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Study of the impacts of a maximum development plan for Allan-Deane Corp.

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Resource Analysis, Inc.
1050 MASSACHUSETTS AVENUE
CAMBRIDGE, MASSACHUSETTS 02138
617-354-1922

June 8, 1977

Mr. Henry A. Hill, Jr.
Mason, Griffin, & Pierson
P.O. Box 391
Princeton, New Jersey 08540

Ref: 116/C

Re: Allan-Deane Property in Bedminster Township
Maximum Development Case

Dear Mr. Hill:

At your request, we have carried out a preliminary study of the impacts of a maximum development plan for the Bedminster portion of the Allan-Deane Corporation property on the runoff from this site. The objective of this analysis was to determine if such a plan would cause downstream flooding problems which would limit development at this density.

Overview

The maximum density development plan given to us on April 5, 1977 is summarized in the attached Figure 1. This information was incorporated into a MITCAT model of the site, and detailed information on three important flooding parameters was derived. The data computed were the total runoff (in acre-feet), the maximum discharge (in cubic feet per second), and time to peak discharge (in minutes) for the following two cases:

1. Present development

2. Future maximum development (worst case condition - before addition of storage controls).

These two cases were simulated under the 10-year and 100-year rainfall events to allow a comparison of present versus most extreme future conditions.

Present findings, as summarized below, and to be reported in detail in our forthcoming Phase I report, indicate that even under these worst case conditions the site runoff is not greatly increased. With properly designed storage controls, it will be possible to control the runoff from the development site to the same or lower level as the present condition at a relatively small loss of land for storage areas. In other words, the proposed maximum development plan can be designed in a cost-effective manner such that no increase in discharge over present conditions will occur.

Runoff Control Storage Assumptions

To design the controls required to deal with flooding problems, it may be necessary to provide for a certain amount of storage capacity (usually measured in acre-feet). An assumption of the allowable depth of water in these storage areas is needed to translate the required volume to the number of acres of land necessary for such controls. A small amount of land is needed for relatively deep storage ponds (e.g., 4 to 5 feet). These have considerable attraction where alternative uses of the land are valuable. Such deep ponds have detracting elements as well. Whether the pond is wet (i.e., always has some water in it) or dry, a five foot deep portion with relatively steep slopes exposed must be kept empty during minor storm events (i.e., most of the time). This can be aesthetically unpleasant. The dry pond may make the land unusable for some other purpose such as recreation. On the other hand, shallow ponds (1 to 2 feet) require more land but are less obstrusive without deep sides exposed. For the following calculations we present two different views. First the present plan has relatively small storage areas. For each of these we show the expected depth and, therefore, the size of structure which must be left exposed. This is generally 3 to 5 feet. Another calculation is made to show how much additional area would be required if a lower depth (e.g., 2 feet) is to be obtained.

The objective of this preliminary analysis is to present the range of options available which can be further refined within the final design studies of the storage systems.

Summary by Drainage Basins

Referring to Figure 1, there are four important drainage basins where increases in discharge can be separately considered. The results for each basin are summarized in the following section.

Area A/Discharge Point 1

This area contains a total of 160 acres subdivided as follows:

18 acres, new town house development
5 acres, new apartment development
137 acres, unchanged from present usage

At Discharge Point 1, the following volumes of discharge were computed:*

Event	Present Case Outflow Volume (acre-feet)	Maximum Development Outflow Volume (acre-feet)	Percent Increase (%)	Preliminary Estimate of Storage Required (acre-feet)
10-yr	9.7	10.7	10	1.0
100-yr	17.2	18.5	8	1.3

To reduce the discharge from the basin under future maximum development conditions down to present conditions, approximately 1.3 acre-feet of storage would have to be provided. In the maximum development plan 0.23 acres have been set aside for storage, but was not used in the simulation in order to investigate worst case conditions. If this area is used, a pond with 5.7 feet depth of set aside storage must be provided. With an addition of 0.42 acres in the lower portions of this basin which could be flooded to a depth of 2 feet for the 100-year event (or 1.5 feet for the 10-year event), adequate storage would be available to fully control increase in flooding.

Area B/Discharge Point 2

This is the largest and most highly developed of the four areas and hence will require the greatest investment in controls. The area contains a total of 145 acres subdivided as follows:

57 acres, new town house development
4 acres, new sewage treatment plant
18 acres, new commercial development
20 acres, new apartment development
46 acres, unchanged from present usage

At Discharge Point 2, the following runoff volumes were computed:

Event	Present Case Outflow Volume (acre-feet)	Maximum Development Outflow Volume (acre-feet)	Percent Increase (%)	Preliminary Estimate of Storage Required (acre-feet)
10-yr	22.3	30.5	37	8.2
100-yr	38.6	48.2	25	9.6

*Only volume of outflow is presented in this summary since it is the most important parameter and gives guidance as to the amount of storage required to reduce outflows to those of present conditions. All other parameters (i.e., timing, peak flows) can be controlled by the addition of this storage. A full description of the other parameters is included in the Phase I Report.

A volume of 9.6 acre feet of storage must be provided in order to bring the discharge under maximum development conditions back to present values. The proposed maximum development plan presently includes an area of 2.65 acres set aside for storage (but again, not used in our studies to insure worst case conditions). If such an area is used, a pond with 3.6 feet depth of set aside storage must be provided. If this area were expanded to 4.8 acres (i.e., giving up 2.15 acres of development land) it would be flooded to a depth of 2 feet for the 100-year event (or 1.7 feet for the 10-year event) and runoff would be limited to present conditions.

Area C/Discharge Point 3

This area is on the northwest edge of the site. It contains 129 acres and drains out through Discharge Point 3. The proposed development of the site can be broken out as follows:

20 acres, new town house development
8 acres, new apartment development
22 acres, new single-family detached development
79 acres, unchanged from present usage

The following value were estimated for Discharge Point 3:

Event	Present Case Outflow Volume (acre-feet)	Maximum Development Outflow Volume (acre-feet)	Percent Increase (%)	Preliminary Estimated of Storage Required (acre-feet)
10-yr	7.2	8.9	24	1.7
100-yr	12.9	15.0	16	2.1

A volume of 2.1 acre feet of storage should be provided to be able to bring the maximum development outflow back to present conditions. The maximum development plan presently includes an area of 0.6 acres set aside for storage in Area C. If this area is used, a pond with 3.5 feet depth of set aside storage must be provided. If this area were expanded by 0.45 acres to 1.05 acres, it would be flooded to a depth of 2 feet for the 100-year event (or 1.6 feet for the 10-year event).

Area D/Discharge Point 4

This area totals 52 acres distributed as follows:

3 acres, new town house development
15 acres, new apartment development
7 acres, new senior citizen housing
4 acres, new commercial development
24 acres, unchanged from present usage

At Discharge Point 4, the following comparisons were seen:

Event	Present Case Outflow Volume (acre-feet)	Maximum Development Outflow Volume (acre-feet)	Percent Increase (%)	Preliminary Estimate of Storage Required (acre-feet)
10-yr	4.8	6.8	42	2.0
100-yr	7.9	10.3	30	2.4

A volume of 2.4 acre-feet will be required to fully control the discharge from this basin. If the proposed area of 0.9 acres is used, a pond of 2.7 feet depth of set aside storage must be provided. This volume could be achieved using an area of 1.2 acres flooding to a depth of 2 feet for the 100-year event (1.7 feet for the 10-year event). This area represents an increase in 0.3 acres from that presently allocated.

Summary

The maximum development plan can be implemented without increasing downstream flooding potential if runoff from the site is controlled by one of the allowing alternatives:

1. deep ponds - i.e., deep flooding of the presently specified 4.4 acres set aside for flood storage. Storage depth would range from 2.7 to 5.7 feet depending on the location.

2. shallow ponds - i.e., by limiting maximum flooding depth to 2 feet, pond area would have to be increased by an additional 3.3 acres to 7.7 acres.

Intermediate solutions between these two extremes are of course possible and will be investigated. The important conclusion to be drawn, however, is that neither alternative probably presents much difficulty

in terms of cost or investment opportunity foregone. Therefore the maximum development plan can likely be implemented with adequate controls to limit flooding impacts to those of pre-development conditions in a cost-effective manner.

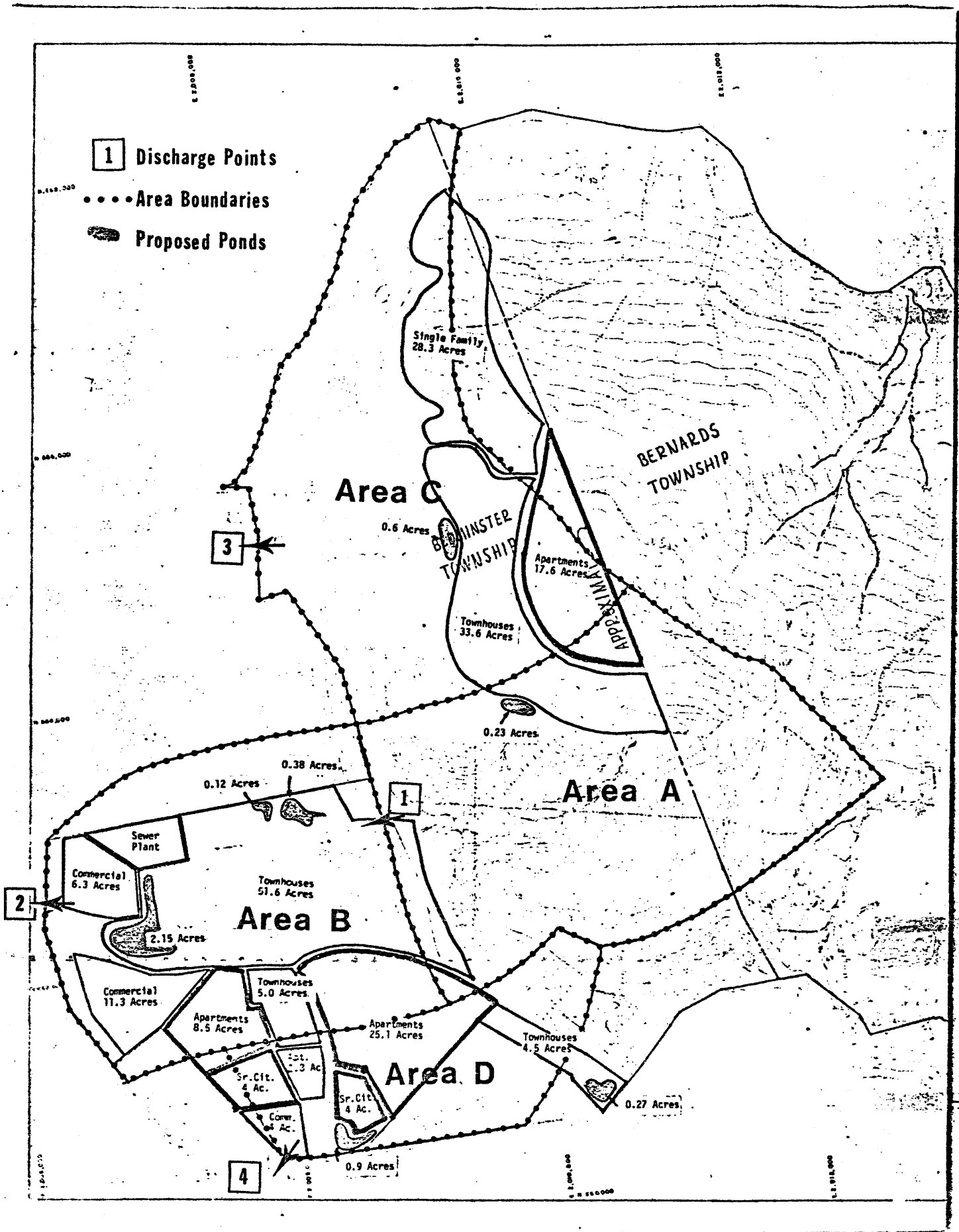
As mentioned earlier we are in the process of preparing a detailed report on our Phase I investigations. In the meantime if you have any questions on the above discussions please feel free to give me a call.

Very truly yours,

RESOURCE ANALYSIS, INC.

David H. Marks, Ph.D., P.E.
Principal

DHM:mmb


1 Discharge Points
Area Boundaries
Proposed Ponds
Single Family
28.3 Acres
Area C
0.6 Acres
BERNARDS TOWNSHIP
BEDMINSTER TOWNSHIP
Apartments
17.6 Acres
APPROXIMATE
Townhouses
33.6 Acres
0.23 Acres
0.38 Acres
0.12 Acres
Area A
Sewer Plant
Commercial
6.3 Acres
Townhouses
51.6 Acres
Area B
2.15 Acres
Commercial
11.3 Acres
Townhouses
5.0 Acres
Apartments
8.5 Acres
Apartments
25.1 Acres
Townhouses
4.5 Acres
Sr.Cit.
4 Ac.
Area D
Sr.Cit.
4 Ac.
Comm.
4 Ac.
0.27 Acres
0.9 Acres
1
2
3
4