WATERVAULT
Tokenized Water Rights

Water Index Formula Informational Summary

The primary aim of WaterVault tokens, which signify ownership stakes in a portfolio of water rights, is to offer institutions and high net worth individuals an efficient avenue to capitalize on the ongoing drought in the Western United States. The fundamental structure of this innovative financial vehicle is outlined below.

SEVERAL FACTORS CONTRIBUTE TO THE INTRICACY OF ACQUIRING AND HOLDING WATER RIGHTS:

- Water rights transactions occur within decentralized and fragmented markets, distinct from openly traded commodities
- Transparent and openly accessible marketplaces for water rights are lacking
- The valuation of water rights varies significantly depending on their location and specific attributes
- Historical data pertaining to water rights is limited and accessible only through a handful of specialized sources

For effective portfolio valuation, many assets require periodic pricing verification. WaterVault aims to address this need by developing an index utilizing available data sources. This index will enable pricing of the portfolio using a basket of comparable water rights transactions.

Implemented as a weighted index, the WaterVault method takes into consideration various factors including population density, anticipated regional growth, transaction volume in acre-feet, and monetary value.

While the index will not directly price individual assets within a portfolio, it will significantly contribute to portfolio valuation. It will serve as a benchmark, provide data points for valuation models, and offer valuable market insights to inform investment decisions, thus ensuring accurate portfolio valuation.

The core formula calculates the weighted average of the prices of agricultural water rights and municipal water based on the number of observations in each category. This ensures that the index reflects the relative importance of each type of water pricing based on the number of sales in each category in the seven fastest-growing counties. This formula is further refined and adjusted based on additional factors such as the volume of water associated with each sale and other relevant factors that might influence the pricing index. Adding the volume of water using a mean average to determine variables can be incorporated into the core formula by regression analysis.

Formulas for Portfolio Valuations

Step 1: Volume-Weighted Average Price Calculation
First, calculate the volume-weighted average price for agricultural water rights (X) and municipal water (Y). Let V_x and V_Y represent the mean volume of water associated with each sale for agricultural water rights and municipal water, respectively.

$$\text{Volume-Weighted Average Price} = \frac{(X \times V_X \times n_X) + (Y \times V_Y \times n_Y)}{V_X \times n_X + V_Y \times n_Y}$$

Step 2: Regression Analysis
Perform regression analysis to assess the relationship between the prices of water rights (both agricultural and municipal) and relevant factors such as location, county growth rate, water scarcity, etc. This analysis will help capture any underlying trends or correlations that affect water prices.

Step 3: Incorporating Regression Analysis
Incorporate the results of the regression analysis into the pricing index. The regression analysis may yield coefficients that indicate how much each factor influences the water prices. Let's denote these coefficients as β_X for agricultural water rights and β_Y for municipal water.

$$\text{Price Index} = \beta_0 + \beta_X \times X + \beta_Y \times Y$$

Step 4: Final Pricing Index
Combine the volume-weighted average price calculation with the regression analysis to create the final pricing index:

$$\text{Final Pricing Index} = \frac{(X \times V_X \times n_X) + (Y \times V_Y \times n_Y)}{V_X \times n_X + V_Y \times n_Y} \times (\beta_0 + \beta_X \times X + \beta_Y \times Y)$$

This final pricing index incorporates both the volume of water associated with each sale and the results of the regression analysis, providing a comprehensive measure of the pricing dynamics for water rights in the portfolio, considering both agricultural and municipal water. Adjustments to this formula may be necessary based on specific requirements and additional factors affecting water prices in the region.

The regression analysis incorporating the average percentage growth rate of the seven fastest-growing counties in the state and the national weather bureau's prediction for the probability of a drought in the coming year, the following is a suggested format a multiple regression model.

Let:
- X = Price per acre-foot of state agricultural water rights
- Y = Price per acre-foot of municipal water
- G = Average percentage growth rate of the 7 fastest-growing counties in the state
- D = Probability of a drought in the coming year (from the national weather bureau's prediction)

The multiple regression model can be represented as:

$$\text{Price Index} = \beta_0 + \beta_X \times X + \beta_Y \times Y + \beta_G \times G + \beta_D \times D + \epsilon$$

Where:

- β_0 is the intercept.
- β_X, β_Y, β_G, and β_D are the regression coefficients for X, Y, G, and D respectively.
- ϵ is the error term.

Estimate the regression coefficients (β_0, β_X, β_Y, β_G, β_D) using historical data on water prices, average growth rates, and drought probabilities. Once these coefficients are estimated, you use them to predict the pricing index based on the values of X, Y, G, and D.

The interpretation of the coefficients would demonstrate how each variable contributes to the pricing index. For example, if β_G is positive, it suggests that higher growth rates in the counties tend to increase water prices, all else being equal. Similarly, if β_D is positive, it implies that higher probabilities of drought increase water prices.

The multiple regression model allows assessing the combined impact of multiple factors on water prices, providing a useful measure of the relationship between water pricing and variables such as county growth rates and drought probabilities.

Formulas for Acquisitions

Given that the price of an acquisition must be 50% less than the cost of acquisition, we can use the given assumptions and define some variables.

- Purchase price of the asset as P
- Cost of acquisition (including transportation and filtration costs) as C
- P is the price per acre-foot of agricultural water as a percentage of the mean price of municipal water per acre-foot in the state.
- C represents the total cost of acquisition, transportation, and filtration.

Given these assumptions, we can represent P and C mathematically:

$$P = \frac{P_{agricultural}}{P_{municipal}}$$

C = Cost of acquisition + Transportation costs + Quality filtration costs

To show that the price of acquisition (P) must be 50% less than the cost of acquisition (C), we need to express this relationship mathematically:

$$P = \frac{1}{2} C$$

To further express P and C in terms of the given parameters, we can write:

$$P = \frac{P_{agricultural}}{P_{municipal}}$$

C = Cost of acquisition + Transportation costs + Quality filtration costs

Now, let's focus on P:

$$P_{agricultural} = P_{municipal} \times P$$

Now, substituting this expression for $P_{agricultural}$ in C:

C = Cost of acquisition + Transportation costs + Quality filtration costs

Since we want to show that P must be 50% less than C:

$\frac{1}{2}$ C = Cost of acquisition + Transportation costs + Quality filtration costs