Not All Pumps are Built the Same
6. Troubleshooting

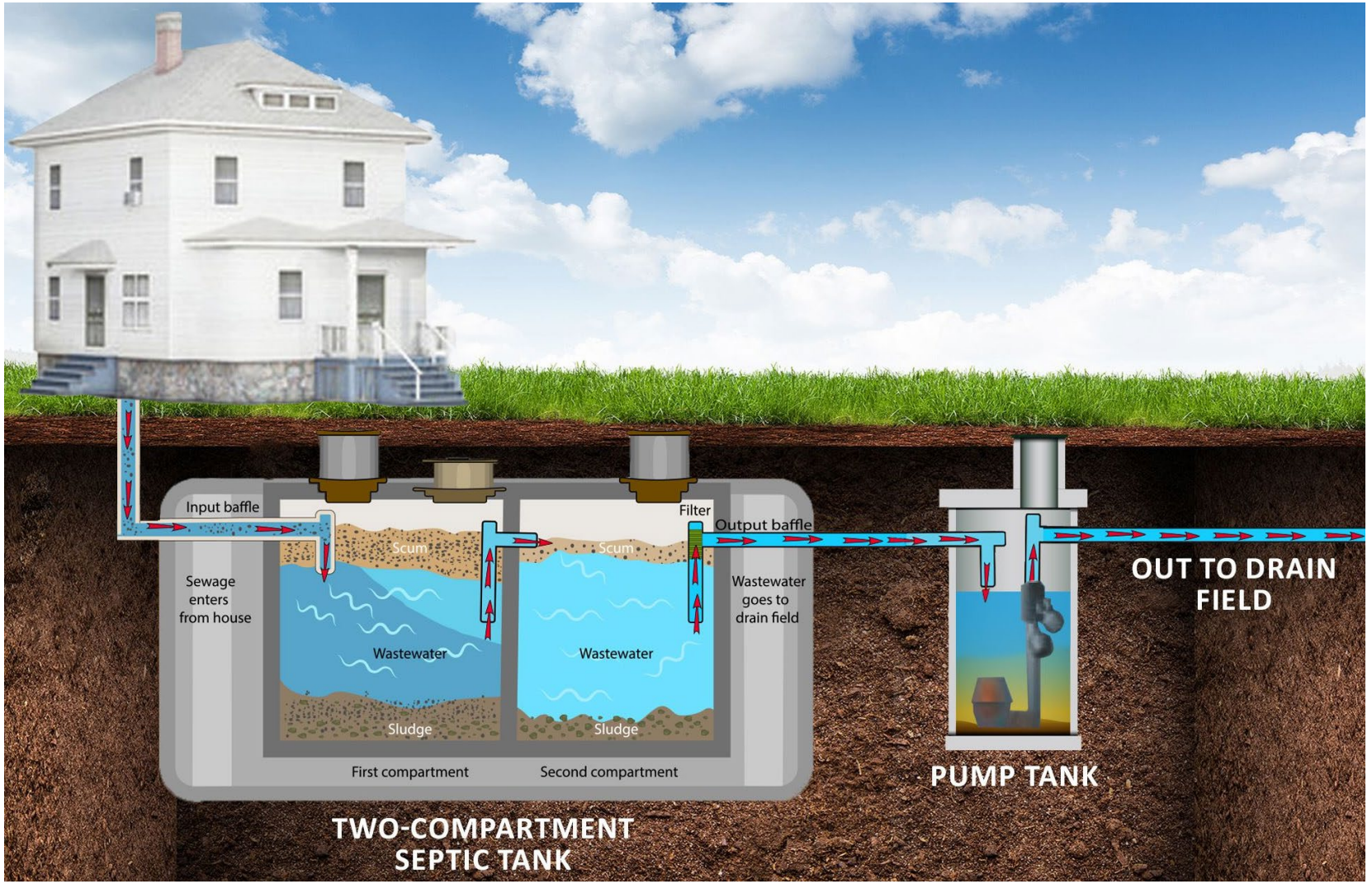
Pennsylvania Department of Environmental Protection Disclaimer

“DEP has approved this conference for SEO continuing education conference credits. The approval is based on the organization’s narrative for the overall conference and each breakout session. DEP has not reviewed the content of the conference and does not guarantee that the sessions provide complete and accurate information about Pennsylvania’s Sewage Facilities Act, the regulations promulgated thereunder, and DEP policy.”

Resources


HYDRAULIC
HANDBOOK
Fairbanks
Pentair Pump Group
Pump Application Guideline
WASTEWATER TREATMENT
PLANT PUMPS
Guidelines for Selection, Application, and
Hydraulic Institute
Submersible
Sewage
Pumping
Systems
(SWPA)
Handbook
Fourth Edition
Published by
SWPA
Submersible Wastewater Pump Association
Forging the future of the submersible wastewater pump industry.
Jeff Weingartner
Piping Syste
Fundamenta
The Complete Guide to Gai
ear Picture of Your Piping
U.S. EDITION
CRANE
Flow of
Fluids
Through Valves, Fittings
and Pipe
Technical Paper No. 410

Role of pumps in an on-site septic system



- Is the pump running to a:
  - Drain field?
  - Mound system?
  - Chamber system?
  - Drip system?
  - Advanced Treatment Unit?

Role of pumps in an on-site septic system

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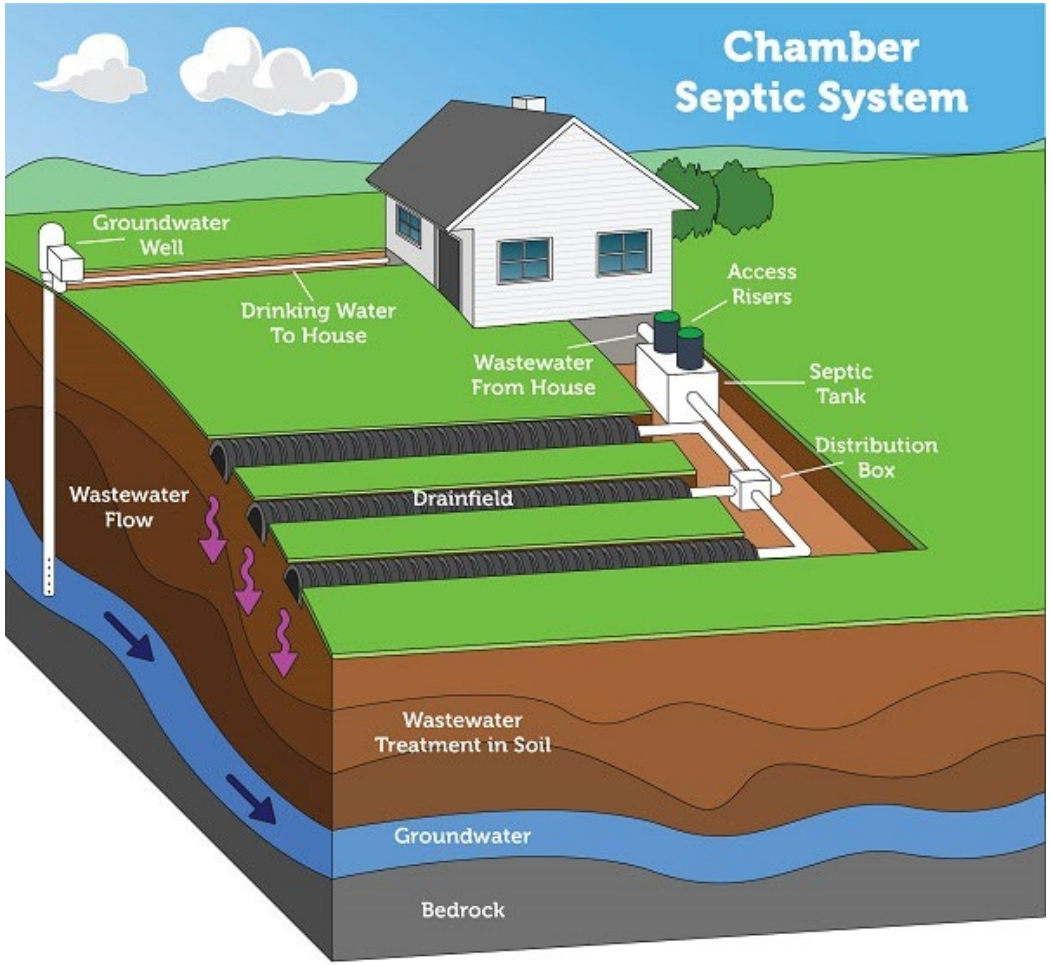
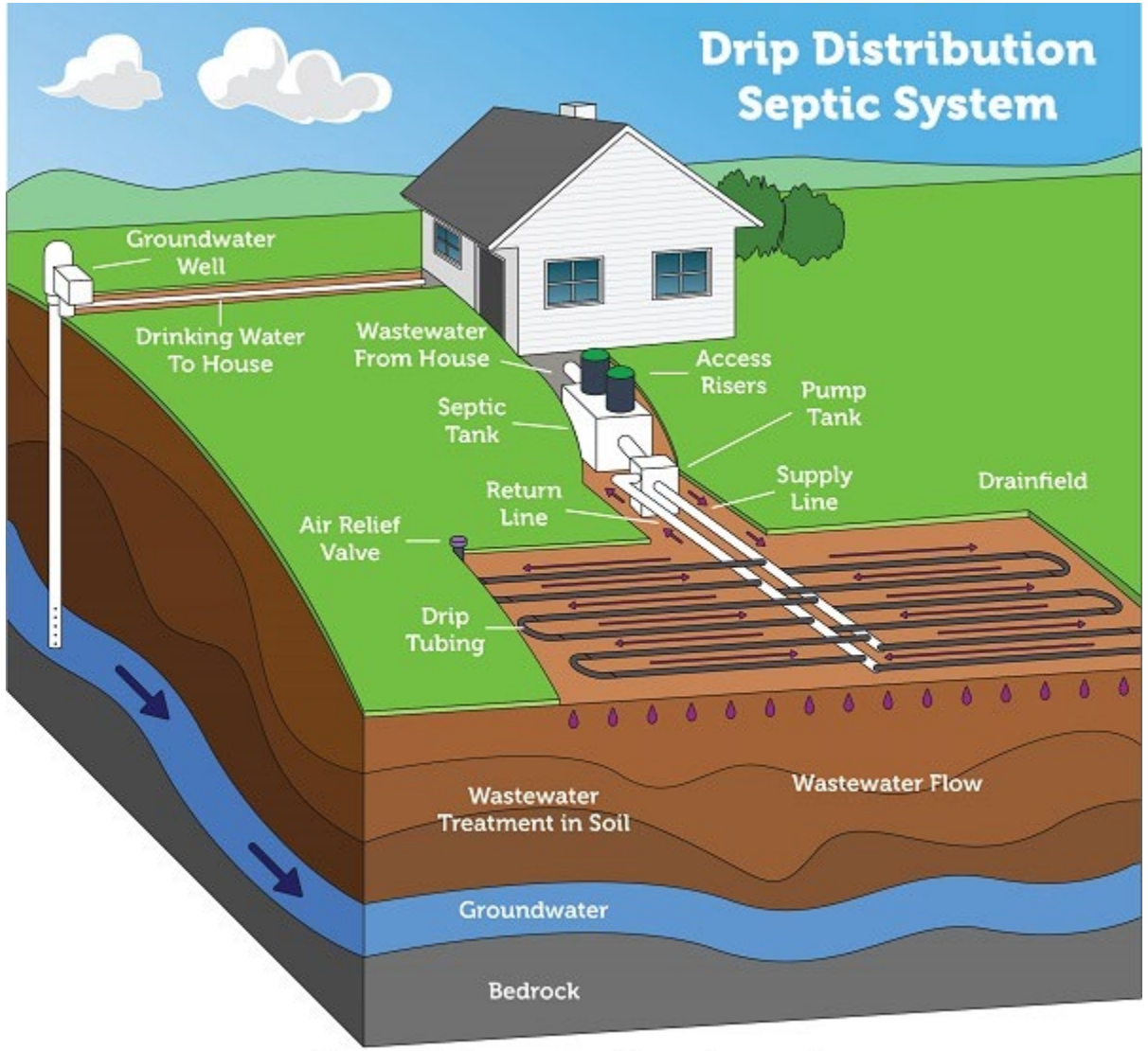


Please note: The ends of the chamber system lines are open for illustrative purposes only. In reality, and when properly installed, these lines are closed at the end. Septic systems vary. Diagram is not to scale.



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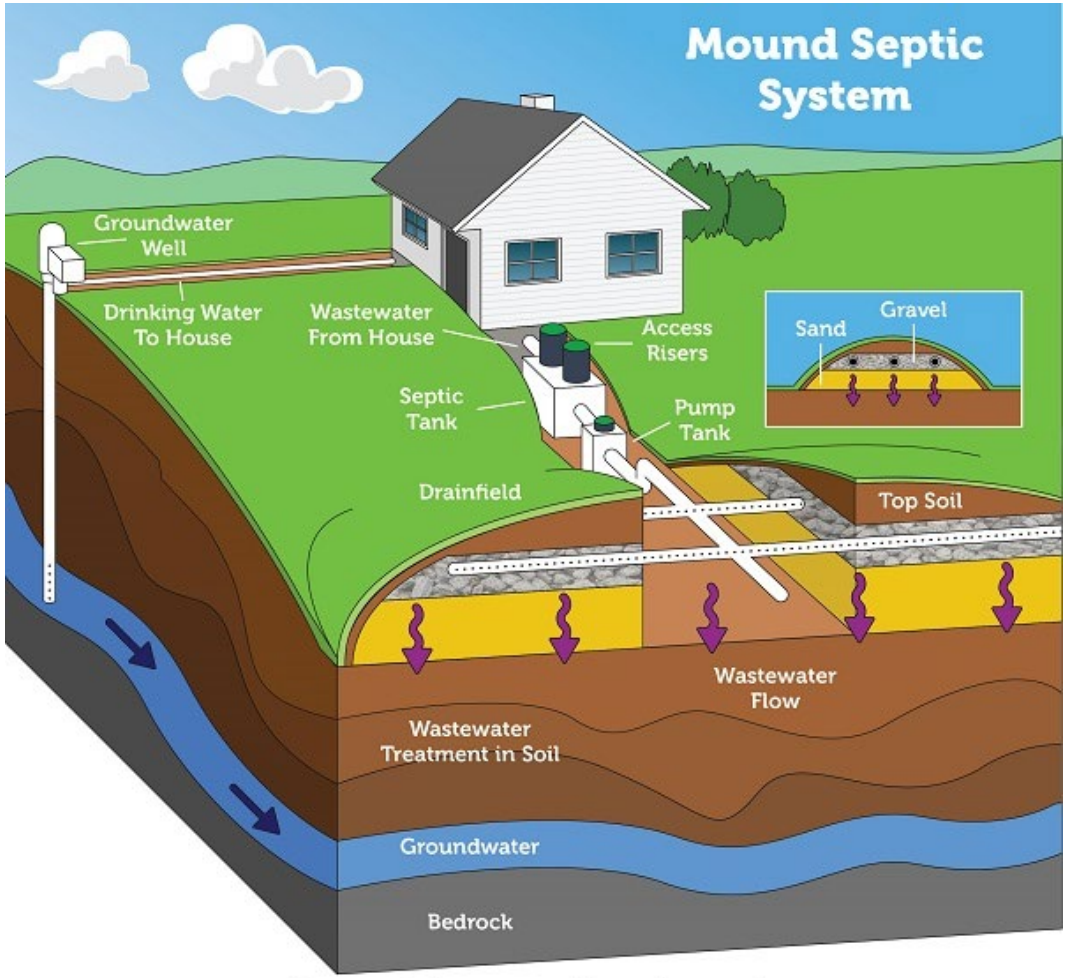
Role of pumps in an on-site septic system



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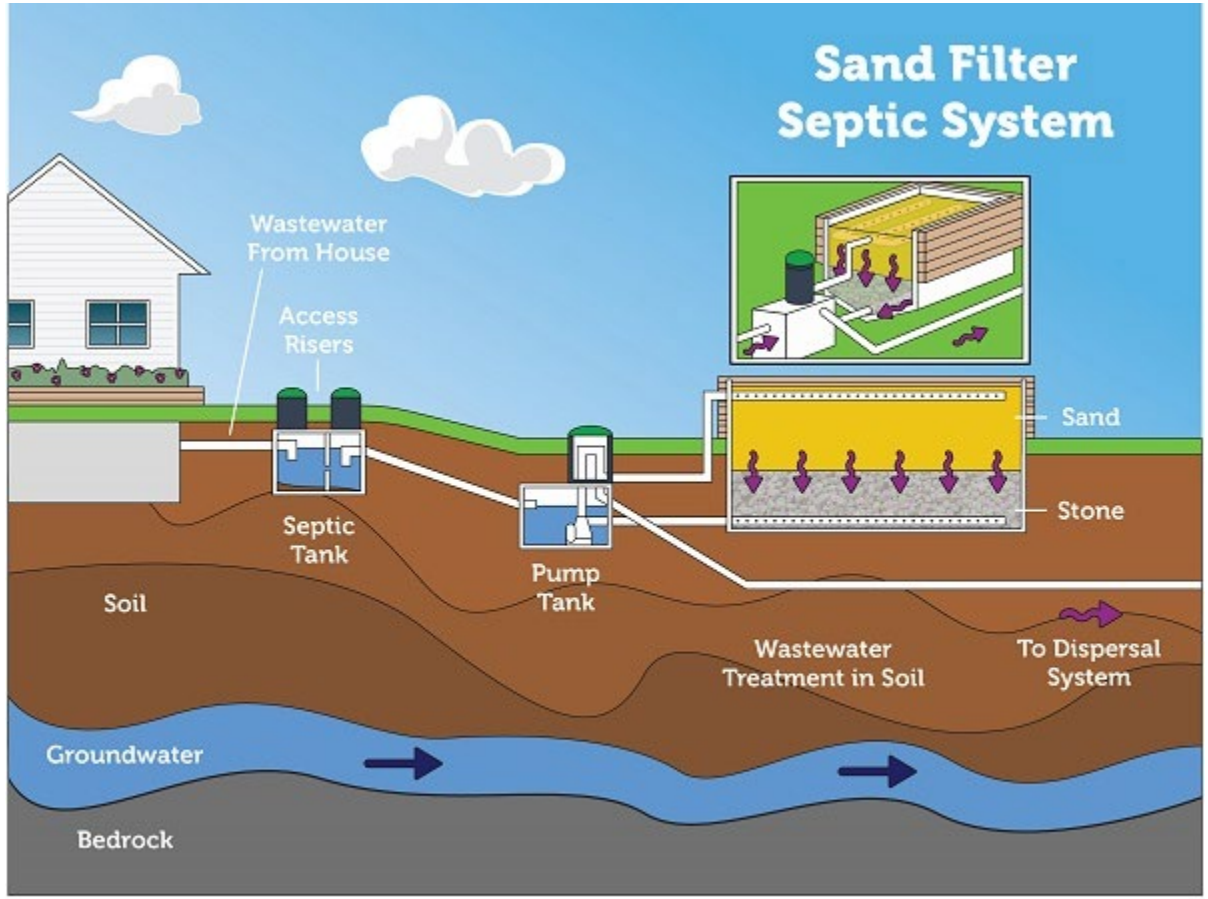

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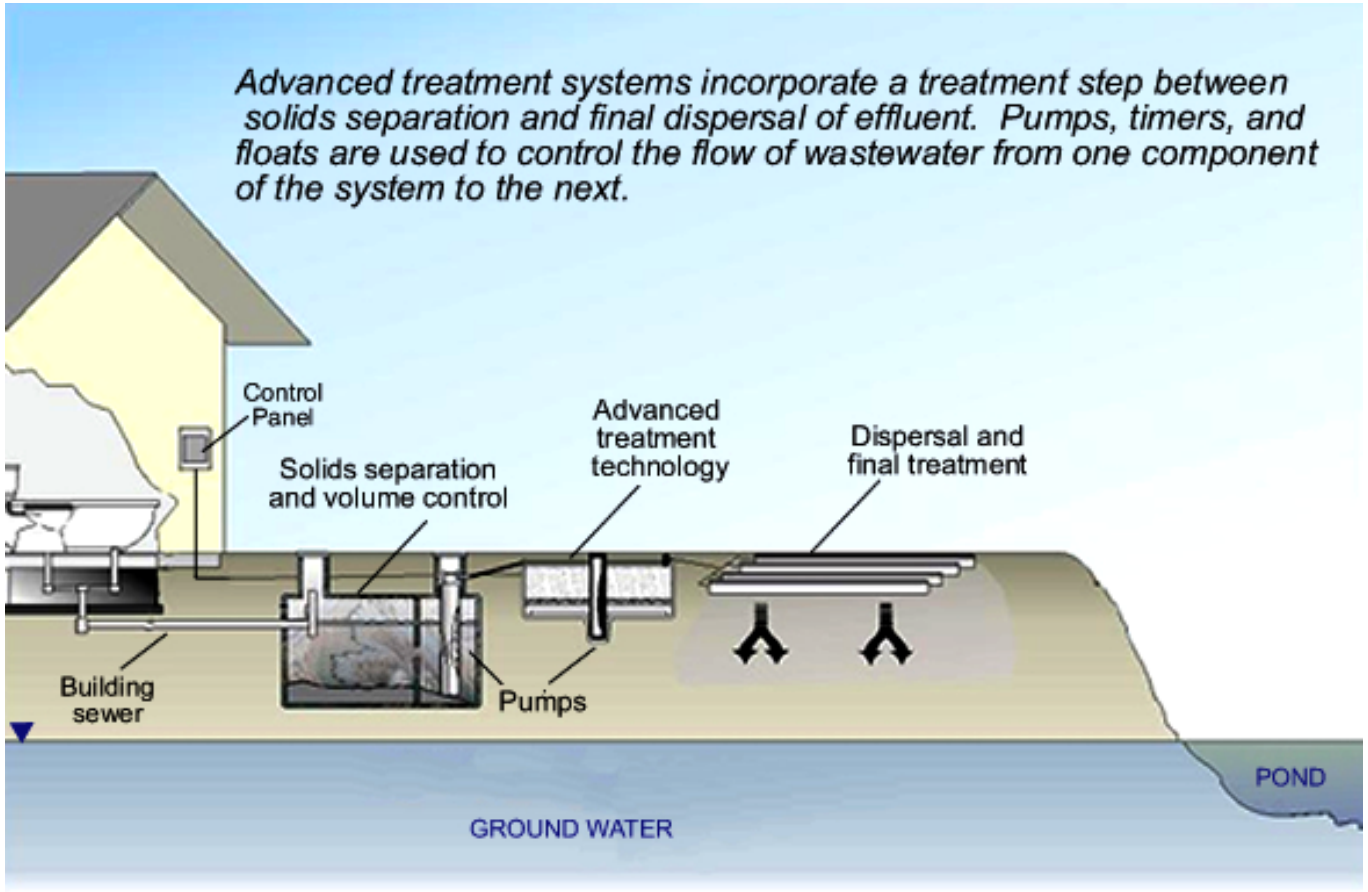
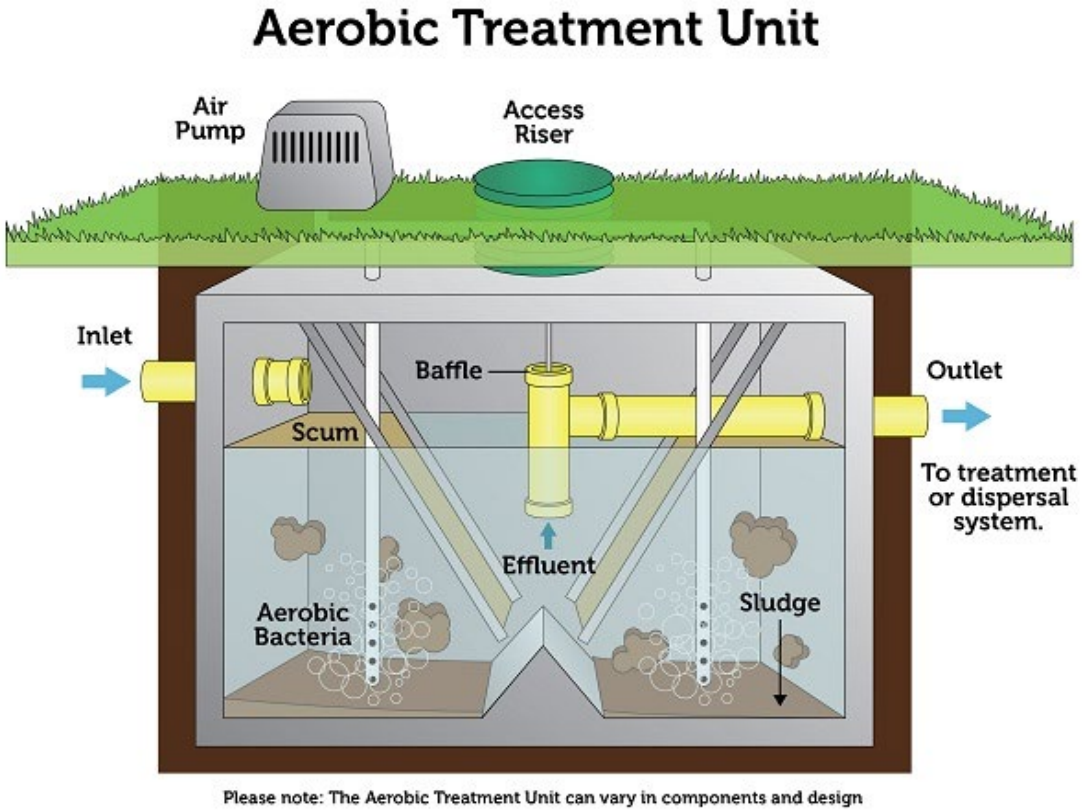
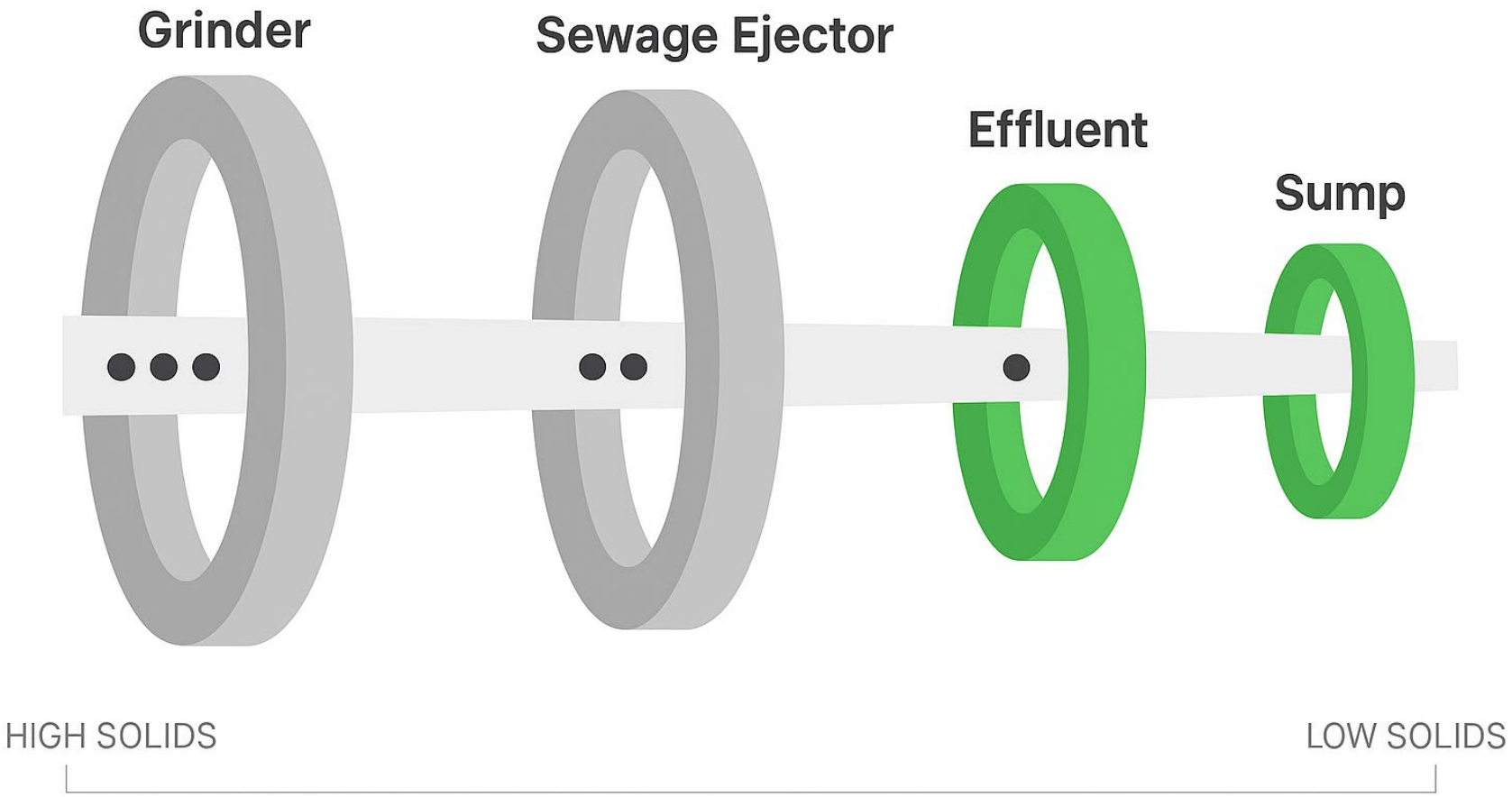
Role of pumps in an on-site septic system





Types of Residential Sewage Pumps



Submersible Pumps

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- Pumps are distinguished by application / solids passing size




pump type	sump	effluent	sewage ejector	solids handling or non-clog	grinder
application	dewatering	light solids	residential or light commercial sewage	raw unscreened sewage	residential or light commercial sewage
solids size	<1/2”	<1”	2”	2.5” or 3”	-

Types of Wastewater Pumps: Sump and Effluent

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Sump/Effluent – ½” solids. Clear water, solids not usually present

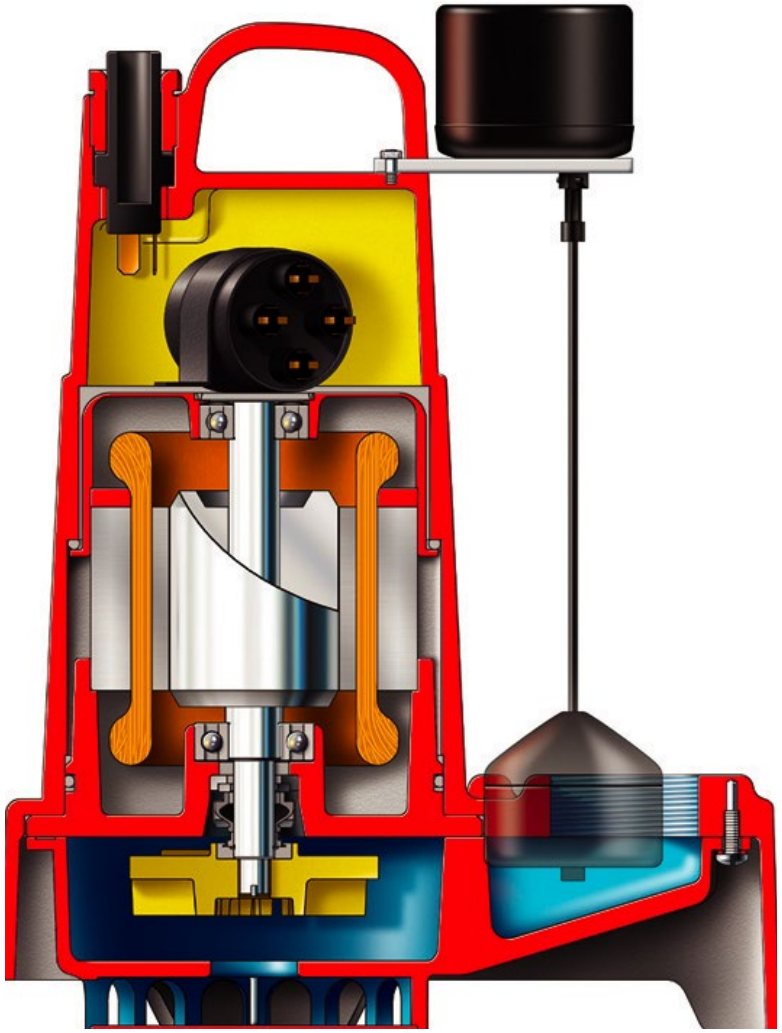
Effluent - ¾” solids. Partially or completely treated wastewater flowing out of a septic tank.

Effluent Pumps

	SP50	EHV412	EH512L	Vertical Effluent
HP	½	½	½	½
Solids Handling	½	¾	¾	1/8
Amp Draw	6.8	6.4	11.4	5.1
Full Flow	72	48	95	10
Shut off Head	30	45	48	220

Pump Components - How Does My Pump Work

- Power Connection
- Pump Housing
- Capacitors
- Motor Components
- Ball Bearings/Sleeve Bearings
- Shaft
- Impeller
- Volute
- Suction Port
- Discharge Port
- Integrated Float or Control Panel



How to Select The Right Pump

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What do we Need to Know to Select the Right Pump?

- Type: Effluent or Sewage
- Gallons per Minute (GPM)
- Feet of head (Elevation and Distance)
- Voltage and Phase
- Current model if known or specification
- Cord length pump to panel
- Local permit requirements

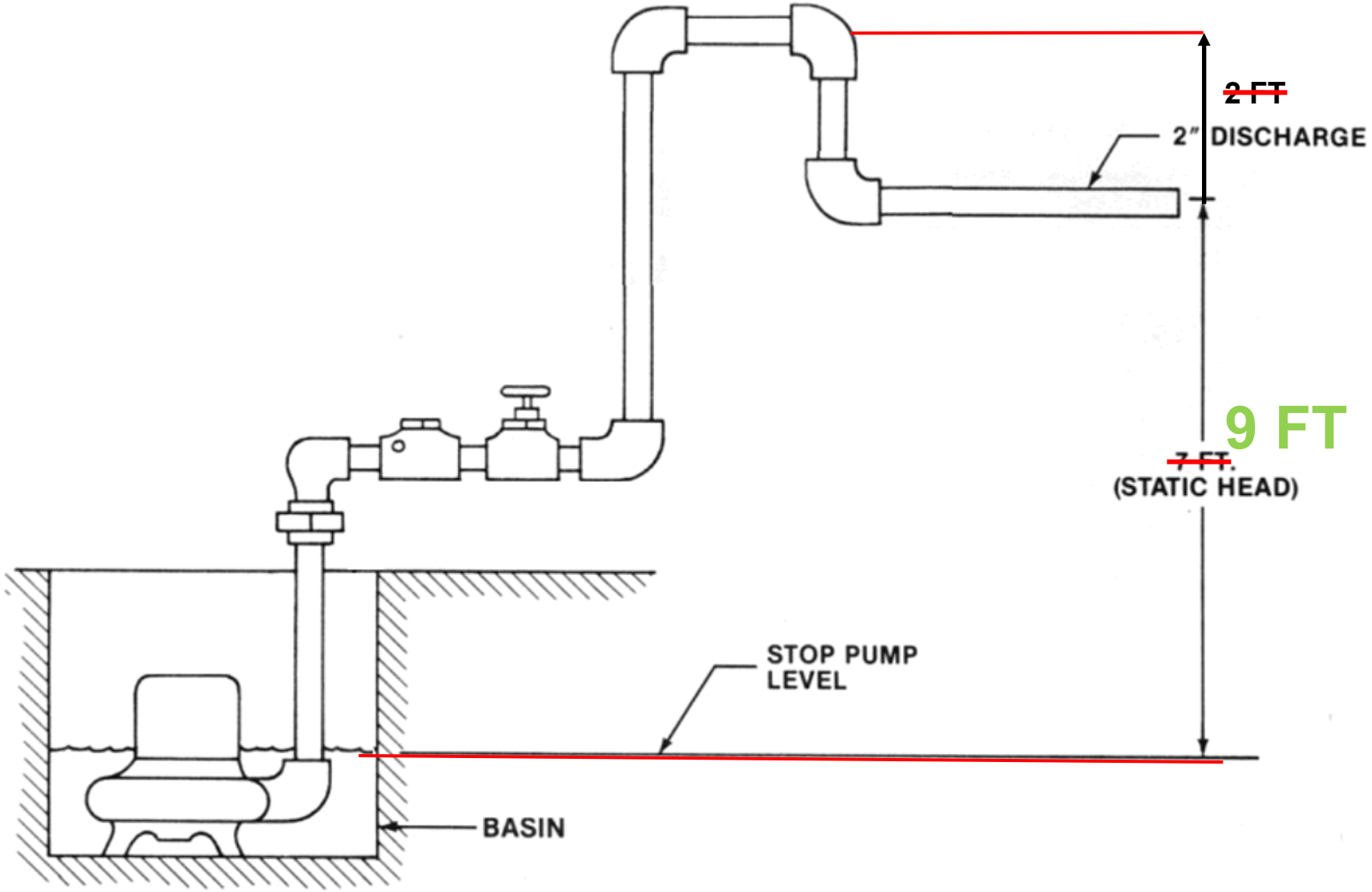
Determining Design Flows & Operating Requirements

- **Daily design flows vs. actual discharge volumes**
- **Time-dosing vs. demand-dosing considerations**
- **Pump run times, dose volumes, and rest cycles**

Does Flow to the Drain Field Matter?

- Problems with elevated flow to a septic field
  - Hydraulic Overloading / Soil Absorption
  - Soil Saturation / Reduced Treatment
  - Solids Carryover from the Septic Tank
  - Biomat Overgrowth
  - Shortened Contact Time in the Septic Tank
  - **Pump System Stress**
    - **Pump Short Cycling**
    - **Pump Burnout**
    - **Float / Control Panel Stress**

Calculating Head Elevation



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Additional Head Considerations

h_f Friction Loss in Plastic Pipe per 100 ft (C=130)					
Nominal Pipe Diameter					
Flow Rate (GPM)	1	1¼	1½	2	3
10	9.11	3.08	1.27	0.31	---
12	12.77	4.31	1.78	0.44	---
14	16.99	5.74	2.36	0.58	---
16	---	7.35	3.03	0.75	0.10
18	---	9.14	3.76	0.93	0.13
20	---	11.11	4.58	1.13	0.16
25	---	16.79	6.92	1.71	0.24
30	---	---	9.69	2.39	0.33
35	---	---	12.90	3.18	0.44
40	---	---	16.52	4.07	0.57
45	---	---	---	5.07	0.70
50	---	---	---	6.16	0.86
55	---	---	---	7.35	1.02
60	---	---	---	8.63	1.20
65	---	---	---	10.01	1.39
70	---	---	---	11.48	1.60

Equivalent Length Factors (ft.) for PVC Pipe Fittings			
Fitting Type	Pipe Diameter (in.)		
	1½	2	3
Gate Valve	1.07	1.38	2.04
90 Deg Elbow	4.03	5.17	7.67
45 Deg Elbow	2.15	2.76	4.09
Tee - Flow Thru	2.68	3.45	5.11
Tee - Branch Flow	8.05	10.30	15.30
Swing Check Valve	13.40	17.20	25.50
Angle Valve	20.10	25.80	38.40
Globe Valve	45.60	58.60	86.90
Butterfly Valve	-	7.75	11.50

Ex: **25 GPM**,1.5" pipe, 9' elevation, 50' run, 5 90 Deg Elbows, 1 Swing check Valve

9' elevation = 9

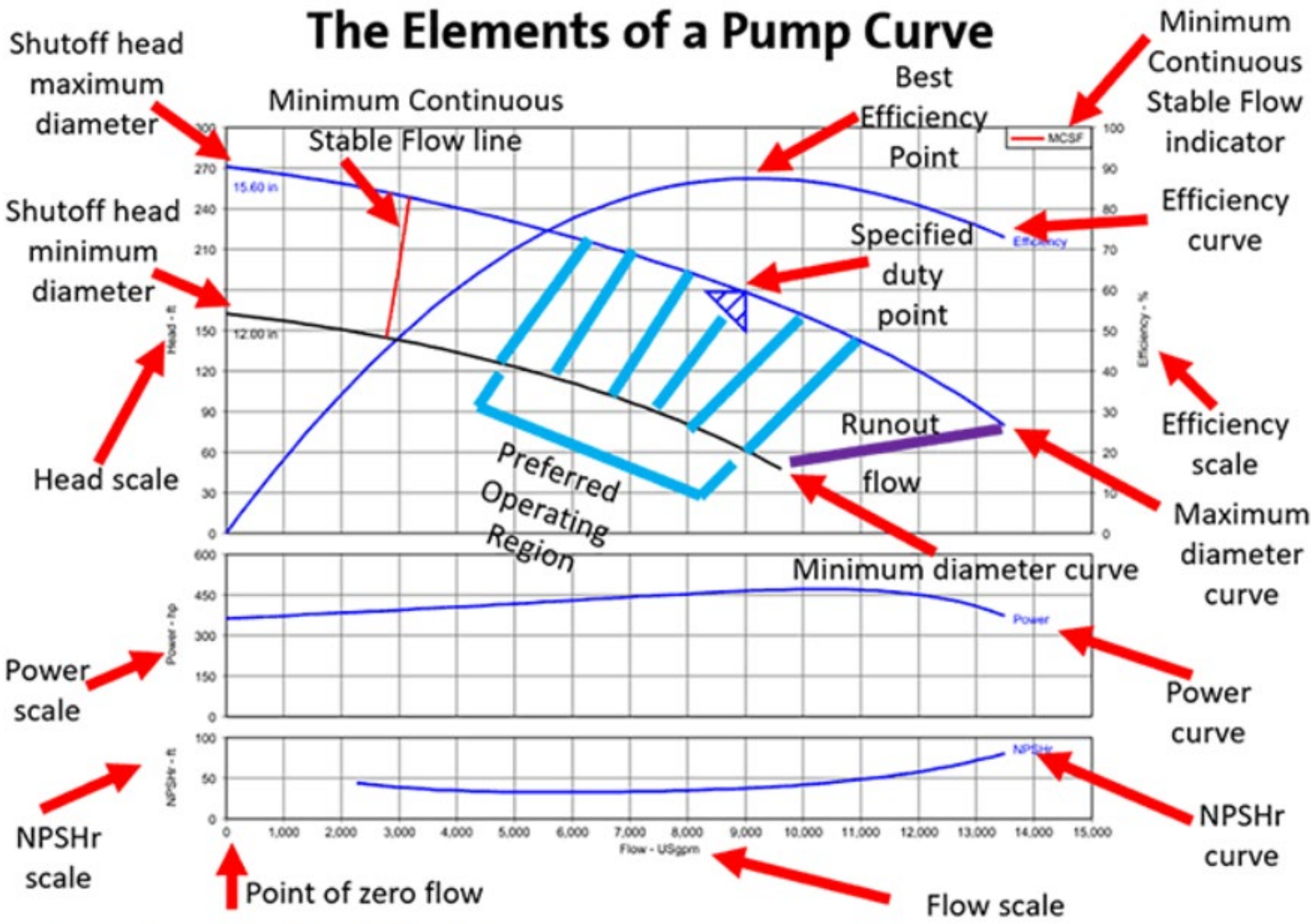
Pipe "Length"= 50 +(4.03*5)+13.4= 83.55

Pipe losses (83.55/100)*6.92 = 5.8

Total Head Required: 9+5.8= **14.8 TDH**

Charts from Minnesota Pollution Control Agency *OSTP Design Summary Worksheet*

How to Read a Pump Curve



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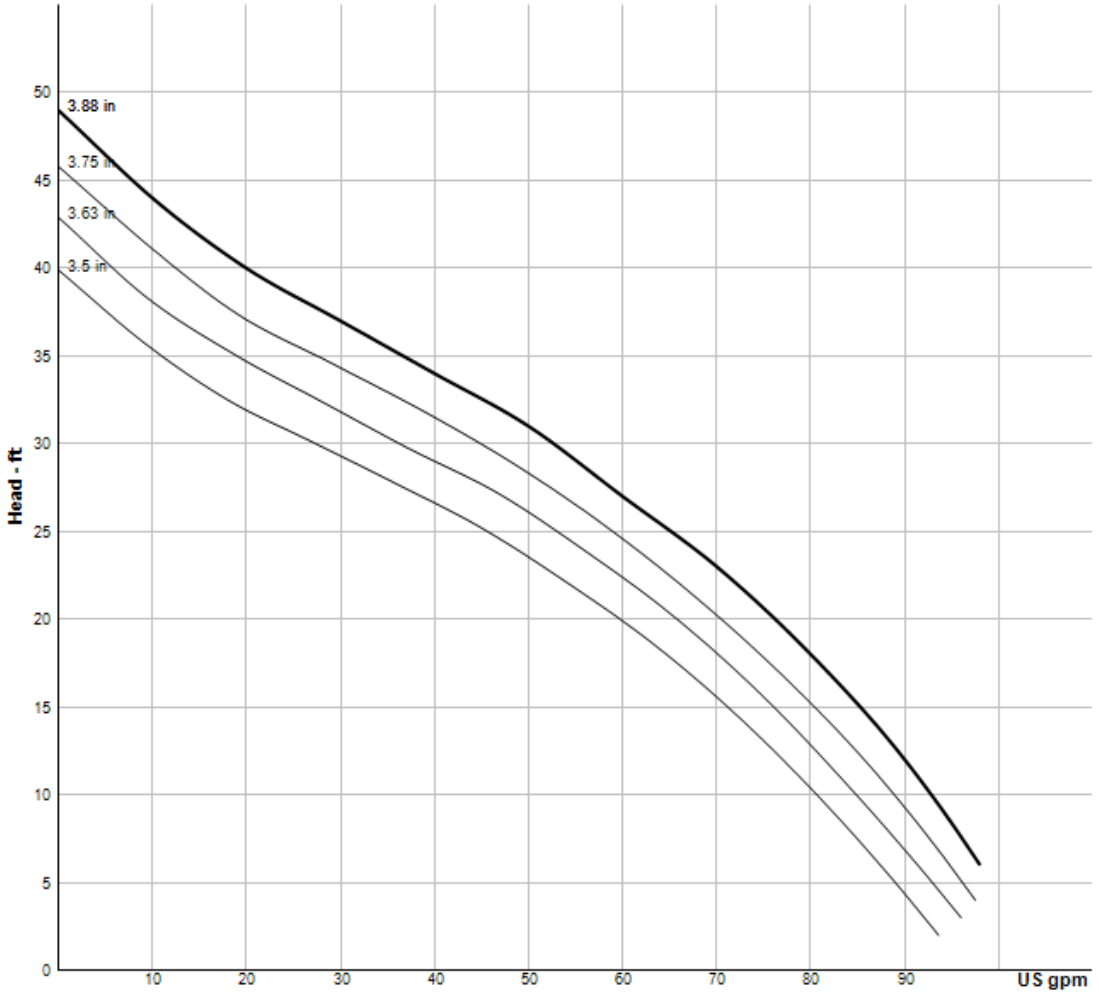
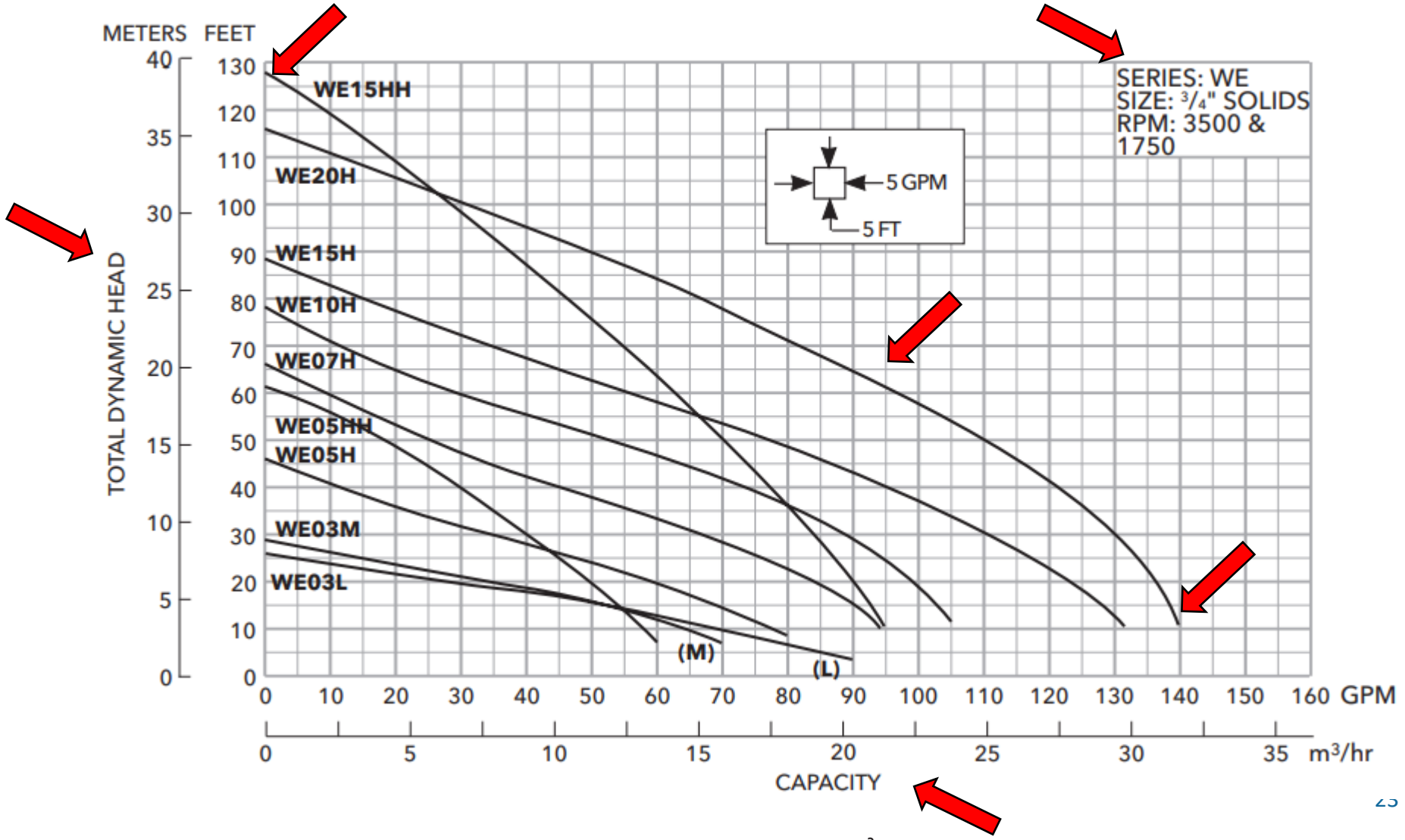


How to Read a Pump Curve

- Series Information
- Head Scale
- Flow Scale
- Shutoff Head
- Runout
- Performance Curve

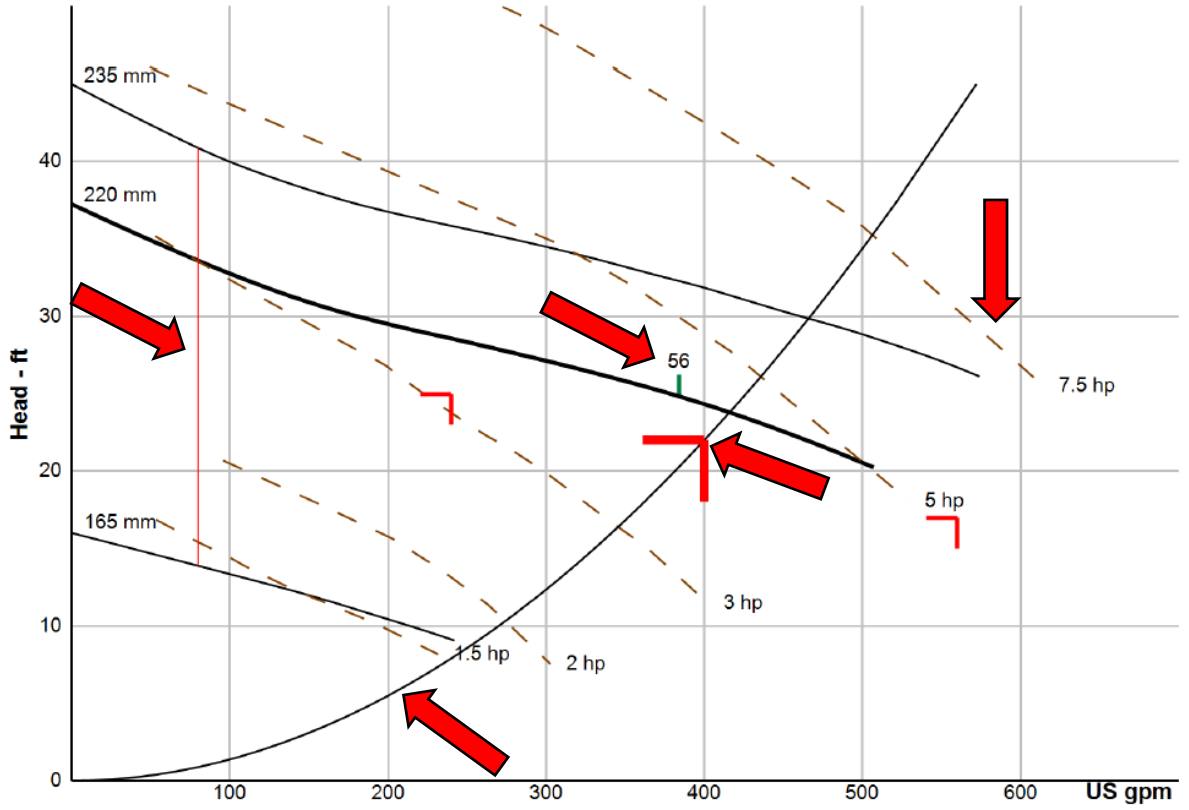


How to Read a Pump Curve

- Series Information
- Head Scale
- Flow Scale
- Shutoff Head
- Runout
- Performance Curve

- Other elements:
- System Curve
- HP Curve
- Preferred Operating Range
- Minimum Flow
- Best Efficiency Point

--- Duty Point ---	
Flow:	416 US gpm
Head:	23.7 ft
Eff:	55.5%
Power:	4.48 hp
NPSHr:	7.89 ft
Speed:	1150 rpm
--- Design Curve ---	
Shutoff Head:	37.3 ft
Shutoff dP:	16.1 psi
Min Flow:	80 US gpm
BEP: 56% @ 384 US gpm	
NOL Power:	
5.03 hp @ 507 US gpm	
--- Max Curve ---	
Max Power:	
6.88 hp @ 574 US gpm	



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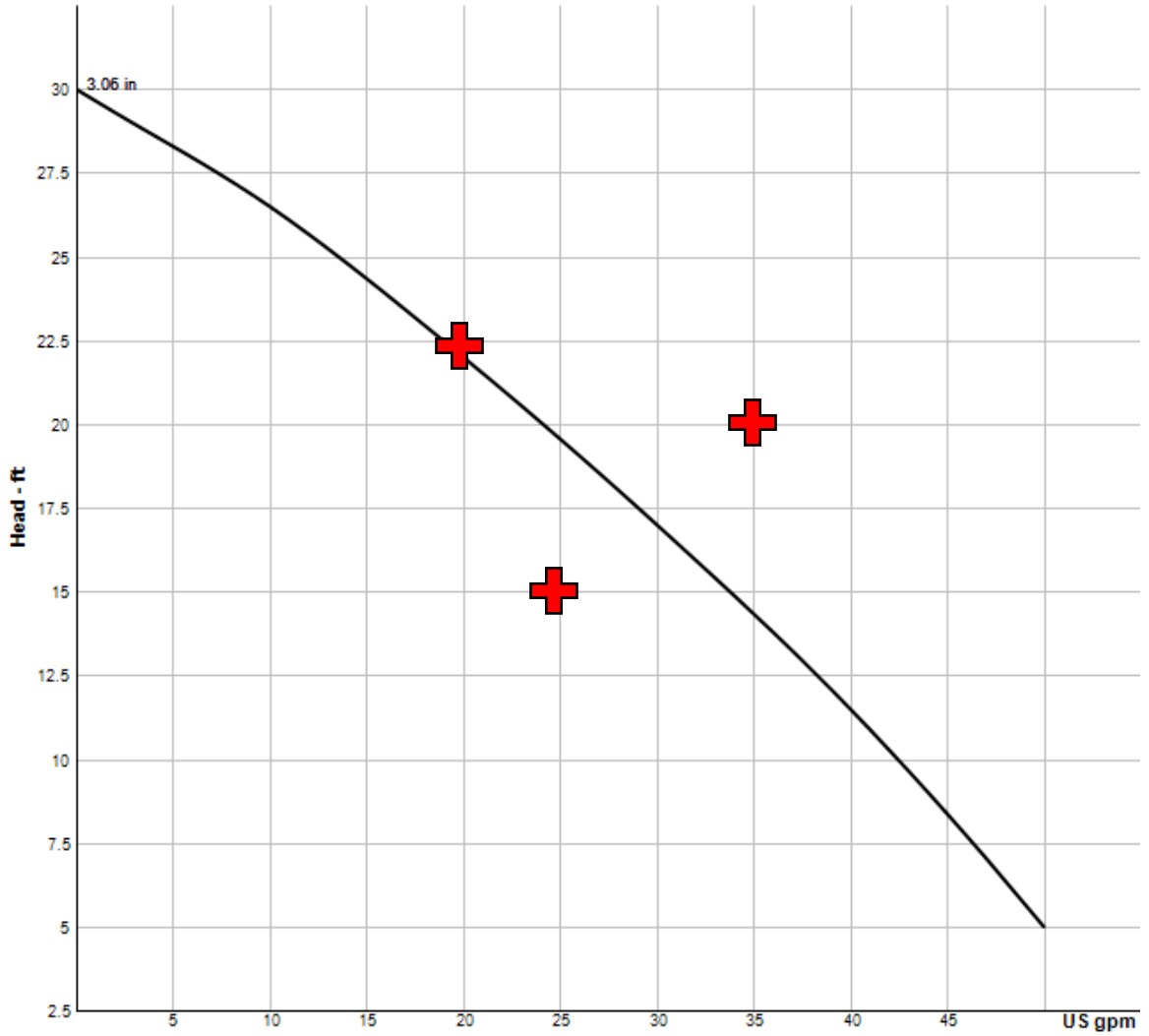

25 GPM, 14.8 TDH Condition Point

Defining Horsepower in Sewage/Effluent Pumps

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- Horsepower (HP) is a measure of the lifting strength and speed. The motors capacity to move the impeller to push wastewater against gravity at a flow rate.

- More HP = More Height or More Flow: A higher HP rating allows a pump to either push liquid higher (more Head) or move more volume (GPM), or both.

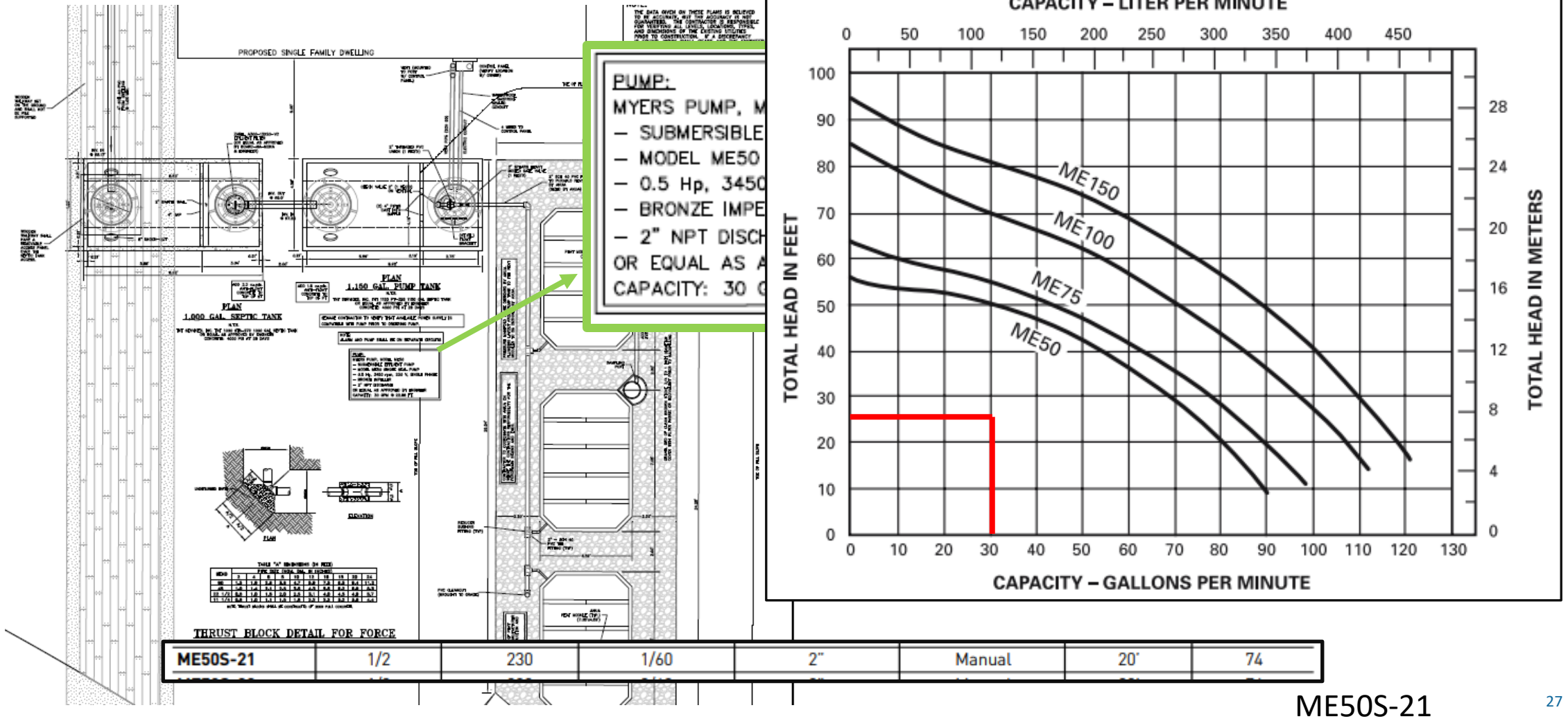
- Solids matter: Higher HP can provide the extra “oomph” needed to push thicker liquids / suspended solids through the system.

- Don’t Oversize: While more HP seems better, an oversized motor can shorten the pump’s lifespan and wastes electricity

HP = Torque X RPM / 5252

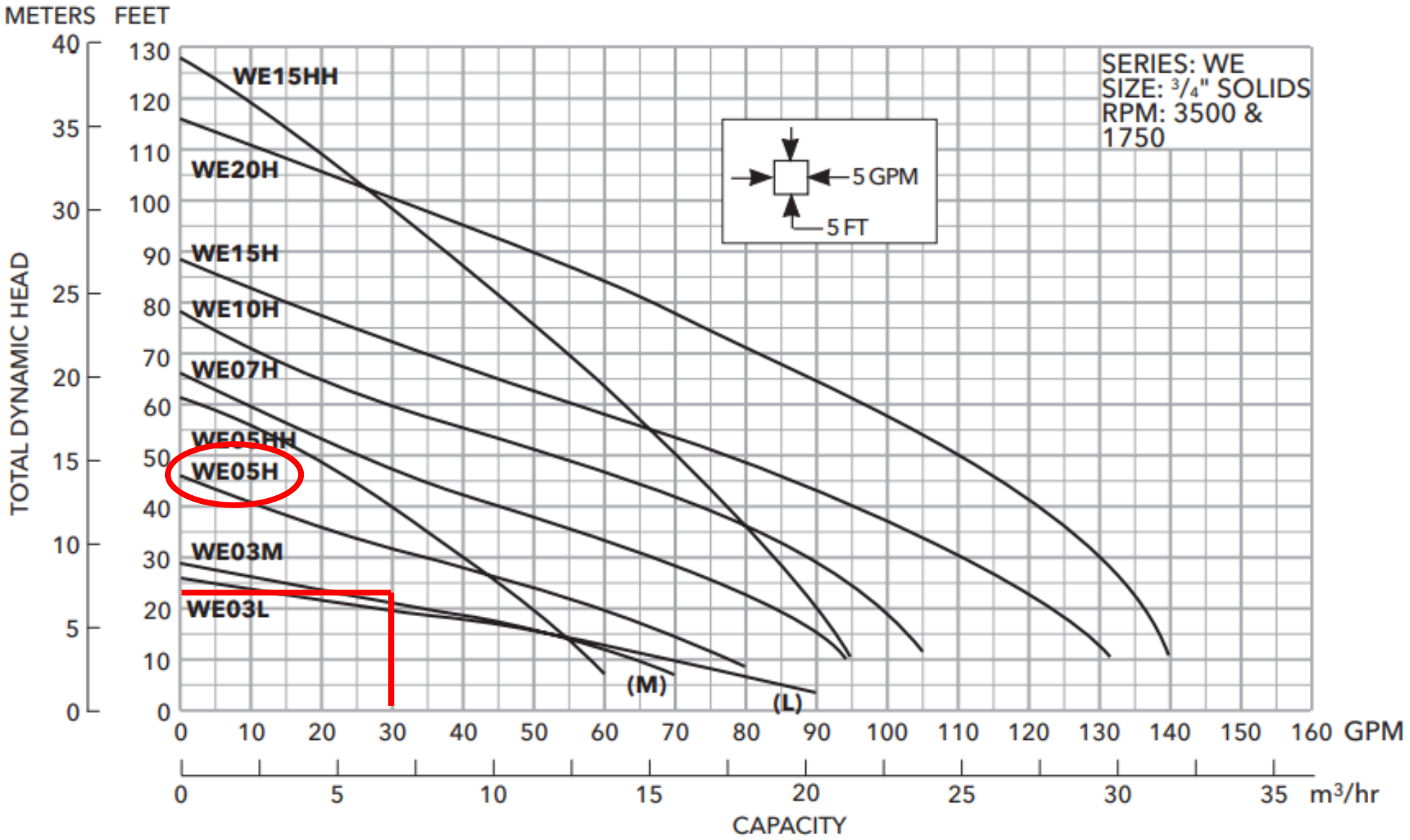
$$HP = \frac{\text{Torque (lb-ft)} \times \text{RPM}}{5252}.$$

Residential Specification Example



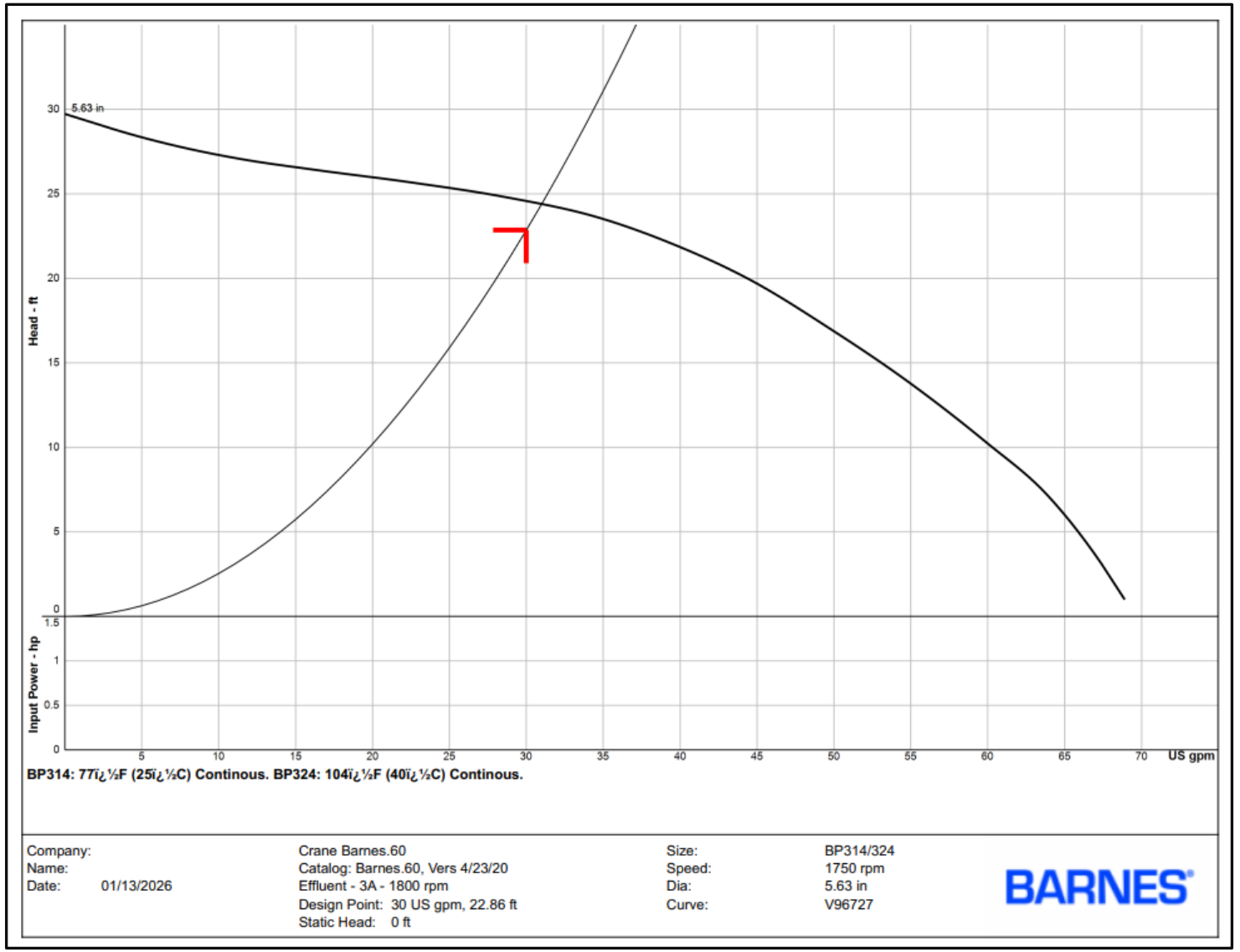
ME50S-21	1/2	230	1/60	2"	Manual	20'	74

ME50S-21


METERS
FEET
TOTAL DYNAMIC HEAD
SERIES: WE
SIZE: 3/4" SOLIDS
RPM: 3500 & 1750
5 GPM
5 FT
WE15HH
WE20H
WE15H
WE10H
WE07H
WE05HH
WE05H
WE03M
WE03L
(M)
(L)
GPM
m³/hr
CAPACITY

Residential Specification Example

PUMP MODEL NUMBER	BP324
PART NUMBER	096730
HP	1/3
VOLTAGE/PHASE	230/1
HZ	60
RPM (NOMINAL)	1750
NEMA START CODE	A
FULL LOAD AMPS	5.4
LOCKED ROTOR AMPS	13.0
CORD SIZE	14/3
CORD TYPE	SJTOW
WEIGHT (LBS)	52



What do we Need to Know to Select the Right Pump?

- Type: Effluent or Sewage
- Gallons per Minute (GPM)
- Feet of head (Elevation and Distance)
- Voltage and Phase
- Current model if known or specification
- Cord length pump to panel
- Local permit requirements

Pump Selection Tools For Contractors

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Cross Reference Tool

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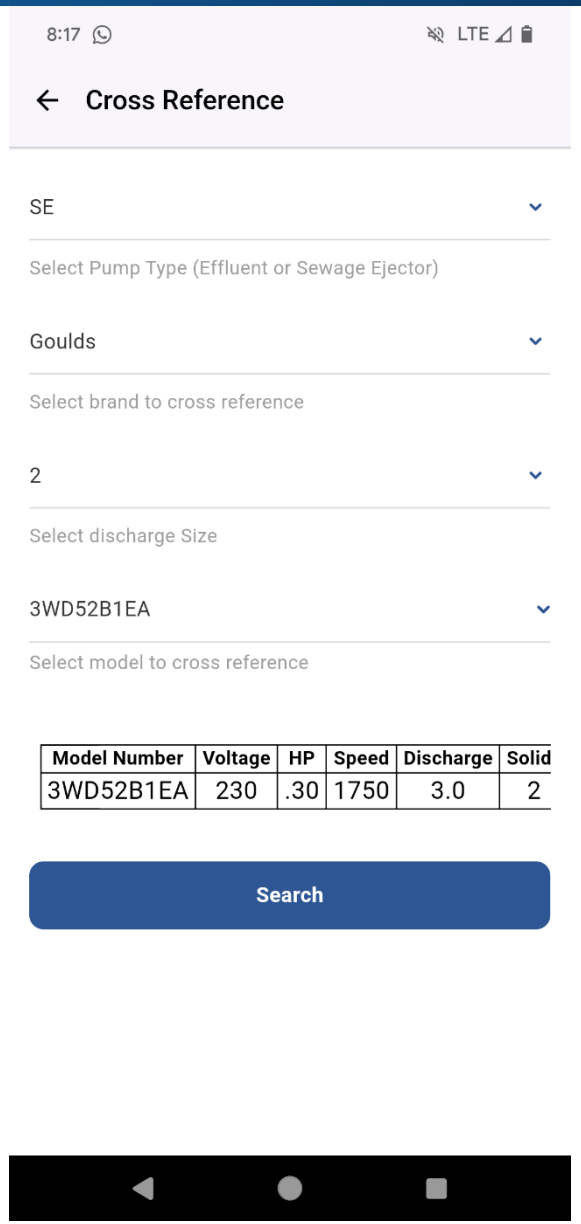
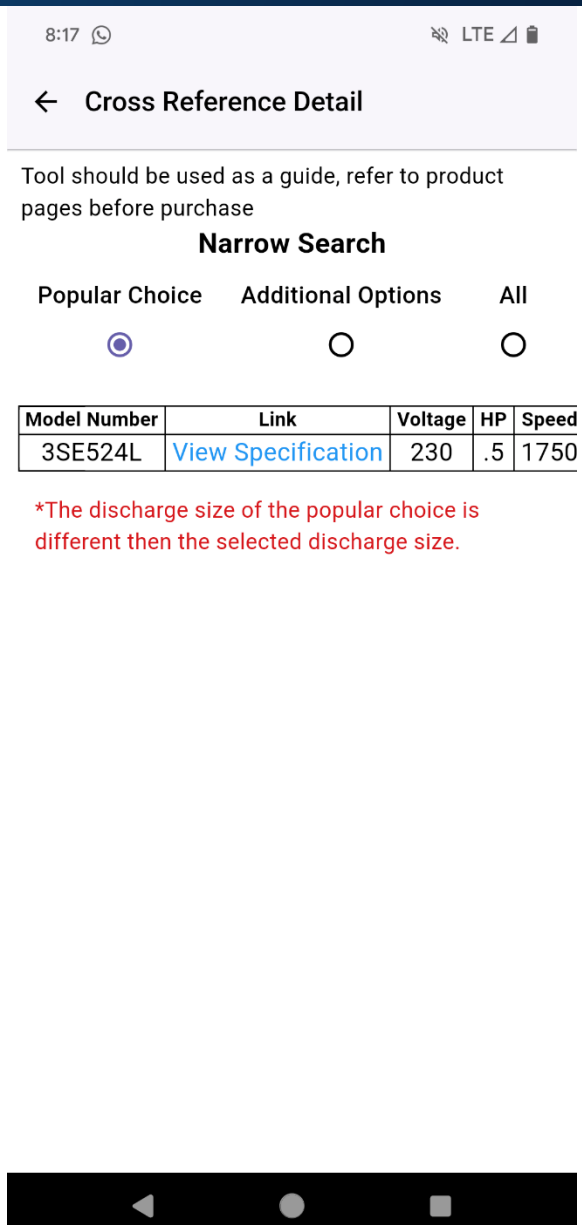
Input:

- Product Type (SE/EFF)
- Competitor (Liberty, Champion, Myers, Zoeller, Goulds)
- Discharge Size
- Competitor Model Number

Output:

- Popular Choice selection, additional options, or All
- Link to product catalog





Pump Selection Tool

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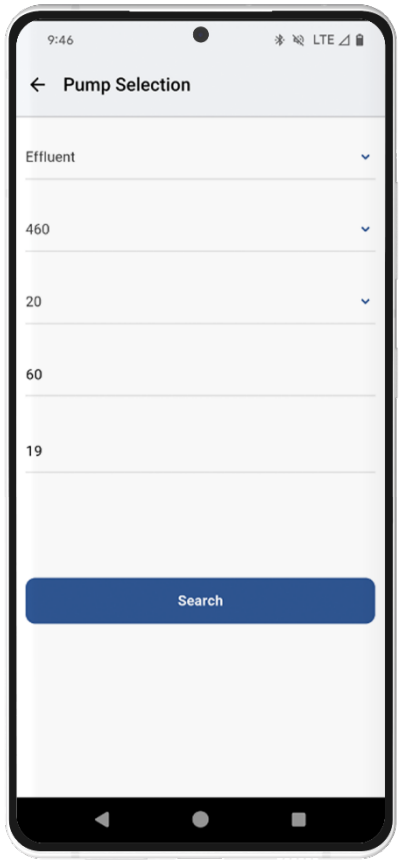
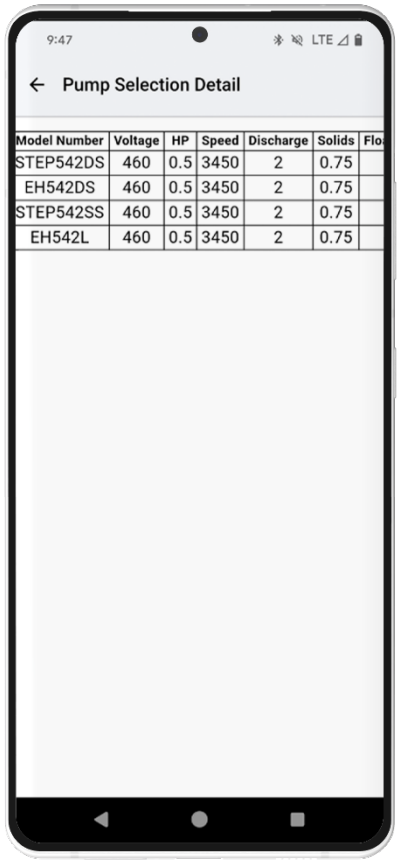
Input:

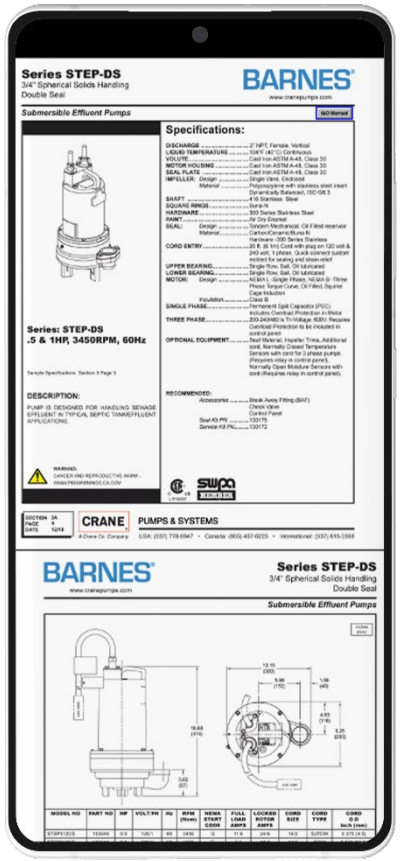
- Product Type (Sump/SE/EFF)
- Voltage
- Tolerance (How close shut off head is to competitor)
- Condition Point (Flow and Head)

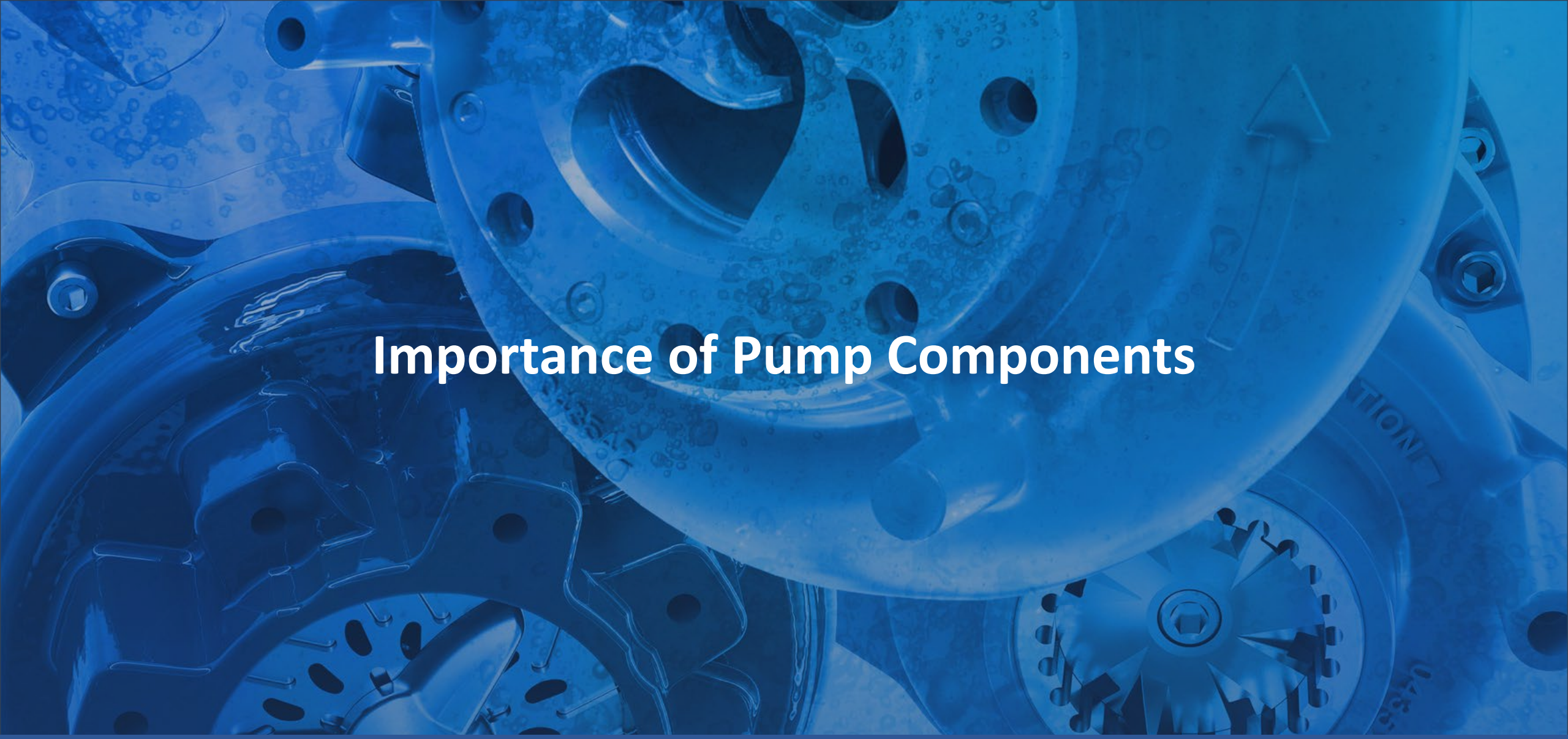
Output:

- List of Barnes Model numbers that match Voltage, Discharge, Float, and condition point
- Link to product catalog









Importance of Pump Components

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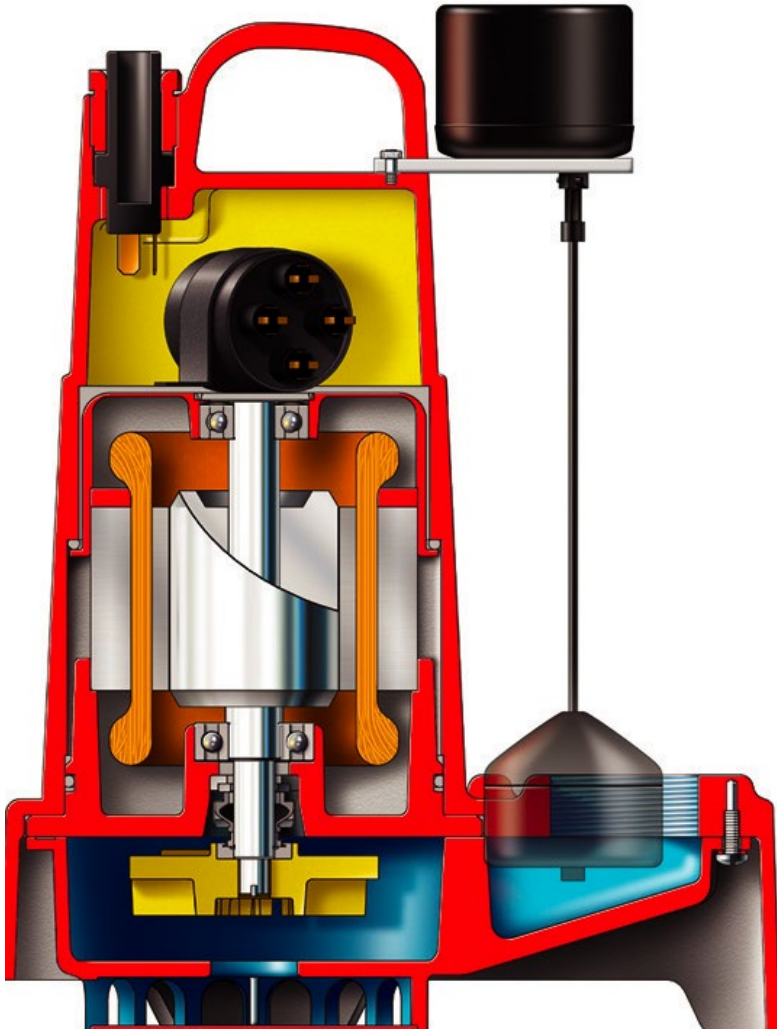
Pump Components

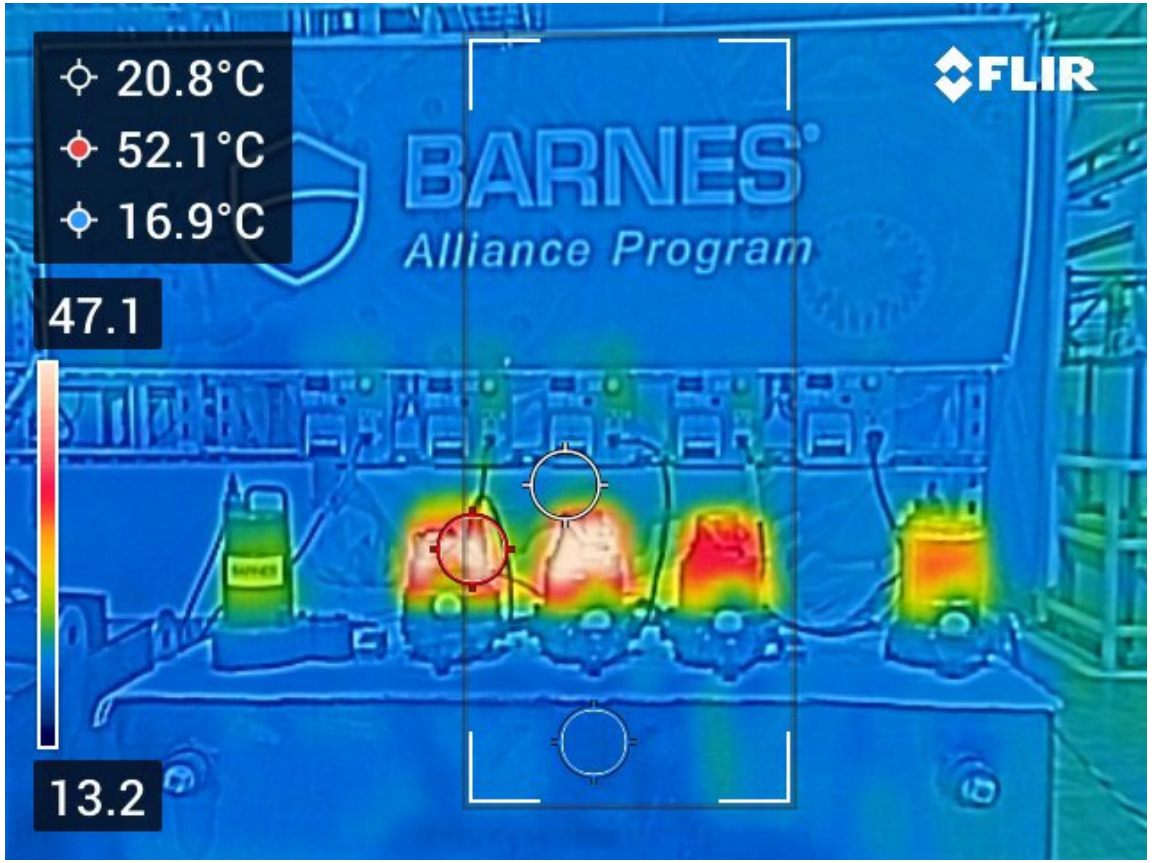
- PSC Vs Shaded Pole Motors
- Ball Bearings Vs Sleeve Bearings
- True Mechanical Vs. Lip Seals
- Cast Iron vs Plastic Impellers
- Cast Iron Vs. Plastic volutes/Casings



Importance of Product Material Quality

Beneath the coat of paint lies the true quality of a pump.

PSC motors, true mechanical seals, ball bearings and oil filled motors can make all the difference and increase product life.



Durability test comparing 5 different brand sump pumps. Heat signatures after 5 minutes of dry run operation

Troubleshooting Your Pump

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Troubleshooting Techniques 1: At the Panel

- Most failure modes can be detected right at the panel
- Attempt to start the pump
  - Use push to run option (if available) or activate level control switch
  - Listen: Does the contactor in the panel pull in? Does the pump make any noise?
- With the panel energized, confirm voltage at the terminal strip
  - If voltage is present, check amp draw from the pump motor leads
  - Does the amp reading exceed the FLA of the pump?

Troubleshooting Technique 2: Capacitors

- Capacitors are electrical components that store and release electrical current
- Necessary to provide the initial power surge to kickstart the motor
  - Provides the start torque needed to overcome initial resistance
  - Permanent split capacitors typically only have one capacitor
  - Capacitor start/capacitor start motors will contain two
  - Capacitors can either be store in the pump or in the control panel
- If your pump fails to turn on when energized, one of the first places to look is the capacitor

Capacitor Symbol

Troubleshooting Technique 2: Capacitors Continued

- To test if you have a failed capacitor:
  - Step 1: DE-ERNGIZE the capacitor
    - Normally not dangerous, but not pleasant to forget
    - Use an insulated tool (ex: screwdriver)
    - Touch both terminals simultaneously
  - Step 2: Check the microfarad rating on the capacitor (µF)
  - Step 3: Confirm reading matches the rating
- If capacitor fails, ensure new capacitor matches both µF and voltage rating of failed capacitor

Capacitor Symbol

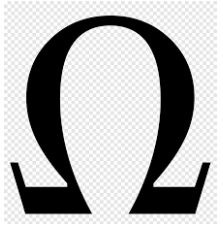
Typical capacitance tolerances is between 5%-10%

Troubleshooting Technique 3: Level Controls

- All power at the panel can be turned off.
  - For a two float configuration
    - Check the highest set float (alarm)
      - Check continuity between the two leads with the float deactivated (there should be no continuity)
      - With the switch activated, check the continuity again to ensure continuity is present
    - Check the second float (On/Off)
      - Check the float both in the on and off positions.
        - Continuity should be present in the on position, not present in the off position

Float in OFF Position (OL)

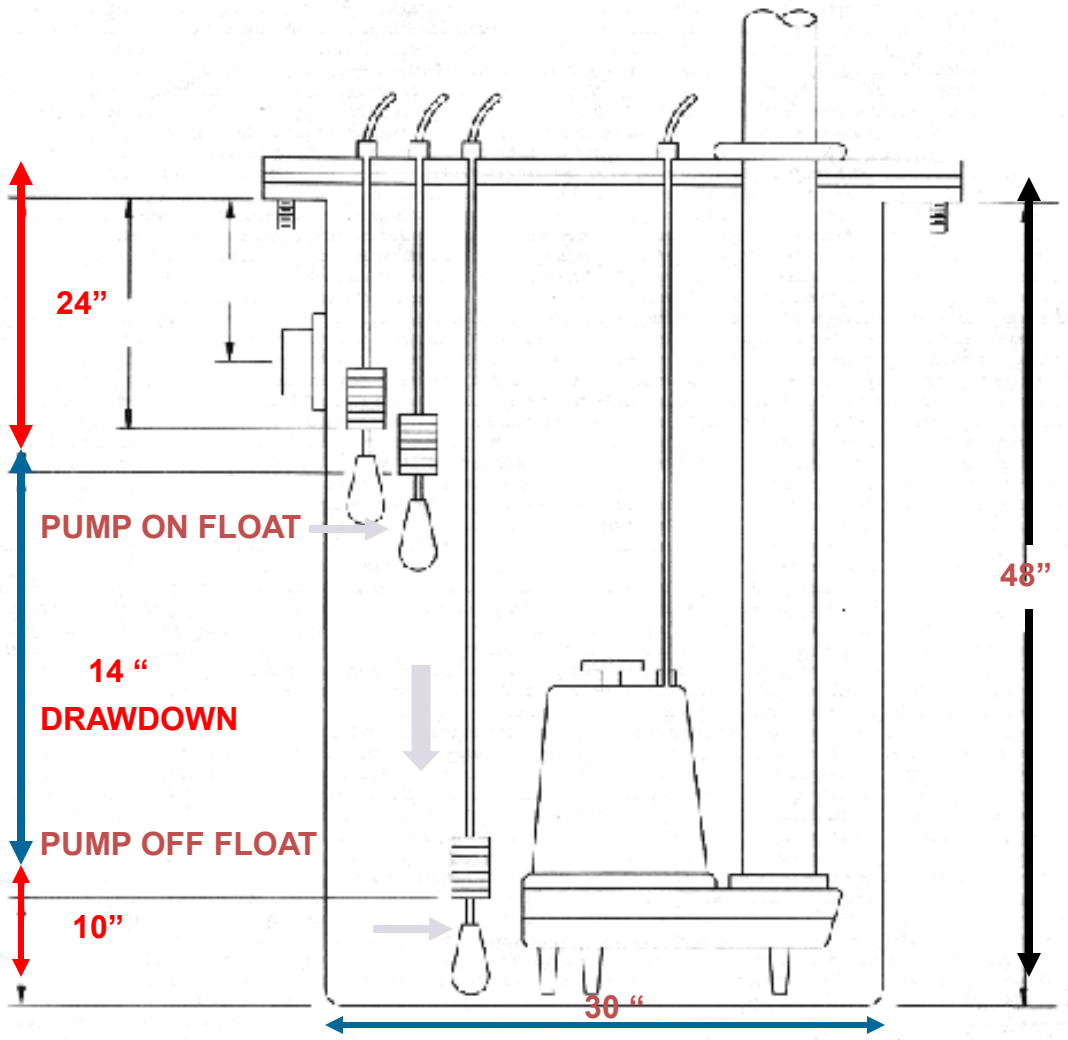
Float in ON Position (8.8 ohms)*

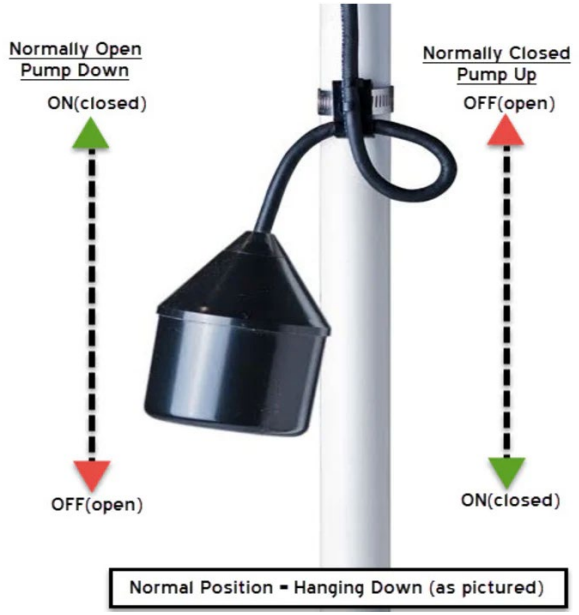


Resistance Symbol

**Resistance reading will vary from float to float*

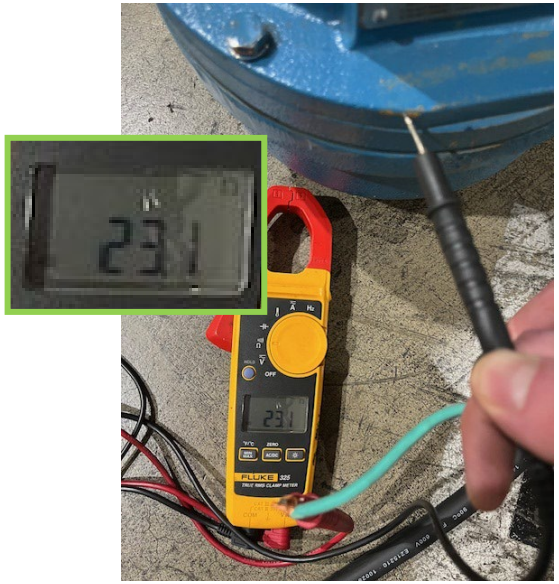
Pump Controls - Floats





Trouble Shooting Techniques 4: Pump Continuity Checks

- If the panel and level control passes electrical checks, we then investigate the circuit integrity of the pump.
- Disconnect the pump wires from the panel
  - Check continuity between the two motor leads (typically black and white for single phase)
  - Check if there is a ground short by testing continuity from the green ground wire to each of the two motor leads
    - If there is continuity between the ground wire and either lead wire, the pump needs to be removed from the station



Resistance reading will vary based on pumps HP & Voltage Rating

Q&A

Thank You!