These computations are based on Rational Method applying a basic equation as follows:

Rational Equation: Q=ciA

WHERE :

Q = Peak discharge in CFS
c = Rational method runoff coefficient
i = Rainfall intensity in INCH/HR
A = Drainage area in ACRE

ASSUMPTIONS ABOUT SUBJECT SITE AND ASSIGNMENT OF COEFFICIENTS:

For this particular project the drainage area is assumed to be localized to the footprint of the site since it is either higher than the immediately adjacent ground or involves a structure impervious area. The swale is considered a closed retention area for purposes of this analysis.

For pre-development and post development conditions the point of site discharge is assumed to be at the southeast spot on the plan where the brush line is shown as a prominence and is representative of an interruption in brush line for access to an existing pathway to the back area.

The selection of the two runoff coefficients is based on readily available table data from several sources online. The following table was found through a Google search.

Ground Cover	**Runoff Coefficient, c**
Lawns	0.05 - 0.35
Forest	0.05 - 0.25
Cultivated land	0.08-0.41
Meadow	0.1 - 0.5
Parks, cemeteries	0.1 - 0.25
Unimproved areas	0.1 - 0.3
Pasture	0.12 - 0.62
Residential areas	0.3 - 0.75
Business areas	0.5 - 0.95
Industrial areas	0.5 - 0.9
Asphalt streets	0.7 - 0.95
Brick streets	0.7 - 0.85
Roofs	0.75 - 0.95
Concrete streets	0.7 - 0.95

Runoff Computations are needed for both the Pre-Development and the Post Development conditions. The overall site is taken to be the open lawn area surrounding the original buildings extending to the mowed edge (brush line of vegetative forest area). The overall site area for the pre-development to the brush line is 28,472 SF. For the proposed salt shed to fit on the site the south edge needs to be pushed further south expanding the post development overall site area to 35,380 SF essentially just outside the proposed haybale line.

The Pre-Development Condition includes four Original Buildings on Piers with impervious roofs but open crawl space beneath the buildings allowing flow of runoff under the buildings in heavy precipitation conditions. The pre-development coverage of impervious includes and an Asphalt Driveway and Parking Area along the edge of travel way that drains toward and flows along the edge of travel way eastward then off the roadway into the wetlands.

Assigned Rational Method Runoff Coefficient for Original Buildings on Piers is .50
Assigned Rational Method Runoff Coefficient for the Driveway and Parking Area is .80
Assigned Rational Method Runoff Coefficient for the remainder of the lawn site is .35

Drainage area for Original Buildings on piers 4170 SF = 0.096 ACRE
Drainage area for the remainder of site is 28,472 SF minus the area of the asphalt driveway and parking area 2812 SF and minus the area considered for the original buildings 4170 SF equaling 21,490 SF = 0.493 ACRE

The Post Development Condition includes the proposed Salt Shed and Asphalt Apron surrounding the shed structure. Since the north side of the shed structure will have an asphalt apron and driveway draining toward Airport Road and the existing parking area along the edge of travel way will be preserved, the computations for the impervious Asphalt Driveway and Parking Area are adjusted for the proposed and are considered to perform in the same way in Post development as it did in Pre-Development.

Assigned Rational Method Runoff Coefficient for the Salt Shed roof and Asphalt Apron is .95
Assigned Rational Method Runoff Coefficient for the Retention Swale is .50
Assigned Rational Method Runoff Coefficient for remainder of the site lawn area is .35
Assigned Rational Method Runoff Coefficient for Driveway and Parking Area is .80

Drainage area for the Salt Shed roof and asphalt apron around the shed is 8816 SF = 0.202 AC
Drainage area for swale considered at top is 3461 SF = 0.079 ACRE
Drainage area of adjusted Asphalt Driveway and Parking Area is 2789 SF
Drainage area for remainder of site is the overall expanded site of 35,380SF minus the salt shed and apron areas, minus the asphalt driveway and parking area, and minus the proposed swale area which is counted separately –(8816 + 2789 + 3461) equaling 20,314 SF = 0.466 ACRE.

RUNOFF COMPUTATIONS: Q = ciA

For the Pre-Development Condition Q Total will equal the summation of the runoff from the site impervious and lawn areas. The runoff from the asphalt driveway and parking area at edge of travel way is not counted in since this flow does not enter the subject site but flows along the edge of travel way east on Airport Road to enter the wetlands more directly approximately 90 feet away. Therefore the runoff computations will include only what is generated on the actual site ignoring only the measured area of asphalt driveway and parking area which in each case of the pre and post development is nearly the same at 2812 SF and 2789 SF respectively.

PRE-DEVELOPMENT RUNOFF COMPUTATIONS:

Q = ciA(Bldngs) + ciA(Lawn)

TWO YEAR STORM: For intensity equivalent to 4 INCH Rain in 24 HR period = 0.17 IN / HR

Q = (0.5 x 0.17 IN/HR x 0.096 ACRE) + (0.35 x .17 x 0.493) = 0.0374935 CFS

TEN YEAR STORM: For intensity equivalent to 6 INCH Rain in 24 HR period = 0.21 IN / HR

Q = (0.5 x 0.21 IN/HR x 0.096 ACRE) + (0.35 x .21 x 0.493) = 0.0463155 CFS

100 YEAR STORM: For intensity equivalent to 9.8 INCH Rain in 24 HR period = 0.31 IN / HR

Q = (0.5 x 0.31 IN/HR x 0.096 ACRE) + (0.35 x .31 x 0.493) = 0.0683705 CFS

POST DEVELOPMENT RUNOFF COMPUTATIONS:

Q = ciA(Salt Shed & Asphalt Apron) + ciA(Retention Swale) + ciA(Remaining Lawn)

TWO YEAR STORM: For intensity equivalent to 4 INCH Rain in 24 HR period = 0.17 IN / HR

Q = (0.95 x 0.17IN/HR x 0.202 AC) + (0.50 x 0.17 x 0.079) + (0.35 x 0.17 x 0.466) = 0.067065 CFS

TEN YEAR STORM: For intensity equivalent to 6 INCH Rain in 24 HR period = 0.21 IN / HR

Q = (0.95 x 0.21IN/HR x 0.202 AC) + (0.50 x 0.21 x 0.079) + (0.35 x 0.21 x 0.466) = 0.082845 CFS

100 YEAR STORM: For intensity equivalent to 9.8 INCH Rain in 24 HR period = 0.31 IN / HR

Q = (0.95 x 0.31IN/HR x 0.202 AC) + (0.50 x 0.31 x 0.079) + (0.35 x 0.31 x 0.466) = 0.122295 CFS

RUNOFF ANALYSIS:

The peak discharge rate post development exceeds the pre-development as follows:

TWO YEAR STORM:	0.067065 – 0.0374935 = 0.0295712 CFS	= 2555 CF in 24 hours
TEN YEAR STORM:	0.082845 – 0.0463155 = 0.036845 CFS	= 3184 CF in 24 hours
100 YEAR STORM:	0.122295 -0.0683705 = 0.0539245 CFS	= 4659 CF in 24 hours

These peak discharge rates and total volumes for a given 24 hour storm event are based on conservative runoff coefficients whereas a relatively high coefficient was selected for the lawn that is known to be in hydrologic Group A well drained soils consisting of coarse sand at 3 to 4 foot depth. An analysis was performed in consideration of the capability of the soils for recharge by infiltration and based on the use of the minimum transmission rate of 0.30 IN /HR derived from the Small Urban Hydrology Guide for the subject site soils the infiltration rates exceeded the peak discharge rate for steady rainfall type events over the full 24 hour period.

If recharge by means of infiltration is taken into account then a substantial amount of the peak discharge volume for each of the storm events being analyzed would be expected to recharge into the soil before having the chance to runoff except perhaps for a burst effect of high intensity rainfall in a short time. In order to accommodate such a burst of rain that would have very little time of concentration before runoff occurred due to the size and nature of the salt shed structure, the City will incorporate the proposed swale design as shown on the design plan. Presently if recharge was not considered, the swale capacity of 2800 CF will be sufficient to hold the entire two year storm event and will hold most of the ten year event with minor topping. The 100 year storm event or an equivalent high intensity burst event would likely fill the swale in a short time. The net effect with respect to runoff is that the swale will act to attenuate sheet flow by retaining the burst volume and allowing slower runoff flow as the swale is breached.