Iowa's 2022 305(b) Supplemental Information Report

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April 1, 2022

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Executive Summary

The Iowa Integrated Water Quality Report was prepared by the Iowa Department of Natural Resources to meet requirements stated in Sections 303(d), 305(b), and 314 of the federal Clean Water Act (CWA). Section 303(d) requires states to submit a list of waters not meeting water quality standards (WQS). Section 305(b) requires an assessment of surface water quality and summary of monitoring and pollution control activities. Section 314 requires a status and trends assessment of publicly owned lakes. The primary purpose of this report is to provide the U.S. Environmental Protection Agency (EPA) and the residents of Iowa with additional information not covered in the 2022 Methodology for Iowa's 2022 Water Quality Assessment and Iowa's Section 303(d) lists and Integrated Reports located on Iowa's ADBNet (Iowa's online database tracking Iowa's water quality assessments). This report will cover or provide reference links to programs containing information about the following 305(b) CWA elements:

- A description of CWA pollution control programs in Iowa, an estimate of the extent to which CWA control programs have improved water quality or will improve water quality in Iowa, and recommendations for future actions necessary.
- A description of the nature and extent of nonpoint source pollution and recommendations of programs needed to control each category of nonpoint sources, including an estimate of implementation costs.
- An estimate of the environmental, economic, and social costs and benefits needed to achieve the objectives of the CWA and an estimate of the date of such achievement.
- A description of Iowa's wetland monitoring program.
- A description of the nature and extent of groundwater pollution and recommendations of State plans or programs needed to maintain or improve groundwater quality.

Water Pollution Control, Water Quality Improvement, or Clean Water Act Control Programs

Iowa Surface Water Quality Standards

The state of Iowa through the Iowa Department of Natural Resources (DNR) has the delegated authority for implementing much of the Clean Water Act (CWA) in the state of Iowa in addition to other state regulations concerning water pollution. Iowa's approach to water quality management is primarily based on its water quality standards (WQS) provided in 567 IAC Chapter 61. Under this chapter, waters of the state are protected for specific designated uses. WQS are the basis for protecting designated uses, which in Iowa include: drinking water supply (C); human health protection - fish consumption (HH); primary contact recreation (e.g., swimming) (A1); secondary contact recreation (e.g., fishing and wading) (A2); children's recreation (A3); aquatic life protection for warm water stream habitats (BWW1, BWW2, and BWW3); aquatic life protection for cold water streams and cold water headwaters (BCW1 and BCW2); and aquatic life protection for lakes and wetlands (BLW). The DNR is responsible for developing scientifically based WQS and proposing them to Iowa's Environmental Protection Commission (EPC) for adoption into state regulations. In accordance with the federal CWA, Iowa is required to review and update WQS at least once every three years.

To determine if designated uses are being protected, two general modes of WQS are used, narrative and numeric criteria. Narrative criteria are protective descriptions that may be measured using numeric values. For example, 567 IAC 61.3(2)(d) states that waters shall be free from substances attributable to wastewater discharges or agricultural practices in concentrations or combinations which are acutely toxic to human, animal, or plant life. Quantitative methodologies then utilize numeric values to determine if a narrative criterion is exceeded and if substance(s) is/are having a toxic effect on human, animal, or aquatic life. In some cases, narrative criteria alone may be used to assess attainment of designated uses. For example, under 567 IAC 61.3(2)(a), waters shall be free from substances attributable to point source wastewater discharges that will settle to form sludge deposits. Streams with sludge deposits from point source wastewater discharges are in violation of this narrative standard. Water monitoring data is compared to numeric criteria to determine if designated uses are attained or not. Quantitative methods always use measured numeric values to examine if the numeric criterion is being upheld.

Additional protection to state waters is provided in the antidegradation component of the WQS in 567 IAC 61.2(2). Iowa's antidegradation policy consists of a four-tiered system. In the first tier, a level of water quality necessary to protect existing uses will be maintained and protected. In the second tier, in cases where water quality is better than applicable water quality criteria, the existing quality shall be protected and maintained. Lowering of in-stream water quality is only allowed in such cases when it is determined to be necessary for important economic and social development. This second tier also contains a set of provisions that must be followed for any permitted degradation of state waters. In the third tier, high quality waters that constitute an outstanding state resource shall be maintained and protected. In the fourth tier, there shall be no degradation of water quality in outstanding national resource waters.

Point Source Pollution Control

The DNR has the delegated authority from EPA to administer the National Pollution Discharge Elimination System (NPDES) program for the state of Iowa. The DNR issues permits for discrete wastewater discharges (e.g., human wastewater, industrial wastewater, stormwater, concentrated animal feeding operations) that flow directly into surface waters. Industrial, municipal, and other facilities are regulated in order to ensure that surface waters receiving treated effluent from these sources meet WQS and other state and federal requirements. Permits include requirements for limitations on specific pollutants (e.g., biochemical oxygen demand, ammonia as nitrogen, chloride), monitoring and reporting, and the implementation of best management practices (BMPs) as needed. The DNR requires wastewater facilities to meet certain design specifications, while plant operators are required to be certified at a level that corresponds to the plant's size and complexity. For additional information on the types of regulated discharges and available permits, please see the DNR's website at https://programs.iowadnr.gov/wwpie/.

Most concentrated animal feeding operations (CAFOs) in Iowa are required to be designed, constructed, operated and maintained as "no discharge" facilities. Manure and wastewater produced by CAFOs is land-applied rather than

discharged to streams. Permit requirements include development and implementation of a manure or nutrient management plan which contains a strategy for the onsite utilization of BMPs. There are over 160 permitted open lot CAFOs in Iowa where a discharge may be allowed from the facility. For more information on CAFOs, please see the DNR's website at https://www.iowadnr.gov/Environmental-Protection/Animal-Feeding-Operations.

The DNR issues stormwater construction permits to control storm water runoff from disturbed sites that comprise an area of one acre or more. These permits require the use of BMPs to prevent the migration of silt and sediment into surface waters. A storm water pollution prevention plan must also be prepared prior to issuance of any permit. Some activities that commonly require land disturbance permits include housing or building construction, road and dam construction, and utility pipelines. For more information on storm water construction permits, please see the Department's website at https://www.iowadnr.gov/environmental-protection/water-quality/npdes-storm-water.

The discharge of storm water runoff transported through Municipal Separate Storm Sewer Systems (MS4s) is another regulated activity. Separate storm sewer systems include any method of conveying storm water including streets, ditches, swales, or any man-made structure that directs flow. There are 47 identified MS4s in Iowa, and each one is required to develop and implement a storm water management program to prevent and reduce any contamination of storm water runoff and prevent illegal discharges. The storm water management program includes six minimum control measures: (1) public education and outreach; (2) a process for public involvement and participation; (3) illicit discharge detection and elimination; (4) construction site storm water runoff control; (5) post-construction storm water management; and, (6) pollution prevention/good housekeeping for municipal operations. For additional information regarding storm water regulations, please see the DNR's website at https://www.iowadnr.gov/environmental-protection/water-quality/npdes-storm-water.

Nonpoint Source Pollution Control

Nonpoint source (NPS) pollution comes from many diffuse sources and is defined as the transport of natural and man-made pollutants by rainfall or snowmelt, moving over and through the land surface and entering lakes, rivers, streams, wetlands, or groundwater. Some common sources of NPS pollution include row crops and agricultural fields, eroding streambanks and shorelines, road surfaces and parking lots, septic systems, and underground storage tanks. In Iowa, significant contributors of NPS pollution include agricultural lands and urban areas. The DNR takes two general approaches in managing NPS pollution: one that is volunteer-based and offers monetary incentives and grants, and another that is regulation-focused.

Many NPSs may be addressed by the DNR's NPS Management Program. This program engages concerned citizen organizations, landowners, federal, state, and local governments, as well as universities and other stakeholders to implement NPS control practices and monitor improvements to water quality and habitat. One priority of Iowa's 2018-2022 NPS Management Program Plan is to restore impaired waters and to protect unimpaired high-quality waters. Grant funds provide local citizens the knowledge and ability to improve their common land use practices and to protect and improve water quality. NPS projects target numerous types of runoff pollutants (e.g., sediment, fertilizers, pesticides, bacteria, animal waste) through the implementation of land management measures (e.g., stream bank stabilization, riparian and wetland improvements) and cost-share programs. With the exception of special projects, funded activities are carried out as part of a larger watershed plan to improve specific stream and lake resources. Project funding is provided by the EPA though Section 319(h) of the federal CWA and supports 60 percent of total project costs. The NPS Program is a key partner of the Natural Resources Conservation Service's (NRCS) Mississippi River Basin Initiative (MRBI) and the recent NRCS-EPA collaborative National Water Quality Initiative (NWQI). For additional information regarding nonpoint source pollution and watershed improvement in Iowa, please see the DNR's website at https://www.iowadnr.gov/Environmental-Protection/Water-Quality/Watershed-Improvement

One of the programs the Iowa Department of Agriculture and Land Stewardship (IDALS) administers is the Iowa Conservation Cost Share program. The program was established in 1973 to protect the soil and water resources of the state from erosion and sediment damage. The program encourages the adoption of land stewardship and conservation practices that sustain agriculture and preserve our state's natural resources. Technical assistance is provided by

IDALS-Division of Soil Conservation and Water Quality and the USDA NRCS, and practices are designed to NRCS technical standards. Applicants are required to enter into maintenance agreements to ensure long-term success and performance. Practices are approved locally by Iowa's 100 Soil and Water Conservation Districts (SWCDs). For more information on this program and other similar water quality and soil conservation programs administered by IDALS, please visit https://iowaagriculture.gov/field-services-bureau.

While general NPS pollution is not formally regulated, there are instances of several different types of NPSs falling under a form of water pollution control. As noted earlier, permits are issued to control storm water runoff from land disturbance activities of an acre or more, as well as for certain industries and mobile asphalt and concrete facilities. Land application of human and animal wastewater is also regulated and permitted by the state. Construction, placement, dredging and filling, or general earth moving activities within a wetland or water body requires a CWA Section 404 permit from the United States Army Corps of Engineers (USACE) and CWA Section 401 water quality certification from the DNR (https://www.iowadnr.gov/Environmental-Protection/Water-Quality/Section-401-Water-Quality-Certification). Single family residential wastewater systems, or septic systems, which are known NPSs, fall under the jurisdiction of the DNR and the counties in which the systems reside (https://www.iowadnr.gov/Environmental-Protection/Water-Quality/Private-Septic-Systems).

Iowa Nutrient Reduction Strategy

The Iowa Nutrient Reduction Strategy (NRS) is a science and technology-based approach to assess and reduce nutrient losses delivered to Iowa waterways and the Gulf of Mexico. The strategy outlines opportunities for efforts to reduce nutrients in surface water from both point sources, such as municipal wastewater treatment plants and industrial facilities, and NPSs, including agricultural operations and urban areas, in a scientific, reasonable, and cost-effective manner.

The NRS, progress reports, and dashboards are collaborations between representatives from the Iowa State University College of Agriculture and Life Sciences, the DNR, and IDALS. To learn more about the Nutrient Reduction Strategy, visit https://www.nutrientstrategy.iastate.edu/.

Total Maximum Daily Load Program

Total maximum daily loads (TMDLs) are tools to inform watershed planning. A TMDL calculates the maximum amount of a pollutant that a water body can receive and still meet WQS. This calculated pollutant load is then allocated to the various sources in the watershed and becomes the goal to restore water quality. A portion of the pollutant load is also often allocated to an explicit margin of safety to account for any uncertainties in scientific and technical understandings of water quality in natural systems. The margin of safety provides additional assurance that WQS will be attained after allocations to point and nonpoint sources have been achieved. In Iowa, all draft TMDLs and implementation plans are made available for public review and comment through a 30-day public notice period. At the time of this report, the DNR has 123 approved or EPA-established TMDL actions. All approved and draft TMDLs are available on the DNR's TMDL webpage at https://www.iowadnr.gov/environmental-protection/water-quality/watershed-improvement/water-improvement-plans. In response to EPA's efforts to develop a new long-term vision for the CWA Section 303(d) program, DNR developed a revised system of prioritization for waterbodies included in IR Category 5. This new long-term vision (TMDL Vision) was developed for the 2014 IR cycle by the DNR. The latest approved version of the TMDL vision can be found on the DNR's TMDL webpage at https://www.iowadnr.gov/Environmental-Protection/Water-Quality/Watershed-Improvement/Water-Improvement-Plans#Iowa-Water-Quality-Improvement-Plan-development-14 under the link "Schedule of future improvement plans" (Berckes 2015). DNR prioritizes TMDLs with a high potential for social impact in accordance with the framework supported by EPA from the 2013 303(d) Vision (Vision). The state of Iowa focuses much of its water quality improvement efforts on nutrients and nutrient-related issues. Additionally, the state of Iowa and its citizens place great value on their lake systems for recreation. As a result, the DNR focuses first and foremost on lake systems impaired for eutrophic conditions (algae, turbidity, pH). The methodology for TMDL prioritization can be found in the current version of the

Methodology for Iowa's Water Quality Assessment, Listing, and Reporting Pursuant to Sections 305(b) and 303(d) of the Federal Clean Water Act document available on the publications webpage at https://programs.iowadnr.gov/adbnet/Docs/Publications.

Cost/Benefit Assessment

Section 305(b) requires the state to report an estimate of economic and social costs and benefits required to realize objectives of the CWA. Cost information pertaining to water quality improvement and protection efforts is difficult to calculate exactly, but can be estimated to some degree. While the DNR tracks its own programmatic costs, those representatives of municipal, private, and industrial treatment facility operations, and in some cases, the implementation of BMPs, are typically not readily available. Economic benefits, in monetary terms, resulting from water protection efforts are even more difficult to calculate. Similarly, accurately calculating time frames to realize the objectives of the CWA is not realistic given the ongoing needs for point source (PS) and NPS infrastructure investments with set useful design lives, perpetual operation and maintenance, and the continual fluctuation targets for clean water under the CWA. An overview of the amount of funding the DNR spends on various aspects of water pollution control and prevention is provided in the following paragraphs.

Clean Watersheds Needs Survey

The Clean Watersheds Needs Survey (CWNS) is a comprehensive assessment of needs to meet the water quality and water-related public health goals of the Clean Water Act (CWA). States and EPA typically conduct the CWNS every 4 years under CWA Section 516(b) when funds are available for the survey. The last CWNS was conducted in 2012 and while dated, is still generally reflective of the needs today (NOTE: A new CWNS is currently under development for 2022). The 2012 CWNS identified $2.438 billion of clean water needs over 7 main need categories. The categories break down as follows:

Secondary Wastewater Treatment - $315 million
Advanced Wastewater Treatment - $630 million
Conveyance System Repair - $802 million
New Conveyance Systems - $264 million
Combined Sewer Overflow Correction - $368 million
Stormwater Management - $55 million
Recycled Water Distribution - $2 million

The CWNS also estimates improvements in the treatment level of Iowa's publicly-owned wastewater treatment plant as identified in the chart below (https://www.epa.gov/cwns/clean-watersheds-needs-survey-cwns-state-fact-sheets-2012).

Improvements in treatment level of Iowa's publicly-owned wastewater treatment plants.

Level of treatment	Population served in millions (number of facilities)				Population change from 2008-2012	Projected population change from 2012-2032
	2004	2008	2012	2032		
Less than Secondary[a]	- (0)	- (0)	- (0)	- (0)	-	-
Secondary	2.1 (716)	2.2 (703)	2.2 (707)	1.1 (523)	0.6%	-51.7%
Greater than Secondary	0.2 (10)	0.4 (47)	0.4 (59)	1.9 (246)	2.1%	381.8%
No Discharge	< 0.1 (1)	< 0.1 (1)	< 0.1 (2)	< 0.1 (2)	75.1%	-6.6%
Partial Treatment	- (3)	- (6)	- (0)	- (0)	-	-
Total	**2.3 (730)**	**2.6 (757)**	**2.6 (768)**	**3.0 (771)**	**0.8%**	**15.5%**

[a] Includes facilities granted section 301(h) waivers from secondary treatment for discharges to marine waters. As of January 1, 2012 waivers for 36 facilities in the CWNS 2012 database had been granted or were pending.

DNR Water Quality Bureau Dashboards

The DNR's Environmental Services Division Metrics webpage is an additional resource where improvements to water quality and environmental benefits are documented (https://experience.arcgis.com/experience/f57d1f8a00f1444596d5045ee6dc6798/page/Water-Quality-Bureau/). The Water Quality Bureau dashboards within this web application highlight the benefits of clean water investments in wastewater infrastructure, specifically regarding the installations of ammonia removal and new disinfection technologies across Iowa.

For example, from 2011-2020 there have been 118 ammonia removal capable wastewater treatment plant upgrades built that remove a cumulative total of 1,020,000 lbs of ammonia annually. Additionally, from 2011-2020 there have been 191 disinfection systems installed that disinfect a cumulative total 86,300,000,000 gallons of wastewater annually.

DNR Water Quality Bureau Budget

The DNR's Water Quality Bureau implements an annual budget of approximately $20 million which include all facets of water quality monitoring, water pollution control, and administrative support. The DNR spends an average of $2.0 million on its ambient water quality monitoring network each year.

Section 319

Another significant expense includes grants aimed at improving water quality. The DNR awards funding provided by the EPA under Section 319 of the CWA for projects that address NPS pollution, and approximately $3.6–$3.8 million was available annually for NPS projects in federal fiscal years (FFYs) 2019 to 2021. Approximately $100,000 to $200,000 was awarded annually for watershed planning, and $1.8 to $1.9 million was awarded annually to watershed implementation projects.

Iowa Nutrient Reduction Strategy

Iowa's NRS identified an initial investment cost range of $1.2 billion to $4 billion to meet the NPS nitrogen and phosphorus reduction goals. Additionally, the NRS identified a total present worth cost of $1.5 billion to meet the PS nitrogen and phosphorus reduction goals. The NRS progress reports track investments, outreach, practice implementation, and water quality data as a part of its logic model progress tracking approach. In the 2018-2019 report, an estimated $560 million was invested in education and outreach, research, practice implementation and water monitoring. For more details and analyses please visit https://www.nutrientstrategy.iastate.edu/documents

Iowa Clean Water State Revolving Fund

Iowa's Clean Water State Revolving Fund (CWSRF) loan program provides low-interest financing to construct wastewater and storm water projects that improve water quality. Other eligible projects include, but are not limited to, NPS projects and water conservation or reuse.

During the 2021 reporting period, approximately 95% of the CWSRF dollars went to wastewater and sewer infrastructure needs. The remaining dollars went to both publicly and privately owned projects in the NPS arena, including Onsite Septic Systems, Hydromodification, Green Infrastructure, Manure Management, Agricultural Soil Erosion Control Practices and Land Acquisition for Conservation. In SFY 2021, the Iowa SRF Program entered into 86 construction loans and 51 Planning & Design loans for a total of $311,207,850 in CWSRF executed assistance agreements including Sponsored Projects amendments and General Nonpoint Source Projects. As of the end of SFY 2021, the Sponsored Project Program alone has cumulatively awarded $90.1 million to 124 Sponsored Projects in 95 communities and 1 state park (https://www.iowasrf.com/media/cms/FINAL_SRF_Annual_Report_2021_ADA_C8C901A60FAD2.pdf).

Source Water Protection Program

The DNR's Source Water Protection Program (SWPP) is designed to keep drinking water source waters protected for Iowa's residents (https://www.iowadnr.gov/Environmental-Protection/Water-Quality/Source-Water-Protection). The SWPP operates under a voluntary basis to provide public water suppliers with opportunities to protect drinking water that may be threatened by potential contaminants such as pesticides, other hazardous chemicals, storm water runoff, and waste disposal sites as well as septic tanks. Funding activities primarily include wellhead protection, BMPs, and capacity development. Costs associated with implementing SWPP activities are generally funded by reserved drinking water SRF monies, approximately $300,000 per year.

DNR Monitoring Program Coordination

To maximize efficiency, the DNR routinely coordinates its monitoring activities to avoid overlap with other agencies and to provide and receive interagency input on monitoring study design. Examples of this coordination include:

- Collaboration with DNR Fisheries on fish tissue monitoring, macroinvertebrate collection, and reference stream identification.
- A memorandum of understanding with the Upper Mississippi River Basin Association (UMRBA) for conducting a pilot study on the Mississippi River. The DNR also participates in meetings and other activities that UMRBA coordinates.

Iowa is strongly committed to protecting water quality in the over 92,852 miles of stream and 767 lakes, reservoirs, and wetlands. Iowa's waters are highly valued public resources, where good water quality promotes a healthy economy, which in turn provides support for better water quality.

Special State Concerns and Recommendations

Iowa has accomplished significant advances in environmental quality due to its water protection programs. Municipal and industrial wastewater discharged to state waters is not permitted without consideration given to the potential impacts to receiving waters. Improved agriculture practices have reduced polluted runoff. The same conservation practices have helped preserve farmland and enhance wildlife habitat. While Iowa waters are certainly cleaner today than 40 or 50 years ago, substantial pollution pressure remains. Today's major environmental concerns may be divided into categories as described in the following paragraphs.

Agricultural and Urban Land Use as Nonpoint Sources of Pollution

Managing agricultural and urban runoff is an ongoing challenge in Iowa; both sources have substantial influence on the condition of water quality. Cropland runoff may contain large amounts of sediment, nutrients, and pesticides. Pollutant loads from urban runoff include sediment from new development and construction; oil, grease, and other chemicals from automobiles; nutrients and pesticides from commercial and residential lawn management; grass clippings and brush disposal into streams; road salts, and heavy metals. Impervious surfaces, such as roadways and rooftops increase water volumes in streams during storm events and lower base flows during dry periods. This hydrological pattern frequently results in eroded stream banks, widened channels, and impaired habitat. Moreover, impervious surfaces are easily heated by the sun which in turn warms surface runoff and ultimately causes stream temperatures to increase. Changes in water quality and habitat conditions that generally accompany urban and agricultural runoff impair aquatic life and diminish the value of other designated uses.

DNR programs that are both regulatory and voluntary have proven effective for managing runoff, but such programs are not available to cover all runoff problems occurring across the state. Additional monitoring, resources, and external support are needed to eliminate the threat of NPS runoff.

Municipal and Industrial Sources

Wastewater treatment plants and other point source dischargers can have a significant impact on water quality. Point sources are subject to NPDES permit requirements; however, pollution incidents still happen occasionally. Failing treatment systems, bypasses, accidental spills, or illicit waste disposal are some types of violations that can occur. Raw or partially treated sludge releases will degrade aquatic communities as organic matter decomposes and dissolved oxygen is removed from the water. Other toxic substances can have more direct effects on aquatic life.

Pharmaceutical and Personal Care Products (PPCPs) include any product used by individuals for personal health or cosmetic reasons, or those used by agribusiness to enhance the growth or health of livestock. Some examples of PPCPs include endocrine disrupting sex hormones, antibiotics, steroids, antidepressants, and various prescription and over-the-counter drugs. Treatment facilities are not equipped to eliminate PPCPs from wastewater as these substances pass through on their way to receiving streams and lakes. While little is known about the impacts of PPCPs on human health, aquatic organisms at any stage in development may be affected. An example of the effect of PPCPs on aquatic biota is the feminization (disruption of normal gonad development and function) of male fish as a result of estrogens being released into the water.

The presence of per- and polyfluoralkyl substances (PFAS) in wastewater influents, effluent, and biosolids is another area of concern moving forward. State and federal efforts are ongoing to better understand the relationships of PFAS within wastewater treatment systems, the significance of those relationships and environmental impacts, and solutions to address and mitigate these impacts.

The DNR has worked with numerous entities to upgrade wastewater treatment plants in order to meet WQS and the requirements of the Iowa NRS. While many treatment facilities are in compliance, several additional facility upgrades are anticipated.

Animal Feeding Operations

Animal feeding operations (AFOs) have the potential to cause water pollution problems. Iowa has over 10,000 active AFOs with 300 or more animal units. Of these, over 160 are open feedlots with active NPDES permits (CAFOs). Land application of manure on agricultural fields is the preferred method of manure management. Small animal feeding operations are not required to submit manure or nutrient management plans.

Iowa's AFO laws and regulations are designed to minimize any threats of water pollution and ensure long-term protection for the environment. Multiple permits may be required for the construction and operation of a CAFO, including a construction permit for earthen basins, a storm water permit, and an NPDES permit. Additionally, NPDES permits require a nutrient management plan to be developed and the implementation of certain BMPs for the land application of animal manure.

Mercury in Fish Tissue

Mercury levels in fish in Iowa waters continue to threaten fish consumption by the sensitive population. For the 2022 IR, totals of 541 stream miles and 2,054 lake acres were listed as impaired based on the existence of mercury consumption advisories. Water bodies that have been monitored for a long time show that mercury levels in fish tissue have remained relatively stable over the years. Without adequate air pollution control worldwide, it is anticipated that future monitoring will detect additional water bodies with elevated levels of mercury in fish tissue.

In 2006, the Iowa Department of Public Health (IDPH) issued a *Heath Issues Regarding Fish Consumption* document that detailed fish consumption guidelines for both the general and sensitive populations of Iowans (https://idph.iowa.gov/Portals/1/userfiles/197/BEHS/PDFs/fish_health_issues.pdf). In that document, IDPH defined the sensitive population: pregnant and nursing women, women of childbearing age, and children younger than 12 years old. This group has been advised to limit consumption of larger predator fish (e.g. walleye, largemouth bass) to one meal per

week. Additional advisories for the general population due to other contaminants may be found at https://www.iowadnr.gov/Environmental-Protection/Water-Quality/Water-Monitoring/Fish-Tissue. Although a recommendation may be made to limit consumption of certain types of fish from specific water bodies, the IDPH still recommends that all Iowans eat fish from a variety of sources at least twice per week.

Eutrophication

Nutrient enrichment, or eutrophication, of state waters is an ongoing concern in Iowa. Iowa's WQS have statewide narrative eutrophication criteria. The DNR assesses lake nutrient conditions and offers various programs and grants to help address any issues and concerns through the 319 program and lake restoration program (https://www.iowadnr.gov/Environmental-Protection/Water-Quality/Lake-Restoration).

Groundwater Protection

Contamination from point and nonpoint sources, including solid wastes, hazardous wastes, and agricultural chemicals, can impact groundwater that is used for drinking water via public and private wells, as well as contribute to surface water quality issues via baseflow or discharges from pumping. Many of these issues are addressed in Iowa's Groundwater Protection Act (GPA) which was passed in 1987 (Iowa Code 455E https://www.legis.iowa.gov/docs/code/2016/455E.pdf). The goal of the Act is stated as follows: "*The intent of the state is to prevent contamination of groundwater from point and nonpoint sources of contamination to the maximum extent practical, and if necessary to restore the groundwater to a potable state, regardless of present condition, use, or characteristics*." This act requires the state to conduct ambient groundwater monitoring and monitoring of points of use (potential sources of contamination) and contaminated sites. The Act established a groundwater protection fund using fees associated with solid waste tonnage, hazardous waste disposal, commercial fertilizer and pesticide sales, and storage tanks. This fund is allocated for research and assessment, clean-up, and educational efforts. The efforts organized as a result of the GPA have significantly reduced threats from petroleum, landfills, pesticides, and other sources. However, new threats, such as those from emerging contaminants like PFAS, pose challenges that have only begun to be assessed on a statewide basis. As discussed in the cost/benefit section, DNR has a Source Water Protection Program that is focused on improving water quality in capture zones of groundwater supplies.

Additional Concerns

Beyond the threats and concerns mentioned above, others remain. Fish and macroinvertebrate data from across the state indicate biological communities are impacted by degraded aquatic habitat. Physical alterations of the channel, alterations in stream flow patterns, removal of much or all of the riparian zone, and upland land use changes in the watershed are all significant contributors to this problem. Stream road crossings are an additional source of habitat degradation. Low-water crossings and improperly placed and/or sized culverts, which are frequently encountered across Iowa, create upstream barriers to fish passage and are primary points of habitat fragmentation.

Aquatic nuisance species pose a significant threat to the aquatic resources and economy of Iowa. Several invasive species are already present in some waters of Iowa, including the zebra mussel, Quagga Mussel, Spiny Waterfleas, Eurasian water milfoil, Curly-leaf Pondweed, and silver carp (https://www.iowadnr.gov/idnr/Fishing/About-Fishing-in-Iowa/Fighting-Invasive-Species).
Long term climatic variability presents additional challenges to the state's aquatic resources.

Additional Surface Water Monitoring

Wetlands Programs

Iowa's current WQS lack designated uses specific to wetlands. The Class BLW aquatic life use applies to lakes, wetlands, and shallow lakes. Additionally, as waters of the state, narrative criteria do apply to wetlands. Additional information

about wetlands in Iowa may be found at https://www.iowadnr.gov/environmental-protection/water-quality/water-monitoring/wetlands.

Wetlands meeting criteria in the United States Army Corps of Engineers Wetlands Delineation Manual 1987, Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Midwest Region, and considered jurisdictional are protected under CWA Sections 404. Persons seeking to alter wetlands through the discharge of "dredge or fill" materials and related impacts (e.g., installing culverts or riprap, rerouting streams, filling wetland for development purposes) must apply for a Section 404 permit with USACE; in conjunction, a federal permit requires Section 401 Water Quality Certification from the DNR ensuring WQS will not be violated.

In 2005, the DNR Water Quality Monitoring and Assessment Section began its wetland monitoring program in the prairie pothole wetlands located in north-central Iowa, through grant funds provided by the EPA. Since this initial grant, a statewide monitoring program has been developed to assess wetlands types throughout Iowa. The results from this monitoring will enable the DNR to determine the ecological condition of Iowa's wetlands. Ultimately, it is intended that reference wetland information may be used as the basis for developing wetland WQS and for establishing an index of biotic integrity (IBI) for wetlands. The most recent wetland program plan for Iowa can be found here: https://www.epa.gov/sites/default/files/2019-03/documents/iowa_wpp_final_1_29_16.pdf.

Numerous state and federal wetland projects have been undertaken to protect and enhance Iowa's wetland resources. As of 2011, nearly 100,000 acres of wetlands exist on State and Federal lands managed by the DNR - Wildlife Bureau and approximately one quarter of those have been restored using a variety of funding sources and partnerships. The USDA holds 181,079 acres of Wetland Easements in the State, the majority of which are permanent. The DNR Wildlife Private Lands Program has made wetland habitat improvement recommendations on 69,523 acres of private land - typically utilizing wetland restoration programs available through the CRP program. Of those recommendations, 34,079 acres were implemented.

Public Health Monitoring

EPA asks states to provide information on public health issues, including information on drinking water supply, whole body contact recreation, and fish consumption advisories. The methods for determining attainment of each use are provided in "The Assessment and Listing Process" section of the "Methodology for Iowa's 2022 Water Quality Assessment, Listing, and Reporting Pursuant to Sections 305(b) and 303(d) of the Federal Clean Water Act" document available for download on the Publications webpage (https://programs.iowadnr.gov/adbnet/Docs/Publications) located in Iowa's water quality assessment database "ADBNet" (https://programs.iowadnr.gov/adbnet/).

Drinking Water Supplies

In Iowa, 255 stream miles, 20,873 lake acres, and 308 wetland acres are designated in ADBNet for drinking water supply usage. In addition to available water quality monitoring data for raw water at drinking water intakes, the drinking water use is assessed for finished water. Impairments related to the quality of finished (treated) water are determined through a review of DNR public drinking water program compliance reports available at http://www.iowadnr.gov/Environmental-Protection/Water-Quality/Water-Supply-Engineering/Annual-Compliance-Report. Reports on violations of Class C water quality criteria and issuance of drinking water advisories are contained within the annual reports.

Fish Consumption Advisories

In Iowa, 471 river segments (5,782 miles), 325 lakes (52,701 acres), 132 wetlands (36,785 acres), and 8 reservoirs (40,850 acres) have the fish consumption use designation (Class HH). For rivers, 41 segments (541 miles) are impaired due to mercury consumption advisories and one segment (11 miles) is impaired due to a polychlorinated biphenyl (PCB) consumption advisory. A total of 16 lakes (2,054 acres) are impaired due to mercury consumption advisories and two lakes (365 acres) are impaired due to PCB consumption advisories.

The DNR publishes the list of waterbody specific consumption advisories on the fish tissue webpage (https://www.iowadnr.gov/Environmental-Protection/Water-Quality/Water-Monitoring/Fish-Tissue) and the annual fishing regulations booklet (https://www.iowadnr.gov/Portals/idnr/uploads/fish/regs_fish2022.pdf). In Iowa, advisories vary according to water body, fish species, and length. Contaminants of concern include mercury, chlordane, and PCBs. For all consumers, recommendations can vary from "one meal per week" to "do not eat" for specific species from specific waterbodies. The IDPH also produced general fish consumption guidelines for the sensitive population, which is defined as pregnant and nursing women, women of childbearing age, and children younger than 12. The IDPH statewide recommendation for the sensitive population is to eat no more than one meal per week of larger predator species. The DNR is in the final stages of developing statewide, length-based consumption advisories of all fish species for the sensitive population due to mercury contamination.

Whole Body Contact Recreation

Indicator bacteria (*E. coli*) and cyanobacteria toxins (microcystin) are sampled for at a select set of designated swimming beaches in the state park system on a regular basis during the primary recreational season from Memorial Day through Labor Day. Swimming is strongly discouraged when the 5 week geometric mean of samples in a collected 30-day period exceeds 126 colony forming units of *E. coli* bacteria per 100 ml of water or when beaches that are classified as vulnerable and transitional beaches exceed the single sample maximum standard of 235 colony forming units of *E. coli* bacteria per 100 ml of water. Additionally, swimming is strongly discouraged when results exceed Iowa's advisory threshold level for cyanobacteria toxins of 8 µg/L total microcystins. See the DNR's current "Beach Monitoring Program Monitoring and Advisory Implementation Plan: Indicator Bacteria – State Beaches" or the State Park Beach monitoring website for beach classification methodology. Sampling results and advisory status can be found during the primary recreational season on the State Park Beach monitoring website (https://www.iowadnr.gov/Environmental-Protection/Water-Quality/Water-Monitoring/Beaches).

Groundwater Monitoring and Assessment

Groundwater Resources

Over seventy-five percent of Iowans rely on groundwater as their primary source of drinking water. Six major aquifer systems provide water for Iowans: Quaternary alluvial aquifers, Pleistocene sand & gravel aquifers, Cretaceous (Dakota) sandstone, Mississippian bedrock, Silurian-Devonian bedrock, and Cambrian-Ordovician bedrock (the Jordan Aquifer). Additional localized aquifers provide drinking water, including the Tertiary "salt & pepper" sands, Pennsylvanian sandstone, Ordovician Galena limestone, and lower Cambrian sandstones. The following table from the "Iowa Groundwater Basics" publication (2003) summarizes these aquifers, aquitards, dominant geologic materials, and stratigraphic relationships.

Iowa's Geologic Strata: Their Aquifers and Confining Layers

Stratigraphic units		Hydrogeologic units	Dominant geologic materials	Hydrologic conditions	Major areas of use
Quaternary	Holocene	Alluvium	sand, gravel, silt, clay	local to regional aquifers	statewide
	Pleistocene	Glacial drift	pebbly clay, silt, sand & gravel	local sand & gravel aquifers	statewide
		Buried valley	sand & gravel	local to regional aquifers	statewide
Tertiary		"salt & pepper" sands	sand & silt	local to regional aquifers	western
Cretaceous	Niobrara Formation (Fm.) Carlile Shale Greenhorn Fm. Graneros Shale	Cretaceous confining units	shale, limestone	confining beds; aquitard	
	Dakota Fm.	Dakota aquifer	sandstone	regional aquifer	western
Jurassic	Fort Dodge Fm.	Jurassic confining unit	gypsum	aquitard	Webster Co.
Pennsylvanian	Virgilian Series Missourian Series	Pennsylvanian confining units	limestone, shale	confining beds; aquitard	
	Marmaton Group Cherokee Group Caseyville Fm.		shale, siltstone, limestone sandstone, coal	confining beds; aquitard local sandstone aquifers	 central, southern
Mississippian	Pella Fm. St. Louis Fm.	Mississippian aquifer	limestone, sandstone, shale		southeast south-central
	Warsaw Fm. Keokuk Fm. Burlington Fm.		dolomite, shale, limestone, chert	local aquitard regional aquifer	 central
	Gilmore City Fm. Maynes Creek Fm.		dolomite, limestone, chert		 north-central
	Prospect Hill Fm.	Mississippian confining units	siltstone, shale	aquitard	

Devonian	Upper Devonian shale formations (Maple Mill)	Devonian confining units	shale, siltstone, dolomite	confining beds; aquitard	
	Lime Creek Fm.		shale, dolomite, limestone	confining beds; aquitard	
				local aquifers	north-central
	Cedar Valley Group	Devonian aquifer	dolomite, limestone, chert	regional aquifer	eastern north-central
	Wapsipinicon Group		limestone, dol., shale, gypsum	local aquitard	eastern
Silurian	Gower, Scotch Grove Hopkinton, Blanding, Tete des Morts, Mosalem formations	Silurian aquifer	dolomite, chert, limestone	regional aquifer	eastern
Ordovician	Maquoketa Fm.	Ordovician confining units	shale, dolomite, chert	confining beds; aquitard	
				local aquifer in northeast	northeast
	Galena Group		dolomite, limestone, chert	confining beds; aquitard	
				local aquifer in northeast	northeast
	Decorah, Platteville, Glenwood formations		shale, limestone, sandstone	confining beds; aquitard	
	St. Peter Sandstone	Cambrian - Ordovician aquifer ("Jordan aquifer")	sandstone	regional aquifer	statewide
	Prairie du Chien Group		dolomite, sandstone, chert	regional aquifer	
Cambrian	Jordan Sandstone		sandstone		
	St. Lawrence Fm.		dolomite		
	Lone Rock Fm.	Cambrian confining units	shale, siltstone, sandstone	confining beds; aquitard	
	Wonewoc Fm. Eau Claire Fm. Mt. Simon Sandstone	Dresbach aquifer	sandstone, shale, dolomite	regional aquifer	east-central northeast
Proterozoic	undifferentiated		igneous & metamorphic rocks; sandstone, shale	unknown	

Groundwater resources vary considerably in quantity and quality across Iowa. Certain aquifers yield high volumes of quality water, whereas in some areas groundwater yields are low and/or contain water that is too mineralized for consumption. In general, while aquifers vulnerable to contamination from the surface are more likely to be contaminated by anthropogenic contaminants such as nitrate, pesticides, organic compounds, and wastewater leachate, deeper, more protected aquifers often contain natural contaminants, such as ammonia, arsenic, radionuclides, and dissolved solids which pose challenges for drinking water treatment. Thus, drilling deeper to avoid widespread nonpoint source contamination can be costly and is not necessarily an economically viable alternative to using less protected aquifers. Shallow unoxidized groundwater sources generally lack nitrate, but are often challenged by iron and manganese. The following section provides an overview of aquifer vulnerability, current monitoring efforts, and protection programs.

Aquifer Vulnerability

Investigations into the occurrence of nonpoint source agricultural chemicals in Iowa groundwater during the early 1980s led to the development and testing of a groundwater vulnerability scheme. This classification provides a general mappable description of the geologic settings where mobile surface-derived contaminants may reach aquifers. This concept was adapted to produce a groundwater vulnerability map for the state (Hoyer and Hallberg, 1991). This classification scheme, shown in the figure below, guides groundwater quality monitoring priorities, such as those described above, as well as groundwater and source water protection activities. Areas where aquifers are overlain by less than 50 feet of slowly permeable confining beds (typically clayey glacial till or shale bedrock) are vulnerable to contamination, and their groundwater commonly contains mobile contaminants such as nitrate. Shallow bedrock aquifers are most common in the eastern half of the state, while alluvial aquifers occur in river valleys statewide. In northeast Iowa, karst areas with sinkholes and losing streams occur in some shallow bedrock settings and add to the overall vulnerability of the underlying groundwater. In contrast, areas where aquifers are covered by more than 50 feet of confining bed material have a significant degree of natural protection from surficial contamination. Contamination can

reach these relatively protected aquifers via direct conduits such as abandoned or inadequately constructed wells, or preferential flow pathways such as fractures, but the geologic setting generally limits contaminant inputs from the surface.

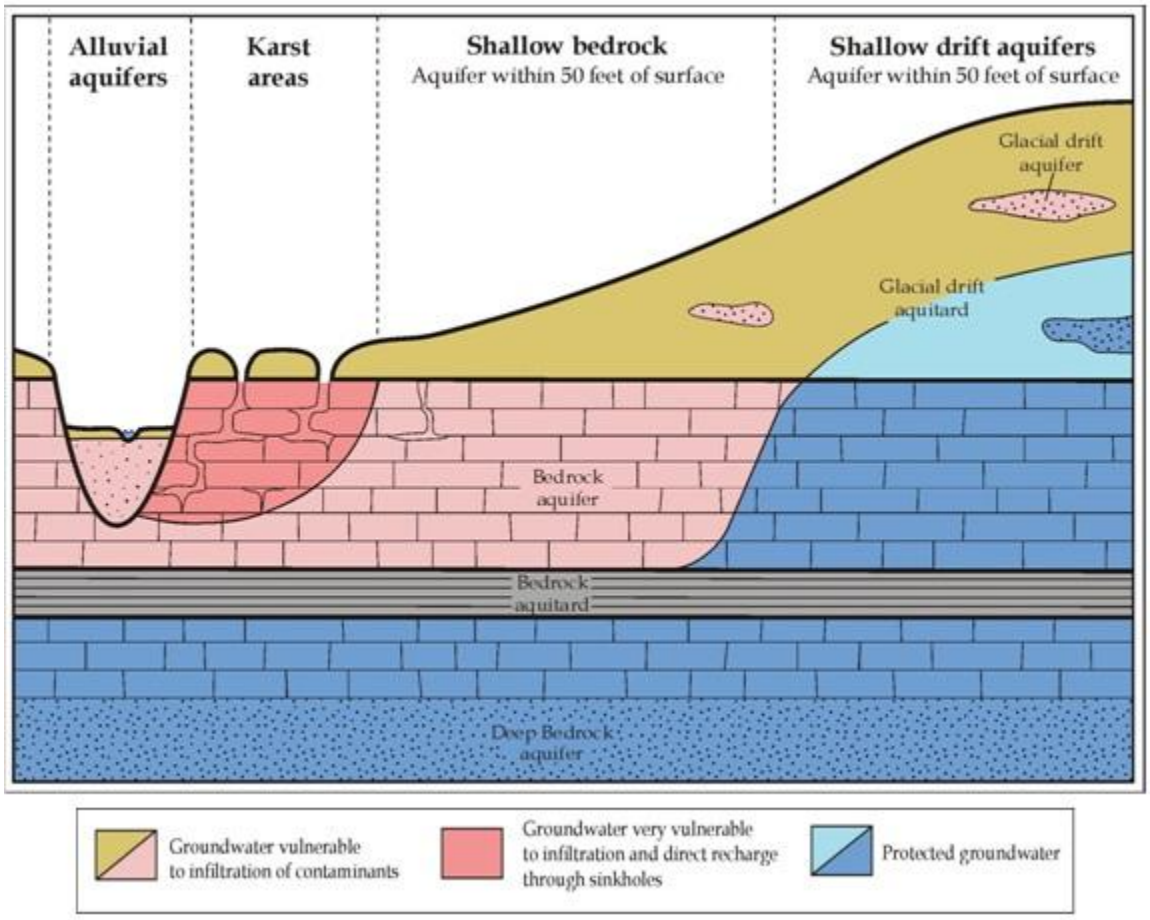

Diagram of the groundwater vulnerability in Iowa

This vulnerability classification was largely derived using nitrate results from private wells. When applied to public wells, several factors alter this approach. First, public wells typically pump significantly larger quantities of water than private wells, resulting in steep downward gradients and the potential to move contaminants to greater depth if pathways exist. Second, these drawdowns result in larger capture zones for public wells, relative to private wells. This increases the potential variability in the confining bed thickness across the capture zone, and the potential for windows of less protected aquifer within the zone. Existing geologic data may be inadequate in terms of density to map this variability. Given this uncertainty and much higher pumping rates (often for many decades) the application of the vulnerability concept to public wells errs on the conservative side, and requires a greater confining bed thickness to be considered naturally protected (Iowa DNR, 2011).

For a 2013 survey of groundwater quality in public water supply wells, wells with less than 50 feet of confining bed thickness were classified as "high vulnerability" wells, wells between 50 – 100 feet of confining materials were classified as "intermediate vulnerability," and wells with greater than 100 feet of confining material were classified as having "low vulnerability" (Hruby et al., 2013). The results of this study showed that high vulnerability wells had significantly higher occurrence of nitrate and chloroacetanilide pesticide degradates as well as significant correlations between confining layer thickness and concentrations of these contaminants. Occurrence of viruses and pharmaceuticals in the 2013 study were too low for statistical correlation.

Groundwater Monitoring

Assessments of Iowa's groundwater quality and quantity are necessary to address public health concerns, help communities, industries, individuals, and ecosystems meet their water needs, and ensure the sustainability of this resource. While the DNR does not directly administer a single statewide monitoring program for groundwater quality, such data is collected for specific projects and tracked by several DNR programs.

Ambient Groundwater Monitoring

Ambient groundwater monitoring efforts have benefitted from collaborations between numerous groups, including the DNR's Water Quality Monitoring and Assessment Section, the Iowa Geological Survey (now a part of the University of Iowa's Institute for Hydraulic Research), the US Geological Survey (USGS), the State Hygienic Laboratory (SHL), the Center for Health Effects of Environmental Contaminants (CHEEC), municipal water operators, state parks, county conservation boards, and well drillers. Iowa's groundwater has been assessed for over 400 individual analytes through the ambient groundwater monitoring program since 2002, including basic water quality parameters, nutrients, pesticides and pesticide degradates, metals, radionuclides, pathogens, PPCPs, synthetic organic compounds, and volatile organic compounds. Links to annual summary documents and special studies can be found on the DNR's ambient groundwater monitoring website: https://www.iowadnr.gov/environmental-protection/water-quality/water-monitoring/groundwater. Groundwater quality results collected since 2002 can be found under the Groundwater facility (IowaGW) groundwater monitoring (GWM) project in DNR's AQuIA database at: https://programs.iowadnr.gov/aquia/search.

Assessment and Clean-Up

The DNR's Land Quality Bureau (LQB) manages several activities to protect groundwater and public health. The goal of the LQB is to protect human health and the environment from threats posed by hazardous wastes. This bureau's primary functions are to oversee cleanup of contaminated sites, Leaking Underground Storage Tanks, and Resource Conservation and Recovery Act sites. The LQB also oversees solid waste activities including landfills and application of sludge.

Drinking Water

Each year, the DNR compiles an annual compliance report to provide information on the activities, measures, and national primary drinking water regulation violations in the public drinking water program for that year. The report is required under the federal Safe Drinking Water Act, for which the DNR has delegated authority. The report lists the public water supply program components, the violations of health-based standards that occurred during the year, and major monitoring and reporting requirements including statistical information. The Iowa Public Drinking Water Program annual compliance reports from various calendar years are available at: https://www.iowadnr.gov/Environmental-Protection/Water-Quality/Water-Supply-Engineering/Annual-Compliance-Report.

In 2021, the DNR initiated a PFAS action plan to assess PFAS occurrence in drinking water and selected raw water sources. Water from 68 communities has been tested to date, and monitoring will be ongoing in 2022. For more information visit: https://www.iowadnr.gov/Environmental-Protection/PFAS.