United States
Department of
Agriculture

Natural
Resources
Conservation
Service

Nolan River
Watershed Plan and Environmental Assessment

Johnson County, Texas

PREPARED BY:

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
PLANNING STAFF
TEMPLE, TEXAS

IN COOPERATION WITH:

JOHNSON COUNTY SOIL AND WATER CONSERVATION DISTRICT
AND
CITY OF CLEBURNE, TEXAS

FEBRUARY 1995

Watershed Plan and Environmental Assessment

Nolan River Watershed

Johnson County, Texas
February 1995

Abstract

Nolan River Watershed Plan and Environmental Assessment is a 10-year local project to improve and protect surface water quality in and below a 64,000 acre watershed by managing animal waste pollutants from 29 dairies.

The installed project will improve and protect water quality in a 25,320 acre-foot municipal and industrial reservoir (Lake Pat Cleburne), 425 farm ponds and 53 miles of stream channels. Health hazards from contaminated water will be reduced and recreational and social uses of the environment will be enhanced. Aquatic wildlife habitat will be improved. Declining real estate values will stabilize due to more desirable esthetic attributes.

The Johnson County Soil and Water Conservation District and the city of Cleburne are the local sponsoring organizations. Through a memorandum of understanding with the soil and water conservation district, the Natural Resources Conservation Service, United States Department of Agriculture will furnish technical assistance in designing and implementing animal waste management systems and associated land treatment practices.

Financial and cost-share assistance for project installation will be provided under the authority of Public Law 83-566, 83rd Congress, 68 Stat. 666, as amended. Estimated project installation costs are $1,924,650. Federal cost-share will be $1,341,850 with local funding of $582,800. The benefit-cost ratio is 4:1.

WATERSHED AGREEMENT
Between the

Johnson County Soil and Water Conservation District
Local Organization

City of Cleburne
Local Organization

(hereinafter referred to as the Sponsors)

State of Texas

and the

Natural Resources Conservation Service
United States Department of Agriculture
(hereinafter referred to as NRCS)

Whereas, application has heretofore been made to the Secretary of Agriculture by the sponsors for assistance in preparing a plan for works of improvement for the Nolan River Watershed, State of Texas, under the authority of the Watershed Protection and Flood Prevention Act (16 U.S.C. 1001-1008); and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to NRCS; and

Whereas, there has been developed through the cooperative efforts of the sponsors and NRCS a plan for works of improvement for the Nolan River Watershed, State of Texas, hereinafter referred to as the Watershed Plan-Environmental Assessment, which plan is annexed to and made a part of this agreement;

Now, therefore, in view of the foregoing considerations, the Secretary of Agriculture, through NRCS, and the sponsors hereby agree on this plan and that the works of improvement for this project will be installed, operated, and maintained in accordance with the terms, conditions, and stipulations provided for in this watershed plan and including the following:

1. Cost-sharing rate for the establishment of enduring land treatment practices is 65 percent of the average cost of installing the enduring practices in the selected plan. The estimated total construction cost for enduring practices is $1,640,500. No practices in the selected plan are approved for incentive payment.

2. The landowners or operators will obtain all necessary Federal, State, and local permits required by law, ordinance, or regulation for installation of the works of improvement.

3. The NRCS will assist the sponsors in providing technical assistance to landowners or operators to plan and install practices shown in the plan. The NRCS will bear 100 percent of the technical assistance costs. Estimated technical assistance costs are $238,250.

4. The sponsors will obtain applications from owners and operators of not less than 10 percent of the dairies eligible to participate in the project indicating that they will carry out the planned land treatment measures. Applications will be obtained before the first long-term contract is executed.

5. The sponsors and NRCS will each bear the costs of project administration that each incurs, estimated to be $8,600 and $37,300, respectively.

6. The sponsors will provide assistance to landowners and operators to ensure the installation of the land treatment measures shown in the watershed plan.

7. The sponsors will obtain agreements with landowners or operators to operate and maintain the planned practices for the protection and improvement of the watershed.

8. The costs shown in this plan are preliminary estimates. Final costs, to be borne by the parties hereto, for payment determinations will be the actual costs not to exceed average costs, or an approved variation.

9. This agreement is not a fund obligating document. Financial and other assistance to be furnished by NRCS in carrying out the plan is contingent upon the fulfillment of applicable laws and regulations and the availability of appropriations for this purpose.

10. A separate agreement (long-term contract) will be entered into between NRCS and landowners or operators before either party initiates work involving funds of the other party. Such agreements will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

11. This plan may be amended or revised only by mutual agreement of the parties hereto, except that NRCS may deauthorize or terminate funding at any time it determine that the sponsor has failed to comply with the conditions of this agreement. In this case, NRCS shall promptly notify the sponsors in writing of the determination and the reasons for the deauthorization of project funding, together with the effective date. Payments made to the sponsors or recoveries

by NRCS shall be in accord with the legal rights and liabilities of the parties when project funding has been deauthorized. An amendment to incorporate changes affecting a specific measure may be made by mutual agreement between NRCS and the sponsors having specific responsibilities for the measure involved.

12. No member of or delegate to Congress, or resident commissioner, shall be admitted to any share or part of this plan, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.

13. The program conducted will be in compliance with the nondiscrimination provisions as contained in Titles VI and VII of the Civil Rights Act of 1964, as amended, the Civil Rights Restoration Act of 1987 (Public Law 100-259) and other nondiscrimination statutes, namely, Section 504 of the Rehabilitation Act of 1973, Title IX of the Education Amendments of 1972, the Age Discrimination Act of 1975, and in accordance with regulations of the Secretary of Agriculture (7 C.F.R. 15, Subparts A & B), which provide that no person in the United States shall, on the grounds of race, color, national origin, age, sex, religion, marital status, or handicap be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any program or activity receiving Federal financial assistance from the Department of Agriculture or any agency thereof.

14. Certification Regarding Drug-Free Workplace Requirements (7 CFR 3017, Subpart F).

By signing this watershed agreement, the sponsors are providing the certification set out below. If it is later determined that the sponsors knowingly rendered a false certification, or otherwise violated the requirements of the Drug-Free Workplace Act, the NRCS, in addition to any other remedies available to the Federal Government, may take action authorized under the Drug-Free Workplace Act.

Controlled substance means a controlled substance in Schedules I through V of the Controlled Substances Act (21 U.S.C. 812) and as further defined by regulation (21 CFR 1308.11 through 1308.15);

Conviction means a finding of (including a plea of nolo contendere) or imposition of sentence, or both, by any judicial body charged with the responsibility to determine violations of the Federal or State criminal drug statues;

Criminal drug statute means a Federal or non-Federal criminal statute involving the manufacturing, distribution, dispensing, use, or possession of any controlled substance;

Employee means the employee of a grantee directly engaged in the performance of work under a grant, including: (i) all direct charge employees; (ii) all indirect charge employees unless their impact or involvement is insignificant to the performance of the grant; and, (iii) temporary personnel and consultants who are directly engaged in the performance of work under the grant and who are on the grantee's payroll. This definition does not include workers not on the payroll of the grantee (e.g., volunteers, even if used to meet a matching requirement; consultants or independent contractors not on the grantees' payroll; or employees of subrecipients or subcontractors in covered workplaces).

Certification:

A. The sponsors certify that they will or will continue to provide a drug-free workplace by:

(1) Publishing a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession, or use of a controlled substance is prohibited in the grantee's workplace and specifying the actions that will be taken against employees for violation of such prohibition;

(2) Establishing an ongoing drug-free awareness program to inform employees about--

(a) The danger of drug abuse in the workplace;

(b) The grantee's policy of maintaining a drug-free workplace;

(c) Any available drug counseling, rehabilitation, and employee assistance programs; and

(d) the penalties that may be imposed upon employees for drug abuse violations occurring in the workplace.

(3) Making it a requirement that each employee to be engaged in the performance of the grant be given a copy of the statement required by paragraph (1);

(4) Notifying the employee in the statement required by paragraph (1) that, as a condition of employment under the grant, the employee will--

(a) Abide by the terms of the statement; and

(b) Notify the employer in writing of his or her conviction for a violation of a criminal drug statute occurring in the workplace no later than five calendar days after such conviction;

(5) Notifying the NRCS in writing, within ten calendar days after receiving notice under paragraph (4)(b) from an employee or otherwise receiving actual notice of such conviction. Employers of convicted employees must provide notice, including position title, to every grant officer or other designee on whose grant activity the convicted employee was working, unless the Federal agency has designated a central point for the receipt of such notices. Notice shall include the identification number(s) of each affected grant;

(6) Taking one of the following actions, within 30 calendar days of receiving notice under paragraph (4)(b), with respect to any employee who is so convicted--

(a) Taking appropriate personnel action against such an employee, up to and including termination, consistent with the requirements of the Rehabilitation Act of 1973, as amended; or

(b) Requiring such employee to participate satisfactorily in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State, or local health, law enforcement, or other appropriate agency.

(7) Making a good faith effort to continue to maintain a drug-free workplace through implementation of paragraphs (1), (2), (3), (4), (5), and (6)

B. The sponsors may provide a list of the site(s) for the performance of work done in connection with a specific project or other agreement.

C. Agencies shall keep the original of all disclosure reports in the official files of the agency.

15. Certification Regarding Lobbying (7 CFR 3018)

(1) The sponsors certify to the best of their knowledge and belief, that:

(a) No Federal appropriated funds have been paid or will be paid, by or on behalf of the sponsors, to any person for influencing or attempting to influence an officer or employee of an agency, member of Congress, an officer or employee of Congress, or an employee of a member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(b) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a member of Congress, an officer or employee of Congress, or an employee of a member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

(c) The sponsors shall require that the language of this certification be included in the award documents for all subawards at all tiers (including subcontracts, subgrants, and contracts under grants, loans, and cooperative agreements) and that all subrecipients shall certify and disclose accordingly.

(2) This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by Section 1352, Title 31, U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

16. Certification Regarding Debarment, Suspension, and Other Responsibility Matters - Primary Covered Transactions (7 CFR 3017).

(1) The sponsors certify to the best of their knowledge and belief, that they and their principals:

(a) Are not presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from covered transactions by any Federal department or agency;

(b) Have not within a three-year period preceding this proposal been convicted of or had a civil judgment rendered against them for commission of fraud or a criminal offense in connection with obtaining, attempting to obtain, or performing a public (Federal, State, or local) transaction or contract under a public transaction; violation of Federal or State antitrust statutes or commission of embezzlement, theft, forgery, bribery, falsification or destruction of records, making false statements, or receiving stolen property;

(c) Are not presently indicted for or otherwise criminally or civilly charged by a governmental entity (Federal, State, or local) with commission of any of the

offenses enumerated in paragraph (1)(b) of this certification; and

(d) Have not within a three-year period preceding this application/proposal had one or more public transactions (Federal, State, or local) terminated for cause or default.

(2) Where the primary sponsors are unable to certify to any of the statements in this certification, such prospective participant shall attach an explanation to this agreement.

Johnson County Soil and Water Conservation District
Local Organization

By Floyd C. Crumbly, III

Title Chairman

4-3-95
Date

The signing of this agreement was authorized by a resolution of the governing body of the Johnson County Soil and Water Conservation District adopted at a meeting held on 4-3-95.

Robert A. Fry
(Secretary, Local Organization)

City of Cleburne , Texas
Local Organization

By _____

Title City Manager

3/29/95
Date

The signing of this agreement was authorized by a resolution of the governing body of the City of Cleburne, Texas adopted at a meeting held on March 28 1995.

Jean Hamilton
(Secretary, Local Organization)

Natural Resources Conservation Service
United States Department of Agriculture

Approved By Harry W Oneth
Harry W. Oneth
State Conservationist

Date 4-11-95

Watershed Plan - Environmental Assessment

Nolan River Watershed, Texas

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CONVERSION FACTORS

English Units to Metric (SI) Units

ENGLISH UNIT	X	CONVERSION FACTOR	=	METRIC (SI) UNIT
Acres		0.4047		hectares
Acre-foot		1.234		cubic decameters
Inches		2.540		centimeters
Degrees Fahrenheit (F)		(F-32)0.5556		degrees Celsius
Feet		0.3048		meters
Gallons		3.785		liters
Miles		1.609		kilometers
Pounds		453.6		grams
Square Miles		2.590		sq. kilometers
Tons (short)		0.9072		megagrams
Tons/acre		2.242		megagrams/hectare

Common Anachronisms

ACP - Agricultural Conservation Program
ASCS - Agricultural Stabilization and Conservation Service
AWMS - Animal Waste Management System
BMP - Best Management Practice
BRA - Brazos River Authority
EPA - Environmental Protection Agency
FmHA - Farmers Home Administration
NRCS - Natural Resources Conservation Service
O&M - Operation and Management
PL-566 - Public Law 83-566
SCS - Soil Conservation Service (see NRCS)
SWCD - Soil and Water Conservation District
TAEX - Texas Agricultural Experiment Station
TDH - Texas Department of Health
TIAER - Texas Institute for Applied Environmental Research
TNRCC - Texas Natural Resource Conservation Commission
TSSWCB - Texas State Soil and Water Conservation Board
TWC - Texas Water Commission (see TNRCC)
USDA - United States Department of Agriculture
USDI - United States Department of Interior
WQMP - Water Quality Management Plan
WQRP - Water Quality Resource Plan

Watershed Plan - Environmental Assessment
for
Nolan River Watershed

Summary of Watershed Plan

Project Name: Nolan River Watershed
County: Johnson County
State: Texas
Sponsors: Johnson County Soil and Water Conservation District;
City of Cleburne, Texas

Description of Recommended Plan:

This plan will improve surface water quality in the watershed by eliminating the pollutant load from dairies for the 25-year frequency, 24-hour storm event. It will provide financial and technical assistance to install animal waste management systems (AWMS) and associated land treatment practices on 29 dairy farms. Implementation of plan measures will be accomplished through the Johnson County Soil and Water Conservation District. Project installation period is ten years.

Resource Information:

Size of watershed: 100 square miles (260 square kilometers)

Land Use:

Rangeland	32,900 acres	(13,310 hectares)
Pastureland	13,900 acres	(5,630 hectares)
Cropland	13,200 acres	(5,340 hectares)
Water	2,000 acres	(810 hectares)
Urban	2,400 acres	(970 hectares)

Land Ownership:

Private, 95 percent
Federal, State & City, 5 percent

Endangered Species:
Golden-cheeked warbler (*Dendroical chrysoparia*)

Cultural Resources:
None are expected to be disturbed.

Problem Identification:

Water quality in the Nolan River Watershed above Lake Pat Cleburne has become a widespread problem and concern of local

citizens, as well as state and federal agencies. Major resource problems are:

1. Potential impairment of water in Lake Pat Cleburne for municipal and industrial use.

2. Reduced domestic, recreational, and wildlife uses along 53 miles of stream, 425 farm ponds, and the upper reaches of Lake Pat Cleburne.

3. Environmental degradation of fisheries, aquatic habitat, wildlife habitat, and aesthetics in the watershed.

4. Current and potential curtailed recreational use of Lake Pat Cleburne.

5. Diminished land values within the watershed.

A Water Quality Resource Plan (WQRP) was developed by the NRCS in cooperation with the Johnson County SWCD and the city of Cleburne in September 1993. The WQRP identifies these water quality problems, their sources, and the treatment to solve the problems. Components of the WQRP consisted of technical assistance to install adequate AWMS's, water quality monitoring, enforcement of state and federal rules on waste disposal and discharge for both animal and human waste, golf course turf management, and a recycling and trash clean-up program.

The WQRP listed 36 dairies operating within the watershed producing approximately 240,000 tons of animal waste per year. Twenty-nine of these have inadequate AWMS. Public Law 83-566 Nolan River Watershed Plan and Environmental Assessment will provide the technical and financial assistance needed to install adequate animal waste management systems on these 29 dairies.

Alternative Plans Considered:

Alternative 1 - No action

Alternative 2 - Install 29 AWMS and associated land treatment measures

Project Purpose: This document describes a plan to protect and improve water quality in and below the watershed by assisting in a project to reduce the pollutant loading from animal waste.

Principal Project Measures: This project includes the design and installation of 29 animal waste management systems, and associated land treatment.

Project Costs:

Project Costs

	PL-566 Funds $	%	Other Funds $	%	Total $	%
AWMS	1,103,600	65	582,800	35	1,686,400	100
Technical Assistance	238,250	100	-0-	-0-	238,250	100
Total	1,341,850		582,800		1,924,650	

Average annual project costs are $262,000.

Project Benefits:

Average annual on-site benefits were estimated at $343,900. Public off-site average annual benefits are $739,200. Benefits exceed costs.

Environmental Impacts:

Reduce nutrients, bacteria and organic matter entering Lake Pat Cleburne and streams of the watershed.

Improve quality of recreational activities in and around Lake Pat Cleburne and streams of the watershed.

Prevent deterioration of the municipal and industrial water supply for the city of Cleburne.

Improve land values along the streams of the watershed.

Major Conclusion:

Implementation of the PL-566 Nolan River Watershed Plan, Nolan River WQRP, and Johnson County SWCD's ongoing conservation program, will solve the water quality problems in the watershed.

INTRODUCTION

Water quality has degraded in the Nolan River watershed during recent years. Water contamination problems have been documented through the Texas Natural Resource Conservation Commission (TNRCC) and the Texas State Soil and Water Conservation Board's (TSSWCB) Section 319 of the Clean Water Act assessment process. Water samples have been taken and fecal contamination has been documented in the watershed.

Nolan River watershed is located about 20 miles (32 kilometers) southwest of Fort Worth, Texas. The watershed is within the Brazos River Basin. The watershed drains into Lake Pat Cleburne. The lake provides municipal and industrial water for the city of Cleburne, population 26,000. The lake is also extensively used for recreation by residents of Johnson County and the surrounding vicinity.

The Sponsors for Nolan River Watershed Plan are Johnson County Soil and Water Conservation District (SWCD) and city of Cleburne. The SWCD is dedicated to solving resource problems, particularly those dealing with agricultural practices. Cleburne is concerned about water quality conditions because of the importance of Lake Pat Cleburne. These two entities have resolved to work with landowners, operators, and businessmen in the watershed, and state and federal agencies to implement a plan to reduce the impaired use of the resources.

The NRCS completed the WQRP in September 1993 in cooperation with the Sponsors for Nolan River Watershed to protect and preserve the soil, air, water, plant, animal, and related resources. In order to implement the animal waste management systems component of the WQRP, the Sponsors requested assistance from the NRCS for development of a PL-566 watershed plan.

The planning process for the WQRP identified watershed resources, impaired or potentially impaired uses of these resources, and sources of potential contamination to water and other related resources. Relative loadings from these sources were determined. The WQRP formulated and evaluated alternatives that will reduce the pollution load in Lake Pat Cleburne, Nolan River and it's tributaries.

Numerous meetings, field reviews, and interviews were held by Sponsors and NRCS to gain input from landowners and operators, the general public, and other local, state, and federal agencies concerning water quality and other concerns in the watershed.

Potential sources of contamination in the watershed include an estimated 8,000 head of confined dairy cattle, a soil

enrichment site, 2,500 private sewage facilities (septic tanks), a manure composting plant, a sewage treatment plant, a golf course, trash disposal, an estimated 4,500 head of other livestock, and other agricultural operations. These were all discussed in detail in the WQRP.

Based on these inputs, planning and scoping process during development of the WQRP, and estimated loadings of each potential source, the relative overall effects on the entire watershed were rated to be as follows:

Source	Degree of Loading for in the watershed
Dairies	High
Erosion & Sedimentation	Low
Fertilizers - Agricultural	Low
Fertilizers - Golf Course	Low
Manure Composting Operation	Low
Pesticides & herbicides	Low
Private Sewage Facilities	Low
Sewage Treatment Plant	Low
Soil Enrichment Operation	Low/High 1/
Trash	Medium

1/ This was identified as a major concern by local citizens and agencies. At the present time this operation is permitted by the TNRCC. The rating should be low if operated according to permit. TNRCC has statutory authority to enforce or modify this permit.

This Public Law 83-566 watershed plan will address only the sources that contribute to water quality degradation from concentrated animal waste in the watershed. All others were scoped out as not being significant and/or will be addressed by the WQRP for Nolan River Watershed or come under the regulatory authority of TNRCC.

The table on page 6 displays factors affected by poor water quality in the watershed and their degree of significance in the decision making process in the development of the WQRP. These same factors were used to develop the PL-566 plan. Most of the factors having a low degree of significance exist in only limited quantities, or not at all within this watershed, and will not be impacted by this project.

Evaluation of Identified Concerns

Economic, Environmental, and Social Factors	Degree of Significance to Decision Making
Water quality	high
Recreation	high
Human health and safety	high
Streams and lakes	high
Fish and wildlife	high
Aesthetics	high
Land management	high
Reduced Property Values	high
Air quality	medium
Erosion	medium
Groundwater	medium
Sedimentation	medium
Social and Cultural	medium
Archaeological Resources	low
Endangered Species	low
Prime Farmland soils	low
Water conservation	low
Wetlands	low

SETTING

Nolan River Watershed, located in the western part of Johnson County in north-central Texas, is comprised of 100 square miles (260 square kilometers). It originates in northwestern Johnson County near Godley, Texas and flows in a southeasterly direction into Lake Pat Cleburne. The dam impounding Lake Pat Cleburne is considered the lower most extremity of the watershed. Appendix E displays the watershed boundary for the project area. Nolan River flows 20 miles (32 kilometers) downstream from the dam to confluence with the Brazos River in Lake Whitney near Blum, Texas. It is a part of the Brazos River system in the Texas Gulf Water Resource Region.

Lake Pat Cleburne has a normal pool area of 1,550 surface acres (630 hectares), and impounds 25,320 acre-feet (31,240 cubic decameters) of water. This impoundment provides water for municipal, industrial, and recreational use to the city of Cleburne and surrounding area.

Cleburne, population 26,000 is located to the east of Nolan River watershed and is the county seat of Johnson County, Texas. Godley, population 800, is located in the northern end of the watershed. The unincorporated community of Bono is located in the southwestern portion of the watershed.

Climate

The watershed and surrounding vicinity has a warm-temperate, subhumid climate. Average daily temperature ranges from a high of 96 degrees Fahrenheit (36 degrees Celsius) in July to a low of 35 degrees Fahrenheit (2 degree Celsius) in January. The daily maximum temperatures during the summer commonly exceed 100 degrees Fahrenheit (38 degrees Celsius). Winter temperatures are mild, with low temperatures at night usually in the mid-30's. The growing season averages 233 days.

Average annual precipitation is 32 inches (82 centimeters). The extreme monthly amounts average 1.7 inches (4.3 centimeters) in January and 4.4 inches (11.3 centimeters) in May, respectively. Average snowfall is 2.0 inches (5.0 centimeters). The largest snow fall recorded is 11 inches (28 centimeters).

Land Use

Cropland, rangeland and pastureland compose 93 percent of the watershed. Small grain and silage crops are grown on most of

the cropland. These crops are primarily used by the local dairy industry. Rangeland and improved pastureland are used by livestock owners and operators. Prior to the late 1970's a considerable portion of this land was in row crops, such as cotton and corn. During the early 1980's a significant portion of this area was converted to permanent pasture.

Estimated Current Land Use

LAND USE	ACRES	(HECTARES)
Rangeland	32,900	(13,310)
Pastureland	13,900	(5,630)
Cropland	13,200	(5,340)
Urban	2,400	(970)
Water 1/	2,000	(810)
Total	64,400	(26,060)

1/ Includes Lake Pat Cleburne with a permanent surface area of 1,550 acres (630 hectares)

Note: Data based on Computer Based Mapping Systems (CBMS) and NRCS field inventories.

Soils

Soils mapped in the watershed are described in detail in Soil Survey of Johnson County, Texas, SCS, 1981. The watershed is located within the Grand Prairie Major Land Resource Areas. Most of the soils in the watershed are in the Aledo-Bolar and Sanger-Slidell-Bolar associations.

The Aledo-Bolar association is composed of gently sloping to strongly sloping, very shallow to moderately deep, moderately alkaline loamy soils, on upland regions. The Sanger-Slidell-Bolar association is nearly level to sloping, moderately deep to deep, moderately alkaline clayey and loamy soils, on uplands.

Geology

Geologic strata cropping out in the watershed, from oldest to youngest, are Lower Cretaceous sedimentary rocks in the Duck Creek Formation, Fort Worth Limestone, Denton Clay, Weno Limestone, Pawpaw Formation, Main Street Limestone and the Grayson Marl; and Pleistocene Fluviatile Terraces and Recent Alluvium.

Watershed Stratigraphy

System	Age	Formation ~ Lithology
Quaternary	Recent	Alluvium
	Pleistocene	Fluviatile Terrace
Cretaceous	Lower Cretaceous	Grayson Marl
		Main Street Limestone
		Pawpaw Formation
		Weno Limestone
		Denton Clay
		Fort Worth Limestone
		Duck Creek Formation

The "Dallas Sheet" of the "Geologic Atlas of Texas" describes and displays in detail the geology of the watershed and surrounding vicinity. The following descriptions are extracted from the "Dallas Sheet".

Alluvium ~ floodplain deposits of gravel, sand, silt, silty clay and organic matter.

Fluviatile Terrace - gravel, sand, silt and clay.

Grayson Marl ~ calcareous clay and marl, fossiliferous, weathers yellowish brown, forms gentle slopes on the eastern watershed divide and higher elevations between major tributaries.

Main Street Limestone ~ medium grained, chalky, thin bedded to massive, yellowish gray, weathers light gray to white.

Pawpaw Formation ~ claystone, mudstone and sandstone; claystone and mudstone massive; sandstone fine to very fine grained.

Weno Limestone - consists of upper limestone, middle limestone and clay, and lower limestone; limestone aphanitic and bioclastic; clay is calcareous.

Denton Clay - Alternating clay, marl and limestone; clay units are calcareous, one to three feet thick; marl ranges from calcareous clay to aphanitic argillaceous limestone.

Fort Worth Limestone - limestone and clay; limestone aphanitic, gray, weathers to yellowish gray; clay calcareous, gray, weathers to yellowish brown; formation forms low rolling hills.

Duck Creek Formation - limestone, aphanitic, forms topographic benches and terraces, weathers dark gray.

All strata strike north-northeast and dip east-southeast. There are no igneous intrusions, volcanics, faulting, etc. in the watershed to influence the topography or storm runoff. Sedimentary lithology, soils characteristics, and climatic conditions are the primary natural phenomena affecting surface runoff.

Groundwater

Texas Water Development Board Report 94, "Ground-Water Resources of Johnson County, Texas," April 1969, discusses in detail groundwater conditions and related subsurface geology. According to Report 94, there are wells in the watershed tapping the Hosston Formation, Travis Peak Formation (equivalent to the Twin Mountains Formation as shown on the "Dallas Sheet" of the "Geologic Atlas of Texas"), and the Paluxy Formation. Regional aquifers in these formations yield significant quantities of water for municipal, industrial, domestic and agricultural uses. Waters from these aquifers are slightly mineralized but are of adequate quality for sustained use.

There are no significant aquifer recharge areas within the watershed. The Twin Mountains Formation (Travis Peak Formation in Report 94) and Paluxy Formation crop out west of the watershed. The underlying Hosston Formation does not crop out in the watershed vicinity. Alluvium in the floodplains, however, is recharged within the watershed, but is capable of furnishing only perched ground water during favorable climatic conditions. This is not a dependable water source, particularly during droughts, and is not extensively or routinely utilized.

Wildlife Resources

Most of the watershed consists of upland rangeland and pastureland of shallow clayey soils underlain by limestone, much of which was farmed in the past. The main crops grown in cultivated areas are small grain and silage. Abandoned cropland and fields converted to grass have been invaded by mesquite, prickly pear, and Ashe-juniper. The principle grasses are little bluestem, big bluestem, sideoats grama, KR bluestem, kleingrass and bermudagrass. Woody vegetation found primarily along stream corridors and drainageways provide the major portion of quality habitat for wildlife.

Large numbers of mourning dove, bobwhite quail and a few Rio Grande turkey may be found. Whitetail deer occupy areas associated with woody vegetation which provide food and cover. Other wildlife common to this habitat are songbirds, fox squirrel, cottontail rabbit, nine-banded armadillo, bobcat, coyote, raccoon, opossum, red and gray fox.

The riparian habitat along the Nolan River drainage consists of deep loamy flood plain soils which supports the greatest plant diversity and is of highest value to wildlife. Native grasses include indiangrass, switchgrass, little bluestem, Canada wildrye, Texas wintergrass and vine mesquite. Liveoak, elm and hackberry also grow in these areas. Large populations of deer, squirrel and turkey can be found in this habitat. Waterfowl and wading birds utilize areas adjacent to the major streams.

Minimum amounts of wildlife habitats are located at existing dairy facilities. These facilities generally consist of milking barns, feeding lots, loafing areas and waste storage ponds. Livestock remain confined to these areas, which are generally devoid of all vegetation. Where vegetation exists, along fence rows and odd areas, it is usually in the form of invading grasses and forbs such as johnsongrass, threeawn, dropseed, buffalograss, ragweed, croton, broomweed and carelessweed. These areas provide habitat for mourning dove, bobwhite quail, various songbirds, rodents and small mammals. Livestock are excluded from waste storage ponds and these areas are usually established to bermudagrass.

Waterfowl and wading birds have been observed utilizing waste storage ponds. Waterfowl also use Lake Pat Cleburne during migratory periods.

Fisheries Resources

Nolan River, Lake Pat Cleburne, and farm ponds provide the major fishery habitats in the project area. Numerous small

intermittent streams are also present. However, these small streams provide only minimal fishery habitats.

Impoundments providing suitable habitats are generally stocked with black bass, channel catfish, blue catfish, and sunfish.

Nolan River and other bodies of water under pristine conditions support a viable fisheries population. However, contaminated water has destroyed the suitable habitat and eliminated most of the fishery resources in the Nolan River system above Lake Pat Cleburne.

The watershed drains into Lake Pat Cleburne which affords recreational fishing opportunities. The lake has been stocked with various species of fish such as black bass, channel catfish, crappie, and various species of sunfish. Also present are many kinds of rough fish such as buffalo, carp, and gar.

Threatened and Endangered Species

The U.S. Fish and Wildlife Service lists the Golden-cheeked Warbler (*Dendroical chrysoparia*) as the only endangered species that may inhabit Johnson County. The endangered bald eagle and the whooping crane may migrate through this area as well. Confirmed sightings of migrating endangered whooping cranes (*Grus americana*) have occurred in Johnson County, although not within the Nolan River watershed. The dairy sites identified in this watershed do not contain habitat for any of the listed species.

No other federally listed or proposed to be listed threatened or endangered species are known to occur in the Nolan River Watershed.

Wetlands

Natural wetlands in the project are intermittent streambeds in the Riverine System found along the Nolan River drainage.

Limnetic and Littoral Lacustrine Wetlands may be found in the numerous farm and ranch ponds in the watershed. Many of these water bodies contain black bass and catfish fisheries.

Cultural and Historic Resources

A search of the cultural resource files at the Texas Archaeological Research Laboratory, Balcones Research Center,

University of Texas at Austin, has revealed that to date only 12 sites have been recorded for Johnson County. All sites that are on the National Register of Historic Places for Johnson County are outside the project area, and will not be affected by this project.

Four archaeological stages have been recognized for Texas: Paleo-Indian, Archaic, Neo-American and Historic. Further information on these stages is described in Appendix B.

Local Economy

Census data limited to the watershed is not available. Cleburne, an incorporated home-rule city, is the largest community in Johnson County, and serves as the county seat. It has a 1990 estimated population of 22,766. The estimated population for Johnson County was 102,412 (Texas Almanac, 1994-1995). Approximately 93 percent of Johnson County's population is white, 7.7 percent Hispanic, 2.6 percent Black, 0.5 percent Asian, 0.4 percent American Indian, and 3.6 percent other. Statewide, the distribution is 60.6 percent Anglo, 25.6 percent Hispanic, 11.6 percent Black, and 2.2 percent other.

Seventy-six percent of the annual agricultural income for Johnson County comes from direct sales of cattle and dairy products. Main crops produced are forage sorghums, wheat, hay, and silage. The majority of these crops are used by the local dairymen. With the projected growth in the dairy industry, the county wide income from agriculture will grow. The dairy industry is traditionally family orientated, with additional labor representing the normally lower income unskilled labor. Therefore, the growth in the dairy industry will represent a rise in employment levels for unskilled workers.

The combined dairy herd in the watershed contributes to Johnson County's status as one of Texas' leading counties in milk production. In 1993, 246 million pounds (112 million kilograms) of milk were produced in Johnson County, making it the fourth highest producer in the state.

Currently none of the dairies in the Nolan River Watershed are owned or operated by minority groups. However, as most dairies are owned and operated by families, women are often involved in the daily operations of nearly all dairies within the watershed.

Agribusiness represents the largest employer in the county. Other businesses include railroad shops, manufacturing, distribution, and lake activities. Many residents of Johnson County are employed in the Dallas - Fort Worth Metroplex.

Total income for Johnson County during 1992 - 1993 was 1,437 million dollars, with the average weekly wage of about 326 dollars. The total county population is over 97,000. The civilian labor force includes over 51,000, with an annual jobless rate of 5.1 percent.

PROBLEMS AND OPPORTUNITIES

Summary

Major resource problems in Nolan River Watershed are:

1. Potential impairment of water in Lake Pat Cleburne for municipal and industrial use.
2. Reduced domestic, recreational, and wildlife uses along 53 miles of stream, 425 farm ponds, and the upper reaches of Lake Pat Cleburne.
3. Environmental degradation of fisheries, aquatic habitat, wildlife habitat, and aesthetics.
4. Current and potential curtailment of recreational use of Lake Pat Cleburne.
5. Diminished land values.

General

Water quality problems exist when the intended use of the water is denied or impaired because of contamination. For water quality problems to deny or impair use, the water's chemical properties could be unacceptable, offensive foreign matter could be present, water quantities could be reduced, or the water's condition could prevent the use of another associated resource. Impaired use can be caused by one or a combination of the following:

1. The water contains and is disseminating pathogenic organisms;
2. The water is nonpotable for human or animal consumption;
3. The water is unfit for aquatic habitat;
4. The water does not meet standards for body contact recreation;
5. Aesthetics in the area are degraded due to odors, accumulation of raw animal waste on roadways, property of others, etc.

Poor water quality in the Nolan River Watershed above Lake Pat Cleburne has become a widespread problem and concern of local citizens and state and federal agencies. Water contamination

problems have been documented through the TNRCC and TSSWCB's evaluation process for Section 319 assessment of the Clean Water Act.

Water quality problems have been publicized in local and metropolitan newspapers throughout the state. The city and state began probing problems on Wallace Branch in June 1988. The Times-Review (Cleburne) issued an article in early June discussing a fish kill that occurred. "So far we've seen 200-300 fish dead," said Kevin Hanby, Assistant Director of Public Information for the TNRCC. "It was a dissolved oxygen depletion kill." A report in the Fort Worth Star Telegram, April 14, 1991, quotes a TNRCC director discussing a fish kill in the watershed.

In an article in the Times-Review, April 28, 1991, the soil enrichment site was discussed, including the opposition by the city and county. The article stated TDH (Texas Department of Health) records show several local official's letters and phone calls from spring of 1988. Their primary concern was the site's location, about three or four miles upstream from Lake Pat Cleburne. The lake is Cleburne's source of drinking water. "Johnson County May Become 'Sludge' Capitol of Texas," titles an article in The Cleburne Eagle News, July 9, 1992. Articles have also been written discussing various lawsuits filed by landowners against dairies and other sources of contamination. Other similar articles have occurred in other newspapers.

During the last five years many water quality tests have been conducted in the watershed. All the samples collected and tested have been in response to complaints or as part of this planning process. These samples were taken and tested by TNRCC, EPA, or the Johnson County SWCD.

Fecal coliform bacteria indicate animal-source pollution and the potential presence of pathogenic organisms. A fecal coliform concentration in excess of 200 cells per 100 ml. of water is an indication of unsafe water quality conditions for bodily contact. Fecal coliform concentrations of up to 1,900,000 cells per 100 milliliters (ml.) of water have been measured in the stream system. Safe drinking water standards require no fecal coliform contamination. During the planning process five samples were gathered and tested. Of these, four exceeded the standards for fecal coliform for bodily contact, ranging from 800 to 3500 cells per 100 ml.

Water resources in the area can be categorized into stream channel flow, impounded water, and groundwater. Approximately 60 miles of stream channels in the watershed convey runoff into Lake Pat Cleburne. The streams are Nolan River and it's major tributaries, including Robinson Branch, Town Branch, West Fork Nolan River, West Nolan Creek, Wallace Branch, and Martin Branch. Reach locations are shown in Appendix B -

Figure B1. These streams receive discharge from Godley's sewage treatment plant and dairies, which contribute to a minimal base flow. Fifty-three miles of these streams can be potentially contaminated by runoff.

Groundwater

Groundwater resources exist mainly as deep aquifers and there are no deep aquifer recharge areas within the watershed. Wells are the only means of contact with these aquifers.

Stream Channel Flow

The rapid growth of the existing dairy industry during the past few years has resulted in tremendous amounts of waste being produced or delivered in the watershed. Water quality in the stream systems and impoundments have been impaired as a result of the increased waste loading in the runoff. Water, land, air, plant, and animal resources in the area have been degraded and will continue to be damaged in the future. The TNRCC, the state agency with statutory authority to enforce state water quality laws, has insisted that action be taken immediately to protect and improve water quality in the watershed.

Runoff from inadequately managed animal waste transports waste and soil pollutants in solution and in suspension to adjacent

lands and streams. The pollutant load consists of dissolved salts and suspended solids, including bedload and floating solids. Upland storm runoff transports untreated and improperly treated waste to stream channels and water impoundments. This results in water quality degradation and water use impairment. Runoff transports solid waste from confinement areas, disposal areas, and stockpile areas, resulting in waste deposits on adjacent property, roads, and in roadside ditches. Many dairy livestock feeding and watering facilities are located near stream channels that increase the potential for contamination of surface runoff.

Public concern continues to grow, especially during rainy periods. The problem is an every-day experience for many residents who see the quality of their natural resources degrading. The problems associated with untreated or inadequately treated animal wastes are expected to increase, continuing to degrade the water quality in the Nolan River system. The following figure shows the expected impairment to the stream system without protection.

Stream Channel Flow Impairments
Future Without Project Implementation

Use	Reach 1/ 1 : 2 : 3 : 4 : 5 : 6 : 7 : 8 : 9	Lake Pat Cleburne
Recreation	S : M : S : S : S : S : L : S : S	S
Aquatic Habitat	S : M : S : S : S : S : M : S : S	M
Social	S : M : S : S : S : S : M : S : S	M
Domestic	S : M : S : S : S : S : M : S : S	L
Aesthetics	S : M : S : S : S : S : M : S : S	S

S - Severe Impairment M - Moderate Impairment
L - Slight Impairment

1/ See Appendix B, Figure B1 for reach locations

Predictions for future conditions indicate that the number of dairies in the watershed will remain constant. However, the number of milking cows in the watershed is expected to increase from 8,000 to 10,900. The number of cows is influenced by milk prices and other economic and physical factors affecting the dairy industry. The projected increase in milking cows per dairy in the watershed is shown on page 18.

Predicted Growth in Size of Dairies in the Watershed

Number of Milking Cows	Number of Dairies Present	Future
0 - 125	10	6
126 - 250	16	15
251 - 500	8	9
501 - 750	2	6
Total Dairies	36	36

Twenty-nine of the 36 dairies shown above do no have an adequately designed AWMS installed. All major stream systems in the watershed are affected by animal waste contamination. However, some stream segments are more contaminated than others. The upstream tributaries have been more heavily affected than those downstream due to higher concentrations of dairies in the upper reaches of the watershed.

The following tables show the incremental waste and nutrient loadings at the lower end of each reach, based on downstream delivery ratios, for the remaining 29 dairies under current and expected growth conditions. Eight of the nine reaches receive runoff directly from dairies. Reach 8 is immediately downstream from reaches 4, 5, 6, and 7. While it is not contaminated from dairies within the reach, any contamination of the upstream reaches will affect reach 8 as well. Further information on loadings may be found in Appendix D.

Waste and Nutrient Loadings By Reach
Current Conditions

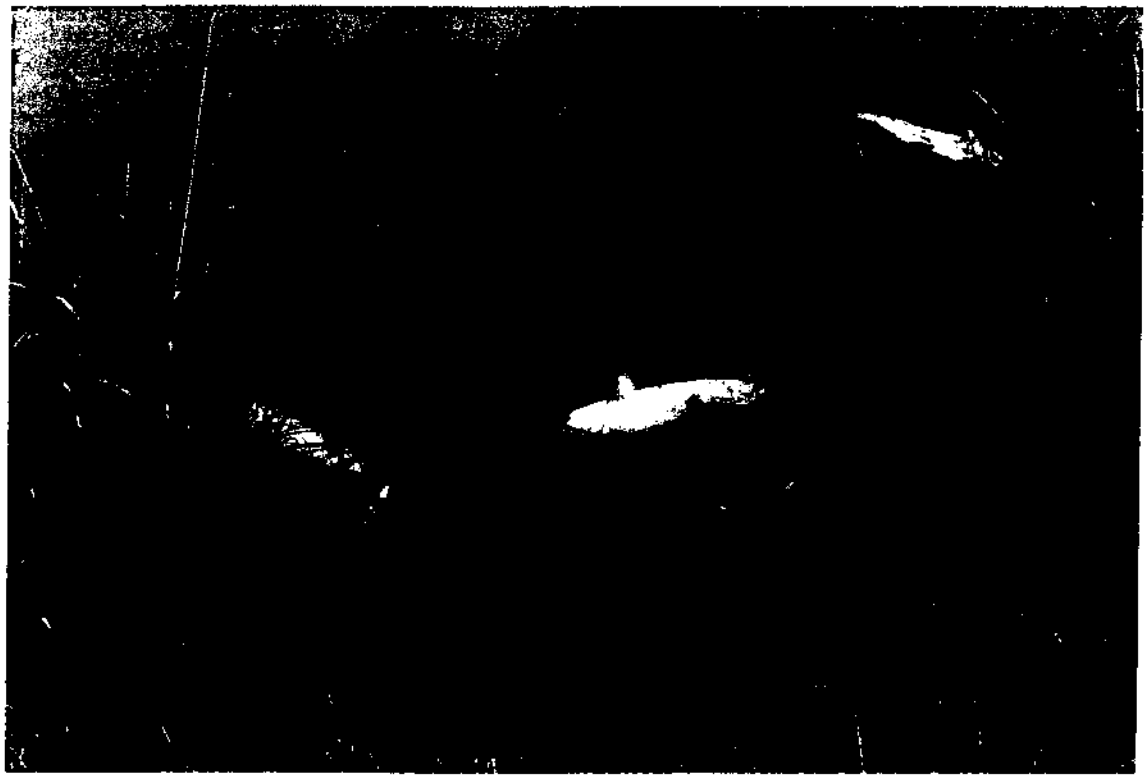
Reach Number	Total Solids lbs.	Volatile Solids lbs.	TKN lbs.	P2O5 Total lbs.	K2O Total lbs.	Na lbs.
1	5,679,960	29,590	1,510	580	7,540	2,970
2	1,166,750	6,080	310	120	1,550	610
3	4,879,140	25,410	1,290	500	6,470	2,550
4	2,625,190	13,670	700	270	3,480	1,370
5	8,803,670	45,860	2,340	900	11,680	4,600
6	795,510	4,140	210	80	1,060	420
7	583,380	3,040	150	60	770	310
8	0	0	0	0	0	0
9	1,193,270	6,220	320	120	1,580	620
Total	25,726,870	134,010	6,830	2,630	34,130	13,450

Note: 1 lb = 0.45 kg

Waste and Nutrient Loadings By Reach
Expected Growth Conditions

Reach Number	Total Solids lbs.	Volatile Solids lbs.	TKN lbs.	P2O5 Total lbs.	K2O Total lbs.	Na lbs.
1	9,201,420	47,930	2,440	940	12,210	4,810
2	2,041,810	10,640	640	210	2,710	1,070
3	6,231,510	32,460	1,650	640	8,270	3,260
4	3,712,390	19,340	990	380	4,930	1,940
5	13,391,120	69,750	3,550	1,370	17,770	7,000
6	1,060,680	5,520	280	110	1,410	550
7	795,510	4,140	210	80	1,060	420
8	0	0	0	0	0	0
9	1,723,610	8,980	460	180	2,290	900
Total	38,158,050	198,670	10,220	3,910	50,650	19,950

Algae blooms have been observed in Nolan River and it's tributaries, indicating excessive nutrient concentrations that may lead to an oxygen deficiency. These conditions degrade aquatic life habitat and reduce or eliminate recreational opportunities.



Fish kills have become a common occurrence in the watershed. They have been reported at several sites, including two locations on Wallace Branch, two locations on West Nolan Creek, a site on Robinson Branch, at least three sites on the Nolan River, and at least three different areas of Lake Pat Cleburne. Some kills have been reported in news articles, while others were reported during the public meeting, steering committee meetings, and interviews.

Degraded water quality in the watershed has also depressed property values. Many landowners have purchased property with stream frontage considering aesthetic value. Loss of the aesthetic value results in decreased property values. Many landowners feel "it would be hard to sell, especially at what you had in it." Realtors indicate they probably couldn't sell the property without taking a loss. Property owners are experiencing the negative impacts on land which is appraised at a higher value than current market value.

Degraded water quality in the tributaries has precluded fishing or swimming. Based on recent interviews and discussions at local public and steering committee meetings, recreational use of these waters is no longer a viable opportunity. There is a risk to the "non-informed" public using the resources of the watershed. Landowners and their families in the past have used the stream systems, as water levels permitted, for contact recreation, such as wading, swimming, and fishing. In larger stream systems and rivers the state has designated the intended use for the waters as well as contamination levels that are acceptable. These streams are considered intermittent and do not have specified state standards. However, body contact use is not prohibited by law in the absence of applicable state standards. The "non-informed" public, however, may still be participating in contact recreation in these streams.

There will also be an associated cost of providing adequate water to livestock in the watershed. The loss of the usable surface water will require additional wells and water storage facilities in the watershed. This also will result in an increase in operating costs for farmers and ranchers.

Additionally, degraded water quality in streams will adversely affect Lake Pat Cleburne. Waste products will eventually move downstream, until they contaminate Lake Pat Cleburne, especially with increased loadings. This will reduce or eliminate all uses of the stream system and the lake.

Impounded Water

Use of impounded water has been impaired in the watershed. There are approximately 600 farm ponds within the watershed. Four hundred and twenty-five of these ponds are subject to runoff contamination. Nutrient levels in some impoundments

are excessive as shown by fish kills and algae blooms. Elevated fecal coliform concentrations also exceed standards for body contact recreation.

Lake Pat Cleburne has a designated use for contact recreation, as well as a high quality aquatic habitat. The lake's tributaries do not have a designated usage, however watershed runoff must not impair the lake's designated use. Appendix E contains a problem location map displaying identified potential sources of contamination, and the area affected by these contaminants.

The following table indicates the effects of continuous contamination on impounded surface water as determined by the sponsors and steering committee.

Impounded Surface Water Impairments
Future Without Project Implementation

Use	Reach [1/] 1 : 2 : 3 : 4 : 5 : 6 : 7 : 8 : 9	Lake Pat Cleburne
Recreation	S : M : S : S : S : S : L : S : S	S
Aquatic Habitat	S : M : S : S : S : S : S : S : S	L
Social	S : M : S : S : S : S : M : S : S	M
Domestic	S : M : S : S : S : S : M : S : S	S
Aesthetics	S : M : S : S : S : S : L : S : S	S

S - Severe Impairment M - Moderate Impairment
L - Slight Impairment

[1/] See Appendix B, Figure B1 for reach locations

The upper portion of Lake Pat Cleburne and the surrounding property is designated as a city park named Stewart Park. Day use is extensive but overnight use is limited. Total use averages 79,000 visitor-days per year. City soccer fields are located within the park. These fields are used by an estimated 9,000 children and their families, friends, etc. every Saturday during spring and fall soccer seasons. Picnic facilities, used regularly, are also located in the park. Overnight use of the park is primarily by local Boy Scouts. The entire park lies within the flood pool of Lake Pat Cleburne, limiting the opportunity for development. Potable water is available throughout the park, and electricity is available in the camping areas. Significant opportunities for bank fishing and water-based contact recreation are available within the park.

Kirtley Park lies along the southeast side of Lake Pat Cleburne. This park is limited to day use, primarily swimming and picnicking. Total use is approximately 13,000 visitor days per year.

Lake Pat Cleburne is also used extensively for boating and fishing. There are four boat ramps for public access along the lake. Approximately 9,000 visitor-days per year can be attributed to use of the lake for boating and fishing.

During the summer months Lake Pat Cleburne experiences frequent fish kills in the upper reaches of the lake. In part, this is caused by the low quality of the watershed runoff. Often the concerns expressed in the watershed have been based on the visual impacts of Lake Pat Cleburne and the river system. Occasionally the lake at the bridge on FM 1121 has taken on a pea green color and thickened to resemble soup. The organisms responsible for the fish kills in the pea soup condition are phytoplankton consisting of a variety of algae, including diatoms and green and blue-green algae. Despite their small size, populations of these plankton can reach tremendous proportions, causing oxygen deficiencies.

Interviews with fishermen and landowners have shown a concern with the odor of the lake. One fisherman stated it occasionally smells like a "septic tank." The odor has been so offensive that fishermen have refused to fish in the shallow water areas, where watershed runoff enter the lake. This has been particularly evident after heavy rainfall events.

Reduced recreational benefits result in a net loss in income to the city of Cleburne. There will also be the additional costs involved with developing new recreational areas in other locations.

Anticipated pollution in Lake Pat Cleburne will require additional time, money, and materials for adequate treatment. Cost to the consumer will increase, and other uses of the lake will be limited. Cleburne currently pays an annual fee to the Brazos River Authority for a 10,000 acre-foot (12,340 cubic decameters) water allocation from Lake Granbury. The annual cost for this allotment changes yearly, with 1993's allotment costing the city $191,500. This provides a backup supply if the city is unable to use the water from Lake Pat Cleburne. Desalinization is required to bring the water from Lake Granbury up to drinking water standards, requiring the building of a desalinization plant, or paying Granbury to use its plant if the allotment were needed. Therefore, it is important that Lake Pat Cleburne's water quality and quantity be protected.

SCOPING OF CONCERNS

Numerous meetings were held by the sponsors to gain input from landowners and operators, the general public, and other state and federal agencies concerning water quality and general concerns of the watershed. The purpose of the meetings was to scope the issues to be addressed, establish priority objectives, and determine if there was a need for a Water Quality Resource Plan (WQRP) and PL-566 Plan for the watershed. A steering committee was formed to provide local input on the planning effort in development of the WQRP. Their interests continues in applying for PL-566 assistance for the implementation of animal waste management systems (AWMS), based on the recommendations of the WQRP. The major concerns expressed at these meetings were:

1. the degradation of the water, land, air, plant, and animal resources;
2. the need to improve these resources, and
3. the prevention of further deterioration of these resources.

A public meeting was conducted by the sponsors on October 27, 1992. Oral and written comments were received at the meeting. Written comments were included in Appendix A of the WQRP. A report was presented during the public meeting that addressed concerns about contamination of groundwater and local aquifers. Three meetings have been held with the sponsors and the steering committee. These meetings have been held to gain local planning input and address progress made in plan development.

Six interviews were also held with local residents that reflected the same concerns as those expressed in the public and other meetings. The main concerns expressed at the public meeting and interviews were the loss of recreation; fish kills; reduced property values; aesthetics; odors; increased health hazards; current and future contamination of ponds, streams, groundwater, and Lake Pat Cleburne; and environmental degradation of other natural resources. Predominant concerns expressed were the quality of runoff from storm events, and the aesthetics of the upper reaches of Lake Pat Cleburne, to the extreme of smelling "just like a septic tank." Water conditions have deteriorated to the point that almost all those interviewed stated they would not participate in any recreational use in or near the Nolan River and it's tributaries.

During the development of the WQRP it was determined there was a need for the PL-566 project in this watershed. All agencies originally involved in the WQRP were also involved in the development of this PL-566 project. An additional public

meeting was held December 6, 1994 as part of the final review process for this project.

All agencies with interests and concerns in this area were also asked for their input on this project, both during the development of the WQRP, and this PL-566 plan. Their concerns were addressed in the planning process. Inventory of all potential sources of contamination was discussed in detail in the WQRP.

Rapid growth in number and size of dairies in the watershed has increased the need for adequate waste management systems. Thirty-six dairies with approximately 8,000 head of confined dairy cattle are in the watershed. Seven dairies have animal waste management systems in operation. The remaining dairies either lack systems or have systems that are inadequate to treat and dispose of the large quantities of liquid waste, solid waste, and wash water.

Most dairy operations maintain high animal concentrations on small acreage as a management tool. Typical animal spacing in the pen areas average 600 square feet (56 sq. meters) per animal. This small spacing leads to large accumulations of manure, and the increased potential for contamination of runoff. Seven dairies with about 3,100 milking cows have implemented adequate animal waste management systems and associated land treatment practices. The animal waste loading from the remaining 29 dairies in the watershed is shown in the following table. The table indicates the animal waste contributed directly to each reach of the watershed. Reach 8 is not receiving direct contamination, but is immediately downstream from reaches 4, 5, 6, and 7. Therefore, it will be affected by any contamination of these upstream reaches.

Dairy Herd and Animal Waste Production
Current Conditions

Reach [1/]	Cows No.	Animal Waste tons/year	Animal Waste megagrams/year
1	1,070	31,900	28,940
2	220	6,560	5,950
3	920	27,430	24,880
4	495	14,760	13,390
5	1,660	49,500	44,910
6	150	4,470	4,060
7	110	3,280	2,980
8	0	0	0
9	225	6,710	6,090
Total	4,850	144,610	131,200

[1/] See Appendix B, Figure B1 for reach locations

Nutrients within the animal waste is a major concern, and will need to be addressed by implementation of adequate AWMS. The following table shows the quantity of animal waste and nutrients to be disposed, after initial storage in the waste storage ponds and holding pens. Volatilization during storage reduces the quantity of some nutrients. Therefore, without an AWMS in place, the quantities of nutrients will be even greater. Some nutrients may be reduced as much as 75%, depending on the retention time of the waste materials. Others, such as sodium, do not go through a reduction process during storage.

Animal Waste Loadings from Dairies

Item	Annual Loading 1/
Number of Cows	4,850
Animal Waste (wet - lbs/yr)	252,791,000
Animal Waste (dry - lbs/yr)	36,431,750
Volatile Solids (lbs/yr)	26,741,360
N (lbs/yr)	306,378
P_2O_5 (total - lbs/yr)	669,155
K_2O (total - lbs/yr)	1,147,476
Na (lbs/yr)	193,450

1/ Appendix D contains figures showing a more detailed listing of animal waste loadings in the watershed.

The dry and replacement cows and heifers are usually held in permanent grass pastures, which effectively controls contaminated runoff from these areas.

Public Involvement and Interagency Coordination

It is common knowledge that several extensive sources of water pollution exist in the watershed due to the quantities of waste produced, contained, and treated in the watershed. As a result of this public awareness, city, county, state, and federal agencies are working to prevent surface runoff contamination. The resources of local, county, state, and federal agencies are needed to solve and prevent water quality

problems. The complexity of the problems require a interdisciplinary approach to formulation and implementing solutions. The general awareness of water quality problems has resulted in private and public application of expertise, authority, and funds in a comprehensive water quality resource plan.

The project objective is to improve and maintain good water quality in and below the watershed. This objective is supported by the TNRCC, TSSWCB, TDH, BRA, and the EPA. To further support this project, and provide overall benefits to the watershed, BRA has implemented a project under the Clean Lakes Act grant program. Four meetings have been held as part of the planning process for their grant. These meetings were attended by representatives of the BRA, EPA, NRCS, Texas Institute for Applied Environmental Research (TIAER), TSSWCB, Johnson County SWCD, and the city of Cleburne. At all meetings the progress of our WQRP and PL-566 project were discussed and input and full approval received.

Normally, under Phase I of the Clean Lakes Act, a majority of the funding is spent gathering background data. However, all data gathered for the WQRP was used as information. Therefore, funding will be available under this project for additional water quality testing. The TSSWCB will also begin a special project under the 319 program, to support the PL-566 project.

Local residents are determined to prevent water quality problems. This is shown by a general awareness of the problems and the willingness to express their concerns in public meetings. Also, local units of government in conjunction with state and federal agencies are working to resolve existing water quality problems.

The TNRCC has statutory authority to publish water quality standards and establish and enforce rules when applicable to streams affected by runoff and effluent from dairy operations in Texas. TNRCC rules and standards meet or exceed the minimum requirements of the EPA. The TNRCC states it "is the policy of the Texas Natural Resource Conservation Commission that there shall be no discharge of waste or wastewater from concentrated animal feeding operations into the waters in the state, but rather these materials shall be retained and utilized or disposed of on agricultural land". The only exception to this ruling applies to storms greater that the 25-year frequency, 24-hour duration storm, at which point contaminants are diluted by surrounding flood waters.

The TNRCC requires dairies with a confined herd of more than 250 milking cows to submit an acceptable animal waste management plan and obtain an operational permit. Dairies with fewer than 250 confined milking cows are required to be in compliance with the Texas Water Code, other laws of the

state, and policies of the TNRCC. Dairies not in compliance with applicable rules and standards are subject to TNRCC fines.

The Farmers Home Administration (FmHA) is requiring TNRCC "letters of concurrence" or a TSSWCB approved Water Quality Management Plan (WQMP) for those dairies below the current criteria level for permit size as a condition for processing loans for confined animal operations. Those diaries above permit size must obtain a permit. Many commercial lenders have also implemented similar policies. As dairies comply with TNRCC rules, they may be considered for loans from these lending agencies.

The Johnson County SWCD, the TSSWCB, and NRCS are assisting dairies in installing animal waste management systems (AWMS). NRCS technical assistance is provided in designing and implementing AWMS and related best management practices (BMP's) at the request of the individual dairy operators. Also, several engineering consultants are designing waste managements systems for the larger dairies. However, the urgent need and demand for assistance exceed that which can be provided under existing programs.

The NRCS, TSSWCB, TAEX, ASCS, TNRCC, BRA, EPA, and the project sponsors are emphasizing the urgent need for implementation of AWMS, and associated BMP's.

Agricultural Conservation Program (ACP) funds are being utilized for cost-share installation, but they are not sufficient to fulfill the need and demand. Other sources of cost-share funds, such as PL-566 funds, are needed to compliment and accelerate the implementation of AWMS and associated land treatment practices.

The U.S. Forest Service, Texas Parks and Wildlife, USDI Fish and Wildlife Service, and State Historical Commission were also contacted early in the planning stages of this project and asked for their input. Their replies were used in the planning process and development of alternatives for completion of the WQRP. These agencies, as well as several others were also contacted for input in the planning process of this PL-566 project. The Texas Institute for Applied Environmental Research (TIAER) offered their technical assistance and support of this project. These agencies were contacted during the draft review stage of this document and asked for comments, which were incorporated into the report as appropriate.

FORMULATION OF ALTERNATIVES

General

Formulation of alternatives to achieve the sponsor's objectives began after defining water quality problems and opportunities in the watershed. An interdisciplinary team was used to identify, locate, and evaluate these problems and opportunities. During this study the scoping process was used to identify water, land, air, plant, and animal resource problems relevant to a plan of action.

The public's desire to prevent further water use impairment and protect water quality in and below the watershed incited development of alternatives for immediate action. Alternative formulation considered the desires and needs expressed by individuals and the general public. Formulation of alternatives were based on the following identified objectives:

1. Protect Lake Pat Cleburne, 53 miles of streams, and 425 farm ponds from contamination.

2. Increase opportunities for recreation and other social uses of the environment.

3. Improve fisheries and aquatic habitat.

4. Reduce the health hazards from contaminated water.

5. Stabilize declining land values.

Alternatives considered for this PL-566 project are compatible with applicable federal and state statutes. The "no action" alternative was considered, however, it will not solve or prevent water quality problems. The "no action" alternative, subsequently described, serves as a benchmark to evaluate the effectiveness of the other alternatives.

Many alternatives were considered for solving various problems in the watershed. Some alternatives included closing and relocating of dairies, large scale composting, and restricting activities in the watershed. These were discarded from serious consideration early in the planning process due to extreme social, monetary, legal, and environmental ramifications.

The city of Cleburne has been instrumental in plan development from the beginning. The city's main concern has been the potential contamination and loss of municipal water and recreational opportunities in Lake Pat Cleburne. Contamination would cause increased treatment costs and higher water bills for local citizens. Recreational activities would also be severely reduced or eliminated.

Local citizens are also concerned with declining land values in areas affected by water quality degradation. The land values should return to fair market values with improved water quality.

Nine evaluation units or reaches shown in Appendix B, Figure B1, were developed to simplify the evaluation process. Eight of the nine reaches are being directly contaminated. Reach 8 is not receiving direct contamination, but is immediately downstream from reaches 4, 5, 6, and 7, which were heavily contaminated. Reach 8 will be impacted by any activity on the upstream reaches.

All alternatives were formulated on a nondiscriminatory basis, without regard to race, color, national origin, sex, religion, age, disability, political beliefs and marital or familial status.

Description, Costs, and Effects of Alternatives

Alternative 1

This is the "no action" alternative. It does not provide project assistance or recommendations to solve the identified resource problems. Current conditions will prevail or worsen without the financial or technical assistance needed to reduce contamination and eliminate the potential loss of use of Lake Pat Cleburne.

Alternative 1 was considered unacceptable by the sponsors. Technical and financial assistance for land treatment would not increase beyond the existing programs. Water quality would continue to decline in Lake Pat Cleburne. Nutrient loadings would not be reduced to acceptable limits. NRCS would still provide technical assistance commensurate with the anticipated levels of funding. Long-term contracts may be developed with the Agriculture Conservation and Stabilization Service (ASCS) with a maximum cost share of $17,500 over the life of the contract. An ASCS contract with maximum cost share on 29 dairies would fund approximately 25 percent of the project costs. ASCS funding rates have only allowed a maximum of four long-term contracts to be written in any fiscal year. However, this funding is spread county wide, and not restricted to just the watershed. The possibility exists that no AWMS in the watershed could be funded in any given year. Only one contract was approved and funded in the last fiscal year. ACP cost share would continue to be administered by the ASCS, assuming ACP will be funded at approximately the same dollar level as in the past.

Other agencies will continue assistance and enforcement based on funding and authority. Water samples collected and tested

in the last five years have been in response to complaints or as part of plan development. A more refined assessment of water quality will be obtained with a program of systematic testing and water quality monitoring. A monitoring program will be set up in response to this need by BRA as part of its Lake Pat Cleburne Study under the Clean Lakes Act program. TIAER will also be involved in the testing and monitoring of water quality. BRA will gather water samples monthly for at least 18 months on a predetermined schedule and during major storm events. This sampling and monitoring, funded at approximately $140,000, will refine the base line data on water quality within the watershed.

The Clean Lakes Act program will be supplemented by the EPA's 319 grant program to be administered through the TSSWCB and BRA. The 319 grant program is set up to monitor water quality before, during, and after implementation of animal waste management systems. However, at the limited rate of installation without project support, no improvement or a decline in water quality may be noted. TNRCC will also continue to enforce their rules for confined animal feeding operations. With a lack of available staff, this program is being administered slowly. Waste will continue to accumulate in the system prior to implementation of AWMS.

Effects;

Twenty-nine dairies will continue to improperly or inadequately handle waste materials, contributing to the contamination of the surface runoff, streams, Nolan River, and Lake Pat Cleburne.

Recreational activities in Lake Pat Cleburne and the stream system will be seriously curtailed by the growth of aquatic vegetation and elevated bacteria levels. This curtailment will result in loss of use in existing recreational facilities, and the added expense of creating additional parks to meet the local recreational needs. Fish and wildlife habitat will be further damaged. The city of Cleburne will face potentially increased treatment costs for its current water supply, and additional costs for obtaining and treating water from other sources. Cleburne could be forced to seek another water source elsewhere at much higher costs. Lake Granbury is the current alternative water source. Desalinization of Lake Granbury water will be needed due to high sodium chloride levels, resulting in increased treatment and pumping costs.

Contamination will continue at the same rate or increase with growth of the dairy industry. The nutrient loadings to the Nolan River and Lake Pat Cleburne will continue at their current level of approximately 2.2 million pounds (1 million kilograms) per year nitrogen, and 1.1 million pounds (0.5

million kilograms) phosphorus (P_2O_5) per year. A growing dairy industry with improperly managed animal wastes will result in increased nutrient loadings in the watershed.

Fecal coliform concentrations will continue to increase, indicating a greater potential for the presence of pathogenic microorganisms. This will adversely affect usage of the Nolan River water system. Recreational usage will be reduced or eliminated. High nitrate levels in the water could become a special concern for infants or pregnant women. Infants and fetuses exposed to high nitrate concentrations are at risk for methemoglobinemia (Blue Baby Syndrome). These conditions can result in retardation or death to the infants.

The city of Cleburne potentially could be forced to find other outside recreational areas. Recreational use by local citizens would be severely restricted. Wildlife and fisheries would continue to be negatively affected by contamination of the water resources.

Costs;

Alternative 1 requires no PL-566 funding.

Benefits;

- 0 -

No positive change in current benefits.

Alternative 2

This alternative consists of installation of 29 animal waste management systems (AWMS) and associated land treatment practices. The installation period for this plan will be ten years.

It is recommended that 100 percent of the remaining AWMS be installed to protect the streams and restore them to their original use. A 70 percent level of participation among the 29 AWMS should adequately protect Lake Pat Cleburne from contamination from dairy animal waste. However, only those streams below the participating dairies would be protected. The remaining stream system quality would remain impaired, or worsen with increased buildup of contaminants. A principal goal of this project is to protect the domestic, recreational, and wildlife uses of the 60 miles of streams and 600 ponds in the watershed. The sponsors anticipate, with adequate cost-share assistance, that all dairies will implement AWMS. Other

sources of contamination will be treated, improved, or controlled by implementation of the WQRP.

For maximum effectiveness, planning and design of on-site AWMS and associated land treatment practices must be based on individual site conditions such as: soil type, topography, distance to stream channels, land use, vegetation, management techniques and size of operation. Each site will need to be looked at technically to determine the best and most economical solution to it's individual problem. As needed, data from soil and water sample analyses will be utilized. Utilization of wastes on agricultural land will be within environmentally acceptable limits to assure excessive nutrients are not applied on pastureland, cropland, and rangeland.

On-site AWMS would generally:

1. divert runoff volume away from pens and corrals;
2. decrease the use of uncontaminated water and recycle wash and flush water;
3. decrease or eliminate contaminated runoff and wastewater discharging into the Nolan River and it's tributaries;
4. minimize solid waste transport to waterways;
5. utilize nutrients in animal wastes by applying waste materials to cropland, pastureland, and rangeland.

Enforcement of rules and regulations for waste management for water quality enhancement will remain the responsibility of the TNRCC. This will be handled through TNRCC's ongoing operations and funding. Established permitting procedures will be followed. Operation, maintenance, and limitations of the system should be followed as designed to insure adequate treatment of all waste materials.

The NRCS will provide technical and financial assistance for implementing 29 AWMS on a voluntary contract basis. The ASCS will also provide assistance as needed subject to it's limitations through the ongoing ACP program. Monitoring of water quality in Nolan River watershed will determine the effects of treatment through the Clean Lakes Act program, funded by the EPA through the BRA. Phase I of this program will provide the vehicle for this funding. With continuation of the program, Phases II and III could provide additional funding for implementation and further testing of water quality projects. The funds from the 319 program would be implemented by BRA and TSSWCB as previously discussed. This program will show the results of implemented AWMS in this time period on the water quality of the watershed, as well as assist in the implementation of AWMS. The local sponsors, NRCS, BRA, EPA, and TSSWCB will be working together toward a common goal of improved water quality in the Nolan River.

Where applicable and practical, new concepts and techniques in AWMS will be incorporated into viable alternatives. It is

anticipated that ongoing research will generate new and unique methods and designs for treatment of animal waste. These will be incorporated, as applicable, into AWMS.

Effects;

This alternative would function in combination with the WQRP, Clean Lakes Project, 319 grant, SWCD programs, and NRCS conservation operations to implement a program of accelerated land treatment to improve water quality in and below the watershed. Land treatment would include the proper management of animal waste. Technical and financial assistance would be provided for installing adequate AWMS and associated land treatment on 29 dairies.

Components of AWMS and associated land treatment may include waste storage ponds, diversions, terraces, grassed waterways, irrigation systems, field windbreaks, fencing, artificial wetlands, and pond sealing or lining. Associated land treatment practices to be applied include nutrient management, waste utilizations, crop residue use, conservation cropping sequence, pasture and hayland management, wildlife plantings, protection and improvement of riparian areas, proper grazing use, and deferred grazing.

AWMS will be planned and established by land users in cooperation with the Johnson County SWCD. A conservation plan will be developed for each landowner and operator specifying practices to be installed and the operation and maintenance (O&M) needed. The O&M plan will include such items as required dewatering, waste utilization locations and limitation, and other limiting criteria. Properly designed, installed and operated, AWMS will assure that dairy runoff from a 25-year, 24-hour storm (4% chance storm) is impounded on-site. There may be flows from climatic events larger than the 25-year, 24-hour storm, but the spills will be minimal. The holding pond's reservoir for impounding runoff will meet minimum permeability specifications to prevent excessive seepage. By containing animal waste in an area with restricted permeability, less pollutants will be available to contaminate surface water. Appendix C contains a typical design for an AWMS.

Application of animal waste on cropland and pastureland will reduce the need for commercial fertilizer, resulting in a savings to landowners and operators. This would partially offset some of the participant's cost of installing, operating and maintaining the AWMS.

Installation of Alternative 2 will reduce contamination and improve the quality of water flowing into Lake Pat Cleburne.

The fishery resources of the lake and it's tributaries will be improved.

Field windbreaks and wildlife plantings will improve the aesthetic value of the area, as well as reducing odor and dust from the dairies. They will also improve the riparian habitat making the areas more desirable for wildlife.

Land values in the watershed will stabilize with improved water quality. Enhanced aesthetic value to the area will also result from reduced contamination of the watershed. Land values should be comparable to surrounding areas with similar land use.

The local sponsors of the project met to discuss their opinions on the expected outcome of implementation of this plan. The following charts indicate their opinions on the expected impact and results of implementation of the WQRP and this PL-566 plan on the stream system and impounded water. This will meet or exceed sponsor's goals for the project.

Stream Channel Flow Impairments

Future With Project Conditions

Use	Reach [1/] 1 : 2 : 3 : 4 : 5 : 6 : 7 : 8 : 9	Lake Pat Cleburne
Recreation	N : N : L : L : L : L : N : L : L	N
Aquatic Habitat	N : N : N : N : N : N : N : L : L	N
Social	N : N : L : L : L : L : N : L : L	N
Domestic	N : N : N : N : N : N : N : N : N	N
Aesthetics	N : N : L : L : L : L : N : L : L	N

S - Severe Impairment M - Moderate Impairment
N - No Impairment L - Slight Impairment

[1/] See Appendix B, Figure B1 for reach locations

Impounded Surface Water Impairments

Future With Project Conditions

Water Usage	Reach [1/] 1 : 2 : 3 : 4 : 5 : 6 : 7 : 8 : 9	Lake Pat Cleburne
Recreation	L : N : L : L : L : L : N : L : L	N
Aquatic Habitat	N : N : N : N : N : N : N : L : L	N
Social	N : N : L : L : L : L : N : L : L	N
Domestic	N : N : N : N : N : N : N : N : N	N
Aesthetics	L : N : L : L : L : L : N : N : L	L

S - Severe Impairment
M - Moderate Impairment
N - No Impairment
L - Slight Impairment

[1/] See Appendix B, Figure B1 for reach locations

The following briefly summarizes the benefits of the plan on the watershed resources and their common uses.

Summary of Benefits From Implementing Alternative 2

Damaged Resource	Use of Resource 1/	Contaminants Reduced 2/
Water		
Streams	a,b,c,d,e,f,g	1,2,3,4,5,6
Lakes	a,b,c,d,e,f,g,h	1,2,3,4,5,6
Soils	a,c,d,e,f	1,3,4,5,7
Air	a,c,d,e	6,8
Plants	a,b,c,d,e,f	1,3,4,5,7
Animals	a,b,c,d,e,f,g	1,2,3,5,6,7,8

1/ a - recreation
b - aquatic habitat
c - social uses
d - domestic uses
e - aesthetics
f - wildlife habitat
g - livestock water
h - municipal & industrial

2/ 1 - nutrients
2 - fecal
3 - salts
4 - sediment
5 - chemicals
6 - ammonia
7 - solid waste
8 - dust

Costs;

Installation of 29 AWMS would cost approximately $1,100,000, with another $600,000 in associated costs. Some of these associated costs would include preparing other cropland for waste disposal, and securing additional land easements for waste disposal. This associated land would need conservation treatment, such as terraces and waterways, to prevent runoff contamination from these sites. Technical assistance would cost an estimated $240,000. Total project cost is under two million dollars.

Benefits;

Alternative 2 monetary benefits were estimated using a 25-year evaluation period. Anticipated costs for construction, replacement, operation and maintenance were used. Estimates indicated average annual on-site benefits to be $343,900. On-site benefits are based on the nutrients (N-P-K) that would be available to plants after discounting for losses during storage and application.

There would be off-site and downstream water quality related benefits in addition to on-site monetary benefits realized by the individual dairy operations. These off-site public benefits relate to enhanced recreational opportunities, aquatic habitat, social and aesthetic attributes, and domestic uses of Lake Pat Cleburne, Nolan River, and it's tributaries.

Through implementation of this alternative recreational opportunities in Lake Pat Cleburne and it's tributaries will be protected and enhanced. Currently, Lake Pat Cleburne and it's facilities, parks, etc annually provide over 100,000 visitor-days of recreation, resulting in an average annual benefit of $80,800.

The city of Cleburne estimates that water treatment costs would increase by 50 percent should the water in Lake Pat Cleburne become polluted by nutrients, animal waste, or other sources. Present cost of treating 3.3 million gallons (12.5 million liters) per day is $4,600 per month. The cost of treating polluted water would be $6,900 monthly. Average annual benefits from reduced treatment cost would be $18,400.

This project will benefit the city of Cleburne and the surrounding area on a nondiscriminatory basis. Since the parks around Lake Pat Cleburne are available for usage without fee, any additional benefits from increased recreational opportunities will benefit all limited resource participants, as well as the general public. This project will not only benefit landowners and operators in the rural setting, but

anyone who drinks or uses Cleburne's public water supply. All groups will have equal access to participate in this program.

The project will prevent the decrease in land values associated with pollution of the river and tributaries. Local realtors and landowners have estimated a decrease in value of 30 percent. A total of 3,200 acres (1,300 hectares) will be benefited during the next 10 years. The average annual benefit is calculated to be $640,000.

Total annual benefits are estimated to be $1,083,100. Average annual costs, including operation and maintenance, are $262,000. All costs are based on a 25-year evaluation period. Benefits are in excess of costs.

Summary and Comparison of Alternatives

A comparison of Alternative 1 and Alternative 2 effects is shown below. The comparison is based on the resources of the watershed, and the effects the implemented alternatives would have on these resources.

	Alternative 1	Alternative 2
Alternative Description	No Treatment	Install AWMS on 29 dairies
Project Investment	- 0 -	$ 1,924,650
Annual Costs	- 0 -	$ 262,000
Annual Benefits	- 0 -	$ 1,083,100
Net Monetary Benefits	- 0 -	$ 821,100
Water	Continued degradation of water quality due to increasing nutrient and fecal contamination.	Sustained, long-term improvement of water quality resulting from reduced discharge of pollutants.

	Alternative 1	Alternative 2
Land	Continued degradation of land due to accumulation of animal waste.	Sustained, long-term improvement of soil resources through implementation of plans for waste management.
Air	Continued degradation of air due to uncontrolled gasses such as ammonia and methane from stockpiled and uncontrolled waste materials.	Improved air quality due to management of nutrients and waste materials.
Plant and Animals	Continued degradation of fish and wildlife habitat due to untreated waste in streams and lakes.	Improved fish and wildlife habitat because of waste materials management.
Recreation	Continued loss of land and water recreational uses due to accumulations of animal wastes and associated health hazards.	Sustained, long term improvement of recreational opportunities because of waste management.
Area Economy	Adverse impacts from inadequately managed animal wastes and degrading water quality.	Protection and improvement of local economy through continued expansion of dairy industry, other industries, and recreational enterprises.
Human Resources	Degradation of quality space for people to live, work, and play due to impairment of natural resources in area.	Improvement of environment for people to live, work, and play.
Cultural Resources	No effect	Protect & Preserve in accordance with NRCS General Manual, Title 420, Part 401.

Project Interaction

This PL-566 project will work in cooperation with the Clean Lakes Act Phase I project. The BRA is the lead agency on this project, with cooperation of the EPA, NRCS, TSSWCB, TIAER, and city of Cleburne. Phase I's purpose is to monitor water quality and determine needs for further works of improvement in the watershed. If the need is present, further work may be completed under Phases II and III of the Clean Lakes Act. This PL-566 project will also work in conjunction with the BRA and TSSWCB 319 grant, to further assist in water quality monitoring and in installing AWMS.

This plan will accelerate land treatment and technical assistance without duplication of current programs.

Risk and Uncertainty

All data used in evaluating and establishing future conditions in the watershed are based on recent history. Agricultural production estimates are based on local records of farm and ranch units. The net benefits of the recommended plan exceed the cost for the planned measures without consideration of any projections. Therefore, the uncertainty aspects of projections for project justification do not negate the positive benefit costs ratio expected. Participation of individual land users is entirely voluntary. Interviews with community leaders and land users indicate that 29 dairies with identified problems will participate in a cost-share project.

Rationale for Plan Selection

Alternative 2 is the recommended plan. It provides for installing 29 AWMS and management practices for controlling the sources of contamination from animal waste in the watershed. This plan, in conjunction with the WQRP and other on-going programs will eliminate identified contamination within the watershed from the 25-year, 24-hour storm or less. This plan, when properly applied and maintained, will accomplish the sponsors' goals of protecting water quality in the Nolan River, it's tributaries, and Lake Pat Cleburne.

RECOMMENDED PLAN

General

The recommended plan consists of implementing AWMS to adequately manage animal waste on 29 dairies. The AWMS may include waste storage ponds, diversions, terraces, grassed waterways, irrigation systems, field windbreaks, fencing and pond sealing or lining. Associated land treatment practices include nutrient management, waste utilization, crop residue use, conservation cropping sequence, pasture and hayland management, proper grazing use, protection and improvement of riparian areas, and deferred grazing. Appendix C displays a typical animal waste management system.

AWMS designed, installed and maintained to meet TNRCC standards and specifications will assure that dairy runoff from a 25-year, 24-hour storm will be impounded on-site. The AWMS holding pond reservoirs will meet minimum permeability specifications to prevent excessive seepage. Less pollutants will be available to contaminate surface water from impounded animal waste in reservoirs with restricted permeability.

Cost and Benefits

Preliminary estimates indicate annual off-site benefits, at an 8.125 percent discount rate, to be $739,200. Annual on-site benefits are estimated to be $343,900. Total annual benefits are $1,083,100. Annual costs, including operation and maintenance, are calculated to be $262,000. Therefore, the benefit-cost ratio would be 4:1.

The PL-566 cost-share rate will be 65 percent. Either the actual cost, not to exceed established average cost, or the average cost, will be used to determine payment per practice. Cost-share payments to landusers will be made by NRCS after a planned eligible practice in the contract has been completed and certified. Payment will be based on cost-share documents prescribed by NRCS.

Operation and maintenance costs are the responsibility of the individual landuser who agrees to apply the practices according to the long-term contract between the landuser and the NRCS. Upon completion of the contract, the land user is expected to continue the operation and maintenance through an agreement with the local soil and water conservation district.

Purpose and Summary

The recommended plan is Alternative 2. Purpose of the project is to improve and maintain good water quality in and below the watershed. The project will provide assistance to 29 dairies for implementing waste management systems designed to comply with TNRCC standards and specifications. Project installation period is ten years.

Plan Elements

AWMS will be planned on-site with the dairy owner. A combination of management practices and enduring practices are needed to reduce the pollutant load leaving the dairy. Management and enduring practices which are known to be economically and environmentally preferable for Nolan River Watershed are listed below:

Management Practices	Enduring Practices
Pest management	Waste storage structures
Nutrient management	Waste treatment lagoons
Waste utilization	Terraces
Conservation cropping sequence	Diversions
Pasture & hayland management	Grassed waterways
Proper grazing use	Pond sealing
Deferred grazing	Critical area treatment
Contour farming	Ponds
Irrigation water management	Irrigation systems
Waste management systems	Sediment Basins

Other approved practices listed in the NRCS Field Office Technical Guide may be used if they are economically and environmentally feasible and meet the goals of the project.

Permits and Compliance

Landowners should obtain permits and/or letters of compliance from the TNRCC and other state agencies as required.

Section 404 of the Clean Water Act regulates the discharge of dredged and fill material into waters of the United States, including wetlands. The need to secure a Section 404 permit will be determined by individual dairy owners before any work begins.

Installation and Financing

The existing ASCS cost-sharing programs (ACP) will be unaffected by the actions of this watershed plan. PL-566 funds provided by this plan will be used to design and install animal waste management systems and related land treatment practices.

Federal assistance will be provided under authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress, 68 Stat. 666), as amended. The balance of funds will be furnished locally.

Project funds will be made available to provide technical assistance for conservation planning and/or application. Additional funds will be available for cost sharing to install conservation practices. The project map (Appendix E) shows the location of the dairies eligible for project participation. Specific locations of identified dairies eligible for cost-share assistance are on file in the local NRCS field offices.

Noncost-shared management practices, such as crop residue use, contour farming, and conservation cropping systems, will be required as a condition to cost-shared assistance for other practices to achieve project objectives. Noncost-shared management practices will be installed concurrently with cost-shared enduring practices.

Federal assistance is subject to the appropriation of funds for the application of project practices.

Project practices have been anticipated and funds estimated for a 10-year installation period. Only technical assistance is included for the last three years to maintain contracts still in effect. The following tabulation shows estimated monetary requirements for each year during the installation period.

Schedule of Obligations

Year	Element	PL-566 Funds	Other Funds	Total Funds
		dollars		
1	Waste Management Systems	147,100	79,200	226,300
	Project Administration	5,200	1,200	6,400
	Technical Assistance	11,900	0	11,900
	Subtotal	**164,200**	**80,400**	**244,600**
2	Waste Management Systems	147,100	79,200	226,300
	Project Administration	5,200	1,200	6,400
	Technical Assistance	23,800	0	23,800
	Subtotal	**176,100**	**80,400**	**256,500**
3	Waste Management Systems	147,100	79,200	226,300
	Project Administration	5,200	1,200	6,400
	Technical Assistance	35,700	0	35,700
	Subtotal	**188,000**	**80,400**	**268,400**
4	Waste Management Systems	183,700	99,000	282,700
	Project Administration	6,100	1,400	7,500
	Technical Assistance	42,800	0	42,800
	Subtotal	**232,600**	**100,400**	**333,000**
5	Waste Management Systems	147,100	79,200	226,300
	Project Administration	5,200	1,200	6,400
	Technical Assistance	35,700	0	35,700
	Subtotal	**188,000**	**80,400**	**268,400**
6	Waste Management Systems	147,100	79,200	226,300
	Project Administration	5,200	1,200	6,400
	Technical Assistance	35,700	0	35,700
	Subtotal	**188,000**	**80,400**	**268,400**
7	Waste Management Systems	147,100	79,200	226,300
	Project Administration	5,200	1,200	6,400
	Technical Assistance	23,800	0	23,800
	Subtotal	**176,100**	**80,400**	**256,500**
8	Technical Assistance	14,500	0	14,500
	Subtotal	**14,500**	**0**	**14,500**
9	Technical Assistance	9,600	0	9,600
	Subtotal	**9,600**	**0**	**9,600**
10	Technical Assistance	4,750	0	4,750
	Subtotal	**4,750**	**0**	**4,750**
TOTAL		**1,341,850**	**582,800**	**1,924,650**

Responsibilities

Animal waste management systems will be planned and established during the project installation period by landusers in cooperation with the Johnson County SWCD. The governing body of this district will arrange for meetings to promote installation of conservation practices.

A conservation plan of operations (long-term contract) will be developed by individual landusers and NRCS. The conservation plan of operations will specify practices to be installed, an installation schedule, and an operation and maintenance agreement for each dairy. Landusers will be responsible for making all necessary arrangements to assure planned work is started and completed in accordance with the conservation plan of operations. Technical assistance will be provided by NRCS to plan and apply land treatment practices.

Cultural Resources

NRCS planning activities for protecting and preserving cultural resources will be in accordance with the Programmatic Memorandum of Agreement with the Advisory Council on Historic Preservation and the State Historic Preservation Offices. The procedures published in the NRCS General Manual, Title 420, Part 401, will be followed. In addition, impact areas will be evaluated by NRCS prior to construction to determine if cultural resources may exist. If significant resources exists, NRCS will take appropriate action to avoid adverse effects on them.

If any cultural resource is discovered during application of the project practices, the resource will be protected from further disturbance. The NRCS will notify the landuser and the State Historic Preservation Officer. The NRCS will take appropriate action to protect any significant cultural resources and avoid adverse effects on them.

Contracting

Conservation practices will be applied by means of long-term contracts between the NRCS and participants on the land they own or control. Eligible practices will be cost-shared. The conservation plan of operations will be used as a basis for developing the long-term contract to solve identified problems. The plan is to include a combination of conservation practices that, when installed, will provide the treatment required to solve the identified problems to the degree needed to meet the objectives of the project.

Cost-shared amounts and formulation of the contracts will follow the guidance in the NRCS General Manual and the National Contracts, Grants, and Cooperative Agreements Manual which is in existence at the time the contract is written. All technical and financial assistance will be provided on a nondiscriminatory basis, without regard to race, color, national origin, sex, religion, age, disability, political beliefs and marital or familial status.

Operation and Maintenance

The landuser will be responsible for operation and maintenance (O&M) of installed practices. O&M requires effort and expenditures by the landuser throughout the life of the practice to maintain safe conditions and assure proper functioning.

Operation is the administration, management, and performance of non-maintenance actions needed to keep a completed conservation practice safe and functioning as planned.

Maintenance includes preventing deterioration of applied conservation practices and repairing damage to, or replacement of the practice, if one or more of its components fail. Damages to completed practices caused by normal deterioration, drought, rainfall in excess of design rainfall, or vandalism is considered maintenance.

The O&M requirements will be documented in the conservation plan of operations (long-term contract). The cooperator must agree to provide and finance adequate and sound arrangements for proper operation and maintenance. The cooperators should carry out the provisions of the agreed-to plan in a manner consistent with the spirit, intent, and purpose of the plan and project.

Representatives of the soil and water conservation districts will periodically inspect the conservation practices. The districts will encourage landusers to perform needed maintenance, replace damaged measures, and in planning and installing new measures to maintain an adequate level of protection. Special maintenance may be necessary to repair damage from unusual storms.

The conservation plan file should reflect the actions required and accomplished. After termination of the long-term contract, the cooperator is expected to continue the O&M requirements for practices in the same manner as prescribed for other conservation practices covered by the district agreement.

Table 1, Estimated Project Installation Cost
Nolan River Watershed, Texas

Installation Cost Item	Unit	Number	Estimated Cost (Dollars) 1/		
			Public Law 83-566 Funds	Other Funds	Total
Land Treatment - Accelerated					
Animal Waste Management Systems	No.	29	1,066,300	574,200	1,640,500
Project Administration			37,300	8,600	45,900
Technical Assistance			238,250	0	238,250
Total Project			1,341,850	582,800	1,924,650

1/ Price Base: 1994

October 1994

Table 2 - Estimated Average Annual Costs
Nolan River Watershed, Texas
Dollars 1/

Item	Annual Costs
Annual Installation	182,000
Operation and Maintenance	80,000
Total	262,000

1/ Price base 1994.

October 1994

Table 3 - Estimated Average Annual Watershed Protection Benefits
Nolan River Watershed, Texas
Dollars 1/

Item	Average annual benefits		Total Annual Benefits
	Agriculture - related	Nonagricultural - related	
Onsite	343,900	0	343,900
Offsite			
Property values	0	640,000	640,000
Water treatment	0	18,400	18,400
Recreation	0	80,800	80,800
Total	343,900	739,200	1,083,100

1/ Price base 1994.

October 1994

Table 4 - Comparison of NED Benefits and Costs
Nolan River Watershed, Texas
(Dollars) 1/

Item	Total Annualized Benefits	Annualized Cost	Benefit Cost Ratio
Land Treatment - Accelerated Waste Management Systems	1,083,100	262,000	4:1

1/ Price base 1994.
Discounted and annualized at 8.125 percent discount rate for 25 years.

October 1994

CONSULTATION AND PUBLIC PARTICIPATION

During the planning stages a public meeting and interviews with local citizens with concerns were held in Cleburne. The input from these meetings was used to form the basis for the water quality study completed on the watershed. The steering committee, Johnson County SWCD, and the City of Cleburne were also directly involved in all steps of planning both the WQRP and the PL-566 project, and held two meetings to specifically gather data on this project. The planning staff also met with the Johnson County SWCD at their regularly scheduled board meeting to discuss the status of the project.

The BRA initiated four meetings to discuss their Clean Lakes Act project. These meetings were attended by representatives of the BRA, EPA, City of Cleburne, Johnson County SWCD, TIAER, TNRCC, TSSWCB, and NRCS. The PL-566 project was discussed in detail at these meetings, and fully supported by all parties present.

The WQRP was reviewed and commented on by various agencies and individuals. Since many of these agencies were involved in the planning stages of both the WQRP and the PL-566 project, only a limited number of comments were received during "interagency review." The following agencies and groups were requested to comment on the Draft WQRP:

Agricultural Stabilization and Conservation Service
Associated Milk Producers, Inc.
Brazos River Authority
City of Cleburne
Environmental Protection Agency (Region 6)
Institute for Applied Environment Research
Johnson County Commissioners Court
Johnson County Soil and Water Conservation District
Local Citizens (By news article)
Texas Agricultural Experiment Station
Texas Agricultural Extension Service
Texas Association of Dairymen
Texas Historical Commission
Texas Natural Resource Conservation Commission
Texas Parks and Wildlife Department
Texas State Soil and Water Conservation Board
U. S. Fish and Wildlife Service
U. S. Forest Service

The responding agencies' and organizations' comments were incorporated as appropriate into the WQRP. All written comments were included in Appendix A of the WQRP.

The agencies listed above as well as the following agencies and groups were also requested to review the draft PL-566

project. There were not any specific comments or substantial changes to this plan. The only comments received required changes that were narrative in nature. Their specific responses have also been included in Appendix A of this plan.

Texas Forest Service
Texas Department of Transportation
U. S. Army Corps of Engineers
USDI, National Park Service

A public meeting was also held during the interagency review period to gain additional input. While there were several questions raised at the meeting, no additions or substantial changes to the plan were required as a result of public input. All questions relating to this plan were answered at the meeting, without the need for further input.

We also received several comments from other agencies and groups supporting the project, without any specific comments to address. These included the following:

Representative Pete Geren
City of Cleburne
Johnson County Soil and Water Conservation District
USDI - Fish and Wildlife Service

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LIST OF PREPARERS

This Watershed Plan and Environmental Assessment was reviewed and concurred in by state staff specialists having responsibility for engineering, soils, agronomy, biology, and geology. During development of this plan coordination and guidance was provided by the Technical Services Center.

LIST OF PREPARERS

NAME AND PRESENT TITLE	EDUCATION Degree(s)	EXPERIENCE Title & Years of experience	OTHER Licenses, Etc.
J.D. Ballard DC (Retired)	B.S., M.S., Agronomy, Biology	DC ..... 18 SC 10	SWCS
Larry Barkman Public Works Director	B.S., Civil Engineering	Public Works Director . 6 Consulting Engineer . 22	PE APWA AWWA
Gary A. Batte AC	B.S., Agriculture Education	AC ..... 18 DC ..... 8 SC 3	SWCS
Max D. Bircket Geologist	B.S., Geology	Geologist 26	Licensed Prof. Geologist
Nancy J. Cole Arch.	B.S., M.A., Archeology	Arch. 17	
James L. Hailey Planning Staff Leader	B.S., M.S., Agricultural Engineering	Planning Staff Leader .. 2 Hyd. Eng. 11 CE ..... 6 Ag. Eng... 5	PE ASAE SWCS ASDSO
James Henson Biologist/ Env. Spec.	B.S., Wildlife Science	Biologist 33	Certified Biologist

LIST OF PREPARERS (cont.)

NAME AND PRESENT TITLE	EDUCATION Degree(s)	EXPERIENCE Title & Years of experience	OTHER Licenses, Etc...
Matthew R. Judy Biologist	B.S., Forest Game Mgt.	Biologist . 4 SC ..... 3 Forester .. 3	Wildlife Society, American Fisheries Society
Jerry W. Kazda Agricultural Economist	B.S., Agricultural Economics	Agricultural Economist 28	
Charlie Mears Water Superintendent		Water Superint. 2 Chief Operator WWTP 10	B Water & B Sewer License AWWA
Lisa K. Moulder Civil Engineer	B.S., Agricultural Engineering	CE ..... 5 Ag. Eng. . 7	PE SWCS ASAE
James Neighbors Resource Conservationist	B.S., M.S., Agronomy, Range Mgmt.	Res. Cons. 3 Agronomist 12 RC ..... 2 SC 8	Certified Prof. Agron.

Abbreviations:

AC - Area Conservationist
Ag. Eng. - Agricultural Engineer
Agron. - Agronomist
APWA - American Public Works Association
Arch. - Archaeologist
ASAE - American Society of Agricultural Engineers
ASDSO - Association of State Dam Safety Officials
AWWA - American Water Works Association
CE - Civil Engineer
DC - District Conservationist
Env. Spec. - Environmental Specialist
Hyd. Eng. - Hydraulic Engineer
PE - Registered Professional Engineer
Prof. - Professional

RC - Range Conservationist
SC - Soil Conservationist
SWCS - Soil and Water Conservation Society of America
WWTP - Waste Water Treatment Plant

APPENDICES

APPENDIX A

Letters of Comment

1995 JAN 12 PM 4:30

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

January 9, 1995

Mr. T. C. Adams
Texas Office of State-Federal Relations
P.O. Box 13005
Austin, Texas 78711

Re: Draft Environmental Assessment/Nolan River Watershed Plan, Johnson County, Texas

Dear Mr. Adams:

Thank you for the opportunity to comment on the above-referenced project. The Commission maintains a keen interest in this type of activity and applauds the sponsors of this project for their efforts in improving and protecting the quality of the water in a very important and highly used watershed.

The Ground-Water Investigations Team, Ground-Water Assessment Section, has reviewed the Nolan River Watershed Plan and Environmental Assessment and offers the following comments:

Over the past two fiscal years, the Ground-Water Investigations Team has conducted Ground-Water Impact Evaluations for six facilities in the subject watershed. We concur that the primary aquifers in the area are deep aquifers, but we have noted in our evaluations that there exists a potential for "perched" water bearing zones nearer the surface, primarily in fractured limestones very near the surface. Any old, hand-dug or windmill powered wells are likely to be completed in this perched water zone. These zones could become contaminated through the leaking of improperly lined runoff control structures or waste lagoons.

The information provided to us by the SCS Soil Survey for Johnson County, and the field offices responsible for that county, indicates that the Hassee and Rader soils are also subject to perched water zones or seasonal high water tables. Contamination introduced to these zones or water tables via a leaking pond or overloaded irrigation site may migrate laterally to a contact with other soils and reemerge as seeps, ultimately impacting surface waters.

This mode of contamination may not be considered a discharge to ground-water in the same sense as direct recharge to an aquifer, but if the laterally migrating contamination encounters an improperly completed or abandoned water well, the effect is the same.

The Ground-Water Investigations Team feels that the proposal to implement Animal Waste Management Systems (AWMS) at 29 dairies that currently do not have them is a major step forward in protecting the watershed. Certain characteristics of the soils found on the facilities and their waste disposal sites need to be considered in the AWMS and their associated management plans, and the remaining seven dairies with such systems need to have their systems and their management plans evaluated for effectiveness as well. For example, this Team's recommendations have expressed concerns about application of wastes to soils that show up as "unsuitable" for such activities in the Soils Survey. Proposed management plans should take these soils into consideration. Existing AWMS systems and management plans should be reviewed with these soil characteristics in mind, and any potential effects of waste application to these soils should be evaluated.

Thank you for the opportunity to review this proposal. If you need any clarification or additional information on the above comments, please contact me at 239-3502 or Cary Betz of our Ground-Water Assessment Team at (512) 239-4506.

Sincerely,

Sidney Wheeler

(Ms.) Sidney Wheeler
Program Administrator
Intergovernmental Relations Division

cc: Mr. Harry W. Oneth
State Conservationist
Natural Resources Conservation Service
101 S. Main Street
Temple, Texas 76501-7682

Mr. James Kowis, Director, TNRCC Agriculture and Rural Assistance Division
Mr. Cary Betz, Ground-Water Assessment Section, TNRCC Water Planning and Assessments Division

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ecological Services
Stadium Centre Building
711 Stadium Drive East, Suite 252
Arlington, Texas 76011

December 13, 1994

PDM 11-11

Mr. Harry W. Oneth
State Conservationist
Natural Resources Conservation Service
101 South Main Street
Temple, Texas 76501-7682

Dear Mr. Oneth:

This responds to your letter dated November 3, 1994, requesting our review of the Draft Plan and Environmental Assessment for the Nolan River Watershed in Johnson County, Texas. The following comments are provided for your use and consideration in preparing the final document.

General Comments

The Fish and Wildlife Service (Service) concurs with the recommended plan (Alternative 2) to install 29 animal waste management systems to improve and maintain good water quality in and below the Nolan River Watershed.

Specific Comments

Page 20, Second paragraph, fourth sentence - This sentence is incomplete.

Page 31, Alternative 2 - Include with the first paragraph that the project installation will take 10 years.

Page 37, first paragraph - Insert 'annual' to read "Total **annual** benefits..." Change the '.' to ',' in the number figure "...$1,083,100."

Page 41, Purpose and Summary - Rewrite to include "Purpose of the project is to improve **and maintain good** water ..."

Page 41, Permits and Compliance, second paragraph - Change 'unto' to **into.**

2096

We appreciate the opportunity to comment. If you have any questions please contact Denise L. Baker at (817) 885-7830.

Sincerely,

Robert M. Short
Field Supervisor

cc: Regional Director, FWS, Albuquerque, NM (AES)

DEPARTMENT OF THE ARMY
FORT WORTH DISTRICT, CORPS OF ENGINEERS
P.O. BOX 17300
FORT WORTH, TEXAS 76102-0300

REPLY TO
ATTENTION OF:

December 9, 1994

Planning Division

Mr. James Hailey
Planning Staff Leader
Soil Conservation Service
101 South Main Street
Temple, Texas 76501-7682

Dear Mr. Hailey:

Thank you for your letter of November 3, 1994, concerning your proposal to improve water quality in the Nolan River Watershed by installing twenty nine animal waste management systems in Johnson County, Texas. This project has been assigned Project Number 199400779. Please include this number in all future correspondence concerning this project. Failure to reference the project number may result in a delay.

We have reviewed this project in accordance with Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899. Under Section 404, the U.S. Army Corps of Engineers (USACE) regulates the discharge of dredged and fill material into waters of the United States, including wetlands. The Corps' responsibility under Section 10 is to regulate any work in, or affecting, navigable waters of the United States.

In a November 22, 1994, telephone conversation with Mr. Michael Lamprecht of the USACE, Ms. Lisa Moulder, of your staff, stated that none of the work associated with the Nolan River Watershed Plan would occur in waters of the United States. Therefore, based on this conversation and your description of the proposed work, we have determined that your watershed plan will not involve any regulated activities. Therefore, it will not require Department of the Army authorization.

Having reviewed the proposed concentration of waste sites and dairy locations they are outside of the 100 year floodplain and appear to have no impact on the 100 year floodplain of Nolan River and its tributaries. For your reference, "Flood Insurance Rate Maps" of Johnson County, Texas and Incorporated Areas, Community Panel Numbers 480879 0025F, 0100F, 0125F, 0175F, dated September 27, 1991 are provided.

Thank you for your interest in our nation's water resources. If you have any questions concerning our regulatory program or your project design changes, please contact Mr. Michael Lamprecht at the address above or telephone (817)885-7547.

Sincerely,

Paul M. Hathorn
Chief, Environmental Resources Branch

COPIES FURNISHED:

Mr. Rollin MacRae
Texas Parks and Wildlife Department
4200 Smith School Road
Austin, Texas 78444

CESWF-OD-O, Attn: Wayne Lea

Johnson County Soil and Water Conservation District No. 541
Box 293 - Cleburne, Texas 76031

Directors

FLOYD ORMSBY	M.J. MOORE	ROBERT GREENFIELD	WILLIAM P. HALLMAN	ROBERT A. XING
Chairman	Vice-Chairman	Secretary-Treasurer	Member	Member
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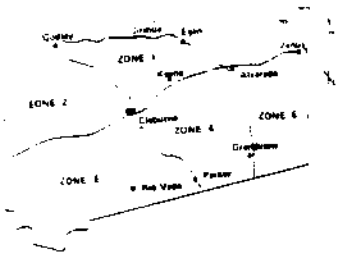
Cleburne, TX 76031	Alvarado, TX 76009	Joshua, TX 76058	Cleburne, TX 76031	Cleburne, TX 76031



December 5, 1994

Wes Oneth
State Conservationist
NRCS, Temple, texas

Attention: James Hailey

We have reviewed the Nolan River Watershed Plan and Environmental Assessment. It looks good and we do not have any comments for improvement.

Sincerely,

Floyd Ormsby, III

Floyd Ormbsy, III
Chairman, Board of Directors

COMMITTEES:
ARMED SERVICES
PUBLIC WORKS AND TRANSPORTATION
SCIENCE, SPACE AND TECHNOLOGY

Congress of the United States
House of Representatives
Washington, DC 20515-4312

PETE GEREN
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WASHINGTON, D.C. 20515
(202) 225-2571

DISTRICT
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SUITE 700
FORT WORTH, TEXAS 76102
(817) 332-3905
(800) 924-7322

August 17, 1994

The Honorable Mike Espy
U S Dept Of Agriculture
12th
Washington, D.C. 20250

Dear Mr. Secretary:

I am writing you in support of the Nolan River Watershed Plan and Environmental Assessment project.

The Nolan River project is very important to the citizens of Cleburne and Johnson County. The project is a 10-year local plan to improve and protect surface water quality in and below a 64,000 acre watershed by managing animal waste pollutants from 29 dairies.

The installed project will improve and protect water quality in a 25,320 acre municipal and industrial reservoir - Lake Pat Cleburne, 425 farm ponds and 53 miles of stream channels. Health hazards from contaminated water will be reduced and recreational and social uses of the environment will be enhanced.

The Nolan River project is very important to Johnson County, I urge your approval for the planning an implementation of this plan as soon as possible.

Please do no hesitate to contact me if I can provide you any additional information.

Sincerely,

Pete Geren
Member of Congress

PG:tb
CC: Bob King

APPENDIX B

Supporting Maps

and

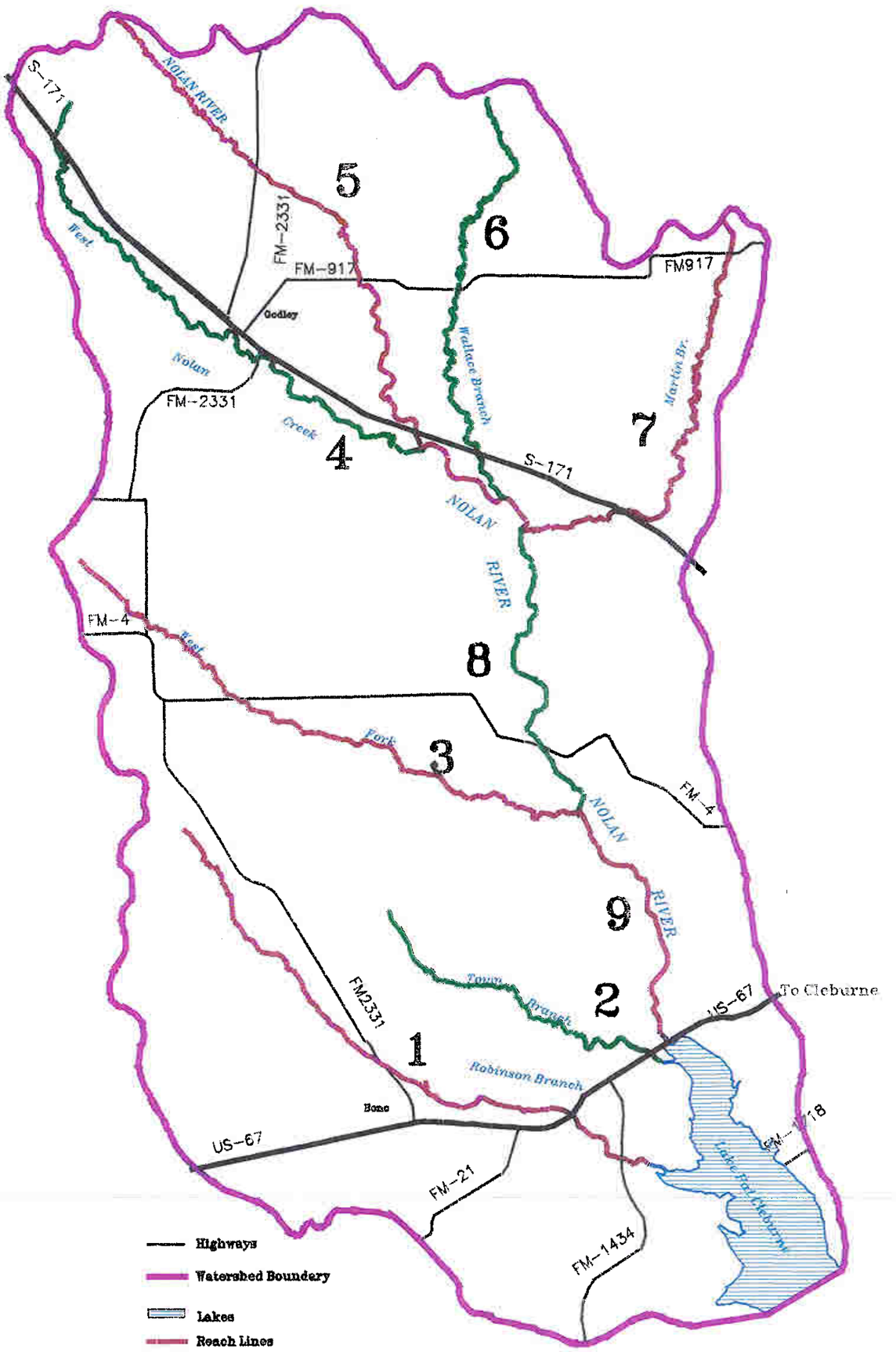
Documentation

U. S. DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

NOLAN RIVER WATERSHED

Johnson County, Texas



APPENDIX B–Fig. B1

REACH MAP

1 Reach Number

Digital information derived from 1990 Tiger line data and information from SCS field personnel.
Map prepared using GRASS–MAPGEN software.
USDA–SCS GIS UNIT, Temple, Texas 1993.

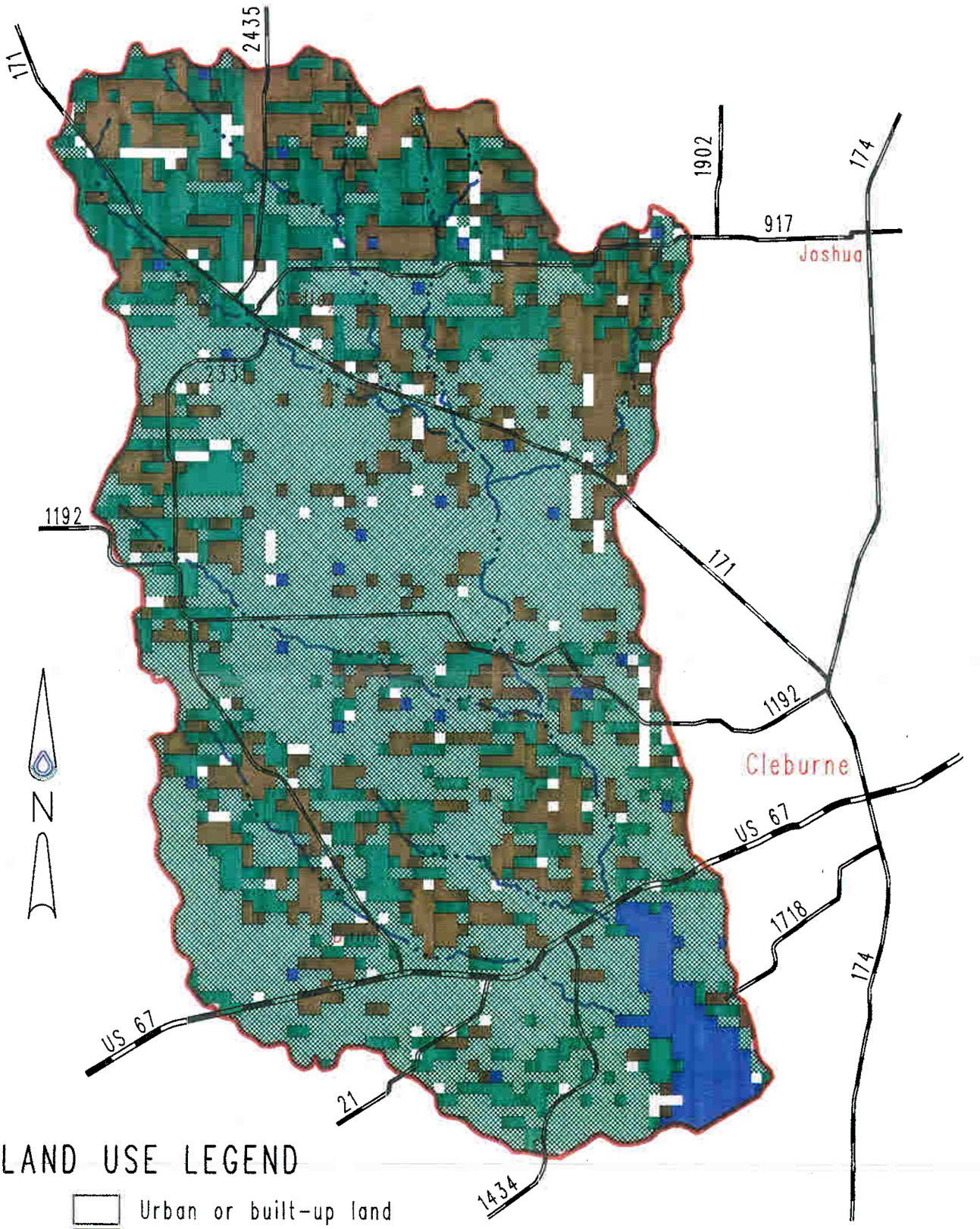
2 0 2 STATUTE MILES

N

12

NOLAN RIVER WATERSHED

Johnson County, Texas



LAND USE LEGEND

- Urban or built-up land
- Cropland
- Pastureland
- Rangeland
- Water

- Watershed Boundary
- Primary Highway
- Secondary Highway
- Stream or River

APPENDIX B-Fig. B2

TOTAL WATERSHED AREA: 100 SQ. MILES

THE MOUTH OF THE WATERSHED IS THE DAM AT LAKE PAT CLEBURNE

0 1 2 3 4

APPROXIMATE SCALE - MILES

PREPARED BY PLANNING STAFF AND GIS UNIT MAY 20, 1991

B3

Archaeological Stages in Texas

Four archaeological stages have been recognized for Texas: Paleo-Indian, Archaic, Neo-American and Historic. A brief description of each follows.

Paleo-Indian;

This stage began approximately 10,000 B.C. and ended about 5,000 B.C. There have been no Paleo-Indian sites recorded for the county. This does not mean that sites do not exist. The closest recorded Paleo site is near Waco, Texas along the Brazos River.

Archaic;

This stage began approximately 5,000 B.C. and ended about A.D. 500. One Late Archaic campsite has been recorded for the county. The presence of burned rock middens, generally attributed to the Archaic stage, also suggests Archaic people were living in the area now called Johnson County. During a survey of Lakeview Lake, Archaic sites including two presumably Archaic burials were found in nearby Tarrant County.

Neo-American;

This stage began approximately A.D. 500 and ends with the coming of Europeans to the area in A.D. 1500. The cultures of this stage are marked by pottery and arrowpoints. The recording of at least one Neo-American shell midden indicates the presence of groups of Neo-Americans in the area now comprising Johnson County.

Historic;

In the 18th Century the area now comprising Johnson County was occupied by bands of Wichita Indians. They farmed and hunted the buffalo on horses they had earlier captured from the Spanish. These tribes spoke a dialect of the Caddoan language and were related in some way to the Caddoes occupying the Angelina and Neches Rivers in east Texas. The land included in the county was once part of the Robertson Colony and later belonged to both the Peter's and Mercer Colony. George Barnard was the first white man to establish a lasting trade with the Indians near and in Johnson County. Henry Briden located near the present Rio Vista, in 1849.

In 1848 the Texas Emigration and Land Company brought more than 2,000 families into parts of Tarrant and Johnson Counties. Cattle raising was the foundation of the county although barley, sorghum and clover were cash crops. In 1875 cotton and corn had become the principal crops. In 1881 the Gulf, Colorado and Santa Fe and the Missouri and Texas railroads both crossed Johnson County.

APPENDIX C

Typical Animal Waste Management System

Typical Animal Waste Management System

A typical animal waste management system (AWMS) was included in Appendix C of the Water Quality Resource Plan (WQRP) for the Nolan River Watershed, September 1993.

A typical AWMS plan would include the following items:

A. Cover Sheet

B. General Description of Dairy Operation

C. Treatment Processes

D. Soil map and legend

E. Irrigation Practices and Equipment Needed

F. Vegetative Plan

G. Conservation Plan Of Operation

(Including detailed design criteria such as size of ponds and required irrigation equipment as well as guidance including dewatering plans, disposal plan, land application of waste, cleanout, pond locations, and operation and maintenance)

H. Waste utilization plan

I. Manure worksheet

J. Water budget analysis

K. Typical cross section of pond

L. Waterway details

M. Plan map of dairy complex and disposal site

N. Technicians notes

Additional components would be added or deleted as needed on each specific confined animal feeding operation.

Copies of a typical plan are available upon request.

APPENDIX D

Animal Waste Calculations

NOLAN RIVER WATERSHED - ALL DAIRIES 01/13/95

MANURE PRODUCTION DATA FOR CONFINED ANIMAL FEEDING OPERATIONS

TYPE OF ANIMAL (Dairy=0, Swine=1, Laying Hens=2, Beef Feedlot=3, Sheep Feedlot=4, Horses=5, Turkeys=6, Broilers=7) => 0

Feeding Facilities For: Dairy

	Buildings, Concrete Pens & Alleys	Open Lots	Total
Number of Animals	8000	8000	
Average Liveweight per Head, lbs/hd	1400	1400	
Total Liveweight, lbs	11200000	11200000	
Confinement Period, hours/hd/day	2.00	22.00	24.00
Adjusted Total Liveweight, lbs	933333	1026666T	11200000
Wet Manure Production, lbs/day	95200	1047200	1142400
Dry Manure Production, lbs/day	13720	150920	164640
Dry Manure Production, tons/year	2504	27543	30047
Volatile Solids (VS) Production, lbs/day	10071	110777	120848
Total Nitrogen Production, lbs/day	511	5616	6126
Total Phosphorus (P2O5), lbs/day	252	2772	3024
Total Potassium (K2O), lbs/day	432	4753	5186
Sodium Production, lbs/day	73	801	874
COD Production, lbs/day	12507	137573	150080
BOD5 Production, lbs/day	1941	21355	23296

NOLAN RIVER WATERSHED - ALL DAIRIES 01/13/95

VOLUME OF MANURE & WASTEWATER FROM CONFINEMENT BUILDINGS

Net Manure Production	=	11415	gal/day
Water Used for Manure Removal			
a. Dry Manure Production	=	13720	lbs/day
b. Water Volume Required for Manure Removal			
1. Flush Systems:			
(Enter gallons water per pound of dry manure production, range 8-12 gal/lb)	=>	12	
Total flush water	=	164640	gal/day
2. Manual Scrape/Wash System (Enter gallons of water per pound of dry manure production, range 3-6 gal/lb)	=>	0	
Total manual wash water	=	0	gal/day
Cleanup and Washwater (Default=10 gal/hd/day)	=>	10	gal/hd/day
	=	80000	gal/day
Other Water That Enters Wastewater System	=>	12	gal/hd/day
[e.g. drinking water, etc.(12 gal/hd/day)]	=	96000	gal/day
Total Process Generated Wastewater Volume			
Daily Volume	=	352055	gal/day
Less Volume of Recycled Wastewater Used for Manure Removal	=>	0	gal/day
Design Wastewater Storage Volume, Minimum Allowable			
Minimum Storage Days (Use Exhibit 2)*	=>	32	days
Minimum Design Storage Volume	=	34.58	ac-ft
Net Manure and Wastewater Volume for Land Application			
Monthly Volume	=	32.86	ac-ft/month
Annual Sludge Accumulation Rate, ac-ft	=	5.36	
Desired Sludge Storage Volume in Pond =	0.00	ac-ft	
Design Sludge Accumulation Storage Volume (Not to be less than 1 Year accumulation)	=	5.36	ac-ft

NOLAN RIVER WATERSHED - ALL DAIRIES 01/13/95

ESTIMATED VOLUME OF RUNOFF FROM OPEN LOTS

Total area draining into Runoff Control Structure (RCS)			
a. Area of open lot surface	=>	200.00	acres
b. Area between open lot surface and RCS	=>	35.00	acres
c. Surface area of RCS	=>	70.00	acres
d. Total area (#1.a + #1.b + #1.c)	=	305.00	acres
Design rainfall (25-year frequency, 24-hour duration storm), inches (Use Exhibit 1)	=>	7.50	inches
Design runoff depth, inches (Use exhibit 3)			
a. For Open Lot Surface * CN 90	=>	6.31	inches
b. For Area Between Lots and RCS ** CN 80	=>	5.16	inches
c. For Surface Area of RCS	=>	7.50	inches
Design runoff volume from 25-year, 24-hour storm			
a. For Open Lot Surface	=	105.2	ac-ft
b. For Area Between Lots and RCS	=	15.0	ac-ft
c. For Surface Area of RCS	=	43.8	ac-ft
d. Total Design Runoff Volume	=	164.0	ac-ft

##########

SUMMARY OF REQUIRED AND DESIGNED STORAGE PONDS

Minimum Design Wastewater Storage Volume	34.58 ac-ft
Minimum Design Runoff Storage Volume	(64.02 ac-ft
Sludge Accumulation Storage Volume	5.36 ac-ft
Additional Capacity Allowance	0.00 ac-ft
Total Capacity Designed	203.96 ac-ft

NOLAN RIVER WATERSHED - ALL DAIRIES 01/13/95

LAND AREA FOR DISPOSAL OF MANURE OR EFFLUENT FROM TREATMENT LAGOONS, BASED ON PLANT-AVAILABLE NITROGEN (PAN)

		Buildings		Open Lots	
Total Daily Nitrogen Production	=	511	more->	5616	lbs/day
Total Annual Nitrogen Production	=	186345	more->	2049791	lbs/yr
Percent Nitrogen Loss from manure storage or treatment system*	=>	20	more->	50	percent
Annual Nitrogen Loss from manure storage or treatment system	=	37269	more->	1024896	lbs/yr
Total Annual Nitrogen Remaining	=	149076	more->	1024896	lbs/yr
Availability of Nitrogen in Manure or Effluent, % (Normal range is 80-95% in lagoon effluent; 50-80% in fresh or pit-stored manure; or 40-50% in feed lot manure)	=>	80	more->	50	percent
Annual Plant-Available Nitrogen (PAN) Applied to Soil	=	119261	more->	512448	lbs/yr
PAN Losses from Soil Surface Application **	=>	20	more->	20	percent
PAN Losses from Soil Surface Application	=	23852	more->	102490	lbs/yr
PAN Entering Soil	=	95408	more->	409958	lbs N/yr

Land Required for Various PAN Application Rates:

Assumed PAN Application Rate, lbs/ac/yr		Buildings Acres		Open Lots Acres		Total Acres
100	=	954	+	4100	=	5054
150	=	636	+	2733	=	3369
200	=	477	+	2050	=	2527
300	=	318	+	1367	=	1685
400	=	239	+	1025	=	1263

* Nitrogen Loss from Lagoon Surface--Normal loss is 40-65% for primary treatment lagoons with 200 days or more storage; 10-20% from liquid manure settling basins or storage pits; and 40-50% from open feedlot surface.

** Normal range of nitrogen loss from soil surface is 15-35% for surface application or, 5% for soil injection. Losses are highest in warm weather and on high pH soils.

N U T R I E N T B A L A N C E W O R K S H E E T

PRODUCER: NOLAN RIVER WATERSHED - ALL DAIRIES DATE: 01/13/95
OPERATION (BROILER=7,ALL OTHERS=0)--> 0
(AEROBIC POND=1,ANAEROBIC LAGOON=2)-> 1

L I Q U I D

	AMOUNT IN POUNDS/YR		
	N	P2O5	K2O
QUANTITY PRODUCED	95,408	91,980	157,729
NUTRIENTS IN POND *	95,408	91,980	157,729
PLANT USAGE (POTENTIAL)	160,000	52,000	160,000
EXCESS NUTRIENTS (LB/AC)	0	100	0
DEFICIT NEEDS (LB/AC)	161	0	6

*NO TREATMENT CONSIDERED IN ONE STAGE (AEROBIC) LAGOON

D R Y M A N U R E

BASIS FOR NUTRIENT APPLICATION: (N=1,P2O5=2)=> 1

	AMOUNT IN POUNDS/YR			MANURE **
	N	P2O5	K2O	TOTAL TONS
QUANTITY PRODUCED	409,958	1,011,780	1,735,015	27543
PLANT USAGE (POTENTIAL)	640,000	208,000	640,000	27543
EXCESS NUTRIENTS (LB/AC)	0	502	684	0
DEFICIT NEEDS (LB/AC)	144	0	0	

** Based On

APPLICATION RATE, TONS/AC (MINIMUM 2 TONS)==> 1T Nitrogen

PLANNED APPLICATION SUMMARY

LIQUID				AMOUNT IN POUNDS N	P2O5	K2O
FIELD	1	ACRES	0.00	0	0	0
FIELD	2	ACRES	400.00	160,000	52,000	160,000
FIELD	0	ACRES	0.00	0	0	0
FIELD	0	ACRES	0.00	0	0	0
	T O T A L S		400.00	160,000	52,000	160,000

DRY MANURE				AMOUNT IN POUNDS N	P2O5	K2O
FIELD	1	ACRES	0.00	0	0	0
FIELD	2	ACRES	0.00	0	0	0
FIELD	0	ACRES	0.00	0	0	0
FIELD	0	ACRES	0.00	0	0	0
FIELD	1	ACRES	1600.00	640,000	208,000	640,000
FIELD	0	ACRES	0.00	0	0	0
	T O T A L S		1600.00	640,000	208,000	640,000

REMARKS:

NOTE: Phosphorus levels should be monitored regularly by soil test and manure application should be made to fields less than VERY HIGH (<500 #/Ac) in PHOSPHATE levels. If VERY HIGH, apply only yearly plant requirements for P2O5 or make application to a new field.

NOLAN RIVER WATERSHED - 29 DAIRIES 01/13/95

MANURE PRODUCTION DATA FOR CONFINED ANIMAL FEEDING OPERATIONS

TYPE OF ANIMAL (Dairy=0, Swine=1, Laying Hens=2, Beef Feedlot=3, Sheep Feedlot=4, Horses=5, Turkeys=6, Broilers=7) => 0

Feeding Facilities For: Dairy

	Buildings, Concrete Pens & Alleys	Open Lots	Total
Number of Animals	4850	4850	
Average Liveweight per Head, lbs/hd	1400	1400	
Total Liveweight, lbs	6790000	6790000	
Confinement Period, hours/hd/day	2.00	22.00	24.00
Adjusted Total Liveweight, lbs	565833	6224167	6790000
Wet Manure Production, lbs/day	57715	634865	692580
Dry Manure Production, lbs/day	8318	91495	99813
Dry Manure Production, tons/year	1518	16698	18216
Volatile Solids (VS) Production, lbs/day	6105	67159	73264
Total Nitrogen Production, lbs/day	310	3405	3714
Total Phosphorus (P2O5), lbs/day	153	1681	1833
Total Potassium (K2O), lbs/day	262	2882	3144
Sodium Production, lbs/day	44	485	530
COD Production, lbs/day	7582	83404	90986
BOD5 Production, lbs/day	1177	12946	14123

NOLAN RIVER WATERSHED - 29 DAIRIES 01/13/95

VOLUME OF MANURE & WASTEWATER FROM CONFINEMENT BUILDINGS

Wet Manure Production	=	6920	gal/day
Water Used for Manure Removal			
a. Dry Manure Production	=	8318	lbs/day
b. Water Volume Required for Manure Removal			
1. Flush Systems:			
(Enter gallons water per pound of dry manure production, range 8-12 gal/lb)	=>	12	
Total flush water	=	99813	gal/day
2. Manual Scrape/Wash System (Enter gallons of water per pound of dry manure production, range 3-6 gal/lb)	=>	0	
Total manual wash water	=	0	gal/day
Cleanup and Washwater (Default=10 gal/hd/day)	=>	10	gal/hd/day
	=	48500	gal/day
Other Water That Enters Wastewater System	=>	12	gal/hd/day
(e.g. drinking water, etc.(12 gal/hd/day))	=	58200	gal/day
Total Process Generated Wastewater Volume			
Daily Volume	=	213433	gal/day
Less Volume of Recycled Wastewater Used for Manure Removal	=>	0	gal/day
Design Wastewater Storage Volume, Minimum Allowable			
Minimum Storage Days (Use Exhibit 2)*	=>	32	days
Minimum Design Storage Volume	=	20.96	ac-ft
Net Manure and Wastewater Volume for Land Application			
Monthly Volume	=	19.92	ac-ft/month
Annual Sludge Accumulation Rate, ac-ft	=	3.25	
Desired Sludge Storage Volume in Pond =	0.00	ac-ft	
Design Sludge Accumulation Storage Volume (Not to be less than 1 Year accumulation)	=	3.25	ac-ft

NOLAN RIVER WATERSHED - 29 DAIRIES 01/13/95

ESTIMATED VOLUME OF RUNOFF FROM OPEN LOTS

Total area draining into Runoff Control Structure (RCS)			
a. Area of open lot surface	=>	200.00	acres
b. Area between open lot surface and RCS	=>	35.00	acres
c. Surface area of RCS	=>	70.00	acres
d. Total area (#1.a + #1.b + #1.c)	=	305.00	acres
Design rainfall (25-year frequency, 24-hour duration storm), inches (Use Exhibit 1)	=>	7.50	inches
Design runoff depth, inches (Use exhibit 3)			
a. For Open Lot Surface * CN 90	=>	6.31	inches
b. For Area Between Lots and RCS ** CN 80	=>	5.16	inches
c. For Surface Area of RCS	=>	7.50	inches
Design runoff volume from 25-year, 24-hour storm			
a. For Open Lot Surface	=	105.2	ac-ft
b. For Area Between Lots and RCS	=	15.0	ac-ft
c. For Surface Area of RCS	=	43.8	ac-ft
d. Total Design Runoff Volume	=	164.0	ac-ft

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SUMMARY OF REQUIRED AND DESIGNED STORAGE PONDS

Minimum Design Wastewater Storage Volume	20.96 ac-ft
Minimum Design Runoff Storage Volume	164.02 ac-ft
Sludge Accumulation Storage Volume	3.25 ac-ft
Additional Capacity Allowance	0.00 ac-ft
Total Capacity Designed	188.23 ac-ft

NOLAN RIVER WATERSHED - 29 DAIRIES 01/13/95

LAND AREA FOR DISPOSAL OF MANURE OR EFFLUENT FROM TREATMENT LAGOONS, BASED ON PLANT-AVAILABLE NITROGEN (PAN)

		Buildings		Open Lots	
Total Daily Nitrogen Production	=	310	more->	3405	lbs/day
Total Annual Nitrogen Production	=	112971	more->	1242686	lbs/yr
Percent Nitrogen Loss from manure storage or treatment system*	=>	20	more->	50	percent
Annual Nitrogen Loss from manure storage or treatment system	=	22594	more->	621343	lbs/yr
Total Annual Nitrogen Remaining	=	90377	more->	621343	lbs/yr
Availability of Nitrogen in Manure or Effluent, % (Normal range is 80-95% in lagoon effluent; 50-80% in fresh or pit-stored manure; or 40-50% in feed lot manure)	=>	80	more->	50	percent
Annual Plant-Available Nitrogen (PAN) Applied to Soil	=	72302	more->	310671	lbs/yr
PAN Losses from Soil Surface Application **	=>	20	more->	20	percent
PAN Losses from Soil Surface Application	=	14460	more->	62134	lbs/yr
PAN Entering Soil	=	57841	more->	248537	lbs N/yr

Land Required for Various PAN Application Rates:

Assumed PAN Application Rate, lbs/ac/yr	Buildings Acres		Open Lots Acres		Total Acres
100	= 578	+	2485	=	3064
150	= 386	+	1657	=	2043
200	= 289	+	1243	=	1532
300	= 193	+	828	=	1021
400	= 145	+	621	=	766

* Nitrogen Loss from Lagoon Surface--Normal loss is 40-65% for primary treatment lagoons with 200 days or more storage; 10-20% from liquid manure settling basins or storage pits; and 40-50% from open feedlot surface.

** Normal range of nitrogen loss from soil surface is 15-35% for surface application or, 5% for soil injection. Losses are highest in warm weather and on high pH soils.

NUTRIENT BALANCE WORKSHEET

PRODUCER: NOLAN RIVER WATERSHED - 29 DAIRIES DATE: 01/13/95

OPERATION (BROILER=7,ALL OTHERS=0)--> 0

(AEROBIC POND=1,ANAEROBIC LAGOON=2)-> 1

LIQUID

	AMOUNT IN POUNDS/YR		
	N	P2O5	K2O
QUANTITY PRODUCED	57,841	55,763	95,623
NUTRIENTS IN POND *	57,841	55,763	95,623
PLANT USAGE (POTENTIAL)	60,000	19,500	60,000
EXCESS NUTRIENTS (LB/AC)	0	242	237
DEFICIT NEEDS (LB/AC)	14	0	0

*NO TREATMENT CONSIDERED IN ONE STAGE (AEROBIC) LAGOON

DRY MANURE

BASIS FOR NUTRIENT APPLICATION: (N=1,P2O5=2)=> 1

	AMOUNT IN POUNDS/YR			MANURE **
	N	P2O5	K2O	TOTAL TONS
QUANTITY PRODUCED	248,537	613,392	1,051,853	16698
PLANT USAGE (POTENTIAL)	400,000	130,000	400,000	16698
EXCESS NUTRIENTS (LB/AC)	0	483	652	0
DEFICIT NEEDS (LB/AC)	151	0	0	

** Based On

APPLICATION RATE, TONS/AC (MINIMUM 2 TONS)==> 17 Nitrogen

PLANNED APPLICATION SUMMARY

				AMOUNT IN POUNDS		
LIQUID				N	P2O5	K2O
FIELD	1	ACRES	0.00	0	0	0
FIELD	2	ACRES	150.00	60,000	19,500	60,000
FIELD	0	ACRES	0.00	0	0	0
FIELD	0	ACRES	0.00	0	0	0
	TOTALS		150.00	60,000	19,500	60,000

				AMOUNT IN POUNDS		
DRY MANURE				N	P2O5	K2O
FIELD	1	ACRES	0.00	0	0	0
FIELD	2	ACRES	0.00	0	0	0
FIELD	0	ACRES	0.00	0	0	0
FIELD	0	ACRES	0.00	0	0	0
FIELD	1	ACRES	1000.00	400,000	130,000	400,000
FIELD	0	ACRES	0.00	0	0	0
	TOTALS		1000.00	400,000	130,000	400,000

REMARKS:

NOTE: Phosphorus levels should be monitored regularly by soil test and manure application should be made to fields less than VERY HIGH (<500 #/Ac) in PHOSPHATE levels. If VERY HIGH, apply only yearly plant requirements for P2O5 or make application to a new field.

File: AWLR

NOLAN RIVER WATERSHED
ANIMAL WASTE IN WATERSHED AVERAGE ANNUAL RUNOFF

PS1

PRESENT CONDITIONS (2 DAIRIES WITH ADEQUATE MANAGEMENT, 29 DAIRIES WITHOUT ADEQUATE MANAGEMENT)

Reach	Cows (No.)	Animal Waste (wet) (lbs./yr.)	total solids %	volatile solids %	TKN %	P2O5 total %	K2O total %	Na %	ON-SITE Delivery Ratio Factors: total solids	volatile solids	TKN	P2O5 total	K2O total	Na	total solids lbs.	volatile solids lbs.	TKN lbs.	P2O5 total lbs.	K2O total lbs.	Na lbs.
5	1,660	84,522,520	40.10	10.60	0.51	0.26	0.45	0.046	1.00	1.00	1.00	1.00	1.00	1.00	35,214,610	9,111,390	161,220	224,960	389,350	65,760
6	150	3,818,300	40.10	10.60	0.54	0.26	0.45	0.036	1.00	1.00	1.00	1.00	1.00	1.00	3,182,050	828,140	42,220	20,330	35,180	5,910
	1,810	94,340,820													38,396,120	10,000,130	609,440	245,290	424,530	71,100
1	495	25,600,390	40.10	10.60	0.54	0.26	0.45	0.036	1.00	1.00	1.00	1.00	1.00	1.00	10,500,160	2,734,040	139,320	67,080	116,100	19,610
total	2,305	120,141,210													48,897,180	12,734,970	448,760	312,370	540,630	91,310
1	110	5,133,420	40.10	10.60	0.54	0.26	0.45	0.036	1.00	1.00	1.00	1.00	1.00	1.00	2,333,500	607,240	30,960	14,910	25,800	4,360
	2,415	125,814,630													51,230,980	13,342,210	679,720	327,280	566,430	95,670
8	0	0	40.10	10.60	0.54	0.26	0.45	0.036	1.00	1.00	1.00	1.00	1.00	1.00	0	0	0	0	0	0
total	2,415	125,871,630													51,230,980	13,342,210	679,720	327,280	566,430	95,670
1	920	11,952,240	40.10	10.60	0.54	0.26	0.45	0.036	1.00	1.00	1.00	1.00	1.00	1.00	19,816,560	5,082,940	258,940	124,680	215,790	36,440
	3,335	133,826,810													10,747,540	10,425,650	930,660	451,960	782,220	132,110
9	225	11,727,450	40.70	10.60	0.54	0.26	0.45	0.036	1.00	1.00	1.00	1.00	1.00	1.00	4,173,070	1,243,118	63,330	30,690	52,770	8,910
total	1,560	185,554,320													75,520,610	19,668,760	1,001,990	482,650	834,990	141,020
2	220	11,464,840	40.10	10.60	0.54	0.26	0.45	0.036	1.00	1.00	1.00	1.00	1.00	1.00	4,667,000	1,215,490	61,920	29,810	51,600	8,710
1	1,071	55,822,660	40.70	10.60	0.54	0.26	0.45	0.036	1.00	1.00	1.00	1.00	1.00	1.00	22,119,820	5,917,200	301,440	145,140	251,280	42,130

FUTURE WITHOUT PROJECT COST-SHARE (2 DAIRIES WITH ADEQUATE MANAGEMENT, 29 DAIRIES WITHOUT ADEQUATE MANAGEMENT)

Reach	Cows (No.)	Animal Waste (wet) (lbs./yr.)	total solids %	volatile solids %	TKN %	P2O5 total %	K2O total %	Na %	ON-SITE Delivery Ratio Factors: total solids	volatile solids	TKN	P2O5 total	K2O total	Na	total solids lbs.	volatile solids lbs.	TKN lbs.	P2O5 total lbs.	K2O total lbs.	Na lbs.
5	2,525	121,608,050	40.10	10.60	0.54	0.26	0.45	0.046	1.00	1.00	1.00	1.00	1.00	1.00	53,564,480	13,950,450	230,680	342,180	592,240	100,020
6	200	10,424,400	40.70	10.60	0.54	0.26	0.45	0.036	1.00	1.00	1.00	1.00	1.00	1.00	4,242,130	1,104,990	56,290	27,100	46,910	7,920
	2,125	142,032,450													57,807,210	15,055,440	286,970	369,280	639,150	107,940
4	100	36,485,400	40.70	10.60	0.54	0.26	0.45	0.036	1.00	1.00	1.00	1.00	1.00	1.00	11,849,560	3,867,450	197,020	94,860	164,180	27,730
total	3,425	178,517,850													22,656,770	18,922,890	963,990	464,140	803,330	135,670
1	150	1,818,300	40.10	10.60	0.54	0.26	0.45	0.646	1.00	1.00	1.00	1.00	1.00	1.00	3,182,050	828,240	42,220	20,330	35,180	5,940
	3,515	186,336,150													75,838,820	19,751,630	1,006,210	484,470	838,510	141,610
8	0	0	40.70	10.60	0.54	0.26	0.45	0.036	1.00	1.00	1.00	1.00	1.00	1.00	0	0	0	0	0	0
total	3,575	186,336,150													75,838,820	19,751,630	1,006,210	484,470	838,510	141,610
3	1,175	61,243,350	40.70	10.60	0.54	0.26	0.45	0.036	1.00	1.00	1.00	1.00	1.00	1.00	24,926,040	6,491,800	330,310	159,230	275,600	46,540
	4,750	241,579,500													100,764,860	26,243,430	1,336,520	643,700	1,113,110	188,150
9	325	16,939,650	40.10	10.60	0.54	0.26	0.45	0.036	1.00	1.00	1.00	1.00	1.00	1.00	9,894,440	1,795,600	91,470	44,040	76,230	12,870
total	5,075	264,519,150													107,659,300	28,039,030	1,428,390	687,740	1,190,340	201,020
2	385	20,066,910	40.70	10.60	0.54	0.26	0.45	0.036	1.00	1.00	1.00	1.00	1.00	1.00	8,167,260	2,127,100	108,360	52,150	90,300	15,250
1	1,175	30,148,210	40.10	10.60	0.54	0.26	0.45	0.036	1.00	1.00	1.00	1.00	1.00	1.00	36,805,690	9,595,160	488,330	235,120	406,940	68,130

Files ANLR

NOLAN RIVER WATERSHED
ANIMAL WASTE IN WATERSHED AVERAGE ANNUAL RUNOFF

FUTURE WITH PROJECT COST-SHARE (36 DAIRIES WITH ADEQUATE MANAGEMENT, 0 WITHOUT ADEQUATE MANAGEMENT)

Reach No.	Cows	Animal Waste (wet lbs./yr.)	total solids %	volatile solids %	TKN %	P2O5 total %	K2O total %	Na %	ON-SITE Delivery Ratio Factors: total solids	volatile solids	TKN	P2O5 total	K2O total	Na	total solids lbs.	volatile solids lbs.	TKN lbs.	P2O5 total lbs.	K2O total lbs.	Na lbs.
5	0	0	40.70	10.60	0.54	0.26	0.45	0.076	1.00	1.00	1.00	1.00	1.00	1.00	0	0	0	0	0	0
6	0	0	40.70	10.60	0.54	0.26	0.45	0.076	1.00	1.00	1.00	1.00	1.00	1.00	0	0	0	0	0	0
	0	0																		
4	0	0	40.70	10.60	0.54	0.26	0.45	0.076	1.00	1.00	1.00	1.00	1.00	1.00	0	0	0	0	0	0
total	0	0													0	0	0	0	0	0
															0	0	0	0	0	0
7	0	0	40.70	10.60	0.54	0.26	0.45	0.076	1.00	1.00	1.00	1.00	1.00	1.00	0	0	0	0	0	0
	0	0																		
8	0	0	40.70	10.60	0.54	0.26	0.45	0.076	1.00	1.00	1.00	1.00	1.00	1.00	0	0	0	0	0	0
total	0	0													0	0	0	0	0	0
															0	0	0	0	0	0
3	0	0	40.70	10.60	0.54	0.26	0.45	0.076	1.00	1.00	1.00	1.00	1.00	1.00	0	0	0	0	0	0
	0	0																		
9	0	0	40.70	10.60	0.54	0.26	0.45	0.076	1.00	1.00	1.00	1.00	1.00	1.00	0	0	0	0	0	0
total	0	0													0	0	0	0	0	0
															0	0	0	0	0	0
2	0	0	40.70	10.60	0.54	0.26	0.45	0.076	1.00	1.00	1.00	1.00	1.00	1.00	0	0	0	0	0	0
1	0	0	40.70	10.60	0.54	0.26	0.45	0.076	1.00	1.00	1.00	1.00	1.00	1.00	0	0	0	0	0	0

File: ANL0

NOLAN RIVER WATERSHED
ANIMAL WASTE IN WATERSHED AVERAGE ANNUAL RUNOFF

PJ 3

PRESENT CONDITIONS (7 DAIRIES WITH ADEQUATE MANAGEMENT, 29 DAIRIES WITHOUT ADEQUATE MANAGEMENT)

Reach	Cows	Animal Waste	Total solids	volatile solids	TKN	P2O5	K2O	Na	DOWNSTREAM Delivery Ratio Factors						total solids	volatile solids	TKN	P2O5	K2O	Na
		fwt				total	total		total solids	volatile solids	TKN	P2O5 total	K2O total	Na				total	total	
	(No.)	lbs./yr.)	%	%	%	%	%	%							lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
5	6,660	96,522,520	40.70	10.60	0.54	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	8,803,670	45,860	2,340	900	11,600	6,600
6	150	7,810,300	40.70	10.60	0.54	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	795,510	4,140	210	80	1,060	420
	1,810	47,340,820													7,599,180	50,000	2,850	980	12,440	5,020
6	495	25,800,390	40.70	10.60	0.54	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	2,625,190	13,670	700	270	3,480	1,370
total	2,305	120,141,210													17,220,770	63,670	3,250	1,250	16,220	6,390
7	110	5,133,420	40.10	10.60	0.54	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	583,380	3,040	150	60	770	310
	2,715	125,874,430													12,807,750	66,710	3,400	1,310	16,990	6,700
0	0	0	40.70	10.60	0.54	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	0	0	0	0	0	0
total	2,615	125,874,430													12,807,750	66,710	3,400	1,310	16,990	6,700
3	920	47,952,240	40.70	10.60	0.54	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	4,879,140	25,010	1,290	500	6,470	2,550
	3,335	173,826,370													17,686,890	92,120	4,690	1,810	23,460	9,250
7	225	11,727,450	40.70	10.60	0.54	0.26	0.45	0.070	0.250	0.005	0.005	0.004	0.030	0.070	1,193,270	6,220	320	120	1,580	620
total	3,560	185,554,320													18,880,160	98,340	5,010	1,930	25,040	9,870
2	220	11,466,840	40.10	10.60	0.54	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	1,166,250	6,080	310	120	1,550	610
1	1,071	55,822,660	40.70	10.60	0.54	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	5,679,960	29,590	1,510	580	7,540	2,770

FUTURE WITHOUT PROJECT COST-SHARE (7 DAIRIES WITH ADEQUATE MANAGEMENT, 29 DAIRIES WITHOUT ADEQUATE MANAGEMENT)

Reach	Cows	Animal Waste	Total solids	volatile solids	TKN	P2O5	K2O	Na	DOWNSTREAM Delivery Ratio Factors						total solids	volatile solids	TKN	P2O5	K2O	Na
		fwt				total	total		total solids	volatile solids	TKN	P2O5 total	K2O total	Na				total	total	
	(No.)	lbs./yr.)	%	%	%	%	%	%							lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
5	2,525	131,408,050	40.70	10.60	0.54	0.26	0.45	0.070	0.250	0.005	0.005	0.004	0.030	0.070	13,391,120	69,780	3,550	1,370	19,770	7,000
6	200	10,421,400	40.70	10.60	0.54	4.26	0.45	0.077	0.250	0.005	0.005	0.004	0.030	0.070	1,060,480	5,520	280	110	1,410	550
	2,725	142,032,450													14,451,600	75,270	3,830	1,480	19,180	7,550
6	700	36,485,400	40.70	10.60	0.54	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	3,712,390	19,340	990	380	1,930	1,940
total	3,425	178,517,850													18,164,190	94,610	4,820	1,860	24,110	9,490
7	150	7,810,300	40.10	10.60	0.54	0.26	0.45	0.070	0.250	0.005	0.005	0.004	0.030	0.070	795,510	4,140	210	80	1,060	420
	3,575	186,336,150													18,959,700	98,750	5,030	1,940	25,130	9,910
0	0	0	40.70	10.60	0.54	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	0	0	0	0	0	0
total	3,575	186,336,150													18,959,700	98,750	5,030	1,940	25,130	9,910
3	1,175	61,747,350	40.70	10.60	0.54	0.26	0.45	0.070	0.250	0.005	0.005	0.004	0.030	0.070	6,231,510	32,460	1,650	640	8,270	3,260
	4,750	247,879,500													25,191,210	131,210	7,680	2,580	33,440	13,170
9	325	16,939,650	40.70	10.60	0.54	0.26	0.45	0.070	0.250	0.005	0.005	0.004	0.030	0.070	1,723,610	8,980	460	180	2,290	900
total	5,075	264,819,150													26,914,820	140,190	7,140	2,760	35,730	14,074
7	385	20,066,970	40.70	10.60	0.54	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	2,041,510	10,640	540	210	2,710	1,070
1	1,035	53,981,100	40.10	10.60	0.54	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	5,491,020	27,930	1,440	540	7,230	2,810

File: NRLR

NOLAN RIVER WATERSHED
ANIMAL WASTE IN WATERSHED AVERAGE ANNUAL RUNOFF

WITH PROJECT COST-SHARE (36 DAIRIES WITH ADEQUATE MANAGEMENT, 0 WITHOUT ADEQUATE MANAGEMENT)

Reach	Cows	Animal Waste (wet) lbs.1yr.)	total solids %	volatile solids %	TKN %	P2O5 total %	K2O total %	Na %	DOWNSTREAM Delivery Ratio Factors: total solids	volatile solids	TKN	P2O5 total	K2O total	Na	total solids lbs.	volatile solids lbs.	TKN lbs.	P2O5 total lbs.	K2O total lbs.	Na lbs.
5	0	0	40.70	10.60	0.54	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	0	0	0	0	0	0
6	0	0	40.70	10.60	0.54	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	0	0	0	0	0	0
	0	0													0	0	0	0	0	0
1	0	0	40.70	10.60	0.54	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	0	0	0	0	0	0
total	0	0													0	0	0	0	0	0
1	0	0	40.70	10.60	0.54	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	0	0	0	0	0	0
	0	0													0	0	0	0	0	0
1	0	0	40.70	10.60	0.54	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	0	0	0	0	0	0
total	0	0													0	0	0	0	0	0
3	0	0	40.70	10.60	0.54	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	0	0	0	0	0	0
	0	0													0	0	0	0	0	0
F	0	0	40.70	10.60	0.54	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	0	0	0	0	0	0
total	0	0													0	0	0	0	0	0
2	0	0	40.70	10.60	0.54	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	0	0	0	0	0	0
1	0	0	40.70	10.60	0.54	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	0	0	0	0	0	0

File: AWLR

NORTH RIVER WATERSHED
ANIMAL WASTE IN WATERSHED AVERAGE ANNUAL RUNOFF

PRESENT CONDITIONS : 1 DAIRIES WITH ADEQUATE MANAGEMENT, 29 DAIRIES WITHOUT ADEQUATE MANAGEMENT :

Reach	Cows	Animal Waste	total solids	volatile solids	TKN	P2O5 total	K2O total	Na	DOWNSTREAM Delivery Ratio Factors: total solids	volatile solids	TKN	P2O5	K2O	Na	total solids lbs.	volatile solids lbs.	TKN lbs.	P2O5 total lbs.	K2O total lbs.	Na lbs.
	No.	lbs/yr	%	%	%	%	%	%				total	total							
1	1,071	55,822,660	40.70	10.60	0.54	0.26	0.45	0.070	0.250	0.005	0.005	0.004	0.030	0.070	5,070,960	29,590	1,510	580	1,540	2,776
2	220	11,466,040	40.70	10.60	0.54	0.26	0.45	0.060	0.250	0.005	0.005	0.004	0.030	0.070	1,166,750	6,080	310	120	1,550	610
3	920	47,952,200	40.70	10.60	0.54	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	4,879,140	25,110	1,290	500	6,610	2,550
4	495	25,800,390	40.10	10.60	0.54	0.26	0.45	0.060	0.250	0.005	0.005	0.004	0.030	0.070	2,625,190	13,670	700	270	2,890	1,310
5	1,660	86,522,520	40.70	10.60	0.54	0.26	0.45	0.066	0.250	0.005	0.005	0.004	0.030	0.070	8,803,670	45,060	2,340	900	11,680	4,600
6	150	7,810,300	40.10	10.60	0.54	0.26	0.45	0.060	0.250	0.005	0.005	0.004	0.030	0.070	795,510	4,140	210	80	1,060	420
7	110	5,733,420	40.10	10.60	0.56	0.20	0.45	0.060	0.250	0.005	0.005	0.004	0.030	0.070	583,300	3,040	150	60	770	310
8	0	0	40.70	10.60	0.54	0.26	0.15	0.060	0.250	0.005	0.005	0.004	0.030	0.070	0	0	0	0	0	0
P	225	11,727,450	40.70	10.60	0.54	0.26	0.45	0.060	0.250	0.005	0.005	0.004	0.030	0.070	1,193,270	6,220	320	120	1,580	620
Total	4,851	252,843,820													25,726,870	134,010	6,830	2,630	34,130	13,456

FUTURE WITHOUT PROJECT COST-SHARE : 7 DAIRIES WITH ADEQUATE MANAGEMENT, 29 DAIRIES WITHOUT ADEQUATE MANAGEMENT :

Reach	Cows	Animal Waste	total solids	volatile solids	TKN	P2O5 total	K2O total	Na	DOWNSTREAM Delivery Ratio Factors: total solids	volatile solids	TKN	P2O5	K2O	Na	PERCENT INCREASE OVER PRESENT CONDITIONS: total solids % increase	volatile solids % increase	TKN % increase	P2O5 total % increase	K2O total % increase	Na % increase
	No.	lbs/yr	%	%	%	%	%	%				total	total								
1	1,135	90,171,670	40.70	10.60	0.54	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	62	62	62	62	62	62
2	385	20,866,710	40.70	10.60	0.54	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	75	75	74	75	75	75
3	1,175	61,213,250	40.70	10.60	0.54	0.26	0.45	0.066	0.250	0.005	0.005	0.004	0.030	0.070	28	28	28	28	28	28
4	100	36,185,400	40.10	10.60	0.54	0.71	0.45	0.061	0.250	0.005	0.005	0.001	0.030	0.070	41	41	41	41	42	42
5	2,525	131,608,050	40.10	10.60	0.51	0.21	0.15	0.076	0.250	0.005	0.005	0.004	0.030	0.070	52	52	52	52	52	52
6	280	10,424,400	40.10	10.60	0.51	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	33	33	33	36	33	31
7	150	1,010,300	40.70	10.60	0.54	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	36	36	40	33	38	35
8	0	0	40.70	10.60	0.54	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	0	0	0	0	0	0
9	325	16,939,650	40.70	10.60	0.54	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	44	44	41	50	45	45
Total	5,195	375,017,790													49	49	49	50	50	50

FUTURE WITH PROJECT COST-SHARE : 36 DAIRIES WITH ADEQUATE MANAGEMENT, 0 WITHOUT ADEQUATE MANAGEMENT :

Reach	Cows	Animal Waste	total solids	volatile solids	TKN	P2O5 total	K2O total	Na	DOWNSTREAM Delivery Ratio Factors: total solids	volatile solids	TKN	P2O5	K2O	Na	PERCENT REDUCTION FROM FUTURE-WITHOUT-PROJECT: total solids % reduct.	volatile solids % reduct.	TKN % reduct.	P2O5 total % reduct.	K2O total % reduct.	Na % reduct.
	No.	lbs/yr	%	%	%	%	%	%				total	total								
1	0	0	40.70	10.60	0.54	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	100	100	100	100	100	100
2	0	0	40.70	10.60	0.54	0.26	0.45	0.066	0.250	0.005	0.005	0.004	0.030	0.070	100	100	100	100	100	100
3	0	0	40.10	10.60	0.54	0.26	0.45	0.061	0.250	0.005	0.005	0.004	0.030	0.070	100	100	100	100	100	100
4	0	0	40.10	10.60	0.54	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	100	100	100	100	100	100
5	0	0	40.10	10.60	0.54	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	100	100	100	100	100	100
6	0	0	40.10	10.60	0.56	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	100	100	100	100	100	100
7	0	0	40.70	10.60	0.54	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	100	100	100	100	100	100
8	0	0	40.70	10.60	0.54	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	0	0	0	0	0	0
9	0	0	40.70	10.60	0.54	0.26	0.45	0.076	0.250	0.005	0.005	0.004	0.030	0.070	100	100	100	100	100	100
Total	0	0													100	100	100	100	100	100

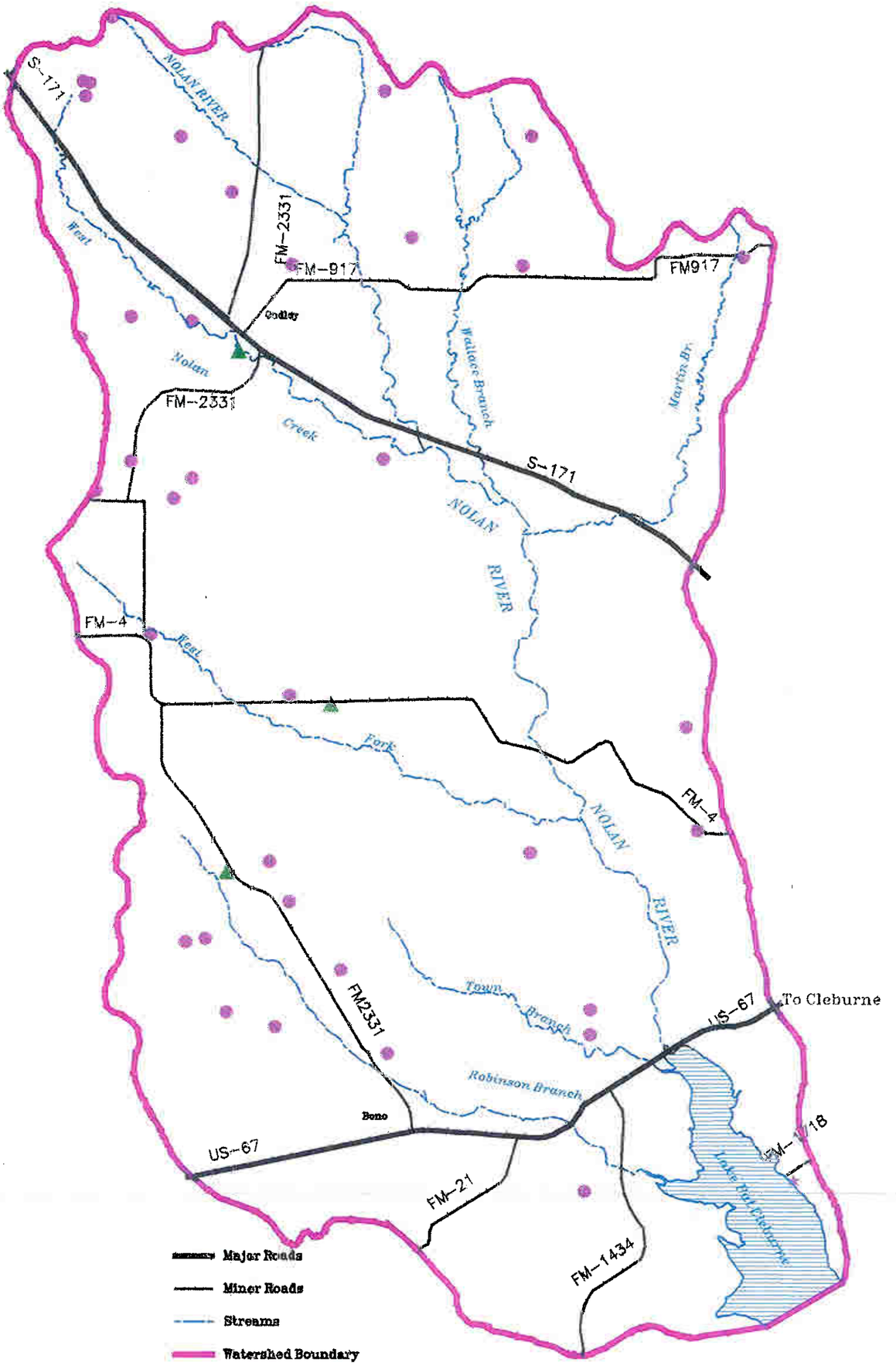
APPENDIX E

Project Map

U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE

NOLAN RIVER WATERSHED

Johnson County, Texas



APPENDIX E

PROJECT MAP

Digital information derived from 1990 Tiger Line data and information from SCS field personnel.
Map prepared using GRASS-MAPGEN software.
USDA-SCS GIS UNIT, Temple, Texas 1993.

2 0 2 STATUTE MILES

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