Minimize Water Usage (Arc 3.4151)

(The analysis below was extracted from one of the assessment reports by the Clemson University Industrial Assessment Center (IAC). This is only an example recommendation and hence, not all the background information and sources for numbers are included here.)

Est. Water Usage Savings	= ***259,200 gallon/yr***
Water Usage cost savings	= ***$ 1,166 /yr***
Est. Total Cost Savings	= ***$ 1,116 /yr***
Est. Implementation Cost	= ***$ 100***
Simple Payback Period	= ***1.03 months***

Recommended Action:
It is recommended that the plant minimizes the water used on site for the purposes of dust suppression. This can be done with the use of a hose water time to limit the amount of time water is being used. It is also recommended that the sprinkler heads be moved lower to the ground, so they are not spraying water on the raw material before it is processed.

Background:
The facility currently uses four sprinkler heads on the corners of the raw materials bin for the purposes of dust suppression and to be following the South Carolina Department of Health and Environmental Control (SC DHEC) dust control plan for asphalt plants. This is an area heavily used by the front-end loader, so dust emissions can become an issue without appropriate control.
The requirements for the BMP plan from SC DHEC state that "the owner/operator shall maintain dust control of the premises and any roadway it owns or controls by paving, or other suitable measures" (S.C. Regulation 61-62.5 Standard No. 4, Section X.B). Currently, the plant is leaving the sprinklers on during all hours that the plant is in operation even if materials are not being moved on the roadway. It was noted during the site visit that using this amount of water is resulting in a constant source of runoff into the plant's detention pond.
It is recommended that a hose timer be installed. The plant will need to experiment with how much time the water should be on and off to keep the pavement wet especially in different seasons and weather conditions. It seems feasible, however, that running the water for five minutes and stopping it for ten would be enough time to wet the pavement and a short enough interval in between cycles that the pavement would not dry out enough for dust to be an issue.
Along with these recommendations, it is also advised that the sprinkler heads be moved down in height, so they are not spraying into the raw material bins. This is currently causing the aggregate about to be processed to have a higher moisture content and therefore require more energy to process.

Anticipated Savings:
For the anticipated savings of this recommendation, the average water usage for the current sprinklers was estimated at 0.54 gallons per minute for each sprinkler head. This value was determined using the referenced sprinkler head flow values table for sprinkler heads that were spraying between a 120°-180° arc and between an 8-10 feet radius. The average flow for each of these values was averaged and found to be 0.54 gallons per minute for each of the four sprinkler heads. This equates to an equivalent water use of 129.6 gal/hr for all four of the sprinklers.

Current Annual Water Usage = 129.6 gal/hr × 3000 hr

Current Annual Water Usage = 388,800 gal

This seems like a reasonable water usage considering the plant uses around 580,000 gallons per year. Water is not used anywhere else in the hot-mix asphalt process, so around 67% of the plants total water consumption seems like a reasonable estimate.

It was assumed that the sprinklers could be operated for 5 minutes at a time and then turned off for 10 minutes using a hose timer. This seems like a reasonable amount of time for the pavement to become wet while the sprinklers are operating and a small enough time in between cycles that the pavement would not become completely dry again. The timer could be changed based on varying seasons, temperatures, and weather patterns as the plant sees fit.

Because it was assumed that the sprinklers would be operated in intervals where they are running for 5 minutes and then off for 10 minutes, this means that the time reduction for running water would be 40 minutes every hour. The new operational hours accounting for the time reduction in running water can be calculated as

Water usage hours with time reduction = 3000 hrs − (3000 hrs × 40 min/60 min)

Water usage hours with time reduction = 1000 hrs

The annual water usage assuming the sprinklers are replaced with low flow sprinkler heads and operated for the reduced time intervals is

Annual Water Usage = 129.6 gal/hr × 1000 hr

Low Flow Annual Water Usage = 129,600 gal

Annual Water Savings = 388,800 − 129,600 = 259,200 gal

The plant pays $4.50 per thousand gallons of water used so the annual cost savings if this recommendation is implemented is calculated as

Annual Cost Savings = (388,800 gal/yr × 0.0045 $/gal) − (129,600 gal/yr × 0.0045 $/gal)

Annual Cost Savings = $1,166

<u>Implementation Cost</u>:
The only cost for this recommendation would be the purchase of a hose time which would be around $60. Assuming it would take 1-2 hours to install the hose timer, an additional $40 will be added to the implementation cost for labour bringing the total to $100.

Simple Payback Period:
Using the estimated $100 for implementation, the *simple payback period* (SPP) is calculated below by dividing the *total cost savings* (TCS) by the *implementation cost* (IC).

$$SPP = \frac{IC}{TCS} \times 12\ months/year$$

$$SPP = \frac{\$100}{\$1{,}166/yr} \times 12\ months/year$$

SPP = 1.03 months

References:

1. Sprinkler Head Flow Table: https://rightscapenow.com/how-do-i/calculate-how-much-water-my-irrigation-system-uses