Draft
Spokane County
Critical Aquifer Recharge Areas Review
Final Report

Prepared for:
Spokane County
Division of Utilities
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Acronyms

AKART	all known, available, and reasonable methods of prevention, control and treatment
BMPs	best management practices
BOD	biochemical oxygen demand
CARA	critical aquifer recharge area
CDEP	Connecticut Department of Environmental Protection
cfs	cubic feet per second
CWA	Clean Water Act
CWPPs	Countywide Planning Policies
Ecology	Washington Department of Ecology
ft^2	square feet
GIS	geographic information system
GMA	Growth Management Act
gpd	gallons per day
gpd/ac	gallons per day per acre
IDEQ	Idaho Department of Environmental Quality
mg/L	milligrams per liter
N/A	not applicable
NHD	National Hydrography Dataset
nitrate-N	nitrate-nitrogen
N-P	nutrient-pathogen
NRCS	Natural Resources Conservation Service
POTW	publicly owned treatment works
RAC	rural activity centers
RCW	Revised Code of Washington
SCC	Spokane County Code
SCSMP	Spokane County Shoreline Master Program
SRHD	Spokane Regional Health District
SVRP	Spokane Valley Rathdrum Prairie
TMDL	total maximum daily load
TN	total nitrogen
TP	total phosphorus
UGA	Urban Growth Area
USC	United States Code
USEPA	U.S. Environmental Protection Agency
USGS	U.S. Geological Survey
WAC	Washington Administrative Code
WDOH	Washington State Department of Health
WEF	Water Environment Federation
WERF	Water Environment Research Foundation

Executive Summary

The Washington State Growth Management Act [Revised Code of Washington (RCW) 36.70A] requires Spokane County to adopt development regulations that protect Critical Aquifer Recharge Areas (CARA), which are areas recognized as critical for maintaining groundwater recharge and quality. The County has addressed these requirements in the Spokane County Code (SCC) under Title 11 Environment, Chapter 20 Critical Areas, Section 075 Critical Aquifer Recharge Areas (SCC 11.20.075). Included in the code are requirements and restrictions on sanitary discharges for non-residential land uses outside the Urban Growth Areas (UGA) (a map illustrating the CARA area is attached). Specifically, the code restricts discharges of non-residential sanitary wastewater to soils through on-site septic systems to less than 90 gallons of wastewater per day per acre in areas where groundwater is currently identified as moderately or highly susceptible to impacts.

SCC 11.20.075 requires the County to regularly update CARA protection measures so they are effective, enforceable, and equitable. Consistent with the code, Spokane County has undertaken a review of SCC 11.20.075. The review process emphasized a technical assessment of non-residential sanitary wastewater discharges to on-site septic systems and fate and transport of wastewater constituents to groundwater and groundwater-to-surface water. In addition, the assessment included a stakeholder participation process that included technical document reviews, meetings, and recommendations for changes to the current standard.

Spokane County contracted with HDR Engineering, Inc. (HDR) to conduct the technical assessment and with Sarah Hubbard-Gray to facilitate the stakeholder participation process. The project included assessing and proposing updates to the CARA wastewater disposal standards for non-residential uses and activities outside the UGA boundary in Spokane County. The project tasks included:

- Review Current Code and Standard
- Evaluate Standard Revisions
- Stakeholder Engagement
- Prepare Recommendations

The *Spokane County Critical Aquifer Recharge Areas Review Final Report* (presented herein) is an outcome of these tasks and includes recommendations for standard updates.

Findings and Recommendations

Existing Code

The main portion of the existing code reviewed was SCC 11.20.075 L-3.2, which states:

> *Non-residential uses and activities in moderate and high susceptibility areas that produce more than ninety gallons of wastewater per acre per day, and any critical material use activity that produces sanitary wastewater discharge, shall have a disposal system that protects the aquifer*.

This restriction applies to areas outside the UGA that are in moderate and high susceptibility CARA zones. The full section of SCC 11.20.075 L-3 is shown in Attachment B under the heading, “Existing Spokane County Code.” Non-residential uses and activities are considered to be those that do not meet the definition of residential use, where residential use is defined as single-family, two-family, multi-family, manufactured and mobile home, community residential facility, community treatment facility, dormitory, fraternity and sorority (SCC 11.20.010).

The review concluded that the existing code provides protection of the underlying aquifer under many non-residential land uses but that a more site specific approach utilizing a simple soil mixing zone model is recommended in order to meet the goal of an effective, enforceable, and equitable standard.

Evaluate Standard Revisions

The technical evaluation examined the characteristics of non-residential wastewater and potential fate and transport of selected wastewater constituents. Understanding wastewater loadings to drain fields that are protective of groundwater in the CARA areas allowed for recommendations for revised standards. In addition, surface water protection associated with groundwater-to-surface-water discharges was considered in the analysis. The CARA evaluation considered nitrate and phosphorus as the primary constituents of concern. Nitrate is mobile in soil and groundwater systems, is at relatively high concentrations in wastewater effluent, and is a “primary contaminant” under the groundwater quality standards. Phosphorus was selected as an important constituent to analyze for the drain field-to-groundwater-to-surface water pathway due to concerns associated with nutrient loading of surface waters and the total maximum daily load (TMDL) for dissolved oxygen in the Spokane River and Lake Spokane, which established phosphorus allocations.

The results of this technical evaluation were used to develop the recommendations.

Stakeholder Engagement

An important component of this study was stakeholder participation, which precipitated the formation of the Spokane County CARA Review Committee representing a range of stakeholder interests. Approximately ten stakeholders on the committee participated in a series of four facilitated meetings and provided comments on a series of four technical memorandums and the final report.

Key points provided by the review committee for the recommended standard revision were:

- The revision must be scientifically based.
- The revision must be protective of water resources and water quality, especially groundwater.
- The application and approval process should be straightforward and concise for applicants and the County to use. Application of the process should provide consistent and equitable evaluation of projects County-wide.
- While the process should include the same evaluation methodology for all applicants, it should also include additional options for supplementary evaluations to provide flexibility for unique situations that may be justified with detailed supporting information.

Recommendations for Modifying SCC 11.20.075 L-3.2

It is recommended that the current standard be revised to allow for an analytical evaluation of potential nitrate loadings to groundwater that incorporates site specific information. The proposed approach integrates hydraulic and nitrogen loadings into one analysis requiring limited inputs by the user and straightforward results for the County’s review. A simple soil nitrogen leachate mixing analysis has been developed in a spreadsheet format, where the spreadsheet calculates a site specific nitrate concentration at the soil/groundwater interface. A calculated nitrate-N concentration in the soil leachate of less than 10 mg/L is acceptable (Attachment B provides the rationale for using this value). This threshold applies to both Levels 1 and 2 analyses described below, and are based on soil nitrate leachate concentration estimates.

For Spokane County approval of a non-residential on-site sanitary wastewater discharge outside the UGA in moderate and high CARA sensitive areas, an application process including use of a spreadsheet tool is recommended. Most applicants have the software (Microsoft Excel) and familiarity with spreadsheets to use this tool. This CARA spreadsheet includes basic project inputs. The applicant would need to determine these inputs either based on the guidance provided as part of the CARA spreadsheet instructions or based on existing planning and zoning requirements. The CARA spreadsheet performs calculations and provides an assessment of the proposal for meeting standard requirements.

A completed CARA spreadsheet and application package would be submitted to the County for review. A CARA spreadsheet that indicates a positive assessment (meets standard criteria) is then generally accepted. The County, however, could deny an application based on other information in the application package or because unreasonable input values were used in the CARA spreadsheet.

While many projects are anticipated to be met the requirements in the CARA spreadsheet, additional options are provided for those that do not. Three levels of analysis are proposed:

- Level 1 - CARA spreadsheet base level analysis using County selected input values with project specific input values provided by applicant. Level 1 is based on a soil nitrogen leachate mixing analysis.
- Level 2 - Mid-level analysis allowing for modifications to County selected input values to the CARA spreadsheet requiring scientific documentation to support applicant value selection. Level 2 is based on a soil nitrogen leachate mixing analysis.
- Level 3 - Detailed study or high level analysis for complicated sites and/or projects providing a means to demonstrate a feasible and protective approach for wastewater disposal. This level does not use the CARA spreadsheet based on a soil nitrogen mixing analysis, rather it uses the Large On-Site Sewage System (LOSS) Level 1 Nitrate Spreadsheet developed by the Washington Department of Health. The applicant could also another analytical approach that is pre-approved by Spokane County. Also, the acceptance criteria (concentration of nitrate-N) is based on a groundwater nitrogen mixing analysis, see Attachments A and B for details.

If an applicant does not meet the Level 1 standard criteria, they can either conduct a Level 2 or Level 3 analysis, and if they still do not meet the criteria, then sanitary wastewater discharge restrictions would be required.

The technical evaluation found that nitrate is the greatest risk to drinking water and groundwater quality. Therefore, the application and assessment process is primarily focused on groundwater protection from nitrate in wastewater effluent. Under certain conditions, phosphorus discharge from on-site treatment systems can be a water quality concern, especially near surface water where phosphorus could migrate from the drain field-to-groundwater-to-surface water. In general, the land use and setback requirements identified in the Spokane County Shoreline Master Plan provide surface water protection from non-residential on-site wastewater disposal systems. Therefore, further restrictions associated with phosphorus for non-residential on-site treatment systems in CARA sensitive areas are not proposed. The CARA spreadsheet, however, requires information on the distance of the parcel to a surface water body. Spokane County has the option to request a detailed phosphorus study (Level 3) for situations not covered in the Shoreline Master Plan.

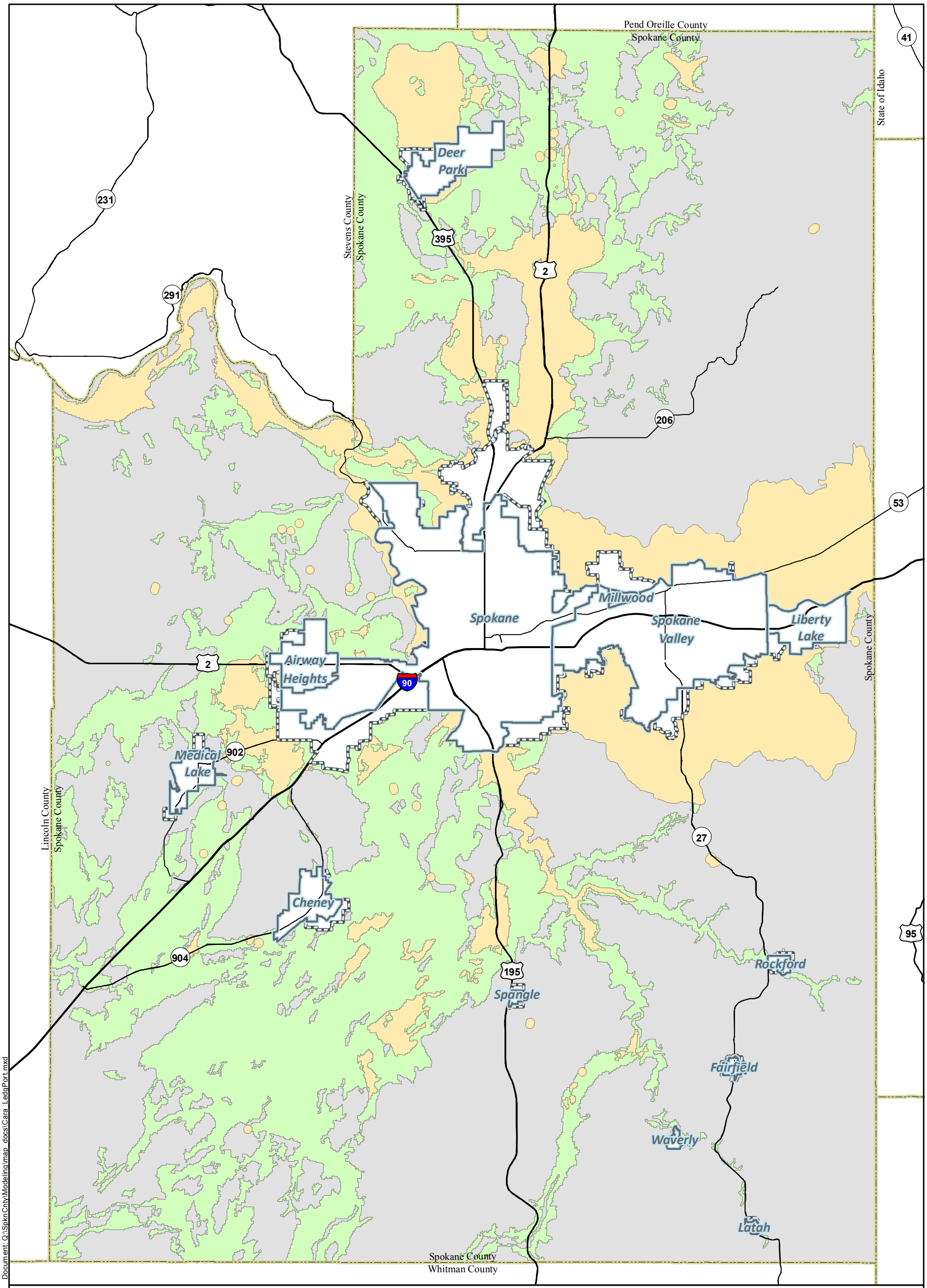
This recommended approach, requiring a completed CARA spreadsheet, is based on scientific data and analyses, is protective of sensitive groundwater and surface water, provides a consistent review method for Spokane County, and should facilitate a relatively straightforward

submittal for the applicant. The proposed approach includes two options for additional documentation which allows an adaptable approach for site specific conditions and/or specific project proposals. These options provide a means for an applicant to work with Spokane County beyond the CARA spreadsheet; however, the additional documentation does require the applicant to provide more information for Spokane County's review to support deviations from the CARA spreadsheet.

Report Organization

This report includes a review of the Spokane County Code and applicable state regulations; a review of pertinent science; and a summary of stakeholder input, that combined led to the development of the recommendations, CARA spreadsheet, and guidance. This document is organized as follows:

- Executive Summary - Project description, findings and recommendations.
- Attachment A - Guidance for Determining Non-residential Wastewater Loadings to Drain Fields Protective of Moderate and High CARA Susceptibility Area - guidance information for using the CARA spreadsheet and levels of analysis (Attachment A). Attachment A is placed after the Executive Summary so it can be readily removed and used as guidance if the code is revised.
- Attachment B – CARA Technical Review - supporting technical documentation for the recommendations.



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Critical Aquifer Recharge Areas (CARA)

Spokane County CARA Review

Legend

Critical Aquifer Recharge Areas (CARA)

Aquifer Susceptibility

- High Susceptibility
- Moderate Susceptibility
- Low Susceptibility

- Municipalities
- Urban Growth Area
- County Boundary

0 6 12
Miles

Map Production Date: 10/19/2012

Data Sources: Spokane County; USGS; US Census Bureau, ESRI

Attachment A: Guidance for Determining Non-residential Wastewater Loadings to Drain Fields Protective of Moderate and High CARA Susceptibility Areas

Introduction

The recommendations for determining non-residential wastewater loadings protective of moderate and high critical aquifer recharge area (CARA) susceptibility areas include three levels (tiers) of analysis to determine if the proposed on-site sanitary wastewater treatment system is protective of the aquifer. Levels 1 and 2 are based on a soil nitrogen leachate analysis, whereas, Level 3 is based on a groundwater nitrogen mixing analysis developed by the Washington Department of Health. This guidance provides further detail regarding the information and analysis required for each of the three levels.

Level 1: CARA Spreadsheet

The CARA spreadsheet includes user-required input information about the proposed project as well as Spokane County default input parameters (a copy of the spreadsheet is attached). User-required input information includes:

- Project name, name of individual who completed the CARA spreadsheet, and date of completion.
- Proposed facility type, size, general description, and address.
- Name of nearest surface water body and distance of facility property to the water body.
- Depth to groundwater and requirement to include map of parcel and surrounding area.
- Parcel lot size. Enter the land area in acres for the facility and on-site treatment system. Include a map of the parcel to the application package.
- Recharge value. Select the recharge value (inches per year) based on the Spokane County-provided recharge map using the lowest recharge value for the project parcel. Recharge is the meteoric water that moves downward from the surface through the soil and into the groundwater (a map to be provided when completed, or web based).
- Wastewater volume. Enter the wastewater flow rate (gallons per day, gpd) based on the facility type, standard references, and additional supporting information. Values are available from a variety of sources (see Attachment B: CARA Technical Review, “Define Non-residential Sanitary Wastewater Characteristics” and “Non-residential Wastewater Characteristics” in the References section for tabular information).
- Drain field area. Enter the area in square feet (ft^2). Drain field sizing is based on design criteria outlined in Washington Administrative Code (WAC) On-Site Sewage Systems Chapter 426-272A.
- Soil type. Select the soil type (based on soil texture) from the dropdown menu in the spreadsheet. Refer to WAC 246-272A-0220 soil and site evaluation for procedures on classifying the soil type.

Outcome

- If the hydraulic or nitrate criteria are not met in the Level 1 analysis (response is “Revise” in the assessment portion of spreadsheet), then the applicant can either accept the results and implement wastewater loading restrictions to drain fields per Spokane County Code (SCC) 11.20.075, or the applicant can modify the input parameters described above (e.g. change wastewater volumes), or conduct a Level 2 or Level 3

analysis to further assess site suitability. If Spokane County does not concur with the analysis provided by the applicant (e.g. unreasonable input values), Spokane County has the right to request additional information or request a Level 2 or Level 3 analysis based on site-specific conditions.

Level 2: CARA Spreadsheet Plus Modifications

The applicant can modify Spokane County default values in the CARA spreadsheet, providing supporting information to justify the modification. Modifications to Spokane County default values include the following:

- Total nitrogen (TN) concentration in effluent wastewater.
- Soil denitrification.
- Nitrate concentration in precipitation.

Outcome

- If the hydraulic or nitrate criteria are not met in the Level 2 analysis, and implement wastewater loading restrictions to drain fields per SCC 11.20.075, or the applicant can conduct a Level 3 analysis to further assess site suitability. If Spokane County does not concur with the analysis provided by the applicant such as the modified input values, Spokane County has the right to reject a Level 2 analysis and request additional information or request a Level 3 analysis based on site-specific conditions.

Level 3: Detailed Study

If Level 2 does not provide an acceptable assessment, and the applicant cannot demonstrate aquifer protection for their proposed development, then a Level 3 – detailed study may be conducted. The detailed study must demonstrate protection, using the Washington State Department of Health method for large on-site sewage systems or an equivalent alternate method pre-approved by Spokane County (WDOH 2011). The applicant must provide a work plan for a proposed study to Spokane County for review. The work plan should include sufficient detail on approach, including any field monitoring activities. The objective of the work plan review is to minimize the risk of investing in a detailed study without County input on approach.

A Level 3 analysis would include evaluation of groundwater conditions and a mixing zone analysis. The applicant should follow the Large On-site Sewage System (LOSS) Level 1 Nitrate Balance Spreadsheet developed by the Washington State Department of Health (WDOH) for assessing nitrate mixing in groundwater (WDOH 2011) unless another or additional method is pre-approved by Spokane County. It would be the responsibility of the applicant to describe and reference this approach in the work plan.

For groundwater nitrate evaluations, potential impacts should be based on not exceeding concentrations above 5 milligrams per liter (mg/L) nitrate-N in groundwater at the edge of the drainfield or an alternative point of compliance, which is considered the critical trigger value (USEPA 2012a and b). For example:

- When the groundwater concentration is less than or equal to 3.0 mg/L, then a 2.0 mg/L increase may be granted.
- When the groundwater concentration is between 3.0 and 5.0 mg/L, then an increase between 0 and 2.0 mg/L may be granted that results in groundwater concentration of no more than 5.0 mg/L.
- When the upgradient groundwater concentration is greater than 5.0 mg/L, then no net

increase in groundwater nitrate is allowed. For modeling purposes, a calculated nitrate-N increase of 0.1 mg/L or less is considered acceptable for demonstrating no net increase in concentration.

The final report should contain the following information, which also serves as a checklist of information needed to support the work plan:

Project Information

- Date of application.
- Name and address of the property owner and the applicant at the head of each page of submission.
- Name, signature and stamp (Washington State Professional Engineer) of the designer.
- Name of nearest water body.
- Distance to shoreline.
- Depth to groundwater.

Parcel Information

- Parcel number, and if available, address of the site.
- Size of the parcel.
- A dimensioned site plan.
- General topography and/or slope.
- Drainage characteristics.
- Designated areas for the proposed on-site treatment system and the drain field reserve area.

Effluent Information

- System operating capacity and design flow.
- Source of sewage, for example, residence, restaurant, or other type of business.
    - Characteristics of sewage: flow, concentration of nitrate, and concentration of phosphorus.

Soil Information

- Soil type.
- The soil and site evaluation as specified under WAC 246-272A-0220.
- The location of all soil logs and other soil tests used to support permitting of the on-site treatment system.
- The depth of the soil dispersal component, the vertical separation, and depth of cover material.

Groundwater Mixing Zone Information (WDOH 2011)

- Hydraulic conductivity value source.
- Hydraulic gradient.
- Depth to groundwater.
- Distance to surface water.
- Background constituent concentrations.

References

WDOH. 2011. Level 1 Nitrate Balance Instructions for Large On-site Sewage Systems. DOH Publication #337-069. Olympia, WA.

ON-SITE SEPTIC SYSTEM ANALYSIS

Instructions: Enter information into areas shaded green. Red values must be updated.

Project name:	**ABC Church**
Completed by and Date:	**John Doe, May 4, 2013**
Facility type, size and description:	**Church, 5 acre parcel, 10,000 square foot building.**
Address:	**####, Spokane County**
Name of nearest waterbody:	**Spokane River**
Distance to shoreline:	**2 miles**
Depth to groundwater:	**75 feet, based on driller well logs within 1/4 mile**
Include a map of the parcel.	**Attached**

Input Values	Sign	Values	Units	Instructions
Parcel lot size	A_P	**5**	**acre**	**Site specific 1 acre = 43,560 ft^2**
Recharge	**R**	**4**	**in/yr**	**Use recharge Map**
Wastewater volume	V_W	**300**	**gpd**	**Use table or provide basis**
Drainfield area	A_D	**900**	**ft^2**	**Primary drainfield area**
Soil Type	**Type 4 - Fine sands, loamy fine**		**unitless**	**Use Drop Menu and WAC 246-272A-0220**

County Values	Sign	Values	Units	Notes
Total nitrogen concentration in wastewater	N_W	45.0	mg/l	Default
Soil denitrification	d	0.1	unitless	Default
Nitrate concentration in precipitation	N_R	0.24	mg/l as N	Default

Hydraulic Output Values	Sign	Values	Units	Notes
Hydraulic loading	D_H	0.6	gal/ft^2/day	
Minimum drainfield area	A_D	500	ft^2	

Nitrate Output Values	Sign	Values	Units	Notes
Volume of recharge over parcel	V_P	1,488	gpd	A_P * R * conversion
Total infiltration (drainfield & parcel)	V_{PT}	1,788	gpd	$V_W + V_P$
Total Nitrogen concentration from drainfield & parcel	N_{ip}	7.0	mg/l as N	$((V_P * N_R + V_W * N_W) * (1 - d)) / (V_P + V_W)$

Assessment	Values	Units	Instructions
Hydraulic loading	**Okay**	unitless	If Revise, review input values
Nitrate	**Okay**	unitless	If Revise, review input values

Attachment B: CARA Technical Review

Introduction

Spokane County conducted a technical review of Spokane County Code (SCC) 11.20.075. This review comprised a compilation of the relevant regulations and definitions, a technical analysis of non-residential sanitary wastewater loadings to soil and groundwater for areas outside the urban growth area (UGA) boundary, and a stakeholder participation process. This review is documented herein.

Study Objectives and Approach

The objective of this study was to review, and if necessary, recommend updates to the critical aquifer recharge area (CARA) wastewater disposal standards for non-residential uses and activities outside the UGA boundary (SCC 11.20.075). This study involved an assessment of non-residential sanitary wastewater loadings to soil (typically through septic system leach fields) that are protective of groundwater in susceptible aquifer areas outside the UGA boundary. Understanding loadings that are protective of groundwater allows for recommendations for revised standards. In addition, surface water protection associated with groundwater-to-surface water discharge was considered in this analysis, particularly phosphorus along with existing protective regulations, specifically the Shoreline Master Program. Acceptable constituent loadings to soil that lead to loadings to groundwater are dependent upon several factors, including wastewater constituent type, soil properties, groundwater properties, surface water properties, hydraulic loadings, and attenuation factors. The following elements were reviewed and considered:

a. Define area of study.
b. Define non-residential uses.
c. Define non-residential sanitary wastewater characteristics.
d. Define environmental and resource properties for the area of study.
e. Define groundwater quality criteria.
f. Review analytical methods.
g. Determine effluent wastewater loadings to soils.
h. Determine sanitary wastewater loadings to treatment system.
i. Develop a predictive model.
j. Develop recommendations and final report.

Review of Current Standard

Spokane County investigated the rationale for the current standard and performed a search of available documentation that was used to support the development of the current standard. The following information is based on interviews with current and previous Spokane County staff conducted by HDR Engineering, Inc. No written documentation was found regarding the development of the 90 gallons per day per acre (gpd/ac) criteria.

Prior to the development of SCC 11.20.075 in 1996, the 1979 *Spokane Aquifer Water Quality Management Plan* served as the framework for groundwater protection for the Spokane Valley Rathdrum Prairie aquifer in Spokane County. This framework included restricting sanitary wastewater disposal for new development outside the priority sewer service areas (similar to today's UGA boundary) in order to achieve an overall goal of no further aquifer degradation. This framework did not allow discharge of non-residential wastewater directly to soil (drain fields) in aquifer sensitive areas.

Spokane County and the Spokane Regional Health District (SRHD) were responsible entities for the development of sanitary wastewater disposal requirements in SCC 11.20.075. In general, the SRHD and Spokane County incorporated the findings and recommendations of the 1979 plan into the standard, but included an acceptance for non-residential sanitary wastewater disposal (conventional septic system drain fields) for situations where the pollutant loads were similar to residential discharges, and where there was no critical materials use activity (see definition of critical materials use activity below). SRHD and Spokane County relied upon available information on sanitary wastewater loading rates to drain fields that were protective of sensitive aquifers to develop a standard for non-residential sanitary discharges. This information included rules developed by the Idaho Panhandle Health District and research studies in Wisconsin (both areas with sandy soil overlying sensitive aquifers). In general, research showed that for sandy soil on top of a sensitive aquifer, a density of one unit (residence with septic drain field) per 5 acres was protective of groundwater quality (nitrate and bacteria were the two main constituents evaluated).

> ***Critical materials use activity:*** *An activity or land use which has been determined to use, transport, or store a critical material. A critical material is a substance present in sufficient quantity that its accidental or intentional release would result in the impairment of one or more of the beneficial uses of aquifer water.*

Based on the interviews, SCC 11.20.075 was developed based on the following assumptions:

- The sanitary disposal for a non-residential land use that was not a critical materials use activity would be similar to residential wastewater quality and loadings.
- For a residence, it was assumed in 1996 that the average person would use 200 gpd of water and that 75 percent of that water would enter a drain field as wastewater. Thus, 150 gpd of wastewater per person would be the discharge to an on-site drain field.
- Typical household size in Spokane County in 1996 was three persons; thus, the total wastewater loading to a drain field would be 450 gpd.
- Given that a density of one unit per 5 acres (as described above) was assumed to be protective of groundwater, it follows that:

$$450 \text{ gpd}/5 \text{ ac} = 90 \text{ gpd/ac}$$

Thus, 90 gpd/ac was developed to protect groundwater, based on preventing the overloading of nitrates and bacteria onto sandy or coarse soil and using residential wastewater loading assumptions.

Background and Regulations

The following section provides background and context regarding SCC 11.20.075, the Growth Management Act (GMA), aquifer protection in Spokane County, and relevant water quality standards and definitions.

Growth Management Act

Washington State adopted the GMA in 1990 (Chapter 36.70A Revised Code of Washington [RCW]). The GMA requires that state and local governments manage Washington's population growth by identifying and protecting critical areas and natural resource lands, designating UGAs, preparing comprehensive plans, and implementing them through capital investments and development regulations. The GMA requires that Washington State counties and cities

experiencing significant population increases designate and protect critical areas' functions and values. The GMA identifies five critical areas for protection:

- Wetlands.
- Areas with a critical recharging effect on aquifers used for potable water.
- Frequently flooded areas.
- Geologically hazardous areas.
- Fish and wildlife habitat conservation areas.

As required by the GMA, each city and county has the responsibility to identify, designate, and protect those critical areas found in their local environment.

Spokane County Aquifer Protection and Implementation of the GMA

As early as the 1970s, Spokane County recognized the importance of protecting the Spokane Valley Rathdrum Prairie (SVRP) aquifer, which underlies much of the urbanized portion of Spokane County. This included the development of a water quality management program that culminated in the 1979 *Spokane Aquifer Water Quality Management Plan (*Spokane County 1979). The plan, which was funded under the federal Clean Water Act (CWA) Section 208 Water Quality Management program, contained recommendations aimed at mitigating specific threats to aquifer quality and mitigating pollutant loads to allow additional development without increasing the total loading of pollutants on the aquifer area.

Also during the 1970s, the federal Sole Source Aquifer Protection Program was authorized by Section 1442(d) of the Safe Drinking Water Act of 1974 (Public Law 93-523, 42 United States Code (USC) 300 et seq.). The SVRP aquifer was designated as a sole source aquifer (see definition of sole source aquifer below) in February 1978. The 1979 *Spokane Aquifer Water Quality Management Plan* served as the main planning document for aquifer protection in Spokane County until the enactment of the GMA.

> ***Sole source aquifer:*** *The United States Environmental Protection Agency (USEPA) defines a sole source aquifer as an aquifer that supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer. These areas may have no alternative drinking water source(s) that could physically, legally, and economically supply all those who depend on the aquifer for drinking water.*

Spokane County began planning under the GMA in 1993, after rapid population growth in the late 1980s and early 1990s made it mandatory. The Spokane County Steering Committee of Elected Officials developed the countywide planning policies (CWPPs) using the GMA goals as guidelines. The primary purpose of the CWPPs was to coordinate efforts between Spokane County and the cities as each jurisdiction's comprehensive plan was developed. The Spokane County CWPPs were adopted in December 1994. An outgrowth of the CWPP was the development of the Spokane County *Critical Areas Ordinance for the Protection of Wetlands, Fish and Wildlife Habitats, Geo-hazard Areas and Critical Aquifer Recharge* Areas (implemented by SCC 11.20.010 through 11.20.090). This ordinance was first adopted in March 1996 and amended in 2003 and 2008. SCC 11.20.075 addresses protecting areas within the unincorporated areas of Spokane County important to maintaining groundwater recharge and quality. SCC 11.20.075 is the focus of this study and is further described below.

Existing Spokane County Code

The following was excerpted from SCC 11.20.075.

L-3 Wastewater Disposal: *shall be consistent with the Spokane County Comprehensive Plan, Capital Facilities and Utilities Element goals and policies for sanitary sewer systems together with the following standards:*

1. *Performance Standards Applicable to All Unincorporated Areas. Critical material use activities that produce a process waste instead of or in addition to sanitary waste shall utilize one of the following methods for waste management and disposal:*

    a. *Separate waste disposal systems shall be provided so those sanitary and process wastes are handled separately. The process waste shall be disposed of by collection in sealed holding tanks and shall be transported and disposed of at a site licensed for disposal of this effluent. An agreement to dispose of process waste under this section shall be recorded in the county auditor's office and shall not be removed without approval by the county.*

    b. *Sanitary and/or process waste waters shall be managed in compliance with a valid authorization from a publicly owned treatment works (POTW), which shall include any required pretreatment or monitoring;*

    c. *Sanitary and/or process wastewaters shall be managed in compliance with a valid surface water discharge permit, which is obtained from the state department of ecology.*

2. *Performance Standards for New Development Located Outside of the Urban Growth Area Boundary.*

    a. *Non-residential uses and activities in moderate and high susceptibility areas that produce more than ninety gallons of wastewater per acre per day, and any critical material use activity that produces sanitary wastewater discharge, shall have a disposal system that protects the aquifer equal to or greater than one of the following:*

        i. *Treatment utilizing sealed lagoons;*

        ii. *Treatment utilizing holding tanks with transport and disposal at a site licensed for disposal of the particular effluent;*

        iii. *Treatment in compliance with a valid surface water discharge permit obtained from the state department of ecology; or*

        iv. *Treatment in a mechanical wastewater treatment plant that produces less than three thousand five hundred gallons per day of effluent which meets the state drinking water standards prior to disposal into the ground using an infiltration system or subsurface disposal system; or*

        v. *Treatment in a mechanical wastewater treatment plant that produces more than three thousand five hundred gallons per day of effluent in compliance with a valid state waste discharge permit obtained from the state department of ecology and meeting the ground water standards, Chapter 173-200 WAC, or as amended.*

b. The evaluation of any plans submitted under RCW 90.48.110 must include consideration of opportunities for the use of reclaimed water as defined in RCW 90.46.010. Wastewater plans submitted under RCW 90.48.110 must include a statement describing how applicable reclamation and reuse elements will be coordinated as required under RCW 90.46.120(2).

c. Non-residential uses and activities in low susceptibility areas that produce more than ninety gallons of wastewater per acre per day may utilize on-site disposal subject to approval by the Spokane Regional Health District or state department of health.

d. Non-residential uses and activities not involving critical material use activities and which produce less than ninety gallons of wastewater per acre per day, may utilize on-site disposal subject to approval by the Spokane Regional Health District or state department of health.

e. Residential uses with lots legally created after March 21, 2000 which requires a new on-site sewage system shall have a minimum lot size of five acres per dwelling unit with the following exceptions.

vi. Lots which are part of an approved rural cluster development

vii. Non-conforming lots that complied with state and local development regulations at the time the parcel was created.

viii. For rural activity centers (RAC).

3. Performance standards for new development located inside of the urban growth area boundary.

a. *Public sewer services consistent with the adopted levels of service and concurrency requirements set forth in the county comprehensive plan and the county zoning code, or as amended, are required for all new residential and non-residential uses*.

Groundwater Quality Standards (WAC 173-200)

Washington's groundwater quality standards apply to any activity which has the potential to contaminate groundwater quality, including on-site sanitary waste treatment systems. Furthermore, the standards apply to all groundwater in the saturated zone, statewide. All groundwater is classified as a potential drinking water source; the standard does not distinguish groundwater that may be perched, seasonal, or artificial.

Regulatory Authority for On-site Sewage Systems and the Groundwater Quality Standards

The following agencies have responsibilities for regulating wastewater treatment systems in Spokane County:

- **Spokane Regional Health District (SRHD)**: Authority and approval over individual and small (up to 3,499 gpd) on-site sewage systems.
- **Washington State Department of Health (WDOH)**: Authority and approval over on-site sewage systems designed to handle domestic strength sewage at design flows from 3,500 to 100,000 gpd (may include mechanical treatment). Staff also reviews and approves all septic tanks, pump chambers, and other tanks used as part of small and large systems in Washington State.

- **Washington Department of Ecology (Ecology)**: Authority and approval over the following:
  - Domestic or industrial wastewater treatment under Chapter 173-240 WAC (wastewater facilities).
  - Wastewater treatment systems with subsurface disposal and design flows above 100,000 gpd.
  - Wastewater treatment systems with subsurface disposal that treat industrial waste.
  - Wastewater treatment systems with subsurface disposal where the groundwater receiving effluent is in hydraulic continuity with surface water.
  - Wastewater treatment systems with evaporative lagoons.
  - Wastewater treatment systems receiving stormwater discharges, including combined sanitary sewer and stormwater systems.

Implementation and enforcement of groundwater quality standards (Chapter 173-200 WAC) for on-site sewage systems is the responsibility of the permitting agencies, SRHD and WDOH.

Standard Outline and Intent

The goal of the groundwater quality standards is to maintain existing high quality groundwater and to protect existing and future beneficial uses. This goal is achieved through three basic mechanisms:

- **Antidegradation**: The antidegradation policy mandates the protection of background water quality and prevents degradation of water quality that would harm a beneficial use or violate the groundwater quality standards.
- **AKART**: All discharges of pollutants to groundwater must be treated at a minimum with all known, available, and reasonable methods of prevention, control and treatment (AKART), or best management practices (BMPs) implemented through permits or agreements with other agencies.
- **Standards**: The human health and welfare-based standards, which include numeric and narrative standards.

Antidegradation

Antidegradation applies to both permitted and non-permitted activities. The antidegradation policy as described in the groundwater quality standards has a two-tiered approach (Ecology 2005):

- Existing and future beneficial uses shall be maintained and protected. Degradation of groundwater quality that would interfere with or become injurious to beneficial uses shall not be allowed, [WAC 173-200-030 (2) (a)]. At a minimum, all groundwater should be protected as a potential source of drinking water. Not all groundwater is presently used for drinking water, nor do the standards presume that all groundwater is suitable as a drinking water source. However, the groundwater quality standards recognize the potential for these sources to be used for drinking water purposes in the future if other sources become diminished or the demand for water increases.
- Whenever groundwaters are of a higher quality than the criteria (see definition of criteria below) assigned for said waters, the existing water quality shall be protected, and contaminants that will reduce the existing quality thereof shall not be allowed to enter

such waters, except in those instances where it can be demonstrated to the department's satisfaction that:

- An overriding public interest will be served.
- All contaminants proposed for entry into said waters shall be provided with AKART prior to entry, [WAC 173-200-030 2(c)].

Criteria: *The term as used in the groundwater quality standards refers to numeric values and narrative standards that represent contaminant concentrations which are not to be exceeded in groundwater (e.g., the numeric criterion for nitrate-N in groundwater is 10 milligrams per liter [mg/L]).*

Nondegradation

The standards also include a nondegradation clause that prohibits a measurable increase of contaminant concentrations in groundwater and applies in the following situations:

- High quality groundwater constituting an outstanding national or state resource, such as waters of national and state parks, wildlife refuges, and waters of exceptional recreational or ecological significance, [WAC 173-200-030 (2)(b)].
- Waters designated as outstanding resource waters through the provisions of Chapter 34.05 RCW, Administrative Procedures Act.
- Designated Special Protection Areas which have been classified as nondegradation areas, (WAC 173-200-090).
- Those areas where groundwater has been degraded to levels greater than the criteria, a nondegradation policy will be in effect for those constituents which exceed the criteria in ground water.

No groundwater in Spokane County has been designated or classified for nondegradation (first three bullets above). If groundwater is found to exceed a criteria (see definition of criteria), then nondegradation applies.

Beneficial Uses

The antidegradation policy requires that beneficial uses be maintained and protected. Beneficial uses of groundwater include drinking water (the main premise for CARA), domestic, stock watering, industrial, commercial, agricultural, irrigation, mining, fish/wildlife maintenance and enhancement, recreation, generation of electrical power, preservation of environmental and aesthetic values, and all other uses compatible with the enjoyment of the public waters of the state, [WAC 173-200-020 (4)].

Groundwater that is hydraulically connected to a surface water body must maintain the water quality standards established in Chapter 173-201A WAC (Water Quality Standards for Surface Water of the State of Washington).

AKART

The antidegradation policy and AKART form the primary mechanisms for protecting groundwater quality. All discharges of pollutants to groundwater must be treated at a minimum with AKART or BMPs implemented through permits or agreements with other agencies. On-site treatment system design requirements are defined in Chapter 246-272A WAC – *On-Site Sewage Systems* and Chapter 246-272C WAC – *On-Site Sewage System Tanks Regulations,* and are regulated and permitted through SRHD and WDOH. The requirements set forth in on-

site sewage systems regulations represent AKART. Thus, for purposes of this CARA evaluation, it is assumed that non-residential sanitary disposal that are permitted through SRHD, and that follow the on-site sewage systems standards, meet the AKART criteria as set forth in the groundwater quality standards.

Point of Compliance

The point of compliance should be in accordance with WAC 173-200-060(1). The point of compliance is intended to protect current and reasonable future uses of the groundwater.

WAC 173-200-060 point of compliance states:

(1) The point of compliance is the location where the enforcement limit, set in accordance with WAC 173-200-050, shall be measured and shall not be exceeded.

(a) The department shall establish the point of compliance for an activity. The point of compliance shall be established in the groundwater as near the source as technically, hydrogeologically, and geographically feasible.

(b) Compliance with the enforcement limits shall be maintained throughout the site from the uppermost level of the saturated zone extending vertically to the lowest depth that could potentially be affected by an activity.

For a Level 3 analysis, a groundwater mixing zone approach may be proposed along with establishing a point of compliance (see WDOH Large On-site Sewage Systems analysis for example of mixing zone approach for nitrate in groundwater (WDOH 2011)).

Critical Aquifer Recharge Areas SCC 11.20.075

The GMA requires Spokane County to designate areas and adopt development regulations for the purpose of protecting areas within the unincorporated areas of Spokane County critical to maintaining groundwater recharge and quality (see definition of CARA below). SCC 11.20.075 specifies the requirements to be enacted when regulated development within these areas is proposed to occur.

> ***Critical Aquifer Recharge Areas (CARA):*** *Areas where there is an aquifer that is a source of drinking water that is vulnerable to contamination that would affect the potability of the water (WAC 365-190-030).*

CARA goals as defined in the code are as follows:

- Prevent degradation of groundwater quality in Spokane County and improve water quality of aquifers that do not meet state standards.
- Protect groundwater quality from development impacts.
- Secure adequate water quantity for the residents of Spokane County.
- Provide public information programs for land users to demonstrate how to protect CARAs from degradation.
- Consistently enforce regulations, effectively monitor compliance, and provide incentives to protect CARAs.
- Regularly update CARA protection measures so they are effective, enforceable, and equitable.

SCC 11.20.075 addresses aquifers in Spokane County, not just the SVRP aquifer. **Table B-1** summarizes uses and activities that are regulated under CARA (SCC 11.20.075) and describes restrictions to land uses and activities based on aquifer susceptibility ratings. The aquifer susceptibility ratings presented in **Table B-1** are based on an aquifer susceptibility model developed by Spokane County.

This study focused on sanitary wastewater disposal from uses and activities outside the UGA. For high and moderate aquifer susceptibility ratings (**Table B-1**), there are limitations on land use that include the need to comply with the standards in SCC 11.20.075. (See report section "Existing Spokane County Code.")

Table B-1. Uses and Activities Regulated in CARA (SCC 11.20.075, Table 11.20.075B)

Uses and Activities	Aquifer Susceptibility Rating		
	High***	Moderate	Low
Biosolids land application	N	L-1	L-1
Critical material storage, handling, generating or use	L-2, L-3	L-2, L-3	L-2, L-3 **
Cultivation of land (commercial)	L-1	L-1	P
Dairy	L-1*	L-1	L-1
Feed lot	N	L-1	L-1
Feed mill	L-2	L-2	P
Floriculture (flower growing)	L-1	L-1	P
Grazing	L-1	L-1	P
Greenhouse – commercial	L-1	L-1	P
Horse boarding and training	L-1	L-1	P
Horticulture (vegetable growing)	L-1	L-1	P
Landfill, demolition, inert	N	L-6	L-6
Landfills (all others)	N	N	L-6
Large animal raising and/or keeping	L-1	L-1	P
Mining	L-5	L-5	L-5
Nursery – wholesale	L-1	L-1	P
Orchard	L-1	L-1	P
Poultry-raising, commercial	N	L-1	L-1
Riding stable	L-1	L-1	P
Sanitary waste discharge	L-3	L-3	P
Stormwater disposal systems	L-4	L-4	L-4
Tree farming	L-1	L-1	P
Truck gardening	L-1	L-1	P
Vineyard	L-1	L-1	P

INDEX:
Uses and activities are defined in the Spokane County zoning code.
P = Permitted without Spokane County review under this ordinance.
N = Not permitted.
L = Limited Uses. These uses are permitted if they comply with the standards in SCC 11.20.075 and the corresponding performance standards listed in SCC 11.20.075.C. L-1 Agriculture; L-2 Critical Materials Storage, L-3 Wastewater Disposal; L-4 Stormwater Disposal; L-5 Mining; L-6 Landfill.
*A hydrogeologic study is required for this use.
**When there are low susceptibility areas hydrologically connected to moderate and high susceptibility areas, the regulations for moderate or high susceptibility areas apply. Hydrologic connection is determined by a hydrogeologic study.
***Designated wellhead protection areas and areas within a one thousand-foot radius of wells without reported

plans are additionally treated as high aquifer susceptibility areas.

Spokane County Shoreline Master Program

The Shoreline Master Program is promulgated under the authority of and pursuant to the requirements of Chapter 90.58 RCW, the Shoreline Management Act of 1971, Shoreline Master Program Guidelines WAC 173-26, and the Shoreline Management Permit and Enforcement Procedures WAC 173-27. The intent of the program includes six purposes primarily focused around preserving and protecting the shoreline and associated water quality. Since the shoreline usually is an area of interconnectivity between groundwater and surface water, programs that protect the water quality of the groundwater, such as CARA, and the surface water, such as the Shoreline Master Program, are also linked as well and should provide compatible levels of protection.

Critical areas within shorelines of the state in Spokane County are managed exclusively through the provisions of this Shoreline Master Program. The Shoreline Management Act, Chapter 90.58 RCW, applies to all streams with a mean annual flow greater than 20 cubic feet per second (cfs), and lakes, impoundments, and reservoirs larger than 20 acres. It applies to land extending landward 200 feet from the ordinary high-water mark. Although the term non-residential is not used, the terms commercial and industrial are used and restrict or limit such uses and activities within four distinct management environments:

Natural Environment: The natural environment is intended to protect those shoreline areas that are relatively free of human influence or include intact or partially degraded shoreline functions intolerant of intensive human use. These shoreline areas require that only very low intensity uses be allowed in order to maintain the ecological functions and ecosystem-wide processes.

Rural Conservancy Environment: The purpose of the rural conservancy environment is to protect ecological functions, conserve existing natural resources, maintain existing character and valuable historic and cultural areas in order to provide for sustained resource use, achieve natural flood plain processes, and provide recreational opportunities. Examples of uses that are appropriate in a rural conservancy environment include low impact outdoor recreation uses (such as public parks and trails), timber harvesting on a sustained-yield basis, agricultural uses, aquaculture, low-intensity residential development, livestock grazing, and other natural resource-based low-intensity uses.

Urban Conservancy Environment: The purpose of the urban conservancy environment is to protect and restore ecological functions of open space, flood plain and other sensitive lands where they exist in urban and developed settings, while allowing a variety of compatible uses.

Shoreline Residential Environment: The purpose of the shoreline residential environment is to accommodate residential development and appurtenant structures that are consistent with this chapter. An additional purpose is to provide appropriate public access and recreational uses.

For example, commercial and industrial uses are not permitted in the natural management environment. Commercial and industrial uses are not allowed except as otherwise noted in the rural conservancy environment. Uses that preserve the natural character of the area or promote preservation of open space, flood plain or sensitive lands, either directly or over the long term, should be the primary allowed uses in the urban conservancy environment. Commercial

development is limited to water-oriented uses and shall be consistent with the comprehensive plan in the shoreline residential environment.

Surface Water Quality Standards (WAC 173-201A)

Recommended modifications to the Spokane County Code are also intended to be protective of surface water quality standards as established by Ecology, including total maximum daily loads (TMDLs) established for water bodies within Spokane County. State regulatory requirements and standards for surface water quality are given WAC Chapter 173-201A: water quality standards for surface waters of the state of Washington.

Conceptual Model

Spokane County developed a general conceptual model of an on-site treatment system for non-residential use to study the processes and routing of wastewater loads during the technical review and is shown in **Figure B-1**. For this system, sanitary wastewater is discharged from a non-residential facility (influent wastewater) and enters into a septic tank where it receives primary biological treatment. This treatment involves the digestion of wastewater into liquid, fats and grease, and insoluble particles. The fine insoluble particles settle to the bottom of the septic tank forming sludge. Greases and fats float to the top forming a scum layer. The liquid (effluent) flows through the outlet pipe into the drain field piping and then into the soil. Once in the soil system, some constituents in the effluent can undergo secondary biological and chemical interactions (treatment). For example, phosphorus can be adsorbed by soil clays, while organic nitrogen can undergo biological mineralization and nitrification processes (microbial process of converting organic nitrogen to ammonium and then to nitrate). The hydraulic loading of the drain field effluent to soil typically exceeds the ability of the soil to retain this water; thus, the effluent, with its dissolved constituents (leachate) can move by gravity downward and enter the groundwater system. This is in addition to the natural recharge from precipitation and snowmelt that moves downward through the unsaturated zone below the root zone and into the groundwater. This natural recharge also provides a loading to the groundwater. Groundwater systems are often connected to surface water systems such as lakes and rivers; therefore constituents in the leachate can reach surface water via the groundwater system.

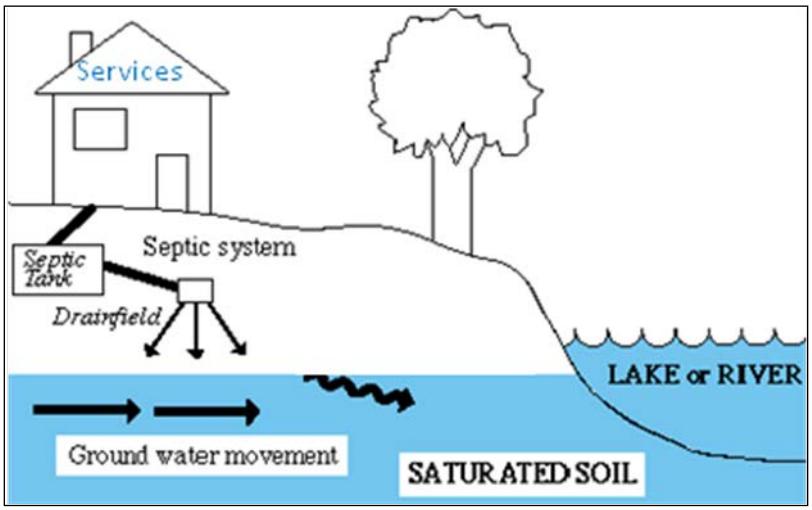

Figure B-1. Conceptual On-site Sanitary Treatment System

Effluent entering the drain field often has constituents at elevated concentrations (relative to typical ambient groundwater concentrations). Such constituents include: chloride, sulfate, nitrate, organic nitrogen, phosphorus, fecal coliform and fecal streptococci bacteria, and total organic carbon (Canter and Knox 1985). In addition, trace organic compounds (e.g., caffeine) may be present. As described above, many of these constituents may undergo additional treatment in the soil system. Much of the regulatory focus for groundwater protection from on-site treatment systems has been on nitrate. This compound is mobile in soil and groundwater systems, occurs at relatively high concentrations in effluent (e.g., typically in the 30 to 60 mg/L range compared to a groundwater quality standard of 10.0 mg/L, expressed as nitrate-N), and is a "primary contaminant" under the groundwater quality standards (e.g., it can be harmful to human health when ingested at elevated concentrations).

The following steps occur within the non-residential on-site wastewater disposal system (**Figure B-2**):

1. Influent wastewater loading to the septic tank.
2. Effluent wastewater loading to the drain field.
3. Leachate moving into and through the soil system after discharge from the drain field.
4. Leachate loading into groundwater.
5. Groundwater to surface water (only for some constituents, such as phosphorus, and only where there is a groundwater to surface water pathway).

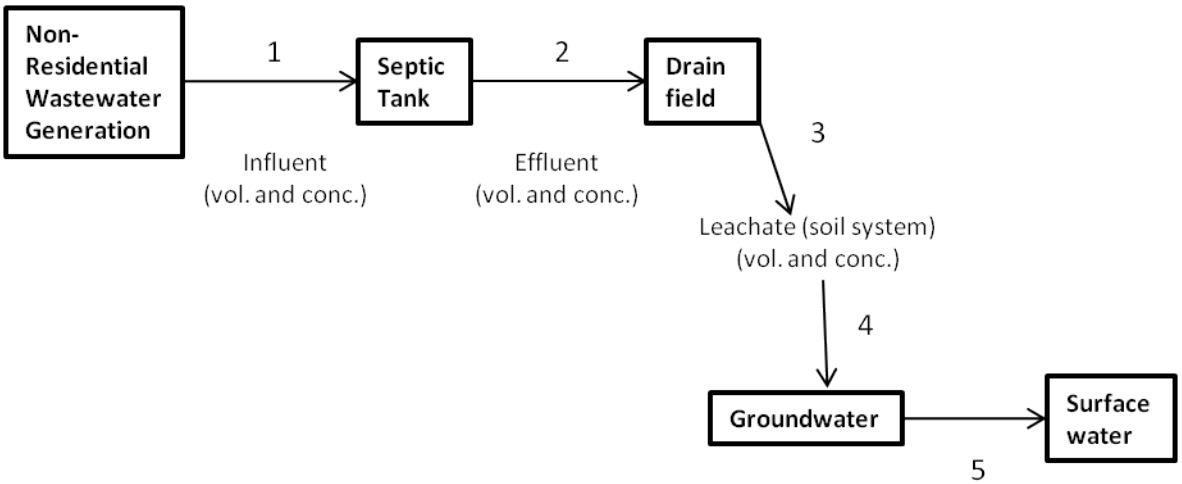

Figure B-2. Process Flow Model

The CARA spreadsheet is primarily an analysis of the leachate or flow between the drain field and groundwater; it is not an analysis of effluent once it enters the groundwater system. The spreadsheet is designed to be a protective yet simplified approach to evaluating on-site treatment systems. The detailed study approach (Level 3) is available if necessary for those interested in evaluating transport in groundwater and potentially surface water.

The CARA spreadsheet includes parcel lot size, recharge rate, wastewater volume, drain field area, and soil type as user inputs. Recharge is the meteoric water that moves downward from the surface through the soil and into the groundwater. Additional parameters selected by Spokane County include the nitrate concentrations for wastewater and rainfall along with the denitrification rate. These are shown conceptually in **Figure B-3**.

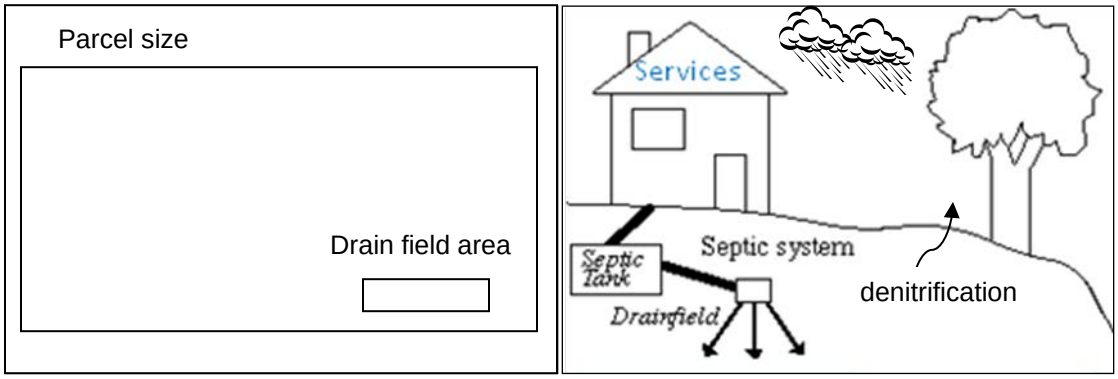

Figure B-3. CARA Spreadsheet Conceptual Model

Phosphorus

Under certain conditions, phosphorus discharge from on-site treatment systems can be a water quality concern, especially near surface water where phosphorus can contribute to eutrophication and algae blooms. The risk from on-site treatment system discharge of phosphorus is related to the distance from the source to surface water, with the greatest risk presented by short distances with low sorptive soil and high groundwater movement. The Shoreline Master Program, described above, provides general protection of areas around water bodies by requiring a 200-foot buffer between the ordinary high water mark and development.

In general, the land use and setback requirements identified in the Shoreline Plan provide surface water protection from non-residential on-site wastewater disposal systems. Therefore, further restrictions associated with phosphorus for non-residential on-site treatment systems in CARA sensitive areas are not proposed. The CARA spreadsheet, however, requires information on the distance of the parcel to a surface water body. Spokane County has the option to request a detailed study (Level 3) for situations not covered in the Shoreline Plan. Examples include parcels that may have a variance allowing for development with less than a 200-foot buffer of sensitive water bodies and streams with less than a mean annual flow greater than 20 cfs.

Loading Analyses

This portion of the technical review included examining non-residential sanitary wastewater loads from the on-site septic system and drain field, the loads into the soil, and the loads to groundwater.

Sanitary Wastewater Loads

Sanitary wastewater generally means wastewater associated with personal hygiene, food preparation, or cleaning. (See report section “Define Non-residential Sanitary Wastewater Characteristics.”) Load is the mass of the constituent in the wastewater and is calculated as the wastewater flow multiplied by the wastewater concentration. This calculation in typical units is shown in **Equation 1**.

$$Load\left(\frac{lbs}{yr}\right) = Flow(gpd) \times Concentration(\frac{mg}{L}) \times 3.875(\frac{L}{gal}) \times \frac{1}{453{,}592.37}(\frac{lb}{mg}) \times 365(\frac{day}{yr})$$

Equation 1. Load Equation

The quality and quantity of treated wastewater load to soil (leachate) are dependent on the following parameters:

- Type of facility or use (e.g., non-residential: restaurant, school, supermarket).
- Treatment type (e.g., conventional septic tank and drain field or advanced treatment).
- Flow rate (based on type of facility).
- Constituent type (e.g., nitrogen).
- Concentration (based on the treatment type).
- Duration (e.g., constant or periods of high flows and concentrations).
- Frequency (e.g., occasional, daily, or weekly periods of high flows and concentrations).

Sanitary Wastewater Loads to Soil

For evaluation purposes, total nitrogen (TN) (organic nitrogen, ammonium, and nitrate) in effluent discharged to a drain field is assumed to convert to nitrate. Once in the soil system, nitrate can undergo several fates:

- **Denitrification**: Under low oxygen conditions (anoxic), nitrate can serve as an electron donor for microbial decomposition of organic matter (C). This reaction is expressed:

  $$5C + 4NO_3^- + 2H_2O \longrightarrow 2N_2 + 4HCO_3 + CO_2$$

  Nitrogen gas (N_2) is lost to the atmosphere. Soil beneath drain fields is subject to alternating aerobic and anaerobic conditions, and therefore, nitrate can undergo denitrification. The amount of denitrification is difficult to quantify and depends on several variables, including soil carbon, soil moisture, soil temperature, and soil pH. In general, a coarse, well-drained soil will have less denitrification than a fine, poorly-drained soil. WDOH recommends a default denitrification rate of 10 percent as part of their Level 1 Nitrate Balance model (Ecology 2011). The Idaho Department of Environmental Quality (IDEQ), on the other hand, assumes no denitrification as part of their nutrient-pathogen (N-P) study guidelines for evaluating of on-site drainage systems (IDEQ 2012).

- **Plant Uptake**: Plant roots can uptake nitrate as a macronutrient. Generally, drain fields are of sufficient depth (3 feet [WAC specifies a layer of between 6 and 24 inches of cover material and the infiltrative surface may not be deeper than 3 feet below the finished grade, except under special conditions approved by the local health officer]) that the quantity of nitrate plant uptake is a small percentage of the nitrate loading to soil and is typically ignored when evaluating nitrate leaching to groundwater from on-site treatment systems (IDEQ 2012; Ecology 2011).

- **Leaching**: As an anion (negatively charged molecule), nitrate is not adsorbed to the negatively charged soil particles and is mobile in soil and groundwater systems.

The CARA spreadsheet assesses the wastewater load to soil by taking into account the volume and concentration of wastewater, volume and concentration of recharge from precipitation, and soil denitrification. Recharge is based on a number of factors, including the precipitation an area receives and soil types.

Sanitary Wastewater Loads to Groundwater

The sanitary wastewater load discharged from the drain field moves through the soil and into the groundwater (assuming no restrictive layers that would prohibit movement to groundwater).

> *The CARA spreadsheet or Level 1 and 2 analyses assess wastewater loads to soils and do not consider groundwater loading and groundwater mixing. Wastewater loads to groundwater and associated groundwater mixing may be*

evaluated as part of a detailed study (Level 3) analysis.

Groundwater flows predominantly in a horizontal direction. The vertical column of leachate moving down through the soil column intersects the horizontal flow of groundwater at the water table where the leachate mixes with the groundwater. Nitrate in the leachate mixes with nitrate in the upgradient groundwater resulting in the downgradient nitrogen concentration. This concentration of nitrogen is informative because the water quality standard is concentration-based. The groundwater quality criterion for nitrate-N in groundwater is 10 mg/L. While the criterion is 10 mg/L, the Water Quality Standard for Ground Water of the State of Washington (Chapter 173-200 WAC) does not simply allow wastewater loadings to groundwater up to the criterion; rather, the antidegradation policy must also be taken into account when assessing loadings to groundwater.

Since WDOH considers a moderate impact an increase in nitrate-N of greater than 2 mg/L above background, an increase of less than 2.0 mg/L nitrate-N in groundwater above background may be considered for meeting groundwater quality standard requirements (WDOH 2011). However, WDOH's policy restricts increases in the groundwater nitrate concentration above 5.0 mg/L. This value is consistent USEPA's safe drinking water policies. "A threshold value of 5 mg/L was chosen because this value represents half of USEPA's maximum contaminant level set to protect against blue baby syndrome" (USEPA 2012a). USEPA's technical factsheet on nitrate/nitrite indicates 5 mg/L is a critical trigger (USEPA 2012b). In Washington, the nitrate action level for drinking water standards is 5 mg/L which triggers additional sampling.

In practice, when the groundwater concentration is less than or equal to 3.0 mg/L, then a 2.0 mg/L increase is possible. When the groundwater concentration is between 3.0 and 5.0 mg/L, then an increase between 0 and 2.0 mg/L is allowed that results in downgradient (point of compliance) groundwater concentration of no more than 5.0 mg/L. When the upgradient groundwater concentration is greater than 5.0 mg/L, then no net increase in downgradient nitrate-N is allowed. For modeling purposes, a no net increase is considered to be a net change of 0.1 mg/L or less nitrate-N.

Movement of the leachate through the groundwater is related to multiple parameters. Understanding these parameters is important to characterizing the sanitary wastewater load. Parameters that have an effect on the wastewater load to groundwater and effluent mixing within the groundwater include:

- Flow rate of wastewater (based on the type of facility).
- Constituent type (e.g., nitrogen).
- Concentration of constituents in wastewater (based on the treatment type).
- Flow rate of the groundwater (based on hydrogeology).
- Concentration of the constituent groundwater (upgradient).
- Geology (e.g., fine or coarse materials).
- Hydraulic conductivity (describes how readily the water moves through the geology).
- Hydraulic gradient (describes the force moving water between locations).
- Mixing zone depth (the depth from the water table where the constituent initially mixes).
- Orientation of the drain field to groundwater flow direction (intersection of the water moving in the soil column (vertically) with the groundwater movement (horizontally).
- Sorption (e.g., adsorption, chemical precipitation, desorption, and dissolution).

Supporting Information

This portion of the technical review included reviewing the history and development of the current standard and defining the components of the technical review, including the study area, non-residential uses, non-residential sanitary wastewater characteristics, and environmental and resources properties for the study area.

Define Area of Study

One of the listed goals of the CARA standard is to "regularly update the CARA protection measures so they are effective, enforceable, and equitable" (SCC 11.20.075). The focus of this study was to review and make recommendations for updates, as necessary, to the current CARA wastewater disposal standards for non-residential uses and activities outside the UGA boundary. Thus, the area of study is defined as non-residential areas that are within CARA (low, medium, and high susceptible areas) and outside the UGA boundary.

Define Non-residential Uses

The Critical Areas Ordinance does not define "non-residential," nor is there a definition in the comprehensive plan. However, the ordinance does define residential development as follows:

> ***Residential:*** *Only single-family, two-family, multi-family, manufactured and mobile home, community residential facility, community treatment facility, dormitory, fraternity and sorority, as defined in the Spokane County Zoning Code, or as amended (SCC 11.20.010).*

Thus, non-residential is interpreted to be any land use that does not meet the above definition of residential development. **Table B-2** summarizes the types of non-residential land uses identified outside the UGA boundary in Spokane County.

Table B-2. Types of Non-residential Land Uses Outside the UGA Boundary

Land Use	
Agricultural – commercial	Retail – general merchandise
Churches	Retail – hardware
Commercial	Retail – other
Communication	Service – construction
Education	Service – education
Hotel/Condo	Service – finance
Manufacturing – chemical	Service – governmental
Manufacturing – petroleum	Service – professional
Manufacturing – stone/glass	Service – miscellaneous
Manufacturing – others	Service – repair
Mining – sand and gravel	Timber
Public assembly	Transportation – aircraft
Recreation	Transportation – motor
Resort camping	Transportation – railroad
Retail – auto	Utilities
Retail – eating	Wholesale
Retail – food	

Define Non-residential Sanitary Wastewater Characteristics

An understanding of typical non-residential wastewater quantity and biological and chemical characteristics is needed to assess potential impacts to groundwater from non-residential sanitary wastewater disposal. Much of the available literature about on-site wastewater flow and characteristics is for residential sanitary wastewater (Metcalf and Eddy 2003; Crites and Tchobanoglous 1998; USEPA 1980a and 2002; and, Water Environment Federation (WEF) Manual of Practice (year unknown); Water Environment Research Foundation (WERF) 2009 and 2008). Identifying the range of non-residential land uses and wastewater quantity and quality for effluent from on-site treatment systems is far more challenging (Seabloom, et.al, 2005).

Furthermore, it is important to distinguish the type of wastewater data available, where *influent* wastewater is sewage that is generated on-site prior to entering the on-site treatment system, *effluent* wastewater is sewage after treatment (e.g., discharge from a septic tank) but prior to entering a drain field, and *leachate* is water that percolates from the drain pipes through the soil (**Figure B-2**).

Given the absence of or incomplete information on non-residential systems, some translations of characteristics from residential systems may be necessary and is reasonable if the similarities between the residential and non-residential usages are understood.

For Spokane County, a wide variety of services (e.g., schools), retail (e.g., restaurants), and manufacturing (e.g., agri-chemical) sites fall into the non-residential wastewater category. (See section, “Non-residential Wastewater Characteristics,” for tabular information.) Wastewater generating activities in some non-residential establishments are similar to those of residential dwellings. For example, a retail store may have restrooms, a small kitchen, and employee showers and would generate similar wastewater characteristics as a dwelling. A restaurant would generate a waste stream dominated by dishwashing activities and food waste, and would have a waste stream of greater volumes and solids loading then a typical single-family dwelling. A church’s waste stream would be expected to generate low solids loading (dominated by urine) compared to a typical residential waste stream. In some cases, non-residential wastewater characteristics can lead to higher strength wastewater to the septic systems that are also outside the treatment capacities of conventional on-site systems (Snowden 2012).

Table B-2 presents a summary of current non-residential land uses outside the UGA. Common non-residential facilities include office, commercial, and service buildings, churches, retail, and restaurants. Some wastewater characteristic data for these types of non-residential facilities are identified in the literature (Metcalf and Eddy 2003; MAR 2012; UMN 2012; Smith and Loveless 1962; Goldstein and Moberg 1973; CDEP 2006).

The Washington State *Criteria for Sewage Works Design* (Orange Book) contains design criteria information that includes wastewater generation for some non-residential uses (Ecology 2008). The Orange Book provides information on flow, biochemical oxygen demand (BOD), suspended solids, and flow duration for a number of non-residential uses.

In the document *Guidance for Design of Large-Scale On-Site Wastewater Renovation Systems*, the Connecticut Department of Environmental Protection (CDEP) provides a discussion of commercial and institutional wastewater characteristics and compares the biological strength (measured as BOD) of various non-residential uses compared to residential uses (CDEP 2006). The guidance provides a comprehensive literature review of effluent wastewater characteristics (BOD, total suspended solids, fats-oil-grease, TN, and total phosphorus (TP)) for food processing, food serving establishments, commercial businesses, and institutional facilities. The

CDEP document presents effluent wastewater data and standard septic tank treatment. Thus, this data is pertinent in assessing wastewater effluent quality entering a drain field.

An example of effluent wastewater characteristics for BOD, TN, and TP for select residential and selected non-residential land uses is presented in **Table B-3**. The data demonstrates that there are differences in effluent wastewater characteristics based on land use. For example, middle and high schools have a higher TN average concentration (104 mg/L) compared to residential, restaurants, and supermarkets (41 to 88 mg/L). The data in this table also illustrates the high range of values presented in the literature for these constituents and the need to consider the applicability of this data to Spokane County.

Much of the regulatory focus for groundwater protection from on-site treatment systems has been on nitrate. This compound is mobile in soil and groundwater systems, is at relatively high concentrations in effluent (e.g., typically in the 30 to 60 mg/L range compared to a groundwater quality standard of 10 mg/L), and is a “primary contaminant” under the groundwater quality standards. Nitrate is a “primary contaminant” due to its biological affects (USEPA 1980b; Lee et.al 2005).

Phosphorus was evaluated due to the TMDL for the Spokane River, which sets phosphorus allocations (Ecology 2010). While the design and permitting of on-site septic systems has historically focused on nitrates and pathogens, more recently, phosphorus loads have been identified as an important contributor to eutrophication of sensitive waters. There is evidence that phosphorus from on-site septic systems affects groundwater and surface water (HDR 2007). Studies have shown drain fields have a hydraulic connection to groundwater and under some conditions can release a phosphorus load; therefore, there is increasing recognition and concern about phosphorus leaching from on-site septic systems reaching surface waters (DDNR 2006; IDEQ 2006; MDEQ 2009; Dillon, et.al 1986). These concerns are based on findings showing on-site septic systems to be major contributors of phosphorus loads to surface waters (Doyle et.al 2005; McCray et.al 2005; McCray et.al 2000; TSWQC 2005). However, critical areas within shorelines of the state in Spokane County are managed exclusively through the provisions of the Shoreline Master Program, which limits non-residential development and incorporated incorporates buffer zones between development and water bodes.

Table B-3. Example of Septic Tank Effluent Concentrations for Residential and Non-residential Land Uses

Type[1]	BOD_5, (mg/L)			TN (mg/L)			TP (mg/L)		
	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Residential	13	184	1,211	10	51	330	3	9	48
Restaurant	53	909	1,216	n/a	41	n/a	n/a	8	n/a
Mid & High Schools	70	179	599	80	104	141	3	12	18
Supermarket	164	500	883	39	88	189	n/a	29	n/a

[1]Source: CDEP 2006. Data are presented to illustrate the range of values for each land use type and within each type.

Define Environmental and Resource Properties for Area of Study

The following geographic information system (GIS) databases (layers) are available for all or portions of Spokane County to support the study:

- Soil series classification, soil texture, soil depth, soil restrictive layer, soil hydrologic group, soil type (as defined by Spokane County Rules and Regulations for On-Site Sewage System), and soil permeability (Source: Natural Resources Conservation Service (NRCS)).
- Vadose zone geology based on well logs (Source: Ecology).
- Depth to groundwater (Source: Ecology [well logs] and Spokane County GIS).
- Aquifer identification (Source: U.S. Geological Survey [USGS] and Spokane County [Including SHADI]).
- Aquifer gradient (Source: USGS and Spokane County [Not available for entire Spokane County]).
- Aquifer flow direction (Source: USGS and Spokane County).
- Aquifer thickness (Source: USGS and Spokane County [Not available for entire Spokane County]).
- Aquifer hydraulic conductivity (Source: USGS and Spokane County [Including SHADI]).
- Surface water distance (Source: Spokane County).
- Groundwater quality for key constituents (Source: Spokane County [Not available for entire Spokane County]).
- Aquifer and surface water discharge (Source: USGS and Spokane County).

Development of Recommendation and Stakeholder Input

A general comment theme from stakeholders cautioned that incorporating too many complexities into a revised standard would be very challenging for applicants and difficult to implement into policy. Attributes that implementation of a revised standard should address include:

- The update must be scientifically based.
- The update must be protective of water resources and water quality, especially the groundwater.
- The application/permitting process should be straightforward and concise for applicants and Spokane County to use. Application of the process should provide consistent and equitable evaluation of projects county-wide.
- While the process should include the same evaluation methodology for all applicants, it should also include additional options for supplementary evaluations to provide flexibility for unique situations that may be justified with detailed supporting information.
- The update should be consistent in application.

A tiered modeling process (levels 1 through 3) for assessing potential impacts to groundwater and surface water is recommended as part of the standard revisions, where level 1 involves evaluations for nitrogen and hydraulic loadings based on a few readily available input parameters and assumed default values. If necessary, the applicant can then conduct a level 2 analysis using more site specific information, or the applicant may choose to conduct a level 3 analysis that involves a detailed site specific study.

Overview of Recommended Process

For Spokane County approval of a non-residential, on-site sanitary wastewater discharge outside the UGA in moderate and high CARA sensitive areas, an application process including

use of a spreadsheet tool is recommended. Most applicants would have software (Microsoft Excel) and familiarity with spreadsheets to use this tool. This CARA spreadsheet includes basic project inputs (**Figure B-4**). The applicant would need to determine these inputs either based on the guidance provided as part of the CARA spreadsheet instructions or based on information that would be obtained to support the parcel development process. The CARA spreadsheet performs calculations and provides an assessment of the proposal.

A completed CARA spreadsheet and application package would be submitted to Spokane County for review. Spokane County may accept or deny the application package. A CARA spreadsheet that indicates a positive assessment does not ensure acceptance. Spokane County may deny an application based on other information in the application package or because unreasonable input values were used in the CARA spreadsheet.

ON-SITE SEPTIC SYSTEM ANALYSIS					
Instructions:	Enter information into areas shaded green. Red values must be updated.				
Project name:	**ABC Church**				
Completed by and Date:	**John Doe, May 4, 2013**				
Facility type, size and description:	**Church, 5 acre parcel, 10,000 square foot building.**				
Address:	**####, Spokane County**				
Name of nearest waterbody:	**Spokane River**				
Distance to shoreline:	**2 miles**				
Depth to groundwater:	**75 feet, based on driller well logs within 1/4 mile**				
Include a map of the parcel.	**Attached**				
Input Values		**Sign**	**Values**	**Units**	**Instructions**
Parcel lot size		A_P	**5**	**acre**	**Site specific 1 acre = 43,560 ft^2**
Recharge		**R**	**4**	**in/yr**	**Use recharge Map**
Wastewater volume		V_W	**300**	**gpd**	**Use table or provide basis**
Drainfield area		A_D	**900**	**ft^2**	**Primary drainfield area**
Soil Type	**Type 4 - Fine sands, loamy fine**			**unitless**	**Use Drop Menu and WAC 246-272A-0220**
County Values		**Sign**	**Values**	**Units**	**Notes**
Total nitrogen concentration in wastewater		N_W	45.0	mg/l	Default
Soil denitrification		d	0.1	unitless	Default
Nitrate concentration in precipitation		N_R	0.24	mg/l as N	Default
Hydraulic Output Values		**Sign**	**Values**	**Units**	**Notes**
Hydraulic loading		D_H	0.6	gal/ft^2/day	
Minimum drainfield area		A_D	500	ft^2	
Nitrate Output Values		**Sign**	**Values**	**Units**	**Notes**
Volume of recharge over parcel		V_P	1,488	gpd	A_P * R * conversion
Total infiltration (drainfield & parcel)		V_{PT}	1,788	gpd	$V_W + V_P$
Total Nitrogen concentration from drainfield & parcel		N_{ip}	7.0	mg/l as N	$((V_P * N_R + V_W * N_W) * (1 - d)) / (V_P + V_W)$
Assessment			**Values**	**Units**	**Instructions**
Hydraulic loading			**Okay**	unitless	If Revise, review input values
Nitrate			**Okay**	unitless	If Revise, review input values

Figure B-4. Snapshot of CARA Spreadsheet

While many projects are anticipated to be met the requirements in the CARA spreadsheet, additional options are provided for those that do not. Three levels of analysis are proposed:

Level 1 - CARA spreadsheet base level analysis using County selected input values with project specific input values provided by applicant. Level 1 is based on a soil nitrogen leachate mixing analysis.

Level 2 - Mid-level analysis allowing for modifications to County selected input values to the CARA spreadsheet requiring scientific documentation to support applicant value selection. Level 2 is based on a soil nitrogen leachate mixing analysis.

Level 3 - Detailed study or high level analysis for complicated sites and/or projects providing a means to demonstrate a feasible and protective approach for wastewater disposal. This level does not use the CARA spreadsheet based on a soil nitrogen mixing analysis, rather it uses the LOSS Level 1 Nitrate Spreadsheet developed by the Washington Department of Health. The applicant could also another analytical approach that is pre-approved by Spokane County. Also, the acceptance criteria (concentration of nitrate-N) is based on a groundwater nitrogen mixing analysis, see Attachments A and B for details.

If an applicant does not meet the Level 1 standard criteria, they can either conduct a Level 2 or Level 3 analysis, and if they still do not meet the criteria, then sanitary wastewater discharge restrictions would be required. For those projects that result in a negative assessment, the next step is for the applicant to make appropriate adjustments or to justify changes in spreadsheet input parameters. Adjustments may include reducing the wastewater volume by reducing the size of the project and/or volume of water used or by changing the size of the drain field area. In considering changes to the spreadsheet input parameters, detailed supporting information is needed to justify these modifications. For example, based on the project type and specific equipment and processes that will be employed, the designer may provide supporting information to use a lower wastewater nitrogen concentration. Finally, for projects resulting in a negative assessment with adjustments and modifications, the designer may elect to perform a detailed study (level 3). The detailed study could include, for example, evaluation of groundwater parameters and implementation of a groundwater mixing zone analysis.

The recommended process with options for meeting CARA is shown in a flow chart in **Figure B-5**. Again, the process is as follows:

1. Complete the CARA spreadsheet.
2. If the assessment is negative, then perform adjustments and/or provide detailed supporting information for a modified CARA Spreadsheet.
3. If adjustments and modifications do not result in a positive assessment, then the applicant may undertake a detailed study or accept restriction of wastewater discharges to soil for the parcel.

A proposal for the approach of the detailed study should be submitted for discussion and review with Spokane County prior to study initiation. The objective of the proposal review is to minimize the risk of investing in a detailed study and still not having a feasible on-site septic system that meets CARA requirements.

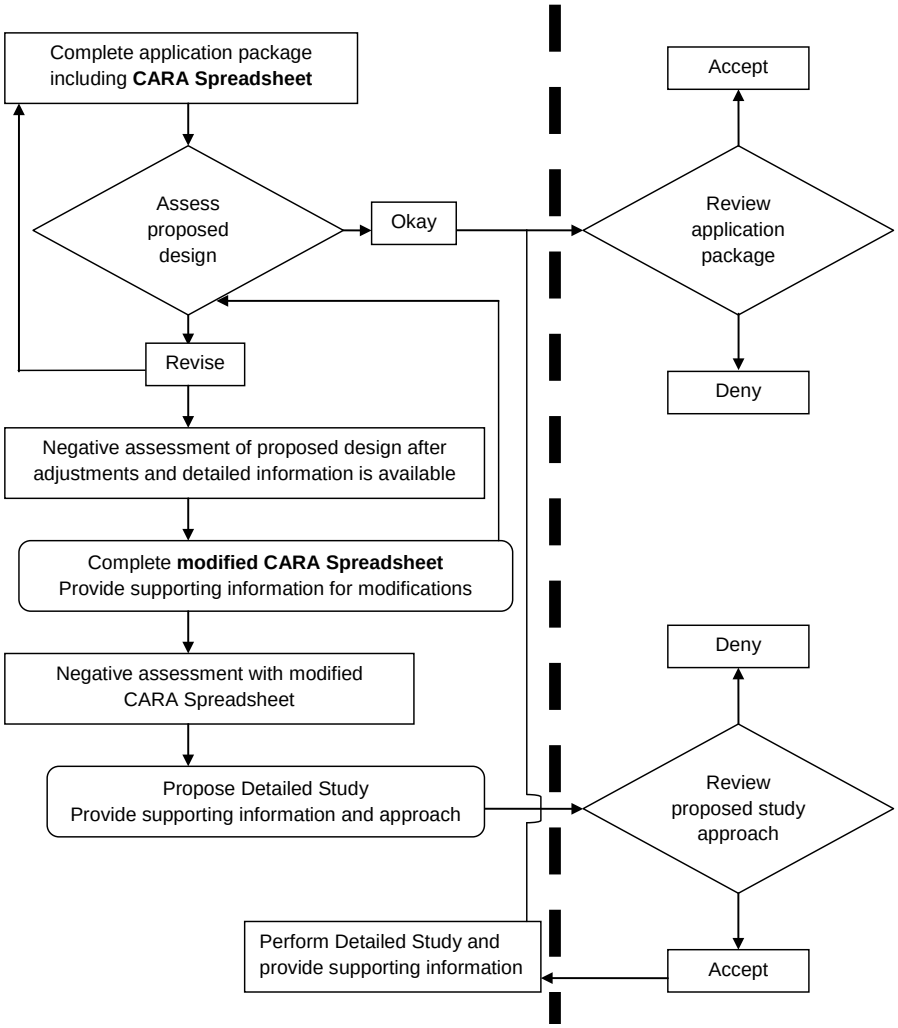

Figure B-5. Flow Diagram of Recommended Process with Options for Meeting CARA

Recommended Approach

The applicant for a non-residential use on a property outside the UGA boundary would complete a Spokane County application for a sanitary system. All applications must include a completed CARA spreadsheet. This application is separate from requirements of Chapter 246-272A WAC, which requires approval of all on-site sewage systems from either SRHD or from WDOH. (See report section "Regulatory Authority for On-site Sewage Systems and the Groundwater Quality Standards.")

The input values to the CARA spreadsheet that must be documented and provided by the applicant include the following:

- Facility or project type, size, and description.
- Parcel lot size.
- Soil type.
- Recharge.
- Wastewater volume.
- Drain field area.

The information in the CARA spreadsheet provides Spokane County information about hydraulic loading and nitrate loading. If the assessment at the bottom of CARA spreadsheet shows a positive assessment, the sanitary system would be considered by Spokane County for approval. If the assessment is negative, Spokane County recommends the applicant consider adjustments to meet the requirements of CARA spreadsheet and/or provide additional documentation specific to the site and proposal, or accept restrictions to wastewater discharge to soil. The options for additional documentation are shown below.

For phosphorus, if the project is located near surface waters, defined as land extending landward 200 feet from the ordinary high-water mark for all streams with a mean annual flow greater than 20 cfs and lakes, impoundments, and reservoirs larger than 20 acres (Chapter 90.58 RCW), then the Spokane County Shoreline Master Program (SCSMP) limits non-residential sanitary systems. If the project is located near surface waters, defined as land extending landward 200 feet from the ordinary high-water mark and as included in the National Hydrography Dataset (NHD) and/or commonly known local watercourses, then Spokane County has discretion regarding the design of on-site treatment systems with special regard to the soil characteristics, distance to the water body, and depth to groundwater.

Additional Documentation – CARA Spreadsheet plus Modifications

The applicant may elect to request and provide supporting information for specific modifications of one or more of the Spokane County input values. Spokane County input values most likely to be requested to modify based on site specific information are recharge, and/or nitrogen concentration in wastewater. Submittal requirements would include CARA spreadsheet, modified CARA spreadsheet with the revised site specific data, and a report documenting the source, selection, and background information for the revised site specific data.

Additional Documentation – CARA Spreadsheet plus Detailed Study

The applicant may elect to request and provide supporting information including calculations for a detailed study with specific evaluation of the site. Submittal requirements would include CARA spreadsheet, nitrate groundwater mixing zone, and a report documenting the source, selection, background, and calculations. The document should include a full report following the requirements of WAC 246-272B, including a hydrogeologic report, mixing analysis, and additional supporting documentation and calculations for review.

Description of the CARA Spreadsheet

The CARA spreadsheet includes “input values” specific to the proposed project and Spokane County selected values. These values are used in calculations for assessment of hydraulic loading and nitrate concentrations. The bottom of the CARA spreadsheet provides an assessment of the inputs.

Input Values

The “input values” provide specific information about the proposed project.

- Parcel lot size. The lot size is the area of the parcel for the facility as recorded by the Spokane County assessor. If there are multiple facilities on the parcel, then the wastewater volume is the sum of the flow from all of the facilities. No distinction is being made for the location of the facility and on-site septic system on the lot.

- Recharge value. The rate of recharge is the amount of inches per year of rainfall that infiltrate into the ground surface below the root zone. The lowest value for recharge within the parcel boundary and the Spokane County supplied map should be used.
- Wastewater volume. The wastewater volume is the rate of wastewater flow anticipated from the facility. Standard references should be cited such as Ecology's Orange Book and Wastewater Engineering: Treatment and Reuse by Metcalf and Eddy. If additional supporting information for the calculation of the wastewater volume is available, it should be provided as part of the application package.
- Drain field area. The minimum drain field area should be based on WAC 246-272A-0234 design requirements--soil dispersal components for drain field area (subsurface soil absorption system) requirements and standard references.
- Soil type. Soil types are soil textural classifications ranging from gravels, coarse sands, medium sands, fine sands, silts, loams, and clays. The texture, structure, compaction and other soil characteristics should be determined using normal field and/or laboratory procedures such as particle size analysis. Soil type is required by WAC 246-272A and the permit application for an on-site septic system.

Spokane County Values

Spokane County has selected representative values for Spokane County for multiple parameters. These values should not be changed for the CARA spreadsheet. If there is supporting information to change these values, an additional modified CARA spreadsheet may be submitted as part of the application package.

- Total nitrogen concentration in wastewater. This is the concentration of TN in the effluent measured at the end of the pipe before it enters the drain field. While the concentration of nitrogen varies in effluent, Spokane County has selected a representative value (IDEQ 2002; USEPA 1980a; UW 1978). The value assumes 100-percent conversion of all nitrogen forms to nitrate; nitrate is measured as nitrogen. The CARA spreadsheet uses a value of 45 mg/L nitrate-N.
- Soil denitrification. Denitrification in the soil can reduce the amount of nitrates that reach groundwater. The amount of denitrification is difficult to quantify and depends on several variables, including soil carbon, soil moisture, soil temperature, and soil pH. In general, a coarse, well-drained soil will have less denitrification than a fine poorly drained soil. The CARA spreadsheet uses a value of 10 percent denitrification (WDOH 2011).
- Nitrate concentration in precipitation. Precipitation in Washington State contains a small amount of nitrates from both natural and man-made sources (WDOH 2011). The CARA spreadsheet uses a value of 0.24 mg/L.

Assessment

The assessment portion of the CARA spreadsheet includes comparison of the calculations from the proposed project with assessment of hydraulic loading and nitrate.

- Hydraulic loading. The hydraulic loading checks that the drain field area is greater than the required minimum drain field area based on sizing criteria established in WAC 246-272A.
- Nitrate. This is a check that the TN concentration from the drain field and the parcel is less than 10 mg/L nitrate-N. This value is the groundwater quality standard. This is the value in soil water at the top of the upper-most aquifer (this value does not include groundwater mixing).

Summary Discussion

This recommended approach, requiring a completed CARA spreadsheet, is based on scientific data and analyses, is protective of sensitive groundwater and surface water, provides a consistent review method for Spokane County, and should facilitate a relatively straightforward submittal for the applicant. The proposed approach includes two options for additional documentation which allows an adaptable approach for site specific conditions and/or specific project proposals. These options provide a means for an applicant to work with Spokane County beyond the CARA spreadsheet; however, the additional documentation does require the applicant to provide more information for Spokane County's review to support deviations from the CARA spreadsheet. Nitrate concentration less than standard at the groundwater interface was selected as protective of groundwater quality. Selection of a nitrate-N concentration of 10 mg/L is based on the drinking water quality standard.

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Most frequently found information in the literature regarding wastewater from non-residential facilities is estimates of the wastewater flow rate from the facility (Table D-1).

Table D-1. Wastewater Flow Rate from Non-Residential Facilities

Establishment	Unit	Flow Rate (gal/unit-day)			Footnote
		typical	low	high	
Residential - 1 person	people	97	75	130	a
Residential - 2 person	people	76	63	81	a
Residential - 3 person	people	66	54	70	a
Residential - 4 person	people	53	41	71	a
Residential - 5 person	people	51	40	68	a
Residential - 6 person	people	50	39	67	a
Residential - 7 person	people	48	37	64	a
Residential - 8 person	people	46	36	62	a
Airport	passenger	4	3	5	a
	passenger	15	--	--	e
Apartment	bedroom	120	100	150	a
Assembly Hall	guest	4	3	5	a
	seat	4	--	--	d
Automobile Service Station	vehicle	10	8	15	a
	employee	13	9	15	a
Bar/Cocktail Lounge	seat	20	12	25	a
	employee	13	10	16	a
	employee	15	--	--	e
Barber Shop	chair	68	--	--	d
Beauty Salon	station	285	--	--	d
Boarding House	person	45	25	65	a
Bowling Alley	alley	185	--	--	d
Church	seat	4	--	--	d
Coffee Shop	customer	7	--	--	d
Conference Center	person	8	6	10	a
Daycare (no meals)	child	19	--	--	d
Daycare (with meals)	child	23	--	--	d
Department Store	toilet room	400	350	600	a
	employee	10	8	15	a
Gas Station/Convenience Store	customer	3.5	--	--	d
Gas Station/Service Station	customer	--	11	250	d
Health Club/Gym	member	35	--	--	d
Hotel	guest	70	65	75	a
	employee	10	8	18	a

	guest	55	--	--	d
	square foot	0.28	--	--	d
Hospital	bed	250	175	400	a
	bed	220	--	--	d
	bed	--	150	300	e
	bed	200	--	--	f
Institutions other than hospitals	bed	100	75	125	a
	employee	10	5	15	a
Industrial Building	employee	20	15	35	a
	employee	17.5	--	--	d
	employee w/shower	25	--	--	d
Laundry (self-service)	machine	450	400	550	a
	customer	50	45	55	a
Laundromat	machine	635	--	--	d
	load	52.5	--	--	d
	square foot	2.6	--	--	d
Medical Office	square foot	1.1	--	--	d
	practioner	275	--	--	d
	patient	8	--	--	d
Mobile Home Park	unit	140	125	150	a
Motel (w/ kitchen)	guest	60	55	90	a
Motel (w/o kitchen)	guest	55	50	75	a
Motel	guest	38	--	--	d
	square foot	0.33	--	--	d
	guest	50	--	--	e
	guest	50	--	--	f
Nursing Home	resident	125	--	--	d
Office	employee	13	7	16	a
	employee	18	--	--	d
	square foot	0.18	--	--	d
	employee	15	--	--	e
Prison	inmate	120	80	150	a
	employee	5	15	10	a
Public Lavatory	user	4	3	5	a
	user	5	--	--	d
Restaurant (conventional)	customer	8	7	10	a
	customer	15	--	--	e
	customer	5	--	--	f
Restaurant (no bar or lounge)	customer	--	3.5	50	d
Restaurant (w/ bar/cocktail lounge)	customer	10	9	12	a
Restaurant (short order)	customer	7	--	--	d

Restaurant (drive-in)	car space	30	--	--	d
Retail Store	square foot	0.13	--	--	d
	customer	3.8	--	--	d
	toilet	590	--	--	d
School, day	student	20	10	30	a
	student	--	15	20	e
School, boarding	student	85	75	100	a
Shopping Center	employee	10	7	13	a
	parking space	2	1	3	a
	employee	11.5	--	--	d
	square foot	0.15	--	--	d
	parking space	2.5	--	--	d
Theater (indoor)	seat	3	2	4	a
	seat	4.5	--	--	d
	seat	5	--	--	e
Footnotes:					
*for all d references add	employee	15	--	--	d
a Metcalf & Eddy b EPA Septic Manual c McCray et.al. d MN Rules Chapter 7081.0130 e Smith and Loveless f Goldstein and Moberg					

Less information in the literature is available regarding wastewater characteristics from non-residential facilities. Information is mostly estimates of the wastewater BOD from the facility (Table D-2).

Table D-2. Wastewater BOD Concentrations from Non-Residential Facilities

Establishment	Unit	5-day Biochemical Oxygen Demand (grams/unit-day)	Footnote
Airport	passenger	9.1	d
	passenger	22.7	e
Apartment	bedroom	79.4	d
Bar/Cocktail Lounge	employee	22.7	e
Boarding House	person	63.5	d
Bowling Alley	alley	68.0	d
Church	seat	9.1	d
Gas Station/Service Station	customer	9.5	d
Hotel	guest	283.5	d
Hospital	bed	235.0	d
	bed	136.0	e
	bed	159.0	f
Industrial Building	employee	33.1	d
	employee w/shower	37.6	d
Mobile Home Park	unit	127.0	d
Motel	guest	63.5	d
	guest	68.0	e
	guest	90.7	f
Nursing Home	resident	117.9	d
Office	employee	22.7	d
	employee	22.7	e
Restaurant (conventional)	customer	40.8	e
	customer	27.2	f
Restaurant (no bar or lounge)	customer	16.3	d
Restaurant (w/ bar/cocktail lounge)	customer	20.9	d
Retail Store	toilet	377.4	d
School, day	student	24.0	d
	student	22.7	e
School, boarding	student	94.3	d
Shopping Center	employee	22.7	d
Theater (indoor)	seat	4.5	d
	seat	9.1	e
Footnotes:			
*for all d references add	employee	18.1	d

a Metcalf & Eddy
b EPA Septic Manual
c McCray et.al.
d MN Rules Chapter 7081.0130
e Smith and Loveless
f Goldstein and Moberg

Information in the literature is available for other wastewater characteristics from residents and from the septic tank (Table D-3). This information could potentially be used for estimates of concentrations from non-residential facilities.

Table D-3. Wastewater Concentrations from Single Residents

Constituent	Mass (grams/person/day)		Concentration (mg/L)		Footnote
	low	high	low	high	
Total Solids	115	200	500	800	b
Volatile Solids	65	85	280	375	b
Total Suspended Solids	35	75	155	330	b
Volatile Suspended Solids	25	60	110	265	b
5-day Biochemical Oxygen Demand	35	36	155	286	b
Chemical Oxygen Demand	115	150	500	600	b
Total Nitrogen	6	7	26	75	b
From STE	--	--	12	453	c
Ammonia	1	3	4	13	b
From STE	--	--	17	178	c
Nitrates and Nitrites	1	--	1	--	b
From STE	--	--	0	1.94	c
Organic N	--	--	--	--	b
From STE	--	--	9.4	15	c
Total Phosphorus	1	2	6	12	b
Phosphate	--	--	--	--	b
From STE	--	--	1.2	21.8	c
Fats, Oils, and Grease	12	18	70	105	b
Volatile Organic Compounds (VOCs)	0.02	0.07	0.1	0.3	b
Surfactants	2	4	9	18	b
Total Coliforms	--	--	1E+9	1E+11	b
Fecal Coliforms	--	--	1E+7	1E+9	b

Footnotes:
a Metcalf & Eddy
b EPA Septic Manual
c McCray et.al.
d MN Rules Chapter 7081.0130
e Smith and Loveless
f Goldstein and Moberg

WASHINGTON STATE
DEPARTMENT OF
ECOLOGY

Criteria for Sewage Works Design

Water Quality Program

Revised August 2008
Publication No. 98-37 WQ

State of Washington
Department of Ecology
Olympia, Washington 98504

The hydraulic capacity of the treatment works should be based on the maximum expected flow. The process design of treatment units should be based on either the average design flow or the peak design flow, whichever is controlling. The following items should be determined from the observed rate of flow during the significant period of discharge. Items to be considered in determining design flows are as follows:

- Peak flow rates continuing over a length of time sufficient to adversely affect the detention time of treatment units or the flow characteristics in conduits.
- Applicable data from similar municipalities.
- Wet weather flows.
- Recirculation and inplant recycle flows.

The design organic loading should be computed in the same manner used in determining design flow.

G2-1.2.3 Existing Systems

Treatment plants designed to serve existing sewerage systems should be designed on the basis of characteristics of sewage obtained from the operating records of the treatment works.

The design engineer or owner shall provide a plan acceptable to Ecology for eliminating or handling excessive inflow/infiltration (I/I) so that there will be no discharge of inadequately treated wastewaters or impairment of the treatment process.

G2-1.2.4 New Systems

Sewage treatment plants to serve new sewerage systems should be designed on the basis of information in Table G2- 2. Numbers of persons per dwelling should be based on planning projections derived from an official source. Any deviations should be based on sound engineering judgment substantiated in the engineering report.

Table G2- 2. Design Basis for New Sewage Works

Discharge Facility	Design Units	Flow* (gpd)	BOD (lb/day)	SS (lb/day)	Flow Duration (hr)
Dwellings	per person	100	0.2	0.2	24
Schools with showers and cafeteria	per person	16	.04	.04	8
Schools without showers and with cafeteria	per person	10	.025	.025	8
Boarding schools	per person	75	0.2	0.2	16
Motels at 65 gal/person (rooms only)	per room	130	0.26	0.26	24
Trailer courts at 3 persons/trailer	per trailer	300	0.6	0.6	24
Restaurants	per seat	50	0.2	0.2	16

Discharge Facility	Design Units	Flow* (gpd)	BOD (lb/day)	SS (lb/day)	Flow Duration (hr)
Interstate or through-highway restaurants	per seat	180	0.7	0.7	16
Interstate rest areas	per person	5	0.01	0.01	24
Service stations	per vehicle serviced	10	0.01	0.01	16
Factories	per person per 8-hr shift	15-35	0.03-0.07	0.03-0.07	Operating period
Shopping centers	per 1,000 sq ft of ultimate floor space	200-300	0.01	0.01	12
Hospitals	per bed	300	0.6	0.6	24
Nursing homes	per bed	200	0.3	0.3	24
Homes for the aged	per bed	100	0.2	0.2	24
Doctor's office in medical center	per 1,000 sq ft	500	0.1	0.1	12
Laundromats, 9 to 12 machines	per machine	500	0.3	0.3	16
Community colleges	per student and faculty	15	0.03	0.03	12
Swimming pools	per swimmer	10	0.001	0.001	12
Theaters, drive-in type	per car	5	0.01	0.01	4
Theaters, auditorium type	per seat	5	0.01	0.01	12
Picnic areas	per person	5	0.01	0.01	12
Resort camps, day and night, with limited plumbing	per campsite	50	0.05	0.05	24
Luxury camps with flush toilets	per campsite	100	0.1	0.1	24

*Includes normal infiltration

G2-1.3 In-Plant Piping and Channels

All piping and channels should be designed to carry the maximum expected flows. The incoming sewer should be designed for free discharge. Bottom corners of the channels should be filleted and pockets and corners where solids can accumulate should be eliminated. Isolation gates should be placed in channels to seal off unused sections where sewage solids might accumulate.

G2-1.4 Design Flows, Collection Systems

See C1-3 and Table G2- 2.

G2-1.5 Plant Location

G2-1.5.1 General

Treatment plant sites should be located as far as practicable from any existing commercial or residential area or any area that will probably be developed within the plant's design life. The plant site should be separated from adjacent

CONNECTICUT DEPARTMENT OF ENVIRONMENTAL PROTECTION

BUREAU OF MATERIALS MANAGEMENT AND COMPLIANCE ASSURANCE

GUIDANCE FOR DESIGN OF LARGE-SCALE ON-SITE WASTEWATER RENOVATION SYSTEMS

February 2006

Funded in part by the CT DEP through a US EPA Nonpoint Source Grant under § 319 Clean Water Act

Nathan L. Jacobson & Associates, Inc.
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TABLE No. 1

REVIEW OF CURRENT LITERATURE ON CONCENTRATIONS OF BOD_5 AND TSS IN RESIDENTIAL SEPTIC TANK EFFLUENT

Reference	BOD_5, mg/L						TSS, mg/L					
	No. of Samples	Median	Mean	Standard Deviation	Min.	Max.	No. of Samples	Median	Mean	Standard Deviation	Min.	Max.
Hargett, Tyler & Siegrist-1981 ASAE	10		153			92-225	10		44		22	45
Oregon DEQ Study-1982	70		217				70		146			
Hampton & Jones -1984 ASAE		185	164					26	47			
Siegrist, et al -1984 ASAE												
Multiple Home Developments												
Westboro, WI	15		168				15		85			
Bend, OR	4		157				4		36			
Glide, OR	4		118				4		52			
Manila, CA	4		189				4		75			
Washington State	7		129				7		47			
Converse et al. 1991 ASAE	25		150	54	47	239	30		99	102	44	572
Sherman & Anderson 1991 ASAE	36		141		111	181	36		161		64	594
Viraraghavan & Rana 1991 ASAE	44		222	63.4	141	421	44		134	62.6	51	290
Bruen & Piluk 1994 ASAE												
Site A			300						77			
Site B			202						123			
Site C			135						141			
Cagle & Johnson 1994 ASAE												
Placer County Study	15		160				15		73			
Osesek, et al. 1994 ASAE												
Site #1			271									
Site#2			126									
Rubin, et al. - 1995 NW												
1 residential site	10		169		158	178						
Stuth & Garrison-1995 NW												
1 residential site			183		102	264			57		18	80
1 residential site	16	255	243	59.5	165	347	16	57	59	15.7	30	80
Bounds - 1997 NW			156						84			
Loudon, et al. -1997 NW												
Normal Ranges					100	250					30	150
Converse & Converse - 1998 ASAE												
(20 septic tks w/screened vaults)	69	186	215	95	36	548	24	51	61	35	11	135
Jantrania, et al. 1998 ASAE												
Site #1	17		314	250	165	1211	17		81	63	37	285
Site #2	15		143	141	22	530	16		48	36	15	139
Site #3	15		270	119	99	570	16		60	21	37	16
Site #4	15		248	151	102	720	16		592	2067	29	8597
Site #5	10		155	58	120	224	11		53	23	26	108
Site #6	11		89	80	16	305	11		58	33	12	111
Site #7	11		264	64	164	409	11		72	32	16	120
O'Driscoll, et al. 1998 ASAE												
Baldwin County, 10 Residences(93-94)	120		132				120		200			
Tuscaloosa County			331						58			
Roy, et al. 1998 ASAE												
2 Family Home	18		162						92			
Sievers 1998 ASAE			297						44			
Thom, et al. 1998 ASAE												
Paris Site			192	44.1					32	10.5		
Scott Co. Site			193	56.5					68	83.4		
Anderson County			224	58.5					154	147.9		
Stuth - 1999 NW												
21 residential sites (unponded)			141		26	216						
8 residential sites (ponded)			247		150	416						
Henneck, et al. 2001 ASAE												
10 home cluster system (G. Lake)			184	43					27	8		
20 home cluster system (Lake Wash.)			63	31					64	62		
Lindbo & MacConnell 2001 ASAE												
Residential Site #2			114						143			
Residential Site #1			172						80			
Siegrist -2001 ASAE					140	200					50	100
Christopherson, et al. 2001 ASAE												
Winter	96		175	119			96		115	59		
Summer	92		120	88			92		72	65		
Watson and Choate-2001ASAE												
Terrell Site	25		147		13	261	25		255		20	2000
Gray Site	24		103		13	240	24		191		20	1150
Jones Site	17		203		34	382	18		910		31	4800
Mean of Means (unweighted)			183 mg/L*						90 mg/L**			

MANUALS & TEXTBOOKS

Reference	BOD_5, mg/L						TSS, mg/L					
	No. of Samples	Median	Mean	Standard Deviation	Min.	Max.	No. of Samples	Median	Mean	Standard Deviation	Min.	Max.
USEPA Manual - 1980, Table 6-1			142		7	480			76		10	485
Cantor and Knox -1985			140						75			
Crites & Tchobanoglous- 1998												
Without Effluent Filter or Garb. Gri.			180		150	250			80		40	140
Without Effluent Filter, w/ Garb. G.			190						85			
With Effluent Filter, w/o Garb. Gri.			130		100	140			30		20	55
With Effluent Filter & Garb. Gri,			140						30			

NOTES:

1.) ASAE = Proceedings of ASAE International Symposiums on Individual and Small community Sewage Systems in year shown.

2.) NW = Proceedings of the Northwest On-Site Wastewater Treatment Short Course and Equipment Exhibitions in year shown.

3.) Crites and Tchobanoglous (1998): with Effluent Screens, the BOD_5 and TSS would be reduced by 28% and 62% respectively.

4.) * Excluding values when septic tank effluent filters were known to be present.

5.) ** Excluding values when septic tank effluent filters were known to be present, and outliers of 592 and 910 mg/L.

TABLE No. 2

REVIEW OF CURRENT LITERATURE ON CONCENTRATIONS OF TOTAL NITROGEN AND PHOSPHORUS IN RESIDENTIAL SEPTIC TANK EFFLUENT

Reference	TN, mg/L						TP, mg/L					
	No. of Samples	Median	Mean	Standard Deviation	Min.	Max.	No. of Samples	Median	Mean	Standard Deviation	Min.	Max.
Hargett, Tyler & Siegrist-1981 ASAE	9*		41		32.8	64.8	11		18.4		8.5	27
Ronayne, et al .Oregon DEQ Study-1982	54		57.5									
Hampton & Jones -1984 ASAE			57*									
Siegrist, et al -1984 ASAE												
Multiple Home Developments												
Westboro, WI	15		57				15		8.1			
Bend, OR	4		41									
Glide, OR	4		50									
Manila, CA												
Washington State	7		34				7		11.4			
Converse et al. 1991 ASAE	30		59		24	132	25		5		3	7
Sherman & Anderson 1991 ASAE	36		36		33	54	36		11		7	15
Viraraghavan & Rana 1991 ASAE	44		46.8	8.8	34	81	44		10.9	2.8	5.2	17.1
Bruen & Piluk 1994 ASAE												
Site A			41.7						7			
Site B			46.9						5.1			
Site C			30.2						13.9			
Cagle & Johnson 1994 ASAE												
Placer County Study	15		61.8									
Osesek, et al. 1994 ASAE												
Site #1			76.6						9			
Site#2			28.7						4			
Rubin, et al. - 1995 NW												
1 residential site	10		48.6		39.8	65.5	10		6.5		5.9	7.7
Loudon, et al. -1997 NW												
Normal Ranges					25	70					5	15
Converse & Converse - 1998 ASAE												
20 septic tks w/screened vaults	70	55	58	23	9.7	144						
* Ammonia-Nitrogen only.												
Jantrania, et al. 1998 ASAE												
Site #1	16		95.6	60.3	52	316	16		8.7	6.6	4.8	33
Site #2	16		39.3	30.7	14	114	16		7.5	4.7	3	24
Site #3	16		153.3	59.8	33	328	16		16.7	7.1	7.4	30
Site #4	16		78.4	73.9	35	330.4	16		10	11	3.5	48
Site #5	11		78.1	9	59	106	11		7.8	1.2	5.2	9.5
Site #6	11		32.1	11.2	13.1	65	11		6.5	1.7	4.9	11
Site #7	11		76.2	12.9	61	97.5	11		11.4	1.9	8.5	15
O'Driscoll, et al. 1998 ASAE												
Baldwin County, 10 Res.-1993-94	120		50									
Roy, et al. 1998 ASAE												
2 Family Home	18		42									
Thom, et al. 1998 ASAE												
Paris Site	>72		46.2	10.9			>72		7.9	5		
Scott Co. Site	>72		70.3	15.8			>72		9.3	3.3		
Anderson County	>24		49.9	17.3			>24		7.4	3.5		
Henneck, et al. 2001 ASAE												
10 S.F. Home cluster system(G.Lake)	81		59	12			81		7.9	1.4		
20 S.F. Home cluster system (L. Wash.)	50		33	11			50		5.4	1.5		
Lindbo & MacConnell 2001 ASAE												
Residential Site #1			27.4						1.9			
Residential Sites #2,3, & 4			29.2						4.4			
Christopherson, et al. 2001 ASAE												
Winter	96	51		43			96	9		24		
Summer	92	47		36			91	8		5		
Siegrist -2001 ASAE					46	100					5	15
Mean of Means (unweighted)++			50.9						8.8			

MANUALS & TEXTBOOKS

Reference	TN, mg/L						TP, mg/L					
	No. of Samples	Median	Mean	Standard Deviation	Min.	Max.	No. of Samples	Median	Mean	Standard Deviation	Min.	Max.
USEPA Manual - 1980, Table 6-1	150		42		9	125						
Cantor and Knox -1985			40						15			
Crites & Tchobanoglous- 1998												
Without Effluent Filter or Garb. Gri.			68		50	90			16		12	20
Without Effluent Filter, w/ Garb. G.			75		50	90			16		12	20
With Effluent Filter, w/o Garb. Gri.			68		50	90			16		12	20
With Effluent Filter & Garb. Gri,			75		50	90			16		12	20

NOTES:

1.) ASAE = Proceedings of ASAE International Symposiums on Individual and Small community Sewage Systems in year shown.

2.) NW = Proceedings of the Northwest On-Site Wastewater Treatment Short Course and Equipment Exhibitions in year shown.

3.) ++ Excluding outliers of 153.3 for TN and 1.9 for TP.

TABLE No. 3

Wastewater Characteristics of Food Processing and Serving Establishments

Ref. No.	Facility Type	BOD_5, mg/L						TSS, mg/L					FOG, mg/L					Mean TKN/TN mg/L	Mean TP mg/L
		No. of Samples	Sample Type	Mean	Std. Dev.	Min.	Max.	No. of Samples	Mean	Std. Dev.	Min.	Max.	No. of Samples	Mean	Std. Dev.	Min.	Max.		
	Restaurants																		
R-1a	2 Restaurants in Honolulu, HI	10	R,C	640		525	759	10	500		202	800							
R-1b	5 Restaurants in Greensboro, NC	15	R,C	546		390	737	15	257		48	402							
R-1c	5 Restaurants in Philadelphia, PA	10	R,C	655		280	960	10	1,030		172	1,985							
R-2	12 Restaurants in Wisconsin																		
R-2a	Restaurants only	37	STE,G	506		245	880	36	177		28	962	32	83		26	256		
R-2b	Restaurants w/other Facilities	25	STE,G	196		101	333	25	73		9	176	25	39	39	3	96		
R-3	Restaurants in Oregon																		
R3-a	Full Service Restaurant		STE,G	1,074					289										
R3-b	Full Service Restaurant		STE,G	1,301					350										
R3-c	Fast Food Restaurant		STE,G	1,917					624										
R3-d	Fast Food Restaurant		STE,G	1,716					358										
R-4a	Full Service Restaurant		GTE,G	1,657					382										
R-4b	Full Service Restaurant		STE,G	1,377					120										
R-5	Student Cafeteria, Univ. in Texas																		
R5-1	Summer Session	15	R,G	576				15	460										
R5-2	Beginning of Fall Semester	25	R,G	992				25	620										
R5-3	During Fall Semester	13	R,G	1,628				13	992										
R-6	Restaurants in Oregon																		
R6-1	Full Service Restaurant	22	GTE,G	913			1,800	23	185			774	22	207			378		
R6-2	Fast Food Restaurant	7	STE,G	985			1,216	7	143			195	7	138					
R-7	Restaurant Kitchen Greywater																		
R7-1	Full Service, American Cusine	2	GTE,G										2	2487		1,424	3,550		
R7-2	National Fast Food Franchise	2	GTE,G										2	1,270		297	2,242		
R7-3	Full Service, American Cusine	2	GTE,G										2	193		152	234		
R7-4	International Fast Food Franchise	2	GTE,G																
R7-4a	First Grease Trap Effluent	2	GTE,G										2	712		692	732		
R7-4b	Second Grease Trap Effluent	2	GTE,G										2	323		306	340		
R7-5	Full Service, American Cusine	2	GTE,G										2	12,802		10,646	14,958		
R-8	Restaurants in Hong Kong																		
8-1	Chinese Restaurant	10	R,U			58	1,430	10			13	246				120	712		
R8-2	Western Cusine Restaurant	10	R,U			489	1,410	10			152	545				53	2,100		
R8-3	American Fast Food Restaurant	11	R,U			405	2,240	11			68	345				158	799		
R8-4	Student Canteen	14	R,U			900	3,250	14			124	1,320				415	1,970		
R8-5	Bistro	3	R,U			1,500	1,760	3			359	567				140	410		
R-9	Restaurants in Florida																		
R9-1	Restaurants operating <16 hrs/d	U	STE,G	761	266				226	19				83	75				
R9-2	Single Serv. Rest. Oper <16 hrs/d	U	STE,G	602	313				123	125				33	35				
R9-3	Single Serv. Rest. Oper>16 hrs/d	U	STE,G	548	290				141	158				80	94				
R9-4	Bars and Cocktail Lounges	U	STE,G	451	71				79	38				24					
R9-5	Drive-in Restaurants	U	STE,G	1,920	1,273				454	269				78	67				
R9-6	Convenience Stores	U	STE,G	441	237				43	20				18	18				
R10	15 Restaurants in Florida	109	STE,C	374	255	53	1009	128	77	49	9	268	122	36	33	5	196		
R11	Full Service Restaurant in CT	39	STE,G	362	149	97	729	39	192	141	18	670							
R12a	Kitchen in Full Service Restaurant in CT	1	STE,C	960				1	240										
R12b	Kitchen in Full Service Restaurant in CT	1	STE,G	878				1	116										
R13	Full Service Restaurant in CT																		
	Kitchen Graywater(Same Day)	4	GTE,G	925		790	1000	4	118		87	136	4	30		<3	60		
	Graywater and Blackwater(Same Day)	4	STI,G	700		520	800	4	93		64	117							
R14	Full Service Restaurant in Baltimore	7	R,G	1320		704	1679	7	490		223	722	7	328		96	469		
R15	Full Service Restaurant in Baltimore	10	GTE,G										7	187	128	85	510		
R16	Fast Food Restaurant in CT	1	STE,C	430				1	40									41	8.4
R17	Oriental Restaurant in CT	1	GTE,G	1380				2	106									52	13.2
R18	Fast Food Restaurant in Michigan																		
R18-a	Kitchen Graywater	6	R,G	3960				6	2090				6	460					3.4
R18-b	Washing Machine Effluent	6	R,G	2525				6	806				6	461					2.7

*** R=Raw; GTE = Grease Trap Effluent; STI = Septic Tank Influent; STE = Septic Tank Effluent; C = Composite; G=Grab, U = Unknown**

Ref No.	Reference (See Bibliography)
R-1	U.S.EPA (1978)
R-2	Siegrist, et al. (1984)
R-3	Stuth and Guichard (1989)
R-4	Stuth and Guichard (1989)
R-5	Lowery (1994)
R-6	Stuth and Garrison (1995)
R-7	Stuth and Wecker (1997)
R-8	Chen et al. (2000)
R-9	Matejcek et al. (2000)
R-10	Matejcek et al. (2000)
R-11	CT DEP Files
R-12	CT DEP Files
R-13	CT DEP Files
R-14	Unpublished (2002)
R-15	Unpublished (2002)
R-16	Unpublished (2002)
R-17	Unpublished (2002)
R-18	Unpublished (2002)

TABLE No.4

Wastewater Characteristics of Commercial and Institutional Facilities

Ref. No.	Facility Type	BOD_5, mg/L						TSS, mg/L					FOG, mg/L					Mean TKN/TN mg/L	Mean TP mg/L
		No. of Samples	Sample Type	Mean	Std. Dev.	Min.	Max.	No. of Samples	Mean	Std. Dev.	Min.	Max.	No. of Samples	Mean	Std. Dev.	Min.	Max.		
HC-1	Skilled Nursing Facility	17	STE,G	171	114	64	271	17	100	99	14	426	17	13	9.6	2	37	35	N.A.
HC-2	Life Care Facility	26	R,G	154	62	41	272	26	159	58	74	288						34	N.A.
HC-3	Health Care Facility																		
	Facility No. 1	2	R,C	218				2	84				2					32	2.6
	Facility No. 2	1	R,C	276				1	199				1	10				43	9.5
	Facility No. 3	2	R,C	197				2	134				2					26	6.6
	Facility No. 4	1	R,C	159				1	72									28	8.3
	Facility No. 5	2	R,G	151				2	374									31	1.9
	Facility No. 6	2	R,G	432				2	638									38	7.6
I/ R-1	Inn & Resort w/Full Service Restaurant	20	R,G	195	147	41	726	20	249	303	20	1,200						62	11.8
I/ R-2	Inn w/Full Service Restaurant	10	STE,G	194	104	86	433	10	93	151	26	520						41	6.9
I/R-3	Inn w/no Restaurant		R,G	221		130	340		154		<5	274						33	N.A.
O-1	15,000 SF Office Building		R,C	240					96									97	10.0
	15,000 SF Office Building		STE,C	150					30									112	11.8
SM-1	Supermarkets in CT, MA, RI																		
SM1-a	Supermarket in CT	8	STE,G	479				8	156					64				39	N.A.
SM1-b	Supermarket in CT		STE,G	576															
SM1-c	Supermarket in CT		STE,G	164					66									55	N.A.
SM1-d	Supermarket in CT	17	STE,G	646				17	162									81	N.A.
SM1-e	Supermarket in MA	9	STE,G	250				9	132									69	N.A.
SM1-f	Supermarket in MA	8	STE,G	426				8	104									53	N.A.
SM1-g	Supermarket in MA	8	STE,G	215				8	86									69	N.A.
SM1-h	Supermarket in MA		STE,G	433															
SM1-I	Supermarket in RI		STE,G	720															
SM-2	Supermarket in CT																		
SM2-a	Influent to ST #1	3	R,G	838				3	172									85	29.5
SM2-b	Effluent from ST#2	3	STE,G	712				3	98									148	29.4
SM-3	Supermarket in CT																		
SM-3a		19	R,G	1132	650	149	2,571	20	313	255	25	1,075						245	N.A.
SM-3b		22	STE,G	883	338	582	2,166	24	178		13	480						189	N.A.
SHPG-1	Shopping Center in CT	46	STE,G	442	219	150	1,260	46	157	99	40	460						51	7.3
SHPG-2	Factory Outlet Complex in CT	4	R,G	118	17	108	143	4	99	55	49	175						117	38.9
SHPG-3	Factory Outlet Complex in CT	23	R,G	409	172	172	795	23	470	556	47	2,480						173	36.9
TC/TT-1	Travel Center in CT	3	R,G	>593				3	374									87	10
TC/TT-2	Express Delivery Truck Terminal	13	R,G	257		70	572	13	350		60	980						68	9.3
TC/TT-3	Travel Centers in TX, CT,TN, AZ																		
TC/TT-3a	Travel Center in Texas	1	U	240				1	120									39	4.1
TC/TT-3b	Travel Center in CT	1	R,C	332				1	294									59	7.9
TC/TT-3c	Travel Center in Tennessee	27	R,U	469				27	346									N.A.	N.A.
TC/TT-3ad	Travel Center in Arizona	7	R,C	349				7	215									40.3	N.A.
SCH-1	Middle School and High School in CT																		
SCH-1a	Middle School		STE,G	215					40									88	17.9
SCH-1b	Middle School		STE,G	115					110									133	3.1
SCH-1b	High School		STE,G	225		70												80	15.4
SCH-2	High School																		
	Septic Tank #1	2	STE,G	220		170	270	2	30		14	46	1	11				84	N.A.
	Septic Tank #2	1	STE,G	90					24									110	N.A.
	Septic Tank #3	2	STE,G	175		130	220	2	33				2	9				86	N.A.
SCH-3	Consolidated School																		
	Septic Tank #1	2	STE,G	146		126	165												
	Septic Tank #2	2	STE,G	117		105	128	2	59		38	80						108	N.A.
SCH-4	Middle School in CT	23	STE,G	304		92	599	24	135		19	1,960						141	N.A.
SCH-5	Boarding School in CT	8	R,G	329		184	510	8	177		121	240							
SCH-6	Schools in Vermont																		
	2 Elem., 2 High and 1 Private																	83	7.5
PP-1	Electrical Generating Facility, CT	12	R,G	324				12	305									136	N.A.
CMP-1	Summer Camp Dining Hall	3	R,G	1,633		1,500	1,800	3	465		74	1,200	2	106		41	170	79	14
	Summer Camp Dining Hall	3	STE,G	1,256		1,070	1400	3	70		33	100	2	17		17	34	76	18
CMP-2	Campground Holding Tank Pumpouts	3	STE,G	717		377	1117						3	91		8	240	650	74
MARINA	Marinas (2), Pump-out only	2	STE,G	648		395	901						2	65		40	91	610	66
	Marinas (4), Pump-out & Rest Rooms	4	STE,G	336		118	644						4	71		6	130	250	27
RRA-1	Interstate Roadside Rest Area, CT	2	STE,G	235		190	280	2	88		86	90	1	15				100	8.7
SKI-1	Ski Resorts																		
SKI-1a	Ski Resort in Oregon	U	R,U	395				U	321									77	12.7
SKI-1b	Ski Resort in Washington	U	R,U	382				U	372									80	13.2
SKI-2	Ski Resort in Vermont	14	R,U	242	53	151	347	14	196	81	68	330							

*** R=Raw; GTE = Grease Trap Effluent; STE = Septic Tank Effluent; C = Composite; G=Grab, U = Unknown**

Ref No.	Reference (See Bibliography)
HC-1	CT DEP Files
HC-2	CT DEP Files
HC-3	Unpublished (2002)
I/R-1	CT DEP Files
I/R-2	CT DEP Files
I/R-3	CT DEP Files
O-1	Unpublished (2002)
SM-1a to 1i	CT DEP Files
SM-2	CT DEP Files
SM-3	Unpublished (2002)
SHPG-1	CT DEP Files
SHPG-2	CT DEP Files
SHPG-3	CT DEP Files
TC/TT-1	CT DEP Files
TC/TT-2	CT DEP Files
TC/TT-3	Unpublished (2002)

Ref. No.	Reference (See Bibliography)
SCH-1	CT DEP Files
SCH-2	CT DEP Files
SCH-3	CT DEP Files
SCH-4	CT DEP Files
SCH-5	CT DEP Files
SCH-6	Unpublished (2002)
PP-1	Unpublished (2002)
CMP-1	Unpublished (2002)
CMP-2	Matassa, McEntyre and Watson
MARINA	Matassa, McEntyre and Watson
RRA-1	Unpublished (2002)
SKI-1	Clark (1969)
SKI-2	Unpublished (2002)

Attachment C: CARA Stakeholder Committee

Introduction

Spokane County undertook a review of SCC 11.20.075 with an emphasis on a technical assessment of this rule. The stakeholder engagement elements of the project included a survey of interested parties, development of a CARA Review Committee, periodic updates to interested parties, and opportunities for interested parties to provide comments. The CARA Review Committee included approximately ten stakeholders that represented a variety of viewpoints and interests. The Committee participated in four meetings at key points during the project, and was asked to:

- Share perspectives.
- Provide feedback on the technical aspects of the CARA review.
- Provide comments and suggestions relating to draft recommendations for CARA standard revisions.

CARA Survey

Spokane County began a review of the CARA non-residential wastewater rule requirements in August 2012. At the beginning of the review process, a survey was developed to gather input from interested parties. The CARA survey was sent to 137 individuals representing a variety of community groups and organizations. In some cases survey recipients forwarded the survey to additional individuals who responded. A total of 39 individuals responded to the survey. The responses represented the following affiliations (note that some respondents indicated more than one affiliation).

- 10 - Homeowner, rural
- 8 - Other
- 7 - Federal or State agency
- 6 - Local agency or district
- 5 - Consulting engineer, planner or scientist
- 4 - Homeowner, urban
- 4 - Commercial development
- 4 - Non-governmental conservation group
- 2 - Land use attorney

Responses to the survey is summarized in the document CARA Survey Responses, October 22, 2012 (attached).

CARA Review Committee Meetings

Four meetings were held with the CARA Review Committee. Meeting agenda and summary notes are attached (meeting notes for the fourth meeting to be held on May 14, 2013 will be added to this document).

CARA Survey Responses

~ October 22, 2012 ~

Introduction

Spokane County's Growth Management Act requires the designation and adoption of development regulations that protect areas critical to maintaining groundwater recharge and quality within unincorporated areas of the County. These requirements are addressed in the Spokane County Code (SCC) 110.20.075 - Critical Aquifer Recharge Areas (CARA). Sections 3.1 through 3.2 of SCC 110.20.075 address wastewater management associated with non-residential uses outside the Urban Growth Area (UGA) Boundary.

Spokane County began a review of these CARA non-residential wastewater regulations and requirements in August 2012. At the beginning of the review process, a survey was developed to gather input from interested parties. This document compiles the responses to the survey. A summary of the responses is provided, followed by the detailed responses.

Summary of CARA Survey Responses

The CARA Survey was sent to 137 individuals representing a variety of community groups and organizations. In some cases survey recipients forwarded the survey to additional individuals who responded. A total of 39 individuals responded to the survey. The responses represented the following affiliations (note that some respondents indicated more than one affiliation).

- 10 - Homeowner, rural
- 8 - Other
- 7 - Federal or State agency
- 6 - Local agency or district
- 5 - Consulting engineer, planner or scientist
- 4 - Homeowner, urban
- 4 - Commercial development
- 4 - Non-governmental conservation group
- 2 - Land use attorney

The detailed responses to the survey, including charts representing the multiple choice responses and narrative responses, are presented in the next section. A summary of the responses is presented below. When the terms 'CARA requirements' or 'CARA regulation' are used, they are an abbreviation for CARA non-residential wastewater requirements or regulation. The respondent comments presented in this summary represent common themes and abbreviations.

CARA Survey respondents' familiarity and experience with the current CARA regulation and requirements:

- The majority of the survey respondents were aware of the CARA requirements (74%) and indicated that they understood the regulation very well or somewhat well (82%).
- 46% of the respondents indicated that they deal with the CARA regulation frequently or occasionally.
- 92% of the respondent indicated that the purpose of the CARA regulation it to protect water quality in aquifers and rivers. 77% indicated that they think the regulation is very or somewhat protective.
- Responses were varied on whether the CARA regulation is thought to be based on sound science (39% unsure, 33% yes, 28% no) and whether there were issues and/or concerns with the current requirements (39% yes, 33% no, 28% unsure). And, the majority of respondents were unsure if the regulation should be changed (62%).
- 32% of the respondents indicated that the CARA regulation has affected them or a project they have pursued. Concerns and issues ranged from: lack of County enforcement; limiting development potential of properties; increased technical and legal costs associated with property development; inconsistencies with the County Comprehensive Plan; and stopping development rather than protect groundwater.

Survey respondents' comments relating to the CARA review and potential changes to the CARA regulations:

- The need to base the CARA evaluation and any new CARA requirements on sound science and engineering studies was an overarching theme that was emphasized by numerous responses to various questions.
- Other considerations relating to updating/changing the CARA regulation and/or concerns about the regulation included: requirements should be consistent with other related County, agency and growth management requirements; commercial services should be allowed to support new residential development outside the UGA; non-residential limitations should not be more than residential limitations; eliminate non-residential wastewater discharge to groundwater; focus on water quality and regional drinking water protection, not land use concerns; ensure that the regulations allow development appropriate for on-site waste disposal; consider site specific requirements based on hydrology and soil chemistry; eliminate areas that have soil characteristics that naturally filter wastewater; consider wastewater characteristics and loading; implement consistent interpretation of the requirements; implement stringent enforcement; and consider economic impacts.
- The majority of respondents indicated:
    - The CARA regulation should include different requirements for low, medium and high aquifer susceptibility areas (72%). Some of the comments included: a tiered approach may clear up some inconsistencies with the regulations; at least conduct a study to consider different allowances; apply demonstrative science; consider the dynamic

characteristics of the aquifer, not just the physical and biological environment over the aquifer; what was true 20 years ago may not apply today; and base the regulation on the threat, not a blanket policy.

- The CARA regulation should include provisions for variable rates of discharge based on different levels of treatment (82%). Comments included: would allow discharge to match pollution potential; sounds reasonable; if practicable; would help clear up some inconsistencies and ambiguities; and limit discharge of wastewater to aquifer.
- The CARA regulation should include flexibility for different types of non-residential development based on the proposed land use (61%). Comments included: only if it doesn't allow discharge of more contaminants; only if land uses are tracked and not transferable to a new/actual land use; demonstrate through best available science; consider flexibility and an adaptable approach that still keeps the aquifer clean; consider densities and critical/hazardous chemicals; and the current regulation provides flexibility based on gallons per day of water use.
- The CARA regulation should include requirements for monitoring of either the wastewater or ground water, if the CARA regulation was modified to allow non-residential wastewater discharge based on specific land use and/or levels of treatment prior to discharge (71%). Most of the comments relayed the importance of monitoring. Other comments indicated interest in offering alternatives, and considering land use (e.g., office vs. industrial), short-term start up monitoring, state waste discharge requirements, and impact on development potential.
- The CARA regulation should include remedial action requirements or penalties for projects that exceed the allowable discharge (69%). Comments provided numerous suggestions for penalties, emphasized that remedial actions are more important than penalties, recommended to use caution and consider how it might apply to existing facilities, and relayed concerns about cost and uniform application.

Survey respondents' additional advice regarding the review of the CARA regulations and requirements:

- *Stakeholder engagement:* Public outreach is good. Great to provide this forum for discussion. Involve various and affected stakeholders from the community to provide balance. Be open to ideas and allow industries to provide solutions. Obtain information from the engineering community. Work closely with other agencies. Educate users.
- *Consider the long-term:* Look at long-term growth. Consider development impacts over time. Do what is necessary to protect ground and surface water.
- *Development considerations:* Be reasonable and logical; use common sense and allow flexibility. Help property owners/taxpayers succeed in implementing their developments.
- *Water quality considerations:* Consider geographic areas in the County with different soil and groundwater characteristics.

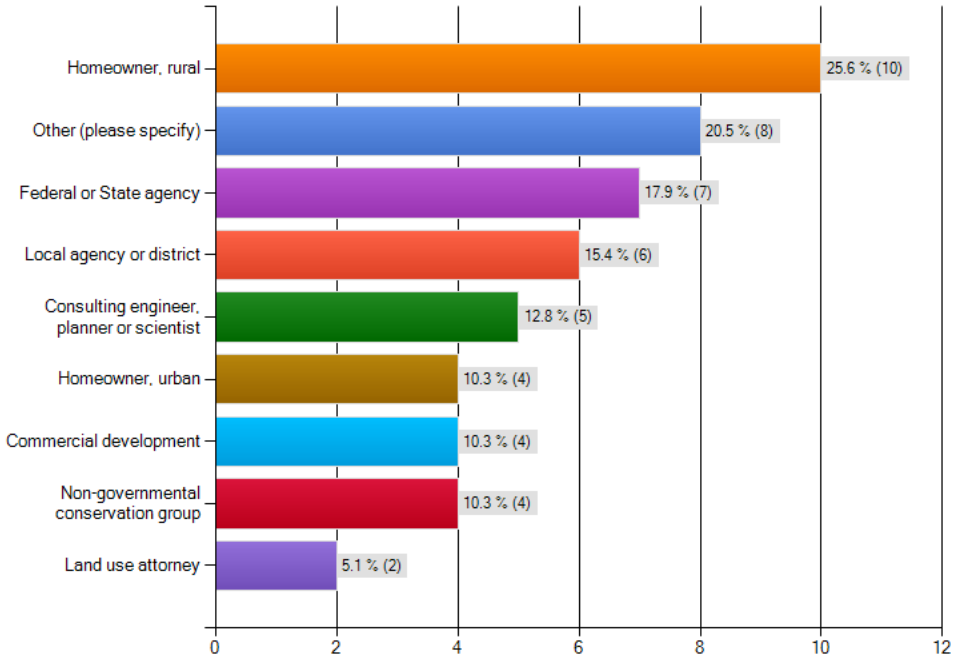
Detailed CARA Survey Responses

Statistics and detailed survey responses from all of the respondents are provided in this section. The individual survey questions are provided in bold type and immediately followed by either a graphical or text-based compilation of survey responses.

Where bar charts are provided below, the x-axes refer to the number of respondents that answered individual survey questions with the specified responses (the percentage and number that shared specific responses are also provided next to the bars). In many cases, respondents did not answer all questions.

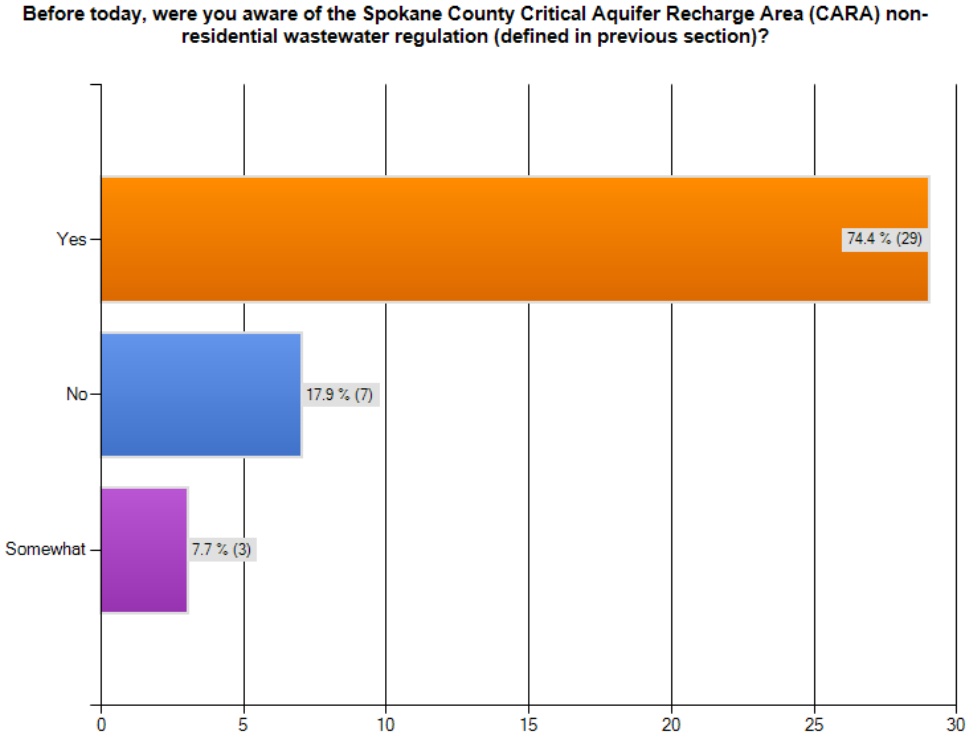
Question #1:

For this survey, which of the following affiliations are you representing? Check all that apply.

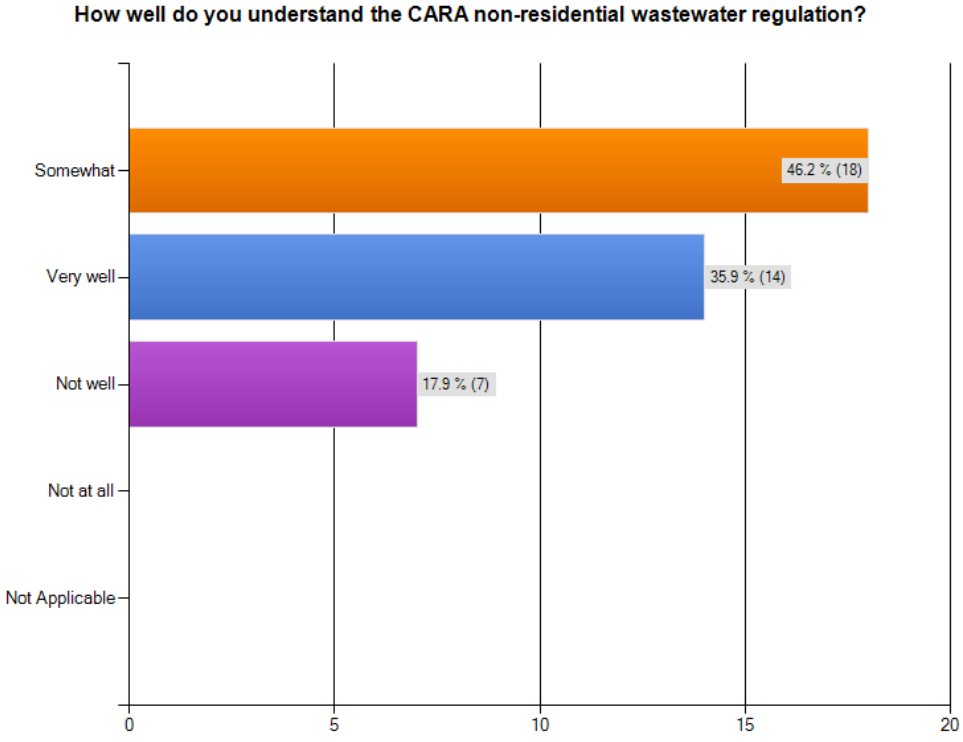


Note: Respondents identified "other" affiliations as: Municipal special purpose district, Neighborhood Alliance, Spokane Association of Realtors, environmental non-profit, lake conservation association, and Tribe.

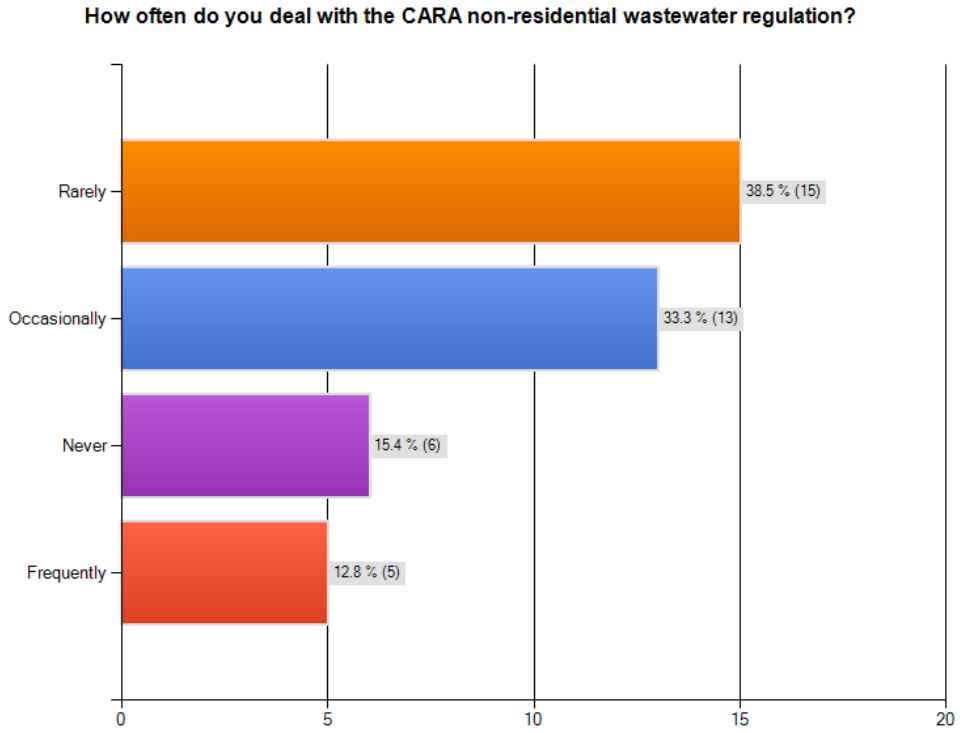
Question #2:



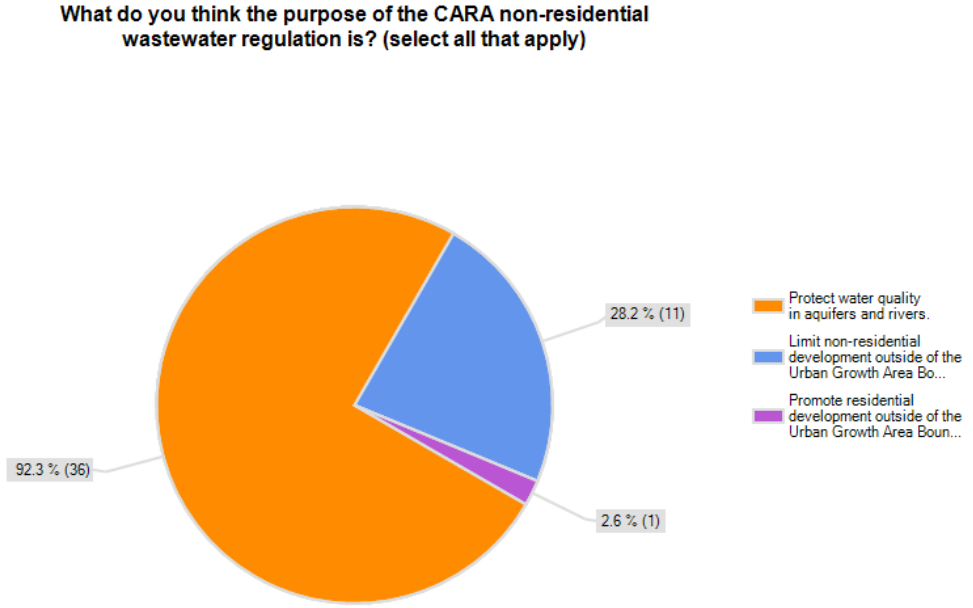
Question #3:



Question #4:



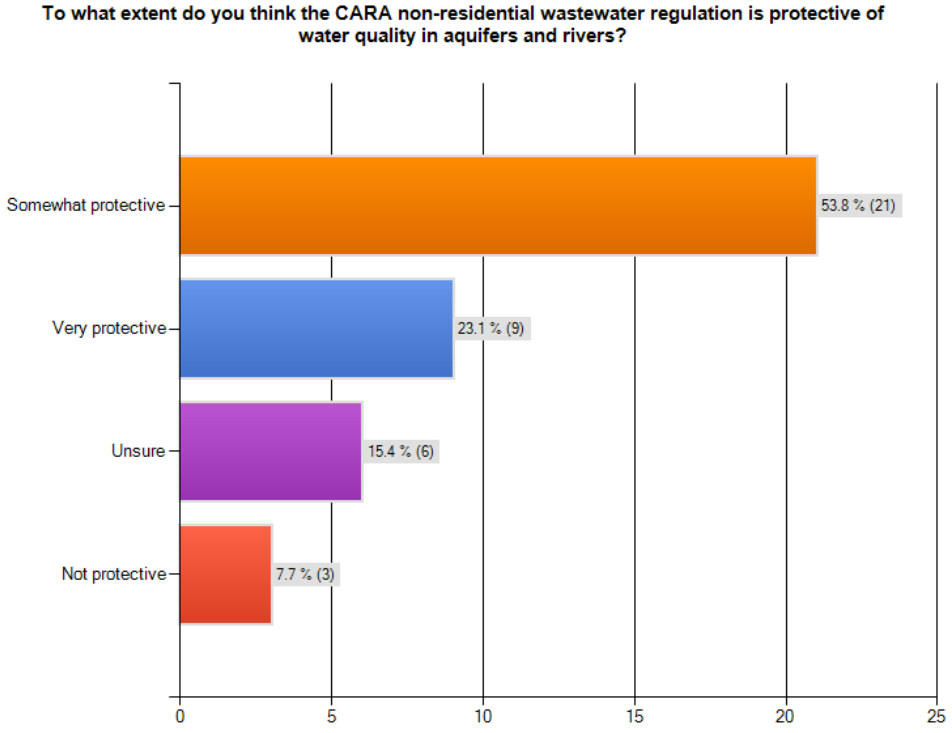
Question #5:



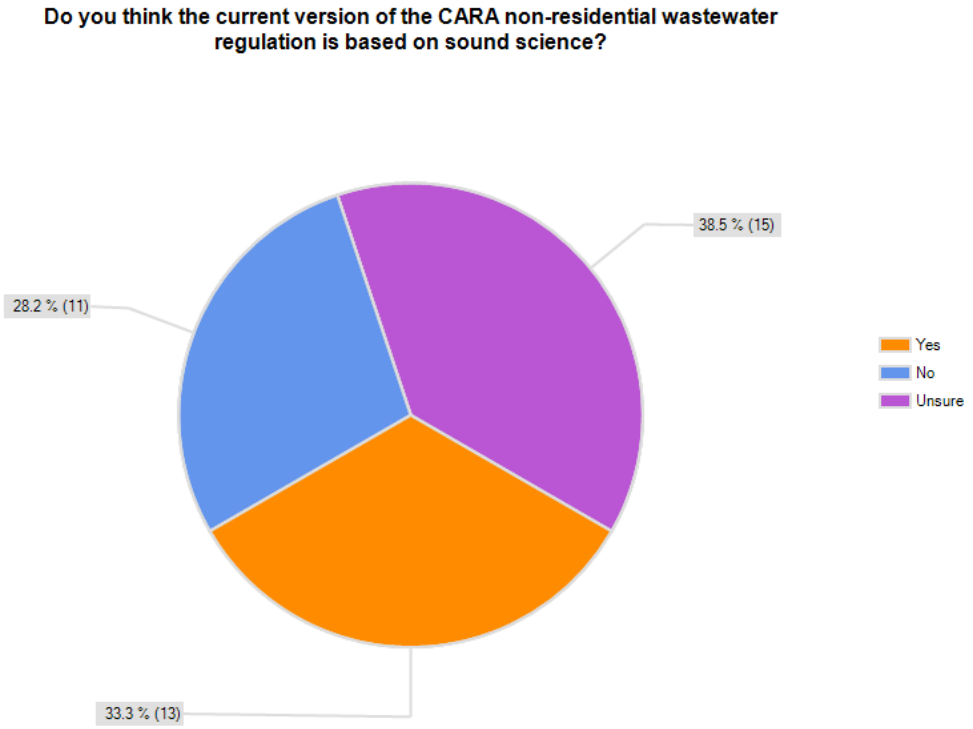
Responses to “Other (please specify)” included:

- Insure that the threat to water quality of non-residential development outside the CARA is no greater than that allowed by a residential development on a similar parcel of land.
- The present CARA regulations were adopted for the purpose of serving a certain political ideology that any growth occurring outside the Spokane County UGA Boundary should not be permitted.
- Growth in rural areas without sewer & water should be limited and strict rules should apply.

Question #6:



Question #7:

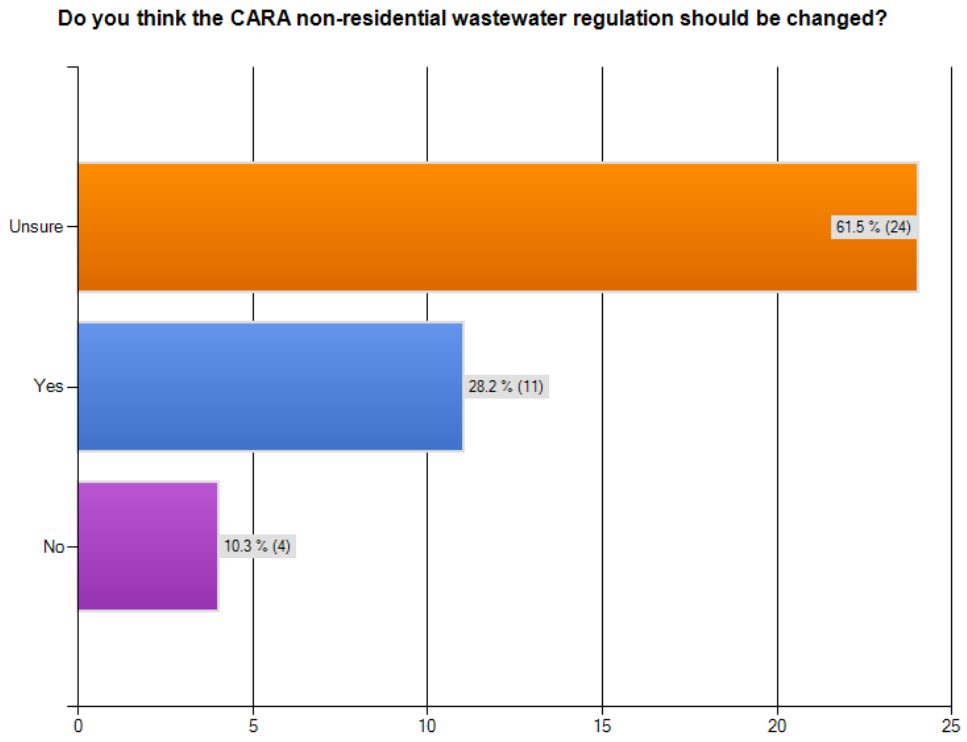


Responses to "If no, please explain" included:

- Certainly hope so.
- Too often politics and pressure from developers sway decisions in Spokane County. Sound science is not always the driving factor -- it should be.
- This is based on basic math principles and soil chemistry.
- There is no science behind it.
- Groundwater, once polluted, is extremely difficult and costly to remediate. Regulations that allow discharge of critical or hazardous materials to drinking water aquifers is not based on sound science.
- CARA boundaries seem very arbitrary and based on road location rather than geology and hydrologic considerations. Although the current regulations are protective, they seem to be unnecessarily restrictive to achieve the desired protection. They do not seem to be based on scientific study, but on how can we be sure of achieving our goal without bothering to do any study.
- The current CARA regulations are based on a number of poorly defined assumptions that need to be reviewed for accuracy. Two key assumptions are: 1) the typical single family residence generates 450 gallons of wastewater per day and 2) the strength of wastewater in terms of its chemical and biological composition is comparable to residential waste; that is there are no chemicals from manufacturing or special cleaning processes or hazardous medical wastes present in the waste stream.

- 90 gallons per acre per day regardless of the activity does not sound like it is based on sound science. If the activity demonstrated it met the water quality requirements, is there a means for approval?
- It is my understanding from talking to Stan Miller, who worked on the CARA regulation originally, that the committee developing the CARA wanted the 90 gpd/acre even thought it was not based upon any sound science.
- I have not been able to find any scientific studies provided by Spokane County Health Dept or any other Spokane County Agency that provides convincing arguments for CARA's existence.
- My negative response is qualified by the absence of any properly conducted scientific evaluation that was completed as a basis for the current regulations.
- The regulations seem to be a one size fits all. We have not seen, nor has there been any reference to science with respect to waste water treatment systems. State of the art and technology has grown tremendously since the enactment of the CARA regulations.

Question #8:

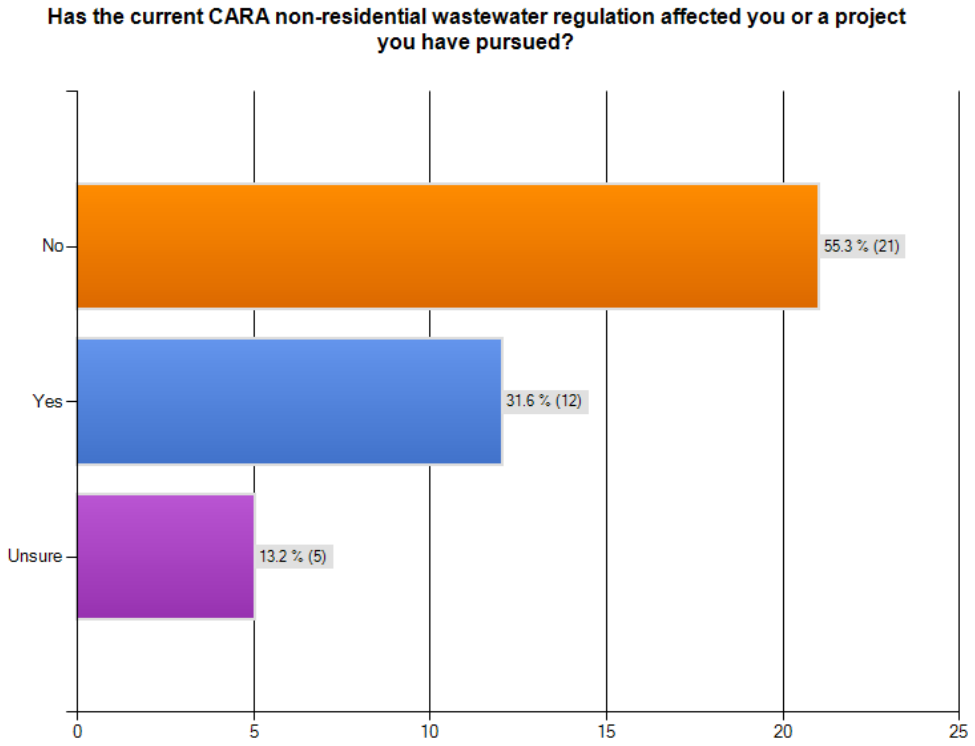


Responses to "If yes, do you have recommendations that should be considered for changes?" included:

- Eliminate the ability of non-residential wastewater (particularly that containing critical materials) to be discharged to groundwater.

- Until a review of the validity of the above assumptions is complete, I will reserve judgment on the need for changes.
- If you cannot justify with science then it needs to be terminated.
- They should be based on engineering studies.
- The limitations for onsite sewage disposal are more limiting than for residential onsite sewage disposal. Typically waste water from non-residential uses have less fecal matter per gallon than residential.
- Consider new demonstrative science.
- It would depend on pre-CARA and post-CARA comparison results based on actual statistics or studies.
- CARA non-residential uses should be revised based on sound science and not be a de facto land use regulation. CARA should focus on use/storage of critical materials instead of limiting use through on-site septic standards that may not be consistent with those enforced by Spokane Regional Health District.
- Have a method of demonstrating your project meets the water quality requirements.
- I think we already have State and Local guidance for sizing on-site disposal systems. Also, hazardous materials are also addressed elsewhere in County Code. I would think if we want to be more protective of the aquifer that those would be the places to do it. The 90 gpd/acre requirement has essentially become a barrier to non-residential development outside the UGA that does not always come to the attention of the party purchasing the land until after they closed. This does not seem to me to be the right way to do business. If Spokane County/State Growth Management does not desire commercial growth outside the UGA the zoning should be changed to reflect that.
- I believe the CARA regulations for non-residential uses in the Mead-Mt Spokane area along U S Hwy No 2 (Newport Hwy) should be eliminated entirely, except for certain specific industrial uses.
- I think that they should be site specific, allowing for discharge that would meet the required intent and allowing for the natural hydrology and soil chemistry to determine the appropriate loading.
- The regulations today seem to be based upon land use concerns outside the UGA. They should be based upon science and focus on water quality protection and not commercial growth. Some commercial uses have very little impact on ground water and therefore should be governed differently.
- Depends on the collective response to question # 16.

Question #9:



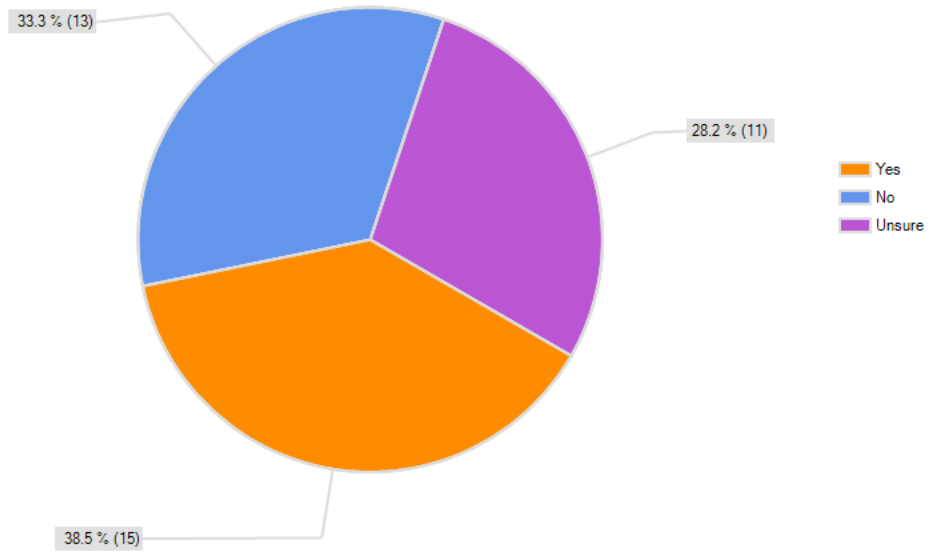
Responses to “If yes, please explain how” included:

- The Lake Spokane area has a septic break-through situation that's possibly adding to the overall phosphorus loading of an already saturated lake. Our hope is that the CARA regulations will aid in diminishing the level of phosphorus and other leeched products entering the water system.
- Yes, the County's unwillingness to enforce the non-residential wastewater regulations has threatened water quality in impacted neighborhood.
- We in Spokane County Engineering and Roads have seen a number of private projects fail due to the current non-residential wastewater regulation.
- Has affected decisions that I make in my official capacity regarding land use actions.
- The restrictions have limited development on a commercial development to about one tenth of the capacity to develop due to the restrictions.
- The current regulation limited the owner’s ability to develop a non-residential land holding which I was engaged to provide design on. This limitation has had the effect of reducing the breadth to which the property could be leased to in terms of differing businesses selecting this site.
- The current CARA non-residential wastewater regulations have interfered and prevented subdividing real property zoned for regional commercial uses. In one particular case, it was necessary for me to obtain and bare the unnecessary costs for legal services to complete a short plat of real property zoned for regional commercial purposes.

- Too limiting, I believe that CARA should acknowledge the Comprehensive Plan for Spokane County and be flexible enough to allow for implementation of the plan, without itself usurping the very heart of Growth Management which is the Comprehensive Plan.
- They have been used as a way to stop development as opposed to protecting the groundwater.
- As a consultant, I've been asked by clients to assist in interpretations of the regulations and explanations of how those regulations would influence the permitting, design and operation of wastewater facilities on the properties they hoped to develop for non-residential uses.

Question #10:

Do you or your organization have issues and/or concerns with the current CARA non-residential wastewater requirements?

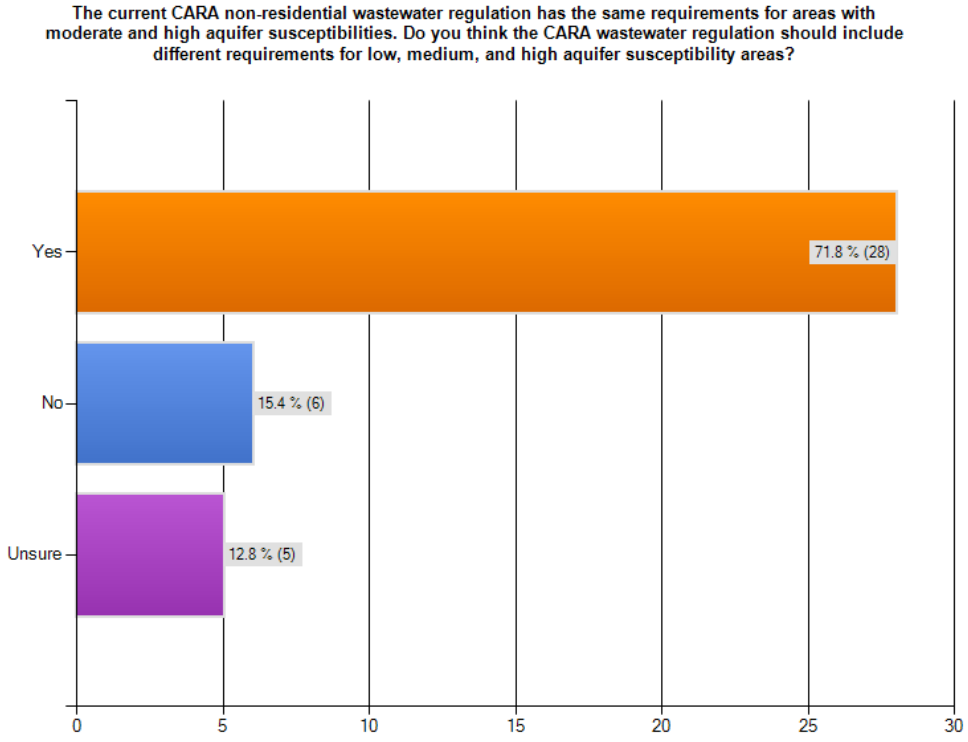


Responses to "If yes, please explain how you have been impacted and/or your concerns" included:

- We have serious concerns with the potential for contamination of regional drinking water.
- I am concerned that any changes in the current rules could reduce the level of protection of aquifer / river quality by allowing development inappropriate for on-site waste disposal.
- There needs to be more stringent enforcement of the CARA requirements.
- We are on 10 acres in a limited aquifer recharge area -- we want strict standards established and consistently upheld.
- Like a lot of things, it is abused by developers and often times not enforced as it should.

- My development has been all but stopped. There are lots of new residential and very little commercial services to serve them.
- This is similar to the question above. The limitations are greater than the health department for on-site sewage disposal. The monitoring requirements are greater which all results in greater costs to the developer. It also seems that if the area is developed in homes that they would be allowed more gallons of disposal and produce far more pollutants from lawns and the like as compared to a parking lot.
- For the reasons mentioned above I think it is important that Spokane County revise the current requirements.
- Information I have obtained by observing and researching certain soils studies in the Mead-Mt Spokane area along U.S. No 2 (Newport Hwy) just northerly of the current Spokane County UGA Boundary indicate there is very sandy soils with relatively thin layers of clay/loam within 8 to 10 feet of the ground surface. Below that we have what is referred to as the Mead Sands with little or no rock of any size. Employees with Central Pre-Mix have advised me the Mead Sands are so pure they do not process the sands before using these sands in the mixing of ready-mix cements sold in the Inland Empire. The sands in many locations extend 75 feet and more below the surface which should act as a natural filter for any wastewater discharged into the ground in these areas. There should be studies conducted that would indicate just how far down wastewater would seep through the sandy soils in our areas and the amount of contamination that occurs in these sandy soils at measured levels. I suspect it would be little or none at depths of 50 feet, well above the normal depth of the water table in this area. Furthermore, Spokane County has determined that the Mead-Mt Spokane area I am referring to is outside the aquifer sensitive area.
- They seem overly restrictive.
- I don't think it is the regulation as much as the interpretation by the specialist. I believe that not all land uses exactly fit within every regulation and then it seems that different interpretations and issues start and there is no reasonable solution but the most restrictive. The most restrictive doesn't always seem appropriate either.
- We do not believe it is based on science, we believe it is a shot gun approach to limit non-residential development, regardless of what the Comprehensive Plan or Zoning Regulations allow.
- That the current requirements or regulations be case by case, depending on the project or use.
- See responses above.

Question #11:

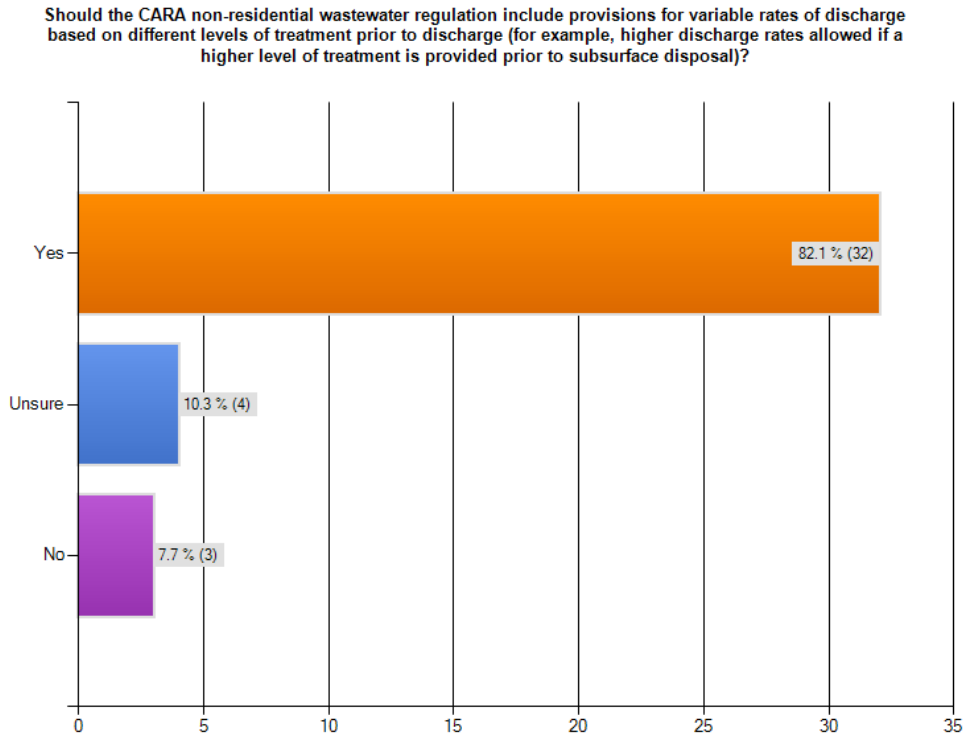


Responses to "Comments" included:

- We should use strict standards, the aquifer is not well understood and it is dynamic -- not static. What was true 20 yrs ago may not be true now, especially after increased rural growth.
- The regulations should be based upon science and the technology available at the time a permit is issued.
- Common sense - logical.
- Makes sense.
- This just demonstrates how arbitrary the regulation is.
- Yes, but not if all of the areas have to meet the high susceptibility areas requirements. The restrictions should match the level of potential pollution as well as balance if it is wastewater from residential uses.
- Again, demonstrative science may provide a differentiation of regulations in susceptibility areas.
- Regulations need to be based on the threat not a blanket policy.
- The current high, medium and low classifications consider primarily how the physical and biological environment over an aquifer affect the potential for contamination. They do not consider the importance of an aquifer as a domestic water supply or the extent to which the aquifer is /was contaminated today. These issues need to be addressed in any review of the CARA.

- Areas of low susceptibility could be evaluated differently.
- I believe at least a study should be conducted to consider different allowances based on differing susceptibility.
- Probably, but if science says something else I'd listen.
- As I have indicated, further studies should be conducted before passing more ordinances that affect the amounts of wastewater that can be discharged into the ground in the Mead-Mt Spokane area along Hwy No 2 (Newport Hwy) just northerly of the Spokane County UGA Boundary.
- I think if there would be a tiered approach to CARA with regards to susceptibilities, it would help clear up some inconsistencies with the regulations.
- Currently, there are separate requirements for low CARAs and for medium/high CARAs. What is the point of having a separate medium and high classification if the requirements are the same for both?
- I do not think CARA should address on-site sewage disposal since there are other agencies that have oversight. If it is deemed important to keep additional regulations in CARA, then yes it might make sense to differentiate between high, medium, and low.
- Previously stated.

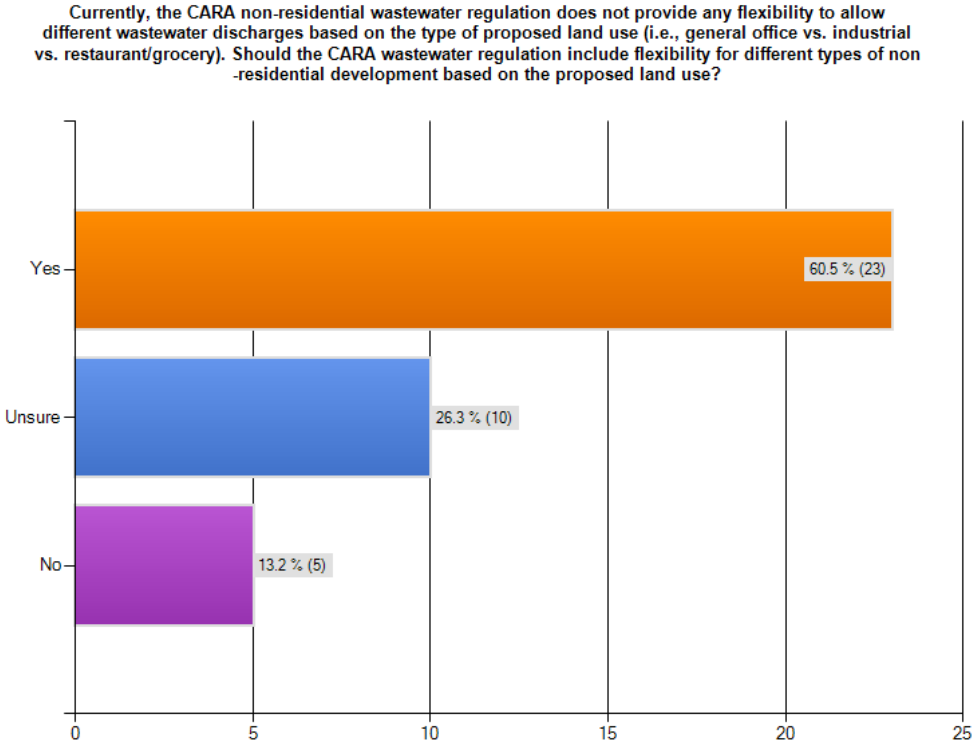
Question #12:



Responses to “Comments” included:

- There should be limited discharge of wastewater to the aquifer.
- Makes sense.
- This sounds reasonable.
- This would allow a discharge to match the potential of pollution.
- This would be a good addition to the rule if the system installed removes contaminants of primary concern like toxics, phosphorous and nitrogen and includes an appropriate disposal method for the contaminants removed.
- Definitely. Why would one consider the cost of using a higher level of treatment if there was no benefit to increase the discharge rate?
- The obvious answer is definitely, YES.
- I think an approach such as this would help clear up some inconsistencies and ambiguities.
- If practicable.
- I do not think CARA should address on-site sewage disposal since there are other agencies that have oversight.
- Previously stated.

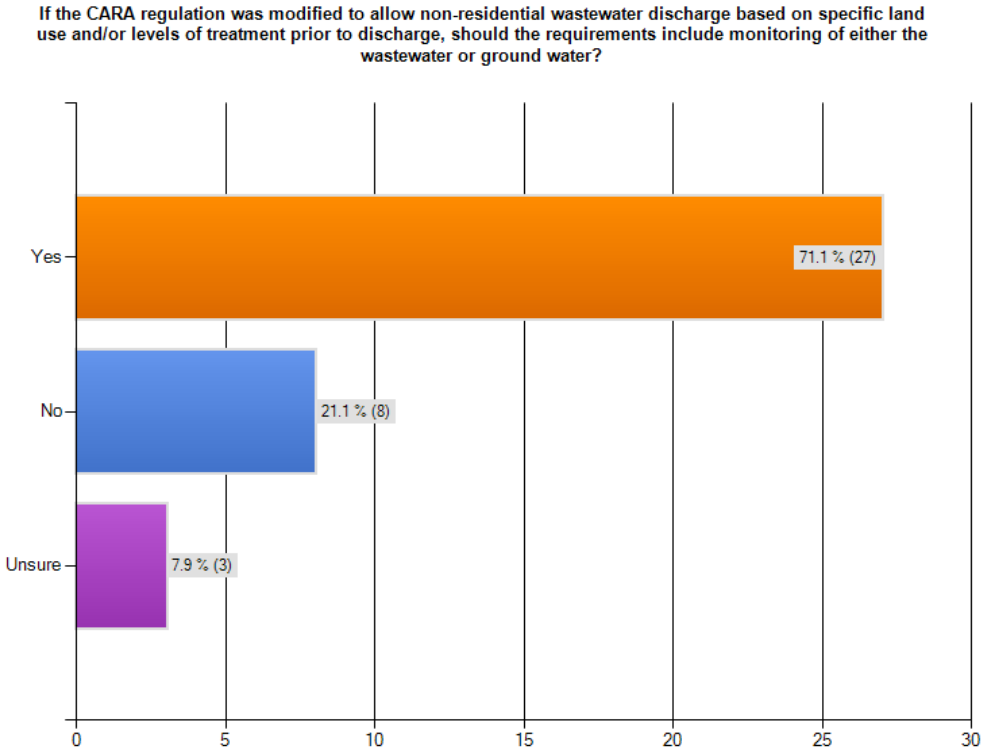
Question #13:



Responses to “If yes, what would you propose?” included:

- The CARA regulations do provide flexibility for different types of wastewater dischargers since the standard is based on gallons per day of water use. An office does not use nearly as much water as a restaurant.
- Only if it can be shown that higher dischargers do not discharge higher total amount of any contaminant of concern.
- As long as those specific land uses are tracked and not transferable to a new land use.
- Not only based on PROPOSED land use, but also based on ACTUAL land use.
- The flexibility of the wastewater discharge should be based upon the potential for pollutants.
- They should be based upon the potential impact that a use may have to groundwater as determined by best available technology. The purpose of the regulations should be to protect groundwater, not to impact land use.
- Probably, but I'd like to see some sound science on this. Site-specific sounds good on the surface, but I'd have to see more.
- Will need new demonstrative BAS to determine if different discharges per land use are warranted.
- If land use has potential for creating water polluted with critical or hazardous chemicals, then higher standard should be required. Densities also matter, particularly given the County's liberal growth policies outside the UGA.
- Flexibility is good when combined with good science and professional judgment/discretion.
- The land use should be considered. But land use changes, so this could present problems.
- I think the CARA should include this flexibility, however land use actions (i.e. Short Plat applications, etc.) need to be considered as well. Regarding this a land use action application should have provided slotted areas where differing uses can be checked as potential future businesses. Much of the land use application process is speculative and the owner/developer does not necessarily know at the time of application who/what the end user of the proposed land may be. Providing slotted discharges/rates based on land use types I believe would be helpful to the owner/developer in directing their efforts in sales and leases without completely tying them to a discharge rate/type.
- Again, definitely yes.
- The different land uses have different discharges. Some land uses have far more issues with wastewater depending on size and capacity. The regulations need to include a more adaptable approach and still meet the requirements of keeping the aquifer clean.
- Again, I believe waste strength and the need for pretreatment for that in excess of residential effluent is addressed in the existing state and local regulations (i.e. the Spokane Regional Health District, Washington State DOH, and Ecology).
- previously stated

Question #14:

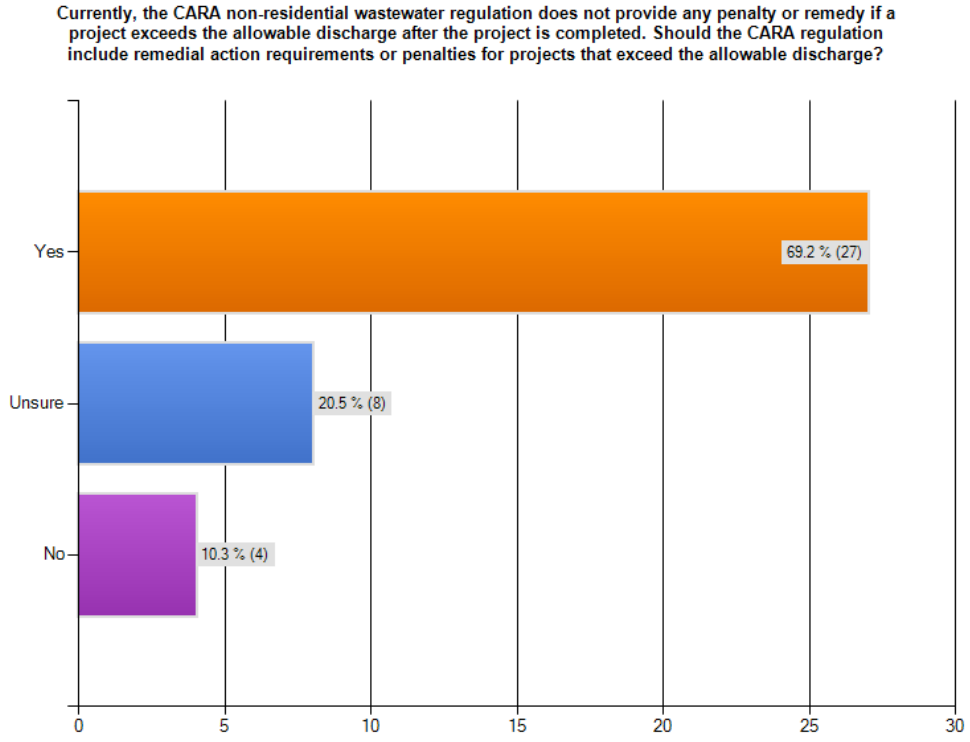


Responses to "Comments" included:

- Yes - monitoring is a MUST. Absolutely necessary.
- Monitoring is key to understanding how policy decisions work in the real world.
- Discharge monitoring should be a requirement.
- Some form of monitoring would be good for characterizing the discharge.
- At least their waste water effluent.
- I think if applicants were offered some alternatives with monitoring depending on the level of treatment and land use that was chosen it would provide for some flexibility.
- I believe that short-term monitoring (say, for a period of 2 years) might be warranted to confirm that impacts to groundwater quality from the development and discharge of wastewater are not occurring.
- Land uses change over time - what was benign when it was constructed could become a higher or lower risk as it is redeveloped into a new use. Treatment should follow specific non-residential use, not zoning or comp plan designation.
- The best way to protect the groundwater would be to install monitoring manholes for dipping and waste stream analysis.
- Although this should still be case by case.
- This would depend on the type of land use. An office might not need monitoring, while an industrial use may.

- Monitoring for amount of flow only. So that the data of water usage based upon the type of use can be used to also provide some flexibility. The charts of water usage are only a guide and actual usage maybe significantly less and the development should reflect that.
- I believe that anything that exceeds residential waste characteristics would need a State Waste discharge permit and would likely require some degree of monitoring. As a result, I doubt that anything additional would be required in CARA.
- While the subject is noble, it can also encumber the property to the extent it is again not developable.
- Currently, I do not know of any rule or regulation requiring private system wastewater dischargers in Spokane County to report either amounts or the chemical composition of their respective wastewaters to Spokane County Officials. Based on current economic conditions, non-residential growth is very slow and until such time there is growth in development of non-residential uses outside the current Spokane County UGA Boundary, I would say there is presently no need for such monitoring of either wastewater or ground water, especially at the expense of private landowners.
- NOTE: Requirements are not always enforced -- there may not be funding for the monitoring.

Question #15:



Responses to “If yes, what would you propose?” included:

- Absolutely!
- YES!!
- The toughest possible penalties!
- What is the value of drinking water to our communities? Remedies should be available and focused on effectiveness. Penalties should be substantial, and should be structured to recoup the costs of groundwater remediation.
- There needs to be accountability for exceedances. Not sure whether that includes penalties, warnings or remedial action requirements - whatever is effective.
- The project owner or proponent should be required to remedy non-compliance within a certain timeframe, for example 2 years, or face fines that increase with increasing time of non compliance.
- Shutting down operation of the offending action until an approved wastewater management approach is installed.
- They should meet the discharge requirements and a mitigation plan to meet them with a time requirement or face losing their business licenses or whatever the county granted them to occupy the site.
- Cost to cover damage (or clean up), plus $ saved by entity for not complying with regulation and require update to facility to bring into compliance. Unless discharge is due to natural disaster or something outside of control of non-residential owner (vandalism, 3rd party damage...).
- I answered, yes, not because of the discharge amount, because I think that the discharge of clean water could be as high as possible, however, penalties should be associated with modified waste streams that in any volume could be hazardous to the aquifer or groundwater.
- There should be some way to stop the discharge. Although any project should have a way to prevent this if permitted. Example: tire facilities should have the right containment on the ground to keep any leakage into the water table or ground in case of fire. Liners should be in place where there are any kinds of materials that might leak into the ground and cause problems with leakage into the water table.
- Requiring a reduction in the usage to allowed levels. Normal enforcement mechanism under the County land use codes.
- Remedial actions should be required. If multiple violations occur then penalties would be appropriate.
- Remedial action only; fines do not correct the problem.
- Would this be based on engineering principles, or just arbitrary punishment?
- The best made plans for mice and men sometimes do not work. We all are trying to do the right thing. Tough to determine. I would like to say yes, but.....
- Not sure at this point. I would think the remedial action is more important than the penalty as it provides the fix to the problem.

- Is this a problem? If so, why is it a problem and how often is this subject determined to be the case? If this is a rare occurrence then one can assume generally most follow the intent of the regulation and I don't believe much action should be taken. If it is often, then a review of the continual cause of exceeding allowable discharges may provide direction as to what direction to take on the subject.
- Spokane County officials should proceed cautiously on remedial actions and penalties as in all probability it would affect schools in our area that have already been built after the CARA regulations were adopted.
- The reality is that enforcement is impossible, would not be uniform, and used only as a tool to prohibit land use. The reality is that the cost of enforcement would be cost prohibitive and not uniform.

Question #16: If the CARA review resulted in the recommendation to update the regulations and requirements, what other considerations do you think are important?

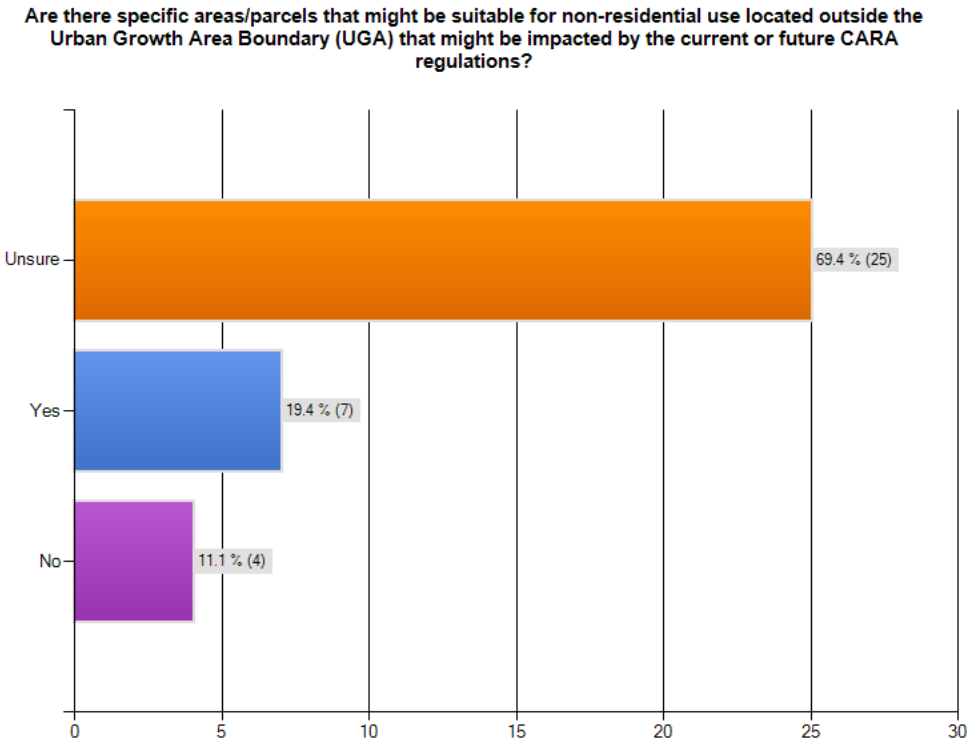
Responses included:

- Keep with current regulations.
- Allow for different soil types and distance above the aquifer and distance from the aquifer.
- Water usage of a proposed development should be able to use another identical site with the same use for water usage.
- Not allowing land uses inconsistent with both County and State planning law for urban development in rural areas.
- Need to address the economic impacts and estimate how much improvement will be achieved with an update to the regulations and requirements (e.g. cost/benefit).
- Need clear enforcement requirements or allowance for citizen enforcement.
- While I have not worked with the current regulations in some time, I think incorporation of newer technologies that meet established standards should be incorporated into the regulation.
- Spokane County Officials should not consider blanket or one size fits all CARA regulations for all of Spokane County. Certain geographical areas, especially the Mead-Mt Spokane area I have referred to several times in this survey, should either be exempt from these regulations, or if continued, Spokane County has the burden to base its actions in controlling wastewater discharges for non-residential uses outside the UGA on more scientific studies than has been done in the past.
- The staff would make consistent interpretations of the regulations and some flexibility within the regulations that would provide some reasonable options to meet the regulations.
- You would need to enforce what is required.
- Mostly, the discharge should be based on soil type, loading and other factors. Definitely not by just limiting to a specific flow. For example, say a grocery store wanted to go into an area where it was allowed. Grocery stores may have 1, 2 or 3 waste streams: 1) bathrooms, 2)freezer and produce drains, and3)deli drains. Have the store separate the waste streams and allow for maximum discharges for all others that can be readily treated using normal standards of

practice and care. The other streams may need pre-treatment with dipping manholes for observation and regulate only those streams.

- How they are used. The presumption should be in favor of the technology.
- Undecided.
- None
- My ideas are generally included in the comments above.

Question #17:



Responses to "If yes, please describe each location (as specific as possible), they type of business and concern." included:

- School district property on Henry and 16th
- I'm surprised that this question has been asked in this survey. The answer is an obvious YES. The current CARA regulations has made it impossible to develop most any type of development allowed by current Spokane County zoning rules and regulations in the Mead-Mt Spokane area along U S Hwy No 2 (Newport Hwy) just northerly of the UGA Boundary.
- I'm sure along every Arterial at Arterial/Collector intersections.
- Areas outside UGAs are by definition rural, consistent with the GMA, and should have appropriate rural services for rural densities.

- Shorefront areas and areas that affect watersheds directly. Those properties have the highest likelihood for ecosystem damage in an already very sensitive water body.
- As stated above.

Question #18: What additional advice would you give Spokane County as it conducts the review of the CARA non-residential wastewater regulations and requirements?

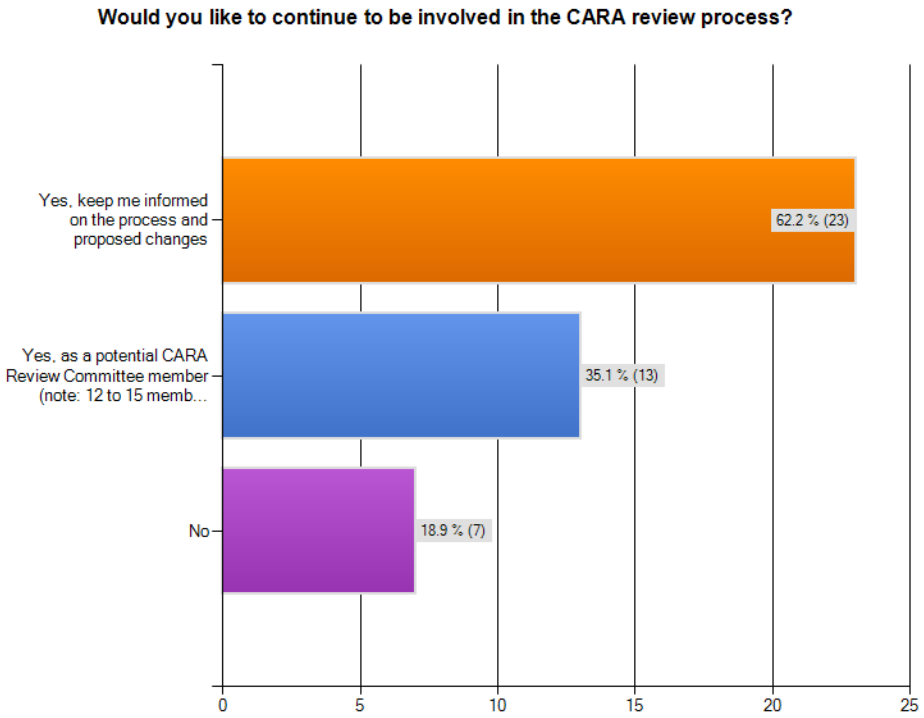
Responses included:

- Public outreach is good, which it looks like is occurring in this process.
- This is great to provide a forum for discussion. It would be advantageous to have a meeting where ideas could be exchanged to build on the synergy of the group. That could bring out some great ideas.
- I think it is important to involve all stakeholders from all of the community. This would include the environmental, business, private property owners, etc. to get a balanced document. One sector of the stakeholder group should not have more influence because of numbers, economic means, etc.
- Please make sure to involve all affected organizations and interface with other projects such as the SRRTTF so that agencies are on the same page.
- Be open to ideas and allow industry to provide solutions and responsibilities for each site.
- Obtain as much information as possible from the engineering community, as well as the manufactures of current state of the art waste water systems.
- Work closely with ecology and the aquifer protection district.
- Gather as much SCIENTIFIC advice as possible, keep politicians and developers out of the process, insofar as possible.
- Try to keep things as simple and straight-forward as possible to benefit the general population of Spokane County.
- Look at long term growth for 20 years or more; both for water and other land uses in the area.
- Look ahead to the future and how development can create long term impacts on our aquifers, from industrial chemicals, health care products, transport of PCB, flame retardants and work to educate both residential and non-residential users.
- Do what is necessary to protect ground/surface water and to meet environmental standards. Collect samples and analyze data to demonstrate the effectiveness of the regulations and requirements.
- Remedial action requirements or penalties for projects that exceed the allowable discharge are a good idea.
- Be reasonable and logical; and develop the science or eliminate the regulation.
- As I have said before, additional scientific studies of each area the CARA regulations would effect and I might add, a little more common sense in its application.
- Remember to think not in terms of ways to restrict the property owners/taxpayers of the county from using their properties as they see fit. Rather, really look at ways to help them to succeed in

their development dreams which will in turn increase the tax revenue base coming to the county.

- CARA regulations should not be used for the purpose of restricting development. The regulation should have the goal of protecting the aquifer, and the regulation should be based on engineering principles.
- Be cautions that changes to CARA policies and regulations to allow non-residential development in one area of the County may be inappropriate in other areas of the County with larger groundwater area.
- However it turns out, be flexible – you cannot write regulations that cover every situation. Look at each development individually, follow the rules but understand not everything is a "boilerplate".
- I think that any comprehensive plan land use designation of LDA Commercial, Industrial or LDA Residential needs to be categorically exempt from this CARA designation. The areas were designated such because of prior existing density and intensity of residential, commercial and industrial development. Limiting loading rates inside these areas is insignificant to the purpose of CARA in protecting the groundwater below because it is near full build out already with septic.
- As I read these survey questions I realize it isn't clear to me whether summer cabins at the lakes are considered residential use or non-residential. Many are not full-year residences, so which use category are they classified under?.
- See comments above.

Question #19:



CARA REVIEW COMMITTEE MEETING

~ OCTOBER 24, 2012 ~

Agenda:

2:30 – 3:00 pm **Welcome and Introductions**

Rob Lindsay – Spokane County Utilities
Bruce Rawls – Spokane County Utilities

3:00 – 3:45 pm **CARA Review Process and Milestones**
Review of Current CARA Non-residential Requirements
Overview of Study Area Characteristics

Mike Murray – HDR Engineering

3:45 – 4:15 pm **Review of CARA Survey Responses**

Sarah Hubbard-Gray - HGC

4:15 – 4:45 pm **Issues and Concerns with CARA Requirements**

Roundtable Discussion

4:45 – 5:00 pm **Next Steps – Review and Discussion**

Mike Murray – HDR Engineering
Sarah Hubbard-Gray - HGC

County and Consultant CARA Review Staff:

Bruce Rawls, Spokane County Utilities
Rob Lindsay, Spokane County Utilities
Mike Murray, HDR Engineering
Michael Kasch, HDR Engineering
Sarah Hubbard-Gray, Hubbard Gray Consulting
Stan Miller, Inland Northwest Water Resources

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Phone: 509-477-3604

CARA Review Committee
October 24, 2012 Meeting Summary

Meeting Attendees

Committee members that attended the meeting:

- Steve Davenport**, Spokane County Building and Planning
- Rick Eichstaedt, Center for Justice/Riverkeeper
- Jim Harakas, GeoEngineers, Inc.
- Kitty Klitzke, Futurewise
- Richard Vandervert
- Ned Wendle, Mead School District
- Guy Gregory, Washington State Department of Ecology
- Steven Holderby, Spokane Regional Health District
- Eric Meyer**, Spokane Regional Health District
  ** alternate committee member

County staff and consultants that attended the meeting:

- Bruce Rawls, Spokane County Utilities
- Rob Lindsay, Spokane County Utilities
- Mike Murray, HDR Engineering
- Michael Kasch, HDR Engineering
- Sarah Hubbard-Gray, Hubbard Gray Consulting
- Stan Miller, Inland Northwest Water Resources

Members of the public that attended the meeting:

- Larry Kunz

Welcome and Introductions

Sarah Hubbard-Gray, the meeting facilitator, welcomed the committee members and asked everyone to introduce themselves.

Bruce Rawls explained that the current CARA non-residential wastewater regulation includes simple language, but it has been complicated for the County to administer and difficult for developers to comply with. He provided background on the current CARA review considerations, including 1) historical implication challenges, 2) need to apply best available science, 3) new development considerations, such as the volume of wastewater discharge unknown or misrepresented, and 4) approved development considerations, such as the actual volume of wastewater discharge not what represented at time of approval.

Rob Lindsay explained that this CARA regulation review is limited to non-residential wastewater outside the Urban Growth Area (UGA) boundary. He provided an overview of the purpose of the current CARA review, which includes review of the current standard, conducting a scientific study, evaluating the need for revisions and developing recommendations for revisions if appropriate. Rob reviewed the opportunities for interested parties' engagement. Rob then explained the role of the CARA Review Committee and that their comments and perspectives will be shared with the County Planning Commission and Board of County Commissioners. Rob explained that the role of the Committee involves:

- Participation in four to five meetings at key points during review
- Sharing perspectives
- Providing feedback on technical aspects of CARA review
- Providing comments and suggestions relating to draft recommendations (if applicable)

Sarah Hubbard-Gray then asked the Committee for input on suggested meeting ground rules. All of the Committee members indicated that the ground rules seemed fine and no additional comments or suggestions were provided. The agreed upon ground rules include:

- Stay engaged
- Provide timely input and suggestions
- Consider different perspectives and experiences
- Listen and speak with respect
- Take a long-term view
- Be productive with our time
- Intervene to help the group
- Enjoy our time together

CARA Review – Process and Milestones, Current CARA Requirements, Study Area Characteristics

Mike Murray reviewed the CARA Review objectives, which include 1) evaluating if the standard is effective, enforceable and equitable, 2) evaluating the need for revisions, and 3) making recommendations for standard revisions, if appropriate. He reviewed the approach, and provided background on the current CARA regulation and CARA susceptibility designations. Mike reviewed the process and tasks associated with the CARA review and the technical memos that will be developed to document the review.

Michael Kasch explained the study area, and provided a summary of the information in Tech Memo 1, which includes:

- Define non-residential uses
- Define non-residential sanitary wastewater characteristics
- Example septic tank effluent concentrations
- Define environmental/resource properties for area of study

Mike Murray explained that defining groundwater quality criteria and a loading analysis will be conducted next.

The Committee members asked a variety of questions that were discussed, including:

- Is the current 90 gallons per day per acre CARA requirement working? The team provided a variety of information about the characteristics of the SVRP Aquifer, Spokane County's current groundwater monitoring program, and that the County does not have specific monitoring data for non-residential areas outside the UGA. Mike Murray explained that a conceptual model will be developed and a mixing zone analysis will be conducted to evaluate if the current requirements are adequately protecting groundwater and surface water quality.
- Why develop a map of the current and possible future non-residential areas/uses outside the UGA? Mike Murray explained that it was intended to get a handle on the study area and the type of non-residential uses in the county.
- What data will be relied on for the study? Is wastewater from non-residential parcels outside the UGA being sampled and/or are property owners being interviewed about their wastewater discharge? Mike Murray explained that sampling is not being conducted, and that the study will rely on research and existing Spokane area data. Mike also explained that the evaluation will consider what loading will not impact groundwater and surface water quality, and then identify non-residential wastewater requirements that do not exceed the acceptable loading.
- Expertise available in the Spokane area to implement the requirements should be considered.
- Will a variety of pollutants be evaluated? Mike Murray explained that this will be covered in Tech Memo 2.
- How will surface water impacts be evaluated? Mike Murray explained that septic tank performance and breakthrough will be included in the evaluation, along with groundwater recharge to surface water.

Review of CARA Survey Responses

Sarah Hubbard-Gray provided a summary of the September 2012 CARA Survey responses. The survey was sent to 137 individuals representing a wide variety of interests, and 39 individuals representing various affiliations completed the survey. The majority of the respondents were aware of the CARA requirements and understood the regulation very well or somewhat well. An overview of the responses to the questions was provided, along with the common comments and perspectives that were shared. It was explained that an overarching theme was that the CARA evaluation and requirements should be based on sound science and engineering studies. The complete documentation of the CARA Survey responses was provided as a handout.

Issues and Concerns with CARA Requirements

Sarah Hubbard-Gray then facilitated a discussion with the Committee regarding issues and concerns with CARA requirements. The following input was provided.

Current CARA purpose and effectiveness considerations and questions:

- 1970 research was considered when the current CARA regulation was developed.
- In the past, Spokane Regional Health District sampled commercial wastewater from facilities that used critical materials. Minimal critical materials were found in the wastewater.
- It was explained how the high, moderate, and low aquifer susceptibility was determined.

CARA Review considerations:

- Advanced treatment on-site systems are available to landowners today that were not available when the CARA requirements were developed. .
- Different uses with different wastewater characteristics need to be considered.
- Different wastewater systems, different soils types, and other types of loading and cumulative impacts (e.g., stormwater runoff / infiltration) should be considered.
- May want to focus on areas with public water systems available, since this is where new development would be anticipated (e.g., Mead area with Whitworth Water District service).
- Challenge will be consideration of different geologic characteristics and geologic zoning needs.

Considerations related to CARA standards:

- Need to avoid contamination.
- The standard should be applicable or addresses both the SVRP and other aquifers in the county and outside the UGA. Different zones with different requirements may be appropriate.
- Who is administering and enforcing CARA requirement in the County? Is it in the correct department? Are there additional tools that are needed?
- Need to know if/when the requirements are not working. It needs to be clear who has authority and how to remediate. Enforcement is critical.

Public Questions and Comments

Larry Kunz explained his concern about potential gas station contamination in the area of his private well. Bruce Rawls and Guy Gregory provided information, and Guy provided Mr. Kunz with contacts at the Department of Ecology to follow up with.

Next Steps

It was requested that documents be posted to the CARA web page a few days before each CARA Review Committee meeting.

Sarah explained that comments on draft Tech Memo 1 are due by Friday November 2, 2012 and that the draft Tech Memo 2 will be available for review in early December 2012.

The next CARA Review Committee meeting was set for Wednesday December 12, 2012 from 2:00 pm to 4:30 pm.

CARA REVIEW COMMITTEE MEETING

~ DECEMBER 12, 2012 ~

Agenda:

2:00 – 2:15 pm **Welcome and Introductions**
Review of CARA Review Process and Milestones
Comments on October 24, 2012 Meeting Summary

Sarah Hubbard-Gray - HGC

2:15 – 3:30 pm **Groundwater Quality Criteria**
Groundwater Loading Limits for Wastewater
Considerations for Establishing CARA Wastewater Loadings

Mike Murray – HDR Engineering
Michael Kasch – HDR Engineering

3:30 – 4:15 pm **Perspectives on Establishing CARA Wastewater Loadings**

Roundtable Discussion

4:15 – 4:30 pm **Next Steps – Review and Discussion**

Mike Murray – HDR Engineering
Sarah Hubbard-Gray - HGC

County and Consultant CARA Review Staff:

Bruce Rawls, Spokane County Utilities
Rob Lindsay, Spokane County Utilities
Mike Hermanson, Spokane County Utilities
Mike Murray, HDR Engineering
Michael Kasch, HDR Engineering
Sarah Hubbard-Gray, Hubbard Gray Consulting
Stan Miller, Inland Northwest Water Resources

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CARA Review Committee
December 12, 2012 Meeting Summary

Meeting Attendees

Committee members that attended the meeting:

- Steve Davenport**, Spokane County Building and Planning
- Kitty Klitzke, Futurewise (via phone)
- Lloyd Torgerson, Torgerson Properties
- Ned Wendle, Mead School District
- Guy Gregory, Washington State Department of Ecology
- Steven Holderby, Spokane Regional Health District
- Eric Meyer**, Spokane Regional Health District
- Jeanne Barnes, Spokane Association of Realtors
- Jon Rudders**, GeoEngineers, Inc.
- Bryce Robbert, Avista Utilities

  ** alternate committee member

County staff and consultants that attended the meeting:

- Bruce Rawls, Spokane County Utilities
- Rob Lindsay, Spokane County Utilities
- Mike Hermanson, Spokane County Utilities
- Mike Murray, HDR Engineering
- Michael Kasch, HDR Engineering
- Sarah Hubbard-Gray, Hubbard Gray Consulting
- Stan Miller, Inland Northwest Water Resources

Members of the public that attended the meeting:

- Rusty Post, Washington State Department of Ecology
- Llyn Doremus, Washington State Department of Ecology

Welcome and Introductions

Sarah Hubbard-Gray, the meeting facilitator, welcomed the committee members and asked everyone to introduce themselves.

Sarah provided a reminder about the CARA Review process and milestones, and reviewed the purpose of the project which is to 1) evaluate the need for revisions of the CARA wastewater disposal standard (SCC 11.20.075) which relate to non-residential uses outside the Urban Growth Area (UGA), 2) evaluate if the standard is effective, enforceable, and equitable, and 3) make recommendations for standard revisions (if appropriate).

Sarah explained the goals for the meeting, which involved 1) getting input from the committee on the technical approach presented in Tech Memos 2 and 3, which form the foundation for upcoming technical evaluations, and 2) getting input and perspectives on establishing CARA wastewater loadings and considerations for incorporation into CARA standards.

Sarah asked if there were any comments or clarification on the October 24, 2012 CARA Review Committee meeting summary. No comments were provided.

Groundwater Quality Criteria, Groundwater Loading Limits for Wastewater, and Considerations for Establishing CARA Wastewater Loadings

Mike Murray reviewed the CARA study objectives, why a CARA standard was established, and the goals of Spokane County's CARA requirements. Mike explained that Tech Memo 2 focuses on the Water Quality Standard for Ground Water Standard (Chapter 173-200 WAC), also referred to as the Groundwater Quality Standards, to meet the goals associated with preventing degradation of groundwater quality, improving water quality of aquifers that do not meet state standards, and protecting groundwater quality from development impacts.

Mike presented a summary of the information presented in Tech Memo 2, including an overview of:

- On-site septic system components
- On-site septic system flow pattern
- Washington State Groundwater Quality Standards – need to consider to evaluate acceptable loading to groundwater
- Groundwater Quality Standards regulatory authority
- Groundwater Quality Standards goals and mechanisms, including anti-degradation, AKART and point of compliance
- Constituent focus for CARA evaluation – why nitrate is the primary constituent of concern (e.g., highly mobile and moves unchanged through soil) and that phosphorus will also be considered
- On-site septic system loading of nitrate to groundwater and Washington Department of Heath nitrate-balance approach
- How Groundwater Quality Standards could be applied to CARA study

Mike Murray and Michael Kasch presented a summary of the information presented in Tech Memo 3, including an overview of:

- Constituents of concern
- Nitrogen cycle from drainfields
- Mixing zone approach
- Use of mixing zone approach used by Washington Department of Health
- Parameters to assess wastewater loading to groundwater

- Examples of sanitary wastewater nitrate loads, example calculations and discussion of default and site specific values
- Point of compliance considerations and possible locations
- Examples of mixing calculations showing variations of non-residential downgradient concentrations and variability between sites with different hydraulic conductivity
- Washington Department of Health Nitrate Mixing Analysis Spreadsheet
- Examples of how the implementation mechanisms (anti-degradation, AKART, Groundwater Standards and point of compliance) could be incorporated into CARA
- Example of allowable nitrogen loading for sites with different wastewater nitrate concentration, wastewater flow rates, and hydraulic conductivity

Sarah asked the committee members if, based on the presentation, they agree with using nitrate as the constituent of concern, using the numeric criterion that aligns with the limits used by the Washington Department of Heath, and the mixing zone approach. None of the committee members expressed any concerns.

Committee members were asked to provide written comments on Technical Memos 2 and 3 by Friday December 21, 2012. It was explained that comments from the December 12th meeting and written comments will be considered during the next phase of technical work.

Perspectives on Establishing CARA Wastewater Loadings – Roundtable Discussion

During and after the presentations, a variety of questions and comments were provided by committee members and County staff, including:

- Guy Gregory indicated that point of compliance is often misunderstood and that the Washington Department of Ecology will provide written comments on Tech Memos 2 and 3, including point of compliance.
- Ned Wendle explained that typical architectural and engineering resource information on flow rates for schools are not accurate for new schools constructed with low flow / water saving features. Mead's new school uses 3 gallons/day/student, not the design rate of 15 gallons/day/student.
- As the project continues and CARA recommendations are developed, the overarching Growth Management Act implications/concerns/issues should be considered (e.g., effect of changing the regulation, land use implications). CARA regulation should not dictate land use, but should consider the effect. Lots of land is available for non-residential development inside the UGA.
- Comments and questions on how to implement the loading method, and how upgradient nitrate concentrations and other site-specific parameters will be determined:
    - Values from maps or look up tables should be provided for project proponents that want to rely on existing information – with the understanding that the values may be more conservative.

    - For project proponents that want to rely on their site-specific information, they should be allowed to provide a hydrogeologic report prepared by a qualified firm/individual.
    - The amount of data needed should be determined (e.g., what is required in a hydrogeologic report). Rob Lindsay explained what some other Washington counties require in their CARA regulations and associated engineering reports.
    - Take advantage of available data (e.g., consider water system data for nitrates in wells close to a proposed project, developed detailed maps with representative data for different geographic areas, use Ecology EIM data that links to well logs).
    - Need to determine how to establish the predicted or expected flow rate of a project.
    - How will applicant provide an estimate of nitrate concentration from drainfield?
- Comments and questions on hydraulic conductivity:
    - It is difficult to get accurate numbers for hydraulic conductivity and it is very important to get the number correct.
    - How does the effect of hydraulic conductivity relate to the current low, medium and high aquifer susceptibility areas?
- Different types of treatment/nitrate reduction should be allowed (e.g., higher flows can be discharged if higher levels of treatment are incorporated into projects that meet the acceptable loading requirements).
- Additional comments and questions relating to incorporation of wastewater loadings into CARA standards:
    - Need to be fair, equitable, and consistent.
    - How will the cumulative effect be determined over time?
    - New uses for a site should be considered.
    - Changes from predicted or expected flow and loading rates should be considered. However, concern was raised about going back when costs had already been incurred by the owner.

Next Steps

Sarah explained that written comments on draft Tech Memos 2 and 3 are due by Friday December 21, 2012. Comments should be sent to Rob Lindsay.

Sarah also explained that the next CARA Review Committee meeting will be in late January or February 2013. It will be on a Wednesday from 2:00 to 4:30 pm, and a notice will be sent out at least three weeks before the meeting. Draft Tech Memo 4, that will cover predictive tools and preliminary recommendations, will be posted on the CARA web page for committee review several days before the meeting.

CARA REVIEW COMMITTEE MEETING

~ FEBRUARY 20, 2012 ~

Agenda:

2:00 – 2:15 pm **Welcome and Introductions**
Review of CARA Review Process and Milestones
Comments on December 12, 2012 Meeting Summary

Sarah Hubbard-Gray - HGC

2:15 – 3:30 pm **Nitrogen & Phosphorus Wastewater Loading Considerations**
Review of Predictive Modeling/Tools Development
Preliminary Recommendations for CARA Modification
Draft CARA Tech Memo 4

Mike Murray – HDR Engineering
Michael Kasch – HDR Engineering

3:30 – 4:15 pm **Perspectives on Predictive Modeling/Tools**
Perspectives on CARA Modification Recommendations

Roundtable Discussion

4:15 – 4:30 pm **Next Steps – Review and Discussion**

Mike Murray – HDR Engineering
Sarah Hubbard-Gray - HGC

County and Consultant CARA Review Staff:

Bruce Rawls, Spokane County Utilities
Rob Lindsay, Spokane County Utilities
Mike Hermanson, Spokane County Utilities
Mike Murray, HDR Engineering
Michael Kasch, HDR Engineering
Sarah Hubbard-Gray, Hubbard Gray Consulting
Stan Miller, Inland Northwest Water Resources

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CARA Review Committee
February 20, 2013 Meeting Summary

Meeting Attendees

Committee members that attended the meeting:

- Steve Davenport**, Spokane County Building and Planning
- Lloyd Torgerson, Torgerson Properties
- Ned Wendle, Mead School District
- Guy Gregory, Washington State Department of Ecology
- Steven Holderby, Spokane Regional Health District
- Eric Meyer**, Spokane Regional Health District
- Jeanne Barnes, Spokane Association of Realtors
- Jim Harakas, GeoEngineers, Inc.
- Bryce Robbert, Avista Utilities

  ** alternate committee member

County staff and consultants that attended the meeting:

- Bruce Rawls, Spokane County Utilities
- Rob Lindsay, Spokane County Utilities
- Mike Hermanson, Spokane County Utilities
- Mike Murray, HDR Engineering
- Michael Kasch, HDR Engineering
- Sarah Hubbard-Gray, Hubbard Gray Consulting
- Stan Miller, Inland Northwest Water Resources

Members of the public that attended the meeting:

- Doug Greenlund, City of Spokane, Environmental Programs

Welcome and Introductions

Sarah Hubbard-Gray, the meeting facilitator, welcomed the committee members and asked everyone to introduce themselves.

Sarah provided a reminder about the CARA Review process and milestones. Then she explained that the goals of the meeting are to 1) provide an overview of the draft Tech Memo 4 and associated CARA recommendations, 2) gather feedback and input from the committee members, 3) provide an opportunity for discussion relating to the recommendations, and 4) prepare the committee members to provide written comments on draft Tech Memo 4 by Friday March 1st.

Sarah asked if there were any comments or clarification on the December 12, 2012 CARA Review Committee meeting summary. No comments were provided.

Overview of Draft Tech Memo 4: Nitrogen and Phosphorus Wastewater Loading Considerations, Review of Predictive Modeling/Tools Development, and Preliminary Recommendations for CARA Modification

Michael Kasch and Mike Murray provided an overview of Tech Memo 4. The presentation included information on:

- Purpose of the CARA Review project.
- Review of the study area.
- Recap of the project progression.
- Summary of the stakeholder input provided to date.
- Overview of the recommendations in draft Tech Memo 4 that combine the policy and regulations, science and data, and stakeholder input:
    - Recommending a three-level nitrogen and phosphorus process to be flexible and accommodate different site conditions and allow for different treatment levels.
    - Recommending a CARA Spreadsheet that uses data to assess hydraulic, nitrate and phosphorus loading (includes project input values, County values, hydraulic output values, nitrate output values, phosphorus output values, and assessment results).
    - Level 1 process incorporates set input values provided by a variety of maps and look-up tables with minor adjustments.
    - Level 2 process allows use of more detailed site specific information with documentation.
    - Level 3 process is a detailed site specific study and analysis.
    - Phosphorus assessment would be required in "Phosphorus Analysis Zones" where phosphorus in groundwater might be recharged to surface water. Rob Lindsay explained that these areas are being delineated by Spokane County.
    - Mike Hermanson explained that the recharge rate map is being updated by Spokane County using a new approach that will provide information relating to smaller geographic areas – more site-specific.

Perspectives on Predictive Modeling/Tools and CARA Modification Recommendations – Roundtable Discussion

During and after the presentations, a variety of questions and comments were provided by committee members and County staff, including:

- The method being used for the recharge rate map update was discussed. Mike Hermanson explained that different methods were considered and that the Modified Thornthwaite-Mather Soil-Water-Balance Code for Estimating Groundwater Recharge was chosen because it is an established method that requires data that is available for Spokane County.

- Questions were asked about the CARA Spreadsheet input values. Michael Kasch and Mike Murray provided more information and explained how more site specific information can be used with references and justification in the level 2 analysis.
- The accuracy of the depth to groundwater map was raised. It was explained that more site specific information can be used (e.g., from site well logs). It was explained that there were no plans to update the depth to groundwater map and that the need will be considered. Stan Miller explained how the map was developed and that the depth relates to the first usable water.
- The soil unit weight was discussed – it was explained that it is a dry unit weight and that there is more adsorption as the density goes up.
- It was asked if the phosphorus input value should be lower since Spokane County has laundry and dishwasher detergent bans. HDR will consider if lower values would be appropriate for the level 1 or level 2 analysis.
- Need to include accurate and up-to-date information in the look up tables. Committee members were asked to provide information they have to be included.
- It was asked if multi-family development outside the UGA should be required to perform the same analysis.
- It was asked if the draft CARA Spreadsheet could be available for review. The County agreed to provide the draft spreadsheet to committee members that requested it.
- It was suggested that a guidance document be developed.
- No concerns were raised about the 3 level approach and associated recommendations.

Discussion then turned to administrative related CARA update recommendations. Rob Lindsay explained that as the science and technical approach is being wrapped up, the County will begin drafting the CARA standard update with the technical approach and incorporate administrative recommendations (e.g., associated with land use changes, changes in loading, County review process). Rob explained that the County is interested in having the CARA Review Committee meet for two or three additional meetings to review the CARA standard language and administrative recommendations. Rob indicated that he hopes to have the final draft CARA standard update developed by mid-June 2013. After this time it would go to the County Planning Commission for their review and a formal public hearing process.

None of the committee members indicated concern about the extra meetings. However, it was recommended that the various agency representatives meet to discuss the CARA language and administrative recommendations separate from and before the CARA Review Committee to iron out details.

Next Steps

Sarah explained that:

- Written comments on draft Tech Memo 4 are due by Friday March 1, 2013. Comments should be sent to Rob Lindsay.

- Suggestions related to the administrative CARA standard recommendations should be sent to Rob Lindsay by Friday March 1, 2013. They will be considered as the draft standard is written, along with responses to the CARA Survey.
- HDR's draft final report on the technical approach, that incorporates the information from the draft tech memos and address the comments provided, will be posted two weeks before the next CARA Review Committee meeting. All committee members are asked to complete their review of the draft final report before the meeting, so final comments can be discussed.
- The County's draft CARA standard that incorporates the technical approach and administrative recommendations will be posted one week before the next CARA Review Committee meeting. All committee members are asked to complete their review of the draft standard before the meeting, so comments and suggestions can be discussed.
- The notice for the next CARA Review Committee meeting will be sent out at least three weeks before the meeting. It will be on a Wednesday in the afternoon, and may start at 1:00 pm to allow an extra hour for discussion of the administrative recommendations.