SECTION 14

REGIONAL WATER QUALITY PROTECTION PLAN

14.1 Introduction

The Caldwell County Regional Water Quality Protection Plan (CCRWQPP) identifies actions that will assist in preventing continuing degradation of groundwater and surface water quality within Caldwell County. Regional water quality measures are necessary to assist in maintaining healthy streams, preventing contamination of groundwater from surface sources and in support of efforts to improve the quality of water flowing in streams within the county.

Segments of Plum Creek, the major drainage Basin within Caldwell County, have experienced declining water quality with increasing nutrient concentrations, sediment loads and bacterial contamination. Stream segment 1810 of Plum Creek was listed in 2002 as an impaired stream segment in accordance the requirements of the Federal Clean Water Act, Section 303(d).

Measures presented in the CCRWQPP include structural and non-structural best management practices (BMPs) that can assist in reducing pollutant loads to streams in the county, assist in improving water quality in streams and assist in guarding against groundwater degradation.

14.2 Caldwell County Watersheds

As discussed in Section 2 of this Report, the streams that are included in the planning region receive discharge from the Guadalupe and Colorado River Basins. The Colorado River Basin receives approximately 11 percent of the drainage and the Guadalupe River Basin receives the remaining 89 percent. The sub-watersheds of the Guadalupe River Basin in the county include Plum Creek (59%), the San Marcos River (16%), and Peach Creek (14%).

14.3 Water Quality Concerns and Sources of Impairment

The constituents that threaten stream water quality in Caldwell County originate from several sources and have resulted in streams being classified as impaired because of the presence of excessive bacteria, concern with dissolved oxygen levels (DO), and high concentrations of total phosphorus, ortho-phosphate, and ammonia-nitrogen. Sources of these pollutants are as follows:

- Urbanization and Runoff – Urbanization almost always results in removal of vegetation that in turn reduces the natural filter processes performed by vegetation and increases soil erosion from caused by larger peak runoff rates and volumes. Pollutants from human activity, pet waste and natural processes reach drains, storm sewers and streams without the benefit of vegetative filtering.

- Livestock and Wildlife – Animal waste deposited in or near waterways can contribute significant pollutant loading to streams. Feral hogs, deer, sheep, goats, horses, cattle, chickens, turkeys and ducks are potential significant pollutant sources in Caldwell County.

- On-Site Sewage Facilities (OSSF) – Improperly designed or installed, leaking and/or failing OSSF facilities can add significant pollutant loading to streams and groundwater. Bacteria from OSSF systems can reach drinking water sources and have severe and life-threatening impacts to human health.

- Wastewater Treatment Facilities – Improperly designed, constructed and/or operated wastewater collection and treatment facilities can result in leaks, overflows and/or discharges to drains, storm sewers and streams that can add significant pollutant loads to natural water bodies.

- Agricultural Practices – Improper and poor agricultural practices can significantly increase sediment, nutrient, organic, bacterial and/or chemical loading to streams. Over-fertilization is an example of a poor practice that can increase nutrient loads and increase production cost without a commensurate return on investment.

- Oil and Gas Production – Brine leakage, nitrogen compounds, salts, and hydrocarbons (petroleum byproducts) can leak to waterways and result in diminished water quality and decrease the quality of the aquatic habitat.

- Solid Waste Sources – Solid waste (such as used tires, home appliances and construction debris) that is improperly disposed of in drainageways and streams add to pollutant loads and can degrade aquatic habitat, stream functions and visual appearance.

- Natural Geological Characteristics – Naturally occurring geological formations can contribute nutrients and other pollutants to water passing through the formation. The nutrient and pollutant loads can impair groundwater quality and surface water quality where groundwater discharges to streams.

The CCRWQPP addresses the potential pollutant sources and recommends BMPs that will reduce the impact of the various pollutant sources. Deployment of the BMPs may be an iterative process to meet pollutant goal removal. Monitoring will be necessary to determine the effectiveness of the management measures.

14.4 Water Quality Standards

Water quality standards established by TCEQ and Environmental Protection Agency (EPA) are used to define the acceptability and suitability of water for various uses including such uses as drinking water, water in streams and wastewater plant return flows. The standards are defined using chemical, biological and physical parameters.

The stream water quality standards for contact recreational waters in Texas include the following provisions for bacteria:

- the geometric mean of samples tested for E.coli should not exceed 126 colony-forming units per 100 milliliters (CFU/100mL)
- the geometric mean of samples tested for fecal coliform should not exceed 200 CFU/100ml fecal coliform
- For grab samples, not more than 25% of the samples tested for E.coli can exceed 394 CFU/100ml
- For grab samples, not more than 25% of the samples tested for fecal coliform can exceed 400 CFU/100ml

If a tested water body does not meet these standards, it can be classified as an impaired water body for bacteria.

For segments of stream where a high level of aquatic life is desired, the following water quality parameters are recommended:

- DO equal to or more than 5.0 mg/L
- pH in the range of 6.5 to 9.0
- Temperature not greater than 90º F

Water quality parameters used to evaluate drinking water for public water supplies include the following secondary criteria:

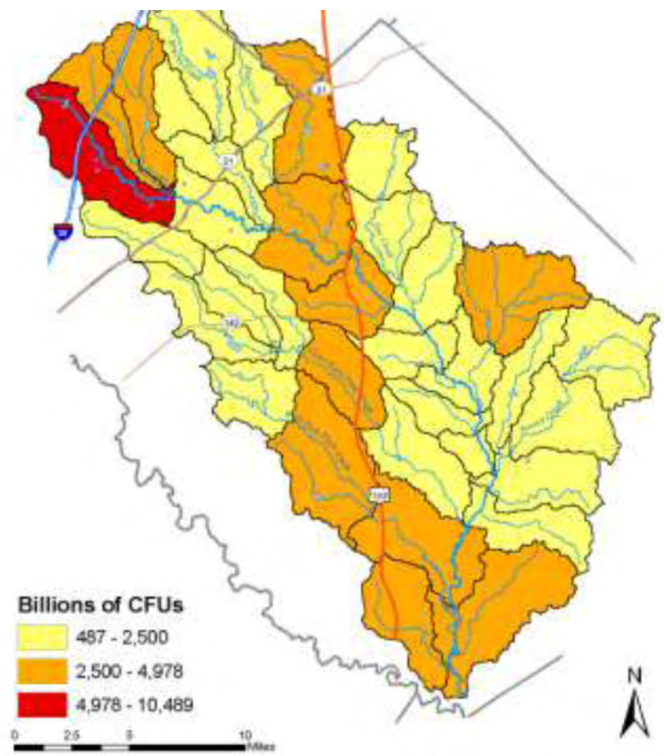
- Chloride not more than 300 mg/L
- Sulfate not more than 300 mg/L
- Total Dissolved Solids not more than 1000 mg/L

14.5 Impairment Locations

Through SELECT modeling in the Plum Creek WPP, subwatersheds were identified that have the greatest potential to contribute specific pollutant parameters. For example, in ***Exhibit 14-1*** E.coli was identified to have the potential to contribute the specified amounts in Billions of CFUs in the delineated watersheds. The E.coli loads were based on average bacteria production rates and the concentration of a source within a subwatershed. The exhibit is taken from the Plum Creek WPP and illustrates one of many parameters analyzed for Daily Potential Loads.

Exhibit 14-1

Total Average Daily Potential E.coli Load



Source: Plum Creek Watershed Protection Plan

14.6 Recommended Load Reductions

Load Duration Curves in the Plum Creek WPP, prepared by the Texas AgriLife Extension Service, indicate both point and non-point pollution sources should be reduced. Water quantity and quality monitoring stations at Lockhart and Luling provided flows and water quality data used to compute existing pollutant loads. The recommended allowable pollutant loads were subtracted from the existing loads to determine the load reduction required. The recommended pollutant load reductions as a percentage of existing loads are shown in ***Table 14-1.***

TABLE 14-1
Pollution Reduction Needed

Location	Parameter		
	E.coli Bacteria	Phosphorus	Nitrate
Lockhart	65%	27%	43%
Luling	15%	49%	80%

14.7 Proposed Management Measures

The proposed management measures identified in the Plum Creek WPP are specific to Plum Creek but can be implemented in parts of the county that are not within the Plum Creek Watershed. The measures are intended to reduce bacterial loads but will also influence the reduction in nutrient loads. Nutrient loads associated from urban landscaping and cropland will also be addressed. Additionally, management measures will also focus on the reduction of phosphorus loads.

Naturally occurring nitrate in groundwater has been reported to discharge into Plum Creek and create impaired water quality conditions (nitrate concentrations exceed desired limits). Management efforts directed at nitrates should be focused on ensuring that additional nitrates from non-groundwater sources are not added to streams and measures are implemented to prevent further increases in nitrate concentrations in groundwater.

14.7.1 Urban Stormwater Management Measures

A workgroup from the Plum Creek WPP specified implementation goals and placed emphasis on programs consistent with Municipal Separate Storm Sewer System (MS4) requirements. **Appendix I** lists the city specific measures to be implemented in Lockhart and Luling.

A study, "Predicting Effect of Urban Development on Water Quality in the Cities of New Braunfels, San Marcos, Seguin and Victoria" was completed in November 2000 by PBSJ. The study developed a series of equations to predict the impact of impervious cover on concentrations of four water quality parameters in stormwater runoff. These formulas may be useful in predicting water quality impacts from the construction of impervious cover in watersheds and assist in determining pollutant removal required as part of a construction permit.

The formulas are:

Total Suspended Solids in mg/L, TSS: TSS = 10^(2.41+(0.0149 IC))
Total Nitrogen in mg/L, TN: TN = 1.08+(0.0564* IC)
Total Phosphorus in mg/L, TP: TP = 0.0231*IC
Fecal Coliform, FC in CFU/100mL: FC = 10^(4.0+(0.0229* IC))

Where IC is impervious cover expressed as a percentage, ^ is the symbol for exponential and * is the symbol for multiplication.

It should be noted that the calculated concentration is an "Event Mean Concentration" (EMC) which is defined as a flow-weighted average. The EMC is used because the concentration of any parameter varies greatly in a storm event as the hydrograph rises (the first flush event), crests and falls in the trailing limb of the hydrograph.

14.7.2 Water Quality Development Ordinances and Policy

Several water quality guidelines can be implemented at the local level to effectively control non-point source pollution and point source pollution. Local governments have a responsibility to the community to develop sound and practical policies that will improve the quality of life. The uneducated, uninformed, and unwilling require nudges to comply. Growing and developing cities have an opportunity to guide, plan, and manage growth. Policies and procedures recommended to provide water quality protection and are not limited to:

- Buffer Ordinances
- Open/ Natural Space Conservation
- Tree Ordinance
- Zoning Ordinances
- BMP Ordinances
- Stringent OSSF Ordinances

These water quality ordinances and policy practices can be accomplished through the development and implementation of a Master Plan for the City that clearly defines buffer areas and open space conservation that protects natural areas. Widths of buffers can be based on contributing drainage areas and their location relative to a stream centerline. The plan should also define development practices through zoning requirements and provide guidance on tree protection and preservation.

Providing comprehensive site planning and pre-development reviews can ensure compliance and the review of water quality measures being incorporated into the design of the site. The preliminary reviews should demonstrate the technical elements that support the operation and maintenance of the water quality measures.

14.8 Structural BMPs for Discharges from Developed Land

Discharges from developed land can be managed through the implementation of structural BMPs. Structural BMPs that can offset the impact of development on water quality can include:

- Infiltration Systems
- Detention/ Sedimentation Basins
- Vegetative Filter Strips
- Vegetative Swales
- Riparian Buffers
- Rain Gardens

A long term operation and maintenance plan should be included in the design and construction of the BMPs. Funding and maintenance schedules should also be included prior to approval of construction.

14.8.1 Infiltration Systems

Infiltration systems are designed to filter out particulates as water percolates through the soil, infiltrating the ground over some area and period of time. Infiltration systems include porous pavement, infiltration basins and trenches. Due to the removal efficiency and potential for migration, this system may not be appropriate over ground water sources.

14.8.2 Detention/ Sedimentation Basins

Detention/Sedimentation Basins are utilized to capture storm water and are effective at removing suspended constituents such as sediment. They can remove up to approximately 80% of suspended solids.

14.8.3 Vegetative Filter Strips

Vegetative filter strips are land areas that are designed to treat stormwater for the purpose of removing sediment and other pollutants. The strips are effective in shallow sheet flow. For concentrated flow, design measures should be taken to distribute the flow and dissipate energy and reduce flow velocity. Vegetative filter strips generally remove suspended particulates and limited dissolved constituents. Vegetated filter strips should be used in series with other BMPs

14.8.4 Vegetative Swales

Grassy swales are vegetated channels that convey stormwater and remove pollutants by filtering, settlement and infiltration through soil. They require shallow slopes and soils that drain well and are limited to light and moderate flows. The swales can be easily integrated into landscaping plans. The placement of these swales along roadside ditches has proven to be effective.

14.8.5 Riparian Buffers

Riparian forest buffers combine trees, shrubs, and native grasses to remove sediment and chemicals from runoff before they reach a waterway. The width of the buffer strips can vary from 35-100 feet depending on slope, soil type, adjacent land use, floodplain, and type of vegetation. The buffers, once established need to be maintained and monitored yearly to remain effective.

14.8.6 Rain Gardens

Rain gardens are man-made depressions in the ground that forms a small bioretention area. The landscaping of the area improves the water quality by filtering the water that is slowly absorbed by the soil. These gardens are functional when placed strategically to intercept water runoff. Placement of these gardens in new proposed development can be accomplished cost-effectively. The rain garden will add value to the home as well as providing a water quality measure.

14.9 Agricultural Best Management Practices

In 1998, the national water quality inventory indicated that 59% of the impaired river miles were a result of agriculture that included crop production, animal operations, and pastures and rangeland. Many agricultural producers are unaware of the practices that may cause impairment to water quality and may require assistance to implement the recommended practices. The following recommendations are presented to assist in reducing the impacts of livestock operations on water quality:

- Utilize rotational grazing – assists in reducing soil erosion
- Develop off-stream water sources for livestock – helps develop and maintain healthy riparian vegetation that filters nutrients and sediment
- Composting of solids – use methods that prevent leaching of fluids or produce runoff to streams
- Accumulate and store manure appropriately – store away from ditches and streams; kept covered to prevent leaching of bacteria and nutrients
- Protect water supply sources - locate wells upgradient from confinement areas
- Plant and maintain buffer zone vegetation - use buffer areas around manure storage and along drainageways and streams
- Armor heavy use areas - use armoring materials to prevent soil erosion in heavily used areas
- Use livestock fences– prevent overgrazing and protect riparian buffers
- Use anaerobic digestion of waste to recover energy

- Use constructed wetlands to capture and treat runoff
- Use bio-filtration to control odor, gas, and dust emissions from facilities
- Use sequencing batch reactor for nitrogen management – nitrogen removal
- Protect groundwater sources from contaminated water sources by installing liners to protect groundwater and allow water to evaporate

Recommendations for crop operations to improve water quality include:

- Use crop rotation to reduce soil loss and prevent nutrient depletion
- Control sediment using straw mulch to reduce erosion and prevent nutrient loss
- Plant streamside buffers to reduces nutrient pollution into streams
- Manage manure and nutrient applications so they are evenly applied as needed by crop type
- Apply fertilizers and chemicals in accordance with soil and plant needs to prevent excess nutrients and chemicals being washed into streams or percolating to groundwater
- Test manure to assist in establishing appropriate levels of manure application and guide fertilizer applications
- Test soils to prevent over application of nutrients
- Schedule irrigation based on crop needs, soil type, climate, topography, and infiltration rates to reduce run-off caused by over-watering

Assessments of the current practices in the county should be identified through survey mailings and questionnaires. Identification of the agricultural practices will determine the needs of the area and assist in developing guides to assist farmers and crop producers.

14.10 Public Education/ Outreach

Public involvement facilitates interest and education while spreading the word. As citizens become informed and educated about the community initiatives they are more likely to participate and volunteer in programs. Public awareness and acceptance are crucial for the political and financial sustainability of water quality programs and efforts by local governments. Specific public education efforts include:

TV Commercials	Newspaper prints
Flyers	Poster Contest
Brochures	Photo Contest
Essay Contest	Billboard Announcements
Workshops	HOA Newsletters
Adopt-a-Stream	Stream Plantings

14.11 Municipal Practices and Good Housekeeping

Activities and efforts by municipalities to participate in pollution prevention and good housekeeping are:

- Municipal Training and Education
- Parking Lot and Street Cleaning
- Municipal Landscaping
- Roadway Maintenance
- Spill Response and Prevention
- Hazardous Waste Pick-up and Drop-off days

The proactive efforts in establishing good housekeeping policies contribute to maintaining healthy streams and rivers by preventing pollution that would otherwise reach our waters.

14.12 Implementation Recommendations for the CCRWQPP

The following elements are recommended for implementation in Caldwell County to assist in improvement of existing water quality in degraded streams and prevent water quality degradation of streams in the future:

- Point Discharge Load Reductions
- Stormwater Filter Strips Along Streams
- Water Quality Remediation Associated with Impervious Cover Installation
- OSSF Inspection and Certification

14.12.1 Point Discharge Load Reductions

Wastewater treatment plant discharges represent a continuous point source of pollutants discharging into streams. Two practices can materially impact the pollutant discharge loading to streams. Producing "higher" quality of water for discharge will reduce loading and implementing reuse of reclaimed water can reduce loading.

Higher quality of discharge water refers to improving the treatment processes within a treatment plant to remove additional pollutants before the treated water is discharged to the stream. The effluent pollutant limits for wastewater treatment plants are established in permits issued by the TCEQ and based on the quality of the discharge and its impact on the receiving waters. The permits consider the ability of the stream to assimilate the pollutants discharged into it without lowering the water quality in the stream below the standards established for the reaches of stream below the outfall.

The larger wastewater treatment plants in the county are operated by the City of Lockhart and the City of Luling. The total existing plant capacity for Lockhart is 2.6 mgd and for Luling it is 1.4 mgd.

The existing wastewater treatment plant discharge parameters for these plants are shown in ***Table 14-2***:

Table 14-2				
Wastewater Treatment Plant Permit Parameters				
Parameter	**Lockhart Plant 1**	**Lockhart Plant 2**	**Luling Plant 1**	**Luling Plant 2**
Permitted Flow Capacity, mgd	1.1	1.5	0.5	0.9
BOD_5, mg/l	-	-	20	-
$CBOD_5$, mg/l	10	10	-	10
NH^3 as N, mg/l	3	3	-	3
Dissolved Oxygen, mg/l	4	5	2	5
Total Suspended Solids, mg/l	15	15	20	15

As the quality of discharge from wastewater treatment plants is raised to a higher standard, it becomes cost effective to implement water reclamation and a water reuse program. The following explanations provide information regarding implementation of a water use program.

Water reuse is the beneficial use of reclaimed water. Examples of water reuse include irrigation, cooling, or washing.

Reclaimed water is domestic or municipal wastewater which has been treated to a quality suitable for beneficial use.

Reclaimed water is not the same as ***greywater*** which is untreated, non-toilet, and household water including water from sinks, showers, and baths.

Type I reclaimed water is defined as use of reclaimed water where contact between humans and the reclaimed water is likely. Examples include landscape irrigation at individual homes or on public golf courses, fire protection, toilet or urinal flushing, and irrigation of pastures for milking animals.

Type II reclaimed water is defined as reclaimed water where contact between humans and the water is unlikely. Examples of Type II use include dust control, cooling tower applications, irrigation of food crops where the reclaimed water is not expected to come in direct contact with the edible part of the crop, and maintenance of impoundments or natural water bodies where direct human contact is not likely.

Direct use means the beneficial use of reclaimed water that has been transported from the point of production to the point of use without intervening discharge to waters of the state.

Indirect use means the beneficial use of reclaimed water that has been transported from the point of production to the point of use with an intervening discharge to waters of the state.

Bed and Banks Permit refers to authorization from the State of Texas to discharge water to waters of the state and subsequently recover that water at a downstream point. Water moved under a bed and banks permit cannot degrade the quality of water in the state waters, must not impact existing water rights, must not negatively impact instream uses, aquatic or riparian habitats or freshwater flows to bays and estuaries.

The use of reclaimed water in Texas is governed by TCEQ Chapter 210 (Use of Reclaimed Water) which provides for the quality criteria, design, and operational requirements for the beneficial use of reclaimed water.

Benefits of using reclaimed water include:

- The water is less expensive to use or to treat and users benefit from the savings
- It is a drought-proof source of water

- It is a source of water that automatically increases with increased economic activity and population growth
- It conserves traditional sources of water such as groundwater and surface water.

Disadvantages of using reclaimed water include:

- Water reuse may be seasonal in nature and can result in the overloading of treatment and disposal facilities during off seasons
- Reclaiming wastewater for reuse requires a treatment system which could result in higher initial costs
- Public acceptance of what some may consider as "dirty water" may be hard to overcome
- The end use for the reclaimed water can be located at a distance from the source and require a conveyance and distribution system that adds to the cost of the reclaimed water

If the wastewater plants produce Type I reclaimed water for reuse, the discharge parameters would be as follows in ***Table 14-3***:

Table 14-3
Reclaimed Water Quality Parameters

Parameter	Type I Reclaimed Water	Type II Reclaimed Water
BOD_5	5 mg/l	20 mg/l
$CBOD_5$	5 mg/l	15 mg/l
Turbidity	3 NTU	No Requirement
Fecal Coliform	20 CFU/100 ml*	200 CFU/100 ml*
Fecal Coliform (not to exceed)	75 CFU/100 ml**	800 CFU/100 ml**

* geometric mean
** single grab sample

Pollutant loading to streams from existing and future wastewater treatment plants can be meaningfully reduced and minimized by implementing two practices. These are:

- Renovate existing wastewater treatment plants and construct future wastewater treatment plants to produce and discharge effluent that has less pollutant load
- Produce reclaimed water that can be diverted for reuse away from streams

Renovating existing treatment plants to produce higher quality effluent can reduce pollutant loading for organic loading, nutrient loading and bacterial loading. If a goal is established for treatment plants to produce Type I reclaimed water, pollutants loads can be reduced as illustrated in Table ***14-4***. If reuse of reclaimed water is implemented, there will be additional reductions in pollutant loading to streams. ***Table 14-5*** illustrates the load reductions if the existing treatment plants are upgraded and 50 percent of the reclaimed water is reused and the remaining 50 percent is discharged to streams.

Table 14-4
Annual Pollutant Load to Streams for Upgraded Existing Wastewater Treatment Plants

Plant	Permitted Flow Capacity, mgd		$CBOD_5$, pounds per year		Total Suspended Solids, pounds per year		NH^3 as N, pounds per year	
	Existing	Upgraded	Existing 10 mg/l	Upgraded 5 mg/l	Existing 15 mg/l	Upgraded 5 mg/l	Existing 3 mg/l	Upgraded 2 mg/l
Lockhart 1	1.1	1.1	33,503	16,751	50,254	16,751	10,051	6,701
Lockhart 2	1.5	1.5	45,685	22,843	68,528	22,843	13,706	9,137
Luling 1	0.5	0.5	30,457*	7,614	30,457**	7,614	4,569***	3,046
Luling 2	0.9	0.9	27,411	13,706	41,117	13,706	8,223	5,482
Total	4	4	137,056	60,914	190,356	60,914	36,549	24,366

**Based on 20 mg/l for BOD_5
** Based on 20 mg/l for Total Suspended Solids
*** Based on 3 mg/l for NH^3 as N, permit has no limit

The pollutant load reduction from the upgrade of existing treatment plants for the shown parameters would be:

- $CBOD_5$ or BOD5 (with 5 mg/l as limit): 76,412 pounds per year
- Total Suspended Solids (with 5 mg/l as limit): 129,442 pounds per year
- NH^3 as N (with 2 mg/l as limit): 12,183 pounds per year

Table 14-5
Annual Pollutant Load to Streams for Upgraded Existing Wastewater Treatment Plants with 50 Percent Reuse of Reclaimed Water

Plant	Permitted Flow Capacity, mgd		$CBOD_5$, pounds per year		Total Suspended Solids, pounds per year		NH^3 as N, pounds per year	
	Existing	Upgraded with Reuse	Existing 10 mg/l	Upgraded 5 mg/l with Reuse	Existing 15 mg/l	Upgraded 5 mg/l with Reuse	Existing 3 mg/l	Upgraded 2 mg/l with Reuse
Lockhart 1	1.1	0.55	33,503	8,376	50,254	8,376	10,051	3,350
Lockhart 2	1.5	0.75	45,685	11,421	68,528	11,421	13,706	4,569
Luling 1	0.5	0.25	30,457*	3,807	30,457**	3,807	4,569***	1,523
Luling 2	0.45	0.9	27,411	6,853	41,117	6,853	8,223	2,741
Total	4	2	137,056	30,457	190,356	30,457	36,549	12,183

**Based on 20 mg/l for BOD_5
** Based on 20 mg/l for Total Suspended Solids
*** Based on 3 mg/l for NH^3 as N, permit has no limit

The pollutant load reduction from the upgrade of existing treatment plants and implementing reuse of 50 percent of the reclaimed water for the shown parameters would be:

- $CBOD_5$ or BOD5 (with 5 mg/l as limit): 106,599 pounds per year
- Total Suspended Solids (with 5 mg/l as limit): 159,899 pounds per year
- NH^3 as N (with 2 mg/l as limit): 24,366 pounds per year

Future growth in Caldwell County will increase wastewater production to an estimated 10.2 mgd. If 70 percent of the wastewater is treated by regional wastewater treatment plants, the volume of wastewater produced will be 7.1 mgd. If 50 percent of the reclaimed water is reused, the wastewater to be discharged to streams will be 3.6 mgd. If Type I reclaimed water is produced, the future pollutant loading will be less than the current loading. Table ***14-6*** illustrates this comparison.

Table 14-6
Comparison of Future Changes to Annual Pollutant Load to Streams

Year	Portion of Permitted Flow Discharged to Streams, mgd	$CBOD_5$, pounds per year	Total Suspended Solids, pounds per year	NH^3 as N, pounds per year
2010*	4	137,056	190,356	36,549
2040**	3.6	54,822	54,822	21,929
Difference	0.4	82,234	135,534	14,620

* Based on existing discharge pollutant limits
** Based on Type I Reclaimed Water and 50 % reuse of reclaimed water

14.12.2 Stormwater Filter Strips Along Streams

Stormwater runoff produces significant pollutant loading for streams in Caldwell County. Vegetated filter strips adjacent to streams can provide significant stormwater treatment as overland flow passes through the filter strips.

It is recommended that entities in Caldwell County that have regulatory authority implement requirements for filter strips adjacent to streams. The filter strips should be on each side of the stream with the width of the filter strip being measured from the top of bank for the stream. The recommended filter strips widths are presented in ***Table 14-7***.

Table 14-7 Vegetated Filter Strip Width Requirements	
Drainage Area of Stream at Design Point, Acres	Filter Strip Width, Feet
0 to 10	10
>10 to 100	25
>100	50

14.12.3 Water Quality Remediation Associated with Impervious Cover Installation

Increased stormwater runoff associated with installation of impervious cover results in increased pollutant loading associated with the stormwater. Capturing and filtering the "first-flush" runoff can significantly reduce pollutant loads. In addition, development rules that encourage limited impervious cover on tracts should be utilized.

It is recommended that entities in Caldwell County (those that have regulatory authority) implement requirements for limited impervious cover on tracts and requirements to capture and filter first flush runoff. The recommended impervious cover limits and filter requirements are presented in ***Table 14-8***.

Table 14-8 Impervious Cover Filtration Requirements	
Impervious Cover Percentage	Volume of Water to Be Filtered, Inches
0 to 20	0.00
>20 to 50	0.50
>50 to 80	0.75
>80 to 100	1.00

14.12.4 OSSF Annual Inspection and Certification

Failed OSSFs can be significant sources of bacteria and other pollutants for streams. In addition, improperly constructed, operated and/or maintained OSSFs can be contributors to bacteria and pollutants in streams.

Each entity responsible for permitting OSSFs should implement inspection and recertification programs. The frequency of inspection and recertification should be based the type of facility being served by each OSSF. ***Table 14-9*** presents the recommended program.

Table 14-9

Frequency of OSSF Inspection and Recertification Program

Type of System	Frequency of Self Inspection with Report to Regulatory Entity, years	Recertification by Regulatory Entity, years
Single Family Residential	2	5
Multiple Family Units	1	3
Commercial	1	3
Other	Established at Permitting	Established at Permitting