Excel for Hydrology

Section 5

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Regression

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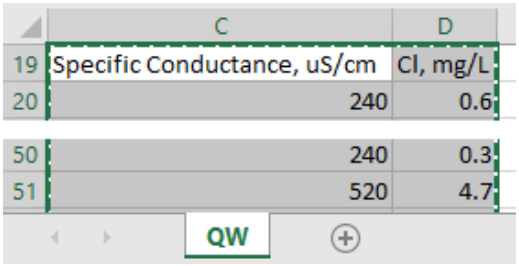
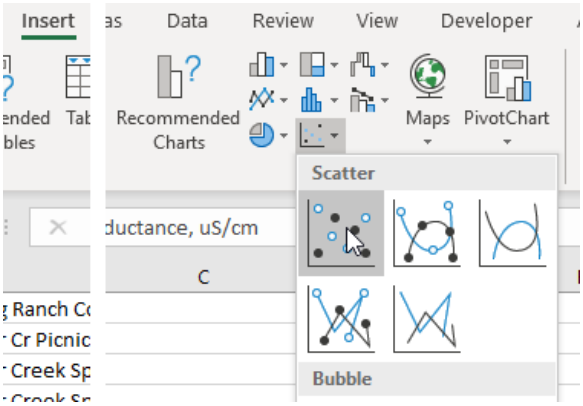
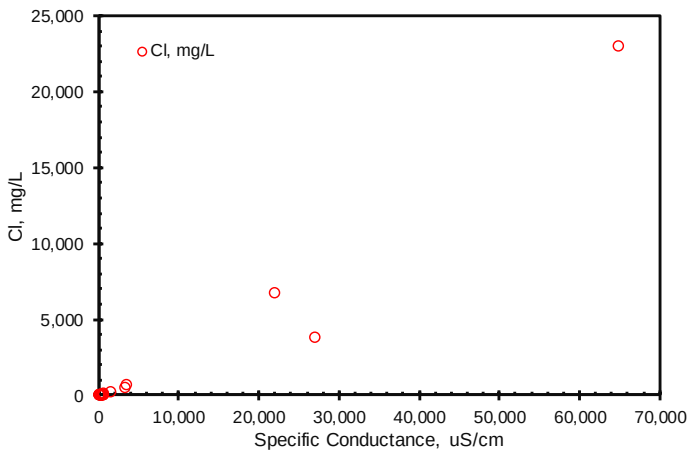
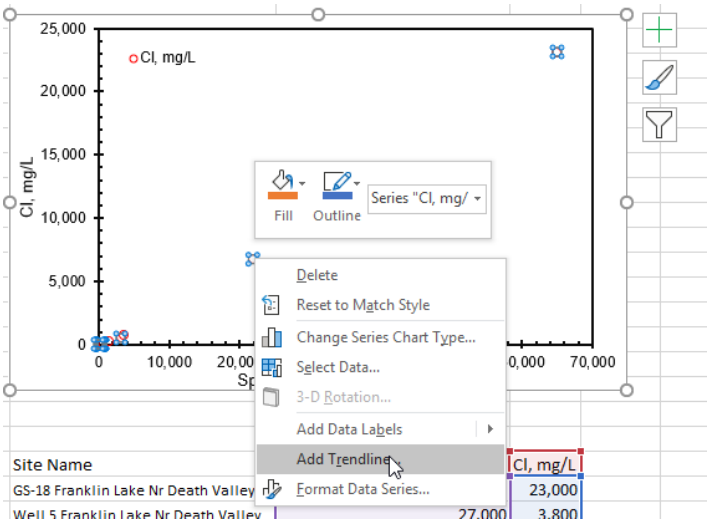
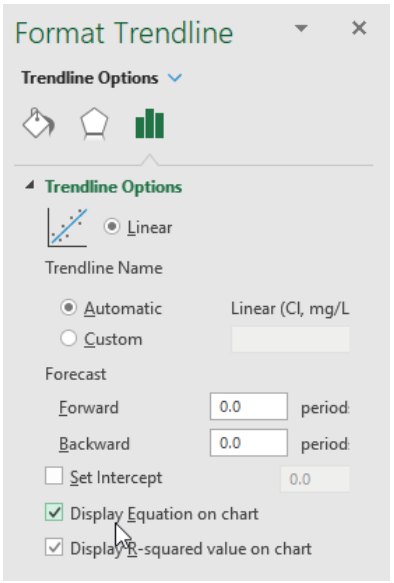
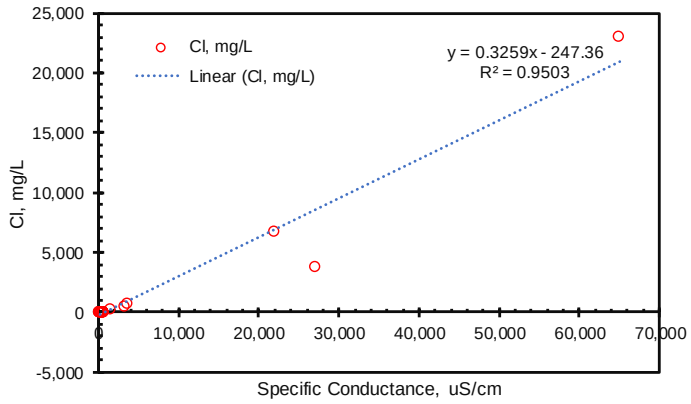
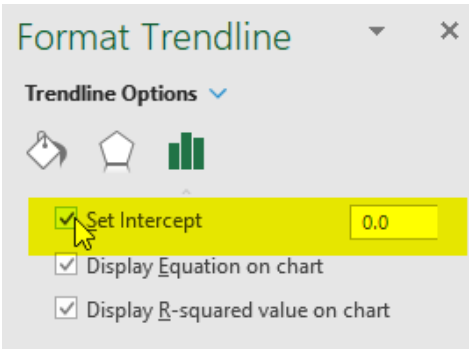
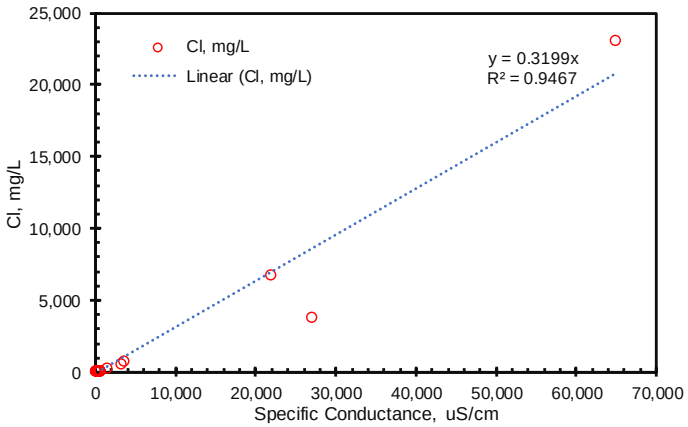
05_Regression

Linear and log-linear regressions are foundations of preliminary interpretations, which are computed quickly by adding trendlines to XY charts. This approach is fast, but estimated slope and intercept are not available for other equations. Alternatively, SLOPE and INTERCEPT are functions for linear regression, where estimated slope and intercept are available for other equations.

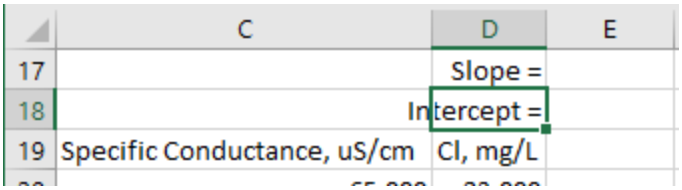
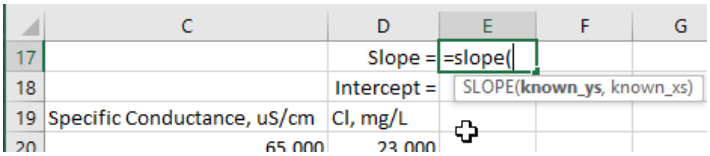
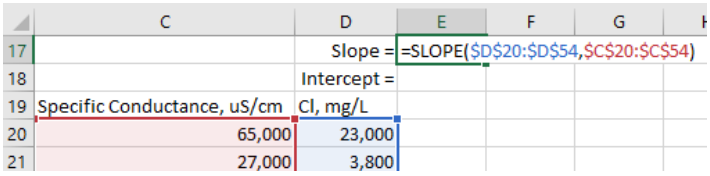
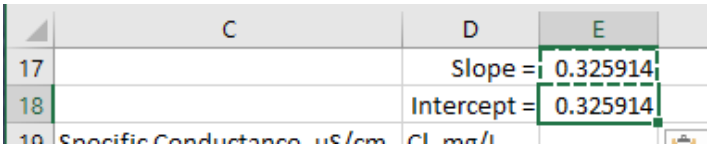
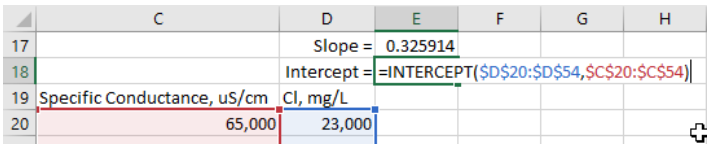
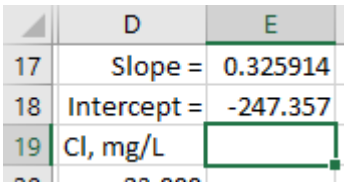
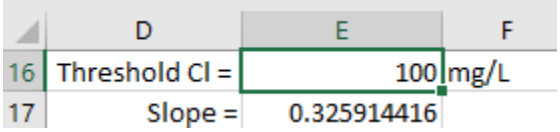
01_linearQW.xlsx Regression – Specific Conductance and Chloride

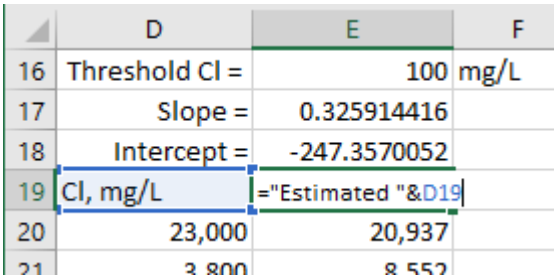
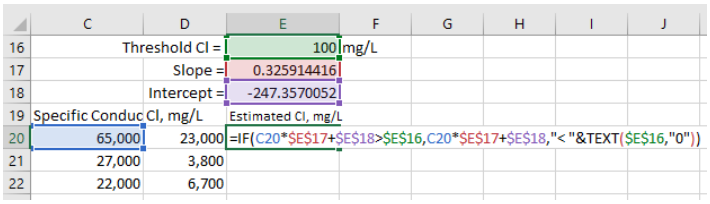
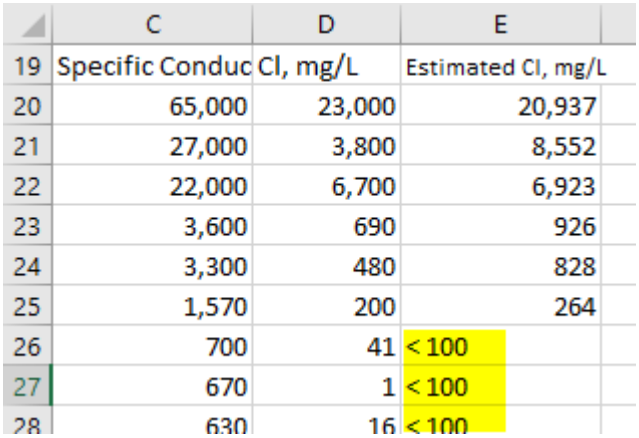
Regression by Trendline	
Select range **C19: D54**.	
Add XY chart of Specific Conductance and Chloride. Select "Scatter."	
XY chart with formatting for clarity.	

Select series. Right-click and select “Add Trendline” from dialog.	
Select Trendline option, **Linear**. Check options, “*Display Equation on chart*”, and “*Display R-squared value on chart*”.	
$r^2 > 0.95$, but equation is non-sensical. Cl = **-**247 mg/L, negative concentration, where SC = 0 µS/cm.	

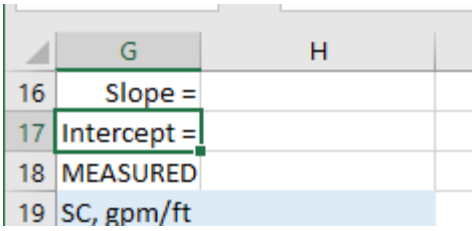
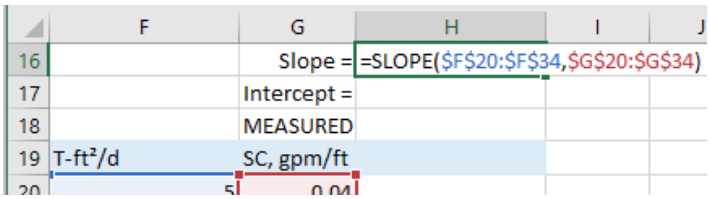
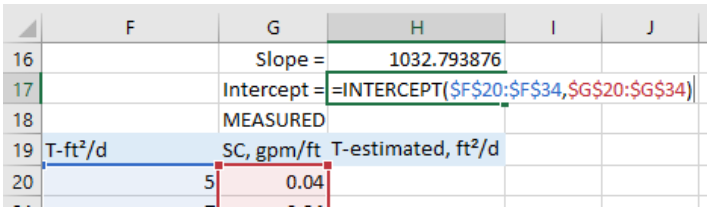
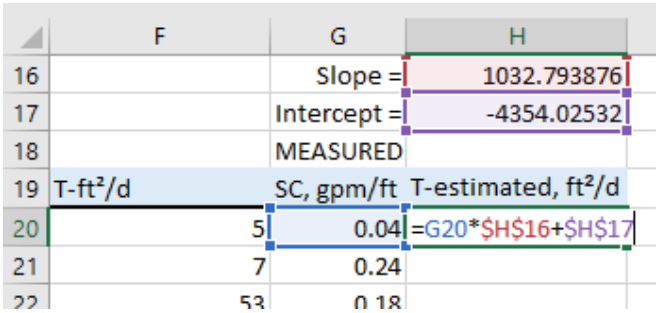
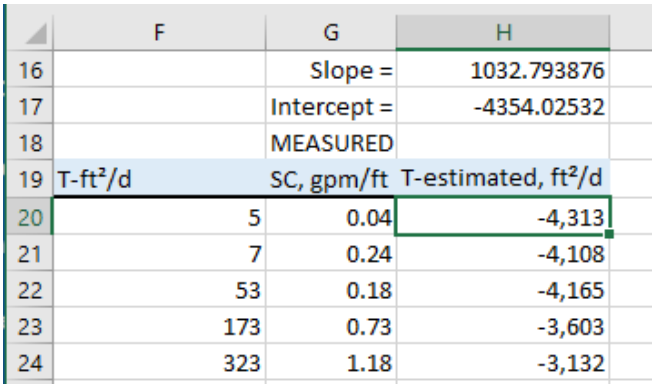
Format trendline and set intercept to 0.	
r^2 marginally less, but Results are physically possible.	

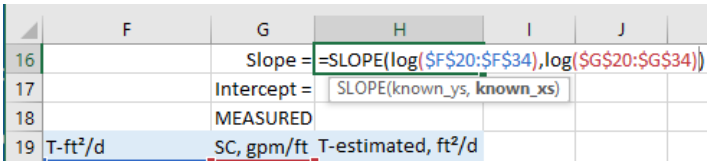
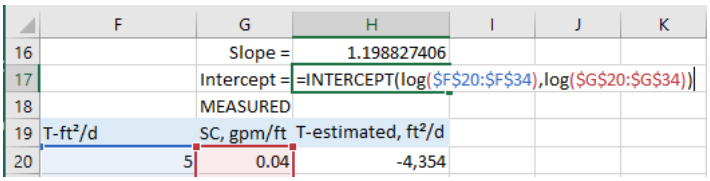
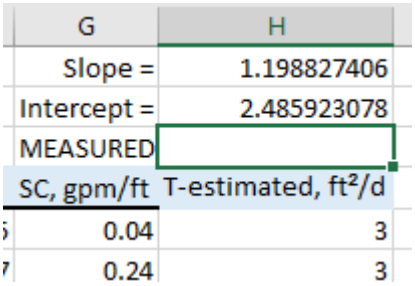
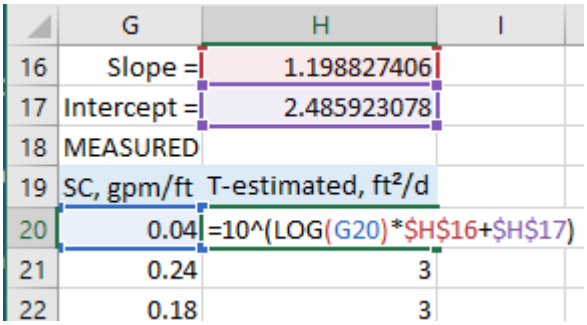
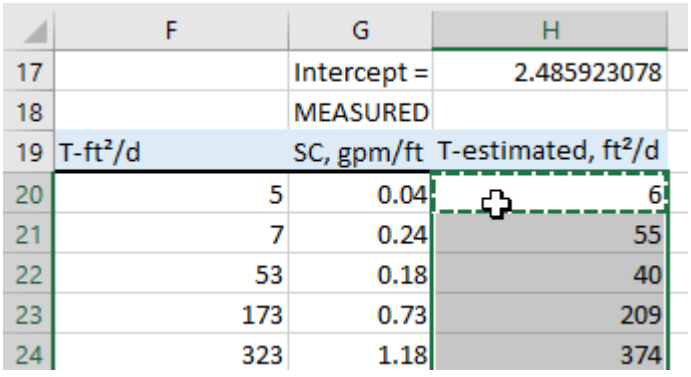
01_linearQW.xlsx Regression – Specific Conductance and Chloride

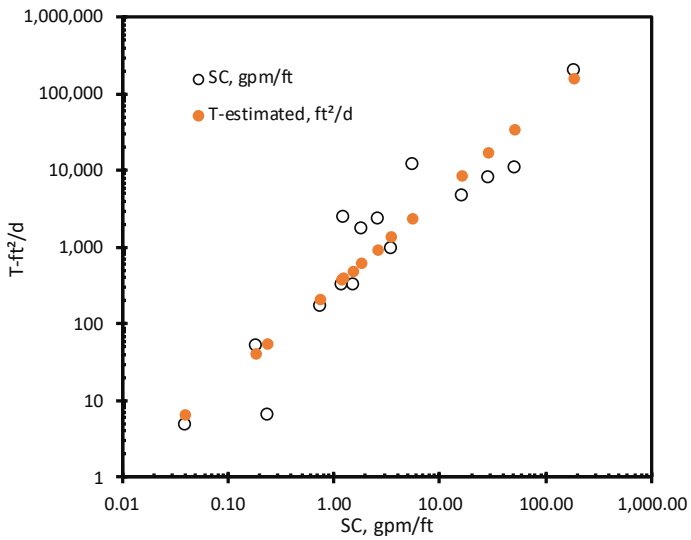
Regression by Functions SLOPE+INTERCEPT	
Enter labels “Slope =” and “Intercept =” in cells **D17** and **D18**.	
Type function *=SLOPE(* into cell **E17**. after typing “*(*“ a reminder appears that First range is **Ys** and Second range is **Xs**.	
Complete equation with ranges, **$D$20:$D$54** and **$C$20:$C$54**. Finished formula reads, “=SLOPE($D$20:$D$54,$C$20:$C$54)”	
Copy cell **E17**. Paste to cell **E18**.	
Open cell **E18** for editing with F2. Change SLOPE to INTERCEPT. Finished formula reads, “=INTERCEPT($D$20:$D$54,$C$20:$C$54)”	
PLUS: slope and intercept available. **MINUS**: Intercept cannot be specified.	
Can control reporting of estimated Cl with a threshold value. Add Threshold Cl =, 100, mg/L to range **D16:F16**.	

Add header equation to cell **E19**, ="Estimated "&D19.	
Add censored estimate equation cell **E20** =IF(C20*$E$17+$E$18>$E$16, C20*$E$17+$E$18, "< "&TEXT($E$16,"0")).	
Copy cell **E20**. Paste to range **E20:E54**. Estimated Cl values less than the threshold are censored.	

02_Example_T-SC-DeathValley+OtherSCeqs.xlsx – Log-Log Regression

Log-Log Regression by Functions SLOPE+INTERCEPT	
Enter labels “Slope =” and “Intercept =” in cells **G16** and **G17**.	
Add slope function in cell **H16**. . ***Note:*** ***Ys*** *in column* ***F*** *and* ***Xs*** *in column* ***G****.*	
Add intercept function in cell **H17**. Add header, T-estimated, ft²/d to cell **H19**.	
Estimate T with regression in cell **H20**. With, =G20*$H$16+$H$17 Copy cell **H20**. Paste to range **H20:H34**.	
Whoa, Negative transmissivities, Seriously wrong results because regressed SC vs. T rather than log(SC) vs. log(T).	

Open cell **H16** for editing with F2. Encapsulate each range with log, **log(*range*)**. Revised formula reads, "=SLOPE(**log(**$F$20:$F$34**)**,**log(**$G$20:$G$34**)**)"	
Open cell **H17** for editing with F2. Revise INTERCEPT equation by encapsulating each range with log, **log(*range*)**.	
Less wrong but still wrong. Equation is log(T) = A*log(SC) + B, T = 10^[A*log(SC) + B], or T = 10^B * SC^A	
Revise estimate T in cell **H20** with T = 10^[A*log(SC) + B] Formula, =10^(LOG(G20)*$H$16+$H$17) Copy cell **H20**. Paste to range **H20:H34**.	
Estimated Ts seem plausible. Copy range **H19:H34**.	

Select XY chart. Paste special and add series, **T-estimated, ft²/d.** Add legend.	
Revise series, **T-estimated, ft²/d**, from markers to a solid line.