



WATER RESOURCE CONSULTANTS, LLC

February 20, 2003

Bell Properties, LLC
1212 8th Street
Golden, CO 80401

RE: Opinion of Availability of Potable Water Supply for Replat of
Elkhorn Subdivision

Dear Sirs,

This letter report is in response to Routt County's request for a water supply report that outlines the feasibility of obtaining a potable water supply for domestic use in Elkhorn Subdivision. Specifically, when a replat is presented to Routt County for approval, the County is now requesting that adequate ground water at reasonable depths be available to service anticipated demands ¹.

In summary, it is my conclusion and opinion that individual wells drilled to serve each of the newly replatted lots in Elkhorn Subdivision will in all likelihood be able to obtain enough water to sustain the in-house use of one single family residence. Additionally some wells may produce enough water to service outside domestic livestock and landscape uses.

SCOPE OF REPORT

The scope of this report is intended for Elkhorn Subdivision. However, findings are applicable to virtually all of the area known as "Steamboat Lake Subdivision" west of Routt County Road 129 and roughly bounded on the west and north by Steamboat Lake. The location of Elkhorn Subdivision is shown on Figure 1. While some of this information is applicable to areas east of County Road 129, a major fault running mostly parallel with the road creates a significantly different hydrogeologic condition on the east side of the road.

BACKGROUND

The production of water from household wells in the area of Steamboat Lake is highly variable. Production rates of wells vary from reported lows of 0.5 to 2 gallons per minute (gpm) to occasionally 20 to 30 gpm ². The vast majority of wells are formation wells which obtain their water from bedrock, as opposed to shallower wells which obtain their water from surficial deposits. Because of the difficulty in obtaining "high" producing wells, e.g. wells that produce more than 5 to 10 gpm, Routt County has recently requested that the "adequacy" of ground water at "reasonable" depths be evaluated before replats are approved by the County.

¹ Draft Routt County Resubdivision (Replat) Submittal Requirements, paragraph 4(a), version 08/09/2002

² Colorado Division of Water Resources, review of well logs

To adequately respond to the County's request, several terms must first be defined. These include "adequacy" and "reasonable."

Definition of "Adequacy" of Groundwater to Service Anticipated Demands

"Adequacy" of a water supply requires a three-fold test: 1) legal availability, 2) suitable water quality, and 3) physical availability.

Legal Availability – Exempt well permits are available from the Colorado Division of Water Resources for the area of Steamboat Lake³. The Elk River drainage is under appropriated which allows the issuance of exempt well permits for parcels less than 35 acres in size. An exempt well permit allows instantaneous pumping or diversion of up to 15 gpm, allows watering of domestic stock, irrigation of up to one acre, and in-house use for up to three single family residences. No further legal ability is needed to obtain well permits in the upper Elk River drainage.

Water Quality - While water quality is important, modern water treatment technology is widely used for single family residences. The need to treat water for minerals, taste, color, odor or other real or perceived contaminants usually plays a very small role in determining the feasibility of providing a safe, potable water supply. For the vast majority of home owners who rely on individual wells, this concern is not considered a major or driving issue.

Physical Availability – Physical availability, or the actual ability to divert or pump water, is vitally important. In Colorado the current standard of physical availability of a water supply is based on providing at least 100 gallons per day per capita of potable water. This is for in-house use only. To determine the required supply for a single family residence an occupancy rate of 3.5 people per residence is used. Thus, for planning purposes, the total daily demand per residence is 3.5 people x 100 gpcd = 350 gallons per day/residence (gpd). This is sometimes referred to as an "equivalent residential unit," or EQR. While 350 gpd is considered the average for planning purposes, the range of in-house use can be expected to vary from 80 gpd per person to a maximum of 100 to 120 gpd per person.

Since legal water supply and water quality are not considered major issues, for purposes of this report "adequacy" will be defined as "an adequate physical supply for in-house use for a single family residence." Thus, an adequate supply is considered to be a well that provides an average of at least 350 gpd, for in-house service of one residence.

For a well to produce an average daily production of 350 gallons it will need to produce an average of nearly one-quarter gallons or water per minute. With a minimum flow rate of one-quarter gpm, practical considerations such as well and pump cycling and instantaneous demand such as showers and other household uses, requires on-site storage. With sufficient storage a sustained pumping rate of one-quarter to one-half of a gpm or more is feasible. The amount of storage depends on the desires of a home owner, but typically two to three days of storage or 700 to 1000 gallons of storage is considered reasonable for most single family residences.

³ Colorado Division of Water Resources, Division 6, personal correspondence, 11-Feb-03, Lynn Peters

“Reasonable Depth” Defined

A “reasonable depth” to drill to obtain water is strictly subjective. It is largely based on personal economics. A “reasonable depth” also varies by location. In areas where water is readily available near the ground surface “reasonable depth” may be only 20 to 30 feet. In areas where there is limited water supply depths of several hundred up to 500 feet or more may be considered “reasonable.” For practical considerations of cost, equipment, difficulty of drilling and difficulty to install and maintain pumping equipment, depths of more than 600 to 800 feet for domestic wells for single family residences usually become cost prohibitive. Meanwhile depths of 50 to 500 feet are very common for domestic wells for single family residences in much of Western Colorado.

AVAILABILITY OF WATER IN THE ELKHORN SUBDIVISION AREA

Review of well logs of existing wells in the area of Elkhorn Subdivision indicates most wells obtain water from formation rock or bedrock, rather than from surface or alluvium sources. Previous studies⁴ conclude that the primary source of water is “fracture flow” or flow through cracks, faults and fissures within the otherwise solid or massive bedrock or formation rock. Some wells receive their source of water from recharge from precipitation on the same lot the well is located on; others receive water from locations that are literally miles away. Figure 2 is a map of the subdivision overlaid onto the USGS geologic map for the area. The reader is referred to standard USGS map symbols and definitions for a key to the geologic formations. Additional information is also available in the previously referenced USGS Bulletin 1349.

A review of drilling records available from the Colorado Division of Water Resources indicates production flows vary greatly. A review of records shows wells west of County Road 129 produce from 0.5 gpm to up to 15 gpm or more. Occasionally dry holes occur; however few of these are recorded, and new wells are usually drilled nearby until an adequate source of water is located. As with drilling in any geologic formation at any location, drilling is an exercise in judgement and subsurface exploration of unknown specifics; hence it is not uncommon to need to drill more than one hole to obtain an adequate physical supply of water. Not only is this true for the Steamboat Lake area, it is true anywhere water development and drilling occurs.

Two geologic issues both add to the potential to obtain an adequate well, and also compound the difficulty in predicting how much water can be obtained from any given well. As previously stated, the primary source of water is fracture flow, or flow between massive blocks of bedrock. Fracture flow is often a very good physical source of water. However, the highly

⁴ *General Geology of the Hahns Peak and Farwell Mountain Quadrangles, Routt County, Colorado*, USGS, Geologic Survey Bulletin 1349, Segerstrom et. al., 1972

Replats of Steamboat Lake Subdivision – Evaluation of Well Hydrology and Potential Impact of New Wells to the Steamboat Lake Water and Sanitation District’s Well, Water Resource Consultants, LLC, 23-April-2002

Site Technical Evaluation, Parkside at Steamboat Lake, Routt County, Colorado, Maphis International, Ltd., November, 1998

distorted and folded nature of the geologic formations in the Hahns Peak and Steamboat Lake areas makes it very difficult to predict with precision where fractures will exist at depth. Surface features imply trends, and much can be learned from observation of the such features. However, caution should be exercised in extropolating visible surface features to any great depth.

Based on the generally successful history of wells in the area – as noted by many dozens of wells that produce adequate supplies of water – it is probable that drilling can be successfully carried to completion on the lots subject to re-plat.

Should you have any questions, please feel free to contact me.

Sincerely,

WATER RESOURCE CONSULTANTS, LLC



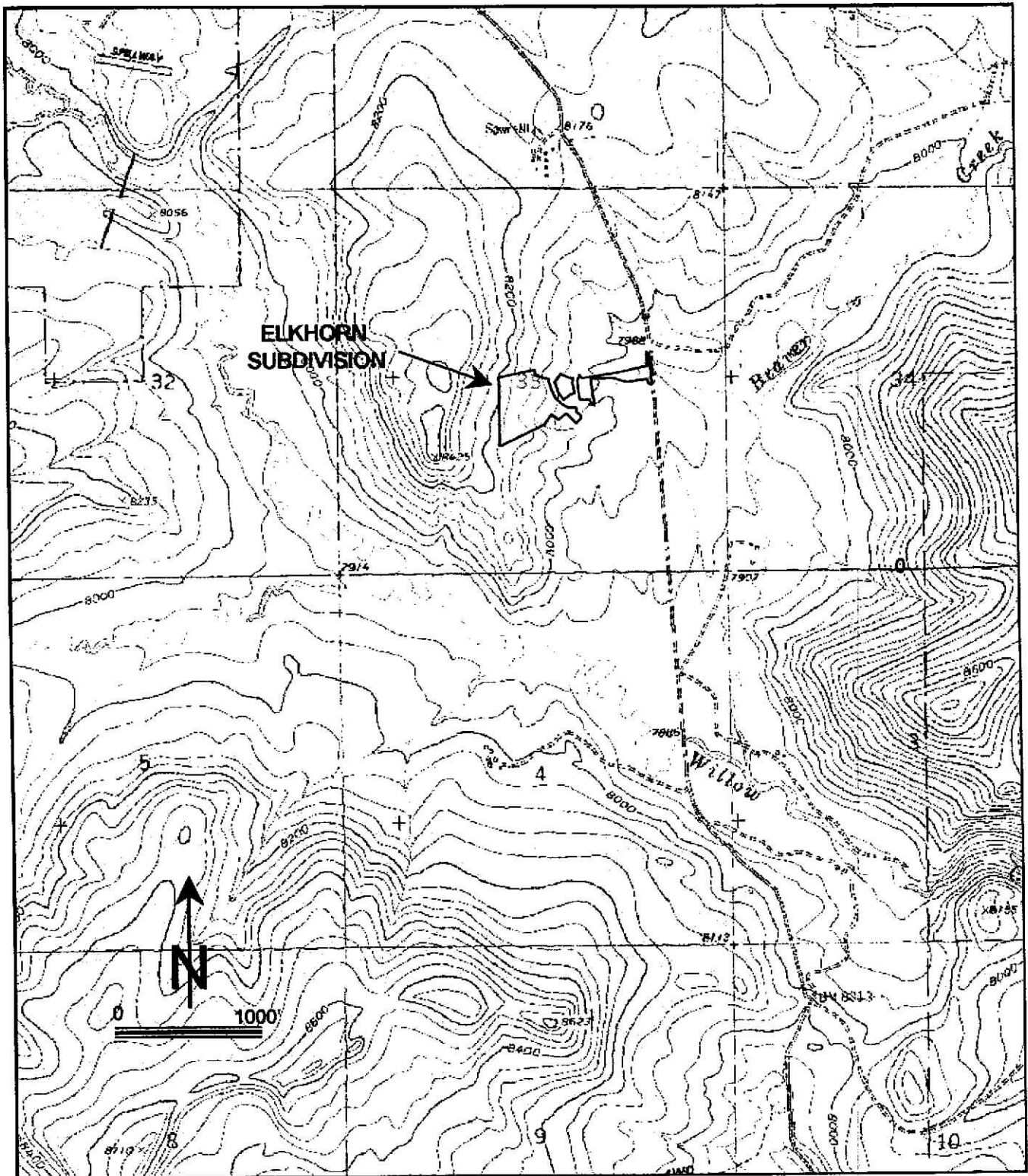
Paul C. Currier, P.E.

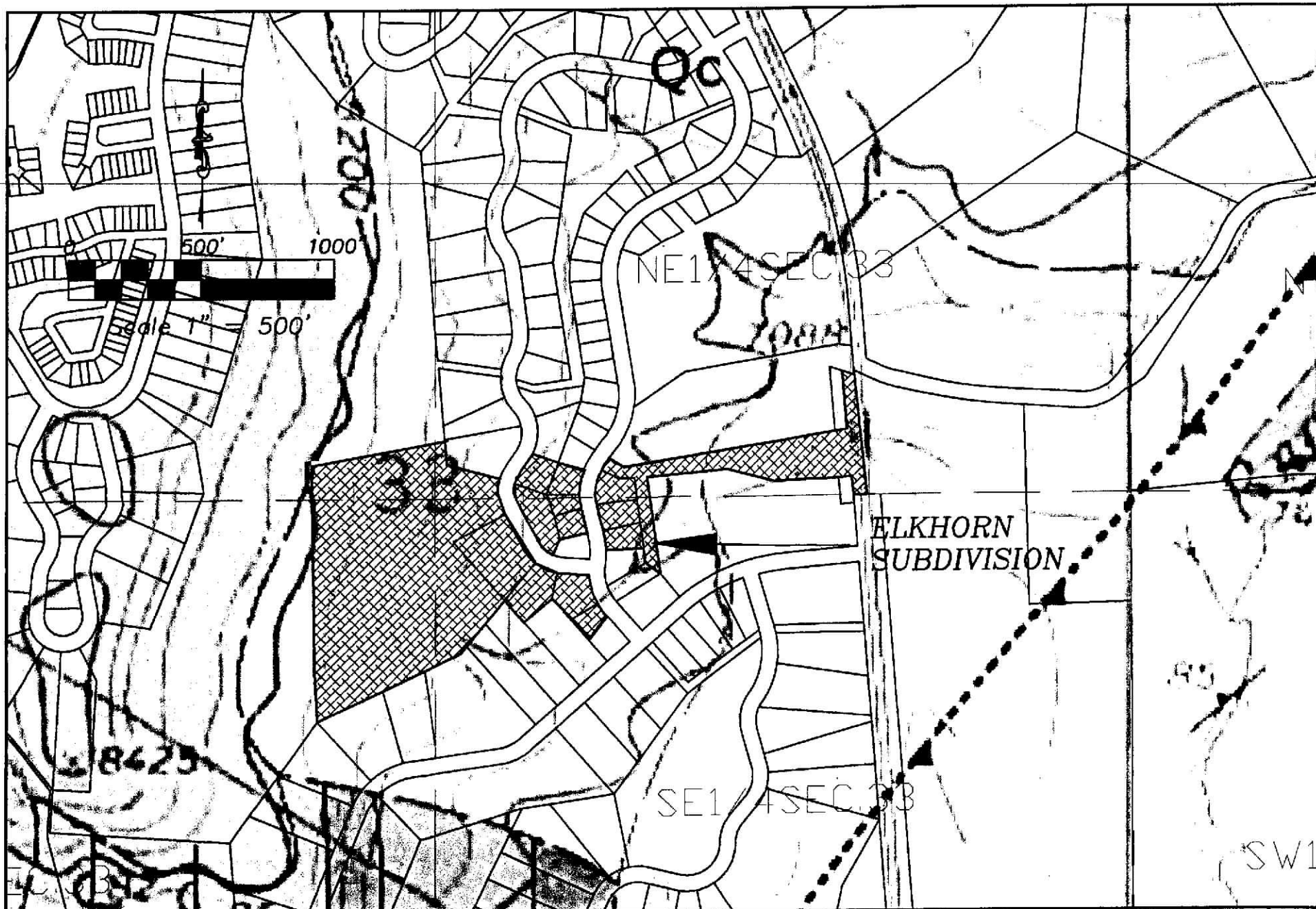
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FIGURE 1
LOCATION MAP

ELKHORN SUBDIVISION RE-PLAT






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ELKHORN
 SUBDIVISION
 CLARK, CO.

GEOLOGIC MAP
 AND LOT LAYOUT
 MAP

				DATE : 20-FEB-2003	FIG. 2
				FILE : 200-1.0	
				DWG : 200-SLS.Dwg	
				BY : PCC	
				CWD : PCC	
NO.	BY	DATE	REVISIONS		