

BUILDING A WORLD OF DIFFERENCE

Design Considerations for Dry Pit and Wet Pit Pumping Stations

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PRESENTATION FOCUS

- Wastewater
- Collection System Applications
- General Aspects – All Situations are Unique

TOPICS

- Characteristics and Features
 - Types of Pumping Equipment
 - Station Descriptions
- Considerations for Proper Design
- Summarize Advantages and Disadvantages

TERMINOLOGY

WET PIT

- Single chamber (wetwell)
- Pump bodies in contact with pumped fluid
 - Fully or partially submerged

DRY PIT

- Two chambers, wetwell and pump pit (drywell)
- Pump bodies not in contact with pumped fluid

Many similar characteristics due to both types having wetwells

General Descriptions and Features

WET PIT PUMPS

SUBMERSIBLE

- Typically less than 15 mgd capacity
- Motor and pump provided as single unit from one manufacturer
- Designed for easy removal
- Connects to base discharge elbow



Most common type for wet pit applications

WET PIT PUMPS

VERTICAL TURBINE SOLIDS HANDLING

- Supported from wetwell top slab
- Non-proprietary motor
- Capable of high capacity (40 mgd +)
- Limited head range (max 120 ft +/-)
- Depending on size, can pass 3" to 8" solids

Easy access to motor for maintenance



Pentair

WET PIT PUMPS

AXIAL FLOW (PROPELLER)

- Supported from wetwell top slab
- Non-proprietary motor
- High Capacity
- Not suitable for head conditions above 40 – 50 ft.
- May have difficulty with stringy solids



Also available in submersible styles

DRY PIT PUMPS

END SUCTION

- “Non-clog” design
- Available in high capacities
- Non-proprietary motor
- Numerous manufacturers
- Vertical and horizontal configurations



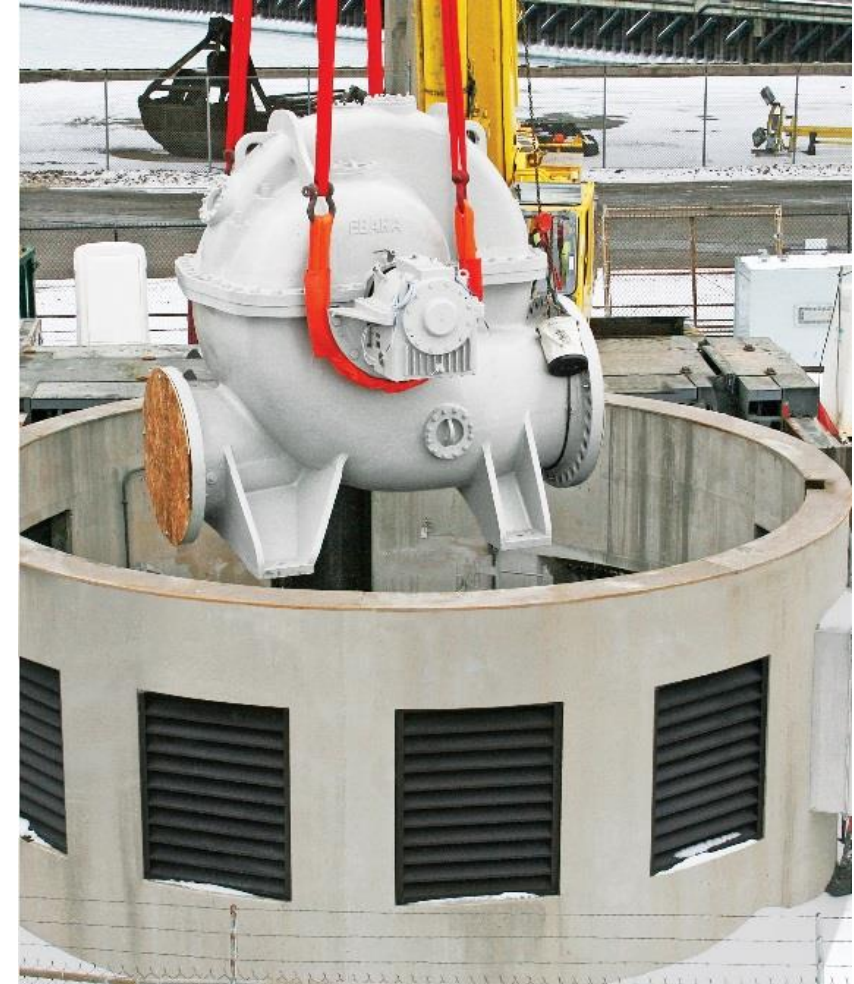
Most common dry pit style

DRY PIT PUMPS

DOUBLE SUCTION (SPLIT CASE)

- Limited solids handling ability in smaller sizes
- Capable of extremely high capacity and head
- Non-proprietary motor
- Vertical or horizontal configurations

Primarily used in high flow applications



DRY PIT PUMPS

IMMERSIBLE (DRY-PIT SUBMERSIBLE)

- Same characteristics as submersible
- Requires cooling system for motor jacket
- Capable of immersion service, if properly installed



Typical Installations

WET PIT



- Circular or rectangular
- Precast or cast-in-place concrete construction
- Package systems available
- Adjacent above-grade electrical building or enclosure
- May have separate valve vault
- Less visible facility

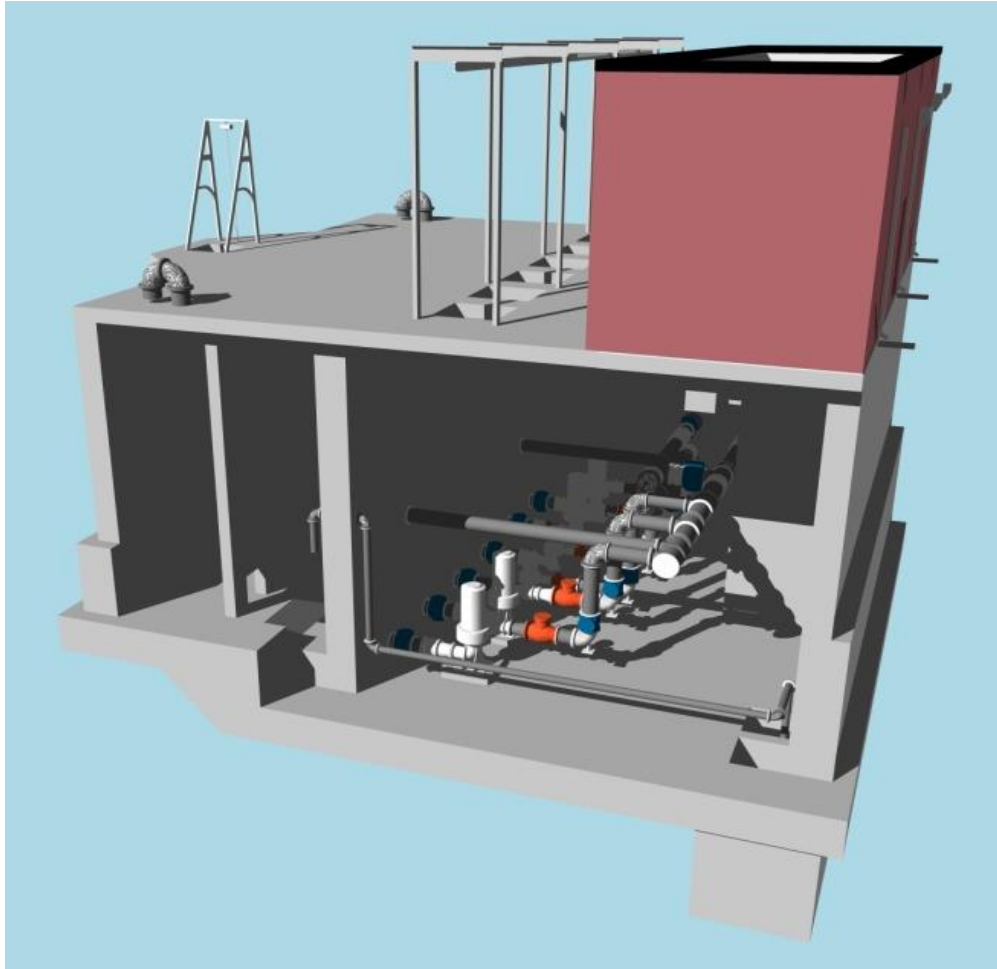
WET PIT



Submersible Pump Installation

- Guide rails
- Control and power cables
- Lifting chain
- Access hatches or other openings

DRY PIT



- More complex design and construction
- Wet well can be separate or attached
- Electrical gear typically housed above grade
- Pump chamber usually set slightly below wet well

DRY PIT



- Isolation valves on pump suction
- May require seal water systems
- Pump pit considered as occupied space
 - Ingress / egress provisions
 - Lighting
 - Ventilation

Design Considerations



WET PIT CONSIDERATIONS

- Confined spaces
- Restricted equipment access
- Location of electrical equipment and controls
- Potential Submersible pump issues
 - Cable handling and removal
 - Uplift during reverse operation
 - Erosion of sealing surfaces
 - High pressure at base connection



DRY PIT CONSIDERATIONS

- Confined space access (wetwell)
- Additional valving for pump isolation
- HVAC and lighting
- Leakage / flooding provisions
- Noise
- Headroom



CONSIDERATIONS COMMON TO BOTH TYPES

- Equipment removal provisions
 - Permanent hoists or cranes
 - Temporary hoist systems, boom trucks, or mobile cranes
 - Access openings, hatches, removable skylights
- Odor control
 - Tributary sewershed characteristics
 - Detention time in upstream sewers and wetwell
 - Turbulence at wetwell discharge



CONSIDERATIONS COMMON TO BOTH TYPES

- Materials of construction, particularly in wetwells (H_2S exposure)
- Solids, Debris, Rags, Grit
 - Bar racks
 - Basket screens
 - Screening equipment

CONSIDERATIONS COMMON TO BOTH TYPES

Flow profiles and patterns

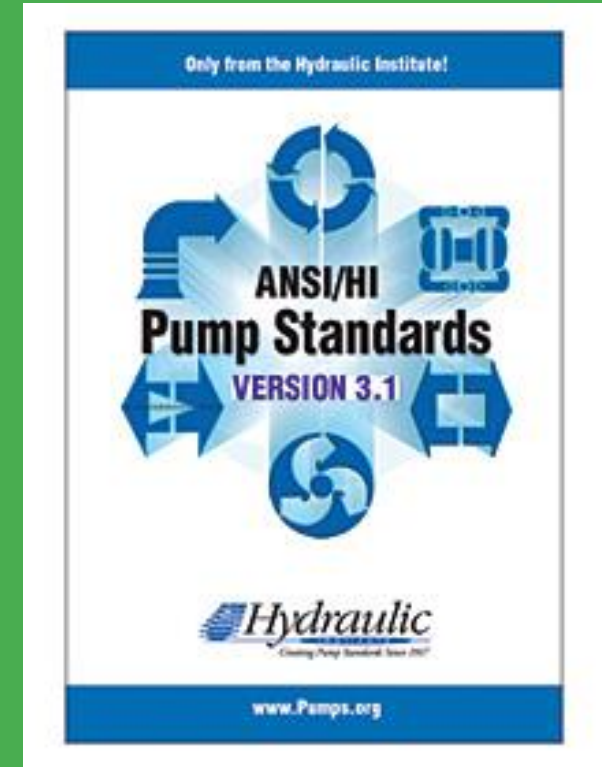
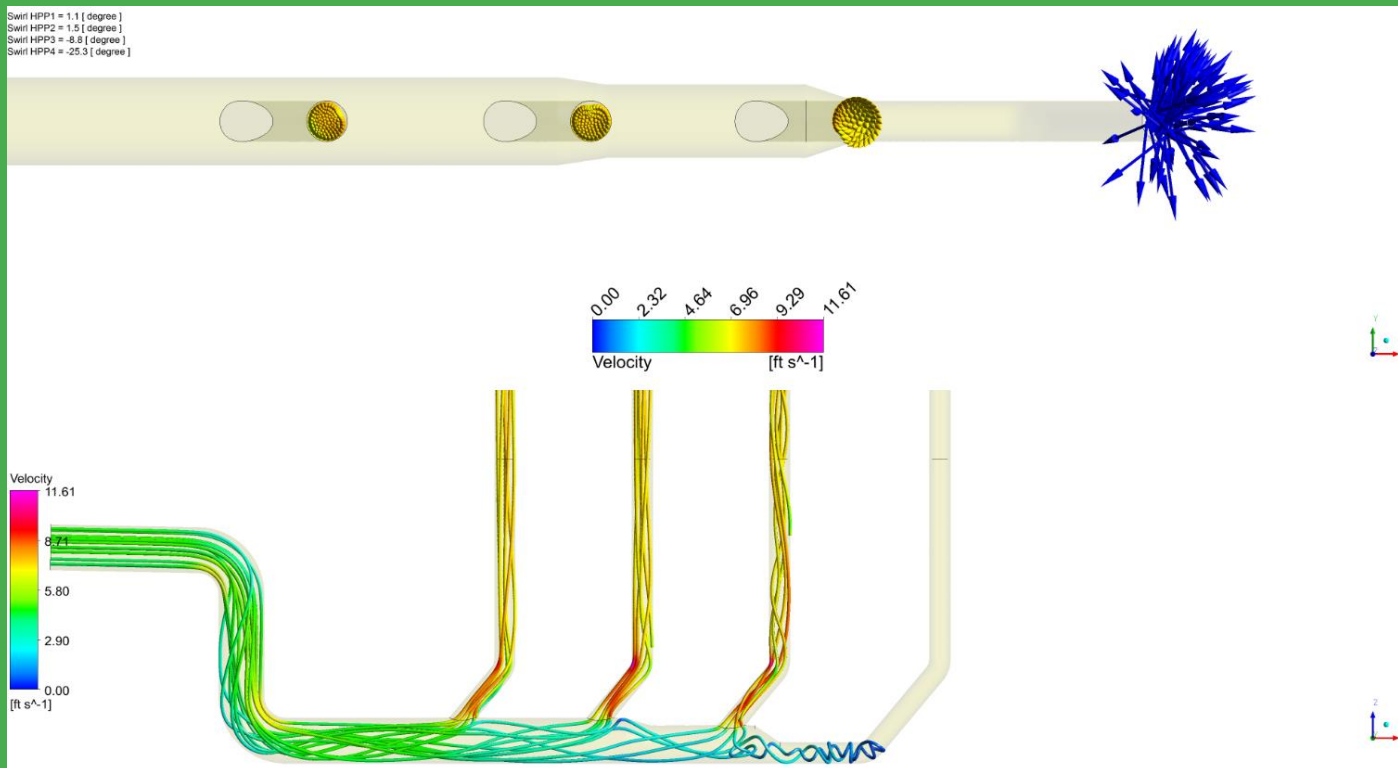
- Pump Suction / Inlet
 - Noise
 - Vibration
 - Wear of bearings and seals
 - Cavitation and impeller wear
 - Shaft failure
- Solids / Grit Deposition
 - Loss of wetwell volume
 - Flushing during high flow



Pumps and Systems

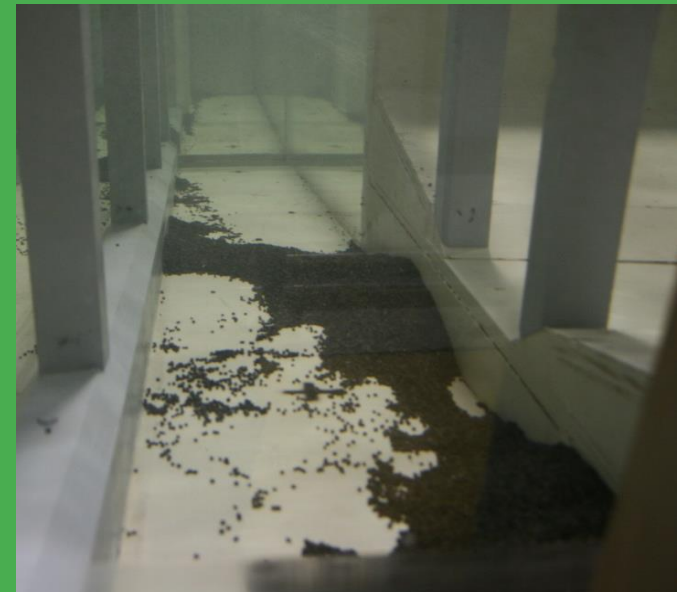
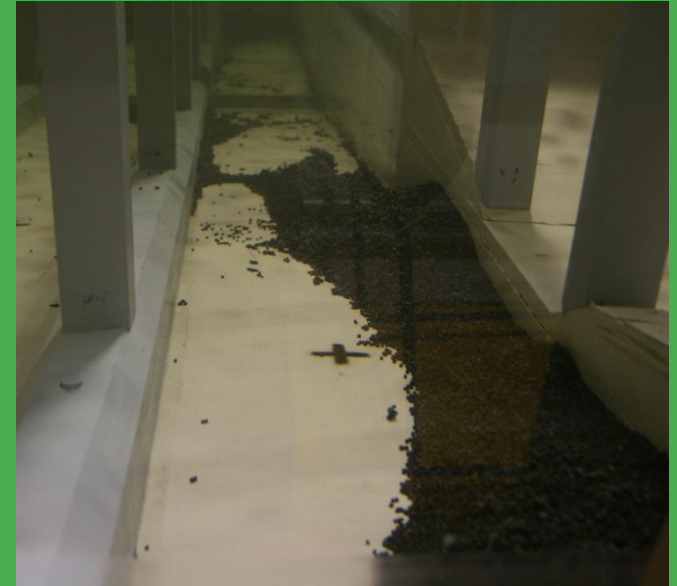
DESIGN TOOLS

- Hydraulic Institute Standards
- Computational Fluid Dynamic (CFD) Modeling



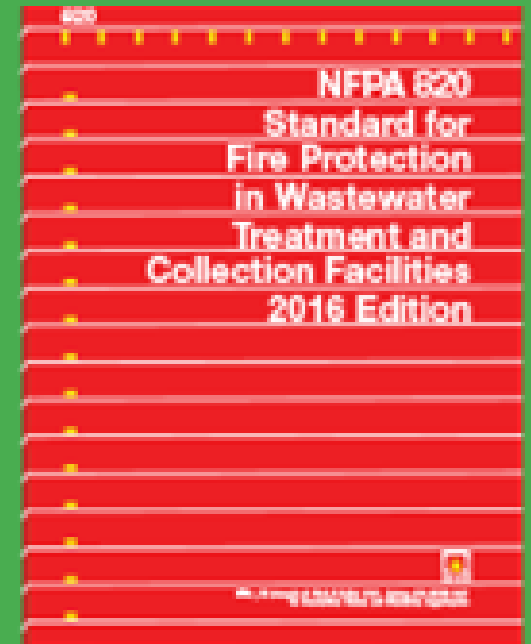
DESIGN TOOLS

- Physical Modeling
 - Flow profiles
 - Solids transport and deposition



OTHER IMPORTANT DESIGN ITEMS

- Suction head (NPSHA and NPSHR)
- Proper wetwell sizing
 - Consider min and max flow conditions
 - Pump capacity and wetwell volume are interrelated
 - Minimize detention time and number of pump starts
- Head conditions may determine pump type
- NFPA 820 – Standard for Fire Protection in Wastewater Treatment and Collection Facilities
 - First issued 1990, became required standard 1995
 - Hazard Classifications
 - Requirements for electrical equipment, ventilation, building spaces, construction materials, etc.



Summary of Advantages and Disadvantages

WET PIT ADVANTAGES AND DISADVANTAGES

Wet Pit	
<u>Advantages</u>	<u>Disadvantages</u>
Cheaper construction and operating costs	Cable handling for deep submersible pumps
Requires less land area	Shorter pump service life
Suction isolation valves not required	Grit accumulation can impact pump operation
	Must remove pump for maintenance
	Proprietary motors (submersible pumps)
	Pump connection at discharge base is critical
	Restricted equipment access

DRY PIT ADVANTAGES AND DISADVANTAGES

Dry Pit	
<u>Advantages</u>	<u>Disadvantages</u>
Ease of pump access and maintenance	Higher capital and operating costs
Less issues with pump suction flow profile	More land area needed
Typically longer pump service life	Need for sump and/or flood pumps
Non-proprietary motors (split case and end suction)	HVAC systems required
Motor can be disassembled from pump	Pump suction valves
	Seal water systems may be necessary
	Noise in pump chamber

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Questions

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