



GREELEY AND HANSEN

Forcemain Odors: A Remedy

**Indiana Water Environment Association
74th Annual Conference
November 17, 2010**

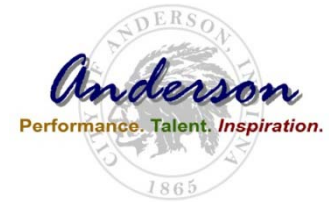
Nara Manor, Anderson, Indiana Water Pollution Control
Plant Superintendent

Kristin L. Comer, P.E., Greeley and Hansen

Tim Healy, P.E., Greeley and Hansen



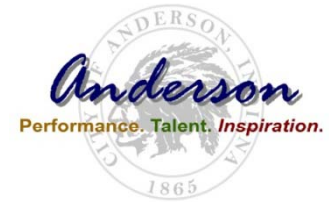
Outline



- Background
- The Problem
- Alternative Analysis
- The Solution
- Questions/Comments



Background



- Odor is always a concern with wastewater utilities.
 - At Wastewater Treatment Plant
 - In Collection System
- Presentation will describe one example of a cost effective solution for the City of Anderson

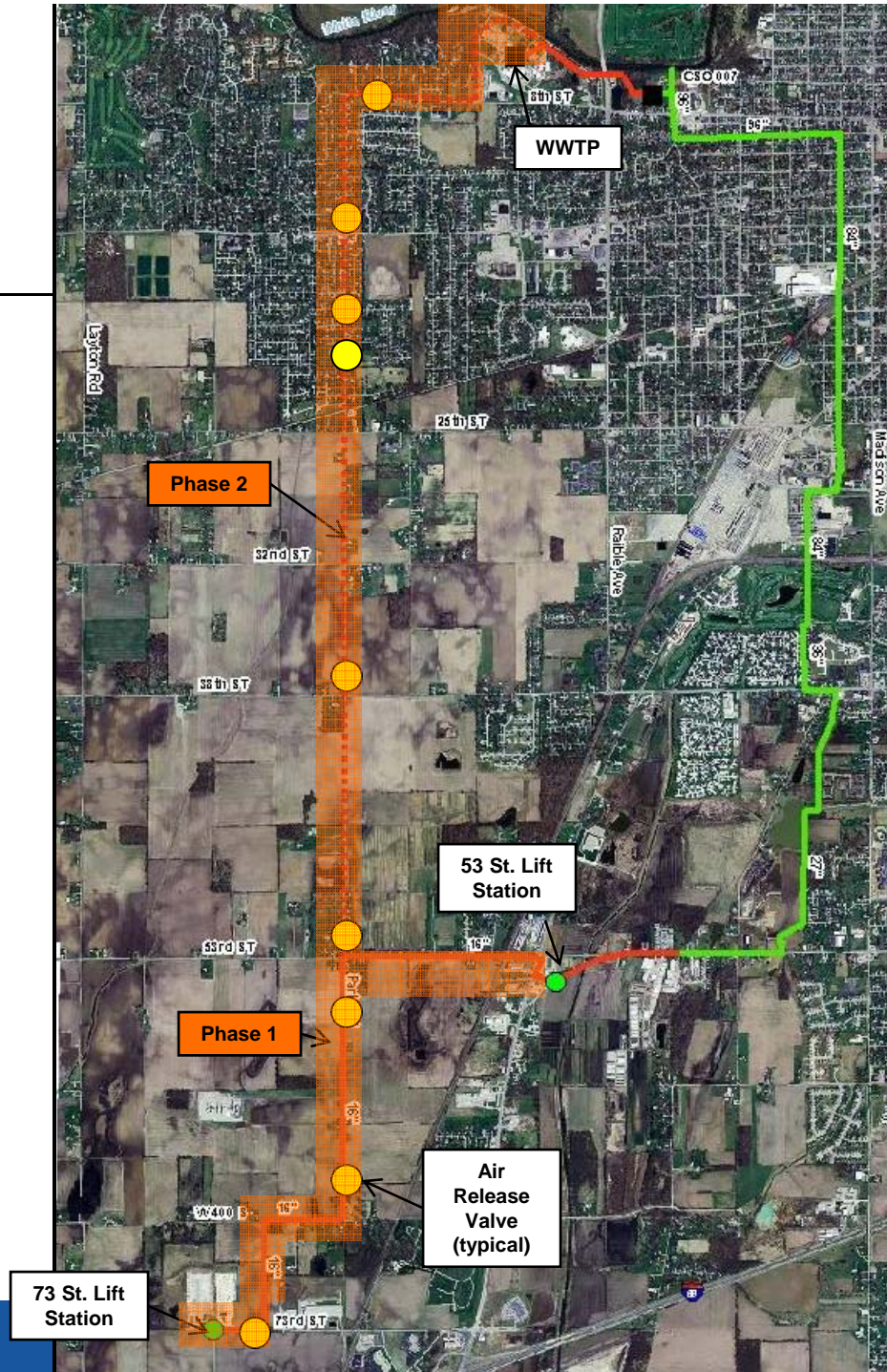
Background Information



- In 2006, the City of Anderson, Indiana needed to extend sewer service to a new industry
- Topography is Flat
- Determine best to build a new forcemain

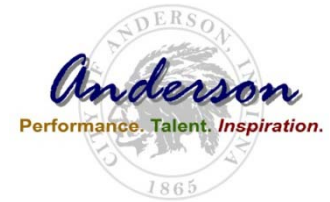


Forcemain Details



- Built in 2 Phases
 - 2007
 - Nov. 2010
- Length
 - 5 miles
- Pipe Size
 - 24" HDPE
- Construction Method
 - Directional Drilled
- Number of Combination Air/Vacuum Release Valves
 - 9

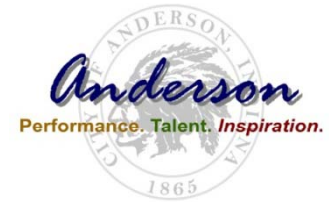
Outline



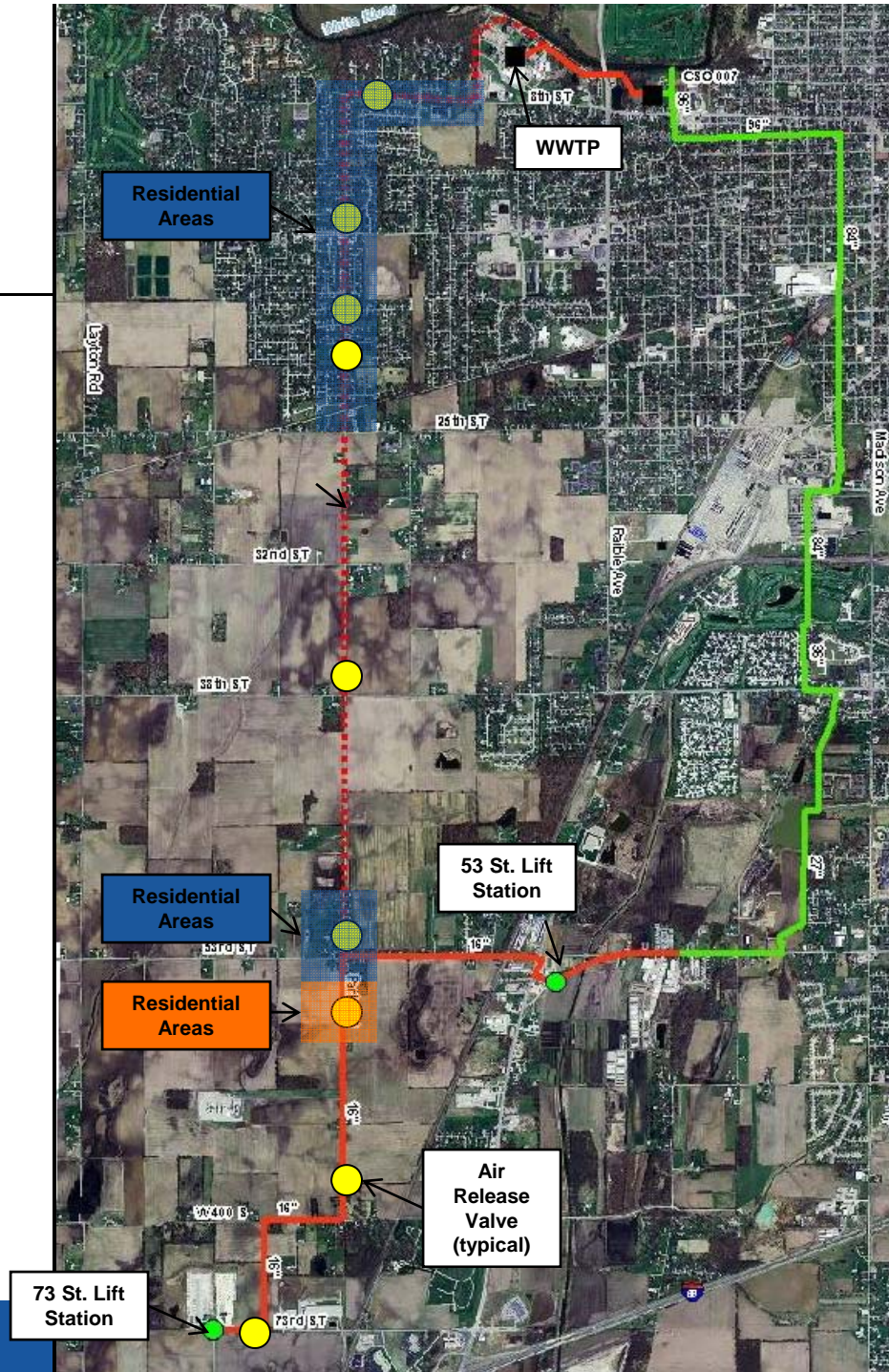
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The Problem



- Odor Complaints from Residence
 - After Completion of Phase I
- City investigation
 - Hydrogen Sulfide released from forcemain through Air Release Valve

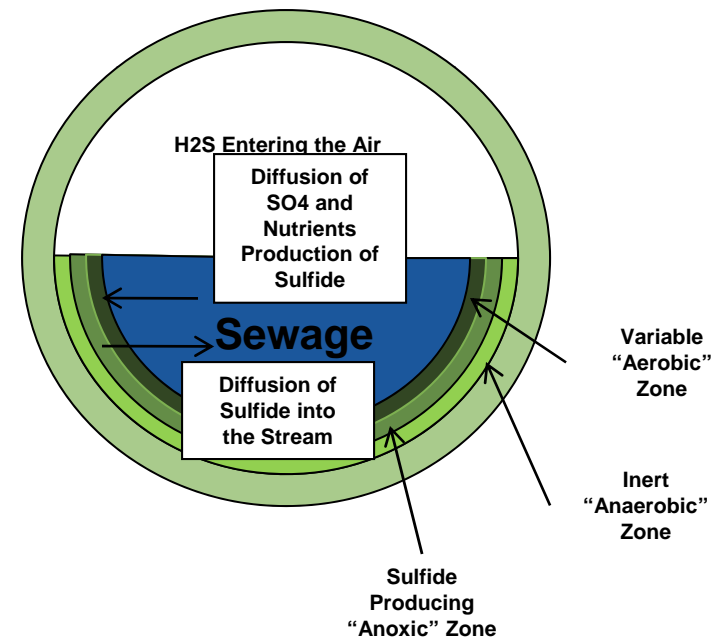


- Phase I – Location of Original Complaints
- Phase 2 – Five Air/Vacuum Release Valves

How does Hydrogen Sulfide Form in a Sewer?

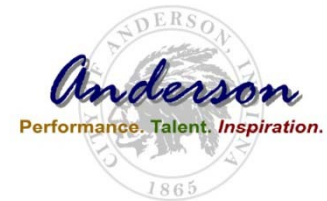


- Sulfate in Wastewater biologically converts to sulfide
- Sulfide Chemically converts Hydrogen Sulfide Gas



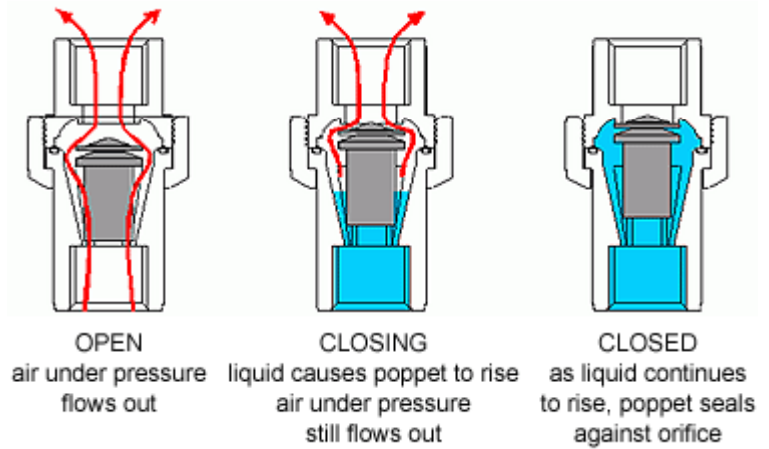
Source: Gravity Sanitary Sewer Design and Construction, 2nd Edition, ASCE, 2007

The Conditions were Right



- Forcemain was oversized for current conditions
 - Designed for Future Growth
- Long Travel Time in the Forcemain
- Caused Formation of Hydrogen Sulfide in Forcemain and Release to Atmosphere through Air Release Valve

How does an Air Release Valve Work?



Source: www.pipingfitting.com

Outline



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- The Solution
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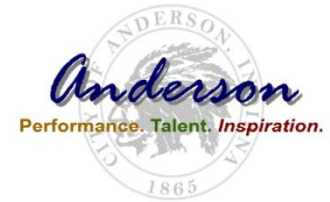


Alternative Analysis



- **Alternative Analysis Performed**
 - Chemical Addition at the Lift Station
 - Chemical Addition in the Collection System
 - Odor Control in Collection System
 - Address Odors at Water Pollution Control Facility

Outline



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The Solution



- Address the Odors at WWTP Plant
 - Overflow tower with a weir and plunge pool
 - The Tower forces the hydraulic grade line to be above the air release valves (i.e. the forcemain is kept full)



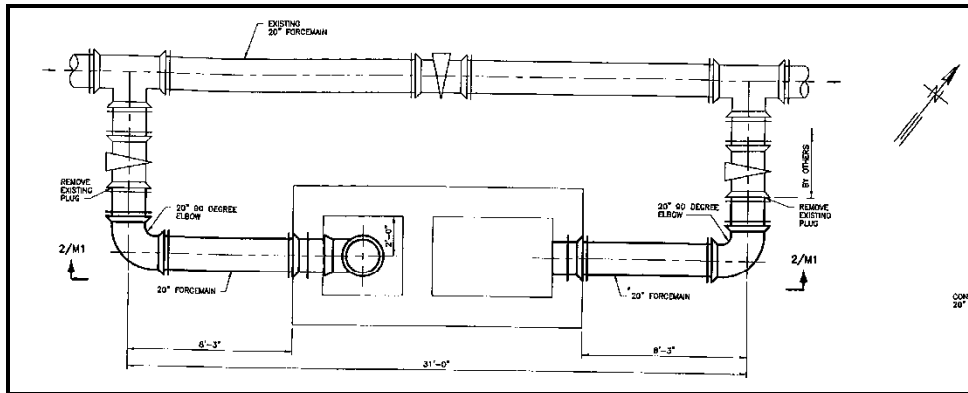
Overflow Structure Details



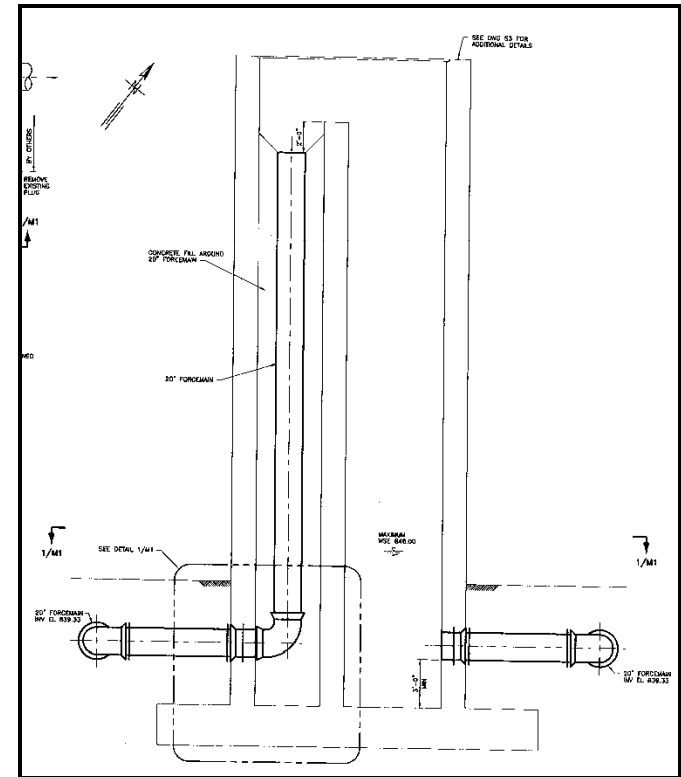
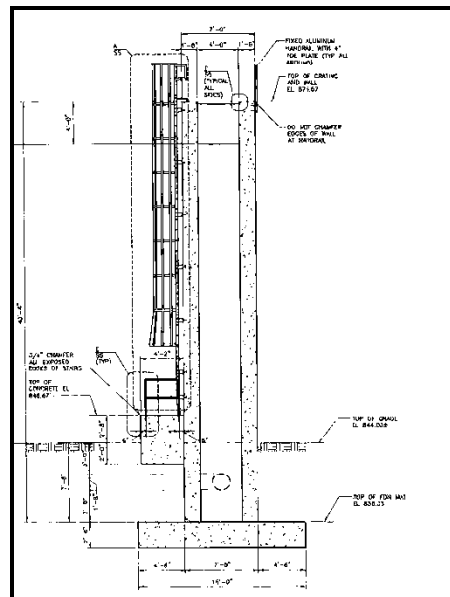
- Height – 34 feet above Grade
- Footprint – 14'-6" x 7'-0"
- 20" Ductile Iron Pipe
- Plunge Pool
- Bypass Line



Tower Details

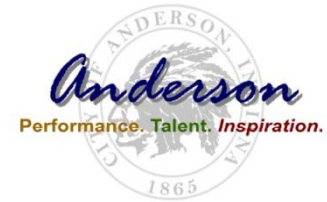


Plan



Sections

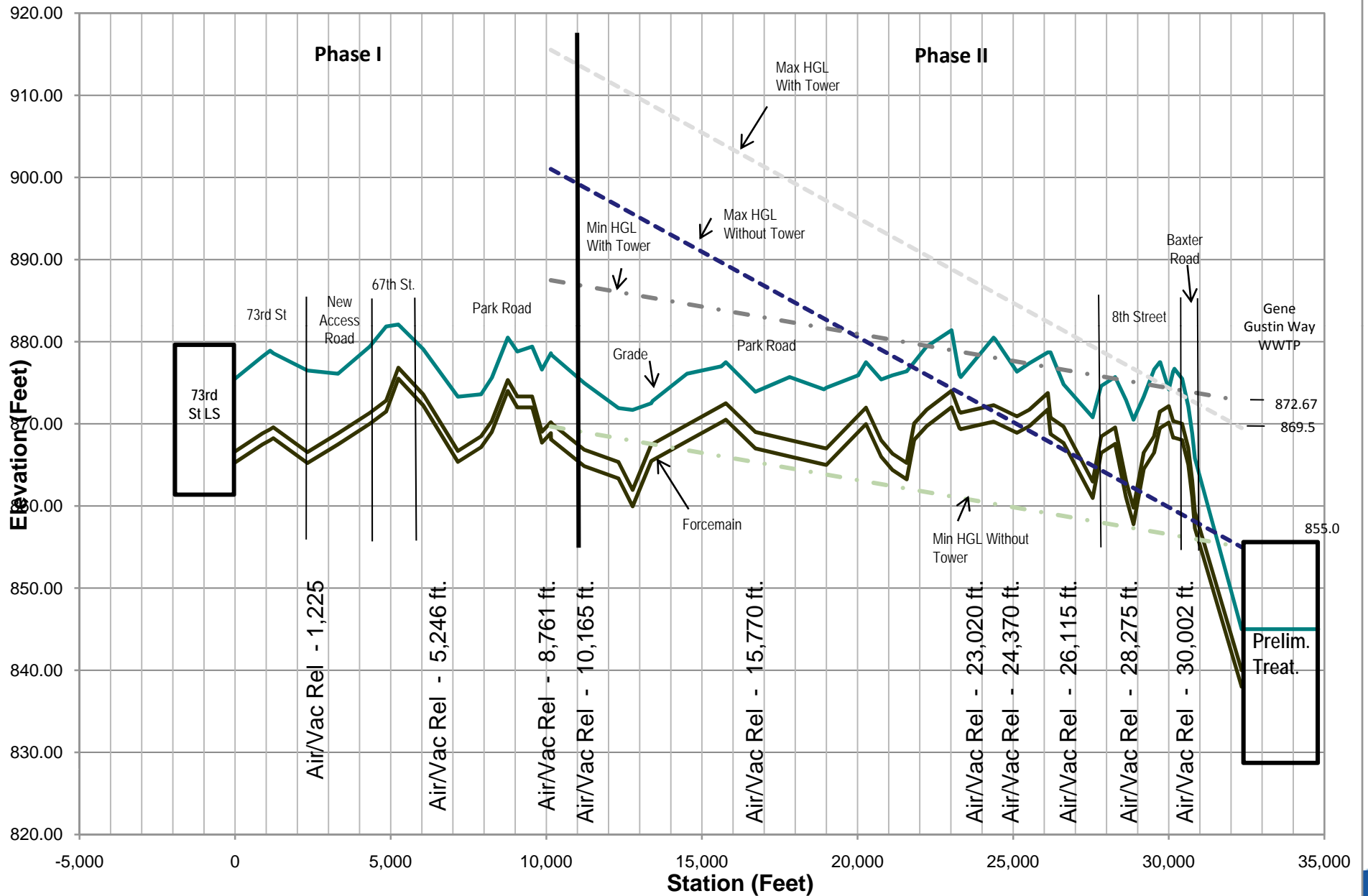
Overflow Tower Design Components - Height



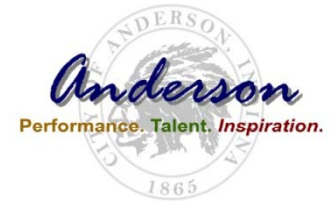
- How was it determined?
 - Hydraulics for the forcemain were calculated to determine what the controlling hydraulic grade line elevation would be to keep the forcemain full.



73rd Street Lift Station Forcemain Profile - Phase I and II



Overflow Tower Design Components – Weir Length



- How was it determined?
 - Weir with End Contractions
 - $Q = 2/3C_dsr(2g) (L-0.1nH)^*H^{3/2}$
 - Q = Flow (cfs)
 - C_d = Discharge Coefficient
 - g = Acceleration due to Gravity
 - N = Number of Contractions (2)
 - H = Headloss over the Weir (1 foot)
 - L = 4 feet

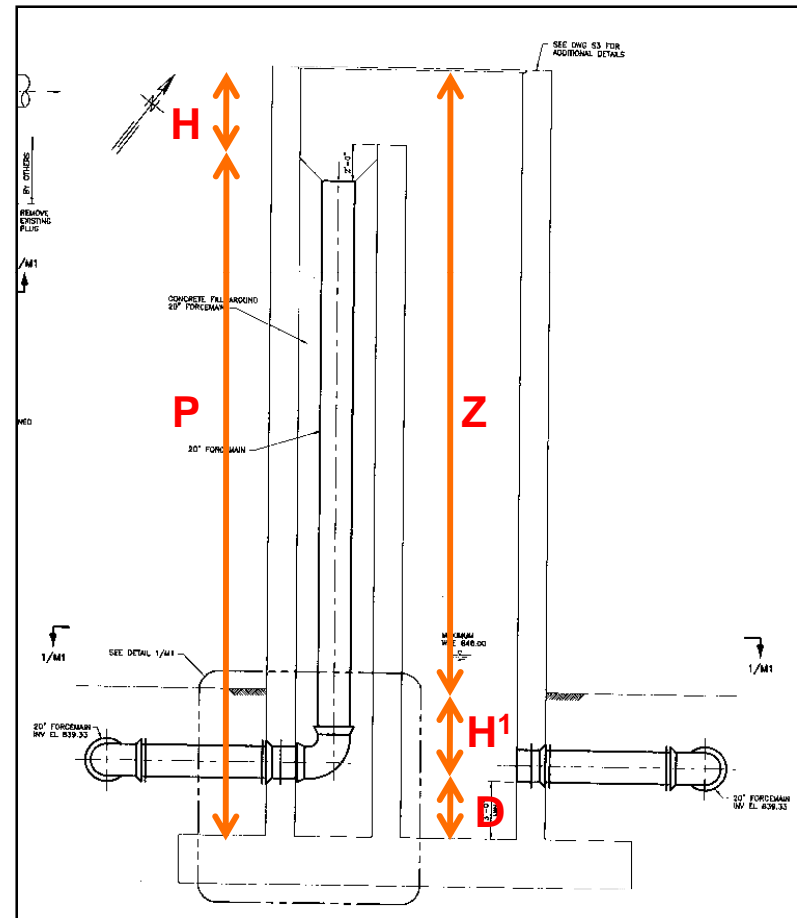


Overflow Tower Design Components – Plunge Pool

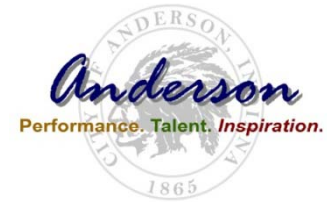


■ How was it determined?

- Equation for Determination Depth in a Plunge Pool
- $Z = P + H - D - H^1$
- Purpose of plunge pool is to dissipate all energy create from fall



Provisions for the Future



- As designed, odors will be release through grating at top of structure
- Currently, designing preliminary treatment facility that will require odor control
- One system for both structures



Conclusions



- Cost Effective Solution to an Odor Problem
 - Construction Costs = \$158,400
- Safer than other Alternatives
 - No Chemicals in Remotes Areas
- Less O&M than other Alternatives
 - One only system
 - Can be dealt with in one place

Acknowledgements



- A special thanks goes to Tim Healy and Gui DeReamer with Greeley and Hansen.



Questions