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Preliminary Report upon Sewage outlet facilities for the Olympia and York Development (and Contiguous Tributary Areas)

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OLYMPIA AND YORK

OLD BRIDGE, NEW JERSEY

PRELIMINARY REPORT

UPON

SEWAGE OUTLET FACILITIES

FOR THE

OLYMPIA AND YORK

DEVELOPMENT

(AND CONTIGUOUS TRIBUTARY AREAS)

JANUARY, 1981

Elson T. Killam Associates, Inc.

Environmental and Hydraulic Engineers

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FOR THE
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(And Contiguous Tributary Areas)

JANUARY, 1981

ELSON T. KILLAM ASSOCIATES, INC.
Environmental and Hydraulic Engineers
Millburn, New Jersey

SUMMARY REPORT
UPON
SEWAGE OUTLET FACILITIES
for the
OLYMPIA & YORK DEVELOPMENT

The attached preliminary report provides a basic plan for providing sewage outlet facilities for the Olympia & York development as well as contiguous areas in the Iresick Brook and adjacent watershed areas. We have summarized herein the most significant findings and recommendations set forth in the preliminary report.

1) We have made a field study and investigation of the carrying-capacity of the existing Iresick Brook outlet sewer. We have found that the carrying-capacity of this line is not exceeded by the present house connections to this line. There are approximately 12,000 house connections to this interceptor sewer. Based upon studies of the existing flow, we have estimated that approximately 17,600 housing units can be connected before the interceptor sewer will be at its maximum carrying capacity, and 19,400 units can be connected if the bottleneck of 2000 feet at the lower end (Sandfield Road) is eliminated.

2) Our studies indicate that there is a potential of about 12,900 additional homes (or equivalent single family housing units) that may be constructed in the area tributary to the Iresick Brook interceptor sewer based upon presently planned developments. Additional development may occur in the future, particularly in those areas that are presently undeveloped with no known plans presently for development. Based upon our studies, it appears that outlet sewage facilities may ultimately be required to accomodate a total of as many as 18,000 additional dwelling

units or a total ultimate potential of 30,000 homes in this watershed, as compared to the 12,000 homes presently served.

3) It will be necessary to construct at some time in the future a relief sewer (or a pumping station and force main, or alternate sewage disposal facilities) to serve the potential of approximately 12,400 additional dwelling units which may be constructed in the Iresick, Matchaponix and Barkley's Brook basins, which cannot be served by the existing Iresick Brook interceptor sewer.

4) It appears that a pumping station and force main (Plate IV) would be one alternative of providing an environmentally acceptable outlet facility or "relief" line for the additional homes which may be built in the Iresick Brook basin as well as the adjoining areas in the Matchaponix and Barkley's Brook drainage basin. Such a pumping station should be designed so as to be able to ultimately serve 12,400 dwelling units or an average daily flow of approximately 2.3 MGD. The pumping station would be located near Birch Street, adjacent to Iresick Brook, with a force main approximately 20 inches in diameter and 14,000 feet long located along an existing power line right of way connecting directly to the MCUA South River Interceptor.

5) It would be possible to connect 5,600 homes to the Iresick Brook trunk sewer before the existing line is utilized at its maximum carrying capacity and while plans are proceeding for the design and construction of the pumping station and force main which would parallel the existing facilities. In the future, some or all of the flow from the 5,600 homes connected by gravity to the Iresick Brook interceptor could be diverted back to the pumping station if downstream capacity in Iresick Brook should

be required. However, since gravity flow is most desirable and would be more economical than pumping, we would even suggest pumping peak day time flows only with all night time flow diverted to the existing Iresick Brook gravity line when ample carrying-capacity would be available.

6) The construction of flow equalization facilities, to eliminate peak discharge rates from the proposed development, would allow even greater utilization of the existing Iresick Brook interceptor sewer. With these facilities, it has been estimated that at least 7500 units could be connected to the existing system. If the "bottleneck" portion of the existing sewer is eliminated by a parallel relief sewer, it has been estimated that 11,000 units could connect if flow equalization facilities are constructedd. This would allow development to proceed for at least 5 years, or more, under the presently proposed schedule of development, prior to the relief outlet facilities being required. During this time period, the required relief facilities would be planned and constructed to coincide with the growth of housing and development in the watershed.

7) In order to avoid the construction of relief outlet sewage facilities as outlined above (pumping station and force main) and, more importantly, to provide an alternative plan for water conservation and re-use (golf course irrigation and groundwater re-charge), an alternative plan has been developed which would utilize the Iresick Brook Interceptor to its maximum extent, namely the accommodation of 7500 units with treatment provided for excess flows above this number which the existing line cannot handle. By paralleling the bottleneck section in Sandfield Road, the Iresick Brook interceptor can acccmmodate 11,000 units, with treatment required for excess flows above this number greatly reduced.

8) In summary, the following conclusions have been reached as a result of this study.

1. The existing Iresick Brook interceptor sewer can readily accommodate 5,600 additional housing units before the line reaches its maximum carrying capacity.

2. The installation of storage and equalization facilities to eliminate peak flows from major proposed developments in the Iresick Brook and Deep Run watersheds will enable the interceptor sewer to accommodate 7,500 additional units (in lieu of 5600 as set forth in No. 1).

3. If, in addition to No. 2 above, the lower end of the Iresick Brook interceptor sewer along Sandfield Road is paralleled so as to eliminate this bottleneck, it has been estimated that 11,000 additional homes can be connected to the existing Iresick Brook interceptor sewer.

4. From the foregoing, a total of 23,000 units can be served by the existing Iresick Brook interceptor sewer (as compared to the existing connections of about 12,000 units) by constructing storage and equalization facilities and by paralleling the sewer at the outlet end in Sandfield Road.

It appears that a total of 30,000 units could potentially be constructed in the watershed. If this were to occur, an additional 7,000 units would have to be accommodated by alternative means. Two plans appear to be feasible. The most obvious would be to construct a relief line which would consist of a pumping station and force main. The alternative plan would be to construct a wastewater treatment plant designed for beneficial wastewater re-use. It has been estimated that a treatment plant with a capacity to treat an average daily flow of 1.3 to about 1.6 MGD would be required.

The highly treated effluent from this plant would be utilized for golf course irrigation, maintenance of stream flow during dry weather periods, and/or the re-charge of groundwater, seasonally, as required.

9) All of the foregoing could be staged or timed to coincide with the planned, orderly growth and development in the Iresick Brook watershed.

Olympia & York
Old Bridge, New Jersey

Preliminary Report
Upon
Sewage Outlet Facilities
for the
Olympia & York Development

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PRELIMINARY REPORT
UPON
SEWAGE OUTLET FACILITIES
FOR THE
OLYMPIA & YORK DEVELOPMENT
(And Contiguous Tributary Areas)

I. INTRODUCTION

The proposed Olympia & York development includes approximately 2500 acres of land within Old Bridge Township. This property consists of an assembly of numerous parcels within an area generally bounded by Route 18 on the east, Old Texas Road on the south, the Matchaponix Brook on the west, and Graystone Road and Birch Street on the north. Within these boundaries are included large acreage which is not controlled by Olympia & York. The Olympia & York property is delineated on Plate I, included in the Appendix to this report. It will be noted on Plate I that the properties are generally contiguous with parcels not controlled by Olympia & York, some of which are substantial, located throughout the boundaries outlined above.

Olympia & York has proposed that these properties be developed over a 10 to 15 year period with a mix of primarily residential units. The total number of units proposed is approximately 9,000 units. It is anticipated that this development may have an ultimate population of approximately 27,000 to 32,000.

The purpose of this report is to assess the sewage disposal needs of the development, to investigate the adequacy of the existing sanitary sewers in the area to serve this development, and provide feasible options, consistent with good engineering planning, for short-term and ultimate disposal of sewage from the proposed development.

In general, consideration will also be given to the sewage disposal requirements of properties not controlled by Olympia & York but, because of their location, would normally be handled by the outlet facilities provided for the drainage basin area.

II. EXISTING SEWERAGE FACILITIES

Sewage disposal within Old Bridge Township is generally by individual household subsurface septic tank systems and by a sanitary sewerage system operated by the Old Bridge Sewerage Authority. The Old Bridge Sewerage Authority system generally serves the more densely populated areas of the Township. Existing low-density development, including properties adjacent the Olympia & York tract and other areas in the vicinity are presently served by individual household septic tank systems. The Old Bridge Sewerage Authority's sanitary sewer system does, however, extend into the northern portion of Olympia & York properties along Iresick Brook.

The Old Bridge Sewerage Authority's system includes the Iresick Brook interceptor sewer which is shown on Plate II.

The Iresick Brook interceptor sewer is the only sewer in the Township to which the Olympia & York property has direct access. From the Olympia & York property the Iresick Brook interceptor sewer flows downstream (north), generally paralleling Iresick Brook to the mouth of the stream at Duhernal Lake and then extends north along the east side of Duhernal Lake and the South River to Route 18. The interceptor sewer crosses Route 18 and continues in Kearney Avenue and Sandfield Road to the Middlesex County Utilities Authority sanitary sewer system located approximately at the intersection of Sandfield Road and the Bordentown-Amboy Turnpike. The length of the Iresick Brook interceptor sewer is approximately 17,000 feet. The sewer is comprised of pipe sizes ranging in diameter from 24 to 36 inches beginning at the MCUA interceptor sewer and extending to its terminus at Maple Street, where the Olympia & York property is located.

In order to assess the capabilities of the existing Iresick Brook trunk sewer and the portion of the main interceptor sewer located in Sandfield Road, which conveys the combined flow of both the Iresick Brook and Deep Run interceptor sewers, a detailed field investigation and office analysis was conducted of this portion of the Old Bridge Sewerage Authority (OBSA) system. The field and office studies will be described within Section III of this report along with the conclusions of that anlaysis. Briefly, the study showed that while ample excess capacity is presently available within the existing Iresick Brook trunk sewer since only about 65 percent of the pipeline's capacity is utilized, adequate capacity is not available to accommodate the estimated ultimate requirement of the entire drainage area.

Final treatment and disposal of sewage from this portion of Old Bridge Township is through the facilities of the Middlesex County Utilities Authority system, including the Authority's treatment plant located adjacent the Raritan River in Sayreville. Treated effluent is discharged into Raritan Bay. The Authority's plant was recently expanded to a capacity of 120 million gallons per day (MGD), and the present average daily flow in the plant is approximately 95 MGD. Accordingly, substantial capacity is available at this plant.

The Middlesex County Utilities Authority (MCUA) recently constructed a parallel interceptor sewer along the South River. This sewer has provided greatly increased capacity for future flows in the South River interceptor sewer. The upstream terminus of the existing 45-inch diameter interceptor sewer and the recently constructed 66-inch diameter interceptor sewer is at the intersection of the South River and Route 18. The capacity

of the pipelines at this location is 97.6 MGD. This capacity is a combination of the capacity of the existing 45-inch diameter interceptor sewer, which has a capacity of 18.4 MGD, and the recently constructed 66-inch diameter interceptor line, which has a capacity of 79.2 MGD. The relief interceptor sewer was designed to provide a peak flow factor of 2.0. Accordingly, the available capacity in terms of average daily flow is approximately 49 MGD. The flow in the existing 45-inch diameter South River interceptor sewer is presently about 8 MGD. Therefore, substantial excess capacity is now available as the MCUA places the recently constructed relief interceptor sewer into service. It is anticipated that these facilities will all be operable during 1981 after the completion of the Sayreville pumping station and force main enlargement which is nearing completion.

In order to obtain more detailed information concerning MCUA facilities, informal discussions were held with representatives of MCUA. Also determined were constraints, if any, which MCUA may impose upon the connection of additional houses from Old Bridge Township. Although it was indicated that any action on the request for additional connections would be based upon a formal request by the Old Bridge Sewerage Authority, it was indicated that the MCUA would be receptive to any request providing for the connection of additional facilities to the MCUA system. This flow could be connected at one of the existing metering points or at a new connection and metering location, subject to MCUA approval. MCUA representatives verified that capacity exists for the anticipated sewage flow well in excess of that required for the proposed Olympia & York development and the entire tribu-

tary area of the Iresick Brook watershed. Capacity is, or soon will be, available both in terms of treatment capacity and capacity in the interceptor sewers and pumping stations between Old Bridge Township and the MCUA sewage treatment plant. (Actually, there is no limit to the flow that any member or customer of the MCUA discharges into their system. Only a new point of connection to the MCUA system would require formal approval).

The MCUA has a policy of not committing portions of plant capacity or sewer capacity to specific participants and generally has a policy of providing capacity when and where needed within the constraints of their system's capacity. Although treatment capacity presently exists, depending upon the timing of the proposed Olympia & York development and other developments within the MCUA system, flow to the plant may approach the treatment plant capacity of 120 MGD within 10 to 15 years. The MCUA system serves most of Middlesex County and smaller areas of Union and Somerset Counties. The contemplated reduction in system flow following extensive Infiltration/Inflow studies and rehabilitation of the MCUA system will extend the time during which additional flow can be accepted.

Projections of sewage flow in the MCUA system were estimated under the 208 Water Quality Management Planning Program and are shown in the report submitted in August, 1977. This report provided various estimates of probable flow in the MCUA system for the years 1985 and 2000. Three methods were used in the 208 report to develop the possible ranges of estimated flows for these years. The estimates indicated that the 1985 flow would range from 66 MGD and 93 MGD, and in 2000 the flow would range between 74 MGD and 122 MGD.

Based upon the present flow in the Middlesex County Utilities Authority system, which is reported to be 95 MGD, it appears that this flow is above the range projected in the 208 study. It is possible that the MCUA system may approach its plant design capacity of 120 MGD prior to the year 2000 and possibly within a 10 to 15 year period.

It was also reported that the Middlesex County Utilities Authority treatment plant has the capability of being expanded to a 240 MGD capacity plant. The plant presently has a hydraulic capacity of 240 MGD, and it is possible to add additional units of 120 MGD capacity to double the treatment capability of this facility. The first 60 MGD of additional process capacity can be achieved with relatively minor modifications to the existing treatment plant. These modifications would raise the treatment plant capacity to 180 MGD. With this plant expansion there would be more than adequate treatment capacity for Olympia & York and the entire Old Bridge area during the contemplated development period.

III. EVALUATION OF EXISTING IRESICK BROOK TRUNK SEWER CAPACITY

An investigation has been made of the maximum carrying capacity and existing flow conditions in the Iresick Brook interceptor sewer. The Iresick Brook interceptor sewer was examined beginning at the connection to the Middlesex County Utilities Authority interceptor sewer and thence extending along Sandfield Road, Kearney Avenue, under Route 18, and thereafter along Sunset Road, Brookside Road and the Iresick Brook to its termination near the intersection of the Iresick Brook and Maple Street. The Iresick Brook interceptor sewer is a 36-inch diameter sewer along Sandfield Road and across Route 18 to Brookside Road; in Brookside Road it is a 30-inch diameter sewer, and east of Englishtown Road it is 24-inch diameter. The location of this sewer is shown on Plate II of this report. A profile of the sewer is shown on Plate III.

To determine the flow carrying capacity of this interceptor sewer, flow monitoring equipment was installed at six locations as shown on Plate II. The six locations were selected based upon their suitability in obtaining accurate information and in consideration of pipe size and slope in the area. The intent was to monitor the flow at the more critical sections of the sewer and determine actual flow and available capacity at these critical locations.

The equipment installed in each location included a portable level recorder that was set to record the depth of flow within each sanitary manhole monitored. A record was obtained from each of the six locations for a period of approximately two months starting on or about February 20, 1980, and ending during mid-April, 1980. Several heavy rainfalls

occurred during this period, providing a good record of flow conditions in the sanitary sewer during both relatively dry and wet weather periods.

The sanitary sewers were calibrated. That is, a determination was made of the instantaneous rate of flow passing through the manhole to verify the depth versus flow relationship. This calibration was accomplished through the use of a velocity meter and calculated cross-sectional areas of flow during the velocity measurements. The calibration measurements were made at several depths, and a curve relating depth of flow to flow-rate was developed. As a further verification, direct reading high capacity weirs were installed in several of the manholes during low-flow nighttime conditions to check the depth calibration curve prepared for determining the daily flow through each monitoring manhole.

A field survey was also undertaken of the more critical sections of the sewer system from the MCUA metering chamber upstream to a point west of Route 18. The survey included a visual inspection of each manhole that could be found, as well as a determination of the sanitary sewer's invert elevation, relative to the first manhole upstream of the MCUA meter chamber and the depth of the manhole itself. Other information obtained and recorded during the survey included the depth of sediment measured within the sanitary sewers, and the maximum depth of surcharge. This could be determined through an examination of the interior manhole surface.

The results of this investigation are shown on Plate III which identifies, to scale, the manholes found along the sanitary interceptor sewer as well as the calibration curve for each monitoring point. These curves provide the relationship between depth of flow within the sanitary

sewer section and the flow-rate in million gallons per day. The depth of sediment is also shown as well as the elevation of surcharge which was measured where evidence of surcharge was observed.

This surcharge appeared to be caused as a result of the downstream conditions of flow. Although the Middlesex County Utilities Authority interceptor was not monitored continuously, it is suspected that high flow levels in this sewer caused the surcharge in the Sandfield Road and Iresick Brook interceptors.

The Old Bridge meter chamber on Sandfield Road was investigated to determine if it was a "bottleneck" in the system. It was found that the 12-inch wide Parshall Flume in this chamber has adequate capacity for peak flows, and accordingly it is not expected that the metering device causes surcharge.

The significant deposition of sediment in the lower reaches of the interceptor is likely to have been caused by repeated periods of surcharge or backup. Generally, very low velocities prevail throughout the Iresick Brook trunk sewer, and periods of surcharge would further aggravate a tendency for deposition of solids in the invert of the pipeline. Until the new MCUA interceptor is connected at Sandfield Road, it is expected that this situation will continue, after which the surcharge conditions should be alleviated.

Table 1 provides a summary of the results of the analysis at five of the manholes and indicates that the capacity of this system is generally substantially less than the theoretical capacity based upon normal design criteria (pipe line size and slope). The information collected at Monitoring Point "F" (Manhole 38) indicated that a partial blockage existed down-

stream from this manhole. For this reason accurate conclusions could not be drawn concerning actual flow rates or capacity in this reach of sewer, and therefore it is not listed in Table 1.

TABLE 1

ESTIMATED CARRYING CAPACITY

LOCATION	MEASURED AVERAGE DAILY FLOW (MGD)	MEASURED AVERAGE PEAK FLOW RATE (MGD)	THEORETICAL CAPACITY* (MGD)	OBSERVED CAPACITY** (MGD)
A-Manhole-2 36" Diameter Interceptor	2.78	3.70	10.95	5.10
B-Manhole-7 36" Diameter Interceptor	1.12	1.46	6.74	2.53 (3.58)***
C-Manhole-17 36" Diameter Interceptor	1.06	1.58	6.30	5.11
D-Manhole-23 30" Diameter Interceptor	0.89	1.30	8.38	5.24
E-Manhole-32 24" Diameter Interceptor	0.20	0.30	5.73	2.40

* Based upon Manning Equation @ n = 0.015
** Based upon calibration/verification measurements and field conditions
*** With sediment removed

In some cases a portion of the reduction in capacity between the theoretical and that observed is due to sediment within the manhole. In other cases it appears that other conditions result in higher head losses through the pipe than normally expected and correspondingly lower capacity.

The monitoring which was performed also allowed development of the diurnal pattern of sewage flow at each location. The variation in flow throughout the day determined the relationship between peak and average daily flow. This information was used to estimate the quantity of additional flow, in terms of average daily flow rate, that could be accommodated by portions of the Iresick Brook interceptor sewer. Table 2 lists the estimated available or additional capacity which is not being utilized presently at various monitoring points along the Iresick Brook trunk sewer.

TABLE 2

ESTIMATED ADDITIONAL CAPACITY
(Average Daily Flow in MGD)

Location	Additional Capacity
A	1.05
B	0.82 (1.62)(1)
C	2.37
D	2.70
E	1.40

(1) With sediment removed

Observations made during the investigations of the Iresick Brook trunk sewer indicated that this sewer is generally below the groundwater table. Accordingly, the potential exists for groundwater infiltration. The period during which the monitoring was done, March-April, is representative of a period for maximum groundwater conditions with respect to infiltration to which a sanitary sewer is generally subjected. The field information obtained revealed that the lateral sewer system tributary to the Iresick Brook trunk sewer is <u>not</u> seriously affected by infiltration or inflow. The diurnal flow patterns during periods of heavy rainfall did not

indicate sharp, sudden peak flow rates which are indicative of storm water runoff or roof drains connected to the sanitary sewer system (inflow). Although a minor increase in flow after periods of rainfall was observed, the characteristics of this increase would indicate that it was due to a low level of infiltration, that is, leaking pipelines, manholes, etc.

Based upon the present number of connections tributary to the Sandfield Road sewer (12,000), which includes approximately 10,000 connections from Old Bridge Township and 2,000 from Monroe Township, the average daily flow per connection was found to be 230 gallons per day. This is relatively low compared to about 375 gallons per day which is often used for design purposes (3.75 persons/house times 100 gallons per day). Assuming 3.75 persons per connection, the per capita contribution is approximately 62 gallons per day which is typical of the water consumption per capita in a residential community. This verifies the field observation that infiltration is practically negligible in the Old Bridge Township Sewerage Authority system.

In summary, the investigation and analysis of the Iresick Brook interceptor sewer revealed that excess capacity exists to accommodate additional flow. The most critical portions of the interceptor system with respect to available capacity is the line within Sandfield Road which also conveys the sewage from the Deep Run interceptor sewer. This reach of sewer has available capacity of approximately 1.05 MGD. The portion of the Iresick Brook sewer along Kearney Avenue also has limited available capacity. This sewer has available capacity of approximately .82 MGD, but this could readily be doubled, to about 1.6 MGD if sediment were cleaned from the pipeline. When the MCUA parallel relief interceptor sewer is placed in

service, additional capacity may readily become available in this reach of the Iresick Brook line. It is expected that after the MCUA line is in service sedimentation in the Iresick Brook trunk sewer may no longer be a problem, as surcharge conditions should be eliminated and velocity conditions are improved in the downstream reaches of the Iresick Brook line.

Portions of the Iresick Book interceptor sewer west of Route 18 have excess available capacity estimated to be between 1.4 MGD and 2.7 MGD. In view of this, it would appear that some additional flow from the proposed Olympia & York and other upstream developments could readily be served by the Iresick Brook interceptor sewer and the Sandfield Road outlet sewer. Further utilization of this available capacity is discussed in Section VI of this report.

IV. SEWAGE DISPOSAL REQUIREMENTS

The Olympia & York development will consist of approximately 9,000 residential units as well as some commercial development as permitted by prevailing zoning regulations. The actual number of units will depend to some extent upon Olympia & York's detailed development plan. Proposed planning regulations provide some flexibility in the number of units that may be developed, depending upon the degree of planning treatment given to alternative development considerations. For the purpose of this report, 9,000 units has been used as the maximum number of residential units which will ultimately be developed.

The estimated sewage discharge from this development (at 90% of water consumption of 65 gallons per day per capita) results in an estimated average daily flow of 1.7 MGD. It is anticipated that the "mix" of residential units will result in an average of 3.2 persons/unit. In addition, the estimatee sewage flow from the commercial area (SD5 zone) is approximately 0.3 MGD. This is the equivalent of about 1500 residential units. Therefore, the total estimated average daily flow from the completed Olympia & York development will be approximately 2.0 MGD (with ultimate development).

The analysis described in Section III of this report indicates available capacity in the Sandfield Road line and Iresick Brook interceptor sewer to be between 1.05 and 2.7 MGD (average daily flow with further allowance for actual peak flow conditions). Comparison of the available flow capacity in the Iresick Brook interceptor sewer with that required by Olympia & York with complete development indicates that sufficient excess capacity does not exist. In addition to the space requirements (2.0 MGD)

for the Olympia & York development, additional capacity may also be required for other presently undeveloped areas in the tributary watershed. An estimate has been made to determine the requirements of other potential developments in order to establish the maximum capacity which may be required in the future. The possible developments in this drainage area are shown on Plate I.

Within the Iresick Brook drainage area, there are reported to be four possible developments which are relatively small:

Development	Number of Units
Green Valley	10
Eugene Novella	8
Graystone Village	81
SJR Construction Company	2
TOTAL	101

In addition, Matchaponix Hills, a 282-unit development, has been proposed with a connection to the Iresick Brook interceptor sewer. This development would be located adjacent the Matchaponix Brook, where it crosses under Old Texas Road.

Another proposed development, called Woodhaven Village, would construct approximately 2,000 units on a tract within the Barkley's Brook drainage basin. Previous plans contemplated 3,574 units on this tract. Barkley's Brook is tributary to the Matchaponix Brook. It appears that the only practical means of sewering this area to the MCUA system would be by way of a long interceptor sewer along the Matchaponix Brook which may not be feasible because of environmental restraints or by a pumping station and force main connection into the Iresick Brook watershed.

These developments, comprising a total of about 2,383 units, have been submitted to the Old Bridge Township governing body and Planning Board for review and are in various stages of the approval process.

In order to establish an estimate of the ultimate growth in this watershed and to determine the sewer capacity requirement of the Iresick Brook and tributary watersheds, the present Township zoning of this area was reviewed. It has been estimated that if development of this area were to reach saturation density, assuming concentrated development in accordance with prevailing zoning, a total of 18,000 units might be constructed in the area that would be tributary to the Iresick Brook facilities.

If this degree of development activity (18,000) were to proceed, it has been estimated that the average daily sewage flow would be approximately 3.4 MGD, all of which could be tributary to the Iresick Brook interceptor sewer. This also assumes that water conservation fixtures are installed so that the per capita water usage would be about 65 gallons per day. It has further been estimated that the average unit occupancy will be 3.2 persons, or a total of 57,600 people. It should be recognized that this "ultimate" degree of development may not occur.

A number of additional housing developments have also been proposed within the Deep Run basin, which is adjacent the Iresick Brook basin. Some of these proposed developments are also shown on Plate I. Others lie further to the east. Connection of these developments to the existing Deep Run interceptor sewer would utilize a portion of the availability of capacity in the section of the interceptor sewer in Sandfield Road. The capacity of the Deep Run interceptor sewer has not been inves-

tigated as part of this study. (It has been studied under another project). Major developments in this drainage basin, and those which are planned to be pumped from other drainage basins into the Deep Run basin, include the following:

Development	Number of Units
Foxborough Village	522
Oakwood and Madison	1220
Kaufman & Broad	280
Tri-Centennial Homes	45
Deep Run	83
T.B.S.	507
Cottrell Village	38
Winston Associates	430
Cottrell Estates	119
Rotary Club (Senior Citizens)	209
Landing Lane Estates	8
National Kinney Corp.	242
Northwood Manor	62
TOTAL UNITS	3,765

The developments proposed to be connected to the Deep Run interceptor sewer total approximately 3,800 units. Collectively, these developments will require sewer carrying capacity which will average about 0.8 MGD.

Although the aforementioned developments, along with the proposed Olympia & York development, will cover a major portion of the undeveloped land within the western portion of Old Bridge Township, there is still some additional undeveloped land which may require sewer outlet capacity in the future. It is obvious that all of the developments proposed require sewer capacity in excess of that available in the Sandfield Road sewer line, which is a serious bottleneck which can readily be eliminated by the construction of a relief or parallel sewer. The Sandfield Road sewer has

available capacity of 1.05 MGD (average daily flow) and the estimated average daily flow which will result from all of the above-outlined developments located in both the Iresick Brook and Deep Run watersheds is approximately 4.2 MGD.

Additional sewer capacity must be provided initially in the Sandfield Road reach to maximize the existing capacity in both the Iresick Brook interceptor sewer and the Deep Run interceptor sewer.

V. ALTERNATIVE PLANS FOR SEWERAGE FACILITIES

This section of the report will discuss several alternatives which might be considered for providing sanitary sewer service for the Olympia & York properties. These alternatives would serve the entire drainage area and would provide sewage disposal or outlet facilities for Olympia & York as well as all other properties located in the tributary watersheds of Iresick Brook in the southwest portion of the Township.

Each of the alternative plans would provide for serving the Olympia & York development and would include on-site facilities for pumping sewage from portions of the Olympia & York properties which are naturally tributary to the Deep Run and Barkley's Brook drainage basins back into the Iresick Brook drainage basin. Those portions of the site which are naturally tributary to the Matchaponix Brook would also be conveyed to the Iresick Brook basin. These facilities would also serve properties not owned by Olympia & York.

Through a proposed system of collector sewers within the Iresick Brook basin, which would receive sewage from developments within that basin and also provide connection points for sewage pumped from the areas outside the Iresick Brook basin, all sewage would be conveyed to a central location adjacent the Iresick Brook interceptor sewer near Birch Street. A schematic presentation of such a collection system is shown on Plate IV. Proposed pipelines would be constructed within Olympia & York properties or road rights-of-way dedicated by Olympia & York. This would minimize disturbance of existing roadways.

These facilities would be designed to handle an average daily flow of approximately 3.4 MGD. This flow would be delivered to a point

near the terminus of the existing Iresick Brook interceptor sewer. Major collectors and pumping stations would be designed for the ultimate flow that may be generated in their service areas. In the case of pumping stations, future pump and/or motor changes may be necessary to avoid operating problems in early years.

The analysis of the existing Iresick Brook interceptor sewer revealed that the existing system had available excess capacity. However, the existing Iresick Brook interceptor sewer cannot handle the estimated ultimate flow from the tributary area, and additional capacities will be required at some time in the future. For this reason, one alternative would provide for a parallel sewer for the entire length of the Sandfield Road and Iresick Brook interceptor sewer.

Alternate A-1 proposes such a relief sewer. The capacity of this sewer would allow an additional average daily flow of 3.4 MGD to be discharged from the drainage basin, and would depend upon the flow which could be added to the existing interceptor sewer. Depending upon the interim measures exployed to maximize utilization of the available capacity in the existing Iresick Brook interceptor sewer, capacity requirements for this relief sewer would range from 1.3 to 2.3 MGD (Average Daily Flow). The interim measures are described in Section VI of this report.

A relief sewer would be less costly than a normal gravity interceptor sewer, since house connections and connection of lateral sewers would not be necessary. Nevertheless, it is anticipated that a gravity relief sewer would be costly, whether it parallels the existing Iresick Brook interceptor sewer within present easements or rights-of-way or if a shorter alignment within alternative rights-of-way was practical.

Considering that a gravity relief sewer could be somewhat shorter than the existing Iresick interceptor sewer by virtue of not having to follow the present alignment, and based upon available grade differentials between the MCUA system and the Olympia & York site, a relief sewer, between 18 and 24 inches in diameter, would be required. This sewer would be about 16,000 feet in length if it were to connect to the existing interceptor in the vicinity of Sandfield Road. A siphon crossing of the South River and connection to the MCUA system at Route 18 could be considered; otherwise, a tunnel under Route 18 would probably be required.

Another alternative, Alternative A-2, would comprise the construction of a pumping station adjacent Iresick Brook in the vicinity of Birch Street. This pumping station would pump the sewage from the Olympia & York development and the tributary upstream areas through a force main to the Middlesex County Utilities Authority system. It would be practical to connect this flow directly into the MCUA interceptor, thereby bypassing the existing Old Bridge Sewerage Authority facilities. Separate flow metering facilities would be provided under this alternative.

The proposed force main would be between 14 and 20 inches in diameter, depending upon the extent to which available capacity in the existing Iresick Brook interceptor sewer is utilized. The force main could be aligned within Olympia & York properties to Englishtown Road and along Englishtown Road and municipal streets to the South River interceptor at Route 18. An alternative alignment would be along an existing Jersey Central Power and Light Company right-of-way and along Sandfield Road to the MCUA interceptor. These alignments avoid environmentally sensitive

areas which may not be possible under Alternate A-1. This alternative would have a lower cost and less environmental impact than Alternate A-1.

If the "bottleneck" portion of the existing system along Sandfield Road is eliminated by a parallel relief sewer, as is recommended in Section VI of this report, then the force main proposed under this alternative would discharge to the terminus of that pipeline at the intersection of Sandfield Road and Kearney Avenue. This Alternative is shown on Plate IV.

Another alternative (A-3) for meeting the sewage disposal needs of the Olympia & York properties would be the construction of a sewage treatment facility along the Iresick Brook or Matchaponix Brook. This facility could be a permanent wastewater treatment plant or an interim facility operated until a more convenient connection point for the Olympia & York development is available. The construction of a treatment plant would provide for water conservation and re-use.

The requirements for approval of a treatment facility was discussed with representatives of the DEP. It was indicated that a treatment plant might be approved if it were designed with advanced wastewater treatment facilities and if the effluent was re-used (irrigation) or discharged into groundwater recharge facilities (injection wells or recharge basin) rather than direct discharge to surface waters. Recharge of treated wastewater was proposed within the Lower Raritan/Middlesex County 208 study as one of the possible methods of alleviating the critical water supply problem of the area.

The first cost and operating cost of such a system would be high. Cost estimates will be developed after effluent requirements and recharge

capability of the area are determined. It is anticipated that the cost of treatment facilities would be higher than either Alternate A-1 or A-2.

Alternate A-2 is illustrated on Plate IV. This alternate has advantages with respect to cost and environmental impacts over Alternates A-1 and A-3. Accordingly, Alternate A-2 is considered to be the most practical method of providing relief for the Iresick Brook interceptor sewer.

VI. INTERIM SEWERAGE FACILITIES

The previous section of this report presented methods of meeting the ultimate needs of the Olympia & York development and other developments and/or properties within the southwest portion of Old Bridge Township. Recognizing that the planning, approval, and construction of sewerage facilities of the magnitude suggested might require considerable lead time (2 to 3 years), and realizing that Olympia & York and other developers may desire to commence development within this period, interim sewage disposal availability has been evaluated. This evaluation has been based upon the investigation and analysis of the Sandfield Road and Iresick Brook sewers as described in Section III of this report. Section III concluded that capacity presently exists for additional connections to the system.

The Sandfield Road sewer to which the Iresick Brook and Deep Run interceptors are tributary has an excess capacity of approximately 1.4 MGD which is presently not being utilized. This capacity is equivalent to an average daily flow of 1.05 MGD. The Iresick Brook interceptor sewer, after cleaning of some sections, has available average daily flow capacity in excess of 1.05 MGD. This capacity could be equated to an additional connected population of 18,000 persons, based upon an average daily flow contribution of 90 percent of water consumption of 65 gallons per capita. This is equivalent to about 5,600 residential units at 3.2 persons per unit. If facilities are installed to equalize flow (eliminate peaks), 7,500 additional units could be connected.

For these reasons the existing system could accommodate a significant number of connections prior to reaching its capacity. The available capacity appears to be sufficient to allow controlled development,

while planning and construction of the ultimately approved outlet facilities are proceeding. A schedule could be developed and implemented which would allow these facilities to be ready for operation at the time that some 5,600 additional units have been connected to the existing Iresick Brook interceptor sewer. This number of units is based upon estimated per capita sewage flow and unit occupancy rates. Conceivably, considerably more than 5,600 units could be connected prior to both the Sandfield Road and Iresick Brook interceptor sewers reaching their capacities. If flow equalization facilities are provided, 7,500 units could be connected. Through periodic monitoring of the Sandfield Road, Iresick Brook and Deep Run sewers in the future, when additional connections are being made, a very accurate determination of the actual number of additional connections could be determined and regulated as required through constant monitoring.

Approximately 16,700 equivalent residential units are presently planned to be constructed within the Deep Run, Iresick Brook, Barkley's Brook and Matchaponix Brook watersheds. This includes approximately 9,000 residential and 1500 equivalent units of commercial development within the Olympia & York development. Although the anticipated development period of other developments are not known, an average development period of ten years has been assumed for the proposed developments or a maximum rate of 1,670 units per year. At this rate, the available capacity in the Sandfield Road sewer would be adequate to provide for from three to four years of this rate of development. If flow equalization facilities are provided, the sewer would be adequate for at least five years before reaching its capacity. A concurrent program of design and construction of the ultimate

facilities would provide for their availability probably within a 2 to 3 year period. Accordingly, it appears that the short-term requirements of Olympia & York and other proposed developments can be met by the existing facilities. It is again emphasized that planning should proceed immediately for the ultimate sewerage facilities required for the entire southwest portion of the Old Bridge Township, which is tributary to the Iresick Brook interceptor sewer.

Another interim measure which would allow greater utilization of both the Iresick Brook and Deep Run interceptor sewers would be the elimination of the "bottleneck" portion of the sewer system along Sandfield Road. Presently both the Deep Run and Iresick Brook interceptor sewers, which are 36-inch diameter pipes, connect to the Sandfield Road sewer, which is also a 36-inch diameter pipeline. Construction of a parallel relief sewer along Sandfield Road, between the MCUA interceptor and Kearney Avenue (2000 feet), would eliminate the "bottleneck." A connection point for such a relief sewer has already been provided. The new metering chamber and appurtenances constructed by MCUA includes a 36-inch diameter stub in addition to provision for the existing 36-inch sewer in Sandfield Road.

Construction of a relief sewer would allow approximately 7400 units to be connected to the Iresick Brook interceptor sewer before reaching its capacity. If flow equalization facilities are constructed, approximately 11,000 units could be connected to the Iresick Brook interceptor sewer. These estimates are based upon the available capacity in the upstream portion of the Iresick Brook interceptor sewer, and are therefore independent of the number of connections that may be made into the existing

Deep Run interceptor sewer. Accordingly, with the construction of the relief sewer and equalization facilities, it has been estimated that approximately 85 percent of the 12,900 units presently proposed in the Iresick Brook watershed could be accommodated. The relief sewer could also be utilized to convey the ultimate sewage flow generated in the Iresick Brook and tributary watersheds. The relief sewer could be designed with provisions for future connection of the force main which has been proposed as a method of providing for ultimate development of this watershed.

The construction of the relief sewer is not immediately necessary, but its construction could be staged to allow controlled development to proceed in the Iresick Brook watershed for several years.

VII. CONCLUSIONS

As outlined in previous sections of this report, the capacity available within existing sewer lines and treatment facilities between the Olympia & York property and the Middlesex County Utilities Authority treatment plant has been evaluated. The sewage disposal requirements of the Olympia & York development and other properties in the southwest portion of the Township has also been estimated. Alternatives have been proposed which provide feasible means of providing the sewage service to the Olympia & York development. These proposals have considered long range and interim sewerage disposal requirements of the southwest portion of the Township.

The primary purpose of this report is to establish the feasibility of providing for the sewage disposal needs of the Olympia & York development. The following points demonstrate that it is practical to dispose of the sewage from this development.

1. The existing Iresick Brook interceptor sewer now serves approximately 12,000 units.

2. It has been estimated that the Iresick Brook interceptor sewer has the capacity to serve 17,600 units, i.e. an additional 5,600 units.

3. If the bottleneck along Sandfield Road is eliminated, an additional 7,400 units over that presently served could be accommodated.

4. If, in addition to No. 3, equalization facilities are constructed, it has been estimated that an additional 11,000 units could be connected.

5. Presently proposed developments in the Iresick Brook and tributary watersheds include approximately 12,900 units.

6. It has been estimated that these developments will be constructed over a 10-15 year period and that the available capacity and increased capacity provided by the proposed Sandfield Road relief sewer would allow controlled development for several years.

7. Ultimate development of the Iresick Brook and tributary watersheds may result in the construction of 18,000 equivalent residential units, which includes those presently proposed.

8. Assuming flow equalization facilities and the Sandfield Road relief sewer are constructed, additional treatment or relief facilities for 7,000 units would be required to allow ultimate development of the Iresick Brook and tributary watersheds.

9. This capacity could be provided by the construction of a pumping station and force main as shown on Plate IV.

10. An alternative would be the construction of an advanced wastewater treatment plant, the effluent from which could be beneficially reused for golf course irrigation, maintenance of stream flow, and groundwater recharge.