

# Proposed Groundwater Quality Standards Staff Report

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December 15, 2016

## Introduction/Background

Over the past decade, the development of water reuse has been explored as a means to augment water supplies to meet current and future water supply demands. In 2010, representatives from a number of Oklahoma municipalities, through the Oklahoma Municipal League, expressed interest in using reclaimed water as a way to help conserve water due to the extreme droughts that Oklahoma has been experiencing. Eventually, the Oklahoma Department of Environmental Quality (ODEQ) began formulating rules for non-potable reuse, and also reserved “Category 1” within the regulations to house future indirect potable reuse (IPR) rules (ODEQ, 2015a and 2015b).

Coincidental to the development of reuse rules was the update of Oklahoma’s Comprehensive Water Plan (OCWP) (OWRB, 2012). Of the eight priority recommendations, several dealt directly with creating more reliable water supplies, including water conservation, recycling, and reuse. As a result of the OCWP, the Oklahoma Legislature enacted the Water for 2060 Act (House Bill 3055) in 2012 (Oklahoma Statutes, 2012). The legislation set forth an unprecedented goal of using no more fresh water in 2060 than was used in 2012, while supporting Oklahoma’s continued growth and prosperity. It also created the Oklahoma Water for 2060 Advisory Council, which in its Water for 2060 Report recommended several measures to increase water supply reliability, including conservation, incentives, and education, but also augmentation of water supplies through IPR (OWRB, 2015). To explore the feasibility of IPR, the Water Reuse Workgroup was formed at ODEQ and has concentrated mostly on development of rules for IPR in surface waters. To investigate a potential corollary in groundwater, the Aquifer Storage and Recovery (ASR) Workgroup (Figure 1) was formed in 2014 to explore the possibility of storing water from various sources into Oklahoma’s groundwaters. Eventually, the workgroup developed a 2-pronged approach, considering water quantity and water quality questions separately. In considering water quality, it became evident that the most immediate need would be to determine if Oklahoma’s Groundwater quality Standards (GWQS) allow for the augmentation of groundwater using reclaimed or transferred water.

Over two decades ago, Oklahoma’s groundwater quality standards were developed to protect groundwater resources for drinking water, agriculture, and municipal/industrial beneficial uses. Then and today it is recognized that Oklahoma’s groundwaters are of high quality. Accordingly, Oklahoma’s groundwater protection philosophy is to maintain our groundwaters at background water quality, allowing no degradation, and to ultimately protect our general use groundwaters for an untreated drinking water use.

This is accomplished through a three-tiered approach. First, the GWQS explicitly protects against the “degradation of the existing quality of groundwater” (785:45-7-1(b)) through several provisions. In 785:45-7-2(a)(1), the stated intent of the GWQS is to “preserve and protect background (or ambient) quality” and to ensure *“the concentration of any synthetic substance or any substance not naturally occurring in that location shall not exceed the PQL in an unpolluted groundwater sample”*.

In effect, two very stringent narrative criteria were developed to protect ambient water quality and keep any man made contaminant from occurring in groundwater. Furthermore, the GWQS has the explicitly stated goal of minimizing impact through “*protective measures*” and “*measures to prevent noncompliance*”. The GWQS assign regulatory responsibilities to Oklahoma’s various environmental agencies and requires corrective action when water quality is degraded. Essentially, Oklahoma’s current GWQS are wholly restrictive of any augmentation using reclaimed water, surface water, or transferred groundwater, unless the augmentation activity improves or maintains existing groundwater quality.

Figure 1. Aquifer Storage and Recovery Workgroup Member Organizations



Oklahoma Department of Environmental Quality  
Oklahoma Water Resources Board  
Burns & McDonnell  
Carollo Engineers  
City of Ada  
Groundwater Protection Council  
Honorable Scott Martin—Oklahoma State Legislature  
Oklahoma Department of Agriculture Food and Forestry  
Oklahoma Corporation Commission  
Oklahoma Geological Survey  
Oklahoma Office of the Secretary of Energy and Environment  
United States Geological Survey

## Proposed Groundwater Quality Standards

To facilitate potential augmentation and still provide a high level of protection to Oklahoma's groundwaters, revisions to the GWQS are necessary. As the OWRB and the ASR Workgroup began to investigate a potential standards revision, four overriding goals for the work were established.

- Protect human health and drinking water supplies.
- Protect users of raw, untreated groundwater.
- Develop effective, comprehensive, and protective narrative and numeric criteria.
- Clarify and strengthen the framework of the groundwater protection philosophy.

First, any revision must maintain a high level of protection for Oklahoma's groundwaters and protect groundwater beneficial uses. While allowance for regulated augmentation is a goal of the revision, the protection of human health and drinking water supplies is absolutely essential.

Second, the revision must create more definitive protection for users of raw, untreated drinking water. More than a half million Oklahomans currently use untreated groundwater as their primary drinking water supply. Developing a distinctive, unique beneficial use and criteria for this population is imperative.

Third, numeric and narrative criteria to protect beneficial uses must be developed. Currently, the only two criteria are narrative and difficult to implement. Narrative criteria should address the broad protections needed to maintain the beneficial use of groundwater, including aesthetics, mineralization, toxicity, and geochemical and physical composition of the aquifer. Additionally, numeric criteria should be developed to address microorganisms, radioactivity, chemical constituents of concern (including organic and inorganic contaminants, and disinfectants and disinfection byproducts), toxicity to human health, and secondary drinking water contaminants (e.g., copper, corrosivity, minerals, etc.).

Lastly, the revision must clarify the overlying protection policy for Oklahoma's groundwaters. The antidegradation policy should accomplish three distinct things. First, it must create protective measures to protect beneficial uses and disallow any degradation that contribute to their non-attainment. Second, the policy must also protect existing water quality when it exceeds the level necessary to protect the use, while also creating a framework to allow for lessening of water quality when necessary and important. Third, the antidegradation policy should create a framework that requires no degradation of exceptional water quality in some groundwaters.

To meet these goals, a substantial revision of the OGWQS is proposed and described in the following sections. All water quality standards have three components 1) the state's antidegradation policy, 2) beneficial uses, and 3) criteria to protect beneficial uses. The proposed standards include these three components for all groundwaters in the state. Additionally, proposed definitions for *aquifer storage and recovery activities* and *artificial aquifer recharge* are included and would be added to the definition section of the Oklahoma Water Quality Standards (OWQS)(785:45-1-2). The draft regulatory language is presented below and Attachment A presents the underline/ strikeout language where the language will be place in

Title 785, Chapter 45. Proposed standard revisions and corresponding location in Oklahoma’s Water Quality Standards (Chapter 45) are presented in Table 1.

Table 1. Location of Proposed Standard Revisions

Component of Standard		Location in Water Quality Standards (Chapter 45)
Definitions	<i>Aquifer Storage and Recovery Activities</i>	785:45-1-2
	<i>Artificial Aquifer Recharge</i>	
Groundwater Quality Antidegradation Policy		785:45-7-2 (revised Subchapter 7)
Beneficial Uses		785:45-7-3 (revised Subchapter 7)
Groundwater Quality Criteria		785:45-7-4 (new section in subchapter 7)
Corrective Action		785:45-7-5 (existing language, placed in new section in subchapter 7)

## Definitions

The definitions below are used to characterize *aquifer storage and recovery activities* and *artificial aquifer recharge* and thereby delineate the application of numeric criteria. They would be added to the definition section of the OWQS (785:45-1-2).

- *Aquifer Storage and Recovery Activities (ASR) means activities that exclusively include activities for the storage of water in and recovery of water from an aquifer pursuant to a site-specific aquifer storage and recovery plan authorized by 82 O.S. § 1020.2A. Activities not conducted pursuant to a site-specific aquifer storage and recovery plan shall not be considered ASR activities. For purposes of this chapter, ASR activities also shall not include groundwater recharge or augmentation through a natural connection with a farm pond or other impoundment otherwise authorized by law.*
- *Artificial Aquifer Recharge means activities with the primary purpose of recharging or augmenting an aquifer with no intention of recovering such water for future use. For purposes of this chapter, Artificial Aquifer Recharge activities shall not include activities specifically authorized pursuant to 82 O.S. § 1020.2(G) or stormwater runoff management practices otherwise authorized by law.*

## Antidegradation Policy

The state's antidegradation policy, as it applies to all waters of the state, has three distinct purposes, as expressed in the "Antidegradation Requirements" of the OWQS (785:45-3). Primarily, there is recognition of the value and importance of water and water quality. The OWQS explicitly gives intent to water quality protection, stating that "*waters of the state constitute a valuable resource and shall be protected, maintained and improved for the benefit of all the citizens*".

The second purpose is to establish two definitive boundaries of protection. The first boundary is established by setting the waters beneficial uses, which establishes the intended use and baseline water quality expectations. Protecting and attaining the baseline water quality expectation is achieved through applying narrative and numeric criteria and prohibiting water quality degradation which will interfere with attainment of those uses (785:45-3-2(d)). This concept is ported into the proposed revision at 785:45-7-2(b) with the language "*Beneficial uses shall be maintained and protected and human degradation of groundwater quality that would cause or contribute to the nonattainment of beneficial uses shall not be allowed.*" The second boundary is the recognition and protection of existing water "*quality that exceeds the level necessary for beneficial uses to be maintained and protected*" (785:45-7-2(c) and (d)). Essentially, the policy goal is protection of water quality conditions that are better than (*exceeds*) the baseline expectation described above. The OWQS antidegradation policy requirements explicitly protect the maintenance and protection of both high quality waters and improved waters.

The third purpose of the policy is to provide a framework for how water quality protection and improvement will be managed. Oklahoma uses a three-tiered management framework in surface water and is proposing a similar approach in groundwaters. As described in the preceding paragraph, Tier 1 is the "baseline expectation" of beneficial use maintenance and protection. Tiers 2 and 3 encompass the maintenance and protection of high quality waters (i.e. those waters with water quality conditions that exceed the level necessary for beneficial uses to be maintained and protected). High quality waters are categorized into two groups:

1. Tier 3 - those waters where no degradation of water is quality is allowed
2. Tier 2 - those waters where degradation may be allowed, if necessary.

In the proposed revision, Tier 3 waters are delineated in subsection 785:45-7-2(d) as "certain groundwaters". Special Source Groundwaters, as currently defined in the GWQS, are delineated for Tier 3 protection. The proposed revision provides that existing water quality in Special Source Groundwaters must be maintained and protected, and direct, proximate, or adjacent activities that may lower existing water quality in these groundwaters are prohibited. Furthermore, Tier 2 groundwaters and the mechanism for potentially lowering existing water quality are provided in subsection 785:45-7-2(c). An antidegradation review structure for lowering existing water quality, if necessary, is created, and a requirement for protective measures to protect beneficial uses is established. An antidegradation review has several working parts, which will be further described in future rules for

implementation of the antidegradation policy. The key components of a robust antidegradation policy include:

- Documentation and regulated use of assimilative capacity
- An analysis of alternatives to lowering water quality
- A determination if the lowering of water quality is necessary
- A determination of an important social or economic development needs accommodation
- Intergovernmental coordination and public participation

## Beneficial Uses and Classifications

Beneficial uses describe the types of purposes for which a water body may be used. From a water quality protection perspective, they are the explicit goals for protection and achieving desired water quality. The current GWQS contain three beneficial uses, including Public and Private Drinking Water Supply, Agriculture, and Municipal and Industrial Process and Cooling Water (M&I). Additionally, the GWQS establishes four distinct classes of groundwater. Class I, Special Source Groundwaters, are defined by special characteristics. The remaining 3 classes are delineated based upon the concentration of total dissolved solids and include: Class II – General Use Groundwater (TDS < 3,000 mg/L), Class III – Limited Use Groundwater (3,000 < TDS < 5,000 mg/L), and Class IV – Highly Mineralized Treatable Groundwater (5,000 < TDS < 10,000 mg/L).

The proposed revision (785:45-7-3) maintains the Agriculture and M&I beneficial uses. However, as part of this proposed revision the existing drinking water beneficial use is separated into two beneficial uses: Domestic Untreated Water Supply and Public Water Supply. This distinction allows for explicit, independent protection for users of raw untreated groundwater and public water supplies. The domestic untreated use is defined as “those groundwaters capable of delivering suitable quantities of untreated groundwater for domestic consumption” (785:45-7-3(b)(1)(B)).

Additionally, several revisions were made to groundwater classification (785:45-7-3(a)). Because Special Source Groundwaters are now delineated as Tier 3 waters in the antidegradation policy, the Class I “classification” is empty but “reserved”. Also, to create uniformity and flexibility within the remaining three classes, revisions to the class description language are proposed as follows. For full addition/strikeout language, please refer to Attachment A.

- *General Use Groundwaters (Class II): These are groundwaters which have good quality due to natural conditions and generally have a mean concentration of total dissolved solids of less than 3,000 milligrams per liter.*
- *Limited Use Groundwaters (Class III): These are groundwaters which have poor quality due to natural conditions and generally have a mean concentration of total dissolved solids of greater than or equal to 3000 milligrams per liter but less than 5000 milligrams per liter.*

- *Highly Mineralized Treatable Groundwaters (Class III): These are groundwaters which have poor quality due to natural conditions and generally have a mean concentration of total dissolved solids of greater than or equal to 5000 milligrams per liter but less than 10000 milligrams per liter.*

Finally, all beneficial uses are assigned to Class II groundwaters, while only the Agriculture and M&I uses are assigned to Class III and IV groundwaters.

## Criteria

Criteria are an essential component of groundwater quality standards; criteria are established at a level(s) protective of groundwater beneficial uses. The proposed groundwater quality criteria include both narrative and numeric criteria and work to protect all beneficial uses. At the same time, it is recognized that there can be natural variations in groundwater quality and some constituents for which criteria are necessary can be naturally occurring. Thus, improvements over background water quality are not required for naturally occurring background concentration. The draft criteria are presented below.

### Narrative Criteria

Narrative criteria are used to qualitatively describe the water quality condition necessary to protect a given beneficial use. The following narrative criteria apply to all groundwaters for the protection of all beneficial uses.

- Taste and Odor

*Groundwaters shall be free from taste and odor producing substances, in concentrations that cause nuisance or adversely affect any beneficial use.*

- Chemical Constituents

*Groundwaters shall not contain chemical constituents in concentrations that adversely affect any beneficial use.*

- Toxicity

*Groundwaters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life associated with any beneficial use(s). This criterion applies regardless of whether the toxicity is caused by a single substance or the interactive effect of multiple substances or the mobilization and or transformation of a substance due to changes in physiochemical properties within the aquifer.*

- Geochemical and Physical Composition

*The geochemical and physical composition of groundwaters shall not be altered such that mobilization of any introduced or in-situ contaminants, natural or non-natural, occurs and impairs any beneficial use.*

- Minerals

*Increased mineralization, in comparison to existing water quality, from elements such as, but not limited to, calcium, magnesium, sodium and their associated anions shall not impair any beneficial use.*

### **Numeric Criteria**

Numeric criteria specify a numeric value not to be exceeded for individual parameters and are particularly important to protect human health. The United States Environmental Protection Agency (US EPA) through the Safe Drinking Water Act and Clean Water Act programs provides technical information and or human health based limits (e.g. maximum contaminant level and 304(a) recommended criteria) to protect drinking water and sources of drinking water. Maximum contaminant levels (MCL) and secondary drinking water standards developed by EPA under the Safe Drinking Water Act and technical information provided to states for the development of human health criteria under the Clean Water Act were both relied upon to identify and develop groundwater quality numeric criteria to protect the Domestic Untreated Water Supply and Public Water Supply beneficial uses.

### **Maximum Contaminant Level & Secondary Drinking Water Standards**

Under the Safe Drinking Water Act, the maximum contaminant level is the maximum level allowed of a contaminant in water, which is delivered to any user of a public water system. The following MCLs are incorporated by reference into the Oklahoma Groundwater Quality Standards to protect drinking water beneficial uses.

- Microorganisms (40 CFR 141.63 & 40 CFR 141.70-73)
- Radioactivity (40 CFR 141.66)
- Organic Contaminants (40 CFR 141.61(a))
- Synthetic Organic Contaminants (40 CFR 141.61(c))
- Inorganic Contaminants (40 CFR 141.62(b))
- Disinfection Byproducts (40 CFR 141.64)
- Disinfectants (40 CFR 141.65(a))

The secondary drinking water standards address parameters that are not health threatening, but can cause issues related to the aesthetics (i.e. taste and odor) and maintaining the integrity of the water treatment and delivery systems. Table 2 presents the secondary drinking water standards for the protection of drinking water beneficial uses.

Table 2. Secondary drinking water standards

Parameter	Criteria
Aluminum	0.05 mg/L
Color	15 color units
Corrosivity	Non-corrosive
Copper	1.0 mg/L
Fluoride	2.0 mg/L
Foaming Agents	0.5 mg/L

Iron	0.3 mg/L
Manganese	0.05 mg/L
Odor	3 TON (threshold odor number)
pH	6.5 – 8.5
Silver	0.1 mg/L
Chloride	250 mg/L
Sulfate	250 mg/L
Total Dissolved Solids (TDS)	500 mg/L
Zinc	5.0 mg/L

### Human Health Criteria

Human health criteria are numeric values developed to protect humans from exposure to pollutants in ambient waters. The human health criteria developed for groundwater protect humans from pollutant exposure through the consumption of drinking water. In 2000, EPA updated its guidance for deriving human health criteria and staff relied upon this guidance when calculating criteria (USEPA, 2000). Under the Clean Water Act for surface waters, EPA publishes information for two types of human health criteria:

1. Protection from ingestion of water and aquatic organisms.
2. Protection from ingestion of aquatic organisms only.

For the purpose of developing human health criteria for groundwaters, staff adjusted the equation for protection from ingestion of water and aquatic organisms by removing the portion of the equation which address the aquatic organism exposure pathway and thus, obtaining an equation which only includes the water ingestion exposure pathway. Presented below are the two equations used to calculate human health criteria for groundwaters. Human health criteria are derived to address either cancer effects or non-cancer effects. Therefore, there are two equations, one for each health endpoint.

- Carcinogens

$$WQC = (Risk\ Level \times BW) / [CSF \times (DI)]$$

Where:

- WQC = Water Quality Criterion (mg/L)
- Risk Level = Risk Level (unitless)
- CSF = Cancer Slope Factor (mg/kg/day)
- BW = Human Body Weight (kg)
- DI = Drinking Water Intake (L/day)

- Noncarcinogens

$$WQC = RfD \times RSC \times (BW / (DW))$$

Where:

WQC	=	Water Quality Criterion (mg/L)
RfD	=	Reference dose for noncancer effects (mg/kg/day)
RSC	=	Relative source contributions factor to account for non-water sources of exposure (unitless)
BW	=	Human Body Weight (kg)
DI	=	Drinking Water Intake (L/day)

Two types of data are needed to calculate human health criteria: toxicology data and exposure data. The toxicology data needed to calculate the criteria are obtained from the EPA Integrated Risk Information System (IRIS) (USEPA, 2016). The IRIS program provides a database of human health assessments for chemicals found in the environment. The toxicity values obtained from the IRIS database include, oral reference dose (RfD) and cancer slope factors (CSF). Carcinogenic pollutants are evaluated based on a targeted incremental increase in lifetime cancer risk. In Oklahoma the lifetime increased cancer risk level is  $10^{-5}$ , which is considered appropriate for protection of the general population. The exposure data needed to calculate criteria includes the relative source contribution (RSC) term for noncarcinogenic pollutants, which accounts for pollutant exposures from sources other than drinking water. The two remaining exposure factors 1) body weight and 2) drinking water intake are default values for criteria developed to be protective for the general public. Table 3 and 4 below present all of the terms used to calculate the human health criteria for each pollutant. The information in Tables 3 and 4 were used to calculate human health criteria for the protection of drinking water beneficial uses in groundwater. The human health criteria values for groundwaters are below (Table 5).

### Numeric Criteria Applicability

The numeric criteria for microorganisms and radioactivity apply to all groundwaters for the protection of the both public water supply and domestic untreated water supply beneficial uses. The numeric criteria for organic contaminants, synthetic organic contaminants, inorganic contaminants, disinfection byproducts, disinfectants, and human health values apply to artificial recharge and aquifer storage and recovery activities to ensure the protection of public water supply and domestic untreated water supply beneficial uses.

Table 3. Terms for calculation of human health criteria for carcinogens.

Pollutant	Risk Level	Body Weight (kg)	Cancer Slope Factor (mg/kg/day)	Drinking Water Intake (L)
Acrylonitrile	$10^{-5}$	70	0.54	2
Aldrin	$10^{-5}$	70	17	2
4,4' DDD	$10^{-5}$	70	0.24	2
4,4' DDT	$10^{-5}$	70	0.34	2
Dichlorobromomethane	$10^{-5}$	70	0.062	2
Dieldrin	$10^{-5}$	70	16	2
Bis(2-ethylhexyl) Phthalate	$10^{-5}$	70	0.014	2

Table 4. Terms for calculation of human health criteria for noncarcinogens.

Pollutant	Reference Dose (mg/kg/day)	Relative Source Contribution	Body Weight (kg)	Drinking Water Intake (L)
Acrolein	0.0005	0.2	70	2
Chloroform	0.01	0.2	70	2
Perchlorate	0.0007	0.2	70	2
Phenol	0.6	0.2	70	2
Nickel	0.02	0.2	70	2
Butylbenzyl Phthalate	0.2	0.2	70	2
Diethyl Phthalate	0.8	0.2	70	2
Dimethyl Phthalate	10	0.2	70	2
Di-n-Butyl Phthalate	0.1	0.2	70	2

Table 5. Human Health Criteria for Groundwater

Parameter	Criteria (µg/L)
<b>Carcinogens</b>	
Acrylonitrile	0.65
Aldrin	0.021
4,4"-DDD	1.5
4,4'-DDT	1
Dichlorobromomethane	5.6
Dieldrin	0.022
Bis(2-ethylhexyl)phthalate (BEHP)	25
<b>Noncarcinogens</b>	
Nickel	140
Acrolein	3.5
Chloroform	70
Perchlorate	4.9
Phenol	4,200
Butylbenzyl phthalate	1,400
Diethyl Phthalate	5,600
Dimethyl Phthalate	70,000
Di-n-Butyl Phthalate	700

## References

ODEQ. 2015a. Title 252. Department of Environmental Quality. Chapter 627. Operation and Maintenance of Water Reuse Systems. <http://www.deq.state.ok.us/rules/627.pdf>.

ODEQ. 2015b. Title 252. Department of Environmental Quality. Chapter 656:27. Water Pollution Control Facility Construction Standards: Wastewater Reuse. <http://www.deq.state.ok.us/rules/656.pdf>

Oklahoma Statutes. 2012. Title 82. Waters and Water Rights §82-1088.11. Water for 2060 Act. [http://webserver1.lsb.state.ok.us/cf\\_pdf/2011-12%20ENR/hB/HB3055%20ENR.PDF](http://webserver1.lsb.state.ok.us/cf_pdf/2011-12%20ENR/hB/HB3055%20ENR.PDF)

OWRB. 2012. Oklahoma Comprehensive Water Plan Executive Report. [http://www.owrb.ok.gov/supply/ocwp/pdf\\_ocwp/WaterPlanUpdate/draftreports/OCWP%20Executive%20Rpt%20FINAL.pdf](http://www.owrb.ok.gov/supply/ocwp/pdf_ocwp/WaterPlanUpdate/draftreports/OCWP%20Executive%20Rpt%20FINAL.pdf).

OWRB. 2015. Report of the Oklahoma Water for 2060 Advisory Council. <http://www.owrb.ok.gov/2060/pdf/2060Recommendations.pdf>.

USEPA. 2000. Methodology for Deriving Ambient Water Quality Criteria for the Protection of Human Health. Office of Water, Office of Science and Technology. EPA-822-B-00-004. <https://www.epa.gov/wqc/human-health-water-quality-criteria>

USEPA. 2016. *Integrated Risk Information System*. Web page, accessed in October and November 2016. <https://www.epa.gov/iris>.

# Attachment A. Proposed Language Groundwater Standards and Associated Definitions

## TITLE 785. OKLAHOMA WATER RESOURCES BOARD

### CHAPTER 45. OKLAHOMA'S WATER QUALITY STANDARDS

#### SUBCHAPTER 1. GENERAL PROVISIONS

##### 785:45-1-2. Definitions

The following words and terms, when used in this Chapter, shall have the following meaning unless the context clearly indicates otherwise:

"**Aquifer Storage and Recovery Activities**" ("**ASR**") means activities that exclusively include activities for the storage of water in and recovery of water from an aquifer pursuant to a site-specific aquifer storage and recovery plan authorized by 82 O.S. § 1020.2A. Activities not conducted pursuant to a site-specific aquifer storage and recovery plan shall not be considered ASR activities. For purposes of this chapter, ASR activities also shall not include groundwater recharge or augmentation through a natural connection with a farm pond or other impoundment otherwise authorized by law.

"**Artificial Aquifer Recharge**" means activities with the primary purpose of recharging or augmenting an aquifer with no intention of recovering such water for future use. For purposes of this chapter, Artificial Aquifer Recharge activities shall not include activities specifically authorized pursuant to 82 O.S. § 1020.2(G) or stormwater runoff management practices otherwise authorized by law.

#### SUBCHAPTER 7. GROUNDWATER QUALITY STANDARDS

##### Section

785:45-7-1. Scope and Applicability; Purpose

785:45-7-2. ~~Criteria for Groundwater Protection and Corrective Actions~~ Groundwater Quality Antidegradation Policy

785:45-7-3. Groundwater Classifications, beneficial uses and vulnerability levels

785:45-7-4. Criteria for Groundwater Quality Protection

785:45-7-5. Corrective Action

785:45-7-1. Scope and Applicability; Purpose

(a) The provisions of this Subchapter apply only to fresh groundwater.

(b) The purposes of the rules in this Subchapter are to protect beneficial uses and classifications of groundwater, to assure that degradation of the existing quality of groundwater does not occur, and to provide minimum standards for remediation when groundwater becomes polluted by humans.

(c) Implementation provisions for groundwater quality standards are locations in 785:46-13.

785:45-7-2. Criteria for Groundwater Protection and Corrective Actions Groundwater Quality Antidegradation Policy

(a) Criteria for protection of groundwater quality. The groundwaters of the state of Oklahoma are an important and valuable resource that shall be maintained and protected.

~~(1) The groundwaters of the state shall be maintained to prevent alteration of their chemical properties by harmful substances not naturally found in groundwater.~~

~~(2) Protective measures adequate to preserve and protect background quality of the groundwater and existing and designated groundwater basin classifications shall be maintained at all times. Protective measures shall also be sufficient to minimize the impact of pollutants on groundwater quality. The concentration of any synthetic substance or any substance not naturally occurring in that location shall not exceed the PQL in an unpolluted groundwater sample using laboratory technology. If the concentration found in the test sample exceeds the PQL, or if other substances in the groundwater are found in concentrations greater than those found in background conditions, that groundwater shall be deemed to be polluted and corrective action may be required.~~

~~(3) Measures to prevent noncompliance with this Section caused by any person shall be the responsibility of each state environmental agency within their jurisdictional areas of environmental responsibility. Such measures shall be prescribed in the Water Quality Standards Implementation Plan of each such agency. When regulating activities that have the potential to contaminate groundwater from the surface, state environmental agencies shall consider the vulnerability level of an affected hydrogeologic basin (for example, more stringent measures such as siting limitations, lagoon liners, or additional monitoring wells may be required to protect groundwater in hydrogeologic basins with High or Very High vulnerability levels).~~

(b) Beneficial uses shall be maintained and protected and human degradation of groundwater quality that would cause or contribute to the nonattainment of beneficial uses shall not be allowed.

(c) Whenever existing groundwater quality exceeds the level necessary for beneficial uses to be maintained and protected, the existing groundwater quality shall be maintained and protected, unless it is demonstrated to the State that any lowering of groundwater quality:

(1) After an analysis of alternatives, is necessary to accommodate important economic and social development and is in the public interest; and

(2) Protective measures sufficient to protect beneficial uses shall be maintained at all times.

(d) In certain groundwaters, whenever existing groundwater quality exceeds the level necessary for beneficial uses to be maintained and protected, the existing groundwater quality shall be maintained and protected.

(1) Special Source Groundwaters

(A) Special source groundwaters are defined as groundwaters where exceptional water quality exists, where there is an irreplaceable source of

water, where it is necessary to maintain an outstanding resource, or where the quality of the groundwater may be important for maintaining a uniquely designated characteristic of certain surface waters, as defined in i-iv below:

- i. All groundwater likely to influence the quality of waters designated as a "Scenic River" in Appendix A of this Chapter and their watersheds; and
- ii. All groundwater likely to influence the quality of waters located within the boundaries of the areas described in Appendix B of this Chapter; and
- iii. All groundwater likely to influence the quality of waters designated as "HQW" in Appendix A of this Chapter; and
- iv. All groundwater likely to influence the quality of waters located within the boundaries of a State approved source water protection area for public water supply.

(B) Groundwaters designated as special source groundwaters are prohibited from receiving any discrete discharge(s), surface water from constructed infiltration basins, or surface application of waste, unless the activity maintains or improves existing water quality.

(C) Discharges proximate and/or adjacent to special source groundwaters shall take into consideration the requirement to maintain or improve existing water quality in special source groundwaters and shall ensure that any activity provides for the maintenance or improvement of water quality in special source groundwaters

#### 785:45-7-3. Groundwater Classifications, beneficial uses and vulnerability levels

(a) Classifications. Classification of all groundwater shall be designated as follows:

(1) ~~(Class I): RESERVED (Special Source Groundwater): Special source groundwaters are defined as groundwaters where exceptional water quality exists, where there is an irreplaceable source of water, where it is necessary to maintain an outstanding resource or where the groundwater is ecologically important. Special source groundwaters are considered to be very vulnerable to contamination. This classification shall include:~~

~~(A) All groundwater located underneath the watersheds of waterbodies designated "Scenic River" in Appendix A of this Chapter;~~

~~(B) Special source groundwater located underneath lands located within the boundaries of the areas described in Appendix B of this Chapter; and~~

~~(C) All groundwater located underneath lands located within the boundaries of a State approved wellhead or source water protection area for public water supply.~~

(2) ~~Class II (General Use Groundwater) (Class II): These are groundwaters which have good quality due to natural conditions capable of being used as a drinking water supply~~

~~with no treatment or with conventional treatment methods, which have the potential to be used for other beneficial uses and which and generally~~ have a mean concentration of total dissolved solids of less than 3,000 milligrams per liter.

(3) ~~Class III (Limited Use Groundwater) (Class III)~~: These are groundwaters which have poor quality due to natural conditions ~~and which could require extensive treatment for use as a source of drinking water, and which~~ generally have a mean concentration of total dissolved solids of greater than or equal to 3000 milligrams per liter but less than 5000 milligrams per liter.

(4) ~~Class IV (Highly Mineralized Treatable Groundwater) (Class IV)~~: These are groundwaters which have very poor quality due to natural conditions ~~and which would require extensive treatment for use as a source of drinking water, and which~~ generally have a mean concentration of total dissolved solids of greater than or equal to 5000 milligrams per liter but less than 10,000 milligrams per liter.

(b) Beneficial uses. This subsection lists the various beneficial uses of groundwater and designates certain beneficial uses for certain classifications of groundwater.

(1) List of beneficial uses for groundwater.

(A) ~~Public and Private Water Supply~~. The beneficial use designation of ~~Public and Private Water Supply~~ refers to those groundwaters capable of delivering suitable quantities of ~~fresh~~ groundwater for municipal ~~or domestic~~ consumption whether or not treatment is required.

(B) Domestic Untreated Water Supply. The beneficial use designation of Domestic Untreated Water Supply refers to those groundwaters capable of delivering suitable quantities of untreated groundwater for domestic consumption.

~~(BC)~~ Agriculture. The beneficial use designation of Agriculture refers to that groundwater which is or could be used for irrigation or livestock watering.

~~(CD)~~ Industrial and Municipal Process and Cooling Water. The beneficial use designation of Industrial and Municipal Process and Cooling Water refers to that groundwater that is or could be used for a municipal or industrial process or cooling function.

(2) Beneficial use designations.

(A) The beneficial uses for General Use Groundwater (Class II), ~~Class I and Class II groundwater~~ not identified in Appendix H of this Chapter, shall be Domestic Untreated Water Supply, ~~Public and Private Water Supply~~, Agriculture, and Industrial and Municipal Process and Cooling Water.

(B) The beneficial uses for Limited Use Groundwater (Class III) and Highly Mineralized Treatable Groundwater (Class IV) ~~Class III and Class IV groundwater~~, not identified in Appendix H of this Chapter, shall be Agriculture and Industrial and Municipal Process and Cooling Water.

(C) The beneficial uses for any groundwater identified in Appendix H of this Chapter shall be as designated in that appendix.

(D) The beneficial use for groundwater which is used for ~~domestic water supply~~ purposes on or after July 1, 2000, has a mean concentration of total dissolved solids of less than ~~3000~~5000 milligrams per liter, and has not been determined by any state environmental agency to be not suitable for human consumption, shall be Public Water Supply and or Domestic Untreated Water Supply ~~Public and Private Water Supply~~.

(E) A beneficial use designation for groundwater may be amended or removed only after a demonstration to the satisfaction of the Board that meets one of the following tests:

(i) The designated use does not exist due to a condition that was not caused by humans, and treatment using Best Available Technology will not achieve the designated use, or

(ii) The designated use does not exist due to a condition that is attributable to irreversible impacts caused by humans, and the remedy would cause substantial and widespread economic and social impact.

(F) Groundwater which has had a beneficial use designation amended or removed pursuant to (E) of this paragraph shall be identified in Appendix H of this Chapter.

(c) Vulnerability level. Groundwater in certain hydrogeologic basins is further classified according to its vulnerability to contamination as determined by DRASTIC. Such vulnerability levels of hydrogeologic basins shall be identified as Very Low, Low, Moderate, High, and Very High as prescribed in Table 1 of Appendix D of this Chapter. The vulnerability level may vary within each hydrogeologic basin, depending on site-specific hydrogeologic factors.

(d) Nutrient-vulnerable groundwater. Certain specified groundwaters shall be further subject to designation in Table 2 of Appendix D of this Chapter as nutrient-vulnerable groundwater.

#### **785:45-7-4. Criteria for groundwater quality protection**

(a) Groundwaters of the state support many different beneficial uses. The criteria below do not require improvement over naturally occurring background concentrations. When naturally occurring background concentrations exceed the criterion for a given parameter, the naturally occurring background concentration may be utilized as a criterion, if suitable. If a given parameter has more than one criterion associated with it, the most stringent criteria shall apply to ensure beneficial use protection.

(b) The following criteria apply to all groundwaters for the protection of beneficial uses. Where specific numeric criteria for any constituent of concern have not been adopted, narrative criteria may be translated, in a scientifically defensible manner, into numeric endpoints applicable in state environmental agency regulatory and or corrective action programs.

(1) Microorganisms. In groundwaters with the designated or existing use of Public Water Supply and Domestic Untreated Water Supply microorganisms shall not exceed the limits specified in 40 CFR 141.63 and 40 CFR 141.70-73. These provisions are

incorporated by reference into this rule; this incorporation by reference is prospective including future changes to the incorporated provisions as the changes take effect.

(2) Taste and Odor. Groundwaters shall be free from taste and odor producing substances, in concentrations that cause nuisance or adversely affect any beneficial use.

(3) Chemical Constituents. Groundwaters shall not contain chemical constituents in concentrations that adversely affect any beneficial use.

(4) Radioactivity. At a minimum, groundwaters designated Public Water Supply and Domestic Untreated Water Supply shall not contain concentrations of radionuclides in excess of limits specified in 40 CFR 141.66. This provision is incorporated by reference into this rule; this incorporation by reference is prospective including future changes to the incorporated provisions as the changes take effect.

(5) Toxicity. Groundwaters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life associated with any beneficial use(s). This criterion applies regardless of whether the toxicity is caused by a single substance or the interactive effect of multiple substances or the mobilization and or transformation of a substance due to changes in physiochemical properties within the aquifer.

(6) Geochemical and Physical Composition. The geochemical and physical composition of groundwaters shall not be altered such that mobilization of any introduced or in-situ contaminants, natural or non-natural, occurs and impairs any beneficial use.

(7) Minerals. Increased mineralization, in comparison to existing water quality, from elements such as, but not limited to, calcium, magnesium, sodium and their associated anions shall not impair any beneficial use.

(c) For artificial aquifer recharge and or aquifer storage and recovery activities, the criteria below and presented in Tables 1 and 2 shall also apply to ensure the protection of the public water supply and the domestic untreated water supply beneficial uses. Artificial recharge and or aquifer storage and recovery activities shall not cause or contribute to a condition of pollution or nuisance or result in nonattainment of any applicable groundwater quality standard.

(1) Chemical Constituents. At a minimum, groundwaters shall not contain concentrations of chemical constituents in excess of the maximum contaminant levels specified in the following provisions:

(A) Organic Contaminants in 40 CFR 141.61(a)

(B) Synthetic Organic Contaminants in 40 CFR 141.61(c)

(C) Inorganic Contaminants in 40 CFR 141.62(b)

(D) Disinfection Byproducts in 40 CFR 141.64

(E) Disinfectants in 40 CFR 141.65(a)

(2) Toxicity. At a minimum, groundwaters shall not exceed limits specified in Table 1 of this subchapter.

Table 1. Numerical criteria to protect the Public Water Supply and Domestic Untreated Water Supply beneficial uses.

<u>Parameter</u>	<u>CAS #</u>	<u>Criteria (ug/L, unless otherwise noted)</u>
<u>Nickel</u>	<u>7440020</u>	<u>140</u>
<u>Acrolein</u>	<u>107028</u>	<u>3.5</u>
<u>Acrylonitrile</u>	<u>107131</u>	<u>0.65</u>
<u>Aldrin</u>	<u>309002</u>	<u>0.021</u>
<u>Chloroform</u>	<u>67663</u>	<u>70</u>
<u>4,4"-DDD</u>	<u>72548</u>	<u>1.5</u>
<u>4,4'-DDT</u>	<u>50293</u>	<u>1</u>
<u>Dichlorobromomethane</u>	<u>75274</u>	<u>5.6</u>
<u>Dieldrin</u>	<u>60571</u>	<u>0.022</u>
<u>Perchlorate</u>	<u>7601-90-3</u>	<u>4.9</u>
<u>Phenol</u>	<u>108952</u>	<u>4,200</u>
<u>Bis(2-ethylhexyl)phthalate (BEHP)</u>	<u>117817</u>	<u>25</u>
<u>Butylbenzyl phthalate</u>	<u>85687</u>	<u>1,400</u>
<u>Diethyl Phthalate</u>	<u>84662</u>	<u>5,600</u>
<u>Dimethyl Phthalate</u>	<u>131113</u>	<u>70,000</u>
<u>Di-n-Butyl Phthalate</u>	<u>84742</u>	<u>700</u>

(3) Secondary Contaminants. At a minimum, groundwaters shall not exceed the criteria limits presented in Table 2 of this subchapter and consistent with 40 CFR 143.3. This provision for the parameters listed below is incorporated by reference into this rule; this incorporation by reference is prospective including future changes to the incorporated provisions as the changes take effect.

Table 2. Secondary drinking water contaminants and associated criteria as listed in 40 CFR 143.3.

<u>Parameter</u>	<u>Criteria</u>
<u>Aluminum</u>	<u>0.05 mg/L</u>
<u>Color</u>	<u>15 color units</u>
<u>Corrosivity</u>	<u>Non-corrosive</u>
<u>Copper</u>	<u>1.0 mg/L</u>
<u>Fluoride</u>	<u>2.0 mg/L</u>
<u>Foaming Agents</u>	<u>0.5 mg/L</u>
<u>Iron</u>	<u>0.3 mg/L</u>
<u>Manganese</u>	<u>0.05 mg/L</u>
<u>Odor</u>	<u>3 TON (threshold odor number)</u>
<u>pH</u>	<u>6.5 – 8.5</u>
<u>Silver</u>	<u>0.1 mg/L</u>
<u>Chloride</u>	<u>250 mg/L</u>
<u>Sulfate</u>	<u>250 mg/L</u>
<u>Total Dissolved Solids (TDS)</u>	<u>500 mg/L</u>
<u>Zinc</u>	<u>5.0 mg/L</u>

(d) Measures to prevent noncompliance with this Section caused by any person, or activity, shall be the responsibility of each state environmental agency within their jurisdictional areas of environmental responsibility. Such measures shall be prescribed in the Water Quality Standards Implementation Plan of each such agency. When regulating activities that have the potential to contaminate groundwater from the surface, state environmental agencies shall consider the vulnerability level of an affected hydrogeologic basin (for example, more stringent measures such as siting limitations, lagoon liners, or additional monitoring wells may be required to protect groundwater in hydrogeologic basins with High or Very High vulnerability levels). When regulating groundwater quality activities that have the potential to cause or contribute to impairment of a surface water beneficial use, state environmental agencies shall include provisions to prevent the impairment of any surface water beneficial use.

**785:45-7-5. Corrective Action**

(a) Groundwater that has been polluted as a result of human activities shall be restored to a quality that will support the beneficial uses designated in OAC 785:45-7-3 for that groundwater, or as otherwise specified in a site-specific remediation plan approved by an agency of competent jurisdiction.

(b) Measures to remedy, control or abate groundwater pollution caused by any person shall be the responsibility of each state environmental agency within its jurisdictional areas. Such measures shall be prescribed in the Water Quality Standards Implementation Plan of each such agency. When regulating activities that have the potential to contaminate groundwater from the surface, state environmental agencies shall consider the vulnerability level of an affected hydrogeologic basin (for example, more stringent measures such as siting limitations, lagoon liners, or additional monitoring wells may be required to protect groundwater in hydrogeologic basins with High or Very High vulnerability levels).