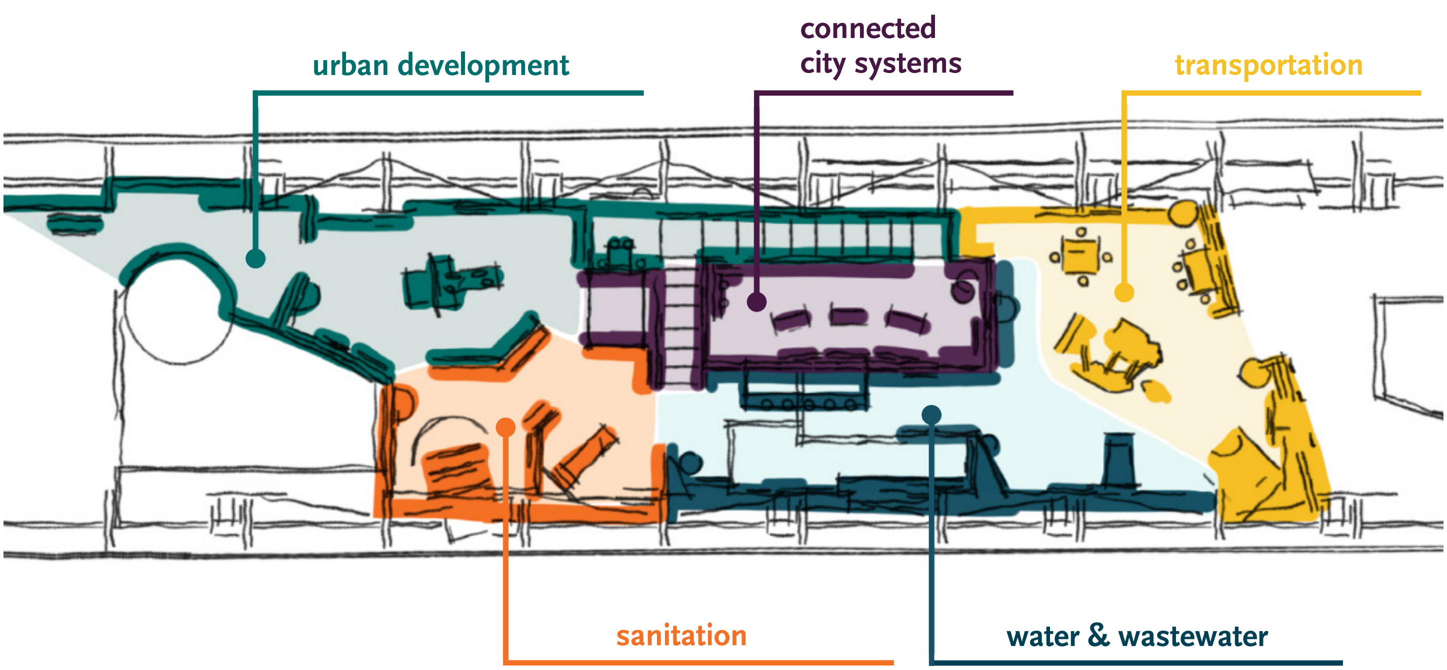
Educator Guide: CityWorks Worksheet Grade 9 – 12

Welcome to the CityWorks exhibition at the New York Hall of Science!

CityWorks is an immersive exhibit that invites students to explore four major infrastructure systems that keep New York City running. Through hands-on activities, interactive displays, and real-world examples, students learn how each system functions, how they connect to one another, and how they affect daily life in the city. The four main sections include:

- **Transportation:** Explore how engineering, management, and design shape the way subways, buses, sidewalks, and roads work.
- **Water & Wastewater:** Discover how clean water reaches our homes and where it goes after we use it, including filtration, treatment, and sewer systems.
- **Sanitation:** Learn about NYC's waste system, from collection to recycling, and explore the many tools, vehicles, and workers involved in managing our city's trash.
- **Urban Development:** Explore how New York City's buildings and neighborhoods are designed and built. Learn about the materials, engineering, and construction processes that create the city.
- **Connected City Systems:** Explore how natural and human-made systems work together and against each other in a city.



Cityworks Exhibit Worksheet for Grade 9 – 12

For school groups seeking a more structured experience, NYSCI offers grade-appropriate worksheets that guide students through CityWorks. For high school students (grades 9–12), these materials are intentionally designed to align with the FutureReadyNYC initiative by introducing students to the wide range of STEM professionals who design, maintain, and operate essential city systems. By spotlighting these real-world careers, the resource helps students understand how science, technology, and engineering shape the functioning of a modern city while illuminating the skills, pathways, and opportunities that can lead them into meaningful STEM futures.

Using This Worksheet Provides

- **Focused Exploration**

Each section begins with a City Worker Story exhibit interaction by listening to an audio recording in which a city worker explains their role and how it supports a specific urban system. Students listen and reflect on what surprised them, what skills or knowledge the worker relies on, and what questions they would ask if they could meet the worker in person.

Following each of the four City Worker Story, students investigate a key exhibit related to that system — Transportation, Water and Wastewater, Sanitation, or Urban Development. Together, these experiences help students connect real-world infrastructure to the science and engineering concepts they are learning in the classroom, deepening their understanding of how city systems function.

City Worker	**Veronica Torres**	**Sudeep Deb**	**Alicia Shorter**	**Eric Gibson**
Title	**Surface Line Dispatcher**	**Process Control Engineer**	**Sanitation Worker**	**Parks Worker**
Job Description	Coordinates bus operators and monitors buses to keep the system safe and on schedule. Requires patience, communication, and teamwork.	Manages wastewater disinfection to ensure safe water release. Requires attention to detail, scientific knowledge, and responsibility.	Operates equipment and maintains clean streets and recycling systems. Requires mechanical skills, physical strength, and community awareness.	Maintains trees and green spaces to ensure safety and healthy parks. Requires planning, safety awareness, and knowledge of nature.

- **Independent Discovery**

The worksheet invites students to explore the exhibition from beginning to end. While it offers a suggested pathway, teachers can also encourage students to visit other exhibits in CityWorks as they work through the activities or after completing the worksheet.

- **Student Reflection**

The worksheet concludes with reflection questions that invite students to connect what they observe in CityWorks to their own communities and to consider how their interests and skills might relate to STEM or civic careers that help cities function effectively.

TIPS FOR USE

Pre-visit

- Review key vocabulary terms found throughout the exhibit before your visit:

  Wastewater — water that has been used in households, industries, or businesses and is carried away through sinks, toilets, and drains; it often requires treatment before being released back into the environment.

  Infrastructure — the fundamental physical and organizational structures that support a city's operation, including transportation networks, water supply systems, energy grids, and buildings.

  System — an organized set of interdependent parts that interact to perform a function or process; for example, the interconnected network of pipes, pumps, and treatment plants that manage water.

  Sanitation — the development and maintenance of clean, healthy conditions in urban environments, typically involving solid waste management and wastewater collection and treatment.

  Logistics — the detailed coordination of complex operations involving people, facilities, and supplies; for example, planning bus routes or scheduling vehicle maintenance.

  Treatment Plan — a facility where water or wastewater is processed to remove contaminants before it is released back into the environment.

  Disinfection — a stage in water or wastewater treatment where chemicals or other methods are used to kill harmful microorganisms.

  Resource Recovery — the process of extracting useful materials or energy from waste streams, often done at modern wastewater treatment facilities.

  Urban Planning — the process of designing and organizing the physical layout of a city, including land use, transportation networks, green spaces, and infrastructure.

  Transfer Station — a facility where waste is temporarily held and consolidated before being transported to its final processing or disposal site.

  Fleet Maintenance — the inspection, repair, and upkeep of vehicles used by a city agency, such as sanitation trucks or buses.

  Green Infrastructure — systems that use natural processes such as soil, vegetation, and permeable surfaces to manage stormwater and support environmental health in urban areas.

- Discuss how different types of city work involve science, technology, and problem-solving.
- Print and prepare copies of the worksheet. Since worksheets contain color-coded exhibit sections as visual references, it is best to print worksheets in color if possible.
- Collect and bring clipboards and pencils to ease writing on the worksheets while in the exhibit.

During visit

- Encourage students to use the worksheet to guide their exploration and to locate the four featured exhibits using the map.
- Remind students to take notes as they listen to each *City Worker Story*, focusing on the three guiding questions in the worksheet.
- Allow time for students to explore other *CityWorks* exhibits or revisit areas of interest.

Post-visit

- Review students' responses to the *City Worker Story* questions to spark discussion about the wide range of STEM and civic careers connected to city systems.
- Use student reflections as a springboard for further projects about sustainable city design, infrastructure improvements, or career pathways in science and engineering.

Curriculum Connections

The following table outlines how CityWorks exhibits align with the New York State Science Learning Standards (NYSSLS), Science and Engineering Practices, Disciplinary Core Ideas, Crosscutting Concepts, and corresponding Amplify curriculum units.

CityWorks Exhibit	POV Drive the Bus	Wastewater Treatment Process Overview	Wastestream Journey Map	Build a Park
NYSSLS Standards (Performance Expectations)	HS-ESS3-1: Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity; HS-ETS1-2: Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved	HS-ESS3-1: Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity; HS-PS1-6: Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium	HS-ESS3-3: Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity	HS-ESS3-1: Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity; HS-ETS1-3: Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs
Science & Engineering Practices	Developing & using models, designing solutions	Analyzing & interpreting data, using mathematics & computational thinking	Planning & carrying out investigations, constructing explanations	Designing solutions, constructing explanations
Disciplinary Core Ideas	ESS3.C: Human Impacts on Earth Systems; ETS1.A: Defining and Delimiting Engineering Problems	ESS3.C: Human Impacts on Earth Systems; PS1.B: Chemical Reactions	ESS3.C: Human Impacts on Earth Systems	ESS3.C: Human Impacts on Earth Systems; ETS1.B: Developing Possible Solutions
Cross Cutting Concepts	Cause & Effect; Systems & System Models	Systems & System Models; Cause & Effect	Cause & Effect; Systems & System Models	Systems & System Models; Cause & Effect
New Vision Connections	Earth & Space Science (Human Sustainability & Resource Use)	Earth & Space Science (Water Cycle, Human Use of Water Systems) and Biology (Human Impact on Ecosystems)	Earth & Space Science (Human Sustainability) and Biology (Matter and Energy in Ecosystems)	Biology (Ecosystem Interactions, Biodiversity, and Human Impact) and Earth & Space (Urban Sustainability and Climate Resilience)