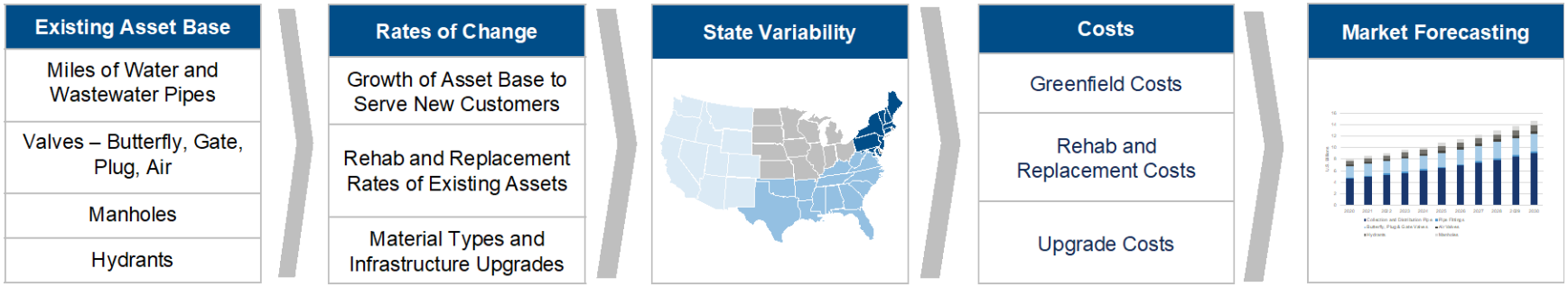
Section 2. Forecast Methodology & Assumptions

Exhibit 16: Bluefield Forecast Methodology



Source: Bluefield Research

2.1 Bluefield Approach & Assumptions

Bluefield's forecast is founded on the currently installed asset base, replacement, rehabilitation, and upgrade rates of major underground network asset classes. This report is focused exclusively on linear assets.

- **Linear assets** are defined as the water distribution and wastewater collection pipe systems and their critical components: valves, hydrants, and manholes.
- **Vertical assets** are defined as the pumping and lift stations and storage facilities integrated into these networks and connected water & wastewater treatment plants, including all components integrated into plants for conventional and advanced drinking water treatment and secondary and tertiary wastewater treatment. For more information on vertical assets please see U.S. Municipal Utility Forecast: Refining the Impacts of the Pandemic on Water Utility CAPEX

2.2 Building on the Existing Asset Base

Bluefield's data on the existing asset base is compiled from a range of sources, including publicly available data sets and assumptions that enable estimates of the number of installed assets.

- Water & wastewater pipe network growth estimates were calculated by combining baseline EPA pipe length data with pipe length-per-housing start ratios and private well/septic system usage rates, which vary by state and geography.
- Other assets integrated into water & wastewater collection and distribution networks including hydrants, manholes, and valves, were estimated using assumptions around the number of asserts per mile of water & wastewater pipe, which can vary by pipe size and geography.

2.3 Calculating the Underlying Costs

Costs for greenfield infrastructure, rehabilitation, replacement, and upgrades for existing infrastructure were triangulated from a range of sources including case studies, primary research from leading industry equipment suppliers, and project data pulled from utility Capital Improvement Plans (CIPs).

2.4 Determining Rates of Change

Bluefield's model quantifies the rate at which new underground network assets are added to the installed base, the rate at which assets are rehabilitated and replaced based on average lifespans.

New network infrastructure additions are based on urban and rural housing starts.

2.5 Geographic Inputs Shape Variability

Bluefield's model allows for differentiation of underlying assumptions across every state and territory. At a baseline, this flexibility allows for different growth rates in urban and rural population additions and to reflect regional differences in pipe material type and diameter.

2.6 Diverging Material & Hardware Costs

Costs of underground network assets are dependent on material type, size in terms of pipe diameter, and the labor associated with the equipment installation.

2.7 Sowing Seeds for Greenfield Infrastructure

The basis for the greenfield component of the forecast is to determine the rate of capacity additions to water & wastewater networks and treatment plants. These greenfield developments are based on housing starts, which require new network connections, along with state specific assumptions for pipe installed per housing start.

Exhibit 17: Greenfield Infrastructure Inputs

Greenfield Infrastructure Inputs	Growth Rate (%)
Pipe Construction Rate Urban Housing Starts	%
Pipe Construction Rate Rural Housing Starts	%

Source: Bluefield Research

2.8 Replacement & Rehabilitation to Maintain Current System

Replacement and rehabilitation rates are based on historical lifespans and replacement rates for water & wastewater network assets. This is in many cases larger than the recommended lifespan of the infrastructure but attempts to reflect the reality of the market, which in the U.S. reflects the delayed investment and increasingly aging systems. These rehabilitation and replacement rates vary by region, reflecting the diverging ages of pipe networks.

Exhibit 18: Example of Region Replacement and Rehabilitation Inputs, Northeastern U.S.

Infrastructure Asset Class	2021 Replacement / Rehabilitation Rate (%)
Rural Water Pipes	% / %
Rural Wastewater Pipes	% / %
Urban Water Pipes	% / %
Urban Wastewater Pipes	% / %

Note: This chart shows an example of the rates of change for the Northeast. Rehabilitation and replacement rates vary by region
Source: Bluefield Research