Figure 1 - Hydraulic Rating Curves for Gated Culvert & Diversion Channel

- **Diversion Channel**
- **D/S Intake Structure**
- **Channel Stage**
- **Gated Culvert**
- **U/S Intake Structure**
- **Miss. River Stage**

**Target Flow**
2,000 cfs
Figure 3 - Statistical Annual Curves for Historical Mississippi River Stages

River Stage (ft)

Average  Standard Error Max  Maximum Recorded  95% Probability (55-wk)
90% Probability (13-mo)  75% Probability (16-mo)  50% Probability (2-yr)  25% Probability (4-yr)
10% Probability (10-yr)  5% Probability (20-yr)  Minimum Recorded  Standard Error Min
Figure 4 - Hydraulic Rating Curves for Vacuum Siphon by No. Pipes

Notes:
- Transition Zone = Velocity between 5 - 7 ft/s.
- Priming Stage = Min. river stage req'd to prime a siphon pipe using a vacuum system.
- Siphon pipes can continue to operate at river stages below the priming stage.
Figure 5 – Vacuum Siphon System Logic Diagram
Figure 6 - Average River Year Flows for Vacuum Siphon & Gated Culvert Systems
This donut chart consists of three nested pie charts, each representing an intake alternative.

Note: 1% of a year is about 3.5 days, 2% of a year is roughly 1 week & 8% of a year is approx. 1 month.

Legend
- 2000 cfs
- 1750-2000 cfs
- 1500-1750 cfs
- 1000-1500 cfs
- 500-1000 cfs
- 0-500 cfs
- Not Operational

Figure 7 - Operational Time & Flow of 8- and 10-Pipe Vacuum Siphons vs Gated Culvert
Notes:
- For a Rising River, a stage of 10.5-ft and a velocity of 7 ft/s is required to prime the pipes.
- For a Falling River, a velocity of 5 ft/s is required to maintain prime in an operating siphon.
  If prime is lost, it can not be re-established until the river stage exceeds 10.5-ft.
- For a Low River, too many pipes operating can increase the diversion channel WSE too high, which decreases the velocity, and can potentially lead to a loss of prime.
- For a High River, too many pipes operating can lead to flows in the diversion channel above 2,000 cfs, which can cause the guide levees to overflow onto adjacent properties.

Figure 9 - Hydraulic Rating Curves for 8- & 10-Pipe Vacuum Siphons and Gated Culvert
Figure 10 – Overview of Pumped Siphon System Layout
Figure 11 – Forebay Intake & Sediment Basin
Figure 12 – Pump Station Transverse Section
Figure 13 – Pump Station Longitudinal Section
Figure 14 - Pumped Siphon Pump & System Curves

- **Design Point**: 5.63' TDH, 2,000 cfs
- **Priming Point**: 12.02' TDH, 1,585 cfs

Numbers on System Curves Denote River Stages

Note: Throttling valves are required to adjust system curves upward so pumps stay within their operating limits for higher river stages, and/or to operate fewer pumps for lower flows.

Total Discharge (cfs)

Total Head (Channel Stage + Losses - River Stage)
Figure 15 – Profile of Levee and Roadway Pipe Crossing
Figure 17 – Roadway Crossing Section & Vertical Geometry