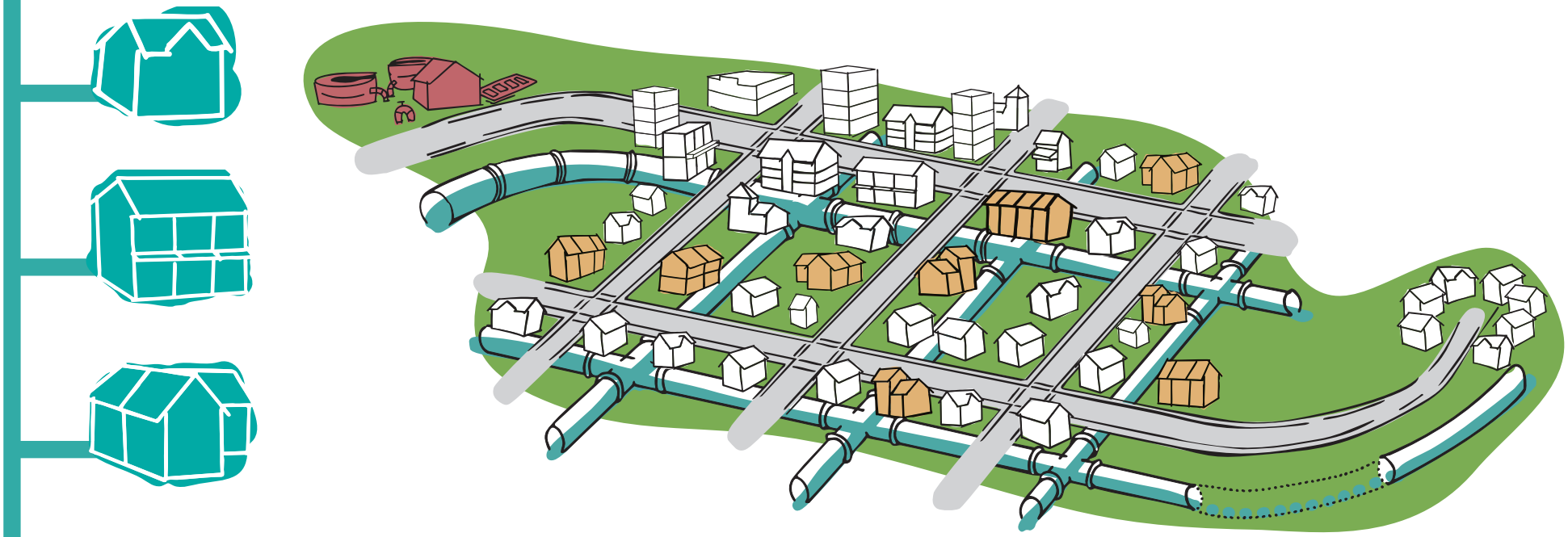

Flush the Fear

Middle Housing Can Fit Within Your Sewer's Capacity

June 2025
Research Brief

welcoming neighbors network

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Methodology

Between January and April 2025, the research team interviewed subject-matter experts on the impacts of infill middle housing on sewer-system capacity. Interviewees included several private-sector civil engineers with national practices, as well as urban planners and civil engineers within city planning and sewer agencies serving the City of Portland, OR; the Metropolitan Government of Nashville and Davidson County, TN; the City of South Bend, IN; and the City of Charlottesville, VA. This report and its conclusions should be attributed to the research team. The report does not represent the official perspective of any jurisdictions, infrastructure agencies, or private-sector engineers interviewed for this report.

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Special Thanks To

All interviewees, including public servants at the City of Portland, the Metropolitan Government of Nashville and Davidson County, the City of South Bend, and the City of Charlottesville.

Finley Heeb – Associate, Cascadia Partners (Illustrations)

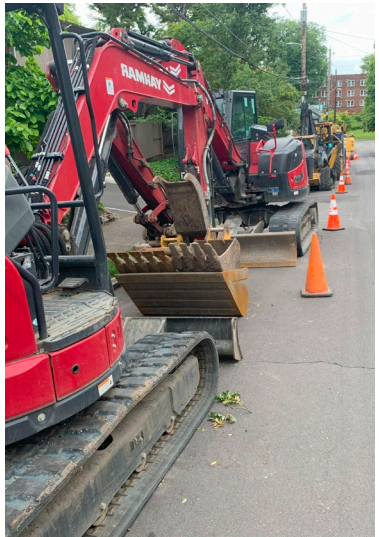
Don’t block middle housing over sewer concerns.

Most housing experts agree.

We have to create a lot of new homes to meet everyone’s needs. To help make more housing options available to workers, families, and downsizing seniors, many cities around the country are legalizing middle housing–such as duplexes, fourplexes, and townhomes–in neighborhoods that previously allowed single detached houses only.

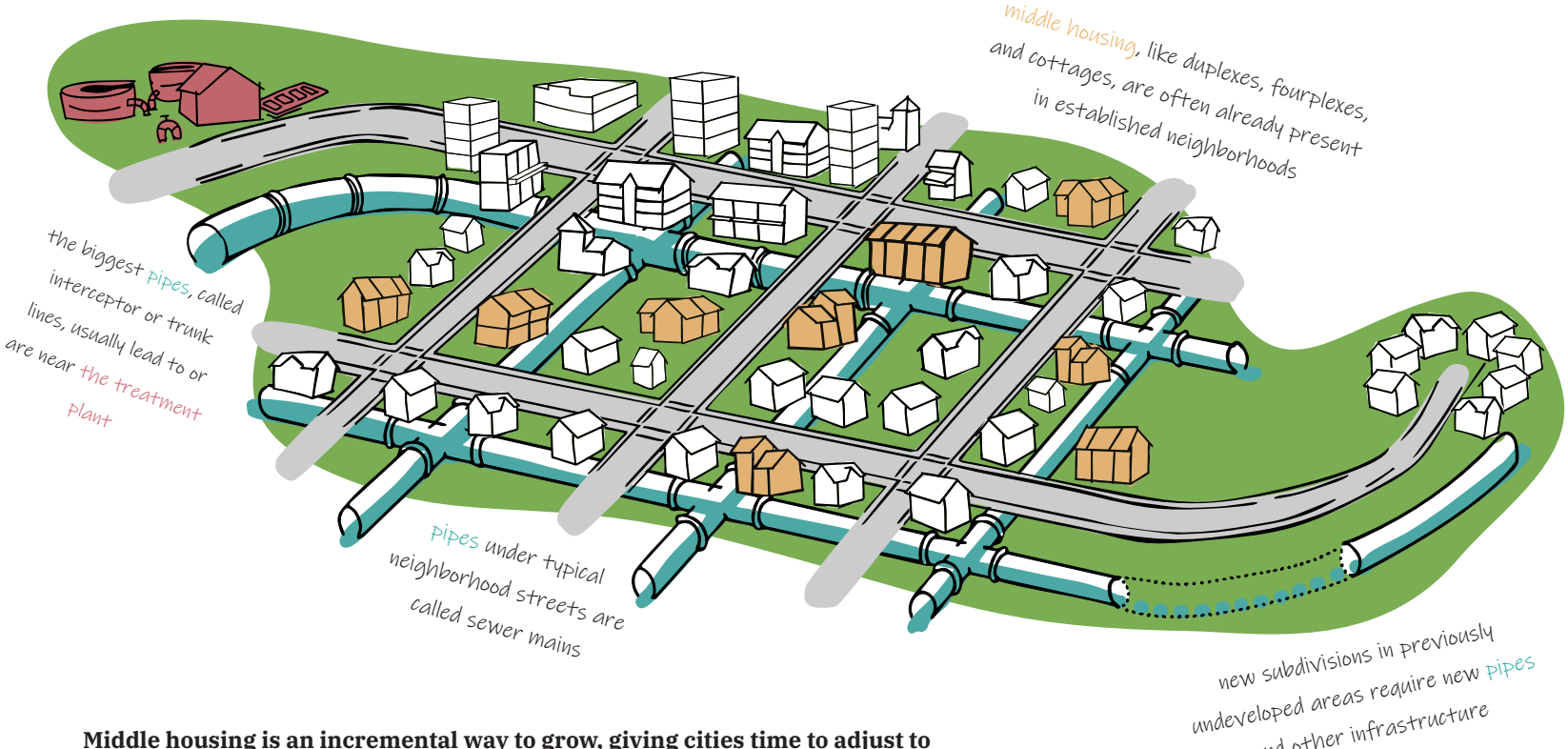
But can our cities’ existing sewers handle those additional homes and people without getting backed up? By and large, the answer is yes!

Adding middle housing in existing neighborhoods is a smart way to grow, and is generally accommodated by current sewer capacity. The four cities studied for this report–Portland, Nashville, South Bend, and Charlottesville–all serve as helpful examples: they have each allowed forms of middle housing without notable impacts to their sewer system’s capacity or performance. Their experience also shows it helps to do a little planning to prepare. Here are some things to remember to get it right.



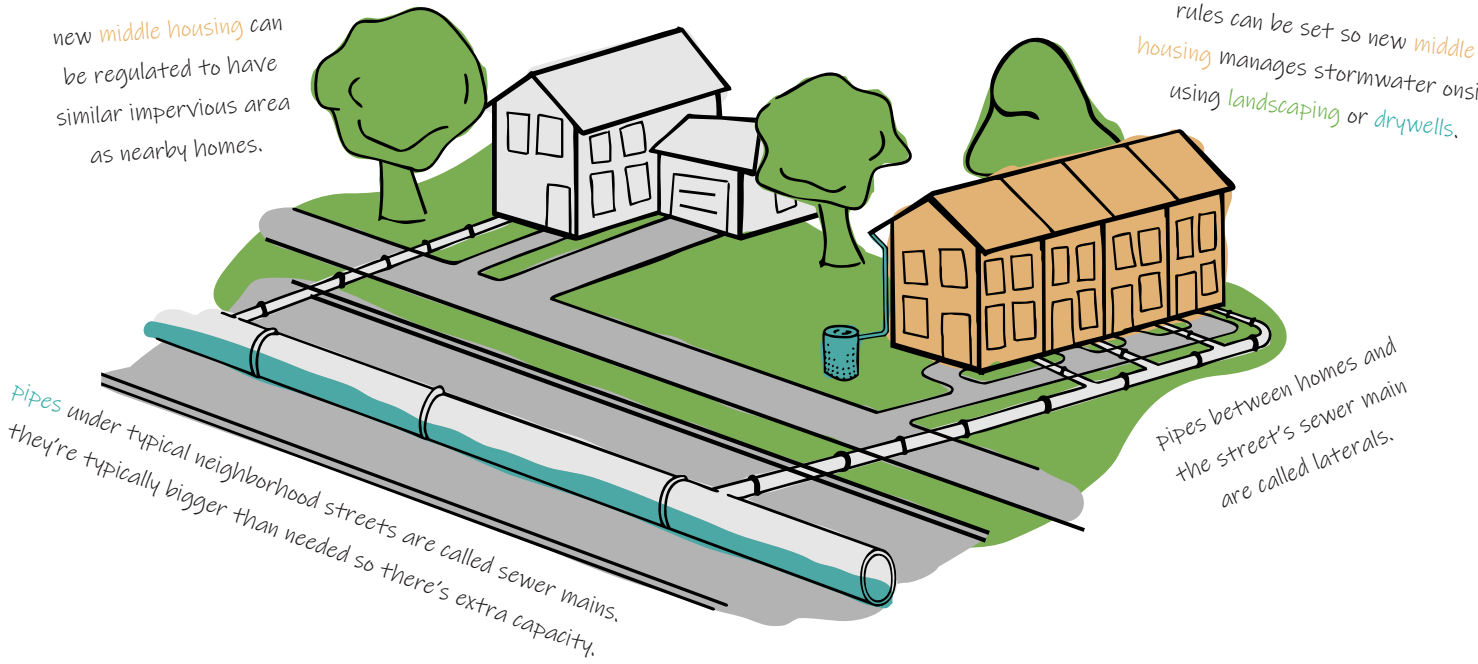
Adding middle housing to existing neighborhoods can actually save on infrastructure costs. Every kind of growth impacts infrastructure–not just middle housing. But growing by adding middle housing in existing neighborhoods can actually minimize infrastructure impacts, because using the neighborhood sewers cities already have is more affordable than building whole new neighborhoods with entirely new sewers.

Adding middle housing in existing neighborhoods disperses the impact of growth on sewers. Builders of large-scale housing developments sometimes need to upgrade nearby sewers or build new ones because their developments significantly increase sewer flows in one area. In contrast, middle housing tends to be added at smaller scales, more gradually, and across a wider area, spreading impacts across the sewer system and across time.



Middle housing is an incremental way to grow, giving cities time to adjust to meet infrastructure needs. Most often, the pace that middle housing is added into existing neighborhoods is incremental enough and the sewer impacts are limited enough that routine monitoring can detect capacity issues in advance. This gives cities time to adjust their policies if needed, require developers to make upgrades, or make upgrades themselves. It also gives cities currently under regulatory agreements to reduce sewer overflows into local waterways time to monitor their systems and make sure they stay on track to fulfill their agreements.

Neighborhood sanitary sewers–which carry wastewater from homes' drains and toilets–tend to be big enough to handle some additional homes. Sanitary sewer mains under neighborhood streets are typically a minimum of 8 inches wide. That's big enough to accommodate 100 or more homes. Often, in neighborhoods of detached houses, each sewer main serves far fewer than 100 homes, meaning there's extra local capacity. So, any capacity bottlenecks that might occur over the long run are actually more likely to appear downstream where multiple sewer mains converge into larger sewer trunks. But sewer trunks are sized to serve thousands–even tens of thousands–of homes, which makes it unlikely that middle housing will quickly or solely cause bottlenecks there. Public works departments are usually already aware of these bottlenecks and have plans to fix them.



Cities can enact policies to free up sewer capacity and reduce the sewer impacts of new homes, helping existing sewers serve more people. To manage *stormwater* sewer–which channels rainwater, melting snow, and water used outside buildings–cities can incentivize downspout disconnection, require onsite stormwater management for new homes, and limit new homes' impervious areas, particularly by not requiring new off-street parking. To manage *sanitary* sewer capacity, cities can require new homes to have efficient toilets and sinks and conduct maintenance to reduce stormwater from getting into cracked pipes–a common problem called inflow and infiltration. For cities with combined sewer systems where stormwater and wastewater flow in the same pipes, all of the above apply.

Engineers can embrace growth in existing neighborhoods and use it to make infrastructure more functional and financially sustainable. Civil engineers' role is sometimes viewed simply as providing infrastructure and services. But engineers should also embrace a role participating in strategic long-range planning discussions about how and where it's smart to grow. Engineers can help housing planners better leverage existing infrastructure and view infill growth as an opportunity to grow revenue for maintenance and investments in making systems more efficient, functional, and financially sustainable.

Urban Mythbusting

Myth	Truth
New middle housing on my street will overload the sewer system and cause sewage backups nearby.	This is unlikely. Neighborhood sanitary sewer pipes are typically sized for more homes than use them, and in many places water usage has fallen substantially over time due to conservation efforts and more efficient appliances. This means the nearby sanitary pipes typically have room to spare. Moreover, cities that know the location and size of their sanitary pipes can spot issues in advance and ask builders to resolve them.
Cities are not proactively planning for growth in their sewer systems and are not making necessary infrastructure upgrades.	Engineers at all cities interviewed for this report demonstrated this is simply not true. Engineers are actively aware of bottlenecks and planning for system improvements. They are often required by state and local government policies to conduct such proactive planning. They are typically consulted in middle housing legalizations and analyze system capacity to ensure infrastructure is prepared for middle housing. They often have monitoring systems in place so that they can detect and resolve issues before they manifest.
My street floods during storms, so the sewers cannot handle more homes or housing density.	Street flooding is most often due to a clogged sewer grate or stormwater overwhelming the sewer. Many cities require that new housing, including middle housing, does not add stormwater to the sewer and instead catches as much of it as possible in drywells or landscaping. Middle housing often doesn't have as much impervious pavement for parking too – especially if cities have reduced or repealed off-street parking requirements. In those ways, new housing can avoid adding (or even reduce) stormwater runoff into sewers. That means streets that flood can see new housing get built without it exacerbating street conditions. Sometimes a street does have real infrastructure deficiencies. But that doesn't mean the whole city's system is deficient and unprepared for growth. If cities know about specific bottlenecks, they can plan upgrades, ask developers to make upgrades if they want to build, and use growth to add ratepayers and fee revenue to pay for improvements.
Allowing middle housing is going to rapidly change cities, not leaving time to invest in infrastructure.	Around the country, cities by and large haven't observed rapid neighborhood change due to middle housing. Instead, middle housing construction has tended to be gradual and dispersed. That means middle housing is actually a way of growing that gives cities more time to plan for infrastructure.
The sewer is old, needs maintenance, & sometimes overflows into the river. It's not possible to add homes.	It is true that many sewer systems are old, need maintenance, and overflow into local waterways. But these are reasons to improve the sewer system and how residents use it rather than reasons not to grow there. Cities can enact a host of policies to minimize the impact of new homes on sewer capacity. And growth can help pay for sewer maintenance and improvements through new ratepayers and fee revenues.

Best Sewer Practices for Policymakers Implementing Middle Housing

How can cities best navigate sewer-related concerns during middle-housing implementation?

Collaboration + Coordination

Encourage collaboration between housing planners and engineers. Cities will benefit from collaboration between engineering and planning staff throughout middle-housing legalization and implementation. Engineers can help guide growth to best use existing infrastructure and planned investments. Engineers can help housing planners draft policy and code for how middle housing will connect to the sewer system under the street. And engineers and planners can collaborate on using growth as a way to incrementally move their city toward financial sustainability for core infrastructure systems.

Holistic Infrastructure Planning

Allow middle housing broadly, but transparently communicate about any bottleneck areas where developers may need to provide infrastructure upgrades. Two cities included in this report–Portland and Nashville– have allowed forms of middle housing across broad areas, while knowing certain parts of each city had infrastructure shortcomings. These broad middle housing allowances haven't resulted in significant sewer issues because both cities simply require developers to make infrastructure upgrades if the existing infrastructure isn't adequate. This prevents development from overwhelming any inadequate system. Ideally, cities should work to avoid surprising developers by communicating clearly to them where bottleneck areas are located and thus the risk of having to invest in public infrastructure is highest. This will naturally guide development toward areas with adequate infrastructure.

Know your sewer system and monitor sewer capacity regularly. Cities should know the size, location, type, age, and performance of their sewer infrastructure. Cities should regularly and transparently study sewer capacity and improvement needs, such as during comprehensive planning or capital improvement planning processes. When legalizing middle housing, cities can leverage or build upon such existing processes to examine how middle housing might influence growth trends, providing a forum for any necessary adjustments to sewer maintenance and improvement plans. Sewer flows at treatment plants, subbasins, known bottlenecks, and other key parts of the system should be monitored on an ongoing basis to track performance so that needed upgrades can be identified and planned for.

Consider offering pre-approved middle housing plans and example site plans. These can save money for smaller developers but also demonstrate the design choices that will minimize sewer impacts (e.g. reducing impervious area, using efficient fixtures, connecting to a shared sewer pipe).

Policy Guidance and Tools for Sewer Impact Mitigation

Minimize the sewer impacts of new housing through policy. Cities can manage and improve stormwater sewer capacity by incentivizing downspout disconnection, requiring onsite stormwater management for new development, and limiting new homes' impervious areas, particularly by not requiring parking. Cities can manage and improve sanitary sewer capacity by incentivizing and requiring efficient toilets and sinks and conducting maintenance to prevent stormwater from getting into cracked pipes. An important aspect of many of these policies is they don't cost much to implement.

Leverage emerging implementation best practices for connecting middle housing to existing sewers. Cities should allow a shared sewer pipe of a minimum of 6 inches in diameter to serve multiple middle housing units rather than requiring each middle-housing unit to connect to the sewer main individually. Middle housing units on shared sewer pipes should also require mitigation measures and legal documentation (e.g. backflow prevention valves, a recorded utility easement, and a shared maintenance agreement among property owners on the shared sewer). Cities should encourage state-level building and plumbing code officials to provide further statewide guidance and cross-jurisdictional standardization of code requirements.

Test your stormwater management requirements to ensure they're physically and financially feasible. Requiring some amount of onsite stormwater management for new development can be a helpful tool to bypass constrained storm sewer capacity. However, cities should test potential requirements to ensure they are physically and financially feasible to meet and not so complex as to discourage people from building middle housing.

Images: *Landscaping for Stormwater Mitigation at Cully Green and Tillamook Row. Accessed via Sightline Institute* [Modest Middle Homes Library.]

Image: *Portland from Pittock Mansion. Accessed via Wikimedia Commons, User: King of Hearts.*

CASE STUDY

PORTLAND, OR

West Coast **630,500**

During Portland's middle housing legalization effort, a Portland Bureau of Environmental Services (BES) analysis confirmed that the combined sewer system covering most of the City had adequate capacity to handle forecasted housing growth due to middle housing. In the three years since, the city has seen roughly 1,400 middle housing and accessory dwelling units added atop the system without apparent issue–as expected. One of the primary factors supporting this outcome is how the City handles stormwater. In Portland, the vast majority of combined sewer flows come from stormwater rather than sanitary sewer flows. But new development resulting in at least 1,000 sf of additional impervious area is required to manage its stormwater on-site to the extent feasible, reducing flows into the combined system and preserving capacity. Portland's middle housing rules support that outcome by limiting how much of each lot can be covered by buildings and hard surfaces, leaving more open, porous areas to absorb stormwater.

QUICK FACTS

IMPACT

Middle housing has not caused and is not expected to cause sewer capacity problems. Sewer infrastructure is monitored and capacity investments are prioritized to meet public needs.

TYPE OF SEWER SYSTEM

Mostly combined with some separated system areas.

MIDDLE HOUSING LEGALIZATION

- 2-6 unit structures
- ADUs
- Cottage Clusters

Throughout lower-density residential neighborhoods (2021-22).

MIDDLE HOUSING PRODUCTION

Hundreds per year, largely fourplexes.

The System

Portland has a combined sewer system, meaning stormwater and sanitary sewage share the same pipes in many areas. While the City has added separate storm sewers and additional facilities to infiltrate stormwater in parts of Portland, most older neighborhoods still use the combined system, with some pipes Downtown dating back over 100 years. The combined system has large pipes, which are advantageous from a capacity perspective. But it has a critical problem: when downstream treatment and storage capacity is exceeded, such as during heavy rains, the system is designed to overflow sewage into nearby rivers.

In 1991, Oregon's Department of Environmental Quality and The City of Portland entered into a formal agreement to sharply reduce sewer overflows into rivers. The City completed the Big Pipe Project in 2011, which added large pipes capable of storing up to 119 million gallons of stormwater and sewage before pumping it to treatment plants. This reduced sewer overflows into the Willamette and Columbia Rivers by 94% and 99% respectively.[1] Even with the Big Pipe Project complete, BES staff grapple with a backlog of deferred maintenance and must carefully prioritize money for capacity improvement.

Portland allows middle housing on most residential lots, with 1,400 new middle housing and ADU units produced in the last three years.

In 2021 and 2022, in two successive stages of code changes, Portland adopted the Residential Infill Project (RIP) and began permitting duplexes, triplexes, fourplexes, affordable sixplexes, cottage clusters and expanded ADU allowances in its lower density residential zones. Since RIP adoption, Portland has permitted 1,400 new ADU and middle housing units, which–according to a recent study–sold for roughly $250,000 less on average than new detached houses.[2] Most of this development has been focused in the same areas where infill housing development occurred before RIP's adoption: inner neighborhoods, particularly SE, NE, and N Portland, that are served by the City's combined sewer system.

Capacity modeling by Portland's Bureau of Environmental Services concluded the sewer system's capacity is adequate for middle housing.

When developing RIP, Portland's Bureau of Planning and Sustainability (BPS) updated its Buildable Land Inventory (i.e. its land capacity and growth model) to reflect proposed density increases and new development restrictions in areas with topographical and flooding constraints. Portland's Bureau of Environmental Services (BES) used that update to assess where dwelling units were expected to increase and how that would impact both the City's combined and separated sewer systems.

BES found that the combined sewer system has adequate capacity to handle added density from middle housing. Stormwater, rather than sanitary sewage, is the main contributor to and consideration for combined sewer capacity. However, much of the expected infill will occur in areas where the combined system is supplemented by underground injection control systems, which filter stormwater into the ground and keep it out of sewers. Additionally, the City had already planned capital improvement projects to address known capacity issues in the combined system over the next 20 years. In essence, the City already had a plan for ensuring it could handle the growth from RIP.

BES found that in areas of the City with a separated sewer system, sanitary sewer capacity is adequate to handle the growth from RIP. Stormwater capacity in these areas face more challenges due to the system's complexity and existing deficiencies. The separated stormwater system consists of an intricate network of pipes, ditches, streams, wetlands, engineered structures, and drainageways that manage the conveyance, detention, and treatment of stormwater runoff. This network is hard to maintain, in poor condition, and was built to differing regulatory standards depending on the section of the network and when it was built. Some areas of the system are further challenged by steep slopes and impermeable soils and surfaces. The combination of these challenges means the separated stormwater system covering part of the City is likely inadequate for infill middle housing in

1. About combined sewer overflows. (n.d.) City of Portland. Retrieved March 11, 2025 from https://www.portland.gov/bes/about-csos
2. Portland sees significant production of middle housing resulting from recently adopted zoning changes. (2025). City of Portland. Retrieved March 11, 2025 from https://www.portland.gov/bps/planning/rip2/news/2025/2/4/portland-sees-significant-production-middle-housing-resulting

some locations. BES assessed this issue as affecting roughly 6% of residential lots affected by RIP.

In those cases where stormwater capacity is an issue, City policy decisions helped allay the concerns. Lot coverage allowances are unchanged under RIP and FAR (Floor Area Ratio) is capped, keeping building footprints modest. This means new middle housing is not likely to increase the overall impervious surface of a lot any more than a new single family home would. For new development, developers are required to either manage stormwater on site, pay a fee in lieu which goes towards managing the stormwater system, or wait for BES to install needed infrastructure on their own timeline. These policies ultimately drive middle housing development towards the remaining 94% of lots where sewer capacity is adequate.

For Portland's combined sewer system, additional stormwater from development is the primary concern. Portland is addressing that concern in several ways.

For Portland's combined sewer system, stormwater contributes much more to peak flows than sanitary sewage. The biggest challenge historically has not been sanitary sewer flows or capacity, but rather managing overflows into nearby rivers caused by heavy rain storms.

In order to improve sewer capacity and prevent overflows, the City determined in the 1980s and 90s – decades before middle housing reforms were under consideration – that it had to make big investments and policy changes. In the years since, the City:

- Completed the $1.2B Big Pipe project, a massive infrastructure investment that added large pipes capable of storing up to 119 million gallons of sewage during peak flows, nearly eliminating combined sewer overflows.
- Encouraged homeowners to disconnect their downspouts by offering a discount on their utility bill, redirecting stormwater into the ground rather than the combined sewer.
- Required through its Stormwater Management Manual that, in most cases, stormwater from new development must be managed on-site where feasible, ensuring reduced stormwater flows into the combined system.
- Experienced a steady decrease in water use, thanks to water conservation efforts like updated building codes requiring efficient fixtures and appliances.

These efforts—investments in infrastructure, policies for managing stormwater, and water conservation—were needed irrespective of zoning reform. But what's more, they have resulted in a sewer system with enough capacity to nearly eliminate sewer overflows while supporting growth to date and into the future.

Portland's infrastructure bureaus are taking on broader roles, balancing service responsibilities with growth planning and management.

Now that the City has met its combined system overflow obligations through the Big Pipe Project, BES has shifted to focus on new critical investments. A backlog of deferred improvements has left infrastructure including treatment plants and high risk trunk lines– those under highways and rivers– needing repair or replacement. With limited financial resources, the bureau will likely have to be more reactive than proactive to issues within the combined system while staff focuses on those deferred improvement priorities.

This sort of compromise is common for BES, which as a bureau has historically been viewed as a service provider. With limited funds, it is impossible to meet all the needs of the community at once. Yet, the RIP process seemed to bring to light the key role BES plays in analyzing and preparing policy to enable growth. BES and other partner bureaus have begun conversations and organizational alignment around BES's role in

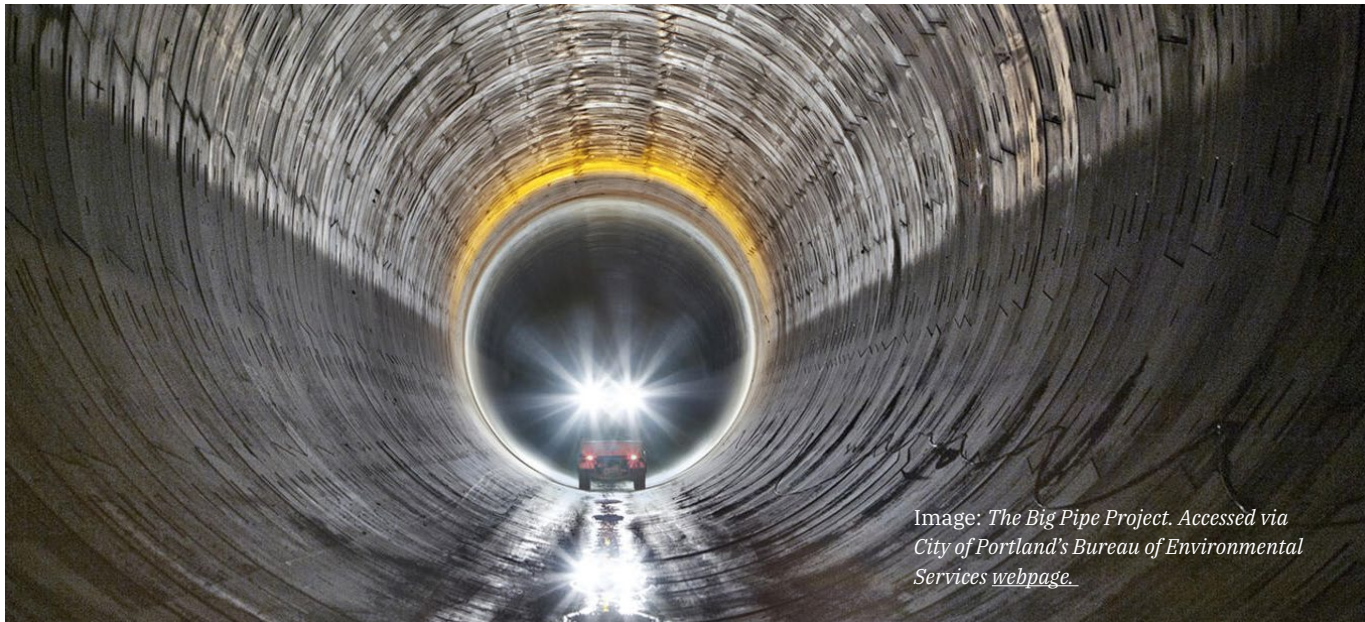
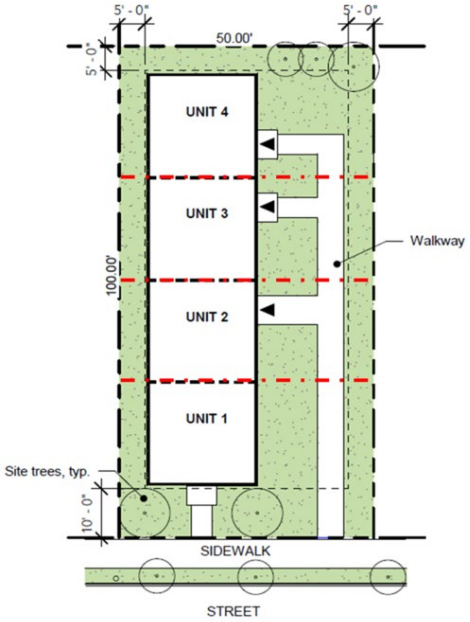


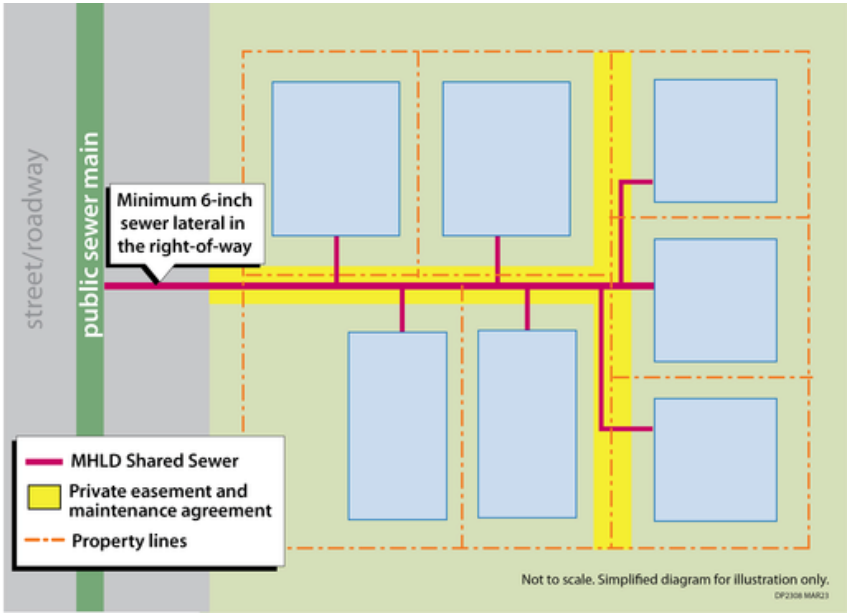
Image: *The Big Pipe Project. Accessed via City of Portland's Bureau of Environmental Services webpage.*

helping the City think critically about where and how to grow, elevating the bureau beyond being just a service provider. As a reflection of that organizational change, BPS and BES, along with Portland's Transportation and Water Bureaus, recently created an Infrastructure Investment Coordinator role to take a more strategic, big-picture approach to planning for growth.

BES is not alone in adapting and taking on new challenges to accommodate middle housing. Portland Permitting and Development (PP&D), in partnership with BES and BPS, played an integral role in on-the-ground implementation. It ended a decadeslong policy of disallowing shared sewers and established from whole cloth new best practices for sewer connections from middle housing units to existing public sewer mains under the streets. Those best practices include a minimum 6-inch shared lateral pipe, backflow prevention valves for all housing units, a recorded utility easement, and a shared maintenance agreement among property owners on the shared sewer. PP&D has also advocated for state-level building and plumbing code guidance around shared sewers, an implementation best practice for areas considering statewide reform.

These new roles and approaches are still in their early stages; the City is still strategizing on how to best invest in areas with high development potential and facilitate and use growth to expand the base of ratepayers to help maintain the City's infrastructure. But the City has opened the door to such planning and collaboration through its trailblazing work around middle housing. This bodes well for the idea that infrastructure and growth can be complementary rather than opposed in the decades to come.





Images: *Middle Housing Land Division (MHLD) Examples with a Shared Sewer. Accessed via City of Portland's main MHLD and sewer connection webpages.*

Image: *Nashville City Skyline. Accessed via Visit Music City webpage.*

CASE STUDY

NASHVILLE, TN

Southern US **688,000**

Metro Nashville has seen significant growth and development in recent decades, adding thousands of middle housing units to existing neighborhoods. During that same time period, the City has maintained reliable sewer service and made significant strides toward reducing sewer overflows into local waterways. To support future infill and greenfield development, Metro Nashville is now completing a Housing & Infrastructure Study to direct housing growth–which is anticipated to include new middle housing allowances–toward centers and corridors where investments are being made to expand infrastructure capacity. Considered together, Nashville's experience demonstrates two key principles: cities and counties can successfully add middle housing to existing neighborhoods and sewer systems, and continual maintenance, investment, and planning is required to support a well functioning and growing system.

QUICK FACTS

IMPACT

Small-scale infill middle housing has not caused sewer capacity problems. Large-scale subdivisions that include middle housing sometimes require sewer infrastructure investments. The City is studying how to align future growth with existing and planned infrastructure capacity.

TYPE OF SEWER SYSTEM

Separated with some legacy combined system Downtown.

MIDDLE HOUSING LEGALIZATION

- Duplex (attached & detached)
- Townhouses

These have been allowed in some areas of the city for more than a decade.

MIDDLE HOUSING PRODUCTION

Over 1,000 attached single-family units and detached skinny lot developments per year.

The System

Metro Nashville, a consolidated city-county government, has the fourth-largest separated sewer system in the nation, with a legacy combined sewer system making up roughly 2% of the total system.[1] Starting in the 1990s, Metro Nashville reached an agreement (called a consent decree) with the Environmental Protection Agency and the State of Tennessee to work to prevent sewer overflows into local waterways. According to Nashville's 2011 Long-Term Control Plan, these efforts successfully reduced average annual overflow volume by roughly 60% between 1990 and 2009.[2] However, work remained to be done, and in 2009 a federal consent decree required additional actions to meet Clean Water Act standards. To date, Metro Nashville has invested roughly $2 billion and anticipates spending roughly another $1 billion to complete required upgrades and comply with regulatory agreements. Investments are aimed at reducing overflow volumes as well as bacterial levels in receiving streams and rivers when overflows do occur. As a secondary benefit, investments tend to reduce inflow and infiltration and redirect stormwater into separated sewer systems, helping expand capacity for other sources of sewer flows, such as growth.

Nashville has experienced significant middle-housing development for more than a decade.

Nashville's population growth has outpaced its comprehensive plan's projections over the past two decades. Between 2010 and 2024, the city added nearly 88,000 new households. This significant growth has driven demand for diverse housing options and highlighted the need for infill and higher-density developments to accommodate new residents near the central business district.

While Nashville does not have widespread allowances for all types of middle housing, the City has an established permitting pathway and history of allowing infill townhomes and detached duplex development. A significant driver of this trend is the Horizontal Property Regime (TN Code§ 66-27-104), a 1960s state law that facilitates small-scale infill ownership housing by allowing two detached units on a single lot without subdivision or HOA requirements. From 2010 to 2023, nearly 9,000 detached duplexes (also called tall-skinnies locally) were constructed, and between 2010 and 2020, annual permits for townhouses ranged from 1,000 to 2,000 units.[3]

Nashville's thousands of units of infill middle housing development have not resulted in localized sewer issues–and when capacity is found to be inadequate, Metro Water Services requires the developer to invest in upgrades.

The City's sewer system has functioned reliably despite years of rapid growth in both infill and greenfield settings. This is likely due to a confluence of factors, such as existing excess sewer capacity, investments in infrastructure capacity, rehabilitation, and replacement to comply with regulatory agreements, and a practice of making developers pay for local capacity upgrades needed to adequately serve new units. Specifically, developers must either fund infrastructure upgrades or abandon projects when sewer capacity is found to be insufficient, a scenario most common with larger developments like subdivisions or apartment complexes. While such requirements can frustrate and surprise developers, they appear to have effectively prevented localized sewer problems while facilitating housing growth.

According to a lead engineer for Metro Water Services, small infill developments rarely raise sewer capacity concerns. While hypothetically a high concentration of infill in a small area could eventually necessitate sewer upgrades, that has not been observed often to date. Moreover, in that hypothetical case, the costs of the infrastructure upgrade would ultimately fall on the development that might cause the sewer to switch from a functional to non-functional level of flow. That developer's project may or may not be able to shoulder the infrastructure cost, meaning the project could stall. However, this demonstrates the rarity of small scale infill development causing issues in Nashville and the

1. Stormwater Program FAQ. (2018). Metropolitan Government of Nashville & Davidson County. Retrieved April 23, 2025, from https://filetransfer.nashville.gov/portals/0/sitecontent/WaterServices/Stormwater/docs/FeeRestructure/Stormwater%20Program%20FAQ%20v2018.1.11.pdf
2. Long Term Control Plan. (2011). Metropolitan Government of Nashville - Davidson County, Tennessee Department of Water and Sewerage Services.
3. The Housing and Infrastructure Study Initial Findings and Preliminary Recommendations. (2025). Nashville Planning. Retrieved April 29, 2025 from https://publicinput.com/Customer/File/Full/77ddef52-7976-4ef3-98c9-cf3bc98affa2

natural safeguard Metro Water Services has in place due to being able to require developers to make upgrades when they are needed.

Future housing density increases in Nashville are being prioritized where there is existing infrastructure capacity and planned funding for expansion.

In 2024, the Metro Council adopted a resolution directing city departments to study policy changes that would expand housing allowances in alignment with infrastructure capacity and planned infrastructure improvements. In response, Metro Nashville launched the Housing and Infrastructure Study, which includes a review of regulatory barriers to housing, infrastructure capacity, and funding needs to support anticipated growth. Sewers are one of the infrastructure systems being studied, and while they are an important consideration the regional transportation system appears more poised to guide Nashville's growth pattern. Transportation and development are commonly linked, but in this case coordination is being emphasized as, in November 2024, Metro Nashville voters approved a $3.1 billion transportation improvement plan aimed at improving Metro's bus system, sidewalks, bike lanes, and traffic signals.[4]

Areas near those investments are logical locations to allow more housing, including middle housing and various scales of apartments. The study will reveal the extent to which the existing sewer system in such locations can accommodate denser forms of housing, with large apartments being the primary concern. If capacity is found to be inadequate, Metro Water Services–which does not receive sales tax or property tax revenue–may find itself seeking funds for improvements. A capacity charge Metro Water Services levies on all new connections to the public sewer could play a critical role in funding such improvements. Those funds are restricted for use on upgrading pipes greater than 15" in diameter. While that restriction is limiting, areas in and near downtown, neighborhood centers, and along transportation corridors are candidates likely to qualify for those funds. This will assist Metro Nashville in upgrading sewer capacity, coordinating those improvements with transportation investments, and supporting housing growth, including middle housing and apartments.

4. The Housing and Infrastructure Study Initial Findings and Preliminary Recommendations. (2025). Nashville Planning. Retrieved April 29, 2025 from https://publicinput.com/Customer/File/Full/77ddef52-7976-4ef3-98c9-cf3bc98affa2

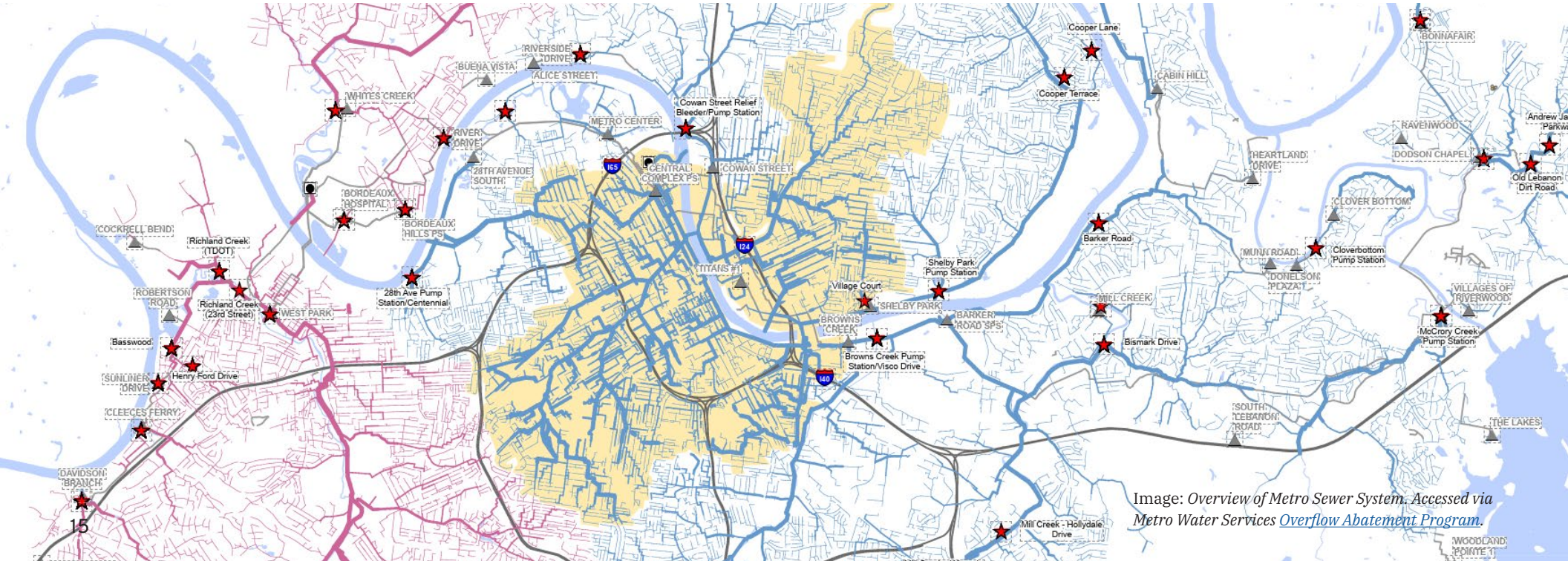


Image: *Overview of Metro Sewer System. Accessed via Metro Water Services Overflow Abatement Program.*

Image: *Downtown South Bend. Accessed via Wikimedia Commons, User: Scott Palmer*

CASE STUDY

SOUTH BEND, IN

Midwest **103,500**

In 2019, South Bend updated its zoning ordinance to allow middle housing, resulting in over 230 units built, under construction, or permitted, including duplexes, cottages, ADUs, and small-lot single detached homes. The City's sewer capacity can currently sustain this level and pace of development. However, capacity would need to be reevaluated if significantly more development occurs than expected, due to the federal mandate the City faces to reduce sewer overflows into the St. Joseph River.

Because stormwater contributes much more to combined sewer flows than sanitary sewage, the City's Planning Department may eventually need ways of assuring engineers that middle housing won't increase stormwater flows into the existing combined system. This could include stricter requirements for onsite stormwater management or changes to where middle housing is allowed to focus on the City's less capacity constrained sewer basins.

QUICK FACTS

IMPACT

Middle housing has not caused sewer capacity problems. Sewer infrastructure is monitored and new investments could be required if significantly more or faster development occurs in the future.

TYPE OF SEWER SYSTEM

Mostly combined with some separated system areas.

MIDDLE HOUSING LEGALIZATION

- 2-6 unit structures
- ADUs
- Cottage Clusters

In over 10 neighborhoods to date (2019-ongoing iteration).

MIDDLE HOUSING PRODUCTION

Dozens of units per year.

The System

The City of South Bend has a combined sewer system, meaning stormwater and sanitary sewage share the same pipes in many areas. The system has a critical problem: during peak flows events, such as heavy rains, the system overflows into the St. Joseph River, degrading water quality. The City of South Bend has significantly reduced overflows in recent decades, but it still releases hundreds of millions of gallons of stormwater and sanitary sewage into the river each year. The City is investing $276M to effectively end overflows, but these investments may not leave the system with additional capacity to accommodate rapid or significant growth.

South Bend overflows over 300M gallons of combined sewer flows into the St. Joseph River each year. Growing while reducing these overflows is a balancing act.

The City of South Bend's combined sewer system has a long history of overflows into the St. Joseph River. Despite losing roughly 30,000 residents since 1960, the City sustained annual overflows of 1-2 billion gallons of mixed stormwater and sewage into the river during the 2000s, degrading water quality and violating the Clean Water Act. This attracted the attention of federal regulators, and in 2012 the City entered into a legal agreement called a consent decree with the U.S. Department of Justice and the Environmental Protection Agency. That original consent decree was renegotiated in 2021 and now requires $276M in investments through 2038 to reduce overflows to under 800,000 gallons per year, less than 1% of previous levels.[1] According to a City engineer, if the City does not succeed, it could face fines in the ballpark of $10,000 per day.

Today, the City's initial investments are paying off. Overflows have been reduced by about 80% because of a new "smart sewer" system that strategically holds back sewage in pipes with excess capacity, while allowing pipes already at capacity to flow into storage or treatment. This success is worth celebrating, but it also illustrates the aging system's capacity constraints and the balance required to prevent overflows. According to one engineer, the City system requires another decade of investment in reducing overflows per the regulatory agreement, and then faces a maintenance backlog of crumbling pipes that allow storm and groundwater to infiltrate and crowd its facilities.

South Bend allows middle housing in many of its neighborhoods and is seeing gradual production–so far, often with the help of subsidy.

At the same time that the City is working to significantly reduce sewer overflows into the St. Joseph, it is working to encourage growth and revitalize neighborhoods that sustained population loss and residential demolitions over the past 60 years. Encouraging middle housing – a common, historic typology in South Bend – is part of the City's growth strategy. In 2019, the City Council adopted updates to the City's zoning ordinance that opened the door to middle housing development. The City Planning Department has followed that change by offering pre-approved middle housing plans and conducting an iterative process to refine development regulations and promote middle housing. That process has resulted in over 10 neighborhood plans identifying the areas and lots that will allow middle housing. The City, whose housing development activity and growth has tended to center on higher end product types near Notre Dame, has seen over 230 units of middle housing and small-lot detached homes get permitted, break ground, or be completed–most often with the support of some subsidy or the use of pre-approved plans.

South Bend's sewer system can accommodate the middle-housing growth to date, but faster or more significant growth might require new policies to reduce new flows.

A City engineer said that the current pace of middle housing production does not threaten the City's capacity or ability to fulfill its consent decree. But if production significantly ramped up like the Planning Department hopes, concerns about meeting the terms of the consent decree would emerge. The City engineer indicated that while a few dozen or even a few hundred units would likely not be an issue, thousands of infill units distributed across the system would be. That's because all of the City's combined sewer pipes feed downstream into large interceptor pipes, the point at which overflows into the river occur. Significantly more sewer users distributed across the sewage basins likely wouldn't affect pipes' capacity within those individual basins. However, collectively they could threaten the work the City is doing to manage flows into its downstream

1. USDC IN/ND case 3:11-cv-00505-JD-MGG. (2021). United States District Court Northern District of Indiana South Bend Division. Retrieved February 11, 2025 from https://southbendin.gov/wp-content/uploads/2022/04/SAGE.pdf

interceptor pipes and prevent overflows. While the City has made significant strides toward minimizing flows from growth–such as mandating Citywide disconnection of downspouts and sharply curtailing expansion to new users at the system's edges–it is starting from a capacity deficit given its history of overflows.

Per one engineer, growth could be a fiscal boon to the City but other development paradigms may need to be explored, such as riverside apartments that use developer-funded infrastructure to directly drain stormwater into the river, bypassing the existing system. Because stormwater contributes much more to combined sewer flows than sanitary sewage, City engineers may ultimately need policymakers to ensure that growth, including middle housing, isn't adding too much stormwater to the City's sewer flows. This could include stricter requirements for onsite stormwater management or policy changes that concentrate middle housing development in the City's less capacity constrained sewer basins. Regardless, if the City sees faster growth in the coming years, City staff will likely find themselves continuing to evolve the balance of competing goals: growth, financial health, and infrastructure capacity and operations.

Image: *Infill Housing Diagrams. Accessed via City of South Bend's "Neighborhood Infill: Pre-Approved, Ready-to-Build Housing" Catalog.*

Image: *Bird's-eye view of the city. Accessed via UVA Today webpage. By Sanjay Suchak, University communications, UVA*

CASE STUDY

CHARLOTTESVILLE, VA

Eastern US **45,000**

Charlottesville has sufficient sewer capacity for middle housing and does not anticipate sewer capacity issues from middle housing development. The comprehensive planning process requires city engineers to review sewer capacity every five years, which–given the modest, incremental pace of infill middle housing development–provides enough time to monitor capacity and plan for upgrades if needed. In line with that approach, Charlottesville's Department of Utilities plans for upgrades by reviewing the capacity of the system through flow monitoring, and prioritizes work dependent on the monitoring results. Though the City does not anticipate issues, if or when infill exceeds several hundred units, engineers will monitor capacity more closely to determine if planned sewer investments need adjustment or reprioritization.

QUICK FACTS

IMPACT

Middle housing is not expected to cause sewer capacity problems. Sewer infrastructure is monitored and capacity investments are prioritized to meet public needs.

TYPE OF SEWER SYSTEM

Separated.

MIDDLE HOUSING LEGALIZATION

6 to 12 units per lot in RB district

8 to 12 units per lot in RC district

These allowances were put in place in 2023.

MIDDLE HOUSING PRODUCTION

None yet.

The System

Charlottesville has a separated sewer system, meaning sanitary and storm sewer flows run in separate pipes. The City manages its stormwater, and then Rivanna, the local water and sewer authority, treats the City's wastewater. Rivanna covers a larger geography than just the City, handling water and wastewater treatment for the County as well.

Cross connections between sanitary and storm, deteriorated pipes underground and by creeks, and a neglected stormwater system were contributing to inflow and infiltration into the sanitary system, increasing flows. The Virginia Department of Environmental Quality and the City agreed to a consent decree in 2010 because inflow and infiltration during peak flows and heavy rain events were causing unpermitted discharges into the river. By 2017, around 28% of sanitary and 6% of storm infrastructure had been replaced or rehabbed due to the consent decree. The investment in infrastructure reduced the amount of extra water getting into the sanitary pipes and dropped peak flows in some local sanitary basins by 50 to 60 percent.

Charlottesville's new zoning code allows at least 3 units on lots formerly zoned for single dwellings, but the City has not approved any permits yet.

In 2023, the City passed a new zoning ordinance that allows more than one dwelling unit on lots previously zoned only for one dwelling unit. Under the new code, the RA district allows lots to have up to three units or six if those additional units are affordable. Similarly, in the RC district, lots can have up to eight units or twelve units if those additional units are affordable. Most of the City's land already has some form of development on it, so while the new zoning ordinance opens up a lot of land to middle housing development, that growth is likely to occur through redevelopment and infill on unused parts of parcels.

A member of the City's planning department indicated that, since the ordinance's adoption, the City has approved no permits for development of more than one unit on a lot. City staff suspect the lack of applications could be due to stormwater management requirements placed on residential development. Specifically, the City requires developments disturbing six thousand square feet or more of lot area to comply with Virginia Erosion and Stormwater Management Regulations. These requirements include physical interventions that take up significant space on a lot–such as sediment traps, stormwater detention, and vegetative cover–with the goal of not only capturing stormwater but treating it to state water quality standards. First, these requirements are technically complex, which may discourage smaller scale developers or homeowners from attempting to navigate them. Second, while requiring these stormwater interventions may not seem like an issue on its face–for instance, other cities also require on-site mitigation–on smaller lots there does not appear to be enough room to install the required facilities for stormwater management alongside the development of multiple units. According to testing completed by engineering partners of the City, if a site isn't capturing all of its impervious-area stormwater–for example due to a driveway directing water into the street–the amount of additional impervious area allowed on an infill site drops significantly under existing state rules. While there may be other obstacles within the City's development standards that hinder the feasibility of building infill housing, it appears these state requirements and the City's 6,000 square foot disturbance-area threshold triggering them amount to a significant physical barrier to development.

The other side of this issue is that, even with a separated sewer system, stormwater management is a factor in maintaining adequate system capacity. In other words, it is reasonable for jurisdictions to have–particularly in the context of superseding state law–some requirements related to stormwater management. The issue in this case appears to be that the stormwater management requirements are not calibrated to facilitate the infill housing production the City is interested in promoting. City staff are aware of this issue and are considering a study to evaluate the potential impacts on housing production and stormwater system capacity of increasing the City's disturbance-area threshold to be more in line with the 10,000 square foot threshold allowed by the state.

The City currently has sufficient sewer capacity for infill middle housing development.

Despite what might be implied by the City's stormwater management requirements, the City has enough capacity in its sewer system to accommodate incremental infill middle housing development. One City engineer reported that, due to the City's investments during the 2000s and 2010s in pipe rehabilitation and replacement, ninety percent of the system currently does not have capacity concerns,

meaning no overflows, backups, or capacity issues have been found during routine monitoring. The main bottlenecks the City sees are within two older collector lines that need upgrades and are likely to receive them in the next 5-7 years. Because of monitoring and a history of investments still continuing today, City staff generally did not express sewer concerns related to incremental, modest increases in density.

The incremental nature of middle-housing growth is expected to provide enough time for capacity constraints to be predicted and addressed as they arise.

Charlottesville has routine processes for managing its sewer capacity. City engineers and planners are required to study sewer capacity every five years as part of the comprehensive planning process, and City engineers regularly monitor sewer flows, particularly in conjunction with larger-scale development activity. Because of this operation and planning routine, City engineers have a good grasp on capacity and needed upgrades at any given time. Just like when a large apartment complex is proposed, if a large subdivision or planned-unit development of middle housing were to be built all at once, that would automatically trigger additional review of sewer capacity and collaboration with Rivanna for wastewater management. Because infill middle housing growth is typically incremental, not likely to happen all at once, and spread across the city, any capacity concerns that arise are expected to be caught by routine monitoring. In general, plans for upgrades are triggered by reviewing flow data, meaning the City would have the information to help address concerns before consequences like overflows or backups would occur.

Even though middle housing infill development is incremental and spread out, over the long-term there could be instances where capacity eventually becomes an issue. The City has three collector lines that service a large portion of sewer flows that then flow into larger interceptor pipes that go to the wastewater treatment plant. This means that an overall increase in sanitary sewer flows due to growth–including middle housing–is still something the City will monitor even if neighborhoods' sewer mains are not experiencing any capacity issues. That monitoring is already occurring on a regular basis, offering opportunities to address concerns in advance of problems emerging.

After the zoning code update, a lawsuit was filed against the City citing sewer capacity concerns, among other things.

The new zoning ordinance prompted some local residents to file a lawsuit against the City. The lawsuit–similar to one filed in Arlington, VA–argues that the City did not study the impacts that increased density would have on the sewer system and other public services like transportation and schools.[1] Although transportation capacity is the primary complaint in Charlottesville, both lawsuits pose the questions: when must infrastructure capacity be studied? Is studying capacity during the comprehensive planning process every five years, as already required, adequate? Or is supplementary study needed at the time of density increases? The lawsuit in Charlottesville is in litigation as of this report's publication. While City staff did not comment directly on the lawsuit, their observations countered some of the lawsuit's concerns: middle housing isn't causing infrastructure issues at the moment, isn't anticipated to do so, and staff anticipates the existing comprehensive planning processes and monitoring procedures will provide adequate time to adjust sewer infrastructure planning as needed for middle housing.

1. White, et al. v. Charlottesville City Council, et al. (2024). Circuit Court for the City of Charlottesville.

Glossary

Clean Water Act: A U.S. federal law enacted in 1972 aimed at regulating the discharge of pollutants into the nation's surface waters and ensuring water quality standards. This Act prompted the federal enforcement, often through consent decrees, of cities to reduce overflows into local rivers.

Combined Sewer Overflow (CSO): A discharge from a combined sewer system into a water body, typically occurring during heavy rainfall when the system's capacity is exceeded.

Combined Sewer System: A type of sewer system that carries both wastewater (from homes and businesses) and stormwater in the same pipe.

Consent Decree: A legal agreement, approved by a judge, often used to resolve disputes between regulatory agencies and entities found to be in violation of environmental laws.

Drywell: An underground structure designed to collect and infiltrate stormwater runoff into the ground, typically used in areas with permeable soils.

Impervious Surface: Any surface that does not allow water to infiltrate into the ground, such as asphalt, concrete, rooftops, or other hard materials. These surfaces contribute to increased stormwater runoff and can exacerbate flooding and water pollution.

Infill Development: The process of developing vacant or underutilized parcels within existing neighborhoods and developed areas, rather than expanding outward into undeveloped land.

Inflow and Infiltration (I&I): Water that unintentionally enters a sewer system from surface water (inflow) or groundwater (infiltration), increasing system burden. Often due to disconnected, broken, or cracked pipes.

Interceptor: A large sewer line that transports water or sewage from smaller sewer lines to a treatment facility.

Lateral: A small pipe that connects individual properties and homes to larger sewer mains or trunks.

Middle Housing: A term for housing types that have a unit density and size between detached single dwellings and apartment buildings, such as duplexes, triplexes, fourplexes, townhouses, accessory dwelling units, and cottage courts.

Sanitary Sewer System: A sewer system designed to carry only wastewater from homes, businesses, and industries to a treatment plant. This type of sewer does not carry stormwater unless there is inflow and infiltration.

Sewer Main: A broad term for the principal pipelines in a sewer system that convey water or sewage from laterals to larger pipes, discharge points, or treatment facilities. It can refer to pipes of various sizes, often serving neighborhoods or districts.

Sanitary Sewer Overflow (SSO): An unintentional discharge of untreated or partially treated sewage from a sanitary sewer system into the environment.

Glossary (Cont.)

Separated Sewer System: A sewer system where wastewater and stormwater are conveyed in separate pipes.

Stormwater: Water that originates from precipitation events, such as rain or snowmelt, and often flows over impervious surfaces into sewers or other drainage systems.

Stormwater Management: The practice of controlling, capturing, and treating stormwater runoff to reduce flooding, prevent erosion, and improve water quality. Techniques include the use of green infrastructure (like rain gardens and permeable pavements), detention and retention basins, and stormwater drains.

Trunk: A specific type of larger sewer main designed to carry water or sewage from multiple mains or laterals to an interceptor or treatment facility. Trunks typically serve as an intermediate step between smaller mains and the largest pipes in the system, such as interceptors.

Wastewater Treatment Plant: A facility designed to treat and process wastewater to remove pollutants before discharging it into the environment.