GS Vortex SYSTEMS

Vortex Flow Amplifier

Lower Cost Crude and Products Handling

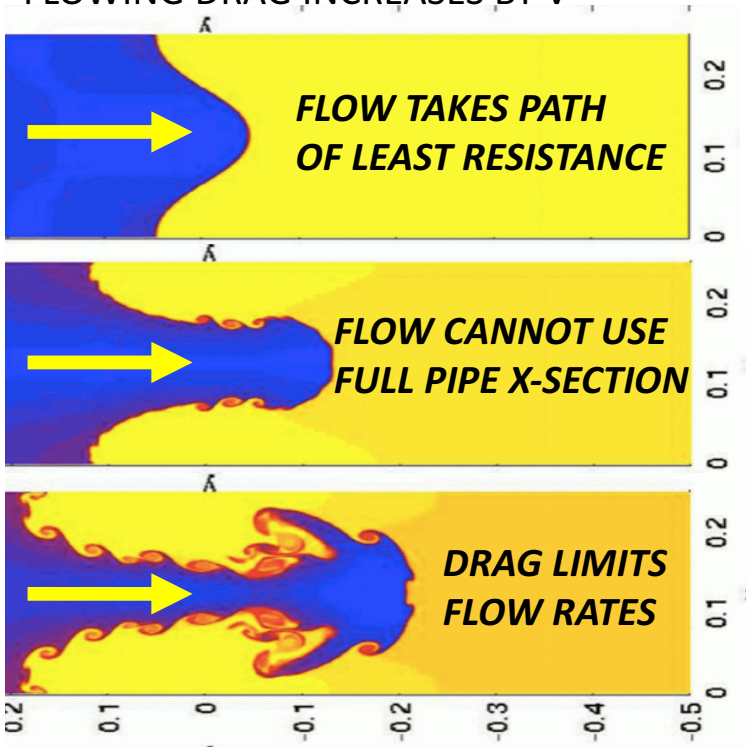
Improved Pipeline Flows and Viscosity Handling
Delivering Energy and Opex Savings

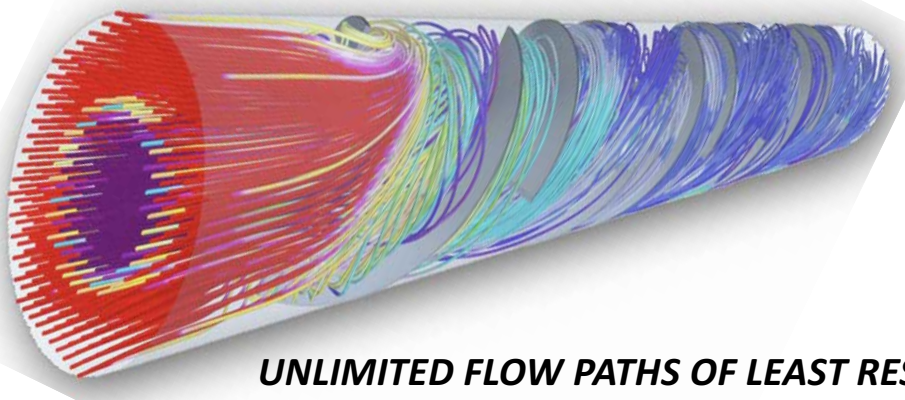
GS Vortex SYSTEMS

VORTEX FLOW TECHNOLOGY

INEFFICIENCY OF STANDARD PARABOLIC FLOW :

- ***SINGLE PATH OF LEAST RESISTANCE***
- THIS LIMITS FLOW VOLUMES
- FLOWING DRAG INCREASES BY V^2





UNLIMITED FLOW PATHS OF LEAST RESISTANCE

- USES FULL PIPE X-SECTION
- UTILISES FULL PIPE VOLUMETRIC CAPACITY
- FLOW ROTATION REDUCES FRICTIONAL DRAG
- LESS ENERGY CONSUMED AT ANY FLOW RATE
- HIGHER FLOW RATES POSSIBLE IN EXISTING LINES

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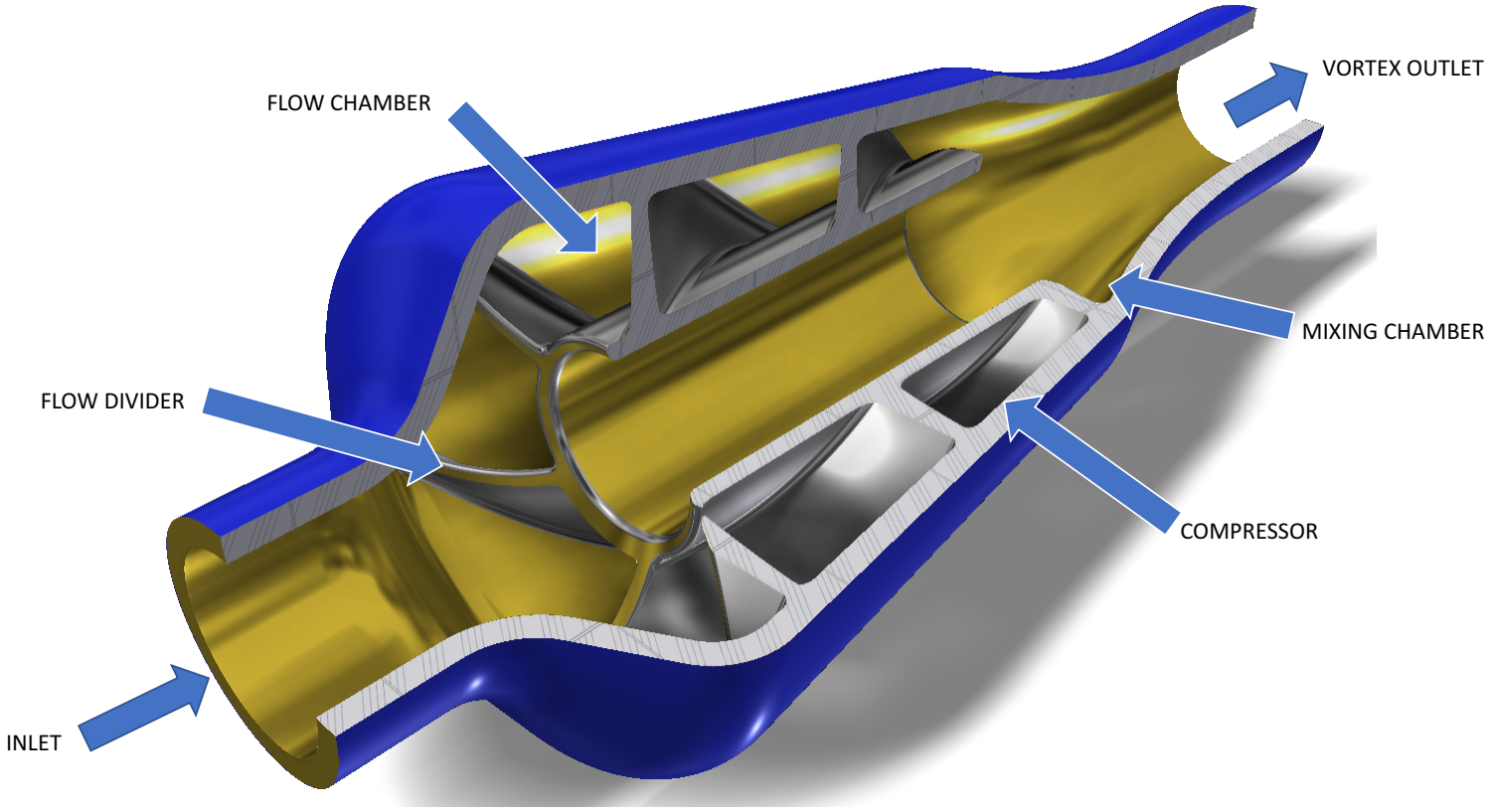
VORTEX AMPLIFIER CROSS-SECTION



- Multiple material and size options
- Simple to install in line
- ***No moving parts***
- ***No energy required***
- ***No maintenance***

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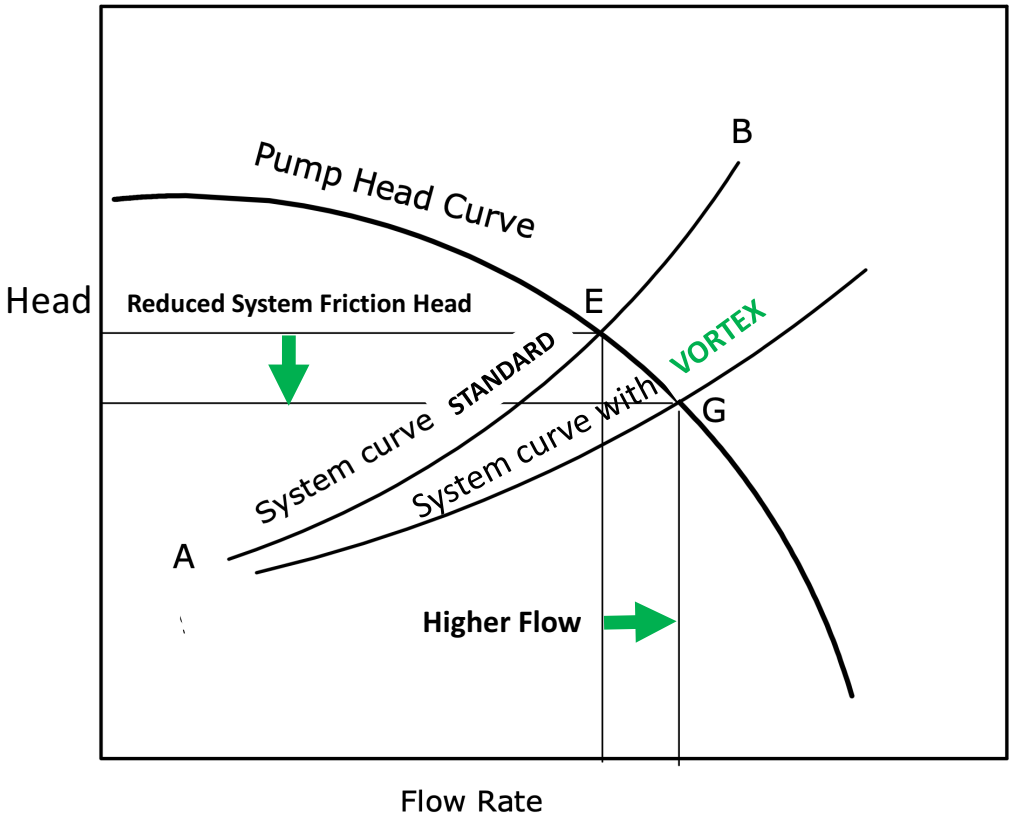
VORTEX DELIVERS PERMANENT SYSTEMS CURVE IMPROVEMENT



Pipeline Hydraulics, Dr. S. Menon

- VORTEX REDUCES FRICTION HEAD IN THE SYSTEM CURVE
- BEST EFFICIENCY POINT (BEP) AT HIGHER FLOWRATE
- REDUCED PUMPING ENERGY AND OPEX
- OR HIGHER FLOW RATES AS DESIRED
- FLUID ROTATION INCREASES SEDIMENT LOAD CAPACITY
- HIGHER SYSTEM UPTIME
- IMPROVED FLOW ASSURANCE

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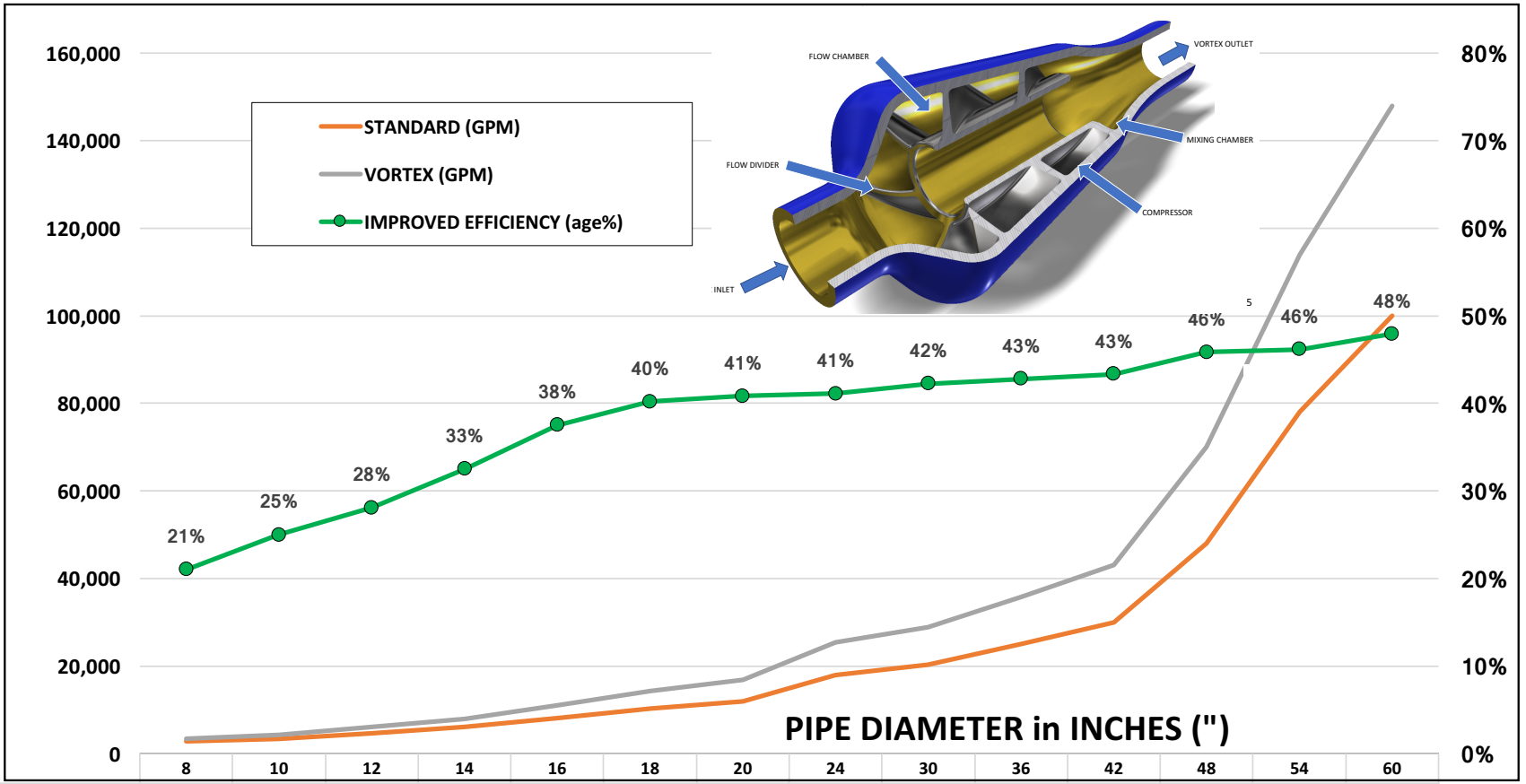
VORTEX FLOW EFFICIENCY COMPARISON



	8	10	12	14	16	18	20	24	30	36	42	48	54	60
STANDARD (GPM)	2,800	3,400	4,700	6,000	8,000	10,200	12,000	18,000	20,250	25,000	30,000	48,000	78,000	100,000
VORTEX (GPM)	3,388	4,250	6,020	7,950	11,000	14,300	16,900	25,400	28,800	35,700	43,000	70,000	114,000	147,939
IMPROVED EFFICIENCY (age%)	21%	25%	28%	33%	38%	40%	41%	41%	42%	43%	43%	46%	46%	48%

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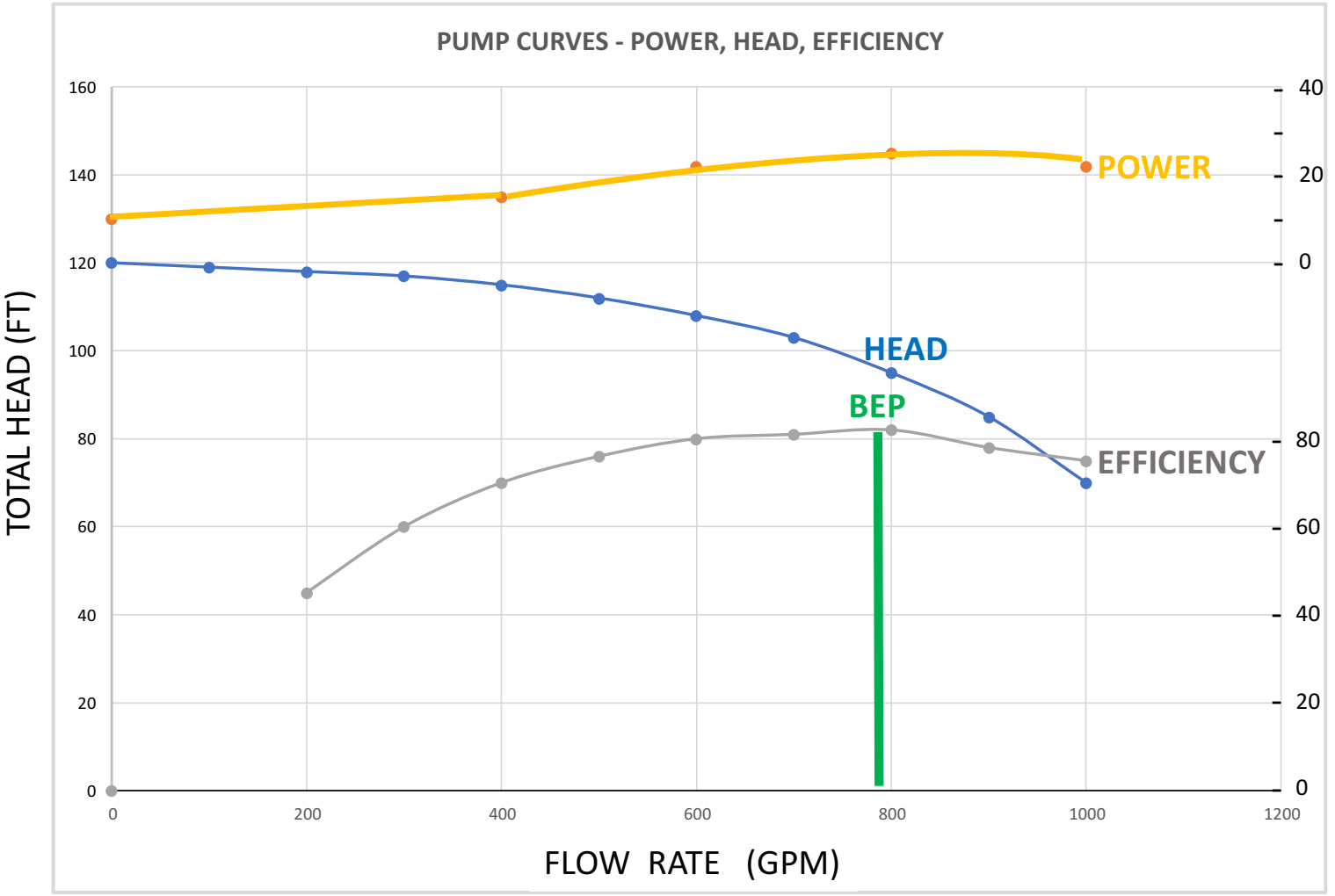
Standard Pump Curve - Water



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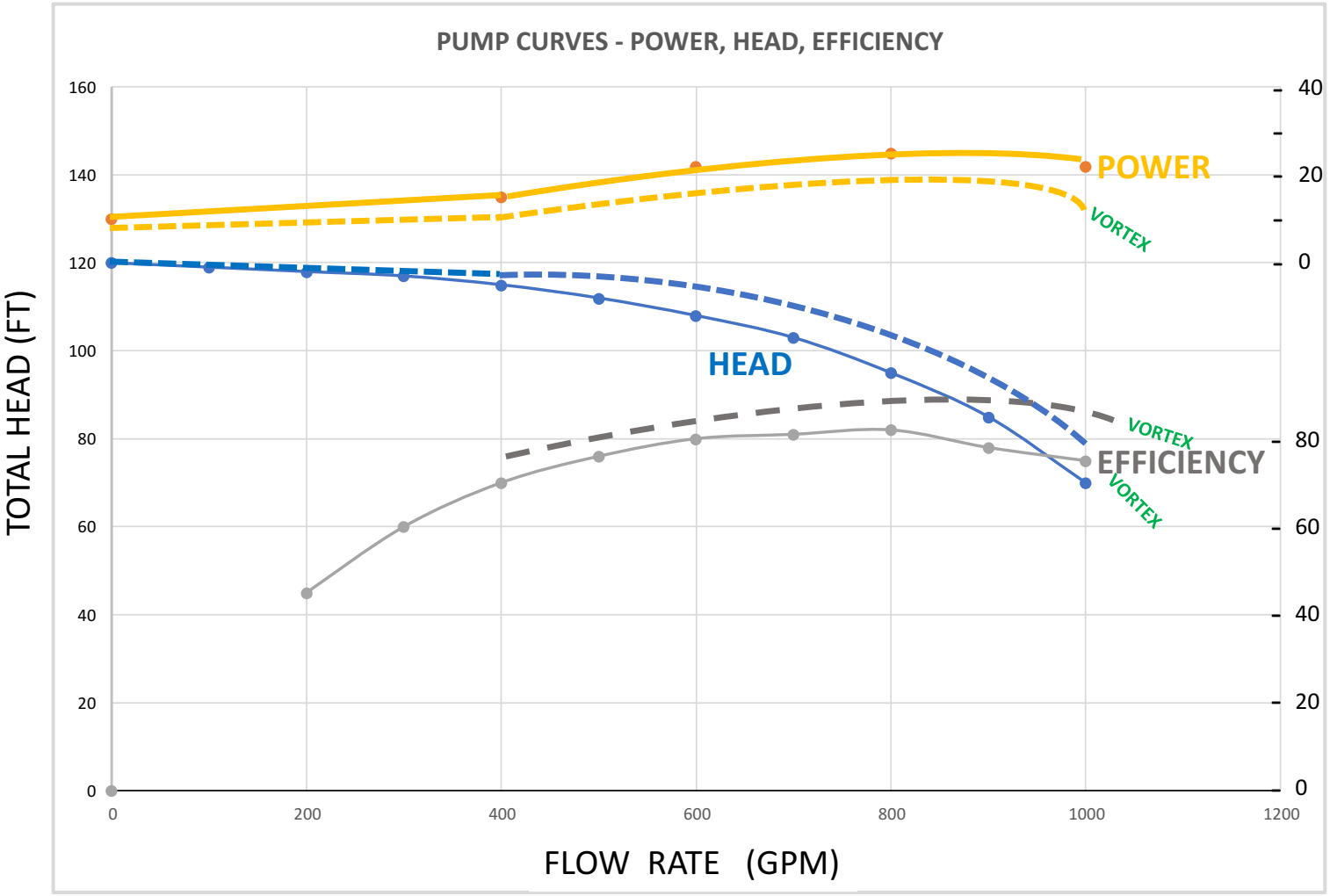
Vortex Effect on Pump Curve - Water



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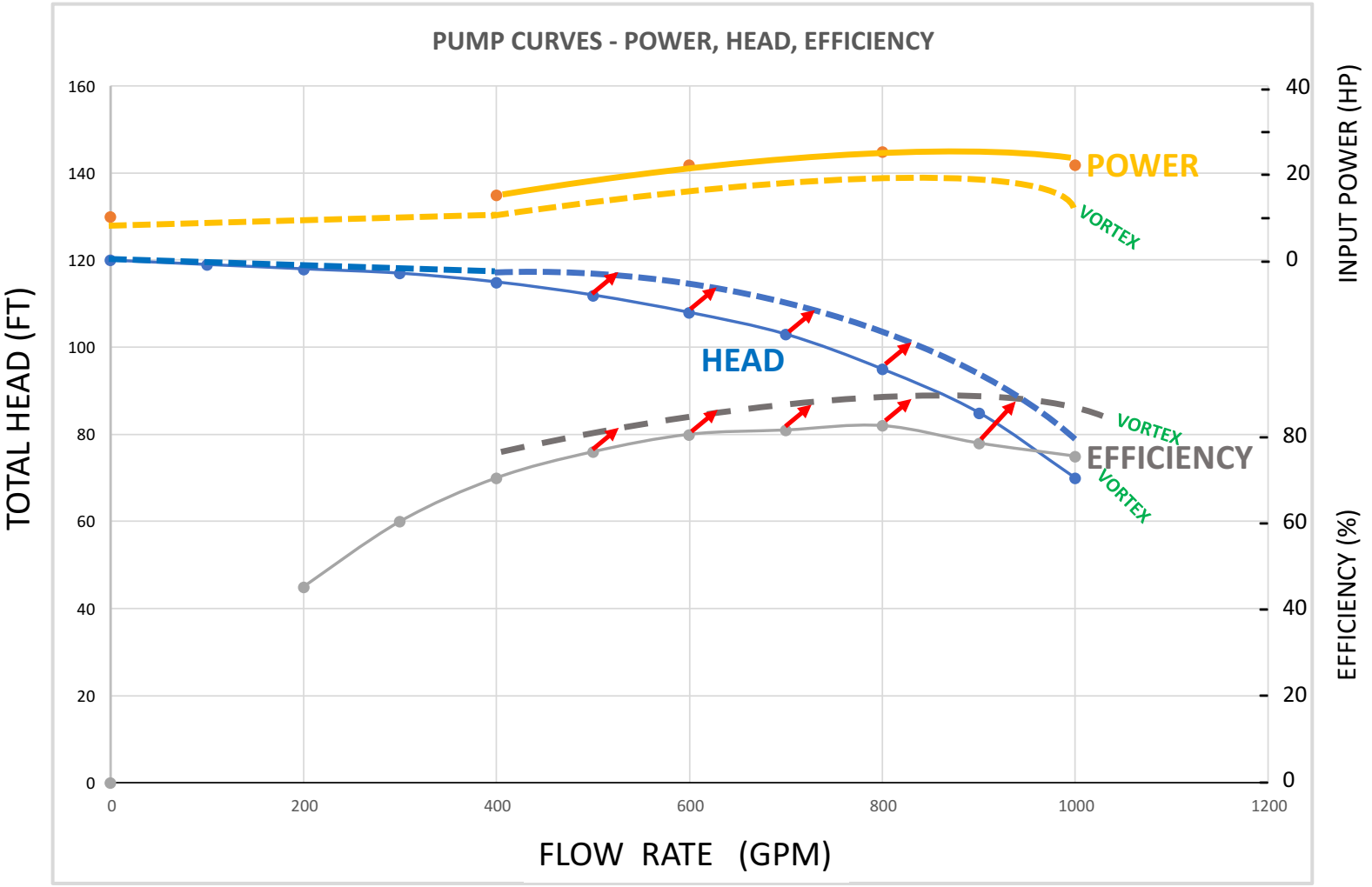
Vortex Effect on Pump Curve - Water



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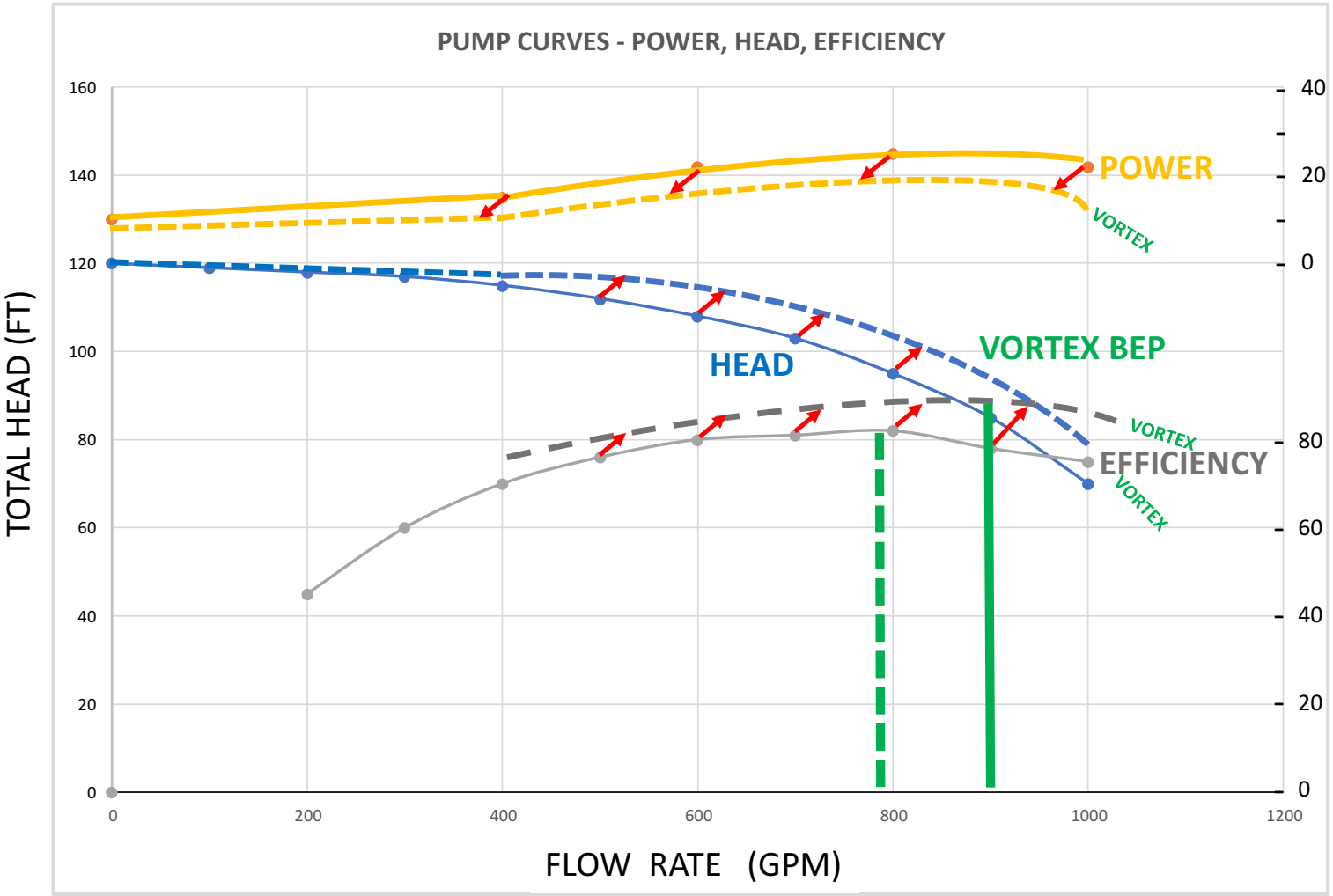
Vortex Effect on Pump Curve - Water



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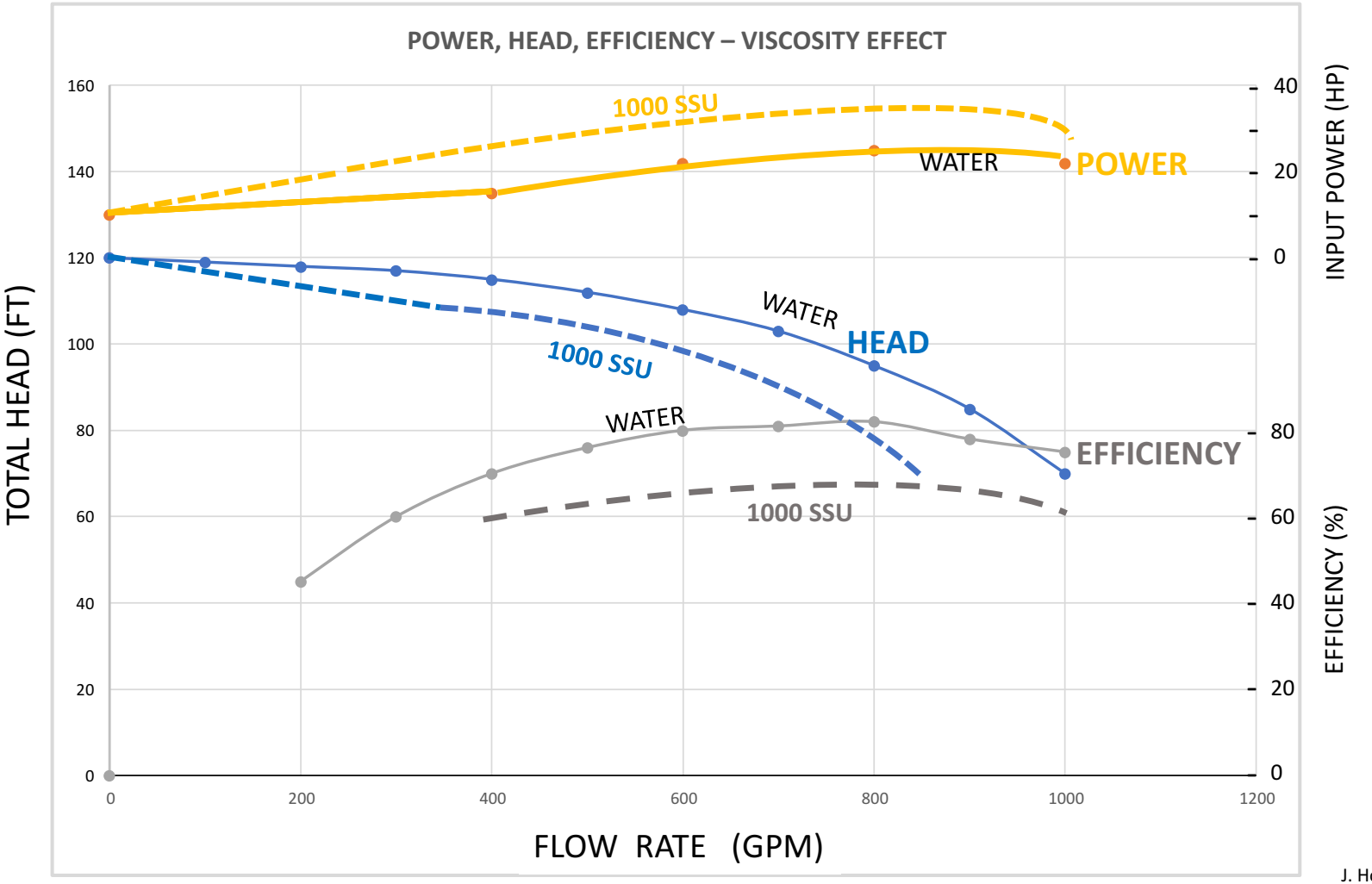
Viscosity Effect on Pump Curve



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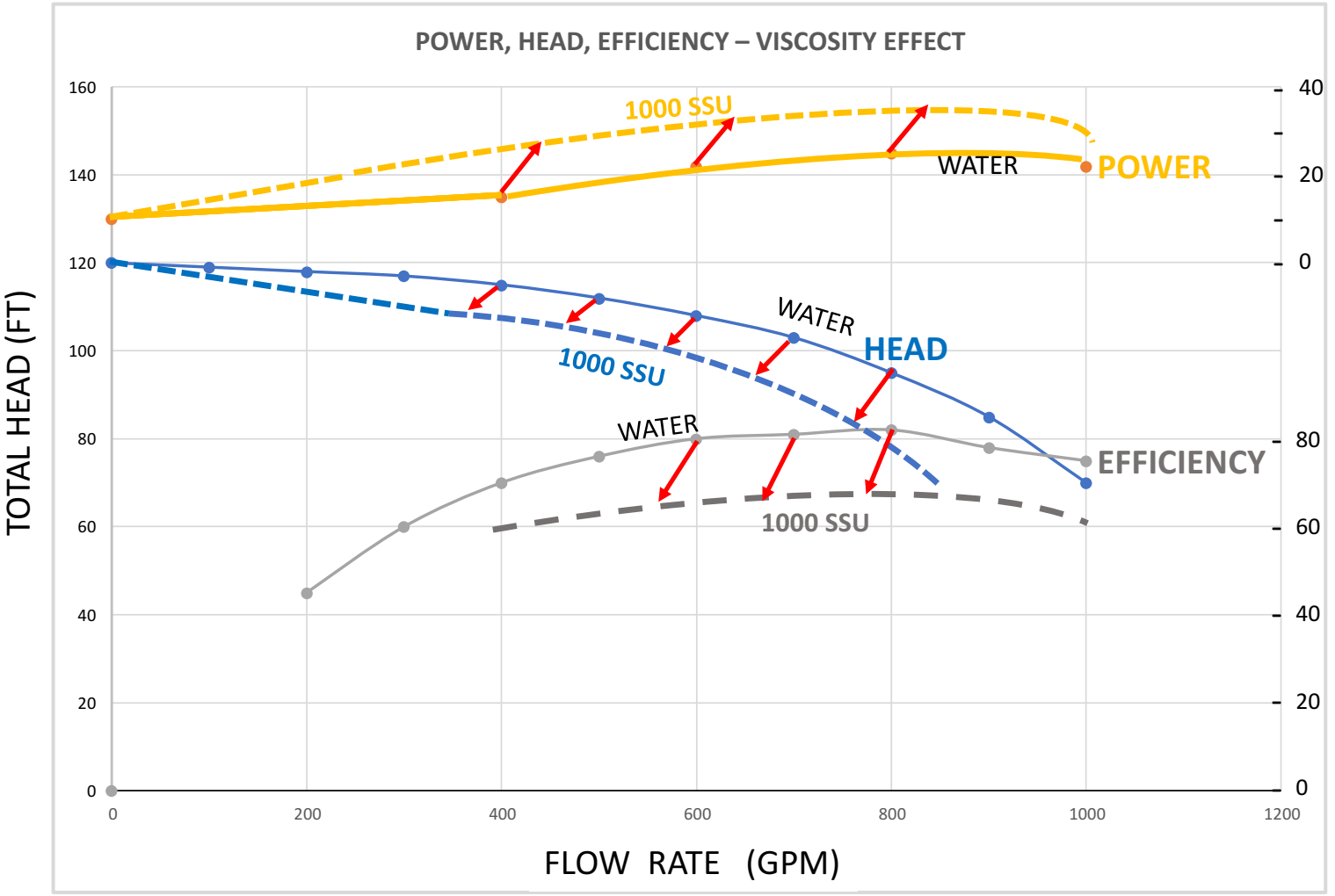
Viscosity Effect on Pump Curve



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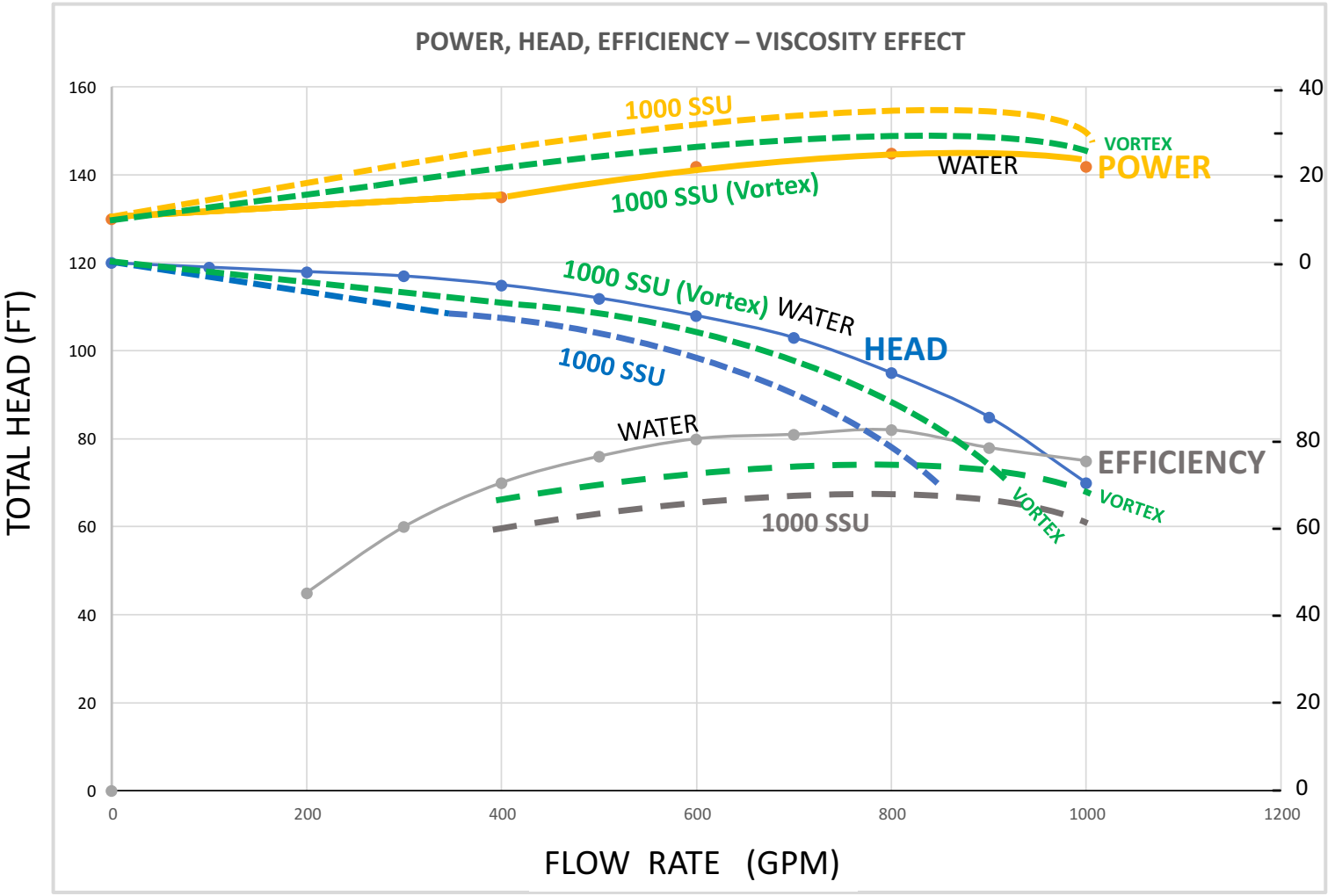
Vortex Effect on Viscosity - Pump Curve



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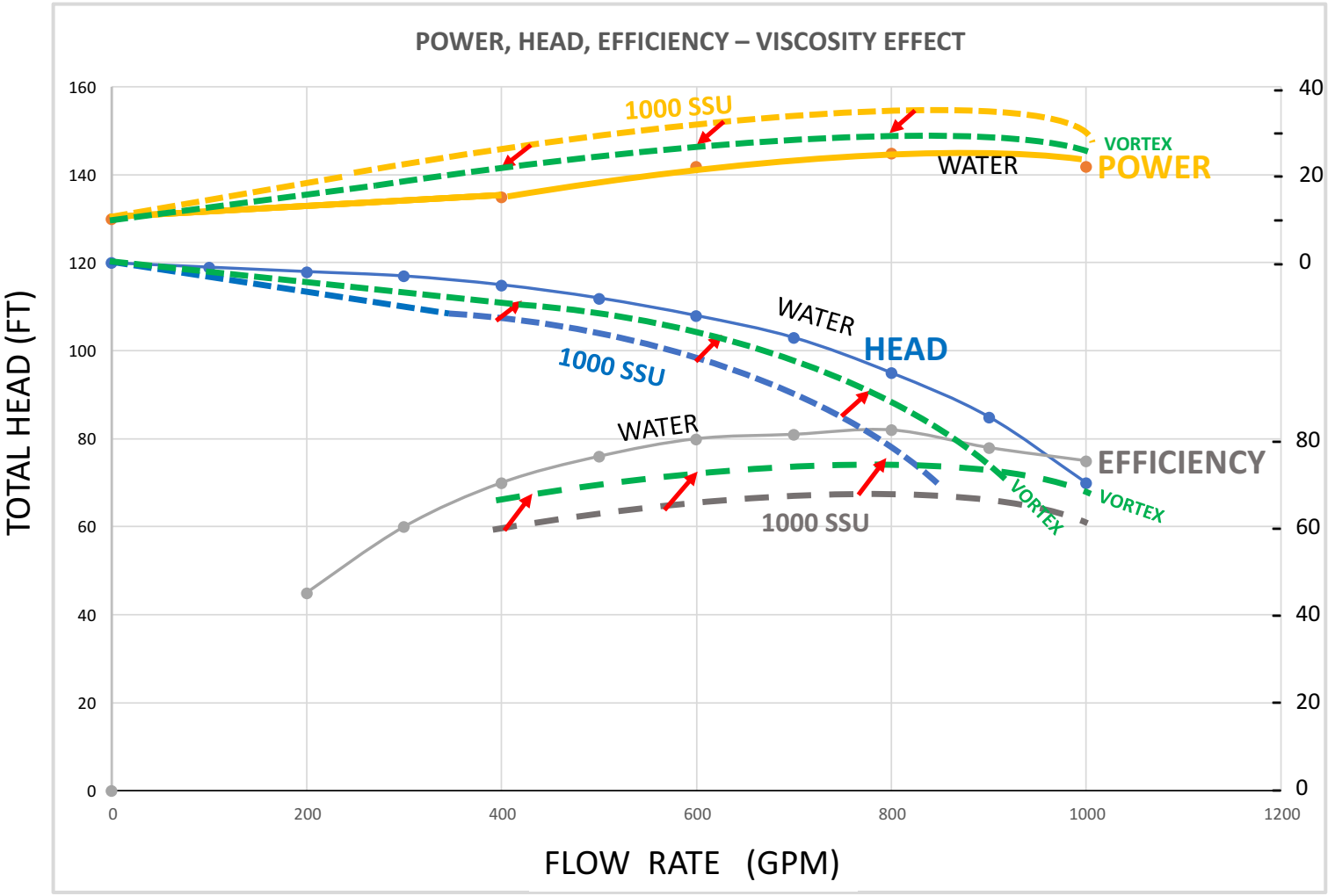
Vortex Effect on Viscosity - Pump Curve



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FAQ

1.Will Vortex work with high viscosity crude in a laminar flow regime?	Yes
2.Based on the given plan how many Vortex units would be required?	Dependent on system and pump(s)
3.What increase in flow could be expected?	~30%, subject to system constraints
4.Are there pipeline diameter limitations?	No
5.How much linear space would be required for a 20” installation?	Approx 22’ length, Flanged
6.If crude/products unstrained, would particulates influence flow?	No, Vortex will suspend particulates
7.Any similar applications that have been proven successful	Municipal Water, active projects
8.Would there be a benefit in turbulent flow 40 API/5 cSt crude?	Yes, and flow would become rotational
9.Does paraffin content/wax build up influence the performance?	Yes, but Vortex rotation inhibits deposition