State University System of Florida

FLORIDA INTERNATIONAL UNIVERSITY

University Park Campus/ North Miami Campus/ Miami, Florida

MASTER PLAN UPDATE 1986 - 2001

Technical Report August 1987

The Architects Collaborative Inc./ SDM Consulting Engineers

A Joint Venture Miami, Florida

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1.0 INTRODUCTION

Florida International University, a member institution of the State University System of Florida, was established by the Florida State Legislature on June 22, 1965. Florida International University currently has one major campus located in Southwest Dade County (University Park Campus) with a second major campus in North Miami. (See Figure I.)

The University Park Campus consists of 344 acres with seven major buildings completed and the eighth currently under design. The campus plan is designed as an interactive complex of facilities connected by internal courts for easy passage from one building to another. The complex is surrounded by a natural buffer of lakes and green areas. In recent years, on-site student housing has been added.

2.0 PURPOSE OF THE REPORT

The purpose of this report is to establish the status of the water, sewer, drainage, chilled water (Air Conditioning) supply/distribution and electrical and telephone systems at the Florida International University, University Park Campus and to evaluate the present capacities and future needs in a coordinated effort with planned, orderly campus growth.

2.1 New Campus Architectural Master Plan

Following the 50% advanced report TAC/SDM joint venture submitted an architectural campus development Master Plan. The Master Plan study central utilities final report conforms to the TAC/SDM campus development Master Plan.

3.0 DESCRIPTION OF THE UNIVERSITY PARK CAMPUS SERVICE AREA

The University Park Campus Service area is located in unincorporated Dade County. It is bounded on the north by SW 8 Street (Tamiami Trail, US 41); SW 107 Avenue on the east; the Dade County Youth Fair Grounds and Tamiami Park property on the south; and by SW 117 Avenue on the west. (See Figure II.)

4.0 WATER DISTRIBUTION SYSTEM

4.1 Source of Water Supply

The University Park Campus is served by the distribution system of the Miami-Dade Water and Sewer Authority Department (MDWASAD) which draws its water supply from the Biscayne aquifer and treats it at the Alexander Orr Water Treatment Plant. The treatment consist of lime softening, filtration and disinfection.

The MDWASAD has existing mains at the west, north and east boundaries of the campus. The existing distribution system within the campus is supplied by connections to the MDWASAD's 12 inch diameter water main at the east on SW 107TH Avenue and by a 36 inch diameter water main at the west on SW 117 Avenue utilizing a 12 inch diameter main. (See Figure III.)

4.2 Type of Use

The MDWASAD water supply is primarily for potable use and secondarily for fire protection. Water for lawn sprinklers is taken from this water network for well water if used, stains the walls of buildings.

4.3 Existing Piping and Hydrants

The existing campus water distribution system approximately consists of 8,500 feet of 12 inch diameter pipe, 1,300 feet of 8 inch diameter pipe, and 2,000 feet of 6 inch diameter pipe. (See Figure III.)

There are 28 hydrants servicing the campus for fire protection. (See Figure IV)

4.4 Consumptive Use and Fire Flow Capabilities

The existing distribution system is adequate for consumptive use and although it meets fire flow requirements as set forth under Chapter 32 of the Dade County Public Works Design Manual, it requires further looping in order to provide better reliability.

In order to achieve a more reliable system, existing dead end loops such as the one servicing the Sunblazers Arena and single main services such as the ones servicing the Viertes Haus, Library and Owa Ehan buildings, as well as isolated supply loops such as the existing student housing, should be interconnected on a priority basis. (See Figure V.)

4.5 Future Connections

Proposed future building construction as provided by the university will require major additions to the system. No attempt has been made to establish a time-frame for the additional facilities but the mains will be added as the building program progresses. The ultimate system will require the addition of approximately 1,200 lineal feet of 16 inch and 13,000 lineal feet of 12 inch diameter water mains and about 40 fire hydrants. Early stages of the construction must include a 16 inch diameter connection main to the existing 30 inch diameter main at the north boundary of the campus on SW 8 Street.

This interconnection, in addition to the aforementioned recommended system improvements discussed in the previous section, will provide the sought after reliability. (See Figures VIA & VIB.)

Hydraulic analysis of the proposed system indicates that fire flows at all areas within the campus will be available and well within the parameters established by the Fire Department. The location of the proposed additional water mains is tentative and will be refined as the actual building construction is developed. (See Figure VII.)

4.6 Engineering and Applied Science Building

In conformity with the recommendations included in the above sections, construction of the Engineering and Applied Sciences Building should prompt the extension and completion of a 12 inch diameter loop. This extension should provide the necessary water supply and fire protection required by the proposed construction. As a minimum. the existing 8 inch diameter dead end main at the northeast corner of the Owa Ehan building should be extended west with a 12 inch diameter main approximately 1300 feet along the path of the proposed east-west road to the north-south entrance road (SW 112 Avenue) and south with a 16 inch diameter main for approximately 500 feet and then east for approximately 160 feet to the existing 12 inch diameter main on the east side of the Viertes Haus parking lot (west of the Viertes Haus building). (See Figure VIII)

Proper design of this extension shall incorporate tees, crosses and valves for future extensions and/or loop completions in accordance with the recommendations for system expansion, betterment and reliability.

4.7 Building Meters

The existing buildings within the campus are metered separately. An existing central sewage meter measures total flow. It has been assumed that this practice will continue. Since the cost of sewage service is a function of the water usage, water use can best be controlled by utilizing individual metering, but within the limits of the controlling tariff at the time of connection. Thus, if prescribed minimum usage cannot be met by the served building, multiple connections to the meter would be recommended.

4.8 Present-Year 2000 Estimated Average Daily Demand

Average Daily Flows for the Florida International University, University Park Campus computed from billing records shows an consumption of 152,000 GPD for the past sixteen month period.

Based on the given enrollment of 12,000 commuting students and 641 housed students, using industry per capita figures, the FIU University Park Campus Average Daily Consumption is 244,100 GPD and has a Peak Hour Demand of 699 gpm.

The actual metered consumption at the University Park Campus is 62% of the accepted utility industry statistical values.

Statistical Consumption

Commuting Students	1200	x	14 GPD =	180,000 GPD
Housed Students	641	X	100 GPD =	46,100 GPD
				244,100 GPD

Average Daily Flow -

180,000 GPD/16 hrs./day /60 min./hr. = 188 GPM

Peak Hr. Flow - 188 GPM x 3 = 564 GPM

Average Daily Flow -

64,100 GPD / 24hrs. /day /60 min./hr = 45 GPM

Peak Hr. Flow - 45 GPM x 3 = 135 GPM

Total Peak Hour Flow -

564 GPM + 135 GPM = 699 GPM

School projected enrollment information provided to engineer estimates a population of 21,000 commuting and 2140 housed students by the year 2000. The estimated Average Daily Consumption and Peak Hour Flows by the year 2000 can be found by using the same industry accepted per capita figures. This will represent an Average Daily Consumption of 564,000 GPD and a Peak Hour Demand of 1542 GPM.

Statistical Consumption

Commuting Students	21,000 x	15 GPD =	350,000 GPD
Housed Students	2,140 x	100 GPD =	214,000 GPD
Total Daily Flow			564,100 GPD

Average Daily Flow -
350,000 GPD/16 hrs./day/ 60 min./hr = 365 GPM

Peak Hr. Flow - 365 GPM x 3 = 1095 GPM

Average Daily Flow -

214,000 GPD /24 hrs./day/60 min./hr. = 149 GPM

Peak Hr. Flow - 149 GPM x 3 = 447 GPM

Total Peak Hour Flow -

1095 GPM + 447 GPM = 1542 GPM

Correcting the flows by applying the 62% of actual vs. statistical usage from present records, the estimated Average Daily Consumption in the year 2000 will be 350,000 GPD.

4.9 Supporting Information

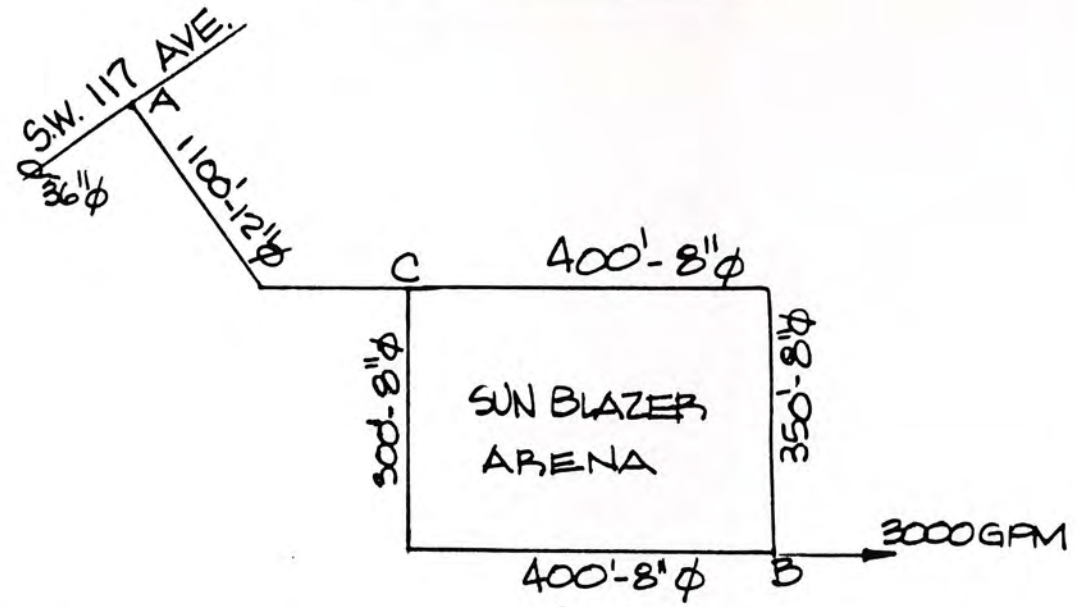
The following hydraulic analysis simulate fire flow conditions at different locations of the campus. (See Figures IXA through IXC.)

4.10 Summary

The existing internal water distribution system of the Florida International University, University Park Campus in most cases meets the present consumptive and fire flow demands. However, system reliability must be improved by completing and interconnecting loops and providing another supply connection.

Future needs are to be addressed as the building program progresses and should follow the recommendations included herein above. Certain portions of the Master Plan must be installed during Phase I and require the allocation of special funds for infrastructure improvements such as some priority looping to the Sunblazer's Arena, the master pumping station to serve the North East quarter of the campus and the force main manifolding.

FIRE FLOW ANALYSIS



ASSUME 45 PSI @ A

FOR 20 PSI @ B – PRESSURE LOSS = 25 PSI = 58'

3000 G.P.M. A-C = 24'
C-B = 45'
69'

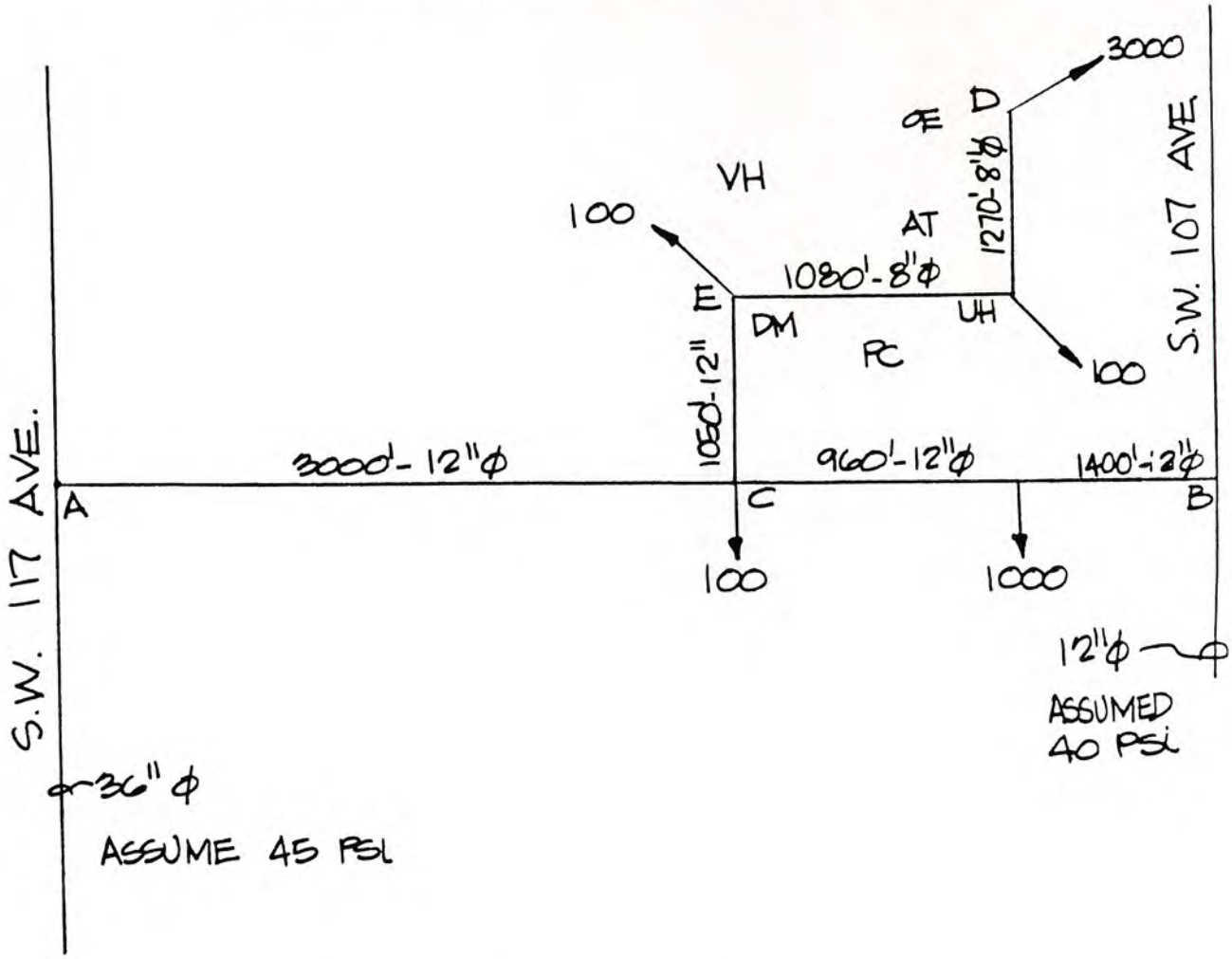
2500 G.P.M. A-C = 18'
C-B = 33'
51'

2750 G.P.M. A-C = 21.1'
C-B = 39'
60'

∴ MAX FLOW @ B = ± 2700 G.P.M.

EXISTING SYSTEM

WORST CONDITION FIRE FLOW ANALYSIS



BASED ON ASSUMED PRESSURES & 3000 G.P.M.
FLOW @ D

LOSS IS EXCESSIVE

TO MAINTAIN 20 PSI @ D BASED ON ASSUMED PRESSURES
MAX. FLOW OBTAINABLE @ D = 750 G.P.M.
@ OFF PEAK NORMAL FLOW

EXISTING SYSTEM

5.0 SEWAGE COLLECTION SYSTEM

5.1 Sewage Sources

The principal source of sewage at the Florida International University, University Park Campus is domestic sewage from the usage of the restrooms, kitchens and student housing facilities.

Limited amounts of laboratory sewage waste are usually neutralized prior to combining with the domestic sewage. Laboratory waste neutralization is the responsibility of the professor or researcher doing the work prior to discharging the wastes down the pipes. Neutralization methods will vary depending upon the work being done. For example, acid neutralization basins can be installed under cabinets; however, these are obsolete for reducing hexavalent chrome, absorbing organic chemicals, reducing phenols, etc.

Under EPA, FDER and DERM (Chapter 24), all dischargers to sewer have the responsibility to pretreat and render waste safe for handling at the POTW. In addition, the personnel using the laboratory facilities must comply with the Florida Right-to-Know Law and with the appropriate EPA sections published under the CFR for the handling or disposal of toxic or hazardous waste.

The Physical Sciences Building, now under design will have a state of the art chemical waste treatment system. All existing disposal systems should be modified to homologate their design with their latest concepts.

5.2 Existing Collection, Pumping and Transmission System

The sewage collection system of the University Park Campus consists of approximately 7,000 feet of gravity mains, 6,400 feet of force mains, and 3 sewage lift stations that pump to a master sewage pumping station that delivers to the force main system of the Miami-Dade Water and Sewer Authority Department for treatment by the MDWASAD at the Virginia Key Sewage Treatment Plant. (See Figure X.) The Virginia Key Sewage Treatment Plant provides secondary treatment (activated sludge mode) and disposal via an ocean outfall. Effluent quality meets the criteria set forth by the Florida Department of Environmental Protection Regulation (FDER) and the United States Environmental Protection Agency (USEPA).

The existing system makes use of piggy-back stations; that is, gravity systems are pumped and discharged into another gravity system. This practice requires smaller pumps with lesser heads since the discharge is to atmosphere at the discharging manhole. Drawbacks to this approach are the overloading conditions that are created in the receiving collection system and pumping station, and the chance that infiltration problems could go unnoticed and, therefore, increase pumping costs.

It is recommended that all pumping stations be manifolded in order to provide a more efficient and energy conservative system.

5.3 Comparison of Water Purchase vs. Sewage Volume

The Florida International University, University Park Campus master pumping station flows are presently metered through a magnetic meter. The comparison of water purchase vs. sewage flow is based on the billing records provided by the university staff.

It should be pointed out that meter readouts give a total volume for a specific period and, therefore, cannot distinguish where the pump is working along the curve, that is, the high head/low flow condition or a low head/high flow condition.

To address the possible flow questions and to determine the working range of the pumps in accordance with the characteristics, analysis of the force main and pertinent head conditions at the connecting 36 inch diameter MDWASAD force main were conducted. The results indicate that if the pumps perform as shown by the manufacturer's curves, they should be capable of delivering the necessary flows at the rated heads

5.4 Infiltration

Due to the high water table conditions that generally exist in South Florida, most gravity sewer lines are subject to infiltration from groundwater sources. In order to control and minimize the effects of infiltration, maintenance programs such as line isolation, flow measuring and line TV examination should be periodically conducted.

It is recommended that the existing gravity systems on the University Park Campus be inspected and evaluated for infiltration by using the line TV examination method. This will assure the integrity of the gravity system or determine the extent of repairs necessary.

16 MONTH AVERAGE

Month	Water	Sewer
October 86	3,538,040	3,479,700
September 86	3,434,816	3.038,700
August 86	2,758,580	3,139,000
July 86	2,366,672	3,881,700
June 86	2,544,696	2,382,600
May 86	4,440,128	2,785,900
April 86	3,144,592	3,015,100
March 86	3,745,984	2,717,900
February 86	3,714,568	2,376,400
January 86	1,455,324	2,706,500
December 85	2,485,888	2,709,400
November 85	3,498,360	3,241,200
October 85	3,107,940	3,535,500
September 85	2,583,592	2,692,900
August 85	2,939,640	3,094,938
July 85	2,858,108	2,858,108
	48,616,928	75,509,996
AMF	3,038,558 GP Mo.	4,719,375 GP Mo.
ADF	151,928 GPD	235,969 GPD
Peak Hr.	475 GPM	737 GPM

Sewer = 1.55% of water

LAST 3 MONTH AVERAGE

Month	Water	Sewer
October 86	3,538,040	3,479,700
September 86	3,434,816	3,038,700
August 86	2,758,580	3,139,000
	9,731,436	9,657,400
Average	3,243,812	3,219,133
ADF	162,191 GPD	160,957 GPD
Peak Hr.	506 GPM	502 GPM

Sewer = .99% of water

5.5 Future Connections

The present gravity system can be extended to provide for service to a portion of the anticipated development. Other portions of the future requirements will require lift stations that will deliver the sewage by manifolding to the existing force mains. (See Figures XIA thru XID) Based on the campus development information provided to the engineer, three master pumping stations and two lift stations together with approximately 7,300 feet of force main will be required. About 8,300 feet of gravity main extension to the existing system will provide for the balance of the proposed campus development, as per the aforementioned provided information.

5.6 Engineering and Applied Science Building

Sewer service to the Engineering and Applied Science Building can be provided by the existing gravity sewer main approximately 50 feet north of the Viertes Haus building. The service connection can be either by core drilling into one of the existing manholes or by a built-in-place manhole on the 12 inch diameter gravity main depending upon the final building location and plumbing arrangements. (See Figure XII.)

5.7 Present-Year 2000 Estimated Average Daily Demand

Previously discussed projections for water consumption based upon industry accepted statistical values and corrected by the percentage factor of actual consumption vs. statistical use from present records showed an estimated average daily consumption in the year 2000 of 350,000 GPD. This water consumption projection when corrected by 1.55% factor as shown in the 16 month average table shows that sewage flow figures for the year 2000 will be 542,500 GPD.

5.8 Meter Installation

Metering of sewage flows is usually done for the purpose of charging for treatment or determining plant flows. New technology has made it possible to utilize ultrasonic flow meters and recording instruments which allows better management of the maintenance and repair of the water and sewer system since a very valuable tool, that is, the comparison of water purchase versus sewage volume, can be used. The value of this comparison is that leaky plumbing, infiltration, and system overload can be diagnosed.

It is recommended that an ultrasonic flow meter be installed in the discharge side of the master sewage pumping station or that the present magnetic meter be upgraded to include remote reading, instantaneous flow readouts and totalizer with record graph.

Ultrasonic meter offers accuracy, reliability, instantaneous and totalizing readouts, have no moving parts, are not plagued by buildups and fouling, and, in short, are ideal for sewage metering.

The meter works by measuring the speed of sound in the upstream and downstream directions of the flow. The resulting difference is proportional to the flow rate.

The meter assembly consists of two transducer assemblies with their mounting bases, a transmitter, and cables for connecting all of the above. Direct readout liquid crystal display for flow rate and attenuator at the transmitter NEMA enclosure or remote location, as well as chart recorders and remote flow totalizers can be specified.

5.9 Pumping Station Rehabilitation

It is recommended that the station wet well be drained and inspected for concrete deterioration every year. This could be done during the times when classes are not held such as winter or spring break. Planned complete rehabilitation of the wet well and dry well structure in general should be done on regular five year intervals. This prevents the corrosive action of hydrogen sulfide from deteriorating the concrete work beyond repair by usual methods such as epoxy and coal-tar epoxy coatings.

We are very pleased to know that the central pumping station has been updated and repaired since our initial visit to the campus when we found the pumping station to be in poor condition. The controls have been upgraded, the pumps have been rehabilitated, the station has been painted and the station comminutor has been repaired. A second comminutor is being installed and piping of the discharge manifold has been changed and seal water system has been installed. In addition the generator has been reconditioned to handle the load of the two pumps and other station motors. The Preventive Maintenance Department, under Mr. H. Danker, has done an out-standing job with the repairs of the station.

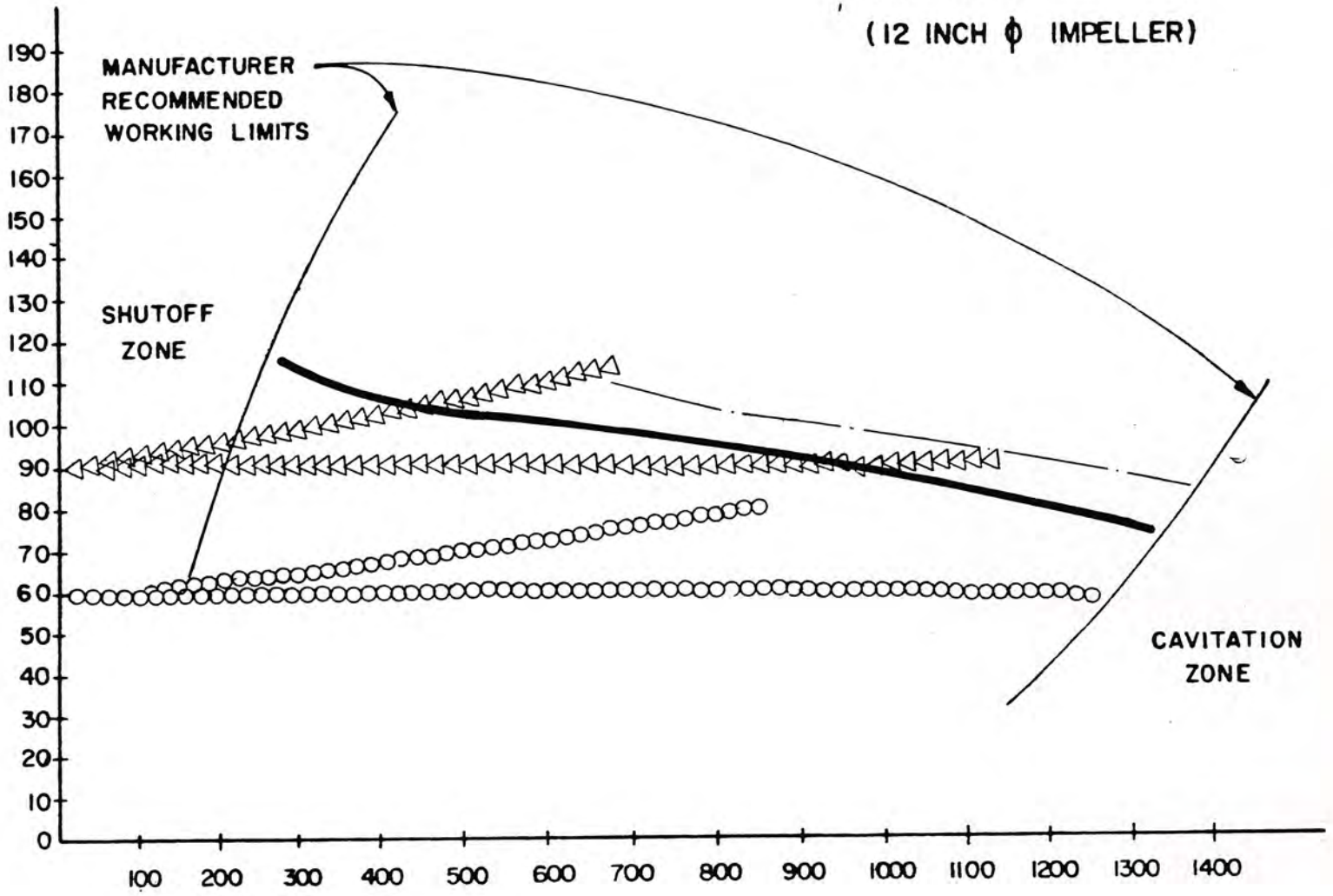
Although repairs have been made, it should be noted that all three pumps cannot operate at one time. The station does not have sufficient amperage to support this. Only two pumps can run at the same time. The Student Housing station, the Arena Station and the West Campus station should be manifolded into the force main, therefore, providing more capacity to the central pumping station to accept all of the flows from the Central Campus future buildings, the Engineering Building and the Physical Science Building as called for in the TAC/SDM Master Plan.

5.10 Supporting Information

Flow analysis using a Hazen Williams coefficient of 100 for the 2200 ft. 10 inch diameter force main diagonally traversing the campus to the northwest corner and connecting to the MDWASAD 36 inch diameter force main are included herein.

The pumps are Aurora 4 x 5 x 12 models 612, the set one speed curves for the 1750 RPM and 1150 RPM are found on page 404 of the 1967 Aurora catalog. The 1750 RPM 12 inch diameter impeller curve was modified to a 1550 RPM in order to produce the needed analysis. This was accomplished by taking the name plate data and using the affinity laws to compensate for the variations in the head and flow based upon the speed (RPM). The design point of the name plate states a flow of 550 gpm at 100 ft. TDH in the 1750 RPM curve with a 12 inch diameter impeller.

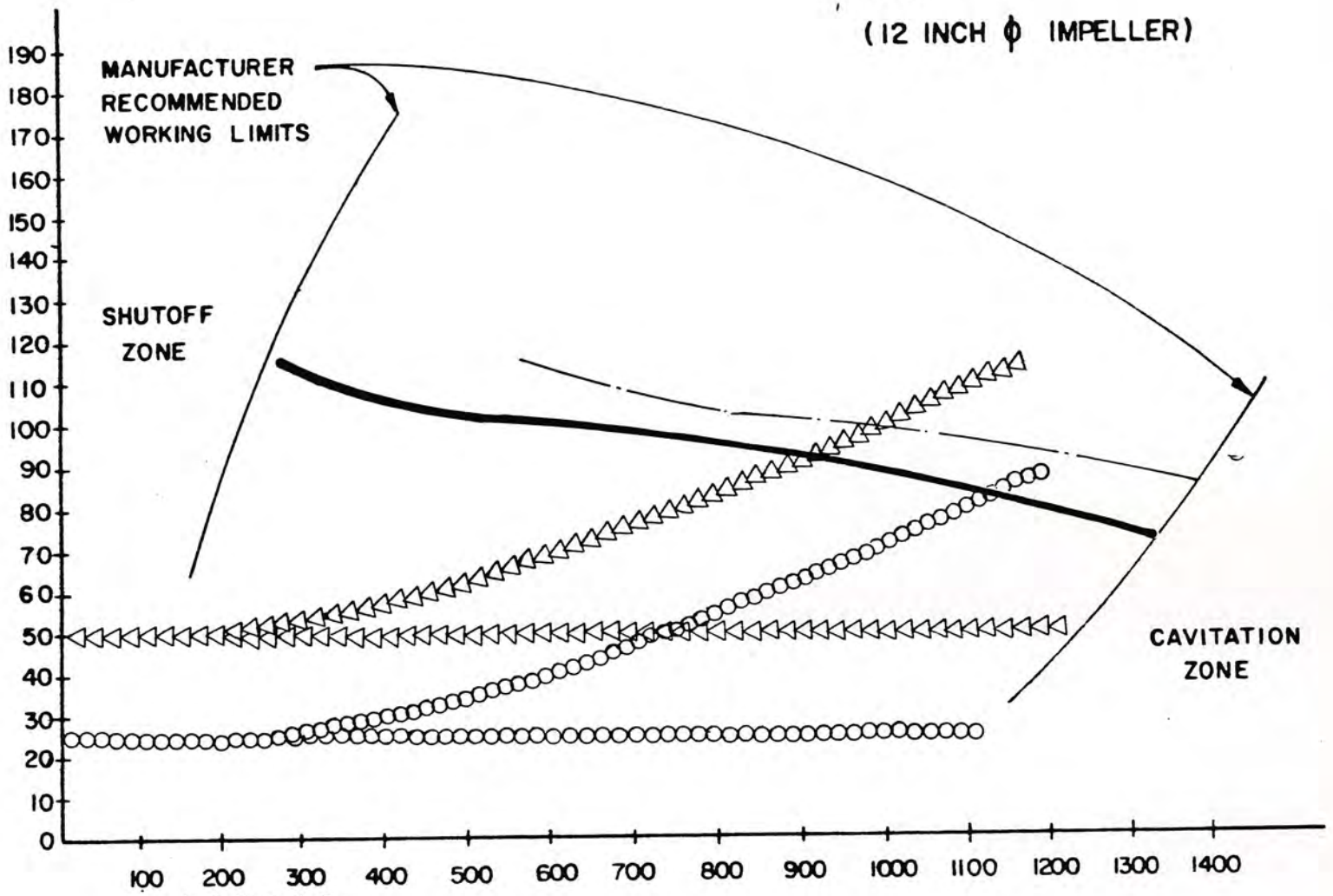
Based upon the analysis conducted it can be seen that prior to the opening of the MDWASAD Black Creek Plant, force main pressures in the range of 20 to 40 psi existing thus limiting the volume and making the pumps work close to shut off head. Since the Black Creek Plant opening and the force main flow reversal, the pressures on the MDWASAD 36 inch diameter force main dropped to the 5 to 15 psi range making the pumps work close to the manufacturer's recommended working limit end of the curve and possibly causing cavitation.



L E G E N D

SYMBOL	DENOTES
——·——	2nd PUMP IN PARALLEL
◁	STATIC 20', PRESSURE 35psi & FRICTION
○	STATIC 20', PRESSURE 20psi & FRICTION

SYSTEM CURVES BASED ON 1983-1984 FORCE MAIN PRESSURES.



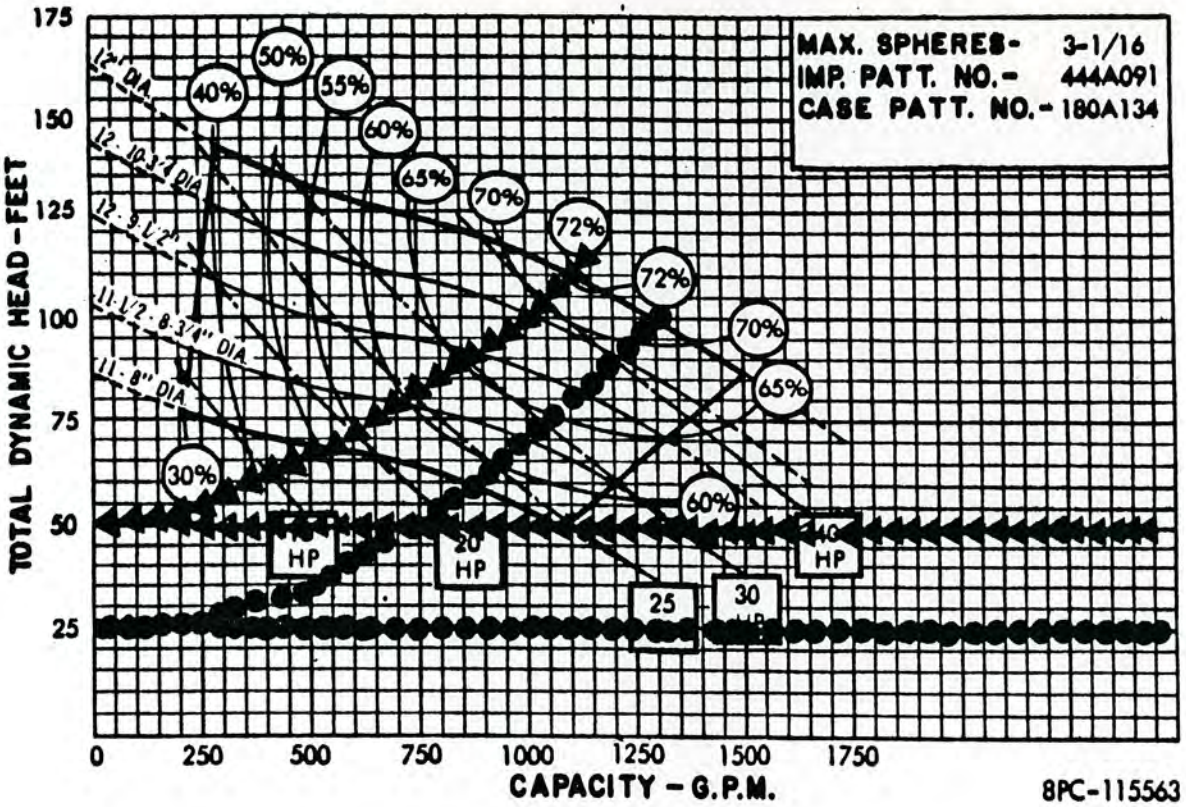
LEGEND

SYMBOL	DENOTES
—·—	2nd PUMP IN PARALLEL
◁	STATIC 15', PRESSURE 15psi & FRICTION
○	STATIC 15', PRESSURE 5psi & FRICTION

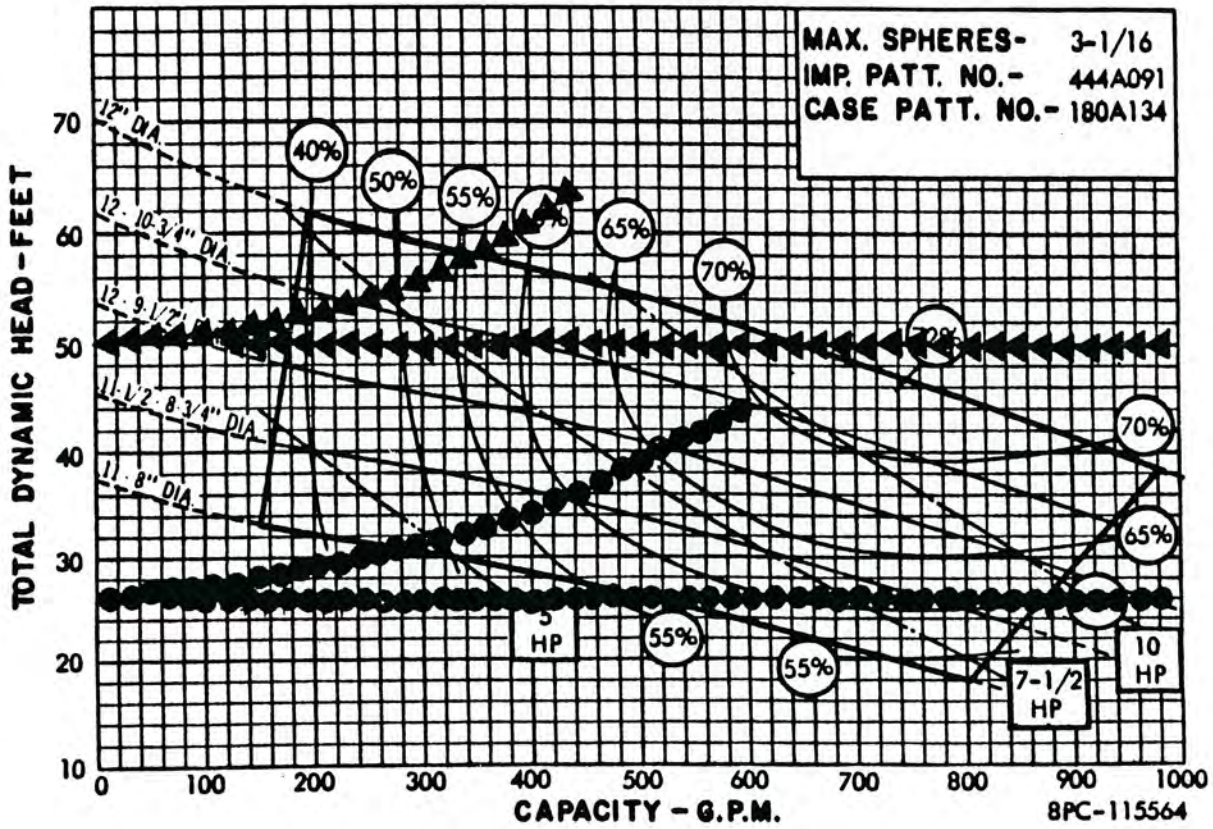
SYSTEM CURVES BASED ON PRESENT FORCE MAIN PRESSURES.

4 x 5 x 12 SPHER-FLO
ENCLOSED IMPELLER

1750 R.P.M.



1150 R.P.M.



5.11 Summary

The sewage collection system serving the main section of the Florida International University, University Park Campus is adequate for present needs. The practice of piggy-back discharging should be discontinued and future extensions to service the planned buildings should follow a master planning approach in accordance with the recommendations described herein above.

6.0 ROADS AND DRAINAGE

6.1 Flood Criteria

Flood criteria for the Florida International University, University Park Campus area is set at elevation +7. (See Flood Criteria Map, Figure XIII.) The flood criterion is the minimum prescribed ground level based on an estimate of the highest water level expected to occur once in 10 years.

Resolution No. 4120 of October 27, 1959 established Flood Criteria Elevations. Maps showing elevations currently required are filed in the Public Records of Dade County and are part of the Dade County Public Works Manual. These are minimum allowable elevations for crowns of streets and for land surface as required by Chapter 28 of the Metropolitan Dade County Code. These elevations are subject to continual review and are revised as drainage improvements become effective. Reasonable protection from flood damage will result only from proper combinations of filling, grading, and installation of drainage facilities.

6.2 Grading

Flood Criteria Elevations noted above establish minimum elevations for land to be developed. Land filled to such elevations must be carefully graded and shaped. Slopes must trend away from structures or areas to be protected, and the area must be properly graded to direct surface runoff into the drainage system. Future roads and parking facilities at the University Park Campus should conform to Section C 3 of the Dade County Public Works Manual requirements.

6.3 Existing and Future Drainage Systems

Disposal systems are termed positive drainage systems or seepage systems. Positive systems include canals and storm sewers that drain through a continuous outfall to the bay or ocean; whereas seepage systems drain into the ground water, and may consist in part of basins and pipe systems which dead end at lakes. Until such lakes are connected to a continuous outfall to the bay, they are not considered as positive drainage systems. The acceptability of seepage trenches depends considerably on runoff, hydraulic head, size

and number of seepage drains, and transmissivity of the subsurface which is to receive storm water. Design must be supported by date from special tests made to determine seepage characteristics, one such acceptable test being the USGS-PWD Slug Test developed by the U.S. Geological Survey and the Metro Dade County Public Works Department or the trench test. Other tests are listed in Manual IV of the South Florida Water Management District.

The exfiltration method (seepage system) most commonly used in Dade County consists of French drains or exfiltration trenches which work by allowing the water to be collected in a catch basin and then passing it through a trench which allows a lateral movement of the water through the walls. This can be a very efficient system in Dade County because of the permeability and transmissibility of the aquifer. (The Biscayne Aquifer is composed mainly of very porous limestone.) A method that was commonly used when the campus was first constructed was positive drainage to the land locked lakes. The system consists of a series of catch basins collecting the storm runoff and then conveying the runoff in an enclosed pipe in an open channel flow fashion down to a low point of discharge. The low point of discharge is usually located at or below the water level in one of the land locked lakes or canals. This type of drainage system is not encouraged due to the fact that a lot of pollutants and many nutrients do go in with the first flush of water into the lakes or canals. Therefore, the nutrification process is accelerated in the lakes and canals.

Presently the several lakes receive runoff from the parking lots and from the green areas either via the catch basins and drainage pipes or by overland flow. The system can be adapted to receive the overflow of seepage facilities and perform a better function in the Campus Storm Water Management.

A properly managed system with a combination of exfiltration trenches to provide good detention of the first flush and then a system of lakes to take care of the overflow of the extra runoff being taken in by the catch basins on campus should be able to provide the best possible drainage for the Florida International University, University Park Campus. The lakes act as retention basins, and in the event of a major flood, at least one lake should be provided with the proper pumpage to discharge into the Snapper Creek Canal (SW 117 Avenue canal) which in turn will discharge directly into the bay past the salinity structures or backpumped into the conservation areas.

6.4 Storm Frequency and Disposal

Selection of design frequency consideration is to be given to future conditions, and to the design frequency used for other facilities within the same system. "Frequency" as used herein refers to rainfall frequency or to storm frequency and not to flood frequency unless specifically stated. The design frequency to be used will depend on a balance between cost of a drainage facility and

the damage it will prevent. After preliminary selection of drainage facility sizes, evaluation should be made of the damage that would be caused by flooding resulting from more intense, and less intense, storms.

For the Florida International University, University Park Campus, the frequency selected should be the 10 year frequency and the storm disposal system sized by using the rational formula Q = Cia or the Soil Conservation Service Mockus' equation.

Future exfiltration systems should be designed in accordance with the South Florida Water Management District regulatory criteria as per the South Florida Water Management District Manual IV or Metro Dade County's Public Works Manual Section D4.

6.5 Roads

The Florida International University, University Park Campus has several access roads. Housing has access from SW 107 Avenue and ample parking. Access to the campus has been barricaded with large boulders and large timbers possibly to discourage students living on campus from bringing their cars into the overcrowded commuter parking lots.

The campus itself has a main entrance on SW 107 Avenue which continues west and allows for a circular, smooth flowing traffic pattern to all points of the campus. The existing road that encircles the southern portion of the campus does connect with another entrance-exit into the Tamiami Trail. It also connects with some of the old Tamiami Airport runways behind the "old tower" to another main road that leaves the campus on the west side on SW 117 Avenue. (See Figure XIV.)

A system of roads should be master planned at this time by following the path of the proposed campus development and recommended water and sewer line extension. A complete loop road or circle of the campus should be established to provide convenient access and facilitate a smooth traffic flow to the future buildings according to the development building master plan. Water and sewer force mains will be located along this road which will also serve as a utility corridor.

Included in the road program, there should be a straight connecting road from SW 112 Street (north-south entrance road from the Tamiami Trail) to the Athletic Building for easy access for those members of the community and campus population that will attend special events.

6.6. Summary

The existing connections to the major thoroughfares are satisfactory at this time. However, as the campus grows, a larger and wider entrance road at the Tamiami Trail and the connecting road between the west side of the campus and the east side should be provided. Buildings, such as the Athletic Building, which will draw alumni and other community members in addition to students, faculty and staff, for special activities and events should be easily accessible from one of the aforementioned entrances. An effort to provide passenger dropoff, valet parking and convenient self-parking should be made and stressed as a promotional item for the events. As previously discussed, a system of roads should be master planned at this time which will also serve as a utility corridor.

Present drainage facilities are adequate but should be modified and improved in accordance with proper storm disposal management practices as campus growth proceeds.

7.0 CHILLED WATER SUPPLY AND DISTRIBUTION SYSTEM

7.1 General Description

Six of the seven major buildings completed in this campus are served with chilled water for air conditioning from a central utility plant. The seventh building, Athletic Facility/Gym, due to its remoteness within the campus and operational nature has its own source of chilled water service. The Owa-Ehan building even though connected to the network has a stand alone chiller. This unit provides service during central utility plant stand down hours. Several areas within this building require continuous air conditioning to satisfy environmental demands such as experiments in progress.

Chilled water supply and return is carried to the buildings via an underground piping loop extending north and east; south and east from central utility plant. (See Figure XV).

7.2 Central Utility Plant Present Conditions

The Chiller Plant in its present configuration was completed during the mid nineteen seventies. It consists of a total of three chillers in a combination series-parallel array. Chillers number 1 and 2 in a series configuration have an individual capacity of 666 tons (Unit #1) and 723 tons (Unit #2) for a combined capacity at full load of approximately 1389 tons of refrigeration. A third chiller (Unit #3) with a present capacity of 1193 tons is positioned in parallel with the units in series.

The campus chilled water load up to the present has been handled mainly by the series chillers. The load configuration has been such that for the average load only one of the series machines has been sufficient. A study commissioned by the university showed a maximum recorded load of 888 tons with an average requirement of approximately 600 tons of refrigeration produced at the plant. This data did not include the Owa-Ehan Building which at the time of the study, was running its own chiller. This arrangement for chilled water at the Owa Ehan Building has been considered for regular supply to the building after an unusually high temperature drop was detected between the Central Plant and the Owa Ehan Building.

The efficiency of all the three existing chillers is not close to optimum standards; basically due to improvements in the state of the art and normal wear. In this light, the University is about to commission a retrofit project on chiller number 3. This machine exhibits the least wear for it has been sparingly used. The retrofit process will improve the machine efficiency by more than twenty percent above the nominal performance (Original Rating) and considerably more than the actual condition. It will receive new motor/compressor plus refurbished heat exchangers. The process is done at the expense of a reduction in total capacity. The retrofitted unit will have 915 tons of refrigeration at full load. The capacity decrease improves the efficiency by allowing expanded condensing capabilities. Given the present and ever escalating energy costs the loss in capacity is recuperated through dramatic operational savings. Since the plant chiller arrangement, is predicated on a planned redundancy the capacity lost comes from the reserve.

Under the present configuration (with retrofitted unit #3) the plant has a total capacity of approximately 2304 tons. The maximum total recorded load was 888 tons. Adding the Owa Ehan requirements (over 200 tons) the total becomes approximately 1100 tons of refrigeration. A projected load for the School of Engineering is approximately 300 tons of refrigeration. Including this to the present requirement would result in a total of 1388 tons at peak conditions. The total campus average requirement including Engineering Building Phase I would be 900 tons.

Therefore we conclude, that the plant at present (and with retrofit project in place) has the capability to absorb the School of Engineering Phase I and still maintain almost 100% stand by capability at peak load requirements.

The other main components of the plant consist of both chilled and condenser water pumps and an array of cooling towers connected by a common sump. Due to present day energy realities and normal wear/tear; these components have fallen outside an efficient configuration tailored to the campus chilled water demands. In order to guarantee energy consumption optimization at the plant and follow through the initial benefits of the chiller #3 retrofit the following steps will be addressed to coincide with the new Physical Science Building completion.

(a) Refurbishment of chiller #1 and #2.
(b) New chilled water pumps and refurbishment of condenser water pumps.
(c) Energy management system for Central Utility Plant to optimize chiller and auxiliary component operation.
(d) Modification of pipe supports, addition of sensors, flow measuring devices, etc. to operate with energy management system.

7.3 Plant Future Requirements

The construction of the Physical Science Building and subsequent campus expansion will require an expansion of the Chilled Water Plant capacity. The projected maximum chilled water consumption up to the year 2000 is approximately 2100 tons of refrigeration. Following is a summary of present and future requirements.

A. Approximate present building net square footage served from central chilled water plant..... 369140 Ft^2

B. Owa Ehan Building square footage ..... 52296 Ft^2
(Bldg. operating on independent chiller at present, during chiller plant stand down hours)

C. Approximate projected New building net square footage to be served from central chilled water plant (up to year 2000).. 450872 Ft^2

D. Maximum recorded tonnage used by buildings in Item (A) ..... 888.4 tons

E. Average square footage per ton of refrigeration at present Item (A)/Item (D) 415.51 Ft2/Ton

F. Present chilled water plant capacity ..... 2582 tons

G. Projected chilled water usage on year 2000.
[¼ Item (C) + Item (B) ½/ Item (E)] + Item (D) 2100 Tons

H. Owa Ehan chiller capacity ..... 186 Tons
(operating independently at present) recommend tying this unit into existing campus piping loop as backup and to provide first step of chilled water service to buildings requiring air conditioning during chiller plant stand down hours.

I. Retrofitting large chiller at central plant for increased efficiency with small reduction in capacity
Total tonnage resulting (for this unit) ..... 900 Tons

J. Total tonnage available after completion of modification in Item (I) (See attached data) 666 t + 723 T + 900 T + 186 T ..... 2475 Tons

K. Reserve capacity projected to year 2000 Item (J) - Item (G) ..... 375 Tons

This reserve capacity is insufficient both in terms of tonnage availability and in terms of quantity of machines. We therefore recommend that an increase of between 800 to 1000 tons be incorporated to the plant. The increase could be broken into two machines or perhaps two systems.

The reference to a second system is based on a strong indication that the local utility will offer strong monetary incentives for new installation of thermal storage systems. (See amplified discussion under the Electrical Distribution section).

7.4 Chilled Water Distribution Loop Present Condition

The existing loop extends north and south from utility plant. The north leg turns east toward the Owa Ehan Building. The south leg has several branches serving the Library/Auditorium (AT Bldg.) and the University House (UH Bldg.). Last leg goes to Primera Casa (PC Bldg.) (See Figure XV.)

The leg heading west-east to Owa Ehan Building presently exhibits a large temperature rise between the plant and the building. This problem is primarily due to insulation failure. An excavation of the piping leg produced evidence of the exiting insulation. This insulation is "UpJohn" Poly-urethane with a "Johns Manville" asbestos fiber reinforced asphalt jacket.It is from this leg that the new Engineering Building will be fed.

7.5 Distribution Loop Modification and Future Extensions

We recommend unearthing the piping leg (approx. 670 lineal feet) removing existing insulation with appropriate safeguards for the ASBESTOS presence and installing new cellular (Foamglass) insulation with jacket of Bituminous resin reinforced with woven glass fiber. and isolating valves for the future Engineering Building. Economic consideration might dictate abandoning the existing pipe and replacing it by a new pipe running parallel to the existing one. We also, strongly recommend, introducing a manhole to house taps with blind flanges and isolating valves for future Engineering Building. The location of the manhole to be accurately established by chilled water service point of entry to Engineering Building.

Another manhole to be introduced at the end of the leg to house the existing tap to the Owa Ehan Building and blind flanges with isolating valves for future loop extension to the Physical Science Building and future structures on the eastern side of existing building core. The chilled water loop should be extended north-south on the eastern corridor to closed and form a true loop which could be fed from either side lending flexibility and balance to the whole installation. (See Figure XVI.)

All work related to the refurbishment of the (west-east) leg and two (2) new manholes will be done to coincide with the Engineering Building.

7.6 Building Chilled Water System/Loop Interface

The existing buildings were designed for a primary/secondary pumping arrangement. At present, in the interest of energy conservation, the secondary pumps housed in each of the buildings are shut down. The campus uses the primary pumps at the Central Utility to effect the chilled water distribution right up to the air handlers. This approach has been somewhat successful since the primary pumps had excess capacity. Upon refurbishment of the equipment at the Central Plant, as discussed previously, the primary pumps should be downsized to handle circulation through the loop only. The existing secondary pumps will then be activated without augmenting the overall energy consumption. The utility plant will operate on a constant chilled water supply temperature of 44 degree F. Return water temperature will be allowed to swing since the chiller arrangement does not lend itself to variable pumping. All existing air handling units except one, have three way valves at the chilled water coils.

Therefore all existing buildings will reuse the present primary/secondary interface. This interface is somewhat different for each buildings. In some cases, such as at University House, The secondary pumping is an inline booster type arrangement. The piping/valving arrangements will be modified to a three way modulating valve mixing primary water from the loop with return water from building system. The valve is controlled by temperature sensor on the secondary pump discharge. The retrofit work will be included under the central plant Refurbishment/Expansion contract

All new buildings will have a primary/secondary system also. Secondary pumps will draw primary water from the loop and circulate it through the air handling coils. All air handlers except the last in the network will be equipped with two way valves. The last unit will have a three way valve. At the discretion of the particular design engineer for each building this arrangement may be substituted by a pipe bypass at the end of the secondary distribution network. In this case the bypass should have a pressure compensating valve. This system for new buildings will allow water flows to be varied according to load configuration.

Chiller plant energy management will monitor temperatures from buildings as well as loop pressures to select optimum combination of chillers to satisfy campus requirements.

7.7 Summary

The chilled water system upgrade has a threefold objective. They are: capacity expansion, improved energy efficiency, and flexibility. To achieve it the existing plant will be increased by augmenting the number of chilling units and auxilliary equipment. It will also receive new monitoring and optimizing controls. This work is coinciding with phase I of The Master Plan.

The existing piping loop will be partly refurbished and extended to serve the entire building core with all the expansions. The loop will be closed thus allowing feed from both sides for reliability. The link between primary/secondary loops at the existing buildings will be refurbished to accomplish a standard operating mode. This arrangement is extensive to all new buildings. The work on the chilled water loop and the interface retrofit will coincide with the projects in phase I of The Master Plan.

8.0 ELECTRICAL DISTRIBUTION

8.1 Present Distribution Network

University Park Campus is presently serviced by two interlocked main feeders running north-south at 107 Ave. and at 117 Ave. Each of these feeders is connected to a separate substation. In this fashion the core campus may be fed from one or the other source, providing flexibility and backup capability should one service fail. West Campus is serviced by feeder at 117 Ave. only.

Under the present configuration the system has enough capacity to absorb the Engineering and Physical Science Buildings. An existing manhole (MH-1100 SW 105) strategically located north of the Owa Ehan Building has the provisions to service the Engineering Building to the west and the Physical Science Building to the east.

There is also another manhole (MH-1140 SW 115) with service available located south of the proposed site for the Engineering Building. This provides an alternative location for servicing the building.

8.2 Future Provisions By Utility

As part of their expansion program the Local Utility will be expanding their service capability along the Tamiami Trail where it connects to the feeder running at 107 Ave. This projected expansion will accommodate the university building requirements up to the year 2000.

FIGURE XVIII Indicates the proposed expansion to the distribution network. To serve the new buildings as well as to looping the network for better reliability.

8.3 Rate Structure and Contemplated Revisions

Utility representatives have indicated that a substantial incentive program is about to be instituted for commercial customers introducing thermal storage systems which will help to shave peak demand. The maximum electrical demand per billing cycle as measured at the meter at fifteen or thirty minute intervals determining the rate at which kilowatt-hour consumption is charged.

An ice or chilled water storage system for example will allow the chillers to be supplemented to meet load requirements without exceeding a predetermined peak demand. Stored thermal energy may be produced overnight by a small chiller. At that hour most other equipment is shutdown and outdoor temperatures are cooler, therefore achieving better system efficiency. Another benefit of a thermal storage system is the readily available capacity to handle shock loads due to chiller malfunction, large assemblies of occupants, etc.

9.0 TELEPHONE AND COMMUNICATION DISTRIBUTION

9.1 Present Distribution Network

The Campus is served by a main feeder entering from 107 Ave (See Figure XIX). An existing network of underground cables, manholes, and pullboxes crisscrosses the campus. To serve the Engineering Building there are (3) three existing two inch conduits located between the Central Utility Buildings and Viertes Haus. This service needs extension of approximately 200 feet north by northeast from manhole (FIU-8) to connect with the building.

On the eastern side of the existing building core there is a manhole (FIU-1) located southeast of the Owa Ehan Building. These manholes tie (2) two existing four inch diameter conduits. Extensions from that manhole north will be adequate to feed the future Physical Science Building. Extensions east from this same manhole will feed future buildings contemplated in the eastern fringe of the existing building core.

9.2 Future Expansions

This same network of conduits and manholes being used to pass fiberoptic cables for a direct computer link to main equipment located in the Primera Casa Building. The new buildings that are in the design stage are also being connected to this network.

FIGURE XX depicts a proposed extension to the existing network to connect the new buildings.

10.0 STANDARD ENGINEERING DESIGN GUIDELINES

10.1 Energy Management

It is the intent of the University to acquire a complete energy management system. The system will serve all existing buildings indicated hereinafter through a retrofit process. All new buildings will be incorporated into the energy management network as they come on line. Compatibility will be insured using the same performance specification throughout. These specifications will be made available to all university consultants as part of the Engineering Design Guidelines for future buildings as well as existing buildings undergoing alterations and expansions.

The procedure to implement the energy management system will consist of a progressive operation as follows:

STEP I - Covers retrofit system for Primera Casa (PC Building). Performance Specifications, completed bid package in process of implementation.

STEP II - Bid package covering retrofit systems for Deuxieme Maison (DM Building) and telephone link for Step I, Step II, and Athletic Building (GYM) to central personal computer at location selected by the University. Stand alone system for Athletic Building (GYM) is existing. Implementation to follow completion of STEP I.

STEP III - Covers retrofit energy management system for Viertes House (VH Bldg.) (retrofit) and a system for the new Engineering Building. System will be specified in construction documents for these buildings.

STEP IV - Covers energy management system for new Physical Science Building, Central Utility Building (retrofit), and retrofit system for the Owa Ehan Building. System will be specified in construction documents for these buildings.

STEP V - Covers retrofit energy management system for University House and Athenaeum Buildings. System will be incorporated into construction documents for forthcoming alterations and expansions to these buildings.

Long range new buildings with significant enviromental systems will be equipped with energy management controls as indicated hereinafter. The system will consist of programmable stand alone (intelligent) panels at each building monitoring and operating mainly the HVAC systems. The Energy Management will have the ability to monitor life-safety and security functions as well as operating other utilities, such as lighting systems. Panels at each building, will be linked through dedicated telephone lines (modems) to a personal computer located at the Central Utility Building. Operators will have choice of resetting and monitoring each building, either at local panel or at the personal computer console. Access to panels from various manufacturers will be accomplished by substituting memory/program diskettes compatible to the particular system (building) being addressed.

10.2 Mechanical

A. HVAC

1. Design Criteria

a. Full compliance with the South Florida Building Code (Dade County Edition), city ordinances if applicable, and regulations from other agencies having jurisdiction. (Such as OSHA, EPA, DERM, ETC.)

b. Summer outdoor design conditions - ASHRAE - 1% col.
Winter outdoor design conditions - ASHRAE - 97% col.

c. Summer indoor design conditions
(1) Classrooms - 78 Deg. F - 50% R.H.
(2) Offices - 76 Deg. F - 50% R.H.
(3) Special rooms - per ASHRAE recommendations for specific functions

d. Toilet ventilation - Min 2 CFM/SQ.FT exhaust (No Air Conditioning)

e. System to use chilled water from Central Plants where available. Independent systems shall be considered only when plant supply is not within practical distance or for system requiring cooling at times when plant may be shutdown.

2. Equipment Selection.
   a. Air handling units
      (1) Coils - Maximum 6 Rows/8 Fins-inch
      (2) Whenever possible use various dedicated air handlers in lieu of large units serving extensive areas.
      (3) Maximum fan RPM - 1200 RPM. Stricter conditions to be considered for acoustically sensitive applications.
      (4) Maximum coil face velocity - 525 FPM
      (5) Variable volume system with inlet vanes or variable frequency drives to be furnished by air handling unit manufacturer.
      (6) Motors selected for expandable capacity. Capable of absorbing an increase of 300 RPM's maximum on fan speed.
      (7) Drives to be of the fixed sheave type mounted in an accessible location. Contract specifications to require the manufacturer to provide unit with an adjustable drive selected so design conditions are achieved at mid-point of adjustment range. Project contractor to replace adjustable drive with fixed one after Test and Balance Agency has indicated required RPM.

      (8) Coil Piping - as per enclosed Standard Detail.

   b. Pumps
      (1) Select pumps so there is no overload throughout entire performance curve.
      (2) Pump piping and valving as per enclosed Standard Detail.

   c. Primary/Secondary Pump Interface as per enclosed Detail.

10.3 <u>Electrical</u>

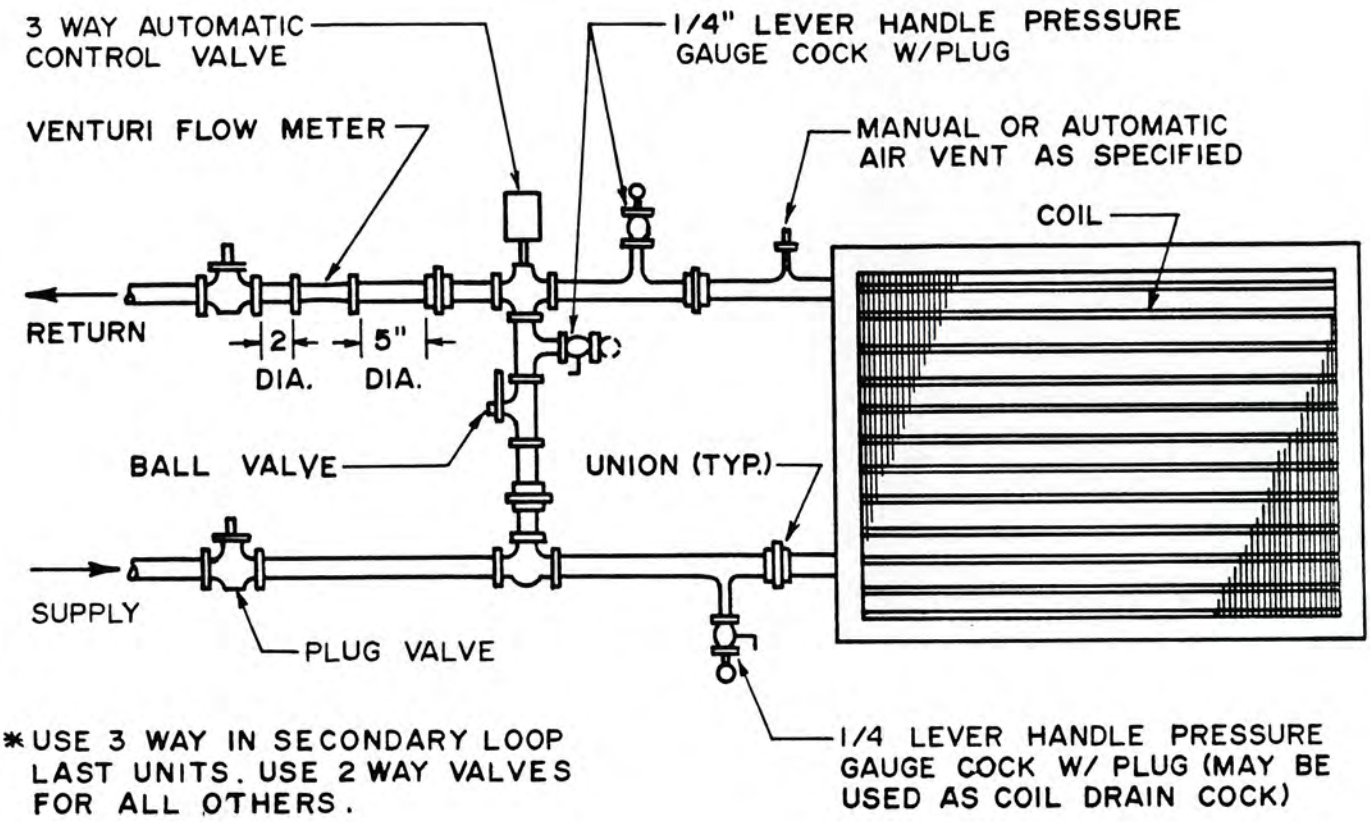
A. Basic design criteria:
   (1) Vault designed to local utility standards feeding switchgear at 277/480 volt 3 phase, four wire system.
   (2) Utilize 480 volt 3 phase to supply major motive equipment above 1/2 horsepower. Lighting systems served by 277 volts circuits. Using dry type transformers strategically located step down to 120/208 volts for receptacles and smaller loads (up to 1/2 HP 10cc)
   (3) All rooms shall have two levels of illumination accomplished by multiple switching.

(4) Fluorescent lamps and ballast to be of the energy efficient type.
(5) Exterior lighting to switch on progressively, and to switch on/off automatically.

10.4 Service and Accessibility

Engineering systems shall be designed for ease of service. Accessibility to components requiring periodical service shall be given careful consideration in the design process. The following shall be observed inasmuch as possible:

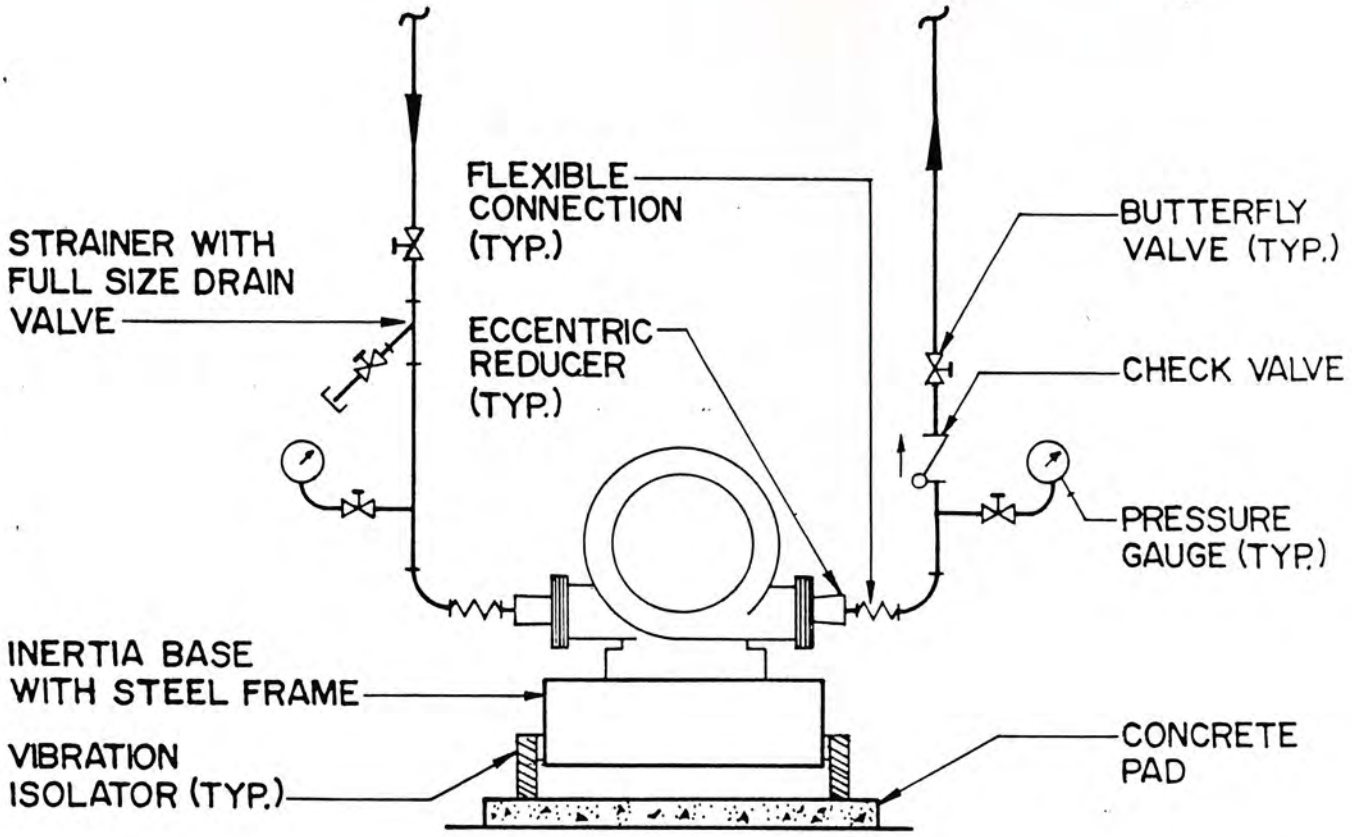
A. Air handling and pumping equipment mounted on floor slab not in suspended ceilings.
B. Plumbing, HVAC, Electrical and communication ducts, pipes, and conduits to run in corridor ceiling spaces as much as practicable. Consider use of distribution cabletrays for wiring.
C. Mechanical rooms electrical and telephone closets opening into corridors. Group building services equipment rooms together. Avoid penthouse mechanical equipment rooms.
D. Provide strategically located isolating valves for all piping systems, including gas, air and vacuum.
E. Use glass shock protected pipe traps for laboratory sinks receiving chemical wastes.
F. Coordinate ceiling types with equipment location to provide full accessibility to VAV boxes, controls, etc.



*USE 3 WAY IN SECONDARY LOOP LAST UNITS. USE 2 WAY VALVES FOR ALL OTHERS.

CHILLED WATER COIL CONN. DETAIL

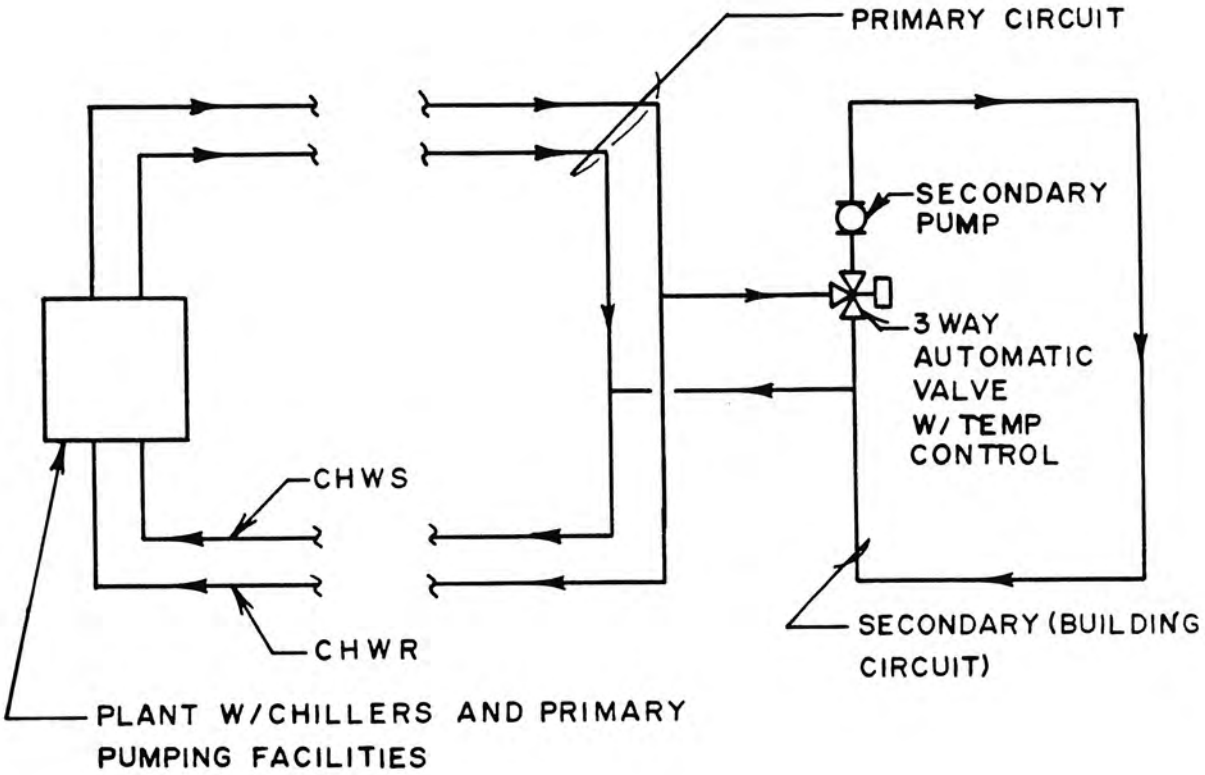
STANDARD DETAIL



PUMP CONNECTION DETAIL (HORIZONTAL SPLIT CASE TYPE)

CHILLED WATER SERVICE

STANDARD DETAIL



PRIMARY/SECONDARY LOOP INTERFACE DETAIL

STANDARD DETAIL

FIGURES

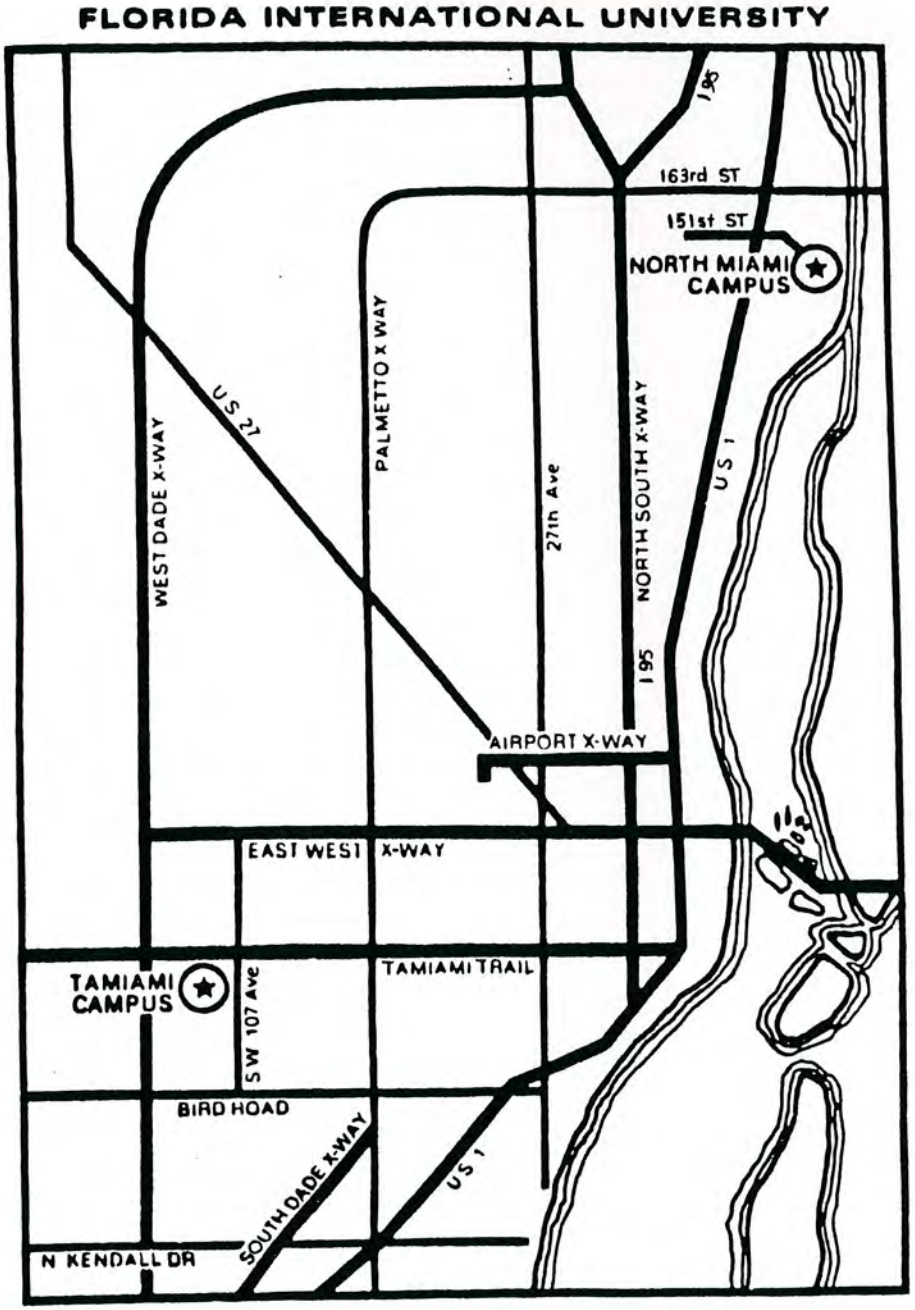


FIGURE I

FIU UNIVERSITY PARK

AREA MAP

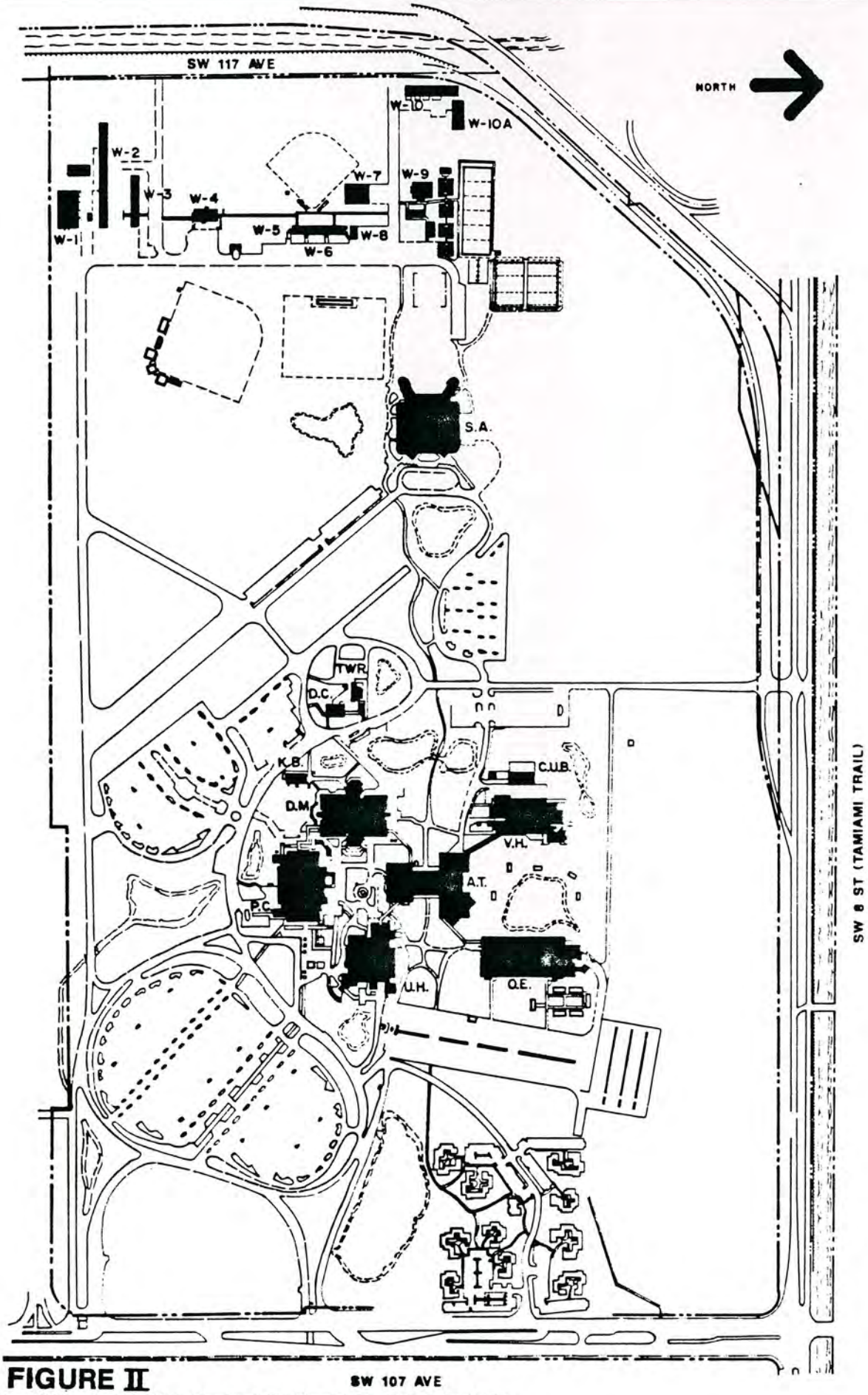


FIGURE II

FIU UNIVERSITY PARK

TAMIAMI CAMPUS SERVICE AREA - BOUNDARY

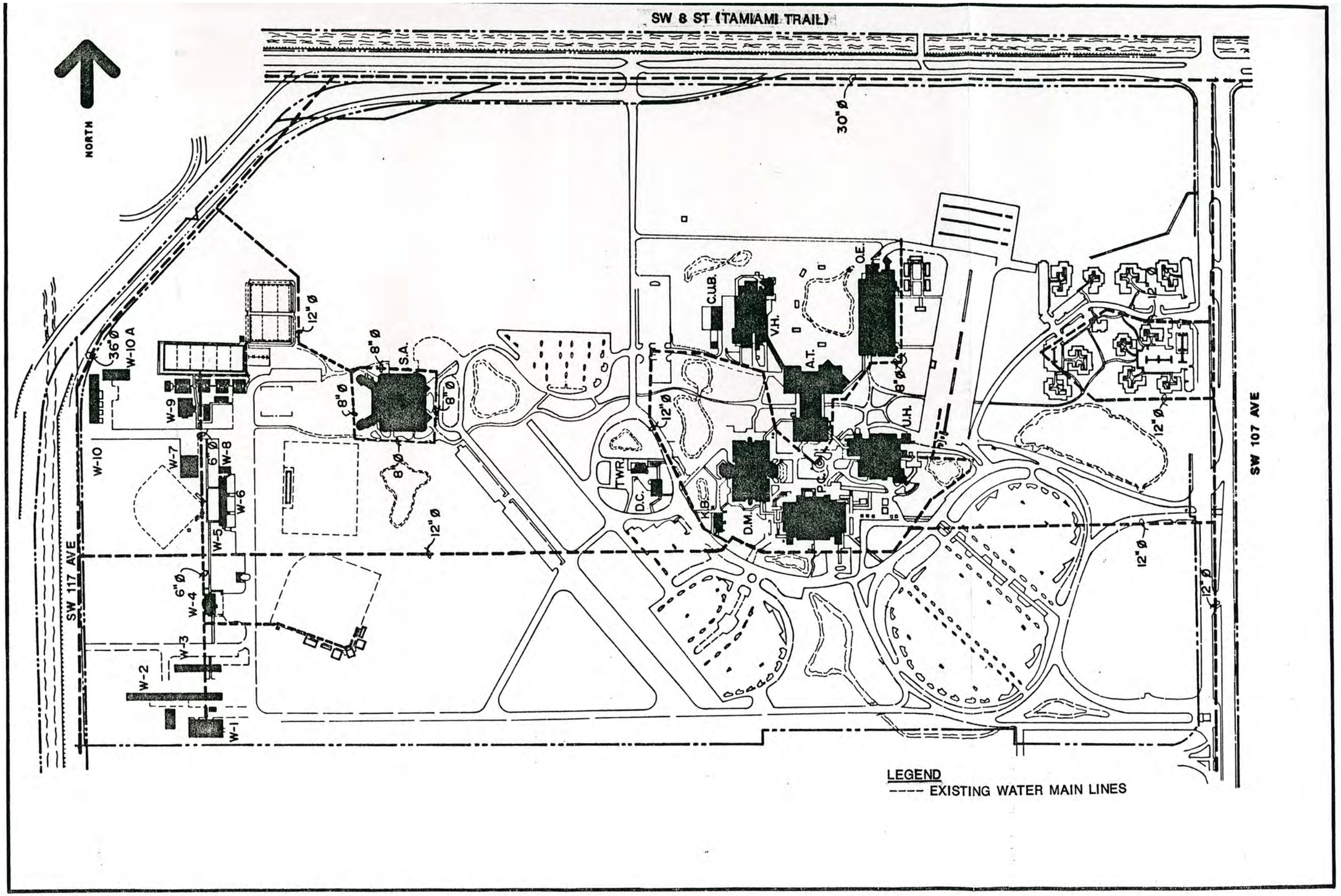


FIGURE III

FIU UNIVERSITY PARK

EXISTING WATER DISTRIBUTION SYSTEM

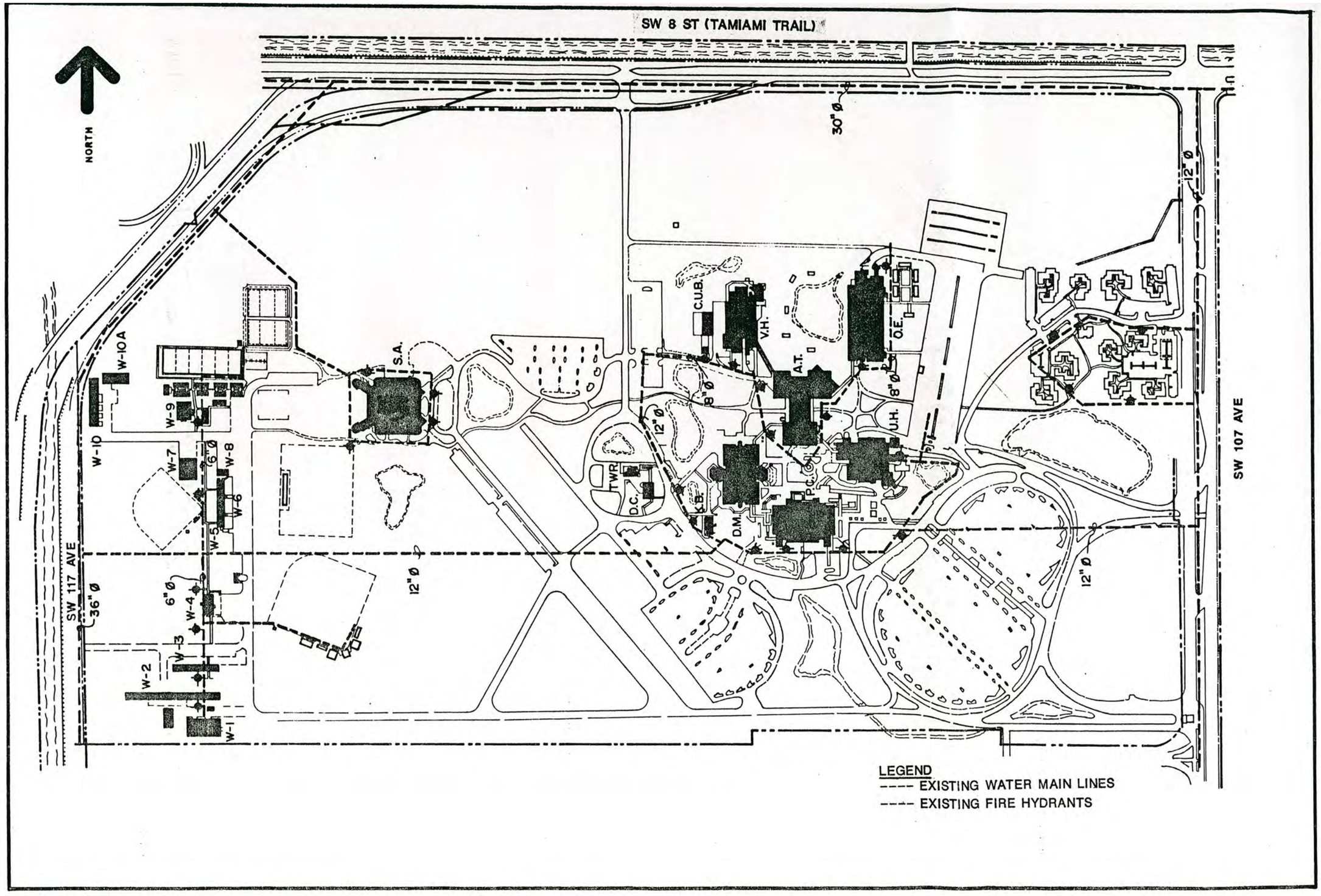


FIGURE IV

FIU UNIVERSITY PARK

EXISTING FIRE HYDRANTS

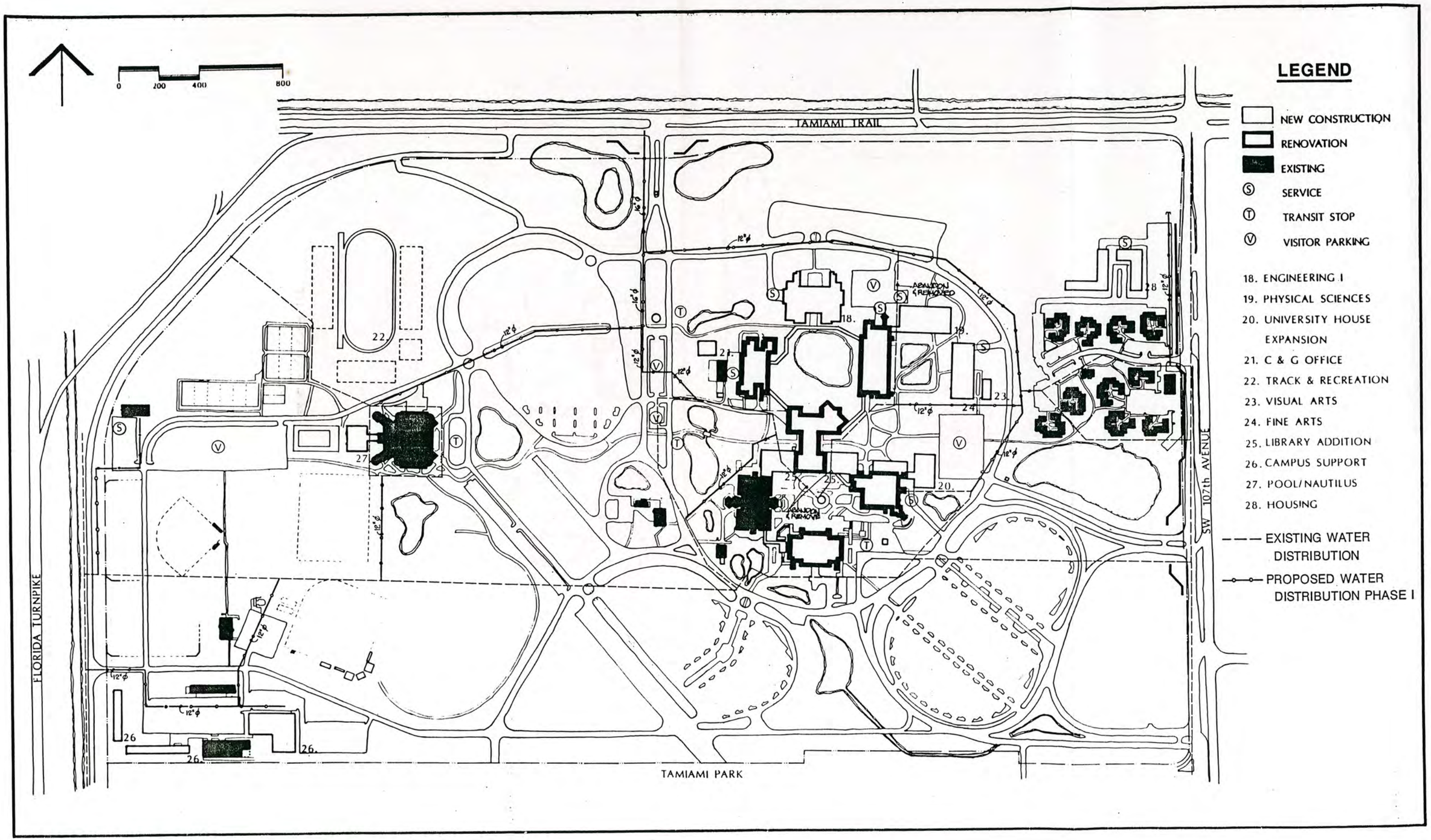


FIGURE V

FIU UNIVERSITY PARK

PROPOSED PRIORITY LOOPING PHASE I 1991 - WATER DISTRIBUTION

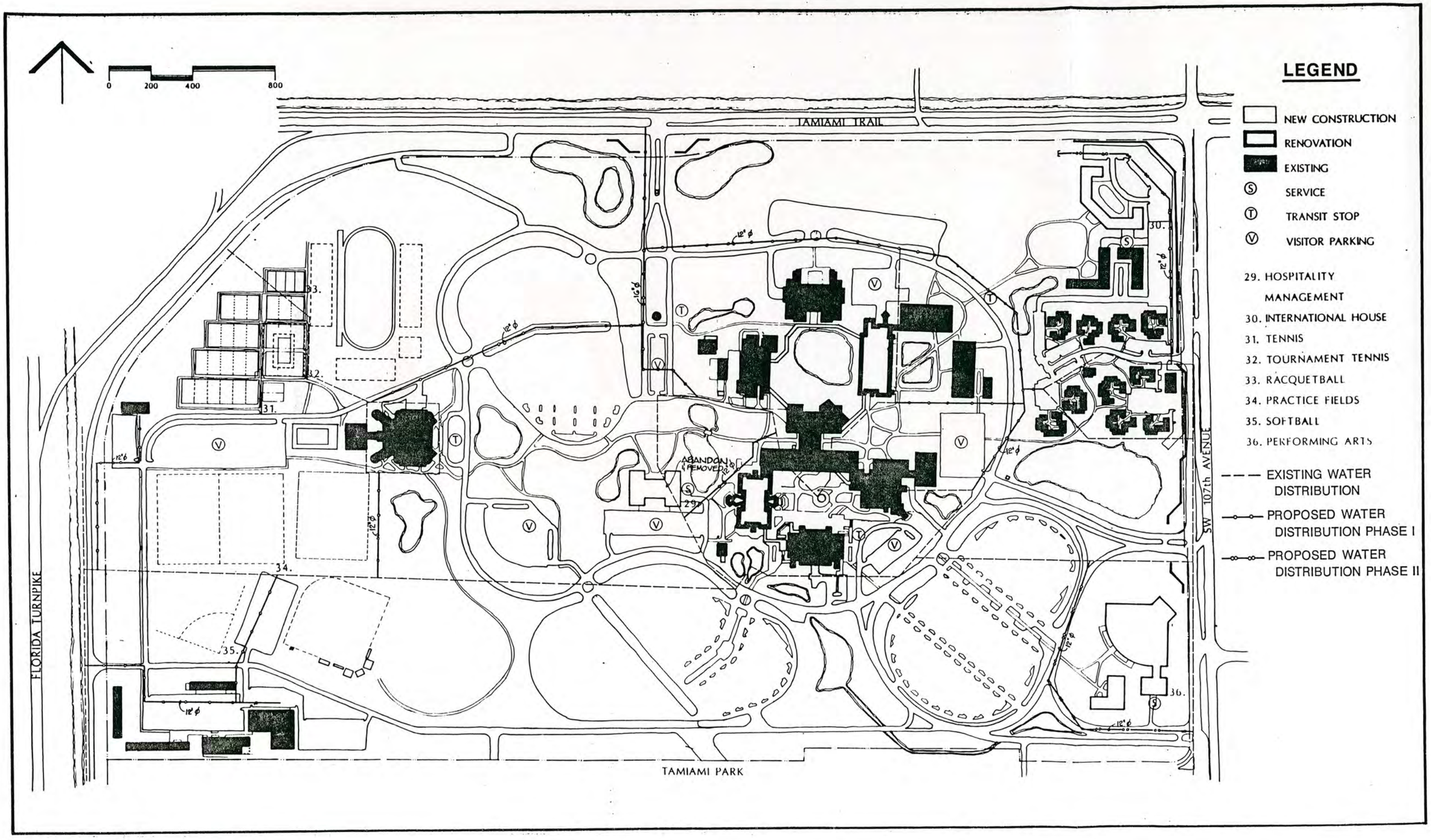


FIGURE VI A

FIU UNIVERSITY PARK

PROPOSED PHASE II IMPROVEMENT 1996 - WATER DISTRIBUTION

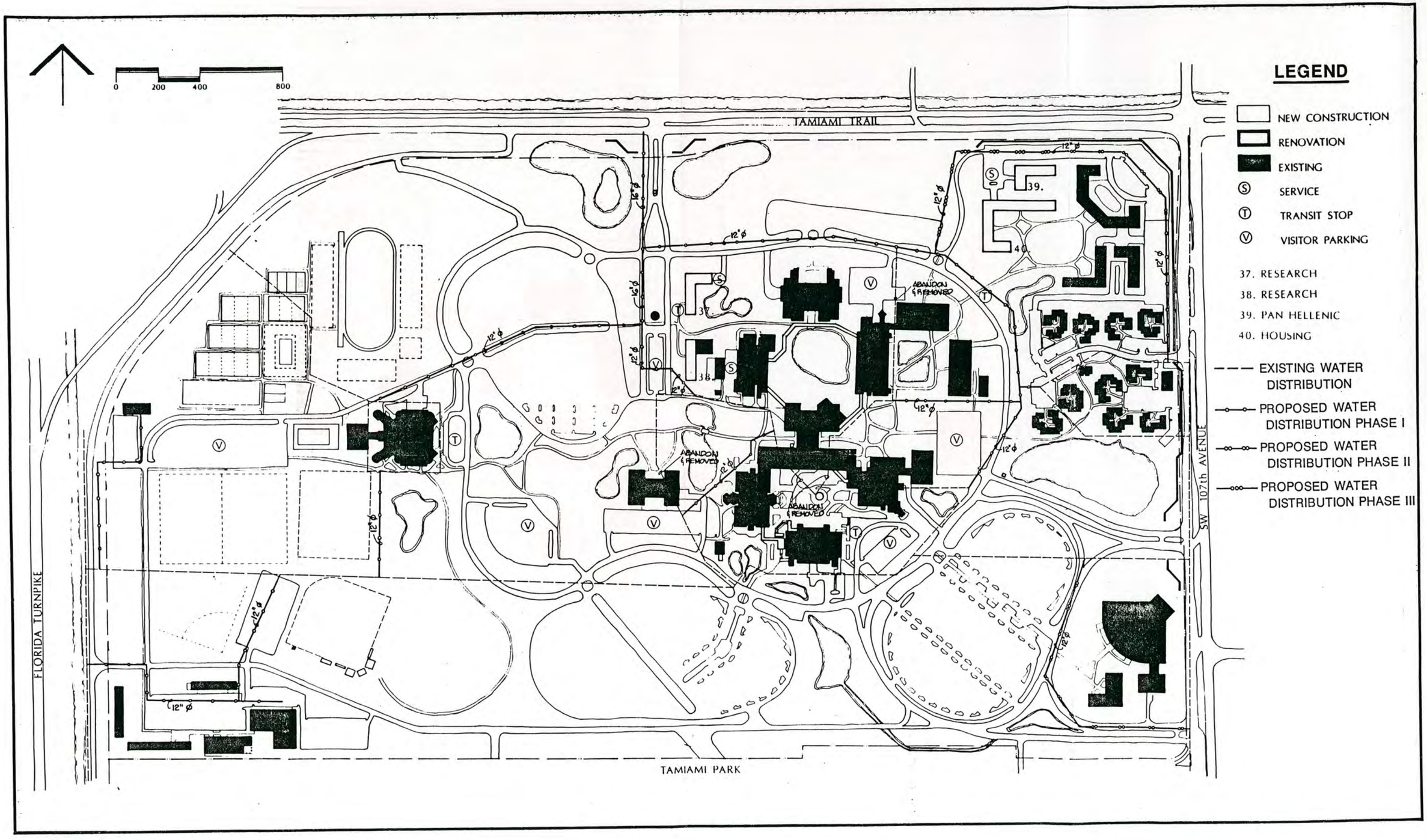


FIGURE VI B

FIU UNIVERSITY PARK

PROPOSED PHASE III 2001 - WATER DISTRIBUTION

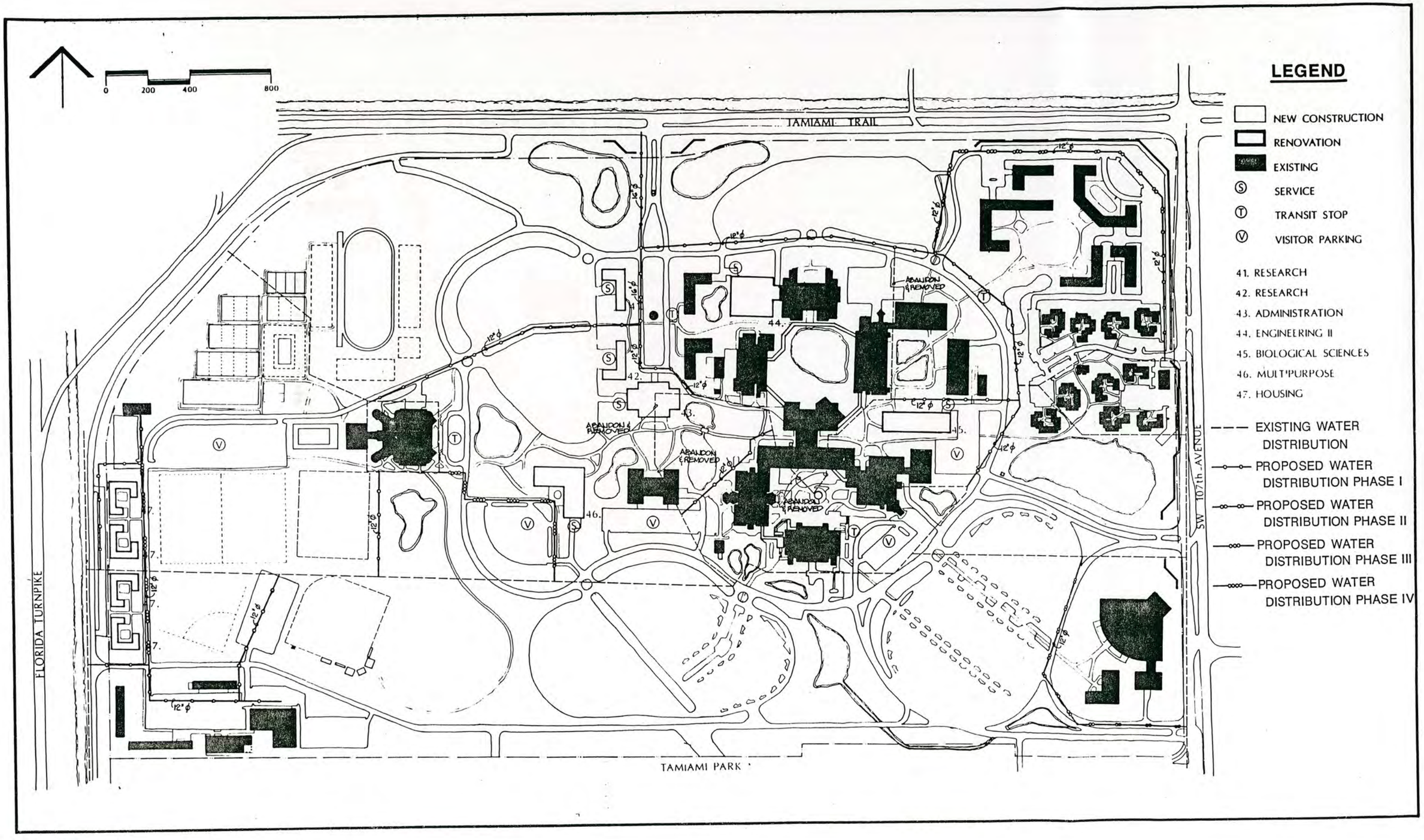
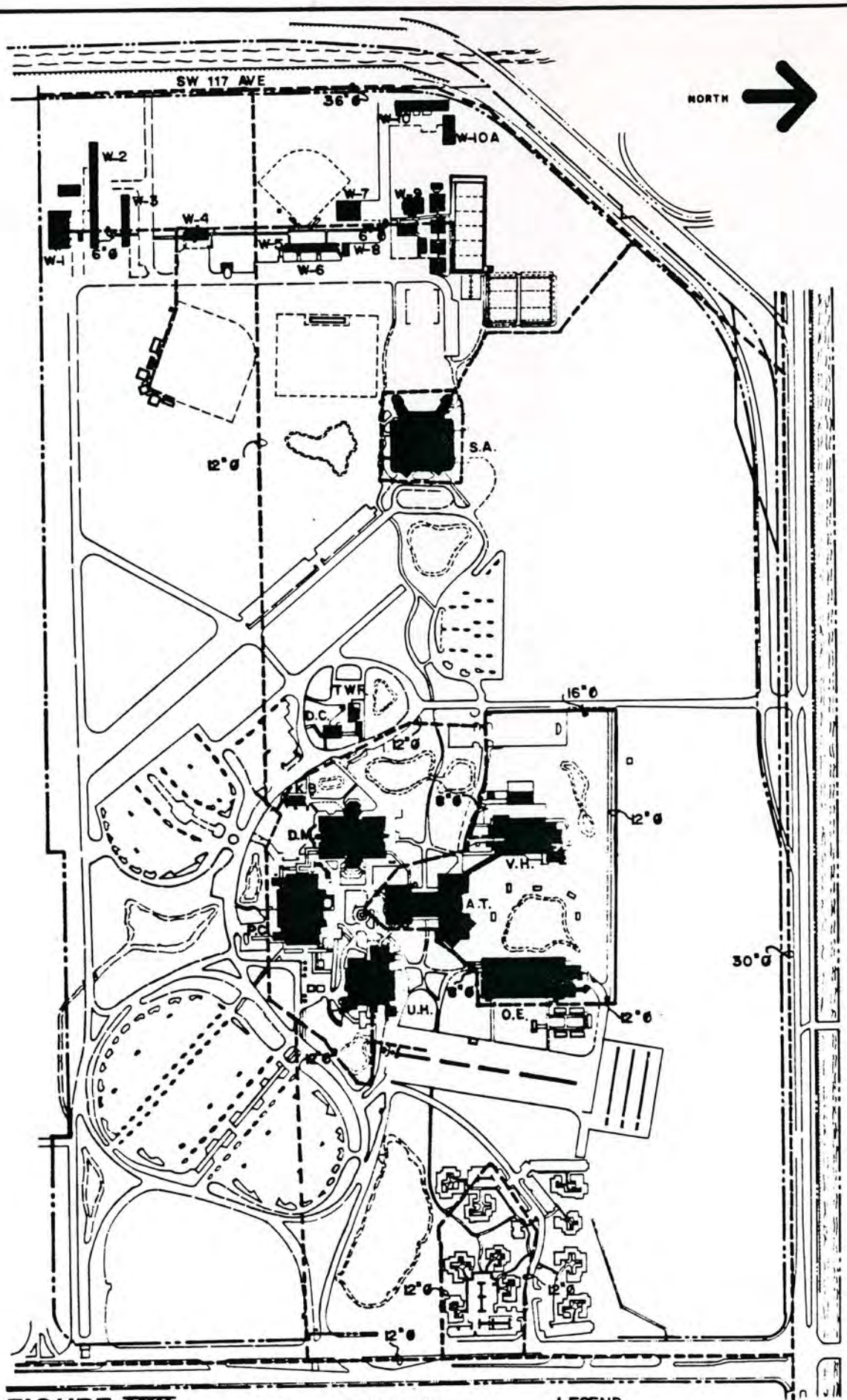


FIGURE VII

FIU UNIVERSITY PARK

FUTURE DISTRIBUTION SERVICE - PHASE IV LONG RANGE - WATER



LEGEND

PROPOSED WATER MAIN LINES

EXISTING WATER MAIN LINES

FIGURE VIII

FIU UNIVERSITY PARK

ENGINEERING BUILDING WATER MAIN LOOP COMPLETION

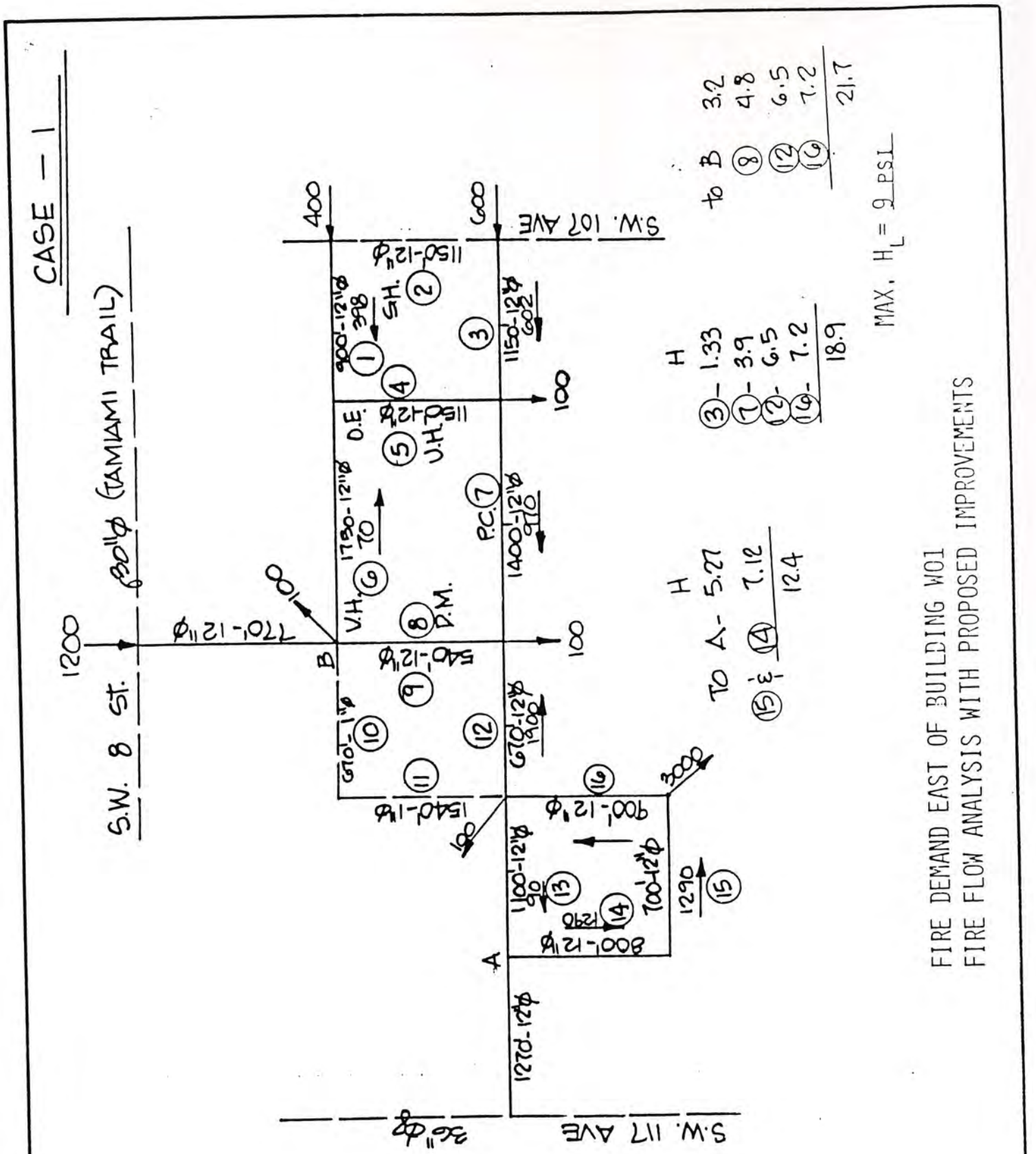


FIGURE IX A

FIU UNIVERSITY PARK

HYDRAULIC ANALYSIS 1

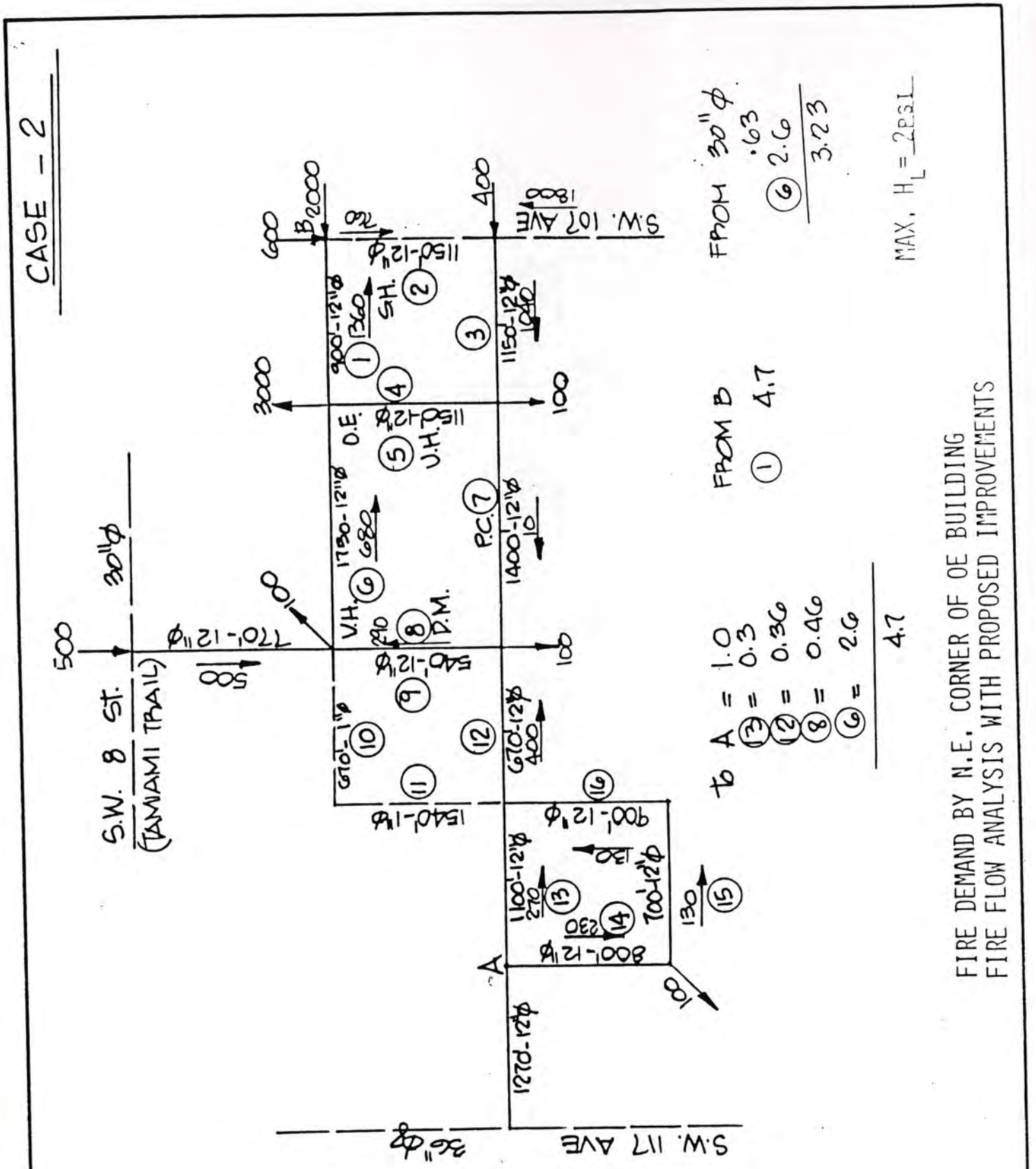


FIGURE IX B

FIU UNIVERSITY PARK

HYDRAULIC ANALYSIS 2

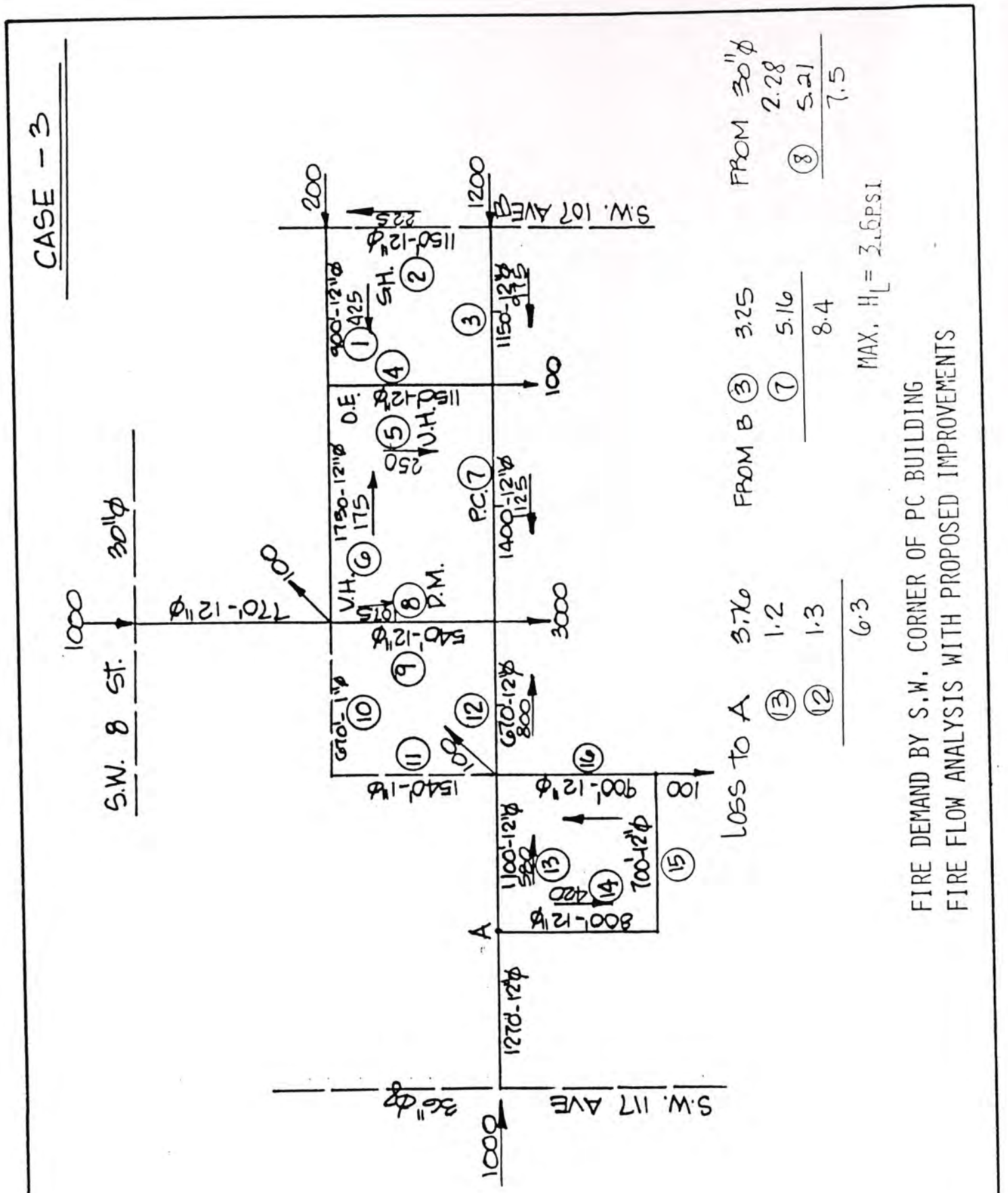


FIGURE IX C

FIU UNIVERSITY PARK

HYDRAULIC ANALYSIS 3

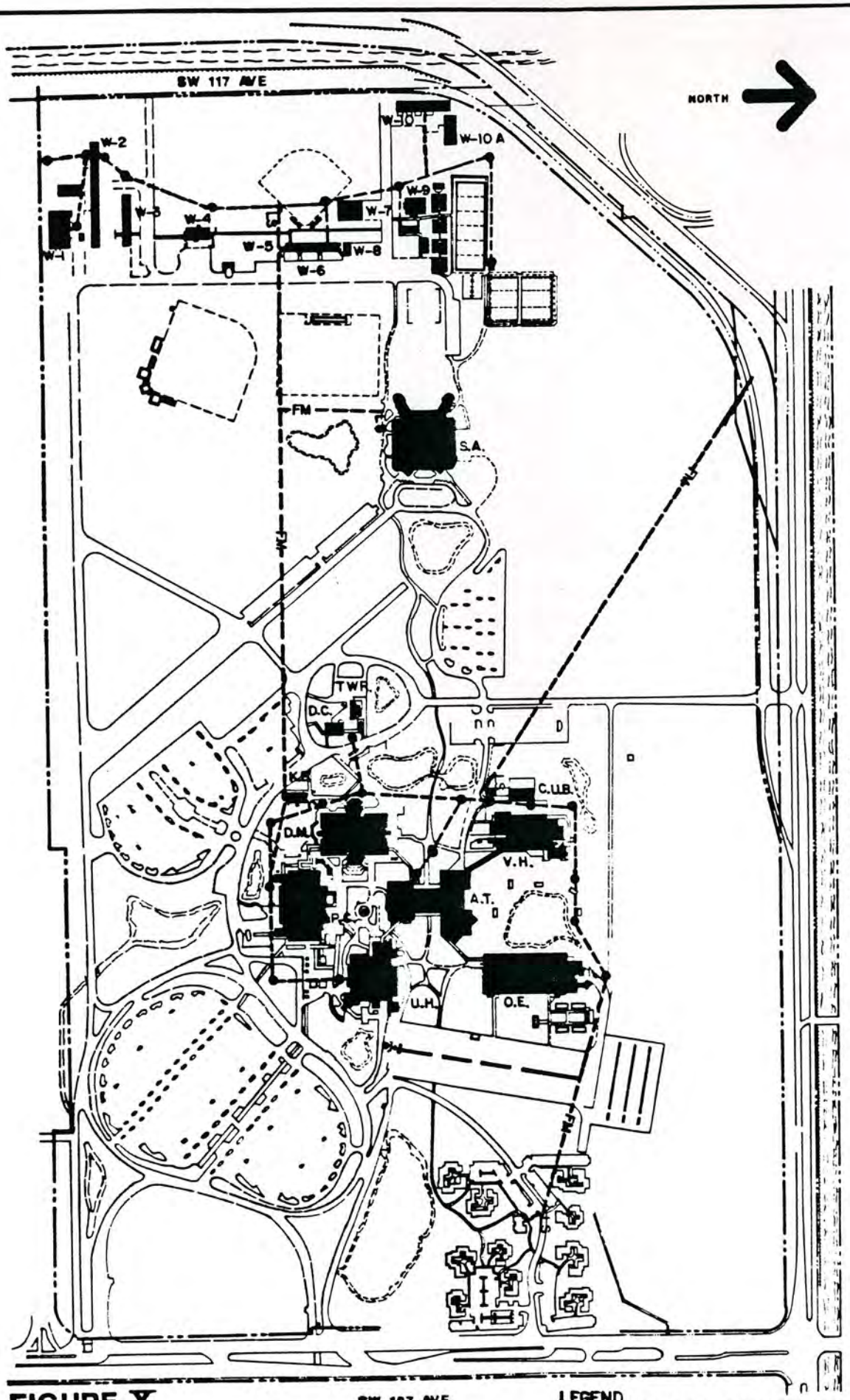


FIGURE X

FIU UNIVERSITY PARK

EXISTING GRAVITY & FORCE MAIN SYSTEM

LEGEND

- EXISTING GRAVITY SYSTEM
- —FM— EXISTING FORCE MAIN SYSTEM
- EXISTING SEWER MAN HOLE
- —LS— EXISTING LIFT STATION

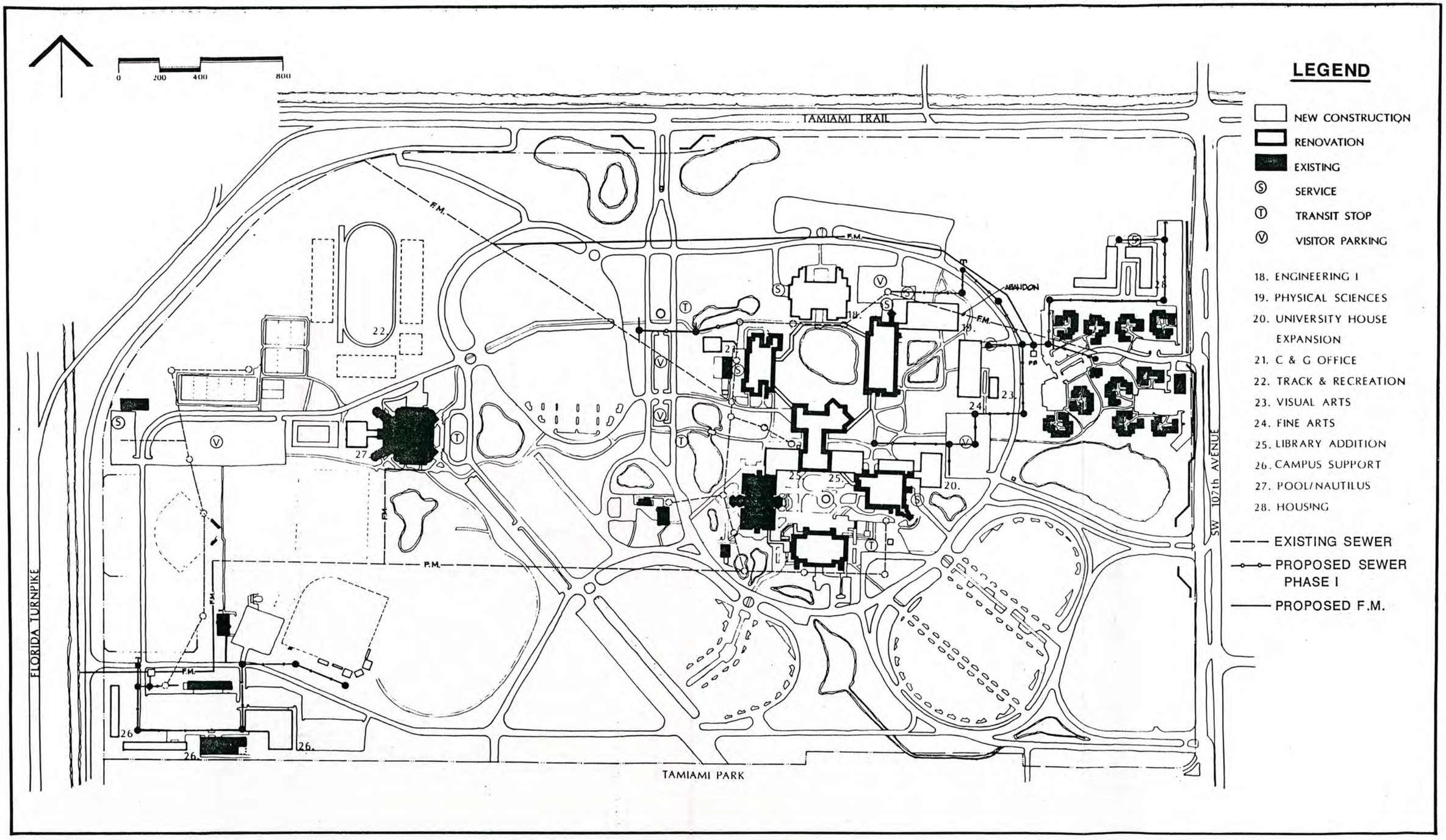


FIGURE XI A

FIU UNIVERSITY PARK

PHASE I 1991 SEWER SYSTEM EXPANSION

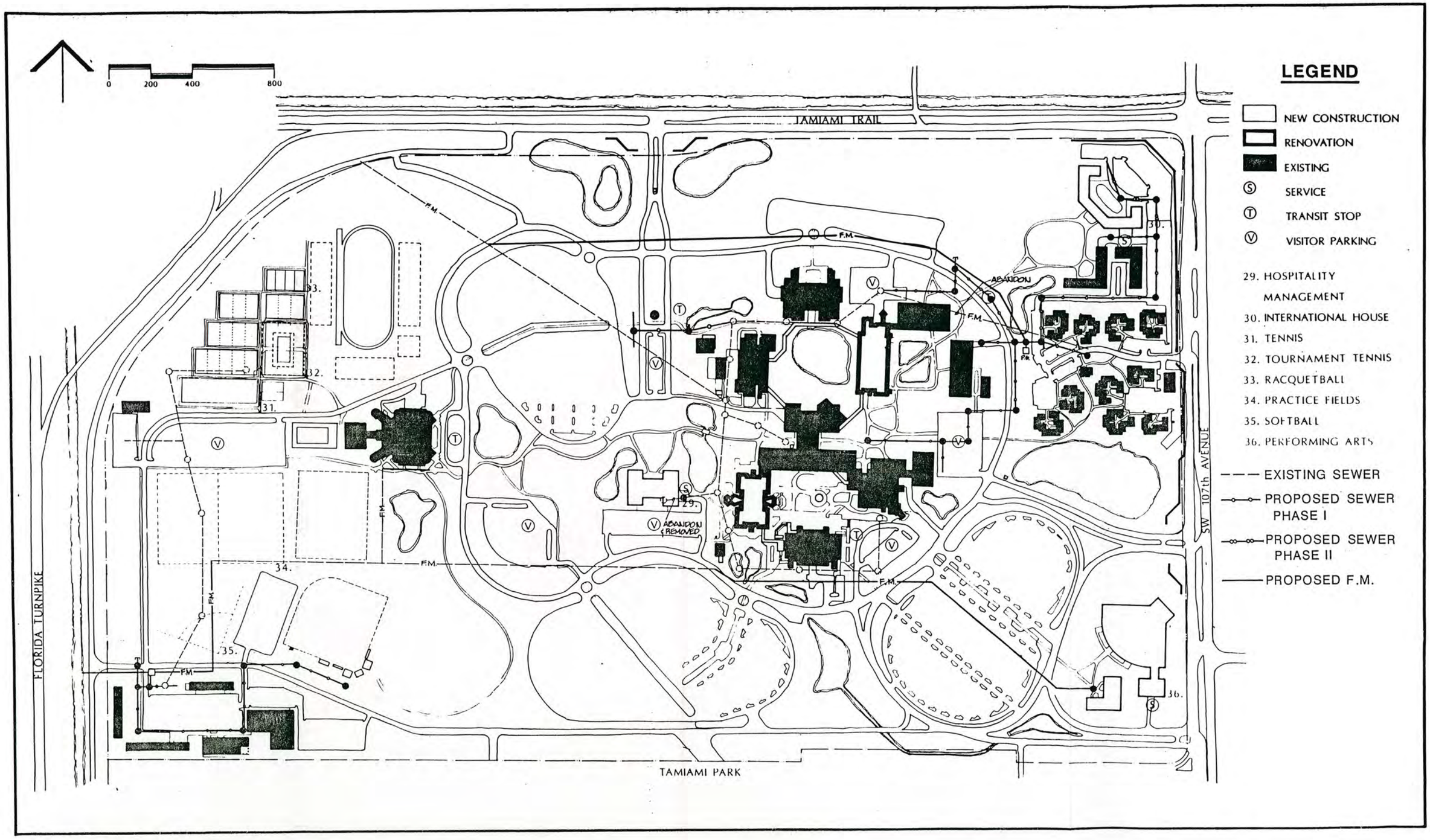


FIGURE XI B

FIU UNIVERSITY PARK

PHASE II 1996 SEWER SYSTEM EXPANSION

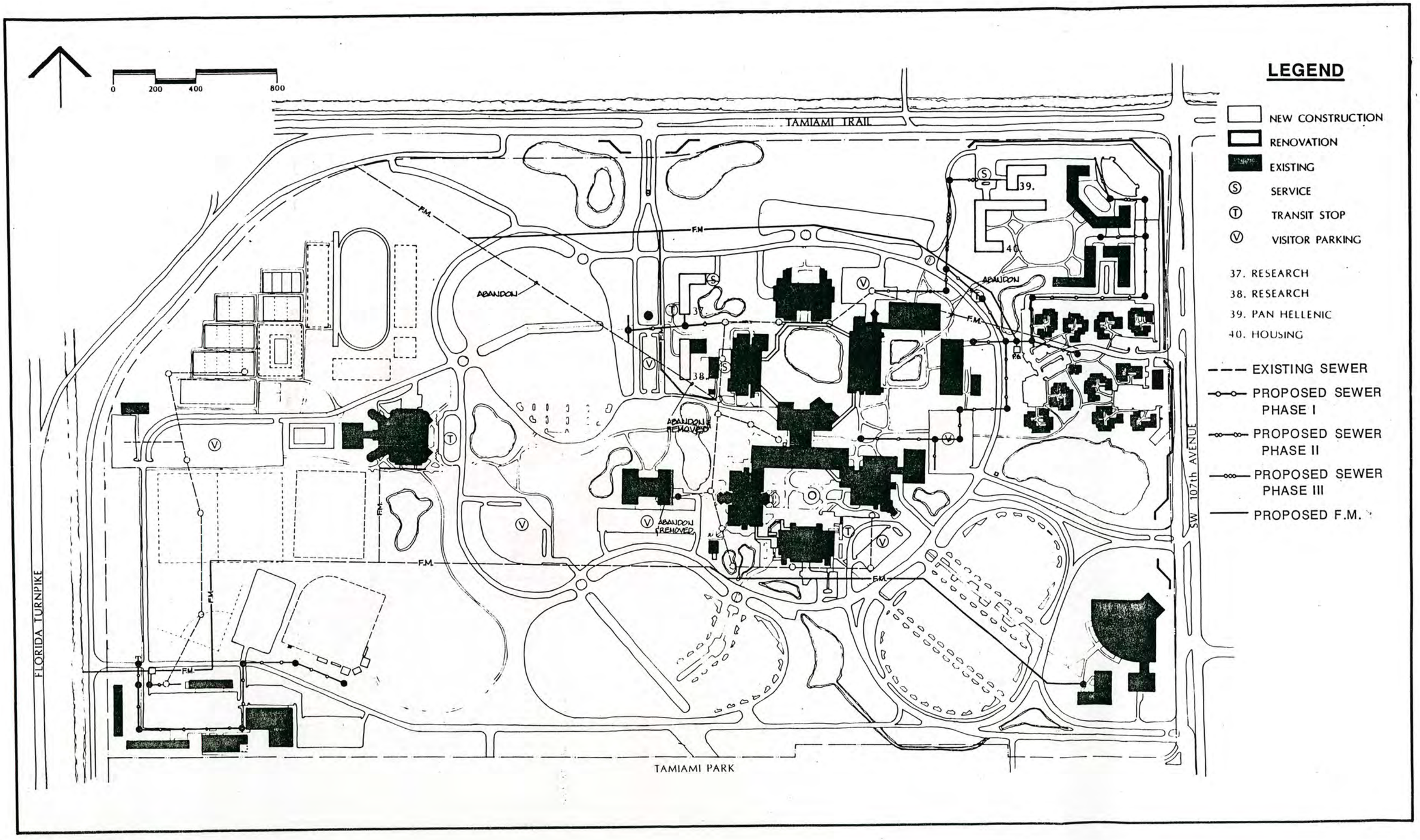


FIGURE XI C

FIU UNIVERSITY PARK

PHASE III 2001 SEWER SYSTEM EXPANSION

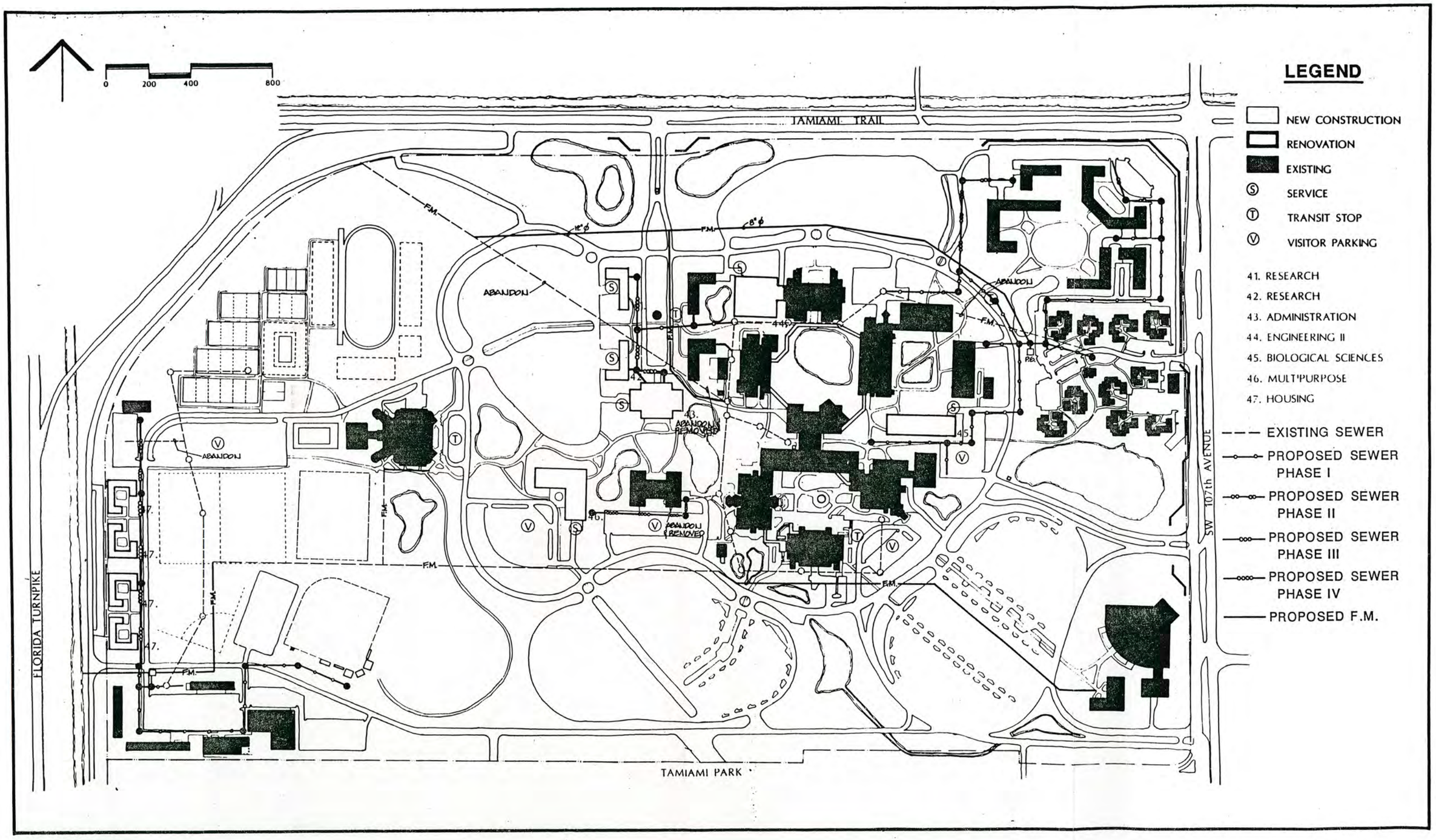


FIGURE XI D

FIU UNIVERSITY PARK

PHASE IV LONG RANGE SEWER SYSTEM EXPANSION

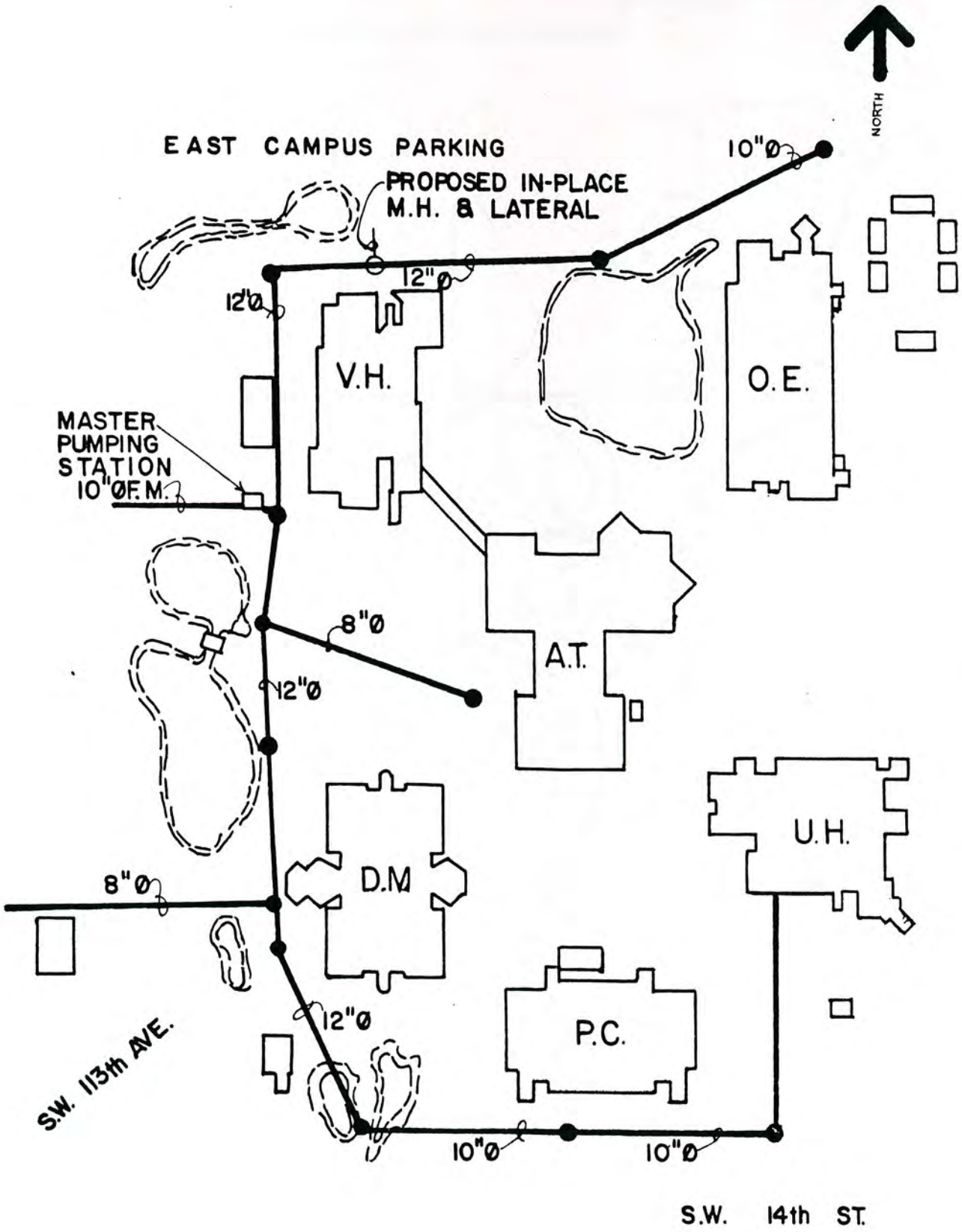


FIGURE XII

FIU UNIVERSITY PARK

PROPOSED SEWER SERVICE CONNECTION TO THE ENGINEERING BUILDING

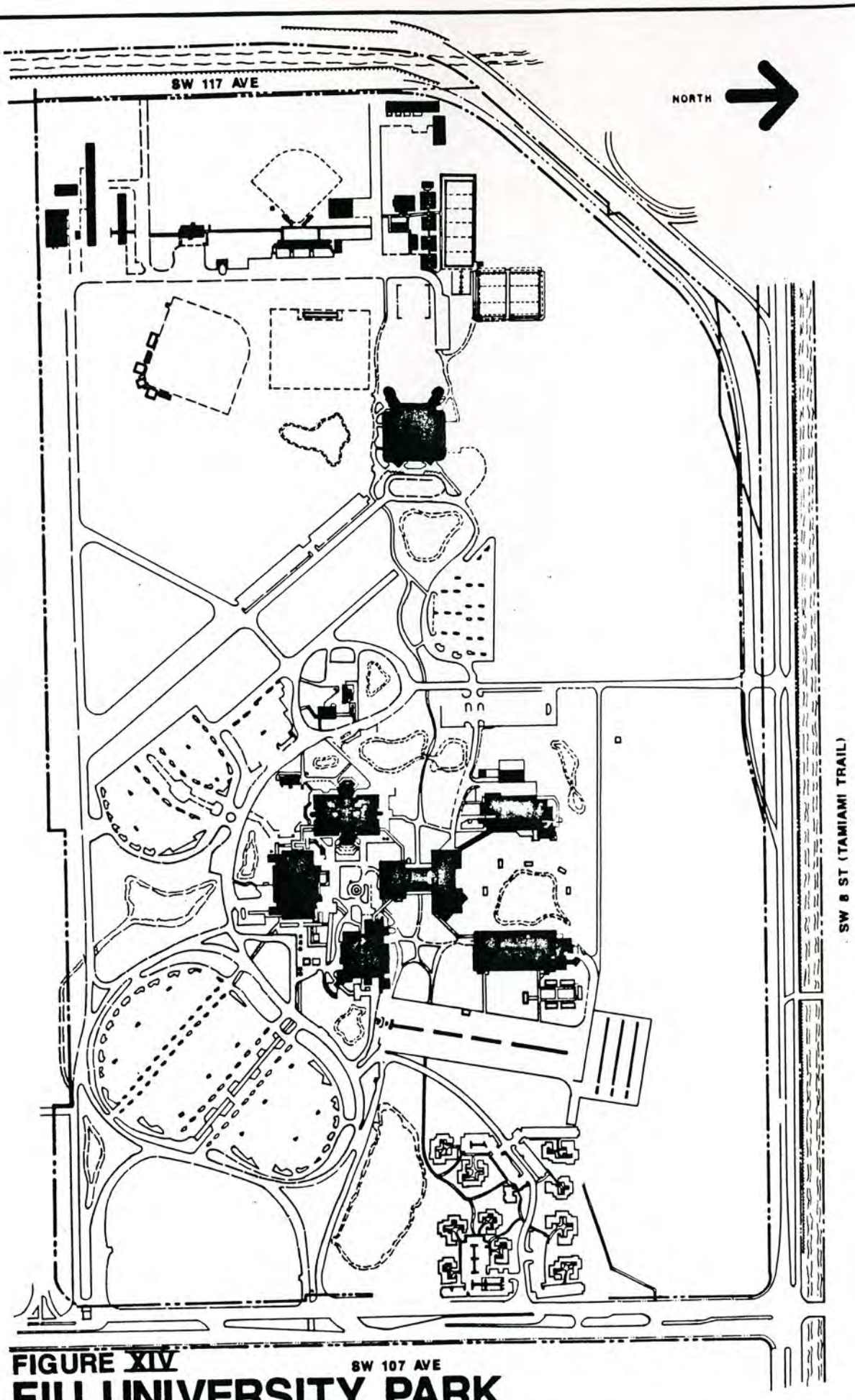


FIGURE XIV

FIU UNIVERSITY PARK

EXISTING ROADS

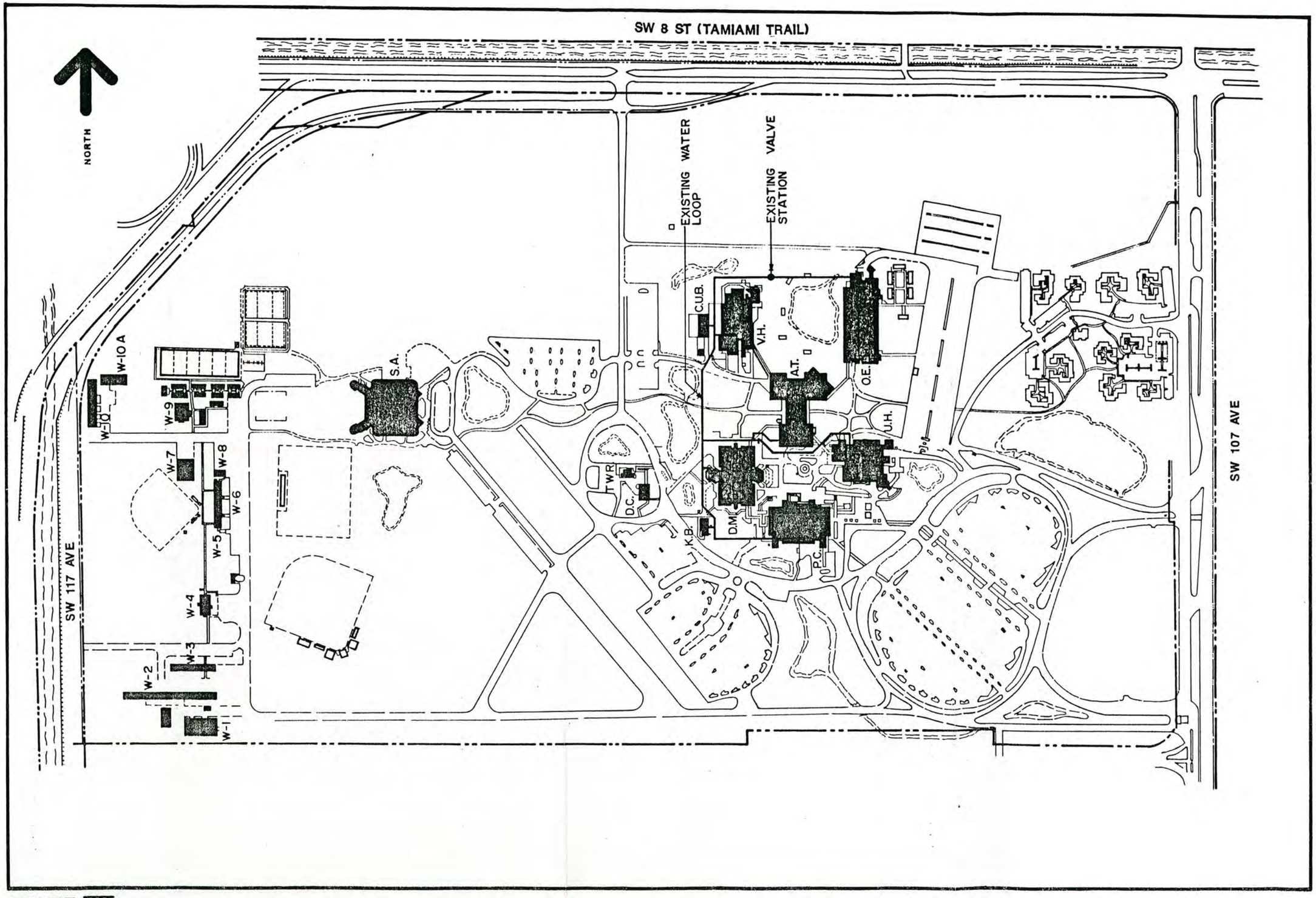


FIGURE XV

FIU UNIVERSITY PARK

EXISTING CHILLED WATER DISTRIBUTION LOOP

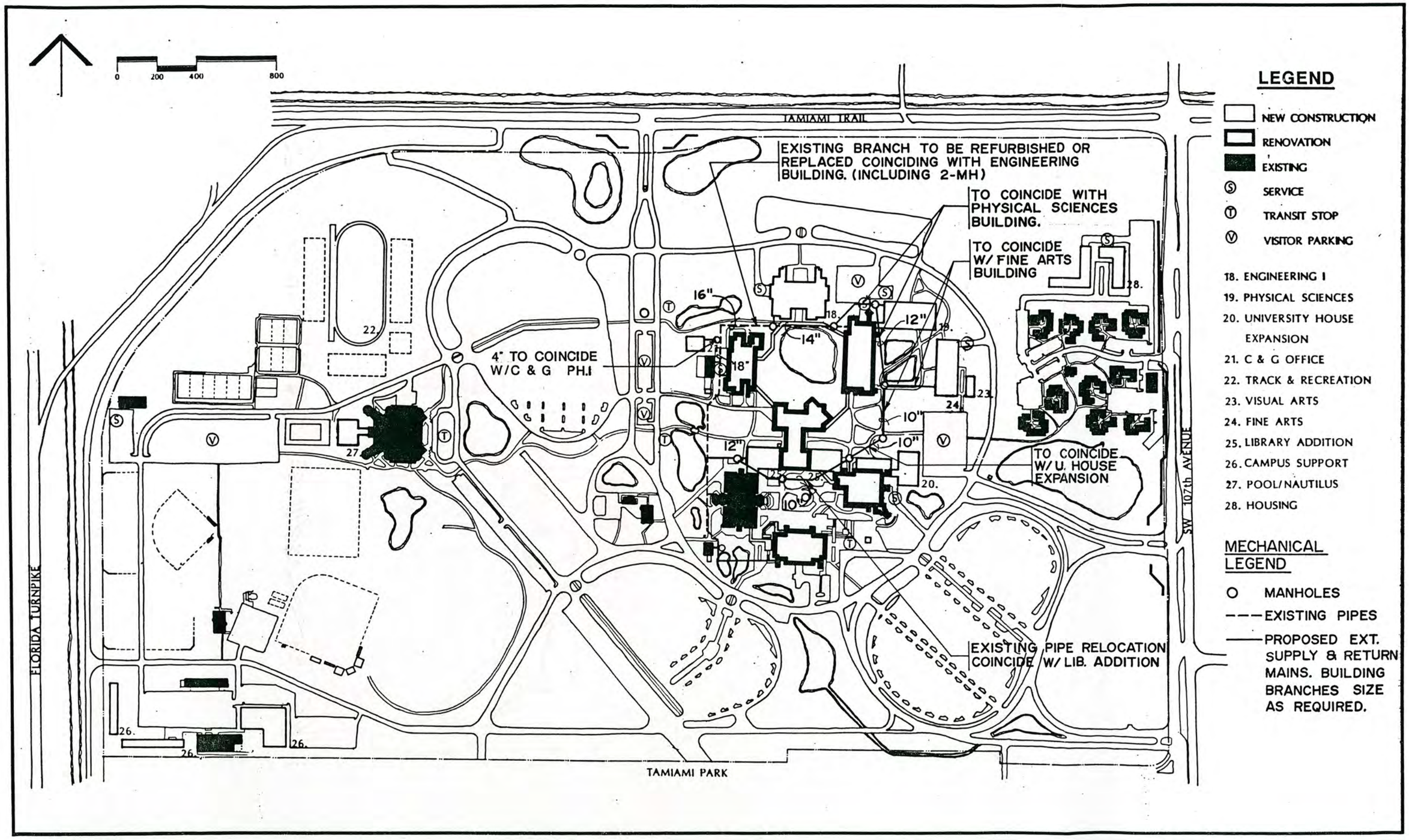


FIGURE XVI

FIU UNIVERSITY PARK

PROPOSED CHILLED WATER LOOP EXTENSIONS PHASE I 1991

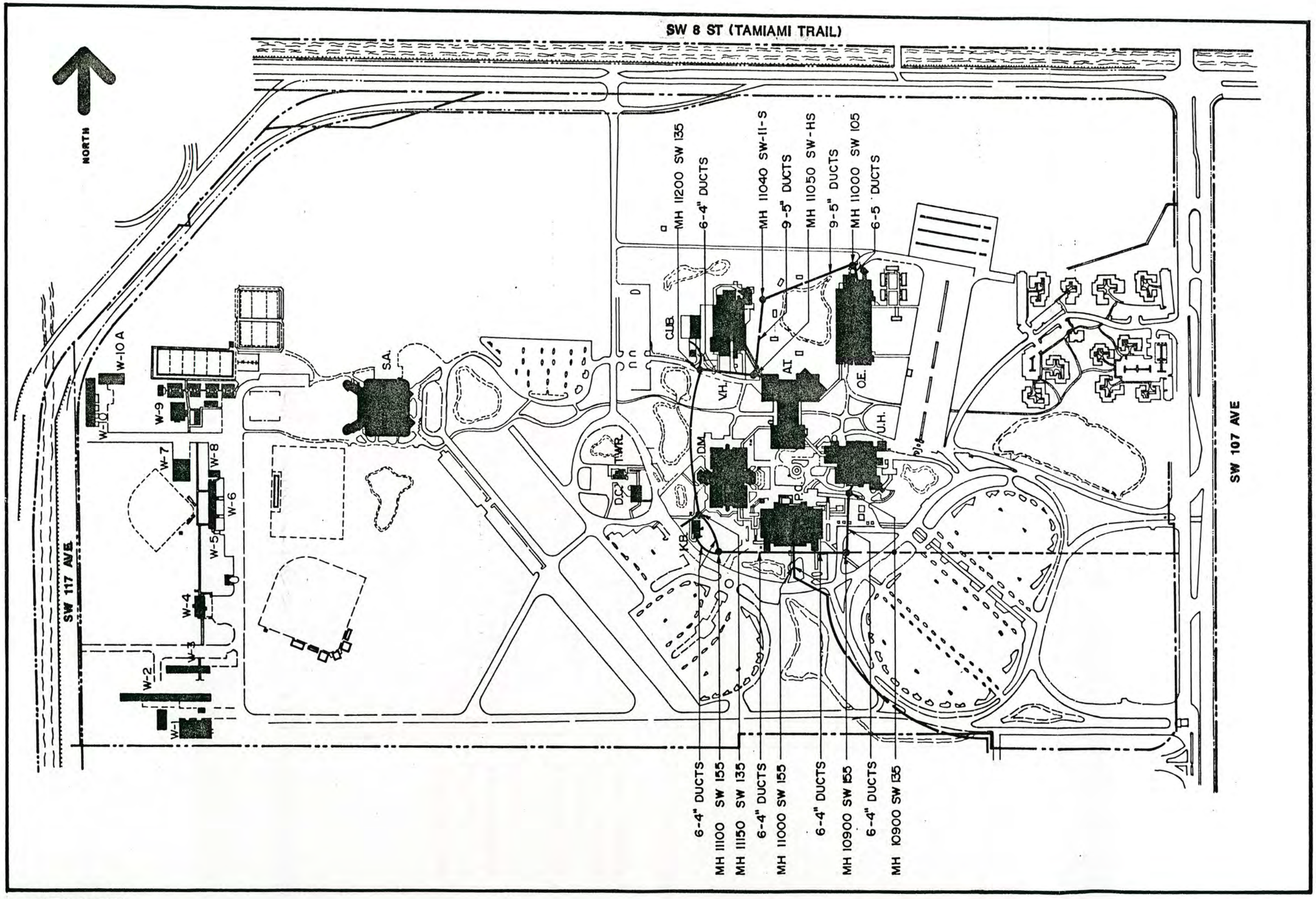


FIGURE XVII

FIU UNIVERSITY PARK

EXISTING ELECTRICAL DISTRIBUTION NETWORK

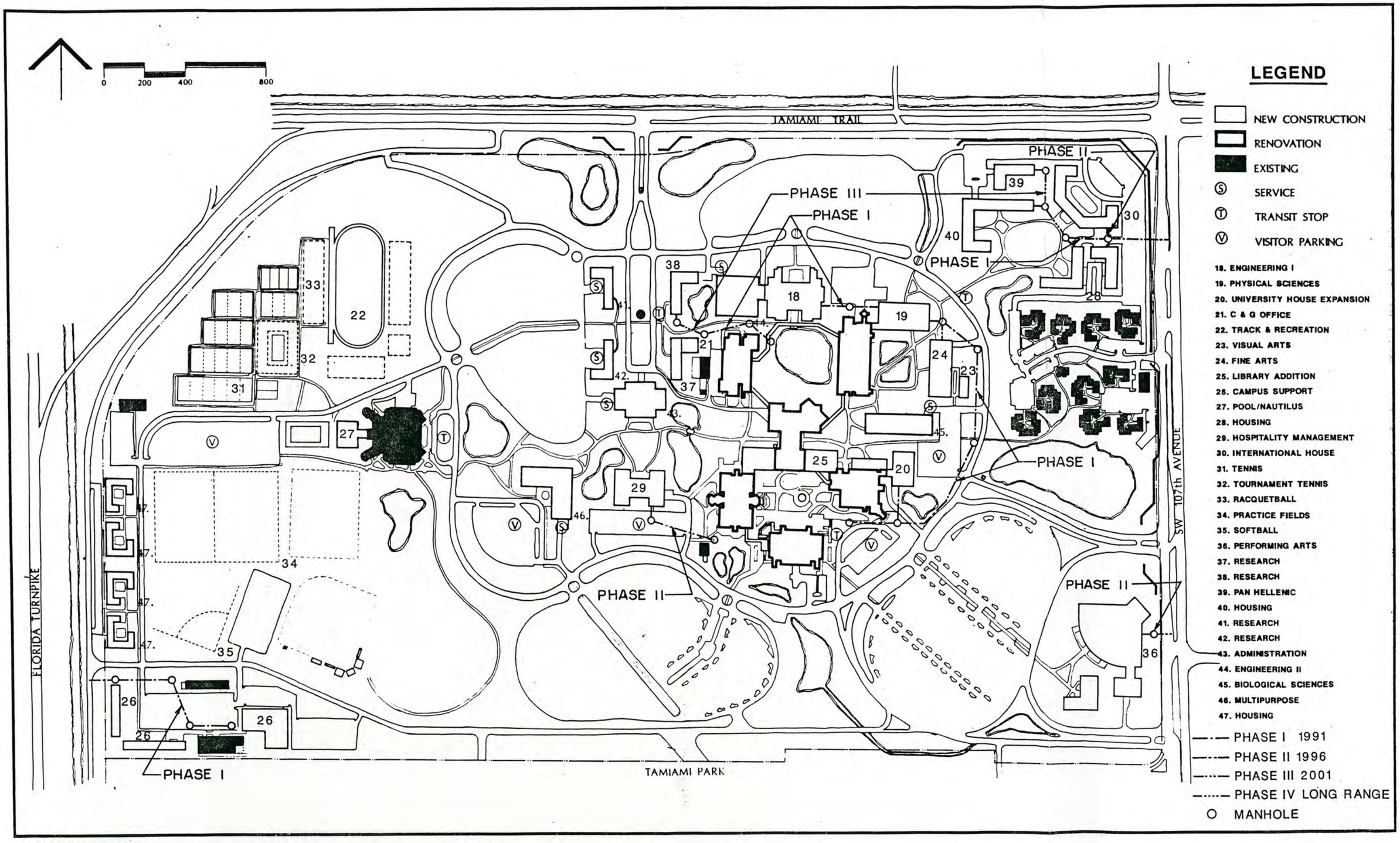


FIGURE XVIII

FIU UNIVERSITY PARK

PROPOSED ELECTRICAL DISTRIBUTION NETWORK

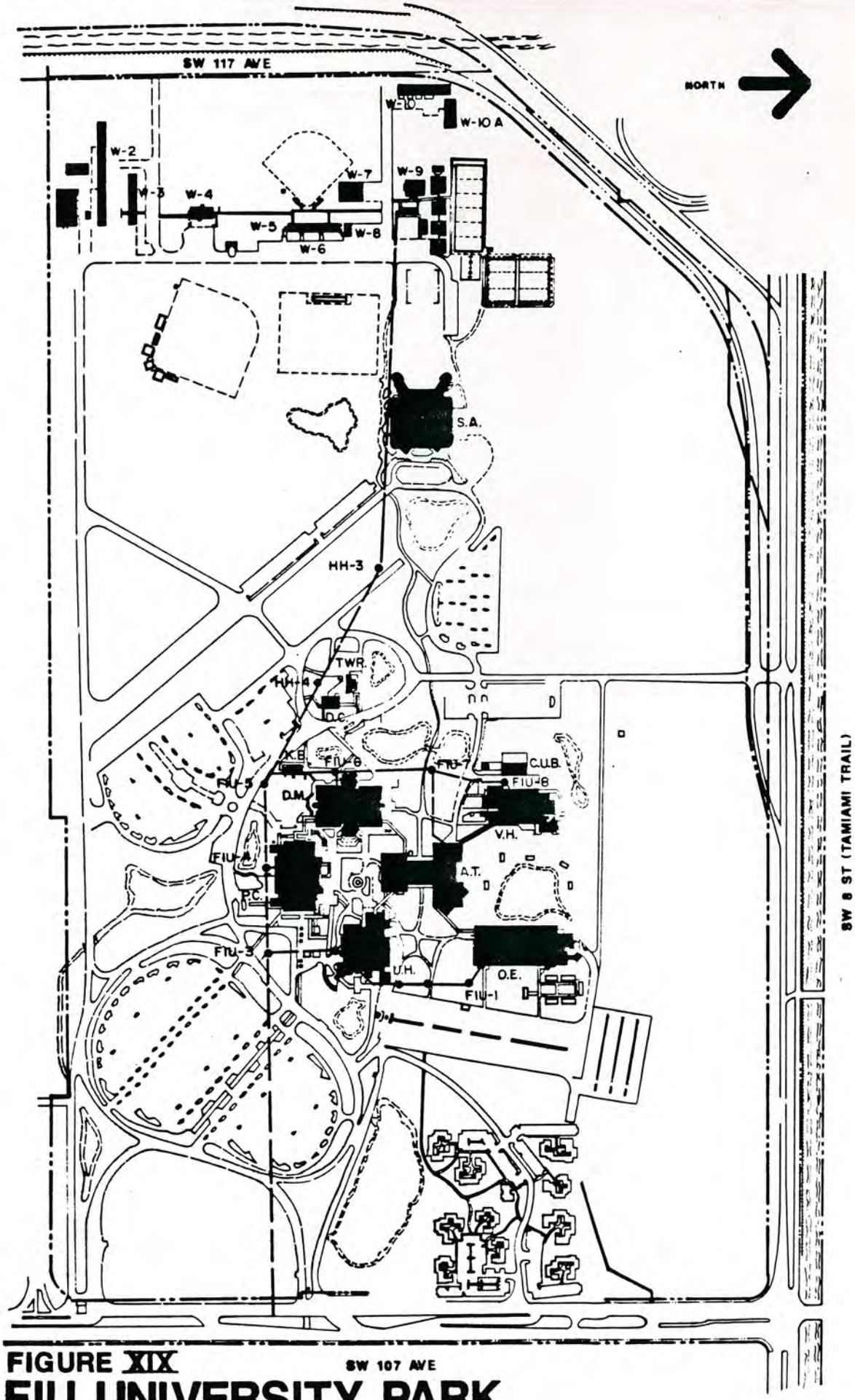


FIGURE XIX

FIU UNIVERSITY PARK

EXISTING TELECOMMUNICATION DISTRIBUTION NETWORK

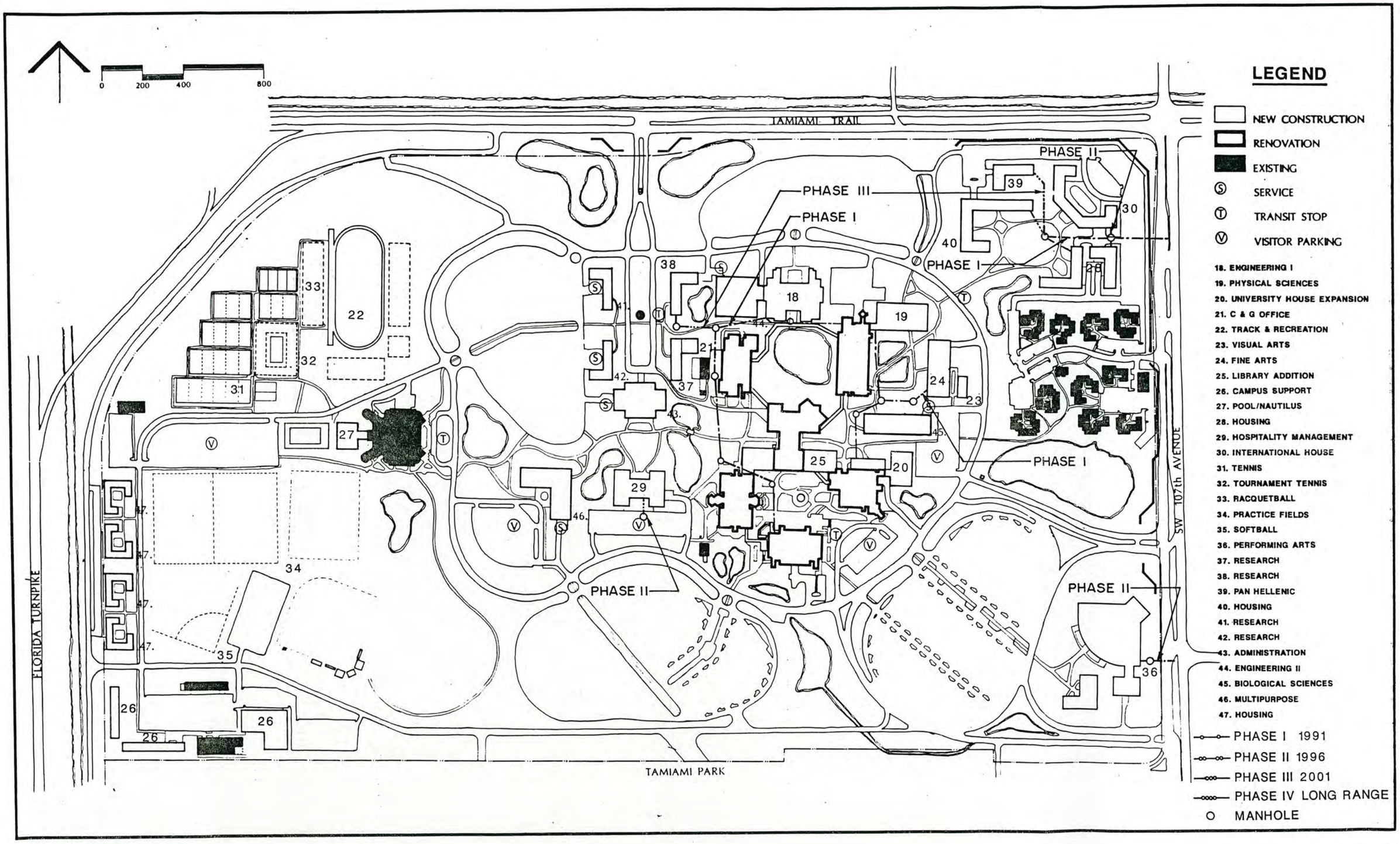


FIGURE XX

FIU UNIVERSITY PARK

PROPOSED TELECOMMUNICATION DISTRIBUTION NETWORK

APPENDIX

ADDITIONAL CALCULATIONS REGARDING WATER ANALYSIS

Authorized Inspector
Date Completed

Subdivision:

Account Number	Meter Number	Location	Service Address	Meter Size
0913-0965	21169357	IN OPEN FIELD @ FRT. N. S	11600 SW 16 ST	3"
	7248172	100' N/BLDG. W.H. LINE/F HYD.	" "	2"
0913-0970	16279611	BTWN W-4 & W-5 100' N/BLDG.	11601 SW 16 ST	3"
	6189675	W-4 OPP 11600 BLDG. W-4	" "	2"
0913-1040	49527	E ESTM/CONT. TWR 50' S/FLAG P	11290 SW 8 ST	1"
0913-1045	18278947	ESM E/FIU TWR X ST N/SIDEWALK	11280 SW 8 ST	2"
0913-1050	15330164	30'W/BLDG W ESM/W BLDG	11201 SW 8 ST	4"
0913-1051-D	14302660	ON FIRELINE W ESM	" "	5/8" DETECTO
0913-1055	22059220	C SW COR/NW BLDG ON CAMP MI	11210 SW 8 ST	2"
0913-1056-D	21739764	C/ SW BLDG	" "	5/8" DETECTO
0913-1060	2925414	15'NE/HYD	11200 SW 8 ST	2"
0913-1060-D	21733433	C 3' W/SERV.	11200 SW 8 ST	5/8" DETECTO
0913-1065	18986120	WS/BLDG ON FIRELINE B X 2	10900 SW 8 ST	2"
0913-1066-D	29242395	WS/BLDG ON FIRELINE B X 1	" "	5/8" DETECTO
0913-1070	18211515	ES/AUDIT 18' SW/HYD PK	" "	2" SPK
0913-1101	6528941	SE COR/S CENTRAL BLDG	10901 SW 16 ST	2"
	3111105	SW/BUS STOP OPP W/WINDOWS	" "	2"
0913-1102-D	5991806		" "	5/8" DETECTO

Authorized Inspector
Date Completed

Subdivision:

Account Number	Meter Number	Location	Service Address	Meter Size
0913-1125	3030929	100' S/NL. BLDG X FRT	10851 SW 16 ST	2"
	11901854	FORE HYD 40'W/SMALL LAKE	" "	1"
0913-1126-D	21294326	ESM/BLDG 100'S.NL/BLDG	" "	5/8"DETECTO
0913-1135	21503028	SS/BLDG W/CTR	FIU SCIENCE BLDG	2" SPKLR
0913-1160	7753990	C 50'N/N ENT A MET POLE	1000 SW 107 AV	5/8"

FORCE MAIN ANALYSIS

2,200 ft. – 10" 0 D.I.P.
Static Head ± 20 ft.
Pressure Head ± 92 ft. (40 psi)

SYSTEM HEAD CURVE

Q,GPM	H,FT	TDH,FT	V,FPS	HV,FT
250	1.687766	113.6878	1.021325	1.619728E-02
300	2.364821	114.3648	1.22559	2.332408E-02
350	3.145209	115.1452	1.429855	3.174667E-02
400	4.026565	116.0266	1.63412	4.146503E-02
450	5.006874	117.0069	1.838385	5.247918E-02
500	6.084406	118.0844	2.04265	6.478912E-02
550	7.257635	119.2576	2.246915	7.839481E-02
600	8.525181	120.5252	2.45118	9.329632E-02
650	9.885838	121.8858	2.655445	.1094936
700	11.33848	123.3385	2.85971	.1269867
750	12.88212	124.8821	3.063975	.1457755
800	14.51579	126.5158	3.26824	.1658601
850	16.2386	128.2386	3.472505	.1872405
900	18.0498	130.0498	3.67677	.2099167
950	19.94862	131.9486	3.881035	.2338887
1000	21.93427	133.9343	4.0853	.2591565
1050	24.00623	136.0062	4.289565	.2857199
1100	26.16376	138.1638	4.49383	.3135793
1150	28.4063	140.4063	4.698096	.3427345
1200	30.73326	142.7333	4.90236	.3731853
1250	33.14415	145.1442	5.106625	.404932
1300	35.63847	147.6385	5.31089	.4379744
1350	38.21567	150.2157	5.515155	.4723126
1400	40.87525	152.8753	5.71942	.5079467
1450	43.61686	155.6169	5.923685	.5448763
1500	46.44003	158.44	6.12795	.583102
1550	49.34431	161.3443	6.332215	.6226233
1600	52.32939	164.3294	6.53648	.6634405
1650	55.39485	167.3948	6.740745	.7055534
1700	58.54027	170.5403	6.94501	.7489621
1750	61.76525	173.7652	7.149275	.7936666
1800	65.06948	177.0695	7.35354	.8396669
1850	68.45285	180.4529	7.557805	.886963
1900	71.91472	183.9147	7.76207	.9355548
1950	75.45495	187.455	7.966335	.9854423
2000	79.07321	191.0732	8.1706	1.036626

FORCE MAIN ANALYSIS

2,200 ft. – 10" 0 D.I.P.
Static Head ± 20 ft.
Pressure Head ± 46 ft. (20 psi)

SYSTEM HEAD CURVE

Q,GPM	H,FT	TDH,FT	V,FPS	HV,FT
250	1.687766	67.68777	1.021325	1.619728E-02
300	2.364821	68.36483	1.22559	2.332408E-02
350	3.145209	69.14521	1.429855	3.174667E-02
400	4.026565	70.02656	1.63412	4.146503E-02
450	5.006874	71.00688	1.838385	5.247918E-02
500	6.084406	72.08441	2.04265	6.478912E-02
550	7.257635	73.25764	2.246915	7.839481E-02
600	8.525181	74.52518	2.45118	9.329632E-02
650	9.885838	75.88583	2.655445	.1094936
700	11.33848	77.33848	2.85971	.1269867
750	12.88212	78.88212	3.063975	.1457755
800	14.51579	80.51579	3.26824	.1658601
850	16.2386	82.2386	3.472505	.1872405
900	18.0498	84.0498	3.67677	.2099167
950	19.94862	85.94862	3.881035	.2338887
1000	21.93427	87.93426	4.0853	.2591565
1050	24.00623	90.00623	4.289565	.2857199
1100	26.16376	92.16376	4.49383	.3135793
1150	28.4063	94.40629	4.698096	.3427345
1200	30.73326	96.73326	4.90236	.3731853
1250	33.14415	99.14415	5.106625	.404932
1300	35.63847	101.6385	5.31089	.4379744
1350	38.21567	104.2157	5.515155	.4723126
1400	40.87525	106.8753	5.71942	.5079467
1450	43.61686	109.6169	5.923685	.5448763
1500	46.44003	112.44	6.12795	.583102
1550	49.34431	115.3443	6.332215	.6226233
1600	52.32939	118.3294	6.53648	.6634405
1650	55.39485	121.3949	6.740745	.7055534
1700	58.54027	124.5403	6.94501	.7489621
1750	61.76525	127.7652	7.149275	.7936666
1800	65.06948	131.0695	7.35354	.8396669
1850	68.45285	134.4529	7.557805	.886963
1900	71.91472	137.9147	7.76207	.9355548
1950	75.45495	141.455	7.966335	.9854423
2000	79.07321	145.0732	8.1706	1.036626

FORCE MAIN ANALYSIS

2,200 ft. – 10" 0 D.I.P.
Static Head ± 20 ft.
Pressure Head ± 58 ft. (25 psi)

SYSTEM HEAD CURVE

Q,GPM	H,FT	TDH,FT	V,FPS	HV,FT
250	1.687766	79.68777	1.021325	1.619728E-02
300	2.364821	80.36483	1.22559	2.332408E-02
350	3.145209	81.14521	1.429855	3.174667E-02
400	4.026565	82.02656	1.63412	4.146503E-02
450	5.006874	83.00688	1.838385	5.247918E-02
500	6.084406	84.08441	2.04265	6.478912E-02
550	7.257635	85.25764	2.246915	7.839481E-02
600	8.525181	86.52518	2.45118	9.329632E-02
650	9.885838	87.88583	2.655445	.1094936
700	11.33848	89.33848	2.85971	.1269867
750	12.88212	90.88212	3.063975	.1457755
800	14.51579	92.51579	3.26824	.1658601
850	16.2386	94.2386	3.472505	.1872405
900	18.0498	96.0498	3.67677	.2099167
950	19.94862	97.94862	3.881035	.2338887
1000	21.93427	99.93426	4.0853	.2591565
1050	24.00623	102.0062	4.289565	.2857199
1100	26.16376	104.1638	4.49383	.3135793
1150	28.4063	106.4063	4.698096	.3427345
1200	30.73326	108.7333	4.90236	.3731853
1250	33.14415	111.1442	5.106625	.404932
1300	35.63847	113.6385	5.31089	.4379744
1350	38.21567	116.2157	5.515155	.4723126
1400	40.87525	118.8753	5.71942	.5079467
1450	43.61686	121.6169	5.923685	.5448763
1500	46.44003	124.44	6.12795	.583102
1550	49.34431	127.3443	6.332215	.6226233
1600	52.32939	130.3294	6.53648	.6634405
1650	55.39485	133.3948	6.740745	.7055534
1700	58.54027	136.5403	6.94501	.7489621
1750	61.76525	139.7652	7.149275	.7936666
1800	65.06948	143.0695	7.35354	.8396669
1850	68.45285	146.4529	7.557805	.886963
1900	71.91472	149.9147	7.76207	.9355548
1950	75.45495	153.455	7.966335	.9854423
2000	79.07321	157.0732	8.1706	1.036626

FORCE MAIN ANALYSIS

2,200 ft. – 10" 0 D.I.P.
Static Head ± 20 ft.
Pressure Head ± 69 ft. (30 psi)

SYSTEM HEAD CURVE

Q,GPM	H,FT	TDH,FT	V,FPS	HV,FT
250	1.687766	91.68777	1.021325	1.619728E-02
300	2.364821	92.36482	1.22559	2.332408E-02
350	3.145209	93.14521	1.429855	3.174667E-02
400	4.026565	94.02656	1.63412	4.146503E-02
450	5.006874	95.00688	1.838385	5.247918E-02
500	6.084406	96.08441	2.04265	6.478912E-02
550	7.257635	97.25764	2.246915	7.839481E-02
600	8.525181	98.52518	2.45118	9.329632E-02
650	9.885838	99.88583	2.655445	.1094936
700	11.33848	101.3385	2.85971	.1269867
750	12.88212	102.8821	3.063975	.1457755
800	14.51579	104.5158	3.26824	.1658601
850	16.2386	106.2386	3.472505	.1872405
900	18.0498	108.0498	3.67677	.2099167
950	19.94862	109.9486	3.881035	.2338887
1000	21.93427	111.9343	4.0853	.2591565
1050	24.00623	114.0062	4.289565	.2857199
1100	26.16376	116.1638	4.49383	.3135793
1150	28.4063	118.4063	4.698096	.3427345
1200	30.73326	120.7333	4.90236	.3731853
1250	33.14415	123.1442	5.106625	.404932
1300	35.63847	125.6385	5.31089	.4379744
1350	38.21567	128.2157	5.515155	.4723126
1400	40.87525	130.8753	5.71942	.5079467
1450	43.61686	133.6169	5.923685	.5448763
1500	46.44003	136.44	6.12795	.583102
1550	49.34431	139.3443	6.332215	.6226233
1600	52.32939	142.3294	6.53648	.6634405
1650	55.39485	145.3948	6.740745	.7055534
1700	58.54027	148.5403	6.94501	.7489621
1750	61.76525	151.7652	7.149275	.7936666
1800	65.06948	155.0695	7.35354	.8396669
1850	68.45285	158.4529	7.557805	.886963
1900	71.91472	161.9147	7.76207	.9355548
1950	75.45495	165.455	7.966335	.9854423
2000	79.07321	169.0732	8.1706	1.036626

FORCE MAIN ANALYSIS

2,200 ft. - 10" 0 D.I.P.
Static Head ± 20 ft.
Pressure Head ± 81 ft. (35 psi)

SYSTEM HEAD CURVE

Q,GPM	H,FT	TDH,FT	V,FPS	HV,FT
250	1.687766	101.6878	1.021325	1.619728E-02
300	2.364821	102.3648	1.22559	2.332408E-02
350	3.145209	103.1452	1.429855	3.174667E-02
400	4.026565	104.0266	1.63412	4.146503E-02
450	5.006874	105.0069	1.838385	5.247918E-02
500	6.084406	106.0844	2.04265	6.478912E-02
550	7.257635	107.2576	2.246915	7.839481E-02
600	8.525181	108.5252	2.45118	9.329632E-02
650	9.885838	109.8858	2.655445	.1094936
700	11.33848	111.3385	2.85971	.1269867
750	12.88212	112.8821	3.063975	.1457755
800	14.51579	114.5158	3.26824	.1658601
850	16.2386	116.2386	3.472505	.1872405
900	18.0498	118.0498	3.67677	.2099167
950	19.94862	119.9486	3.881035	.2338887
1000	21.93427	121.9343	4.0853	.2591565
1050	24.00623	124.0062	4.289565	.2857199
1100	26.16376	126.1638	4.49383	.3135793
1150	28.4063	128.4063	4.698096	.3427345
1200	30.73326	130.7333	4.90236	.3731853
1250	33.14415	133.1442	5.106625	.404932
1300	35.63847	135.6385	5.31089	.4379744
1350	38.21567	138.2157	5.515155	.4723126
1400	40.87525	140.8753	5.71942	.5079467
1450	43.61686	143.6169	5.923685	.5448763
1500	46.44003	146.44	6.12795	.583102
1550	49.34431	149.3443	6.332215	.6226233
1600	52.32939	152.3294	6.53648	.6634405
1650	55.39485	155.3948	6.740745	.7055534
1700	58.54027	158.5403	6.94501	.7489621
1750	61.76525	161.7652	7.149275	.7936666
1800	65.06948	165.0695	7.35354	.8396669
1850	68.45285	168.4529	7.557805	.886963
1900	71.91472	171.9147	7.76207	.9355548
1950	75.45495	175.455	7.966335	.9854423
2000	79.07321	179.0732	8.1706	1.036626

FORCE MAIN ANALYSIS

2,200 ft. – 10" 0 D.I.P.
Static Head ± 20 (15) ft.
Pressure Head ± 13 (15) psi

SYSTEM HEAD CURVE

Q,GPM	H,FT	TDH,FT	V,FPS	HV,FT
250	1.687766	51.68777	1.021325	1.619728E-02
300	2.364821	52.36482	1.22559	2.332408E-02
350	3.145209	53.14521	1.429855	3.174667E-02
400	4.026565	54.02657	1.63412	4.146503E-02
450	5.006874	55.00688	1.838385	5.247918E-02
500	6.084406	56.08441	2.04265	6.478912E-02
550	7.257635	57.25764	2.246915	7.839481E-02
600	8.525181	58.52518	2.45118	9.329632E-02
650	9.885838	59.88584	2.655445	.1094936
700	11.33848	61.33848	2.85971	.1269867
750	12.88212	62.88212	3.063975	.1457755
800	14.51579	64.51579	3.26824	.1658601
850	16.2386	66.2386	3.472505	.1872405
900	18.0498	68.0498	3.67677	.2099167
950	19.94862	69.94862	3.881035	.2338887
1000	21.93427	71.93426	4.0853	.2591565
1050	24.00623	74.00623	4.289565	.2857199
1100	26.16376	76.16376	4.49383	.3135793
1150	28.4063	78.4063	4.698096	.3427345
1200	30.73326	80.73326	4.90236	.3731853
1250	33.14415	83.14415	5.106625	.404932
1300	35.63847	85.63848	5.31089	.4379744
1350	38.21567	88.21567	5.515155	.4723126
1400	40.87525	90.87525	5.71942	.5079467
1450	43.61686	93.61686	5.923685	.5448763
1500	46.44003	96.44002	6.12795	.583102
1550	49.34431	99.3443	6.332215	.6226233
1600	52.32939	102.3294	6.53648	.6634405
1650	55.39485	105.3949	6.740745	.7055534
1700	58.54027	108.5403	6.94501	.7489621
1750	61.76525	111.7652	7.149275	.7936666
1800	65.06948	115.0695	7.35354	.8396669
1850	68.45285	118.4529	7.557805	.886963
1900	71.91472	121.9147	7.76207	.9355548
1950	75.45495	125.455	7.966335	.9854423
2000	79.07321	129.0732	8.1706	1.036626
2050	82.76907	132.7691	8.374865	1.089105
2100	86.54254	136.5425	8.579129	1.14288
2150	90.39311	140.3931	8.783395	1.197951
2200	94.32042	144.3204	8.987659	1.254317
2250	98.32448	148.3245	9.191925	1.31198
2300	102.4048	152.4048	9.396191	1.370938
2350	106.5612	156.5613	9.600454	1.431191
2400	110.7937	160.7937	9.80472	1.492741
2450	115.1015	165.1014	10.00898	1.555587
2500	119.4848	169.4848	10.21325	1.619728

FORCE MAIN ANALYSIS

2,200 ft. – 10" 0 D.I.P.
Static Head ± 20 (15) ft.
Pressure Head ± 8 (10) psi

SYSTEM HEAD CURVE

Q,GPM	H,FT	TDH,FT	V,FPS	HV,FT
250	1.687766	39.68777	1.021325	1.619728E-02
300	2.364821	40.36482	1.22559	2.332408E-02
350	3.145209	41.14521	1.429855	3.174667E-02
400	4.026565	42.02657	1.63412	4.146503E-02
450	5.006874	43.00688	1.838385	5.247918E-02
500	6.084406	44.08441	2.04265	6.478912E-02
550	7.257635	45.25764	2.246915	7.839481E-02
600	8.525181	46.52518	2.45118	9.329632E-02
650	9.885838	47.88584	2.655445	.1094936
700	11.33848	49.33848	2.85971	.1269867
750	12.88212	50.88212	3.063975	.1457755
800	14.51579	52.51579	3.26824	.1658601
850	16.2386	54.2386	3.472505	.1872405
900	18.0498	56.0498	3.67677	.2099167
950	19.94862	57.94862	3.881035	.2338887
1000	21.93427	59.93427	4.0853	.2591565
1050	24.00623	62.00624	4.289565	.2857199
1100	26.16376	64.16376	4.49383	.3135793
1150	28.4063	66.4063	4.698096	.3427345
1200	30.73326	68.73326	4.90236	.3731853
1250	33.14415	71.14415	5.106625	.404932
1300	35.63847	73.63848	5.31089	.4379744
1350	38.21567	76.21567	5.515155	.4723126
1400	40.87525	78.87525	5.71942	.5079467
1450	43.61686	81.61686	5.923685	.5448763
1500	46.44003	84.44002	6.12795	.583102
1550	49.34431	87.3443	6.332215	.6226233
1600	52.32939	90.32938	6.53648	.6634405
1650	55.39485	93.39484	6.740745	.7055534
1700	58.54027	96.54027	6.94501	.7489621
1750	61.76525	99.76524	7.149275	.7936666
1800	65.06948	103.0695	7.35354	.8396669
1850	68.45285	106.4529	7.557805	.886963
1900	71.91472	109.9147	7.76207	.9355548
1950	75.45495	113.455	7.966335	.9854423
2000	79.07321	117.0732	8.1706	1.036626
2050	82.76907	120.7691	8.374865	1.089105
2100	86.54254	124.5425	8.579129	1.14288
2150	90.39311	128.3931	8.783395	1.197951
2200	94.32042	132.3204	8.987659	1.254317
2250	98.32448	136.3245	9.191925	1.31198
2300	102.4048	140.4048	9.396191	1.370938
2350	106.5612	144.5613	9.600454	1.431191
2400	110.7937	148.7937	9.80472	1.492741
2450	115.1015	153.1014	10.00898	1.555587
2500	119.4848	157.4848	10.21325	1.619728

FORCE MAIN ANALYSIS

2,200 ft. – 10" 0 D.I.P.
Static Head ± 20 (15) ft.
Pressure Head ± 3 (5) psi

SYSTEM HEAD CURVE

Q,GPM	H,FT	TDH,FT	V,FPS	HV,FT
250	1.687766	28.68777	1.021325	1.619728E-02
300	2.364821	29.36482	1.22559	2.332408E-02
350	3.145209	30.14521	1.429855	3.174667E-02
400	4.026565	31.02657	1.63412	4.146503E-02
450	5.006874	32.00688	1.838385	5.247918E-02
500	6.084406	33.08441	2.04265	6.478912E-02
550	7.257635	34.25763	2.246915	7.839481E-02
600	8.525181	35.52518	2.45118	9.329632E-02
650	9.885838	36.88584	2.655445	.1094936
700	11.33848	38.33848	2.85971	.1269867
750	12.88212	39.88212	3.063975	.1457755
800	14.51579	41.51579	3.26824	.1658601
850	16.2386	43.2386	3.472505	.1872405
900	18.0498	45.0498	3.67677	.2099167
950	19.94862	46.94862	3.881035	.2338887
1000	21.93427	48.93427	4.0853	.2591565
1050	24.00623	51.00624	4.289565	.2857199
1100	26.16376	53.16376	4.49383	.3135793
1150	28.4063	55.4063	4.698096	.3427345
1200	30.73326	57.73326	4.90236	.3731853
1250	33.14415	60.14416	5.106625	.404932
1300	35.63847	62.63847	5.31089	.4379744
1350	38.21567	65.21567	5.515155	.4723126
1400	40.87525	67.87525	5.71942	.5079467
1450	43.61686	70.61686	5.923685	.5448763
1500	46.44003	73.44003	6.12795	.583102
1550	49.34431	76.3443	6.332215	.6226233
1600	52.32939	79.32938	6.53648	.6634405
1650	55.39485	82.39485	6.740745	.7055534
1700	58.54027	85.54027	6.94501	.7489621
1750	61.76525	88.76524	7.149275	.7936666
1800	65.06948	92.06948	7.35354	.8396669
1850	68.45285	95.45285	7.557805	.886963
1900	71.91472	98.91472	7.76207	.9355548
1950	75.45495	102.455	7.966335	.9854423
2000	79.07321	106.0732	8.1706	1.036626
2050	82.76907	109.7691	8.374865	1.089105
2100	86.54254	113.5425	8.579129	1.14288
2150	90.39311	117.3931	8.783395	1.197951
2200	94.32042	121.3204	8.987659	1.254317
2250	98.32448	125.3245	9.191925	1.31198
2300	102.4048	129.4048	9.396191	1.370938
2350	106.5612	133.5613	9.600454	1.431191
2400	110.7937	137.7937	9.80472	1.492741
2450	115.1015	142.1014	10.00898	1.555587
2500	119.4848	146.4848	10.21325	1.619728

FORCE MAIN ANALYSIS

2,200 ft. – 10" 0 D.I.P.
Static Head ± 15 ft.
Pressure Head ± 0 psi

SYSTEM HEAD CURVE

Q,GPM	H,FT	TDH,FT	V,FPS	HV,FT
250	1.687766	16.68777	1.021325	1.619728E-02
300	2.364821	17.36482	1.22559	2.332408E-02
350	3.145209	18.14521	1.429855	3.174667E-02
400	4.026565	19.02657	1.63412	4.146503E-02
450	5.006874	20.00687	1.838385	5.247918E-02
500	6.084406	21.08441	2.04265	6.478912E-02
550	7.257635	22.25764	2.246915	7.839481E-02
600	8.525181	23.52518	2.45118	9.329632E-02
650	9.885838	24.88584	2.655445	.1094936
700	11.33848	26.33848	2.85971	.1269867
750	12.88212	27.88212	3.063975	.1457755
800	14.51579	29.51579	3.26824	.1658601
850	16.2386	31.2386	3.472505	.1872405
900	18.0498	33.0498	3.67677	.2099167
950	19.94862	34.94862	3.881035	.2338887
1000	21.93427	36.93427	4.0853	.2591565
1050	24.00623	39.00623	4.289565	.2857199
1100	26.16376	41.16376	4.49383	.3135793
1150	28.4063	43.4063	4.698096	.3427345
1200	30.73326	45.73326	4.90236	.3731853
1250	33.14415	48.14416	5.106625	.404932
1300	35.63847	50.63847	5.31089	.4379744
1350	38.21567	53.21567	5.515155	.4723126
1400	40.87525	55.87525	5.71942	.5079467
1450	43.61686	58.61686	5.923685	.5448763
1500	46.44003	61.44003	6.12795	.583102
1550	49.34431	64.3443	6.332215	.6226233
1600	52.32939	67.32938	6.53648	.6634405
1650	55.39485	70.39485	6.740745	.7055534
1700	58.54027	73.54027	6.94501	.7489621
1750	61.76525	76.76525	7.149275	.7936666
1800	65.06948	80.06948	7.35354	.8396669
1850	68.45285	83.45285	7.557805	.886963
1900	71.91472	86.91472	7.76207	.9355548
1950	75.45495	90.45495	7.966335	.9854423
2000	79.07321	94.07321	8.1706	1.036626
2050	82.76907	97.76907	8.374865	1.089105
2100	86.54254	101.5425	8.579129	1.14288
2150	90.39311	105.3931	8.783395	1.197951
2200	94.32042	109.3204	8.987659	1.254317
2250	98.32448	113.3245	9.191925	1.31198
2300	102.4048	117.4048	9.396191	1.370938
2350	106.5612	121.5612	9.600454	1.431191
2400	110.7937	125.7937	9.80472	1.492741
2450	115.1015	130.1014	10.00898	1.555587
2500	119.4848	134.4848	10.21325	1.619728

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PART 1 INTRODUCTION

Florida International University, a member institution of the State University Systems of Florida, was established by the Florida State Legislature on June 22, 1965. Florida International University currently has one major campus located in Southwest Dade County (University Park Campus) with a second campus in North Miami, The North Miami Campus (See Figure I.)

The North Miami Campus consists of seven major buildings completed and one currently under construction. The campus plan is designed as an interactive complex of facilities connected by internal courts for easy passage from one building to another. The complex is surrounded by a natural buffer of lakes, canals, green areas and preservation areas. The first on-site student housing complex of the University was built on this campus and it is served by the campus utilities.

PART 2 PURPOSE OF THE REPORT

The purpose of this report is to establish the status of the water, sewer, drainage, chilled water (air conditioning) supply/distribution electrical and telephone systems at the Florida International University North Miami Campus and to evaluate the planned, orderly campus growth, from a utilities point of view.

PART 3 DESCRIPTION OF THE NORTH MIAMI CAMPUS SERVICE AREA

The North Miami Campus Service area is located in the City of North Miami. It is bounded on the north by The Oleta River Park Reserve; Intracoastal Waterways on the east; the Biscayne Bay water passageway and NE 135 Street on the south; and by Bay Vista Blvd. and mangrove marshes on the west.

PART 4 WATER DISTRIBUTION SYSTEM

4.1 SOURCE OF WATER SUPPLY

The North Miami Campus is served by the distribution system of the City of North Miami which buys its water supply from the Miami Dade Water and Sewer Authority Department (MDWASAD) which in turn draws its water supply from the Biscayne aquifer and treats it at the Hialeah-Preston Water Treatment Plant. The treatment consist of lime softening, filtration and disinfection. The City of North Miami has existing mains through the campus running north and south. The existing distribution system within the campus is supplied by connections to the City of North Miami 30 inch diameter water main at the south end on NW 135 street and by a 16 inch diameter water main at the north end of the campus.

4.2 TYPE OF USE

The City of North Miami water supply is primarily for potable use and secondarily for fire protection. Water for lawn sprinklers is also provided by metered connections to the city mains.

4.3 EXISTING PIPING AND HYDRANTS

The existing campus water distribution system approximately consists of 4,600 feet of 16 inch diameter pipe, 1,500 feet of 12 inch diameter pipe, 600 feet of 10 inch diameter pipe and 1,000 feet of 8 inch diameter pipe.

There are 10 hydrants servicing the campus for fire protection.

4.4 CONSUMPTIVE USE AND FIRE FLOW CAPABILITIES

The existing distribution system is adequate for consumptive use and meets fire flow requirements as set forth under Chapter 32 of the Dade County Public Works Design Manual. However, it does require more hydrants in order to provide better reliability.

There is a loop system with a (normally closed) valve serving the new Trade Center and Student Services Buildings.

4.5 FUTURE CONNECTIONS

Proposed future building construction as provided by the University will require minor additions to the system and relocation of some existing mains. Additions and relocations can be handled best as the building program progresses. The ultimate system will require the addition of approximately 2,500 lineal feet of 12 inch and 2000 lineal feet of 8 inch diameter water mains and about 10 fire hydrants. Early stages of the construction must include relocation of the 16 inch diameter main east of the existing housing complex. See Fig. V through VIII.

4.6 BUILDING & SPRINKLER METERS

The existing buildings and sprinkler areas within the campus are metered separately. It has been assumed that this practice will continue. The serial number and locations as given by the City of North Miami are included herein as Figure (II).

4.7 PRESENT YEAR 2000 ESTIMATED AVERAGE DAILY DEMAND

Average Daily Flows for the Florida International University North Miami Campus computed from billing records shows an average consumption of 980.00 GPD for the past 24 month period.

4.8 SUMMARY

The existing internal water distribution system of the Florida International University, North Miami Campus meets the present consumptive and fire flow demands.

PART 5 SEWAGE COLLECTION SYSTEM

5.1 SEWAGE SOURCES

The principal source of sewage at the Florida International University, North Miami Campus is domestic sewage from the usage of the restrooms, kitchens and student housing facilities.

Limited amounts of laboratory sewage waste are neutralized prior to combining with the domestic sewage. Laboratory waste neutralization is the responsibility of the professor or researcher doing the work prior to discharging the waste down the pipes. Neutralization methods vary depending upon the work being done. For example, acid neutralization basins can be installed under cabinets; however, these are obsolete for reducing hexavalent chrome, absorbing organic chemicals, reducing phenols, etc.

Under EPA, FDER and DERM (Chapter 24), all dischargers to sewer to pretreat and render waste safe for handling at the POTW. In addition, the personnel using the laboratory facilities must comply with the Florida Right-to-Know Law and with the appropriate EPA sections published under the CFR for the handling or disposal of toxic or hazardous waste.

5.2 EXISTING COLLECTION, PUMPING AND TRANSMISSION SYSTEM

The sewage collection system of the North Miami Campus consists of approximately 4,900 feet of gravity mains, 3000 feet of force main and one sewage pumping station that delivers from the City of North Miami System to the force main system of the Miami-Dade Water and Sewer Authority Department for treatment by the MDWASAD at the North Regional Sewage Treatment plant.

The North Regional Sewage Treatment Plant provides secondary treatment (activated sludge made) and disposal via and ocean outfall. Effluent quality meets the criteria set forth by the Florida Department of Environmental Protection Regulation (FDER) and the United States Environmental Protection Agency (USEPA).

The existing system was installed as part of the Interama Project and the gravity sewer mains extend well beyond the present campus development. See Fig. IV.

5.3 COMPARISON OF WATER PURCHASE VS. SEWAGE VOLUME

The Florida International University North Miami Campus master pumping station flows are not presently metered through a magnetic or doppler meter. For a true comparison between water purchased vs. sewage volume a sewage measuring program must be initiated. This program must take into account subterranean water intrusion to obtain accurate data.

5.4 METER INSTALLATION

Metering of sewage flows is usually done for the purpose of charging for treatment or determining plant flows. New technology has made it possible to utilize ultrasonic flow meters and recording instruments which allow better management of the maintenance, the water purchased versus sewage volumes, is a useful parameter by comparison; leaky plumbing, infiltration, and system overload may be diagnosed.

It is recommended that an ultrasonic flow meter be installed in the discharge side of the master sewage pumping station or that the present magnetic meter be upgraded to include remote reading, instantaneous flow readouts and totalizer with record graph.

Ultrasonic meter offers accuracy, reliability, instantaneous and totalizing readouts, have no moving parts, are not plagued by buildups and fouling, and, in short, are ideal for sewage metering.

The meter works by measuring the speed of sound in the upstream and downstream directions of the flow. The resulting difference is proportional to the flow rate.

The meter assembly consist of two transducer assemblies with their mounting bases, a transmitter, and cables for connecting all of the above. Direct readout liquid crystal display for flow rate and attenuator at the transmitter NEMA enclosure or remote location, as well as chart recorders and remote flow totalizers can be specified.

5.5 INFILTRATION

Due to the high water table conditions that generally exist in South Florida, most gravity sewer lines are subject to the effects of infiltration, maintenance programs such as line isolation, flow measuring and line TV examination should be periodically conducted.

It is recommended that the existing gravity system on the North Miami Campus be inspected and evaluated for infiltration by using the line TV examination method. This will assure the integrity of the gravity system or determine the extent of repairs necessary.

5.6 FUTURE CONNECTIONS

The present gravity system can be extended to provide for service to a portion of the anticipated development. Other portions of the future requirements will require lift stations that will deliver the sewage by manifolding to the existing 12 inch diameter force main. Based on the campus development indicated in the Architectural Masterplan update, one lift station together with about 1000 feet of gravity main extension to the existing system will provide for the balance of the proposed campus development. See Fig. V through VIII.

5.7 PUMPING STATION REHABILITATION

It is recommended that the station wet well be drained and inspected for concrete deterioration every year. This could be done during the times when classes are not held such as winter or spring break. Planned complete rehabilitation of the wet well and dry well structure in general should be done on regular five year intervals. This prevents the corrosive action of hydrogen sulfide from deteriorating the concrete work beyond repair by usual methods such as ferrocement, epoxy and coal-tar epoxy coatings. Local Water and Sewer Authority have the responsibility for pumping station maintenance.

5.8 SUMMARY

The sewage collection system serving the Florida International University, North Miami Campus is adequate for present and future needs.

Existing 4000 Gallon grease trap serving cafeteria at the Student Center is adequate for present service. Additional trapping facilities may be required if future food service expansion is contemplated.

A 1000 gallon chemical dilution trap is presently serving the Academic III Building, this facility may need upgrading for additional capacity. PART 6 ROADS AND DRAINAGE

6.1 FLOOD CRITERIA

Flood Criteria for the Florida International University, North Miami Campus area is set at elevation +5. (See Flood Criteria Map, Figure XIII.) The flood criteria is the minimum prescribed ground level based on an estimated of the highest water level expected to occur once in 10 years. See Fig. III

Resolution No. 4120 of October 27, 1959 established Flood Criteria Elevations. Maps showing elevations currently required are filed in the Public Works Manual. These are minimum allowable elevations for crowns of streets and for land surface as required by Chapter 28 of the Metropolitan Dade County Code. These elevations are subject to continual update and are revised as drainage improvements become effective. Reasonable protection from flood damage will result only from proper combinations of filling, grading, and installation of drainage facilities.

6.2 EXISTING AND FUTURE DRAINAGE SYSTEMS

Disposal systems are termed positive drainage systems or seepage systems. Positive systems include canals and storm sewers that drain through a continuous outfall to the Bay or ocean; whereas seepage systems drain into ground water, and may consist in part of basins and pipe systems which dead end at lakes. Until such lakes are connected to a continuous outfall to the Bay, they are not considered as positive drainage systems. The acceptability of seepage trenches depends considerably on runoff, hydraulic head, size and number of seepage drains, and transmissibility of the subsurface which is to receive storm water. Design must be supported by date from special tests made to determine characteristics. One such acceptable test is the USGS-PWD Slug Test developed by the U.S. Geological Survey and Metro Dade County Public Works Department or the trench test. Other tests are listed in Manual IV of the South Florida Water Management District.

The location of the North Miami Campus does not allow for the economical design of exfiltration facilities because of the ground conditions (i.e., poor swampy soils). In accordance with the SFWMD design practices and the Dade County Water Resources DERM dry retention ponds capable of holding the first 1/2 inch of runoff must be incorporated into the design. The ponds in turn will be connected to land locked lakes.

6.3 STORM FREQUENCY AND DISPOSAL

Consideration to the selection of design frequency consideration is to be given to future conditions, and to the design frequency used for other facilities within the same system. "Frequency" as used herein refers to rainfall frequency or to storm frequency and not to flood frequency unless specifically stated. The design frequency to be used will depend on a balance between cost of a drainage facility and the damage it will prevent. After preliminary selection of drainage facility size, evaluation should be made of the damage that would be caused by flooding resulting from more intense, and less intense, storms.

For the Florida International University North Miami Campus, the frequency selected should be the 10 year frequency and the storm disposal system sized by using the rational formula Q= CIA or the Soil Conservation Service Mockus equation.

Future dry retention systems should be designed in accordance with the South Florida Water Management District regulatory criteria as per the South Florida Water Management District Manual IV or Metro Dade County's Public Works Manual Section D4.

6.4 ROADS

The Florida International University, North Miami Campus has two access roads. Access from NW 135 Street is presently blocked. Present access to the campus is solely through the NW 151 Street entrance.

The campus itself has a main entrance on the perimeter road which continues East and allows for a smooth flowing traffic pattern to all points of the campus.

The system of roads is tied to the old Interama Plan and has blended into the path of the proposed campus development and existing water and sewer line extensions. A complete loop road (Access road) with convenient access from NW 135 Street will facilitate a smooth traffic flow to the future buildings according to the development of master plan update.

Included in the road program is this connecting road from NW 151 Street (north entrance road) to the NW 135 Street entrance road for easy access to those members of the community and campus population that will attend special events and desire to travel a more direct route to I-95.

6.5 SUMMARY

The existing connection to the major thoroughfares (US-1) is satisfactory at this time. However, as the campus grows, a second entrance road at 135 Street should be provided. Buildings, such as the Continuing Education, which will draw alumni and other community members in addition to students, faculty and staff, for special activities and events should be easily accessible from one of the aforementioned entrances. An effort to provide passenger drop off and convenient self-parking should be made and stressed as a promotional item for the planned courses and events.

PART 7 CHILLED WATER SUPPLY AND DISTRIBUTION SYSTEM

7.1 GENERAL DESCRIPTION

A central utility building containing three chillers and their auxiliary equipment provide chilled water to all of the existing academic buildings with provisions for future extensions. A primary/secondary pumping system operating through a two pipe loop carry the chilled water to and from the Central Utility Building to the various campus structures. The central Utility Building has a present capacity of 1000 tons of refrigeration. This capacity includes a new 350 ton unit which has been added as part of the work coinciding with the new Library Building which is in advance stage of construction.

As part of this work, the existing piping loop was extended to serve the new Library and an extensive redesign process was included to incorporate a decoupler valve system to each primary-secondary junction at the existing buildings.

There is a 215 ton chiller serving the Trade Center Building. When the decoupler design scheme is extended to this building, this chiller will be incorporated into the piping loop system. The small capacity of this chiller in the loop will allow the system to operate efficiently on conditions of low loads. These conditions will be encountered during late fall, winter, early spring, and systems which may require continuous air.

7.2 CENTRAL UTILITY PLANT PRESENT CONDITIONS

The plant was built in 1977. It consists of two centrifugal chillers of 310 and 340 tons of refrigeration respectively. A 350 to unit has been added recently. There are two types of cooling towers; an original "Ceramic" type and a "Marley" of more recent vintage. The chillers have their complement of chilled and condenser water pumps. The two original chillers are "Carrier" and the recent one is a "McQuay". The original equipment has been properly maintained and it is therefore operating satisfactorily.

The small plant at the Trade Center Building consists of a centrifugal 215 to "Trane" chiller with a "Ceramic" cooling tower and its complement of chilled and condenser water pumps. This equipment is also in good state of maintenance thus providing satisfactory operation. There are stand alone systems for the theatre and telephone switch room.

7.3 FUTURE REQUIREMENTS

Plant capacity in this latest configuration will handle the proposed Trade Center expansion. Piping connections are in place serving existing portion of the building. The new buildings considered for Phases I, II, and III of the Architectural Master Plan are either far removed from existing piping loop or of a special operating nature. In any case they should not be connected to the Central Utility Plant. These buildings are: Daycare Center, which is remotely located in Phase I; Housing units and Continuing Education special operating characteristics and remoteness respectively in Phase II; Student Housing with special operating characteristics in Phase III.

The long range development contemplated in Phase IV of the Master Plan includes an extension to the academic core of buildings as well as more student housing units. The latter will receive independent air conditioning systems as it behooves their specialized occupancy characteristics. The proposed Academic Building will receive chilled water from the Central Utility Plant. At this point, the plant will require an expansion in capacity and probably some refurbishment of the older equipment.

7.4 CHILLED WATER DISTRIBUTION LOOP PRESENT CONDITION

At present, the loop has been extended to serve all existing buildings as well as the ones under construction. See figure IX.

7.5 DISTRIBUTION LOOP MODIFICATIONS AND FUTURE EXTENSIONS

Provisions for extending the existing piping loop have been made at Academic II Building. In phase IV these pipes must be extended to provide chilled water service to the new building which is proposed as Academic III. This will conclude the loop system. The design shall also incorporate a decoupler valve system at the primary/secondary junction for the building as well as a secondary pump system.

7.6 SUMMARY

In general, the existing plant/distribution system is in an advance of state of development. Once the ongoing design changes to an automated primary/secondary decoupler system are in place, the efficiency of the operation will be greatly enhanced. No immediate modifications are required. Only the building developments of Phase IV of the Architectural Master Plan will necessitate a plant expansion.

PART 8 ELECTRICAL DISTRIBUTION

8.1 PRESENT DISTRIBUTION NETWORK

Main power feed to the campus follows the entry road to the Central Utilities Building. From there, Academic I, Student Center, and Chiller Plant are served. Pool area is served from Trade Center building vault. Academic II Building has its own direct feed with vault, transformers, and switchgear. The Physical Plant, Public Safety, and Central Receiving have their own transformer. The Trade Center Building has a transformer which also provides power to the Tennis Courts. The existing Housing Buildings also have their own independent power feed with transformer.

The new Library Building under construction, has its own feed and transformer arrangement. The portable Buildings are deriving their power from the existing Library at the Trade Center Building.

8.2 FUTURE PROVISIONS

All new buildings will receive independent power from local utility. Service will be extended from mains running along streets bordering the Campus. Existing buildings being expanded will be fed from existing service which will have to be upgraded accordingly.

PART 9 TELEPHONE DISTRIBUTION

9.1 PRESENT DISTRIBUTION NETWORK

At present, the telephone system is fed from a control point at Academic II Building. Existing Housing Building is fed through the main Campus switching system. This arrangement is in the process of being separated so the Dormitories will have a direct link to local utility rather than going through the campus system.

9.2 FUTURE EXTENSIONS

All future housing units will have direct telephone links to local utility. Future academic buildings will operate through the Campus system by service extensions from the existing network.

PART 10 GENERAL ENGINEERING DESIGN GUIDELINES

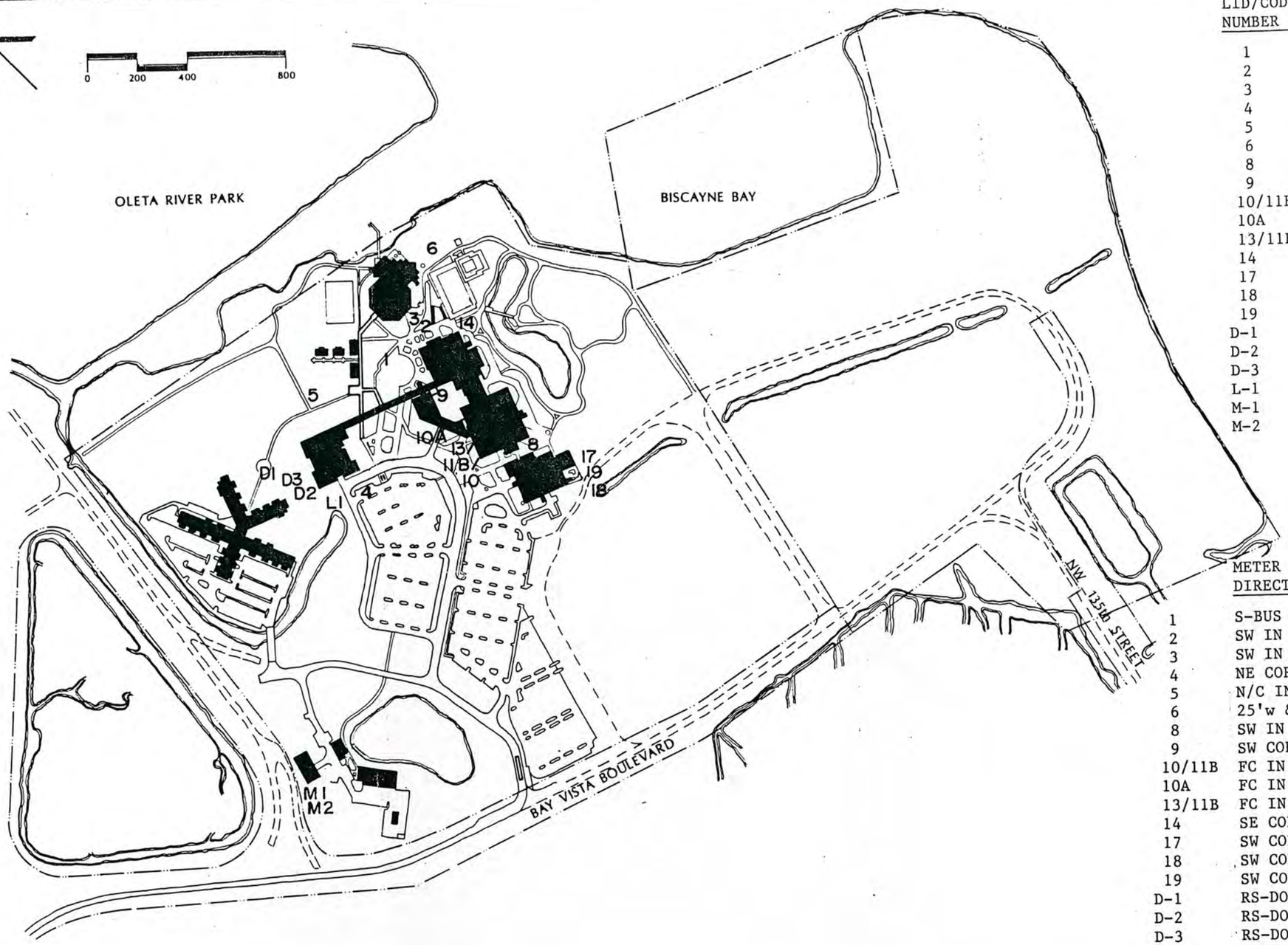
10.1 ENERGY MANAGEMENT

At present all the major buildings except the Trade Center in the academic core are connected to central computer based energy management systems. The main hardware station is located in the Chiller Plant. It consists of two separate systems. The original unit is a "Robertshaw" which serves the Chiller Plant, Student Center, and Academic I Buildings. The newer unit is a "Powers" and it serves the Academic II Building. The new Library Building presently under construction will be connected to this unit, which has expansion capabilities. Along with the modifications to the Chiller Plant coinciding with the Library Building; its automation functions are being enhanced and transferred to the "Powers" energy management system.

As new systems are constructed, they will be connected to the "Powers" unit. Existing buildings which are expanded or extensively modified, should use the opportunity to change the automation connection from the older to the newer energy management console.

10.2 NOTES

The engineering master plan update for University Park Campus contains general engineering guidelines for mechanical and electrical systems. These guidelines are applicable to North Miami Campus with the exeption of the chilled water primary/secondary link. Each campus has a different method of junction valving arrangement.



LID/CODE NUMBER	ACCOUNT NUMBER	METER NUMBER	METER SIZE	TYPE OF USAGE
1	41-22-07603	8571263	3"	SPRK
2	41-22-07633	3823580	3/4"	DETECT
3	41-22-07618	126533654	3"	W/S
4	41-22-07688	12781137	3"	SPRK
5	41-22-07708	13069727	2"	SPRK
6	41-22-07648	13823117	3"	SPRK
8	41-22-07813	14121125	1"	DETECT
9	41-22-07723	13823118	3"	SPRK
10/11B	41-22-07693	13912428	3"	W/S
10A	41-22-07738	13912429	3"	SPRK
13/11B	41-22-07798	14121124	1"	DETECT
14	41-22-07753	13912437	3"	W/S
17	41-22-07890	820177	1"	W/S
18	41-22-07894	820197	1"	SPRK
19	41-22-07892	820178	1"	W/S
D-1	41-22-07680	830031	2"	SPRK
D-2	41-22-07681	830024	2"	W/S
D-3	41-22-07682	830025	2"	W/S
L-1	41-22-07687	L077994	2"	W/S
M-1	41-22-07858	830022	2"	W/S
M-2	41-22-07873	830023	3"	SPRK

	METER DIRECTIONS	BUILDING
1	S-BUS STAND	COMMON GROUNDS
2	SW IN COR-TRADE CENTER	TRADE CENTER
3	SW IN COR-TRADE CENTER	TRADE CENTER
4	NE COR PARKING LOT	PARKING GROUNDS
5	N/C IN GRASS OF TRAILER #112	TRAILER GROUNDS
6	25'w & 35" N-WOODEN BRIDGE	EXERCISE FIELDS
8	SW IN COR-ACADEMIC ONE	ACADEMIC ONE
9	SW COR IN ENCLOSED PARKING LOT	BUILDING GROUNDS
10/11B	FC IN GRASS-ACADEMIC ONE	ACADEMIC ONE
10A	FC IN GRASS-ACADEMIC ONE	BUILDING GROUNDS
13/11B	FC IN GRASS-ACADEMIC ONE	STUDENT CENTER
14	SE COR IN-STUDENT CENTER	STUDENT CENTER
17	SW COR IN-ACADEMIC TWO	ACADEMIC TWO
18	SW COR IN-ACADEMIC TWO	ACADEMIC TWO
19	SW COR IN-ACADEMIC TWO	ACADEMIC TWO
D-1	RS-DORMS, NORTH-SIDEWALK	DORMS
D-2	RS-DORMS. SOUTH-SIDEWALK	DORMS
D-3	RS-DORMS, SOUTH-SIDEWALK	DORMS
L-1	W-C, 4' FROM LIBRARY	LIBRARY (Construction
M-1	IN LINE W/NORTH DELIV. ENTER	SUPPORT COMPLEX
M-2	IN LINE W/NORTH DELIV. ENTER	SUPPORT COMPLEX
	W-PUBLIC SAFETY BLDG.	GROUNDS

FIGURE II

FIU NORTH MIAMI CAMPUS

METER LOCATIONS

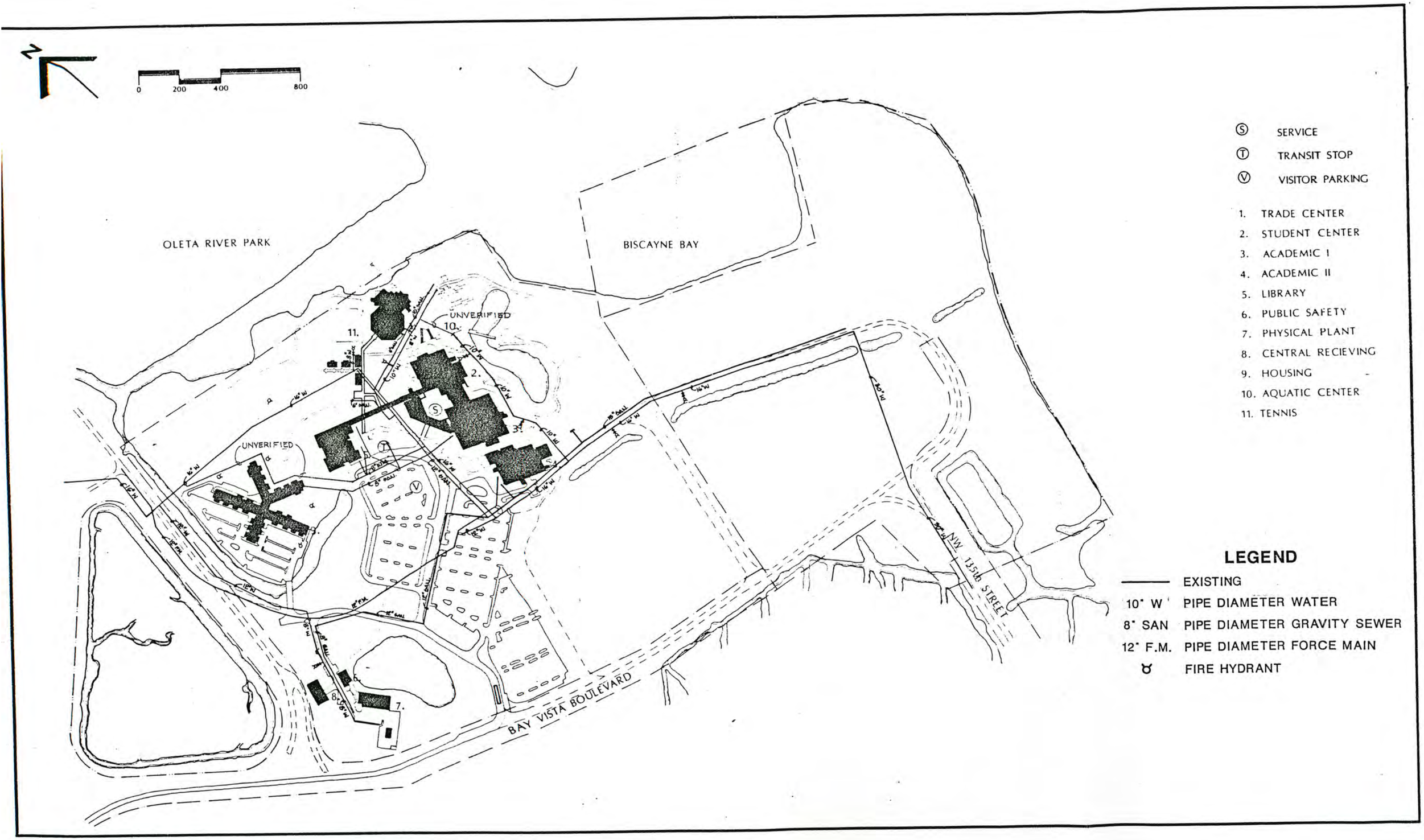


FIGURE IV

FIU NORTH MIAMI CAMPUS

EXISTING WATER DISTRIBUTION AND HYDRANTS • EXISTING SEWER COLLECTION AND TRANSMISSION

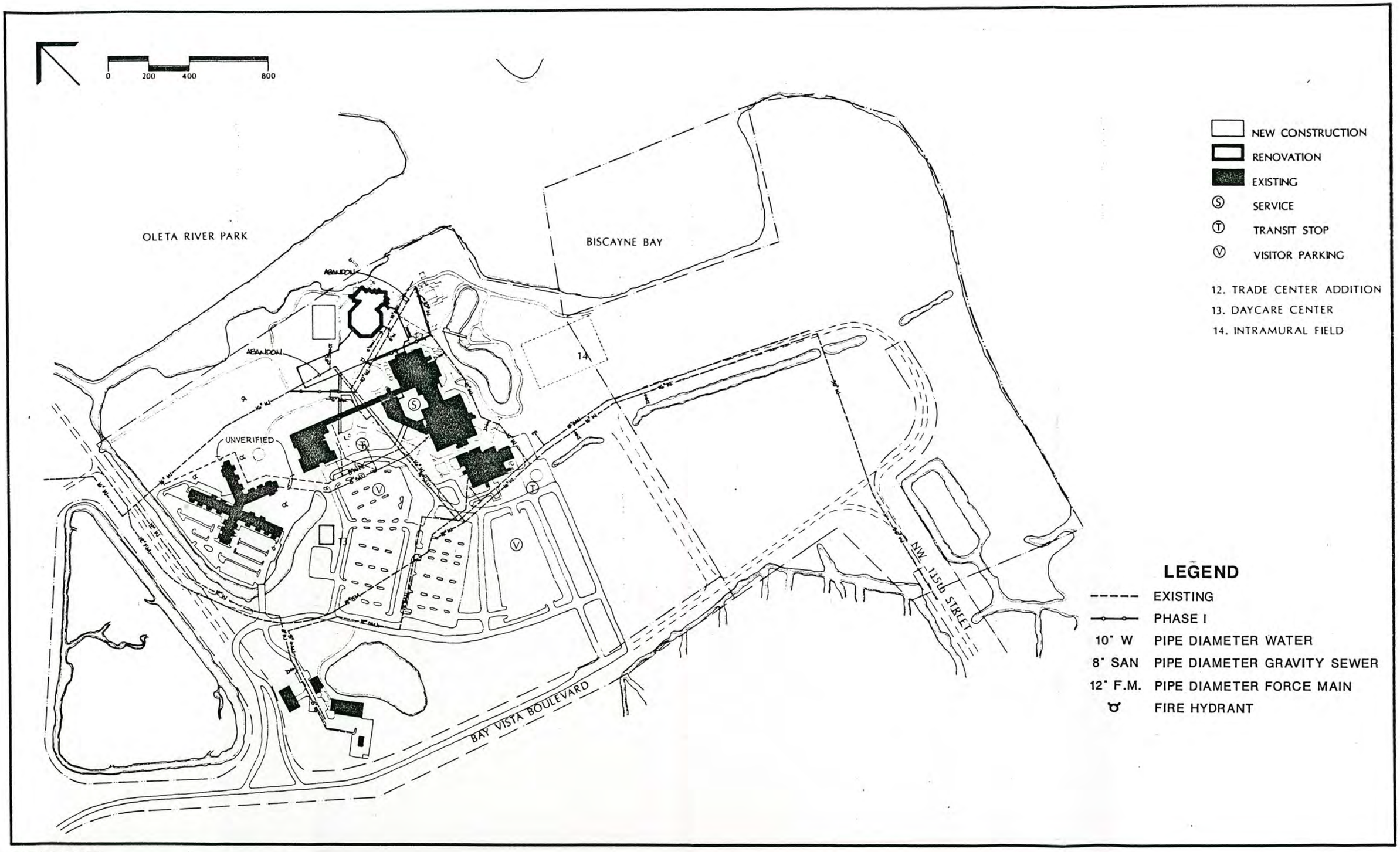


FIGURE V

FIU NORTH MIAMI CAMPUS

PHASE I,1991 – WATER DISTRIBUTION AND HYDRANTS • SEWER COLLECTION AND TRANSMISSION

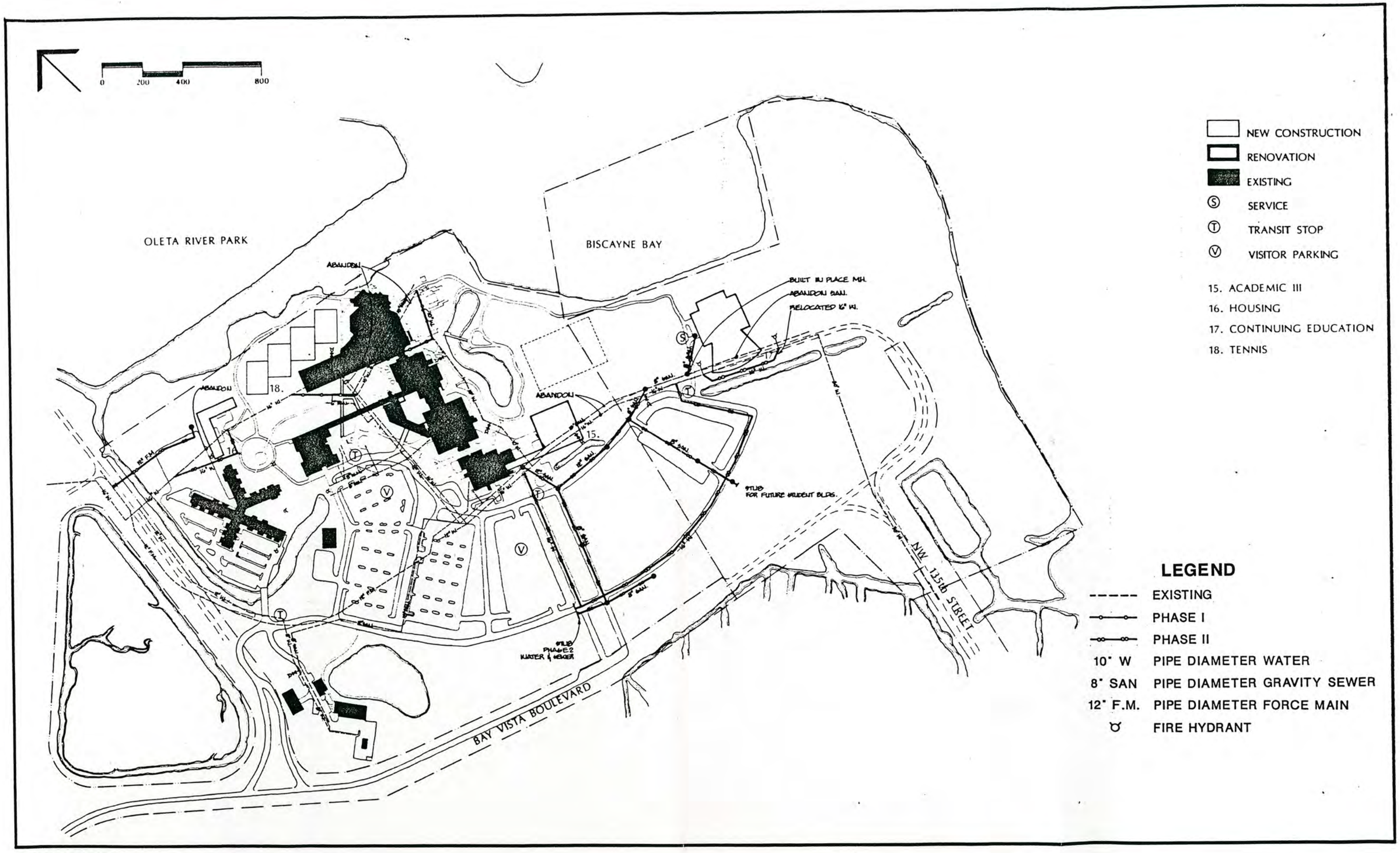


FIGURE VI

FIU NORTH MIAMI CAMPUS

PHASE II, 1996 – WATER DISTRIBUTION AND HYDRANTS • SEWER COLLECTION AND TRANSMISSION

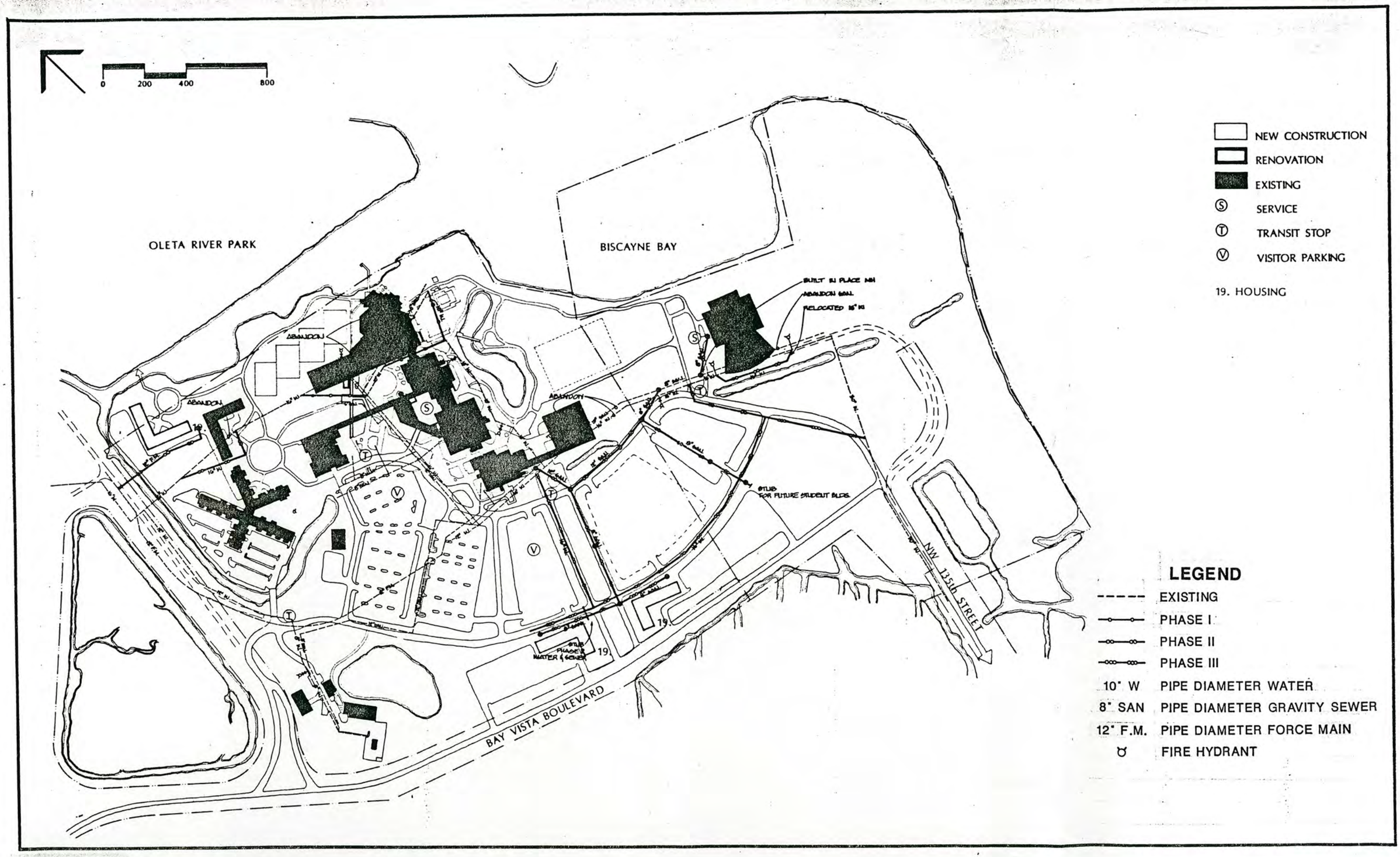


FIGURE VII

FIU NORTH MIAMI CAMPUS

PHASE III, 2001 – WATER DISTRIBUTION AND HYDRANTS • SEWER COLLECTION AND TRANSMISSION

VII

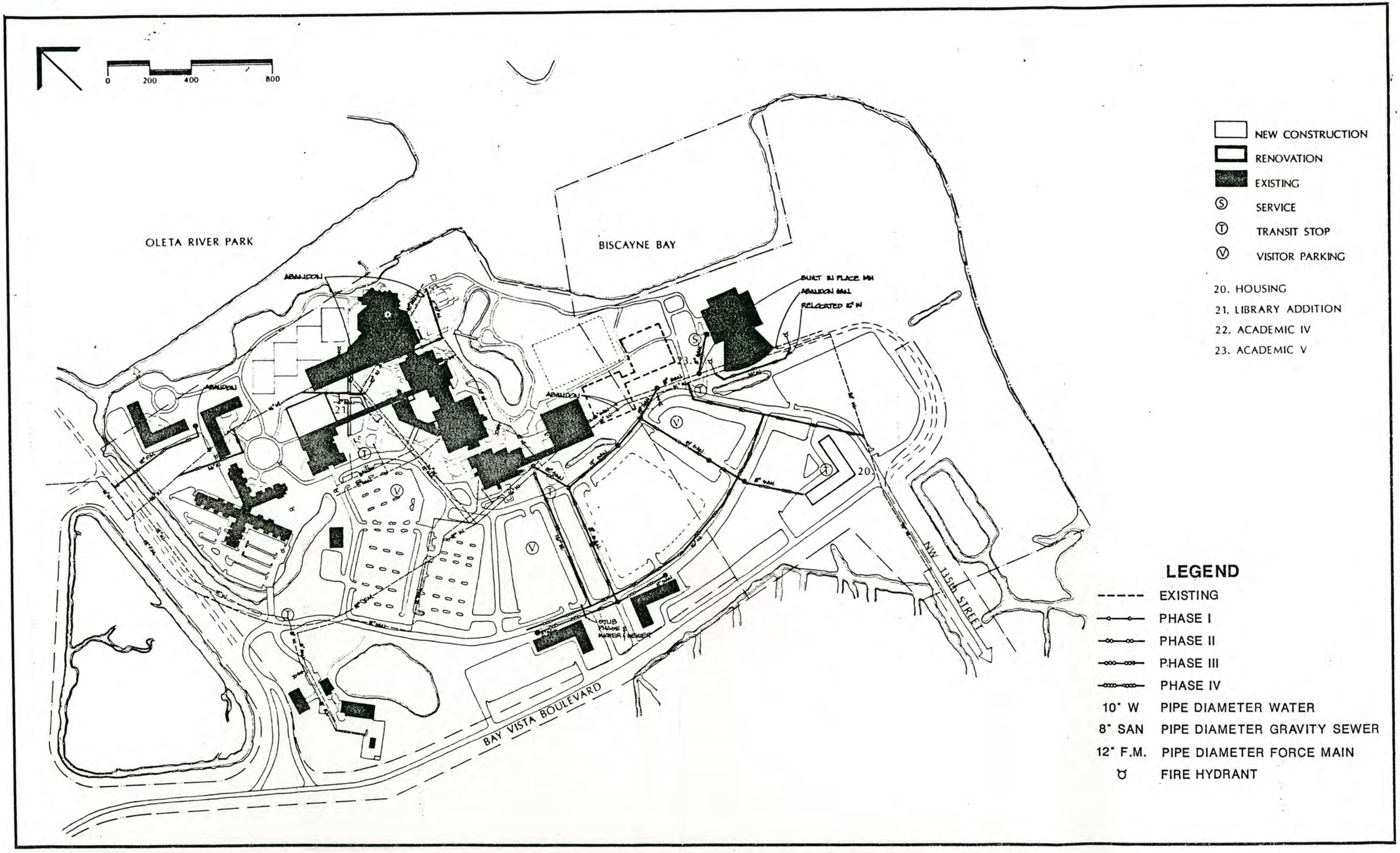


FIGURE VIII

FIU NORTH MIAMI CAMPUS

PHASE IV, LONG RANGE - WATER DISTRIBUTION AND HYDRANTS • SEWER COLLECTION AND TRANSMISSION

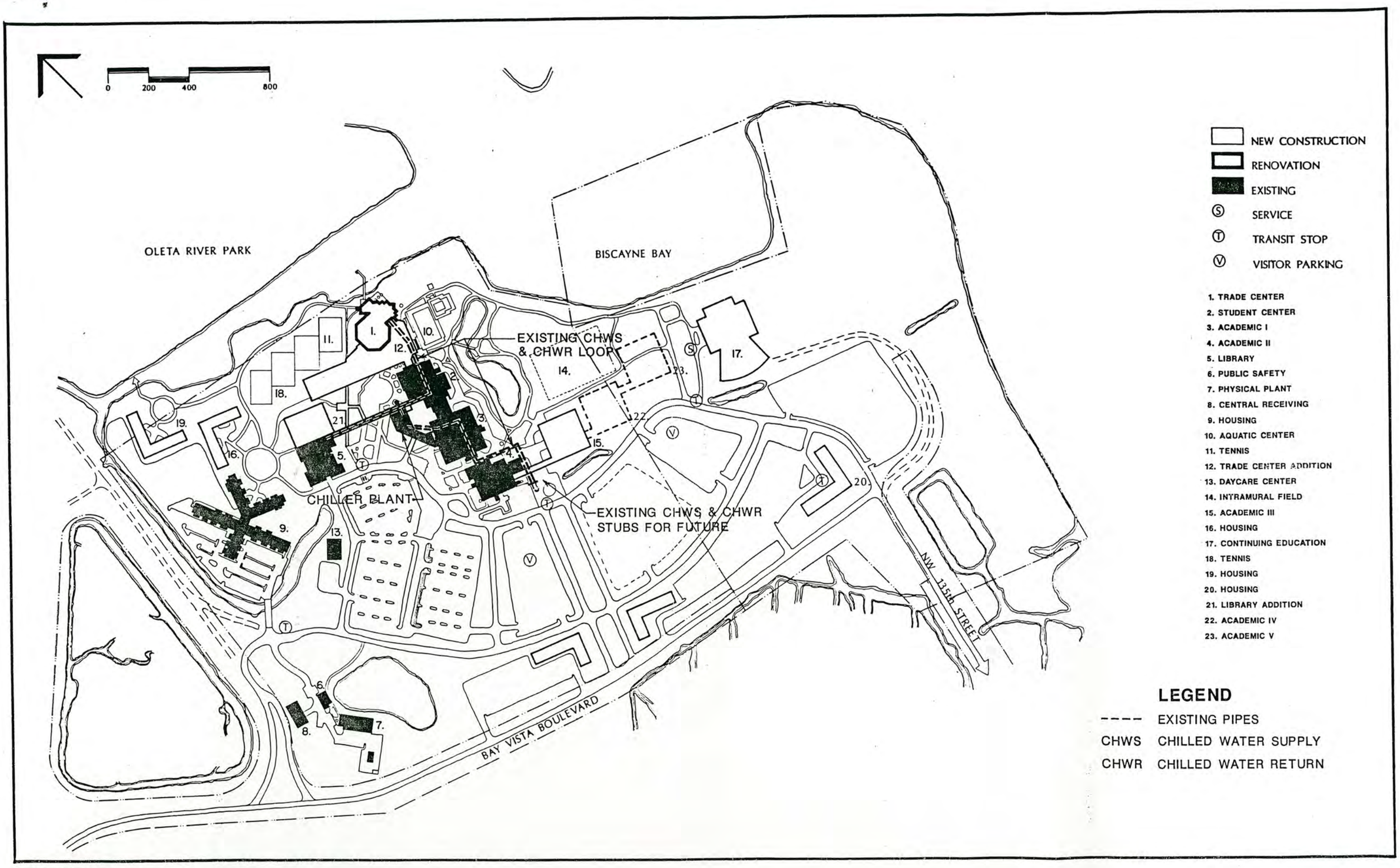


FIGURE IX

FIU NORTH MIAMI CAMPUS

EXISTING CHILLED WATER DISTRIBUTION LOOP

FLORIDA INTERNATIONAL UNIVERSITY

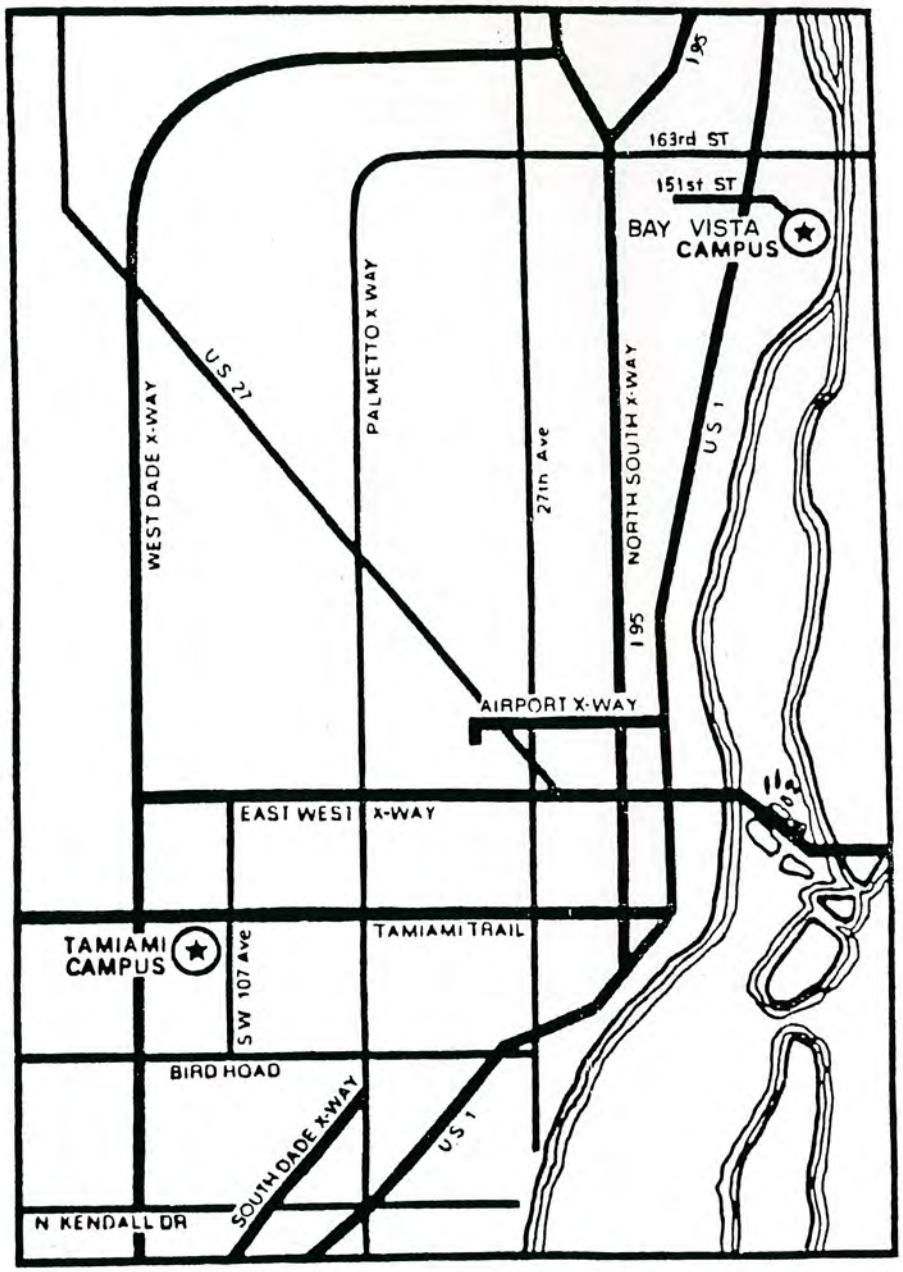


FIGURE I

FIU NORTH MIAMI CAMPUS

AREA MAP

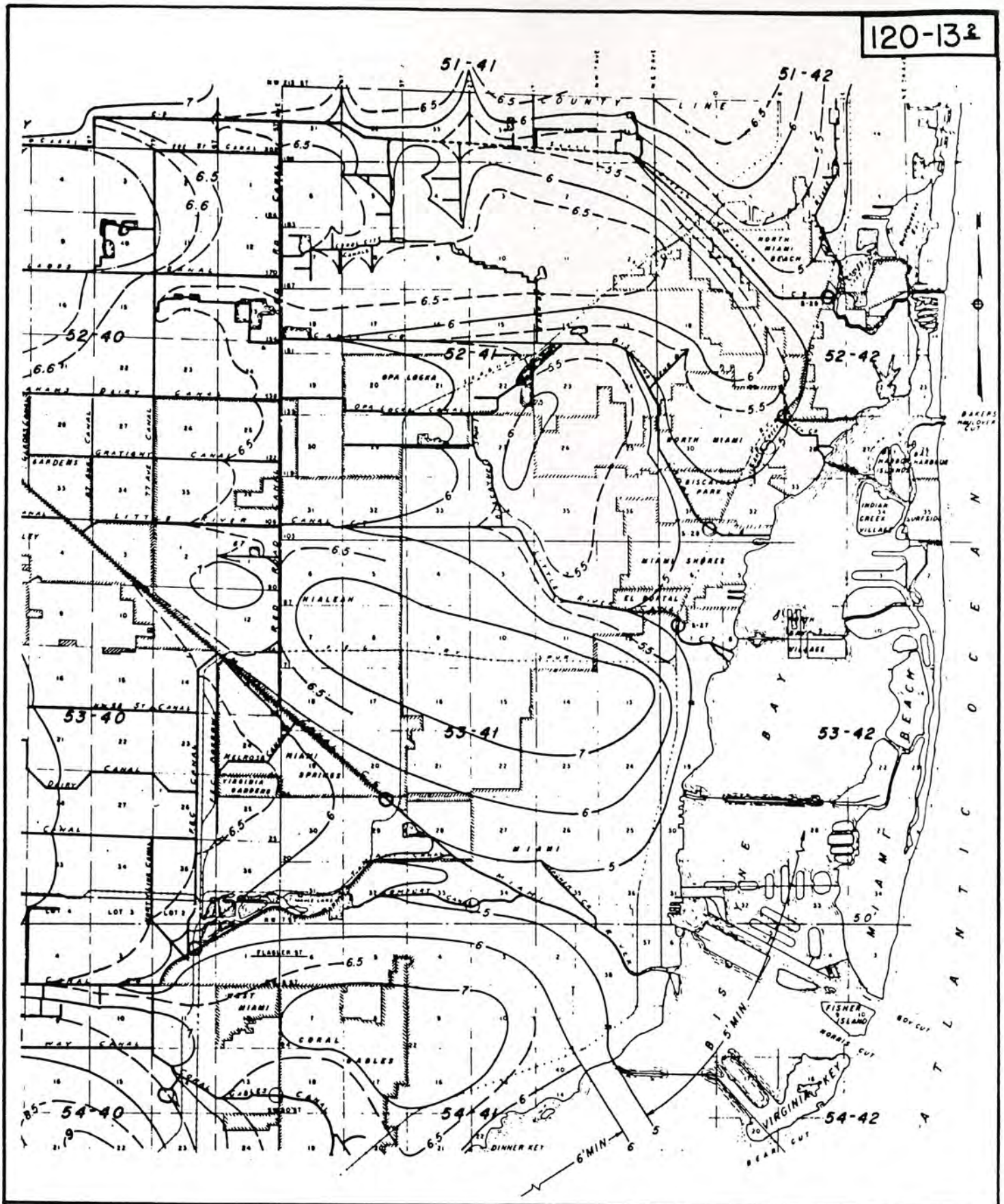


FIGURE III

NORTH MIAMI CAMPUS

FLOOD CRITERIA

LEGEND

- EXISTING CANAL
- PROPOSED CANAL
- F C D WATER CONTROL STRUCTURE
- DADE CO WATER CONTROL STRUCTURE

FLOOD CRITERIA CONTOURS

- EVEN-FOOT INTERVAL
- HALF-FOOT INTERVAL
- INTERMEDIATE INTERVAL

SCALE IN FEET

0 4000 8000 12000

NOTE

1. MINIMUM ELEVATION OF 5.0 FT APPLIES TO ALL AREAS EXCEPT WHERE INDICATED OTHERWISE. FOR AREAS WEST OF EVERGLADES NATIONAL PARK AND WEST OF CONSERVATION AREA NO 3, FLOOD CRITERIA IS TENTATIVELY ESTABLISHED AT 10.0 FT.
2. MIN ELEV OF SEAWALLS FOR WAVE PROTECTION NOT SHOWN
3. ELEVATIONS MSL NATIONAL 1929 DATUM