2022 Clean Watersheds Needs Survey

Detailed Scope and Methods

Submitted to:
U.S. Environmental Protection Agency
William Jefferson Clinton Building, 4204M
1200 Pennsylvania Avenue, NW
Washington, DC 20460

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List of Abbreviations

BMP	best management practice
CAFCom	Cost Analysis for Compliance
Capdet	CapdetWorks
CEAP	Conservation Effects Assessment Project
CET	cost estimation tool
CFR	Code of Federal Regulations
CIP	capital improvement plan
CSV	comma-separated values
CSO	combined sewer overflow
CWA	Clean Water Act
CWNS	Clean Watersheds Needs Survey
CWSRF	Clean Water State Revolving Fund
DEP	data entry portal
EPA	U.S. Environmental Protection Agency
FIA	Forest Inventory and Analysis
i-DST Green	Green Integrated Decision Support Tool
i-DST Grey	Grey Integrated Decision Support Tool
I/I	inflow and infiltration
IIJA	Infrastructure Investment and Jobs Act
IUP	Intended Use Plan
LF	location factor
LTCP	Long-Term Control Plan
MGD	million gallons per day
NASF	National Association of State Foresters
NEP	National Estuary Program
NPDES	National Pollutant Discharge Elimination System
NPS	nonpoint source
NRCS	U.S. Department of Agriculture's Natural Resources Conservation Service
PER	preliminary engineering report
P.L.	Public Law
POTW	publicly owned treatment works
SLF	stormwater location cost factor
TMDL	total maximum daily load
U.S.	United States
U.S.C.	United States Code

1. Introduction

As directed by Congress, the Clean Watershed Needs Survey (CWNS) provides an assessment of the capital investments necessary for states, the District of Columbia, and U.S. territories (herein referred to as "states") to meet the water quality goals of the Clean Water Act (CWA) over 20 years. The CWNS is a voluntary census (non-statistical sample survey) that requests project information to estimate needs.

The U.S. Environmental Protection Agency (EPA) conducted the first survey in 1972 and continued biennially until 1992. From 1996 to 2012, the EPA conducted the survey every four years. The last survey was conducted in 2012. The 2022 CWNS is the EPA's 17th survey.

1.1. Survey Purpose

The EPA, in partnership with the states, performs the CWNS to comply with CWA section 516(b)(1)(B) as well as CWA section 609, which was added by the Infrastructure Investment and Jobs Act, P.L. 117-58, November 15, 2021 (IIJA).[2] The CWNS is a voluntary, non-statistical sample survey that captures needs as of January 1, 2022, that are expected to occur within the next 20 years.

Needs

A "need" is defined as a currently unfunded project (or portion of a project) and the associated capital cost that addresses a water quality problem—or a public health problem related to water quality—existing as of January 1, 2022, or that is expected to occur within the next 20 years.[1]

1.2. Companion Material

Detailed information about the findings of the survey, CWNS policies and procedures, and estimating costs can be found in other companion material to this document available at www.epa.gov/cwns. Materials include:

- The 2022 CWNS Report to Congress.
- The 2022 CWNS data dashboard, which features interactive maps and charts of both needs data and wastewater technical data. The 2022 CWNS dataset can also be downloaded here, as a set of CSV files or Access database.
- The State Coordinator Manual, used by states when completing the survey.
- A report on cost estimation tool (CET) methods that documents the development of each tool.
- The 2012, 2008, 2004, and 2000 CWNS reports and data.

Note that this document does not provide a full description of all survey aspects. For descriptions of data elements, need categories, and CWNS-specific terminology, refer to the companion material. Certain analyses and data included in the Report to Congress or other documents are not reiterated here.

[1] Classification in this report as a "need" does not suggest that funding from local, state, or federal sources including collected rates, bonds, loans, or grants will not be available for these projects, and should not be construed as a request for additional federal funding.

[2] CWA section 516(b)(1)(B), 33 U.S.C. § 1375; CWA section 609, 33 U.S.C. § 1389.

2. Scope

2.1. Information Collected

The CWNS collects information about water pollution control facilities (referred to as technical data) as well as any projects and related costs documented for those facilities (referred to as needs data). Technical data include information about the infrastructure, such as treatment capacity, population served, effluent treatment level, and discharge type. Needs data include information about the capital improvement projects, such as need category and estimated cost.

The survey captures data about the following facilities:

- **Wastewater infrastructure:** A system consisting of collection sewers and/or a treatment plant used to collect and treat wastewater from a service area. When publicly owned, such systems are referred to as publicly owned treatment works (POTWs), as defined at Title 40 of the Code of Federal Regulations (CFR) Part 122.2.
- **Stormwater infrastructure:** Infrastructure used to collect, convey, treat, or infiltrate stormwater. Stormwater is rainwater or melted snow that runs off streets, lawns, and other sites. Includes both gray and green infrastructure.
- **Nonpoint source (NPS) controls:** Infrastructure used to manage and/or treat NPS pollution. NPS pollution is any source of water pollution that does not meet the legal definition of "point source," per CWA section 402(14). It generally results from land runoff, precipitation, atmospheric deposition, drainage, seepage, or hydrologic modification.
- **Decentralized wastewater treatment:** A system relying on natural processes and/or mechanical components to collect, treat, and disperse or reclaim wastewater from a single dwelling or building *or* a wastewater collection and treatment system under some form of common ownership that collects wastewater from two or more dwellings or buildings and conveys it to a treatment and dispersal system on a suitable site near the dwellings or buildings. For the purposes of the CWNS, decentralized systems may be on-site (individual) or clustered; clustered systems may include multifamily on-site systems or package plants.

Each submission of data to the CWNS represents some form of infrastructure asset or group of related assets. For example, a wastewater submission could represent a single collection system or complete community system, including the collection system, pump stations, and treatment plant.

2.2. Needs Collected

To be considered a need for the CWNS, a project must be eligible to receive funding from the Clean Water State Revolving Fund (CWSRF) under CWA section 1383(c), which defines projects and activities eligible for CWSRF assistance. Although some state programs have different eligibility requirements, the needs included in the survey are based on federal eligibilities.

The previous CWNS (2012) did not include the NPS Control and Decentralized Wastewater Treatment Systems categories. These categories were added to the current survey scope as directed by Congress in the IIJA.

The CWSRF has very broad eligibilities with the 11 areas listed below, outlined in the EPA's *Overview of Clean Water State Revolving Fund Eligibilities*. The CWSRF programs can provide assistance:

- To any municipality, intermunicipal, interstate, or State agency for construction of publicly owned treatment works (as defined in section 212 of the *Overview*).
- For the implementation of a management program established under section 319.
- For the development and implementation of a conservation and management plan under section 320.
- For the construction, repair, or replacement of decentralized wastewater treatment systems that treat municipal wastewater or domestic sewage.
- For measures to manage, reduce, treat, or recapture stormwater or subsurface drainage water.
- To any municipality, intermunicipal, interstate, or state agency for measures to reduce the demand for POTW capacity through water conservation, efficiency, or reuse.
- For the development and implementation of watershed projects meeting the criteria set forth in section 122.
- To any municipality, intermunicipal, interstate, or state agency for measures to reduce the energy consumption needs for POTWs.
- For reusing or recycling wastewater, stormwater, or subsurface drainage water.
- For measures to increase the security of POTWs.
- To any qualified nonprofit entity, as determined by the Administrator, to provide assistance to owners and operators of small and medium-sized POTWs 1) to plan, develop, and obtain financing for eligible projects under this subsection, including planning, design, and associated preconstruction activities; and 2) to assist such treatment works in achieving compliance with this Act.

Examples of projects and costs that are not CWSRF-eligible are:

- Any project for a federally owned facility.
- Any project without a water quality benefit.
- Planning activities that are not reasonably expected to result in a capital project (e.g., water quality monitoring plan).
- Non-capital costs (e.g., operation and maintenance, municipality payroll).
- Land acquisition that is not part of an eligible project.

In addition, the following were not included in the CWNS even for CWSRF-eligible projects:

- Funded projects. To be included in the survey, a project must have been unfunded as of January 1, 2022. For the CWNS, a project or a portion of a project was considered funded if construction had started or external funds (e.g., a grant or loan) were committed to it.
- Any costs for a CWSRF-eligible project starting before January 1, 2022, or that is planned for after December 31, 2041.
- Portions of costs based on escalation or inflation.
- Projects on Tribal lands and in Alaska Native Villages; these needs are reported separately by the Indian Health Service.

3. Data Collection

3.1. Data Entry Portal

Each state designated representatives, referred to as state coordinators, to complete the survey on the state's behalf. During the data entry period (March 1, 2022, to May 3, 2023), the EPA hosted and maintained an online data entry portal (DEP) that allowed state coordinators to enter data for more than 30,000 submissions.

3.1.1. Location Data

States entered location data for each submission, including the physical location and areas related to needs, if applicable:

- **Physical location:** The state entered a latitude and longitude for each submission, representing either the point location of the facility (e.g., physical address of a treatment plant) or the area covered by the submission (e.g., the centroid of a group of on-site wastewater treatment systems). Location data are used to assign needs to a primary state, congressional district, county, and watershed in which the need is located. They are also used to map submissions on the public data dashboard.
- **Areas related to needs:** If the state determined that a need spanned a geographic area beyond the primary county(ies), congressional district(s), and watershed(s), they could add areas. This addition could be based on the physical location of the infrastructure (e.g., the stormwater or wastewater collection system), the expanse of the water quality impact (e.g., for NPS controls), ratepayer coverage, or other relevant factors at the state's discretion.

3.1.2. Technical Data

States reported technical data in the CWNS to gather facility-level information. For wastewater infrastructure, these data were used to evaluate trends in the nation's ability to provide wastewater treatment. States were also required to enter or review a more limited set of technical data for stormwater, NPS, and decentralized wastewater treatment submissions. These additional technical data were only required for submissions with reported needs.

Technical data for wastewater infrastructure include:

- **Population:** These are required data fields for any submission that includes a collection system. They include estimates of the residential and non-residential population for 2022 and projected design population for 2042.
    - For the 2022 CWNS, the EPA prepopulated the "population receiving treatment" for each wastewater collection facility with data from the 2012 survey, adjusted to account for population change between surveys. The adjustment was based on the percent population change for each state according to U.S. Census Bureau data—the statewide average change in population was applied to each wastewater collection submission.
    - States reviewed and updated these data during the data entry period to ensure that the EPA could accurately report the population served by level of treatment.

- **Flow:** These are required data fields for any submission that includes a treatment plant, indicating its current and future design flow.
- **Effluent treatment level:** These are required data fields for any submission that includes a treatment plant, indicating the plant's current and future levels of treatment.
- **Discharge:** These are required data fields for all wastewater submissions, indicating the present and future discharge (e.g., discharge to surface waters, reuse, discharge to another facility).
- **Permits:** This is an optional data field linking associated National Pollutant Discharge Elimination System (NPDES) and non-NPDES permits to the submission.
- **Asset management:** These are optional data fields informing the EPA about the state of asset management plans for the facility.
- **Unit processes:** This is an optional dataset indicating which unit processes are in place at the facility.

To track the trends in wastewater treatment over time, the CWNS collects technical data for all wastewater treatment and conveyance facilities, regardless of whether there are documented needs for those facilities. States were asked to review and update technical data for all wastewater facilities, with an emphasis on population, flow, effluent, and discharge data, which are used to link facilities within a **sewershed**.

A **sewershed** is a group of facilities that ultimately discharge to a single point or multiple shared points. Sewersheds are only generated in the DEP for wastewater submissions.

3.1.3. Needs Data

States collected information about needs (projects and their related costs) from a variety of sources including in-house documents such as their CWSRF intended use plans (IUPs), grant and loan applications (CWSRF or others), NPS management plans, or other state-generated documents and plans; from documents generated by the facility such as capital improvement plans (CIPs), preliminary engineering reports (PERs), or long-term control plans (LTCPs), as well as other independent documentation. Needs could also come from documents generated specifically for the purpose of the survey such as small community forms and state-specific approaches to assessing need.

For a need to be included in the CWNS, the project had to be described in the documentation, and the cost associated with the project had to be independently documented or generated by the EPA's CETs or a state's approved approach to assessing the costs.

For the 2022 CWNS, needs data entered in the DEP included:

- **Document information:** States linked documents that supported the needs to the submission and entered information about the documents (e.g., document author, base date of the costs). Date was particularly important, as it was used to adjust all needs to January 2022 dollars.
- **Costs by category:** States input the capital costs associated with each need category by document (see Table 3-1 for category numbers and names). States could input costs at the project level or category level. They also indicated here whether the cost addresses a sanitary sewer overflow.
- **CET inputs:** The DEP allowed states to document inputs to CETs for submissions that had identified projects, but no documented costs.

Table 3-1. CWNS Need Category Numbers and Names

Category Number	Category Name
I	Secondary Wastewater Treatment
II	Advanced Wastewater Treatment
III-A	Infiltration/Inflow (I/I) Correction
III-B	Sewer Replacement/ Rehabilitation
IV-A	New Collector Sewers and Appurtenances
IV-B	New Interceptor Sewers and Appurtenances
V	Combined Sewer Overflow (CSO) Correction
VI-A	Gray Infrastructure
VI-B	Green Infrastructure
VI-C	General Stormwater Management
VII-A	NPS Control: Agriculture (Cropland)
VII-B	NPS Control: Agriculture (Animals)
VII-C	NPS Control: Silviculture
VII-E	NPS Control: Groundwater Protection (Unknown Source)
VII-F	NPS Control: Marinas
VII-G	NPS Control: Resource Extraction
VII-H	NPS Control: Brownfields/Superfund
VII-I	NPS Control: Storage Tanks
VII-J	NPS Control: Sanitary Landfills
VII-K	NPS Control: Hydromodification
VII-M	NPS Control: Other Estuary Management Activities
X	Water Reuse
XII	Decentralized Wastewater Treatment Systems
XIV	Desalination

3.2. Documentation

3.2.1. Documentation Guidelines

States were required to provide documentation supporting project and cost information for all needs reported in the CWNS. Documentation had to include the following elements, through either data entered into the DEP or documents submitted:

- **A description of the current or potential water quality impairment or human health issue.** The state addressed this documentation element within the DEP by choosing one or more options from the list below that describe the water quality or public health issue addressed by the project(s).
    - The project(s) is required to maintain compliance with a NPDES permit.
    - The project(s) is necessary to obtain compliance with a new permit requirement.
    - The project(s) is to increase capacity or improve treatment in advance of anticipated new permit requirements.

  - The project(s) is to achieve or maintain compliance with a Total Maximum Daily Load (TMDL).
  - The project(s) will prevent unregulated water quality or human health impacts.
  - The project(s) improves water efficiency, improves energy efficiency, improves water conservation, addresses climate change, or improves resiliency.

- **The location of the submission.** The state identified the physical location of the submission as a single latitude/longitude point, county, watershed, or town within the DEP.
- **A description of the project(s) that will solve the problem.** The state provided documents describing one or more specific projects that address the identified problem or threat.
- **The cost of each project.** The state provided the cost to implement each project.
- **The source of the cost.** The state identified the source of the cost (e.g., CIP, engineer's estimates, estimates from equipment suppliers) for each project.
- **Current documentation.** For all needs, the document had to be "current" (published within six years of survey launch). The state could use documents more than six years old if they confirmed that that the need still exists and the scope of the solution is the same.

3.2.2. Designated and Approved Documents

The EPA provided states with a list and descriptions of document types most likely to be used to document needs. For the list of designated documents, see Appendix A. States could use documents designated by the EPA as pre-approved to support projects and costs, or they could request approval for documents not on the list. The most common way states documented needs was with a budget or planning document, such as a CIP or LTCP.

The EPA categorized documents into two designations: primary and alternate. Primary documents were likely to contain information about the project and the cost for each project, while alternate documents commonly had information on the project only and were used in conjunction with other documents that included costs or CETs to document costs.

3.2.3. State-Specific Approaches

As in past surveys, the EPA allowed states without designated documents to develop methodologies using state-specific data to describe needed projects and/or estimate costs. The EPA evaluated all approaches to ensure that the methods were current and based on robust, relevant data. The EPA then approved each method before a state submitted the resulting project(s) and cost(s) through the DEP.

The EPA posted the approved state-specific approaches within the DEP so that other states could adapt the approved approach for their own estimations. Table 3-2 presents the number of approved state-specific approaches by state and category.

Table 3-2. Number of State-Specific Approaches Used by State and Category

Infrastructure Type	Category	Number of States with an Approved Approach	States with an Approved Approach
Wastewater treatment	I/II	1	MO
Wastewater conveyance	III/IV	1	UT
Stormwater	VI	11	AR, CT, GA, NJ, MA, ME, NH, RI, UT, VT, WV
NPS control	VII	15	AR, CA, CO, CT, IA, MA, ME, ND, NE, NM, NV, RI, VT, WA, WV
Decentralized wastewater treatment	XII	32	AR, AZ, CA, CT, FL, GA, IA, IN, KS, LA, ME, MI, MN, MT, NC, ND, NH, NJ, NM, NV, NY, OH, OK, OR, RI, SC, TX, UT, VA, VT, WA, WI, WV

3.2.4. Cost Estimation Tools

The EPA developed CETs to estimate costs for certain types of documented projects without cost estimates in the supporting documentation. These DEP-based tools assign dollar values for projects based on documented inputs provided by the state, such as the project location and design specifications. The CETs were developed using external data sources (such as state loan data and proprietary models) and project data from past surveys. Each CET has maximum sizes or capacities based on the range of the data used to build the tool.

The EPA was unable to develop CETs for all project types due to lack of sufficient high-quality national datasets. In 2022, the EPA developed or updated CETs for:

- Secondary and advanced wastewater treatment (Categories I and II).
- Wastewater conveyance (Categories III and IV).
- CSO correction (Category V).
- Stormwater management (Category VI).
- NPS controls (Subcategories VII-A [Agriculture (Cropland)] and VII-C [Silviculture]).
- Decentralized wastewater treatment systems (Category XII).

Table 3-3 presents the total needs and number of submissions supported by CETs by category. CETs are described in more detail in section 5.1.2.

Table 3-3. Total Needs Calculated Using CETs by Category

Category	CET Needs Total (January 2022 Dollars in Millions)	Number of Submissions
I	$584	144
II	$2,865	347
III	$686	206
IV	$78	30

Category	CET Needs Total (January 2022 Dollars in Millions)	Number of Submissions
V	$7	5
VI	$36	15
VII-A	$24,302	290
VII-C	$95	18
XII	$59,987	1,601
Total	**$88,639**	**2,656**

3.2.5. Small Community Form

The EPA developed an online survey form for communities with populations of 10,000 or fewer. State coordinators could send this form via email to officials (e.g., mayor, public works manager, operator) to document needs when other documentation did not exist. The small community form provided two options for supporting project costs:

- Through the EPA's CETs using inputs provided by the local staff.
- By the local staff entering their own cost estimates and having a state or local professional engineer certify the costs.

4. Quality Assurance and Quality Control

The EPA conducted quality assurance and quality control reviews of the data presented in the Report to Congress to ensure their precision and accuracy. Throughout these reviews, the EPA followed a quality assurance project plan, which it developed in keeping with its Information Quality Guidelines and the *EPA Requirements for Quality Assurance Project Plans* (EPA QA/R-5, EPA/240/B-01/003).

The DEP allowed states to directly enter needs and technical data and upload the required supporting documentation. The DEP included automated checks of expected entries and value ranges to minimize incorrect or incompatible data entry. In addition, the EPA followed specific, documented protocols for reviewing technical and needs data submitted by states. These reviews were focused on needs data for all infrastructure types and technical data for wastewater submissions. The EPA reviewed DEP data throughout the data entry period and performed additional quality control checks at the close of data entry.

4.1. Data Review

This section details the reviews that the EPA performed during and after the data entry period. The EPA created a tiered review plan for the over 30,000 submissions. Submissions received in-depth reviews ("full reviews") if they either had high-value projects (i.e., projects totaling above $40 million) or were supported by documentation that might not have included the required cost and detailed project description (alternate documents). Submissions with needs that did not qualify for full review received "partial reviews."

To confirm that costs had been properly documented and reported, the EPAalso performed quarterly audits of a random selection of approximately 5 percent of submissions from each state that had

received partial reviews. The audit results were used to make minor adjustments to a subset of the state's overall needs. See section 4.3 for more information about how the EPA used audit findings.

Wastewater submissions with no needs, meanwhile, received partial reviews (focused solely on technical data) but were not subject to the audit. Stormwater, NPS control, and decentralized wastewater treatment submissions with no needs were accepted as submitted with no review.

See Appendix B for the number of submissions receiving partial, full, and audit reviews.

4.1.1. Technical Data Review

Both full and partial reviews of wastewater submissions included checks to ensure the accuracy of the technical data, including population, flow,effluent treatment level, and discharge type data submitted. The technical data review process included checks to:

- Confirm facility types were consistent with need categories.
- Check the locations of certain treatment types if those treatment types were unlikely to be found at the submitted locations: for example, "honey bucket lagoons" outside Alaska.
- Review that reported physical locations were within the submitting states.
- Confirm that links in submissions between collection systems and/or treatment plants result in "complete sewersheds."
- Confirm that all water reuse facilities are associated with upstream treatment plants.
- Confirm that change type (i.e., new, abandonment, existing) aligns with the technical and needs data.
- Confirm that all required technical data are included (e.g., submissions with a collection system must have an associated population).
- Confirm that technical data do not misalign (e.g., flow should be reported for a treatment plant, not a collection system; effluent treatment level of raw would not typically align with a surface water discharge).
- Review "other" discharges and recategorize them with existing selections if applicable.
- Confirm that need categories align with the effluent treatment level (i.e., if there are Category II needs [advanced wastewater treatment], the treatment plant is reported to have advanced effluent).

Partial reviews of stormwater, NPS control, and decentralized wastewater treatment consisted of confirming that the location fell within the state identified and that the facility type aligned with the need category.

4.1.2. Needs Data Review

Projects totaling more than $40 million or that were only supported by alternate documents received full reviews with the following checks:

- Confirm document metadata (e.g., document base date, author).
- Verify that the costs entered in the DEP category totals match the information in the documentation.
- Review the project descriptions to ensure all projects are CWSRF-eligible.
- Confirm that the costs are entered in the correct category.

- Review the project start and end dates to make sure they are within the 20-year survey period.
- Check for indications of funding (i.e., project has started construction or external funds committed).
- Verify that costs have not been escalated or inflated to future years.
- If the document includes an alternatives analysis, check that the alternative entered into the DEP is the recommended alternative.

4.1.3. Review Statuses

The EPA worked with states to correct errors found during full and partial reviews. If the EPA found errors during data review for a submission, it was sent back to the state as a "state correction request" with a detailed description of the issues to be addressed. Submissions were only assigned a status of "federally accepted" for inclusion in the Report to Congress once all errors were resolved.

4.2. Population Review

After data collection, the EPA reviewed each state's total population receiving centralized wastewater collection and treatment to look for potential overestimation. To do this, the EPA compared each state's reported wastewater population receiving treatment in the DEP to the information submitted in the 2012 CWNS (adjusting for population growth) to identify states where the percent of the population on centralized wastewater treatment changed more than 5 percent. The EPA also compared the total state population reported in the CWNS (centralized plus decentralized) to the 2020 Census data. If either comparison was outside the expected range, the state's population data were flagged for further review.

If a state was audited, the EPA worked with that state to reconcile population data to the greatest extent possible. This included looking for "order of magnitude" errors (such as a submission with a reported population of 1,000,000 instead of 100,000) or double counting (e.g., a town's population was reported in both upstream and downstream submissions) in the state's population data.

4.3. Audit Adjustment

To ensure high-quality data, the EPA audited a percentage of the submissions with needs that received only partial reviews. These are referred to as **auditable** submissions. The audits were conducted on a quarterly basis, with an additional final audit at the close of data entry. The EPA based the audit on the assumption that basis of these audits was the assumption that cost-related errors found during a review reflect consistent errors across all auditable submissions submitted in that state.

A submission was **auditable** if its cost is $40 million or less, it uses at least one primary document, and it has been federally accepted after a partial review.

The EPA determined the total number of submissions required for the audit in each state. Each state's audit rate started at 5 percent in the first quarter but changed throughout the data entry period based on the accuracy of the state's data entry. The purpose of the variable audit rate was to determine the level of confidence in the state's understanding of CWNS policies and to adjust the percentage of submissions receiving additional review accordingly.

The EPA chose submissions for audit using a random number generator. Audited submissions received a full review, and the EPA compared the needs the state entered into the DEP to the needs actually reflected in the documentation. If the EPA encountered pervasive cost-related errors that indicated a misunderstanding of survey policy, they paused the audit and provided the state corrective guidance. After correction, the audit resumed with a new randomly chosen submission. The EPA corrected the needs data in the DEP for the audited submission, and used the ratio of the corrected to the originally submitted needs to develop an adjustment factor for that submission. The EPA calculated the weighted average of all adjustment factors for a given state, then used that average to adjust the needs of the submissions in that state that had *not* been reviewed and corrected (auditable submissions that did not receive an audit review). See Appendix B for the audit adjustment factor for each state.

5. Report Development

5.1. Dataset Post-processing

From June through September 2023, the EPA reviewed and adjusted the dataset to ensure the accuracy of the data reported to Congress.

5.1.1. Confirmed Treatment Plants

Many states did not have the resources to gather technical data for all the wastewater treatment plants within the state. Since estimating the number of treatment plants and population served by treatment type nationwide is an objective of the CWNS, the EPA asked states to confirm the existence of treatment plants previously submitted to the 2012 CWNS and provide treatment level data for those plants, including total served population and effluent treatment level. These submissions are referred to as "confirmed" since they are confirmed to exist but did not undergo the same review process as a federally accepted submission and have no reported needs.

5.1.2. Quality Control

Once the data entry period ended, the EPA conducted a series of computerized checks on the entire dataset to ensure quality and consistency. Checks included:

- Identifying potential duplicate submissions.
- Confirming that physical locations for submissions were in the correct state.
- Confirming that areas related to needs for submissions were in the correct state.
- Identifying incomplete sewersheds.
- Identifying collection systems that do not discharge to treatment plants.
- Identifying treatment plants that do not receive flow (population) from upstream collection systems.
- Identifying submissions that are linked to archived or confirmed submissions.
- Identifying supporting documents that had not uploaded properly.
- Recategorizing "Other" discharge types if there was adequate information.
- Recategorizing "Spray irrigation" or "Reuse: Irrigation" discharge types carried over from the 2012 CWNS to the more specific irrigation discharge types in the 2022 CWNS.
- Relinking costs to the correct documentation (rather than annotation spreadsheets).

- Removing test submissions created prior to data collection.
- Comparing population and flow data to facility types to identify misalignment.
- Confirming that submissions marked as "No Change" did not have needs.
- Reviewing any documents labeled as "Mailed" and confirming receipt.
- Reviewing documents labeled as "Pending Approval" and resolving them.

To reduce burden on states, the EPA updated data without state input when adequate information was available in documentation or through internet searches and worked with states to resolve issues that required additional input.

5.1.3. Public Dataset Review

After the EPA performed the quality checks for individual data elements listed in section 5.1.2, the database was considered final for the Report to Congress analyses. In addition, the EPA prepared a dataset for each state as a series of comma-separated values (CSV) files that allowed for easier access to the data than through the DEP. The public datasets are available to the states and to the public through the CWNS data dashboard, available at www.epa.gov/cwns.

To generate these files, the database was labeled and organized for public use. These steps included:

- Creating tables that have the CWNS ID, state code, and facility ID for all records so additional joins are not needed.
- Splitting out concatenated values into individual records.
- Adding readable labels for clarity, such as changing the permits source column from "Y" to "NPDES Lookup" and "N" to "Manual Data Entry."
- Removing orphan records (i.e., records that are no longer properly attributed to surveys) and empty records.
- Removing any records not federally accepted from data tables, except for those that include archived and confirmed records.
- Removing any ineligible costs associated with privately or federally owned wastewater submissions.

5.1.4. CET Finalization

This section presents a summary of each CET, including a description of the supporting data and final CET equations. Each CET consists of a national average cost estimate in January 2022 dollars, which is then adjusted for location using ZIP code or county cost factors that are based on a translation of RSMeans city cost index. A full description of the CET development process can be found in *Cost Est mat on Tool Methods*, available at www.epa.gov/cwns.

Wastewater Treatment CETs

Wastewater treatment plant CETs are based on several sources of information depending on construction type. For "new" or "replacement" construction types, the EPA primarily used Hydromantis CapdetWorks™ (Capdet), a model that performs planning-level design and cost estimation of wastewater treatment construction projects (Hydromantis, 2014), to estimate construction costs for broad categories of treatment plants. For the remaining construction types ("rehabilitation," "system expansion," "treatment upgrade," and "add disinfection"), the EPA reviewed similar cost models

including Missouri's Cost Analysis for Compliance (CAFCom) tool[3] and the Grey Integrated Decision Support Tool (i-DST Grey).[4] Project cost data were also compiled from several sources including peer-reviewed literature, state IUPs, and documented costs from the 2022 CWNS.

The equation used to calculate practice cost is as follows:

Equation 5-1. $$Cost = LF_{ZIP\ Code} \times Base\ Cost\ Curve$$

Where

Cost = total estimated capital cost
$LF_{ZIP\ Code}$ = ZIP code location factor
Base Cost Curve = see Table 5-1

Table 5-1. Wastewater Treatment CETs by Practice Type and Change Type

Construction Type	Base Curve Equation	Limit[a] (Million Gallons per Day [MGD])
Lagoon		
New or replacement	$4{,}978{,}405 \times C + 4{,}259{,}108$	5
Rehabilitation, system expansion, treatment upgrade	$4{,}334{,}434 \times C^{0.619}$	2.1
Aerated Lagoon		
New or replace	$8{,}871{,}326 \times C + 4{,}184{,}999$	5
Rehabilitation, system expansion, treatment upgrade	$6{,}663{,}409 \times C$	2.1
Secondary Mechanical		
New or replacement, ≤0.6 MGD	$16{,}221{,}460 \times C^{0.749}$	5
New or replacement, >0.6 MGD	$5{,}062{,}323 \times C + 8{,}081{,}189$	5
Rehabilitation	$2{,}824{,}125 \times C^{0.383}$	15
System expansion, treatment upgrade	$8{,}177{,}714 \times C^{0.459}$	8
Advanced		
New or replacement, ≤1.1 MGD	$13{,}657{,}111 \times C^{0.678}$	5
New or replacement, >1.1 MGD	$6{,}193{,}944 \times C + 8{,}141{,}130$	5
Rehabilitation	$2{,}202{,}081 \times C^{0.605}$	15
System expansion	$4{,}854{,}422 \times C^{1.03}$	14
Treatment upgrade	$7{,}161{,}849 \times C^{0.400}$	12

[3] The Missouri Department of Natural Resources developed the CAFCom tool to estimate the potential cost for publicly owned treatment works to comply with new requirements in a permit. CAFCom is based on Capdet, but uses inputs targeted toward and validated with common wastewater treatment systems in Missouri.

[4] The Integrated Decision Support Tool is a cost-estimate decision support tool for planners implementing gray, green, and hybrid stormwater control measures (SCMs). The Grey Infrastructure Module, a component of the tool, is based on a statistical survey of project costs from numerous literature sources to develop cost curves for a range of green and gray combined sewage management unit processes. As the EPA only has access to the user interface of i-DST Grey, and not the underlying data or curve equations, i-DST Grey is used for comparison only. The Green module, which the EPA uses as described below under "Stormwater CET," is for other SCMs and is based on a standard construction line-item cost estimation approach.

Construction Type	Base Curve Equation	Limit[a] (Million Gallons per Day [MGD])
Add Disinfection		
Add disinfection—UV	$870{,}933 \times C^{0.699}$	30
Add disinfection—chlorine	$78{,}178 \times C + 766{,}233$	30

C = capacity in MGD.

[a] Cost curve limits are based on largest value of underlying project data or range of applicability for underlying model.

Wastewater Conveyance CETs

Wastewater conveyance CETs are based on project cost data compiled by the EPA. Data sources include 2019 and 2020 state IUPs as well as documented costs submitted by states for the 2022 CWNS. Although Category III and IV needs have "A" and "B" subtypes, underlying cost data were too variable to split into separate curves for each category. Accordingly, the EPA developed cost curve equations for each main category.

For Category III, the CET equation is based on total project length, since that was found to be the most important predictor variable for project cost. For Category IV projects, total pipe length, pump station size, and quantity were found to be important predictor variables. The EPA therefore based the Category IV CET on two equations: one for estimating non-pump-station project costs and one for estimating pump station costs.

The final equations used to calculate practice cost are as follows.

Equation 5-2. $$Cost_{III} = LF_{ZIP\ Code} \times L \times 14{,}632 L^{-0.45}$$

Equation 5-3. $$Cost_{IV,Pipe} = LF_{ZIP\ Code} \times L \times 26{,}736 L^{-0.51}$$

Equation 5-4. $$Cost_{IV,Pump} = LF_{ZIP\ Code} \times n \times (423{,}184 C + 499{,}364)$$

Where

$Cost_{III}$ = total estimated capital cost of Category III projects (Table 5-2)
$Cost_{IV,Pipe}$ = total estimated capital cost of pipe portion of Category IV projects (Table 5-2)
$Cost_{IV,Pump}$ = total estimated capital cost of pump station portion of Category IV projects, as applicable (Table 5-2)
$LF_{ZIP\ Code}$ = ZIP Code location factor
L = total length of all piping included in the project (ft)
n = number of pump stations
C = capacity of pump stations (MGD)

Final cost curve equations are provided in Table 5-2.

Table 5-2. Wastewater Conveyance CETs by Conveyance Category

Category	Component	Base Curve Equation	Limit[a]	Base Curve Equation Source
III	Total project	$L \times 14{,}632 \times L^{-0.45}$	195,000 ft	PCD III-A and III-B
IV	Pump stations	$n \times (423{,}184 \times C + 499{,}364)$	10 MGD	i-DST Grey

Category	Component	Base Curve Equation	Limit[a]	Base Curve Equation Source
IV	Total project without pump stations	$L \times 26{,}736 \times L^{-0.51}$	450,000 ft	PCD IV-A and IV-B

C = capacity in MGD; *L* = total project length in feet; PCD = project cost data, including state IUPs and documented costs from 2022 CWNS; *n* = number of pump stations.

[a] Cost curve limits based on largest value of underlying project data or range of applicability for underlying model.

CSO CET

The CSO CET is based on project cost data obtained from municipal reports for combined sewage storage facilities. These are common, relatively simple practices that can be used throughout a sewershed or at a treatment plant to reduce wet weather peak flows and mitigate overflows. Additionally, because many of the practices potentially used by CSO communities to reduce wet-weather flows may be captured by the stormwater CET, both the CSO CET and Stormwater CET were made available for Category V needs within the DEP.

The final equation used to calculate practice cost is as follows:

Equation 5-5. $$Cost = LF_{ZIP\ Code} \times Base\ Cost\ Curve$$

Where,

Cost = total estimated capital cost
$LF_{ZIP\ Code}$ = ZIP code location factor
Base Cost Curve = see Table 5-3.

Table 5-3. CSO Storage CET

Category	Component	Base Curve Equation	Limit (Million Gallons)	Base Curve Equation Source
V	Total project	$5{,}818{,}000 \times S^{0.94}$	38	Literature review

S = storage volume in million gallons.

Stormwater CET

The stormwater CET is based on an adaptation of i-DST Green, a standard line-item cost model developed by the Georgia Institute of Technology (Grubert & Krieger, 2020; Krieger & Grubert, 2021). Within i-DST Green, individual unit costs are adjusted for location using RSMeans material and installation cost factors. However, these cost factors do not affect total practice cost uniformly, as each practice is based on a unique combination of line-item inputs. To simplify the number of calculations needed to estimate the influence of location on cost, the EPA used a modeling approach to express i-DST estimates using a series of regression equations. First, the EPA modeled the national average cost of each practice, which can be expressed using a simple linear regression equation (Equation 5-6). Next, the EPA modeled practice costs across hundreds of randomly chosen locations. Each location-specific cost was combined with the practice national average cost to generate a ratio of the two costs, referred to as a stormwater location cost factor, or SLF (Equation 5-7). Lastly, the EPA generated a multiple regression

equation to express the SLF as a function of RSMeans material and installation cost factors (Equation 5-8).

Equation 5-6. $$Cost_{National\ Average} = aA_p + b$$

Equation 5-7. $$Cost_{Location\ i} = SLF \times Cost_{National\ Average}$$

Equation 5-8. $$SLF = cI + dM + e$$

Where,

$Cost_{National\ Average}$ = national average practice cost as a function of practice area
a = cost coefficient for national average cost curve
A_p = practice area (ft^2)
b = y-intercept for national average cost curve
$Cost_{Location\ i}$ = practice cost for a randomly chosen location and the same practice area
SLF = stormwater location cost adjustment factor
c = installation cost factor coefficient (Table 5-4)
I = RSMeans installation cost factor
d = material cost factor coefficient (Table 5-4)
M = RSMeans material cost factor
e = regression y-intercept

Table 5-4. Stormwater Base and Location Cost Curve Coefficients

Practice	$Cost_{National\ Average} = aA_p + b$		$SLF = cI + dM + e$		
	a	***b***	***c***	***d***	***e***
Porous pavement	12.39	11,233	0.0017	0.0079	0.0364
Green roof, <2,000 sf	63.9	7,438	0.0016	0.0085	-0.0007
Green roof, >2,000 sf	53.8	28,050	0.0011	0.0089	0.0007
Bioretention	21.12	10,943	0.0010	0.0088	0.0137
Buffer strip	3.68	5,985	0.0041	0.0068	-0.0946
Infiltration trench	32.25	13,714	0.0015	0.0081	0.0436
Vegetated swale	6.15	12,547	0.0029	0.0065	0.0612
Constructed wetland	11.87	41,179	0.0031	0.0076	-0.0663
Dry pond	12.8	66,120	0.0058	0.0031	0.1112
Wet pond	18.4	77,041	0.0066	0.0018	0.1438
Underground detention/retention	12.38	63,749	0.0012	0.0084	0.0358

In addition to base costs, all stormwater cost models the EPA reviewed as part of the CET development process included estimates of cost factors for difficult site conditions as well as pre-construction costs. While i-DST Green allows for incorporation of these cost factors, it does not specify any. The EPA therefore summarized these cost factors from a range of other models, with resulting values provided in Table 5-5.

Table 5-5. Stormwater Redevelopment and Pre-construction Cost Factors

Practice	Redevelopment Construction Type Cost Factor	Pre-construction Cost Factor	
		New Development	Redevelopment
Porous pavement	1.3	18%	28%
Green roof	2.0	30%	45%
Constructed wetland	2.0	33%	50%
Bioretention	2.0	28%	40%
Buffer strip	2.0	10%	15%
Infiltration trench	2.0	38%	56%
Vegetated swale	2.0	23%	34%
Dry pond	1.8	30%	50%
Wet pond	1.9	30%	50%
Underground detention or retention	1.0	35%	53%

The final equation used to calculate practice cost is as follows:

Equation 5-9. $$\boldsymbol{Cost = n \times CF_{Construction\ Type} \times (1 + CF_{Pre-construction}) \times SLF \times aA_p + b}$$

Where,

Cost = total estimated capital cost
n = number of practices
$CF_{Construction\ Type}$ = construction type cost factor (Table 5-5)
$CF_{Pre\text{-}construction}$ = pre-construction cost factor (Table 5-5)
SLF = location factor (Table 5-4)
a = cost coefficient for national average cost curve (Table 5-4)
A_p = practice area (ft^2)
b = y-intercept for national average cost curve (Table 5-4)

NPS CETs

To help states estimate NPS needs, the EPA developed CETs for cropland agriculture and silviculture—two NPS subcategories that were known sources of existing need, that were likely under-reported in previous surveys, and for which suitable data existed to develop reasonable cost estimates.

The cropland agricultural CET consists of two tools. The first is the cropland acres tool, which helps states estimate the acres of cropland, by county or state, in need of conservation practices to address water quality concerns. The cropland acres tool is based on results of the National Resources Conservation Service's (NRCS's) first Conservation Effects Assessment Project (CEAP), which estimated the need for conservation practices across cultivated cropland in each major river basin. The EPA summarized the results of the 2003–2006 CEAP reports (Table 5-6) and assigned a percent need value to each county according to the major river basin that county is in. Given the age of the data (2003–2006) and the likelihood that additional conservation practices have been incorporated since publishing of the reports, a reduction factor of 50 percent was applied to the values shown in Table 5-6. To use the cropland acres tool, states entered the acres of harvested cropland at the county or state level (Equation 5-10).

Equation 5-10. $$Acres\ of\ Need = 50\% \times Percent\ Need \times Harvested\ Cropland$$

Where,

Acres of Need = total estimated acres of need
50% = reduction factor to account for increased practice implementation since CEAP
Percent Need = based on the CEAP assessment
Harvested Cropland = acres of harvested cropland

Table 5-6. CEAP Estimates of Cropland Needed Acres by Major River Basin, 2003–2006

CEAP River Basin	Cultivated Cropland (Million Acres)	Medium Need (Million Acres)	High Need (Million Acres)	Percent Medium and High
Upper Mississippi River Basin	58	26	9.0	61%
Ohio-Tennessee River Basin	25	12	6.0	70%
Missouri River Basin	84	14	1.1	18%
Arkansas-White-Red Basin	30	9.1	1.3	34%
Texas Gulf Basin	18	10	7.6	97%
Lower Mississippi Basin	19	10	6.3	86%
Great Lakes region	15	5.0	2.8	53%
Souris-Red-Rainy Basin	18	4.3	—	25%
South Atlantic Gulf Basin	13	4.1	6.7	82%
Chesapeake Bay region	4	1.7	0.8	59%
Delaware River Basin	0.8	0.2	0.4	74%
Pacific Northwest Basin	12	8.2	0.4	74%

The results of the cropland acres tool feed into the cropland CET, which combines acres of need with a per-acre, state-specific estimate for the cost of addressing that need. The cropland CET is based on a suite of representative practices intended to address each of the three main NPS pollution sources—in-field nutrient mitigation, edge-of-field nutrient mitigation, and nutrient management. The EPA obtained costs for each practice from NRCS state payment schedules, resulting in state-specific estimates for the cost to treat an acre of harvested cropland with a mix of the representative practices. The range of per-acre costs across all states is summarized in Table 5-7. Note that for various reasons, including state-level and farm-level planning horizons, the EPA established a five-year timeframe for cropland needs estimation, which is reflected in the per-acre costs in Table 5-7 and the total needs estimates of the cropland CET.

Table 5-7. Cropland CET Unit Costs

BMP Function	NRCS Conservation Practices Used for Costing (Practice Standard Code No.)	BMP Cost ($/Acre)[a]		
		Minimum	Average	Maximum
In-field runoff mitigation	Average of: Terrace (600) Stripcropping (585) Contour farming (330)	$10	$42	$114

BMP Function	NRCS Conservation Practices Used for Costing (Practice Standard Code No.)	BMP Cost ($/Acre)[a]		
		Minimum	Average	Maximum
Edge-of-field loading mitigation	Average of: Riparian forest buffer (391) Filter strip (393)	$5	$179	$489
Nutrient management[b]	Nutrient management (590)	$142	$186	$326
	Total Unit Cost:[c,d]	$188	$408	$747

[a] National average, based on average of NRCS scenario costs for each practice.
[b] Cost reflects implementation of practice for five years.
[c] Total cost reflects five years of nutrient management implementation and installation of structural practices.
[d] Sum of components may not add up to total due to averaging methods and rounding.

The silviculture CET is based on a combination of three sources of data to estimate 1) acres of forest land in each state subject to active cutting, 2) average state best management practice (BMP) implementation rates on those acres of active cutting, and 3) the per-acre cost of BMP implementation.

The first two sources of data are used to estimate acres of need. The EPA recommended states use the U.S. Department of Agriculture Forest Service's Forest Inventory and Analysis (FIA) Program and the National Association of State Foresters' (NASF's) BMP surveys to estimate acres of active cutting and state BMP implementation rate, respectively.

To determine the cost of silviculture BMP implementation, the EPA, with the assistance of forestry experts, used several studies from the peer-reviewed literature. Table 5-8 shows the studies the EPA reviewed and the range of values estimated by the studies for various practices and suites of practices. Ultimately, the EPA used data from Kelly et al. (2017), as they provided the most current and applicable estimate of forestry BMP costs. Kelly et al. (2017) asked over 100 loggers to bid on a hypothetical, 100-acre harvest job with and without a suite of typical BMPs, taking the difference in costs as BMP cost.

Table 5-8. Per-Acre Silviculture BMP Implementation Costs

Source	Year	States	Average	Min	Max
Lickwar et al., 1992	1987	AL, FL, GA	$31	$11	$63
Woodman and Cubbage, 1994	1994	GA	$47	$37	$159
Shaffer et al., 1998	1998	VA	$33	$6	$164
Sawyers et al., 2012	2009	VA	$86	$86	$181
Kelly et al., 2017	2017	Northeast	$72	—	—

As with the cropland CET (and for similar reasons), the EPA used a five-year time horizon for silviculture CET needs estimates. The total need is therefore calculated as five times the annual cost, using Equation 5-11.

Equation 5-11.
$$\boldsymbol{Need}\ (\$/\boldsymbol{Year}) = \left(1 - \boldsymbol{BMP\ Rate}\ (\%)\right) \times \boldsymbol{Harvest\ Area}\ \left(\frac{\boldsymbol{Acres}}{\boldsymbol{Year}}\right) \times \boldsymbol{Adjusted\ State\ Cost}\ \left(\frac{\$}{\boldsymbol{Acre}}\right)$$

Where

BMP Rate = BMP implementation rate from NASF BMP survey

Harvest Area = actively harvested acres from FIA
Adjusted State Cost = per-acre cost from Kelly et al. (2017) (Table 5-8), adjusted using state-average RSMeans cost factors

Decentralized Wastewater Treatment CET

To develop the decentralized CET, the EPA reviewed many cost sources including past survey data, data submitted as part of the 2022 CWNS, and data compiled by various experts within the field. This was seemingly a simple task—the estimation of the average cost to install one of the most common and long-standing wastewater treatment processes in the United States—it became increasingly apparent that costs can vary tremendously. First, difficult construction conditions such as site access challenges, high groundwater tables, rocky geology, and steep topography can easily double the cost of a "standard" new system. Second, there is a recent but growing trend of states requiring more expensive advanced treatment, such as aerobic treatment systems, in environmentally sensitive locations. Combined, these factors can lead to project-level costs that span an order of magnitude in a single state. To develop a reasonable average, the EPA combined current cost estimates with U.S. Census Bureau data to weigh low-cost, "standard" systems with higher-cost systems indicative of difficult construction conditions or advanced treatment.

Project cost data that went into the CET equation were from nine states, with values ranging from $3,517 to $56,387. Across the nine states, the average minimum and maximum values were $11,976 and $34,426, respectively, with the low end a likely representation of standard systems under typical construction conditions and the high end a likely representation of advanced systems and/or difficult construction conditions. Rather than take a simple average, the EPA reviewed data from the U.S. Census Bureau's 2021 American Housing Survey, which provides a breakdown of household wastewater treatment systems across the United States. Based on those data, 94 percent of systems are standard systems, with only 6 percent including pumps, mound systems, or other advanced technologies. As a national average value for the decentralized CET, the EPA therefore calculated a weighted average cost (Table 5-9), with a resulting value of $14,221 per system.

Table 5-9. Average Cost for New or Full-Replacement Septic Systems

Parameter	Average Minimum	Average Maximum
Cost	$11,976	$34,426
Weight (%)	90%	10%
Weighted Average	**$14,221**	

Using the base cost from Table 5-9, the decentralized CET equations are as follows:

Equation 5-12. $$\boldsymbol{Cost = LF_{ZIP\ Code} \times System\ Cost \times n}$$

Equation 5-13. $$\boldsymbol{n = Population\ Served / People\ per\ Household}$$

Where

Cost = total estimated capital cost
$LF_{ZIP\ Code}$ = ZIP Code location cost factor
System Cost = $14,221
n = number of systems, entered directly or calculated using Equation 5-13

Population Served = population served by decentralized systems
People per Household = average, based on most recent U.S. Census Bureau data for the scale at which data are entered (county or state)

5.2. Data Analysis

5.2.1. Urban and Rural Analysis

To classify reported needs in urban and rural areas, the EPA used the U.S. Census Bureau's definition and identification of urban areas combined with physical locations provided during the 2022 CWNS. In ArcGIS, the EPA mapped each wastewater and stormwater submission using the point locations entered into the DEP and uploaded the 2022 urban area TIGER/Line shapefile downloaded from the U.S. Census Bureau.[5] Using "Select by Location," the EPA identified wastewater and stormwater submissions that intersected with urban areas or were within 1 mile of an urban area. The EPA used the 1-mile buffer to account for wastewater and stormwater infrastructure that is just outside an urban area and is primarily used to treat wastewater or stormwater from the broader urban area. Any infrastructure points not identified as urban were categorized as rural for this analysis.

5.2.2. Small Community Wastewater Needs Analysis

To capture the small community designation, a state could flag a submission as serving a small community via a checkbox during data entry. The checkbox was primarily used to identify which submissions were eligible to use the small community form, so this designation did not comprehensively identify all submissions that served a small community.

In addition to the state-designated submissions, the EPA included communities in this analysis based on the reported population served. Wastewater submissions serving populations of 10,000 or fewer that were not part of larger sewersheds were included. While the population served by centralized wastewater treatment can approximate a community's population, it does not account for any population served by decentralized wastewater treatment such as individual septic systems.

5.2.3. Wastewater Trends Analysis

Population Served by Treatment Type

In addition to estimating the capital investment needed to meet the water quality goals of the CWA, an objective of the CWNS is to evaluate trends in the nation's ability to provide wastewater treatment for its population and improvements to that treatment over time. This includes estimating the population served by the nation's wastewater treatment plants at different effluent treatment levels. The EPA used the sewershed information gathered in the survey to estimate how many people are served by each treatment plant and, ultimately, each treatment level.

If a treatment plant sent a portion of its wastewater to another treatment plant for additional treatment, the EPA proportioned the population served by each plant using the reported percent of discharge sent

[5] Available at https://www.census.gov/geographies/mapping-files/time-series/geo/tiger-line-file.2022.html#list-tab-790442341.

for further treatment. The number of non-discharging treatment plants reported to Congress represents only treatment plants that are 100 percent non-discharging (i.e., they do not send any portion of their discharge to surface waters). Treatment plants that partially discharge to surface water and are partially non-discharging are included under the surface water discharge entries.

In cases where the sewershed information was incomplete, the EPA reviewed each submission individually and assigned an effluent level based on other information in the sewershed or documentation supplied by the state. For confirmed treatment plants, the EPA assumed secondary effluent if no effluent data were provided. For any treatment plant that did not indicate a future effluent treatment level, the EPA defaulted to the current effluent treatment level.

Treatment Plant Count

To estimate the number of treatment plants nationwide, the EPA summed all submissions with a "Treatment Plant" facility type. The current number of treatment plants includes all existing and confirmed plants (see section 5.1.1) plus those that states indicated were to be abandoned before the end of the survey period (December 31, 2041). The future number of treatment plants include all existing and confirmed plants plus those that states indicated were to be constructed before the end of the survey period.

Table 5-10. Count of Treatment Plants by Status

Status	Number of Treatment Plants
Existing	15,919
Confirmed	1,425
Slated to be abandoned by 2042	200
2022 Total	**17,544**
Existing	15,919
Confirmed	1,425
Slated to be constructed by 2042	335
2042 Total	**17,679**

6. References

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Appendix A. Designated Documents

Table A-1. List of Designated Documents with Document Number, Type, and Designation

Document No.	Document Type	Designation
1	CWSRF IUP/Project Priority List	Primary
2	Non-CWSRF Governmental Loan and Grant Application	Primary
3	CWSRF Loan Pre-application/Final Application	Primary
4	Non-governmental Grant Application	Alternate
5	Cost of Previous Comparable Construction	Alternate
6	State-Approved Area-Wide or Regional Basin Plan	Alternate
7	State-Approved Local Comprehensive Water and Sewer Plan	Alternate
8	Total Maximum Daily Load (TMDL)	Alternate
9	National Estuary Program (NEP) Comprehensive Conservation and Management Plan	Alternate
12a	Completed State Needs Surveys and other state forms (approved as primary)	Primary
12b	Completed State Needs Surveys and other state forms (approved as alternate)	Alternate
13	Wastewater/Stormwater User Rate Study	Alternate
14	Climate Resilience Evaluation and Awareness Tool Report	Alternate
15	Regional Water Plan	Alternate
16	Hazard Mitigation Plan	Alternate
17	Integrated Stormwater and Wastewater Plan	Alternate
20	CIP or Master Plan	Primary
21	Facility Plan or Preliminary Engineering Report	Primary
22	Engineer's Study	Alternate
23	Final Engineer's Estimate/Lowest Bid	Primary
24	Sewer System Evaluation Document	Alternate
25	Diagnostic Evaluation	Alternate
26	Sanitary Survey	Alternate
27	State-Approved Municipal Wasteload Allocation Plan	Alternate
28	Recently Promulgated Municipal, State, or Federal Regulation	Alternate
30	Administrative Order, Court Order, or Consent Decree	Alternate
31	National Pollutant Discharge Elimination System (NPDES) or State Permit Requirement (with Schedule)	Alternate
32	Draft CSO Long-Term Control Plan (LTCP)	Alternate
33	Approved CSO LTCP/Annual Report	Primary
34	Signed Draft LTCP from CSO LTCP-EZ Template	Alternate
35	State-Approved LTCP from CSO LTCP-EZ Template	Primary
40	Watershed-Based Plan	Alternate
41	Section 319 Funded or EPA Reviewed Watershed-Based Plan	Primary
42	Approved State Annual 319 Workplan	Alternate
43	Approved State 319 Project Implementation Plan	Primary
44	NPS Management Program/Assessment Report	Alternate

Document No.	Document Type	Designation
45	NPS Management Program/Groundwater Protection Strategy Report	Alternate
46	NPS Management Program/Wellhead Protection Program and Plan	Alternate
47	NPS Management Program/Delegated Underground Injection Control Program Plan	Alternate
48	Source Water Assessment/Source Water Protection Plan	Alternate
49	Natural Resources Conservation Service (NRCS) Conservation Plan or Farm Plan	Alternate
50	Electronic Field Office Technical Guide (eFOTG)	Alternate
51	State/Federal Agricultural Cost-Share Program Cost Tables	Alternate
52	Professional Appraisal	Alternate
53	Census of Agriculture	Alternate
54	Conservation Effects Assessment Project, Cropland Assessment	Alternate
55	U.S. Forest Service Forest Inventory and Analysis Database	Alternate
56	National Association of State Foresters BMP Survey	Alternate
60	Municipal Storm Water Management Program Plan	Alternate
61	Stormwater Utility Feasibility Study	Alternate
71	Small Community Form	Primary
72	Information from an Assistance Provider	Alternate
73	Asset Management Plan	Alternate
74	Asset Management Plan with Costs	Primary
75	Small Community Form (uploaded as attachment)	Primary
96	Excel Spreadsheet Annotations	n/a
99a	Other—Undesignated (submitted as primary)	Primary
99b	Other—Undesignated (submitted as alternate)	Alternate
100a	State Needs Surveys and other state forms (submitted as primary)	n/a
100b	State Needs Surveys and other state forms (submitted as alternate)	n/a
101a	State-Specific Approach (submitted as primary)	n/a
101b	State-Specific Approach (submitted as alternate)	n/a
101c	CWNS ID–Specific Output to State-Specific Approach (approved as primary)	Primary
101d	CWNS ID–Specific Output to State-Specific Approach (approved as alternate)	Alternate

Appendix B. Reviews by State

Table B-1. Number of Submissions Receiving Partial, Full, and Audit Reviews, Along with the Audit Adjustment Factor, for Each State

State	Number of Full Reviews	Number of Partial Reviews	Number of Audit Reviews	Audit Adjustment Factor
Alabama	27	334	12	1.00
Alaska	10	170	4	0.94
American Samoa	0	2	1	1.00
Arizona	41	180	8	0.96
Arkansas	119	490	21	0.98
California	217	660	22	0.97
Colorado	88	712	14	1.00
Connecticut	155	146	2	1.00
Delaware	7	37	2	1.00
District of Columbia	2	0	0	1.00
Florida	271	513	18	0.99
Georgia	460	617	21	0.99
Guam	3	3	1	1.00
Hawaii	14	13	1	1.00
Idaho	18	200	22	1.00
Illinois	133	1,039	10	1.00
Indiana	93	664	10	0.99
Iowa	285	742	7	1.00
Kansas	118	682	4	1.00
Kentucky	23	301	7	0.97
Louisiana	125	336	9	0.94
Maine	67	178	5	0.98
Maryland	85	233	8	0.95
Massachusetts	446	196	7	0.97
Michigan	116	702	3	1.00
Minnesota	104	749	21	1.00
Mississippi	6	51	14	1.00
Missouri	147	966	13	1.00
Montana	2	203	6	1.00
N. Mariana Islands	4	3	1	1.00
Nebraska	9	490	22	1.00
Nevada	5	36	4	1.00
New Hampshire	214	196	11	1.00
New Jersey	463	790	32	1.00
New Mexico	64	192	10	0.99
New York	155	1,171	25	0.99
North Carolina	166	628	20	0.98
North Dakota	60	326	12	1.00
Ohio	158	1,198	21	0.94

State	Number of Full Reviews	Number of Partial Reviews	Number of Audit Reviews	Audit Adjustment Factor
Oklahoma	18	501	6	1.00
Oregon	139	285	10	0.93
Pennsylvania	143	201	4	1.00
Puerto Rico	37	53	3	1.00
Rhode Island	43	53	2	1.00
South Carolina	74	29	4	1.00
South Dakota	5	57	4	0.98
Tennessee	13	298	3	1.00
Texas	461	1,794	10	1.00
Utah	240	84	4	1.00
Vermont	64	142	3	0.84
Virgin Islands	1	20	1	1.00
Virginia	354	378	12	0.97
Washington	123	390	8	0.96
West Virginia	339	353	8	0.93
Wisconsin	135	993	12	1.00
Wyoming	3	195	8	0.94