SATELLITE MONITORS LAKE WATER QUALITY
Landsat Makes Pass at Predicting Algae Content in Nine Oklahoma Reservoirs

The sky is no longer the limit for the Oklahoma Water Resources Board's efforts to improve the quality of water in state reservoirs. OWRB is employing the space technology of Landsat earth satellite to determine the amount of sediment in reservoirs throughout the state.

Natural erosion and sedimentation adversely affect the quality and quantity of water in the reservoirs and streams. Eroding soil is washed into lakes and streams causing a condition called "eutrophication," or nutrient enrichment of the water. Such high nutrient levels from fertilizers high in nitrogen and phosphorus result in accelerated growth of algae and other microscopic organisms, choking area lakes and decreasing their capacity to store water as well as degrading the quality of the water.

To look into the problem, OWRB received a grant in 1979 from the Environmental Protection Agency to rank the publicly owned reservoirs in the state according to their need to be cleaned up. This grant provided OWRB the opportunity to evaluate the suitability of satellite-based multispectral scanner data for use in a statewide reservoir water quality monitoring program.

The project was funded by both state and federal monies, totalling $142,857. Ranking the reservoirs allowed the problem lakes to be prioritized and qualified the state for further EPA funding for research, diagnostic studies and restoration of problem lakes.

OWRB scientists participating in the project which began in February were Ken Morris, Project Leader; Dr. Jim Grimshaw, Principal Investigator; and Susan Meyer Torrans, Project Limnologist.

Nine reservoirs were picked as typical — Lakes Atoka, Oologah, Texoma, Foss, Thunderbird, Keystone, Mountain Park, Eufaula and Fort Cobb.

The study used satellite data taken at the same time water samples were collected so that they could be directly linked and the interpretations would be more accurate. Because sampling must occur on the same day as the satellite scanning, or "pass" was made, the crew had to sample on clear days so that the satellite pictures were not obscured by clouds.

The nine lakes were tested monthly from June to October 1979. The data from the satellite, which shows the reflectivity of the water which is indicative of the amount of algae and sediment, were then compared to the water samples to develop a relationship between the aerial view and the lake sample.

Samples were taken at each lake and at various depths to determine average chlorophyll and sediment content, temperature, pH and chemical analysis.

With the satellite data plotted against the water sample data on a graph, a scientist could determine the algae content of a lake without ever going to the lake.

At the core of the project is NASA's Landsat, linked to a system developed to provide data about the earth's surface. The two Landsats repeat an orbit every 18 days.

Continued on page 2
The ground trace of Landsat as it scans the state on paths 28, 29, 30 and 31.

**Water Plan Available in July**

After six years and thousands of hours of research and compilation of data, the Oklahoma Comprehensive Water Plan is now ready for public distribution. The Plan, which was authorized in 1974 by the state legislature, was devised by the Oklahoma Water Resources Board in cooperation with the U.S. Army Corps of Engineers, the Water and Power Resources Service (formerly Bureau of Reclamation), the Soil Conservation Service and other federal, state and local agencies.

The report shows that Oklahoma has an abundance of water within its own boundaries, however it is unevenly distributed. The eastern part of the state possesses water in excess of needs and the western part exhibits a water deficit. The Plan addresses itself to the problems of eliminating the deficit by development of additional water supplies, including transfer of surplus water, and nonstructural means such as conservation, weather modification and artificial recharge of ground water aquifers. Also covered are problems associated with industrial and population growth such as pollution and increased water demand.

The Plan is based on 50-year projections of growth and water requirements for the state. The state was divided into eight planning regions on the basis of geography, hydrologic characteristics and water resource potential. Before the year 2040 (the last year of the Plan), five of the eight regions would show severe water deficits, even after the development of all potential water resources. On the other hand, the remaining three regions would have a surplus of water. The proposed water conveyance system would alleviate the water shortages predicted in the central and western regions.

*The Southern Water Conveyance System* would deliver a total of 1.3 million acre-feet of water per year; 487,000 acre-feet for municipal and industrial use in Central Oklahoma, and 823,000 acre-feet of irrigation water to southwestern Oklahoma. The southern system would therefore, a part of Oklahoma is covered every nine days. Flyovers take pictures in a 115-mile-wide band that angles across the state. The information is transmitted back to earth and stored for sale.

Dr. Charles E. Barb and John Harrington of the University of Oklahoma geography department were contracted to interpret the reflectance values of the lakes then give the data to OWRB to compare with samples.

On the basis of the study, the algae and sediment problems of 80-some publicly owned lakes can be monitored. Upon completion of the study in June, the Board was awarded a $400,000 EPA grant for the further study of four problem lakes — Northeast Lake at Oklahoma City’s Lincoln Park and Lakes Atoka, Overholser and Carl Blackwell.

require seven terminal reservoirs, four of which already exist and three proposed. This system would pick up water in southeastern Oklahoma at Hugo and Clayton Lakes, as well as at the authorized Boswell and Tuska Reservoirs.

**The Northern Water Conveyance System** would utilize existing reservoirs, since most of the suitable sites in east central Oklahoma have already been developed. The northern system calls for the capturing of flood flows, or “scalping,” at Eufaula and Robert S. Kerr Reservoirs. These flood waters would then be diverted to a canal for ultimate delivery to northwestern Oklahoma. Regulating reservoirs Welty and Vian Creek are included in the system to collect and store water during rainy seasons for release during periods of low flow.

Six new reservoirs are proposed for terminal or storage use, while three existing lakes would tie into the system. The total amount of water transferred through the northern system would be 1.2 million acre-feet annually, approximately 88 percent of it for irrigation.

The cost of the southern and northern water conveyance systems is estimated to be $2.5 billion and $5.3 billion, respectively, at 1978 prices.

Construction of the Statewide Water Conveyance System would be staged over a 30-year period — the southern system completed in four steps, the northern system in three.

Two versions of the Oklahoma Comprehensive Water Plan are available — the complete 256-page Plan and a 24-page Synopsis. Copies of both publications are available without charge from the Oklahoma Water Resources Board, 1000 N.E. 10th St., P.O. Box 53585, Oklahoma City, Okla. 73152.

**This Session’s Water Legislation**

Legislature OKs Floodplain Management Act

Gov. Nigh’s signature on HB 1094 for the first time makes available at a reasonable cost flood insurance to

*Continued on page 3*
thousands of Oklahoma families formerly denied insurance at any cost. The Floodplain Management Act makes flood insurance available to residents in areas identified as flood prone by federal planners. The act enables Oklahoma cities and towns which choose to adopt criteria set down by Federal Emergency Management Agency (FEMA) to qualify for the agency's national flood insurance program. In addition, the new legislation prohibits further development in identified flood prone areas and makes participating communities eligible for federal disaster assistance in the event of a declared flood disaster.

Financial Assistance Program Up for Review
A recent request for an Attorney General's opinion concerning the Oklahoma Water Resources Board's financial assistance program created by SB 215 of the First Session of the 37th Legislature has left the program and additions to it at least temporarily in limbo.

Senate Bill 215 allows OWRB to issue investment certificates or revenue bonds and establish a fund from the loan proceeds. From the fund OWRB could provide loans up to $1.5 million per project to qualified cities, counties and rural water districts for water development projects partially backed by federal funds.

Write for High Plains Brochure
The heart of mid-America's vibrant agricultural economy is the Ogallala Aquifer, for over 40 years supplying irrigation water to the food and fiber crops of the High Plains Region. Today overpumping of this vast water resource, once estimated to store two billion acre-feet of water, threatens to exhaust water supplies and portends a disastrous return to dryland farming.

In 1976 Congress authorized the $6 million Six-State High Plains-Ogallala Aquifer Area Study and assigned responsibility for its accomplishment to the Economic Development Administration of the U.S. Department of Commerce. Oklahoma, represented by the Oklahoma Water Resources Board, participates in the study.

More information on the High Plains Study is available without charge from the Oklahoma Water Resources Board. Please order with the coupon below.

Oklahoma Water Resources Board
Post Office Box 53585
Oklahoma City, Oklahoma 73152

Please send me _______ (copies) of the brochure concerning the Six-State High Plains-Ogallala Aquifer Study.

Name ____________________________
Address _________________________________________
City ______ State ________ Zip _______

JUNE CROP AND WEATHER SUMMARY
Crops of wheat, oats, barley, corn, sorghum, soybeans, peanuts, cotton and alfalfa were rated good, and pastures and ranges were in good condition statewide.

Mid-June topsoil moisture was adequate in 76 percent of the counties reporting, and subsoil moisture was adequate in 87 percent of the counties reporting.
Legislation, continued from page 3

House Bill 1710, signed by the governor during the Second Session amended the law created by SB 215 by including sewage treatment facilities as eligible projects and removing the requirement for federal participation. It also established a framework for providing grants up to $50,000 for water development and water and sewage treatment facilities.

Since the program's inception last fall, 13 applications have been received by OWRB, but all remain stalled pending clarification by the Attorney General.

**Sediment Included in Quality Standards**

Senate Bill 528 signed by the governor on May 21 expanded the authority of Oklahoma Water Resources Board by including sediment as a factor to be considered in setting water quality standards. Excepted are the impacts on sediment which may result from acceptable forestry, agricultural and petroleum operations.

**J.D. Hall Accepts WAPA Post in Denver**

J.D. (Joe) Hall, former Oklahoman and 18-year veteran of the Bureau of Reclamation, recently renamed the Water and Power Resources Service, has accepted a position with the Western Area Power Administration in Denver. Oklahomans should remember Hall for his assistance on behalf of the Bureau in the planning effort which preceded Phase I of the Oklahoma Comprehensive Water Plan.

**Task Force Denies Higher PCB Levels**

Refuting newspaper reports early in June that the concentration of polychlorinated biphenyls (PCBs) in fish from Fort Gibson Lake was higher now than originally found last summer, Gov. Nigh's task force said the level of contamination has not risen since earlier samplings. The task force consensus was that PCB levels had not risen, but rather, sampling variation that is expected when a relatively small number of fish are sampled from the entire lake population. Generally, the more fish collected for determining PCB level, the more indicative the levels found will be of levels actually occurring in the lake.

**Arcadia Groundbreaking Set July 19**

Groundbreaking, which will signal the beginning of construction of Arcadia Lake on Deep Fork River near Edmond, will be held July 19 at 10:30 A.M. with Sen. Henry Bellmon the featured speaker.

**Ernest R. Tucker Appointed to Board**

Ernest R. Tucker of Idabel has been appointed to the Oklahoma Water Resources Board following the resignation of Jewel B. Callaham, a member since 1977. Appointments to the 9-member board are made by the governor and confirmed by the Senate for 7-year terms.

**OWRB Leads Tar Creek Investigation**

OWRB was specified lead agency by Gov. Nigh last month to spearhead a 24-agency task force charged with solving the pollution of northeastern Oklahoma's Tar Creek. The contamination of area stream and ground water is traced to some 435 lead and zinc mines which have filled with water since mining operations ceased in 1970.

**Corps Names New Division Engineer**

Brig. Gen. Hugh G. Robinson will succeed Brig. Gen. James C. Donovan on August 1 as the U.S. Army Corps Engineers' Southwestern Division Engineer in Dallas, Texas. Robinson is currently Deputy Director of Civil Works, Office of the Chief of Engineers, Washington, D.C. Donovan's retirement marks 30 years of service.

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**OKLAHOMA WATER NEWS**

Oklahoma Water Resources Board
1000 N.E. 10th  P.O. Box 53585
Oklahoma City, Okla. 73152

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Computers make mistakes too! The OWRB computer printed out more than one label for some subscribers last month, and we apologize. We're reworking its program, but until such time, please be patient.
Twelve Area College Students Close out Summer at OWRB

Their backgrounds are as varied as the campuses they came from. College students with majors ranging from filmmaking and fashion merchandising to engineering and zoology, but this summer all 11 sharing the common experience of working at the Oklahoma Water Resources Board.

Five divisions — Stream Water, Ground Water, Engineering, Administration and Water Quality — employed these young people to assist Board “regulars” in the office and in the field. Before May, most of their firsthand knowledge of water had come from the shower, swimming pool or kitchen water tap. They leave OWRB with a greater appreciation for the problems of water supply and demand, quality, and permits for its use.

In the Water Quality Division, Elizabeth Zablatnik, OU environmental sciences major, assisted in water samplings, inspections and computer coding; Delana Haley, OSU fashion merchandising major, served as a secretarial assistant; Pat Dailey, OU zoology major, worked on water quality standards enforcement and inspections; Richard Sheirman, University of Texas filmmaking graduate and OU engineering student, performed inspections; and Robert Miller, OU Environmental Sciences major performed sampling for the Arkansas River Thermal Project.

In the Ground Water Division, Barbara Bowens, a CSU physical education major, was a secretarial assistant;

Continued on page 2

OWRB Ground Water Division Joins Tar Creek Investigation

Co-chairmen Ron Jarman, OWRB Water Quality Division Chief, and Ron Coker, leader of an Ottawa County citizens group, met with representatives of 23 state and federal agencies on August 14 for the monthly Tar Creek Task Force update. They learned that the OWRB is continuing a survey of seeps, discharges, mine shafts and drill holes in the former Eagle Picher mine area. Water quality tests are being made weekly by new monitoring equipment at two sites on Tar Creek; one near Commerce, the other in Miami. The additional gages were partially funded through a $5,300 EPA grant to monitor the contaminant levels of the water in Tar Creek.

Eagle Picher, operator of the once-productive lead and zinc mines, has been asked by Northeastern Counties of Oklahoma (NECO) to release mining operation records to aid in the location of shafts and mines.

Rep. Mike Synar is currently exploring the possibility of federal funding under the Clean Water Act for the project and reclamation measures. To date, funding of the Tar Creek Project has been provided by an $80,000 appropriation by the Oklahoma Legislature.

Continued on page 2
and Russell Hurst, OU petroleum engineering major, and Lisa Funkhouser, OSU geology major, collected well and ground water data.

Lori Bose, Oscar Rose Junior College drafting student, worked this summer plotting dam locations on maps for OWRB’s Engineering Division.

Stream Water Division employed Slade Hanson, OU journalism major, to update files and investigate complaints, and Brooks Kiri, OU chemical engineering major, to update files and process applications.

Tim Kincaid, OU public relations major, assisted in the Board’s public information office of Administration.

“It’s great for the students and the Board,” said James R. Barnett, OWRB executive director. “Working a summer or two with us often piques their interest in a water-related career, and some of them come to us upon graduation for regular employment.”

Barnett believes the OWRB policy of hiring young people for the summer is a sound one, providing the students practical experience and an opportunity to learn more about the agency and Oklahoma’s water, as well as giving OWRB an opportunity to “recruit” for careers in water.

Photo by Tim Kincaid, OWRB staff

Betty Tyson, Ground Water Division secretary, (standing) shows college students Russell Hurst, Barbara Bowens and Lisa Funkhouser the procedure for coding water use cards.

Tar Creek Investigation, continued from page 1

The Corps of Engineers is supporting the investigation by providing a full-time staff member to conduct actual field operations, maintain equipment and monitor new developments in the mine area.

The Tar Creek Task Force has asked OWRB’s Ground Water Division to participate in the study by supplying information on water wells in northeastern Oklahoma’s Boone Aquifer. The Division has recently completed an inventory of all office material on the ground water resources in Ottawa County and provided the task force with information on water wells drilled and completed in the Boone Formation of the Tar Creek area. These records show the location of each water well, total depth, data from drillers’ logs and water quality information. This information has been plotted on maps and will be verified during field investigations, when several wells per section will be inventoried and additional data collected.
OU-OSU Study to Measure Benefits of Water Conveyance

The Oklahoma Comprehensive Water Plan completed by OWRB earlier this year proposed a massive conveyance system for the transfer of water from areas of surplus to areas elsewhere in the state where there is or soon will be a water deficit. To evaluate the immense investment for such an intrastate canal system, the Oklahoma Legislature authorized and funded a study by OWRB to assess the statewide economic impact of the system.

The Center for Economic and Management Research at the University of Oklahoma is the prime contracting agency, with the Department of Agricultural Economics and College of Business Administration at Oklahoma State University subcontracted to prepare a portion of the study.

The major objectives of the study are to measure the impact of future water shortages on state economic activity through the year 2040, and to evaluate the direct and indirect benefits of the water conveyance system to the state's economy and to areas outside Oklahoma. The completed study will be submitted to the legislature in January 1981.

Although federal guidelines consider only primary benefits in weighing feasibility for construction, an assessment of secondary and tertiary benefits could justify the state's assuming the portions of the costs which fail to meet federal feasibility criteria.

First Phase of ACOG-GWA Study Over; Phase II Ahead

Central Oklahomans' interest in the vast Garber-Wellington ground water aquifer has led to a study launched last fall by the Association of Central Oklahoma Governments (ACOG) and the Garber-Wellington Ground Water Improvement District. The study is funded by a $150,000 grant from the Oklahoma Water Resources Board (OWRB) to determine the feasibility of water conveyance from the groundwater level of the Garber ground water aquifer in Garber County to the Wellington ground water aquifer in Cushing, Oklahoma, to meet the needs of the water-short Central Oklahoma region.

The study is being conducted by the University of Oklahoma's Center for Economic and Management Research, the Department of Agricultural Economics, and the College of Business Administration. The study will evaluate the economic impact of the conveyance system on the state's economy and to areas outside Oklahoma. The completed study will be submitted to the legislature in January 1981.
ACOG-GWA Study, continued from page 3

Phase II, now underway, consists of prior rights hearings and work sessions, completed in Cleveland and Pottawatomie Counties in late August, and scheduled for six other central Oklahoma counties in coming months. Prior rights hearings are set for Logan County on September 3; Lincoln, September 10; Canadian, October 1; Payne, October 8; Kingfisher, October 29; and Oklahoma, November 19.

Work sessions held in conjunction with the hearings are scheduled in Logan County September 2-5; Lincoln, September 8-11; Canadian, September 29-October 2; Payne, October 6-9; Kingfisher, October 27-30; and Oklahoma, November 17-21.

Prior rights hearings and the work sessions that accompany them afford the opportunity to establish prior ground water rights for beneficial uses which meet the requirements of laws prior to July 1, 1973, the effective date of Oklahoma's "new" ground water law.

Tulsa Hosts Joint Meetings Sept. 17-20


To mark the 10th anniversary of the Tulsa Port of Catoosa, delegates are invited to tour the port facility and attend an open house on September 20.

ICWP Meeting in Cincinnati Sept. 21-25

The Interstate Conference on Water Problems (ICWP) will hold its annual meeting on September 21-25 in Cincinnati in cooperation with the United States Water Resources Council. Delegates will discuss water for industry, recreation and energy.

House Passes Ground Water Research Bill

The U.S. House of Representatives passed an appropriations bill in August that specifically recommends additional funding for the Garber-Wellington research project. The bill now proceeds to the Senate.

AUGUST CROP AND WEATHER SUMMARY

Although some significant rains occurred in the state after the middle of the month, they were widely scattered and drought continued to take its toll of crops in many areas. Autumn crop yields are expected to drop as much as 50 percent in some areas. Corn has suffered the biggest loss from the prolonged drought, centered mainly in the Panhandle counties. Grain sorghum is down 31 percent from this time last year, and peanut and soybean crops are down 19 percent and 26 percent respectively. With the wheat harvest complete for over a month, the 1980 harvest was the second largest on record.

Maximum soil temperatures were in the upper 90s and low 100s, with minimum temperatures in the mid-80s; all measured at a 4-inch depth.
Summer’s Drought Fires Feuds Between Stream Water Users

Although the summer is one of the driest in recent memory, the OWRB Stream Water Division has been flooded with complaints from downstream water users in central and western Oklahoma that upstream users are depriving them of necessary water.

Harold Springer, division chief, said over 30 complaints have been registered since July 1 — a ten-fold increase over normal summers. He estimates that at least that many more are unreported by water rights holders who aren’t familiar with the Board’s complaint procedures. Springer reminded that they should be directed to the Stream Water Division at OWRB offices in Oklahoma City.

“Many of the complaints are repeats,” he pointed out, “and most are lodged against oil and gas drillers and nonpermitted irrigators. Many oil and gas drillers are using water for drilling mud and for cleaning platforms and equipment without permits for water use. Other water uses are for irrigation and domestic watering, and in some areas users have been asked to stop watering entirely,” he said.

There are relatively few complaints from eastern and southeastern Oklahoma due to greater supplies, and virtually none from the Panhandle, since there is little stream water available there, Springer said. Areas from Stillwater and north received some relief in the form of recent sporadic showers, so problems there also have been minimized.

“Most people have plenty of water available in conservation storage to make it through the drought with little trouble. If owners of dams upstream would release some water to downstream users, it would help tremendously,” he explained. “This is everyone’s problem. Water rights holders call us to settle disputes instead of working it out with their neighbors. It is a form of feuding, and the only solution to these problems is cooperation between water users.”

The unprecedented releases from Waurika and Pine Creek Lakes earlier this summer were small, but they were highly effective in supplying water downstream.

New District Engineer, Deputy for Corps’ Tulsa District Office

Col. James J. Harmon is the new District Engineer of the Tulsa District of the Corps of Engineers. His appointment to the post vacated by Col. Robert G. Bening on retirement last month was announced September 15.

Harmon is a 1961 graduate of the U.S. Military Academy at West Point, and he holds a master’s degree in civil engineering from Princeton University. He is also a graduate of the Army Command and General Staff College and the Army War College.

Also recently named to a Tulsa District post is Lt. Col. Richard S. Waldrop, who succeeds Lt. Col. Jack J. King as Deputy District Engineer.

Waldrop holds a bachelor of science degree in mechanical engineering and a master’s degree in engineering from Auburn University. He served two years in Vietnam and came to Tulsa following a 3-year tour in Hawaii as engineer adviser to Reserve Components in the Pacific.
Regionalism Continues to Haunt Legislative Committee Studying Statewide Water Transfer Plan

The September 10 meeting of the Interim Study Committee on the Oklahoma Comprehensive Water Plan — the fourth in a series of 10 — mirrored previous meetings in aligning the “haves” versus the “have-nots” on the issue of east-west water transfer. In fierce defense of their area’s water resources, eastern Oklahoma legislators pitted themselves against those of the west, where declining ground water supplies threaten the agricultural economy.

Perennial fears were revoiced that a plan to supply water to western regions would deprive eastern areas of water needed for future growth and development. Although statutorily defined and reiterated in the Oklahoma Comprehensive Water Plan published by OWRB earlier this year, definitions of surplus water and area-of-origin continued to be the bogey men of the transfer plan.

James R. Barnett, OWRB executive director, called fears of low lake levels in eastern Oklahoma ungrounded and pointed out that water appropriated from reservoirs to holders of stream water rights is allocated from conservation storage, not from the flood flows which are proposed for capture, storage and conveyance westward. He told eastern legislators that the Eastern Oklahoma Water Supply System included in the Plan recognizes and provides for satisfying the area’s claim to year 2040 water needs, more than doubling those originally projected in the Plan.

In order to dispel the surplus water bogey man, Sen. Robert S. Kerr III, committee chairman, assured his colleagues that all future needs of eastern Oklahoma would be insured prior to any transfer of water. He also recommended that OWRB present the committee with a breakdown by use of the land involved in the proposed water transfer system and thereby removed from local tax rolls.

Charles Huddleston, an Ames attorney representing the Oklahoma Farm Bureau, sketched a bleak picture for rural areas. He said if the legislature fails to move on a statewide water plan, it is likely the federal government or Oklahoma’s two major cities will remove any opportunity for decision. As municipal water needs increase, Tulsa and Oklahoma City can be expected to engage in a shootout for available water that could dry up rural areas. “An orderly statewide plan of water development would assure balanced growth, instead of allowing metropolitan areas to capture most of the state’s water and populations,” said Huddleston.


As in previous public meetings of the legislative committee, OWRB presented a new 22-minute slide show summarizing nontransfer alternatives, costs, and water development and conveyance strategies included in the Oklahoma Comprehensive Water Plan.

At the fifth meeting in the series — held in Tulsa on September 25 — representatives of the Corps of Engineers presented a status report on chloride control efforts and explained the role such measures would play in the Plan.

Five additional meetings of the legislative committee are scheduled throughout the state through early December.

James R. Barnett, OWRB executive director, said the slide show on the water plan is available to groups interested in reviewing it. The 22-minute show contains more than 130 color slides and a taped narrative sketching elements of the Plan.

Group showings may be scheduled by calling the Oklahoma Water Resources Board, (405) 271-2555, or by writing Board offices, P.O. Box 53585, Oklahoma City, 73152.

Well Drillers and Water Users Need Sanction, Reminds Board

All users or potential users of ground water for other than domestic purposes must obtain a permit before beginning construction of a well and the driller they hire must be licensed by OWRB, reminded J.A. Wood, OWRB Ground Water Division chief.

Applications for ground water use and drillers’ licenses are available from OWRB and are required by state law for the protection, proper allocation and management of the state’s ground water from each basin.

Wood explained that the licensed water well contractors are needed to insure that wells are properly constructed, test holes and abandoned water wells properly

*SEPTEMBER CROP AND WEATHER SUMMARY*

Crop and pasture conditions continued to deteriorate as the scattered showers that teased most of the state provided insignificant amounts of rain. Wheat seedbed preparation lagged, slowed by lack of moisture.

Corn, sorghum, soybeans, peanuts and cotton were rated in fair to poor condition. Recent rains slightly improved the soybean crop in the northeast, but dryland acreages of soybeans and peanuts have been cut for hay in many areas. Only Panhandle and north central areas report part of the pastures and ranges in good condition as a result of recent rains. Generally, more rain is needed statewide to rejuvenate forage growth for winter feed.

*Oklahoma Crop and Livestock Reporting Service*
plugged, and wells not in use properly capped. “Our licensing law insures sanitary standards for sealing off abandoned wells and test holes to prevent pollution of the state’s ground water basins,” he pointed out.

“The permits for water use are a valuable management tool, allowing each person to take only his equal proportionate share of the fresh ground water, since the water in each basin underlies the property of many landowners. It is not simply a requirement of a state agency; it is a law and we are required to enforce it.”

Domestic users — those who use ground water for household purposes, watering farm or domestic animals up to the normal grazing capacity of the land, or for irrigation of household gardens and orchards up to three acres in size — are exempt from the permit requirement.

Violation of the law by ground water users or well drillers can be prosecuted as a misdemeanor, punishable by fines of $25 to $250. If violation continues, each day can be counted as a separate violation. Members of OWRB’s Ground Water Division are available for information and assistance Monday through Friday, 8 a.m. to 4:45 p.m. by calling (405) 271-2555.

### Dates of Prior Rights Hearings Changed

Prior rights hearings and the work sessions that accompany them have been rescheduled in two central Oklahoma counties. Representatives of OWRB’s Ground Water Division will conduct work sessions in Oklahoma County October 27-30, with prior rights hearings on October 29; and in Kingfisher County December 1-4, with prior rights hearings on December 3.

These sessions afford landowners the opportunity to establish prior ground water rights for beneficial uses which meet the requirements of laws prior to July 1, 1973.

### Drought Qualifies State for FmHA Loans

Effective August 14, all counties in Oklahoma were designated for emergency loans from the FmHA to cover physical or production losses inflicted by the current drought. The incidence period for 18 counties is September 15, 1979 to August 14, 1980: Beckham, Bryan, Caddo, Carter, Comanche, Cotton, Grady, Greer, Harmon, Jackson, Jefferson, Johnston, Kiowa, Love, Marshall, Murray, Stephens and Tillman.

The incidence period for the remaining counties is from June 25 to August 14, 1980, and losses due to drought and high temperatures are eligible. FmHA loans at an interest rate of five percent are available to farmers and ranchers so that they may continue their operations and return to local sources of credit as soon as possible.

### Corps Offers Revised Navigation Charts

Revised navigation charts for the McClellan-Kerr Arkansas River Navigation System from the Port of Catoosa to the mouth of the White River (Mississippi River) are available from the Tulsa and Little Rock Engineer Districts.

The new charts include the sailing line, location of navigation aids, bridges, navigation structures, pipeline and aerial crossings, docks and safety harbors, as well as regulations, mileages and lists of terminals, marinas and public use areas. Cost of the charts is $7 from the Corps’ Tulsa office in the federal building (old post office).
Mainstream, continued from page 3

**Rural Water Survey Ready from OWRB**

"Rural Water Systems in Oklahoma," the newest OWRB publication is now available free for public distribution. The survey traces the development of 398 rural water systems that serve over half a million Oklahomans, maps their locations, provides water sources and other pertinent data, summarizes authorizing legislation, outlines funding options and presents quality analyses.

**Coordinating Committee Meets October 11**

The Fall meeting of the Governor's Coordinating Committee on Water Resources Research will be held Saturday, October 11 at 9 a.m. in the Council Room of the OSU Student Union, Stillwater. The coordinating committee is made up of heads of state and federal agencies with an interest in water resources development, conservation and management. Programs suggested by the committee become the research priorities of the Oklahoma Water Resources Research Institute at OSU.

**Clinton W. Hall New Director of Kerr Lab**

In a move effective September 15, Clinton W. Hall replaced William C. Galegar as director of the Robert S. Kerr Environmental Research Laboratory in Ada. Hall comes to the Oklahoma post from Washington, D.C. Galegar has accepted an interagency personnel agreement position with East Central State University.

**OIDC Creates New Waterways Division**

The Oklahoma Industrial Development Commission has added a Waterways Division within the Department of Industrial Development and named as director Jim Lay, former Northeast Oklahoma Area Director for the department. The purpose of the new division is to give full attention to one of the primary resources that Oklahoma has — the McClellan-Kerr Arkansas River Navigation System.

**New Irrigation Conservation Bulletin Ready**

A new brochure produced by the Oklahoma Water Resources Research Institute at OSU in cooperation with OWRB tells irrigators how to hold the line on energy bills, which are expected to pyramid in the next two years by 80 percent for electricity and 30 percent for natural gas. The brochure offers dozens of water conservation hints to help increase the efficiency of irrigation systems, and is available free. Write to the Oklahoma Water Resources Research Institute, 203 Whitehurst, Stillwater, Okla. 74078.

**Albert, Morris Attend Waurika Dedication**

Hundreds gathered northwest of the town at Waurika Lake September 18 to hear featured speakers Carl Albert, former speaker of the House of Representatives, and Lt. Gen. John W. Morris, U.S. Army Corps of Engineers chief from Washington, D.C. Morris conducted the first public meeting on the project in Waurika as Tulsa District engineer in 1962.

The ceremony marked a quarter of a century of planning and work by local citizens and government officials. First conceived after a disastrous flood in 1955, Waurika residents formed a caravan that visited surrounding southern Oklahoma communities to seek support from the municipalities that would become the lake's water customers.
State Needs Financial Assistance Program to Prevent Recurrence Of Summer's Drought Damage

When the rains finally came, more than 250 Oklahoma communities continued to labor under immediate water supply problems, said the final report to Gov. Nigh on October 2, concluding OWRB's 90-day assignment to keep the Governor apprised of state water supplies. In an ironic twist, water delivery systems, storage, treatment and pumping facilities — not short supplies — generally inflicted the sharpest blows.

James R. Barnett, OWRB executive director, warned that the state still faces a serious water crisis. "We must maintain an awareness of our water problems in upcoming months if we are to avoid the tragedies of the past summer," he said. "The outdated, undersized and inadequate water delivery equipment that squeezed off water supplies will need repair or replacement."

OWRB, a member of the Governor's Water Response Task Force and lead agency for the Water Situation Monitoring Subcommittee, compiled the reports from information gathered by weekly surveys of substate planning districts, municipal water systems and rural water districts throughout the state.

Summer's double-whammy inflicted by heat and drought on water systems and communities is shown in the graph above.

The Board's first report on July 8 set the pattern for the state's prolonged drought drama. It tallied 118 systems experiencing water supply problems, with 22 systems serving 35 communities rated critical — practice.
First in a Series of Nine

Meet L.L. Males, Board Member, Conservationist, Cheyenne Banker

In introducing readers of "Oklahoma Water News" to members of the OWRB executive board, it seems appropriate to feature its senior member, L.L. "Red" Males of Cheyenne, in the first article. Males, a lifelong soil and water conservationist, has represented his interest on the Board continuously since its creation in 1957. His 23-year tenure distinguishes him as the member appointed to more consecutive 7-year terms by the governors of Oklahoma than any other member.

When Males was born in Roger Mills County, it was a land of flood and death, drought and dust. Floods inundated crops, tore out fences and washed cattle to a watery downstream grave. Winds ravaged the land, crops withered under blistering drought and livestock died for want of water. A pageant played out year after year before young Males' eyes. A tragedy that inspired his longstanding love affair with the soil and water of his native plains.

It was a love affair not altogether sentimental, but rather stemming from sound business sense. Males' attention was drawn to the plight of the dryland farmer in the 1930's, when as a young banker he looked out the window of the bank and saw the fertility of the farms floating down the streams or carried away on the wings of the wind. The Depression, the Dust Bowl and flooding threatened to leave western Oklahoma an abandoned, orphaned land.

"It didn't take much imagination to see the schools, the churches, the homes and the bank going the same way," he said. Taking this cue, the young banker set out on one of the most dynamic and timely crusades for watershed control and protection in the nation.

His entry into banking was modest—his first job that of janitor at the First State Bank in Strong City, on the unpredictable Washita River. After graduation from high school, he continued working at the bank, in 1935 moving with it down the road to Cheyenne. He remained with the bank — now Security State Bank — and serves as its president.

"During the 'Dirty Thirties' we were in the Dust Bowl, where every afternoon or so a cloud would roll in until you had to turn on the lights to see. Yet right in the midst of that Dust Bowl we had the worst flood in history, followed almost immediately by more dust storms, because almost all the water that fell ran off."

Convinced that the solution to the water problem begins right out on the land where the raindrop first strikes the soil, he preached getting that raindrop into the soil to grow crops, to restore the water table, to cause the streams to flow, and to prevent flooding.

"We must trap the runoff where it falls, then use that trapped water over and over again as it goes downstream," he said. "A million gallons of water isn't worth a dime to us in the Gulf of Mexico."

His homespun wisdom told him that what affects the farmers would surely affect the bank. He put the resources of the bank behind a conservation program. The bank bought terracing equipment, encouraged farmers to terrace their land and loaned them money for it. "It was just plain good business to me as a banker, a taxpayer and a citizen to protect the farmlands of the nation through good watershed management."

Males barnstormed for a flood control project for Oklahoma, and in 1944 the Federal Government approved projects on 11 Oklahoma watersheds, including the Washita. Sandstone Creek, a tributary to the Washita, was selected and Males' Upper Washita Soil Conservation District was ready to play a dominant role in the nation's first upstream flood control project.

"Our community is so proud of the Sandstone Creek Project we put up a sign. We claim that we are the first in

OCTOBER CROP AND WEATHER SUMMARY

Most areas of the state received moisture needed for small grain development and pasture improvement the week preceding October 20. Only the Panhandle was exempt, averaging only one-tenth inch.

Corn, sorghum, soybeans, peanuts and pecans were rated in fair to poor condition and cotton was rated poor. Pastures and ranges continue to be rated fair to poor, although recent rains produced some greening.

Temperatures ranged from one-half to three degrees above normal. Soil temperatures measured at a 4-inch depth averaged highs in the mid-70s and lows in the mid-50s in the north to mid-60s in the south.

Oklahoma Crop and Livestock Reporting Service
L.L. Males, continued from page 2

the world and nobody disputes it, so we go ahead claim-
ing it,” he smiled.

And it is the plaque given him by the homefolks pay-
ing tribute to his work on the Sandstone Creek Project
that’s the source of most pride to the man whose counsel
on soil and water conservation is sought by presidents,
federal agencies, both houses of Congress, foreign
leaders, state water boards and watershed associations
and soil conservation districts in numbers untold. The
simple tribute to a man who’s been president of almost
every organization he’s ever joined and recognized by
colleagues in conservation the nation over, reads,
“Presented to L.L. (Red) Males in recognition of unself-
devilotion to the City of Cheyenne, Roger Mills County,
the State of Oklahoma, and to his Nation, in initiating
the World’s First Upstream Flood Prevention Project —
Sandstone Creek — and in building a better tomorrow.”

Today, the 65,000-acre watershed blooms with sor-
ghum, alfalfa, cotton, wheat and corn, and cattle graze
on the grass-covered plains. All safe from the angry red
waters that boiled through the creekbanks in a fury of
flood and death a scant 30 years ago. The disciplined
creek provides dependable irrigation water that quiets
the earth before the hungry, rushing winds.

Drought Damage, continued from page 1

ing voluntary or mandatory rationing, in extreme fire
danger, and/or out of water.

By mid-July, 133 systems serving 162 communities
were troubled, with 53 systems serving 69 communities
in the “critical” column.

In addition to staggering costs to repair physical da-
mages to the state’s water supply systems, higher op-
erating costs in the form of more chemicals for treat-
ment, extra electricity for pumping and additional labor
charges plagued local officials with a total of $750,000
above regular monthly operating and maintenance costs
during the month of July. Some small towns reported
costs $1,000 to $5,000 above normal, while cities spent
$10,000 to $16,000 over budgeted expenses.

At the peak of the drought in mid-August, when mean
daily temperatures soared to their highest point, the
state’s water systems had reported more than $2 million
in physical damages. An assessment included in the
August 5 report estimated that $63 million would be
needed to prevent a recurrence of drought tragedies in
subsequent years. That cost would include the drilling of
new wells, replacement of insufficient pumps, repair and
installation of distribution lines and additional storage
facilities to meet only the short-to-intermediate-term
needs.

By the second week in August, 272 systems serving 344
communities — or one-fourth of all public water supply
systems in the state — suffered immediate problems. As
August drew to a close, failures leveled off, indicating
that among drought-susceptible systems, most or all that
would experience problems had already succumbed to
summer’s double punch.

### Active Conservation Storage in Selected Oklahoma Lakes and Reservoirs

<table>
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<tr>
<th>Planning Region</th>
<th>Lake/Reservoir</th>
<th>Conservation Storage (AF)</th>
<th>Percent of Capacity</th>
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<td>Hugo</td>
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<td>Fort Cobb</td>
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<td>Great Salt Plains</td>
<td>20,553</td>
<td>65.5</td>
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</table>

**STATE TOTALS**

|                    | 9,666,741  | 82.3%  |

1. In initial filling stage.
2. Temporarily lowered for maintenance.
3. Lake Optima storage excluded from state total.


In its wrap-up report, OWRB asked the Governor to
take the initiative in implementing a comprehensive pro-
gram of education in water conservation; the prepara-
tion of a weather modification program; a continuous
water supply inventory aimed at designing local, re-
gional and statewide plans for future water resources
development; the enhancement of the Board’s financial
assistance program to provide loans and grants to cities,
towns and rural water districts for water supply im-
provements; and the creation of a financial mechanism
capable of funding large-scale, long-range water de-
velopment projects in Oklahoma.
Legislators, OWRB to Tour Salt Sources

In a helicopter tour scheduled November 6, members of the Special Committee on the Statewide Water Development Plan and representatives of OWRB and the Corps of Engineers will survey the natural salt sources in Oklahoma and Texas which pollute much of the stream water in the Red River Basin.

The flight will originate in Lawton, tour the Elm Fork Project in Harmon County, land in Vernon, Texas, to pick up U.S. Rep. William Hightower (Texas), then survey an inflatable dam installed by the Corps of Engineers to divert discharges from a salt spring around usable fresh water sources.

Engineering Division Completes Inventory

Paul R. Wilson, OWRB Engineering Division chief, reported that the Board’s contract with the Corps of Engineers to update the inventory of nonfederal dams was completed September 30. Identified in the survey were 4,123 dams of jurisdictional size — those 25 feet or more in height or impounding 50 acre-feet of water or more. To date, the division has performed comprehensive inspections on approximately 170 dams and submitted reports to owners.

First Contract for Arcadia Lake Awarded

Seven K Corporation of Texarkana, Texas, was awarded a $5,677,466 contract to construct the outlet works for Arcadia Lake on the Deep Fork River about five miles east of Edmond, Oklahoma, last month by the U.S. Army Engineer District, Tulsa.

Federal Payments Scheduled for Oklahoma

Several Oklahoma counties and school districts will share in $784,538 in payments in lieu of taxes to offset the fiscal impact of certain tax-exempt federal lands in the state. The tax-exempt status is given to lands dedicated to federal use for water resources and development projects, dredge disposal areas under the jurisdiction of the U.S. Army Corps of Engineers, National Wildlife Reserve Areas withdrawn from the public domain and inactive military areas used for nonindustrial purposes. A recent opinion issued by the Attorney General’s office reversed a prior interpretation by the state examiner by ruling that Oklahoma school districts are eligible to share in such payments.

AG’s Office Rules on Ground Water Use

In an effort to clarify priority of uses of ground water, the Attorney General’s Office recently ruled that exempting water for domestic use from the state’s permit requirement does not imply priority over any other beneficial uses — that all beneficial uses are equal in priority, none taking precedence over others.
Statewide Meeting Convenes in Oklahoma City December 15

Board Hosts Governor’s Water Conference

At noon the conference will move to the Skirvin Plaza Hotel for a luncheon and afternoon workshops. Jim Gillie, Assistant to the Vice President, Phillips Petroleum Company, will be the featured luncheon speaker.

Afternoon sessions will give participants an opportunity to choose from eight panel discussions of water issues related to Municipalities, Rural Water Districts, Agriculture, Energy, Environment, Tourism and Recreation/Fish and Wildlife, Conservation/Education and Industry.

OWRB Assistant Director Michael R. Melton, who is overseeing conference arrangements, said a few reservations are still available through OWRB or at the conference registration desk on December 15. Cost of registration, including lunch, is $10.

For further information on the conference or for advance registration, call the Oklahoma Water Resources Board at (405) 271-2555.

Second in a Series of Nine

OWRB Chairman Gerald Borelli Is Cattleman and Oil Producer

An interest in Oklahoma’s water fostered by his uncle, Francis Borelli, the first executive director of the Oklahoma Water Resources Board, set Gerald E. Borelli’s feet on the path that would lead him to six consecutive terms as chairman of the 9-member governing board.

Borelli, the youngest member of the Board, was first appointed in 1972 to serve a 7-year term, and every year since, his colleagues have voted to leave the gavel in his able hands. Leadership rests gracefully on the shoulders of the tall and boyish-faced cattleman and independent oil producer, who serves his hometown of Kingfisher as a director of Peoples National Bank and parish board member of Sts. Peter and Paul Catholic Church. He has also served his state as a member of the

Continued on page 2
tragedies that could loom before a state ill prepared to deal with prolonged drought.

With characteristic enthusiasm, Borelli cites completion of the Six-State High Plains-Ogallala Aquifer Area Study in 1982, desalination and chloride control of existing water supplies, implementation of the Board’s financial assistance program and the education of Oklahoma’s citizens on water issues as other high priority issues.

In the hands of a do-er, a visionary, a whirlwind like Gerald E. Borelli, one must believe the solutions to the state’s water problems are at hand.

**Water Board Receives Funding for Weather Mod Planning**

A planning project for weather modification – a further effort to insulate Oklahoma from future devastation by drought – was recently announced by Harold Springer, OWRB Stream Water Division chief.

The 18-month joint project funded by the Water and Power Resources Service will measure the potential of cloud seeding and design a “state-of-the-art” weather modification program tailor-made to the state’s precipitation and weather patterns. Under the $250,000 cooperative agreement, OWRB will contract studies to develop a cloud seeding program that can take over when nature short changes the state’s farming communities.

Springer said an investigation of cloud seeding opportunities has been contracted to the Oklahoma Climatological Survey. Studies to explore the most efficient cloud seeding techniques for the state will be performed by Aeromet, Inc., a Tulsa-based firm experienced in weather modification research.

OWRB will evaluate Board Rules and Regulations and Oklahoma Statutes to determine procedures for implementing on short notice a comprehensive weather mod program and investigate potential funding mechanisms.

Groundwork was laid in 1972 with passage of the Weather Modification Act. As amended in 1973, it assigned OWRB the responsibility for administering the act, approving contracts between local entities and contractors, licensing operators and issuing permits for weather modification activities. An 11-member advisory committee assists the Board in matters of policy, administration, research and legislation.

“We expect the outcome of the study to be a state weather mod plan which will recommend policy on weather management, determine proper use of the technology and address legal implications,” said Springer. “Potential for increasing precipitation through cloud seeding has been estimated at 10 to 30 percent – fair odds if we were faced with another drought like last summer’s.”

“However,” he emphasized, “for success during prolonged drought, we must have clouds to seed. We hope
this project will result in a long-term plan to augment water resources to tide the state over during dry periods when there are very few opportunities to seed clouds.”

At a November 19 meeting of project sponsors and contractors, the Water and Power Resources Service approved the OWRB work plan as part of the cooperative agreement.

“It will be up to us to present the Governor and Legislature a program that employs sound standards of practice which are consistent with the requirements of current scientific thinking and the general public good,” concluded Springer.

The Water and Power Resources Service drought research project is part of a $1 million program adopted by Congress in 1978 to develop weather modification as a means of lessening the impact of drought in semi-arid regions. Also sharing in the federal funds were Arizona, Colorado, Kansas, New Mexico, Texas and Utah.

Liaison Committee to Meet December 12

Members of the Liaison Committee to the Six-State High Plains-Ogallala Aquifer Area Study will assemble at the Ramada Inn West in Oklahoma City on December 12. Representatives of Colorado, Kansas, Nebraska, New Mexico, Oklahoma and Texas will confer with members of the planning consultant firm of Camp, Dresser and McKee general contractor, to review progress on research elements assigned to the participating states.

“Oklahoma Today” to Celebrate 25th Year

An anniversary celebration on January 7 hosted by Gov. and Mrs. George Nigh will mark the 25th year of publication of the Oklahoma Tourism and Recreation Department’s “Oklahoma Today” magazine. The reception will get under way at 10 a.m. in the capitol’s second floor rotunda.

The Discoveryland Singers will entertain with selections from the musical “Oklahoma!” and Gov. Raymond Gary, under whose administration magazine began in 1956, will head up the guest list. All 103 of the magazine’s covers will be displayed in the Governor’s Gallery at the capitol during the month of January.

OWRB Completes High Plains Slide Show

A new slide show prepared by OWBR staff on the Six-State High Plains-Ogallala Aquifer Area Study is ready for public viewing. The 17-minute slide/tape presentation explores the potential impact of the failing ground water aquifer on the state’s agricultural economy; outlines the study underway by the Economic Development Administration; and explains Oklahoma’s participation.

Gov. Nigh named OWBR lead state agency in accomplishing Oklahoma’s portion of the study and designated Executive Director James R. Barnet to represent Oklahoma on the High Plains Study Council.

Groups and organizations interested in scheduling the slide show may do so by calling Rick Smith, OWRB Planning and Development Division chief at (405) 271-2555.

Corps Area Office Moves to Broken Bow

The Little River Area Engineer Office, formerly located in DeQueen, Arkansas, will be opened at Broken Bow, Oklahoma, before the end of the year. Area Engineer Sam Cupps will head the office which will supervise the operation and maintenance of Broken Bow, Pine Creek, Hugo and Pat Mayse Lakes, as well as the operations phase of Clayton Lake, which is still under construction on Jackfork Creek near Clayton.

**ACTIVE CONSERVATION STORAGE IN SELECTED OKLAHOMA LAKES AND RESERVOIRS AS OF NOVEMBER 14, 1980**

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<tr>
<th>PLANNING REGION</th>
<th>LAKE/RESERVOIR</th>
<th>CONSERVATION STORAGE (AF)</th>
<th>PERCENT OF CAPACITY</th>
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<td>Broken Bow</td>
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<td>Pine Creek</td>
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<td>Hugo</td>
<td>157,600</td>
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**STATE TOTALS** 9,642,376 82.1%

1. In initial filling stage.
2. Temporarily lowered for maintenance.
3. Lake Optima storage excluded from state total.

Turkey Creek Development Weathers Drought

Reuel Little, Marshall County leader and supporter of local water development, reports that three small lakes developed on Turkey Creek provided abundant supplies of good water throughout the past summer’s drought. Little believes Turkey Creek’s watershed—augmented by Cedar Creek and fed by natural springs—is one of the most productive in the state.

Lake Oteka, Carrie and Prudence provide water of excellent quality to the 2,000 customers of the Marshall County Water Corporation at a cost of seven cents per 1,000 gallons. To supply an additional reserve, local water developers have planned the construction of a fourth, Lake Reuel. The new 200-acre lake on Turkey Creek will be approximately a mile-and-a-quarter north of Lake Oteka.

Beef Tallow Examined as Antitranspirant

An estimated 3.5 billion pounds of unused tallow, a fat byproduct of the beef production industry, may have found a market in West Texas as a possible antitranspirant to decrease plant water requirements.

A research team at the Texas Agricultural Experiment Station at Lubbock tested tallow-water emulsions containing 1.5, two, three and six percent tallow concentrations on field grown potatoes. Results showed the two percent tallow emulsion as efficient as a commercially marketed product that costs $40.58 per acre. Cost of the tallow-water emulsion is $5.20 per acre, suggesting its value as an evaporation suppressant and opening a new market for a currently unused beef byproduct.

Well Measurement Resumes in January

As part of a continuous annual program to collect and update information on Oklahoma’s fresh ground water basins, OWRB field personnel will again measure water levels in approximately 1,400 selected wells statewide. The OWRB-USGS cooperative program will begin in early January in the Panhandle and move eastward throughout the state, culminating in March.

Landowners on which these wells are located are again asked to allow access to OWRB field personnel.

NOVEMBER CROP AND WEATHER SUMMARY

A biting mid-month cold snap brought temperatures back to near normal levels throughout the state. Precipitation from an upper level storm brought snowfalls of two to four inches to southwest and central sections and one inch in the northwest.

Maximum soil temperatures averaged from the upper 60s before the cold front to the upper 40s later. Minimum soil temperatures averaged upper 50s to the mid-40s. All soil temperatures are measured at a 4-inch depth.

Small grains remained in fair condition. Wheat seeding was estimated 95% complete by mid-month. Sorghum harvest was 90% complete. Seeding of oats and barley was 85% complete, soybean and peanut harvests were 65% complete, and cotton harvest was 55% complete.

Pasture and range conditions continue fair to poor, and short forage supplies present a problem in all parts of the state. Cool-season grasses continue to show development, while cattle graze crop stubbles and require supplemental feeding.

Oklahoma Crop and Livestock Reporting Service

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