Kansas Water Resources Research Institute
Annual Technical Report
FY 2011

Introduction

The Kansas Water Resources Institute (KWRI) is part of a national network of water resources research institutes in every state and territory of the U.S. established by law in the Water Resources Research Act of 1964. The network is funded by a combination of federal funds through the U.S. Department of the Interior/Geological Survey (USGS) and non-federal funds from state and other sources.

KWRI is administered by the Kansas Center for Agricultural Resources and the Environment (KCARE) at Kansas State University. An Administrative Council comprised of representatives from participating higher education or research institutions, state agencies, and federal agencies assists in policy making.

The mission of KWRI is to: 1) develop and support research on high priority water resource problems and objectives, as identified through the state water planning process; 2) facilitate effective communications among water resource professionals; and 3) foster the dissemination and application of research results.

We work towards this mission by: 1) providing and facilitating a communications network among professionals working on water resources research and education, through electronic means, newsletters, and conferences; and 2) supporting research and dissemination of results on high priority topics, as identified by the Kansas State Water Plan, through a competitive grants program.

Research Program Introduction

Our mission is partially accomplished through our competitive research program. We encourage the following through the research that we support: interdisciplinary approaches; interagency collaboration; scientific innovation; support of students and new young scientists; cost-effectiveness; relevance to present and future water resource issues/problems as identified by the State Water Plan; and dissemination and interpretation of results to appropriate audiences.

In implementing our research program, KWRI desires to: 1) be proactive rather that reactive in addressing water resource problems of the state; 2) involve the many water resources stakeholders in identifying and prioritizing the water resource research needs of the state; 3) foster collaboration among state agencies, federal agencies, and institutions of higher education in the state on water resource issues; 4) leverage additional financial support from state, private, and other federal sources; and 5) be recognized in Kansas as a major institution to go to for water resources research.

Sediment Baseline Assessment

Basic Information

Title:	Sediment Baseline Assessment
Project Number:	2009KS71B
Start Date:	3/1/2010
End Date:	2/28/2013
Funding Source:	104B
Congressional District:	2nd
Research Category:	Climate and Hydrologic Processes
Focus Category:	Sediments, Water Quality, None
Descriptors:	None
Principal Investigators:	Dan Devlin, Will Boyer, Brock Emmert, Bruce McEnroe, DeAnn Presley, C. Bryan Young

Publications

There are no publications.

Sediment Baseline Assessment: Assessment of sediment contribution from three watersheds in North-East Kansas

Aleksey Sheshukov

Biological and Agricultural Engineering, Kansas State University
129 Seaton Hall, Manhattan, KS 66506

Overview: The watershed modeling study of three watersheds in North-east Kansas was conducted to determine sources of sediment and potential management measures to reduce sediment transport in streams and sediment delivery to water bodies. The three study watersheds, Banner Creek Watershed, Centralia Lake Watershed, and Atchison County Lake Watershed, of comparative size from about 6,000 to 12,000 acres and located within the same Western Corn Belt Plains eco-region in Kansas, were selected for the analysis. SWAT model was used as a watershed model.

The Soil and Water Assessment Tool (SWAT) model: SWAT is a continuous, physically based hydrologic and water-quality model developed to assess the impacts of land practice management and climate variations on non-point source pollution in complex watersheds, from catchment to river basin scale, that has been developed and supported since 1990s (Arnold et al. 1998, Douglas-Mankin et al. 2010). In SWAT, a watershed is divided into subwatersheds according to flow accumulation and stream network delineation procedures. Within each subwatershed, geo-referenced homogeneous units with uniform average slope, land use, and soil type are further identified and aggregated into HRUs. SWAT components calculate various hydrologic and physical parameters within each HRU and stream network on a daily basis. Outputs from all HRUs within a subwatershed are summed and routed through the stream network to the watershed outlet where they can be compared with monitoring data for model calibration and validation.

Model setup: Three SWAT models were built for three studied watersheds using the input database information from online and local sources. The watersheds were delineated with the GIS module in SWAT using a 10 m × 10 m digital elevation model for Jackson, Brown, and Nemaha Counties. The watershed outlet for each watershed was set at the streamflow gaging station location downstream of the Banner Lake, Centralia Lake, or Atchison County Lake. The stream network was created during the delineation process. Each watershed was divided into three subarea groups of high, medium, and low slope using a 3% and 6% slope thresholds. The areas of high slope (>6%) occupy 52% of the Banner Creek Watershed, 46% of the Centralia Lake Watershed, and 20% of the Atchison County Lake Watershed, while the areas of low slope (<3%) occupy 14%, 42%, and 40%, respectively. The slope analysis shows the prevalence of high slope areas in Banner Creek and Centralia Lake watersheds (>45%), while low slope areas are prevalent in Atchison County lake and Centralia Lake watersheds (>40%).

The land-use data base was created based on field reconnaissance survey conducted by Dr. Devlin and Mr. Boyer, and used as input land-use coverage for the SWAT models. This study used a summary of watershed management practices collected for Delaware River WRAPS. The Centralia Late Watershed and the Atchison County Lake Watershed had majority of land use in row-crop agriculture (78% and 75%, respectively), while the Banner Creek Watershed had majority in rangeland and pasture (87%). The difference in land use between the two row crop dominated watersheds (Centralia and Atchison) and a

grassland watershed (Banner) manifests the main goal of the project that is to assess management mitigation strategies to improve water-quality in agricultural watersheds. For Centralia Lake Watershed, corn was planted in 17% of land, soybeans in 31%, and winter wheat in 8%. For Atchison Lake Watershed, corn covered 29% of the land, while soybeans were planted in 39%. For Banner Creek Watershed, 67% of grassland was grazed and 27% was hayed. Based on the field reconnaissance survey and analysis of digital ortho imagery, the following conservation practices were applied to row-crop fields: terraces coupled with contour farming, terraces with waterways, no tillage or residue management practice, and conventional tillage.

Daily precipitation and maximum and minimum temperature data were acquired from National Climatic Data Center (NCDC 2009) weather stations (COOP ID# 143134, 143620, and 145744) located within 5 km of watersheds for the years of 2000 through 2010. Daily values for other weather variables (solar radiation, relative humidity, and wind speed) were simulated with the weather generator embedded in SWAT. For each watershed, a USGS gaging station was identified for streamflow and suspended sediment calibration. The selected gaging stations were monitored by Kansas Geological Survey from April 2009 to December 2010: 393817095260100 at Clear Creek at Decator Road near Horton used for Atchison County Lake Watershed, 392652095484100 at Banner Creek at M Road used for Banner Creek Watershed, and 394126096073500 at Black Vermillion River Tributary above Centralia Lake used for Centralia Lake Watershed. Watershed areas that drain into the gaging stations were parts of three studied watersheds and covered 47% of Banner Creek Watershed, 62% of Atchison County Lake Watershed, and 35% of Centralia Lake Watershed. The calibrated areas of the watershed were delineated into 10 subwatersheds for Banner Creek, 7 watersheds for Atchison Lake, and 5 subwatersheds for Centralia Lake. The number of HRUs were 1193, 791, and 662, respectively.

Model calibration: Three SWAT models were run from 1/1/2005 to 12/31/2010 with a three-year (1/1/2005-12/31/2007) spin-off period. Daily simulated streamflows from 4/1/2009 to 12/31/2010 were collected at the watershed outlet to compare with the stream-monitoring USGS station data available for this period only. The results from 2005 to 2010 were collected to analyze the watershed hydrologic and suspended sediment conditions.

Monthly model performance was assessed using coefficient of determination (R2), NSE, and PBIAS (Moriasi et al. 2007). A set of 11 model parameters were selected for model calibration. The parameters were selected from SWAT modules on surface flow, baseflow, evapotranspiration, and weather (snowmelt and freezing). The streamflow calibration was declared acceptable when calibration coefficients reached the satisfactory/good threshold value. For example, the NSE coefficient for Banner Creek Lake and Atchison County Lake Watersheds SWAT models reached values above 0.5 and 0.6, while it was above 0.3 for the Centralia Lake model. The lower value of the NSE for the Centralia Lake Watershed model was due to lower model performance in 2010 (NSE=0.18), while NSE=0.68 in 2009.

Results and analysis: Average annual streamflow yield for the studied watersheds was calculated from the SWAT outputs. The streamflow yield (called water yield in SWAT) is composed of overland runoff, baseflow yield, and lateral flow yield. Additionally, suspended sediment yield contributing with surface runoff into the stream was collected at all subwatersheds that drain into a streamflow gage station. The units of water yield were converted to tons per square mile. The units of sediment yield were converted to acre-foot per square mile. The results are shown in the table below:

	Banner	Centralia	Atchison
Total watershed area (acres)	12,447	5,794	8,021
Gage station drainage area (acres)	5,837	3,608	2,832
Water yield (acre-ft/sqmi)	664	275	445
Sediment yield (tn/sqmi)	513	1,677	4,555

Water yield was calculated the lowest for Centralia Lake Watershed and the highest for Banner Creek Watershed. The values appear to be lower than the values observed at the gage stations. The observed values were higher than 800 acre-ft/sqmi at all three gage stations. Although the calibration results were declared satisfactory, the difference in high stream flow peaks from excessive surface runoff between monitored and simulated data could contribute to the overall difference in annual average water yield.

Sediment yield for Centralia Lake Watershed was three times higher than the yield for Banner Creek Watershed. This is a result that is easy to understand due to row-crop production widely adopted in Centralia Lake Watershed, while it was minimal in Banner Creek Watershed; 78% of all the fields compared to only 5.5%. However, the sediment contribution to a stream can be simulated higher for Banner Creek Watershed if the model takes into account gully erosion. From the reconnaissance survey data and aerial imagery in Banner Creek Watershed and Delaware River Watershed it was observed that majority of rangeland contains a developed network of gullies. During high peak flows such network of eroded land can produce an amount of suspended sediment comparable with the amount carried by surface runoff (which was simulated by SWAT). Another important erosion factor not well modeled in SWAT is streambank erosion. Since, the values presented in the table above show only suspended sediment yields from the overland erosion, streambank and channel bed erosion can also contribute to total sediment load measured at a gage station. Sediment yield produced by the SWAT model for Atchison County Lake Watershed was almost three times higher than the yield for Centralia Lake Watershed. The load was unusually high and need to be adjusted by further calibrating the model. The calibration attempts are currently underway.

Riparian Forest Functioning Condition Analysis and Centralia Sedimentation FY 11

Report prepared by: William Beck, Kansas Forest Service

Report prepared for: Dan Devlin, Kansas Water Resources Institute

5/15/12

Objective

The Kansas Forest Service (KFS) in cooperation with the Kansas Water Resources Institute (KWRI) will perform riparian forest health inventory and functioning condition classification analysis in the watershed above Centralia Lake using the Sediment Baseline Work Plan (2/2/2009) as a guide to implementation.

Activities/Deliverables

1. The KFS will conduct forest inventory and assessment on 6 sites within a 100 foot stream zone where The Watershed Institute (TWI) has already established data collection locations for geomorphologic information to determine extent, composition, and condition of riparian forests. All sites will be georeferenced.

   During FY 11, 12 riparian forest inventory and assessment plots were performed within the Centralia Lake watershed (Figure 1). It was determined to collect data from 12 plots, 6 more than indicated in the original grant narrative, for statistical validity. Data and photos from all 12 plots have been georeferenced. Plots did not occur on the 6 pre-established TWI data collection locations as previously planned in the original grant narrative. This is because the TWI locations completely lacked riparian forest landcover, and would not have provided adequate riparian forest stand data to satisfy the KFS assessment method. Instead, existing tracts of riparian forest were located using GIS, and the appropriate landowners were contacted to request KFS access.

2. ArcPad 7.1 software will be used to collect the following forest stand data: stocking/density, species composition (including invasives), volume, basal area, trees/acre, canopy class, and regeneration. Additionally, active channel width and forest buffer width will be collected to help determine functioning condition based on SVAP and PFC guidelines (BLM).

   During FY 11, the aforemention data was collected from the 12 Centralia Lake watershed plots. The on-the-ground forest inventory and assessment data was combined with existing GIS data (e.g., existing riparian land cover, active channel width) to determine

riparian forest functioning condition (classification based on SVAP and PFC). Forest stand data was used to calculate per acre estimates of forest basal area, stocking/density, and regeneration for all riparian areas within the Centralia Lake watershed. Data will be used for future riparian forestry BMP targeting and promotion.

3. Data will be incorporated and results summarized into a report including forest inventory information from Atchison County Lake watershed and Banner Creek Lake watershed for comparative purposes. The report will be shared with the Baseline Sediment Working Group and other partners.

During FY 11, riparian forest stand data from both Atchison County Lake and Banner Creek Lake watersheds was being collected as part of a related project (U.S. Forest Service Competitive Grant funding: "Assessment of Riparian Forests to Reduce Sedimentation of Federal Reservoirs"). Data from all three watersheds have been recently combined and analyzed using SAS v.9.1 statistical software. A final report is currently being produced, and will be provided to the Baseline Sediment Working Group in October, 2012. K-State Research and Extension Forestry and a graduate student within the K-State Department of Horticulture, Forestry, and Recreation Resources (KSU HFRR) are currently assisting with data analysis and the creation of the final report.

Publications

None that were supported by this grant. However, a KSU HFRR M.S. graduate student (Dalila Maradiaga) presented preliminary riparian forest assessment results from the Centralia Lake, Banner Creek, and Atchison County Lake watersheds during the 2012 Kansas Natural Resources Conference:

Maradiaga, D.C., C.J. Barden, and W.J. Beck, 2012, *Composition of Riparian Woodlands in Three Northeast Kansas Lake Watersheds*, 2012 Kansas Natural Resources Conference.

Information Transfer Program

NA

Student Support

No graduate students were supported by these funds. However, a KSU HFRR M.S. graduate student (Dalila Maradiaga) is significantly involved with the project because of her work on the

U.S. Forest Service Competitive Grant funding project: "Assessment of Riparian Forests to Reduce Sedimentation of Federal Reservoirs."

NIWR-USGS Student Internship Program

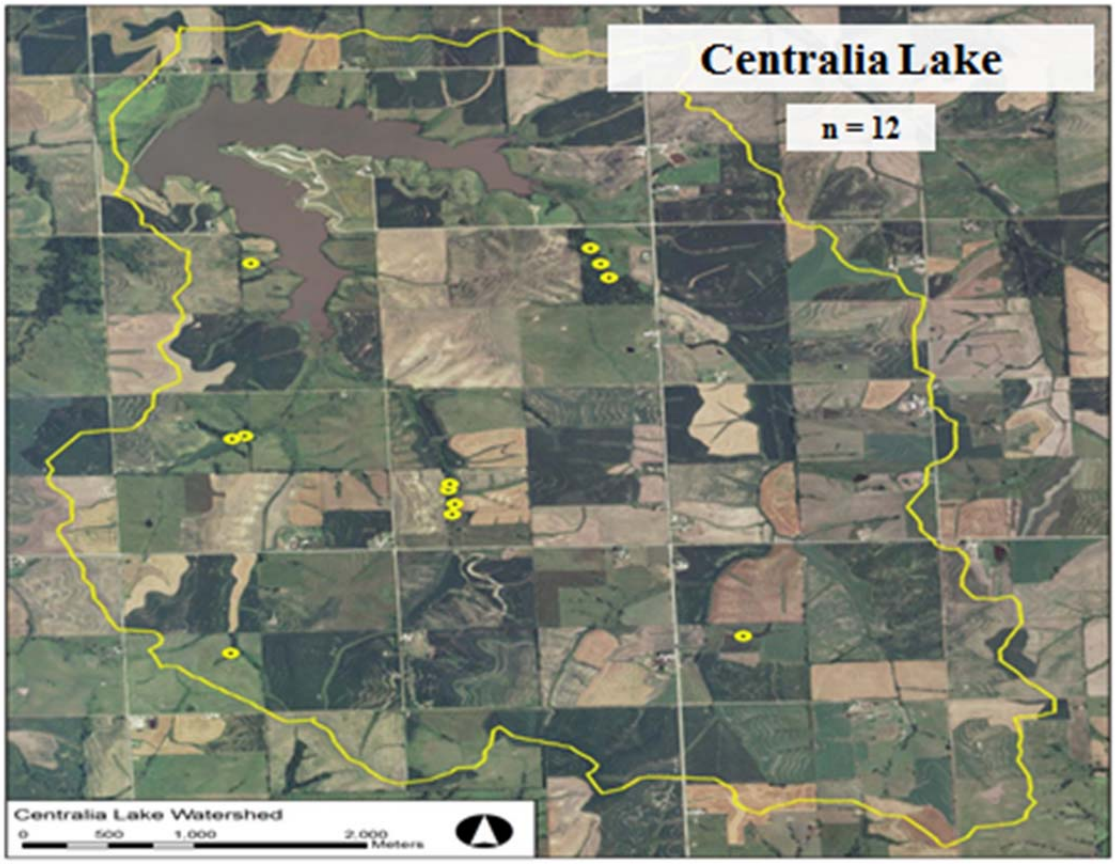
NA

Notable Achievements and Awards

None

Figures

Figure 1: Location of the 12 riparian forest assessment inventory plots performed within Centralia Lake watershed, KS.



Surface Soil Properties: Comparison Between Crop and Pasturelands

DeAnn Presley
Department of Agronomy,
Kansas State University

Three transects have been completed in the watershed for Atchison County Lake, and four transects each have been completed for the watersheds above Banner and Centralia Lakes, respectively. Soils were cored to a depth of 120 cm and described by horizon. Approximately half of the soil cores have been described as of May 2012, and will be completed by June 30, 2012. Samples from the A horizons have been submitted to the Kansas State University Department of Agronomy's Soil Testing Laboratory for the analysis of total carbon and nitrogen, as well as Mehlich-3 P. The Mehlich-3 was added at the request of staff from the Kansas Water Office in conjunction with work that is being conducted on grids in producer-owned fields throughout the Centralia Lake watershed. As the remainder of the cores are described the samples will be submitted to the Soil Testing Laboratory. At two locations per transect the infiltration rates were measured using mini-disk infiltrometers. All soil sampling and infiltration measurements are completed for all three watersheds and data analysis is ongoing. Upon completion of the description and laboratory analyses, a comparison between the observed properties and values will be made with data for the soil mapunits inventoried in the Soil Survey Geographic (SSURGO) database. Results will be provided to the USDA-NRCS for use in continued updates to the SSURGO database. Furthermore, the data will be provided to watershed model users for the potential input into watershed models. For example, if the values of infiltration and horizon thickness vary with land use, modelers could use our data in concert with the land use data to compare actual with observed data for runoff and/or sediment yield of the watersheds, thus leading to increased understanding of the function and performance of the watersheds and water quality/quantity within the lakes.

Aquifer Storage and Recovery in Near-Surface Aquifers: Development of a New Recharge Approach Using Small-Diameter, Low-Cost Wells

Basic Information

Title:	Aquifer Storage and Recovery in Near-Surface Aquifers: Development of a New Recharge Approach Using Small-Diameter, Low-Cost Wells
Project Number:	2011KS113G
Start Date:	9/1/2011
End Date:	8/31/2013
Funding Source:	104G
Congressional District:	KS-003
Research Category:	Climate and Hydrologic Processes
Focus Category:	Water Supply, Hydrology, Methods
Descriptors:	None
Principal Investigators:	Gaisheng Liu, Andrea Elizabeth Brookfield, James J. Butler, Marios Sophocleous, Donald Whittemore, Andrew Ziegler

Publications

There are no publications.

Aquifer Storage and Recovery in Near-Surface Aquifers: Development of a New Recharge Approach Using Small-Diameter, Low-Cost Wells

Project Number: 2011KS113G
Start Date: 9/1/2011
End Date: 8/31/2013
Funding Source: 104G
Focus Categories: WS, HYDROL, MET
Descriptors: Aquifer Storage and Recovery, Artificial Recharge, Direct-Push Technology, Integrated Hydrological Modeling, Recharge Wells, Infiltration Basin and Trench
Primary PI: Dr. Gaisheng Liu, Kansas Geological Survey, University of Kansas
Other PIs:
Dr. Andrea Brookfield, Kansas Geological Survey, University of Kansas
Dr. Donald O. Whittemore, Kansas Geological Survey, University of Kansas
Dr. Marios Sophocleous, Kansas Geological Survey, University of Kansas
Dr. Andrew C. Ziegler, United States Geological Survey Kansas Water Science Center, Lawrence, Kansas
Dr. James J. Butler, Jr., Kansas Geological Survey, University of Kansas
Project Class: Research

I: Technical Report

Problem Statement

Aquifer storage and recovery (ASR) is the artificial recharge and temporary storage of water in an aquifer during times when water is abundant, and recovery of all or a portion of the water during times when it is needed (Pyne, 2005). In recent years, interest in ASR has increased due to various concerns such as declining groundwater resources, vulnerability of surface water supplies to contamination and reservoir sedimentation, and unfavorable projections of future climate change. Most climate change scenarios indicate that due to a likely increase in future global temperature, there will be more severe and prolonged droughts, with precipitation events becoming more intense but less frequent (IPCC, 2007). By capturing and storing excess water in the underground when precipitation is plentiful, ASR offers one of the most practical approaches for resources managers to combat future water-supply challenges. Compared to a traditional surface-water reservoir, aquifer storage eliminates evaporative losses and the need to convert large land areas into reservoirs, provides a much larger storage capacity (which is critical in the case of multi-year drought), and is much less vulnerable to surface-water contamination activities. Because of these advantages, the number of ASR projects that are either fully operational or in various phases of development is quickly growing across the United States.

A successful implementation of ASR typically involves four key components, 1) an aquifer that is suitable for temporarily storing a large volume of water, 2) source water that is of good quality and quantity, 3) a means to transfer the source water into the

aquifer, and 4) a means to recover the water from the aquifer. Currently, many limiting factors still hinder the effectiveness of ASR as a new tool for water resources management (Pyne, 2005; Sophocleous, 2009). One of the major technical challenges has been how to design artificial recharge systems that can efficiently transfer source water into the aquifer. Typically aquifer recharge is achieved through various surface infiltration methods (such as basins and trenches) and/or large-diameter injection wells. Surface infiltration methods only work when the storage aquifer is shallow, and no low-permeability layers exist between the ground surface and the aquifer that would constrain downward movement of recharge water. Moreover, surface methods require adequate land area available at reasonable cost. Due to their dependency on natural soil conditions, surface infiltration methods have a limited infiltration capacity. This can greatly undermine the performance of ASR during times when precipitation is intense and a significant amount of water must be stored within a short duration. Surface infiltration methods are often supplemented with injection wells that typically have a diameter of 40 cm or larger. These large-diameter injection wells are equipped with high-power pumps so that water can be forcefully injected into the aquifer at a high rate. When surface infiltration methods are not applicable, e.g., the storage zone is deep or there is a near-surface zone of low permeability, injection wells are the only aquifer recharge option. In general, large-diameter injection wells are more expensive than surface infiltration methods, as they require a much higher amount of logistical and infrastructure support for pump operation and maintenance. Well clogging remains a problem at many ASR projects (Brown et al., 2005), although it can be somewhat alleviated by operating the wells in a dual-purpose mode for both water recharge and recovery (Pyne, 2005).

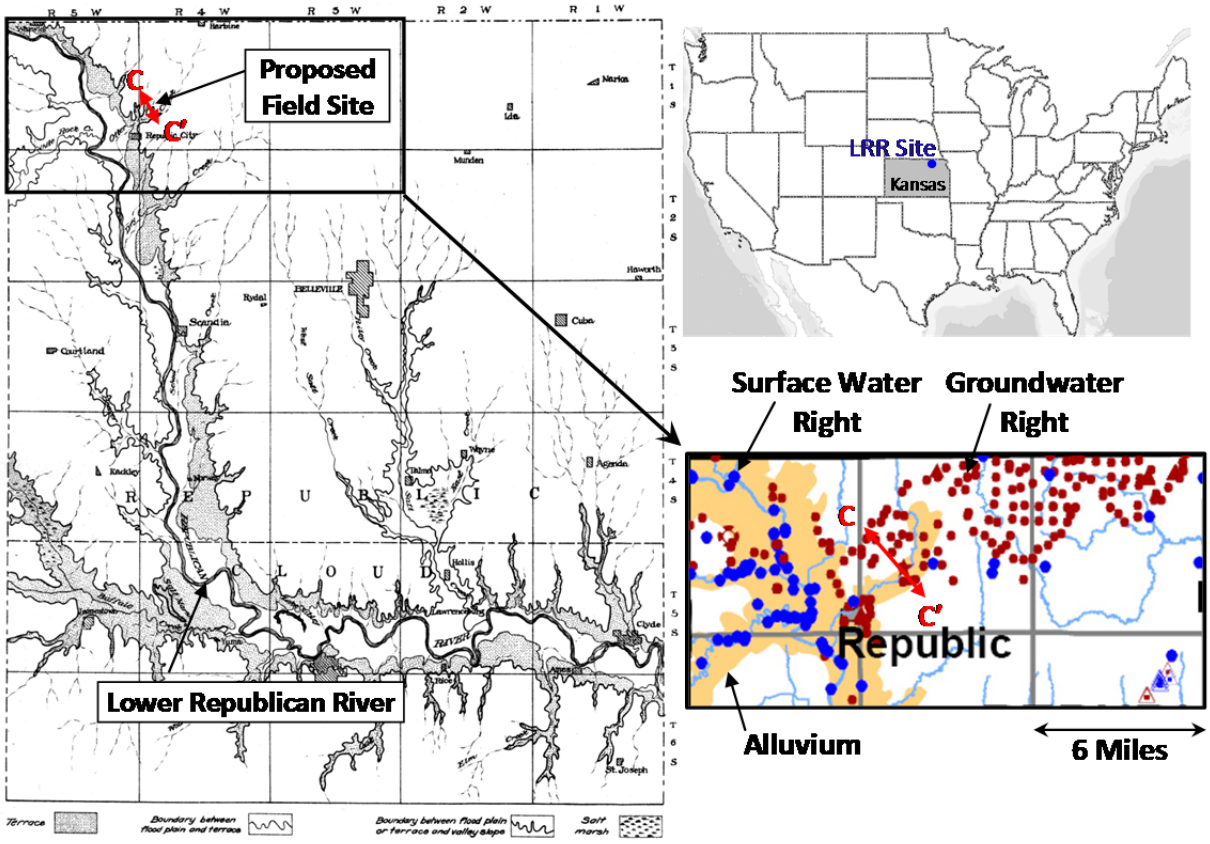
In this research we investigate a new recharge method for near-surface aquifers using small-diameter, low-cost wells installed with direct-push (DP) technology. Unlike the large-diameter injection wells, the DP wells are typically small in diameter (less than 10 cm), low in construction and maintenance costs, and limited to depths less than 30 m. Water is allowed to move through the wells by gravity, so the required logistical and infrastructure support are modest. Given the various constraints of surface infiltration methods, the DP wells, if proven practically useful as a supplemental or alternative recharge option to the surface methods, could greatly increase the effectiveness of ASR in near-surface aquifers.

Objectives and Methods

The main objective of this research is to increase the effectiveness of ASR in near-surface aquifers by developing a new aquifer recharge method through small-diameter, low-cost wells installed with DP technology. Unlike the common large-diameter injection wells that typically have a diameter of 40 cm or larger and require expensive logistical and infrastructure support, the DP wells are small in diameter (less than 10 cm), low in construction and maintenance costs, and limited to depths less than 30 m. Water is allowed to move through the wells by gravity so the required logistical and infrastructure support are modest. DP wells can be employed either as a supplemental or alternative recharge option to surface infiltration methods as long as the aquifer for water storage is relatively shallow.

In this research, we combine numerical model simulations with field tests to systematically investigate the utility of DP wells in artificially recharging near-surface aquifers. We use a site in the Lower Republican River (LRR) basin in Kansas to perform the proposed field investigations (Figure 1a). Figure 1b shows a cross-section of lithology at the site. The sand and gravel portion of the Belleville formation on the south part of the ancestral Republican River valley, which is overlain by a thin layer of silt and clay (also part of the Belleville formation), is used as the intended aquifer for water storage. In addition to the site characteristics suitable for this project, various Kansas state agencies have become increasingly interested in considering ASR implementation in this area as a potential water-resources management method for utilizing high flows of the Republican River in the LRR basin.

(**a**) Location of proposed study area in the Lower Republican River basin



(**b**) Lithologic cross-section of the ancestral Republican River valley in the study area

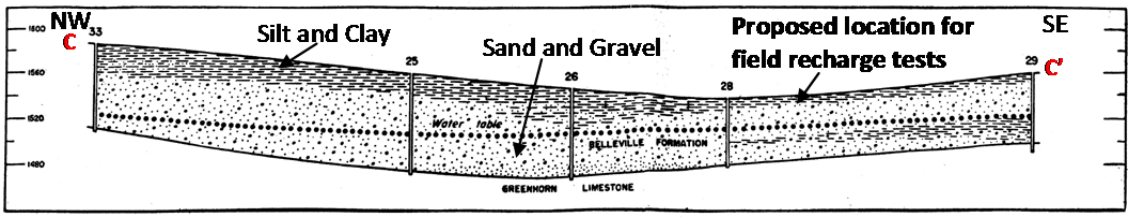


Figure 1. (**a**) Location of proposed study area within a stream valley on the south part of the ancestral Republican River valley. (**b**) Lithologic cross-section of the ancestral Republican River valley in the study area.

This research involves two major activities, 1) a series of numerical simulations to evaluate the recharge process of DP wells, surface infiltration basins and trenches, and 2) field water recharge tests under different conditions to directly assess the practical usefulness of DP wells as an artificial recharge option alternative or supplement to the surface methods. The insights developed from the numerical simulations will provide important guidelines for designing and conducting the recharge tests in the field. Numerical simulations will be performed using the fully-integrated, multiphysics modeling software (Comsol). The DP wells for the field tests at the LRR site will be installed using a Kansas Geological Survey (KGS) DP unit (Geoprobe).

Project Activities and Results

During the first year of the project (9/1/2011 - 8/31/2012), our research tasks are 1) to conduct a series of numerical simulations to rigorously evaluate the recharge process of DP wells, surface infiltration basins and trenches, and 2) to perform a series of EC and HPT profiles using a KGS DP unit (Geoprobe) to better characterize the subsurface hydrogeology at the LRR test site. The major project activities we have performed are:

a) Comsol installation and training. We installed the Comsol software on a KGS parallel computing PC cluster. The parallel version of Comsol allows us to increase tremendously the computational speed for the ASR numerical simulations planned for this summer. The PI's (Liu and Brookfield) also attended a Comsol training workshop and spent days learning how to use Comsol for ASR simulations.
b) Site hydrogeology study and field scoping. We performed a detailed hydrogeology study for the ASR field site using two online KGS databases – Water Well Completion Records (WWC5; http://www.kgs.ku.edu/Magellan/WaterWell/index.html) and Water Well Levels (WIZARD; http://www.kgs.ku.edu/Magellan/WaterLevels/index.html). We investigated over twenty lithology logs in the general study area and identified four potential locations for performing DP characterization and field recharge tests (see Appendix).

II. Publications

This research has not resulted in any publications due to the limited project time.

III. Information Transfer Program

During the first year of this project, teleconference and meetings have been arranged among very state agencies including, Kansas Water Office (Susan Stover) and Division of Water Resources, Kansas Department of Agriculture (Scott Ross) to provide frequent project updates. Scott Ross is also providing support to establish site access with the landowners for performing field work.

As the project goes into the second year, we will dissimilate project results through 1) reports and presentations to regulatory agencies; 2) presentations at local, regional, and

national scientific meetings; 3) public information circulars and open-access web publications; 4) short courses and webinars; and 5) articles in peer-reviewed literature. We anticipate the results will be of particular interest to various state agencies and local entities such as Kansas Department of Health and Environment (KDHE), Kansas Water Office (KWO), and Lower Republican River Stakeholder Management Committee (LRRSMC). We will emphasize the transfer of our research findings to KDHE, KWO and LRRSMC and other interested personnel in our outreach activities. Specifically, the project results will be presented at meetings ranging from the American Institute of Hydrology Seminar in Topeka, to the Water and the Future of Kansas Conference, to educational seminars of the KWO and KDHE. Summary of the main findings will be published in public information circulars and open-access web publications (e.g., KSG open-file report) in a timely fashion.

We also anticipate the results of this project will be of significant interest to other states, research institutes and professionals. To effectively transfer the project results to the interested audience beyond Kansas, we will make presentations at national meetings of scientific organizations such as the Geological Society of America and the American Geophysical Union. To allow ready access to the results by the general public, a project page will be created on the KGS web site and project data and reports will be posted there. The results will also be published in scientific journals frequently read by practicing hydrologists. Project results will also be incorporated into short courses and webinars (e.g., Midwest GeoSciences Webinar series) for technology transfer to practicing professionals.

III. Student Support

Due to the limited time between project funding and the start of school, we couldn't recruit a graduate student to work on the ASR project in the fall semester of 2011. Nevertheless, we successfully recruited a graduate student (Brant Konetchy from Trinity University) that will start working on the ASR project this summer. This project also supported an undergraduate student as part of the 2012 KGS Applied Geohydrology Summer Research Program. A visiting student from Helmholtz Centre for Environmental Research-UFZ, Leipzig, Germany is also trained in this project (funding fully provided by UFZ).

IV. USGS Summer Intern Program

None.

Appendix: Field Hydrogeology and Scoping

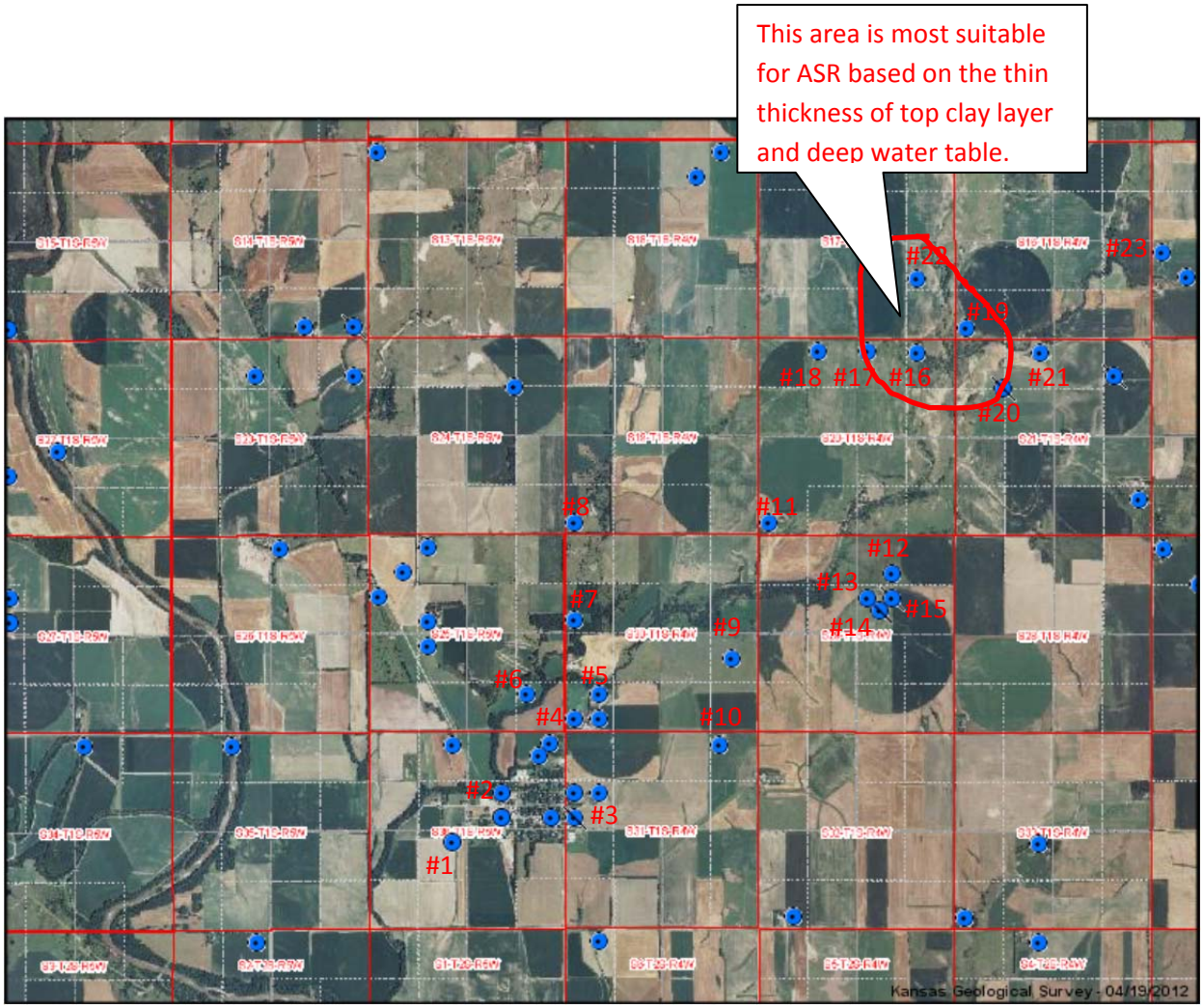


Figure A1. Distribution of WWC5 water wells in the ASR project area. The lithology log for each marked well is shown as follows.

WATER WELL RECORD Form WWC-5 KSA 82a-1212

1 LOCATION OF WATER WELL: County: Republic | Fraction: NE ¼ NE ¼ SW ¼ | Section Number: 36 | Township Number: T 1 S | Range Number: R 5 E (W)

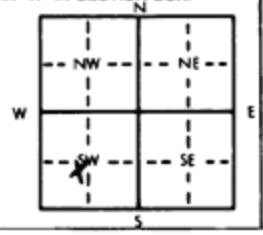
#1

Distance and direction from nearest town or city street address of well if located within city?
SW Corner of Republic Ks.

2 WATER WELL OWNER: James Hurley
RR#, St. Address, Box # :
City, State, ZIP Code : Republic Ks.

Board of Agriculture, Division of Water Resources
Application Number:

3 LOCATE WELL'S LOCATION WITH AN "X" IN SECTION BOX:



4 DEPTH OF COMPLETED WELL 30' ft. ELEVATION:
Depth(s) Groundwater Encountered 1. 10 ft. 2. ft. 3. ft.
WELL'S STATIC WATER LEVEL 10 ft. below land surface measured on mo/day/yr 6-20-91
Pump test data: Well water was 24 ft. after 1 hours pumping 125 gpm
Est. Yield 125 gpm: Well water was ft. after hours pumping gpm
Bore Hole Diameter 9 in. to 30 ft., and in. to ft.
WELL WATER TO BE USED AS: 1 Domestic 2 Irrigation 3 Feedlot 4 Industrial 5 Public water supply 6 Oil field water supply 7 Lawn and garden only 8 Air conditioning 9 Dewatering 10 Monitoring well 11 Injection well 12 Other (Specify below)
Was a chemical/bacteriological sample submitted to Department? Yes No X; If yes, mo/day/yr sample was submitted
Water Well Disinfected? Yes X No

5 TYPE OF BLANK CASING USED: 1 Steel 2 PVC 3 RMP (SR) 4 ABS 5 Wrought iron 6 Asbestos-Cement 7 Fiberglass 8 Concrete tile 9 Other (specify below)
CASING JOINTS: Glued X Clamped Welded Threaded
Blank casing diameter 6 in. to 16 ft., Dia in. to ft., Dia in. to ft.
Casing height above land surface 16" in., weight .325 CFT lbs./ft. Wall thickness or gauge No. .255
TYPE OF SCREEN OR PERFORATION MATERIAL: 1 Steel 2 Brass 3 Stainless steel 4 Galvanized steel 5 Fiberglass 6 Concrete tile 7 PVC 8 RMP (SR) 9 ABS 10 Asbestos-cement 11 Other (specify) 12 None used (open hole)
SCREEN OR PERFORATION OPENINGS ARE: 1 Continuous slot 2 Louvered shutter 3 Mill slot 4 Key punched 5 Gauzed wrapped 6 Wire wrapped 7 Torch cut 8 Saw cut 9 Drilled holes 10 Other (specify) 11 None (open hole)
SCREEN-PERFORATED INTERVALS: From 16 ft. to 26 ft., From ft. to ft.
From ft. to ft., From ft. to ft.
GRAVEL PACK INTERVALS: From 9 ft. to 30 ft., From ft. to ft.
From ft. to ft., From ft. to ft.

6 GROUT MATERIAL: 1 Neat cement 2 Cement grout 3 Bentonite 4 Other hole plug
Grout Intervals: From 0 ft. to 9 ft., From ft. to ft., From ft. to ft.
What is the nearest source of possible contamination: 1 Septic tank 2 Sewer lines 3 Watertight sewer lines 4 Lateral lines 5 Cess pool 6 Seepage pit 7 Pit privy 8 Sewage lagoon 9 Feedyard 10 Livestock pens 11 Fuel storage 12 Fertilizer storage 13 Insecticide storage 14 Abandoned water well 15 Oil well/Gas well 16 Other (specify below) None within Sig
Direction from well? How many feet?

FROM	TO	LITHOLOGIC LOG	FROM	TO	PLUGGING INTERVALS
0	10	Top Soil & Clay			
10	20	Sand Fine Some Med			
20	26	Sand Med to Coarse			
26	31	Shale			

7 CONTRACTOR'S OR LANDOWNER'S CERTIFICATION: This water well was (1) constructed, (2) reconstructed, or (3) plugged under my jurisdiction and was completed on (mo/day/year) 6-20-91 and this record is true to the best of my knowledge and belief. Kansas Water Well Contractor's License No. 165 This Water Well Record was completed on (mo/day/yr) 6-23-91 under the business name of Marchn Well Drilling by (signature) Leroy Marchn

INSTRUCTIONS: Use typewriter or ball point pen. PLEASE PRESS FIRMLY and PRINT clearly. Please fill in blanks, underline or circle the correct answers. Send top three copies to Kansas Department of Health and Environment, Bureau of Water, Topeka, Kansas 66620-7320. Telephone: 913-296-5545. Send one to WATER WELL OWNER and retain one for your records.

WATER WELL RECORD Form WWC-5 KSA 82a-1212

1 LOCATION OF WATER WELL:

County:	Fraction	Section Number	Township Number	Range Number
Republic	near ¼ center ¼ NE ¼	36	T 1 S	R 5 X E/W

Distance and direction from nearest town or city street address of well if located within city?
In city limits

#2

2 WATER WELL OWNER: Kent Swartz
RR#, St. Address, Box # : 112 W. Main
City, State, ZIP Code : Republic, KS 66964

Board of Agriculture, Division of Water Resources
Application Number: N/A

3 LOCATE WELL'S LOCATION WITH AN "X" IN SECTION BOX:

N / NW / NE / X / W / E / SW / SE / S / 1 Mile

4 DEPTH OF COMPLETED WELL 26 ft. ELEVATION:
Depth(s) Groundwater Encountered 1. ft. 2. ft. 3. ft.
WELL'S STATIC WATER LEVEL 8 ft. below land surface measured on mo/day/yr 6/16/98
Pump test data: Well water was ft. after hours pumping gpm
Est. Yield 10-20 gpm: Well water was ft. after hours pumping gpm
Bore Hole Diameter 8 in. to 27 ft., and in. to ft.
WELL WATER TO BE USED AS: X 1 Domestic 2 Irrigation 3 Feedlot 4 Industrial 5 Public water supply 6 Oil field water supply 7 Lawn and garden only 8 Air conditioning 9 Dewatering 10 Monitoring well 11 Injection well 12 Other (Specify below)
Was a chemical/bacteriological sample submitted to Department? Yes No X; If yes, mo/day/yr sample was submitted
Water Well Disinfected? Yes X No

5 TYPE OF BLANK CASING USED: 1 Steel X PVC 3 RMP (SR) 4 ABS 5 Wrought iron 6 Asbestos-Cement 7 Fiberglass 8 Concrete tile 9 Other (specify below)
CASING JOINTS: Glued X Clamped Welded Threaded
Blank casing diameter 5 in. to 16 ft., Dia in. to ft., Dia in. to ft.
Casing height above land surface 12 in., weight 2.37 lbs./ft. Wall thickness or gauge No. .214
TYPE OF SCREEN OR PERFORATION MATERIAL: 1 Steel 2 Brass 3 Stainless steel 4 Galvanized steel 5 Fiberglass 6 Concrete tile X PVC 8 RMP (SR) 9 ABS 10 Asbestos-cement 11 Other (specify) 12 None used (open hole)
SCREEN OR PERFORATION OPENINGS ARE: 1 Continuous slot 2 Louvered shutter X Mill slot 4 Key punched 5 Gauzed wrapped 6 Wire wrapped 7 Torch cut 8 Saw cut 9 Drilled holes 10 Other (specify) 11 None (open hole)
SCREEN-PERFORATED INTERVALS: From 16 ft. to 26 ft., From ft. to ft.
From ft. to ft., From ft. to ft.
GRAVEL PACK INTERVALS: From 16 ft. to 26 ft., From ft. to ft.
From ft. to ft., From ft. to ft.

6 GROUT MATERIAL: 1 Neat cement 2 Cement grout X Bentonite 4 Other
Grout Intervals: From 0 ft. to 16 ft., From ft. to ft., From ft. to ft.
What is the nearest source of possible contamination:
1 Septic tank 2 Sewer lines 3 Watertight sewer lines 4 Lateral lines 5 Cess pool 6 Seepage pit 7 Pit privy 8 Sewage lagoon 9 Feedyard 10 X Livestock pens 11 Fuel storage 12 Fertilizer storage 13 Insecticide storage 14 Abandoned water well 15 Oil well/Gas well 16 Other (specify below)
Direction from well? South How many feet? 50 ft.

FROM	TO	LITHOLOGIC LOG	FROM	TO	PLUGGING INTERVALS
0	2	topsoil			
2	16	Brown Clay			
16	26	Medium to Coarse Sand, Gray			
26	27	Black Shale			

7 CONTRACTOR'S OR LANDOWNER'S CERTIFICATION: This water well was (X constructed, (2) reconstructed, or (3) plugged under my jurisdiction and was completed on (mo/day/year) 6/16/98 and this record is true to the best of my knowledge and belief. Kansas Water Well Contractor's License No. 138 This Water Well Record was completed on (mo/day/yr) 7/8/98
under the business name of Peterson Irrigation, Inc. by (signature) Michael Peterson

INSTRUCTIONS: Use typewriter or ball point pen. PLEASE PRESS FIRMLY and PRINT clearly. Please fill in blanks, underline or circle the correct answers. Send top three copies to Kansas Department of Health and Environment, Bureau of Water, Topeka, Kansas 66620-0001, Telephone: 913-296-5545. Send one to WATER WELL OWNER and retain one for your records.

OFFICE USE ONLY

WATER WELL RECORD Form WWC-5 KSA 82a-1212 (copy)

1 LOCATION OF WATER WELL

County: REPUBLIC | Fraction: NE ¼ SW ¼ NW ¼ | Section Number: 31 | Township Number: T 1 S | Range Number: R 4 E (W)

Distance and direction from nearest town or city? IN REPUBLIC

Street address of well if located within city? #3

2 WATER WELL OWNER: CITY OF REPUBLIC

RR#, St. Address, Box # :

City, State, ZIP Code : REPUBLIC, KANSAS 66964

Board of Agriculture, Division of Water Resources Application Number:

3 DEPTH OF COMPLETED WELL 47 ft. Bore Hole Diameter 30 in. to 47 ft., and ..... in. to ..... ft.

Well Water to be used as: (5) Public water supply; 1 Domestic; 2 Irrigation; 3 Feedlot; 4 Industrial; 6 Oil field water supply; 7 Lawn and garden only; 8 Air conditioning; 9 Dewatering; 10 Observation well; 11 Injection well; 12 Other (Specify below)

Well's static water level 27 ft. below land surface measured on 8 month 21 day 1980 year

Pump Test Data: Well water was 40' 6" ft. after 1 hours pumping 319 gpm

Est. Yield 350 gpm: Well water was 40' 10" ft. after 24 hours pumping 270 gpm

4 TYPE OF BLANK CASING USED: (1) Steel; 2 PVC; 3 RMP (SR); 4 ABS; 5 Wrought iron; 6 Asbestos-Cement; 7 Fiberglass; 8 Concrete tile; 9 Other (specify below)

Casing Joints: Glued ..... Clamped ..... Welded X Threaded .....

Blank casing dia 8 in. to 36 ft., Dia ..... in. to ..... ft., Dia ..... in. to ..... ft.

Casing height above land surface 3 in., weight 25 lbs./ft. Wall thickness or gauge No. .277

TYPE OF SCREEN OR PERFORATION MATERIAL: 1 Steel; 2 Brass; (3) Stainless steel; 4 Galvanized steel; 5 Fiberglass; 6 Concrete tile; 7 PVC; 8 RMP (SR); 9 ABS; 10 Asbestos-cement; 11 Other (specify) ..... 12 None used (open hole)

Screen or Perforation Openings Are: 1 Continuous slot; 2 Louvered shutter; 3 Mill slot; 4 Key punched; 5 Gauzed wrapped; 6 Wire wrapped; 7 Torch cut; 8 Saw cut; 9 Drilled holes; 10 Other (specify) ..... 11 None (open hole)

Screen-Perforation Dia 8 in. to 47 ft., Dia ..... in. to ..... ft., Dia ..... in. to ..... ft.

Screen-Perforated Intervals: From 36 ft. to 47 ft., From ..... ft. to ..... ft.

From ..... ft. to ..... ft., From ..... ft. to ..... ft.

Gravel Pack Intervals: From 13 ft. to 47 ft., From ..... ft. to ..... ft.

From ..... ft. to ..... ft., From ..... ft. to ..... ft.

5 GROUT MATERIAL: (1) Neat cement; 2 Cement grout; 3 Bentonite; 4 Other .....

Grouted Intervals: From 3 ft. to 13 ft., From ..... ft. to ..... ft., From ..... ft. to ..... ft.

What is the nearest source of possible contamination:

1 Septic tank; 2 Sewer lines; 3 Lateral lines; 4 Cess pool; 5 Seepage pit; 6 Pit privy; 7 Sewage lagoon; 8 Feed yard; 9 Livestock pens; 10 Fuel storage; 11 Fertilizer storage; 12 Insecticide storage; (13) Watertight sewer lines; 14 Abandoned water well; 15 Oil well/Gas well; 16 Other (specify below)

Direction from well SOUTH How many feet 150 ? Water Well Disinfected? Yes X No .....

Was a chemical/bacteriological sample submitted to Department? Yes ..... No X ..... If yes, date sample was submitted ..... month ..... day ..... year: Pump Installed? Yes X ..... No .....

If Yes: Pump Manufacturer's name PUMPCO Model No. 4PB230 HP 15 Volts 220

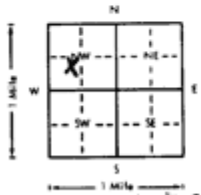
Depth of Pump Intake 43 ft. Pumps Capacity rated at 200 gal./min.

Type of pump: (1) Submersible; 2 Turbine; 3 Jet; 4 Centrifugal; 5 Reciprocating; 6 Other

6 CONTRACTOR'S OR LANDOWNER'S CERTIFICATION: This water well was (X) constructed, (2) reconstructed, or (3) plugged under my jurisdiction and was completed on 12 month 15 day 1980 year and this record is true to the best of my knowledge and belief. Kansas Water Well Contractor's License No. 359

This Water Well Record was completed on 12 month 29 day 1980 year under the business name of DARYL COX + SONS INC by (signature) Daryl Cox

7 LOCATE WELL'S LOCATION WITH AN "X" IN SECTION BOX:



ELEVATION: 1530'

FROM	TO	LITHOLOGIC LOG	FROM	TO	LITHOLOGIC LOG
0	3	TOPSOIL			
3	17	LIGHT BROWN CLAY			
17	29	DARK BROWN CLAY			
29	31	SILTY SAND			
31	41	FINE GRAVEL			
41	45	COARSE GRAVEL			
45	48	BLUE SHALE			
48		STOP			

Depth(s) Groundwater Encountered 1. ..... ft. 2. ..... ft. 3. ..... ft. 4. ..... ft. (Use a second sheet if needed)

INSTRUCTIONS: Use typewriter or ball point pen, *please press firmly* and *PRINT* clearly. Please fill in blanks, underline or circle the correct answers. Send top three copies to Kansas Department of Health and Environment, Division of Environment, Water Well Contractors, Topeka, KS 66620. Send one to WATER WELL OWNER and retain one for your records.

USE TYPEWRITER OR BALL POINT PEN-PRESS FIRMLY, PRINT CLEARLY.

WATER WELL RECORD
KSA 82a-1201-1215

Kansas Department of Health and Environment-Division of Environment
(Water well Contractors)
Topeka, Kansas 66620

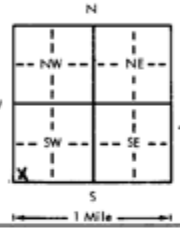
#4

1. Location of well: County	Fraction	Section number	Township number	Range number
Republic	SW1/4 SW 1/4 S 1/4	30	T 1 S	R 4 E/W

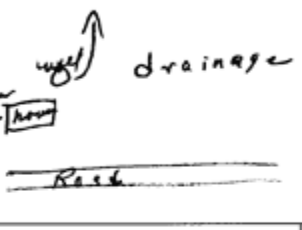
2. Distance and direction from nearest town or city: NE Edge of Republic KS
Street address of well location if in city:

3. Owner of well: James Hurley
R.R. or street:
City, state, zip code: Republic KS 66964

4. Locate with "X" in section below:



Sketch map:



6. Bore hole dia. 8 in. Completion date 12-11-78
Well depth 67 ft.

7. __ Cable tool X Rotary __ Driven __ Dug
__ Hollow rod __ Jetted __ Bored __ Reverse rotary

8. Use: X Domestic __ Public supply __ Industry
__ Irrigation __ Air conditioning __ Stock
__ Lawn __ Oil field water __ Other

9. Casing: Material ____ Height: (Above) or below
Threaded ____ Welded ____ Surface 13 in.
RMP ____ PVC X Weight 28 lbs./ft. CFT
Dia. 5 in. to 67 ft. depth Wall Thickness: inches or
Dia. ____ in. to ____ ft. depth gage No. 1265

5. Type and color of material	From	To
Top Soil & clay's	0	40
Silty clay	40	49
Sand & clay	49	63
Shale	63	70
(Use a second sheet if needed)		

10. Screen: Manufacturer's name Jet Stream
Type Slotted Pvc Dia. 5
Slot/gauze .0030 Length 10
Set between 55 ft. and 65 ft.
____ ft. and ____ ft.
Gravel pack? yes Size range of material fine 3/8

11. Static water level: mo./day/yr.
43 ft. below land surface Date 12-11-78

12. Pumping level below land surface 48 ft. mo./day/yr.
____ ft. after 1 hrs. pumping 12 g.p.m.
____ ft. after ____ hrs. pumping ____ g.p.m.
Estimated maximum yield 20 g.p.m.

13. Water sample submitted: mo./day/yr.
__ Yes X No Date

14. Well head completion:
__ Pitless adapter 13 Inches above grade

15. Well grouted? yes
With X Neat cement __ Bentonite __ Concrete
Depth: From 0 ft. to 11 ft.

16. Nearest source of possible contamination:
ft. 75 Direction W Type Septic
Well disinfected upon completion? X Yes __ No

17. Pump: X Not installed
Manufacturer's name
Model number HP Volts
Length of drop pipe ft. capacity g.p.m.
Type:
__ Submersible __ Turbine
__ Jet __ Reciprocating
__ Centrifugal __ Other

18. Elevation: 1530'
Topography:
__ Hill
__ Slope
X Upland
__ Valley

19. Remarks:

20. Water well contractor's certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Murphy Well Drilling Inc. 165
Business name License No.
Address Beloit Cloud Ne 68970
Sign Larry Murphy Date 1-9-79
Authorized representative

T 1 R 4 (W) Sec 30 SE SW SW 1/4 1/4 1/4

Forward the white, blue and pink copies to the Department of Health and Environment

Form WWC-5

WATER WELL RECORD Form WWC-5 KSA 82a-1212

#5

1 LOCATION OF WATER WELL: County: Republic | Fraction: NE ¼ SW ¼ SW ¼ | Section Number: 30 | Township Number: T 1 S | Range Number: R 4 E (W)

Distance and direction from nearest town or city street address of well if located within city? NE corner of Republic.

2 WATER WELL OWNER: James Hurley

RR#, St. Address, Box #: RR1

City, State, ZIP Code: Republic KS 66964

Board of Agriculture, Division of Water Resources Application Number:

3 LOCATE WELL'S LOCATION WITH AN "X" IN SECTION BOX:

N / NW / NE / W / E / SW / SE / S / 1 Mile

4 DEPTH OF COMPLETED WELL: 60 ft. ELEVATION:

Depth(s) Groundwater Encountered 1. 38 ft. 2. ft. 3. ft.

WELL'S STATIC WATER LEVEL 38 ft. below land surface measured on mo/day/yr

Pump test data: Well water was 52 ft. after 1 hours pumping 100 gpm

Est. Yield 100 gpm: Well water was ft. after hours pumping gpm

Bore Hole Diameter 9 7/8 in. to 60 ft., and in. to ft.

WELL WATER TO BE USED AS: 1 Domestic 2 Irrigation 3 Feedlot 4 Industrial 5 Public water supply 6 Oil field water supply 7 Lawn and garden only 8 Air conditioning 9 Dewatering 10 Monitoring well 11 Injection well 12 Other (Specify below)

Was a chemical/bacteriological sample submitted to Department? Yes No X; If yes, mo/day/yr sample was submitted

Water Well Disinfected? Yes X No

5 TYPE OF BLANK CASING USED: 1 Steel 2 PVC 3 RMP (SR) 4 ABS 5 Wrought iron 6 Asbestos-Cement 7 Fiberglass 8 Concrete tile 9 Other (specify below)

CASING JOINTS: Glued X Clamped Welded Threaded

Blank casing diameter 6 in. to 44.5 ft., Dia 6 in. to 54.5 60' ft., Dia in. to ft.

Casing height above land surface 16 in., weight 3.25 cft lbs./ft. Wall thickness or gauge No. .255

TYPE OF SCREEN OR PERFORATION MATERIAL: 1 Steel 2 Brass 3 Stainless steel 4 Galvanized steel 5 Fiberglass 6 Concrete tile 7 PVC 8 RMP (SR) 9 ABS 10 Asbestos-cement 11 Other (specify) 12 None used (open hole)

SCREEN OR PERFORATION OPENINGS ARE: 1 Continuous slot 2 Louvered shutter 3 Mill slot 4 Key punched 5 Gauzed wrapped 6 Wire wrapped 7 Torch cut 8 Saw cut 9 Drilled holes 10 Other (specify) 11 None (open hole)

SCREEN-PERFORATED INTERVALS: From 44.5 ft. to 54.5 ft., From ft. to ft.

From ft. to ft., From ft. to ft.

GRAVEL PACK INTERVALS: From 20 ft. to 60 ft., From ft. to ft.

From ft. to ft., From ft. to ft.

6 GROUT MATERIAL: 1 Neat cement 2 Cement grout 3 Bentonite 4 Other Hole plug

Grout Intervals: From 0 ft. to 20 ft., From ft. to ft., From ft. to ft.

What is the nearest source of possible contamination: 1 Septic tank 2 Sewer lines 3 Watertight sewer lines 4 Lateral lines 5 Cess pool 6 Seepage pit 7 Pit privy 8 Sewage lagoon 9 Feedyard 10 Livestock pens 11 Fuel storage 12 Fertilizer storage 13 Insecticide storage 14 Abandoned water well 15 Oil well/Gas well 16 Other (specify below)

Direction from well? How many feet? None within 500'

FROM	TO	LITHOLOGIC LOG	FROM	TO	PLUGGING INTERVALS
0	42	Top Soil & Clay's			
42	54	Sand & Gravel			
54	60	Shale			

7 CONTRACTOR'S OR LANDOWNER'S CERTIFICATION: This water well was (1) constructed, (2) reconstructed, or (3) plugged under my jurisdiction and was completed on (mo/day/year) 6-9-97 and this record is true to the best of my knowledge and belief. Kansas Water Well Contractor's License No. 165 This Water Well Record was completed on (mo/day/yr) 6-21-97 under the business name of Maruhn Well Drilling by (signature) Leroy Maruhn

INSTRUCTIONS: Use typewriter or ball point pen. *PLEASE PRESS FIRMLY* and *PRINT* clearly. Please fill in blanks, underline or circle the correct answers. Send top three copies to Kansas Department of Health and Environment, Bureau of Water, Topeka, Kansas 66620-0001. Telephone: 913-296-5545. Send one to WATER WELL OWNER and retain one for your records.

OFFICE USE ONLY

WATER WELL RECORD Form WWC-5 KSA 82a-1212

1 LOCATION OF WATER WELL

County: Republic

Fraction: NW ¼ SE ¼ SE ¼

Section Number: 25

Township Number: T 1 S

Range Number: R 5 E/W

Distance and direction from nearest town or city? 1 mile N of Republic

Street address of well if located within city? —

#6

2 WATER WELL OWNER: Jim Hurlay

RR#, St. Address, Box # :

City, State, ZIP Code : Republic, Kansas 66964

Board of Agriculture, Division of Water Resources Application Number: 35722

3 DEPTH OF COMPLETED WELL 32 ft. Bore Hole Diameter 30 in. to 32 ft., and ..... in. to ..... ft.

Well Water to be used as: 1 Domestic 3 Feedlot 5 Public water supply 6 Oil field water supply 7 Lawn and garden only 8 Air conditioning 9 Dewatering 10 Observation well 11 Injection well 12 Other (Specify below) (2) Irrigation 4 Industrial

Well's static water level 18 ft. below land surface measured on August month 3 day 19.83 year

Pump Test Data: Well water was 32 ft. after 1½ hours pumping 50 gpm

Est. Yield NO GOOD gpm: Well water was ft. after hours pumping gpm

4 TYPE OF BLANK CASING USED: 1 Steel 2 PVC 3 RMP (SR) 4 ABS 5 Wrought iron (6) Asbestos-Cement 7 Fiberglass 8 Concrete tile 9 Other (specify below)

Casing Joints: Glued ..... Clamped X Welded ..... Threaded .....

Blank casing dia 16 in. to 14 ft., Dia ..... in. to ..... ft., Dia ..... in. to ..... ft.

Casing height above land surface 12 in., weight ..... lbs./ft. Wall thickness or gauge No .....

TYPE OF SCREEN OR PERFORATION MATERIAL: 1 Steel 2 Brass 3 Stainless steel (4) Galvanized steel 5 Fiberglass 6 Concrete tile 7 PVC 8 RMP (SR) 9 ABS (10) Asbestos-cement 11 Other (specify) ..... 12 None used (open hole)

Screen or Perforation Openings Are: (1) Continuous slot 2 Louvered shutter 3 Mill slot 4 Key punched 5 Gauzed wrapped 6 Wire wrapped 7 Torch cut (8) Saw cut 9 Drilled holes 10 Other (specify) ..... 11 None (open hole)

Screen-Perforation Dia 16 in. to 32 ft., Dia ..... in. to ..... ft., Dia ..... in. to ..... ft.

Screen-Perforated Intervals: (8) From 14 ft. to 27 ft., From ..... ft. to ..... ft.

(1) From 27 ft. to 32 ft., From ..... ft. to ..... ft.

Gravel Pack Intervals: From 10 ft. to 32 ft., From ..... ft. to ..... ft.

From ..... ft. to ..... ft., From ..... ft. to ..... ft.

5 GROUT MATERIAL: 1 Neat cement 2 Cement grout (3) Bentonite 4 Other .....

Grouted Intervals: From 0 ft. to 10 ft., From ..... ft. to ..... ft., From ..... ft. to ..... ft.

What is the nearest source of possible contamination: NONE

1 Septic tank 2 Sewer lines 3 Lateral lines 4 Cess pool 5 Seepage pit 6 Pit privy 7 Sewage lagoon 8 Feed yard 9 Livestock pens 10 Fuel storage 11 Fertilizer storage 12 Insecticide storage 13 Watertight sewer lines 14 Abandoned water well 15 Oil well/Gas well 16 Other (specify below)

Direction from well ANT How many feet 1300? Water Well Disinfected? Yes X No

Was a chemical/bacteriological sample submitted to Department? Yes ..... No X If yes, date sample was submitted ..... month ..... day ..... year: Pump Installed? Yes ..... No X

If Yes: Pump Manufacturer's name ..... Model No. ..... HP ..... Volts .....

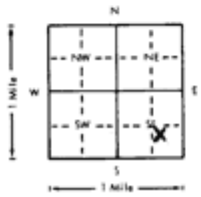
Depth of Pump Intake ..... ft. Pumps Capacity rated at ..... gal./min.

Type of pump: 1 Submersible 2 Turbine 3 Jet 4 Centrifugal 5 Reciprocating 6 Other

6 CONTRACTOR'S OR LANDOWNER'S CERTIFICATION: This water well was (1) constructed, (2) reconstructed, or (3) plugged under my jurisdiction and was completed on MAY 30 month 30 day 1983 year, and this record is true to the best of my knowledge and belief. Kansas Water Well Contractor's License No. 272

This Water Well Record was completed on June 30 month 26 day 1983 year under the business name of Smith Drilling Co. by (signature) Del Smith

7 LOCATE WELL'S LOCATION WITH AN "X" IN SECTION BOX:



ELEVATION:

FROM	TO	LITHOLOGIC LOG	FROM	TO	LITHOLOGIC LOG
0	4	Topsoil			
4	12	Blue clay			
12	19	Sandy clay			
19	23	Black clay			
23	30	Sand & Gravel			
30	32	Shale			

Depth(s) Groundwater Encountered 1 18 ft. 2 ..... ft. 3 ..... ft. 4 ..... ft. (Use a second sheet if needed)

INSTRUCTIONS: Use typewriter or ball point pen, *please press firmly and PRINT clearly*. Please fill in blanks, underline or circle the correct answers. Send top three copies to Kansas Department of Health and Environment, Division of Environment, Water Well Contractors, Topeka, KS 66620. Send one to WATER WELL OWNER and retain one for your records.

USE TYPEWRITER OR BALL POINT PEN-PRESS FIRMLly, PRINT CLEARLY.

WATER WELL RECORD
KSA 82a-1201-1215

Kansas Department of Health and Environment-Division of Environment
(Water well Contractors)
Topeka, Kansas 66620

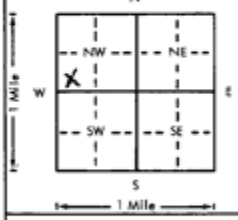
#7

1. Location of well: County: Republic | Fraction: 40 SW1/4 10 SW1/4 160 NW1/4 | Section number: 30 | Township number: T 1 S | Range number: R 4 E(W)

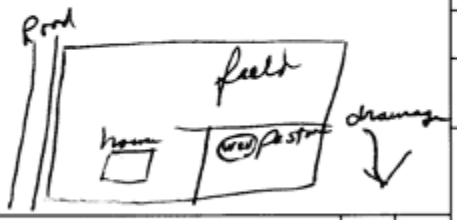
2. Distance and direction from nearest town or city: 1/4 N of Republic
Street address of well location if in city: KS

3. Owner of well: MAX Thayer
R.R. or street:
City, state, zip code: Republic Ks 66964

4. Locate with "X" in section below:



Sketch map:



6. Bore hole dia. 8 in. Completion date 12-11-98
Well depth 35 ft.

7. __ Cable tool X Rotary __ Driven __ Dug
__ Hollow rod __ Jetted __ Bored __ Reverse rotary

8. Use: __ Domestic __ Public supply __ Industry
__ Irrigation __ Air conditioning X Stock
__ Lawn __ Oil field water __ Other

9. Casing: Material ____ Height: Above or below
Threaded ____ Welded ____ Surface 14 in.
RMP ____ PVC X Weight ____ lbs./ft.
Dia. 5 in. to 35 ft. depth Wall Thickness: inches or
Dia. ____ in. to ____ ft. depth gage No. 265

5. Type and color of material	From	To
Top Soil & Clay	0	5
Sand & gravel	5	10
Clay blue	10	17
Sand med to coarse	17	26
Shale	26	35

(Use a second sheet if needed)

10. Screen: Manufacturer's name
Jet Stream
Type Slotted pvc Dia. 5"
Slot/gauze .0030 Length 20'
Set between 15 ft. and 35 ft.
____ ft. and ____ ft.
Gravel pack? yes Size range of material Fine 3/8

11. Static water level: mo./day/yr.
9 ft. below land surface Date 12-11-98

12. Pumping level below land surface: Unknown air lifting
____ ft. after 1 hrs. pumping 5 g.p.m.
____ ft. after ____ hrs. pumping ____ g.p.m.
Estimated maximum yield 10+ g.p.m.

13. Water sample submitted: mo./day/yr.
__ Yes X No Date

14. Well head completion:
__ Pitless adapter 14 inches above grade

15. Well grouted? yes
With: __ Neat cement X Bentonite __ Concrete
Depth: From 0 ft. to 12 ft.

16. Nearest source of possible contamination:
ft. 100 Direction S Type Cattle
Well disinfected upon completion? X Yes __ No

17. Pump: X Not installed
Manufacturer's name
Model number HP Volts
Length of drop pipe ____ ft. capacity ____ g.p.m.
Type:
__ Submersible __ Turbine
__ Jet __ Reciprocating
__ Centrifugal __ Other

18. Elevation: [illegible]
Topography:
__ Hill
__ Slope
__ Upland
X Valley

19. Remarks:

20. Water well contractor's certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Business name: MARUHN Well Drilling Inc. License No. 165
Address: Box Cloud Ne 68970
Signed: Leroy Maruhn (Authorized representative) Date 1-7-99

T 1 S R 4 E(W) Sec 30 1/4 SW 1/4 SW 1/4 NW

Forward the white, blue and pink copies to the Department of Health and Environment

Form WWC-5

WATER WELL RECORD Form WWC-5 KSA 82a-1212

1 LOCATION OF WATER WELL

County: Republic	Fraction: SW ¼ SW ¼ SW ¼	Section Number: 19	Township Number: T 1 S	Range Number: R 4 E (W)

Distance and direction from nearest town or city? 1N Republic

Street address of well if located within city? #8

2 WATER WELL OWNER: Robert Gunn

RR#, St. Address, Box # : RR

City, State, ZIP Code : Republic KS 66964

Board of Agriculture, Division of Water Resources Application Number:

3 DEPTH OF COMPLETED WELL 75 ft. Bore Hole Diameter 8 in. to 75 ft., and ..... in. to ..... ft.

Well Water to be used as: 1 Domestic 2 Irrigation 3 Feedlot 4 Industrial 5 Public water supply 6 Oil field water supply 7 Lawn and garden only 8 Air conditioning 9 Dewatering 10 Observation well 11 Injection well 12 Other (Specify below) Stock well

Well's static water level 40 ft. below land surface measured on 7 month 14 day 81 year

Pump Test Data: Well water was 4 ft Known ft. after 1 hours pumping 16 gpm

Est. Yield 20+ gpm: Well water was ft. after hours pumping gpm

4 TYPE OF BLANK CASING USED: 1 Steel 2 (PVC) 3 RMP (SR) 4 ABS 5 Wrought iron 6 Asbestos-Cement 7 Fiberglass 8 Concrete tile 9 Other (specify below)

Casing Joints: Glued X Clamped ..... Welded ..... Threaded .....

Blank casing dia 5 in. to 50 ft., Dia ..... in. to ..... ft., Dia ..... in. to ..... ft.

Casing height above land surface 15 in., weight 229 CFT lbs./ft. Wall thickness or gauge No. .219

TYPE OF SCREEN OR PERFORATION MATERIAL: 1 Steel 2 Brass 3 Stainless steel 4 Galvanized steel 5 Fiberglass 6 Concrete tile 7 (PVC) 8 RMP (SR) 9 ABS 10 Asbestos-cement 11 Other (specify) ..... 12 None used (open hole)

Screen or Perforation Openings Are: 1 Continuous slot 2 Louvered shutter 3 Mill slot 4 Key punched 5 Gauzed wrapped 6 Wire wrapped 7 Torch cut 8 (Saw cut) 9 Drilled holes 10 Other (specify) ..... 11 None (open hole)

Screen-Perforation Dia 5 in. to ..... ft., Dia ..... in. to ..... ft., Dia ..... in to ..... ft.

Screen-Perforated Intervals: From 50 ft. to 75 ft., From ..... ft. to ..... ft.

From ..... ft. to ..... ft., From ..... ft. to ..... ft.

Gravel Pack Intervals: From 10 ft. to 75 ft., From ..... ft. to ..... ft.

From ..... ft. to ..... ft., From ..... ft. to ..... ft.

5 GROUT MATERIAL: 1 (Neat cement) 2 Cement grout 3 Bentonite 4 Other .....

Grouted Intervals: From 0 ft. to 10 ft., From ..... ft. to ..... ft., From ..... ft. to ..... ft.

What is the nearest source of possible contamination: 1 Septic tank 2 (Sewer lines) 3 Lateral lines 4 Cess pool 5 Seepage pit 6 Pit privy 7 Sewage lagoon 8 Feed yard 9 Livestock pens 10 Fuel storage 11 Fertilizer storage 12 Insecticide storage 13 Watertight sewer lines 14 Abandoned water well 15 Oil well/Gas well 16 Other (specify below) .....

Direction from well South How many feet 1/8 mile ? Water Well Disinfected? Yes X No

Was a chemical/bacteriological sample submitted to Department? Yes ..... No X If yes, date sample was submitted ..... month ..... day ..... year: Pump Installed? Yes ..... No X

If Yes: Pump Manufacturer's name ..... Model No. ..... HP ..... Volts .....

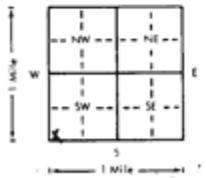
Depth of Pump Intake ..... ft. Pumps Capacity rated at ..... gal./min.

Type of pump: 1 Submersible 2 Turbine 3 Jet 4 Centrifugal 5 Reciprocating 6 Other

6 CONTRACTOR'S OR LANDOWNER'S CERTIFICATION: This water well was (1) constructed, (2) reconstructed, or (3) plugged under my jurisdiction and was completed on 7 month 14 day 81 year and this record is true to the best of my knowledge and belief. Kansas Water Well Contractor's License No. 165

This Water Well Record was completed on 1 month 3 day 82 year under the business name of Maruhn Well Drilling by (signature) Leroy Maruhn

7 LOCATE WELL'S LOCATION WITH AN "X" IN SECTION BOX:



ELEVATION:

FROM	TO	LITHOLOGIC LOG	FROM	TO	LITHOLOGIC LOG
0	25	Top Soil & Clay			
25	32	Sand & Clay			
32	42	Clay hard			
42	50	Sandy Clay			
50	55	Sand med to very Coarse			
55	60	Sand & gravel (med)			
60	66	Sand & gravel			
66	75	Shale			

Depth(s) Groundwater Encountered 1. 40 ft. 2. ..... ft. 3. ..... ft. 4. ..... ft. (Use a second sheet if needed)

INSTRUCTIONS: Use typewriter or ball point pen, *please press firmly* and *PRINT* clearly. Please fill in blanks, underline or circle the correct answers. Send top three copies to Kansas Department of Health and Environment, Division of Environment, Water Well Contractors, Topeka, KS 66620. Send one to WATER WELL OWNER and retain one for your records.

WATER WELL RECORD Form WWC-5 KSA 82a-1212 ID No. _____

1 LOCATION OF WATER WELL:

County:	Fraction	Section Number	Township Number	Range Number
Republic	NE ¼ SE ¼ ¼	30	T 1 S	R 4 E (W)

Distance and direction from nearest town or city street address of well if located within city? #9

2 WATER WELL OWNER: Randy Elder + Ron Ewert

RR#, St. Address, Box # : 1110 S. 5th Street

City, State, ZIP Code : Belleville, KS 66938

Board of Agriculture, Division of Water Resources Application Number:

3 LOCATE WELL'S LOCATION WITH AN "X" IN SECTION BOX:

N / NW / NE / W / E / X / SW / SE / S

4 DEPTH OF COMPLETED WELL 30 ft. ELEVATION:

Depth(s) Groundwater Encountered 1 ..... ft. 2 ..... ft. 3 ..... ft.

WELL'S STATIC WATER LEVEL 11 ft. below land surface measured on mo/day/yr .....

Pump test data: Well water was ..... ft. after air Develop hours pumping ..... gpm

Est. Yield 20 gpm: Well water was ..... ft. after ..... hours pumping ..... gpm

WELL WATER TO BE USED AS: 1 Domestic 2 Irrigation 3 Feedlot 4 Industrial 5 Public water supply 6 Oil field water supply 7 Domestic (lawn & garden) 8 Air conditioning 9 Dewatering 10 Monitoring well 11 Injection well 12 Other (Specify below)

Was a chemical/bacteriological sample submitted to Department? Yes ..... No ..... ; If yes, mo/day/yrs sample was submitted

Water Well Disinfected? Yes No

5 TYPE OF BLANK CASING USED: 1 Steel 2 PVC 3 RMP (SR) 4 ABS 5 Wrought iron 6 Asbestos-Cement 7 Fiberglass 8 Concrete tile 9 Other (specify below)

CASING JOINTS: Glued X Clamped ..... Welded ..... Threaded .....

Blank casing diameter 5 in. to 17 ft., Dia 5 in. to 30 ft., Dia ..... in. to ..... ft.

Casing height above land surface 12 in., weight ..... lbs./ft. Wall thickness or guage No. .214

TYPE OF SCREEN OR PERFORATION MATERIAL: 1 Steel 2 Brass 3 Stainless Steel 4 Galvanized Steel 5 Fiberglass 6 Concrete tile 7 PVC 8 RMP (SR) 9 ABS 10 Asbestos-Cement 11 Other (Specify) ..... 12 None used (open hole)

SCREEN OR PERFORATION OPENINGS ARE: 1 Continuous slot 2 Louvered shutter 3 Mill slot 4 Key punched 5 Guazed wrapped 6 Wire wrapped 7 Torch cut 8 Saw cut 9 Drilled holes 10 Other (specify) ..... 11 None (open hole)

SCREEN-PERFORATED INTERVALS: From 19 ft. to 24 ft., From ..... ft. to ..... ft.

From ..... ft. to ..... ft., From ..... ft. to ..... ft.

GRAVEL PACK INTERVALS: From 18 ft. to 30 ft., From ..... ft. to ..... ft.

From ..... ft. to ..... ft., From ..... ft. to ..... ft.

6 GROUT MATERIAL: 1 Neat cement 2 Cement grout 3 Bentonite 4 Other .....

Grout Intervals: From 0 ft. to 18 ft., From ..... ft. to ..... ft., From ..... ft. to ..... ft.

What is the nearest source of possible contamination:

1 Septic tank 2 Sewer lines 3 Watertight sewer lines 4 Lateral lines 5 Cess pool 6 Seepage pit 7 Pit privy 8 Sewage lagoon 9 Feedyard 10 Livestock pens 11 Fuel storage 12 Fertilizer storage 13 Insecticide storage 14 Abandoned water well 15 Oil well/Gas well 16 Other (specify below) none

Direction from well? How many feet?

FROM	TO	LITHOLOGIC LOG	FROM	TO	PLUGGING INTERVALS
0	20	Topsoil + Clay			
20	23	medium Sand			
23	30	Gray Shale			

7 CONTRACTOR'S OR LANDOWNER'S CERTIFICATION: This water well was (1) constructed, (2) reconstructed, or (3) plugged under my jurisdiction and was completed on (mo/day/year) 6/3/06 and this record is true to the best of my knowledge and belief. Kansas Water Well Contractor's Licence No 741 This Water Well Record was completed on (mo/day/yr) 7/10/06 under the business name of Watson Well Drilling by (signature) Eddie Watson

INSTRUCTIONS: Use typewriter or ball point pen. *PLEASE PRESS FIRMLY* and *PRINT* clearly. Please fill in blanks, underline or circle the correct answers. Send top three copies to Kansas Department of Health and Environment, Bureau of Water, Geology Section, 1000 SW Jackson St., Suite 420, Topeka, Kansas 66612-1367. Telephone 785-296-5522. Send one to WATER WELL OWNER and retain one for your

WATER WELL RECORD Form WWC-5 KSA 82a-1212

1 LOCATION OF WATER WELL:
County: Republic | Fraction: NW ¼ NE ¼ NE ¼ | Section Number: 31 | Township Number: T 1 S | Range Number: R 4 E (W)

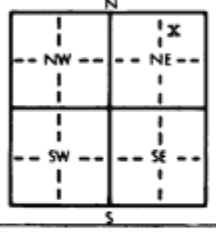
Distance and direction from nearest town or city street address of well if located within city?
3/4 East of Republic Ks.

#10

2 WATER WELL OWNER: Dorothy Hoops
RR#, St. Address, Box # : Republic Ks.66964
City, State, ZIP Code :

Board of Agriculture, Division of Water Resources
Application Number:

3 LOCATE WELL'S LOCATION WITH AN "X" IN SECTION BOX:



4 DEPTH OF COMPLETED WELL 70 ft. ELEVATION: 1370'
Depth(s) Groundwater Encountered 1. 54' ft. 2. ft. 3. ft.
WELL'S STATIC WATER LEVEL 54 ft. below land surface measured on mo/day/yr 6 28 85
Pump test data: Well water was 58 ft. after 1 hours pumping 7 gpm
Est. Yield 7 gpm: Well water was ft. after hours pumping gpm
Bore Hole Diameter 8 in. to 70 ft., and in. to ft.
WELL WATER TO BE USED AS: 5 Public water supply 8 Air conditioning 11 Injection well
X Domestic 3 Feedlot 6 Oil field water supply 9 Dewatering 12 Other (Specify below)
2 Irrigation 4 Industrial 7 Lawn and garden only 10 Observation well
Was a chemical/bacteriological sample submitted to Department? Yes No X ; If yes, mo/day/yr sample was submitted
Water Well Disinfected? Yes X No

5 TYPE OF BLANK CASING USED: 5 Wrought iron 8 Concrete tile CASING JOINTS: Glued X Clamped
1 Steel 3 RMP (SR) 6 Asbestos-Cement 9 Other (specify below) Welded
X PVC 4 ABS 7 Fiberglass Threaded
Blank casing diameter 5 in. to 50 ft., Dia in. to ft., Dia in. to ft.
Casing height above land surface 14 in., weight 229 cft lbs./ft. Wall thickness or gauge No. .214
TYPE OF SCREEN OR PERFORATION MATERIAL: X PVC 10 Asbestos-cement
1 Steel 3 Stainless steel 5 Fiberglass 8 RMP (SR) 11 Other (specify)
2 Brass 4 Galvanized steel 6 Concrete tile 9 ABS 12 None used (open hole)
SCREEN OR PERFORATION OPENINGS ARE: 5 Gauzed wrapped X Saw cut 11 None (open hole)
1 Continuous slot 3 Mill slot 6 Wire wrapped 9 Drilled holes
2 Louvered shutter 4 Key punched 7 Torch cut 10 Other (specify)
SCREEN-PERFORATED INTERVALS: From 50 ft. to 60 ft., From ft. to ft.
From ft. to ft., From ft. to ft.
GRAVEL PACK INTERVALS: From 18 ft. to 70 ft., From ft. to ft.
From ft. to ft., From ft. to ft.

6 GROUT MATERIAL: X Neat cement 2 Cement grout 3 Bentonite 4 Other
Grout Intervals: From 0 ft. to 18 ft., From ft. to ft., From ft. to ft.
What is the nearest source of possible contamination:
X Septic tank 4 Lateral lines 7 Pit privy 10 Livestock pens 14 Abandoned water well
2 Sewer lines 5 Cess pool 8 Sewage lagoon 11 Fuel storage 15 Oil well/Gas well
3 Watertight sewer lines 6 Seepage pit 9 Feedyard 12 Fertilizer storage 16 Other (specify below)
13 Insecticide storage
Direction from well? SW How many feet? 100

FROM	TO	LITHOLOGIC LOG	FROM	TO	LITHOLOGIC LOG
0	25	Top Soil & Clay			
25	45	Sand W/some clay			
45	58	Sand & Gravel (med)			
58	70	Shale			

7 CONTRACTOR'S OR LANDOWNER'S CERTIFICATION: This water well was (1) X constructed, (2) reconstructed, or (3) plugged under my jurisdiction and was completed on (mo/day/year) 6 28 85 and this record is true to the best of my knowledge and belief. Kansas Water Well Contractor's License No. 165 This Water Well Record was completed on (mo/day/yr) 7 1 85
under the business name of Maruhn Well Drilling Inc. by (signature) Leroy Maruhn

INSTRUCTIONS: Use typewriter or ball point pen, *PLEASE PRESS FIRMLY* and *PRINT* clearly. Please fill in blanks, underline or circle the correct answers. Send top three copies to Kansas Department of Health and Environment, Division of Environment, Environmental Geology Section, Topeka, KS 66620. Send one to WATER WELL OWNER and retain one for your records.

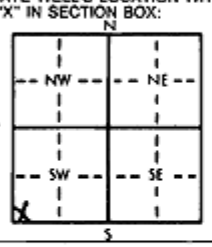
WATER WELL RECORD Form WWC-5 KSA 82a-1212

#11

1 LOCATION OF WATER WELL:
County: Republic
Fraction: SW ¼ SW ¼ SW ¼
Section Number: 20
Township Number: T 1 S
Range Number: R 14 E (W)
Distance and direction from nearest town or city street address of well if located within city?
1E 1N of Republic KS

2 WATER WELL OWNER: B & H Ranch
RR#, St. Address, Box # : Box 137
City, State, ZIP Code : Courtland, KS
Board of Agriculture, Division of Water Resources
Application Number:

3 LOCATE WELL'S LOCATION WITH AN "X" IN SECTION BOX:



4 DEPTH OF COMPLETED WELL 85 ft. ELEVATION:
Depth(s) Groundwater Encountered 1. 56' 2" ft. 2. ft. 3. ft.
WELL'S STATIC WATER LEVEL 56' 2" ft. below land surface measured on mo/day/yr 9-26-00
Pump test data: Well water was air blowed ft. after hours pumping gpm
Est. Yield 50 gpm: Well water was ft. after hours pumping gpm
Bore Hole Diameter 10 in. to 22 ft., and 8 in. to 85 ft.
WELL WATER TO BE USED AS: 5 Public water supply 8 Air conditioning 11 Injection well
(1) Domestic 3 Feedlot 6 Oil field water supply 9 Dewatering 12 Other (Specify below)
2 Irrigation 4 Industrial 7 Lawn and garden only 10 Monitoring well
Was a chemical/bacteriological sample submitted to Department? Yes No X; If yes, mo/day/yr sample was submitted
Water Well Disinfected? (Yes) No

5 TYPE OF BLANK CASING USED: 5 Wrought iron 8 Concrete tile CASING JOINTS: Glued X Clamped
1 Steel 3 RMP (SR) 6 Asbestos-Cement 9 Other (specify below) Welded
(2) PVC 4 ABS 7 Fiberglass Threaded
Blank casing diameter 5 in. to 75 ft., Dia in. to ft., Dia in. to ft.
Casing height above land surface 14 in., weight lbs./ft. Wall thickness or gauge No. .214
TYPE OF SCREEN OR PERFORATION MATERIAL: (7) PVC 10 Asbestos-cement
1 Steel 3 Stainless steel 5 Fiberglass 8 RMP (SR) 11 Other (specify)
2 Brass 4 Galvanized steel 6 Concrete tile 9 ABS 12 None used (open hole)
SCREEN OR PERFORATION OPENINGS ARE: 5 Gauzed wrapped (8) Saw cut 11 None (open hole)
1 Continuous slot 3 Mill slot 6 Wire wrapped 9 Drilled holes
2 Louvered shutter 4 Key punched 7 Torch cut 10 Other (specify)
SCREEN-PERFORATED INTERVALS: From 75 ft. to 85 ft., From ft. to ft.
From ft. to ft., From ft. to ft.
GRAVEL PACK INTERVALS: From 25 ft. to 64 ft., From 67 ft. to 85 ft.
From ft. to ft., From ft. to ft.

6 GROUT MATERIAL: 1 Neat cement 2 Cement grout (3) Bentonite 4 Other
Grout Intervals: From 5 ft. to 25 ft., From 64 ft. to 67 ft., From ft. to ft.
What is the nearest source of possible contamination: 10 Livestock pens 14 Abandoned water well
(1) Septic tank 4 Lateral lines 7 Pit privy 11 Fuel storage 15 Oil well/Gas well
2 Sewer lines 5 Cess pool 8 Sewage lagoon 12 Fertilizer storage 16 Other (specify below)
3 Watertight sewer lines 6 Seepage pit 9 Feedyard 13 Insecticide storage
Direction from well? SW How many feet? 150'

FROM	TO	LITHOLOGIC LOG	FROM	TO	PLUGGING INTERVALS
0	27	top Soil & clay			
27	32	Sandy Clay			
32	62	Sand & Gravel			
62	75	Clay			
75	82	Sand & Gravel (med)			
82	83	Ochre			
83	90	Shale			

7 CONTRACTOR'S OR LANDOWNER'S CERTIFICATION: This water well was (1) constructed, (2) reconstructed, or (3) plugged under my jurisdiction and was completed on (mo/day/year) 9-26-00 and this record is true to the best of my knowledge and belief. Kansas Water Well Contractor's License No. 165 This Water Well Record was completed on (mo/day/yr) 9-26-00 10 pm under the business name of Marubi Well Drilling by (signature) Terry Marubi

INSTRUCTIONS: Use typewriter or ball point pen. *PLEASE PRESS FIRMLY* and *PRINT* clearly. Please fill in blanks, underline or circle the correct answers. Send top three copies to Kansas Department of Health and Environment, Bureau of Water, Topeka, Kansas 66620-0001, Telephone: 913-296-5545. Send one to WATER WELL OWNER and retain one for your records.

WATER WELL RECORD Form WWC-5 KSA 82a-1212

1 LOCATION OF WATER WELL	Fraction	Section Number	Township Number	Range Number
County: Republic	SE ¼ NW ¼ NE ¼	29	T 1 S	R 4 E/W

Distance and direction from nearest town or city? 2 miles NE of Republic Street address of well if located within city? #12

2 WATER WELL OWNER: James J. Hurley
RR#, St. Address, Box # :
City, State, ZIP Code : Republic, KS. 66964

Board of Agriculture, Division of Water Resources Application Number: 33,693

3 DEPTH OF COMPLETED WELL 103 ft. Bore Hole Diameter 30" in. to 103 ft., and ... in. to ... ft.

Well Water to be used as: 1 Domestic 3 Feedlot (2) Irrigation 4 Industrial 5 Public water supply 6 Oil field water supply 7 Lawn and garden only 8 Air conditioning 9 Dewatering 10 Observation well 11 Injection well 12 Other (Specify below)

Well's static water level 59 ft. below land surface measured on 8 month 5 day 82 year

Pump Test Data : Well water was 76 ft. after 1 hours pumping 1000 gpm

Est. Yield gpm: Well water was 87 ft. after 1½ hours pumping 1500 gpm

4 TYPE OF BLANK CASING USED: 1 Steel 2 PVC 3 RMP (SR) 4 ABS 5 Wrought iron 6 Asbestos-Cement 7 Fiberglass (8) Concrete tile 9 Other (specify below)

Casing Joints: Glued ... Clamped ... Welded ... Threaded ...

Blank casing dia 16 in. to 63 ft., Dia ... in. to ... ft., Dia ... in. to ... ft.

Casing height above land surface 12 in., weight 80 lbs./ft. Wall thickness or gauge No 2"

TYPE OF SCREEN OR PERFORATION MATERIAL: 1 Steel 2 Brass 3 Stainless steel 4 Galvanized steel 5 Fiberglass (6) Concrete tile 7 PVC 8 RMP (SR) 9 ABS 10 Asbestos-cement 11 Other (specify) 12 None used (open hole)

Screen or Perforation Openings Are: 1 Continuous slot 2 Louvered shutter 3 Mill slot 4 Key punched 5 Gauzed wrapped 6 Wire wrapped 7 Torch cut 8 Saw cut 9 Drilled holes (10) Other (specify) reamed 11 None (open hole)

Screen-Perforation Dia 16 in. to 103 ft., Dia ... in. to ... ft., Dia ... in to ... ft.

Screen-Perforated Intervals: From 63 ft. to 103 ft., From ... ft. to ... ft.
From ... ft. to ... ft., From ... ft. to ... ft.

Gravel Pack Intervals: From 10 ft. to 103 ft., From ... ft. to ... ft.
From ... ft. to ... ft., From ... ft. to ... ft.

5 GROUT MATERIAL: 1 Neat cement 2 Cement grout (3) Bentonite 4 Other ...

Grouted Intervals: From 0 ft. to 10 ft., From ... ft. to ... ft., From ... ft. to ... ft.

What is the nearest source of possible contamination: None

1 Septic tank 2 Sewer lines 3 Lateral lines 4 Cess pool 5 Seepage pit 6 Pit privy 7 Sewage lagoon 8 Feed yard 9 Livestock pens 10 Fuel storage 11 Fertilizer storage 12 Insecticide storage 13 Watertight sewer lines 14 Abandoned water well 15 Oil well/Gas well 16 Other (specify below)

Direction from well Any How many feet 1500? Water Well Disinfected? Yes X No

Was a chemical/bacteriological sample submitted to Department? Yes ... No X If yes, date sample was submitted ... month ... day ... year: Pump Installed? Yes X No

If Yes: Pump Manufacturer's name Western Land Roller Model No. 6010L HP N/A Volts N/A

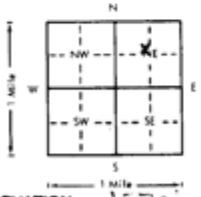
Depth of Pump Intake 82' ft. Pumps Capacity rated at 600 gal./min.

Type of pump: 1 Submersible (2) Turbine 3 Jet 4 Centrifugal 5 Reciprocating 6 Other

6 CONTRACTOR'S OR LANDOWNER'S CERTIFICATION: This water well was (1) constructed, (2) reconstructed, or (3) plugged under my jurisdiction and was completed on Nov. month 7 day 1983 year, and this record is true to the best of my knowledge and belief. Kansas Water Well Contractor's License No. 272

This Water Well Record was completed on Nov month 10 day 1983 year under the business name of Shuck Drilling Co. by (signature) Dell Shuck V.P.

7 LOCATE WELL'S LOCATION WITH AN "X" IN SECTION BOX:



ELEVATION: 1570

FROM	TO	LITHOLOGIC LOG	FROM	TO	LITHOLOGIC LOG
0	10	01 Topsoil & Clay			
10	21	07 F. Sand			
21	28	S&G fine			
28	50	Coarse Sand some gravel			
50	60	S&G med to coarse			
60	71	17 S&G Very Coarse			
71	82	09 Coarse sand			
82	100	11 white wheat gravel			
100	101	Niobrara Shale			
101	103	19 Carlisle Shale			

Depth(s) Groundwater Encountered 1 59 ft. 2 ... ft. 3 ... ft. 4 ... ft. (Use a second sheet if needed)

INSTRUCTIONS: Use typewriter or ball point pen, *please press firmly* and *PRINT* clearly. Please fill in blanks, underline or circle the correct answers. Send top three copies to Kansas Department of Health and Environment, Division of Environment, Water Well Contractors, Topeka, KS 66620. Send one to WATER WELL OWNER and retain one for your records.

USE TYPEWRITER OR BALL POINT PEN-PRESS FIRMLY, PRINT CLEARLY.

WATER WELL RECORD
KSA 82a-1201-1215

Kansas Department of Health and Environment-Division of Environment
(Water well Contractors)
Topeka, Kansas 66620

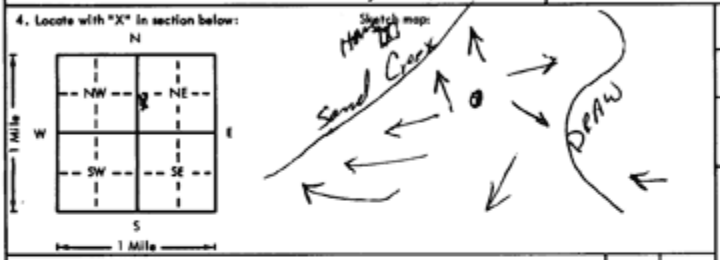
#13

1. Location of well:	County: Republic	Fraction: NW 1/4 SW 1/4 NE 1/4	Section number: 29	Township number: T 1 S	Range number: R 4 W

2. Distance and direction from nearest town or city: 6 mi SW
Street address of well location if in city: 0 F Byron, Ne.

3. Owner of well: Verle Tertian
R.R. or street:
City, state, zip code: Byron, Ne. 68325

4. Locate with "X" in section below:



6. Bore hole dia. 30 in. Completion date 3/26/77
Well depth 84 ft.

7. __ Cable tool __ Rotary __ Driven __ Dug
__ Hollow rod __ Jetted __ Bored X Reverse rotary

8. Use: __ Domestic __ Public supply __ Industry
X Irrigation __ Air conditioning __ Stock
__ Lawn __ Oil field water __ Other

9. Casing: Material A-C Height: Above ~~or below~~
Threaded ___ Welded ___ Surface 12 in.
RMP ___ PVC ___ Weight 34 lbs./ft.
Dia. 16 in. to 84 ft. depth Wall Thickness: inches or ~~gage~~ No. .875
Dia. ___ in. to ___ ft. depth

5. Type and color of material	From	To
Topsoil & clay	0	23
S & G	23	57
S & G. -mod to fine	57	66
Clay	66	70
White wheat sand	70	83
Rock	83	84
Carlisle Shale	84	95

(Use a second sheet if needed)

10. Screen: Manufacturer's name Johnson-Concrete
Type Transite Dia. 16"
Slot/gauze .125 Length 39
Set between 45 ft. and 84 ft.
___ ft. and ___ ft.
Gravel pack? Yes Size range of material ½"-¼"

11. Static water level: mo./day/yr.
31 ft. below land surface Date 3/25/76

12. Pumping level below land surfaces:
71 ft. after 1 hrs. pumping 300 g.p.m.
76 ft. after 1½ hrs. pumping 500 g.p.m.
Estimated maximum yield 590 g.p.m.

13. Water sample submitted: mo./day/yr.
__ Yes X No Date

14. Well head completion:
__ Pitless adapter 12 Inches above grade

15. Well grouted? Yes
With: __ Neat cement __ Bentonite X Concrete
Depth: From 0 ft. to 20 ft. MHC

16. Nearest source of possible contamination: ~~Home cistern~~
ft. 2000 Direction ~~Hwy~~ NW Type Holes
Well disinfected ~~upon~~ ~~completion~~? ~~No~~ Yes 30 HP

17. Pump: __ Not installed
Manufacturer's name Western Land Roller
Model number 6m830 HP — Volts ___
Length of drop pipe 70 ft. capacity 500 g.p.m.
Type:
__ Submersible X Turbine
__ Jet __ Reciprocating
__ Centrifugal __ Other

18. Elevation: 1540'
Topography:
__ Hill
__ Slope
X Upland
__ Valley

19. Remarks:

20. Water well contractor's certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Shuck Drilling Co 272
Business name License No.
Address Edgar, Ne.
Signed Dale Shuck Date 4/1/77
Authorized representative

T 1 S R 4 W Sec 29 1/4 NW 1/4 SW 1/4 NE

Forward the white, blue and pink copies to the Department of Health and Environment

Form WWC-5

WATER WELL RECORD **Form WWC-5** Division of Water Resources; App. No. ____

1 LOCATION OF WATER WELL: County: Republic | Fraction: ¼ SW ¼ NE ¼ | Section Number: 29 | Township Number: T 1 S | Range Number: R 4 E (W)

Distance and direction from nearest town or city street address of well if located within city?
1/2 mile North and 1 1/2 miles East of Republic

Global Positioning Systems (decimal degrees, min. of 4 digits)
Latitude: 39° 56' 23.7" #14
Longitude: 097° 47' 23"
Elevation:
Datum:
Data Collection Method: Hand held

2 WATER WELL OWNER: Tietjen and Sons
RR#, St. Address, Box # : 401 N. Railroad St.
City, State, ZIP Code : Byron, NE 68325

3 LOCATE WELL'S LOCATION WITH AN "X" IN SECTION BOX:

N
W | - - NW - - | - - NE - - | E
- - SW - - | - - SE - - |
S

4 DEPTH OF COMPLETED WELL 69 ft.

Depth(s) Groundwater Encountered (1) 13 ft. (2) ..... ft. (3) ..... ft.
WELL'S STATIC WATER LEVEL 21 ft. below land surface measured on mo/day/yr 04/20/2009
Pump test data: Well water was 49 ft. after 2 hours pumping 800 gpm
Est. Yield 800 gpm: Well water was 52 ft. after 2 hours pumping 900 gpm
WELL WATER TO BE USED AS: 5 Public water supply 8 Air conditioning 11 Injection well
1 Domestic 3 Feedlot 6 Oil field water supply 9 Dewatering 12 Other (Specify below)
(2) Irrigation 4 Industrial 7 Domestic (lawn & garden) 10 Monitoring well .....

Was a chemical/bacteriological sample submitted to Department? Yes ..... No X; If yes, mo/day/yrs Sample was submitted.....
Water well disinfected? Yes ..... No .....

5 TYPE OF CASING USED: 5 Wrought Iron 8 Concrete tile CASING JOINTS: Glued ..... Clamped .....
1 Steel 3 RMP (SR) 6 Asbestos-Cement 9 Other (specify below) Welded .....
(2 PVC) 4 ABS 7 Fiberglass ..... Threaded .....
Blank casing diameter 16 in. to 50 ft., Diameter ..... in. to ..... ft., Diameter ..... in. to ..... ft.
Casing height above land surface 12 in., Weight 20.183 lbs./ft. Wall thickness or guage No. .625
TYPE OF SCREEN OR PERFORATION MATERIAL:
(1 Steel) 3 Stainless Steel 5 Fiberglass 7 PVC 9 ABS 11 Other (Specify) .....
2 Brass 4 Galvanized Steal 6 Concrete tile 8 RM (SR) 10 Asbestos-Cement 12 None used (open hole)
SCREEN OR PERFORATION OPENINGS ARE:
(1 Continuous slot) 3 Mill slot 5 Gauzed wrapped 7 Torch cut 9 Drilled holes 11 None (open hole)
2 Louvered shutter 4 Key punched 6 Wire wrapped 8 Saw cut 10 Other (specify) .....
SCREEN-PERFORATED INTERVALS: From 50 ft. to 69 ft., From ..... ft. to ..... ft.
From ..... ft. to ..... ft., From ..... ft. to ..... ft.
GRAVEL PACK INTERVALS: From 22 ft. to 69 ft., From ..... ft. to ..... ft.
From ..... ft. to ..... ft., From ..... ft. to ..... ft.

6 GROUT MATERIAL: 1 Neat cement 2 Cement grout (3 Bentonite) 4 Other .....
Grout Intervals: From 0 ft. to 22 ft., From ..... ft. to ..... ft., From ..... ft. to ..... ft.
What is the nearest source of possible contamination:
1 Septic tank 4 Lateral lines 7 Pit privy 10 Livestock pens 13 Insecticide storage 16 Other (specify below)
2 Sewer lines 5 Cess pool 8 Sewage lagoon 11 Fuel storage 14 Abandoned water well
3 Watertight sewer lines 6 Seepage pit 9 Feedyard 12 Fertilizer storage 15 Oil well/gas well .....
Direction from well? Southwest How many feet? 100'

FROM	TO	LITHOLOGIC LOG	FROM	TO	PLUGGING INTERVALS
0'	13'	sandy topsoil			
13'	33'	Medium and fine sand and gravel			
33'	44'	Medium and fine sand and gravel			
44'	60'	Medium sand and gravel			
60'	67'	Fine and medium sand and gravel			
67'	69'	Lime rock			

7 CONTRACTOR'S OR LANDOWNER'S CERTIFICATION: This water well was (1) constructed, (2) reconstructed, or (3) plugged under my jurisdiction and was completed on (mo/day/year) 04/14/2009 and this record is true to the best of my knowledge and belief. Kansas Water Well Contractor's License No. 755 This Water Well Record was completed on (mo/day/year) 05/07/2009 under the business name of Sargent Drilling by (signature) [signature]

INSTRUCTIONS: Use typewriter or ball point pen. *PLEASE PRESS FIRMLY* and *PRINT* clearly. Please fill in blanks, underline or circle the correct answers. Send top three copies to Kansas Department of Health and Environment, Bureau of Water, Geology Section, 1000 SW Jackson St., Suite 420, Topeka, Kansas 66612-1367. Telephone 785-296-5522. Send one to WATER WELL OWNER and retain one for your records. Fee of $5.00 for each constructed well. Visit us at http://www.kdheks.gov/waterwell/index.html.

KSA 82a-1212

USE TYPEWRITER OR BALL POINT PEN-PRESS FIRMLY, PRINT CLEARLY.

WATER WELL RECORD
KSA 82a-1201-1215

Kansas Department of Health and Environment-Division of Environment
(Water well Contractors)
Topeka, Kansas 66620

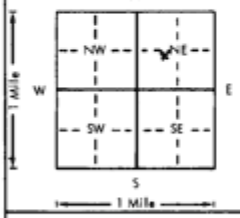
#15

1. Location of well:	County: Republic	Fraction: NE 1/4 SW 1/4 NE 1/4	Section number: 29	Township number: T 1 S	Range number: R 4 E/W

2. Distance and direction from nearest town or city: 7 miles SW of Byron, Ne.
Street address of well location if in city:

3. Owner of well: Verle Tietjen
R.R. or street:
City, state, zip code: Byron, Ne. 68325

4. Locate with "X" in section below:



Sketch map:

6. Bore hole dia. 30 in. Completion date 6-7-78
Well depth 69 ft.

7. __ Cable tool __ Rotary __ Driven __ Dug
__ Hollow rod __ Jetted __ Bored X Reverse rotary

8. Use: __ Domestic __ Public supply __ Industry
X Irrigation __ Air conditioning __ Stock
__ Lawn __ Oil field water __ Other

9. Casing: Material A-C Height: Above ~~or below~~
Threaded ___ Welded ___ Surface 12 in.
RMP ___ PVC ___ Weight 34 lbs./ft.
Dia. 16 in. to 65 ft. depth Wall Thickness: inches or
Dia. ___ in. to ___ ft. depth ~~gage No.~~ .875

5. Type and color of material	From	To
Topsoil & clay	0	8
Fine sand	8	12
Clay	12	16
Sand & gravel	16	66
Limerock	66	69
Shale	69	70
(Use a second sheet if needed)		

10. Screen: Manufacturer's name Johnson Concrete
Type Transite Dia. 16"
Slot/~~gauze~~ .125" x 1" Length 26'/10'
Set between 33 ft. and 59 ft.
59 ft. and 69 ft.
Gravel pack? Yes Size range of material ½"-½"

11. Static water level: mo./day/yr.
19 ft. below land surface Date 5/19/78

12. Pumping level below land surfaces:
41 ft. after 1 hrs. pumping 500 g.p.m.
55 ft. after 12 hrs. pumping 1400 g.p.m.
Estimated maximum yield 1400 g.p.m.

13. Water sample submitted: mo./day/yr.
__ Yes X No Date

14. Well head completion:
__ Pitless adapter 12 Inches above grade

15. Well grouted? Yes
With: X Neat cement __ Bentonite __ Concrete
Depth: From 0 ft. to 20 ft.

16. Nearest source of possible contamination:
ft. 2600 Direction ANY Type NONE
Well disinfected upon completion? __ Yes X No

17. Pump: __ Not installed
Manufacturer's name Western Land Roller
Model number 8 MOSO HP 100 Volts 480
Length of drop pipe 55 ft. capacity 750 g.p.m.
Type:
__ Submersible X Turbine
__ Jet __ Reciprocating
__ Centrifugal __ Other

18. Elevation: 1550'
Topography:
__ Hill
__ Slope
X Upland
__ Valley

19. Remarks:

20. Water well contractor's certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Shuck Drilling Co. 272
Business name License No.
Address Edgar, NE. 68935
Signed Dale Shuck Date 6/27/78
Authorized representative

T 1 S R 4 E/W Sec 29 1/4 NE 1/4 1/4 SWNE

Forward the white, blue and pink copies to the Department of Health and Environment

Form WWC-5

#7 98-99

WATER WELL RECORD Form WWC-5 KSA 82a-1212

#16

1 LOCATION OF WATER WELL: County: Republic | Fraction: NW ¼ NE ¼ NE ¼ | Section Number: 20 | Township Number: T 1 S | Range Number: R 4 E/W

Distance and direction from nearest town or city street address of well if located within city?
1E 2N 3/4 E of Republic

2 WATER WELL OWNER: Allen Hunley
RR#, St. Address, Box # : RR1
City, State, ZIP Code : Republic Ks

Board of Agriculture, Division of Water Resources Application Number:

3 LOCATE WELL'S LOCATION WITH AN "X" IN SECTION BOX:

N / NW / NE / W / E / SW / SE / S / 1 Mile

4 DEPTH OF COMPLETED WELL: 70 ft. ELEVATION:

Depth(s) Groundwater Encountered 1. 40' 2" ft. 2. ft. 3. ft.

WELL'S STATIC WATER LEVEL 40' 2" ft. below land surface measured on mo/day/yr 4-12-99

Pump test data: Well water was unknown ft. after 9.2 bevel hours pumping 10 gpm

Est. Yield 50+ gpm: Well water was ft. after hours pumping gpm

Bore Hole Diameter 10 in. to 0-20 ft., and 8" in. to 20-70 ft.

WELL WATER TO BE USED AS: 1 Domestic 3 Feedlot 5 Public water supply 8 Air conditioning 11 Injection well 2 Irrigation 4 Industrial 6 Oil field water supply 9 Dewatering 12 Other (Specify below) 7 Lawn and garden only 10 Monitoring well Livestock (Possible)

Was a chemical/bacteriological sample submitted to Department? Yes No X; If yes, mo/day/yr sample was submitted Water Well Disinfected? Yes X No

5 TYPE OF BLANK CASING USED: 1 Steel 3 RMP (SR) 5 Wrought iron 8 Concrete tile 2 PVC 4 ABS 6 Asbestos-Cement 9 Other (specify below) 7 Fiberglass

CASING JOINTS: Glued X Clamped Welded Threaded

Blank casing diameter 5 in. to 50 ft., Dia in. to ft., Dia in. to ft.

Casing height above land surface 16 in., weight lbs./ft. Wall thickness or gauge No. .214

TYPE OF SCREEN OR PERFORATION MATERIAL: 7 PVC 10 Asbestos-cement
1 Steel 3 Stainless steel 5 Fiberglass 8 RMP (SR) 11 Other (specify)
2 Brass 4 Galvanized steel 6 Concrete tile 9 ABS 12 None used (open hole)

SCREEN OR PERFORATION OPENINGS ARE: 5 Gauzed wrapped 8 Saw cut 11 None (open hole)
1 Continuous slot 3 Mill slot 6 Wire wrapped 9 Drilled holes
2 Louvered shutter 4 Key punched 7 Torch cut 10 Other (specify)

SCREEN-PERFORATED INTERVALS: From 50 ft. to 70 ft., From ft. to ft.
From ft. to ft., From ft. to ft.

GRAVEL PACK INTERVALS: From 21 ft. to 70 ft., From ft. to ft.
From ft. to ft., From ft. to ft.

6 GROUT MATERIAL: 1 Neat cement 2 Cement grout 3 Bentonite 4 Other Hole Plug

Grout Intervals: From 0 ft. to 21 ft., From ft. to ft., From ft. to ft.

What is the nearest source of possible contamination:
1 Septic tank 4 Lateral lines 7 Pit privy 10 Livestock pens 14 Abandoned water well
2 Sewer lines 5 Cess pool 8 Sewage lagoon 11 Fuel storage 15 Oil well/Gas well
3 Watertight sewer lines 6 Seepage pit 9 Feedyard 12 Fertilizer storage 16 Other (specify below)
13 Insecticide storage None in Sight

Direction from well? How many feet?

FROM	TO	LITHOLOGIC LOG	FROM	TO	PLUGGING INTERVALS
0	20	Top Soil & Sand			
20	67	Sand & Gravel			
67	75	Shale			

7 CONTRACTOR'S OR LANDOWNER'S CERTIFICATION: This water well was (1) constructed, (2) reconstructed, or (3) plugged under my jurisdiction and was completed on (mo/day/year) 4-12-99 and this record is true to the best of my knowledge and belief. Kansas Water Well Contractor's License No. 165 This Water Well Record was completed on (mo/day/yr) 4-13-99 under the business name of Martin Well Drilling by (signature) Terry Martin

INSTRUCTIONS: Use typewriter or ball point pen. PLEASE PRESS FIRMLY and PRINT clearly. Please fill in blanks, underline or circle the correct answers. Send top three copies to Kansas Department of Health and Environment, Bureau of Water, Topeka, Kansas 66620-0001. Telephone: 913-296-5545. Send one to WATER WELL OWNER and retain one for your records.

OFFICE USE ONLY T R E/W SEC. ¼ ¼ ¼

WATER WELL RECORD Form WWC-5 KSA 82a-1212

#17

1 LOCATION OF WATER WELL:
County: Republic | Fraction: NW ¼ NW ¼ NE ¼ | Section Number: 20 | Township Number: T 1 S | Range Number: R 4 E (W)

Distance and direction from nearest town or city street address of well if located within city?
1 E 2 N ½ E Republic, KS

2 WATER WELL OWNER: Howard Millen
RR#, St. Address, Box # : 2625 P
City, State, ZIP Code : Belleville, KS

Board of Agriculture, Division of Water Resources
Application Number:

3 LOCATE WELL'S LOCATION WITH AN "X" IN SECTION BOX:
N / NW / NE / W / E / SW / SE / S — 1 Mile

4 DEPTH OF COMPLETED WELL 86 ft. ELEVATION:
Depth(s) Groundwater Encountered 1. 49 ft. 2. ft. 3. ft.
WELL'S STATIC WATER LEVEL 49 ft. below land surface measured on mo/day/yr 8-16-91
Pump test data: Well water was unknown ft. after 1 hours pumping 20 gpm
Est. Yield 100+ gpm: Well water was ft. after hours pumping gpm
Bore Hole Diameter 8 in. to 86' ft., and in. to ft.
WELL WATER TO BE USED AS: 1 Domestic 2 Irrigation 3 Feedlot 4 Industrial 5 Public water supply 6 Oil field water supply 7 Lawn and garden only 8 Air conditioning 9 Dewatering 10 Monitoring well 11 Injection well 12 Other (Specify below)
Was a chemical/bacteriological sample submitted to Department? Yes No X; If yes, mo/day/yr sample was submitted
Water Well Disinfected? Yes X No

5 TYPE OF BLANK CASING USED: 1 Steel 2 PVC 3 RMP (SR) 4 ABS 5 Wrought iron 6 Asbestos-Cement 7 Fiberglass 8 Concrete tile 9 Other (specify below)
CASING JOINTS: Glued X Clamped Welded Threaded
Blank casing diameter in. to ft., Dia in. to ft., Dia in. to ft.
Casing height above land surface 16 in., weight 229 a ft lbs./ft. Wall thickness or gauge No. .214
TYPE OF SCREEN OR PERFORATION MATERIAL: 1 Steel 2 Brass 3 Stainless steel 4 Galvanized steel 5 Fiberglass 6 Concrete tile 7 PVC 8 RMP (SR) 9 ABS 10 Asbestos-cement 11 Other (specify) 12 None used (open hole)
SCREEN OR PERFORATION OPENINGS ARE: 1 Continuous slot 2 Louvered shutter 3 Mill slot 4 Key punched 5 Gauzed wrapped 6 Wire wrapped 7 Torch cut 8 Saw cut 9 Drilled holes 10 Other (specify) 11 None (open hole)
SCREEN-PERFORATED INTERVALS: From 66 ft. to 86 ft., From ft. to ft.
From ft. to ft., From ft. to ft.
GRAVEL PACK INTERVALS: From 20 ft. to 86 ft., From ft. to ft.
From ft. to ft., From ft. to ft.

6 GROUT MATERIAL: 1 Neat cement 2 Cement grout 3 Bentonite 4 Other Hole plug
Grout Intervals: From 0 ft. to 20 ft., From ft. to ft., From ft. to ft.
What is the nearest source of possible contamination:
1 Septic tank 2 Sewer lines 3 Watertight sewer lines 4 Lateral lines 5 Cess pool 6 Seepage pit 7 Pit privy 8 Sewage lagoon 9 Feedyard 10 Livestock pens 11 Fuel storage 12 Fertilizer storage 13 Insecticide storage 14 Abandoned water well 15 Oil well/Gas well 16 Other (specify below)
Direction from well? How many feet? None with sight (in pasture)

FROM	TO	LITHOLOGIC LOG	FROM	TO	PLUGGING INTERVALS
0	21	Top Soil & Clay			
21	84	Sand & gravel			
84	95	Shale			

7 CONTRACTOR'S OR LANDOWNER'S CERTIFICATION: This water well was (1) constructed, (2) reconstructed, or (3) plugged under my jurisdiction and was completed on (mo/day/year) 8-16-91 and this record is true to the best of my knowledge and belief. Kansas Water Well Contractor's License No. 165 This Water Well Record was completed on (mo/day/yr) 8-17-91 under the business name of Marubin Well Drilling by (signature) Leroy Marubin

INSTRUCTIONS: Use typewriter or ball point pen. *PLEASE PRESS FIRMLY* and *PRINT* clearly. Please fill in blanks, underline or circle the correct answers. Send top three copies to Kansas Department of Health and Environment, Bureau of Water, Topeka, Kansas 66620-7320. Telephone: 913-296-5545. Send one to WATER WELL OWNER and retain one for your records.

WATER WELL RECORD Form WWC-5 KSA 82a-1212

#18

1 LOCATION OF WATER WELL

County: Republic

Fraction: NW ¼ NE ¼ NW ¼

Section Number: 20

Township Number: T 1 S

Range Number: R 4 (E) W

Distance and direction from nearest town or city? 2 miles NE of Republic

Street address of well if located within city? —

2 WATER WELL OWNER: Jim Hurley

RR#, St. Address, Box # :

City, State, ZIP Code : Republic, Kansas 66964

Board of Agriculture, Division of Water Resources Application Number: 34019

3 DEPTH OF COMPLETED WELL 110 ft. Bore Hole Diameter 30 in. to 110 ft., and ... in. to ... ft.

Well Water to be used as: 1 Domestic 3 Feedlot (2) Irrigation 4 Industrial 5 Public water supply 6 Oil field water supply 7 Lawn and garden only 8 Air conditioning 9 Dewatering 10 Observation well 11 Injection well 12 Other (Specify below)

Well's static water level 75 ft. below land surface measured on August month 5 day 82 year

Pump Test Data: Well water was 85 ft. after 1 hours pumping 1000 gpm

Est. Yield gpm: Well water was 95 ft. after 1½ hours pumping 1500 gpm

4 TYPE OF BLANK CASING USED: 1 Steel 2 PVC 3 RMP (SR) 4 ABS 5 Wrought iron (●) Asbestos-Cement 7 Fiberglass (6) Concrete tile 9 Other (specify below)

Casing Joints: Glued ... Clamped X Welded ... Threaded ...

Blank casing dia 16 in. to 66 ft., Dia ... in. to ... ft., Dia ... in. to ... ft.

Casing height above land surface 12 in., weight 150 lbs./ft. Wall thickness or gauge No 1.5"

TYPE OF SCREEN OR PERFORATION MATERIAL: 1 Steel 2 Brass 3 Stainless steel 4 Galvanized steel 5 Fiberglass (6) Concrete tile 7 PVC 8 RMP (SR) 9 ABS 10 Asbestos-cement 11 Other (specify) ... 12 None used (open hole)

Screen or Perforation Openings Are: 1 Continuous slot 2 Louvered shutter 3 Mill slot 4 Key punched 5 Gauzed wrapped 6 Wire wrapped 7 Torch cut 8 Saw cut 9 Drilled holes 10 Other (specify) Poured - tapered 11 None (open hole)

Screen-Perforation Dia 16 in. to 110 ft., Dia ... in. to ... ft., Dia ... in to ... ft.

Screen-Perforated Intervals: From 66 ft. to 110 ft., From ... ft. to ... ft.

From ... ft. to ... ft., From ... ft. to ... ft.

Gravel Pack Intervals: From 10 ft. to 110 ft., From ... ft. to ... ft.

From ... ft. to ... ft., From ... ft. to ... ft.

5 GROUT MATERIAL: 1 Neat cement 2 Cement grout (3) Bentonite 4 Other ...

Grouted Intervals: From 0 ft. to 10 ft., From ... ft. to ... ft., From ... ft. to ... ft.

What is the nearest source of possible contamination: NONE

1 Septic tank 2 Sewer lines 3 Lateral lines 4 Cess pool 5 Seepage pit 6 Pit privy 7 Sewage lagoon 8 Feed yard 9 Livestock pens 10 Fuel storage 11 Fertilizer storage 12 Insecticide storage 13 Watertight sewer lines 14 Abandoned water well 15 Oil well/Gas well 16 Other (specify below)

Direction from well ANT How many feet 1300? Water Well Disinfected? Yes X No

Was a chemical/bacteriological sample submitted to Department? Yes ... No X ... if yes, date sample was submitted ... month ... day ... year: Pump Installed? Yes X No

If Yes: Pump Manufacturer's name Western Land Roller Model No. 8M HP NA Volts

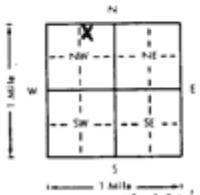
Depth of Pump Intake 107 ft. Pumps Capacity rated at 1200 gal./min.

Type of pump: 1 Submersible (2) Turbine 3 Jet 4 Centrifugal 5 Reciprocating 6 Other

6 CONTRACTOR'S OR LANDOWNER'S CERTIFICATION: This water well was (1) constructed, (2) reconstructed, or (3) plugged under my jurisdiction and was completed on Dec. month 28 day 82 year, and this record is true to the best of my knowledge and belief. Kansas Water Well Contractor's License No. 272

This Water Well Record was completed on June month 26 day 83 year under the business name of Smuck Drilling Co. by (signature) Dale Smuck

7 LOCATE WELL'S LOCATION WITH AN "X" IN SECTION BOX:



ELEVATION: 70

FROM	TO	LITHOLOGIC LOG	FROM	TO	LITHOLOGIC LOG
0	18	Topsoil & clay & S. clay			
18	30	Fine to med. sand			
30	32	Clay			
32	97	Sand & Gravel			
97	99	Clay			
99	105	Sand & Gravel			
105	108	Niobrara Shale			
108	110	Carlisle Shale			

Depth(s) Groundwater Encountered 1 75 ft. 2 ... ft. 3 ... ft. 4 ... ft. (Use a second sheet if needed)

INSTRUCTIONS: Use typewriter or ball point pen, *please press firmly* and *PRINT* clearly. Please fill in blanks, underline or circle the correct answers. Send top three copies to Kansas Department of Health and Environment, Division of Environment, Water Well Contractors, Topeka, KS 66620. Send one to WATER WELL OWNER and retain one for your records.

K a 549

WATER WELL RECORD **Form WWC-5** Division of Water Resources; App. No.

1 LOCATION OF WATER WELL: County: Republic | Fraction: SW ¼ SW ¼ SW ¼ | Section Number: 16 | Township Number: T 1 S | Range Number: R 4 E (W)

Distance and direction from nearest town or city street address of well if located within city? Byron - 100 Rd South to Diamond Road then 7/8 mile west - North Side

Global Positioning Systems (decimal degrees, min. of 4 digits)
Latitude: 39.958222
Longitude: 97.781583
Elevation:
Datum:
Data Collection Method:

2 WATER WELL OWNER: Kirk Duensing
RR#, St. Address, Box # : 9145 Cedar Road
City, State, ZIP Code : Byron NE 68325

3 LOCATE WELL'S LOCATION WITH AN "X" IN SECTION BOX:

N
W | - - NW - - | - - NE - - | E
- - SW - - | - - SE - - |
X
S

4 DEPTH OF COMPLETED WELL ……80…… ft.

Depth(s) Groundwater Encountered (1)…… ft. (2)…… ft. (3)…… ft.
WELL'S STATIC WATER LEVEL…13…… ft. below land surface measured on mo/day/yr……
Pump test data: Well water was……ft. after…… hours pumping…… gpm
Est. Yield…7…gpm: Well water was……ft. after…… hours pumping…… gpm
WELL WATER TO BE USED AS: 5 Public water supply 8 Air conditioning 11 Injection well
1 Domestic 3 Feedlot 6 Oil field water supply 9 Dewatering (12) Other (Specify below)
2 Irrigation 4 Industrial 7 Domestic (lawn & garden) 10 Monitoring well …Stock……

Was a chemical/bacteriological sample submitted to Department? Yes …… No …X…; If yes, mo/day/yrs Sample was submitted…… Water well disinfected? Yes …X… No ……

5 TYPE OF CASING USED: 5 Wrought Iron 8 Concrete tile CASING JOINTS: Glued…X… Clamped……
1 Steel 3 RMP (SR) 6 Asbestos-Cement 9 Other (specify below) Welded……
(2) PVC 4 ABS 7 Fiberglass …… Threaded……
Blank casing diameter ….5….. in. to …60…… ft., Diameter. …… in. to …… ft., Diameter …… in. to ……ft.
Casing height above land surface……18…… in., Weight….3.893…lbs./ft. Wall thickness or guage No. ….24-5……
TYPE OF SCREEN OR PERFORATION MATERIAL:
1 Steel 3 Stainless Steel 5 Fiberglass (7) PVC 9 ABS 11 Other (Specify) ……
2 Brass 4 Galvanized Steal 6 Concrete tile 8 RM (SR) 10 Asbestos-Cement 12 None used (open hole)
SCREEN OR PERFORATION OPENINGS ARE:
1 Continuous slot (3) Mill slot 5 Guazed wrapped 7 Torch cut 9 Drilled holes 11 None (open hole)
2 Louvered shutter 4 Key punched 6 Wire wrapped 8 Saw Cut 10 Other (specify) ……
SCREEN-PERFORATED INTERVALS: From…60…… ft. to …80…… ft., From …… ft. to …… ft.
From…… ft. to …… ft., From …… ft. to …… ft.
GRAVEL PACK INTERVALS: From…20…… ft. to …80…… ft., From …… ft. to …… ft.
From…… ft. to …… ft., From …… ft. to …… ft.

6 GROUT MATERIAL: 1 Neat cement 2 Cement grout (3) Bentonite 4 Other ……
Grout Intervals: From …0…… ft. to …20…… ft., From …… ft. to …… ft., From …… ft. to ……ft.
What is the nearest source of possible contamination:
1 Septic tank 4 Lateral lines 7 Pit privy 10 Livestock pens 13 Insecticide Storage 16 Other (specify below)
2 Sewer lines 5 Cess pool 8 Sewage lagoon 11 Fuel storage 14 Abandoned water well
3 Watertight sewer lines 6 Seepage pit 9 Feedyard 12 Fertilizer Storage 15 Oil well/gas well ……
Direction from well? …… How many feet? ……

FROM	TO	LITHOLOGIC LOG	FROM	TO	PLUGGING INTERVALS
0	1	Top Soil			
1	12	Fine Sand			
12	43	Medium Sand			
43	76	Fine Gravel - Coarse Sand			
76	80	Lime Stone			

7 CONTRACTOR'S OR LANDOWNER'S CERTIFICATION: This water well was (1) constructed, (2) reconstructed, or (3) plugged under my jurisdiction and was completed on (mo/day/year) ..12-8-11.. and this record is true to the best of my knowledge and belief. Kansas Water Well Contractor's License No. ..48…… This Water Well Record was completed on (mo/day/year) 12-28-11…… under the business name of Williams Drilling Co Inc by (signature) Ron Williams

INSTRUCTIONS: Use typewriter or ball point pen. *PLEASE PRESS FIRMLY* and *PRINT* clearly. Please fill in blanks, underline or circle the correct answers. Send top three copies to Kansas Department of Health and Environment, Bureau of Water, Geology Section, 1000 SW Jackson St., Suite 420, Topeka, Kansas 66612-1367. Telephone 785-296-5522. Send one to WATER WELL OWNER and retain one for your records. Fee of $5.00 for each constructed well. Visit us at http://www.kdhe.state.ks.us/geo/waterwells.

KSA 82a-1212

#19 – water level Is wrong based on wizard

WATER WELL RECORD Form WWC-5 KSA 82a-1212

#20

1 LOCATION OF WATER WELL: County: Republic | Fraction: ¼ ¼ NW¼ ¼ | Section Number: 21 | Township Number: T 1 S | Range Number: R 4 E (W)

Distance and direction from nearest town or city street address of well if located within city?
3/4 mile South + 3/4 mile west of Byron Nebraska.

2 WATER WELL OWNER: Sybil Rahe
RR#, St. Address, Box # : 1415 State Street
City, State, ZIP Code : Concordia, KS 66901

Board of Agriculture, Division of Water Resources
Application Number:

3 LOCATE WELL'S LOCATION WITH AN "X" IN SECTION BOX:

N / NW / NE / W / E / SW / SE / S — 1 Mile

4 DEPTH OF COMPLETED WELL 100 ft. ELEVATION:
Depth(s) Groundwater Encountered 1. 63 ft. 2. ft. 3. ft.
WELL'S STATIC WATER LEVEL 63 ft. below land surface measured on mo/day/yr 5/12/99
Pump test data: Well water was 66 ft. after 1 hours pumping 500 gpm
Est. Yield 1500 gpm: Well water was 70 ft. after 1 hours pumping 1200 gpm
Bore Hole Diameter 26 in. to 100 ft., and in. to ft.
WELL WATER TO BE USED AS: 1 Domestic 2 Irrigation 3 Feedlot 4 Industrial 5 Public water supply 6 Oil field water supply 7 Lawn and garden only 8 Air conditioning 9 Dewatering 10 Monitoring well 11 Injection well 12 Other (Specify below)
Was a chemical/bacteriological sample submitted to Department? Yes No X If yes, mo/day/yr sample was submitted
Water Well Disinfected? Yes No

5 TYPE OF BLANK CASING USED: 1 Steel 2 PVC 3 RMP (SR) 4 ABS 5 Wrought iron 6 Asbestos-Cement 7 Fiberglass 8 Concrete tile 9 Other (specify below)
CASING JOINTS: Glued Clamped Welded Threaded
Blank casing diameter 16 in. to 60 ft., Dia in. to ft., Dia in. to ft.
Casing height above land surface 12 in., weight lbs./ft. Wall thickness or gauge No.
TYPE OF SCREEN OR PERFORATION MATERIAL: 1 Steel 2 Brass 3 Stainless steel 4 Galvanized steel 5 Fiberglass 6 Concrete tile 7 PVC 8 RMP (SR) 9 ABS 10 Asbestos-cement 11 Other (specify) 12 None used (open hole)
SCREEN OR PERFORATION OPENINGS ARE: 1 Continuous slot 2 Louvered shutter 3 Mill slot 4 Key punched 5 Gauzed wrapped 6 Wire wrapped 7 Torch cut 8 Saw cut 9 Drilled holes 10 Other (specify) 11 None (open hole)
SCREEN-PERFORATED INTERVALS: From 60 ft. to 100 ft., From ft. to ft.
From ft. to ft., From ft. to ft.
GRAVEL PACK INTERVALS: From 20 ft. to 100 ft., From ft. to ft.
From ft. to ft., From ft. to ft.

6 GROUT MATERIAL: 1 Neat cement 2 Cement grout 3 Bentonite 4 Other
Grout Intervals: From 0 ft. to 20 ft., From ft. to ft., From ft. to ft.
What is the nearest source of possible contamination: 1 Septic tank 2 Sewer lines 3 Watertight sewer lines 4 Lateral lines 5 Cess pool 6 Seepage pit 7 Pit privy 8 Sewage lagoon 9 Feedyard 10 Livestock pens 11 Fuel storage 12 Fertilizer storage 13 Insecticide storage 14 Abandoned water well 15 Oil well/Gas well 16 Other (specify below)
Direction from well? How many feet?

FROM	TO	LITHOLOGIC LOG	FROM	TO	PLUGGING INTERVALS
0	6	topsoil + Clay.			
6	11	SAND			
11	15	SAND Some gravel			
15	20	SAND + Gravel			
20	21	Clay			
21	24	SAND			
24	35	SAND + gravel med.			
35	47	SAND + gravel med to Cor.			
47	53	SAND			
53	67	SAND + gravel			
67	77	SAND + gravel, med			
77	90	SAND + gravel med to Cor			
90	94	SAND + gravel med			
94	98	SAND + gravel med to Cor			
98	100	Shale			

7 CONTRACTOR'S OR LANDOWNER'S CERTIFICATION: This water well was (1) constructed, (2) reconstructed, or (3) plugged under my jurisdiction and was completed on (mo/day/year) 5-12-99 and this record is true to the best of my knowledge and belief. Kansas Water Well Contractor's License No. 272 This Water Well Record was completed on (mo/day/yr) 6-15-99
under the business name of Shuck Drilling Co. by (signature) Jerry L Shuck

INSTRUCTIONS: Use typewriter or ball point pen. PLEASE PRESS FIRMLY and PRINT clearly. Please fill in blanks, underline or circle the correct answers. Send top three copies to Kansas Department of Health and Environment, Bureau of Water, Topeka, Kansas 66620-0001. Telephone: 913-296-5545. Send one to WATER WELL OWNER and retain one for your records.

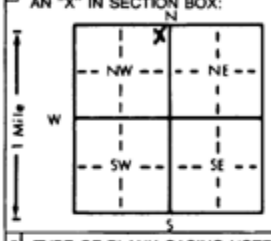
WATER WELL RECORD Form WWC-5 KSA 82a-1212

1 LOCATION OF WATER WELL:
County: Republic | Fraction: NE ¼ NE ¼ NW ¼ | Section Number: 21 | Township Number: T 1 S | Range Number: R 4 E (W)

Distance and direction from nearest town or city street address of well if located within city?
3 S ½ W Byron, NE

2 WATER WELL OWNER: Sybil Rahe #21
RR#, St. Address, Box # : 1415 State St
City, State, ZIP Code : Concordia Ks
Board of Agriculture, Division of Water Resources
Application Number:

3 LOCATE WELL'S LOCATION WITH AN "X" IN SECTION BOX:



4 DEPTH OF COMPLETED WELL 110 ft. ELEVATION:
Depth(s) Groundwater Encountered 1. 77'2" ft. 2. ft. 3. ft.
WELL'S STATIC WATER LEVEL 77'2" ft. below land surface measured on mo/day/yr 9-26-00
Pump test data: Well water was a.c. developed after hours pumping gpm
Est. Yield 50 gpm: Well water was ft. after hours pumping gpm
Bore Hole Diameter 10" in. to 22 ft., and 8 in. to 110 ft.
WELL WATER TO BE USED AS: 5 Public water supply 8 Air conditioning 11 Injection well
(1) Domestic 3 Feedlot 6 Oil field water supply 9 Dewatering 12 Other (Specify below)
2 Irrigation 4 Industrial 7 Lawn and garden only 10 Monitoring well
Was a chemical/bacteriological sample submitted to Department? Yes No X; If yes, mo/day/yr sample was submitted
Water Well Disinfected? (Yes) No

5 TYPE OF BLANK CASING USED:
1 Steel 3 RMP (SR) 6 Asbestos-Cement 9 Other (specify below)
(2) PVC 4 ABS 7 Fiberglass
CASING JOINTS: Glued X Clamped
Welded
Threaded
Blank casing diameter 5 in. to 90 ft., Dia in. to ft., Dia in. to ft.
Casing height above land surface 16 in., weight lbs./ft. Wall thickness or gauge No. .214
TYPE OF SCREEN OR PERFORATION MATERIAL: (7) PVC 10 Asbestos-cement
1 Steel 3 Stainless steel 5 Fiberglass 8 RMP (SR) 11 Other (specify)
2 Brass 4 Galvanized steel 6 Concrete tile 9 ABS 12 None used (open hole)
SCREEN OR PERFORATION OPENINGS ARE: 5 Gauzed wrapped (8) Saw cut 11 None (open hole)
1 Continuous slot 3 Mill slot 6 Wire wrapped 9 Drilled holes
2 Louvered shutter 4 Key punched 7 Torch cut 10 Other (specify)
SCREEN-PERFORATED INTERVALS: From 90 ft. to 110 ft., From ft. to ft.
From ft. to ft., From ft. to ft.
GRAVEL PACK INTERVALS: From 26½ ft. to 110 ft., From ft. to ft.
From ft. to ft., From ft. to ft.

6 GROUT MATERIAL: 1 Neat cement 2 Cement grout (3) Bentonite 4 Other
Grout Intervals: From 5 ft. to 26½ ft., From ft. to ft., From ft. to ft.
What is the nearest source of possible contamination:
1 Septic tank 4 Lateral lines 7 Pit privy 10 Livestock pens 14 Abandoned water well
2 Sewer lines 5 Cess pool 8 Sewage lagoon (11) Fuel storage 15 Oil well/Gas well
3 Watertight sewer lines 6 Seepage pit 9 Feedyard 12 Fertilizer storage 16 Other (specify below)
13 Insecticide storage
Direction from well? S W How many feet? 25'

FROM	TO	LITHOLOGIC LOG	FROM	TO	PLUGGING INTERVALS
0	15	Top Soil & Clay			
15	40	Silty Sand			
40	110	Sand & Gravel			
110	115	Shale			

7 CONTRACTOR'S OR LANDOWNER'S CERTIFICATION: This water well was (1) constructed, (2) reconstructed, or (3) plugged under my jurisdiction and was completed on (mo/day/year) 9-26-00 and this record is true to the best of my knowledge and belief. Kansas Water Well Contractor's License No. 165 This Water Well Record was completed on (mo/day/yr) 9-26-00 under the business name of MARUHN Well Drilling by (signature) Leroy Maruhn

INSTRUCTIONS: Use typewriter or ball point pen. *PLEASE PRESS FIRMLY* and *PRINT* clearly. Please fill in blanks, underline or circle the correct answers. Send top three copies to Kansas Department of Health and Environment, Bureau of Water, Topeka, Kansas 66620-0001. Telephone: 913-296-5545. Send one to WATER WELL OWNER and retain one for your records.

OFFICE USE ONLY T R E/W SEC. ¼ ¼ ¼

USE TYPEWRITER OR BALL POINT PEN-PRESS FIRMLY, PRINT CLEARLY.

WATER WELL RECORD
KSA 82a-1201-1215

Kansas Department of Health and Environment-Division of Environment
(Water well Contractors)
Topeka, Kansas 66620

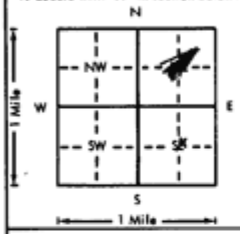
#22

1. Location of well:	County: REPUBLIC	Fraction: SW 1/4 NE 1/4 SE 1/4	Section number: 17	Township number: T 1 S	Range number: R 4 E/W

2. Distance and direction from nearest town or city: 3 S 1 W
Street address of well location if in city: BYRON NE

3. Owner of well: LOVIS DVENSING
R.R. or street:
City, state, zip code: BYRON NE 68325

4. Locate with "X" in section below:



Sketch map:

6. Bore hole dia. 32 in. Completion date 11-26-75
Well depth 92 ft.

7. __ Cable tool __ Rotary __ Driven __ Dug
__ Hollow rod __ Jetted __ Bored X Reverse rotary

8. Use: __ Domestic __ Public supply __ Industry
X Irrigation __ Air conditioning __ Stock
__ Lawn __ Oil field water __ Other

9. Casing: Material A-C Height: Above or below
Threaded ___ Welded ___ Surface 12 in.
RMP ___ PVC ___ Weight 34 lbs./ft.
Dia. 16 in. to 92 ft. depth Well Thickness: inches or
Dia. ___ in. to ___ ft. depth Gage No. 311

5. Type and color of material	From	To
BROWN TOPSOIL + CLAY	0	8
RED SAND + GRAVEL	8	22
CLAY BROWN	22	30
SAND + GRAVEL RED	30	90
OCHRE WHITE	90	91
CARLISLE SHALE	91	
(Use a second sheet if needed)		

10. Screen: Manufacturer's name JOHNSON
Type SAWED SLOT Dia. 16
Slot/gauze ___ Length ___
Set between 53 ft. and 92 ft.
___ ft. and ___ ft.
Gravel pack? X Size range of material 1/2

11. Static water level: mo./day/yr.
58 ft. below land surface Date 8-26-75

12. Pumping level below land surfaces:
74 ft. after 2 hrs. pumping 800 g.p.m.
90 ft. after 2 hrs. pumping 1100 g.p.m.
Estimated maximum yield 1100 g.p.m.

13. Water sample submitted: mo./day/yr.
__ Yes X No Date ___

14. Well head completion:
__ Pitless adapter 12 Inches above grade

15. Well grouted? X
With: __ Neat cement __ Bentonite __ Concrete
Depth: From ___ ft. to ___ ft. CLAY

16. Nearest source of possible contamination:
ft. 500 Direction W Type FUEL
Well disinfected upon completion? ___ Yes X No

17. Pump: __ Not installed
Manufacturer's name WESTERN LAND
Model number LMD 30 HP 40 Volts ___
Length of drop pipe 80 ft. capacity ___ g.p.m.
Type:
__ Submersible X Turbine
__ Jet __ Reciprocating
__ Centrifugal __ Other

18. Elevation: 3'60'
Topography:
__ Hill
__ Slope
X Upland
__ Valley

19. Remarks:

20. Water well contractor's certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
SHULA DRILLING LLC 272
Business name License No.
Address EDGAR NE 68933
Signed [signature] Date 11-26-75
Authorized representative

T 1 S R 4 E
SW NE SE
Sec. 1/4 1/4 1/4

Forward the white, blue and pink copies to the Department of Health and Environment

Form WWC-5

WATER WELL RECORD Form WWC-5 KSA 82a-1212

1 LOCATION OF WATER WELL

County: Republic	Fraction: NW ¼ NW ¼ SW ¼	Section Number: 15	Township Number: T 1 S	Range Number: R 4 E(W)

Distance and direction from nearest town or city? 2 3/4 S Byron Nc

Street address of well if located within city?

2 WATER WELL OWNER: Harold Mitchell

RR#, St. Address, Box # : RR

City, State, ZIP Code : Republic, Kansas

Board of Agriculture, Division of Water Resources Application Number: #23

3 DEPTH OF COMPLETED WELL 133 ft. Bore Hole Diameter 8 in. to ft., and in. to ft.

Well Water to be used as: (1) Domestic 2 Irrigation 3 Feedlot 4 Industrial 5 Public water supply 6 Oil field water supply 7 Lawn and garden only 8 Air conditioning 9 Dewatering 10 Observation well 11 Injection well 12 Other (Specify below)

Well's static water level 92 ft. below land surface measured on 10 month 26 day 82 year

Pump Test Data: Well water was unknown ft. after 1 hours pumping 15 gpm

Est. Yield 10 gpm: Well water was ft. after hours pumping gpm

4 TYPE OF BLANK CASING USED: 1 Steel (2) PVC 3 RMP (SR) 4 ABS 5 Wrought iron 6 Asbestos-Cement 7 Fiberglass 8 Concrete tile 9 Other (specify below)

Casing Joints: Glued X Clamped Welded Threaded

Blank casing dia 0 5 in. to 113 ft., Dia in. to ft., Dia in. to ft.

Casing height above land surface 14 in., weight 22 lbs./ft. Wall thickness or gauge No. .219

TYPE OF SCREEN OR PERFORATION MATERIAL: 1 Steel 2 Brass 3 Stainless steel 4 Galvanized steel 5 Fiberglass 6 Concrete tile (7) PVC 8 RMP (SR) 9 ABS 10 Asbestos-cement 11 Other (specify) 12 None used (open hole)

Screen or Perforation Openings Are: 1 Continuous slot 2 Louvered shutter 3 Mill slot 4 Key punched 5 Gauzed wrapped 6 Wire wrapped 7 Torch cut (8) Saw cut 9 Drilled holes 10 Other (specify) 11 None (open hole)

Screen-Perforation Dia 5 in. to ft., Dia in. to ft., Dia in. to ft.

Screen-Perforated Intervals: From 113 ft. to 133 ft., From ft. to ft.

From ft. to ft., From ft. to ft.

Gravel Pack Intervals: From 15 ft. to 133 ft., From ft. to ft.

From ft. to ft., From ft. to ft.

5 GROUT MATERIAL: (1) Neat cement 2 Cement grout 3 Bentonite 4 Other

Grouted Intervals: From 0 ft. to 15 ft., From ft. to ft., From ft. to ft.

What is the nearest source of possible contamination: (1) Septic tank 2 Sewer lines 3 Lateral lines 4 Cess pool 5 Seepage pit 6 Pit privy 7 Sewage lagoon 8 Feed yard 9 Livestock pens 10 Fuel storage 11 Fertilizer storage 12 Insecticide storage 13 Watertight sewer lines 14 Abandoned water well 15 Oil well/Gas well 16 Other (specify below)

Direction from well W How many feet 50 ? Water Well Disinfected? Yes X No

Was a chemical/bacteriological sample submitted to Department? Yes No If yes, date sample was submitted month day year: Pump Installed? Yes No X

If Yes: Pump Manufacturer's name Model No. HP Volts

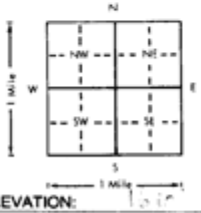
Depth of Pump Intake ft. Pumps Capacity rated at gal./min.

Type of pump: 1 Submersible 2 Turbine 3 Jet 4 Centrifugal 5 Reciprocating 6 Other

6 CONTRACTOR'S OR LANDOWNER'S CERTIFICATION: This water well was (1) constructed, (2) reconstructed, or (3) plugged under my jurisdiction and was completed on 10 month 26 day 81 year, and this record is true to the best of my knowledge and belief. Kansas Water Well Contractor's License No. 165

This Water Well Record was completed on 1 month 3 day 82 year under the business name of MARUHN Well Drilling by (signature) Leroy Maruhn

7 LOCATE WELL'S LOCATION WITH AN "X" IN SECTION BOX:



ELEVATION:

FROM	TO	LITHOLOGIC LOG	FROM	TO	LITHOLOGIC LOG
0	50	Top Soil & Clay			
50	125	Sand & gravel			
125	127	Clay			
127	133	Sand med to Coarse			
133	135	Shale			

Depth(s) Groundwater Encountered 1 92 ft. 2 ft. 3 ft. 4 ft. (Use a second sheet if needed)

INSTRUCTIONS: Use typewriter or ball point pen, *please press firmly* and *PRINT* clearly. Please fill in blanks, underline or circle the correct answers. Send top three copies to Kansas Department of Health and Environment, Division of Environment, Water Well Contractors, Topeka, KS 66620. Send one to WATER WELL OWNER and retain one for your records.

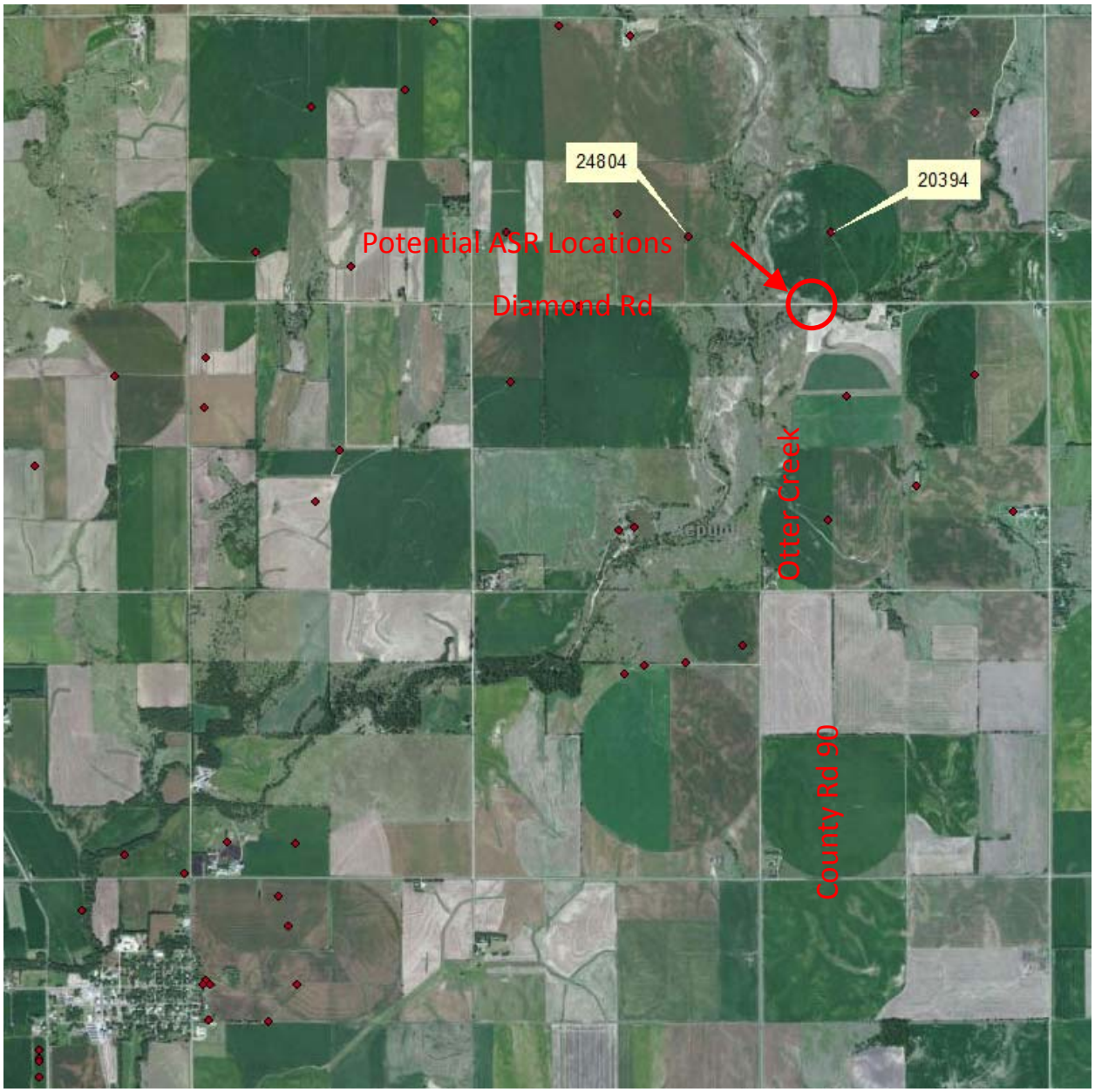


Figure A2. Potential ASR project locations determined from lithology logs and a field scoping trip. The photos of four potential locations are shown as follows.

The irrigation well on the pivot to the east of the creek, north of Diamond Road is water right 20394, NC SW of 16-01S-04W (Lewis Duensing being the water use corespondent).
The irrigation well to the west of the creek, north of Diamond Road is water right 24804 NW SE SE 17-01S-04W (Egbert and Loretta Schardt WUCs).

Note: Google maps lists county RD 90 as CO RD 9 and Diamond Road as CO RD D.

Location 1 – North of Diamond, West of Creek; Land owner: Egbert & Loretta Schardt

Assessment: This is potentially the best location for our project. The site is a little further away from the Diamond rd so we will have a little more privacy. We can get water from the center pivot well, which appears only a few hundred feet to the west on the map. There is not much top clay/site layer and we may be able to construct infiltration basin even without a bobcat. The downside is that land surface is low and we may have flooding problem, but we can probably plan ahead to avoid it.

Location 2 – South of Diamond, West of Creek; Land owner: Allen & Barbara Hurley

Assessment: The main advantage for this site is its high surface elevation so we don't need to worry about flooding. Also there is a wire fence that can provide a little more security if we are going to leave the long term monitoring equipments (maybe another DTS job box, pressure sensors, seepage meters ...). The disadvantage is that we may have to dig a little deeper to remove the top clay/silt layer and there is no nearby well for us to get source water. But we can probably just drill a well on our own if other options are not available.

Location 3 – North of Diamond, East of Creek; Landowner – KED Farm Inc.

Assessment: This site is fenced too and is close to a feedlot well. So potentially we can get water from the well. The disadvantage, in addition to the low elevation (similar to location 1), is its closer proximity to a center pivot well, but probably not much of a concern for our project.

Location 4 – South of Diamond, East of Creek; Landowner – Randall Rahe

Assessment: This site is not fenced and relatively closer to the road, and so less secure compared to other locations. It also has a low elevation and there are no nearby wells.

Information Transfer Program Introduction

The KWRI is committed to transferring knowledge generated by its researchers to clientele. The KWRI uses a variety of methods. These include:

1. The 28th annual statewide water conference held on September 30, 2011. The theme was “Kansas Water Resources: Vision for 2050.” Approximately 215 people attended. Twenty-six scientific presentations were presented in plenary and concurrent sessions. Nineteen scientific posters were presented in the poster session. For the second year, an undergraduate/graduate student poster award program was conducted to encourage student participation. Twelve students participated. The agenda is included with this report.

2. Two statewide conferences, the Kansas Water Forums (February 29 in Wichita and March 1 in Hays), were held in partnership with the Kansas Water Office. The theme was “Just Add Water: Kansas and the Economy.” The Kansas Water Forums have the goal of presenting science and policy issues around water quality and water quantity. This past year there were 415 total attendees at the forums. The major topic this year was hydraulic fracturing for gas and oil and the impact on Kansas water resources. The agenda is included with this report.

3. An educational symposium, “Conserving the Ogallala Aquifer,” was held on the Kansas State University campus on October 19, 2011. The symposium was sponsored by the Kansas Water Resources Institute and focused on providing stakeholders and faculty a research update and input on research priorities. The day long symposium had 75 attendees.

4. The KWRI website, http://www.kcare.ksu.edu/p.aspx?tabid=921, is used to transfer project results and inform the public on issues and scientists on grant opportunities.

Governor's Water Conference

Basic Information

Title:	Governor's Water Conference
Project Number:	2011KS98B
Start Date:	3/1/2011
End Date:	2/29/2013
Funding Source:	104B
Congressional District:	2nd
Research Category:	Not Applicable
Focus Category:	Water Use, Sediments, Economics
Descriptors:	
Principal Investigators:	Dan Devlin

Publications

1. Selfa, T. and T. Becerra. 2011. Conservation decision-making factors. Kansas State University Agricultural Experiment Station and Cooperative Extension Service. MF3035. 2 pg.
2. Barnes, P. and N. Nelson. 2011. Water quality monitoring. Kansas State University Agricultural Experiment Station and Cooperative Extension Service. MF3037. 2 pg.
3. Nelson, N., K. Douglas-Mankin, D. Devlin, A. Bontrager, P. Barnes and L. Frees. 2011. Prioritization of conservation practice implementation. Kansas State University Agricultural Experiment Station and Cooperative Extension Service. MF3031. 2 pg.
4. Nelson, N., D. Devlin, K. Douglas-Mankin and P. Barnes. 2011. Modeling the effect of no-till. Kansas State University Agricultural Experiment Station and Cooperative Extension Service. MF3036. 2 pg.
5. Devlin, D. and L. French. 2011. Local leadership: goals and actions. Kansas State University Agricultural Experiment Station and Cooperative Extension Service. MF3032. 2 pg.
6. Douglas-Mankin, K., P. Daggupai, A. Sheshukov, P. Barnes, D. Devlin, and N. Nelson. 2011. Erosion from ephemeral gullies. Kansas State University Agricultural Experiment Station and Cooperative Extension Service. MF3030. 2 pg.
7. Devlin, D., K. Douglas-Mankin, T. Selfa, N. Nelson, P. Barnes, H. Miller, L. French, L. Frees and M. Langemeier. 2011. Assessing the effect of conservation practices. Kansas State University Agricultural Experiment Station and Cooperative Extension Service. MF3033. 2 pg.
8. Rogers, D., G. M. Powell, and K. Ebert. 3021. Water primer: part 2. The hydrologic cycle. Kansas State University Agricultural Experiment Station and Cooperative Extension Service. MF3031. 4 pg.
9. Rogers, D., G. M. Powell, and K. Ebert. 3020. Water primer: part 1. Overview. Kansas State University Agricultural Experiment Station and Cooperative Extension Service. MF3031. 4 pg.

Kansas Water Resources: Vision for 2050

28th Annual

Water and the Future of Kansas Conference Program

September 30, 2011
Capitol Plaza Hotel
Topeka, Kansas

Sponsored by
Kansas Water Resources Institute
Kansas Center for Agricultural Resources and the Environment
K-State Research and Extension
U.S. Geological Survey

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Agenda

7:00 a.m.
Poster Setup

8:00 a.m.
Registration opens

8:30 a.m.
Welcome
Daniel Devlin, Director of KWRI and KCARE

8:40 a.m.
Vision for the Future of Kansas Water Resources
Kansas Governor Sam Brownback (videotaped)

8:50 a.m.
Current and Projected Conditions of the Ogallala/High Plains Aquifer
Brownie Wilson, Kansas Geological Survey

9:20 a.m.
Break and Poster Viewing

9:50 a.m.
Wichita Water 2050: A Plan for Sustainable Water Resources
Debra Ary, City of Wichita

10:25 a.m.
Trends for Water Use in the U.S.
Eric Evenson, USGS WaterSmart Program Leader

11:00 a.m.
Dealing with Drought and Water Resources in Texas
Weir Labatt, Texas Water Development Board

11:40 a.m.
Poster Viewing

Noon
Lunch
My Experience with International Comparative Water Law
Speaker: John Peck, University of Kansas Law School
Announcement of Student Poster Award

1:15 p.m.

CONCURRENT SESSIONS

Ogallala Sustainability
Moderator: Jim Butler, Kansas Geological Survey

1:10 p.m.
Evolution of groundwater management practices in the
Kansas High Plains aquifer towards sustainability
Mario Sophocleous, Kansas Geological Survey

1:30 p.m.
Interpretation of hydrographs from the index well sites in the High Plains Aquifer in western Kansas
Jim Butler, Kansas Geological Survey

1:50 p.m.
Fuzzy aquifer subunits – A concept for water right reallocations in Southwest Kansas GMD#3
Brownie Wilson, Kansas Geological Survey

2:10 p.m.
Recent research on the Ogallala Aquifer
David Steward, Kansas State University

The Future of Public Water Utilties
Moderator: Don Snethen

1:10 p.m.
Managing Water in 2050: Implications of Macrotrends
Edward Means, ARCADIS/Malcom Pirnie

2:10 p.m.
Salina Water Supply Master Plan
Martha Tasker, City of Salina

Sedimentation of Kansas Reservoirs I
Moderator: Edward Martinko, Kansas Biological Survey

1:10 p.m.
Kansas base line sediment overview
Chris Gnau, Water Office

1:30 p.m.
Use of continuous turbidity and modeling to quantify the effect of altered reservoir release strategies on sedimentation in John Redmond Reservoir from 2007-2010
Casey Lee, U.S. Geological Survey

1:50 p.m.
Bathymetric Mapping and Sediment Studies in Kansas Reservoirs: 2010–2011
Edward Martinko, Kansas Biological Survey

2:10 p.m.
Development of automated extraction of reservoir pre-impoundment surfaces from acoustic echosounder data
Jude Kastens, Kansas Biological Survey

Quality of Surface and Groundwater
Moderator: Marcia Schulmeister, Emporia State University

1:10 p.m.
Uranium in the Upper Arkansas River and impact on the Ogallala High Plains Aquifer
Don Whittemore, Kansas Geological Survey

1:30 p.m.
Nutrient losses in surface runoff from claypan soil receiving turkey litter and fertilizer
Dan Sweeney, Kansas State University

1:50 p.m.
Determining reference conditions of wetlands in the Central Plains
Donald Huggins, Kansas Biological Survey

2:10 p.m.
Water Quality Results From BMP Implementation In The Little Arkansas River Watershed
Ron Graber, Kansas State University

Reservoir and Watershed Economics
Moderator: Lane Letourneau, Kansas Department of Agriculture

1:10 p.m.
Economic benefits of recreation at three Kansas reservoirs and impacts to the quality of recreation due to navigation releases
Natalie Postel, CDM

1:30 p.m.
Tillage date for Kansas: results from 2010 survey
DeAnn Presley, Kansas State University

1:50 p.m.
Economic analysis of crop rotation net returns and water quality in the Cheney Lake watershed
Michael Langemeier, Kansas State University

2:10 p.m.
Economics of Nutrient and Sediment Reduction Strategies for Tuttle Creek Lake

Craig Smith, Fort Hays State University

Assessment Tools and Benchmarks

1:10 p.m.
Kansas Weather Data Network
Mary Knapp, Kansas State University

1:30 p.m.
Conservation status of reference streams in Kansas
Robert Angelo, Kansas Department of Health and Environment

1:50 p.m.
RESonate: A new ArcGIS® toolbar designed to facilitate rapid and low-cost hydrogeomorphic assessments at the river-valley and river reach scales
Bradley Williams, Kansas Biological Survey

2:10 p.m.
Application of Rosgen's BANCS model for northeast Kansas and the development of predictive streambank erosion curves
Chris Sass, Kansas State University

Stream Bank Erosion and Restoration

1:10 p.m.
U.S. Army Corps of Engineers projects for bank erosion and sediment management in the Kansas River Basin
John Shelley, U.S. Army Corps of Engineers

1:30 p.m.
The influence of stream active channel width or riparian forest species composition within the Delaware River watershed
William Beck, Kansas Forest Service

1:50 p.m.
Red cedar revetments for bank stabilization
Charles Barden, Kansas State University

2:10 p.m.
Stream channel succession and sediment yield, Black Vermillion River, Kansas
Tim Keane, Kansas State University

2:30 p.m.
Break

2:45 p.m.

CONCURRENT SESSIONS

Irrigation Management Research
Moderator: Joe Harner, Kansas State University

2:45 p.m.
Crop response to limited irrigation
Norman Klocke, Kansas State University

3:05p.m.
Preseason irrigation with diminished irrigation capacities
Alan Schlegel, Kansas State University

3:25p.m.
Crop selection and irrigation scheduling decision tools for limited water resources
Norman Klocke, Kansas State University

3:45 p.m.
Irrigation management in Kyrgyz Republic
Nazgul Sharshenova, Kansas Water Office

Climate Change Impacts on Water Resources
Moderator: Susan Stover, Kansas Water Office

2:45 p.m.
Changing climate means more or less water for the future of Kansas?
Charles Rice, Kansas State University

3:05 p.m.
Agricultural and Rural Community Perspectives on Climate Change
Ben Champion, Kansas State University

3:25 p.m.
Simulating the effects of a changing climate on water resources
Andrea Brookfield, Kansas Geological Survey

3:45 p.m.
Farmer's land use decisions adaption to climate change
Dietrich Earnhart, University of Kansas

Sedimentation of Kansas Reservoirs II
Moderator: Susan Metzger, Kansas Water Office

2:45 p.m.
Role of streambank restoration in reservoir sustainability
Susan Metzger, Kansas Water Office

3:05 p.m.
Bathymetric and sediment surveys of Augusta City Lake and August – Santa Fe Lake
Mark Jakubauskas, Kansas Biological Survey

3:25p.m.
Continuous monitoring for suspended-sediment transport to and from small impoundments in northeast Kansas, March 2009–May 2011
Guy Foster, U.S. Geological Survey

3:45 p.m.
Modification of the V* method of estimating sediment in low gradient streams
Robert Everhart, Kansas Biological Survey

Water Quality Biological Properties
Moderator: Andrew Ziegler, U.S. Geological Survey

2:45 p.m.
Cyanobacterial blooms: tastes, odors, and toxins
Jennifer Graham, U. S. Geological Survey

3:05 p.m.
Ecological responses to hydrogeomorphic fluctuations in the Kansas River: consequences of river alteration
Brian O'Neill, Kansas Biological Survey

3:25p.m.
Examining the Kansas River phytoplankton community
Sara Schmidt, Kansas Biological Survey

3:45p.m.
Preliminary Assessment of Cyanotoxin Occurrence in the United States
Keith Loftin, U. S. Geological Survey

WRAPS and Other Resources for Watershed Management
Moderator: Jaime Gaggero, Kansas Department of Health and Environment

2:45 p.m.
Kansas WRAPS now and in the future
Jaime Gaggero, Kansas Department of Health and Environment

3:05 p.m.
Roll out the rain barrels
Stacie Minson, Kansas State University

3:25p.m.

Watershed restoration and protection in the Upper Wakarusa Watershed: a vision for 2050
Tom Huntzinger, Kansas Alliance for Wetlands and Streams

3:45 p.m.
Wichita WRAPS
Becky Lewis, City of Wichita, and Brian Meier, Burns & McDonnell

Kansas Water Resources Institute
Moderator: Dan Devlin, KWRI

2:45 p.m.
Understanding grant opportunities through the Water Resources Institute of Kansas
Dan Devlin, KWRI

3:05 p.m.
Kansas Weather Data Network
Mary Knapp, Kansas State University

4:00 p.m.
Conference Ends

Poster Presentations

Student:

A Study to Identify Groundwater to Surface Water Interaction in the Ogallala Aquifer. Andy Allen, Water Resources Engineering, Kansas State University, David Steward, Department of Civil Engineering, Kansas State University.

A New Method to Characterize the Spatial Variability of Infiltration in the Field. Sarah Auvenshine, Department of Civil Engineering, Kansas State University, David Steward, Department of Civil Engineering, Kansas State University.

A High-resolution Approach to Modeling the Fate and Occurrence of Arsenic in the Equus Beds Aquifer. John Barker, Earth Science Department, Emporia State University, Marcia Schulmeister, Earth Science Department, Emporia State University.

A Spatial Analysis of Farm Ponds in Kansas. Ryan Callihan, Department of Geography, University of Kansas.

Regional Assessment of the Effects of Corn Stover Removal as a Bioenergy Feedstock on Soil Erosion by Water. Ian Kenney, Department of Agronomy, Kansas State University.

Comparing Riparian Woodlands in the Watersheds of Three Northeast Kansas Lakes. Dalila Maradiaga, Department of Horticulture, Forestry and Recreation Resources, Kansas State University, Charles Barden, Department of Horticulture, Forestry and Recreation Resources,

Kansas State University
, William Beck, Kansas Forest Service, Kansas State University.

An Inventory of the Kansas River
. Heidi Mehl, Department of Geography/Hydrology, Kansas State University and
Friends of the Kaw, Bryanna Pockrandt, Kansas State University, Diana Restrepo, Biology, University of Kansas, Melinda Daniels, Department of Geography, Kansas State University, Cynthia Annett, Friends of the Kaw, Laura Calwell, Friends of the Kaw.

Direct-push Electrical Conductivity Assessment of a Chloride Plume in the Equus Beds Aquifer, Kansas. Dolores Neshyba-Bird, Earth Science Department, Emporia State University, Marcia Schulmeister, Earth Science Department, Emporia State University.

Evapotranspiration measurement techniques in turfgrass. Kenton Peterson, Department of Horticulture, Forestry and Recreation Resources,
Kansas State University, Dale Bemer, Department of Horticulture, Forestry and Recreation Resources, Kansas
State University, Jack Fry, Department of Horticulture, Forestry and Recreation Resources, Kansas State
University, Steve Keeley, Department of Horticulture, Forestry and Recreation Resources, Kansas
State University
, M. B. Kirkham, Department of Agronomy, Kansas State University.

Agricultural Contaminants and Stream-Aquifer Interaction in the Upper Neosho River, a Mid-Continent River. Jacob Petty, Earth Science Department, Emporia State University, Marcia Schulmeister, Earth Science Department, Emporia State University.

Rock Creek's Natural Resource Inventory Assessment
. Diana Restrepo, Biology, University of Kansas, Tom Huntzinger, Upper Wakarusa WRAPS, Cynthia Annett, Kansas State University
, Raymond Pierotti, Department of Ecology and Evolutionary Biology, University of
Kansas
, Heidi Mehl, Department of Geography, Kansas State University.

Sediment Quantity In Pristine Prairie Streams: Do Burning And Bison Have An Effect?
Danelle Russell, Division of Biology, Kansas State University
, Walter Dodds, Division of Biology, Kansas State University, Bartosz Grudzinski, Department of Geography, Kansas State University, Melinda Daniels, Department of Geography, Kansas State University.

Faculty/Staff/Professional:

Analysis of 2011 Western Kansas High Plains Aquifer Water Levels. Geoffrey Bohling and Brownie Wilson, Kansas Geological Survey, University of Kansas.

Water Use in Kansas
. William R. Eubank, Division of Water Resources, Kansas Department of Agriculture.

Flooding Damage along Two Major Kansas Rivers. Wayne A. Geyer and Charles L. Barden, Department of Horticulture, Forestry and Recreation Resources, Kansas State University, Robert L. Atchison, Kansas Forest Service, Kansas State University.

Groundwater levels and storage-volume change in the Equus Beds aquifer, Kansas, 1940-2011. Cristi V. Hansen, Kansas Water Science Center, U.S. Geological Survey.

Emergency Action Plans and Hazard Classifications for Kansas Dams
. Cindy Higgins, Division of Water Resources, Kansas Department of Agriculture Kansas Biological Survey
, Mark Jakubauskas, Kansas Biological Survey, University of Kansas.

Acoustic Remote Sensing of Total Phosphorus in Reservoir Bottom Sediments
. Mark Jakubauskas, Donald Huggins, Jerry Denoyelles, Ed Martinko and Ryan Callihan, Kansas Biological Survey, University of Kansas.

From the Dust Bowl to the Mud Bowl: Economics of Reservoir Sedimentation. Craig Smith, Agriculture Department, Fort Hays State University
, Jeff Williams, Department of Agricultural Economics, Kansas State University, Pouyan Nejadhashemi, Biosystems and Agricultural Engineering, Michigan State University, Sean Woznicki, Biosystems and Agricultural Engineering, Michigan State University, Bill Golden, Department of Agricultural Economics, Kansas State University, Kyle Douglas-Mankin, Department of Biological and Agricultural Engineering, Kansas State University.

Kansas Water Forums

Wichita and Hays, Kansas

February 29 - March 1, 2012

Kansas Water Issues Forum
2012 Mail-In Registration Form

_____
Name

_____
Mailing Address

_____
City, State, Zip

_____
Email Address

_____
Phone

☐ Please indicate here if you are a BAC/KWA member.
(Registration fee is waived for BAC/KWA members.)

SELECT MEETING TO ATTEND (Select One)

☐ **Wichita, Wednesday February 29, 2012**

Sedgwick County Extension Education Center
7001 W. 21st Street North
Wichita, KS
9:00 - 3:15

☐ **Hays, Thursday, March 1, 2012**

Kansas State University
Agriculture Research Center
1232 240th Avenue
Hays, KS
9:00 - 3:15

REGISTRATION FEE IS $15
Please make checks payable to Kansas Water Office

LATE REGISTRATION FEE IS $20 *(after 2/22/2012)*

Mail form to:	Kansas Water Office 901 S. Kansas Avenue Topeka, KS 66612

Kansas Water Office

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HOSTS

Kansas Water Office

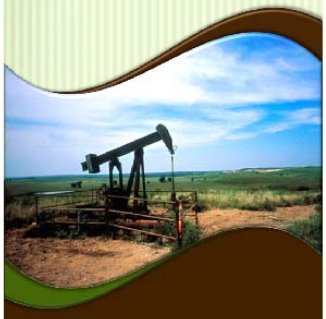
The Kansas Water Office works to achieve proactive solutions for resource issues of the state and to ensure good quality water of sufficient quantity to meet the needs of the people and the environment of Kansas. The Office evaluates and develops public policies, coordinating the water resource operations of agencies at all levels of government.

Kansas Center for Agricultural Resources and the Environment (KCARE) was established to coordinate and enhance research, extension and teaching activities pertaining to environmental issues related to agriculture. Their mission is to develop and deliver knowledge that helps Kansans balance 'utilization' and 'protection' of natural resources today and into the future.

Kansas Water Office
901 S. Kansas Avenue
Topeka, KS 66612
785-296-3185
www.kwo.org

Just Add Water:

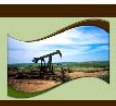
Kansas and the Economy



February 29, 2012
Sedgwick County Extension Education Center
7001 W. 21st Street North
Wichita, Kansas

March 1, 2012
Kansas State University
Agriculture Research Center
1232 240th Avenue
Hays, Kansas

Just Add Water: Kansas and the Economy



Water has always been key to Kansas' economy, and that is especially true with oil and gas development. This forum will explore energy development in Kansas, particularly the new technologies of horizontal drilling and hydraulic fracturing (fracking) and its potential impact on water supplies. The economic boom from the new development is welcome, yet there are questions as to the impacts on water and land.

Industry experts and state agencies will present fact based information on oil and gas development, its trends and potential in Kansas, related water issues and the permitting processes.

Oklahoma will share their experiences with the recent boom of the shale gas development.

The forum will also explore related questions on how an energy company identifies energy sources to meet future demands and the role of government in energy development.

A town hall discussion of what the governments role should be in energy development will complete the day.

Who should attend? Anyone involved with or interested in water, energy, or growth issues is encouraged to attend.

Forum Topics

- **Overview of Water Forums** - *Kansas Water Office*
- **Oil and Gas Development**
  - Horizontal drilling - Is this the next Big Thing? - *Kansas Geological Survey*
  - Horizontal wells, fracking and regulation - *Kansas Corporation Commission*
  - Water permitting - *Division of Water Resources*
- **Development, Production and Water** - *Shell Exploration and Production Company*
- **Watering the Boom in Oklahoma** - Supplies, Demands and Neighbors - *Oklahoma State Water Board*
- **Water Bills in the 2012 Kansas Legislature** - *Kansas Water Office*
- **Planning the Mix of Energy Sources to Meet Future Demands** - *Westar Energy*

Town Hall Discussion

What is the role of government in energy development?

Panel:

- *Kansas Department of Commerce*
- *Kansas Independent Oil and Gas Association*
- *Kansas Corporation Commission*
- *City of Wellington*

Moderator: *Rex Buchanan, Kansas Geological Survey*

Registration

Meetings are open to the public but space is limited. REGISTRATION IS REQUIRED.

Early registration is $15. **Late registration** after February 22, 2012 will be $20.

To register and pay online visit: **www.kwo.org**. For more information call: 1-888-526-9283 or contact us at: **kwo-info@kwo.ks.gov**

Registration fees cover lunch, refreshments and meeting materials.

Conserving the Ogallala Aquifer

Research and Extension Symposium

Sponsored by the Kansas Water Resources Institute
IGP Main Conference Room
KSU Campus, Manhattan
Wednesday, October 19, 2011

Purpose: 1) To summarize KSU's past and current research efforts on conserving the Ogallala Aquifer.

2) To obtain stakeholder input on future research needs.

Agenda

2:00 p.m. Welcome and Introductory Remarks - Dr. Dan Devlin, Director, KCARE

2:10 p.m. An Overview of the Ogallala Aquifer: - Dr. David Brauer, Research Scientist, USDA-ARS, Bushland, Texas

2:40 p.m. Kansas Irrigation Trends and Impacts – Dr. Danny Rogers, Department of Biological and Agricultural Engineering

3:00 p.m. Break

3:20 p.m. Effectiveness of Irrigation Technologies - Dr Norm Klocke and Dr. Freddie Lamm, Western Kansas Agricultural Research Center

4:00 p.m. Economic Implications of Water Management Policy - Dr. Bill Golden, Department of Agricultural Economics

4:40 p.m. Irrigation Scheduling using Climatic Data for a Range of Weather Conditions - Dr. Danny Rogers, Department of Biological and Agricultural Engineering

5:20 p.m. Setting the Future Research and Extension Objectives

5:50 p.m. Social

6:30 p.m. Oktoberfest Tailgate Meal

USGS Summer Intern Program

None.

Student Support					
Category	**Section 104 Base Grant**	**Section 104 NCGP Award**	**NIWR-USGS Internship**	**Supplemental Awards**	**Total**
Undergraduate	1	0	0	0	1
Masters	2	0	0	0	2
Ph.D.	0	0	0	0	0
Post-Doc.	0	0	0	0	0
Total	3	0	0	0	3

Notable Awards and Achievements

U.S. EPA, Best Watershed Plan (1 of 4 nationally), Kansas Lower Big Blue/Lower Little Blue River Watershed Plan, Watershed Based Plan Review: Final Report.

Farm Foundation; Agriculture, Food, Nutrition, and Natural Resources R&D Roundtable; Exemplary R&D Collaborations: Adoption of BMPs and Water Quality (Little Ark Watershed, KS), Case Study Selected for Special Recognition (1 of 14 selected nationally [61 nominated]) (www.farmfoundation.org).

Farm Foundation; Agriculture, Food, Nutrition, and Natural Resources R&D Roundtable; Exemplary R&D Collaborations: Ogallala Aquifer Program, Case Study Selected for Special Recognition (1 of 14 selected nationally [61 nominated]) (www.farmfoundation.org).

USDA-NIFA, Project of Excellence, Sources and Abatement of Fecal Bacteria in a High Priority TMDL Watershed in NE Kansas.

USDA-NIFA, Project of Excellence, Measuring Success of a TMDL Implementation Plan: Land, Stream, and Economic Responses to Targeted Stakeholder Actions.

NIFA National Water Quality Project of Excellence Recognition for the extension and research program, Measuring Success of a TMDL Implementation Plan: Land, Stream, and Economic Responses to Targeted Stakeholder Actions.