To elaborate on my previous comment:

Mannings equation is found at the link posted.

V is velocity in feet per second.

R is the hydraulic radius which is the area (sq ft) divided by the wetted perimeter. Wetted perimeter (P, feet) is the contact boundary length between the water and the conduit.

S is the slope of the conduit units of feet of fall per foot of run.

The capacity of a conduit is Q=A*V in cubic feet per second.

This can be applied to both the gutters and the pipe.

Storm duration for gutters is generally the 5 minute storm. House gutters are generally sized for a 10 year storm (10% chance in a given year.) For water harvest this may not be critical, but may be an appropriate design storm. Note that the home gutter trade typically uses rule of thumb to determine gutter size. (Based on square footage coming to the downspout) This link provides some data for rainfall. http://www.rain-gutter-guide.com/gutter-design.html Roof area in square feet times the intensity divided by 21,600 will provide the cfs. (12"/ft * 3600 seconds/hr)

So, to determine pipe size to carry the water from the gutter, you need to know the gutter capacity and/or the capacity to push water out of the gutter at the downspout. The latter is orifice flow. (Q=.06*A*sq rt (64.4*h)) (all units in A is sq ft, h is ft(depth of gutter), and Q is cfs) Use the smaller of Mannings flow or the orifice flow.

For round pipe, the maximum flow is at about 0.94 times the diameter (D). However, the small reduction is not worth the effort for a layman to calculate P. I put the area of the pipe into both sides of Mannings equation to have Q=1.486/n*A*R^0.67*S^0.5.

The capacity of a pipe is dependent only on the slope when at the water is just filling the pipe as the area and wetted perimeter are fixed. So the 1.486/n*A*R^0.67 becomes constant. Since n for PVC is best used at 0.012, the following table allows the square root of the slope times the constant (K) to determine the capacity of the pipe.

The table below should cover most applications needed for rainfall harvest.

Diameter, inches	Area, Sq ft	P, Ft	R	K
1	0.005	0.262	0.021	0.051
1.25	0.009	0.327	0.026	0.093
1.5	0.012	0.393	0.031	0.151
1.75	0.017	0.458	0.036	0.227
2	0.022	0.524	0.042	0.325
2.25	0.028	0.589	0.047	0.445
2.5	0.034	0.654	0.052	0.589
2.75	0.041	0.720	0.057	0.759
3	0.049	0.785	0.063	0.957
3.25	0.058	0.851	0.068	1.185
3.5	0.067	0.916	0.073	1.444
3.75	0.077	0.982	0.078	1.736
4	0.087	1.047	0.083	2.062
4.25	0.099	1.113	0.089	2.423
4.5	0.110	1.178	0.094	2.823
4.75	0.123	1.244	0.099	3.260
5	0.136	1.309	0.104	3.738
5.25	0.150	1.374	0.109	4.258
5.5	0.165	1.440	0.115	4.820
5.75	0.180	1.505	0.120	5.426
6	0.196	1.571	0.125	6.079

Show a 2" pipe on a slope of 0.008 ft per ft would have a Q of 0.325*sq rt(0.008)=0.029 cfs (times 448.8 gallons/minute/cfs = 13.0 gpm)

If you need 0.2 cfs and your slope is .01 ft/ft, then 0.2/sq rt(0.01)=2 (K) and you would need a 4" pipe.

A similar K table can be built for the gutter styles that are readily available in an area. The typically house gutter has architectural features that make determining A and P a bit of a challenge, but possible. For harvesting water, using the rectangular area (bottom times depth) and 2*depth plus width of the bottom for P would get you in the ball park.

If you have 4 times the pipe diameter in the initial vertical pipe after the gutter, then pressure flow is a more likely happening.

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