

**Solar Carports for Chilton Medical Center
Pequannock Township, NJ**

Stormwater Management Strategy - Executive Summary, August 19, 2021, revised October 15, 2021

Background:

The PQ is located at 97 West Parkway and is also known as Block 2401, Lots 15 & 16; Block 2402, Lots 1, 2, 3, & 4, Pequannock Township, Morris County, NJ. It is presently occupied by a 4-story hospital, outpatient and medical office buildings, and appurtenant parking. The PQ is surrounded by residential development to the north, forested areas to the south, Pequannock Township High School to the east, and commercial nurseries to the west. The Project seeks to install six (6) solar panel arrays (carports), consisting of foundations, columns, a racking system, solar panels, and an electrical distribution system. These arrays will be placed in parking areas servicing the building. Solar energy captured by the carports will be converted to AC current via column-mounted inverters and wired back to the building's electrical room. Storm water runoff from the carports will be captured by an integral gutter system and conveyed via downspouts to an underground collection manifold ultimately connecting to nearby catch basins. LED lights will be mounted under the carport canopies to provide lighting after dark for parking and security.

Design Requirements:

Storm Water Management design is regulated pursuant to the New Jersey Storm Water Regulations at NJAC 7:8. These Regulations govern the minimum performance standards required storm water management design based upon whether the project is a "Major" development. Projects classified as Major developments must meet Groundwater Recharge, Stormwater Runoff Quality, and Stormwater Runoff Quantity standards at NJAC 7:8-5.4, 5.5, and 5.6 respectively.

"Major development" means an individual "development," as well as multiple developments that individually or collectively result in:

1. The disturbance of one or more acres of land since February 2, 2004;
2. The creation of one-quarter acre or more of "regulated impervious surface" since February 2, 2004;
3. The creation of one-quarter acre or more of "regulated motor vehicle surface" since March 2, 2021; or
4. A combination of 2 and 3 above that totals an area of one-quarter acre or more. The same surface shall not be counted twice when determining if the combination area equals one-quarter acre or more.

Since the Project proposes to disturb less than one acre of land and creates virtually no new impervious surface, the Project does not constitute a Major development. Therefore, storm water management shall be designed to safely mitigate and convey storm water runoff from the Project site. An existing subsurface drainage system is in place and functions adequately. The installation of carports over the currently paved parking areas does not increase the stormwater generated, does not increase regulated impervious surface except for an inconsequential 203 SF, does

not increase regulated motor vehicle surface, does not increase stormwater pollutant loading, does not alter land use, and does not change vegetative cover.

In accordance with Senate Bill 921, approved by the New Jersey Legislature on April 22, 2010, (area of) solar panels shall not be included in the calculation of proposed impervious cover at the site. However, any bases, foundations or mounting structures for the solar panels shall be counted in the proposed impervious cover calculation for the site.

Since the carport installation will be located within the floodplain, additional design considerations must be addressed, namely the Flood Hazard Control Act at NJAC 7:13. Provisions set forward in NJAC 7:13-7.30 Permit-by-Rule 30 – Placement of Solar Panels and Associated Equipment state “Permit-by-rule 30 authorizes the placement of solar panels and associated equipment, provided the conditions at N.J.A.C. 7:13-6.7 are met and:

1. No panels and associated equipment are placed in a floodway;
2. The existing ground elevation is not raised in any floodway or fluvial flood hazard area;
3. Except for vertical support poles, all panels, cross-bracing, and other structural components, and all associated equipment are elevated to at least one foot above the flood hazard area design flood elevation. This permit-by-rule does not authorize the placement of solar panels that rely on ballast systems or concrete foundations for support;
4. No disturbance is located within 25 feet of any top of bank, unless the project lies adjacent to a lawfully existing bulkhead, retaining wall, or revetment along a tidal water or impounded fluvial water; and
5. Any clearing, cutting and/or removal of riparian zone vegetation is limited to actively disturbed areas.”

Both the conditions at NJAC 7:13-6.7 Conditions applicable to a Permit-by-Rule and those stated above for the Permit by Rule are met. The Applicant shall apply for a Permit-by-Rule 30 for the installation of the carport canopies as depicted on the site plans.

Design Approach:

The PQ presently contains subsurface drainage in the parking field in front of the hospital. This system also includes underground storage. At the rear of the hospital, only a very small portion of the surface area is captured by subsurface drainage, around the rear circulation drive. The vast majority of the parking field conveys runoff as sheet flow, flowing north to south, and discharges over the edge of pavement to a large, vegetated area. For both these areas, the carports will be placed within paved areas and the associated runoff will be captured by an integral gutter connected to a downspout. For portions of the paved areas with subsurface drainage, these downspouts will be connected to a manifold pipe system ultimately tying into nearby catch basins. For the majority of the rear parking field, downspouts will instead discharge via a “bubbler” system intended to mimic existing drainage patterns. This will avoid issues of concentrated flow from the carport runoff, and preserve a more uniform sheet flow as currently exists. For analysis, runoff from the largest carport draining to a manifold has been calculated using the Rational Method utilizing the 25-year storm event. The manifold collecting runoff from the various connected downspouts has been sized using Manning’s Equation to confirm adequate capacity based on pipe size and material, roughness coefficient, and slope.

In the case of the “bubbler” systems, the largest area contributing to the downspouts is considered. Refer to the attached calculations and maps for supporting documentation.

Conclusion:

The anticipated storm water runoff from the carports will be captured and safely conveyed to the existing subsurface drainage system onsite via the proposed conveyance piping and via a “bubbler” system intended to mimic existing sheet flow. There is a negligible increase to impervious area (203 SF) which will not create a perceptible increase to runoff rates or volumes.

Please feel free to contact our office directly with any questions or comments at (732) 221-8066 or via email to jszabo@partneresi.com.

Very truly yours,

PARTNER ENGINEERING AND SCIENCE, INC.



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Peak flow calculations for Chilton Medical Center:

Using Rational Method to determine peak flow:

$$C = 0.99$$

$i = 5.71$ in/hr (25 year, 10 minute storm, Per "NOAA ATLAS 14 POINT PRECIPITATION FREQUENCY ESTIMATES" attached)

$$A = 0.28 \text{ ac. (Per Site Plan, Array A1, 41.5'x298.5')}$$

$$Q (\text{peak}) = CiA = 1.58 \text{ cfs}$$

$$Q(\text{max, 10" PVC @ 1.0\%}) = 2.85 \text{ cfs (Per attached Manning Equation calculation)}$$

Impervious area calculation for existing and proposed conditions:

Existing impervious area = 18.51 ac. (806,116 SF) (based on CAD)

Tract area = 40.33 ac.

Existing impervious coverage = 45.9%

Proposed impervious area increase = One 1' radius utility pole, 2 proposed 10'x10' concrete pad = 203SF (0.005AC.)

Proposed impervious coverage = 45.9%



NOAA Atlas 14, Volume 2, Version 3
Location name: Pompton Plains, New Jersey,
USA*

Latitude: 40.9588°, Longitude: -74.3104°

Elevation: 185.94 ft**

* source: ESRI Maps

** source: USGS



POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M. Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

[PF_tabular](#) | [PF_graphical](#) | [Maps_&_aerials](#)

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches/hour) ¹										
Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	4.10 (3.73-4.51)	4.90 (4.45-5.39)	5.81 (5.28-6.40)	6.46 (5.84-7.08)	7.27 (6.56-7.97)	7.86 (7.07-8.62)	8.41 (7.52-9.22)	8.94 (7.96-9.80)	9.59 (8.46-10.5)	10.0 (8.80-11.0)
10-min	3.24 (2.95-3.57)	3.87 (3.52-4.26)	4.59 (4.17-5.05)	5.09 (4.61-5.59)	5.71 (5.15-6.26)	6.14 (5.52-6.73)	6.55 (5.86-7.18)	6.91 (6.16-7.58)	7.36 (6.50-8.09)	7.66 (6.72-8.44)
15-min	2.68 (2.44-2.95)	3.21 (2.92-3.54)	3.82 (3.47-4.21)	4.25 (3.85-4.66)	4.76 (4.30-5.22)	5.13 (4.61-5.62)	5.47 (4.90-6.00)	5.78 (5.14-6.34)	6.15 (5.43-6.76)	6.40 (5.61-7.04)
30-min	1.81 (1.65-1.99)	2.19 (2.00-2.41)	2.68 (2.43-2.95)	3.03 (2.75-3.33)	3.47 (3.13-3.80)	3.79 (3.41-4.15)	4.10 (3.67-4.49)	4.39 (3.91-4.82)	4.77 (4.21-5.24)	5.03 (4.41-5.54)
60-min	1.12 (1.02-1.23)	1.36 (1.24-1.50)	1.70 (1.55-1.88)	1.96 (1.77-2.15)	2.29 (2.06-2.51)	2.54 (2.28-2.78)	2.79 (2.50-3.06)	3.04 (2.71-3.34)	3.37 (2.98-3.71)	3.62 (3.17-3.98)
2-hr	0.687 (0.626-0.752)	0.836 (0.762-0.918)	1.06 (0.962-1.16)	1.23 (1.12-1.35)	1.47 (1.32-1.60)	1.66 (1.49-1.81)	1.85 (1.65-2.02)	2.06 (1.82-2.25)	2.34 (2.05-2.56)	2.57 (2.22-2.81)
3-hr	0.514 (0.471-0.564)	0.625 (0.572-0.686)	0.792 (0.723-0.868)	0.921 (0.838-1.01)	1.10 (0.995-1.20)	1.24 (1.12-1.36)	1.39 (1.24-1.52)	1.55 (1.37-1.68)	1.76 (1.54-1.92)	1.93 (1.67-2.11)
6-hr	0.336 (0.309-0.368)	0.408 (0.375-0.446)	0.515 (0.472-0.563)	0.602 (0.549-0.656)	0.725 (0.657-0.788)	0.827 (0.744-0.898)	0.936 (0.835-1.01)	1.05 (0.929-1.14)	1.22 (1.06-1.32)	1.35 (1.17-1.47)
12-hr	0.209 (0.190-0.231)	0.254 (0.231-0.281)	0.322 (0.293-0.355)	0.379 (0.343-0.417)	0.463 (0.415-0.507)	0.534 (0.475-0.584)	0.611 (0.538-0.667)	0.696 (0.606-0.760)	0.821 (0.701-0.895)	0.928 (0.780-1.01)
24-hr	0.118 (0.110-0.129)	0.143 (0.132-0.156)	0.182 (0.168-0.198)	0.215 (0.198-0.234)	0.264 (0.241-0.286)	0.305 (0.277-0.331)	0.351 (0.316-0.381)	0.402 (0.358-0.436)	0.477 (0.419-0.519)	0.541 (0.469-0.589)
2-day	0.070 (0.065-0.075)	0.084 (0.078-0.091)	0.107 (0.099-0.116)	0.126 (0.116-0.136)	0.153 (0.141-0.165)	0.176 (0.161-0.190)	0.201 (0.182-0.217)	0.227 (0.205-0.246)	0.266 (0.236-0.289)	0.299 (0.262-0.325)
3-day	0.049 (0.045-0.053)	0.059 (0.055-0.064)	0.075 (0.069-0.080)	0.087 (0.081-0.094)	0.106 (0.098-0.114)	0.121 (0.111-0.131)	0.138 (0.126-0.149)	0.156 (0.141-0.168)	0.182 (0.162-0.197)	0.203 (0.179-0.221)
4-day	0.038 (0.036-0.041)	0.046 (0.043-0.050)	0.058 (0.054-0.063)	0.068 (0.063-0.073)	0.082 (0.076-0.088)	0.094 (0.086-0.101)	0.107 (0.097-0.115)	0.120 (0.109-0.129)	0.139 (0.124-0.150)	0.156 (0.137-0.169)
7-day	0.026 (0.024-0.028)	0.031 (0.029-0.033)	0.038 (0.036-0.041)	0.045 (0.042-0.048)	0.053 (0.049-0.057)	0.061 (0.056-0.065)	0.068 (0.063-0.073)	0.076 (0.070-0.082)	0.088 (0.079-0.095)	0.098 (0.087-0.106)
10-day	0.021 (0.020-0.022)	0.025 (0.023-0.027)	0.030 (0.029-0.032)	0.035 (0.033-0.037)	0.041 (0.038-0.044)	0.046 (0.043-0.049)	0.052 (0.048-0.055)	0.057 (0.053-0.061)	0.065 (0.059-0.070)	0.071 (0.064-0.077)
20-day	0.014 (0.013-0.015)	0.017 (0.016-0.018)	0.020 (0.019-0.021)	0.022 (0.021-0.024)	0.026 (0.024-0.027)	0.028 (0.027-0.030)	0.031 (0.029-0.033)	0.034 (0.031-0.036)	0.037 (0.035-0.040)	0.040 (0.037-0.043)
30-day	0.012 (0.011-0.012)	0.014 (0.013-0.015)	0.016 (0.015-0.017)	0.018 (0.017-0.019)	0.020 (0.019-0.021)	0.022 (0.021-0.023)	0.024 (0.022-0.025)	0.025 (0.024-0.027)	0.027 (0.026-0.029)	0.029 (0.027-0.031)
45-day	0.010 (0.009-0.010)	0.012 (0.011-0.012)	0.013 (0.013-0.014)	0.015 (0.014-0.015)	0.016 (0.016-0.017)	0.018 (0.017-0.019)	0.019 (0.018-0.020)	0.020 (0.019-0.021)	0.021 (0.020-0.023)	0.023 (0.021-0.024)
60-day	0.009 (0.008-0.009)	0.010 (0.010-0.011)	0.012 (0.011-0.013)	0.013 (0.012-0.014)	0.014 (0.014-0.015)	0.015 (0.015-0.016)	0.016 (0.015-0.017)	0.017 (0.016-0.018)	0.018 (0.017-0.019)	0.019 (0.018-0.020)

¹ Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

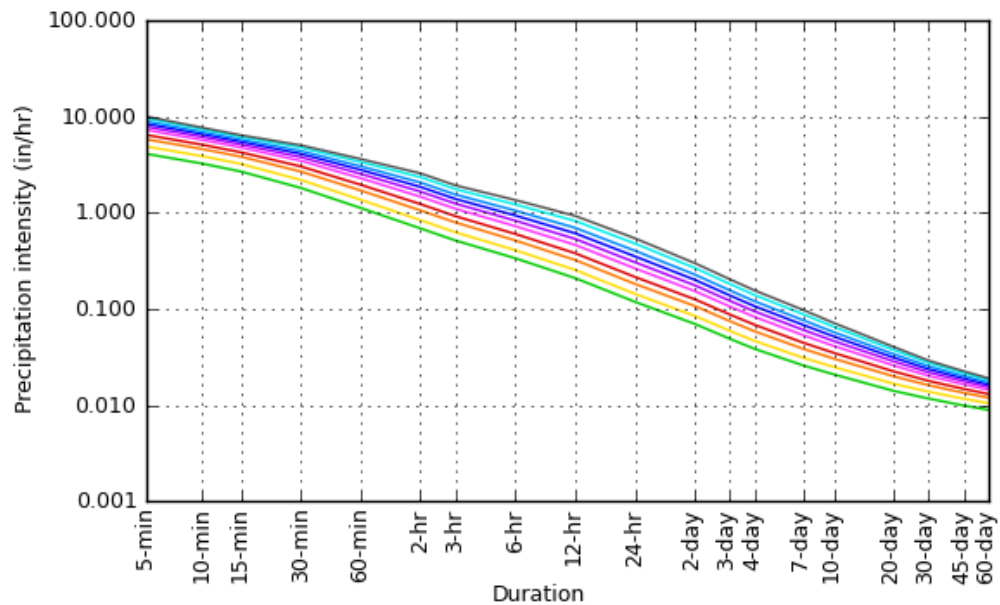
Please refer to NOAA Atlas 14 document for more information.

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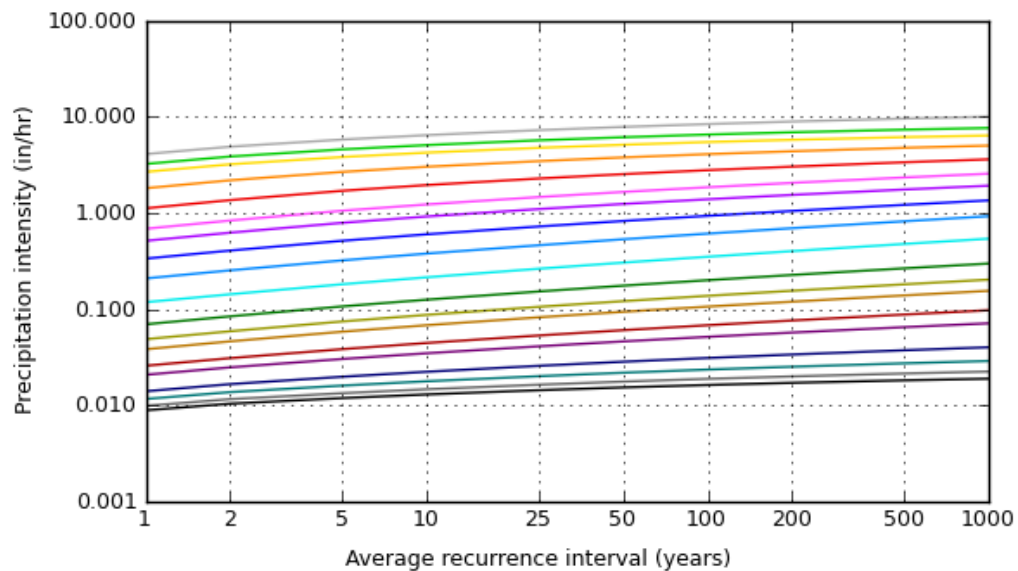
PF graphical

PDS-based intensity-duration-frequency (IDF) curves

Latitude: 40.9588°, Longitude: -74.3104°



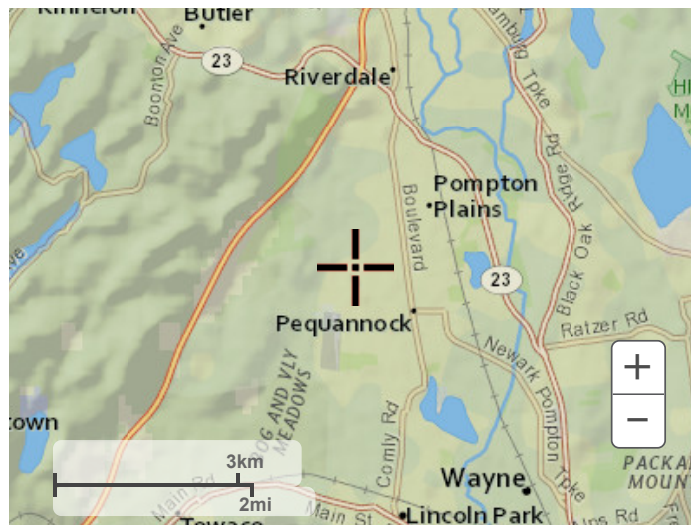
Average recurrence interval (years)
1
2
5
10
25
50
100
200
500
1000



Duration
5-min
10-min
15-min
30-min
60-min
2-hr
3-hr
6-hr
12-hr
24-hr
2-day
3-day
4-day
7-day
10-day
20-day
30-day
45-day
60-day

Maps & aerials

Small scale terrain



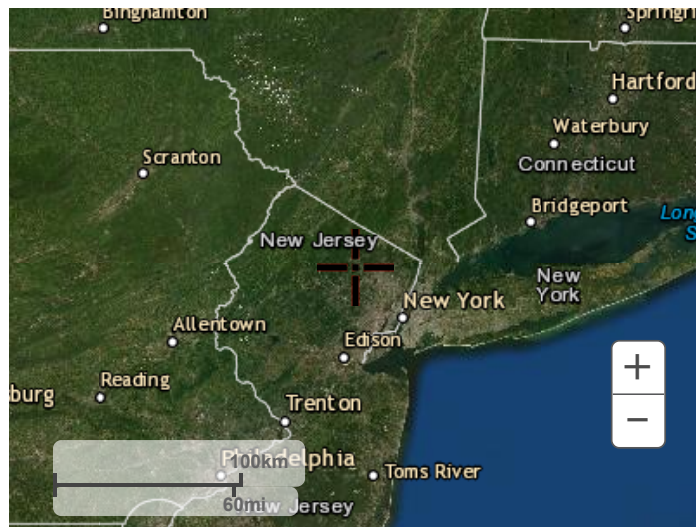
Large scale terrain



Large scale map



Large scale aerial



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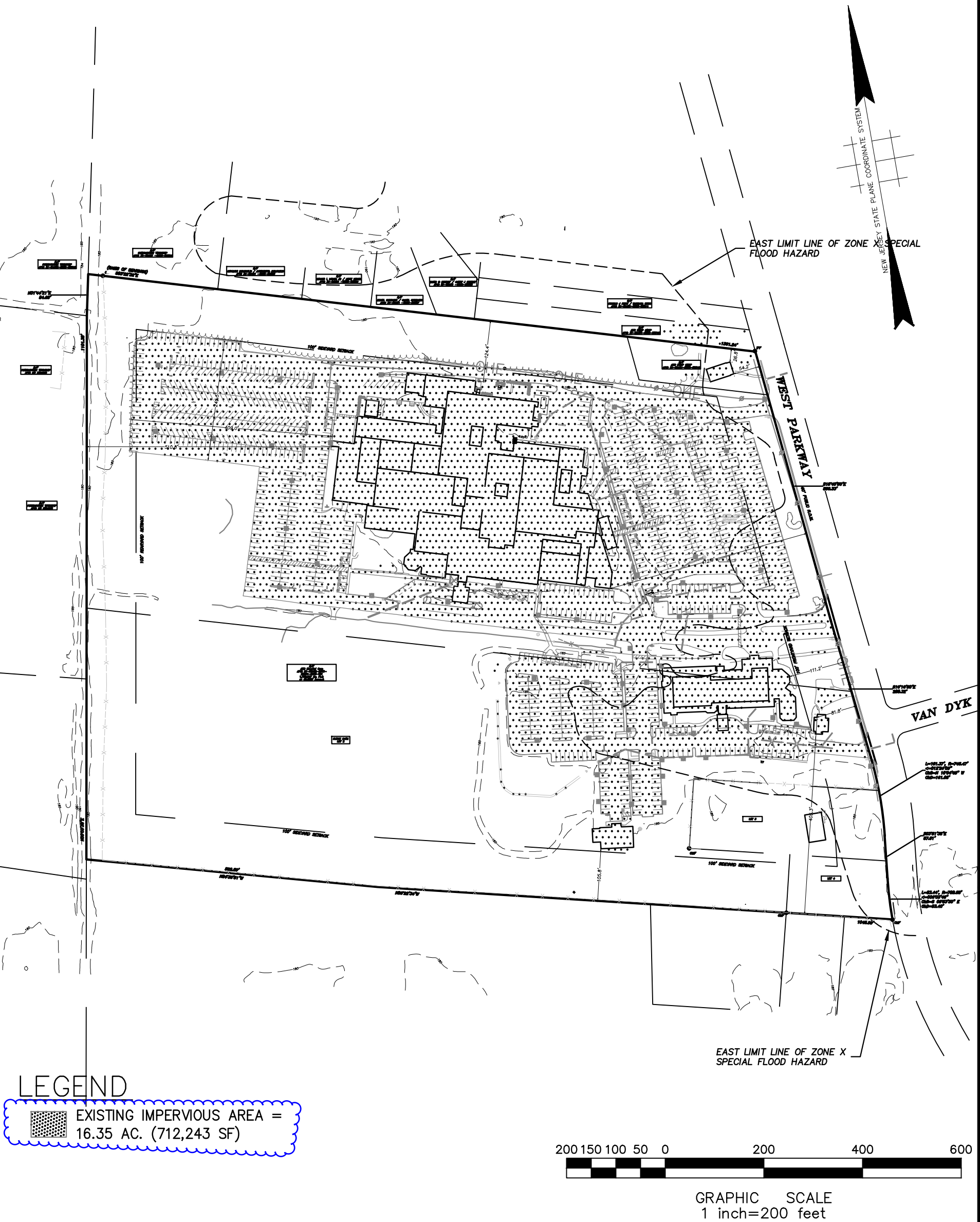
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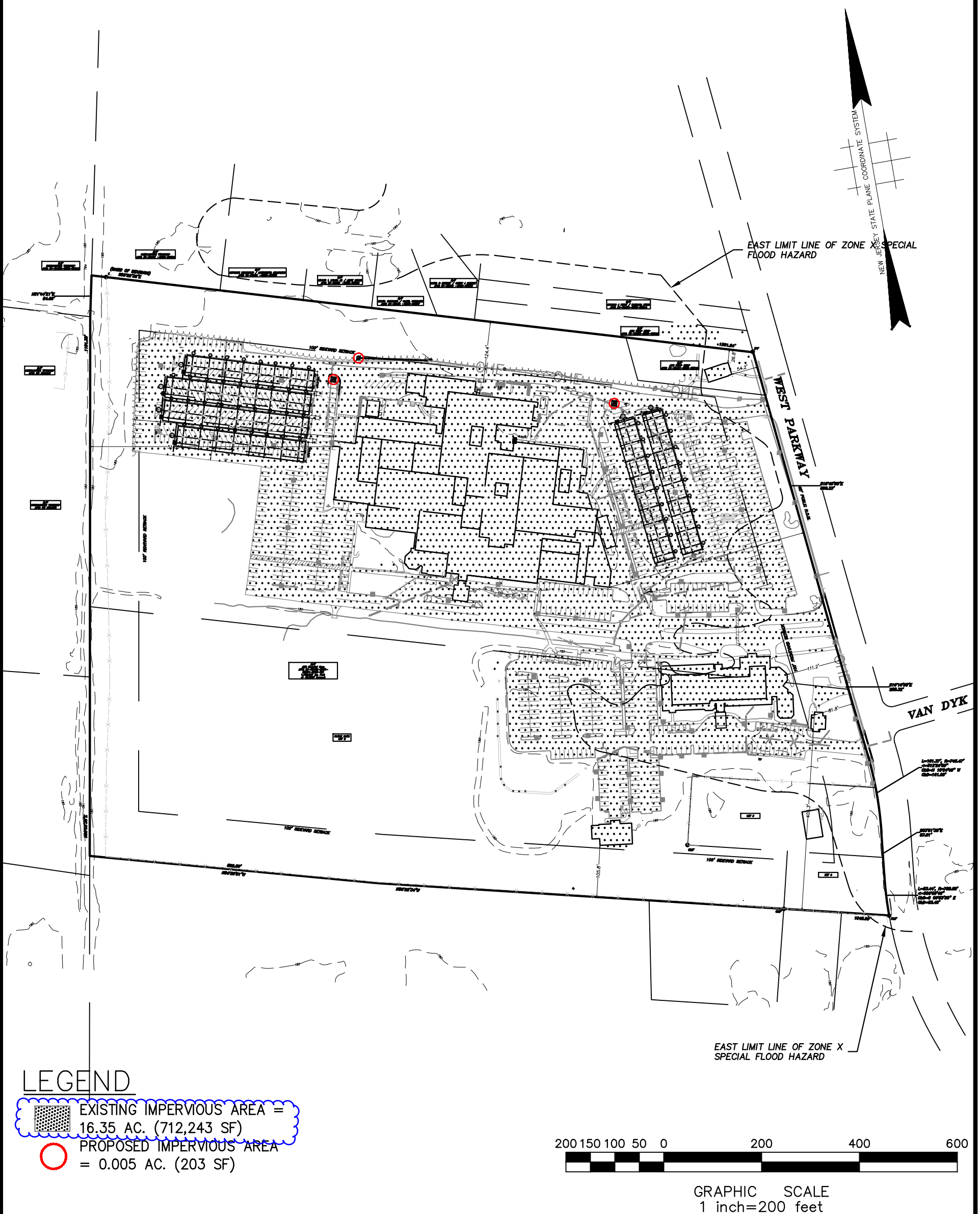
Manning Equation - Chilton Medical Center

Pipe size (inches)	10
Material	PVC
"n"	0.01
slope (%)	1.00

Pipe Q (full) (cfs)	2.85
Pipe Q (full) (gpm)	1278
Velocity (fps)	5.22
Pipe Q (Half Full) (cfs)	1.42
Pipe Q (Half Full) (gpm)	639

Area (sf)	0.545415391
Perimeter (ft)	2.617993878
Hydraulic radius	0.208333333
R ^{2/3}	0.351430277
S	0.01
S ^{1/2}	0.1





**PROPOSED IMPERVIOUS AREAS
MAJOR SITE PLAN
SOLAR CARPOTS FOR CHILTON MEDICAL CENTER
BLOCK 2401, LOTS 15 & 16; BLOCK 2402, LOTS 1,2,3,4**

SITUATED IN
TOWNSHIP OF PEQUANNOCK, MORRIS COUNTY, NEW JERSEY

Drawing Name:
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Drawn
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JS

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JS

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JS

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Job No.
003 - 20 -003

Date
08/19/2021

Scale:(H) 1"=200'
(V) N/A

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