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July 9, 1979

Mr. Robert Steimer
Watermaster, District #14
714 N.W. "A" Street
Grants Pass, Oregon 97526

Dear Mr. Steimer:

The enclosed progress report on the ground water resource of Josephine County has been prepared for your review and submittal to the Josephine County Board of Commissioners.

The report, along with the Geohydrologic Map and the map of Areas of Known Ground Water Availability, represent a regional or county-wide view of current ground water conditions.

In summary, there are more than 8600 recorded wells within the county. Most wells produce small to moderate quantities of potable water for domestic use. With the exception of the alluvial aquifer adjacent the Illinois River near Cave Junction, ground water sources with a sufficient quantity of water for community-wide distribution systems are not known.

The infiltration of precipitation is the primary source of ground water. Locally, ground water is derived from stream and irrigation losses. With few exceptions, the water in the subsurface is of local origin.

The most productive aquifers are within the Granite Intrusive and the Quaternary Alluvium with more than 50% of all wells producing from the

granitic rocks. Two other rock units, the Applegate Group and the Galice Formation, are sources of ground water. The aquifers in these rocks are unpredictable as to quantity and quality of water. Yields are generally less than 10 gallons per minute.

Regional ground water levels appear to remain relatively stable with few instances of declining water levels. In most areas recharge is in balance with discharge. Perched shallow aquifers in all rock units are noticeably affected by periods of below normal rainfall. Severe droughts, such as occured in 1976-77, has resulted in a number of shallow wells becoming dry.

Local area studies are needed in order to determine the availability of water for future growth. These studies should be conducted in a manner to meet the priorities of both the County and the local communities.

I will be available at your request to proceed with future studies.

Respectfully,

Paul W Hughes

Paul W. Hughes,
Engineering Geologist

PWH/ah

PROGRESS REPORT

THE GROUND WATER RESOURCE OF JOSEPHINE COUNTY, OREGON

By

PAUL W. HUGHES
Consulting Geologist

PREPARED UNDER CONTRACT WITH THE
JOSEPHINE COUNTY BOARD OF COMMISSIONERS
AND IN COOPERATION WITH THE DISTRICT
WATERMASTER AND STAFF

July 1979

INTRODUCTION

Purpose of Investigation

For the past several years, population growth within Josephine County has placed a high demand for supplies of potable water. Most domestic water is furnished by individual wells as community water systems are available only within the cities of Grants Pass and Cave Junction.

Since 1955 the state of Oregon has required the filing of water reports for all wells drilled. To date more than 8500 water wells have been recorded within Josephine County. In 1977 and 1978 a total of 1900 wells were drilled which represents 22% of all recorded wells and is indicative of rapid growth.

This study was requested by the Josephine County Board of Commissioners for the purpose of assessing the future potential of ground water development in relationship to the population growth.

Sources of Data

The primary source of ground water data is the water well reports prepared by licensed drilling contractors. The information contained within these reports is considered to meet acceptable limits as to accuracy especially when there is agreement between the reports of several contractors.

Josephine County is one of two counties within the state in which the well report data is computerized, stored and available in several formats. Two ground water reports prepared by others were available for use in this investigation. An open file report entitled "Ground-water Resources of the Rogue River Basin, Oregon," was prepared by Richard A. Young of the U.S. Geological Survey in January 1959. The 1973 map report "Availability of Ground water in Grants Pass Area, Josephine County, Oregon," by J.H. Robison of the U.S. Geological Survey was used as a model to extend the geo-hydrologic map coverage for the entire county excluding federal lands.

Other sources of data include discussions with well contractors, water users, and limited field investigations. Previous reports cover specific site studies.

Acknowledgements

Much of the basic data used in this report was furnished by Mr. Robert Steimer, Watermaster and members of his staff. Other county departments, citizen groups, and several drilling contractors furnished assistance for the investigation.

Interpretation of the data used was solely the responsibility of this writer.

GENERAL GROUND WATER FEATURES

Sources of Water

Within Josephine County, recharge of the ground water body takes place from rainfall (including snow melt), the influent seepage from streams, and irrigation losses. With few exceptions, the recharge water is derived locally.

Precipitation within the county varies depending upon the location. In Grants Pass, the annual rainfall approximates 30 inches as compared to 60 inches at Kerby and 45 inches in the Sucker Creek area. In the northern areas of the county, at Wolf Creek and Merlin, the rainfall averages 35 inches but increases to 50 inches at Galice. The rainy season generally occurs during the period of October through April and represents the period of principal recharge. During the summer months of May through September, the evaporation losses exceed rainfall and there is little if any contribution to ground water storage.

The amount of precipitation which infiltrates to ground water storage is dependent upon a number of factors in which topography and surface rock types are significant. For example, runoff increases with slope and therefore recharge is diminished. Infiltration into the granite intrusive exposures is high in comparison to most surrounding rock types as the weathered granitic rock is highly porous.

Periods of drought generally have less effect upon the ground water

than upon surface streams. Exceptions to this are discussed under the section entitled Ground Water Systems.

Influent seepage or stream losses to ground water are known to occur within the county. The most common occurrence of this type of recharge is the influent seepage to the unconsolidated gravels adjacent the rivers and major tributaries. In the vicinity of Cave Junction for example, there is a direct connection of some alluvial deposits and the Illinois River. Water production from wells is replenished by influent flow from the nearby stream. Other areas of stream losses to the ground water includes the alluvial deposits adjacent the Applegate and Rogue Rivers.

Losses of water from irrigation canals is a form of artificial recharge. Within the Grants Pass Irrigation District water losses from canals are in the order of 7% to 8% of the total flow. Additional losses take place from the irrigated agricultural lands, especially where water spreading rather than sprinkler systems is utilized.

Ground Water Movement

The flow of ground water through permeable material is proportional to the head loss and inversely proportional to the thickness of the material through which it flows. The aquifers are not uniform and multiple aquifers are common especially within the alluvium and granitic intrusive. The rate of water movement between aquifers is dependent

upon permeability, hydrostatic head and interconnections between the aquifers. Water percolates downward to zones of saturation and then laterally to the surface drainage. Low flows of the Rogue, Applegate and Illinois Rivers are sustained during the summer months by ground water runoff.

Ground Water Levels & Fluctuations

Water levels and their fluctuations have been measured periodically in a network of observation wells throughout Josephine County since 1952. A careful study of water level fluctuations can aid in determining the relation of ground water recharge to precipitation and irrigation, predicting low stream flow and the effect of heavy withdrawals on water levels. With other supporting data, estimates as to the amount of ground water available for use can be determined.

Any phenomena which produces a change in pressure on the ground water will cause the ground water level to change. These would include secular and seasonal variations, stream flow, fluctuations in evapo-transpiration and withdrawal of water by drains and wells.

Water level measurements within observation wells are generally obtained periodically with a minimum of 4 measurements annually. It is generally desirable to choose dates for measuring water level fluctuations in order to record the low stage, high stage, and the periods of decline and recovery. In areas of high ground water usage, continuous automatic recorders would yield the optimum data for future planning.

Water levels of three observation wells are included with this report. It is obvious that the water level in the Highway Department well has been declining since 1964 for which the cause is not known. Water levels in the Grants Pass Golf Course well have risen possibly due to recharge from irrigation water. The J.R. Smith well fluctuates through a moderate range of depths and is probably sensitive to local rainfall patterns. The January water levels are used in this example as these represent the highest levels for the year and were measured during a period in which withdrawals were minimal.

WATER LEVEL FLUCTUATIONS WITHIN
THREE OBSERVATION WELLS
JOSEPHINE COUNTY, OREGON

Date	Well # 35/6W-24D1	Well # 36/5W-31L2	Well # 38/8W-33H1
Jan - 1964	34.83'	-	3.70'
" 1965	-	25.88'	2.73'
" 1966	-	-	2.80 (Feb)
" 1967	38.64'	17.92'	6.70'
" 1968	37.62'	15.34'	2.15'
" 1969	38.05'	9.38'	1.90'
" 1970	33.50'	22.73'	1.77'
" 1971	38.51'	30.68'	2.74'
" 1972	37.30'	22.29'	5.63'
" 1973	39.36'	26.67'	1.62'
" 1974	39.30'	32.37'	4.03'
" 1975	37.50'	14.95'	2.40'
" 1976	37.90'	-	0.97'
" 1977	42.35	-	6.20'
" 1978	pumping	-	1.90'
" 1979	42.34'	14.50'	4.10'

(Data for observation wells on following page)

OBSERVATION WELLS

Well # 35S/6W-24D1
Oregon State Highway Department
123 feet deep
Produces from Granitic Intrusive, located about 5 miles northwest of Grants Pass

Well # 36S/5W-31L2
Grants Pass Golf Course
300 feet deep
Produces from Granitic Intrusive, located about 3 miles south of Grants Pass

Well # 38S/8W-33H1
J.R. Smith
29 feet deep
Produces from Quaternary Alluvium, located about 2 miles north of Kerby

GROUND WATER SYSTEMS

Unconfined Aquifers

When the water table serves as the upper surface of the zone of saturation, the aquifer is said to be unconfined. The water table elevation varies depending upon topography, areas of recharge and discharge, withdrawal through wells and permeability. Rises and falls of the water table are a measure of changes in storage in the aquifer.

Unconfined perched aquifers occur where an impermeable layer creates a ground water body above a deeper or regional aquifer.

Unconfined aquifers are common in the unconsolidated alluvial deposits adjacent to major streams. Perched aquifers are common in nearly all rock units within the county. During periods of limited rainfall, such as the drought of 1976-77, many of the perched aquifers became dry. Deeper regional aquifers were affected to a much lesser degree, that is, a temporary drop in the water levels.

Confined Areas

When ground water is confined under a pressure greater than atmosphere by a relatively impermeable bed, the term confined or artesian aquifer applies. The water level in this instance rises above the bottom of the confining layer and is termed the piezometric surface. The rise and fall of the piezometric surface is therefore primarily a measure of

pressure changes and not volume changes.

The drillers well reports indicate that most wells are drilled into confined aquifers, especially the wells drilled below perched aquifers in the alluvium and the granitic intrusive. During periods of pumping the drawdown, in many if not most of the confined aquifers, falls below the confining layer and the aquifer then has the characteristics of an unconfined aquifer. With pumping dewatering (?) of the aquifer takes place with a corresponding change in storage.

GEOHYDROLOGIC & GROUND WATER AVAILABLILITY MAPS

Two maps have been prepared to show, as accurately as possible, the occurrence and availability of ground water within Josephine County.

The Geohydrologic Map is a display of the rock units within the county with a concise statement as to the water-yielding capacity of each unit. As the scale of the map is 2 miles to the inch, it is limited to a regional overview and is not of sufficient detail for local use.

An overlay map has been prepared for use with the Geohydrologic Map in which the number of wells drilled in each section are listed along with pertinent data as to the range of depths, water levels and yields are given. The Ground Water Availability Map should be useful in future regional land capability studies. Special site studies will require additional data.

GEOLOGIC UNITS & THEIR WATER BEARING PROPERTIES

APPLEGATE GROUP - TRIASSIC PERIOD

Areal Extent

The Applegate Group of rocks is named after the Applegate River and is the dominant rock unit within the river basin. Regionally, the rock group has a northeast to southwest linear trend through the eastern part of Josephine County and the western part of Jackson County and extends southward into northern California. The Applegate Group of rocks is believed to be the oldest rock unit shown on the geohydrologic map which is part of this report.

Physical Characteristics

Applegate Group rocks are a thick assemblage of metamorphosed volcanic and sedimentary rocks. The altered sedimentary rocks are often interbedded with the volcanic rocks and include conglomerates quartzite, argillite (derived from siltstone), and marble.

Narrow zones of gneissic and schistose rocks of the Applegate Group lie adjacent to the later intrusion of granitic rocks. These zones of intense alterations were formed by contact metamorphism from the high temperature of the granitic intruding mass.

The rocks dip steeply to the southeast over most of the area of outcrop. Some westerly and southerly dips are known in the southwesterly part of Josephine County such as the Deer Creek drainage.

Water Bearing Properties

The metavolcanic and metasediments of the Applegate Group have a low permeability due to the mineral realignment and crystallization caused by various stages of metamorphism. Ground water occurs in the fractures, joints and cleavages which have been enlarged near the surface by physical and chemical weathering. A knowledge of the local geologic structure increases the probability of locating small quantities of ground water for domestic use. Areas in which the fracture and cleavage planes intersect the dipping bedding planes, at a relatively shallow depth are potential sources of ground water. Yields are generally less than 10 gallons per minute from wells drilled to depths less than 200 feet (refer to Ground Water Availability Map.) Water quality varies and will be discussed in a separate report.

The potential of obtaining sufficient water for domestic use is increased when the well site selection can be made on larger tracts of acerage.

DOTHAN FORMATION - JURASSIC PERIOD

Areal Extent

The Dothan Formation was named for a series of sedimentary rocks exposed near the Dothan postoffice on Cow Creek in Douglas County. Regionally, the formation has a northeast to southwest trend, forming the surface geology in a linear band from Douglas County southwesterly

to the Oregon Coast. Within the mapped area considered in this report, exposures of the Dothan Formation are limited to the northwest corner of the County.

Physical Characteristics

The Dothan Formation consists of a thick sequence of sandstones, siltstones, and shale with lenticular beds of chert and conglomerate. Near the top of the formation, layers of volcanic rock are in evidence.

This rock unit has been strongly affected by tangential forces forming folds and thrust faults which have a northeast to southwest linear trend. The sedimentary beds dip to the east and southeast.

Water Bearing Properties

No ground water data is available from drillers logs within Josephine County. Small quantities of ground water likely occur within the fractures and bedding planes of the rock unit.

ROGUE FORMATION - JURASSIC PERIOD

Areal Extent

The Rogue Formation is exposed in a linear northeast to southwest trending band parallel to and immediately east of the exposures of the Dothan Formation in northwestern Josephine County. This series of interbedded altered volcanics, are in part intensely metamorphosed to gneissic rocks and extend from northern California into Curry,

Josephine and Douglas counties.

Physical Characteristics

This formation consists of a thick sequence of metavolcanic flows and tuffs. The volcanic flows have a wide range of rock types including basalts, dacites and rhyolites. The basalt flows, which are predominant near the base of the formation, are a green to greenish gray color in contrast to the light colored siliceous rocks (rhyolites & dacites) which predominate near the top of the formation. Clastic rock units interbedded with the metavolcanics include thick beds of tuffs and thin layers of cherty material.

The metamorphic facies of the Rogue Formation consists of foliated gneissic rocks, green schistose rocks derived from the basalts or metaquartzites and mica schists derived from the silicic rhyolites and dacites.

Structurally, the strike of the Rogue Formation is northeasterly and the beds dip steeply to the southeast.

Water Bearing Properties

Both the metavolcanics and the intensely metamorphosed gneissic and schistose rocks have a low permeability due to mineral re-alignment. Openings within the rocks capable of transmitting ground water to a well are therefore mostly secondary in origin. Small quantities of ground water are available from storage in geologic faults, fractures, joints and between bedding planes.

Outcrops of the Rogue Formation are in a sparsely populated area and therefore very few wells are known to exist. Though yield from wells are generally less the 5 gpm (?). One well (35-9-11) is reported to be capable of producing 20 gpm from a depth of 10 feet.

GALICE FORMATION - JURASSIC PERIOD

Areal Extent

The Galice Formation forms a narrow linear band which trends northeast to southwest. This formation extends beyond the boundary of Josephine County to the north and northeast into Douglas and Jackson Counties, and southward into California. It is one of the most prominent rock units within the County.

Physical Characteristics

This formation was deposited on the pre-existing surface of the Applegate Group of rocks. The Galice Formation consists of two members, a basal group of predominately volcanic rocks overlain by sedimentary rocks.

The volcanic rock member is estimated to be 10,000 feet in thickness. Predominately the rocks consist of agglomerates, tuffs and flows which are rhyolitic and andesitic in composition.

The sedimentary rock member is estimated to be 15,000 feet thick. These rocks are a black to dark gray slaty shale with some

interbeds of sandstone and conglomerate. Cementation of the sedimentary rocks with siliceous material has rendered most of the member impermeable.

Structurally, the rocks of the Galice Formation have been subjected to compressionable forces which have developed a slaty texture to the fine-grained sediments. Fractures and several joint systems have developed in the rocks. The beds dip, generally at a high angle to the southeast and east.

Water Bearing Properties

With a few exceptions, the production of ground water from the Galice Formation is limited and unpredictable. The accumulation of water within the slaty shales is limited to fractures, joints and shear zones. Structural deformation of the formation has resulted in the beds dipping at a high angle toward the southeast and east. Wells drilled in the high angle dipping beds remain in the same lithologic unit.

The production of water is generally limited to less than 10 gallons per minute. Dry holes are common and salt water is known to occur in some areas.

UNDIFFERENTIATED ROCKS - JURASSIC PERIOD

Areal Extent

The undifferentiated rocks are located within a narrow northeast-southwest trending band in the northwest quarter of the County.

Physical Characteristics

The rocks included in this grouping are a complex mixture which likely are not of the same age. The rock types apparently include both igneous and metamorphic varieties.

Water Bearing Properties

There is no available information of wells within this unit.

ULTRAMAFIC INTRUSIVES - JURASSIC PERIOD

Areal Extent

The ultramafic rocks occur throughout the county with exposures in all of the river drainage basins. The outcrops are generally elongate in a northeast-southwest direction which is the major structural trend of the older rocks and suggests that the intrusive masses are located along fault zones.

Physical Characteristics

The intrusive rocks are peridotites or their altered product serpentine. The term serpentine is commonly used to cover all rock types within the intrusive masses. Ultramafics are mineral assemblages which contain high amounts of magnesium and iron. On the fresh surface the rocks are generally some shade of green. In many localities, the rock surface is curved and shines as if polished.

The ultramafic rocks are widespread in the Applegate Group and

the volcanic rock member of the Galice Formation. The intrusives occur in linear masses and in lenticular or horizontal tabular bodies in the volcanic rocks.

Water Bearing Properties

The potential of developing water from the ultramafic intrusive masses is poor. Possibly a few wells produce water from this formation. The high iron and magnesium content of the rocks would have an undesirable effect upon the water quality.

GRANITIC INTRUSIVE - CRETACEOUS & JURASSIC PERIOD

Areal Extent

Crystalline intrusive rocks of granite, diorite and granodiorite are exposed at the surface at two major localities within the county. A large oval-shaped exposure is located between the Applegate River and the community of Hugo, a distance of 16 miles. At its widest point, parallel to the Rogue River, the intrusive measures 8 miles in width.

In the Williams Creek drainage exposures of the granitic rock extend from the headwaters to the confluence with the Rogue River, a distance of 14 miles within the mapped area, and extends southward into unmapped federal lands. Small irregularly-shaped exposures occur at several places near the eastern boundary of the county. These isolated exposures are assumed to be connected to the larger exposed outcrops at some depth below the surface.

Physical Characteristics

Due to popular useage the term granitic intrusive is used although the most abundant rock types are quartz diorite and diorite having little quartz. The rocks are medium to coarsely crystalline. The light-colored minerals consist of quartz and feldspar with lesser amounts of dark-colored minerals consisting of biotite and hornblende.

The surface exposures are generally weathered to material consisting of granular to clay-sized particles. Weathering is most pronounced along joint planes. Some jointing is horizontal and therefore there is a layering of fresh rock and weathered water bearing material. The clay size particles are the weathering product of the feldspars. These fine particles fill the voids between the coarser fragments which reduces the permeability of the weathered rock.

Water Bearing Properties

Aquifers within the Granitic Intrusive yield more water to wells than aquifers in all other geologic units. Of the more than 8,500 wells within Josephine County, it is estimated that 50 percent of the total number are producing from the granitic rocks. Up to 200 gallons per minute has been reported though the average yield is less than 20 gallons per minute for all wells. Water quality is generally good although a high iron content is a common local problem.

Ground water production is generally from zones of weathering and fractures within the rock. Wells producing from shallow perched aquifers having limited quantities of water are less reliable than wells drilled to deeper aquifers.

SANDSTONE - CRETACEOUS PERIOD

Areal Extent

The sandstone is limited to a small area south of Cave Junction in Township 40 South, Range 8 West and within the West Fork drainage of the Illinois River. The outcrop is approximately 5 miles in length and 1½ miles in width.

Physical Characteristics

The formation consists of a basal conglomerate overlain by an arkosic sandstone. Though limited in areal extent, it is estimated that the formation is 5,000 feet thick. The term Horsetown Formation was formally used for this sequence of rocks.

Water Bearing Properties

The capability of this unit to yield water to wells is not known.

ALLUVIUM - QUATERNARY PERIOD

Areal Extent

Extensive deposits of alluvium sediments eroded from pre-existing rocks form the surface in the major river valleys (Rogue,

Applegate & Illinois) and the larger tributary streams. No attempt has been made to separate the various alluvial deposits on the basis of age, origin, or topographic position.

Physical Characteristics

The valleys of the major streams are underlain by deposits of clay, silt, sand, gravel and boulders. These deposits are estimated to be up to 150 feet thick locally. Some of the older alluvial deposits are cemented with minerals such as iron oxide and carbonates. The permeability of the coarse sands and gravels is often low due to the interstitial filling of finer-grained material.

Water Bearing Properties

The occurrence and availability of ground water in the alluvial deposits is little understood except in a few local areas. The alluvium is an important source of ground water in the vicinity of Grants Pass and Cave Junction, and the Cave Junction water system is supplies from ground water.

Wells with the capability of yielding up to 450 gpm have been reported. In areas where the gravels are cemented, the availability of ground water is generally limited to quantities sufficient for limited domestic use.

Many of the gravel outcrops are located on terraces and slopes above the regional water table and are therefore not a reliable source for even small domestic supplies.

RECOMMENDATIONS

Decisions concerning ground water resources requires a data base which is kept current with selective data acquisition and analysis. The following list of studies should be considered to insure an adequate data base:

1. Local Area Studies

Within the past year, most ground water studies have been limited to areas adjacent to Grants Pass. Within the Harbeck-Fruitdale area, it has been determined that under present conditions, additional wells can be drilled before a proposed limit of one well per acre is reached. Within the Redwood District, the ground water potential was reported to be superior to the potential within the Harbeck-Fruitdale area. However, there is not sufficient ground water within either area to supply a community water supply distribution and and storage system to meet the proposed zoning density of the Comprehensive Plan.

Additional local studies should be conducted at Merlin, Cave Junction, and Murphy. As ground water will continue to be the source of potable water in these communities, the adequacy of the supplies should be investigated.

2. Observation Well Program

In order to collect data pertinent to future water use decisions,

it is suggested that the observation well program be reviewed as to location and number of existing wells used for this purpose. Ideally, observation wells should be used solely for that purpose. Unless accurate records are kept as to periods of pumping, it is difficult to separate the effects of ground water withdrawal from other factors which cause water level fluctuations. Automatic recordings which measure water level changes in reference to clock time yield the best results. It is our understanding that the U.S. Geological Survey may supply one or two automatic recorders for use within Josephine County.

3. Aquifer Testing Program

The yield and drawdown of well over a measured period of time is determined by a test program which is commonly termed a pumping test. The testing of a well has two objectives - one is to obtain data as to the performance and efficiency of the well in order to properly select the pumping equipment and the second is to determine the aquifer performance and its ability to supply a reliable quantity of water over an extended period of time. Aquifer tests of community wells should be required, especially in new subdivisions, prior to approval of the final plat.

4. Graphic Display of Ground Water Data

Josephine County is one of two counties within the State having computer facilities for the storage and display of well data. In

order to increase our abilities to make sound decisions, well location maps should be prepared for localities experiencing rapid growth in which ground water supplies are a source of potable water. Individual wells would be plotted on topographic sheets along with pertinent data including depth, yield and water level elevations.