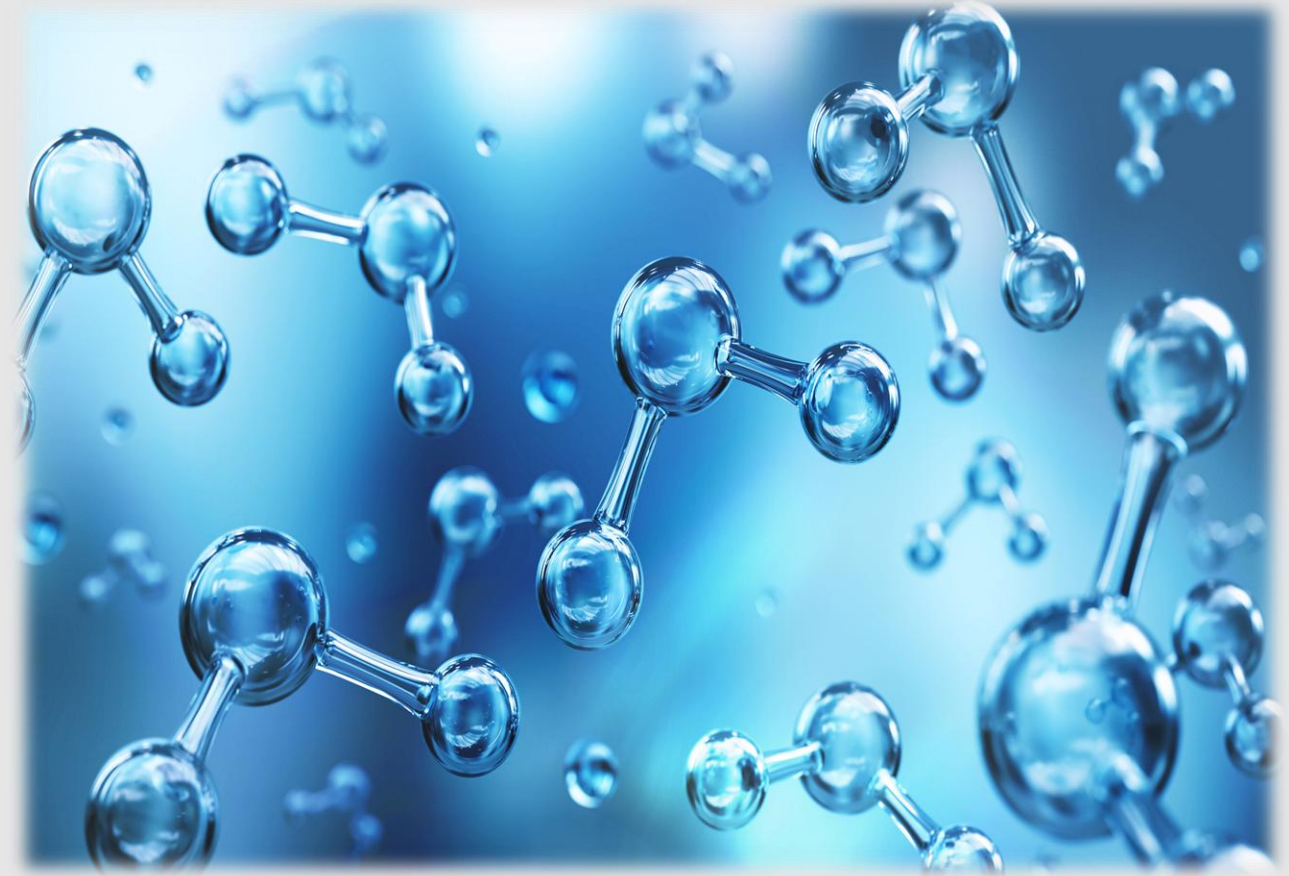




NOVEMBER MEETING

BUTLER COUNTY BREWING SOCIETY

WATER CHEMISTRY

Why should I think about brewing water?

- 90 - 95% of your ingredients
- Better mash performance
- Better tasting beer
 - Chloride – Emphasize malt character
 - Sulfate – Emphasize hop bitterness & crispness



Key Brewing Ions & Typical Ranges



Ion	Role	Common Range (ppm)
Calcium (Ca ²⁺)	Enzymes, flocculation, clarity, reduces mash pH	40–100
Magnesium (Mg ²⁺)	Yeast co-factor; too high can be harsh	5–30
Sodium (Na ⁺)	Enhances sweetness/body; too high tastes salty	0–50 (≤100 max)
Sulfate (SO ₄ ²⁻)	Sharpens dryness/bitterness; hop accentuation	50–300 (hoppy styles)
Chloride (Cl ⁻)	Enhances fullness/malt smoothness	50–150 (malty styles)
Bicarbonate (HCO ₃ ⁻)/Alkalinity	Buffers pH; supports dark grists; too much raises pH	As needed; keep low for pale beers



Beer Style	Ca ²⁺	Mg ²⁺	Na ⁺	SO ₄ ²⁻	Cl ⁻
Pilsner	60	8	16	90	60
Kolsch	50	10	16	70	70
Porter	130	10	16	70	90
IPA	110	18	16	275	50
NEIPA	100	18	16	100	200

WATER CHEMISTRY

*Sounds great
but how do I get
started?*



WATER CHEMISTRY

First step is to know what you're starting with

- **City Water Report**
 - Free
 - Might not have all the information you need
- **Water test kit**
 - Expensive ~\$300
- **Ward Labs**
 - Reasonable ~ \$58
 - Provides all necessary data



WATER CHEMISTRY

Butler County Brewing Society



pH	7.6
Total Dissolved Solids (TDS) Est, ppm	77
Electrical Conductivity, mmho/cm	0.13
Cations / Anions, me/L	1.4 / 1.1

	ppm
Sodium, Na	5
Potassium, K	< 1
Calcium, Ca	21
Magnesium, Mg	2
Total Hardness, CaCO ₃	61
Nitrate, NO ₃ -N	0.1 (SAFE)
Sulfate, SO ₄ -S	2
Chloride, Cl	4
Carbonate, CO ₃	< 1.0
Bicarbonate, HCO ₃	54
Total Alkalinity, CaCO ₃	45
Total Phosphorus, P	< 0.01
Total Iron, Fe	0.01

"<" - Not Detected / Below Detection Limit

Reviewed By : Raymond Ward

4/20/2018

Copy : 1

Page 1 of 1

Bus: 308-234-2418
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web site
www.wardlab.com

4007 Cherry Ave., P.O. Box 788
Kearney, Nebraska 68848-0788



WATER CHEMISTRY

Calculations for adjusting water

- **BeerSmith**
- **Brewers Friend**
- **Bru'n Water**
 - Excel spreadsheet
 - Free & Supporter's (donation) versions
 - Provides all necessary data
 - Designed for brewers by a brewer
 - <https://www.brunwater.com/>



Brewing Better Beer With Bru'n Water

0. Instructions 1. Water Report Input 2. Sparge Acidification 3. Grain Bill Input 4. Water Adjustment 5. Adjustment Summary 6. Data Manager Raw Text Summary Water Knowledge

Bru'n Water

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Instructions

Created by Martin Brungard, P.E. D.WRE. (mbrungard@hotmail.com)

Most water sources that have an acceptable taste can be used to brew beer. But to brew great beer across a wide variety of styles, adjustment of brewing water is probably needed. **Bru'n Water** is a brewing water analysis program that enables a brewer to successfully evaluate and modify their water supply to improve their beer. The program steps through the evaluation of a brewer's water supply, adjustment to a desired water profile, evaluation of potential mash pH, and adjustments to produce desirable mash pH.

Bru'n Water

Enter data into **Light Blue** cells, **Yellow** cells display calculated results, **Pink** cells contain selection

Program Volume Setting Gallons < Select

Water Report Input

Cation	Enter Ion Concentration from Water Report (mg/L or ppm)	Anion
Calcium (Ca)	0.0	Bicarbonate (HCO ₃)
Magnesium (Mg)	0.0	Chloride (Cl)
Sodium (Na)	0.0	Sulfate (SO ₄)
	0.0	

Optional Inputs (not required, but may improve ion balance)

Potassium (K)	0.0	
Iron (Fe)	0.0	

Calculated Alkalinity		
Alkalinity (ppm as CaCO ₃)	0	← This value is auto

Use the calculator below, only if your water report does not balance and you

Alkalinity Conversion Calculator		
Reported Alkalinity or Temporary Hardness (as CaCO ₃) (mg/L or ppm)	Reported or Measured Water pH	Estimated Bicarbonate Concentration (ppm)
0.0	7.0	0.0

Ion Concentration Conversion Calculator

Input Reporting Unit	Input	Output
Calcium (ppm as CaCO ₃)	0.0	0.0
Magnesium (ppm as CaCO ₃)	0.0	0.0
Bicarbonate (ppm as CaCO ₃)	0.0	0.0
Carbonate (ppm as CaCO ₃)	0.0	0.0
Sulfate (ppm as SO ₄ -S)	0.0	0.0
Nitrate (ppm as NO ₃ -N)	0.0	0.0
US Hardness (grains/gallon)	0.0	0.0
English (Clark) Hardness (grains/imp gal)	0.0	0.0
German Hardness (°dH) (degrees)	0.0	0.0
Karlsbad Hardness (°dKH) (degrees)	0.0	0.0
Calcium Hardness (mg/L) as (mval)	0.0	0.0
Alkalinity (mg/L) as (mval)	0.0	0.0
Convert (mg/L as ppt) to (mg/L as ppm)	0.0	0.00

Bru'n Water

Grain Bill Input

Enter data into **Light Blue** cells, **Yellow** cells display calculated results, **Pink** cells

Grains	Grain Type	Quantity (lb)	Quantity (oz)
2 Row Pale Malt	Base Malt	10.0	0.0
Munich	Base Malt	0.0	0.0
Crystal 40L	Crystal Malt	0.0	0.0
Special B	Crystal Malt	0.0	0.0
Carafa	Roast Malt	0.0	0.0
Chocolate	Roast Malt	0.0	0.0
Acid Malt	Acid Malt	0.0	0.0
	Base Malt	0.0	0.0
	Base Malt	0.0	0.0
	Base Malt	0.0	0.0
	Base Malt	0.0	0.0
	Base Malt	0.0	0.0
Enter grain names above to help verify that all the grist is entered			

Total Grist Weight (lbs)	10.0	Est. Beer Color (EBC)	0.0
Water to Grist Ratio (Qts/Lb)	1.50	Est. Beer Color (SRM)	3.5

Malt Color Setting	Lowibond
Water used for Mash	Adjusted Water

Mash pH Result

Estimated Room-Temperature Mash pH

5.70

Mash pH Guidance

Suggested mash pH range for lighter colored beers is 5.3 to 5.4
Suggested mash pH range for darker colored beers is 5.4 to 5.6
crisp beer styles may benefit from a mash pH range of 5.2 to 5.3

Bru'n Water v. 1.25

Water Profile Adjustment Calculator

Hover cursor over cells w/ red corner marks to display helpful information

Desired Water Profile	Calcium (ppm)	Magnesium (ppm)	Sodium (ppm)	Sulfate (ppm)	Chloride (ppm)	Bicarbonate (ppm)	Approximate Color Descriptors for Water Profiles	Batch Notes
Hoppy Pale Ale	140	18	25	300	55	110	Yellow: under 6 SRM	Insert any notes for the batch or the calculation here.
Existing Water Profile	24	14	32	45	38	95	Amber: 7 to 17 SRM	
Dilution Water Profile							Brown: 18 to 30 SRM	
Distilled Water	0	0	0	0	0	0	Black: over 31 SRM	
Percent Dilution Water	0	0	0	0	0	0	< These conversions are provided for your convenience	
Diluted Water Profile	24	14	32	45	38	95		
Target Finished Water Adjustment (ppm)	116	4	-7	255	17	15		
Actual Finished Water Adjustment (ppm)	117	0	0	258	17	-18		
Mashing Water Profile	141	14	32	303	55	77	Add Sparging Mineral Additions to the Mash	
Overall Finished Water Profile	141	14	32	303	55	NA		Finished SO ₄ /Cl Ratio 5.5

Estimated Mash pH	5.33	This pH value is NOT VALID until the grain information is properly entered for the beer on the Grain Bill Input sheet.	Total Water Additions		Total Batch Volume	
			Mash	Sparge		
			Water Volume (gal)	9.88	Water Volume (gal)	0.00
			Water Volume (gal)		Water Volume (gal)	6.00

Water Additions	Addition (gram/gal)	Calcium (ppm)	Magnesium (ppm)	Sodium (ppm)	Sulfate (ppm)	Chloride (ppm)	Bicarbonate (ppm)	Total Mineral Additions (mg/L)	Total Mineral Additions (mg/L)	
Minerals										
Gypsum (CaSO ₄ × 2H ₂ O)	1.75	107.6			258.0			17.29	0.00	
Calcium Chloride (CaCl ₂)	0.10	9.5				16.9		0.99	0.00	Anhydrous
Epsom Salt (MgSO ₄ × 7H ₂ O)	0.00		0.0		0.0			0.00	0.00	10.0
Magnesium Chloride (MgCl ₂ × 6H ₂ O)	0.00		0.0			0.0		0.00	0.00	Liquid CaCl ₂
Canning Salt (NaCl)	0.00			0.0		0.0		0.00	0.00	Liquid CaCl ₂ Solution
Baking Soda (NaHCO ₃)	0.00			0.0			0.0	0.00	Not Recommended	Yes
Chalk (CaCO ₃)	0.00	0.0				0.0		0.00	Not Recommended	No
Pickling Lime (Ca(OH) ₂)	0.00	0.0				0.0		0.00	Not Recommended	No
Sodium Metabisulfite (Na ₂ S ₂ O ₅)	0.00	< ppm		0.0	0.0			0.00	0.00	Add CaSO ₄ & Chalk & Lime

Acids	Addition	Sulfate (ppm)	Chloride (ppm)	Bicarbonate (ppm)	
Mash	(mL/gal)				
Phosphoric	0.00	Strength	88.0	%	0.0
	(mL/gal)				
Phosphoric	1.00	Strength	10.0	%	0.0
Sparge					
Phosphoric		Strength	10.0	%	0.0

Acid Anion Concentration

28 (ppm) Phosphate

99 (ppm) Phosphate

WATER CHEMISTRY

Bru'n Water – Water Report Input

- Enter data from your water report

- Ca
- Mg
- Na
- HCO_3
- SO_4
- Cl



WARD
Laboratories, Inc.

pH	7.6
Total Dissolved Solids (TDS) Est, ppm	77
Electrical Conductivity, mmho/cm	0.13
Cations / Anions, me/L	1.4 / 1.1

	ppm
Sodium, Na	5
Potassium, K	< 1
Calcium, Ca	21
Magnesium, Mg	2
Total Hardness, CaCO_3	61
Nitrate, $\text{NO}_3\text{-N}$	0.1 (SAFE)
Sulfate, $\text{SO}_4\text{-S}$	2
Chloride, Cl	4
Carbonate, CO_3	< 1.0
Bicarbonate, HCO_3	54
Total Alkalinity, CaCO_3	45
Total Phosphorus, P	< 0.01
Total Iron, Fe	0.01

*< - Not Detected / Below Detection Limit

Reviewed By : Raymond Ward 4/20/2018 Copy : 1 Page 1 of 1
Bus: 308-234-2418 web site: 4007 Cherry Ave., P.O. Box 788
Fax: 308-234-1940 www.wardlab.com Kearney, Nebraska 68848-0788

Bru'n Water David Ward

Program Volume Setting Gallons < Select

Enter Data into Light Blue cells, Yellow cells show Calculated results, Pink cells contain Selection boxes

Water Report Input Hover cursor over cells w/ red corner marks to display information

Cations	Enter Ion Concentrations from Water Report (mg/L or ppm)		Anions
Calcium (Ca)	16.4	65.0	Bicarbonate (HCO_3)
Magnesium (Mg)	21.0	2.6	Carbonate (CO_3)
Sodium (Na)	41.0	48.0	Sulfate (SO_4)
		70.0	Chloride (Cl)
Optional Inputs (not required, but may improve ion balance)		4.0	Nitrate (NO_3)
Potassium (K)	3.0	0.0	Nitrite (NO_2)
Iron (Fe)	0.0	0.0	Fluoride (F)

Boiled Water Calculator

Convert Water Inputs to Boiled Results? Click to Convert Select Boiling Effectiveness Setting

Ion Balance Results

Total Cations (meq/L) or (mval)	4.41	0.21	Cation/Anion Difference (meq/L)
Total Anions (meq/L) or (mval)	4.19	238	Total Dissolved Solids (TDS) (ppm)

Hardness and Alkalinity Results

Total Hardness, as CaCO_3 , (ppm)	127	58	Alkalinity (ppm as CaCO_3)
Permanent Hardness, as CaCO_3 , (ppm)	70	34	Residual Alkalinity (RA), (ppm as CaCO_3)
Temporary Hardness, as CaCO_3 , (ppm)	58		

WATER CHEMISTRY

Bru'n Water – Grain Bill Input

- Enter amount of all grains

- Name
- Type (base, crystal, roast, acid)
- Weight
- Color (Lovibond)

- Used to estimate pH

- Mash pH guidance
 - Lighter color beers 5.3 – 5.4
 - Darker color beers 5.4 – 5.6
 - Tart / crisp beers 5.2 – 5.3



	A	B	C	D	E	F
1	Bru'n Water		David Ward			
2	Batch Name:		BIAB Test - Double IPA			
3	Enter Data into Light Blue cells, Yellow cells show Calculated results, Pink cells contain Selection boxes					
4	Grain Bill Input		Hover cursor over cells w/ red corner marks to display helpful information			
5	Grains	Grain Type	Quantity (lb)	Quantity (oz)	Color (L)	Percentage of Grain Bill
6	2-Row	Base Malt	7.00	0.00	3.0	74.9
7	Munich	Base Malt	0.00	15.00	9.5	10.0
8	Honey Malt	Base Malt	0.00	7.50	25.0	5.0
9	Crystal 60	Crystal Malt	0.00	7.50	60.0	5.0
10	White Wheat	Base Malt	0.00	7.50	2.8	5.0
11		Base Malt	0.00	0.00	0.0	0.0
12		Base Malt	0.00	0.00	0.0	0.0
13		Base Malt	0.00	0.00	0.0	0.0
14		Base Malt	0.00	0.00	0.0	0.0
15		Base Malt	0.00	0.00	0.0	0.0
16	Enter grain names above to help	Base Malt	0.00	0.00	0.0	0.0
17	verify that all the grist is entered	Base Malt	0.00	0.00	0.0	0.0
18	Total Grist Weight (lbs)		9.34	Est. Beer Color (EBC)		16.3
19	Water to Grist Ratio (Qts/Lb)		2.50	Est. Beer Color (SRM)		8.3
20	Malt Color Setting	Lovibond	Remove Crystal Malts from Main Mash?		No	
21	Water used for Mash	Adjusted Water	Remove Roast Malts from Main Mash?		No	
22						
23	Mash pH Result					
24	Estimated Room-Temperature Mash pH					5.29
25	Acid Malt Strength Setting					
26	1					
27						
28	Bru'n Water v. 5.5		Mash pH Guidance Suggested mash pH range for lighter colored beers is 5.3 to 5.4 Suggested mash pH range for darker colored beers is 5.4 to 5.6 Tart or crisp beer styles may benefit from a mash pH range of 5.2 to 5.3			

WATER CHEMISTRY

Bru'n Water – Water Adjustments



- Enter total water volume
 - Mash
 - Sparge
 - Total batch

*For BIAB and all in one's
put the total water volume
in Mash.*

Bru'n Water								David Ward			
Batch Name:		LTHB Pale Ale									
Enter Data into Light Blue cells, Yellow cells show Calculated results, Pink cells contain Selection boxes											
Water Profile Adjustment Calculator											
Hover cursor over cells w/ red corner marks to display helpful information											
Desired Water Profile		Calcium (ppm)	Magnesium (ppm)	Sodium (ppm)	Sulfate (ppm)	Chloride (ppm)	Bicarbonate (ppm)	Approximate Color Descriptors for Water Profiles		Batch Notes	
Hoppy Pale Ale		140	18	25	300	55	110	Yellow: under 6 SRM		Insert any notes for the batch or the calculation here.	
Existing Water Profile		24	14	32	45	38	95	Amber: 7 to 17 SRM			
Dilution Water Profile								Brown: 18 to 30 SRM			
Distilled Water		0	0	0	0	0	0	Black: over 31 SRM			
Percent Dilution Water		0	0	oz/gal	0	pt/gal	< These conversions are provided for your convenience				
Diluted Water Profile		24	14	32	45	38	95				
Target Finished Water Adjustment (ppm)		116	4	-7	255	17	15				
Actual Finished Water Adjustment (ppm)		117	0	0	258	17	-18				
Mashing Water Profile		141	14	32	303	55	77	Add Sparging Mineral Additions to the Mash			
Overall Finished Water Profile		141	14	32	303	55	NA	Finished SO ₄ /Cl Ratio 5.5			
Estimated Mash pH		5.33	This pH value is NOT VALID until the grain information is properly entered for the beer on the Grain Bill Input sheet.								
Water Additions											
Minerals		Addition (gram/gal)	Calcium (ppm)	Magnesium (ppm)	Sodium (ppm)	Sulfate (ppm)	Chloride (ppm)	Bicarbonate (ppm)	Total Water Additions		Total Batch Volume
									Mash	Sparge	
									Water Volume (gal)	Water Volume (gal)	Water Volume (gal)
									9.88	0.00	6.00
									Total Mineral Additions (grams)		
Gypsum (CaSO ₄ × 2H ₂ O)		1.75	107.6			258.0			17.29	0.00	
Calcium Chloride (CaCl ₂)		0.10	9.5				16.9		0.99	0.00	Anhydrous
Epsom Salt (MgSO ₄ × 7H ₂ O)		0.00		0.0		0.0			0.00	0.00	10.0
Magnesium Chloride (MgCl ₂ × 6H ₂ O)		0.00		0.0			0.0		0.00	0.00	Liquid
Canning Salt (NaCl)		0.00			0.0		0.0		0.00	0.00	
Baking Soda (NaHCO ₃)		0.00			0.0			0.0	0.00	Not Recommended	Yes
Chalk (CaCO ₃)		0.00	0.0					0.0	0.00	Not Recommended	No
Pickling Lime (Ca(OH) ₂)		0.00	0.0					0.0	0.00	Not Recommended	No
Sodium Metabisulfite (Na ₂ S ₂ O ₅)		0.00	< ppm		0.0	0.0			0.00	0.00	



WATER CHEMISTRY

Bru'n Water – Water Adjustments

- Enter data

- Type of

- Hoppy

- Yellow

- Brown

- Black

- Location

- Pilsner

- Vienna

- Dunkel

- Custom

Bru'n Water

David Ward

Batch Name: LTHB Pale Ale

Enter Data into Light Blue cells, Yellow cells show Calculated results, Pink cells contain Setpoints

Water Profile Adjustment

Desired Water Profile

Hoppy Pale Ale

Existing Water Profile

Dilution Water Profile

Distilled Water

Percent Dilution Water

0

Diluted Water Profile

Target Finished Water Adjustment (ppm)

Actual Finished Water Adjustment (ppm)

Mashing Water Profile

Overall Finished Water Profile

Estimated Mash pH

5.33

Water Additions

Minerals

Addition (gram/gal)

Gypsum ($\text{CaSO}_4 \times 2\text{H}_2\text{O}$)

1.75

Calcium Chloride (CaCl_2)

0.10

Epsom Salt ($\text{MgSO}_4 \times 7\text{H}_2\text{O}$)

0.00

Magnesium Chloride ($\text{MgCl}_2 \times 6\text{H}_2\text{O}$)

0.00

Canning Salt (NaCl)

0.00

Baking Soda (NaHCO_3)

0.00

Chalk (CaCO_3)

0.00

Pickling Lime (Ca(OH)_2)

0.00

Sodium Metabisulfite ($\text{Na}_2\text{S}_2\text{O}_5$)

0.00

Bru'n Water

Batch Name: LTHB Pale Ale

Enter Data into Light Blue cells, Yellow cells show Calculated results, Pink cells contain Setpoints

Water Profile Adjustment Calculator

Hover cursor over cells

Desired Water Profile

Hoppy Pale Ale

Existing Water Profile

Dilution Water Profile

Distilled Water

Percent Dilution Water

0

Diluted Water Profile

Target Finished Water Adjustment (ppm)

Actual Finished Water Adjustment (ppm)

Mashing Water Profile

Overall Finished Water Profile

Calcium (ppm)	Magnesium (ppm)	Sodium (ppm)	Sulfate (ppm)	Chloride (ppm)	Bicarbonate (ppm)
140	18	25	300	55	110
24	14	32	45	38	95
0	0	0	0	0	0
0	oz/gal	0	pt/gal	< These conversions are	
24	14	32	45	38	95
116	4	-7	255	17	15
117	0	0	258	17	-18
141	14	32	303	55	77
141	14	32	303	55	NA
0.0	0.00	Not Recommended	No		
0.0	0.00	Not Recommended	No		
< ppm	0.0	0.0	0.00	0.00	

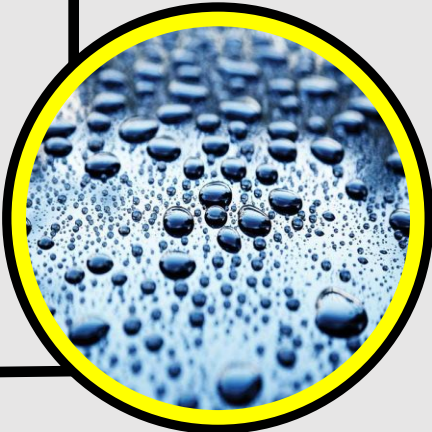


WATER CHEMISTRY

Bru'n Water – Water Adjustments



A		B	C	D	E	F	G	H	I	J	K	L	M	N				
Bru'n Water			David Ward															
Batch Name:		LTHB Pale Ale																
Enter Data into Light Blue cells, Yellow cells show Calculated results, Pink cells contain Selection boxes																		
Water Profile Adjustment Calculator																		
Hover cursor over cells w/ red corner marks to display helpful information																		
Desired Water Profile		Calcium (ppm)	Magnesium (ppm)	Sodium (ppm)	Sulfate (ppm)	Chloride (ppm)	Bicarbonate (ppm)	Approximate Color Descriptors for Water Profiles				Batch Notes						
Hoppy Pale Ale		140	18	25	300	55	110	Yellow: under 6 SRM				Insert any notes for the batch or the calculation here.						
Existing Water Profile		24	14	32	45	38	95	Amber: 7 to 17 SRM										
Dilution Water Profile								Brown: 18 to 30 SRM										
Distilled Water		0	0	0	0	0	0	Black: over 31 SRM										
Percent Dilution Water		0	0	oz/gal	0	pt/gal	< These conversions are provided for your convenience											
Diluted Water Profile		24	14	32	45	38	95											
Target Finished Water Adjustment (ppm)		116	4	-7	255	17	15											
Actual Finished Water Adjustment (ppm)		0	0	0	0	0	-18											
Mashing Water Profile		24	14	32	45	38	77	Add Sparging Mineral Additions to the Mash										
Overall Finished Water Profile		24	14	32	45	38	NA	Finished SO ₄ /Cl Ratio 1.2										
Estimated Mash pH		5.89	This pH value is NOT VALID until the grain information is properly entered for the beer on the Grain Bill Input sheet.										Total Water Additions		Total Batch Volume			
													Mash		Sparge			
Water Additions													Water Volume (gal)	9.88	Water Volume (gal)	0.00	Water Volume (gal)	6.00





Bru'n Water

David Ward

Batch Name: LTHB Pale Ale

Enter **Data** into **Light Blue** cells, **Yellow** cells show **Calculated** results, **Pink** cells contain **Selection** boxes

Water Profile Adjustment Calculator

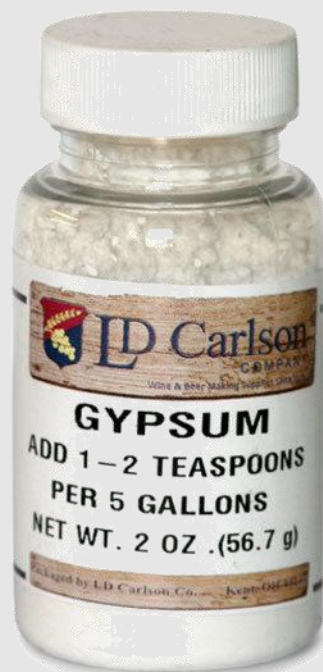
Hover cursor over cells w/ red corner marks to display helpful

Desired Water Profile	Calcium (ppm)	Magnesium (ppm)	Sodium (ppm)	Sulfate (ppm)	Chloride (ppm)	Bicarbonate (ppm)	Approximate Color Descriptors for Water Profiles	
Hoppy Pale Ale	140	18	25	300	55	110	Yellow: under 6 SRM	
Existing Water Profile	24	14	32	45	38	95	Amber: 7 to 17 SRM	
Dilution Water Profile							Brown: 18 to 30 SRM	
Distilled Water	0	0	0	0	0	0	Black: over 31 SRM	
Percent Dilution Water	0	oz/gal	0	pt/gal	< These conversions are provided for your convenience			
Diluted Water Profile	24	14	32	45	38	95		
Target Finished Water Adjustment (ppm)	116	4	-7	255	17	15		
Actual Finished Water Adjustment (ppm)	0	0	0	0	0	-18		
Mashing Water Profile	24	14	32	45	38	77		
Overall Finished Water Profile	24	14	32	45	38	NA		

Add Sparging Mineral Additions to the

								Total Water Additions			
Estimated Mash pH		5.89	This pH value is NOT VALID until the grain information is properly entered for the beer on the Grain Bill Input sheet.					Mash		Sparge	
Water Additions								Water Volume (gal)	9.88	Water Volume (gal)	0.00
Minerals	Addition (gram/gal)	Calcium (ppm)	Magnesium (ppm)	Sodium (ppm)	Sulfate (ppm)	Chloride (ppm)	Bicarbonate (ppm)	Total Mineral Additions (grams)	Total Mineral Additions (grams)		
Gypsum (CaSO ₄ × 2H ₂ O)	0.00	0.0			0.0			0.00	0.00		
Calcium Chloride (CaCl ₂)	0.00	0.0				0.0		0.00	0.00		
Epsom Salt (MgSO ₄ × 7H ₂ O)	0.00		0.0		0.0			0.00	0.00		
Magnesium Chloride (MgCl ₂ × 6H ₂ O)	0.00		0.0			0.0		0.00	0.00		
Canning Salt (NaCl)	0.00			0.0		0.0		0.00	0.00		
Baking Soda (NaHCO ₃)	0.00			0.0			0.0	0.00	Not Recommended		
Chalk (CaCO ₃)	0.00	0.0					0.0	0.00	Not Recommended		
Pickling Lime (Ca(OH) ₂)	0.00	0.0					0.0	0.00	Not Recommended		
Sodium Metabisulfite (Na ₂ S ₂ O ₅)	0.00	< ppm		0.0	0.0			0.00	0.00		

Gypsum



Bru'n Water

David Ward

Batch Name: LTHB Pale Ale

Enter **Data** into **Light Blue** cells, **Yellow** cells show **Calculated** results, **Pink** cells contain **Selection** boxes

Water Profile Adjustment Calculator

Hover cursor over cells w/ red corner marks to display helpful

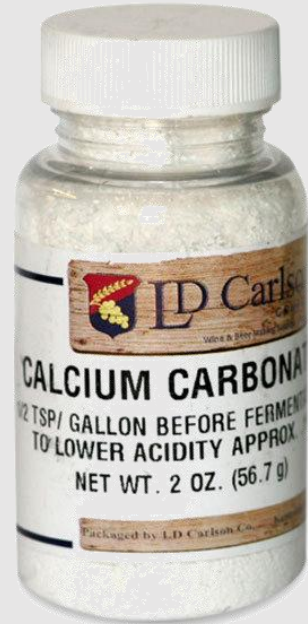
Desired Water Profile	Calcium (ppm)	Magnesium (ppm)	Sodium (ppm)	Sulfate (ppm)	Chloride (ppm)	Bicarbonate (ppm)	Approximate Color Descriptors for Water Profiles	
Hoppy Pale Ale	140	18	25	300	55	110	Yellow: under 6 SRM	
Existing Water Profile	24	14	32	45	38	95	Amber: 7 to 17 SRM	
Dilution Water Profile							Brown: 18 to 30 SRM	
Distilled Water	0	0	0	0	0	0	Black: over 31 SRM	
Percent Dilution Water	0	oz/gal	0	pt/gal	< These conversions are provided for your convenience			
Diluted Water Profile	24	14	32	45	38	95		
Target Finished Water Adjustment (ppm)	116	4	-7	255	17	15		
Actual Finished Water Adjustment (ppm)	0	0	0	0	0	-18		
Mashing Water Profile	24	14	32	45	38	77		
Overall Finished Water Profile	24	14	32	45	38	NA		

Add Sparging Mineral Additions to the F

								Total Water Additions			
Estimated Mash pH		5.89		This pH value is NOT VALID until the grain information is properly entered for the beer on the Grain Bill Input sheet.				Mash		Sparge	
Water Additions								Water Volume (gal)	9.88	Water Volume (gal)	0.00
Minerals	Addition (gram/gal)	Calcium (ppm)	Magnesium (ppm)	Sodium (ppm)	Sulfate (ppm)	Chloride (ppm)	Bicarbonate (ppm)	Total Mineral Additions (grams)	Total Mineral Additions (grams)		
Gypsum (CaSO ₄ × 2H ₂ O)	0.00	0.0			0.0			0.00	0.00		
Calcium Chloride (CaCl ₂)	0.00	0.0				0.0		0.00	0.00		
Epsom Salt (MgSO ₄ × 7H ₂ O)	0.00		0.0		0.0			0.00	0.00		
Magnesium Chloride (MgCl ₂ × 6H ₂ O)	0.00		0.0			0.0		0.00	0.00		
Canning Salt (NaCl)	0.00			0.0		0.0		0.00	0.00		
Baking Soda (NaHCO ₃)	0.00			0.0			0.0	0.00	Not Recommended		
Chalk (CaCO ₃)	0.00	0.0					0.0	0.00	Not Recommended		
Pickling Lime (Ca(OH) ₂)	0.00	0.0					0.0	0.00	Not Recommended		
Sodium Metabisulfite (Na ₂ S ₂ O ₅)	0.00	< ppm		0.0	0.0			0.00	0.00		



Calcium Chloride



Bru'n Water

David Ward

Batch Name: LTHB Pale Ale

Enter **Data** into **Light Blue** cells, **Yellow** cells show **Calculated** results, **Pink** cells contain **Selection** boxes

Water Profile Adjustment Calculator

Hover cursor over cells w/ red corner marks to display helpful

Desired Water Profile	Calcium (ppm)	Magnesium (ppm)	Sodium (ppm)	Sulfate (ppm)	Chloride (ppm)	Bicarbonate (ppm)	Approximate Color Descriptors for Water Profiles	
Hoppy Pale Ale	140	18	25	300	55	110	Yellow: under 6 SRM	
Existing Water Profile	24	14	32	45	38	95	Amber: 7 to 17 SRM	
Dilution Water Profile							Brown: 18 to 30 SRM	
Distilled Water	0	0	0	0	0	0	Black: over 31 SRM	
Percent Dilution Water	0	oz/gal	0	pt/gal	< These conversions are provided for your convenience			
Diluted Water Profile	24	14	32	45	38	95		
Target Finished Water Adjustment (ppm)	116	4	-7	255	17	15		
Actual Finished Water Adjustment (ppm)	0	0	0	0	0	-18		
Mashing Water Profile	24	14	32	45	38	77		
Overall Finished Water Profile	24	14	32	45	38	NA		

Add Sparging Mineral Additions to the

								Total Water Additions			
Estimated Mash pH		5.89		This pH value is NOT VALID until the grain information is properly entered for the beer on the Grain Mill Input sheet.				Mash		Sparge	
Water Additions								Water Volume (gal)	9.88	Water Volume (gal)	0.00
Minerals	Addition (gram/gal)	Calcium (ppm)	Magnesium (ppm)	Sodium (ppm)	Sulfate (ppm)	Chloride (ppm)	Bicarbonate (ppm)	Total Mineral Additions (grams)	Total Mineral Additions (grams)		
Gypsum (CaSO ₄ × 2H ₂ O)	0.00				0.0			0.00	0.00		
Calcium Chloride (CaCl ₂)	0.00	0.0				0.0		0.00	0.00		
Epsom Salt (MgSO ₄ × 7H ₂ O)	0.00		0.0		0.0			0.00	0.00		
Magnesium Chloride (MgCl ₂ × 6H ₂ O)	0.00		0.0			0.0		0.00	0.00		
Canning Salt (NaCl)	0.00			0.0		0.0		0.00	0.00		
Baking Soda (NaHCO ₃)	0.00			0.0			0.0	0.00	Not Recommended		
Chalk (CaCO ₃)	0.00	0.0					0.0	0.00	Not Recommended		
Pickling Lime (Ca(OH) ₂)	0.00	0.0					0.0	0.00	Not Recommended		
Sodium Metabisulfite (Na ₂ S ₂ O ₅)	0.00	< ppm		0.0	0.0			0.00	0.00		



Hover cursor over cells w/ red corner marks to display help

Desired Water Profile		Calcium (ppm)	Magnesium (ppm)	Sodium (ppm)	Sulfate (ppm)	Chloride (ppm)	Bicarbonate (ppm)	Approximate Color Descriptors for Water Profiles		Insert any notes about the water
Hoppy Pale Ale		140	18	25	300	55	110	Yellow: under 6 SRM		
Existing Water Profile		24	14	32	45	38	95	Amber: 7 to 17 SRM		
Dilution Water Profile								Brown: 18 to 30 SRM		
Distilled Water		0	0	0	0	0	0	Black: over 31 SRM		
Percent Dilution Water	0	0	oz/gal	0	pt/gal	< These conversions are provided for your convenience				
Diluted Water Profile		24	14	32	45	38	95			
Target Finished Water Adjustment (ppm)		116	4	-7	255	17	15			
Actual Finished Water Adjustment (ppm)		117	0	0	258	17	-18			
Mashing Water Profile		141	14	32	303	55	77	Add Sparging Mineral Additions to the		
Overall Finished Water Profile		141	14	32	303	55	NA			
								Total Water Additions		
Estimated Mash pH		5.33	This pH value is NOT VALID until the grain information is properly entered for the beer on the Grain Bill Input sheet.					Mash		Sparge
								Water Volume (gal)	9.88	Water Volume (gal) 0.00
Water Additions										
Minerals	Addition (gram/gal)	Calcium (ppm)	Magnesium (ppm)	Sodium (ppm)	Sulfate (ppm)	Chloride (ppm)	Bicarbonate (ppm)	Total Mineral Additions (grams)	Total Mineral Additions (grams)	
Gypsum (CaSO ₄ x 2H ₂ O)	1.75	107.6			258.0			17.29	0.00	
Calcium Chloride (CaCl ₂)	0.10	9.5				16.9		0.99	0.00	
Epsom Salt (MgSO ₄ x 7H ₂ O)	0.00		0.0		0.0			0.00	0.00	
Magnesium Chloride (MgCl ₂ x 6H ₂ O)	0.00		0.0			0.0		0.00	0.00	
Canning Salt (NaCl)	0.00			0.0		0.0		0.00	0.00	
Baking Soda (NaHCO ₃)	0.00			0.0			0.0	0.00	Not Recommended	
Chalk (CaCO ₃)	0.00	0.0					0.0	0.00	Not Recommended	
Pickling Lime (Ca(OH) ₂)	0.00	0.0					0.0	0.00	Not Recommended	
Sodium Metabisulfite (Na ₂ S ₂ O ₅)	0.00	< ppm		0.0	0.0			0.00	0.00	
Acids	Addition				Sulfate (ppm)	Chloride (ppm)	Bicarbonate (ppm)			
Mash	(mL/gal)	Mash Acid Strength parameters are entered below						Total Acid Addition (ml)		
Phosphoric	0.00	Strength	88.0	%	0.0	0.0	0.0	0.00		
	(mL/gal)							Total Acid Addition (ml)		
Phosphoric	1.00	Strength	10.0	%	0.0	0.0	-17.6	9.88		

RESOURCES

Water: A Comprehensive Guide for Brewers – by John Palmer & Colin Kaminski

<https://www.brewerspublications.com/collections/all-books/products/water-a-comprehensive-guide-for-brewers>

How to Brew – by John Palmer

<https://www.brewerspublications.com/collections/all-books/products/how-to-brew-everything-you-need-to-know-to-brew-great-beer-every-time>

Ward Laboratories, Inc. – Water analysis

<https://www.wardlab.com/product/water-test-kit/>

Bru'n Water – Water adjustment software

<https://www.brunwater.com/download>



QUESTIONS?

