DESIGN CRITERIA
VIABILITY CRITERIA
LIFE CYCLE COST ANALYSIS

Sewer Infrastructure Advisory Group

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Engineers/Planners

PRESENTATION CONTENTS

- Provide information and review of
  - Viability Criteria
  - Design Criteria
- Provide information and opportunity for input on
  - Life Cycle Cost Analysis 

VIABILITY CRITERIA

- What are Viability Criteria?
  – Used to determine what types of technology will be included in the optimization
    - Treatment Alternatives*
    - Pipe Alternatives
    - Pump Alternatives
    - Storage Alternatives

*Primary Focus of Viability Criteria

PURPOSE OF THE VIABILITY CRITERIA

- Provides a Cost Baseline
  - Optimization compares alternatives on a cost basis
  - Reliable cost info is needed to load the model
- Provides a Confidence Baseline
  - The community expects performance for its $
  - Permitting agencies will require performance
  - City staff is responsible for performance (e.g. no overflows)

WHAT ARE THE VIABILITY CRITERIA

- Technology alternatives need to demonstrate:

COST

- Life Cycle Costs can be "independently" verified
  - Land area, Initial cost, Energy Use, O&M, Chemicals, etc

CONFIDENCE

- Has performed in municipal installations
- Has performed in similar applications
  - Regulatory, Climate, Geology
- Record of multiple years of O&M, energy data
- Support from a U.S. based "supplier" of equipment and parts

- See handout for details

TREATMENT/EFFLUENT ALTERNATIVES

- Wastewater Treatment Package/Satellite Systems
  - Membranes
  - Conventional Mechanical
  - Innovative Technologies
- Effluent Disposal (must be year-round solution)
  - Ground Application
    - Infiltration Pond/Lagoon
    - Wetlands
    - Direct Injection
    - Land Application
    - Reuse
  - Surface Water

SIAG DISCUSSION

- Q/A/Discussion?

LIFE CYCLE COST ANALYSIS (LCCA)

- What is infrastructure life cycle cost analysis?
- Why should we care about LCCA?
- What is the useful life of sewer infrastructure?
- What analysis period is appropriate for use in the CSMP?

WHAT IS LCCA?

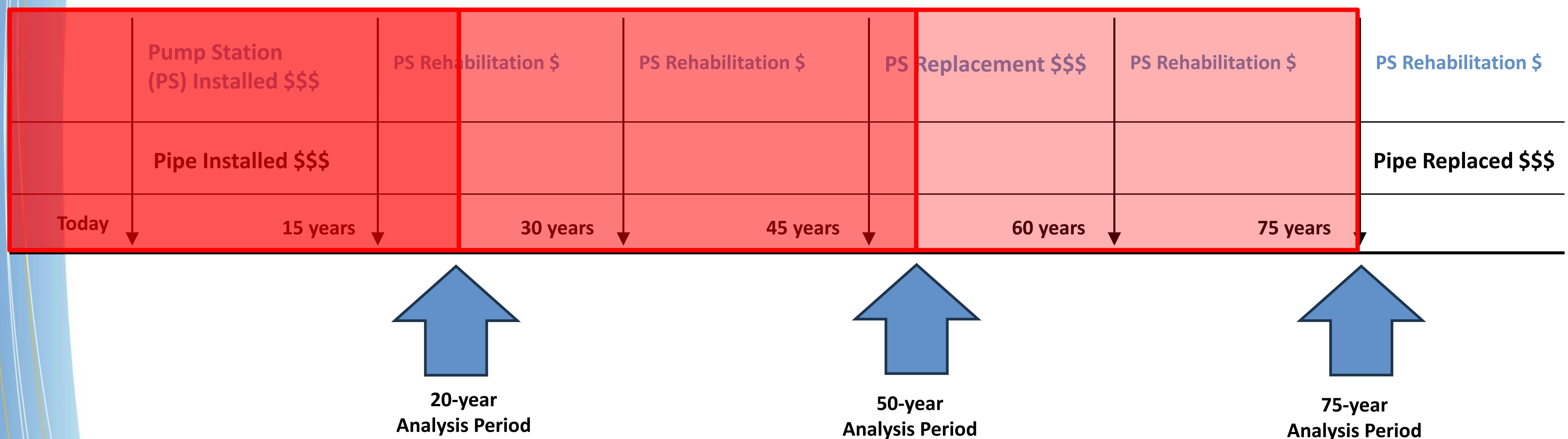
- An economic analysis procedure that uses engineering and financial inputs to compare alternatives over time
- LCCA provides a long term assessment of project effectiveness compared with evaluating up-front capital costs alone
- Expresses results in equivalent dollars - Present Value

SEWER INFRASTRUCTURE USEFUL LIFE

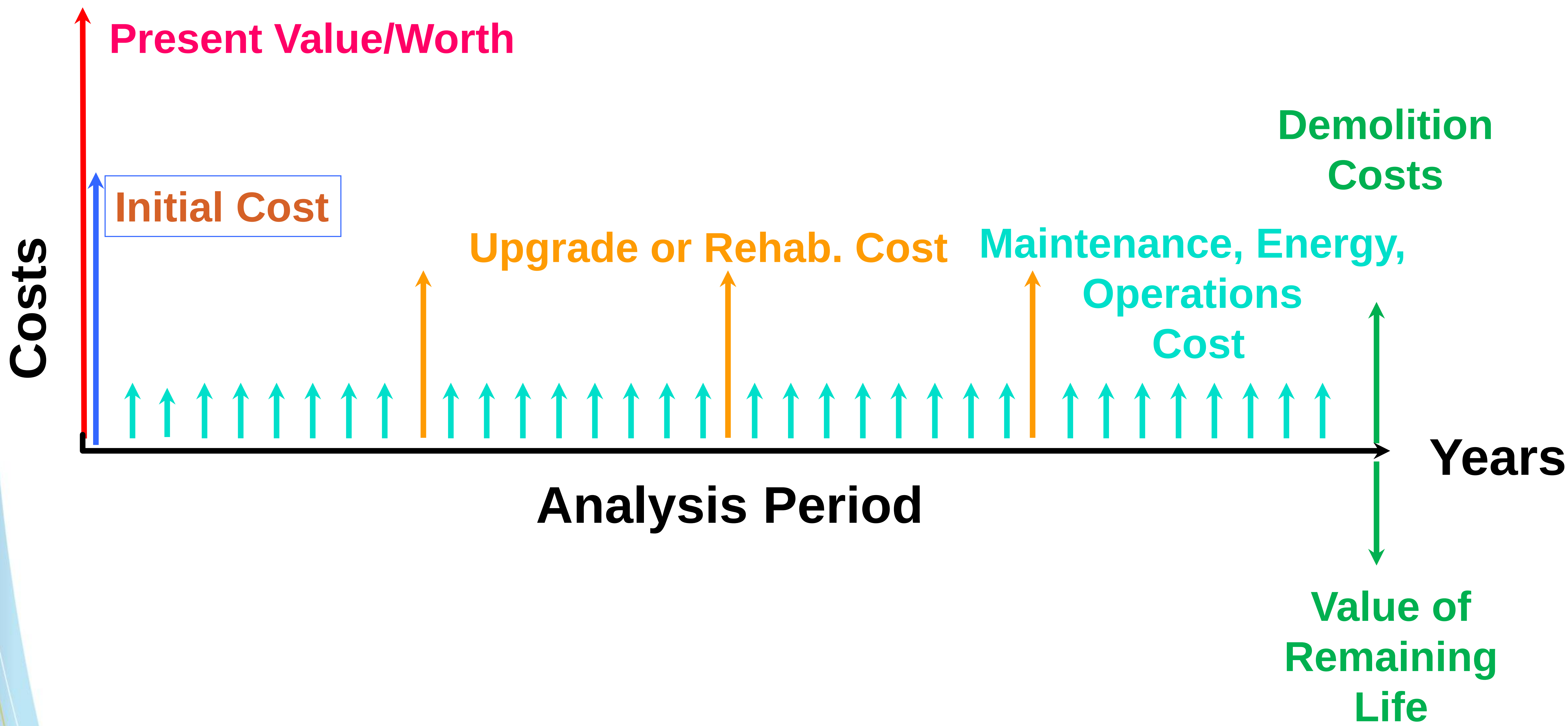
Component	Useful Life (years)
Gravity Sewer Mains	80-100
Treatment Plants – Concrete Structures	50
Treatment Plants – Mechanical and Electrical	15-25
Force Mains	25
Pumping Stations – Concrete Structures	50
Pumping Stations – Mechanical and Electrical	15

- Sources: Environmental Protection Agency (EPA), 2002, American Society of Civil Engineers (ASCE), 2011

LCCA PERIOD (CAPITAL ONLY EXAMPLE)



LCCA COMPONENTS



ANALYSIS PERIOD CONT.

- Short analysis period (20 years) may not accurately capture the remaining value of long lived assets (e.g. pipes)
- Long analysis period (> 50 years) may not accurately predict long-term O&M costs and financial factors (e.g. inflation)
- Medium analysis period (30-40 years) may better balance short and long term uncertainties

LCCA SENSITIVITY ANALYSIS

- The optimization will employ sensitivity analysis to assess one or more of:
  - – Analysis Period
  - – Remaining Useful Life
  - – Discount Rate (Time value of money)
    - Inflation Rate
    - Cost to Borrow Money

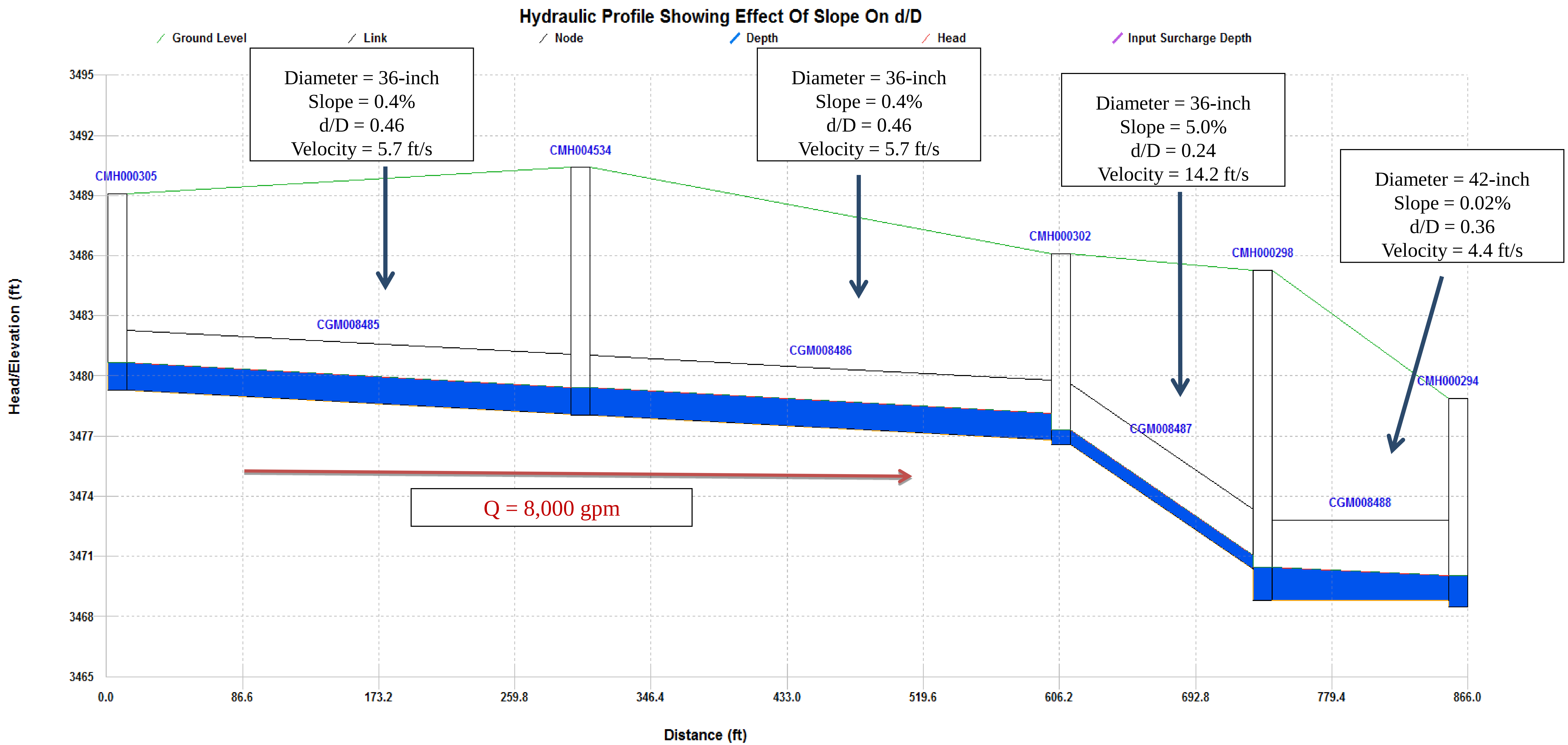
WHAT ANALYSIS PERIOD?

- Discussion/Questions

WHAT ARE DESIGN CRITERIA?

- Define the hydraulic and basic facility parameters used in the optimization analysis:
  - Sewage Level in Pipes/Manholes
  - Flow Velocity
  - Pump Operation Under Dry and Wet Weather
  - Emergency Power at Lift Stations
  - Standard Pipe Sizes
  - Pipe Slope
  - Others (See Handout)
- Used to identify existing deficiencies and set requirements for proposed improvements.

EXAMPLE - PIPE SLOPE, % FULL, VELOCITY



WHAT ARE DESIGN CRITERIA BASED ON?

- Regulatory Agency and Industry Standards
  - Oregon Department of Environmental Quality (ODEQ)*
  - Bend Standards and Specifications
  - Ten States Standards
  - Washington State "Orange Book"
  - Previous Bend Planning Work
  - Engineering Best Practices
  - Other Municipalities

*ODEQ has primacy in Oregon for EPA regulations

DESIGN CRITERIA SHEET – SEE HANDOUT

PROPOSED COLLECTION SYSTEM DESIGN CRITERIA
FOR THE CITY OF BEND
OPTIMIZED SEWER COLLECTION SYSTEM PLAN UPDATE

Category	Bend 2011 Standards and Specifications	Redmond, Oregon	ODEQ Oregon Standards for Design and Construction of Wastewater Pump Stations (May, 2001)*	Composite of Other Sources**	Proposed Standard
During Peak Dry Weather Flows, d/D	≤ 0.8 at peak design flow (Part 2 Section 4.2.6)	NA	Not Mentioned	0.5 – 0.8	0.8
During Peak Wet Weather Flows, d/D	Not Mentioned	≤ 0.8	Not Mentioned	0.5 – 1.0	Covered under freeboard requirements
During peak wet weather flows, maximum surcharge (freeboard from water surface to manhole rim)	Not Mentioned	No Surcharging	Not Mentioned	No surcharging – 2.0 feet from manhole rim	Never less than 2.0 ft of freeboard system wide for unsealed gravity pipelines. Manholes with less than 2.0 ft from crown to rim will be identified and evaluated individually as exceptions or required improvements.
Shallow Manhole (crown of pipe to rim < 2.5 ft), during peak wet weather flows, maximum surcharge (freeboard from water surface to manhole rim)	Not Mentioned	Not differentiated from above criterion	Not Mentioned	No surcharging – 0.5 feet from manhole rim	Covered under freeboard requirements
Pump Station Firm Capacity	Pump capacity to discharge the Peak Hour Flow with one unit out of service, minimum 2 pumps operating alternately and an additional pump as installed backup (Part 2 Section 4.5.3)	Peak hour flow must not exceed lift station capacity with largest pump out of service (firm capacity).	A station with firm capacity to pump the peak hourly and peak instantaneous flows associated with the 5-year, 24-hour storm intensity of its tributary area, without overflows from the station or its collection system. (Part III, pg 5)	Minimum of 2 pumps installed – Firm capacity must be provided under design storm conditions	Firm capacity will be adequate for peak dry weather flow, total capacity will be adequate for total peak flow during the design wet weather event.
Maximum Force main velocity	8 ft/s at average daily flow rate (Part 2 Section 4.2.11)	8 ft/s	Pump suction lines - 3 to 5 ft/s Pump vertical discharge lines - 6 to 10 ft/s Pump discharge lines including force mains - 3.5 to 8 ft/s (Part VI.A, pg. 13)	5 – 10 ft/s	6 ft/s max under peak dry weather flows, 10 ft/s max under wet weather conditions with all pumps operating
Maximum gravity pipeline velocity	Not Mentioned	Not mentioned	Not mentioned	< 10 ft/s - < 15 ft/s, proper anchoring required above 10 ft/s	10 ft/s to identify pipelines that may require anchoring and regular inspection
Minimum cleansing/scouring velocity, gravity pipeline and force main	Gravity - 2 ft/s at average daily flow rate (Part 2 Section 4.2.7) Force Main - 3 ft/s at average daily flow rate (Part 2 Section 4.2.10)	Not mentioned	Pump suction lines - 3 to 5 ft/s Pump vertical discharge lines - 6 to 10 ft/s Pump discharge lines including force mains - 3.5 to 8 ft/s (Part VI.A, pg. 13)	2 ft/s for gravity pipelines 3 – 3.5 ft/s for force mains	2 ft/s flow rate attained during peak dry weather flow to maintain cleansing or identify pipelines in need of flushing.
Minimum cleansing/scouring velocity, siphon (2 barrels required)	Inverted Siphons shall not be permitted.	Not mentioned	Not mentioned	Inverted siphons not permitted – 3 ft/s where permitted	3 ft/s
Backup Power (Response Time)	Emergency Capacity reviewed on case by case basis (Part 2 Section 4.5.1.2), Standby Power required for new lift stations or existing lift stations that go through a "material modification" (Part 2, Section 4.5.3)	"Standby generators at most facilities".	Part X.U - Backup Power - For stations without a dedicated backup generator or a secondary electrical feed, install a manual transfer switch and an emergency plug-in power connection to the station for use with an approved portable generator. The plug-in connector shall be a as approved by the Owner. Part X.V - Standby Generator - A diesel-oil fueled, engine-driven electric generator unit shall be provided for all pump stations, unless otherwise approved by the Owner. Part VII.C - Wet Well - Stations without on-site standby generators or a second source of power shall be designed for a minimum one hour of holding time at the 5-year peak hourly design flow. Inlet sewers shall not be used to provide wet-well storage, except for linear self-cleaning designs.	Case by case – Onsite generator power required at all lift stations	Onsite Backup Power or Backup Diesel Pumps should be provided for any large or regional lift stations. Other lift stations (excluding private pumps) should comply with ODEQ guidelines for onsite storage, auxiliary power, etc.