APPENDIX G
WATER RESOURCES REPORT

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with

STORM WATER MANAGEMENT REPORT

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APPENDIX G
WATER RESOURCES REPORT

Outline

	Page
1.0 GROUNDWATER	1
1.1 Existing Conditions	1
1.1.1 Volume	1
1.1.2 Quality	4
1.2 Construction Impacts	6
1.2.1 Volume	6
1.2.2 Quality	6
1.3 Operation Impacts	6
1.3.1 Volume	6
1.3.2 Quality	6
2.0 SURFACE WATER	10
2.1 Existing Conditions	10
2.1.1 Volume	10
2.1.2 Quality	10
2.2 Construction Impacts	10
2.2.1 Volume	10
2.2.2 Quality	12
2.3 Operation Impacts	12
2.3.1 Parameters	12
2.3.2 Methodology	12
2.3.3 Concentrations in Runoff and Receiving Water	14
2.3.4 Effects	14
2.3.4.1 Water Quality Standards	14
2.3.4.2 Eutrophication	18
2.3.4.3 Use	18
3.0 REFERENCES CITED	21
Annex A: Stormwater Management Plan (by Raymond Keyes Engineers, PC)	

1.0 GROUNDWATER

1.1 Existing Conditions

1.1.1 Volume

The glacial sands on the site provide a potential groundwater aquifer. The uniform nature of this unit is demonstrated by the results of the test boring program reported in detail in Appendix F, "Soils Report". This uniformity and the dune geomorphology which is apparent on the topographic map (Sheet T-1) indicate the prevalence of aeolian processes in creating the surficial sand unit on the site from glacial lake sands.

Davis de DeWiest (1966) discuss the general properties of dune sand:

> "The dune sand is very well sorted with most grains in the 0.05 to 0.5 millimeter size range. Median sizes are generally within the 0.1 to 0.3 millimeter size range...Dune sand has about the most uniform hydrogeologic properties of any type of waterbearing material. Porosity will be between 35 and 40% and permeability between 5 and 50 darcys with a median of perhaps 25 darcys. Scant data suggest that the specific yield should be between 35 and 38%...Aquifers of dune sand are not widely utilized because wells that prevent entrance of the loose sand are difficult to construct by standard practices, because permeable dune sand may drain rapidly and saturated zones are not present in many dunes, and, finally, because active dune areas are not favorable for habitation. Despite these drawbacks, dune areas are favorable for water development because of high recharge rates, good water quality, and moderately high permeabilities".

The dune sands on the site have been stabilized by vegetation and are not active.

The sands on the site are fine-grained (Table 1) with geometric mean grain size of 0.16 mm and a logarithmic standard deviation of 0.59. Based on the empirical formula of Krumbein and Monk (1943), such sands have a permeability expressed by:

$$k = 760\ d^{*2}\ e^{-1.31s}$$

where

- k is permeability in darcys
- d^* is the geometric mean diameter in millimeters
- e is the dimensionless constant 2.718
- s is the $\log_2$ standard deviation of size distribution which is dimensionless

and 760 is a constant for the conversion of permeability units to darcys

TABLE 1

GRAIN SIZE ANALYSIS OF 3 SAMPLES
FROM THE PROJECT SITE

SIZE (mm)	PERCENTAGE			AVERAGE PERCENTAGE
	SAMPLE 1	SAMPLE 2	SAMPLE 3	
0.075	5	5	9	6.33
0.150	16	18	16	16.67
0.200	40	44	40	41.33
0.400	34	30	30	31.33
0.500	5	3	0	2.67
0.600	0	0	5	1.67

Source: Edinger, 1978, Plate 2

Accordingly, the permeability of the sands on the site is 9 darcys or 165 gallons per day per square foot cross sectional area at unit hydraulic gradient.

The test borings made in July, 1978, encoutered groundwater elevations ranging from approximately 280 feet above mean sea level to 240 feet above mean sea level, at depths of 0-40 feet in the central portions of the site. In the southeastern corner of the site, the headwaters of the Krum Kill intercept the groundwater table at elevation 234. The wetland on the site has at its lowest point an elevation of about 255 feet above mean sea level. Although only one boring completely penetrated the sand unit and the underlying impermeable glacial lake clay unit to an underlying till unit, it is believed that the entire site is underlain by an aquitard of glacial lake clays. There is no evidence to indicate the presence of any confined aquifer on the site The elevation (220') of the lake clay is lower than the regional average, perhaps due to post-depositional deformation during a glaciel readvance (Dineen, 1979, personal communication) and may not be at a uniform elevation throughout the site.

Groundwater elevations (see Appendix F, "Soils Report") establish the groundwater gradient on the site (Figure 1)as 0.02 ft/ft.

Groundwater enters the site from the northwest and leaves towards the south along the New York State Thruwey. The polygon marked ABCDE in Figures 1 and 2 can be considered as the area of influence of the project. Along AE, the average daily inflow based on observed water levels and the calculated permeability is approximately 415,800 gallons per day through a saturated zone 60' in depth and 2100 feet wide. Along BC, the average daily outflow is about 54,450 gallons per day through a saturated zone 15' in depth and 1100 feet wide. On an annual basis therefore, inflow is estimated at 152 million gallons and outflow is 19.9 million gallons. The difference of 132 million gallons per year reflects groundwater discharge through runoff and evapotranspiration.

Normal precipitation over the area defined by ABCDE (140 acres) amounts to 33.36 inches per year which results in the approximate volume of 127 million gallons per year. Losses of water have been computed from the Thornthwaite equation (Chow; 1964) .

The computed monthly relationship of evapotranspiration to precipitation is indicated in Figure 3. As the figure indicates evapotranspiration losses exceed precipitation during the summer and there is a depletion of soil moisture. The annual evapotranspiration loss is approximately 24.83 inches, which, over the area of ABCDE, amounts to 94 million gallons per year. The net water resource volume for the area ABCDE therefore, may be computed as the difference between groundwater inflow plus precipitation minus groundwater outflow and evapotranspiration. This volume is approximately 165 million gallons per year. Runoff can be determined as the difference between precipitation and evapotranspiration. Using normal precipitation values, the runoff is 8.5 inches per year or 32.3 million gallons per year. Using mean precipitation values (36.55 inches) runoff is 11.7 inches per year. Hydrologic Investigations Atlas HA 7 (C.E.Knox and T.J. Nordenson, Average Annual Runoff and Precipitation in the New England - New York Area) reports the approximate average annual runoff in the area between Albany and Schenectady is 10 inches. The computed runoff for the area ABCDE, of course, is exclusive of that originating outside of the 140 acres.

It is apparent that the site iteelf is a locus of net discharge of regional groundwater averaging 132 million gallons per year (0.56 cfs) entering surface streams on the site each year while only 19.9 million gallons per year continues as groundwater flow leaving the site. These volumes are graphically represented in Figure 2.

It should be noted that the contribution of inflowing groundwater from the northwest is the dominant controlling factor in the site's groundwater regime, compared to which other components of the water budget are clearly secondary. Increasing the impervious area of the site will, indeed, speed runoff, but mainly has the effect of routing precipitation from evaporation and infiltration to discharge via a more direct route on the site than now occurs. It should also be noted that outflow from the site via groundwater is limited by the thickness of the unit in the southeastern corner of the site to no more than 19.9 million gallons per year.

1.1.2 Quality

No groundwater samples were taken for this study; however, one surface water sample location was selected as representative of groundwater conditions (Figure 3 of the EIS). A spring-fed stream enters the Krum Kill on the site from the north. Its characteristics are considered to be close to those of groundwater in its vicinity since the water table is at or near the surface at that location. Table 2 shows the results of analysis of samples taken in late June, 1978 and March, 1979.

TABLE 2

WATER QUALITY ANALYSIS OF SPRING-FED STREAM ON SITE

Parameter	Concentration 6/29/78	3/12/79
Temperature	14.5°C	NA
Color	38 color units'	7
Turbidity	4.4 NTU	3.7 NTU
Alkalinity		
Phenolphthalein	0.00 mg/l	0.00 mg/l
Total	77.6 mg/l	61.3 mg/l
Cloride	4.8 mg/l	6.0 mg/l
Cadmium	<0.006 mg/l	<0.006 mg/l
Chromium	0.01 mg/l	0.04 mg/l
Copper	0.01 mg/l	0.01 mg/l
Iron-total	3.9 mg/l	1.6 mg/l
Lead	0.05 mg/l	0.05 mg/l
Manganese	0.16 mg/l	0.12 mg/l
Mercury	0.02 ug/l	NA
Zinc	0.18 mg/l	0.07 mg/l
Nitrogen		
Ammonia as N	0.21 mg/l	0.50 mg/l
Nitrate as N	0.02 mg/l	NA
Phosphate		
Ortho as P	0.04 mg/l	0.33 mg/l
Total as P	0.05 mg/l	0.33 mg/l
pH	7.4 pH units	7.3 pH units
Carbon Dioxide	11.25 mg/l	NA
Dissolved Oxygen	14.5 mg/l	NA
Solids		
Total	163.2 mg/l	123.9 mg/l
Suspended	2.3 mg/l	5.9 mg/l
Dissolved	160 mg/l	118.0 mg/l
Conductivity	225 u-mhos/cm	183.0 u-mhos/cm
Total Coliform Bacteria	520 count/100 ml	100.0 count/100ml

NA - Not analyzed

Source: Water Quality Laboratory of JASON M. CORTELL and ASSOCIATES INC., Waltham, Massachusetts

Water quality of this water is generally good with respect to most parameters except for color, total iron, and manganese which are excessive.

1.2 Construction Impacts

1.2.1 Volume

Grading and paving of the site will change the groundwater regime by reducing infiltration and evapotranspiration and increasing the rate of runoff on the site.

Inflowing groundwater will continue to enter the site from the northwest at existing rates, (baring large-scale land use changes in that direction). In the center of the site, excavation for emplacement of utilities and foundations will require dewatering during construction to depress groundwater levels to permit work. This would be accomplished by a well-point system (Figure 4) to depress the water table locally.

Groundwater now discharging to become surface runoff would no longer be able to directly enter the Krum Kill and its on-site tributary drainageways due to filling. The water would instead be collected by an underdrain system and discharged to the Krum Kill through existing culverts under the New York State Thrnway.

Since there would still be 15+ feet of saturated thickness of sand underlying the site's southeastern corner (line BC, Figure 2), the balancing volume of groundwater outflow would be nnaffected.

1.2.2 Quality

Quality of the groundwater outflow from the site across BC (Fignre 2), would be unaffected by construction activities since any contaminants which were introduced into the groundwater system locally would become surface runoff within a relatively short time due to discharge of groundwater on the site.

1.3 Operation Impacts

1.3.1 Volume

The operation of the project once construction is complete has no additional impacts on the groundwater system other than those already described under "Construction Impacts" above.

1.3.2 Quality

During the operation of the project, automobile traffic can be expected to introduce the potential for water pollution as

discussed in the following sections concerning surface water quality. Pollutants created by automobiles are deposited primarily on the road network and parking areas in the form of street dust and dripping of gasoline, oil and grease, emission particulates, and deterioration of the vehicles and tires. Some of the street dust falls directly on soil areas or is redistributed to soil areas by wind. The remainder of the surface load is carried by storm water runoff through storm sewers and drainage channels to detention basis where it is gradually released downstream. Thus, there are two potential routes by which pollutants can enter the groundwater system on the site: Leaching of soil and percolation through the bottom of drainage channels and detention basins.

For pollutants which are deposited on soil surfaces surrounding the parking areas, an indication of the potential effect on groundwater is available by studies of lead. Significant deposition beyond highways has been found to be confined to a strip of land extending approximately 100 feet (Laxen and Harrison, 1977). Assuming that all other parameters are similarly distributed, fallout would occur on approximately 14 acres of soil surface around the approximately 6000 foot perimeter of the parking area. Once parking lot contaminants reach the soil surface, however, there are a variety of processes by which they are immobilized. These include absorption exchange, complexing, percipitation, and other processess (SCS Engineers, 1977). Lead, for example, is virtually completely immobilized in the upper soil horizon (Laxen and Harrison, 1977). Infiltration-percolation, when used on rapidly permeable soils such as sands, loamy sands and sandy loams as a wastewater management technique, removes 85-99% of biochemical oxygen demand and suspended solids, up to 50% of nitrogen and 60 to 95% of phosphorous (Pound and others, 1975).

One method by which loading rates for pollutants can be approached is by reference to irrigation water quality criteria with respect to phytotoxic trace elements (EPA, 1972). These criteria set maximum trace element concentrations for continuous use on sandy soils with low reactivities. Of the parameters considered in Table 4, in Section 2.3.2 of this Appendix, these criteria suggest that copper and nickle can be accomodated in the soil when concentrations are less than or equal to 0.20 mg/l. For zinc, the recommended limit is 2.0 mg/l; and for lead the criterion is 5.0 mg/l.

Street surface lead is 1% soluble (Pitt and Amy, 1972). The total amount of soluble lead which would be available if the entire annual loading shown on Table 4 were to be deposited on the 14 acres of soil is 5.05×10^6 mg. A reasonable estimate of the water available annually over 14 acres is 7.0×10^7 l, after allowing for evapotranspiration losses and runoff. The expected annual average concentration of lead in soil water,

therefore, is 0.07 mg/l, which is well within the reactive capacity of the soil. However, if soil removal were only, say, 50%, there would be introduced into the groundwater system some 7×10^7 l with concentrations of 0.04 mg/l lead, or 0.07 mg/l if there were no removal by the soil. This water would percolate to the water table and become mixed with, perhaps, the upper foot, or so, of groundwater and move with it across line BC on Figure 2. By mass balance, the concentration of percolating water at 0.07 or 0.04 mg/l with the upper layer of the water table at 0.05 mg/l would produce an average annual concentration in ground water of slightly less than 0.07 or 0.04 mg/l, depending of the efficacy of soil removal. However, conclusions of Laxen and Harrison (1977) previously cited make it appear likely that soil immobilization is very effective and that lead would be unlikely to contaminate groundwater in this case.

The case is similar for both copper and zinc. Even assuming 100% solubility of the surface street dust and 100% transport to the surrounding soil areas, the suggested criteria for irrigation water (EPA, 1972) strongly support the hypothesis that these constituents would be accomodated in the soil horizon.

For nickle, however, under the assumption of 100% solubility and availability, the indicated capacity of the soil would be exceeded by about 8.5×10^6 mg, potentially producing concentrations of about 0.1 mg/l in the percolating water, which is about the estimated safe concentration for fathead minnows in soft water (EPA, 1972) but which is a level which would seem to have little significance in groundwater systems.

The only other parameter considered in Table 4 which might be of concern in groundwater is nitrate. Again assuming 100% transport from source areas (parking lots) to adjacent soil areas, the average annual concentration in percolating water would be less than 2 mg/l, well within standards (EPA, 1972).

The more likely route of street surface contaminants, however, is deposition in detention basins. Rather than a 100% transport to soil areas, it is much more reasonable to assume that rainfall will be effective in removing surface contaminants via the drainage system to the detention basins. For those areas of the system which are at or below the water table surface, of course, no movement of constituents into the groundwater system will occur because of upward hydrostatic pressure. In areas, however, the base of the detention basins will be above the water table and the potential exists for some percolation. Percolation will be retarded due to the build-up of fine-grained sediments and establishment of vegetation. Movement of water from detention ponds is much more likely to be accomplished by way of surface runoff than percolation due to the very much greater rate of release of surface water

compared to percolation. But since the design of the detention basins will include invert elevations designed to maintain a foot or so of water after each storm (to enhance wetland vegetation potential) some percolation may occur. The question then becomes the amount of contaminants which will be carried with percolating waters.

There are two possible assumptions to make concerning the solubility of surface contaminants which accumulate in the detention basins. Either they are dominently soluble or they are dominently insoluble. If they are dominently insoluble, then they will not enter the groundwater system with percolation. If they are dominently soluble, they will (as is assumed for purposes of a conservative analysis in the following section on surface water quality impacts) be carried away with surface runoff, initially, and will not be available for percolation into the groundwater, since the majority of pollutants are removed by "first flush" effects (Turner and Burton, 1975). In either case, pollution of groundwater resources by percolation through the base of detention basin is not a problem.

2.0 SURFACE WATER

2.1 Existing Conditions

2.1.1 Volume

The site lies in the headwaters of the Krum Kill, a tributary to the Normans Kill which flows into the Hudson River.

There are no stream gage records for the Krum Kill. The base flow of the Krum Kill downstream from the site has been estimated (Eissler, 1979) as ranging between 1-2 cfs during the fall of 1978 and early 1979.

2.1.2 Quality

Samples were taken 1978 and 1979 from the Krum Kill on the site and from McKownville Reservoir immediately downstream from the site. Analysis of these samples are shown in Table 3.

Water quality in the Krum Kill on the site is satisfactory with respect to all parameters with the exception of total iron and manganese which are elevated.

Water quality in McKownville Reservoir shows high levels of chlorides and total dissolved solids relative to upstream conditions, perhaps reflecting the contributions of highway runoff. A concentration of 1.2 mg/l zinc in the June, 1978, and 2.01 mg/l in the January 1979, samples are anomolously high; they are not in equilibrium with pH and alkalinity conditions. The origin of the zinc is not known. Several shopping carts were observed in the reservoir during sampling. The January, 1979, results show anomolously high nitrogen levels which might be due to upstream construction of a drainage project on the site by the New York State Department of Transportation. McKownville Reservoir also has higher levels of iron and manganese than are suitable for its classification as a public water supply, a condition which also existed in 1955 (Mulberg and others, 1965). Phenols are also in excess of standards. From a nutrients standpoint, the water body is highly enriched.

2.2 Construction Impacts

2.2.1 Volume

The principal effect on stream volume of the project would be to increase the rate of runoff on the site. As discussed above under "Groundwater" there is already considerable runoff due to groundwater discharge, which would continue at its present rate. Stormwater runoff would travel at an increased rate due

TABLE 5

WATER QUALITY ANALYSES OF KRUM KILL

ON SITE AND OF MCKOWNVILLE RESERVOIR

Parameter	Concentration Krum Kill 6/29/78		Concentration Krum Kill 3/12/79		Concentration McKownville 6/29/78		Concentration McKownville 1/10/79	
Temperature	20°C				22°C		4°C	
Color	16	units	4	units	15	units	90	units
Turbidity	12	NTU	24	NTU	3	NTU	16	NTU
Alkalinity								
Phenolphtalein	0	mg/l	0.	mg/l	0	mg/l	0	mg/l
Total	132.5	mg/l	146.8	mg/l	133.6	mg/l	160.6	mg/l
Chloride	42.1	mg/l	60.1	mg/l	135.9	mg/l	167.9	mg/l
Cadmium	< 0.006	mg/l	< 0.006	mg/l	< 0.006	mg/l	< 0.005	mg/l
Chromium	0.01	mg/l	0.02	mg/l	0.01	mg/l	< 0.01	mg/l
Copper	< 0.01	mg/l	< 0.01	mg/l	< 0.01	mg/l	< 0.01	mg/l
Iron-total	4.0	mg/l	2.8	mg/l	1.9	mg/l	0.82	mg/l
Lead	0.05	mg/l	0.06	mg/l	0.05	mg/l	0.05	mg/l
Manganese	0.33	mg/l	0.41	mg/l	0.21	mg/l	0.41	mg/l
Mercury	0.02	microg/l	N.A.		0.02	microg/l	N.A.	
Nickel	N.A.		N.A.		N.D.		0.02	mg/l
Sodium	N.A.		N.A.		N.D.		101.2	mg/l
Zinc	0.18	mg/l	0.10	mg/l	1.2	mg/l	2.01	mg/l
Nitrogen								
Ammonia as N	0.36	mg/l	0.28	mg/l	0.01	mg/l	8.30	mg/l
Nitrate as N	0.49	mg/l	1.3	mg/l	0.41	mg/l	1.42	mg/l
Phosphate								
Ortho as P	0.06	mg/l	0.10	mg/l	0.01	mg/l	0.02	mg/l
Total as P	0.08	mg/l	0.36	mg/l	0.02	mg/l	0.03	mg/l
Oil & Grease	N.A.		N.A.		N.A.		< 2.0	mg/l
Phenol	N.A.		N.A.		N.A.		0.012	mg/l
pH	7.6	units	7.7	units	8.1	units	7.6	units
Carbon Dioxide	12.5	mg/l	N.A.		7.5	mg/l	N.A.	
Dissolved Oxygen	12.5	mg/l	N.A.		15	mg/l	N.A.	
BOD	N.A.		N.A.		N.A.		2.5	mg/l
Solids								
Total	298	mg/l	370.9	mg/l	485	mg/l	540.2	mg/l
Suspended	10.0	mg/l	42.9	mg/l	10.0	mg/l	8.2	mg/l
Dissolved	288	mg/l	328	mg/l	475	mg/l	532	mg/l
Conductivity	422	mmhos/cm	470	micromhos/cm	730	mmhos/cm	720	mmhos/cm
Total coliform	1880/100	ml	460/100	ml	220/100	ml	N.A.	
Fecal coliform	N.A.		N.A.		N.A.		760/100	ml

N.A. = not analyzed

Source: Water Quality Laboratory of JASON M. CORTELL and ASSOCIATES INC., Waltham, Massachusetts

to an increase in impervious area. As described in "Storm Water Management Report" (Annex A to this Appendix) a system of retention basins would control release through an existing culvert under the New York State Thruway to rates at or below existing conditions for the various storm events.

2.2.2 Quality

The clearing of vegetation from the site may result in the release of accumulated organic detritus, leading to increased nutrient concentrations in McKownville Reservoir. Such releases, however, would be minimized by specifications for erosion and sedimentation control as outlined on Sheet SP-4." Because the soils on the site are dominantly sands with only minor amounts of silt, erosion and sedimentation control should also be effective in limiting increases in turbidity in McKownville Reservoir.

2.3 Operations Impacts

2.3.1 Parameters

The pollutants which are associated with parking lot runoff probably include many parameters. Data are available only for some of the major parameters, however. Studies by Shaheen (1975) and by Smullen and others (1978) provide data specifically for parking lot runoff from shopping centers. Parameters considered here include lead, zinc, copper, nickel, chemical oxygen demand (COD), volatile solids (VS), fecal coliform bacteria, grease, nitrate-nitrogen, total Kjeldahl nitrogen (TKN), and phosphorus.

2.3.2 Methodology

Zinc, and phosphorus, are estimated from data published by Smullen and others (1978) which provides estimates of mass loadings per unit area per year. Other parameters are estimated from the data of Shaheen (1975) which provides estimates which relate mass loadings to traffic (Table 4)

For the purposes of analysis, the parking area is estimated at 70 acres; daily traffic on the site is estimated at 41,376 axle miles per day. Daily loadings calculated from annual data or from traffic are assumed to accumulate to a maximum level 3 days following a storm (Shaheen, 1975).

A rainfall sufficient to produce 2 mm runoff was selected as the critical event as the smallest volume of runoff capable of transporting 100% of soluable contaminants (Laxen and Harrison, 1977). Concentrations of pollutants in runoff are calculated by assuming 100% solubility (except for lead, of which only 1% is soluble: Pitt and Amy, 1973). Concentrations of pollutants

Table 4

LOADING RATES FOR PARKING LOT CONTAMINANTS

AFTER SHAHEEN (1975)

Parameter	Loading/axle-mile/day	Axle-miles/day	Daily Load	3-Day Maximum Load	Annual Load
Lead	7.70×10^{-5} lbs	41,376	1.38×10^{0} mg	4.15×10^{4} mg	5.05×10^{6} mg
Copper	1.693×10^{-6} lbs	41,376	3.04×10^{4} mg	9.12×10^{4} mg	1.11×10^{7} mg
Nickel	3.328×10^{-6} lbs	41,376	5.98×10^{4} mg	1.79×10^{5} mg	2.18×10^{7} mg
COD	5.964×10^{-3} lbs	41,376	1.07×10^{9} mg	3.21×10^{8} mg	3.91×10^{10} mg
Fecal Coliform*	7.52×10^{-7} organisms		3.76×10^{8} org.	1.13×10^{4} mg	1.37×10^{11} mg
Nitrate	2.148×10^{-6} lbs	41,376	3.86×10^{4} mg	1.16×10^{5} mg	1.41×10^{7} mg
TKN	3.92×10^{-5} lbs	41,376	7.04×10^{5} mg	2.11×10^{6} mg	2.57×10^{8} mg
Grease	5.28×10^{-4} lbs	41,376	9.48×10^{6} mg	2.84×10^{7} mg	3.46×10^{9} mg
Volatile Solids	6.077×10^{-3} lbs	41,376	1.09×10^{8} mg	3.27×10^{8} mg	3.98×10^{10} mg

*Loading rate is per curb mile; loadings based on 5 curb miles for the project

AFTER SMULLEN AND OTHERS (1978)

Parameter	Loading/acre/year	Acres	Daily Load	3-Day Maximum Load	Annual Load
Zinc	2.92 lbs	70	2.43×10^{5} mg	7.29×10^{5} mg	8.87×10^{7} mg
Phosphorus	1.93 lbs	70	1.61×10^{5} mg	4.82×10^{5} mg	5.86×10^{7} mg

NOTE: Assumed 100% soluble except for lead which is 1% soluble (Pitt and Amy, 1972) and shown at a factor of 0.01 of solid loading rate of 7.70×10^{-5} lb/ax-mi/day

in receiving waters are calculated by mass balance. The volume of receiving water is taken as drought base flow of 425,000 gpd (Department of Water Resources 1948) plus storage in McKownville Reservoir of 1,629,500 gallons (5 acre-feet) or 7.78×10^6 l.

Concentrations on an annual basis are estimated by use of 1.33×10^9 of water, based on a watershed area of 1.1 mi^2 for McKownville Reservoir, a runoff coefficient of 0.80 and precipitation of 33.36" per year.

2.3.3 Concentrations in Runoff and Receiving Water

Concentrations in runoff and receiving water for a storm in excess of 2 mm over 87 acres (roof and parking lot area) and on an annual basis are shown in Table 5.

2.3.4 Effects

2.3.4.1 Water Quality Standards

New York State Water Quality Standards for Class A streams are summarized in Table 6. There are no effluent standards applicable to stormwater runoff.

There are several parameters in the standards for which no data are available to assess the impact of parking lot runoff. Among these parameters cyanide, ferrocyanide, cadmium, ammonia as NH3, phenols, and total dissolved solids.

Cyanides are present in industrial wastewater from such sources as gas works, coke ovens, scrubbing of gases in steel plants metal plating operations and chemical plants. Cyanide radicals might occur in parking lot runoff and would cause a violation of water quality standards if the concentration of cyanides in the receiving water were zero initially and loading rates for cyanide were as high a those for copper or nitrate, which seems unlikely.

Cadmium may be present in parking lot runoff due to its use in tires and motoroils. With an initial concentration of less than 0.006 mg/l in the receiving water, water quality standards would be violated during a 2 mm storm event if loadings of cadmium in surface dust were approximately 70 times higher than solid lead loadings, which is very unlikely.

Ammonia is a component of total Kjeldahl nitrogen, togther with organic nitrogenous compounds. In strongly reducing (anerobic) environments, ammonia would account for a larger portion of TKN, so that TKN serves as an upper bound for the concentration of ammonia. The predicted increase in TKN due to

TABLE 6
NEW YORK STATE WATER QUALITY STANDARDS
CLASS A STREAMS

Parameter	Concentration
Coliform	5000/100 ml as the monthly median of at least 5 samples
pH	6.5-8.5 units
Total dissolved solids	500 mg/l
Dissolved Oxygen	5.0 mg/l
Phenol	0.005 mg/l
Ammonia*	2.0 mg/l at pH of 8.0 or greater
Cyanide*	0.1 mg/l as CN
Ferrol(i) cyanide*	0.4 mg/l as Fe(CN)6
Copper*	0.2 mg/l
Zinc*	0.3 mg/l
Cadmium*	0.3 mg/l

*Guideline

Source: Part 701 of Title 6, Chapter X, New York Statutes

TABLE 7

WATER QUALITY IMPACTS OF PROJECT

Parameter	Concentration in 2mm runoff (mg/l)	Concentration of Receiving Water (mg/l)	Resulting Concentration (mg/l)	Project Annual Soluble Load (mg)	Resulting Annual Average Concentration (mg/l)
Lead	0.06	0.05	0.05	5.05×10^{6}	0.05
Zinc	1.05	0.18	0.25	8.87×10^{7}	0.25
Copper	0.13	< 0.01	< 0.02	1.11×10^{7}	< 0.02
Nickel	0.26	0.02	0.04	2.18×10^{7}	0.04
COD	461.57	N.A.	> 37.89	3.91×10^{10}	> 29.42
Fecal Coliform*	162	760	711	1.37×10^{13}	770
Phosphorus	0.69	0.03	0.08	5.36×10^{7}	0.07
Nitrate as N	0.17	0.49	0.46	1.41×10^{7}	0.50
TKN	3.03	N.A	0.25	2.57×10^{8}	> 0.19
Grease	40.96	< 2.0	< 5.19	3.46×10^{9}	< 4.60
Volatile Solids	470.31	N.A.	> 38.64	3.98×10^{10}	> 29.98

*Based on 5 curb miles for project; units are organisms per 100 ml

N.A. means not analysed

stormwater runoff from the project is 0.25 mg/l or more, which should not cause violation of the standard for ammonia of 2 mg/l as NH3.

Phenols are present in industrial wastewater, domestic sewage, pesticides and their products of breakdown and in the decomposition of naturally occurring substances. Phenols in the receiving water, as measured by one sample, are already in excess of the standard; any contribution from parking lot runoff would further contribute to this excess.

Total dissolved solids are presently in excess in the receiving water compared to standards; any contribution from parking lot runoff would further contribute to this excess.

All other parameters in the receiving water would be at acceptable concentrations with respect to standards.

2.3.4.2 Eutrophication

McKownville Reservoir is presently moderately enriched. The added contribution of nutrients from parking lot runoff would not substantially change this condition. McKownville Reservoir is a nutrient sink controlling downstream nutrient levels.

2.3.4.3 Use

It is the opinion of the Albany County Health Department (Svenson, 1978) that the McKownville Reservoir "should not be considered for drinking water purposes because of existing poor quality and because of the proximity to transportation corridors (which create non-point dishcarges and a spill potential)." The McKownville District does not now use the reservoir as either a primary supply or as an active back-up supply. Therefore, the impact of parking lot runoff from the proposed project can be considered not to adversely affect the operation of a public water supply.

Because the receiving water is designated as a potable water supply, New York State Drinking Water Standards, summarized in Table 7 should also be considered. These standards apply to finished water quality after treatment and not to receiving water quality.

No loading data for parking lot runoff are available for arsenic, barium, cadmium, chromium, flouride, mercury, selenium and silver.

Assuming an initial concentration of zero, arsenic loading rates would have to be comparable to those of zinc in order to result in a violation of the standard if the treatment process does not remove arsenic.

The standard for barium is 1 mg/l which is the limit of solubility of barium in water (EPA, 1972) so that barium is not of concern in parking lot runoff.

The Drinking Water Standards limit for cadmium is 0.01 mg/l. A loading rate of 4.76×10^{7} mg/year, which is comparable to that estimated for nickle, would result in violation of standards, if the entire loading were soluble. However, the solubility product for cadmium carbonate, which would be controlling in the aqueous environment of McKownville Reservoir, is 5.01×10^{-12} which is extremely low (Krauskopf, 1967). With adequate treatment, it should be possible to produce a finished water quality within the standards.

Chromium loading rates in excess of 1.07×10^{9} mg/year would produce levels in excess of 0.05 mg/l in McKownville Reservoir, bnt this level is unreasonably high, much higher than any of the metals for which data is available.

TABLE 7
NEW YORK STATE DRINKING WATER STANDARDS

Parameter	Concentration
	(Requiring State, consumer and public notification when exceeded)
Arsenic	0.05 mg/l
Barium	1 mg/l
Cadmium	0.01 mg/l
Chromium	0.05 mg/l
Flouride	2.2 mg/l
Lead	0.05 mg/l
Mercury	0.002 mg/l
Nitrate as N	10 mg/l
Selenium	0.01 mg/l
Silver	0.05 mg/l
	(Requiring State notification when exceeded)
Chloride	250.0 mg/l
Copper	1.0 mg/l
Iron	0.3 mg/l
Manganese	0.3 mg/l
Sulfate	250.0 mg/l
Zinc	5.0 mg/l

Source: Part 5 of Title 10, Chapter I, New York Statutes

Similarly, flouride loadings would have to be 2.38×10^9 mg/year to produce levels as high as the standard of 2.2 mg/l.

Similarly, mercury loadings would have to be 2.14×10^6 mg/year to produce levels as high as the standard of 0.002 mg/l.

Similarly, selenium loadings would have to be 1.08×10^7 mg/year to produce levels as high as the standard of 0.01 mg/l.

Similarly, silver loadings would have to be 1.09×10^9 mg/year to produce levels as high as the standard of 0.05 mg/l.

In order to cause sulfate to exceed the recommended level of 250 mg/l assuming existing concentrations of zero, annual loadings would have to be in excess of 2.70×10^{11} mg.

Copper levels due to parking lot runoff would not cause a violation of recommended limits.

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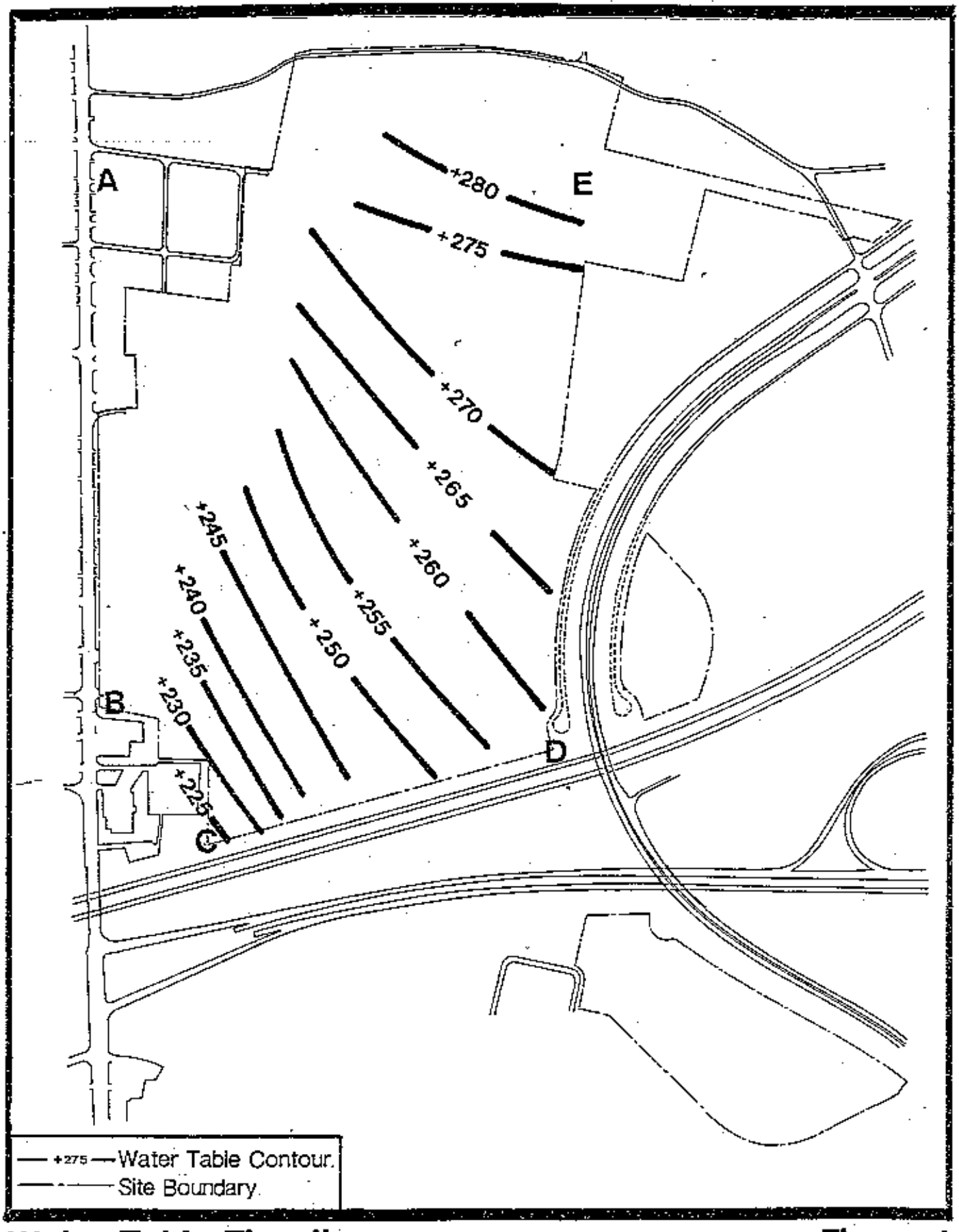


Water Table Elevation **Figure 1**

Source: Edinger, 1979

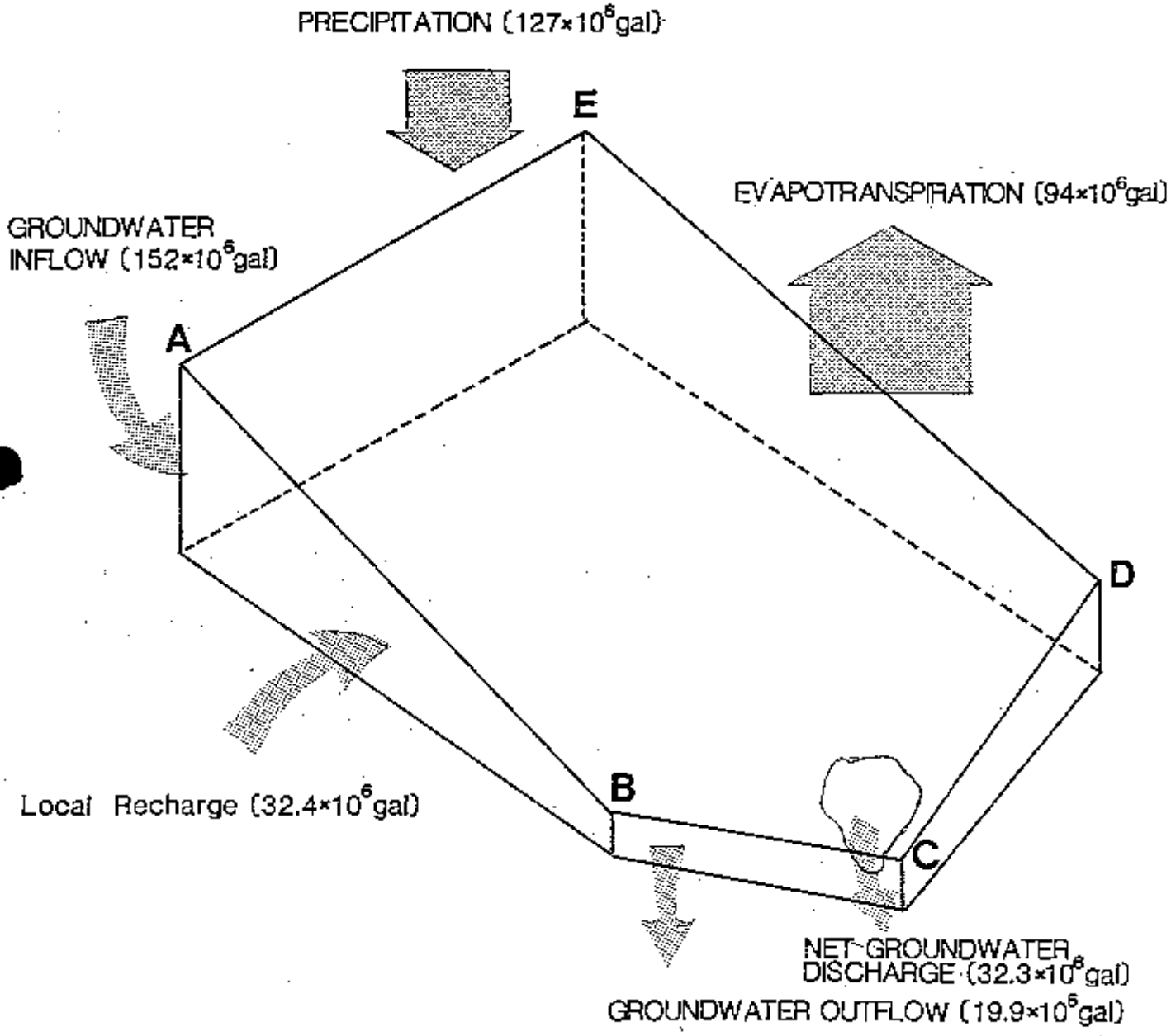
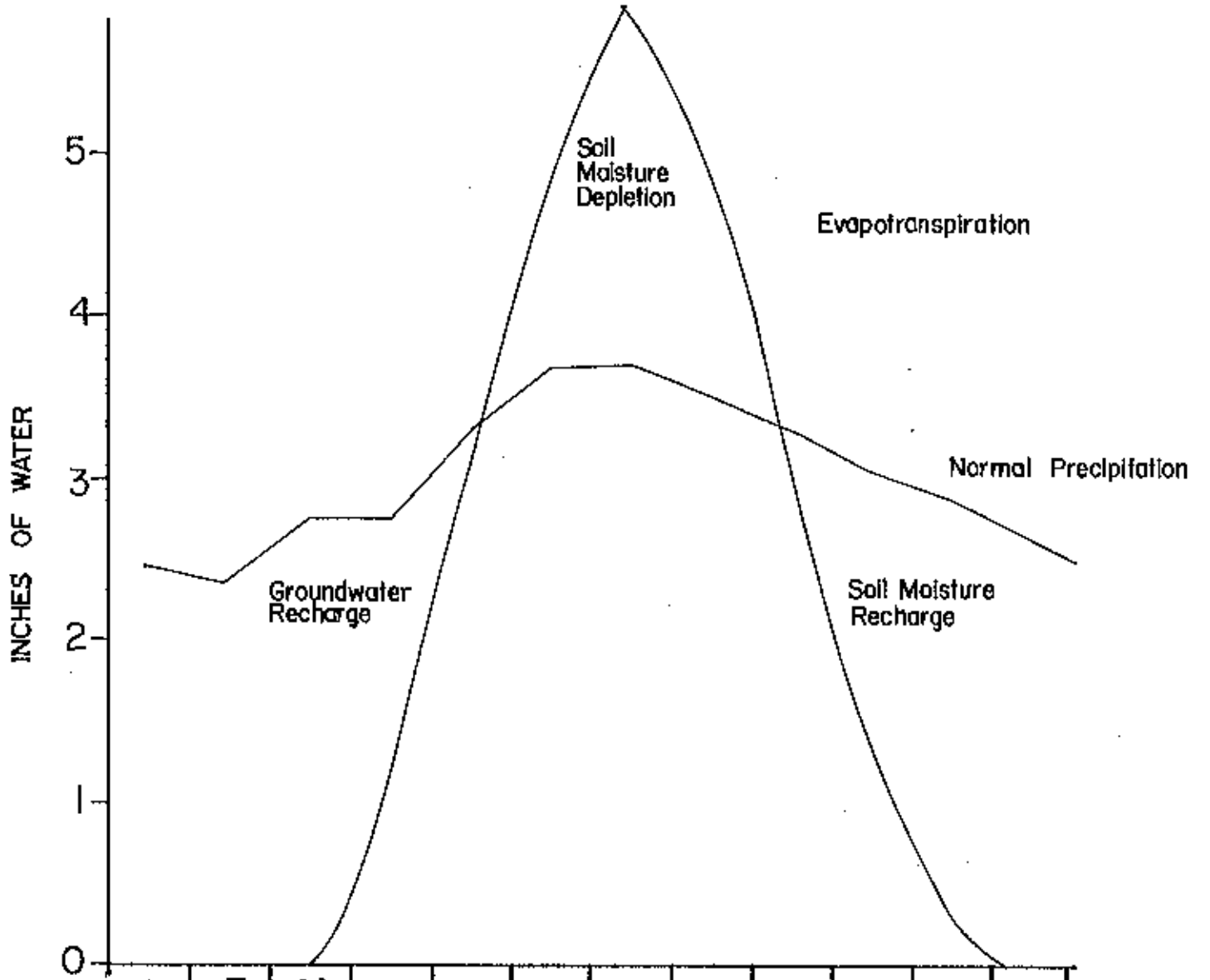


Figure 2 Schematic Model of Site Annual Water Budget



MONTHLY WATER BUDGET FOR THE ALBANY AREA - Based on Thornwaite Equation

Figure 3

ANNEX A

RAYMOND KEYES ENGINEERS, P.C.
CONSULTING SITE AND TRAFFIC ENGINEERS

44 EXECUTIVE BLVD.
ELMSFORD, NEW YORK 10523
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RAYMOND KEYES, P.E.
JOHN H. MEYER, P.E.
RANDOLPH W. LAURENT, P.E.

STORM WATER MANAGEMENT REPORT

* * * * * * * * * * * * * * * * * * * *

Crossgates
U.S. 20 & Fuller Road Alternate
Guilderland, New York

CLIENT: Pyramid Crossgates Company
Executive Park Tower
Albany, New York 12203

Project No. 2838
May 30, 1979

TABLE OF CONTENTS

SECTION A

A-1	PROJECT LOCATION AND DESCRIPTION	1
A-2	GENERAL DESCRIPTION OF SITE	2
A-3	SCOPE OF REPORT	2
A-4	FINDINGS AND CONCLUSIONS	3

SECTION B

B-1	EXISTING DRAINAGE AREA CHARACTERISTICS	6
B-2	METHODOLOGY OF REPORT	10
B-3	DESIGN CRITERIA	11
B-4	SUPPORTING DATA AND CALCULATIONS	12
B-5	HYDRAULIC DATA	13
B-6	ENGINEERING ANALYSIS	14
B-7	CONCLUSIONS	18

LIST OF DHAWINGS

D-1 "Drainage Area Map - Before Development"
D-2 "Existing Land Uses & Hydrological Classifications"
D-3 "Drainage Area Map - After Development"
D-4 "Profiles"

SP-1 "Site Layout Plan"
SP-2 "Site Grading Plan"
SP-3 "Site Utilities Plan"
SP-4 "Sedimentation & Erosion Control Plan"

Calculation Sheets 1 through 103

SECTION A

INTRODUCTION

A-1 PROJECT LOCATION AND DESCRIPTION

"Crossgates" is proposed as an enclosed regional shopping mall, to be constructed on a site of approximately 160 acres in the northwest quadrant of the intersection of Western Avenue (U.S. Route 20) and the New York State Thruway, approximately six miles west of the Albany Central Business District.

The site is bordered on the east by the New York State Thruway, on the south by Western Avenue, on the west by Rapp Road and on the north by the Washington Avenue Extension.

The land surrounding the site has a variety of mixed commercial uses, with some residential development located to the southwest in the vicinity of Rapp Road and Western Avenue. Major development along Western Avenue consists primarily of commercial uses, with the most prominent being Stuyvesant Plaza located approximately 1/4 mile east of the site at the intersection of Fuller Road and Western Avenue.

Crossgates is to be constructed in two stages with its ultimate development to include six major department stores, a variety of smaller satellite shops and a 2,500 seat cinema comprising a total Gross Leasable Area of some 1,300,000 s.f., with parking for approximately 7,090 cars.

Parking will be provided for 7,090 cars in six distinct areas surrounding the buildings. Three of those areas will serve the Upper Level of the Mall and Department Stores, while the remaining will serve the Lower Level.

A-2 GENERAL DESCRIPTION OF SITE

The Crossgates property is an irregularly shaped parcel, which lies along the southerly boundary of an area known as the "Albany Pine Bush", noted for its sandy soils and pitch pine-scrub oak forest. However, the Crossgates site is in an urban setting, the bulk of which can be described as undeveloped.

The site lies within the drainage basin of the Hudson River, which is approximately six miles downstream to the east. Runoff from upstream watershed areas and the site generally flows to the southeast, primarily in open streams and watercourses, with culverts under.

A-3 SCOPE OF REPORT (Refer to Drawing D-1)

This Report analyzes the watershed area upstream of Crossgates, as well as the Crossgates property, which totals approximately 489 acres, to several existing outfall locations at the New York State Thruway. Approximately 175 acres remain essentially unchanged while the remaining 314 acres are included in the Storm Water Management Plan proposed.

The Storm Water Management Plan developed in this Report attenuates the anticipated increase in rate of runoff which will be created by virtne of the paving and building construction for Crossgates, to avoid the overtaxing of existing downstream facilities, which presently flow near capacity during major storms.

The Crossgates Storm Water Management Plan provides for onsite detention of runoff for both the Crossgates site and several upstream areas which cnrrently drain onto the Crossgates property. This Report analyzes the impact of design storms of 2, 5, 10, 25 and 100 year recurrence intervals, considering existing and developed runoff characteristics of the site and upstream drainage areas. It establishes the parameters of peak runoff rates and storm volumes which now exist and compares them to runoff rates and storage volumes which will resnlt upon completion of Crossgates, taking into account the onsite detention on the Crossgates site.

A-4 FINDINGS AND CONCLUSIONS

Based upon a detailed engineering analysis contained herein, it is the considered professional opinion of Raymond Keyes Engineers that, upon implementation of the drainage improvements and storm water management facilities recommended herein, construction of Crossgates Mall will reduce peak runoff rates

to downstream areas for storms of all frequencies studied, by the following methods:

1. By proper grading of the perimeter of the Crossgates site, all streams, ditches, culverts and overland flow areas from offsite will be accepted into drainage channels running around the perimeter of the developed area and led to onsite detention facilities.

2. In general, the flow of drainage will be from west to the southeast corner.

3. Almost all the runoff from the roofs and parking/roadway areas will pass through grassed open channels and basins.

4. Runoff from impervious areas of the Crossgates project - parking areas, roadways and building roofs, will be conveyed underground through a storm drainage system. Generally, drainage will be carried away from the center building core to the exterior perimeter of the site, discharging into the drainage channels.

5. The onsite drainage system will incorporate catch basins with sumps and open bottoms to reduce storm water runoff by utilizing groundwater recharge.

6. The Detention Basin volumes have been oversized to result in a reduced rate of runoff from the total property below the capacity of the existing 60 inch culvert which passes under the New York State Thruway at the southeast corner of the property. Other culverts under the Thruway will have substantial reductions in discharge since a portion of their present offsite contributing areas and all their onsite areas will be eliminated.

7. The increased volume of runoff resulting from Crossgates development will be detained in the onsite Detention Basin Release of runoff from the property will be accomplished at a controlled rate.

SECTION B

ENGINEERING ANALYSIS

B-1 EXISTING DRAINAGE AREA CHARACTERISTICS (Drawing D-1)

The Crossgates site is part of an overall Drainage Area of some 489 acres as shown on Drawing D-1. It is essentially comprised of three major sub-areas and some minor areas, as follows:

Area A (267 acres)

Sub-Area A-1 (9.0 acres)

Sub-Area A-1 includes the runoff from the pavement of Western Avenue beginning at Rapp Road and continuing west a distance of approximately 2,000 feet. In addition, a small area surrounding the east and west sides of Rapp Road drain into the site. This Sub-Area's drainage includes a piped storm drainage system running west to east along the north side of Western Avenue, thence north along the west side of Rapp Road, under Rapp Road in a 48 inch culvert and continuing in an open ditch into the southwest corner of the property.

Sub-Area A-2 (94.0 acres)

After flowing overland, Sub-Area A-2 collects in a swale which begins at the most westerly end of the offsite watershed and flows easterly to Rapp Road where a culvert

exists under Rapp Road. Drainage then enters the Crossgates site and continues to the east aloug the most prominent water-course in the southern third of the Crossgates site. This drainage, combines with Sub-Area A-1 from Western Avenue and Rapp Road, and continues easterly through the site.

Sub-Area A-3 (28 acres)

Sub-Area A-3 contributes from the south of Western Avenue between Johnston and Alton Roads to a second drainage system in Western Avenue which is being constructed by the New York State Department of Transportation as part of its improvemeut program. Its character is primarily residential and undeveloped, and its flow drains overland to the north into catch basins and culverts along Western Avenue. Ultimately these culverts join into a culvert at the intersection of Western Avenue and Lehner Terrace which continues onto the site.

Drainage from these various Sub-Areas A-1, A-2 and A-3 combine to flow into the major drainage course of the site, exiting at its southeast coruer into an existing 60 inch culvert under the New York State Thruway.

At the southeast corner of Area A on the Crossgates site, a low area exists which was the former bed of a "manmade lake" created by a dam which was breached in the recent past during a major storm. By this breach, previous reservoir storage capacity within the Crossgates site was eliminated, and the flow of runoff out of the site is no longer detained.

Drainage Area B (47 acres)

Drainage Area B comprises 47 acres totally within the Crossgates site, located in the north-central area of the property. Drainage from this Area is discharged through an open swale into a 21 inch culvert which ultimately finds its way under the New York State Thruway, continues south in the center median of the New York State Thruway, ultimately discharging by means of a 24 inch culvert in the area of the discharge point from Area A.

Drainage Area C (175 acres)

The northwest offsite Drainage Area C primarily includes land to the west of Rapp Road, north to Washington Avenue and includes the site of an existing Wellspring Nursing Home northwest of the Crossgates site. This drainage area contributes flow into broad depressions in the land and ultimately enters the site at its extreme north end, adjacent to the south side of the Washington Avenue Extension South Service Road. Drainage continues easterly along the northern edge of the site through an open swale, discharging into two culverts under the New York State Thruway just south of the Washington Avenne Extension bridge. These culverts are within 100 feet of each other, and consist of one 24 inch and one 30 inch pipe.

Ultimate Discharge Point

Drainage from the three major discharge points from the Crossgates site eventually finds its way to the former McKownville Reservoir.

To the south of the McKnownville Reservoir, drainage passes under Western Avenue through a 24 inch diameter culvert and ultimately continues to the southeast joining the Krumkill. The Krumkill meets the next major watercourse known as Norman Kill in the vicinity of New Scotland Road (N.Y. 85). The Norman Kill then flows generally in an easterly direction ultimately dumping into the Hudson River in the vicinity of the Port of Albany.

B-2 METHODOLODY OF REPORT

In the preparation of this Report and development of the Storm Water Management Plan recommended, the following methodology was utilized:

1. Personal inspections of the site, upstream and downstream drainage areas, were made by Raymond Keyes Engineers.

2. Topographical survey maps were obtained for the entire drainage watershed area. Where necessary, these maps were updated to reflect additional construction between the time of the original aerial phopography and the present.

3. Drainage areas were calculated and soil types analyzed based on the U.S.D.A. Soil Conservation Service soil survey for Albany.

4. Existing channels, pipes, culverts and other drainage appurtenances were analyzed in specific detail as to size, invert and location.

5. Hydrographs were developed for both existing and developed conditions to reflect the total flow from the entire drainage area, considering both existing runoff conditions and the Crossgates development characteristics which will affect existing conditions.

6. Calculations were developed to determine the amount of drainage to be detained onsite to effect a reduction in discharge rates from Crossgates into downstream drainage facilities.

7. Calculations were developed to show that the drainage discharge rate from the site after the development would be less than that which occurs under existing conditions for all storms, by use of the onsite detention basins.

B-3 DESIGN CRITERIA

In the preparation of this Report, the following engineering data and design criteria were used:

1. U.S. Geological Survey Quadrangles:

Albany, New York	1953
Voorheesville, New York	1954

These maps were updated to reflect current developments including new building and parking area construction, new roadways and new drainage facilities.

2. Aerial topographical mapping for the Town of Guilderland and City of Albany.

These topographical survey maps were updated to include new construction such as building, parking areas, roadways and drainage facilities to reflect current conditions.

3. U.S. Department of Agriculture Soil Conservation Service "Soil Survey for Albany County New York".

4. U.S. Department of Agriculture Soil Conservation Service Technical Release No. 55 and Technical Note - Engineering UD 20 respectively, for analysis of storm water runoff characteristics.

5. U.S. Department of Commerce Weather Bureau Technical Paper No. 40 "Rainfall Frequency Atlas of the United States".

6. Design storm for 2, 5, 10, 25 and 100 year flood frequency recnrrence intervals.

B-4 SUPPORTING DRAWINGS AND CALCULATIONS

Appended to this Report are the following Drawings and calculations dated May 30, 1979.

SP-1 "Site Layout Plan"
SP-2 "Site Grading Plan"
SP-3 "Site Utilities Plan"
SP-4 "Sedimentation & Erosion Control Plan"

D-1 "Drainage Area Map - Before Development"
D-2 "Existing Land Uses & Hydrological Classifications"
D-3 "Drainage Area Map - After Development"
D-4 "Profiles"

Calculation Sheets 1 through 103

B-5 HYDRAULIC DATA

Storm flows for 2, 5, 10, 25 and 100 recurrence intervals were analyzed for the total watershed area currently routed through the site. The design storms studied were of 24 hour duration and the mass rainfall for each respective storm was as follows:

Recurrence Intervals	Inches of Rainfall
2 year	2.85
5 year	3.70
10 year	4.25
25 year	4.90
100 year	5.90

Inflow hydrographs for the various design storms were developed by applying the "inches of rainfall" values to the CN values* determined for existing and developed conditions, taking into account existing natural ponding areas and other existing characteristics.

* CN Values are indications of potential maximum percent of mass rainfall that will run off into storm drainage systems and/or streams, thereby contributing to flood flows. The higher the value, the greater the runoff.

B-6 ENGINEERING ANALYSIS

1. Existing Conditions (Drawing D-1)

Under existing conditions the flow rates and developed onsite storage volumes for the various design storms are as follows:

Recurrence Interval	Peak Flow Rate (c.f.s.)	Volumes (Ac.Ft.)
2 year	39.2	0.63
5 year	77.1	1.44
10 year	101.2	2.38
25 year	138.8	3.78
100 year	176.0	7.35

2. Increased Runoff from Proposed Development

Recurrence Interval	Volumes (Ac.Ft.)
2 year	8.08
5 year	12.43
10 year	14.93
25 year	17.85
100 year	21.56

This increased volume of runoff determined minimum requirements for detention storage volumes after development.

3. Developed Conditions (Drawing D-3)

Routing of the design storm flows throngh the proposed detention areas after development results in the following:

Recurrence Intervals	Peak Rate (c.f.s.)	Volumes Detained (Ac.Ft.)
2 years	27.10	10.21
5 years	48.49	17.25
10 years	65.77	22.04
25 years	85.13	28.11
100 years	111.01	39.06

4. Methods

The passage of runoff from upstream offsite watershed areas will be interrupted by virtue of the uew development. In order to maintain continuity of offsite flows through the site, however, new drainage ditches will be constructed around the perimeter of the proposed Ring Road. Drainage pipes from the roofs and parking areas of Crossgates will be connected at numerous points along the length of the proposed chaunels.

Flow in the proposed channels will be routed through detention basins, where outlet control structures will meter the discharge rates to the ultimate outfall into the existing 60 inch culvert uuder the New York State Thruway.

5. Impoundments

A number of the proposed detention basins will be partially constructed with earth fill embankments. Inasmnch as water will be impounded behind these earth fill embankments, they will constitute impoundments of a Class "A" hazard, in accordance with the regulations of the New York State Department of Environmental Conservation. The construction of the embankments will meet or exceed the regulations of the New York State Department of Environmental Conservation as contained in their "Guidelines for Design of Small Dams".

Embankments will be constructed utilizing select materials, which will be placed and compacted as structural fills. Appropriate gradations of the select fill material will be provided to control all possible seepage. The subgrades will be properly prepared and compacted and embankment materials will be installed in a controlled manner under the supervision of the project's soil engineer.

6. Sedimentation and Erosion Control (Drawing SE-1)

During the construction of Crossgates, temporary soil erosion control measnres will be implemented. These measures will inclnde sedimentation ponds, silt traps, check dams, drainage ditches, hay bales, riprap and quick seeding measnres to minimize exposed area of grading and rednce erosion and sediment transport.

The Sedimentation and Erosion Control Plan will provide for considerable temporary control measures before grading starts. Throughout the course of construction additional control measures will be implemented, consistent with the rate of progress of earthwork and drainage installation operations. Continuous maintenance of sedimentation and erosion control facilities will be carried out and onsite resident inspection will monitor activities to insure compliance.

After construction, the site will be restored to a stabilized condition. Obviously building roofs and paved parking and roadway areas will not cause erosion and sediment transport because they are essentially impervious and are uniformly stable. The surrounding areas disturbed during construction will be topsoiled and seeded and maintained by the Developer on a continual basis. Slope and embankment treatment will be suitable to prevent erosion after construction and only minimal transport of sediment is anticipated.

The open channels and detention ponds will serve to remove materials transported from the improved and unimproved areas of the site after construction in a natural manner.

B-7 CONCLUSIONS

Based upon the results of this study and the implementation of the Storm Water Management Plan contained herein, it is the considered professional opinion of Raymond Keyes Engineers that the construction of Crossgates will not adversely affect existing upstream and downstream drainage facilities. In actuality, upstream drainage area watersheds will be allowed to discharge conveniently onto the Crossgates site without interruption. The proposed detention basins within Crossgates property will serve to reduce the peak rate of runoff during the various design storms after construction below those conditions which current exist.

Adequate provision has been made for sedimentation and erosion control during and after construction and, upon completion of the project, ground surfaces will be restored to a stabilized condition.

Respectfully submitted,

RAYMOND KEYES ENGINEERS, P.C.

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N.Y. PE #24816

John H. Meyer, P.E.
Executive Vice President
N.Y. PE #47685

RK:JHM:ph

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX
LOCATION GUILDERLAND, N.Y.
TYPE OF CALCULATION DETERMINATION OF TIME OF CONCENTRATION (Tc) FOR UPSTREAM WATERSHED

JOB NO. 2836
DATE 5-30-79
SHEET 1 OF 10.3
COMPUTED BY JS/RR.
CHECKED BY J.M.

$$T_c = \left(\frac{11.9\ L^3}{H}\right)^{.385}$$

WHERE:
L = LENGTH OF REACH (MILES)
H = CHANGE IN ELEVATION (FEET)
Tc = TIME OF CONCENTRATION (HOURS)

EXISTING DRAINAGE AREA "A" (267 ACRES)

L FEET	L MILES	H (FEET)	Tc (HOURS)
300	0.06	20	0.03
3,200	0.61	5	0.79
2,200	0.42	40	0.23
850	0.16	5	0.17
80	0.01	10	0.01
6,630	1.26	80	1.23

TOTALS

USE T_c = 1.25 hrs.

EXISTING DRAINAGE AREA 'B' (47 ACRES)

L FEET	L MILES	H (FEET)	Tc (HOURS)
350	0.07	35	0.03
700	0.13	5	0.13
60	0.01	10	0.01
2,050	0.39	18	0.29
3,169	0.60	68	0.46

TOTALS

USE Tc = 0.50 hrs.

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT Crossgates Complex
LOCATION Guilderland, N.Y.
TYPE OF CALCULATION Before Development
Hydrological Classifications
Drainage Area "A" (267 Acres)

JOB NO. 2838
DATE 5-30-79
SHEET 2 OF 103
COMPUTED BY J.S./R.R.
CHECKED BY J.H.

	CLASS HYDRO	CN	ACRES AREA	CN (A)	
OPEN	A	39	20.7	807.3	
	B	61	2.5	152.5	
	C	74	20.2	1494.8	
	D	80	4.9	392.0	
					2846.6
RESIDENTIAL	A	57	27.1	1544.7	
	B	72	45.7	3290.4	
	C	81	6.2	502.2	
	D	86	—	—	5337.3
WOODED	A	25	55.0	1375.0	
	B	55	12.0	660.0	
	C	70	7.0	490.0	
	D	77	34.2	2633.0	
					5158.0
BUSINESS	A	89	1.5	133.5	
COMMERCIAL	B	92	30.0	2760.0	
	C	94	—	—	
	D	95	—	—	
					2893.5
TOTAL			267		16,235.4

$$CN = \frac{16235.4}{267} = 60.8 \approx 61$$

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 7838
LOCATION GUILDERLAND, N.Y. — DATE 5-30-79
TYPE OF CALCULATION BEFORE DEVELOPMENT — SHEET 3 OF 103
STORM DRAINAGE WATERSHED CHARACTERISTICS — COMPUTED BY J.S./R.R.
DRAINAGE AREA "A" (267 ACRES) — CHECKED BY J.H.

AREA = 267 ACRES = 0.42 Sq. Mi.

CN	=	61
P_2	=	2.85
P_5	=	3.70
P_{10}	=	4.25
P_{25}	=	4.90
P_{100}	=	5.90
T_C	=	1.25
T_T	=	0.00

WHERE P IS DESIGN RAINFALL IN INCHES FOR 2, 5, 10, 25 & 100 YR. STORM FREQUENCY RECURRENCE INTERVALS OVER A 24 HOUR DURATION. FROM TECHNICAL PAPER No. 40 MAY 1961.

$S = \frac{1000}{CN} - 10 = 6.393$ WHERE CN = 61

MASS RUNOFF

2 YR. R.O. = $\frac{(P-.25)^2}{P+.85}$ = 0.31 WHERE P = 2.85, S = 6.393

5 YR. R.O. = $\frac{(P-.25)^2}{P+.85}$ = 0.66 WHERE P = 3.70, S = 6.393

10 YR. R.O. = $\frac{(P-.25)^2}{P+.85}$ = 0.94 WHERE P = 4.25, S = 6.393

25 YR. R.O. = $\frac{(P-.25)^2}{P+.85}$ = 1.31 WHERE P = 4.90, S = 6.393

100 YR R.O. = $\frac{(P-.25)^2}{P+.85}$ = 1.96 WHERE P = 5.90, S = 6.393

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PROJECT CROSSGATES COMPLEX — JOB NO. 7838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION BEFORE DEVELOPMENT — SHEET 4 OF 103

2 Yr. INFLOW HYDROGRAPH - DRAIN. AREA "A" — COMPUTED BY J.S./R.R.

(CN = 61) TABULAR METHOD (767 ACRES) — CHECKED BY J.H.

TIME HRS.	CSM/IN. RO ① T_C = 1.25 T_T = 0.00	C.F.S. DA=0.42 R.O.=0.31	INFLOW HYDROGRAPH (C.F.S.)
8.00	0.00	0.13	0.000
8.25	0.10		0.013
8.50	0.25		0.033
8.75	0.45		0.059
9.00	0.70		0.091
9.25	1.00		0.130
9.50	1.50		0.195
9.75	2.50		0.325
10.00	3.70		0.481
10.25	5.90		0.767
10.50	7.10		0.923
10.75	8.50		1.105
11.00	10.40		1.352
11.25	13.90		1.807
11.50	18.60		2.418
11.75	38.40		4.992
12.00	95.60		12.428
12.25	193.20		25.116
12.50	272.80		35.464
12.75	261.10		55.943
13.00	219.90		28.587
13.25	173.90		22.607
13.50	136.80		17.784
13.75	108.60		14.118
14.00	87.10		11.323
14.25	72.20		9.386
14.50	60.50		7.865
14.75	52.00		6.760
15.00	45.70		5.941
15.25	40.00		5.200
15.50	36.80		4.784

NOTES:

① TABULAR DISCHARGES FROM TSC TECHNICAL NOTE - ENGINEERING UD-20; pgs. 16-17

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION BEFORE DEVELOPMENT — SHEET 5 OF 103

5 Yr. INFLOW HYDROGRAPH - DRAINAGE AREA "A" (267Ac.) — COMPUTED BY J.S./R.R.

(CN = 61) TABULAR METHOD — CHECKED BY J.M.

TIME HRS.	CSM/IN. R.O. ① T_c=1.25 T_T=0.00	C.F.S. D.A.=0.42 R.O.=0.66	INFLOWS HYDROGRAPH (C.F.S)
8.00	0.00	0.28	0.000
8.25	0.10		0.028
8.50	0.25		0.070
8.75	0.45		0.126
9.00	0.70		0.196
9.25	1.00		0.280
9.50	1.50		0.420
9.75	2.50		0.700
10.00	3.70		1.036
10.25	5.90		1.652
10.50	7.10		1.988
10.75	8.50		2.380
11.00	10.40		2.912
11.25	13.90		3.892
11.50	18.60		5.208
11.75	38.40		10.752
12.00	95.60		26.768
12.25	193.20		54.096
12.50	272.80		76.384
12.75	261.10		73.108
13.00	219.90		61.572
13.25	173.90		48.692
13.50	136.80		38.304
13.75	108.60		30.408
14.00	87.10		24.388
14.25	72.20		20.216
14.50	60.50		16.940
14.75	52.00		14.560
15.00	45.70		12.796
15.25	40.00		11.200
15.50	36.80		10.304

NOTES:

① TABULAR DISCHARGES FROM TSC TECHNICAL NOTE- ENGINEERING UD-20

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX
LOCATION GUILDFRLAND, N.Y.
TYPE OF CALCULATION BEFORE DEVELOPMENT
10 Yr. INFLOW HYDROGRAPH - DRAINAGE AREA "A" (267Ac)
(CN = 61) TABULAR METHOD

JOB NO. 2838
DATE 5-30-79
SHEET 6 OF 103
COMPUTED BY J.S./R.R.
CHECKED BY J.M.

TIME HRS.	CSM/IN.R.O. ① T_c=1.25 T_T=0.00	C.F.S. D.A.=0.42 R.O.=0.94 0.395	INFLOWS HYDROGRAPH (C.F.S)
8.00	0.00		0.00
8.25	0.10		0.04
8.50	0.25		0.10
8.75	0.45		0.18
9.00	0.70		0.28
9.25	1.00		0.40
9.50	1.50		0.59
9.75	2.50		0.99
10.00	3.70		1.46
10.25	5.90		2.33
10.50	7.10		2.80
10.75	8.50		3.36
11.00	10.40		4.11
11.25	13.90		5.49
11.50	18.60		7.35
11.75	38.40		15.17
12.00	95.60		37.76
12.25	193.20		76.31
12.50	272.80		107.76
12.75	261.10		103.10
13.00	219.90		86.86
13.25	173.90		68.69
13.50	136.80		54.04
13.75	108.60		42.90
14.00	87.10		34.40
14.25	72.20		28.52
14.50	60.50		23.90
14.75	52.00		20.54
15.00	45.70		18.05
15.25	40.00		15.80
15.50	36.80		14.54

NOTES:

① TABULAR DISCHARGES FROM TSC TECHNICAL NOTE- ENGINEERING UD-20; PGS. 16-17

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION BEFORE DEVELOPMENT — SHEET 7 OF 103

25 YR. INFLOW HYDROGRAPH - DRAINAGE AREA "A" (26TAC.) — COMPUTED BY J.S./R.R.

(CN = 61) TABULAR METHOD — CHECKED BY J.M.

TIME HRS.	CSM/IN.R.O. ① T_c=1.25 T_T=0.00	C.F.S. D.A.=0.42 R.O.=1.31	INFLOWS HYDROGRAPH (C.F.S)
8.00	0.00	0.55	0.00
8.25	0.10		0.06
8.50	0.25		0.14
8.75	0.45		0.25
9.00	0.70		0.39
9.25	1.00		0.55
9.50	1.50		0.83
9.75	2.50		1.38
10.00	3.70		2.04
10.25	5.90		3.25
10.50	7.10		3.91
10.75	8.50		4.68
11.00	10.40		5.72
11.25	13.90		7.65
11.50	18.60		10.23
11.75	38.40		21.12
12.00	95.60		52.58
12.25	193.20		106.26
12.50	272.80		150.04
12.75	261.10		143.61
13.00	219.90		120.95
13.25	173.90		95.65
13.50	136.80		75.24
13.75	108.60		59.73
14.00	87.10		47.91
14.25	72.20		39.71
14.50	60.50		33.28
14.75	52.00		28.60
15.00	45.70		25.14
15.25	40.00		22.00
15.50	36.80		20.24

NOTES:

① TABULAR DISCHARGES FROM TSC TECHNICAL NOTE- ENGINEERING UD-20; Pgs. 16-17

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION BEFORE DEVELOPMENT — SHEET 8 OF 103

100 Yr. INFLOW HYDROGRAPH - DRAINAGE AREA "A" (267 AC.) — COMPUTED BY J.S./R.R.

(CN = 61) TABULAR METHOD — CHECKED BY J.M.

TIME HRS.	CSM/IN. R.O. ① T_c=1.25 T_T=0.00	C.F.S. D.A.=0.42 R.O.=1.96	INFLOWS HYDROGRAPH (C.F.S)
8.00	0.00	0.82	0.00
8.25	0.10		0.08
8.50	0.25		0.21
8.75	0.45		0.37
9.00	0.70		0.57
9.25	1.00		0.82
9.50	1.50		1.23
9.75	2.50		2.05
10.00	3.70		3.03
10.25	5.90		4.84
10.50	7.10		5.82
10.75	8.50		6.97
11.00	10.40		8.53
11.25	13.90		11.40
11.50	18.60		15.25
11.75	38.40		31.49
12.00	95.60		78.39
12.25	193.20		158.42
12.50	272.80		223.70
12.75	261.10		214.10
13.00	219.90		180.32
13.25	173.90		145.60
13.50	136.80		112.18
13.75	108.60		89.05
14.00	87.10		71.42
14.25	72.20		59.20
14.50	60.50		49.61
14.75	52.00		42.64
15.00	45.70		37.47
15.25	40.00		32.80
15.50	36.80		30.18

NOTES:

① TABULAR DISCHARGES FROM TSC TECHNICAL NOTE- ENGINEERING UD-20; pgs. 16-17

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PROJECT CROSSGATES COMPLEX
LOCATION GUILDERLAND, N.Y.
TYPE OF CALCULATION BEFORE DEVELOPMENT
STORAGE VOLUMES
DRAINAGE AREA "A" (267 ACRES)

JOB NO. 2838
DATE 5-30-79
SHEET 9 OF 103
COMPUTED BY J.S./R.R.
CHECKED BY J.M.

STORAGE VOLUMES

ELEV.	Area	Av. Area	Depth	Volume c.f.	CUM. Volume c.f.	CUM. Volume Ac. ft
215.0	0					
		2000	10	20,000	20,000	0.46
225.0	4000					
		13,500	1	13,500	33,500	0.77
226.0	23,000					
		54,500	4	218,000	251,500	5.77
230.0	86,000					
		129,000	5	645,000	896,500	20.58
235.0	172,000					

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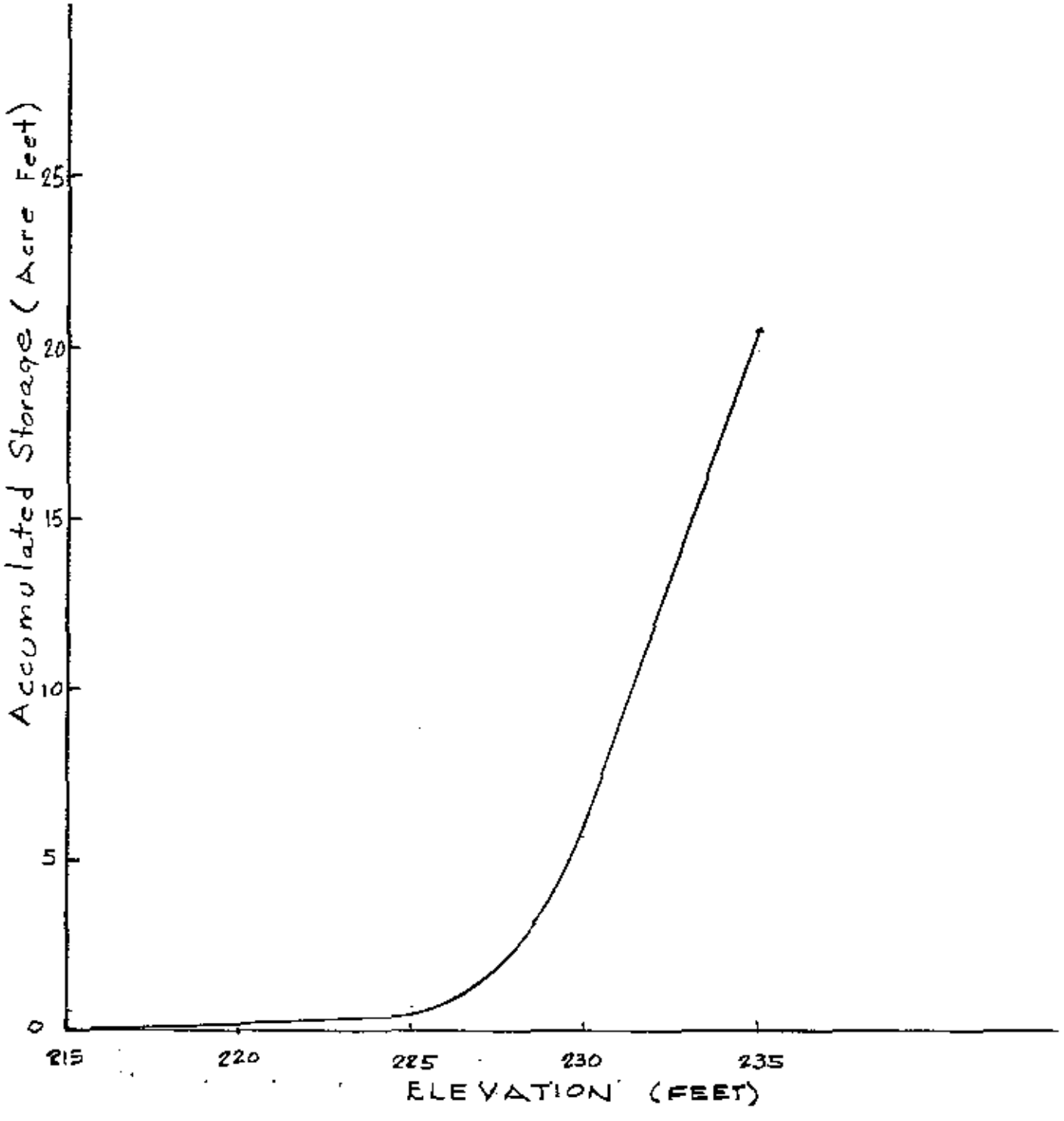
PROJECT CROSSGATES COMPLEX
LOCATION GUILDERLAND, N.Y.
TYPE OF CALCULATION BEFORE DEVELOPMENT
ELEVATION - STORAGE CURVE
DRAINAGE AREA "A" (267 ACRES)

JOB NO. 2838
DATE 5-30-79
SHEET 10 OF 103
COMPUTED BY J.S./RR
CHECKED BY JM



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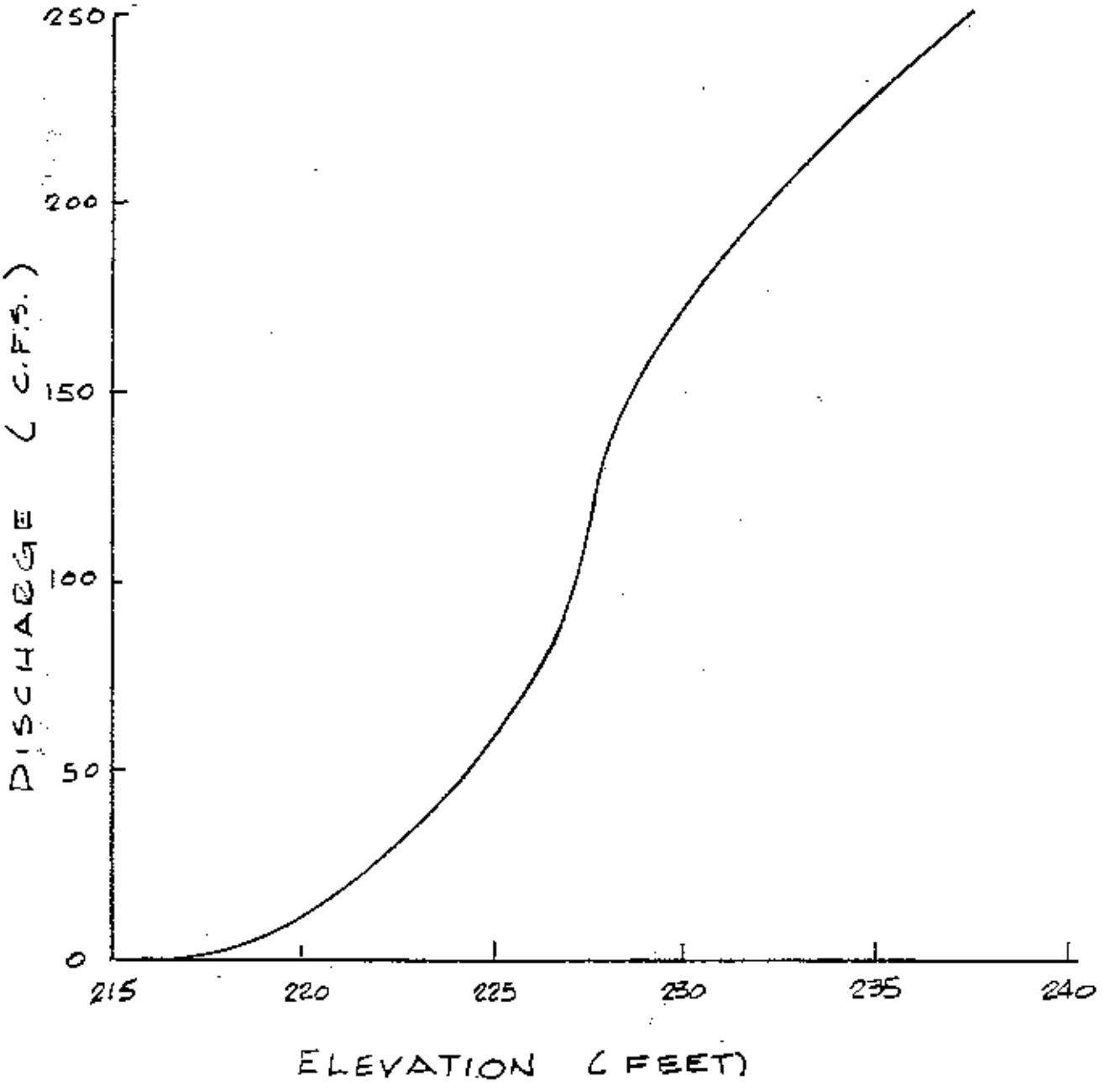
PROJECT CROSSGATES COMPLEX
LOCATION GUILDERLAND, N.Y.
TYPE OF CALCULATION BEFORE DEVELOPMENT
ELEVATION-DISCHARGE CURVE - 60" R.C.P.
DRAINAGE AREA "A" (267 ACRES)

JOB NO. 2838
DATE 5-30-79
SHEET 11 OF 103
COMPUTED BY JS/RR
CHECKED BY JM



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CONSULTING SITE ENGINEERS

PROJECT: CROSSGATES COMPLEX
LOCATION: GUILDERLAND, N.Y.
TYPE OF CALCULATION:

JOB NO. 2838
DATE: 5-30-79
SHEET 12 OF 103
COMPUTED BY JS/EE
CHECKED BY JM

WORKING CURVE

Form BEFORE DEVELOPMENT-DRAINAGE AREA "A" (26 Ac.)

TAILWATER ELEV. = N.A.

FOR Δt = 0.25 HRS.

ELEV. (FT.)	DISC. O_2 CFS	STORAGE S_2 Ac. Ft.	S_2 CFS-HRS.	$O_2/2$ CFS	$S_2/\Delta t$ CFS	$S_2/\Delta t + O_2/2$ CFS
215.00	0.0	0.00	0.0	0.0	0.0	0.0
215.50	0.2	0.05	0.6	0.1	2.4	2.5
216.00	0.5	0.10	1.2	0.3	4.8	5.1
216.50	0.7	0.12	1.5	0.4	6.0	6.4
217.00	1.0	0.13	1.6	0.5	6.4	6.9
217.50	2.0	0.18	2.2	1.0	8.8	9.8
218.00	3.0	0.20	2.4	1.5	9.6	11.1
218.50	4.2	0.21	2.5	2.1	10.0	12.1
219.00	6.5	0.22	2.7	3.3	10.8	14.1
219.50	9.0	0.25	3.0	4.5	12.0	16.5
220.00	12.0	0.28	3.4	6.0	13.6	19.6
220.50	15.0	0.30	3.6	7.5	14.4	21.9
221.00	19.0	0.31	3.8	9.5	15.2	24.7
221.50	22.5	0.32	3.9	11.3	15.6	26.9
222.00	26.8	0.35	4.2	13.4	16.8	30.2
222.50	31.5	0.38	4.6	15.8	18.4	34.2
223.00	36.5	0.40	4.8	18.3	19.2	37.5
223.50	42.0	0.46	5.6	21.0	22.4	43.4
224.00	47.5	0.52	6.3	23.8	25.2	49.0
224.50	54.0	0.60	7.3	27.0	29.2	56.2
225.00	60.0	0.67	8.1	30.0	32.4	62.4
225.50	67.5	0.73	8.8	33.8	35.2	69.0
226.00	75.0	0.85	10.3	37.5	41.2	78.7
226.50	85.0	1.15	13.9	42.5	55.6	98.1
227.00	99.0	1.50	18.2	49.5	72.8	122.3
227.50	118.5	1.95	23.6	59.3	94.4	153.7
228.00	137.5	2.50	30.3	68.8	121.2	190.0
228.50	149.0	3.15	38.1	74.5	152.4	226.9
229.00	158.0	4.00	48.4	79.0	193.6	272.6
229.50	165.0	4.90	59.3	82.5	237.2	319.7
230.00	173.0	6.00	72.6	86.5	290.4	376.9

RAYMOND KEYES ENGINEERS, P.C.
CONSULTING SITE ENGINEERS

PROJECT: CROSSGATES COMPLEX — JOB NO. 2838
LOCATION: GUILDERLAND, N.Y. — DATE: 5-30-79
TYPE OF CALCULATION: — SHEET 13 OF 103
WORKING CURVE — COMPUTED BY JS/RR
Form BEFORE DEVELOPMENT-DRAINAGE AREA "A" (26TAc) — CHECKED BY JM

TAILWATER ELEV. = N.A.

FOR Δt = 0.25 HRS.

ELEV. (FT.)	DISC. O_2 CFS	STORAGE S_2 Ac. Ft.	S_2 CFS-HRS.	$O_2/2$ CFS	$S_2/\Delta t$ CFS	$S_2/\Delta t + O_2/2$ CFS
230.50	179.0	7.40	89.5	89.5	358.0	447.5
231.00	185.5	8.80	106.5	92.8	426.0	518.8
231.50	193.0	10.30	124.6	96.5	498.4	594.9
232.00	197.5	11.70	141.6	98.8	566.4	665.2
232.50	203.5	13.00	157.3	101.8	629.2	731.0
233.00	209.0	14.50	175.5	104.5	702.0	806.5
233.50	214.5	16.00	193.6	107.3	774.4	881.7
234.00	219.0	17.40	210.5	109.5	842.0	951.5
234.50	224.0	18.90	228.7	112.0	914.8	1026.8
235.00	228.0	20.60	249.3	114.0	997.2	1111.2

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION BEFORE DEVELOPMENT — SHEET 14 OF 103

2 YR. FLOOD ROUTING- DRAINAGE AREA "A" (STORAGE INDICATION METHOD) — COMPUTED BY JS/RR

CHECKED BY JM

TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	
8.00	0.000				11.75	5.00				
		0.007	0.007	0.001			8.72	16.38	8.88	
8.25	0.013				12.00	12.43				
		0.023	0.029	0.002			18.78	26.28	21.51	
8.50	0.033				12.25	25.12				
		0.046	0.073	0.006			30.29	35.06	32.80	
8.75	0.059				12.50	35.46				
		0.075	0.142	0.011			35.70	38.43	37.96	*
9.00	0.091				12.75	35.94				
		0.111	0.242	0.019			32.27	32.74	29.78	
9.25	0.130				13.00	28.57				
		0.162	0.286	0.031			25.60	28.56	24.66	
9.50	0.193				13.25	22.61				
		0.260	0.615	0.049			20.20	24.10	18.14	
9.75	0.325				13.50	17.78				
		0.403	0.969	0.078			15.95	21.91	15.01	
10.00	0.481				13.75	14.12				
		0.624	1.515	0.121			12.72	19.62	12.03	
10.25	0.767				14.00	11.32				
		0.845	2.24	0.18			10.36	17.95	10.40	
10.50	0.923				14.25	9.39				
		1.02	3.08	0.27			8.65	16.18	8.67	
10.75	1.11				14.50	7.87				
		1.23	4.04	0.38			7.32	14.83	7.26	
11.00	1.35				14.75	6.76				
		1.58	5.24	0.52			6.35	13.92	6.29	
11.25	1.81				15.00	5.94				
		2.12	6.84	0.96			5.57	13.20	5.47	
11.50	2.42				15.25	5.20				
		3.71	9.59	1.93			4.99	12.72	4.91	
11.75	5.00				15.50	4.78				

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION BEFORE DEVELOPMENT — SHEET 15 OF 103

5 YR. FLOOD ROUTING- DRAINAGE AREA "A" — COMPUTED BY JS/RE

(STORAGE INDICATION METHOD) — CHECKED BY JM

TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	
8.00	0.00				11.75	10.75				
		0.014	0.014	0.001			18.76	26.29	21.53	
8.25	0.028				12.00	26.77				
		0.049	0.062	0.005			40.44	45.20	43.70	
8.50	0.070				12.25	54.10				
		0.098	0.155	0.012			65.24	66.74	64.89	
8.75	0.126				12.50	76.38				
		0.161	0.304	0.024			74.75	76.60	73.38	*
9.00	0.196				12.75	73.11				
		0.238	0.52	0.04			67.34	70.56	68.71	
9.25	0.250				13.00	61.57				
		0.35	0.83	0.07			55.13	56.98	54.90	
9.50	0.420				13.25	48.69				
		0.56	1.32	0.11			43.50	45.58	44.08	
9.75	0.700				13.50	38.30				
		0.87	2.08	0.17			34.36	35.86	34.02	
10.00	1.04				13.75	30.41				
		1.35	3.26	0.29			27.40	29.24	25.55	
10.25	1.65				14.00	24.30				
		1.82	4.79	0.46			22.31	26.00	21.07	
10.50	1.99				14.25	20.22				
		2.19	6.52	0.77			18.58	23.51	17.30	
10.75	2.38				14.50	16.94				
		2.65	8.40	1.52			15.75	21.96	15.09	
11.00	2.91				14.75	14.56				
		3.40	10.26	2.37			13.68	20.55	13.24	
11.25	3.89				15.00	12.80				
		4.46	12.37	4.51			12.00	19.31	11.72	
11.50	5.08				15.25	11.20				
		7.89	15.75	8.22			10.75	18.34	10.78	
11.75	10.75				15.50	10.30				

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION BEFORE DEVELOPMENT — SHEET 16 OF 103

10 YR. FLOOD ROUTING - DRAINAGE AREA "A" — COMPUTED BY JS/RR

(STORAGE INDICATION METHOD) — CHECKED BY JM

TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	
8.00	0.00				11.75	15.17				
		0.020	0.020	0.002			26.47	34.05	31.32	
8.25	0.04				12.00	37.76				
		0.070	0.088	0.007			57.04	59.77	57.48	
8.50	0.10				12.25	76.31				
		0.140	0.221	0.018			92.16	94.45	83.12	
8.75	0.15				12.50	107.8				
		0.23	0.43	0.03			105.45	116.78	95.81	*
9.00	0.25				12.75	103.1				
		0.34	0.74	0.06			94.98	115.95	95.33	
9.25	0.40				13.00	86.86				
		0.50	1.18	0.09			77.78	98.40	85.17	
9.50	0.59				13.25	68.69				
		0.79	1.88	0.15			61.37	74.60	71.83	
9.75	0.97				13.50	54.04				
		1.23	2.96	0.25			48.47	51.24	49.58	
10.00	1.46				13.75	42.90				
		1.90	4.61	0.44			38.65	40.31	39.08	
10.25	2.33				14.00	34.40				
		2.57	6.74	0.90			31.46	32.69	29.73	
10.50	2.80				14.25	28.52				
		3.08	8.92	1.70			26.21	29.17	25.46	
10.75	3.36				14.50	23.90				
		3.74	10.96	2.89			22.22	25.93	20.96	
11.00	4.11				14.75	20.54				
		4.80	12.87	5.09			19.30	24.27	18.39	
11.25	5.49				15.00	18.05				
		6.42	14.20	6.60			16.93	22.81	16.30	
11.50	7.35				15.25	15.80				
		11.26	18.86	11.28			15.17	21.68	14.71	
11.75	15.17				15.50	14.54				

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION BEFORE DEVELOPMENT — SHEET 17 OF 103

25 YR. FLOOD ROUTING- DRAINAGE AREA "A" — COMPUTED BY JS/RE

(STORAGE INDICATION METHOD) — CHECKED BY JM

TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	
8.00	0.00				11.75	21.12				
		0.030	0.030	0.002			36.85	43.20	41.73	
8.25	0.06				12.00	52.58				
		0.070	0.098	0.008			79.44	80.91	76.14	
8.50	0.14				12.25	106.3				
		0.200	0.290	0.023			128.15	137.69	108.56	
8.75	0.25				12.50	150.0				
		0.320	0.33	0.03			146.80	175.93	130.14	
9.00	0.30				12.75	143.6				
		0.47	0.77	0.06			132.30	178.09	131.27	*
9.25	0.55				13.00	121.0				
		0.69	1.39	0.11			108.32	155.14	119.25	
9.50	0.72				13.25	95.65				
		1.11	2.39	0.19			85.45	121.34	98.44	
9.75	1.38				13.50	75.24				
		1.71	3.91	0.36			67.49	90.39	81.03	
10.00	2.04				13.75	59.72				
		2.65	6.20	0.67			53.82	68.18	60.78	
10.25	3.25				14.00	47.91				
		3.58	9.11	1.76			43.81	46.21	44.71	
10.50	3.91				14.25	39.71				
		4.30	11.65	3.66			36.50	38.00	36.96	
10.75	4.68				14.50	33.29				
		5.20	13.19	5.45			30.94	31.98	28.89	
11.00	5.72				14.75	28.60				
		6.69	14.43	6.84			26.57	29.96	26.49	
11.25	7.65				15.00	25.14				
		8.94	16.53	9.03			23.57	27.04	22.68	
11.50	10.23				15.25	22.00				
		15.68	23.18	16.83			21.12	25.48	20.24	
11.75	21.12				15.50	20.24				

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION BEFORE DEVELOPMENT — SHEET 18 OF 103

100 YR. FLOOD ROUTING- DRAINAGE AREA "A" — COMPUTED BY JS/RR

(STORAGE INDICATION METHOD) — CHECKED BY JM

TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	
8.00	0.00				11.75	31.49				
		0.04	0.040	0.003			54.94	58.44	56.75	
8.25	0.09				12.00	78.39				
		0.15	0.187	0.015			118.40	120.59	98.01	
8.50	0.21				12.25	158.4				
		0.29	0.46	0.04			191.05	213.63	144.86	
8.75	0.37				12.50	223.7				
		0.94	1.00	0.08			218.90	287.67	160.24	
9.00	0.57				12.75	214.1				
		0.70	1.62	0.13			197.2	324.63	165.67	*
9.25	0.82				13.00	180.3				
		2.06	3.54	0.32			162.95	321.91	165.31	
9.50	1.22				13.25	145.6				
		1.64	4.86	0.47			128.90	285.50	159.92	
9.75	2.05				13.50	112.2				
		2.54	6.93	1.01			100.63	226.21	148.78	
10.00	2.82				13.75	89.05				
		3.94	9.86	2.05			80.24	157.67	120.58	
10.25	4.84				14.00	71.42				
		5.33	13.14	5.40			65.31	102.40	87.49	
10.50	5.82				14.25	59.20				
		6.40	14.14	6.54			54.41	69.32	67.75	
10.75	6.97				14.50	49.61				
		7.75	15.35	7.80			46.13	47.70	46.20	
11.00	8.53				14.75	42.64				
		9.97	17.52	9.99			40.06	41.56	40.22	
11.25	11.40				15.00	37.47				
		13.33	22.86	16.37			35.14	36.48	34.95	
11.50	15.25				15.25	32.80				
		23.37	29.86	26.36			31.50	33.03	30.13	
11.75	31.49				15.50	30.18				

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX
LOCATION GUILDERLAND, N.Y.
TYPE OF CALCULATION BEFORE DEVELOPMENT
HYDROLOGICAL CLASSIFICATIONS
DRAINAGE AREA "B" (47 ACRES)

JOB NO. 2838
DATE 5-30-79
SHEET 19 OF 103
COMPUTED BY JS/RR
CHECKED BY JM

	CLASS HYDRO	CN	ACRES AREA	∠N(A)	
OPEN	A	39	8.72	340.1	
	B	61	-	-	
	C	74	-	-	
	D	80	-	-	
					340.1
RESIDENTIAL	A	57	-	-	
	B	72	-	-	
	C	81	-	-	
	D	86	-	-	
					-
WOODED	A	25	13.50	337.5	
	B	55	3.12	171.6	
	C	70	1.47	102.9	
	D	77	20.19	1554.6	
					2166.6
BUSINESS	A	89	-	-	
COMMERCIAL	B	92	-	-	
	C	94	-	-	
	D	95	-	-	
TOTAL			47		2506.7

$$CN = \frac{2506.7}{47} = 53.3 \approx 54$$

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PROJECT CROSSGATES COMPLEX
LOCATION GUILDERLAND, N.Y.
TYPE OF CALCULATION BEFORE DEVELOPMENT
STORM DRAINAGE WATERSHED CHARACTERISTICS
DRAINAGE AREA "B" (47 ACRES)

JOB NO. 2838
DATE 5-30-79
SHEET 20 OF 103
COMPUTED BY JS/RL
CHECKED BY JM

AREA = 47 ACRES = 0.073 Sq. mi.

CN	=	54
P_2	=	2.85
P_5	=	3.70
P_{10}	=	4.25
P_{25}	=	4.90
P_{100}	=	5.90
T_c	=	0.50
T_T	=	0.00

WHERE P IS DESIGN RAINFALL IN INCHES FOR 2, 5, 10, 25 & 100 YR. STORM FREQUENCY RECURRENCE INTERVALS OVER A 24 HOUR DURATION. FROM TECHNICAL PAPER No. 40 MAY 1961.

$S = \frac{1000}{CN} - 10 = 8.52$ WHERE CN = 54

MASS RUNOFF

2 YR. R.O. $= \frac{(P-.2S)^2}{P+.8S} = 0.14$ WHERE P = 2.85, S = 8.52

5 YR. R.O. $= \frac{(P-.2S)^2}{P+.8S} = 0.38$ WHERE P = 3.70, S = 8.52

10 YR. R.O. $= \frac{(P-.2S)^2}{P+.8S} = 0.59$ WHERE P = 4.25, S = 8.52

25 YR. R.O. $= \frac{(P-.2S)^2}{P+.8S} = 0.87$ WHERE P = 4.90, S = 8.52

100 YR R.O. $= \frac{(P-.2S)^2}{P+.8S} = 1.38$ WHERE P = 5.90, S = 8.52

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PROJECT CROSSGATES COMPLEX — JOB NO. 2838
LOCATION GUILDERLAND, NY — DATE 5-30-79
TYPE OF CALCULATION BEFORE DEVELOPMENT — SHEET 21 OF 103
2 YR INFLOW HYDROGRAPH - DRAINAGE AREA "B" — COMPUTED BY J.S/RR
(CN = 54) TABULAR METHOD (47Ac.) — CHECKED BY JM

TIME HRS	CSM/IN. R.O. ① Tc = 0.50 Tt = 0.00	C.F.S. D.A. = 0.073 R.O. = .214	INFLOW HYDROGRAPH (C.F.S.)
8.00	0.00	0.010	0.000
8.25	0.25		0.002
8.50	0.50		0.003
8.75	1.00		0.01
9.00	2.00		0.02
9.25	3.05		0.03
9.50	4.15		0.04
9.75	5.25		0.05
10.00	6.30		0.06
10.25	7.80		0.08
10.50	10.50		0.11
10.75	13.90		0.14
11.00	18.10		0.18
11.25	24.80		0.25
11.50	40.20		0.40
11.75	151.60		1.52
12.00	390.90		3.91
12.25	427.50		4.28
12.50	261.50		2.62
12.75	159.60		1.60
13.00	101.80		1.02
13.25	76.30		0.76
13.50	60.30		0.60
13.75	51.50		0.52
14.00	44.70		0.45
14.25	40.80		0.41
14.50	37.40		0.37
14.75	35.00		0.35
15.00	32.90		0.33
15.25	30.50		0.31
15.50	29.10		0.29

NOTES:

① TABULAR DISCHARGES FROM TSC TECHNICAL NOTE - ENGINEERING UD-20; pgs. 7-8

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838
LOCATION GUILDERLAND, NY — DATE 5-30-79
TYPE OF CALCULATION BEFORE DEVELOPMENT — SHEET 22 OF 103
5 YR. INFLOW HYDROGRAPH - DRAINAGE AREA "B" — COMPUTED BY JS/RR
(CN = 54) TABULAR METHOD (47 Ac) — CHECKED BY JM

TIME HRS	CSM/IN. R.O. ① Tc = 0.50 TL = 0.00	C.F.S. D.A. = .0073 R.O. = 0.38	INFLOW HYDROGRAPH (C.F.S.)
8.00	0.00	0.028	0.000
8.25	0.25		0.007
8.50	0.50		0.014
8.75	1.00		0.028
9.00	2.00		0.06
9.25	3.05		0.09
9.50	4.15		0.12
9.75	5.25		0.15
10.00	6.30		0.18
10.25	7.80		0.22
10.50	10.50		0.29
10.75	13.90		0.39
11.00	18.10		0.51
11.25	24.80		0.69
11.50	40.20		1.13
11.75	151.60		4.24
12.00	390.90		10.95
12.25	427.50		11.97
12.50	261.50		7.32
12.75	159.60		4.47
13.00	101.80		2.85
13.25	76.30		2.14
13.50	60.30		1.69
13.75	51.50		1.44
14.00	44.70		1.25
14.25	40.80		1.14
14.50	37.40		1.05
14.75	35.00		0.98
15.00	32.90		0.92
15.25	30.50		0.85
15.50	29.10		0.81

NOTES:

① TABULAR DISCHARGES FROM TSC TECHNICAL NOTE- ENGINEERING UD-20; pgs. 7-8

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838
LOCATION GUILDERLAND, NY — DATE 5-30-79
TYPE OF CALCULATION BEFORE DEVELOPMENT — SHEET 23 OF 103
10 YR INFLOW HYDROGRAPH - DRAINAGE AREA "B" — COMPUTED BY JS/RL
(CN = 54) TABULAR METHOD (47 AC.) — CHECKED BY JM

TIME HRS	CSM/IN. R.O. ① Tc = 0.50 TT = 0.00	C.F.S. D.A. = 0.073 R.O. = 0.59	INFLOW HYDROGRAPH (C.F.S.)
8.00	0.00	0.043	0.00
8.25	0.25		0.01
8.50	0.50		0.02
8.75	1.00		0.04
9.00	2.00		0.09
9.25	3.05		0.13
9.50	4.15		0.18
9.75	5.25		0.23
10.00	6.30		0.27
10.25	7.80		0.34
10.50	10.50		0.45
10.75	13.90		0.60
11.00	18.10		0.78
11.25	24.80		1.07
11.50	40.20		1.73
11.75	151.60		6.52
12.00	390.90		16.81
12.25	427.50		18.38
12.50	261.50		11.24
12.75	159.60		6.86
13.00	101.80		4.38
13.25	76.30		3.28
13.50	60.30		2.59
13.75	51.50		2.21
14.00	44.70		1.92
14.25	40.80		1.75
14.50	37.40		1.61
14.75	35.00		1.50
15.00	32.90		1.41
15.25	30.50		1.31
15.50	29.10		1.25

NOTES:

① TABULAR DISCHARGES FROM TSC TECHNICAL NOTE - ENGINEERING UD-20; pgs. 7-8

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX
LOCATION GUILDERLAND, NY
TYPE OF CALCULATION BEFORE DEVELOPMENT
25 YR INFLOW HYDROGRAPH - DRAINAGE AREA "B"
(CN = 54) TABULAR METHOD (47 AC.)

JOB NO. 2838
DATE 5-30-79
SHEET 24 OF 103
COMPUTED BY JS/RR
CHECKED BY JM

TIME HRS	CSM/IN, R.O. ① Tc = 0.50 Tt = 0.00	C.F.S. D.A. = .0073 R.O. = .87	INFLOW HYDROGRAPH (C.F.S.)
8.00	0.00	0.064	0.00
8.25	0.25		0.02
8.50	0.50		0.03
8.75	1.00		0.06
9.00	2.00		0.13
9.25	3.05		0.20
9.50	4.15		0.27
9.75	5.25		0.34
10.00	6.30		0.40
10.25	7.80		0.50
10.50	10.50		0.67
10.75	13.90		0.89
11.00	18.10		1.16
11.25	24.80		1.59
11.50	40.20		2.57
11.75	151.60		9.70
12.00	390.90		25.02
12.25	427.50		27.36
12.50	261.50		16.74
12.75	159.60		10.21
13.00	101.80		6.52
13.25	76.30		4.88
13.50	60.30		3.86
13.75	51.50		3.30
14.00	44.70		2.86
14.25	40.80		2.61
14.50	37.40		2.40
14.75	35.00		2.24
15.00	32.90		2.11
15.25	30.50		1.95
15.50	29.10		1.86

NOTES:

① TABULAR DISCHARGES FROM TSC TECHNICAL NOTE - ENGINEERING UD-20; pgs. 7-8

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838
LOCATION GUILDERLAND, N.Y. — DATE 5-30-79
TYPE OF CALCULATION BEFORE DEVELOPMENT — SHEET 25 OF 103
100 YR INFLOW HYDROGRAPH - DRAINAGE AREA "B" — COMPUTED BY JS/RL
(CN = 54) TABULAR METHOD (47 AC.) — CHECKED BY JM

TIME HRS	CSM/IN, R.O. ① Tc = 0.50 TT = 0.00	C.F.S. D.A. = .0073 R.O. = 1.38	INFLOW HYDROGRAPH (C.F.S.)
8.00	0.00	0.10	0.00
8.25	0.25		0.03
8.50	0.50		0.05
8.75	1.00		0.10
9.00	2.00		0.20
9.25	3.05		0.31
9.50	4.15		0.42
9.75	5.25		0.53
10.00	6.30		0.63
10.25	7.80		0.78
10.50	10.50		1.05
10.75	13.90		1.39
11.00	18.10		1.81
11.25	24.80		2.45
11.50	40.20		4.02
11.75	151.60		15.16
12.00	390.90		39.09
12.25	427.50		42.75
12.50	261.50		26.15
12.75	159.60		15.96
13.00	101.80		10.18
13.25	76.30		7.63
13.50	60.30		6.03
13.75	51.50		5.15
14.00	44.70		4.47
14.25	40.80		4.08
14.50	37.40		3.74
14.75	35.00		3.50
15.00	32.90		3.29
15.25	30.50		3.05
15.50	29.10		2.91

NOTES:

① TABULAR DISCHARGES FROM TSC TECHNICAL NOTE - ENGINEERING UD-20; pgs. 7-8

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX
LOCATION GUILDERLAND, N.Y.
TYPE OF CALCULATION BEFORE DEVELOPMENT
STORAGE VOLUMES
DRAINAGE AREA "B" (47 ACRES)

JOB NO. 2838
DATE 5-30-79
SHEET 26 OF 103
COMPUTED BY JS/RR
CHECKED BY JM

STORAGE VOLUMES

ELEV.	Area	A.V. Area	Depth	Volume C.F.	CUM. Volume C.F.	CUM. Volume Ac.-Ft.
252.41	0					
		12,438	.59	7928	7928	.18
253	26,875					
		42,938	1.00	42,938	50,866	1.17
254	57,000					
		81,500	1.00	81,500	132,366	3.04
255	106,000					
		188,750	1.00	188,750	321,116	7.37
256	271,5[illegible]					

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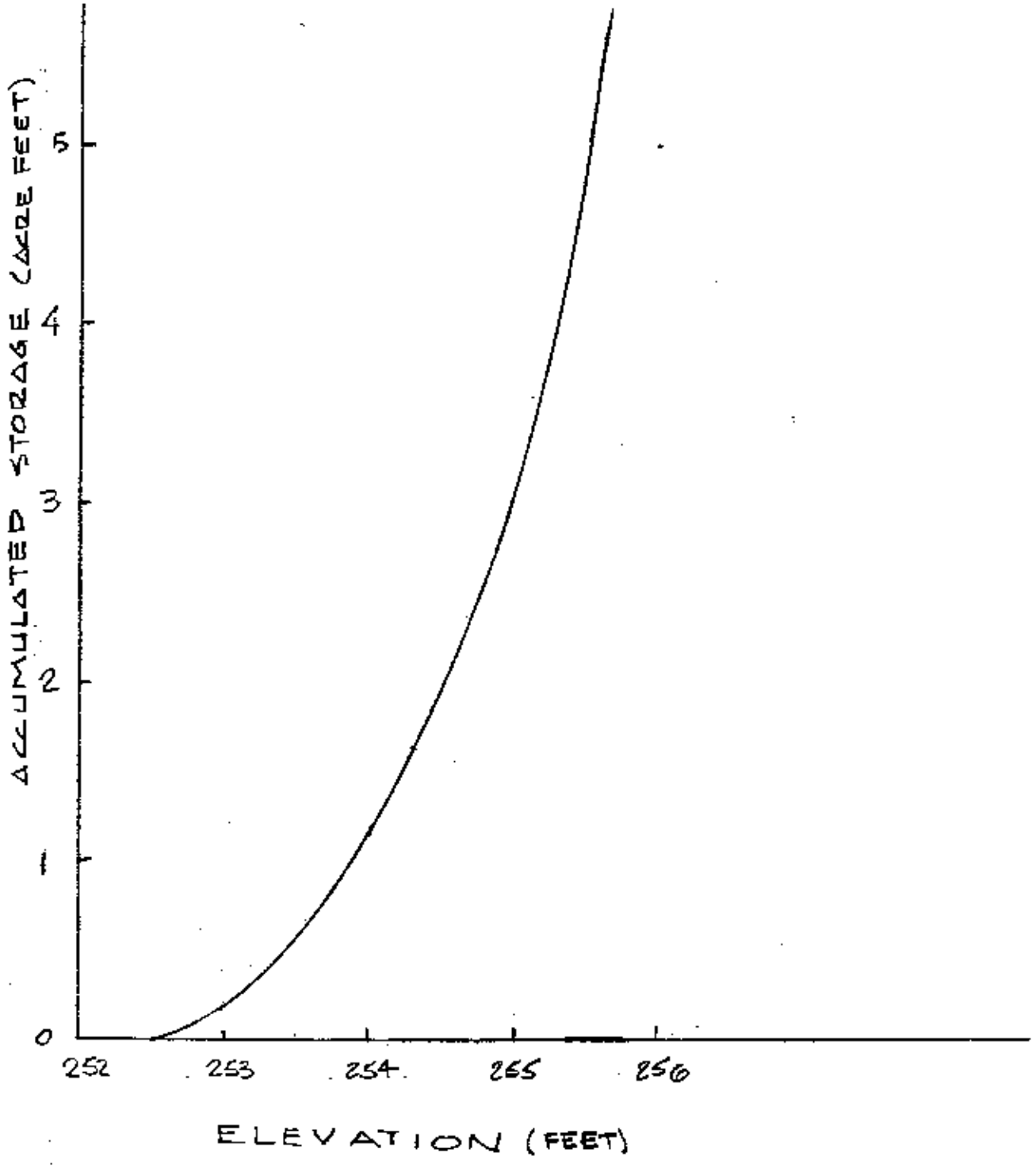
PROJECT CROSS GATES COMPLEX
LOCATION GUILDERLAND, N.Y.
TYPE OF CALCULATION BEFORE DEVELOPMENT
ELEVATION-STORAGE CURVE
DRAINAGE AREA "B" (47 ACRES)

JOB NO. 2838
DATE 5-30-79
SHEET 27 OF 103
COMPUTED BY JS/ER
CHECKED BY JM



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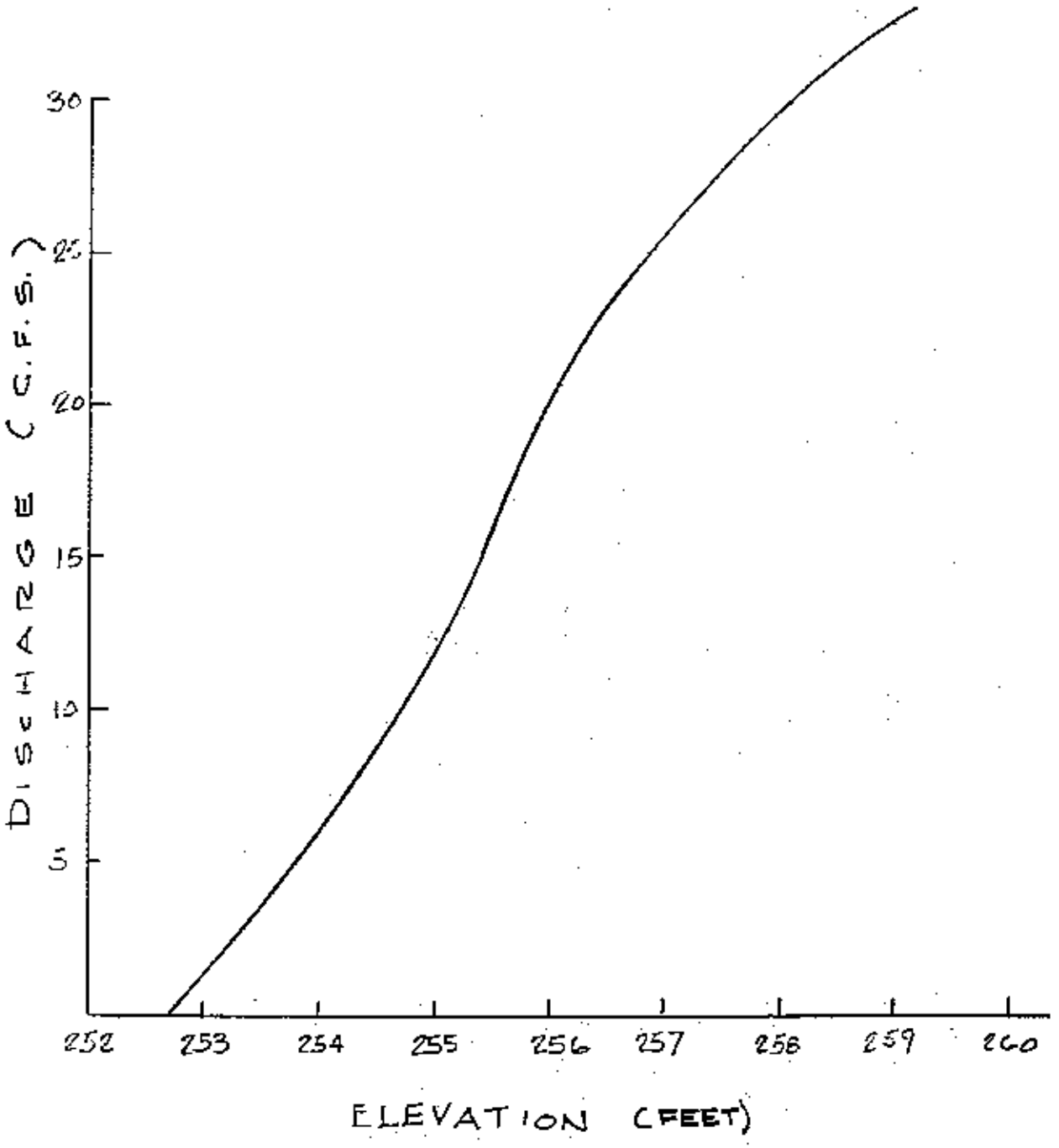
PROJECT Crossgates Complex
LOCATION Guilderland, N.Y.
TYPE OF CALCULATION BEFORE DEVELOPMENT
ELEVATION - DISCHARGE CURVE - 21" R.C.P.
DRAINAGE AREA "B" (47 ACRES)

JOB NO. 2838
DATE 5-30-79
SHEET 28 OF 103
COMPUTED BY JS/RR
CHECKED BY JH



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PROJECT: CROSSGATES COMPLEX — JOB NO. 2838

LOCATION: GUILDERLAND, N.Y. — DATE: 5-30-79

TYPE OF CALCULATION: — SHEET 29 OF 103

WORKING CURVE

COMPUTED BY JS/RR

Form BEFORE DEVELOPMENT - DRAINAGE AREA "B" (47Ac.) CHECKED BY JM

TAILWATER ELEV. = N.A.

FOR Δt = 0.25 HRS.

ELEV. (FT.)	DISC. O_2 CFS	STORAGE S_2 Ac. Ft.	S_2 CFS-HRS.	$O_2/2$ CFS	$S_2/\Delta t$ CFS	$S_2/\Delta t + O_2/2$ CFS
252.50	0.0	0.00	0.0	0.0	0.0	0.0
253.00	1.0	0.18	2.2	0.5	8.8	9.3
253.50	3.7	0.60	7.3	1.9	29.2	31.1
254.00	6.5	1.17	14.2	3.3	56.8	60.1
254.50	9.4	2.00	24.2	4.7	96.8	101.5
255.00	12.3	3.04	36.8	6.2	147.2	153.4
255.50	15.2	5.20	62.9	7.6	251.6	259.2
256.00	21.1	7.37	89.2	10.6	356.8	367.4

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PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION BEFORE DEVELOPMENT — SHEET 30 OF 103

2 YR. FLOOD ROUTING- DRAINAGE AREA "B" — COMPUTED BY JS/RR

(STORAGE INDICATION METHOD) — CHECKED BY JM

TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	
8.00	0.00				11.75	1.52				
		0.001	0.001	0.0001			2.72	4.30	0.46	
8.25	0.002				12.00	3.91				
		0.003	0.0039	0.0004			4.10	7.94	0.85	
8.50	0.003				12.25	4.28				
		0.007	0.011	0.0012			3.45	10.55	1.15	
8.75	0.010				12.50	2.62				
		0.015	0.025	0.003			2.11	11.51	1.27	
9.00	0.02				12.75	1.60				
		0.025	0.047	0.005			1.31	11.55	1.28	*
9.25	0.03				13.00	1.02				
		0.035	0.077	0.008			0.89	11.16	1.23	
9.50	0.04				13.25	0.76				
		0.045	0.114	0.012			0.68	10.61	1.16	
9.75	0.05				13.50	0.60				
		0.055	0.157	0.017			0.56	10.01	1.09	
10.00	0.06				13.75	0.52				
		0.070	0.210	0.023			0.49	9.41	1.01	
10.25	0.08				14.00	0.45				
		0.095	0.282	0.030			0.43	8.83	0.95	
10.50	0.11				14.25	0.41				
		0.125	0.377	0.041			0.39	8.27	0.89	
10.75	0.14				14.50	0.37				
		0.160	0.496	0.053			0.36	7.74	0.83	
11.00	0.18				14.75	0.35				
		0.215	0.658	0.071			0.34	7.25	0.78	
11.25	0.25				15.00	0.33				
		0.325	0.912	0.098			0.32	6.79	0.73	
11.50	0.40				15.25	0.31				
		0.96	1.77	0.19			0.30	6.36	0.68	
11.75	1.52				15.50	0.29				

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838
LOCATION GUILDERLAND, N.Y. — DATE 5-30-79
TYPE OF CALCULATION BEFORE DEVELOPMENT — SHEET 31 OF 103
5 YR. FLOOD ROUTING- DRAINAGE AREA "B" — COMPUTED BY JS/RR
(STORAGE INDICATION METHOD) — CHECKED BY JM

TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	
8.00	0.000				11.75	4.24				
		0.0035	0.0035	0.0004			7.60	12.04	1.34	
8.25	0.007				12.00	10.95				
		0.011	0.0141	0.0015			11.46	22.16	2.59	
8.50	0.014				12.25	11.97				
		0.021	0.034	0.004			9.65	29.22	3.47	
8.75	0.028				12.50	7.32				
		0.044	0.074	0.008			5.71	31.65	3.75	*
9.00	0.06				12.75	4.47				
		0.075	0.141	0.015			3.66	31.56	3.74	
9.25	0.09				13.00	2.85				
		0.105	0.231	0.025			2.50	30.32	3.60	
9.50	0.12				13.25	2.14				
		0.135	0.341	0.037			1.92	28.64	3.40	
9.75	0.15				13.50	1.69				
		0.165	0.469	0.050			1.57	26.81	3.17	
10.00	0.18				13.75	1.44				
		0.200	0.619	0.067			1.35	24.99	2.94	
10.25	0.22				14.00	1.25				
		0.255	0.807	0.087			1.20	23.25	2.73	
10.50	0.29				14.25	1.14				
		0.340	1.060	0.114			1.10	21.62	2.53	
10.75	0.39				14.50	1.05				
		0.450	1.396	0.150			1.02	20.11	2.34	
11.00	0.51				14.75	0.98				
		0.60	1.85	0.20			0.95	18.72	2.17	
11.25	0.69				15.00	0.92				
		0.91	2.56	0.28			0.89	17.44	2.01	
11.50	1.13				15.25	0.85				
		2.69	4.97	0.53			0.83	16.26	1.86	
11.75	4.24				15.50	0.81				

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION BEFORE DEVELOPMENT — SHEET 32 OF 103

10 YR. FLOOD ROUTING- DRAINAGE AREA "B" — COMPUTED BY JS/RR

(STORAGE INDICATION METHOD) — CHECKED BY JM

TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	
8.00	0.00				11.75	6.52				
		0.005	0.0050	0.0005			11.67	18.50	2.14	
8.25	0.01				12.00	16.81				
		0.015	0.0195	0.0021			17.60	33.96	3.98	
8.50	0.02				12.25	18.38				
		0.03	0.047	0.005			14.81	44.79	5.02	
8.75	0.04				12.50	11.24				
		0.07	0.112	0.012			9.05	48.82	5.41	
9.00	0.09				12.75	6.86				
		0.11	0.210	0.023			5.62	49.03	5.43	*
9.25	0.13				13.00	4.38				
		0.16	0.35	0.04			3.33	47.43	5.28	
9.50	0.18				13.25	3.28				
		0.21	0.52	0.06			2.94	45.09	5.05	
9.75	0.23				13.50	2.59				
		0.25	0.71	0.08			2.40	42.44	4.79	
10.00	0.27				13.75	2.21				
		0.31	0.94	0.10			2.07	39.72	4.53	
10.25	0.34				14.00	1.92				
		0.40	1.24	0.13			1.84	37.03	4.27	
10.50	0.45				14.25	1.75				
		0.53	1.64	0.18			1.68	34.44	4.02	
10.75	0.60				14.50	1.61				
		0.69	2.15	0.23			1.56	33.54	3.94	
11.00	0.78				14.75	1.50				
		0.93	2.85	0.31			1.46	31.06	3.70	
11.25	1.07				15.00	1.41				
		1.40	3.94	0.42			1.36	28.72	3.41	
11.50	1.73				15.25	1.31				
		4.13	7.65	0.82			1.28	26.59	3.14	
11.75	6.52				15.50	1.25				

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838
LOCATION GUILDERLAND, N.Y. — DATE 5-30-79
TYPE OF CALCULATION BEFORE DEVELOPMENT — SHEET 33 OF 103
25 YR. FLOOD ROUTING - DRAINAGE AREA "B" — COMPUTED BY JS/RE
(STORAGE INDICATION METHOD) — CHECKED BY JM

TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	
8.00	0.00				11.75	9.70				
		0.010	0.0100	0.0011			17.36	27.47	3.25	
8.25	0.02				12.00	25.02				
		0.025	0.0339	0.0036			26.19	50.41	5.56	
8.50	0.03				12.25	27.36				
		0.045	0.0753	0.0081			22.05	66.90	6.98	
8.75	0.06				12.50	16.74				
		0.095	0.162	0.017			13.48	73.40	7.43	
9.00	0.13				12.75	10.21				
		0.165	0.310	0.033			8.37	74.34	7.50	*
9.25	0.20				13.00	6.52				
		0.235	0.512	0.055			5.70	72.54	7.37	
9.50	0.27				13.25	4.88				
		0.31	0.77	0.08			4.37	69.54	7.16	
9.75	0.34				13.50	3.86				
		0.37	1.06	0.11			3.58	65.96	6.91	
10.00	0.40				13.75	3.30				
		0.45	1.40	0.15			3.08	62.13	6.64	
10.25	0.50				14.00	2.86				
		0.59	1.84	0.20			2.74	58.23	6.32	
10.50	0.67				14.25	2.61				
		0.78	2.42	0.26			2.51	54.42	5.95	
10.75	0.89				14.50	2.40				
		1.03	3.19	0.34			2.32	50.79	5.60	
11.00	1.16				14.75	2.24				
		1.38	4.23	0.45			2.18	47.37	5.27	
11.25	1.59				15.00	2.11				
		2.08	5.86	0.63			2.03	44.13	4.96	
11.50	2.57				15.25	1.95				
		6.14	11.37	1.26			1.91	41.08	4.66	
11.75	9.70				15.50	1.86				

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION BEFORE DEVELOPMENT — SHEET 34 OF 103

100 YR. FLOOD ROUTING - DRAINAGE AREA "B" — COMPUTED BY JS/EE

(STORAGE INDICATION METHOD) — CHECKED BY JM

TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	
8.00	0.00				11.75	15.16				
		0.015	0.0150	0.0016			27.13	42.82	4.83	
8.25	0.03				12.00	39.09				
		0.040	0.053	0.006			40.92	78.91	7.82	
8.50	0.05				12.25	42.75				
		0.075	0.122	0.013			34.45	105.54	9.63	
8.75	0.10				12.50	26.15				
		0.15	0.26	0.03			20.06	115.97	10.21	
9.00	0.20				12.75	15.96				
		0.26	0.49	0.05			13.07	118.87	10.37	*
9.25	0.31				13.00	10.18				
		0.37	0.81	0.09			8.91	117.41	10.29	
9.50	0.42				13.25	7.63				
		0.48	1.20	0.13			6.83	113.95	10.10	
9.75	0.53				13.50	6.03				
		0.58	1.65	0.18			5.59	109.44	9.84	
10.00	0.63				13.75	5.15				
		0.71	2.18	0.23			4.81	104.41	9.56	
10.25	0.78				14.00	4.47				
		0.92	2.87	0.31			4.28	99.13	9.23	
10.50	1.05				14.25	4.08				
		1.22	3.78	0.41			3.91	93.81	8.86	
10.75	1.39				14.50	3.74				
		1.60	4.97	0.53			3.62	88.57	8.49	
11.00	1.81				14.75	3.50				
		2.15	6.59	0.71			3.40	83.48	8.14	
11.25	2.48				15.00	3.29				
		3.25	9.13	0.98			3.17	78.51	7.79	
11.50	4.02				15.25	3.05				
		9.59	17.74	2.05			2.98	73.70	7.45	
11.75	15.16				15.50	2.91				

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX
LOCATION GUILDERLAND, N.Y.
TYPE OF CALCULATION BEFORE DEVELOPMENT SUMMARY
DRAINAGE AREA "A" (267 Ac) & DRAINAGE AREA "B" (47Ac)

JOB NO. 2838
DATE 5-30-79
SHEET 35 OF 103
COMPUTED BY JS/RR
CHECKED BY JM

RECURRENCE INTERVAL	PEAK RUNOFF (C.F.S) AREA "A"	AREA "B"	TOTAL	CONVEYANCE STORAGE VOLUME (AC. FT.) AREA "A"	AREA "B"	TOTAL
2 YEAR	37.96	1.28	39.24	0.40	0.23	0.63
5 YEAR	73.38	3.75	77.13	0.82	0.62	1.44
10 YEAR	95.81	5.43	101.24	1.42	0.96	2.38
25 YEAR	131.27	7.50	138.77	2.32	1.46	3.78
100 YEAR	165.67	10.37	176.04	5.00	2.35	7.35

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PROJECT CROSSGATES COMPLEX
LOCATION Guilderland, N.Y.
TYPE OF CALCULATION After Development
HYDROLOGICAL CLASSIFICATIONS
COMBINED DRAINAGE AREA (327 ACRES)

JOB NO. 2838
DATE 5-30-79
SHEET 36 OF 203
COMPUTED BY JS/RR
CHECKED BY JM

	CLASS HYDRO	CN	ACRES AREA	CN(A)	
OPEN	A	39	20.62	804.18	
	B	61	3.40	207.40	
	C	74	25.10	1857.40	
	D	80	9.50	760.00	
					3628.98
RESIDENTIAL	A	57	37.00	2109.00	
	B	72	34.68	2496.96	
	C	81	6.28	508.68	
	D	86	—		
					5114.64
WOODED	A	25	45.18	1129.50	
	B	55	12.14	667.70	
	C	70	7.28	509.60	
	D	77	13.10	1008.70	
					3315.50
BUSINESS COMMERCIAL	A	89	47.65	4240.85	
	B	92	28.09	2584.28	
	C	94	4.40	413.60	
	D	95	32.58	3095.10	
					10,333,83
TOTAL			327.00		22,392.95

$$CN = \frac{22,392.95}{327} = 68.48 \approx 68.5$$

RAYMOND KEYES ENGINEERS, P.C.

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PROJECT CROSSGATES COMPLEX — JOB NO. 7858
LOCATION GUILDERLAND, N.Y. — DATE 5-30-79
TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 37 OF 103
STORM DRAINAGE WATERSHED CHARACTERISTICS — COMPUTED BY JS/RR
COMBINED DRAINAGE AREAS (327 ACRES — CHECKED BY JM

AREA = 327 ACRES = 0.511 Sq. Mi.

CN	=	68.5
P_2	=	2.85
P_5	=	3.70
P_{10}	=	4.25
P_{25}	=	4.90
P_{100}	=	5.90
T_c	=	
T_T	=	0.00

WHERE P IS DESIGN RAINFALL IN INCHES FOR 2, 5, 10, 25 & 100 YR. STORM FREQUENCY RECURRENCE INTERVALS OVER A 24 HOUR DURATION. FROM TECHNICAL PAPER No 40 MAY 1961.

$S = 1000/CN - 10 = 4.599$ WHERE CN = 68.5

MASS RUNOFF

2 YR. R.O. = $\frac{(P-.25)^2}{P+.85} = 0.57$ WHERE P = 2.85, S = 4.599

5 YR. R.O. = $\frac{(P-.25)^2}{P+.85} = 1.05$ WHERE P = 3.70, S = 4.599

10 YR. R.O. = $\frac{(P-.25)^2}{P+.85} = 1.40$ WHERE P = 4.25, S = 4.599

25 YR. R.O. = $\frac{(P-.25)^2}{P+.85} = 1.85$ WHERE P = 4.90, S = 4.599

100 YR R.O. = $\frac{(P-.25)^2}{P+.85} = 2.59$ WHERE P = 5.90, S = 4.599

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX
LOCATION GUILDERLAND, N.Y.
TYPE OF CALCULATION COMPARATIVE RUNOFF BEFORE & AFTER DEVELOPMENT AND SUMMARY OF REQUIRED STORAGE VOLUMES

JOB NO. 2838
DATE 5-30-79
SHEET 38 OF 103
COMPUTED BY JS/RE
CHECKED BY JM

TIME OF CONCENTRATION (T_c)

BEFORE DEVELOPMENT - 1.25 HRS.
AFTER DEVELOPMENT - 1.25 HRS.

BEFORE DEVELOPMENT

FREQUENCY	DRAINAGE AREA "A"			DRAINAGE AREA "B"			TOTAL VOLUME
INTERVAL	RUNOFF (IN)	AREA (Ac.)	VOLUME (Ac.Ft.)	RUNOFF (IN)	AREA (Ac.)	VOLUME (Ac.Ft.)	(ACRE FEET)
2YR.	0.31	267	6.90	0.14	47	0.55	7.45
5YR.	0.66	↓	14.69	0.38	↓	1.49	16.18
10YR.	0.94		20.91	0.59		2.31	23.22
25YR.	1.31		29.15	0.87		3.41	32.56
100YR.	1.96	↓	43.61	1.38	↓	5.41	49.02

AFTER DEVELOPMENT

FREQUENCY	COMBINED DRAINAGE AREAS			ADDITIONAL STORAGE REQUIRED
INTERVAL	RUNOFF (IN)	AREA (Ac.)	VOLUME (Ac.Ft.)	VOLUME (Ac.Ft.)
2YR.	0.57	327	15.53	8.08
5YR.	1.05	↓	28.61	12.43
10YR.	1.40		38.15	14.93
25YR.	1.85		50.41	17.85
100YR.	2.59	↓	70.58	21.56

SUMMARY

FREQUENCY	BEFORE DEVELOPMENT CONVEYANCE STORAGE	AFTER DEVELOPMENT ADDITIONAL STORAGE REQ.	TOTAL STORAGE REQUIRED
INTERVAL	VOLUME (Ac.Ft.)	VOLUME (Ac.Ft.)	VOLUME (Ac.Ft.)
2YR.	0.63	8.08	8.71
5YR.	1.44	12.43	13.87
10YR.	2.38	14.93	17.31
25YR.	3.78	17.85	21.63
100YR.	7.35	21.56	28.91

RAYMOND KEYES ENGINEERS, P.C.

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PROJECT CROSSGATES COMPLEX
LOCATION Guilderland, N.Y.
TYPE OF CALCULATION After Development
HYDROLOGICAL CLASSIFICATIONS
126 ACRE DRAINAGE AREA TO DETENTION POND No. 1

JOB NO. 2838
DATE 5-30-79
SHEET 39 OF 103
COMPUTED BY JS/EE
CHECKED BY JM

	CLASS HYDRO	CN	ACRES AREA	CN(A)	
OPEN	A	39	11.9	464.1	
	B	61	2.8	170.8	
	C	74	20.2	1494.8	
	D	80	4.6	368.0	
					2497.7
RESIDENTIAL	A	57	19.5	1111.5	
	B	72	6.7	482.4	
	C	81	1.8	145.8	
	D	86	—	—	
					1739.7
WOODED	A	25	20.9	522.5	
	B	55	5.8	319.0	
	C	70	2.2	154.0	
	D	77	13.1	1008.7	
					2004.2
BUSINESS COMMERCIAL	A	89	—		
	B	92	—		
	C	94	—		
	D	95	—		
TOTAL			109.5		6241.6

$$\text{OFFSITE CN} = \frac{6241.6}{109.5} = 57$$

	CN	ACRES AREA	CN(A)
ONSITE DEVELOPMENT	98	16.5	1617

$$\text{COMBINED CN} = \frac{6241.6 + 1617}{109.5 + 16.5} = 62.4 \approx 64$$

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PROJECT CROSSGATES COMPLEX
LOCATION GUILDERLAND, N.Y.
TYPE OF CALCULATION AFTER DEVELOPMENT
STORM DRAINAGE WATERSHED CHARACTERISTICS
126 AC. DRAINAGE AREA TO DETENTION POND No.1

JOB NO. 7858
DATE 5-30-79
SHEET 40 OF 103
COMPUTED BY JS/RR
CHECKED BY JM

AREA = 126 ACRES = 0.197 Sq. Mi.

CN = 64
P_2 = 2.85.
P_5 = 3.70.
P_{10} = 4.25
P_{25} = 4.90
P_{100} = 5.90
T_C = 0.75
T_T = 0.00

WHERE P IS DESIGN RAINFALL IN INCHES FOR 2, 5, 10, 25 & 100 YR. STORM FREQUENCY RECURRENCE INTERVALS OVER A 24 HOUR DURATION. FROM TECHNICAL PAPER No. 40 MAY 1961.

$S = \frac{1000}{CN} - 10 = 5.625$ WHERE CN = 64

MASS RUNOFF

2 YR. R.O. = $\frac{(P-.25)^2}{P+.85}$ = 0.41 WHERE P = 2.85, S = 5.625

5 YR. R.O. = $\frac{(P-.25)^2}{P+.85}$ = 0.81 WHERE P = 3.70, S = 5.625

10 YR. R.O. = $\frac{(P-.25)^2}{P+.85}$ = 1.12 WHERE P = 4.25, S = 5.625

25 YR. R.O. = $\frac{(P-.25)^2}{P+.85}$ = 1.52 WHERE P = 4.90, S = 5.625

100 YR R.O. = $\frac{(P-.25)^2}{P+.85}$ = 2.19 WHERE P = 5.90, S = 5.625

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PROJECT CROSSGATES COMPLEX — JOB NO. 7838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 41 OF 103

2 YR. INFLOW HYDROGRAPH (CN=64) TABULAR METHOD — COMPUTED BY JS/RR

126 AC. DRAINAGE AREA TO DETENTION POND No. 1 — CHECKED BY JM

TIME HRS.	CSM/IN. R.O. ① T_C = 0.75 T_T = 0.00	C.F.S. D.A.= 0.197 R.O.= 0.41	INFLOW HYDROGRAPH (C.F.S.)
8.00	0.00	0.081	0.00
8.25	0.15		0.01
8.50	0.35		0.03
8.75	0.90		0.07
9.00	1.70		0.14
9.25	2.70		0.22
9.50	3.75		0.30
9.75	4.80		0.39
10.00	5.90		0.48
10.25	7.30		0.59
10.50	9.40		0.76
10.75	12.50		1.01
11.00	16.70		1.35
11.25	22.90		1.86
11.50	35.30		2.86
11.75	130.10		10.54
12.00	306.10		24.79
12.25	364.10		29.49
12.50	278.50		22.56
12.75	193.40		15.67
13.00	134.60		10.90
13.25	97.70		7.91
13.50	74.50		6.04
13.75	60.70		4.92
14.00	50.40		4.08
14.25	43.70		3.54
14.50	39.40		3.19
14.75	36.40		2.95
15.00	34.10		2.76
15.25	32.00		2.59
15.50	30.00		2.43

NOTES:

① TABULAR DISCHARGES FROM TSC TECHNICAL NOTE - ENGINEERING UD-20; Pgs 10-11

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2638

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 42 OF 103

5 YR. INFLOW HYDROGRAPH (CN=64) TABULAR METHOD — COMPUTED BY JS/ER

126AC DRAINAGE AREA TO DETENTION POND No. 1 — CHECKED BY JM

TIME HRS.	CSM/IN. R.O. ① T_C = 0.75 T_T = 0.00	C.F.S. D.A. = 0.197 R.O. = 0.81	INFLOW HYDROGRAPH (C.F.S.)	NOTES:
8.00	0.00	0.160	0.00	
8.25	0.15		0.02	① TABULAR DISCHARGES
8.50	0.35		0.06	FROM TSC TECHNICAL
8.75	0.90		0.14	NOTE - ENGINEERING
9.00	1.70		0.27	UD-20; Pgs 10-11
9.25	2.70		0.43	
9.50	3.75		0.60	
9.75	4.80		0.77	
10.00	5.90		0.94	
10.25	7.30		1.67	
10.50	9.40		1.50	
10.75	12.50		2.00	
11.00	16.70		2.67	
11.25	22.90		3.66	
11.50	35.30		5.65	
11.75	130.10		20.82	
12.00	306.10		48.98	
12.25	364.10		58.26	
12.50	278.50		44.56	
12.75	193.40		30.94	
13.00	134.60		21.54	
13.25	97.70		15.63	
13.50	74.50		11.92	
13.75	60.70		9.71	
14.00	50.40		8.06	
14.25	43.70		6.99	
14.50	39.40		6.30	
14.75	36.40		5.82	
15.00	34.10		5.46	
15.25	32.00		5.12	
15.50	30.00		4.80	

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 7838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 43 OF 103

10 YR. INFLOW HYDROGRAPH (CN=64) TABULAR METHOD — COMPUTED BY JS/RR

126 AC DRAINAGE AREA TO DETENTION POND No. 1 — CHECKED BY JM

TIME HRS.	CSM/IN. R.O. ① T_C = 0.75 T_T = 0.00	C.F.S. D.A. = 0.197 R.O. = 1.12	INFLOW HYDROGRAPH (C.F.S.)
8.00	0.00	0.221	0.00
8.25	0.15		0.03
8.50	0.35		0.08
8.75	0.90		0.20
9.00	1.70		0.38
9.25	2.70		0.60
9.50	3.75		0.83
9.75	4.80		1.06
10.00	5.90		1.30
10.25	7.30		1.61
10.50	9.40		2.08
10.75	12.50		2.76
11.00	16.70		3.69
11.25	22.90		5.06
11.50	35.30		7.80
11.75	130.10		28.75
12.00	306.10		67.65
12.25	364.10		80.47
12.50	278.50		61.55
12.75	193.40		42.74
13.00	134.60		29.75
13.25	97.70		21.59
13.50	74.50		16.47
13.75	60.70		13.42
14.00	50.40		11.14
14.25	43.70		9.66
14.50	39.40		8.71
14.75	36.40		8.04
15.00	34.10		7.54
15.25	32.00		7.07
15.50	30.00		6.63

NOTES:

① TABULAR DISCHARGES FROM TSC TECHNICAL NOTE - ENGINEERING UD-20; Pgs 10-11

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 7838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 44 OF 103

25 YR. INFLOW HYDROGRAPH (CN=64) TABULAR METHOD — COMPUTED BY JS/RR

126 AC DRAINAGE AREA TO DETENTION POND No. 1 — CHECKED BY JM

TIME HRS.	CSM/IN. R.O. ① T_C = 0.75 T_T = 0.00	C.F.S. D.A. = 0.197 E.O = 1.52	INFLOW HYDROGRAPH (C.F.S.)	NOTES:
8.00	0.00	0.299	0.00	
8.25	0.15		0.05	① TABULAR DISCHARGES
8.50	0.35		0.11	FROM TSC TECHNICAL
8.75	0.90		0.27	NOTE - ENGINEERING
9.00	1.70		0.51	UD-20; Pgs 10-11
9.25	2.70		0.81	
9.50	3.75		1.12	
9.75	4.80		1.44	
10.00	5.90		1.76	
10.25	7.30		2.18	
10.50	9.40		2.81	
10.75	12.50		3.74	
11.00	16.70		4.99	
11.25	22.90		6.85	
11.50	35.30		10.55	
11.75	130.10		38.70	
12.00	306.10		91.52	
12.25	364.10		108.86	
12.50	278.50		83.27	
12.75	193.40		57.83	
13.00	134.60		40.25	
13.25	97.70		29.21	
13.50	74.50		22.28	
13.75	60.70		18.15	
14.00	50.40		15.07	
14.25	43.70		13.07	
14.50	39.40		11.78	
14.75	36.40		10.88	
15.00	34.10		10.20	
15.25	32.00		9.57	
15.50	30.00		8.97	

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PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 45 OF 103

100 YR. INFLOW HYDROGRAPH (CN=64) TABULAR METHOD — COMPUTED BY JS/RR

126 Ac DRAINAGE AREA TO DETENTION POND No. 1 — CHECKED BY JM

TIME HRS.	CSM/IN. R.O. ① T_C = 0.75 T_T = 0.00	C.F.S. D.A.= 0.197 R.O.= 2.190	INFLOW HYDROGRAPH (C.F.S.)
8.00	0.00	0.43	0.00
8.25	0.15		0.04
8.50	0.35		0.15
8.75	0.90		0.39
9.00	1.70		0.73
9.25	2.70		1.20
9.50	3.75		1.60
9.75	4.80		2.10
10.00	5.90		2.54
10.25	7.30		3.14
10.50	9.40		4.04
10.75	12.50		5.38
11.00	16.70		7.18
11.25	22.90		9.85
11.50	35.30		15.20
11.75	130.10		56.00
12.00	306.10		131.60
12.25	364.10		156.60
12.50	278.50		119.80
12.75	193.40		83.20
13.00	134.60		57.90
13.25	97.70		42.00
13.50	74.50		32.00
13.75	60.70		26.10
14.00	50.40		21.70
14.25	43.70		18.80
14.50	39.40		16.90
14.75	36.40		15.70
15.00	34.10		14.70
15.25	32.00		13.80
15.50	30.00		12.90

NOTES:

① TABULAR DISCHARGES FROM TSC TECHNICAL NOTE - ENGINEERING UD-20; Pgs 10-11

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PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION AFTER DEVELOPMENT STORAGE VOLUMES DETENTION POND NO. 1 — SHEET 46 OF 103

COMPUTED BY JS/RR

CHECKED BY JM

STORAGE VOLUMES

ELEV.	AREA	AVERAGE AREA	DEPTH	VOLUME (C.F.)	CUM. VOL. (C.F.)	CUM. VOL. (ACRE FEET)
276	202,000					
		208,350	2	416,700	416,700	9.57
278	214,700					
		221,050	2	442,100	858,800	19.72
280	227,400					
		233,750	2	467,500	1,326,300	30.45
282	240,100					

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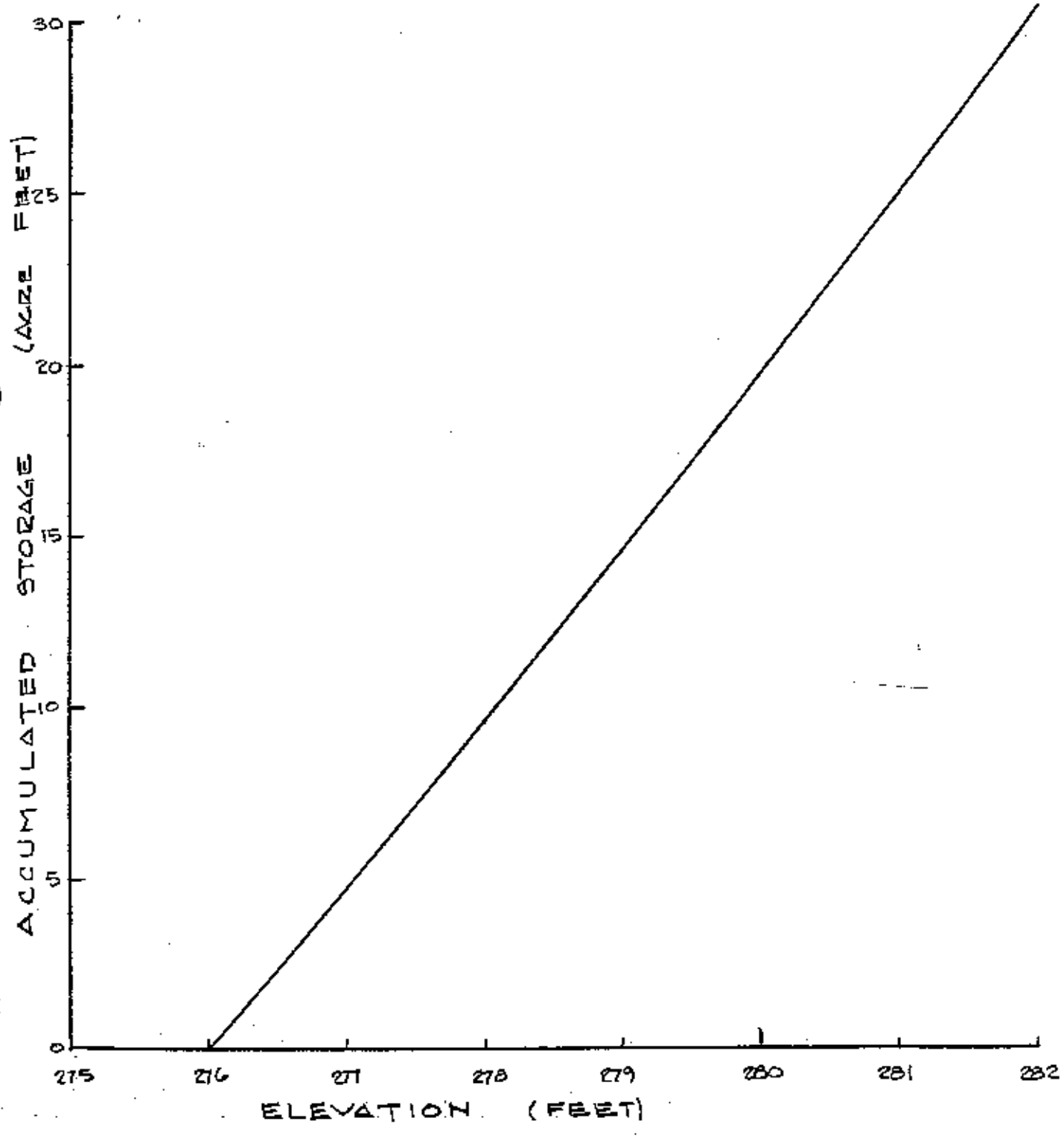
PROJECT CROSSGATES COMPLEX
LOCATION GUILDERLAND, N.Y.
TYPE OF CALCULATION AFTER DEVELOPMENT
ELEVATION - STORAGE CURVE
DETENTION POND NO. 1

JOB NO. 2838
DATE 5-30-79
SHEET 47 OF 103
COMPUTED BY JS/EE
CHECKED BY JM



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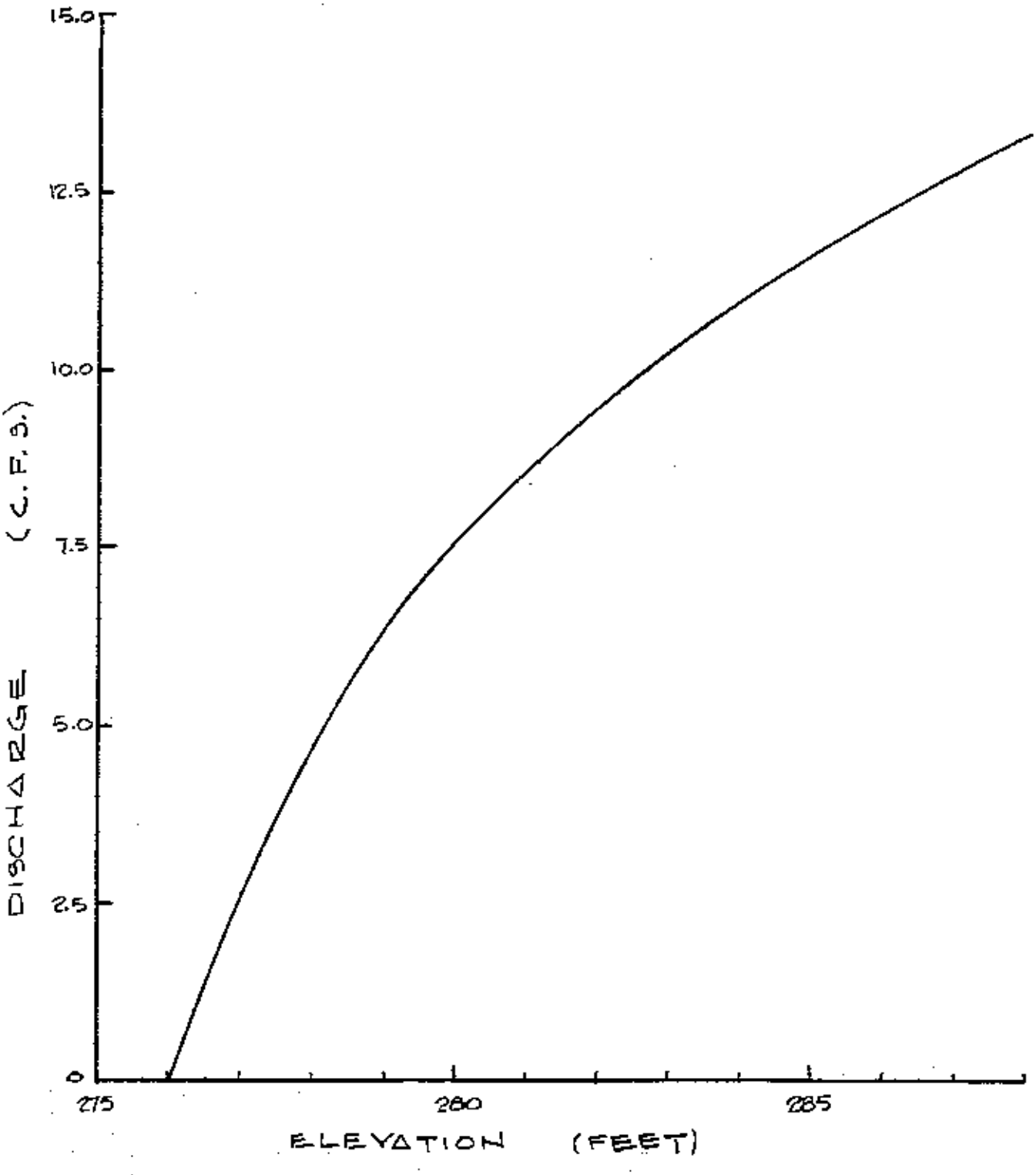
PROJECT CROSSGATES COMPLEX
LOCATION GUILDERLAND, N.Y.
TYPE OF CALCULATION AFTER DEVELOPMENT
ELEVATION - DISCHARGE CURVE - 12" C.M.P.
DETENTION POND No. 1

JOB NO. 2838
DATE 5-30-79
SHEET 48 OF 103
COMPUTED BY JS/RL
CHECKED BY JM



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PROJECT: CROSSGATES COMPLEX — JOB NO. 2838

LOCATION: GUILDERLAND, N.Y. — DATE: 5-30-79

TYPE OF CALCULATION: — SHEET 49 OF 103

WORKING CURVE

COMPUTED BY JS/RR

Form AFTER DEVELOPMENT DETENTION POND No. 1 - 12" C.M.P. DISCHARGE — CHECKED BY JM

TAILWATER ELEV. = N.A.

FOR Δt = 0.25 HRS.

ELEV. (FT.)	DISC. O_2 CFS	STORAGE S_2 Ac. Ft.	STORAGE S_2 CFS-HRS.	$O_2/2$ CFS	$S_2/\Delta t$ CFS	$S_2/\Delta t + O_2/2$ CFS
276.00	0.0	0.00	0.0	0.0	0.0	0.0
276.50	1.3	2.32	28.1	0.7	112.4	113.1
277.00	2.5	4.75	57.5	1.3	230.0	231.3
277.50	3.7	7.21	87.2	1.9	348.8	350.7
278.00	4.7	9.57	115.8	2.4	463.2	465.6
278.50	5.5	12.05	145.8	2.8	583.2	586.0
279.00	6.3	14.48	175.2	3.2	700.8	704.0
279.50	6.9	17.17	207.8	3.5	831.2	834.7
280.00	7.5	19.72	238.6	3.8	954.4	958.2
280.50	8.0	22.40	271.0	4.0	1084.0	1088.0
281.00	8.5	25.20	304.9	4.3	1219.6	1223.9
281.50	9.0	27.68	334.9	4.5	1339.6	1344.1
282.00	9.5	30.45	368.4	4.8	1473.6	1478.4

RAYMOND KEYES ENGINEERS, P.C.

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PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 50 OF 103

2 YR. FLOOD ROUTING-126 ACRE DRAINAGE AREA TO DETENTION POND No 1 (STORAGE INDICATION METHOD) — COMPUTED BY JS/EE — CHECKED BY JM

TIME HRS.	INFLOW I C.F.S.	INFLOW Ī C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	TIME HRS.	INFLOW I C.F.S.	INFLOW Ī C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	
8.00	0.00				11.75	10.54				
		0.005	0.0050	0.0001			17.67	33.28	0.38	
8.25	0.01				12.00	24.79				
		0.020	0.0249	0.0003			27.14	60.04	0.69	
8.50	0.03				12.25	29.49				
		0.050	0.0746	0.001			26.03	85.38	0.98	
8.75	0.07				12.50	22.56				
		0.105	0.178	0.002			19.12	103.52	1.19	
9.00	0.14				12.75	15.67				
		0.180	0.354	0.004			13.29	115.62	1.33	
9.25	0.22				13.00	10.90				
		0.260	0.610	0.007			9.41	123.70	1.41	
9.50	0.30				13.25	7.91				
		0.345	1.551	0.018			6.98	129.27	1.46	
9.75	0.39				13.50	6.04				
		0.435	1.968	0.023			5.48	133.29	1.50	
10.00	0.48				13.75	4.92				
		0.535	2.48	0.029			4.50	136.29	1.54	
10.25	0.59				14.00	4.08				
		0.675	3.126	0.036			3.81	138.56	1.56	
10.50	0.76				14.25	3.54				
		0.885	3.975	0.046			3.37	140.37	1.58	
10.75	1.01				14.50	3.19				
		1.44	5.37	0.06			3.07	141.96	1.59	
11.00	1.35				14.75	2.95				
		1.61	6.92	0.08			2.86	143.13	1.60	
11.25	1.86				15.00	2.76				
		2.36	9.20	0.11			2.68	144.21	1.62	
11.50	2.86				16.50	1.75				
		6.70	15.79	0.18			1.66	146.93	1.64	*
11.75	10.54				16.75	1.57				

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 51 OF 103

5 YR. FLOOD ROUTING- 126 ACRE DRAINAGE AREA — COMPUTED BY JS/EE

TO DETENTION POND No. 1 (STORAGE INDICATION METHOD) — CHECKED BY JM

TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	
8.00	0.00				11.75	20.82				
		0.010	0.0100	0.0001			34.90	64.65	0.74	
8.25	0.02				12.00	48.98				
		0.040	0.0499	0.0006			53.62	117.53	1.34	
8.50	0.06				12.25	58.26				
		0.100	0.1493	0.002			51.41	167.60	1.85	
8.75	0.14				12.50	44.56				
		0.205	0.352	0.004			37.75	203.50	2.22	
9.00	0.27				12.75	30.94				
		0.350	0.698	0.008			26.24	227.52	2.46	
9.25	0.43				13.00	21.54				
		0.515	1.205	0.014			18.59	243.65	2.62	
9.50	0.60				13.25	15.63				
		0.685	1.876	0.022			13.78	254.81	2.74	
9.75	0.77				13.50	11.92				
		0.855	2.709	0.031			10.82	262.89	2.82	
10.00	0.94				13.75	9.71				
		1.31	3.968	0.046			8.89	268.96	2.88	
10.25	1.67				14.00	8.06				
		1.59	5.532	0.064			7.53	273.61	2.93	
10.50	1.50				14.25	6.97				
		1.75	7.218	0.093			6.65	277.33	2.96	
10.75	2.00				14.50	6.30				
		2.34	9.48	0.11			6.06	280.43	2.99	
11.00	2.67				14.75	5.82				
		3.17	12.54	0.14			5.64	283.08	3.02	
11.25	3.66				15.00	5.46				
		4.66	17.06	0.20			5.29	285.35	3.04	
11.50	5.65				16.50	3.48				
		13.24	30.10	0.35			3.31	291.69	3.11	*
11.75	20.82				16.75	3.14				

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CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 52 OF 103

10 YR. FLOOD ROUTING- 126 ACRE DRAINAGE AREA TO DETENTION POND No. 1 (STORAGE INDICATION METHOD) — COMPUTED BY JS/ER — CHECKED BY JM

TIME	INFLOW		STORAGE	OUTFLOW	TIME	INFLOW		STORAGE	OUTFLOW	
HRS.	I C.F.S.	$\bar{I}$ C.F.S.	$S_2/\Delta t + O_2/2$ C.F.S.	O_2 C.F.S.	HRS.	I C.F.S.	$\bar{I}$ C.F.S.	$S_2/\Delta t + O_2/2$ C.F.S.	O_2 C.F.S.	
8.00	0.00				11.75	28.75				
		0.015	0.0150	0.0002			48.20	88.64	1.02	
8.25	0.03				12.00	67.65				
		0.055	0.0698	0.0008			74.06	161.68	1.79	
8.50	0.06				12.25	80.47				
		0.140	0.2090	0.002			71.01	230.09	2.50	
8.75	0.20				12.50	61.55				
		0.290	0.497	0.006			52.15	279.74	2.99	
9.00	0.38				12.75	42.74				
		0.490	0.981	0.011			36.25	313.0	3.32	
9.25	0.60				13.00	29.75				
		0.715	1.685	0.019			25.67	335.35	3.55	
9.50	0.83				13.25	21.59				
		0.945	2.611	0.030			19.03	350.83	3.70	
9.75	1.06				13.50	16.47				
		1.18	3.761	0.043			14.95	362.08	3.80	
10.00	1.30				13.75	13.42				
		1.46	5.178	0.060			12.28	370.56	3.87	
10.25	1.61				14.00	11.14				
		1.85	6.968	0.080			10.40	377.09	3.93	
10.50	2.08				14.25	9.66				
		2.42	9.308	0.107			9.19	382.35	3.98	
10.75	2.76				14.50	8.71				
		3.21	12.41	0.14			8.38	386.75	4.01	
11.00	3.69				14.75	8.04				
		4.38	16.65	0.19			7.79	390.53	4.05	
11.25	5.06				15.00	7.54				
		6.43	22.89	0.26			7.31	393.79	4.09	
11.50	7.80				16.50	4.81				
		18.28	40.91	0.47			4.55	403.25	4.16	*
11.75	28.75				16.75	4.29				

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 53 OF 103

25 YR. FLOOD ROUTING- 126 ACRE DRAINAGE AREA TO DETENTION POND No. 1 (STORAGE INDICATION METHOD) — COMPUTED BY JS/EE

CHECKED BY JM

TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	
8.00	0.00				11.75	38.90				
		0.025	0.0250	0.0003			65.21	119.94	1.37	
8.25	0.05				12.00	91.52				
		0.080	0.1047	0.0012			100.19	218.76	2.37	
8.50	0.11				12.25	108.86				
		0.190	0.2935	0.003			96.07	312.46	3.32	
8.75	0.27				12.50	83.27				
		0.390	0.680	0.008			70.55	379.69	3.95	
9.00	0.51				12.75	57.83				
		0.660	1.332	0.015			49.04	424.78	4.34	
9.25	0.81				13.00	40.25				
		0.97	2.287	0.026			34.73	455.17	4.61	
9.50	1.12				13.25	29.21				
		1.28	3.541	0.041			25.75	476.31	4.77	
9.75	1.44				13.50	22.28				
		1.60	5.10	0.059			20.22	491.76	4.87	
10.00	1.76				13.75	18.15				
		1.97	7.011	0.081			16.61	503.50	4.95	
10.25	2.18				14.00	15.07				
		2.50	9.43	0.108			14.07	512.62	5.01	
10.50	2.81				14.25	13.07				
		3.28	12.602	0.145			12.43	520.04	5.06	
10.75	3.74				14.50	11.78				
		4.37	16.83	0.19			11.33	526.31	5.10	
11.00	4.99				14.75	10.88				
		5.92	22.56	0.26			10.54	531.75	5.14	
11.25	6.85				15.00	10.20				
		8.70	31.00	0.36			9.89	536.50	5.17	
11.50	10.55				16.75	5.85				
		24.73	55.37	0.64			5.55	551.76	5.27	*
11.75	38.90				17.00	5.25				

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 54 OF 103

100 YR. FLOOD ROUTING- 126 ACRE DRAINAGE AREA TO DETENTION POND No. 1 (STORAGE INDICATION METHOD) — COMPUTED BY JS/RR — CHECKED BY JH

TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	
8.00	0.00				11.75	56.00				
		0.030	0.030	0.0003			93.80	185.28	2.03	
8.25	0.06				12.00	131.60				
		0.105	0.1347	0.0015			146.80	330.57	3.50	
8.50	0.15				12.25	156.60				
		0.270	0.4032	0.005			138.20	465.27	4.70	
8.75	0.39				12.50	119.80				
		0.560	0.958	0.011			101.50	562.07	5.34	
9.00	0.73				12.75	83.20				
		0.965	1.912	0.022			70.55	627.28	5.78	
9.25	1.20				13.00	57.90				
		1.40	3.290	0.038			49.95	671.45	6.08	
9.50	1.60				13.25	42.00				
		1.85	5.102	0.059			37.00	702 37	6.29	
9.75	2.10				13.50	32.00				
		2.32	7.363	0.085			29.05	725.13	6.40	
10.00	2.54				13.75	26.10				
		2.84	10.118	0.116			23.90	74263	6.48	
10.25	3.14				14.00	21.70				
		3.59	13.592	0.156			20.25	756.4	6.54	
10.50	4.04				14.25	18.80				
		4.71	31.582	0.363			17.85	767.71	6.59	
10.75	5.38				14.50	16.90				
		6.28	37.50	0.43			16.30	777.42	6.64	
11.00	7.18				14.75	15.70				
		8.52	45.59	0.52			15.20	785.98	6.68	
11.25	9.85				15.00	14.70				
		12.53	57.60	0.66			14.25	793.55	6.71	
11.50	15.20				17.00	7.05				
		35.60	92.54	1.06			7.05	820.84	6.84	*
11.75	56.60				17.25	6.60				

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PROJECT Crossgates Complex — JOB NO. 2838
LOCATION Guilderland, N.Y. — DATE 5-30-79
TYPE OF CALCULATION After Development — SHEET 55 OF 103
HYDROLOGICAL CLASSIFICATIONS — COMPUTED BY JS/ER
24.3 Acre Drainage Area to Detention Pond No. 2A & 2B — CHECKED BY JM

	CLASS HYDRO	CN	ACRES AREA	CN(A)	
OPEN	A	39	—	—	
	B	61	—	—	
	C	74	—	—	
	D	80	—	—	—
RESIDENTIAL	A	57	—	—	
	B	72	—	—	
	C	81	—	—	
	D	86	—	—	—
WOODED	A	25	10.50	262.5	
	B	55	—	—	
	C	70	2.50	175.0	
	D	77	—	—	437.5
BUSINESS COMMERCIAL	A	89	—	—	
	B	92	—	—	
	C	94	—	—	
	D	95	—	—	
TOTAL			13.00		437.5

$$\text{OFFSITE CN} = \frac{437.5}{13.00} = 33.7$$

	CN	ACRES AREA	CN(A)
ONSITE DEVELOPMENT	98	11.3	1107.4

$$\text{COMBINED CN} = \frac{437.5 + 1107.4}{13.0 + 11.3} = 63.58 \approx 63.6$$

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PROJECT Crossgates Complex — JOB NO. 7858

LOCATION Guilderland, N.Y. — DATE 5-30-79

TYPE OF CALCULATION After Development — SHEET 56 OF 103

Storm Drainage Watershed Characteristics — COMPUTED BY JS/EE

24.3 Ac. Drainage Area To Detention Pond No 2A & 2B — CHECKED BY JM

AREA = 24.3 ACRES = 0.038 Sq. Mi.

CN = 63.6

P_2 = 2.85

P_5 = 3.70

P_{10} = 4.25

P_{25} = 4.90

P_{100} = 5.90

T_c = 0.50

T_T = 0.00

WHERE P IS DESIGN RAINFALL IN INCHES FOR 2, 5, 10, 25 & 100 YR. STORM FREQUENCY RECURRENCE INTERVALS OVER A 24 HOUR DURATION. FROM TECHNICAL PAPER No 40 MAY 1961.

$S = \frac{1000}{CN} - 10 = 5.7233$ WHERE CN = 63.6

Mass Runoff

2 YR. R.O. = $\frac{(P-.25)^2}{P+.85} = 0.39$ WHERE P = 2.85, S = 5.7233

5 YR. R.O. = $\frac{(P-.25)^2}{P+.85} = 0.79$ WHERE P = 3.70, S = 5.7233

10 YR. R.O. = $\frac{(P-.25)^2}{P+.85} = 1.09$ WHERE P = 4.25, S = 5.7233

25 YR. R.O. = $\frac{(P-.25)^2}{P+.85} = 1.49$ WHERE P = 4.90, S = 5.7233

100 YR. R.O. = $\frac{(P-.25)^2}{P+.85} = 2.16$ WHERE P = 5.90, S = 5.7233

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PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, NY — DATE 5-30-79

TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 57 OF 103

2 YR INFLOW HYDROGRAPH (CN=63) TABULAR METHOD — COMPUTED BY JS/RR

24.3 Ac. DRAINAGE AREA TO DETENTION POND No. 2A & 2B — CHECKED BY JM

TIME HRS	CSM/IN, R.O. ① Tc = 0.50 Tt = 0.00	C.F.S. D.A. = 0.038 R.O. = 0.39	OUTFLOW FROM DETENTION POND No. 1 (C.F.S.)	INFLOW HYDROGRAPH (C.F.S.)
8.00	0.00	0.015	0.000	0.000
8.25	0.25		0.000	0.004
8.50	0.50		0.000	0.007
8.75	1.00		0.001	0.016
9.00	2.00		0.002	0.032
9.25	3.05		0.004	0.049
9.50	4.15		0.007	0.068
9.75	5.25		0.018	0.096
10.00	6.30		0.023	0.116
10.25	7.80		0.029	0.145
10.50	10.50		0.036	0.191
10.75	13.90		0.046	0.252
11.00	18.10		0.06	0.328
11.25	24.80		0.08	0.447
11.50	40.20		0.11	0.705
11.75	151.60		0.18	2.425
12.00	390.90		0.38	6.168
12.25	427.50		0.69	7.02
12.50	261.50		0.98	4.852
12.75	159.60		1.19	3.553
13.00	101.80		1.33	2.837
13.25	76.30		1.41	2.540
13.50	60.30		1.46	2.353
13.75	51.50		1.50	2.263
14.00	44.70		1.54	2.202
14.25	40.80		1.56	2.164
14.50	37.40		1.58	2.134
14.75	35.00		1.59	2.108
15.00	32.90		1.60	2.087
15.25	30.50		1.62	2.072
15.50	29.10		1.63	2.061

NOTES:

① TABULAR DISCHARGE FROM TSC TECHNICAL NOTE - ENGINEERING UD-20; pgs. 7-8

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838
LOCATION GUILDERLAND, NY — DATE 5-30-79
TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 58 OF 103
5 YR INFLOW HYDROGRAPH (CN=68.8) TABULAR METHOD — COMPUTED BY JS/RR
24.3 Ac. DRAINAGE AREA TO DETENTION POND No. 2A & 2B — CHECKED BY JM

TIME HRS	CSM / IN. R.O. ① Tc = 0.50 Tt = 0.00	C.F.S. D.A. = 0.038 R.O. = 0.79	OUT FLOW FROM DETENTION POND No. 1 (C.F.S.)	INFLOW HYDROGRAPH (C.F.S.)
8.00	0.00	0.030	0.000	0.000
8.25	0.25		0.000	0.007
8.50	0.50		0.000	0.015
8.75	1.00		0.002	0.032
9.00	2.00		0.004	0.064
9.25	3.05		0.008	0.099
9.50	4.15		0.014	0.138
9.75	5.25		0.022	0.179
10.00	6.30		0.031	0.220
10.25	7.80		0.046	0.280
10.50	10.50		0.064	0.379
10.75	13.90		0.083	0.500
11.00	18.10		0.11	0.653
11.25	24.80		0.14	0.884
11.50	40.20		0.20	1.406
11.75	151.60		0.35	4.897
12.00	390.90		0.74	12.465
12.25	427.50		1.34	14.163
12.50	261.50		1.85	9.694
12.75	159.60		2.22	7.007
13.00	101.80		2.46	5.514
13.25	76.30		2.62	4.909
13.50	60.30		2.74	4.549
13.75	51.50		2.82	4.365
14.00	44.70		2.88	4.221
14.25	40.80		2.93	4.154
14.50	37.40		2.96	4.082
14.75	35.00		2.99	4.040
15.00	32.90		3.02	4.007
15.25	30.50		3.04	3.955
15.50	29.10		3.08	3.953

NOTES:

① TABULAR DISCHARGES FROM TSC TECHNICAL NOTE - ENGINEERING UD-20; pgs. 7-8

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX
LOCATION GUILDERLAND, NY
TYPE OF CALCULATION AFTER DEVELOPMENT
10 YR INFLOW HYDROGRAPH (CN=68) TABULAR METHOD
24.3 Ac DRAINAGE AREA TO DETENTION POND No. 2A & 2B

JOB NO. 2838
DATE 5-30-79
SHEET 59 OF 103
COMPUTED BY JS/RR
CHECKED BY JH

TIME HRS	CSM/IN, R.O. ① Tc = 0.50 Tt = 0.00	C.F.S. D.A. = 0.038 R.O. = 1.09	OUTFLOW FROM DETENTION POND No. 1 (C.F.S.)	INFLOW HYDROGRAPH (C.F.S.)
8.00	0.00	0.041	0.000	0.000
8.25	0.25		0.000	0.010
8.50	0.50		0.000	0.021
8.75	1.00		0.002	0.043
9.00	2.00		0.006	0.089
9.25	3.05		0.011	0.137
9.50	4.15		0.019	0.191
9.75	5.25		0.030	0.247
10.00	6.30		0.043	0.304
10.25	7.80		0.060	0.383
10.50	10.50		0.085	0.515
10.75	13.90		0.107	0.682
11.00	18.10		0.14	0.899
11.25	24.80		0.19	1.216
11.50	40.20		0.26	1.924
11.75	151.60		0.47	6.744
12.00	399.90		1.02	17.198
12.25	427.50		1.79	19.482
12.50	261.50		2.50	13.322
12.75	159.60		2.99	9.595
13.00	101.80		3.32	7.533
13.25	76.30		3.55	6.708
13.50	60.30		3.70	6.196
13.75	51.50		3.80	5.931
14.00	44.70		3.87	5.720
14.25	40.80		3.93	5.619
14.50	37.40		3.98	5.528
14.75	35.00		4.01	5.459
15.00	32.90		4.05	5.412
15.25	30.50		4.08	5.342
15.50	29.10		4.10	5.304

NOTES:

① TABULAR DISCHARGE FROM TSC TECHNICAL NOTE- ENGINEERING UD-20; Pgs. 7-8

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838
LOCATION GUILDERLAND, NY — DATE 5-30-79
TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 60 OF 103
25 YR INFLOW HYDROGRAPH (CN=63.6) TABULAR METHOD — COMPUTED BY JS/RE
24.3 Ac DRAINAGE AREA TO DETENTION POND No. 2 & 2B — CHECKED BY JM

TIME HRS	CSM/IN. R.O. ① Tc = 0.50 Tt = 0.00	C.F.S. D.A. = 0.038 R.O. = 1.49	OUTFLOW FROM DETENTION POND No. 1 (C.F.S.)	INFLOW HYDROGRAPH (C.F.S.)
8.00	0.00	0.057	0.000	0.000
8.25	0.25		0.000	0.014
8.50	0.50		0.000	0.028
8.75	1.00		0.003	0.060
9.00	2.00		0.008	0.121
9.25	3.05		0.015	0.188
9.50	4.15		0.026	0.261
9.75	5.25		0.041	0.338
10.00	6.30		0.059	0.415
10.25	7.80		0.081	0.522
10.50	10.50		0.108	0.702
10.75	13.90		0.145	0.931
11.00	18.10		0.190	1.214
11.25	24.80		0.26	1.663
11.50	40.20		0.36	2.634
11.75	151.60		0.64	9.217
12.00	390.90		1.37	23.485
12.25	427.50		2.37	26.555
12.50	261.50		3.32	18.114
12.75	159.60		3.95	12.979
13.00	101.80		4.34	10.099
13.25	76.30		4.61	8.927
13.50	60.30		4.77	8.181
13.75	51.50		4.87	7.784
14.00	44.70		4.95	7.479
14.25	40.80		5.01	7.318
14.50	37.40		5.06	7.176
14.75	35.00		5.10	7.080
15.00	32.90		5.14	7.001
15.25	30.50		5.17	6.895
15.50	29.10		6.20	6.846

NOTES:

① TABULAR DISCHARGES FROM TSC TECHNICAL NOTE - ENGINEERING UD-20; pgs. 7-8

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, NY — DATE 5-30-79

TYPE OF CALCULATION : AFTER DEVELOPMENT — SHEET 6/ OF 103

100 YR INFLOW HYDROGRAPH (CN=63.6) TABULAR METHOD — COMPUTED BY JS/RR

24.3 Ac DRAINAGE AREA TO DETENTION POND No. 2A & 2B — CHECKED BY JM

TIME HRS	CSM/IN. R.O. ① Tc = 0.50 TT = 0.00	C.F.S. D.A. = 0.038 R.O. = 2.16	OUTFLOW FROM DETENTION POND No. 1 (C.F.S.)	INFLOWS HYDROGRAPH (C.F.S.)
8.00	0.00	0.082	0.000	0.000
8.25	0.25		0.000	0.021
8.50	0.50		0.000	0.041
8.75	1.00		0.005	0.087
9.00	2.00		0.011	0.186
9.25	3.05		0.022	0.272
9.50	4.15		0.038	0.378
9.75	5.25		0.059	0.490
10.00	6.30		0.085	0.516
10.25	7.80		0.116	0.633
10.50	10.50		0.156	0.796
10.75	13.90		0.363	1.224
11.00	18.10		0.43	1.570
11.25	24.80		0.52	2.004
11.50	40.20		0.66	2.694
11.75	151.60		1.06	4.357
12.00	390.90		2.03	14.463
12.25	427.50		3.50	35.559
12.50	261.50		4.70	39.760
12.75	159.60		5.34	26.786
13.00	101.80		5.78	18.869
13.25	76.30		6.08	14.429
13.50	60.30		6.29	12.548
13.75	51.50		6.40	11.345
14.00	44.70		6.48	10.704
14.25	40.80		6.54	10.206
14.50	37.40		6.59	9.936
14.75	35.00		6.64	9.707
15.00	32.90		6.68	9.550
15.25	30.50		6.71	9.408
15.50	29.10		6.74	9.127

NOTES:

① TABULAR DISCHARGES FROM TSC TECHNICAL NOTE - ENGINEERING UD-20; pgs. 7-8

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX
LOCATION GUILDERLAND, N.Y.
TYPE OF CALCULATION AFTER DEVELOPMENT
STORAGE VOLUMES
DETENTION POND NO. 2A & 2B

JOB NO. 2858
DATE 5-30-79
SHEET 62 OF 103
COMPUTED BY JS/RR
CHECKED BY JM

STORAGE VOLUMES

ELEV.	AREA	AVERAGE AREA	DEPTH	VOLUME (C.F.)	CUM. VOL. (C.F.)	CUM. VOL. (ACRE FEET)
256	23,000					
		25,500	2	51,000	51,000	1.17
258	28,000					
		40,300	2	80,600	131,600	3.02
260	52,600					
		62,000	2	124,000	255,600	5.87
262	71,400					
		97,800	2	195,600	451,200	10.36
264	124,200					
		137,100	2	274,200	725,400	16.65
266	150,000					

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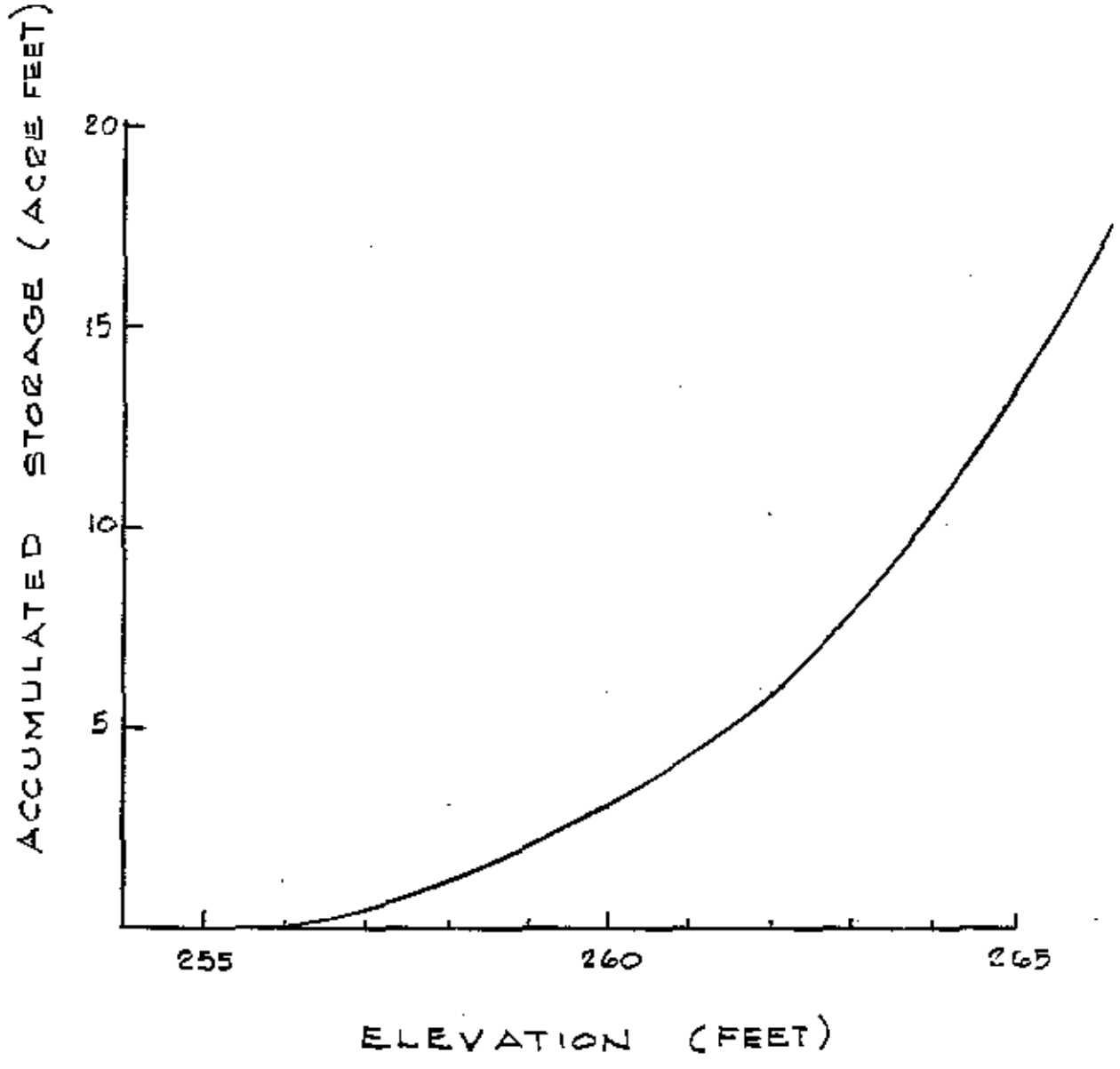
PROJECT CROSSGATES COMPLEX
LOCATION GUILDERLAND, N.Y.
TYPE OF CALCULATION AFTER DEVELOPMENT
ELEVATION - STORAGE CURVE
DETENTION POND No. 2A & 2B

JOB NO. 2838
DATE 5-30-79
SHEET 63 OF 103
COMPUTED BY JS/EE
CHECKED BY JM



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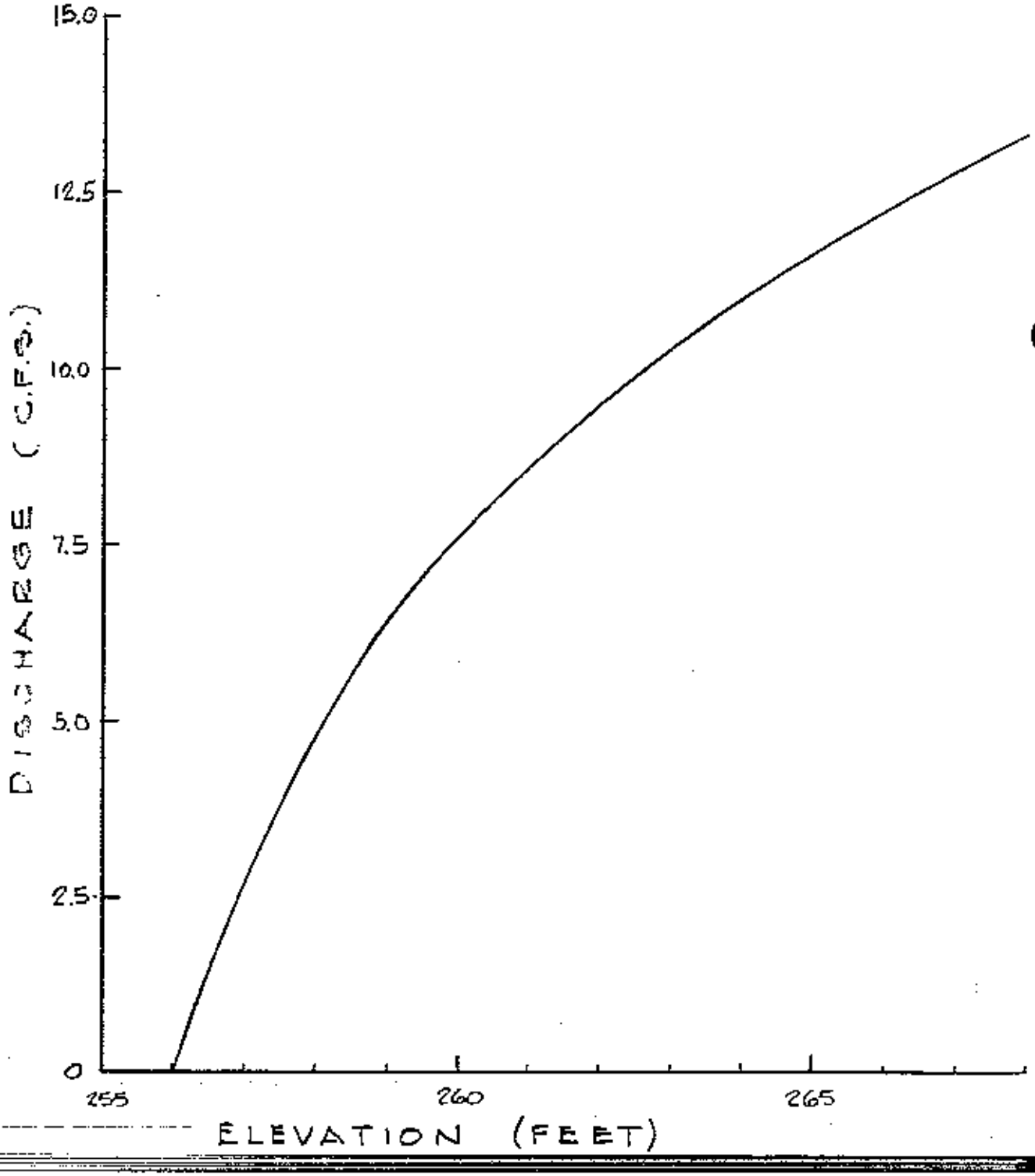
PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 64 OF 103

ELEVATION-DISCHARGE CURVE-12"C.M.P. — COMPUTED BY JS/RR

DETENTION POND No. 2A & 2B — CHECKED BY JM



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CONSULTING SITE ENGINEERS

PROJECT: CROSSGATES COMPLEX — JOB NO. 2838
LOCATION: GUILDERLAND, N.Y. — DATE: 5-30-79
TYPE OF CALCULATION: — SHEET 65 OF 103
WORKING CURVE — COMPUTED BY JS/RR
Form AFTER DEVELOPMENT DETENTION POND No. 2A&2B-12" C.M.P. DISCHARGE — CHECKED BY JM

TAILWATER ELEV. = N.A.

FOR Δt = 0.25 HRS.

ELEV. (FT.)	DISC. O_2 CFS	STORAGE S_2 Ac. Ft.	S_2 CFS-HRS.	$O_2/2$ CFS	$S_2/\Delta t$ CFS	$S_2/\Delta t + O_2/2$ CFS
256.00	0.0	0.00	0.0	0.0	0.0	0.0
256.50	1.3	0.25	3.0	0.7	12.0	12.7
257.00	2.5	0.50	6.1	1.3	24.4	25.7
257.50	3.7	0.82	9.9	1.9	39.6	41.5
258.00	4.7	1.20	14.5	2.4	58.0	60.4
258.50	5.5	1.63	19.7	2.8	78.8	81.6
259.00	6.3	2.12	25.7	3.2	102.8	106.0
259.50	6.9	2.60	31.5	3.5	126.0	129.5
260.00	7.5	3.15	38.1	3.8	152.4	156.2
260.50	8.0	3.70	44.8	4.0	179.2	183.2
261.00	8.5	4.35	52.6	4.3	210.4	214.7
261.50	9.0	5.05	61.1	4.5	244.4	248.9
262.00	9.5	5.85	70.8	4.8	283.2	288.0
262.50	9.8	6.80	82.3	4.9	329.2	334.1
263.00	10.3	7.88	95.3	5.2	381.2	386.4
263.50	10.6	9.12	110.4	5.3	441.6	446.9
264.00	10.9	10.38	125.6	5.5	502.4	507.9
264.50	11.2	11.90	144.0	5.6	576.0	581.6
265.00	11.5	13.42	162.4	5.8	649.6	655.4
265.50	11.8	14.95	180.9	5.9	723.6	729.5
266.00	12.1	16.85	203.9	6.1	815.6	821.7

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 66 OF 103

2 YR. FLOOD ROUTING- 24.3 ACRE DRAINAGE AREA TO DETENTION POND No.2A&B (STORAGE INDICATION METHOD) — COMPUTED BY JS/RK

CHECKED BY JM

TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	
8.00	0.000				11.75	2.425				
		0.002	0.002	0.000			4.297	7.161	0.733	
8.25	0.004				12.00	6.168				
		0.006	0.008	0.001			6.594	13.022	1.330	
8.50	0.007				12.25	7.02				
		0.012	0.019	0.002			5.936	17.628	1.755	
8.75	0.016				12.50	4.852				
		0.024	0.041	0.004			4.203	20.076	1.981	
9.00	0.032				12.75	3.553				
		0.041	0.078	0.008			3.195	21.290	2.093	
9.25	0.049				13.00	2.837				
		0.059	0.129	0.013			2.689	21.895	2.149	
9.50	0.068				13.25	2.540				
		0.082	0.198	0.020			2.447	22.193	2.176	
9.75	0.096				13.50	2.353				
		0.106	0.284	0.029			2.308	22.325	2.188	
10.00	0.116				13.75	2.263				
		0.131	0.386	0.040			2.233	22.370	2.193	*
10.25	0.145				14.00	2.202				
		0.168	0.514	0.053			2.183	22.360	2.192	
10.50	0.191				14.25	2.164				
		0.443	0.904	0.093			2.149	22.317	2.188	
10.75	0.252				14.50	2.134				
		0.290	1.101	0.113			2.121	22.250	2.182	
11.00	0.328				14.75	2.108				
		0.388	1.376	0.141			2.098	22.166	2.174	
11.25	0.447				15.00	2.087				
		0.576	1.811	0.185			2.080	22.072	2.165	
11.50	0.705				15.25	2.072				
		1.565	3.191	0.327			2.067	21.974	2.156	
11.75	2.425				15.50	2.061				

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 67 OF 103

5 YR. FLOOD ROUTING - 24.3 ACRE DRAINAGE AREA — COMPUTED BY JS/ee

TO DETENTION POND No. 2 & 3 (STORAGE INDICATION METHOD) — CHECKED BY JM

TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	
8.00	0.000				11.75	4.897				
		0.004	0.004	0.000			8.681	14.143	1.433	
8.25	0.007				12.00	12.465				
		0.011	0.015	0.002			13.314	26.024	2.525	
8.50	0.015				12.25	14.163				
		0.024	0.037	0.004			11.929	35.428	3.259	
8.75	0.032				12.50	9.694				
		0.048	0.081	0.008			8.351	40.540	3.627	
9.00	0.064				12.75	7.007				
		0.062	0.155	0.016			6.261	43.174	3.789	
9.25	0.099				13.00	5.514				
		0.119	0.258	0.026			5.212	44.597	3.864	
9.50	0.138				13.25	4.909				
		0.159	0.391	0.040			4.729	45.462	3.901	
9.75	0.179				13.50	4.549				
		0.200	0.551	0.056			4.457	46.018	3.939	
10.00	0.220				13.75	4.365				
		0.250	0.745	0.076			4.293	46.372	3.958	
10.25	0.280				14.00	4.221				
		0.330	0.999	0.102			4.188	46.602	3.970	
10.50	0.375				14.25	4.154				
		0.440	1.337	0.137			4.118	46.750	3.978	
10.75	0.500				14.50	4.082				
		0.577	1.777	0.182			4.061	46.833	3.982	
11.00	0.653				14.75	4.040				
		0.769	2.364	0.242			4.024	46.875	3.984	*
11.25	0.884				15.00	4.007				
		1.145	3.267	0.334			3.981	46.872	3.984	
11.50	1.406				15.25	3.955				
		3.152	6.085	0.623			3.954	46.842	3.983	
11.75	4.897				15.50	3.953				

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 68 OF 103

10 YR. FLOOD ROUTING- 24.3 ACRE DRAINAGE AREA TO DETENTION POND No2A&B (STORAGE INDICATION METHOD) — COMPUTED BY JS/RR

CHECKED BY - JM

TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	
8.00	0.000				11.75	6.744				
		0.005	0.005	0.001			11.971	19.464	1.924	
8.25	0.010				12.00	17.198				
		0.016	0.020	0.002			18.340	35.878	3.273	
8.50	0.021				12.25	19.482				
		0.032	0.050	0.005			16.402	49.007	4.097	
8.75	0.043				12.50	13.322				
		0.066	0.111	0.011			11.459	56.369	4.487	
9.00	0.089				12.75	9.595				
		0.113	0.213	0.022			8.564	60.446	4.702	
9.25	0.137				13.00	7.533				
		0.164	0.356	0.036			7.121	62.865	4.793	
9.50	0.191				13.25	6.708				
		0.219	0.538	0.055			6.452	64.524	4.856	
9.75	0.247				13.50	6.196				
		0.276	0.759	0.078			6.064	65.732	4.901	
10.00	0.304				13.75	5.931				
		0.344	1.025	0.105			5.826	66.657	4.936	
10.25	0.383				14.00	5.720				
		0.449	1.369	0.140			5.670	67.391	4.964	
10.50	0.515				14.25	5.619				
		0.599	1.828	0.187			5.574	68.001	4.987	
10.75	0.682				14.50	5.528				
		0.786	2.427	0.248			5.494	68.508	5.006	
11.00	0.889				14.75	5.459				
		1.053	3.232	0.331			5.436	68.938	5.022	
11.25	1.216				15.00	5.412				
		1.570	4.471	0.458			5.377	69.293	5.036	
11.50	1.924				16.25	5.126				
		4.334	8.347	0.854			5.107	70.104	5.066	*
11.75	6.744				16.50	5.088				

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 69 OF 103

25 YR. FLOOD ROUTING- 24.3 ACRE DRAINAGE AREA TO DETENTION POND No.2A&B (STORAGE INDICATION METHOD) — COMPUTED BY JS/RR

CHECKED BY JM

TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	
8.00	0.000				11.75	9.217				
		0.007	0.007	0.001			16.351	26.807	2.584	
8.25	0.014				12.00	23.485				
		0.021	0.027	0.003			25.020	49.243	4.110	
8.50	0.028				12.25	26.555				
		0.044	0.068	0.007			22.335	67.468	4.967	
8.75	0.060				12.50	18.114				
		0.091	0.152	0.016			15.547	78.048	5366	
9.00	0.121				12.75	12.979				
		0.155	0.291	0.030			11.539	84.221	5.586	
9.25	0.188				13.00	10.099				
		0.449	0.710	0.073			9.513	88.148	5.715	
9.50	0.261				13.25	8.927				
		0.300	0.937	0.096			8.554	90.987	5.808	
9.75	0.338				13.50	8.181				
		0.753	1.594	0.163			7.983	93.162	5.879	
10.00	0.415				13.75	7.784				
		0.469	1.900	0.194			7.632	94.915	5.937	
10.25	0.522				14.00	7.479				
		0.612	2.318	0.273			7.399	96.377	5.984	
10.50	0.702				14.25	7.318				
		0.817	2.862	0.293			7.247	97.640	6.026	
10.75	0.931				14.50	7.176				
		1.073	3.642	0.373			7.128	98.742	6.062	
11.00	1.214				14.75	7.080				
		1.439	4.708	0.482			7.041	99.721	6.094	
11.25	1.663				15.00	7.001				
		2.149	6.375	0.653			6.948	100.575	6.122	
11.50	2.634				17.25	6.286				
		5.926	11.648	1.192			6.255	103.924	6.232	*
11.75	9.217				17.50	6.224				

RAYMOND KEYES ENGINEERS, P.C.

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PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 70 OF 103

100 YR. FLOOD ROUTING- 243 ACRE DRAINAGE AREA TO DETENTION POND No2&3 (STORAGE INDICATION METHOD) — COMPUTED BY JS/ER

CHECKED BY JM

TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	
8.00	0.000				11.75	4.357				
		0.011	0.011	0.001			9.410	18.575	1.842	
8.25	0.021				12.00	14.463				
		0.031	0.041	0.004			25.011	41.744	3.713	
8.50	0.041				12.25	35.559				
		0.064	0.101	0.010			37.660	75.691	5.277	
8.75	0.087				12.50	39.760				
		0.137	0.228	0.023			33.273	103.687	6.224	
9.00	0.186				12.75	26.786				
		0.229	0.434	0.044			22.828	120.291	6.665	
9.25	0.272				13.00	18.869				
		0.325	0.715	0.073			16.645	130.276	6.917	
9.50	0.378				13.25	14.429				
		0.434	1.076	0.110			13.489	136.848	7.065	
9.75	0.490				13.50	12.548				
		0.503	1.568	0.161			11.947	141.730	7.175	
10.00	0.516				13.75	11.345				
		0.575	2.012	0.206			11.025	145.580	7.261	
10.25	0.633				14.00	10.704				
		0.715	2.521	0.258			10.455	148.774	7.333	
10.50	0.796				14.25	10.206				
		1.010	3.273	0.335			10.071	151.512	7.395	
10.75	1.224				14.50	9.936				
		1.397	4.335	0.444			9.822	153.939	7.449	
11.00	1.570				14.75	9.707				
		1.787	5.678	0.581			9.629	156.119	7.498	
11.25	2.004				15.00	9.551				
		2.349	7.446	0.762			9.479	158.100	7.535	
11.50	2.694				17.00	7.861				
		3.526	10.210	1.045			7.791	167.157	7.709	*
11.75	4.357				17.25	7.721				

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT Crossgates Complex
LOCATION Guilderland, N.Y.
TYPE OF CALCULATION After Development
HYDROLOGICAL CLASSIFICATIONS
56.8 Acre DRAINAGE AREA TO DETENTION POND No 3

JOB NO. 2838
DATE 5-30-79
SHEET 7/ OF 703
COMPUTED BY JS/ER
CHECKED BY JM

	CLASS HYDRO	CN	ACRES AREA	CN(A)	
OPEN	A	39	7.8	304.2	
	B	61	.6	36.6	
	C	74	.4	29.6	
	D	80	4.9	392.0	
					762.4
RESIDENTIAL	A	57	10.7	609.9	
	B	72	21.4	1504.8	
	C	81	3.1	251.1	
	D	86	—	—	2365.8
WOODED	A	25	—	—	—
	B	55	—	—	—
	C	70	—	—	—
	D	77	—	—	—
BUSINESS COMMERCIAL	A	89	—	—	—
	B	92	—	—	—
	C	94	—	—	—
	D	95	—	—	—
TOTAL			48.9		3128.2

$$CN = \frac{3128.2}{48.9} = 64.0$$

	CN	ACRES AREA	CN (A)
ONSITE DEVELOPMENT	98	7.9	774.2

$$\text{COMBINED CN} = \frac{3128.2 + 774.2}{48.9 + 7.9} = 68.7 \approx 69.0$$

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CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 7858
LOCATION GUILDERLAND, N.Y. — DATE 5-30-79
TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 72 OF 103
STORM DRAINAGE WATERSHED CHARACTERISTICS — COMPUTED BY JS/RR
56.8 AC. DRAINAGE AREA TO DETENTION POND No. 3 — CHECKED BY JM

AREA = 56.8 ACRES = 0.089 Sq. Mi.

CN	=	69.0
P_2	=	2.85
P_5	=	3.70
P_{10}	=	4.25
P_{25}	=	4.90
P_{100}	=	5.90
T_c	=	0.75
T_T	=	0.00

WHERE P IS DESIGN RAINFALL IN INCHES FOR 2, 5, 10, 25 & 100 YR. STORM FREQUENCY RECURRENCE INTERVALS OVER A 24 HOUR DURATION. FROM TECHNICAL PAPER No 40 MAY 1961.

$S = \frac{1000}{CN} - 10 = 4.493$ WHERE CN = 69

MASS RUNOFF

2 YR. R.O. = $\frac{(P-.25)^2}{P+.85} = 0.59$ WHERE P = 2.85, S = 4.493

5 YR. R.O. = $\frac{(P-.25)^2}{P+.85} = 1.08$ WHERE P = 3.70, S = 4.493

10 YR. R.O. = $\frac{(P-.25)^2}{P+.85} = 1.43$ WHERE P = 4.25, S = 4.493

25 YR. R.O. = $\frac{(P-.25)^2}{P+.85} = 1.88$ WHERE P = 4.90, S = 4.493

100 YR. R.O. = $\frac{(P-.25)^2}{P+.85} = 2.63$ WHERE P = 5.90, S = 4.493

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX
LOCATION GUILDERLAND, N.Y.
TYPE OF CALCULATION AFTER DEVELOPMENT
2 Yr. INFLOW HYDROGRAPH (CN=69) TABULAR METHOD
56BAC DRAINAGE AREA TO DETENTION POND No. 3

JOB NO. 7838
DATE 5-30-79
SHEET 73 OF 103
COMPUTED BY JS/ee
CHECKED BY JM

TIME HRS.	CSM/IN. R.O. ① T_C = 0.75 T_T = 0.00	C.F.S. D.A.= 0.089 R.O.= 0.59	INFLOW HYDROGRAPH (C.F.S.)
8.00	0.00	0.052	0.000
8.25	0.15		0.008
8.50	0.35		0.018
8.75	0.90		0.047
9.00	1.70		0.089
9.25	2.70		0.141
9.50	3.75		0.196
9.75	4.80		0.251
10.00	5.90		0.309
10.25	7.30		0.382
10.50	9.40		0.492
10.75	12.50		0.655
11.00	16.70		0.874
11.25	22.90		1.199
11.50	35.30		1.848
11.75	130.10		6.812
12.00	306.10		16.028
12.25	364.10		19.065
12.50	278.50		14.585
12.75	193.40		10.127
13.00	134.60		7.048
13.25	97.70		5.116
13.50	74.50		3.901
13.75	60.70		3.178
14.00	50.40		2.639
14.25	43.70		2.288
14.50	39.40		2.063
14.75	36.40		1.906
15.00	34.10		1.786
15.25	32.00		1.676
15.50	30.00		1.571

NOTES:

① TABULAR DISCHARGES FROM TSC TECHNICAL NOTE - ENGINEERING UD-20; Pgs 10-11

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX
LOCATION GUILDERLAND, N.Y.
TYPE OF CALCULATION AFTER DEVELOPMENT
5 Yr. INFLOW HYDROGRAPH (CN=69) TABULAR METHOD
568ac DRAINAGE AREA TO DETENTION POND No. 3

JOB NO. 7838
DATE 5-30-79
SHEET 74 OF 103
COMPUTED BY JS/EE
CHECKED BY JM

TIME HRS.	CSM/IN. R.O. ① T_C = 0.75 T_T = 0.00	C.F.S. D.A. = 0.089 R.O. = 1.08	INFLOW HYDROGRAPH (C.F.S.)
8.00	0.00	0.096	0.000
8.25	0.15		0.014
8.50	0.35		0.034
8.75	0.90		0.086
9.00	1.70		0.163
9.25	2.70		0.259
9.50	3.75		0.359
9.75	4.80		0.460
10.00	5.90		0.566
10.25	7.30		0.700
10.50	9.40		0.901
10.75	12.50		1.198
11.00	16.70		1.601
11.25	22.90		2.195
11.50	35.30		3.384
11.75	130.10		12.470
12.00	306.10		29.340
12.25	364.10		34.899
12.50	278.50		26.694
12.75	193.40		18.537
13.00	134.60		12.901
13.25	97.70		9.365
13.50	74.50		7.141
13.75	60.70		5.818
14.00	50.40		4.831
14.25	43.70		4.189
14.50	39.40		3.776
14.75	36.40		3.489
15.00	34.10		3.268
15.25	32.00		3.067
15.50	30.00		2.876

NOTES:

① TABULAR DISCHARGES FROM TSC TECHNICAL NOTE - ENGINEERING UD-20; Pgs 10-11

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX
LOCATION GUILDERLAND, N.Y.
TYPE OF CALCULATION AFTER DEVELOPMENT
10 YR. INFLOW HYDROGRAPH (CN=69) TABULAR METHOD
56.84 DRAINAGE AREA TO DETENTION POND No. 3

JOB NO. 7838
DATE 5-30-79
SHEET 75 OF 103
COMPUTED BY JS/EE
CHECKED BY JH

TIME HRS.	CSM/IN. R.O. ① T_c = 0.75 T_T = 0.00	C.F.S. D.A. = 0.089 R.O. = 1.43	INFLOW HYDROGRAPH (C.F.S.)
8.00	0.00	0.127	0.000
8.25	0.15		0.019
8.50	0.35		0.044
8.75	0.90		0.114
9.00	1.70		0.216
9.25	2.70		0.343
9.50	3.75		0.476
9.75	4.80		0.609
10.00	5.90		0.749
10.25	7.30		0.926
10.50	9.40		1.193
10.75	12.50		1.586
11.00	16.70		2.119
11.25	22.90		2.906
11.50	35.30		4.480
11.75	130.10		16.511
12.00	306.10		38.848
12.25	364.10		46.209
12.50	278.50		35.345
12.75	193.40		24.545
13.00	134.60		17.082
13.25	97.70		12.399
13.50	74.50		9.455
13.75	60.70		7.704
14.00	50.40		6.396
14.25	43.70		5.546
14.50	39.40		5.000
14.75	36.40		4.620
15.00	34.10		4.328
15.25	32.00		4.061
15.50	30.00		3.807

NOTES:

① TABULAR DISCHARGES FROM TSC TECHNICAL NOTE - ENGINEERING UD-20; Pgs 10-11

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838
LOCATION GUILDERLAND, N.Y. — DATE 5-30-79
TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 76 OF 103
25 YR. INFLOW HYDROGRAPH (CN=69) TABULAR METHOD — COMPUTED BY JS/RR
56.8A DRAINAGE AREA TO DETENTION POND No. 3 — CHECKED BY JM

TIME HRS.	CSM/IN.R.O. ① T_c = 0.75 T_T = 0.00	C.F.S. D.A.= 0.089 R.O.= 1.88	INFLOW HYDROGRAPH (C.F.S.)
8.00	0.00	0.167	0.000
8.25	0.15		0.025
8.50	0.35		0.058
8.75	0.90		0.150
9.00	1.70		0.284
9.25	2.70		0.450
9.50	3.75		0.626
9.75	4.80		0.801
10.00	5.90		0.984
10.25	7.30		1.218
10.50	9.40		1.568
10.75	12.50		2.086
11.00	16.70		2.786
11.25	22.90		3.821
11.50	35.30		5.890
11.75	130.10		21.707
12.00	306.10		51.073
12.25	364.10		60.750
12.50	278.50		46.468
12.75	193.40		32.269
13.00	134.60		22.458
13.25	97.70		16.301
13.50	74.50		12.430
13.75	60.70		10.128
14.00	50.40		8.409
14.25	43.70		7.291
14.50	39.40		6.574
14.75	36.40		6.073
15.00	34.10		5.690
15.25	32.00		5.339
15.50	30.00		5.006

NOTES:

① TABULAR DISCHARGES FROM TSC TECHNICAL NOTE - ENGINEERING UD-20; Pgs 10-11

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838
LOCATION GUILDERLAND, N.Y. — DATE 5-30-79
TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 77 OF 103
100 YR. INFLOW HYDROGRAPH (CN=69) TABULAR METHOD — COMPUTED BY JS/ER
56.8Ac. DRAINAGE AREA TO DETENTION POND No. 3 — CHECKED BY JM

TIME HRS.	CSM/IN. R.O. ① T_C = 0.75 T_T = 0.00	C.F.S. D.A.= 0.089 R.O.= 2.63	INFLOW HYDROGRAPH (C.F.S.)
8.00	0.00	0.234	0.000
8.25	0.15		0.035
8.50	0.35		0.082
8.75	0.90		0.210
9.00	1.70		0.397
9.25	2.70		0.630
9.50	3.75		0.875
9.75	4.80		1.120
10.00	5.90		1.377
10.25	7.30		1.704
10.50	9.40		2.194
10.75	12.50		2.918
11.00	16.70		3.898
11.25	22.90		5.345
11.50	35.30		8.239
11.75	130.10		30.367
12.00	306.10		71.448
12.25	364.10		84.985
12.50	278.50		65.005
12.75	193.40		45.142
13.00	134.60		31.417
13.25	97.70		22.804
13.50	74.50		17.389
13.75	60.70		14.168
14.00	50.40		11.764
14.25	43.70		10.200
14.50	39.40		9.196
14.75	36.40		8.496
15.00	34.10		7.959
15.25	32.00		7.469
15.50	30.00		7.002

NOTES:

① TABULAR DISCHARGES FROM TSC TECHNICAL NOTE - ENGINEERING UD-20; Pgs 10-11

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX
LOCATION GUILDERLAND, N.Y.
TYPE OF CALCULATION AFTER DEVELOPMENT
STORAGE VOLUMES
DETENTION POND NO. 3

JOB NO. 2858
DATE 5-30-79
SHEET 78 OF 103
COMPUTED BY JS/RE
CHECKED BY JM

STORAGE VOLUMES

ELEV.	AREA	AVERAGE AREA	DEPTH	VOLUME (C.F.)	CUM. VOL. (C.F.)	CUM. VOL. (ACRE FEET)
270	57,000					
		63,350	2	126,700	126,700	2.91
272	69,700					
		76,050	2	152,100	278,800	6.40
274	82,400					
		88,750	2	177,500	456,300	10.48
276	95,100					

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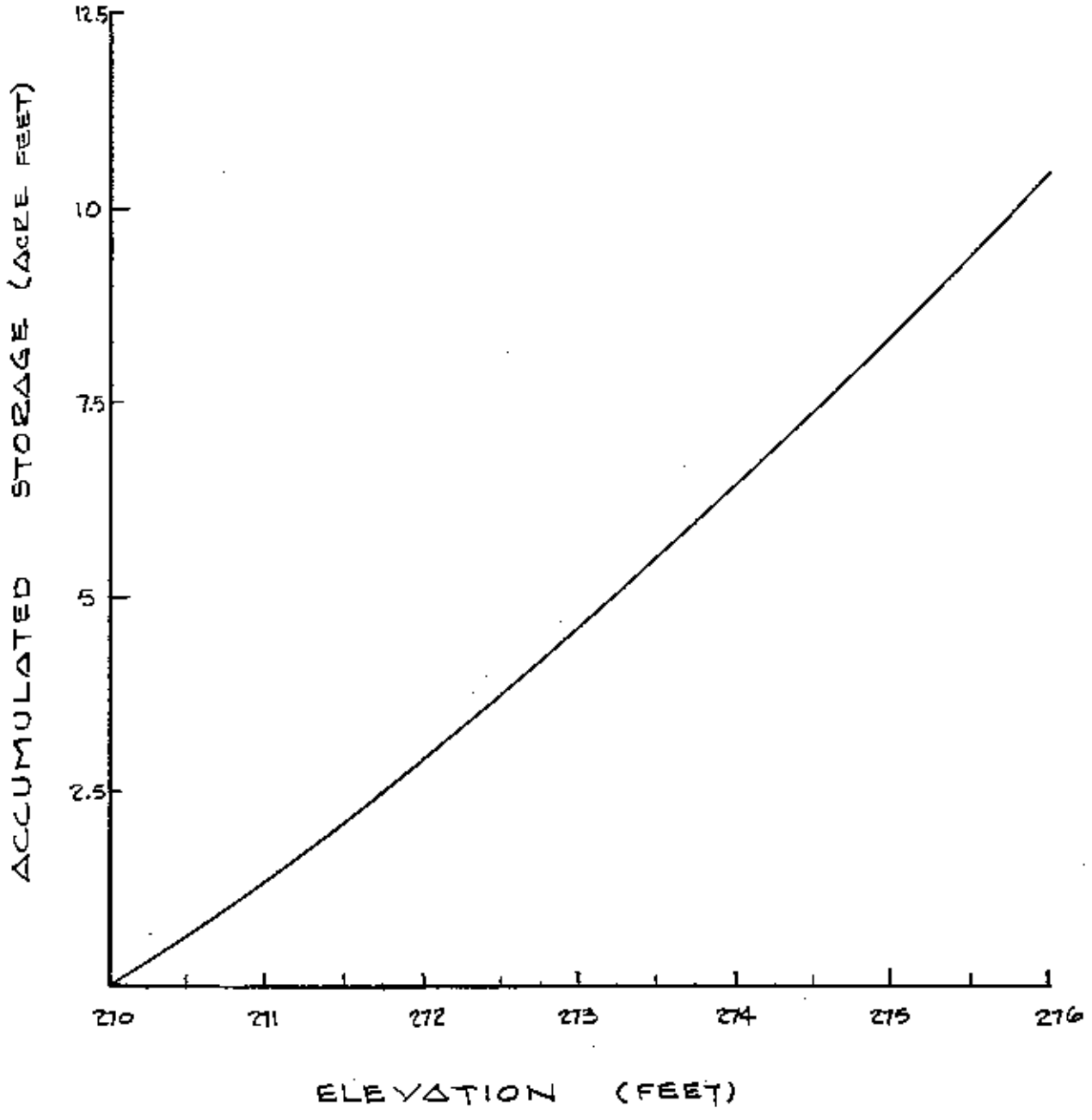
CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX
LOCATION GUILDERLAND, N.Y.
TYPE OF CALCULATION AFTER DEVELOPMENT
ELEVATION - STORAGE CURVE
DETETENTION POND No. 3

JOB NO. 2838
DATE 5-30-79
SHEET 79 OF 103
COMPUTED BY JS/RE
CHECKED BY JM



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PROJECT CROSSGATES COMPLEX

LOCATION GUILDERLAND, N.Y.

TYPE OF CALCULATION AFTER DEVELOPMENT

ELEVATION-DISCHARGE CURVE-12"C.M.P.

DETENTION POND No. 3

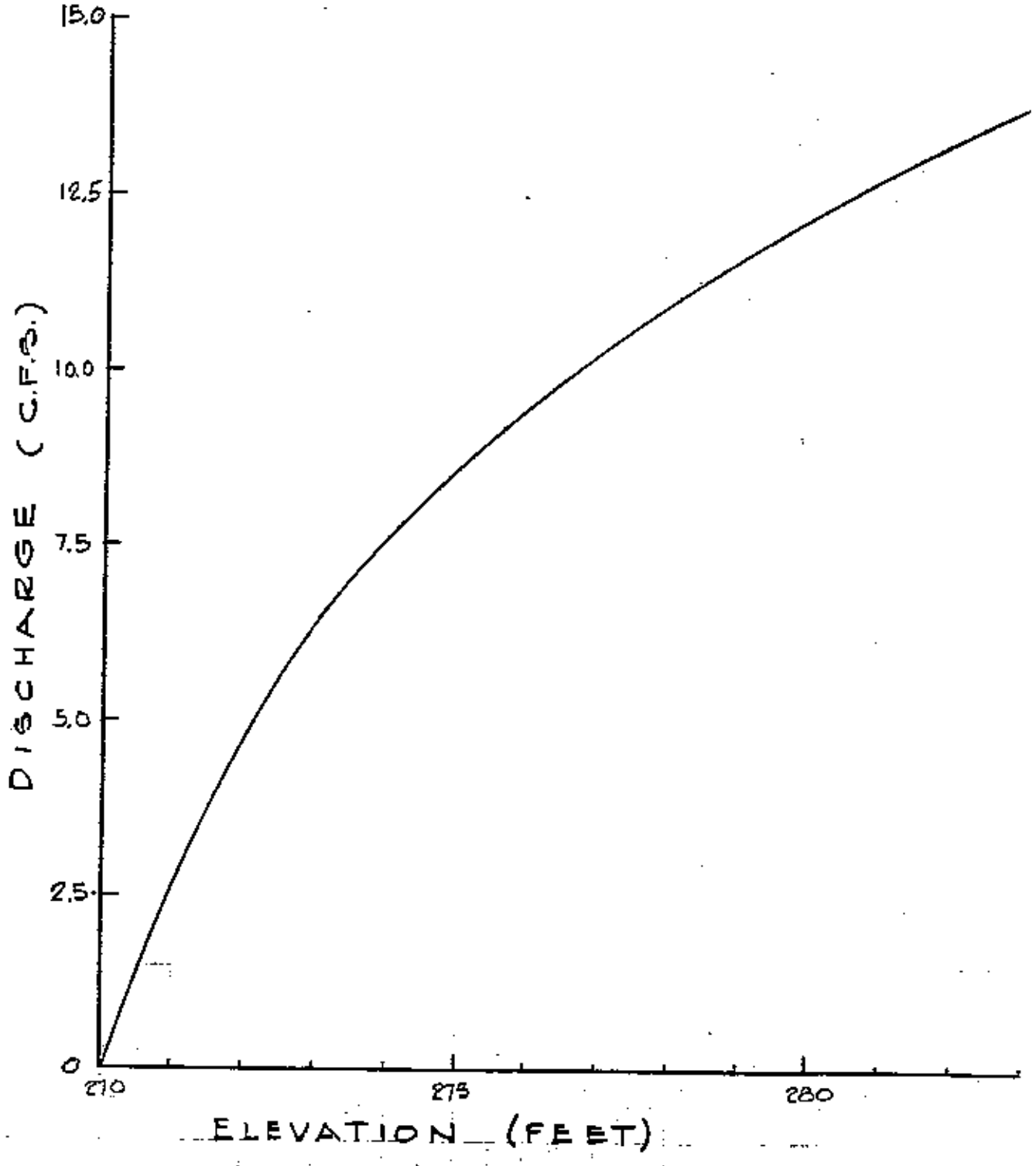
JOB NO. 2838

DATE 5-30-79

SHEET 80 OF 103

COMPUTED BY JS/RR

CHECKED BY JM



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PROJECT: CROSSGATES COMPLEX — JOB NO. 2838

LOCATION: GUILDERLAND, N.Y. — DATE: 5-30-79

TYPE OF CALCULATION: — SHEET 81 OF 103

WORKING CURVE

COMPUTED BY JS/EE

Form AFTER DEVELOPMENT DETENTION POND No. 3 - 12"C.M.P. DISCHARGE — CHECKED BY JM

TAILWATER ELEV. = N.A.

FOR Δt = 0.25 HRS.

ELEV. (FT.)	DISC. O_2 CFS	STORAGE S_2 Ac. Ft.	STORAGE S_2 CFS-HRS.	$O_2/2$ CFS	$S_2/\Delta t$ CFS	$S_2/\Delta t + O_2/2$ CFS
270.00	0.0	0.00	0.0	0.0	0.0	0.0
270.50	1.3	0.65	7.9	0.7	31.6	32.3
271.00	2.5	1.32	16.0	1.3	64.0	65.3
271.50	3.7	2.08	25.2	1.9	100.8	102.7
272.00	4.7	2.91	35.2	2.4	140.8	143.2
272.50	5.5	3.75	45.4	2.8	181.6	184.4
273.00	6.3	4.58	55.4	3.2	221.6	224.8
273.50	6.9	5.50	66.6	3.5	266.4	269.9
274.00	7.5	6.40	77.4	3.8	309.6	313.4
274.50	8.0	7.37	89.2	4.0	356.8	360.8
275.00	8.5	8.36	101.2	4.3	404.8	409.1
275.50	9.0	9.36	113.3	4.5	453.2	457.7
276.00	9.5	10.48	126.8	4.8	507.2	512.0

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CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-75

TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 82 OF 103

2 YR. FLOOD ROUTING- 56.8 ACRE DRAINAGE AREA TO DETENTION POND No. 3 (STORAGE INDICATION METHOD) — COMPUTED BY JS/ER — CHECKED BY JM

TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.
8.00	0.000				11.75	6.812			
		0.004	0.004	0.000			11.420	20.226	0.814
8.25	0.008				12.00	16.028			
		0.013	0.017	0.001			17.547	36.959	1.469
8.50	0.018				12.25	19.065			
		0.033	0.049	0.002			16.824	52.314	2.028
8.75	0.047				12.50	14.585			
		0.068	0.115	0.005			12.355	62.641	2.403
9.00	0.089				12.75	10.127			
		0.115	0.225	0.009			8.588	68.826	2.613
9.25	0.141				13.00	7.048			
		0.165	0.385	0.015			6.062	72.295	2.724
9.50	0.196				13.25	5.116			
		0.224	0.594	0.024			4.509	74.080	2.782
9.75	0.251				13.50	3.901			
		0.280	0.850	0.034			3.540	74.833	2.806
10.00	0.309				13.75	3.178			
		0.346	1.162	0.047			2.909	74.941	2.809
10.25	0.382				14.00	2.639			
		0.437	1.552	0.062			2.464	74.596	2.798
10.50	0.492				14.25	2.289			
		0.574	2.064	0.083			2.176	73.974	2.778
10.75	0.655				14.50	2.063			
		0.765	2.746	0.111			1.985	73.181	2.753
11.00	0.874				14.75	1.906			
		1.037	3.672	0.148			1.846	72.272	2.724
11.25	1.199				15.00	1.786			
		1.524	5.048	0.203			1.731	71.279	2.692
11.50	1.648				15.25	1.676			
		4.330	9.175	0.369			1.624	70.211	2.658
11.75	6.812				15.50	1.571			

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 83 OF 103

5 YR. FLOOD ROUTING- 56.8 ACRE DRAINAGE AREA TO DETENTION POND No 3 (STORAGE INDICATION METHOD) — COMPUTED BY JS/EE

CHECKED BY JM

TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	
8.00	0.000				11.75	12.470				
		0.007	0.007	0.000			20.905	37.025	1.472	
8.25	0.014				12.00	29.340				
		0.024	0.031	0.001			32.120	67.673	2.576	
8.50	0.034				12.25	34.899				
		0.060	0.090	0.004			30.797	95.894	3.482	
8.75	0.086				12.50	26.694				
		0.125	0.211	0.008			22.616	115.028	4.004	
9.00	0.163				12.75	18.537				
		0.211	0.414	0.017			15.719	126.743	4.294	
9.25	0.259				13.00	12.901				
		0.309	0.706	0.028			11.133	133.582	4.462	
9.50	0.359				13.25	9.365				
		0.410	1.088	0.044			8.253	137.373	4.556	
9.75	0.460				13.50	7.141				
		0.513	1.557	0.063			6.480	139.297	4.604	
10.00	0.566				13.75	5.818				
		0.633	2.127	0.086			5.325	140.018	4.621	*
10.25	0.700				14.00	4.831				
		0.801	2.842	0.114			4.510	139.907	4.619	
10.50	0.901				14.25	4.189				
		1.050	3.778	0.152			3.983	139.271	4.603	
10.75	1.196				14.50	3.776				
		1.400	5.026	0.202			3.633	138.301	4.579	
11.00	1.601				14.75	3.489				
		1.898	6.722	0.271			3.379	137.101	4.549	
11.25	2.195				15.00	3.268				
		2.790	9.241	0.372			3.168	135.720	4.515	
11.50	3.384				15.25	3.067				
		7.927	16.796	0.676			2.972	134.177	4.477	
11.75	12.470				15.50	2.876				

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 84 OF 103

10 YR. FLOOD ROUTING- 56.8 ACRE DRAINAGE AREA TO DETENTION POND No. 3 (STORAGE INDICATION METHOD) — COMPUTED BY JS/RR

CHECKED BY JM

TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	
8.00	0.000				11.75	16.511				
		0.010	0.010	0.000			27.680	49.019	1.908	
8.25	0.010				12.00	38.848				
		0.032	0.042	0.002			42.529	89.640	3.281	
8.50	0.044				12.25	46.209				
		0.079	0.119	0.005			40.777	127.136	4.303	
8.75	0.114				12.50	35.345				
		0.165	0.279	0.011			29.945	152.778	4.886	
9.00	0.216				12.75	24.545				
		0.280	0.548	0.022			20.814	168.706	5.195	
9.25	0.343				13.00	17.082				
		0.410	0.936	0.038			14.741	178.252	5.351	
9.50	0.476				13.25	12.399				
		0.543	1.441	0.058			10,927	183.798	5.488	
9.75	0.609				13.50	9.455				
		0.679	2.062	0.083			8.580	186.890	5.549	
10.00	0.749				13.75	7.704				
		0.838	2.817	0.118			7.050	188.391	5.579	
10.25	0.926				14.00	6.396				
		1.060	3.759	0.151			5.971	188.783	5.587	*
10.50	1.193				14.25	5.546				
		1.390	4.998	0.201			5.273	188.469	5.581	
10.75	1.586				14.50	5.000				
		1.853	6.650	0.268			4.810	187.698	5.565	
11.00	2.119				14.75	4.620				
		2.513	8.895	0.358			4.474	186.607	5.544	
11.25	2.906				15.00	4.328				
		3.693	12.230	0.492			4.195	185.517	5.517	
11.50	4.480				15.25	4.061				
		10.496	22.234	0.895			3.934	183.934	5.491	
11.75	16.511				15.50	3.807				

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 85 OF 103

25 YR. FLOOD ROUTING - 56.8 ACRE DRAINAGE AREA TO DETENTION POND No. 3 (STORAGE INDICATION METHOD) — COMPUTED BY JS/RR — CHECKED BY JM

TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	
8.00	0.000				11.75	21.707				
		0.013	0.013	0.001			36.390	64.447	2.469	
8.25	0.025				12.00	51.073				
		0.042	0.054	0.002			55.912	117.890	4.075	
8.50	0.058				12.25	60.750				
		0.104	0.156	0.006			53.609	167.424	5.170	
8.75	0.150				12.50	46.468				
		0.217	0.367	0.015			38.369	201.623	5.841	
9.00	0.284				12.75	32.269				
		0.367	0.719	0.029			27.364	223.146	6.267	
9.25	0.451				13.00	22.458				
		0.538	1.228	0.049			19.380	236.259	6.452	
9.50	0.626				13.25	16.301				
		0.714	1.893	0.076			14.366	244.173	6.558	
9.75	0.801				13.50	12.430				
		0.893	2.710	0.109			11.279	248.894	6.621	
10.00	0.984				13.75	10.128				
		1.101	3.702	0.149			9.269	251.542	6.656	
10.25	1.218				14.00	8.409				
		1.393	4.946	0.199			7.850	252.736	6.672	
10.50	1.568				14.25	7.291				
		1.827	6.574	0.265			6.933	252.997	6.675	*
10.75	2.086				14.50	6.574				
		2.436	8.745	0.352			6.324	252.646	6.670	
11.00	2.786				14.75	6.073				
		3.304	11.697	0.471			5.682	251.858	6.660	
11.25	3.821				15.00	5.690				
		4.856	16.082	0.647			5.515	250.713	6.645	
11.50	5.890				15.25	5.339				
		13.799	29.234	1.177			5.173	249.241	6.625	
11.75	21.707				15.50	5.006				

RAYMOND KEYES ENGINEERS, P.C.

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PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 86 OF 103

100 YR. FLOOD ROUTING- 56.8 ACRE DRAINAGE AREA TO DETENTION POND No. 3 (STORAGE INDICATION METHOD) — COMPUTED BY JS/RE

CHECKED BY JM

TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	
8.00	0.000				11.75	30.367				
		0.018	0.018	0.001			50.908	90.191	3.299	
8.25	0.035				12.00	71.448				
		0.059	0.076	0.003			78.217	165.109	4.710	
8.50	0.082				12.25	84.985				
		0.146	0.219	0.009			74.995	235.394	6.441	
8.75	0.210				12.50	65.005				
		0.304	0.514	0.021			55.074	284.027	7.095	
9.00	0.397				12.75	45.142				
		0.514	1.007	0.041			38.280	315.212	7.519	
9.25	0.630				13.00	31.417				
		0.753	1.719	0.069			27.111	334.804	7.726	
9.50	0.875				13.25	22.804				
		0.998	2.648	0.107			20.097	347.175	7.856	
9.75	1.120				13.50	17.389				
		1.249	3.790	0.153			15.779	355.098	7.940	
10.00	1.377				13.75	14.168				
		1.541	5.178	0.208			12.966	360.124	7.993	
10.25	1.704				14.00	11.764				
		1.949	6.919	0.278			10.982	363.113	8.024	
10.50	2.194				14.25	10.200				
		2.552	9.197	0.370			9.698	364.787	8.041	
10.75	2.918				14.50	9.196				
		3.408	12.235	0.492			8.846	365.592	8.050	
11.00	3.898				14.75	8.496				
		4.622	16.365	0.659			8.228	366.770	8.051	*
11.25	5.345				15.00	7.959				
		6.792	22.498	0.905			7.714	365.433	8.040	
11.50	8.239				15.25	7.469				
		19.303	40.896	1.613			7.236	364.629	8.040	
11.75	30.367				15.50	7.002				

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PROJECT Crossgates Complex
LOCATION Guilderland, N.Y.
TYPE OF CALCULATION After Development
HYDROLOGICAL CLASSIFICATIONS
119.9 Acre Drainage Area To Detention Pond No. 4A & B

JOB NO. 2838
DATE 5-30-79
SHEET 87 OF 108
COMPUTED BY JS/RR
CHECKED BY JM

	CLASS HYDRO	CN	ACRES AREA	CN(A)	
OPEN	A	39	0.92	35.88	
	B	61	—	—	
	C	74	—	—	
	D	80	—	—	
					35.88
RESIDENTIAL	A	57	6.80	387.60	
	B	72	6.58	473.76	
	C	81	1.38	111.78	
	D	86	—	—	
					973.14
WOODED	A	25	13.78	344.5	
	B	55	6.34	348.7	
	C	70	2.58	180.6	
	D	77	—	—	
					873.90
BUSINESS COMMERCIAL	A	89	—	—	
	B	92	9.84	905.28	
	C	94	—	—	
	D	95	—	—	
					905.28
TOTAL			48.22		2788.10

$$CN = \frac{2788.10}{48.22} = 57.82$$

	CN	ACRES AREA	CN(A)
ONSITE DEVELOPMENT	98	71.68	7024.64

$$\text{COMBINED } CN = \frac{2788.10 + 7024.64}{48.22 + 71.68} = 81.8$$

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PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION DEVELOPMENT — SHEET 88 OF 103

STORM DRAINAGE WATERSHED CHARACTERISTICS — COMPUTED BY JS/RR

DRAINAGE AREA TO DETENTION POND N64A/S — CHECKED BY JM

AREA = 119.9 ACRES = 0.187 Sq. Mi.

CN	=	81.8
P_2	=	2.85
P_5	=	3.70
P_{10}	=	4.25
P_{25}	=	4.90
P_{100}	=	5.90
T_c	=	
T_T	=	0.00

WHERE P IS DESIGN RAINFALL IN INCHES FOR 2, 5, 10, 25 & 100 YR. STORM FREQUENCY RECURRENCE INTERVALS OVER A 24 HOUR DURATION. FROM TECHNICAL PAPER No. 40 MAY 1961.

$S = \frac{1000}{CN} - 10 = 2.225$ WHERE CN = 81.8

MASS RUNOFF

2 YR. R.O. = $\frac{(P-.2S)^2}{P+.8S}$ = 1.25 WHERE P = 2.85, S = 2.225

5 YR. R.O. = $\frac{(P-.2S)^2}{P+.8S}$ = 1.93 WHERE P = 3.70, S = 2.225

10 YR. R.O. = $\frac{(P-.2S)^2}{P+.8S}$ = 2.40 WHERE P = 4.25, S = 2.225

25 YR. R.O. = $\frac{(P-.2S)^2}{P+.8S}$ = 2.97 WHERE P = 4.90, S = 2.225

100 YR R.O. = $\frac{(P-.2S)^2}{P+.8S}$ = 3.88 WHERE P = 5.90, S = 2.225

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PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, NY — DATE 5-30-79

TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 89 OF 103

2 YR INFLOW HYDROGRAPH (CN=81.8) TABULAR METHOD — COMPUTED BY JS/RR

119.9 Ac DRAINAGE AREA TO DETENTION POND No. 4A & 4B — CHECKED BY JM

TIME HRS	CSM/IN. R.O. ① Tc = 0.50 Tt = 0.00	C.F.S. D.A. = 0.187 R.O. = 1.25	OUTFLOW FROM DETENTION POND No. 2&2B (C.F.S.)	OUTFLOW FROM DETENTION POND No. 3 (C.F.S.)	INFLOW HYDROGRAPH (C.F.S.)
8.00	0.00	0.234	—	—	0.000
8.25	0.25		0.000	—	0.059
8.50	0.50		0.001	0.000	0.118
8.75	1.00		0.002	0.001	0.237
9.00	2.00		0.004	0.002	0.474
9.25	3.05		0.008	0.005	0.727
9.50	4.15		0.013	0.009	0.994
9.75	5.25		0.020	0.015	1.264
10.00	6.30		0.029	0.024	1.528
10.25	7.80		0.040	0.034	1.901
10.50	10.50		0.053	0.047	2.559
10.75	13.90		0.093	0.062	3.410
11.00	18.10		0.113	0.083	4.435
11.25	24.80		0.141	0.111	6.060
11.50	40.20		0.185	0.148	9.747
11.75	151.60		0.327	0.203	36.032
12.00	390.90		0.733	0.396	92.670
12.25	427.50		1.350	0.814	102.256
12.50	261.50		1.750	1.469	64.457
12.75	159.60		1.981	2.028	41.384
13.00	101.80		2.093	2.403	28.335
13.25	76.30		2.149	2.613	22.630
13.50	60.30		2.176	2.724	19.021
13.75	51.50		2.185	2.782	17.030
14.00	44.70		2.193	2.806	15.467
14.25	40.80		2.192	2.809	14.556
14.50	37.40		2.188	2.798	13.744
14.75	35.00		2.182	2.778	13.156
15.00	32.90		2.174	2.753	12.632
15.25	30.50		2.165	2.724	12.031
15.50	29.10		2.156	2.692	11.663

NOTES: ① TABULAR DISCHARGES FROM TSC TECHNICAL NOTE - ENGINEERING UD-20; PAG. 7-8

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-72

TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 90 OF 103

5 YR INFLOW HYDROGRAPH (CN=81.8) TABULAR METHOD — COMPUTED BY JS/ee

119.9 Ac. DRAINAGE AREA TO DETENTION POND No. 4A & 4B — CHECKED BY JM

TIME HRS	CSM/IN. R.O. ① Tc = 0.50 Tt = 0.00	C.F.S. D.A. = 0.187 R.O. = 1.93	OUTFLOW FROM DETENTION POND No. 2&2B (C.F.S.)	OUTFLOW FROM DETENTION POND No. 3 (C.F.S.)	INFLOW HYDROGRAPH (C.F.S.)
8.00	0.00	0.361	—	—	0.000
8.25	0.25		0.000	—	0.090
8.50	0.50		0.002	0.000	0.183
8.75	1.00		0.004	0.001	0.367
9.00	2.00		0.008	0.004	0.735
9.25	3.05		0.016	0.008	1.127
9.50	4.15		0.026	0.017	1.544
9.75	5.25		0.040	0.028	1.966
10.00	6.30		0.056	0.044	2.378
10.25	7.80		0.076	0.063	2.959
10.50	10.50		0.102	0.086	3.985
10.75	13.90		0.137	0.114	5.277
11.00	18.10		0.182	0.152	6.878
11.25	24.80		0.242	0.202	9.411
11.50	40.20		0.334	0.271	15.140
11.75	151.60		0.623	0.372	55.810
12.00	390.90		1.433	0.676	143.448
12.25	427.50		2.525	1.472	158.570
12.50	261.50		3.239	2.576	100.366
12.75	159.60		3.627	3.482	64.816
13.00	101.80		3.789	4.004	44.601
13.25	76.30		3.864	4.294	35.746
13.50	60.30		3.901	4.462	30.166
13.75	51.50		3.939	4.556	27.116
14.00	44.70		3.958	4.604	24.724
14.25	40.80		3.970	4.621	23.343
14.50	37.40		3.978	4.619	22.120
14.75	35.00		3.982	4.603	21.240
15.00	32.90		3.984	4.579	20.459
15.25	30.50		3.984	4.549	19.561
15.50	29.10		3.983	4.515	19.020

NOTES: ① TABULAR DISCHARGES FROM TRC TECHNICAL NOTE - ENGINEERING UD-20; Pgs. 7-8

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838
LOCATION GUILDERLAND, N Y — DATE 5-30-79
TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 91 OF 163
10 YR INFLOW HYDROGRAPH (CN=818) TABULAR METHOD — COMPUTED BY JS/RR
119.9 Ac. DRAINAGE AREA TO DETENTION POND No. 4A & 4B — CHECKED BY JM

TIME HRS	CSM / IN. R.O. ① Tc = 0.50 TT = 0.00	C.F.S. D.A. = 0.187 R.O. = 2.40	OUTFLOW FROM DETENTION POND No. 2A&2B (C.F.S.)	OUTFLOW FROM DETENTION POND No. 3 (C.F.S.)	INFLOW HYDROGRAPH (C.F.S.)
8.00	0.00	0.449	—	—	0.000
8.25	0.25		0.001	—	0.113
8.50	0.50		0.002	0.000	0.227
8.75	1.00		0.005	0.002	0.457
9.00	2.00		0.011	0.005	0.915
9.25	3.05		0.022	0.011	1.404
9.50	4.15		0.036	0.022	1.924
9.75	5.25		0.055	0.038	2.454
10.00	6.30		0.078	0.058	2.969
10.25	7.80		0.105	0.083	3.695
10.50	10.50		0.140	0.118	4.979
10.75	13.90		0.187	0.151	6.588
11.00	18.10		0.248	0.201	8.587
11.25	24.80		0.331	0.268	11.750
11.50	40.20		0.458	0.358	18.891
11.75	151.60		0.854	0.492	69.509
12.00	399.90		1.924	0.595	178.577
12.25	427.50		3.273	1.908	197.396
12.50	261.50		4.097	3.281	124.955
12.75	159.60		4.487	4.303	80.550
13.00	101.80		4.702	4.886	55.360
13.25	76.30		4.793	5.195	44.294
13.50	60.30		4.856	5.381	37.349
13.75	51.50		4.901	5.488	33.545
14.00	44.70		4.936	5.549	30.583
14.25	40.80		4.964	5.579	28.888
14.50	37.40		4.987	5.587	27.359
14.75	35.00		5.006	5.581	26.324
15.00	32.90		5.022	5.565	25.380
15.25	30.50		5.036	5.544	24.294
15.50	29.10		5.046	5.517	23.647

NOTES: ① TABULAR DISCHARGES FROM TSC TECHNICAL NOTE - ENGINEERING UD-20; PAS. 7-8

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 9k OF 103

25 YR INFLOW HYDROGRAPH (CN=81.8) TABULAR METHOD — COMPUTED BY JS/RR

19.9 Ac DRAINAGE AREA TO DETENTION POND No. 4A & 4B — CHECKED BY JM

TIME HRS	CSM / IN. R.O. ① Tc = 0.50 Tt = 0.00	C.F.S. D.A. = 0.187 R.O. = 2.97	OUTFLOW FROM DETENTION POND No. 2&2B (C.F.S.)	OUTFLOW FROM DETENTION POND No. 3 (C.F.S.)	INFLOW HYDROGRAPH (C.F.S.)
8.00	0.00	0.555	—	—	0.000
8.25	0.25		0.001	—	0.140
8.50	0.50		0.003	0.001	0.282
8.75	1.00		0.007	0.002	0.565
9.00	2.00		0.016	0.006	1.135
9.25	3.05		0.030	0.015	1.727
9.50	4.15		0.073	0.029	2.411
9.75	5.25		0.096	0.049	3.066
10.00	6.30		0.163	0.076	3.744
10.25	7.80		0.194	0.109	4.643
10.50	10.50		0.273	0.149	6.264
10.75	13.90		0.293	0.199	8.226
11.00	18.10		0.373	0.265	10.709
11.25	24.80		0.482	0.352	14.633
11.50	40.20		0.653	0.471	23.492
11.75	151.60		1.192	0.647	86.191
12.00	390.90		2.584	1.177	221.262
12.25	427.50		4.110	2.469	244.445
12.50	261.50		4.967	4.075	154.543
12.75	159.60		5.366	5.170	99.339
13.00	101.80		5.586	5.841	68.070
13.25	76.30		5.715	6.267	54.436
13.50	60.30		5.808	6.452	45.812
13.75	51.50		5.879	6.558	41.092
14.00	44.70		5.937	6.621	37.430
14.25	40.80		5.984	6.656	35.342
14.50	37.40		6.026	6.672	33.508
14.75	35.00		6.062	6.675	32.211
15.00	32.90		6.094	6.670	31.070
15.25	30.50		6.122	6.660	29.753
15.50	29.10		6.147	6.645	28.984

NOTES: ① TABULAR DISCHARGES FROM TRC TECHNICAL NOTE "ENGINEERING UD-20; PAG. 7-8

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, NY — DATE 5-30-79

TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 93 OF 103

100 YR INFLOW HYDROGRAPH (CN=81.8) TABULAR METHOD — COMPUTED BY JS/RR

119.9 Ac DRAINAGE AREA TO DETENTION POND No. 4A & 4B — CHECKED BY JM

TIME HRS	CSM / IN. R.O. ① Tc = 0.50 TT = 0.00	C.F.S. D.A. = 0.187 R.O. = 5.88	OUTFLOW FROM DETENTION POND No. 2&2B (C.F.S.)	OUTFLOW FROM DETENTION POND No. 3 (C.F.S.)	INFLOW HYDROGRAPH (C.F.S.)
8.00	0.00	0.726	—	—	0.000
8.25	0.25		0.001	—	0.183
8.50	0.50		0.004	0.001	0.368
8.75	1.00		0.010	0.003	0.740
9.00	2.00		0.023	0.009	1.485
9.25	3.05		0.044	0.021	2.282
9.50	4.15		0.073	0.041	3.131
9.75	5.25		0.110	0.065	3.995
10.00	6.30		0.161	0.107	4.847
10.25	7.80		0.206	0.153	6.029
10.50	10.50		0.258	0.208	8.098
10.75	13.90		0.335	0.278	10.717
11.00	18.10		0.444	0.370	13.971
11.25	24.80		0.581	0.492	19.100
11.50	40.20		0.762	0.659	30.642
11.75	151.60		1.045	0.905	112.147
12.00	390.90		1.842	1.613	287.598
12.25	427.50		3.713	3.299	317.759
12.50	261.50		5.277	4.710	200.070
12.75	159.60		6.224	6.441	128.677
13.00	101.80		6.665	7.095	87.758
13.25	76.30		6.917	7.519	69.898
13.50	60.30		7.065	7.726	58.623
13.75	51.50		7.175	7.856	52.466
14.00	44.70		7.261	7.940	47.693
14.25	40.80		7.333	7.993	44.983
14.50	37.40		7.395	8.024	42.605
14.75	35.00		7.449	8.041	40.931
15.00	32.90		7.498	8.050	39.463
15.25	30.50		7.535	8.051	37.756
15.50	29.10		7.604	8.040	36.797

NOTES: ① TABULAR DISCHARGES FROM TSC TECHNICAL NOTE - ENGINEERING UD-20; PAG. 7-8

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX
LOCATION GUILDERLAND, N.Y.
TYPE OF CALCULATION AFTER DEVELOPMENT STORAGE VOLUMES DETENTION POND NO. 4A & 4B

JOB NO. 2838
DATE 5-30-79
SHEET 94 OF 103
COMPUTED BY JS/RR
CHECKED BY JM

STORAGE VOLUMES

ELEV.	AREA (S.F.)	AVERAGE AREA (S.F.)	DEPTH	VOLUME (C.F.)	CUM. VOL. (C.F.)	CUM. VOL. (ACRE FEET)
234	48,000					
		54,350	2	108,700	108,700	2.50
236	60,700					
		67,050	2	134,100	242,800	5.57
238	73,400					
		79,750	2	159,500	402,300	9.24
240	86,100					
		92,450	2	184,900	587,200	13.48
242	98,800					
		105,150	2	210,300	797,500	18.31
244	111,500					

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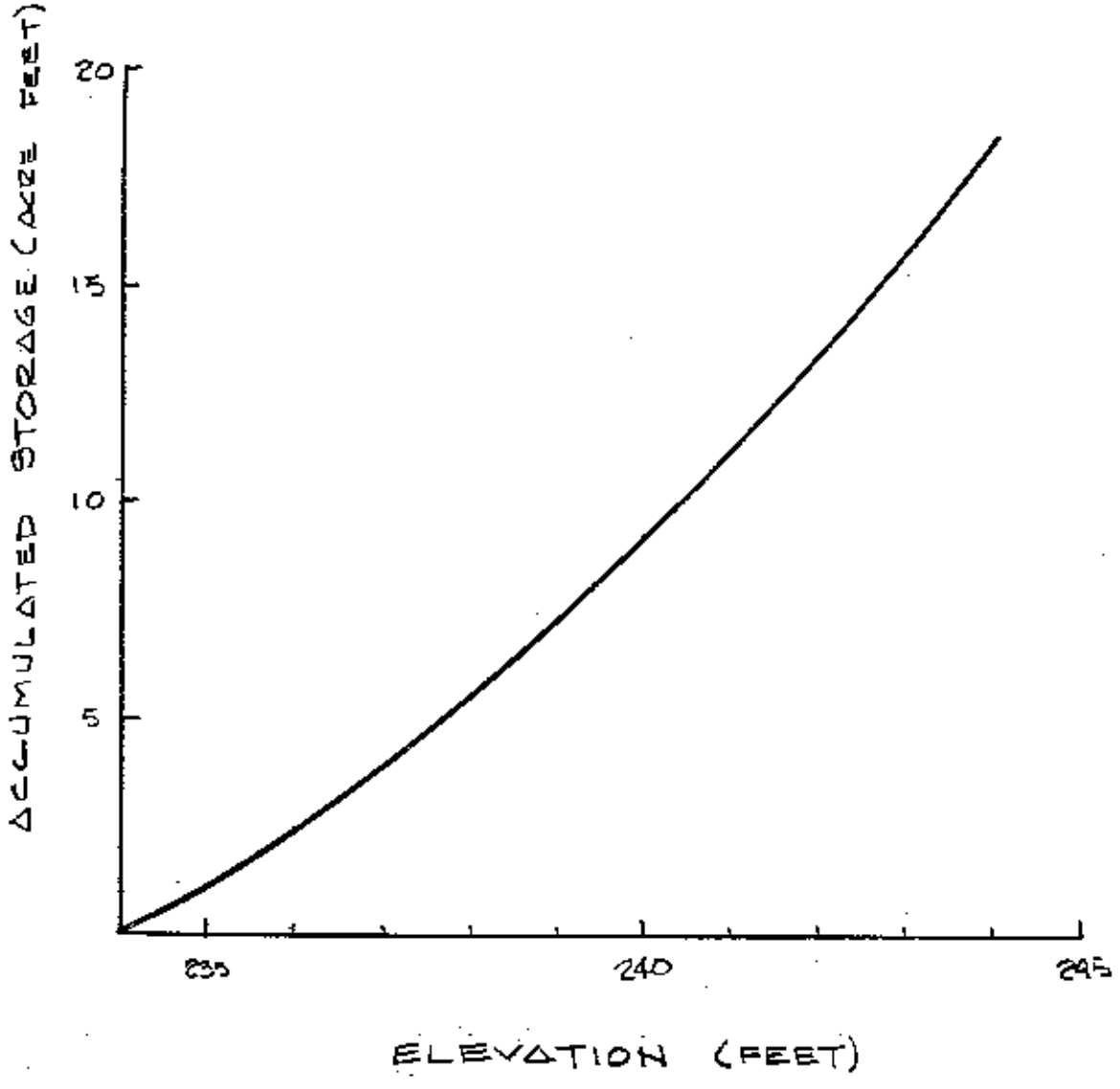
PROJECT CROSSGATES COMPLEX
LOCATION GUILDERLAND, N.Y.
TYPE OF CALCULATION AFTER DEVELOPMENT
ELEVATION - STORAGE CURVE
DETENTION POND No. 4A & 4B

JOB NO. 2838
DATE 5-30-79
SHEET 85 OF 103
COMPUTED BY JS/ER
CHECKED BY JM

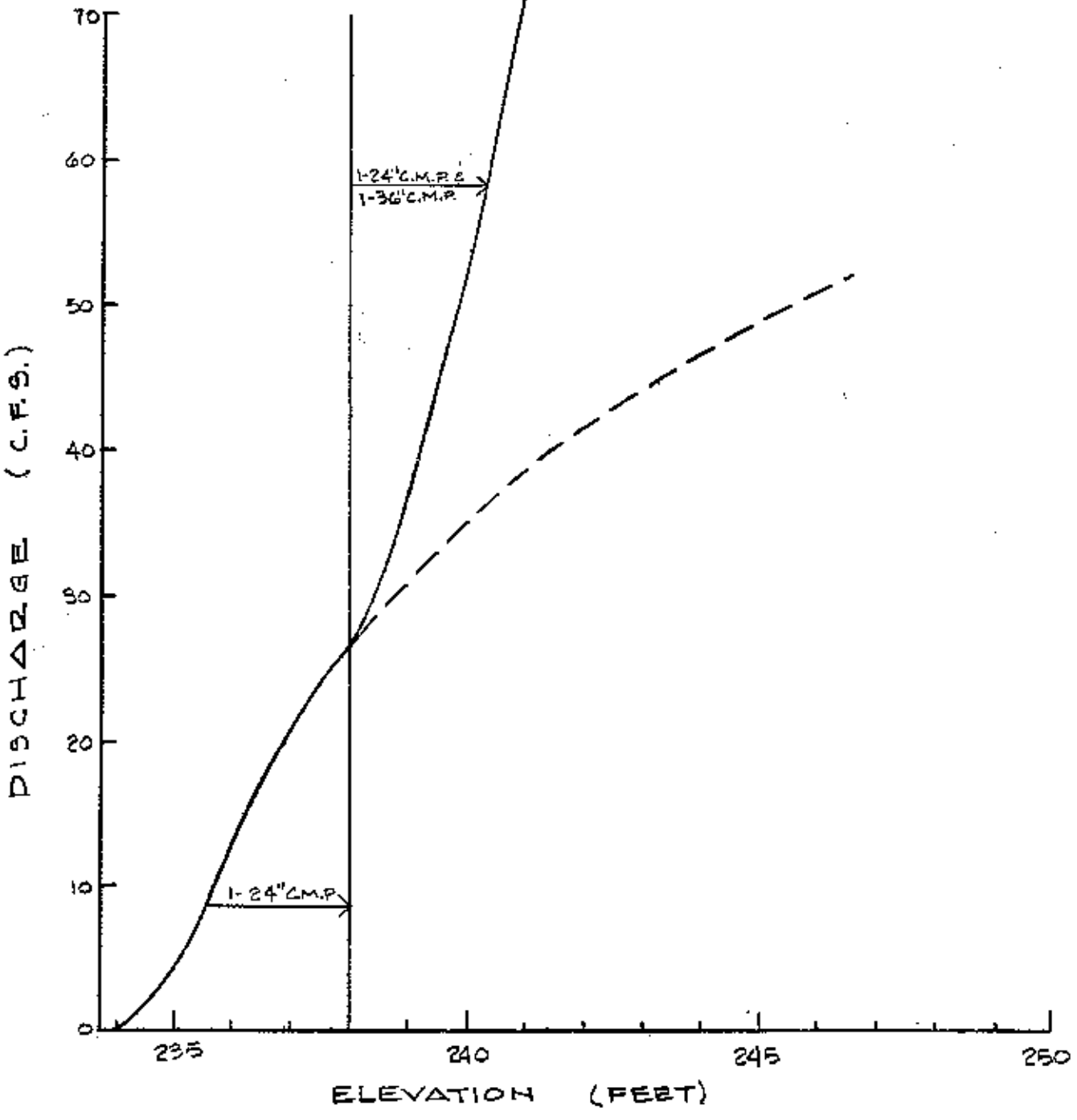


RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX
LOCATION GUILDERLAND, N.Y.
TYPE OF CALCULATION AFTER DEVELOPMENT
ELEVATION-DISCHARGE CURVE - 24" C.M.P @ EL. 234.0, 36" C.M.P @ EL. 238.0
DETENTION POND NO. 4A & 4B

JOB NO. 2838
DATE 5-30-79
SHEET 96 OF 103
COMPUTED BY JS/RR
CHECKED BY JM



RAYMOND KEYES ENGINEERS, P.C.
CONSULTING SITE ENGINEERS

PROJECT: CROSSGATES COMPLEX — JOB NO. 2838
LOCATION: GUILDERLAND, N.Y. — DATE: 5-30-79
TYPE OF CALCULATION: — SHEET 97 OF 103
COMPUTED BY JS/DP
CHECKED BY JM

WORKING CURVE

Form AFTER DEVELOPMENT DETENTION POND No. 4AEB - 24" & 36" C.M.P. DISCHARGES

TAILWATER ELEV. = N.A.

FOR Δt = 0.25 HRS.

ELEV. (FT.)	DISC. O_2 CFS	STORAGE S_2 Ac. Ft.	S_2 CFS-HRS.	$O_2/2$ CFS	$S_2/\Delta t$ CFS	$S_2/\Delta t + O_2/2$ CFS
234.00	0.0	0.00	0.0	0.0	0.0	0.0
234.50	2.0	0.55	6.7	1.0	26.8	27.8
235.00	4.2	1.10	13.3	2.1	53.2	55.3
235.50	7.9	1.70	20.6	4.0	82.4	86.4
236.00	12.4	2.50	30.3	6.2	121.2	127.4
236.50	17.1	3.15	38.1	8.6	152.4	161.0
237.00	20.8	3.90	47.2	10.4	188.8	199.2
237.50	24.1	4.65	56.3	12.1	225.2	237.3
238.00	26.6	5.57	67.4	13.3	269.6	282.9
238.50	31.2	6.42	77.7	15.6	310.8	326.4
239.00	36.9	7.29	88.2	18.5	352.8	371.3
239.50	44.6	8.30	100.4	22.3	401.6	423.9
240.00	52.7	9.24	111.8	26.4	447.2	473.6
240.50	63.4	10.22	123.7	31.7	494.8	526.5
241.00	71.0	11.23	135.9	35.5	543.6	579.1
241.50	81.5	12.30	148.8	40.8	595.2	636.0
242.00	91.2	13.48	163.1	45.6	652.4	698.0
242.50	100.0	14.61	176.8	50.0	707.2	757.2
243.00	108.8	15.80	191.2	54.4	764.8	819.2
243.50	114.4	17.00	205.7	57.2	822.8	880.0
244.00	118.6	18.31	221.6	59.3	886.4	945.7

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 98 OF 103

2 YR. FLOOD ROUTING - 119.9 ACRE DRAINAGE AREA — COMPUTED BY JS/RR

TO DETENTION POND No. 4A & B (STORAGE INDICATION METHOD) — CHECKED BY JM

TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	
8.00	0.000				11.75	36.032				
		0.030	0.030	0.002			64.351	106.134	10.066	
8.25	0.059				12.00	92.670				
		0.089	0.117	0.008			97.463	193.531	20.251	
8.50	0.118				12.25	102.256				
		0.178	0.287	0.021			83.357	256.637	25.160	
8.75	0.237				12.50	64.457				
		0.356	0.622	0.045			52.921	284.398	26.678	
9.00	0.474				12.75	41.384				
		0.601	1.178	0.085			34.860	292.580	27.103	*
9.25	0.727				13.00	28.335				
		0.861	1.954	0.141			25.483	290.960	27.019	
9.50	0.994				13.25	22.630				
		1.129	2.942	0.212			20.856	284.797	26.699	
9.75	1.264				13.50	19.021				
		1.396	4.126	0.297			18.026	276.124	26.229	
10.00	1.528				13.75	17.030				
		1.715	5.544	0.399			16.249	266.144	25.681	
10.25	1.901				14.00	15.467				
		2.230	7.375	0.531			15.012	255.475	25.096	
10.50	2.559				14.25	14.556				
		2.985	9.829	0.707			14.150	244.529	24.496	
10.75	3.410				14.50	13.744				
		3.923	13.045	0.938			13.450	233.483	23.769	
11.00	4.435				14.75	13.156				
		5.248	17.355	1.249			12.894	222.608	22.827	
11.25	6.060				15.00	12.632				
		7.904	24.010	1.727			12.332	212.113	21.918	
11.50	9.747				15.25	12.031				
		22.890	45.173	3.390			11.847	202.042	21.046	
11.75	36.032				15.50	11.663				

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 99 OF 103

5 YR. FLOOD ROUTING- 119.9 ACRE DRAINAGE AREA — COMPUTED BY JS/RR

TO DETENTION POND No. 4A & B (STORAGE INDICATION METHOD) — CHECKED BY JM

TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	
8.00	0.000				11.75	55.810				
		0.045	0.045	0.003			99.629	163.644	17.356	
8.25	0.090				12.00	143.448				
		0.137	0.179	0.013			151.009	297.297	28.122	
8.50	0.183				12.25	158.570				
		0.275	0.441	0.032			129.468	398.643	40.903	
8.75	0.367				12.50	100.366				
		0.551	0.960	0.069			82.591	440.331	47.278	
9.00	0.735				12.75	64.816				
		0.931	1.822	0.131			54.709	447.762	48.489	*
9.25	1.127				13.00	44.601				
		1.336	3.027	0.218			40.174	439.447	47.134	
9.50	1.544				13.25	35.746				
		1.755	4.564	0.328			32.956	425.269	44.823	
9.75	1.966				13.50	30.166				
		2.172	6.408	0.461			28.641	409.087	42.432	
10.00	2.378				13.75	27.116				
		2.669	8.616	0.620			25.920	392.575	40.014	
10.25	2.959				14.00	24.724				
		3.472	11.468	0.825			24.034	376.595	37.675	
10.50	3.985				14.25	23.343				
		4.631	15.274	1.099			22.732	361.652	35.676	
10.75	5.277				14.50	22.120				
		6.032	20.207	1.454			21.680	347.657	33.899	
11.00	6.578				14.75	21.240				
		8.145	26.898	1.935			20.850	334.608	32.242	
11.25	9.411				15.00	20.459				
		12.276	37.239	2.755			20.010	322.376	30.774	
11.50	15.140				15.25	19.561				
		35.475	69.959	5.944			19.291	310.893	29.560	
11.75	55.810				15.50	19.020				

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 100 OF 103

10 YR. FLOOD ROUTING- 119.9 ACRE DRAINAGE AREA — COMPUTED BY JS/RR

TO DETENTION POND NoAA&B(STORAGE INDICATION METHOD) — CHECKED BY JM.

TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	
8.00	0.000				11.75	69.509				
		0.057	0.057	0.004			124.043	203.248	21.151	
8.25	0.113				12.00	178.577				
		0.170	0.223	0.016			187.990	370.087	36.746	
8.50	0.227				12.25	197.396				
		0.342	0.549	0.039			161.176	494.517	56.931	
8.75	0.457				12.50	124.955				
		0.686	1.196	0.086			102.753	540.339	65.400	
9.00	0.915				12.75	80.550				
		1.160	2.270	0.163			67.955	542.894	65.769	*
9.25	1.404				13.00	55.360				
		1.664	3.771	0.271			49.827	526.952	63.465	
9.50	1.924				13.25	44.294				
		2.189	5.689	0.409			40.822	504.309	58.911	
9.75	2.454				13.50	37.349				
		2.712	7.992	0.575			35.447	480.845	54.165	
10.00	2.969				13.75	33.545				
		3.332	10.749	0.773			32.064	458.744	50.279	
10.25	3.695				14.00	30.583				
		4.337	14.313	1.030			29.736	438.201	46.931	
10.50	4.979				14.25	28.888				
		5.784	19.067	1.372			28.124	419.394	43.940	
10.75	6.588				14.50	27.359				
		7.588	25.283	1.819			26.842	402.296	41.437	
11.00	8.587				14.75	26.324				
		10.169	33.633	2.467			25.852	386.711	39.156	
11.25	11.750				15.00	25.380				
		15.321	46.487	3.495			24.837	372.392	37.060	
11.50	18.891				15.25	24.294				
		44.200	87.192	7.987			23.971	359.308	35.377	
11.75	69.509				15.50	23.647				

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 101 OF 103

25 YR. FLOOD ROUTING - 119.9 ACRE DRAINAGE AREA — COMPUTED BY JS/RR

TO DETENTION POND No4A (STORAGE INDICATION METHOD) — CHECKED BY JM

TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.
8.00	0.000				11.75	86.191			
		0.070	0.070	0.005			153.727	251.673	24.888
8.25	0.140				12.00	221.262			
		0.211	0.276	0.020			232.854	459.639	50.425
8.50	0.282				12.25	244.445			
		0.424	0.680	0.049			199.494	608.708	76.464
8.75	0.565				12.50	154.543			
		0.850	1.481	0.107			126.941	659.185	85.127
9.00	1.135				12.75	99.339			
		1.431	2.805	0.202			83.705	657.763	84.905
9.25	1.727				13.00	68.070			
		2.069	4.672	0.336			61.253	634.111	81.151
9.50	2.411				13.25	54.436			
		2.739	7.075	0.509			50.124	603.084	75.426
9.75	3.066				13.50	45.812			
		3.405	9.946	0.716			43.452	571.110	69.846
10.00	3.744				13.75	41.092			
		4.194	13.424	0.966			39.261	540.525	65.426
10.25	4.643				14.00	37.430			
		5.454	17.912	1.289			36.386	511.485	60.363
10.50	6.264				14.25	35.342			
		7.245	23.868	1.717			34.425	485.547	55.117
10.75	8.226				14.50	33.508			
		9.468	31.618	2.305			32.860	463.290	51.020
11.00	10.709				14.75	32.211			
		12.671	41.984	3.135			31.641	443.911	47.861
11.25	14.633				15.00	31.070			
		19.063	57.912	4.511			30.412	426.426	45.018
11.50	23.492				15.25	29.753			
		54.842	108.243	10.297			29.369	410.177	42.619
11.75	86.191				15.50	28.984			

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX — JOB NO. 2838

LOCATION GUILDERLAND, N.Y. — DATE 5-30-79

TYPE OF CALCULATION AFTER DEVELOPMENT — SHEET 102 OF 103

100YR. FLOOD ROUTING-119.9 ACRE DRAINAGE AREA TO DETENTION POND NO. A&B (STORAGE INDICATION METHOD) — COMPUTED BY JS/EE

CHECKED BY JM

TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	TIME HRS.	INFLOW I C.F.S.	INFLOW $\bar{I}$ C.F.S.	STORAGE $S_2/\Delta t + O_2/2$ C.F.S.	OUTFLOW O_2 C.F.S.	
8.00	0.000				11.75	112.147				
		0.092	0.092	0.007			199.873	326.528	31.216	
8.25	0.183				12.00	287.598				
		0.276	0.361	0.026			302.679	597.991	74.486	
8.50	0.368				12.25	317.759				
		0.554	0.889	0.064			258.915	782.420	108.580	
8.75	0.740				12.50	200.070				
		1.113	1.938	0.139			164.374	843.214	111.012	*
9.00	1.485				12.75	128.677				
		3.767	5.566	0.400			108.218	840.420	110.754	
9.25	2.282				13.00	87.758				
		2.707	7.873	0.566			78.828	808.494	107.280	
9.50	3.131				13.25	69.898				
		3.563	10.870	0.782			64.261	765.475	101.175	
9.75	3.995				13.50	58.623				
		4.421	14.509	1.044			55.545	719.845	94.447	
10.00	4.847				13.75	52.466				
		5.438	18.903	1.360			50.080	675.478	87.676	
10.25	6.029				14.00	47.693				
		7.064	24.607	1.770			46.338	634.140	81.157	
10.50	8.098				14.25	44.983				
		9.408	32.245	2.356			43.794	596.777	74.262	
10.75	10.717				14.50	42.605				
		12.344	42.733	3.155			41.768	564.283	68.859	
11.00	13.971				14.75	40.931				
		16.536	55.614	4.237			40.197	536.621	64.718	
11.25	19.100				15.00	39.463				
		24.871	76.248	6.692			38.610	510.513	60.166	
11.50	30.642				15.25	37.756				
		71.395	140.951	14.296			37.277	487.624	55.537	
11.75	112.147				15.50	36.797				

RAYMOND KEYES ENGINEERS, P.C.

CONSULTING SITE ENGINEERS

PROJECT CROSSGATES COMPLEX
LOCATION GUILDERLAND, N.Y.
TYPE OF CALCULATION AFTER DEVELOPMENT
SUMMARY OF COMBINED ONSITE STORAGE VOLUMES & PEAK DISCHARGE RATES

JOB NO. 2838
DATE 5-30-79
SHEET 103 OF 103
COMPUTED BY JS/RL
CHECKED BY JM

STORAGE VOLUMES (ACRE FEET)

FREQUENCY INTERVAL	STORAGE PROVIDED (ACRE FEET) DETENTION POND No. 1	DETENTION POND No. 2A&B	DETENTION POND No. 3	DETENTION POND No. 4A&B	TOTAL STORAGE PROVIDED	TOTAL STORAGE REQUIRED
2 YR.	2.66	0.44	1.50	5.61	10.21	8.71
5 YR.	5.24	0.90	2.79	8.32	17.25	13.87
10 YR.	7.21	1.28	3.74	9.81	22.04	17.31
25 YR.	10.11	1.86	5.07	11.07	28.11	21.63
100 YR.	14.45	2.75	7.09	14.77	39.06	28.91

PEAK DISCHARGE RATES (C.F.S.)

FREQUENCY INTERVAL	BEFORE DEVELOPMENT	AFTER DEVELOPMENT
2 YR.	39.23	27.10
5 YR.	77.13	48.49
10 YR.	101.22	65.77
25 YR.	138.77	85.13
100 YR.	176.04	111.01

Bureau of Industrial Programs
DRAFT SPDES PERMIT TRANSMITTAL FORM AND FACT SHEET DATA

To: George Hansen, Chief, PDES Permit Section
From: Walter Loveridge, Chief, Physical Systems Section
Date: January 8, 1980

Project Engineer: Walter Loveridge

Permit No: NY 010 7930

SIC Code: 5311

Name: Pyramid Crossgates Company

Receiving Water: Krum Kill

Location: Guilderland (T), Albany County

Average Total Flow: 3 MGD

Type of Operation and Major Products:

Shopping Center

Production Levels if Effluent Guidelines Exist:

NA

Rationale for Permit Conditions:

Parking lot runoff from storm waters

Comments on Pertinent Data:

Attachment

WL/sr
cc: Mr. Berner
Region 4 - Water Quality Engineer
Region 4 - Director (w/o att.)

Copies:

Facility ID No. : NY 010 7930

Effective Date : EDP

Expiration Date : EDP + 5 years

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
STATE POLLUTANT DISCHARGE ELIMINATION SYSTEM (SPDES)
DISCHARGE PERMIT

Special Conditions
(Part I)

This SPDES permit is issued in compliance with Title 8 of Article 17 of the Environmental Conservation Law of New York State and in compliance with the provisions of the Federal Water Pollution Control Act, as amended by the Federal Water Pollution Control Act Amendments of 1972, P.L. 92-500, October 18, 1972, (33 U.S.C. §1251 et. seq.) (hereinafter referred to as "the Act").

Pyramid Crossgates Company

(SIC 5311)

is authorized to discharge from the facility described below:

Crossgates Shopping Center
Western Avenue
Guilderland, New York

Guilderland (T), Albany County

into receiving waters known as:

Krum Kill (Class A)

in accordance with the effluent limitations, monitoring requirements and other conditions set forth in this permit.

This permit and the authorization to discharge shall expire on midnight of the expiration date shown above and the permittee shall not discharge after the expiration date unless this permit has been renewed, or written authorization is given by the Department. In order to receive authorization to discharge beyond the expiration date, the permittee shall submit such information, forms, and fees as are required by the Department of Environmental Conservation no later than 180 days prior to the expiration date.

By Authority of _____
Designated Representative of Commissioner of the
Department of Environmental Conservation

_____ _____
Date Signature

EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning _____ and lasting until _____ the discharges from the permitted facility shall be limited and monitored by the permittee as specified below:

Outfall Number	Effluent Parameter	Discharge Limitations kg/day (lbs/day) Daily Avg.	Discharge Limitations kg/day (lbs/day) Daily Max.	Discharge Limitations Other Units (Specify) Daily Avg.	Discharge Limitations Other Units (Specify) Daily Max.	Monitoring Reqmts. Measurement Frequency	Monitoring Reqmts. Sample Type
001*	Storm Water Runoff						
	Flow	---	---	---	---	Monthly	Instant.
	Total Suspended Solids	---	---	30 mg/l	50 mg/l	"	Grab***
	Settleable Solids	---	---	---	.3 ml/l	"	"
	Oil & Grease	---	---	---	15 mg/l	"	"
	Sodium Chloride (NaCl)	---	---	---	500 mg/l	"	"
	Cadmium**	---	---	---	---	Quarterly	"
	Chromium**	---	---	---	---	"	"
	Copper**	---	---	---	---	"	"
	Lead**	---	---	---	---	"	"
	Manganese**	---	---	---	---	"	"
	Mercury**	---	---	---	---	"	"
	Zinc**	---	---	---	---	"	"
	Nickel**	---	---	---	---	"	"
	Iron**	---	---	---	---	"	"

* This discharge is for parking lot runoff only and shall not contain waste from any commercial or industrial operations.

** Monitoring Requirement only.

*** Grab sample will be taken during the first half hour of storm water discharge.

The pH shall not be less than 6.5 standard units nor greater than 8.5 standard units and shall be monitored as follows: monthly grab.

Samples taken in compliance with the monitoring requirements specified above shall be taken at the following location(s): in discharge before entering stream.

The daily average discharge is the total discharge by weight or in other appropriate units as specified herein, during a calendar month divided by the number of days in the month that the production or commercial facility was operating. Where less than daily sampling is required by this permit, the daily average discharge shall be determined by the summation of all the measured daily discharges in appropriate units as specified herein divided by the number of days during the calendar month when the measurements were made.

The daily maximum discharge means the total discharge by weight or in other appropriate units as specified herein, during any calendar day.

MONITORING, RECORDING AND REPORTING

a) The permittee shall also refer to the General Conditions (Part II) of this permit for additional information concerning monitoring and reporting requirements and conditions.

b) The monitoring information required by this permit shall be summarized and reported by submitting a completed and signed Discharge Monitoring Report form once every 3 months to the Department of Environmental Conservation and other appropriate regulatory agencies at the offices specified below. The first report will be due no later than . Thereafter, reports shall be submitted no later than the 28th of the following month(s):

Chief, Waste Source Monitoring Section
New York State Department of Environmental Conservation
Room 300 - 50 Wolf Road - Albany, New York 12233

Regional Engineer
New York State Department of Environmental Conservation
Regional Office #4
50 Wolf Road
Albany, New York 12233

Albany County Health Department
Attn: Director, Div. of Env. Health Services
South Ferry & Green Streets
Albany, New York 12201

c) If so directed by this permit or by previous request, Monthly Wastewater Treatment Plant Operator's Reports shall be submitted to the DEC Regional Office and county health department or county environmental control agency specified above.

d) Each submitted Discharge Monitoring Report shall be signed as follows:

1. If submitted by a corporation, by a principal executive officer of at least the level of vice president, or his duly authorized representative, if such representative is responsible for the overall operation of the facility from which the discharge described in the Discharge Monitoring Report originates;

2. If submitted by a partnership, by a general partner;

3. If submitted by a sole proprietor, by the proprietor;

4. If submitted by a municipality, State or Federal agency, or other public entity; by a principal executive officer, ranking elected official, commanding officer, or other duly authorized employee.

e) Unless otherwise specified, all information submitted on the Discharge Monitoring Form shall be based upon measurements and sampling carried out during the most recently completed reporting period.

f) Blank Discharge Monitoring Report Forms are available at the above addresses.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
STATE POLLUTANT DISCHARGE ELIMINATION SYSTEM (SPDES)
DISCHARGE PERMIT

GENERAL CONDITIONS
(PART II)

SECTION		PAGE
1.	General Provisions	1
2.	Prohibitions	1-2
3.	Exclusions	2
4.	Modification, Suspension, Revocation	2-3
5.	Reporting Noncompliance	3-4
6.	Inspections	4-5
7.	Transfer of Ownership	5
8.	Permit Renewal	5
9.	Special Provisions - New or Modified Disposal Systems	5
10.	Monitoring, Recording and Reporting	6-8
10.1	General	6
10.2	Monitoring Locations	6
10.3	Recording of Monitoring Activities and Results	7
10.4	Analytical Methods	7-8
10.5	Application for Alternate Test Procedures	8
10.6	Confidential Information	8
11.	Disposal System Operation and Quality Control	9-10
11.1	General	9-10
11.2	Prohibition of Bypass	9-10
11.3	Special Condition-Disposal Systems with Septic Tanks	10
11.4	Disposal of Collected Solids	10
12.	Conditions Applicable to a Publicly Owned Treatment Works (POTW) And Users of a POTW	11-12
12.1	General	11
12.2	National Pretreatment Standards: Prohibited Discharges	11-12

PART II - GENERAL CONDITIONS

1. GENERAL PROVISIONS

a. A determination has been made on the basis of a submitted application, plans, or other available information, that compliance with the specified permit provisions will reasonably assure compliance with applicable water quality standards. Satisfaction of permit provisions notwithstanding, if operation pursuant to the permit causes or contributes to a condition in contravention of State water quality standards, or if the Department determines, on the basis of notice provided by the permittee and any related investigation, inspection or sampling, that a modification of the permit is necessary to assure maintenance of water quality standards or compliance with other provisions of ECL Article 17, or the Act, the Department may require such a modification and may require abatement action to be taken by the permittee and may also prohibit the noticed act until the permit has been modified.

b. All discharges authorized by this permit shall be consistent with the terms and conditions of this permit; facility expansions, production increases, or process modifications which result in new or increased discharges of pollutants must be reported by submission of a new SPDES application or, if such new or increased discharge does not violate the effluent limitations specified in this permit, by submission to the permit issuing authority of notice of such new or increased discharges of pollutants (in which case the permit may be modified to specify effluent limitations for any pollutants not identified and limited herein); the discharge of any pollutant not identified and authorized or the discharge of any pollutant more frequently than or at a level in excess of that identified and authorized by this permit shall constitute a violation of the terms and conditions of this permit.

c. The provisions of this permit are severable, and if any provision of this permit, or the application of any provision of this permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of this permit, shall not be affected thereby.

d. If the discharge(s) permitted herein originate within the jurisdiction of an interstate water pollution control agency, then the permitted discharge(s) must also comply with any applicable effluent standards or water quality standards promulgated by that interstate agency.

2. PROHIBITIONS

a. The following discharges into the waters of the State are hereby prohibited:

(1) The discharge of any radiological, chemical or biological warfare agent or high-level radioactive waste, such as terms are defined by the Act or pursuant thereto;

(2) Any discharge which the Secretary of the Army acting through the Chief of Engineers finds would substantially impair anchorage and navigation;

(3) Any discharge to which the Regional Administrator has objected in writing pursuant to any right to object provided the Administrator in Section 402(d) of the Act; and

(4) Any discharge from a point source which is in conflict with a plan or amendment thereto approved pursuant to section 208(b) of the Act, or any other discharge not permitted by this article, article 17 of the ECL, other rules and regulations adopted or applicable pursuant thereto, the Act, or the provisions of a SPDES permit.

3. EXCLUSIONS

a. The issuance of this permit by the Department and the receipt thereof by the Applicant does not supersede, revoke or rescind an order or modification thereof on consent or determination by the Commissioner issued heretofore by the Department or eny of the terms, conditions or requirements contained in such order or modification thereof.

b. The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of Federal, State or local laws or regulations; nor does it obviate the necessity of obtaining other assent required by law for the discharge authorized.

c. This permit does not authorize or approve the construction of any onshore or offshore physical structures or facilities or the undertaking of any work in any navigable waters.

d. Nothing in this permit shall be deemed to preclude the institution of any legal action nor relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Clean Water Act, as amended.

4. MODIFICATION, SUSPENSION, REVOCATION

a. If the permittee fails or refuses to comply with an interim or final requirement in a SPDES permit, such noncompliance shall constitute a violation of the permit for which the Commissioner may modify, suspend, or revoke the permit or take direct enforcement action pursuant to law. When, at any time during or prior to a period for compliance, the permittee announces or otherwise lets it be known, or the Commissioner on reasonable cause determines, that the permittee

will not make the requisite efforts to achieve compliance with an interim or final requirement, the Commissioner may modify, suspend or revoke the permit and take direct enforcement action pursuant to law, without waiting for expiration of the period for compliance with such requirements.

b. After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked in whole or in part during its term for cause including, but not limited to, the following:

1. Violation of any terms or conditions of this permit; or;

2. Obtaining this permit by misrepresentation or failure to disclose fully all relevant facts, or false or inaccurate statements or information in the application; or;

3. A change in any physical circumstances, requirements or criteria applicable to discharges that requires either a temporary or permanent reduction or elimination of the authorized discharges, such as:

(i) standards for construction or operation of the discharging facility,

(ii) the characteristics of the waters into which such discharge is made,

(iii) the water quality standards applicable to such waters,

(iv) the classification of such waters, or

(v) effluent limitations or other requirements applicable pursuant to the Act or State Law.

c. Notwithstanding (b) above, if a toxic effluent standard or prohibition (including any schedule of compliance specified in Section 17-0813 of the Environmental Conservation Law or Section 307(a) of the Act) is established for a toxic pollutant which is present in the discharge authorized herein and such standard or prohibition is more stringent than any limitation upon such pollutant in this permit, or if this permit contains no limitations on such pollutants, this permit shall be revised or modified in accordance with the toxic effluent standards or prohibition and the permittee shall be so notified.

d. This permit shall be modified, or alternatively, revoked and reissued, to comply with any applicable effluent standard or limitation issued or approved under sections 301(b)(2) (C) and (D), 304(b)(2) and 307(a)(2) of the Clean Water Act, if the effluent standard or limitation so issued or approved:

(1) Contains different conditions or is otherwise more stringent than any effluent limitations in the permit; or
(2) Controls any pollutant not limited in the permit.

The permit as modified or reissued under this paragraph shall also contain any other requirements of the Act then applicable.

5. REPORTING NONCOMPLIANCE

a. If for any reason the permittee does not comply with or will be unable to comply with any daily maximum effluent limitation specified in this permit or should any unusual or extraordinary discharge of wastes occur for the permitted facilities, the permittee shall immediately notify the Department of Environmental Conservation Regional Office by telephone and provide the following information in writing within five days of such notification:

(1) Cause of noncompliance;

(2) A description of the noncomplying discharge including its impact upon the receiving waters;

(3) Anticipated time the condition of noncompliance is expected to continue, or if such condition has been corrected, the duration of the period of noncompliance;

(4) Steps taken by the permittee to reduce and eliminate the noncomplying discharge; and

(5) Steps to be taken by the permittee to prevent recurrence of the condition of noncompliance.

b. Permittee shall take all reasonable steps to minimize any adverse impact to navigable waters resulting from noncompliance with any effluent limitation specified in this permit, including such accelerated or additional monitoring as may be necessary to determine the nature and impact of the non-complying discharge.

c. Except as provided herein under Prohibition of Bypass of Treatment Works, nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance.

d. It is recognized that equipment malfunction, acts of God or other circumstances beyond the control of the Permittee may sometimes result in effluent concentrations exceeding the permit limitations despite the exercise of appropriate care and maintenance measures and corrective measures by the Permittee. The Permittee may come forward to demonstrate to the Department that such circumstances exist in any case where effluent concentrations exceed those set forth in this permit. The Department, however, is not bound to wait for or solicit such demonstrations prior to the initiation of any enforcement proceeding; nor must it accept as valid on its face the statements made in any such demonstration. Nevertheless, if the Department seeks to enforce in an administrative or judicial proceeding any provision of any permit issued to the Permittee by any permitting agency, the Permittee may raise at that time the issue of whether under the Constitution, statute, or decisional law it is entitled to a defense that its conduct was caused by circumstances beyond its control.

6. INSPECTIONS

a. The permittee shall allow the Commissioner of the Department of Environmental Conservation, the Regional Administrator, and/or their authorized representative, upon the presentation of credentials:

1. To enter upon the permittee's premises where an effluent source is located or in which any records are required to be kept under the terms and conditions of this permit;

2. To have access to and copy, at reasonable times, any records required to be kept under the terms and conditions of this permit;

3. To inspect any monitoring equipment or practices being maintained pursuant to this permit; or

4. To have access to and sample any discharge of pollutants to waters of the State or to publicly owned treatment works resulting directly or indirectly from activities or operations of the owner or operator of the premises in which the effluent source or outlet is located.

7. TRANSFER OF OWNERSHIP

a. Any permittee who intends to transfer a SPDES permit is required to notify the the Department in advance of the transfer. In the case of a change of ownership only, notice to the Department is required prior to change; in the case of an ownership change accompanied by a change or proposed change in wastewater characteristics, a minimum of 180 days prior notice to the Department is required.

b. The terms and conditions of this permit are binding on the successors or assigns in interest of the original permittee.

8. PERMIT RENEWAL

a. Any permittee who wishes to continue to discharge after the expiration date of a permit shall apply for renewal of its permit no later than 180 days prior to the permit's expiration date (unless permission for a later date has been granted by the Department) by submitting any forms, fees, or supplemental information which may be required by the Department. Upon request, the Department shall provide the permittee with specific information concerning the forms, fees, and supplemental information required.

b. When a permittee has made timely and sufficient application for the renewal of a permit or a new permit with reference to any activity of a continuing nature, the existing permit does not expire until the application has been finally determined by the Department, and, in case the application is denied or the terms of the new permit limited, until the last day for seeking review of the Department order or a later date fixed by order of the reviewing court, provided that this subdivision shall not affect any valid Department action then in effect summarily suspending such permit.

9. SPECIAL PROVISIONS - NEW OR MODIFIED DISPOSAL SYSTEMS

a. Prior to construction of any new waste disposal system or modification which would materially alter the volume of, or the method or effect of treating or disposing of the sewage, industrial waste or other wastes, from an existing waste disposal system, the Permittee shall submit to the Department or its designated field office for review, an approvable engineering report, plans, and specifications which have been prepared by a person or firm licensed to practice Professional Engineering in the State of New York.

b. The construction of the above new or modified disposal system shall not start until the Permittee receives written approval from the Department or its designated field office.

c. The construction of the above new or modified disposal system shall be under the general supervision of a person or firm licensed to practice Professional Engineering in New York State, and upon completion of construction that person or firm shall certify to the Department or its designated field office that the system has been fully completed in accordance with the approved engineering report, plans and specifications, permit and letter of approval.

d. The Department and its designated field offices review wastewater disposal system reports, plans, and specifications for treatment process capability only, and approval by either office does not constitute approval of the system's structural integrity.

10. MONITORING RECORDING AND REPORTING

10.1 General

a. The permittee shall comply with all recording, reporting, monitoring and sampling requirements herein and such other additional terms, provisions, requirements or conditions that the Department may deem to be reasonably necessary to achieve the purposes of the Environmental Conservation Law, Article 17, the Act, or rules and regulations adopted pursuant thereto.

b. Samples and measurements taken to meet the monitoring requirements specified herein shall be representative of the volume and nature of the monitored discharge. Composite samples should be "flow-proportioned" if necessary to obtain a representative sample.

c. The permittee shall periodically calibrate and perform maintenance procedures on all monitoring and analytical instrumentation to insure accuracy of measurements.

10.2 Monitoring Locations

a. Permittee shall take samples and measurements to meet the monitoring requirements at the locations specified.

b. Unless specified otherwise, samples of the effluent shall be taken at the point of combined flow into the outfall sewer.

c. Unless specified otherwise, samples of the influent wastewater shall be taken at the point of plant inflow.

10.3 Recording of Monitoring Activities and Results

a. The permittee shall make and maintain records of all information resulting from the monitoring activities required by this permit.

b. The permittee shall record for each measurement or sample taken pursuant to the requirements of this permit the following information: (1) The date, exact place, and time of sampling; (2) The dates analyses were performed; (3) Who performed the analyses; (4) The analytical techniques or methods used; and, (5) The results of all required analyses.

c. If the permittee monitors any pollutant more frequently than is required by this permit, he shall include the results of such monitoring in the calculation and reporting of the values required in the Discharge Monitoring Report form. Such increased frequency shall be indicated on the Discharge Monitoring Report form.

d. The permittee shall retain for a minimum of three (3) years all records of monitoring activities and results including all records of calibration and maintenance of instrumentation and original strip chart recordings from continnous monitoring instrumentation. This period of retention shall be extended during the course of any unresolved litigation or other proceedings regarding the discharge of pollutants by the permittee or when requested by the Commissioner of the Department of Environmental Conservation or the EPA Regional Administrator.

10.4 Analytical Methods

Following promulgation of guidelines establishing test procedures for the analysis of pollutants, published pursuant to Section 304(g) of the Federal Water Pollution Control Act, as amended, all sampling and analytical methods used to meet the monitoring requirements specified above shall conform to such guidelines. If the Section 304(g guidelines do not specify test procedures for any pollutants reqnired to be monitored by this permit end until such guidelines are promnlgated, sampling and analytical methods used to meet the monitoring requirements specified in this permit shall, unless otherwise specified by the Commissioner, conform to the latest edition of the following references:

1. Standard Methods for the Examination of Water and Waste-Waters, 14th Edition, 1976, American Public Health Association, New York, New York 10019.

2. A. S. T. M. Standards, Part 31, Water; Atmospheric Analysis, 1975, American Society for Testing and Material Philadelphia, Pennsylvania 19103.

3. Methods for Chemical Analysis of Water and Wastes, March, 1979, Environmental Protection Agency Water Quality Office, Analytical Quality Control Laboratory, NECR, Cincinnati, Ohio 45268.

10.5 Application for Alternate Test Procedures

a. The applicant shall submit his application to the Director of the Bureau of Monitoring and Surveillance, Division of Pure Waters, N.Y.D.E.C., 50 Wolf Road, Albany, New York 12233.

b. Unless and until printed application forms are made available, an application for an alternate test procedure may be made by letter in triplicate. Any application for an alternate test procedure shall:

(1) Provide the name and address of the responsible person or firm making the discharge (if not the applicant) and the applicable ID number of the existing or pending permit, issuing agency, and type of permit for which the alternate test procedure is requested, and the discharge serial number.

(2) Identify the pollutant or parameter for which approval of an alternate testing procedure is being requested.

(3) Provide justification for using testing procedures other than those specified in Table I, FEDERAL REGISTER, 52781, Vol. 41, No. 232, Wed., Dec. 1, 1976, or as amended.

(4) Provide a detailed description of the proposed alternate test procedure, together with references to published studies of the applicability of the alternate test procedure to the effluents in question.

10.6 Confidential Information

a. Except for data determined to be confidential under Section 17-0805 of the Environmental Conservation Law or Section 308 of the Act, all such reports shall be available for public inspection at the offices of the Department of Environmental Conservation and the Regional Administrator of EPA Region II. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in Section 71-1933 of the Environmental Conservation Law or Section 309 of the Act.

11. DISPOSAL SYSTEM OPERATION AND QUALITY CONTROL

11.1 General

a. The disposal system shall not receive or be committed to receive wastes beyond its design capacity as to volume and character of wastes treated, nor shall the system be materially altered as to: type, degree, or capacity of treatment provided; disposal of treated effluent; or treatment and disposal of separated scum, liquids, solids or combinations thereof resulting from the treatment process without prior written approval of the Department of Environmental Conservation or its designated field office.

b. The permittee shall at all times maintain in good working order and operate as efficiently as reasonably possible any disposal system or systems installed or used by the permittee to achieve compliance with the terms and conditions of this permit.

c. Any maintenance of the disposal system that may cause a degradation of effluent quality shall be scheduled during non-critical water quality periods and shall be carried out in a manner approved by the New York State Department of Environmental Conservation.

d. When required under Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York (6NYCRR650), sufficient personnel meeting qualifications for operators of sewage treatment works as required therein shall be employed to satisfactorily operate and maintain the treatment works.

e. The permittee shall not discharge floating solids or visible foam, unless specifically authorized by this permit.

11.2 Prohibition of Bypass of Treatment Works

a. Bypass or diversion of wastes from any portion of the treatment facilities is prohibited except:

(1) Where unavoidable to prevent loss of life, serious injury or severe property damage. Severe property damage includes substantial physical damage to property; damage to the treatment facilities which would cause them to become inoperable; or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. It does not include economic loss caused by delays in production; and

(2) Where there are no feasible alternatives to bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime; and

(3) Where the permittee promptly but in no event later than 24 hours after the permittee learns of the bypass, submits notice of the bypass or an anticipated need for bypass to the Department containing the information required by Section 5 of this Part.

Where the permittee knows in advance of the need for the bypass, this notification shall be submitted for approval to the Department before the date of bypass. Bypass shall be either:

(i) Prohibited by the Department in consideration of the adverse effects of the bypass and the factors set out above, or

(ii) Allowed under conditions determined to be necessary by the Department to minimize any adverse effects.

11.3 Special Condition - Disposal Systems with Septic Tanks

If a septic tank is installed as part of the disposal system, it shall be inspected by the permittea or his agent for scum and sludge accumulation at intervals not to exceed one year's duration, and such accumulation will be removed before the depth of either exceeds one-fourth (¼) of the liquid depth so that no settleable solids or scum will leave in the septic tank effluent. Such accumulation shall be disposed of in an approved manner.

11.4 Sludge Disposal

a. The storage or disposal of collected screenings, sludges, other solids, or precipitates separated from the permitted discharges and/or intake or supply water by the permittee shall be done in such a manner as to prevent creation of nuisance conditions or entry of such materials into classified waters or their tributaries, and in a manner approved by the Department. Any live fish, shellfish, or other animals collected or trapped as a result of intake water screening or treatment may be returned to their water body habitat. The permittee shall maintain records of disposal on all effluent screenings, sludges and other solids associated with the discharge(s) herein described. The following data shall be compiled and reported to the Department or its designated field office upon request:

1. The sources of the materials to be disposed of;

2. The approximate volumes and weights;

3. The method by which they were removed and transported;

4. Their final disposal locations.

12. CONDITIONS APPLICABLE TO A PUBLICLY OWNED TREATMENT WORKS (POTW) AND USERS OF A POTW

12.1 GENERAL

a. Notice shall be given the Department of Environmental Conservation of any new introduction of pollutants into the POTW from a source which would be a new source as defined in Section 306 of the Act if such source was discharging pollutants; and, except as to such categories and classes of sources specified by the Commissioner, any new introduction of pollutants which exceed 10,000 gallons on any one day into the POTW from a source which would be subject to Section 301 of the Act if such source was discharging pollutants; and any substantial change in volume or character of pollutants being introduced into the POTW at the time of issuance of the permit. Such notice shall include information on the quality and quantity of effluent to be introduced into the POTW; and an anticipated impact of such change in the quantity or quality of effluent to be discharged from the POTW.

b. The permittee shall require any industrial user of the POTW to comply with the requirements of Section 204(h), 307, and 308 of the Act. Any industrial user subject to the requirements of Section 307 of the Act shall be required by the permittee to prepare and transmit to the New York State Department of Environmental Conservation periodic notice (over intervals not to exceed 9 months) of progress toward full compliance with Section 307 requirements. The permittee, upon receipt of such reports shall transmit a copy promptly to the Department.

c. For discharges from publicly owned treatment works, appropriate measures will be established by the permittee to insure compliance by industrial users with any system of user charges and recovery of construction costs required under the provisions of the Act.

d. Persons discharging industrial waste to a publicly owned treatment works shall comply with toxic effluent standards and pretreatment standards and with monitoring, reporting, recording, sampling and entry requirements provided by the Act or the Environmental Conservation Law, Article 17 or adopted pursuant to the Act or the Environmental Conservation Law, Article 17.

12.2 NATIONAL PRETREATMENT STANDARDS: PROHIBITED DISCHARGES

(Note: The following Section was published in the Federal Register, Vol. 43, No. 123 - Monday June 26, 1978. The effective date of the regulation (Part 403) was August 25, 1978)

§403.5 National Pretreatment Standards: Prohibited Discharges.

(a) Pollutants introduced into POTW's by any source of a nondomestic discharge shall not inhibit or interfere with the operation or performance of the works. These general prohibitions apply to all such users of a POTW whether or not the user is subject to other National Pretreatment Standards or any National, State, or local Pretreatment Requirements.

(b) The following pollutants may not be introduced into a POTW:

(1) Pollutants which create a fire or explosion hazard in the POTW;

(2) Pollutants which will cause corrosive structural damage to the POTW, but in no case discharges with pH lower than 5.0 unless the works is specifically designed to accommodate such discharges;

(3) Solid or viscous pollutants in amounts which will cause obstruction to the flow in sewers, or other Interference with the operation of the POTW;

(4) Any pollutant, including oxygen demanding pollutants (BOD, etc.) released in a discharge of such volume or strength as to cause Interference in the POTW.

(5) Heat in amounts which will inhibit biological activity in the POTW resulting in Interference but in no case heat in such quantities that the temperature at the treatment works influent exceeds 40°C(104°F) unless the works is designed to accommodate such heat.

(c) POTW's developing POTW Pretreatment Programs pursuant to §403.8 shall be required to develop and enforce specific limits for discharges of the pollutants listed in §403.5(b)(1)-(5). In addition, any POTW in violation of an NPDES Permit requirement as a result of Interference by a pollutant listed in §403.5(b)(1)-(5) shall be required by the EPA or NPDES state to develop and enforce such specific limits.

(d) Where specific prohibitions or limits on the pollutants or pollutant parameters listed in §403.5(b)(1)-(5) are developed by a POTW, either as a requirement of an Approved POTW Pretreatment Program pursuant to §403.8 or an NPDES Permit, such limits shall be incorporated in the NPDES Permit issued to the POTW and shall replace and be enforceable in lieu of the general prohibitions set forth in this section.

(e) Compliance with the provisions of this section is required beginning on the effective date of this regulation, except for paragraph (b)(5) of this section which must be complied with within 3 years of the effective date of this regulation.