

## The Cost-Benefit of Upgrading from Low Carbon Steel for Water Well Casing and Well Screen

### Introduction

The installation of an agricultural, industrial or municipal water well represents a considerable financial investment for most water purveyors. The financial “burden” of building a new well facility often leads some of them to select low carbon steel for the blank casing and well screen as a way to reduce the construction cost. An alternative approach would be to construct the well with a type of steel that provides greater durability and longer life for the completed facility. This memorandum discusses the cost-benefit of using either copper-bearing steel or high-strength, low-alloy steel as viable alternatives to low carbon steel well casing and well screen.

### Corrosion Study

In 1999, the City of Fountain Valley, California commissioned GEOSCIENCE Support Services, Incorporated to conduct a corrosion study of steel well casing and screen. The methodology consisted of a long-term evaluation of various types of steel. During the test, the sets of coupons were lowered into a water well and later retrieved after 7 weeks, 11 weeks and 11 months of submergence. Each coupon was then analyzed in the laboratory to determine the resulting weight loss and degree of surface etching (Geoscience, 1999).

The test well (No. 12) utilized for the corrosion study was an existing municipal well that had been constructed with intervals of louvered well screen installed opposite 5 distinct aquifers. The composite water quality of these aquifers is shown in Table 1.

Table 1 – Water Quality

<b>pH</b>	<b>CaCO<sub>3</sub></b>	<b>Alkalinity</b>	<b>TDS</b>	<b>Cl</b>	<b>SO<sub>4</sub></b>	<b>Ca</b>	<b>Hardness</b>
7.8	156	156	260	16	36	41	136

The results of the study (Table 2) showed that compared to low carbon steel, the durabilities of copper-bearing steel and high-strength, low-alloy steel (HSLA) were 4 times and 9 times greater, respectively.

### Cost Comparison

For the purposes of this memorandum, the unit costs of louvered well screen manufactured from low carbon steel, HSLA steel, and copper-bearing steel were compared. These costs (dated January 2005) were based on 16-inch diameter screen with a wall thickness of 0.312 inch. As shown in Table 2, the cost increases from low carbon steel to copper-bearing steel and HSLA were 1.6 times and 1.9 times, respectively.

Table 2 – Results of Coupon Study

<b>Steel Type</b>	<b>Metal Loss (mils/year)</b>	<b>Corrosion Resistance Factor</b>	<b>Steel Cost Factor</b>
High-Strength, Low-Alloy (ASTM 606-Type 4)	0.3131	9X	1.5X
Copper-bearing	0.7438	4X	1.4X
Low Carbon	2.8794	1X	1X

### Summary

Table 2 shows that copper-bearing steel exhibits significantly higher corrosion resistance over low carbon steel with only a moderate increase in cost. For those purveyors who want even greater durability, HSLA provides 2.5 times the durability of copper-bearing steel at only 10% greater cost.

### References

GEOSCIENCE Support Services, Inc., 1999, Corrosion Field Test of Steels Commonly Used in Water Well Casing and Screen.

*Handbook of Ground Water Development*, 1990, Roscoe Moss Company, John Wiley and Sons, New York, NY