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I. EXECUTIVE SUMMARY

The objective and goal of this Storm Sewer Master Plan is to mitigate street flooding within the Study Area.

The City of Wildwood is subjected to significant tide levels and rainfall intensive storms. These events may occur simultaneously or separately. The ground elevations are, generally, elevation 10.0 and less. Therefore, above-normal tide levels result in severe street flooding. When evaluating which frequency storm (2-year, 5-year or 10-year) is to be used for facility design, the existing physical conditions must be considered. The City of Wildwood, being a barrier island, is subjected to tides influenced by storm surges which accompany hurricanes, tropical storms and nor'easters. These natural events are normally accompanied by heavy rainfall. A rainfall of a 10-year storm frequency or greater can be expected to be associated with a severe storm event. At that point in time, the island would be subjected to larger areas of surface flooding due to the height of the tide waters. The City's storm sewer system's tide control valves will be closed and tide waters would submerge the City's storm sewer system rendering the storm sewer system useless. The 5-year frequency is a reasonable cost-effective design parameter when considering the physical nature of the island. It is recommended the City's storm sewer system be designed to accommodate a 5-year storm frequency.

The principle behind the Master Plan is to provide a storm sewer system capable of passing a 5-year storm when tide is not a factor (tide control valves in the open position) and to provide underground storage for a 5-year storm when the tide control valves are in the closed position. The design concept is to collect what is now street flooding and storing it underground until the tide control valves open and release the stored runoff. In other words, the "surface flooding" becomes "underground ponding."

The major underground storage facilities are designed for a 5-year storm frequency. As each underground street storage system is installed the underground storage capacity is increased. The total underground storage will exceed that generated by a 5-year storm frequency.

The more underground street storage systems, installed throughout the City, the more positive impact on the mitigation of street flooding.

The Master Plan consists of the following elements:

A. Installation of tide control values at the ocean and bay outfalls.
B. Major underground storage facilities installed within the limits of the Convention Center parking areas, between Burk Avenue and Bennett Avenue.
C. Underground street storage systems installed in conjunction with the City's street improvement program.

D. Replacement of existing undersized storm pipe with larger diameter pipe.
E. Installation of J-ECO curb boxes, frames and grates.
F. Purchase portable pumps to be used to evacuate stored runoff when tide levels prevent the tide control valves from opening and the particular section of the storm system has no available storage.

The recommended improvements should be programmed into a 10 Year Capital Improvement Program (CIP). As each element of the plan is implemented the impact should be observed and the CIP reevaluated by the Wildwood Sewer Utility and the City Engineer.

II. INTRODUCTION

A. Purpose

The purpose of the Storm Sewer Master Plan is to provide a cost-effective solution to the various flooding issues frequently impacting the City of Wildwood. The City of Wildwood was incorporated in 1912 and is situated on a barrier island comprised of five separate municipalities consisting of Wildwood, North Wildwood, West Wildwood, Wildwood Crest and Diamond Beach which is governed by Lower Township. The City encompasses approximately 1.60 square miles within the above referenced island, as shown on Figure A entitled "USGS Map - Wildwood" and Figure B entitled "Existing Aerial Photograph." The City of Wildwood is bounded on the south by Wildwood Crest and on the north by North Wildwood, on the west by the Grassy Sound, and its various inlets and on the east by the Atlantic Ocean. The City is subjected to significantly high tides, heavy rain storms and the combination of high tides and concurrent heavy rains. During these periods, large portions of the City are flooded, presenting a threat to the public health and safety.

The FEMA Base Flood Elevation is established at 10.0 feet for the majority of the City neighborhoods, with the exception of the area between Ocean Avenue and the Boardwalk where the Base Flood Elevation is higher, at 11.0 feet.

Due to the relative existing grades ranging from approximately 3.5 feet to approximately 10 feet, several areas are adversely impacted by slightly greater than normal high tides. Historic records indicate tide elevations ranging from 6 feet to 7 feet. The most frequently flooded areas have existing ground elevations less than 7 feet. For example, ground elevations along Pacific Avenue range from 6 feet to 7 feet. Ground elevations at the Rio Grande Avenue – Susquehanna Avenue intersection range from 3.5 feet to 4.5 feet.

The "tide" is the most influential contributing factor to the street flooding. The flood elevation is 10.0 feet and the majority of the City of Wildwood is less than 10.0 feet. The complete elimination of flooding is neither practical nor cost-effective.

Therefore, the purpose of this Storm Sewer Master Plan is to mitigate street flooding.

This Master Plan provides a list of recommendations whose purpose is to mitigate, either directly or indirectly, the street flooding. The areas experiencing the most frequent periods of flooding are shown on Figure C "Areas of Frequent Flooding."

B. Study Area

The contracted boundary lines for this Storm Sewer Master Plan cover the City of Wildwood, except for the area between Otten's Harbor and 26th Street and the easterly right-of-way of Park Boulevard and the "Bay". The excluded area has been addressed under separate reports by CMX of Manalapan, N.J. Figure B "Existing Aerial Photographs" outlines the Storm Sewer Master Plan's boundaries.

This Storm Sewer Master Plan's study area is comprised of nine (9) drainage areas. The drainage areas are shown on Figure D "Drainage Area Map" and can be identified as:

Drainage Area #1- Park Boulevard on the west, Davis Avenue on the north, New Jersey Avenue on the east and Cresse Avenue on the south.

Drainage Area #2- New Jersey Avenue on the west, Davis Avenue on the north, the "beach" on the east and Cresse Avenue on the south. This drainage area outlets via seven (7) existing ocean outfalls.

Drainage Area #3- New Jersey Avenue on the west, Davis Avenue on the south, the "beach" on the east and Oak Avenue on the north. This drainage area outlets via the Youngs Avenue and Spencer Avenue ocean outfalls.

NOTE: New Jersey Avenue from Cresse Avenue to Oak Avenue, is the high point with surface runoff flowing to Park Boulevard to the west and Pacific Avenue to the east. Surface runoff flows from Ocean Avenue to Pacific Avenue. Pacific Avenue has the lowest elevations in Drainage Areas #2 and #3.

Drainage Area #4- Mid-block between Pacific Avenue and Atlantic Avenue on the west, Poplar Avenue on the north, the "beach" on the west and Oak Avenue on the south. This drainage area outlets via the Poplar Avenue ocean outfall.

Drainage Area #5- Mid-block between Pacific Avenue and Atlantic Avenue on the east, Poplar Avenue on the north, Park Boulevard on the west and Maple Avenue/Schellenger Avenue on the south. This drainage area drains to Park Boulevard and outlets to the "bay" through five (5) bay outfalls.

Drainage Area #6- Mid-block between Atlantic Avenue and Pacific Avenue on the east, Oak Avenue on the south, Park Boulevard on the west and Pine Avenue on the north. This drainage area outlets to the "bay" (the Schellenger Avenue bay outfall).

Drainage Area #7- New Jersey Avenue on the east, Davis Avenue on the south, Park Boulevard on the west and Schellenger Avenue on the north. This drainage area flows overland to the Park Boulevard storm drainage system and outlets to the "bay" through various "bay" outfalls.

Drainage Area #8- Cresse Avenue and Hildreth Avenue from Park Boulevard to Grassy Sound Channel/Sunset Lake. This drainage area outlets via the Hildreth Avenue and Cresse Avenue "bay" outfalls.

Drainage Area #9- Otten's Harbor on the north, Park Boulevard on the east, Bennett Avenue on the south and Grassy Sound Channel/Sunset Lake. This drainage area outlets via the Leaming Avenue and "Boathouse" bay outfalls.

C. Other Reports

1. Remington, Vernick and Walberg Engineers completed the Rio Grande Avenue-Susquehanna Avenue Storm Drainage Improvement Project, dated May 15, 2008. The May 15, 2008 Report is made part of this report by reference only. Copies of the Report are available through the City of Wildwood Sewer Utility.

2. CMX, Manalapan, completed various studies for the area bounded by Otten's Harbor to the south, the "bay" to the east, 26th Street to the north and the easterly right-of-way of Park Boulevard. Copies of the CMX studies are available through the City of Wildwood Sewer Utility.

3. Remington, Vernick and Walberg Engineers completed the Feasibility Study of Five Options to Eliminate Beach Closures on Five Mile Beach, dated April 2003.

   The City of Wildwood, in conjunction with the New Jersey Department of Environmental Protection (NJDEP) and Cape May County had determined to investigate the most practical, cost effective and environmentally sensitive way to eliminate the possibility of beach closures due to high counts of fecal coliform bacteria and reduce the risks associated with the current beach outfall configuration. It had been determined fecal coliform bacteria was presented into the storm sewer system through fecal contamination in the City being washed into collection points during periods of heavy rain. The heavy rain flushed the streets and sidewalks, flowed through the collection system and discharged through the nine (9) outfalls onto the beach.

   Ranging from several hundred feet to over one thousand feet from the mean low water elevation, the outfalls have become problematic. The City must perform daily excavation to clear the accumulation of sand from the terminus point to allow evacuation of storm flows from the storm sewer system. The outfalls generally have a pool of standing water at their outlet locations. Though the areas are cordoned off with orange snow fence, children have been seen, from time to time, playing in the standing water. The report investigated the installation of pump stations and extension of the outfall pipes into the ocean. These options will be addressed in Section VI Proposed Improvements of this Master Plan.

III. EXISTING CONDITIONS

A. GENERAL

Because of the City's location on the barrier island it is often subjected to flooding as a result of tidal flow. The tidal flooding problem most affects the Rio Grande Avenue – Susquehanna Avenue intersection, the area along the southerly edge of Otten's Harbor, Park Boulevard from Davis Avenue to Juniper Avenue and Pacific Avenue, between Cresse Avenue and Lincoln Avenue. These areas are subjected to flooding due to above normal high tide events.

The combination of above-normal high tides and rain events results in the most significant flooding events. The existing drop inlets collect gutter flow and outlet the flow into a piped drainage system discharging to either the bay, Otten's Harbor, or the Atlantic Ocean. These drop inlets are already full or overflowing due to the tide waters backing up into the storm pipe network. Therefore, the additional surface runoff or rain water has nowhere to drain. The additional rain water, coupled with already high tide, causes increased street flooding.

The term "bubbler(s)" is used in this Master Plan. The definition of "bubbler" is a drop inlet which does not connect in any way to an existing outfall sewer. A "bubbler" may be interconnected to one or more "bubblers" at an intersection. The "bubbler" accepts surface runoff and allows the runoff to percolate into the ground as its method of draining itself. When a "bubbler" is full of surface runoff or subject to high groundwater or tides, the collected runoff "bubbles" onto the surface and flows along gutters to a "piped" storm drainage system. Normally, the collected surface runoff from the "bubbler" will flood a portion of an intersection to a depth that allows the water to reach a point where it can then run by gravity to the next intersection. When the surface runoff reaches the next downstream intersection, generally the existing storm sewer system is already over capacity. Therefore, the intersection and street flooding is exacerbated. This is a domino effect as the surface runoff flows from intersection to intersection. "Bubblers" were installed as an inexpensive method of collecting surface runoff, without extending the storm pipes. The bubblers were to collect runoff and allow the collected runoff to percolate into the sandy soil. However, with high groundwater or tide levels percolation is minimal at best. During periods of high groundwater or tide bubblers become ineffective. "Bubblers" should no longer be allowed to be constructed within public rights-of-way.

B. AREAS OF FREQUENT FLOODING

The areas of frequent flooding are depicted on Figure C entitled "Areas of Frequent Flooding." Site observations were made during the rainstorm and tidal events of:

August 10, 2007
June 14, 2007
May 12, 2008
September 9, 10 and 11, 2009
September 23, 2009
October 15 and 16, 2009

The weather conditions were rain with higher than above-normal tides and no rain with higher than above-normal tides. The greatest amount of flooding occurred during significant tidal events.

C. OUTFALLS

All of the storm drainage systems outlet through "outfall" pipes to either the bayside (8 outfalls) or ocean side (10 outfalls) of the City.

The "bay outfalls" are equipped with tide control valves which open to allow collected storm water to outlet into the bay and then close as the tide rises to prevent the rising tide waters from backing up into the drainage system. Over the years the City has been plagued with significant street flooding due to the failure of the tide control valves. The tide control valves deteriorate with time and are subject to debris being caught in the valve as the valve begins to close. The debris prevents complete closure and thus the tide control valve fails. When a tide control valve fails, the tide waters rush into and fill the drainage facilities. The result is surface runoff from rain events can not enter the drainage facilities due to the lack of capacity of the system. Further, if the tides are "above-normal" the tide waters bubble out of the drainage facilities onto the surface. There is also the combined event of above normal high tide and a rain event. In all these cases the result is street flooding ranging from flooded gutters and shoulders to the complete flooding of the street causing official closing of the street to all vehicular and pedestrian traffic but most importantly to all emergency vehicles.

The existing "ocean outfalls" are not equipped with tide control valves. The tide control valves are designed to attach to the outfall pipe. The "ocean outfalls" are subject to extreme wave action. The wave action becomes so severe at times the tide valves are ripped off the outfall pipes, thus allowing the tides to rush into the drainage system. Without the tide control valve either the rising tide water or the loss of the storm facility's capacity to collect and convey surface runoff results in street flooding. Further, the natural phenomenon of yearly expansion of the City's beaches has created a significant maintenance issue. At present, the beach outfall pipes terminate a significant distance from the mean low water line. Therefore, to keep the outfalls "open", i.e., free of sand, the City must continually excavate the ends of the outfalls to allow the storm drainage systems to outlet to the ocean. Partially or wholly "clogged" outfalls significantly reduce the storm drainage system's ability to convey surface runoff to the ocean. The result is an increase in the street flooding.

There are nine (9) major drainage areas and are shown on Figure D entitled "Drainage Area Map."

D. Drainage Area #1

Drainage Area #1 has limited storm drainage facilities. There are a few "bubbler" inlets located on New Jersey Avenue and Arctic Avenue. The surface runoff from Cresse Avenue and Hand Avenue is collected by the Park Boulevard drainage system and outletted to the "bay" at Leaming Avenue. Both bay outfalls are equipped with tide control valves.

E. Drainage Area #2

Drainage Area #2 is comprised of nine (9) streets and includes seven (7) ocean outfalls. Pacific Avenue from Cresse Avenue to Davis Avenue is the most frequently flooded area, east of Park Boulevard. The lowest street elevation along Pacific Avenue is from Bennett Avenue, to Leaming Avenue to Hand Avenue. All the surface flow from New Jersey Avenue and Atlantic Avenue flows to Pacific Avenue The major cause of the flooding is the tide. The lowest elevation of Pacific Avenue is equal to the normal high tide elevation. Any tides exceeding the normal tide elevation threatens the area with street flooding.

F. Drainage Area #3

Drainage Area #3 is comprised of nine (9) streets and includes two (2) ocean outfalls. Pacific Avenue from Davis Avenue to Garfield Avenue is the most frequently flooded area after Drainage Area #2. Pacific Avenue is the low point between New Jersey Avenue and Atlantic Avenue with the Roberts Avenue intersection being the lowest point.

NOTE: The flooding of Pacific Avenue is, generally, continuous from Cresse Avenue to Garfield Avenue.

G. Drainage Area #4

Drainage Area #4 is comprised of eight (8) streets and includes the Poplar Avenue ocean outfall. The streets in this drainage area are not subject to frequent flooding. The ground elevations in this area are some of the higher in the City. The occurrence of street flooding is minimal. Surface runoff flows from Atlantic Avenue to Park Boulevard.

H. Drainage Area #5

Drainage Area #5 is comprised of several blocks and surface runoff drains to Park Boulevard. There are a limited number of "bubblers" in Pacific Avenue, New Jersey Avenue and New York Avenue. When surface runoff exceeds the "bubblers" capacity, the runoff flows overland to the storm drainage facilities in Park Boulevard and are conveyed to the various "bay" outfalls. The overflow of surface runoff causes increased flooding at Park Boulevard.

I. Drainage Area #6

Drainage Area #6 is comprised of several blocks. A significant storm drainage system exists in Pacific Avenue, New Jersey Avenue and Schellenger Avenue. This drainage system connects to the Park Avenue storm drainage system and is conveyed to the "bay" outfall at Schellenger Avenue. This area has a minimal threat of flooding. However, the Park Boulevard-Schellenger Avenue intersection does experience frequent flooding.

J. Drainage Area #7

Drainage Area #7 is comprised of several blocks. The surface runoff flows from New Jersey Avenue to Park Boulevard. There are no storm drainage facilities in New Jersey Avenue. However, there are "bubblers" at every Arctic Avenue intersection. When surface runoff exceeds the "bubblers" capacity, the runoff flows overland to the storm drainage facilities in Park Boulevard and is conveyed to the various "bay" outfalls. This area has a minimal threat of flooding. However, the overflow runoff reaches Park Boulevard-Youngs Avenue intersection and contributes to frequent flooding of the area between Park Boulevard and the Bay.

K. Drainage Area #8

Drainage Area #8 is comprised of Hildreth Avenue and Cresse Avenue. Each street has an individual "bay" outfall. The streets in this drainage area are subjected to frequent flooding as this area, along with Drainage Area #9, is the lowest lying area covered by this Report.

L. Drainage Area #9

Drainage Area #9 is discussed in detail in the Rio Grande Avenue-Susquehanna Avenue Storm Drainage Improvement Project, by Remington, Vernick and Walberg Engineers dated May 15, 2008. The recommendations of the previous report have not yet been fully implemented and this drainage area remains an area of frequent flooding. There is an issue concerning the ownership of the "boathouse" drainage pipe and tide control valve. The City's research appears to indicate ownership by the NJDOT. The City has requested NJDOT to review the City's findings, however, NJDOT has not responded to the City's inquiry.

IV. ALTERNATIVES

A. GENERAL DISCUSSION OF ALTERNATIVES-the primary cause of flooding is the impact of above-normal tides, coupled with failed tide control valves and secondarily the pipe capacity of the existing storm water system to convey the surface runoff to the respective outfalls. Storm frequencies of greater than five (5) year rainfall intensities generally are accompanied by various strength "nor'easters", "tropical storms" and "hurricanes". During these storms the primary cause of flooding is the above normal tides. The ultimate fix, when you consider the island is generally under ten foot in elevation and the base flood elevation is 10 foot, is to increase the ground elevation and/or construct structural barriers. As this alternative is not a cost effective or realistic solution, the following alternatives have been considered. All improvements are being sized for a five (5) year frequency storm.

Each individual drainage area was analyzed for its specific needs. No one alternative may completely satisfy all the identified needs. Therefore, the Report's proposed improvements may incorporate one or more of the following alternatives.

B. NO-BUILD-this alternative is not acceptable as frequent localized flooding is detrimental to the health and safety of the island residents and visitors. The street flooding enters the sanitary sewer system through the existing manholes and surcharges the sanitary sewer system, at times backing up onto the street. The localized street flooding impairs emergency response team's ability to reach their destination via the shortest route and presents a potential health issue to persons forced or otherwise walking through standing water. Failure to remedy these conditions would adversely impact the health and safety of the general public.

C. Continuance of the existing outfall MAINTENANCE AND REPAIR program-this alternative results in a status quo. As the beach continues to expand the outfall pipes must be continually maintained. The maintenance requires keeping the outfall pipes from being partially or totally blocked with sand. The maintenance and repair alternative would include the routine checking of a tide control valves for objects wedging open the tide control valves and deterioration of the valves. This alternative requires daily maintenance which is an on-going drain on the financial resources of the City. The maintenance and repair alternate must continue to be part of the City's overall sewer maintenance plan until the recommended alternatives are implemented.

D. REPLACE the existing OUTFALLS-this alternative would include replacing the existing outfalls with larger diameter pipes sized to convey the five-year frequency storm. The alternate could include replacement of single outfall pipes or combining multiple outfalls into a single outfall pipe. This alternate would require the extension of the outfalls to the minimum low water elevation. This alternative will require submission of permit applications to New Jersey Department of Environmental Protection.

E. REPLACEMENT of the existing STORM SEWER SYSTEM-this alternative would include replacing the existing undersized storm water piping system with larger diameter pipes sized to convey the five-year frequency storm. This alternative would be phased over a long period of time to correlate with the City's future roadway reconstruction projects. Where an existing roadway is scheduled for reconstruction, the capacity of the existing storm sewer system should be analyzed for a five-year storm frequency and replaced accordingly.

F. Construction of UNDERGROUND RETENTION/DETENTION FACILITIES-this alternative would include the installation of over sized storm pipes with "watertight" gasketed joints to provide underground storage of surface runoff. The facilities provide storage, then slow release of the stored runoff to the existing storm drainage piping. The storage and slow release process limits the quantity of runoff reaching the downstream piping, therefore, not exceeding the existing downstream system capacity. In other words, street "flooding" would be converted to underground "ponding". This alternative would allow storm sewer system improvements to be undertaken without replacing the entire downstream piping system, including the outfall.

G. Construction of PUMP STATIONS-this alternative would include the installation of pump stations where there is no publicly owned land available for the construction of underground retention/detention facilities. The proposed pump stations and stand-by generators would have to be constructed above the base flood elevation of 10.5 feet. The pump station design should be limited to the five-year frequency storm. Storms of greater magnitude are likely to be accompanied by storm surge tides of an elevation exceeding the elevation of the various bulkheads and revetments. In this case the pumps will be "pumping the bay or ocean" back into itself. Thus, the pump stations become ineffective for the 10, 25 and 50 year frequency storms unless coupled with the construction of flood walls or dikes. The pump station alternate requires ownership of land to accommodate the pump station and emergency generators. This alternate is the most costly. This alternate would include possible land acquisition, initial construction and long-term, ongoing maintenance costs.

V. DESIGN ELEMENTS

A. Tide Control Valves-the majority of localized street flooding has occurred due to the failure of existing and absence of tide control valves. These valves were either obstructed by debris wedged in the valve, so as to prevent the valve from completely closing, improper penetration of the bulkhead and/or deterioration due to its exposure to the elements. It is essential to prevent debris floating on the tide or entering the storm sewer pipe system through existing drop inlets, from reaching the tide control valve. The tide control valve must be installed correctly and not exposed to wave action. This Report recommends the installation as illustrated in Figure E. Tide Control Valve Installation. The system is a four-structure system. The most downstream structure contains a trash rack, the second structure contains the tide control valve and the third is a water quality control chamber and the fourth, or most upstream structure would contain a second trash rack. The structures should have significant number of access ports to facilitate inspection and cleaning. Inspection and cleaning of the two trash rack structures should be incorporated in a regular maintenance schedule and immediately before any forecasted major rainfall or storm event.

B. "Bubblers"-the current "bubbler system" provides a minimum of underground storage. The "bubblers" overflow into the adjacent gutters, puddles until the gutter flow reaches an elevation allowing the water to spill over the crest of the roadway or gutter and then flow to the drop inlets and piping system at the next lowest point. The result is the overloading of the downstream system. Therefore, this Report recommends replacement of the existing bubblers with oversized "watertight" storm sewer piping and additional drop inlets on both sides of the streets which presently have no piping system between intersections. The proposed "underground street storage" system would connect to the existing downstream system through a small orifice to produce a slow release rate. The release rate should be such as to minimally impact the downstream systems capacity. Figure F. "Underground Street Storage System Layout" depicts the layout and amount of storage per pipe size per installation.

C. Underground Street Storage-the proposed underground street storage element spreads the peak flow over a longer time of concentration. This delay reduces the maximum flow rate reaching the storm sewer system requiring less pipe capacity. The reduction of the peak flow results in maximizing the existing pipe system to its capacity, therefore, minimizing the need to replace the existing piping with larger capacity pipe. The underground street storage principally mitigates the amount of intersection and associated street surface flooding. See Figure F. "Underground Street Storage System Layout."

D. Major Underground Storage Facilities-the amount of underground storage required to be able to eliminate one or more ocean outfalls is significant and can not be accomplished through "underground street storage" alone. Significant sized underground storage facilities are required. These systems are commonly installed on City owned parcels such as parking lots and ball fields. The specific areas suitable for cost effective underground storage facilities would include the parking lots at the Convention Center and the ball field at Columbus Park/Fox Park. The underground storage facility would be designed for a slow release rate. Similar to the underground street storage system, the release rate would allow for the elimination of one or more of the existing outfalls. The remaining outfall(s) would need to be extended to the mean low water line to effectively reduce the upstream surface flooding. Also, the "major underground storage facilities" would store surface runoff when the above-normal tides force the tide control valves to close, thus preventing surface runoff from outletting to the ocean or bay. Once again, the street flooding becomes underground "ponding", mitigating the flooding. Figure G. "Underground Storage System Technical Data" illustrates the use of the D-RAINTANK or RAINSTORE3, two of several available underground storage systems. These systems should be watertight to eliminate infiltration of groundwater.

E. Portable Pumping Units-the storm sewer pipe system will drain to the ocean or bay as the tide recedes. However, there may be need to evacuate the water at a faster rate.

An example would be the forecasting of another significant tide and/or rain event immediately following the current event. The use of portable pumps, with the ability to pump for a period of 12 to 24 hours on a single tank of fuel, could be employed to reduce the amount of stored water. This would provide additional storage capacity for the forecasted event. The proposed improvements will require years to fully implement. Therefore, the portable pumps can be used, wherever necessary, to evacuate runoff from the outfall pipes directly to the bay or ocean outfalls. The portable pumps suction line can be installed in the upstream trash rack structure, see A. Tide Control Valves above, and the discharge line can be installed in the downstream trash rack structure. Figure H. "Schematic Storm System Layout at Outfalls" depicts the layout of the suction and discharge lines. The use of pumps to evacuate runoff from drainage areas of limited size can be designed as permanent installation with float controls. The CD150M Dir-Prime Pump manufactured by Godwin Pumps, Figure L, is an example of the type of pump suitable to evacuate the stored storm runoff. These pumps have a maximum pumping capacity of approximately 1,700 gallons per minute. To accomplish a greater discharge rate, the City would have to install larger capacity pump stations.

F. Stormwater Pollution Control-when it rains, oils, sediment and other contaminants are washed from paved surfaces directly into storm drains and conveyed to waterways. As non-point source pollution such as stormwater accounts for 80% of water pollution. NJDEP is responding to this issue through regulations to protect water resources. Therefore, it is recommended to use stormwater pollution control structures such as "Stormceptor" and "Vortechs" to effectively remove finer sediment, oil and grease and floating and sinking debris prior to the collected surface runoff entering a major underground storage facility or outletting through a tide control valve. Figure H. illustrates the positioning of the stormwater pollution control structure within the proposed system layout.

G. Watertight Joints-the underground storage concept is based on constructing a system that is "watertight". The storm water piping and precast drop inlets must be manufactured to prevent the infiltration of groundwater and exfiltration of the stored runoff. Therefore, rubber gasketed joints shall be used for both the pipe joints, connections between pipes and structures and the joints between precast units.

H. Calculations – as noted earlier in the report, the design storm shall be five-year. However, calculations included both the two-year and ten-year frequency storms so as to be able to determine existing pipe capacity.

The calculations included:

1) Determining the size of the Major Underground Storage Facility(s).
2) Determining the storage capacity and design storm for the "Underground Street Storage."
3) Determining the adequacy of existing major storm trunk lines.
4) Determining the necessary pipe size increases to convey storm flow to the proposed underground storage facility or directly to an outfall pipe.

The results of the calculations are found in Figure "M" and are shown on Figure "I" Proposed Storm Sewer Master Plan." The proposed storm sewers have been sized for the 5-year frequency storm.

VI. PROPOSED IMPROVEMENTS

GENERAL

There are two factors contributing to localize street flooding. First and foremost is the impact of above-normal tides. Secondly is the impact to significant rainfall. Goal #1 of the following proposals is to mitigate the tide effect. Goal #2 is to provide underground storage necessary with the successful accomplishment of Goal #1.

A. Drainage Area #1

The installation of new larger diameter storm sewer piping, together with "underground street storage" should be coordinated with the planned pavement reconstruction projects. The "underground street storage" will mitigate surface flooding when the tide control valves are closed during tidal events. The underground street storage systems will relieve the Park Boulevard storm sewer system which outlet to the bay at either Leaming Avenue or Otten's Harbor. Both of these outfall locations are located in areas of frequent flooding. The Park Boulevard storm drainage system does not have capacity to convey the five-year storm flows. The systematic installation of the "underground street storage system" will relieve the existing downstream piping system and eliminate the need to replace the existing storm drainage piping with larger diameter pipe. Should a rain event occur concurrently with a major tide event, the underground street storage system would collect the surface runoff "underground" rather than allowing the runoff to flood the roadways where the water will "pond" until the tide recedes and the tide control valves open.

B. Drainage Area #2

It is recommended to install both "underground street storage" and "major underground storage" facilities. The primary objectives are to eliminate the frequent flooding of Pacific Avenue and the reduction in the number of existing beach outfalls. The installation of underground street storage will reduce the amount of surface runoff currently flowing from New Jersey Avenue to Pacific Avenue The surface runoff flows to the drop inlets at the Pacific Avenue intersections and tries to enter the already surcharged existing the storm drain system. The "underground street storage" will detain the surface runoff allowing the peak storm flows to pass prior to the release of the stored runoff. Further, the underground street storage system will provide underground storage during rain coupled with tide events.

The Convention Center parking lot is strategically located at the most downstream point of the existing storm drain systems. The installation of "major underground storage facilities" under the parking lot areas will provide significant storage of surface runoff during high tide events. The improvements are depicted on Figure J. entitled "Schematic Major Underground Storage Facility." The Fox Park ball field is also a potential site for a major underground storage facility.

The tide control valves would prevent the tide from consuming storage within the existing pipe system thus mitigating the flooding of Pacific Avenue. As Pacific Avenue is the lowest point east of New Jersey Avenue, it is the point where above-normal tides, even without a concurrent rain event, begin to bubble out of the existing drop inlets and flood the intersections and ultimately the entire travelway.

The installation of the "major underground storage" facilities can be phased allowing for evaluation of each phase and the need to expand the system's capacity. The existing outfall pipes are undersized for the five year storm event. The major underground storage facility would allow the storing and slow release to match the existing outfall(s) capacities or into one or two new larger diameter outfalls. To address the existing outfall maintenance issues, it is recommended a single larger diameter outfall replace the six outfalls between Bennett Avenue and Burk Avenue. Figure J. illustrates the needed capacity and square footage of parking lot required to store the five-year flows. The outfalls must be extended to the mean low water level, a distance of approximately 700 linear feet. NJDEP approvals will be necessary. The elimination of the existing outfalls mitigates the issues of public health and safety and continued maintenance at the existing outfall discharge points.

C. Drainage Area #3

Unlike Drainage Area #2 there is no available public owned land suitable for the installation of a major underground storage facility. Therefore, the required storage must be provided via the installation of "underground street storage systems." The existing stormwater drainage network connect to each other beneath the Boardwalk. It is recommended to install tide control valves in the Roberts Avenue and Spicer Avenue street ends. The proposed system layout is illustrated on Figure H. "Schematic Storm System Layout at Outfalls."

D. Drainage Area #4

Drainage Area #4 is not subjected to the same degree of street flooding as experienced by the "areas of frequent flooding". Higher tide levels and more intense rainfall events would result in street flooding. However, these events would exceed the five-year storm frequency. Therefore, no improvements are proposed at this time. As street reconstruction projects are contemplated, "underground street storage systems" should be incorporated in the design.

E. Drainage Area #5

Underground street storage is recommended in all streets. These systems will allow surface runoff to be stored and slow released into the Park Boulevard storm drainage system. Drainage Area #5 naturally flows toward Park Boulevard where it is collected and piped to the various bay outfalls. The area west of Park Boulevard is subject to frequent flooding. The City has undertaken a program to install new tide control valves on the bay outfalls, resulting in the need to store surface runoff during periods of high tides where the tide valve is closed.

F. Drainage Area #6

Unlike Drainage Area #5, there is a limited number of streets suitable for underground street storage. The major roadways have existing storm drainage piping. The existing storm drain system has the capacity to convey the five year storm flows. However, when the Schellenger Avenue tide control valve is in the closed position, surface runoff will pond first in the area west of Park Boulevard, and depending on the severity of the storm, to the east of Park Boulevard.

There are no streets subject to frequent flooding within Drainage Area #6. Street flooding does occur on Park Boulevard, which is outside the limits of this Report. Therefore, improvements are outside the scope of this report. "Underground street storage systems" should be incorporated in any future street reconstruction projects.

G. Drainage Area #7

The storm drainage facilities in Drainage Area #7 are limited to "bubblers". The surface flow pattern is from New Jersey Avenue to Park Boulevard. The only street subject to frequent flooding is Park Boulevard. It is recommended to install "underground street storage systems" in future street reconstruction projects. The introduction of upstream storage will relieve the Park Boulevard drainage system of surface runoff which may overload the downstream system capacity. At the same time it will provide underground storage when the bay tide control valves are in the closed position.

H. Drainage Area #8

Drainage Area #8 is one of the lowest lying areas within the City. It is recommended to install new tide control valves and install underground street storage facilities in Hildreth Avenue, Lake Avenue and Bennett Avenue to provide storage for surface runoff during periods of above-normal tides. The proposed improvements are illustrated on Figure H. "Schematic Storm System Layout at Outfalls."

I. Drainage Area #9

Drainage Area # 9 is fully addressed in the May 15, 2008 Rio Grande Avenue-Susquehanna Avenue Storm Drainage Improvement Project. It is recommended to supplement the previous recommendations to include the "Schematic Storm System Layout at Outfalls" (Figure H) and the use of "portable pumps" until such time as the previously recommended permanent pump station is installed.

"Underground Street Storage" Systems should be installed in Hand Avenue, Bennett Avenue between park Boulevard and Lake Road.

J. Best Management Practices

In addition to the above proposed improvements, the development of a continuous program of Best Management Practices should be implemented immediately. Specific recommendations include but are not limited to the following:

1. Periodic inspection of tide control valves.
2. Replacement of existing drop inlet curb boxes with J-ECO curb boxes. See Figure K entitled "Typical J-ECO Curb Box Frame and Grate."
3. Periodic cleaning of all drop inlets of debris and sands.
4. Replace all damaged drop inlets and storm manholes.
5. Replace, rehabilitate and/or seal existing drop inlets and storm manholes to eliminate the source of infiltration due to high groundwater.
6. Sweep/clean gutters to collect all surface debris and sand prior to it entering the storm drainage system.

VII. OPINION OF PROBABLE CONSTRUCTION COST

The top three priority improvements are the installation of tide control valves at each outfall, installation of the major underground storage facility beneath the Convention Hall parking lot and the installation of underground street storage systems. Priority one is to prevent backflow into the system during tidal events. Priority two is to provide the storage necessary to drain Pacific Avenue during periods when the tide control valves are closed. Priority three is to provide additional underground storage necessary to drain portions of the City during periods when the tide control valves are closed. The fourth priority would be the purchase of portable (trailer mounted) pumps to evacuate stored water wherever and whenever there is no storage capacity available within the existing pipe system.

The remaining proposed improvements including the replacement of existing undersized storm pipes with larger diameter pipe and the installation of J-ECO curb boxes should be incorporated in a long term capital improvement plan. Opinions of probable construction costs, representing the appropriate bidding environment, should be developed at the time the projects are identified for inclusion in the capital improvement plan. The opinions of probable construction cost should be prepared by a licensed engineer, experienced with estimating in the Cape May County bidding environment existing at the time the project is scheduled to begin design services.

Following are the Opinions of Probable Construction Costs for Priorities One through Four.

Installation of Tide Control Valves on Existing Outfalls. (Parenthesis refers to Priority)

Street Ends
Cresse Avenue @ Boardwalk – 18" (3)
Cresse Avenue @ Bay – 18" (1)
Bennett Avenue – 18" (1)
Hand Avenue – 18" (1)
Taylor Avenue – 18" (1)
Youngs Avenue – 18" (2)
Spencer Avenue – 18" (2)
Poplar Avenue – 18" (3)

Item	Units	Quantity	Unit Price	Amount
Trash Rack Structure	EA	2	$10,000.00	$20,000.00
Tide Control Valve Manhole	EA	1	$8,000.00	$ 8,000.00
Tide Control Valve	EA	1	$8,000.00	$ 8,000.00
			SUBTOTAL	$36,000.00
			Contingency	$ 9,000.00
			TOTAL	$45,000.00

Priority (1) 4 x 45,000.00 = $180,000.00
Priority (2) 2 x 45,000.00 = $ 90,000.00
Priority (3) 2 x 45,000.00 = $ 90,000.00

Priorities are based on:

Priority (1) – existing conditions cause significant upstream flooding.
Priority (2) – existing conditions cause moderate upstream flooding.
Priority (3) – existing conditions cause minor upstream flooding.

Installation of Tide Control Valves on Existing Outfalls.

Street Ends Rio Grande Avenue – 24" (1)
"Boathouse" Parking Lot – 24" (1)

Item	Units	Quantity	Unit Price	Amount
Trash Rack Structure	EA	2	$12,500.00	$25,000.00
Tide Control Valve Manhole	EA	1	$10,000.00	$10,000.00
Tide Control Valve	EA	1	$12,000.00	$12,000.00
			SUBTOTAL	$47,000.00
			Contingency	$13,000.00
			TOTAL	$60,000.00

Priority (1) 2 x 60,000.00 = $120,000.00

Installation of Tide Control Valves on Existing Outfalls.

Street End Leaming Avenue @ Boardwalk – 30" (1)

Item	Units	Quantity	Unit Price	Amount
Trash Rack Structure	EA	2	$15,000.00	$30,000.00
Tide Control Valve Manhole	EA	1	$12,000.00	$12,000.00
Tide Control Valve	EA	1	$15,000.00	$15,000.00
			SUBTOTAL	$57,000.00
			Contingency	$18,000.00
			TOTAL	$75,000.00
			Priority (1)	$75,000.00

Installation of Tide Control Valves on Existing Outfalls.

Street End Burk Avenue – 48" (1)
Leaming Avenue @ Bay – 48" (2)

Item	Units	Quantity	Unit Price	Amount
Trash Rack Structure	EA	2	$25,000.00	$50,000.00
Tide Control Valve Manhole	EA	1	$15,000.00	$15,000.00
Tide Control Valve	EA	1	$30,000.00	$30,000.00
			SUBTOTAL	$95,000.00
			Contingency	$25,000.00
			TOTAL	$120,000.00
			Priority (1)	$120,000.00
			Priority (2)*	$120,000.00

* The existing tide control valve frequently fails due to debris preventing closing of the valve. Daily maintenance is required.

Summary

Priority (1)	$535,000.00
Priority (2)	$210,000.00
Priority (3)	$ 90,000.00

2A. Major Underground Storage System (5 year storm)

Item	Units	Quantity	Unit Price	Amount
Storage Units	SF	125,000	$20.00	$2,500,000.00
Geo-Grid	SY	15,000	$6.00	$ 90,000.00
Geotextile Fabric	SF	260,000	$2.00	$ 520,000.00
Excavation	CY	25,000	$20.00	$ 500,000.00
Sand	CY	15,000	$15.00	$ 225,000.00
Liner	SF	260,000	$2.00	$ 520,000.00
Maintenance Ports	EA	50	$500.00	$ 25,000.00
Parking Lot Pavement Replacement	SY	15,000	30.00	$ 450,000.00
			TOTAL	$4,830,000.00

2B. Major Underground Storage System Scheme "A"

Item	Units	Quantity	Unit Price	Amount
Major Underground Storage System	EA	1	$4,830,000	$4,830,000
Number of Locations (% Factor)	LS	LS	0%	$0.00
66" Outfall Pipe	LF	1,800	$800	$1,440,000
Ex. 48" Outfall Extension	LF	700	$600	$420,000
Collector Pipes				
54" HDPE	LF	260	$175	$45,500
48" HDPE	LF	780	$150	$117,000
42" HDPE	LF	520	$130	$67,600
36 HDPE	LF	0	$120	$0.00
30" HDPE	LF	0	$100	$0.00
Trash Rack Structure	EA	2	$6,500	$13,000
Tide Control Valve				
66"	EA	1	$50,000	$50,000
54"	EA	-	$35,000	$0.00
48"	EA	1	$30,000	$30,000
42"	EA	-	$20,000	$0.00
24"	EA	-	$10,000	$0.00
Tide Control Valve Manhole	EA	2	$8,000	$16,000
Water Quality Chamber	EA	2	$100,000	$200,000
Diversion Manhole	EA	1	$10,000	$10,000
15" HDPE (distribution piping)	LF	200	$60	$12,000
Remove Existing Outfalls	EA	4	$50,000	$200,000
Pavement Repair For Collector Pipes	SY	2000	$30	$60,000
			SUBTOTAL	$7,511,100
			Contingency	$ 788,900
			TOTAL	$8,300,000

Major Underground Storage System Scheme "B"

Item	Units	Quantity	Unit Price	Amount
Major Underground Storage System	EA	1	$4,830,000	$4,830,000
Number of Location Factor	LS	10%	$483,000	$483,000
54" Outfall Pipe	LF	1,800	$700	$1,260,000
Ex. 48" Outfall Extension	LF	700	$600	$420,000
Collector Pipes				
54" HDPE	LF	-	$175	$0.00
48" HDPE	LF	-	$150	$0.00
42" HDPE	LF	780	$130	$101,400
36 HDPE	LF	260	$120	$31,200
30" HDPE	LF	260	$100	$26,000
Trash Rack Structure	EA	4	$6,500	$26,000
Tide Control Valve				
66"	EA	-	$50,000	$0.00
54"	EA	1	$35,000	$35,000
48"	EA	1	$30,000	$30,000
42"	EA	-	$20,000	$0.00
24"	EA	-	$10,000	$0.00
Tide Control Valve Manhole	EA	2	$8,000	$16,000
Water Quality Chamber	EA	3	$100,000	$300,000
Diversion Manhole	EA	2	$10,000	$20,000
15" HDPE (distribution piping)	LF	300	$60	$18,000
Remove Existing Outfalls	EA	4	$50,000	$200,000
Pavement Repair For Collector Pipes	SY	750	$30	$22,500
			SUBTOTAL	$7,819,100
			Contingency	$ 780,900
			TOTAL	$8,600,000

Major Underground Storage System Scheme "C"

Item	Units	Quantity	Unit Price	Amount
Major Underground Storage System	EA	1	$4,830,000	$4,830,000
Number of Location Factor	LS	15%	$724,500	$724,500
54" Outfall Pipe	LF	1,800	$700	$1,260,000
42" Outfall Pipe	LF	1,800	$550	$990,000
Ex. 48" Outfall Extension	LF	700	$600	$420,000
Collector Pipes				
54" HDPE	LF	-	$175	$0.00
48" HDPE	LF	-	$150	$0.00
42" HDPE	LF	260	$130	$33,800
36 HDPE	LF	520	$120	$62,400
30" HDPE	LF	260	$100	$26,000
Trash Rack Structure	EA	6	$6,500	$39,000
Tide Control Valve				
66"	EA	-	$50,000	$0.00
54"	EA	1	$35,000	$35,000
48"	EA	1	$30,000	$30,000
42"	EA	1	$20,000	$20,000
24"	EA	-	$10,000	$0.00
Tide Control Valve Manhole	EA	3	$8,000	$24,000
Water Quality Chamber	EA	3	$100,000	$300,000
Diversion Manhole	EA	3	$10,000	$30,000
15" HDPE (distribution piping)	LF	300	$60	$18,000
Remove Existing Outfalls	EA	3	$50,000	$150,000
Pavement Repair For Collector Pipes	SY	600	$30	$18,000
			SUBTOTAL	$8,590,700
			Contingency	$859,300
			TOTAL	$9,250,000

3. Underground Street Storage System

18" HDPE	LF	1,200	$65.00	$78,000.00
Inlets	EA	6	$4,000.00	$24,000.00
Concrete Gutter Replacement	LF	1,200	$25.00	$30,000.00
Pavement Repair	SY	500	$35.00	$17,500.00
			SUBTOTAL	$149,500.00
			25% Contingencies	$ 37,500.00
			TOTAL	$187,000.00

4. Portable Pump (Trailer Mounted)

CR 150M Dri-Prime Pump w/Trailer	EA	4	$50,000.00	$200,000.00
			TOTAL	$200,000.00

VIII. Development Costs

For budgeting purposes only, we recommend the inclusion of 25% of the Opinion of Probable Construction Costs (OPCC) to reflect the necessary survey, design and construction services. Actual development costs should be negotiated based on the actual scope of work. The breakdown of services is as follows:

Topographic Survey	3% of OPCC
Design Services	9% of OPCC
Preliminary Design	(30%)
Final Design	(55%)
Preparation of Bid Documents	(15%)
Bid and Award Phase	2% of OPCC
Construction Administration	4% of OPCC
Construction Inspection	7% of OPCC

IX. STORM SEWER MASTER PLAN

A. General

There are several proposed improvements all necessary for the maximum mitigation of frequent localized street flooding.

A. Install Tide Control Valve Structures
B. Install Major Underground Storage Facility
C. Install Underground Street Storage Systems
D. Replace Existing Undersized Storm Sewers
E. Install J-Eco Curb Box, Frame and Grate

These improvements are extensive in scope. The City should incorporate these recommendations into a Storm Improvement Capital Improvement Plan. Every effort should be made to secure funding from outside sources to reduce the cost impact to the City's budget.

As the Storm Improvement Capital Improvement Plan is developed and implemented, the First Priority should be to immediately fund the installation of new tide control valve structures at each ocean outfall. The existing 24" boathouse bay outfall, just north of the Susquehanna Avenue – Rio Grande intersection, has failed and should be the first bay outfall to be replaced. The installation should include, at a minimum, the tide control valve and trash rack structures. The City should purchase a portable pump(s), with a trailer(s) for easy transportation to the sites, to be used to evacuate existing storm water at tide control valve structures until the underground storage facilities can be built. This will mitigate the impact of above-normal tides which is the primary cause of street flooding throughout the Report's study area.

The Second Priority is to install the "major underground storage" facilities within the Convention Center parking area to provide the necessary storage of surface runoff during periods when the tide control valve is in the closed position. The installation of the Major Underground Storage Facility is essential to the mitigating of the Pacific Avenue street flooding.

The above-normal tides are the largest contributor to street flooding throughout the City. The installation of tide control valves eliminates the "higher" tides from backing up through the existing storm system and either bubble up onto the streets or significantly reducing the storage capacity of the storm pipes. However, when the newly installed tide control valves are in the closed position, surface runoff fills the existing pipes. Once the existing pipes are full the remaining surface runoff has no where to go and thus "ponds" in the streets. Therefore, increased underground storage is necessary to store the excess surface runoff until the tide falls and the tide control valves open.

the excess surface runoff until the tide falls and the tide control valves open. Implementation of storage improvements of any type will lessen the street ponding currently being experienced. The storage facility has been sized to reflect outflow through the proposed outfalls to reflect the change from high tide to low tide during the period of the five-year storm.

B. Major Underground Storage Facility

The purpose of the "major underground storage facility" is to mitigate the flooding on Pacific Avenue. The major underground storage facility can be accomplished through three separate schemes. The scope of each scheme is shown in Figure J.

Scheme "A" includes the installation being proposed between Bennett Avenue and Rio Grande Avenue. The area is large enough to accommodate the storage of a five-year storm for the entire area of Drainage Area #2. This scheme requires connecting all the outfalls from Burk Avenue to Bennett Avenue to this facility. The system will outlet to the ocean through a proposed 66" diameter outfall. Scheme "A" allows for the removal of the existing outfalls at Bennett Avenue, Hand Avenue, Rio Grande Avenue and Taylor Avenue. Further, the parking lots between Rio Grande Avenue and the Convention Center would be available for other uses such as a parking garage. Scheme "A" can be constructed in three phases as funding becomes available. Phase I would be the block between Leaming Avenue and Hand Avenue connecting the Leaming Avenue and Hand Avenue storm systems to the storage facility. Phase II would be the block between Bennett Avenue and Leaming Avenue connecting the Bennett Avenue and the Rio Grande storm systems to the storage facility. Phase III would be the block between Hand Avenue and Rio Grande Avenue connecting the Taylor Avenue, Andrews Avenue and Burk Avenue storm systems to the storage facility, installation of the proposed 66" diameter outfall and removal of the four (4) existing outfalls. Scheme "A"'s opinion of probable construction cost is $8,300,000. Implementing the facility in phases would increase the construction cost. The breakdown of costs based on the three phases is as follows:

Phase I	$1,800,000
Phase II	$2,000,000
Phase III	$5,200,000
Total	$9,000,000

Scheme "B" includes the installation being proposed between Bennett Avenue and Hand Avenue and between Andrews Avenue and Burk Avenue and a portion of the block between Andrews Avenue and Taylor Avenue. The Bennett Avenue - Hand Avenue portion will outlet to the ocean through a proposed 54" diameter outfall, whereas, the Andrews Avenue - Burk Avenue portion will outlet using the existing 48" outfall. The 48" outfall will be extended to the mean low water line. Scheme "B" allows for the removal of the same four (4) existing outfalls as Scheme "A". Scheme "B" can be constructed in three phases. Phase I and Phase II are the same as Phase I and Phase II for Scheme "A". Phase III would be the area comprised of a portion of the block between Taylor Avenue and Andrews Avenue and the block between Andrews Avenue and Burk Avenue. Phase III would include installation of the proposed 54" outfall pipe, extension of the existing 48" outfall pipe and removal of four (4) existing outfalls. Scheme "B"'s opinion of probable construction cost is $8,600,000. The breakdown of cost based on the three phases is as follows:

Phase I	$1,800,000
Phase II	$2,000,000
Phase III	$5,700,000
Total	$9,500,000

Scheme "C" includes the installation of the major underground storage system between Bennett Avenue and Leaming Avenue (Phase I), Rio Grande Avenue and Taylor Avenue (Phase II) and Andrews Avenue and Burk Avenue (Phase III). The Bennett Avenue - Leaming Avenue block would outlet to the ocean through a proposed 54" diameter outfall. The Rio Grande Avenue - Taylor Avenue block would outlet to the ocean through a proposed 42" outfall. The Andrews Avenue- Burk Avenue block would outlet using the existing 48" outfall. The 48" outfall will be extended to the mean low water line. Phase III would include installation of the proposed 54" and 42" diameter outfall pipes, extension of the existing 48" outfall pipe and removal of three (3) existing outfalls. Scheme "C"'s opinion of probable construction cost is $9,250,000. The breakdown of cost based on the three phases is as follows:

Phase I	$1,800,000
Phase II	$2,000,000
Phase III	$6,400,000
Total	$10,200,000

It is recommended the City choose one of the three schemes and then proceed on a Phased program evaluating the results before proceeding with the next phase. As the Pacific Avenue street flooding can be mitigated but not eliminated, evaluation of the reduced street flooding can be made. If the results of Phase I and/or Phase II are satisfactory to the City, the City's funds may be to redirected to the remaining improvements recommend in this Master Plan.

The outfalls will be extended to Mean Low Water Level, a distance of approximately 1,500 feet from the Boardwalk. The extended outfalls will mitigate the daily need to clear sand away from the existing outfalls necessary for the proper operation of the storm sewer system.

Implementation of the remaining recommendations should follow completion of priorities one and two. The City should evaluate each successive improvement and revisit its Capital Improvement Plan to determine the next appropriate improvement project.

C. Underground Street Storage

There are many intersections, drained by "bubblers" and not interconnected with the "piped" storm system. These areas should be connected to adequately size pipe to convey the five year flows to the outfalls. Wherever and whenever the City undertakes a street reconstruction or sanitary sewer improvement project the design of an underground street storage system or adequately sized storm sewer, whichever is most appropriate, should be included in the construction contract. The underground street storage systems should be tied into the downstream systems to allow evacuation of the stored surface runoff following the end of the storm.

Surface runoff from Drainage Areas #5, #6 and #7 flows to Park Boulevard where the surface runoff is picked up by the existing drop inlets and conveyed to the Bay. However, the volume of surface runoff is greater than the downstream storm sewers capacity resulting in exasperating the flooding in the streets between Park Boulevard and the Bay. When the tide control valves are in the closed position the problem is magnified. By installation of the underground street storage upstream of Park Boulevard, the rate of surface runoff to Park Boulevard will be reduced while at the same time providing upstream storage both essential to mitigating the downstream flooding. Installation of underground street storage systems in Drainage Areas #1 and #2, between New Jersey Avenue and Park Boulevard will have the same positive impact on downstream flooding.

The majority of storm sewer pipes can not accommodate the projected five year storm frequency. The Master Plan shows the replacement of the undersized storm sewers. The proposed sized pipes will serve to quickly evacuate stored surface runoff when the tide control valve is in the open position. The larger pipes will also provide more storage volume when the tide control valve is in the closed position.

The installation of the J-ECO curb box, frame and grates are essential in keeping debris from entering the storm sewer system and eventually getting wedged in the tide control valve, preventing the valve from closing completely. Partial opened tide control valves, during higher tides, will cause a significant loss of storage volume within the storm sewer system.

D. Recommended Sequence of Improvements

Phase I Improvements

A. Install Tide Control Valves	
Bennett Avenue	$45,000
Hand Avenue	$45,000
Taylor Avenue	$45,000
Rio Grande Avenue	$60,000
Leaming Avenue	$75,000
"Boathouse" Parking Lot	$60,000
Burk Avenue	$120,000
Total "A"	$450,000
B. Purchase Portable Pump (Trailer Mounted)	$200,000
Total "B"	$200,000
C. Replace "Boathouse" Storm Sewer	$120,000 (1)
Install 48" Tide Control Valve Lake Avenue and Leaming Avenue	$120,000 (1)
Total "C"	$240,000
D. Major Underground Storage System Block – Leaming Avenue and Hand Avenue	$1,800,000 (2)
Phase I Improvements Total	$2,690,000

(1) Rio Grande Avenue-Susquehanna Avenue Storm Drainage Improvement Project
(2) 12% Cost Increase for Phasing of Construction ; Use Existing Outfalls; Install Collector Piping

Phase II Improvements

A. Major Underground Storage System Block – Bennet Avenue and Leaming Avenue	$2,000,000 (3)
Phase II Improvements Total	$2,000,000

(3) 12% Cost Increase for Phasing of Construction ; Use Existing Outfalls; Install Collector Piping

Phase III Improvements

A.	Major Underground Storage System Block – Hand Avenue and Rio Grande Avenue	$5,200,000 (4)
	Phase III Improvements Total	$5,200,000

Phase IV Improvements

Phase I, II and III Improvements should be evaluated for effectiveness. The scope of Phase IV and other future improvement should be determined following the evaluation.

Phase IV Improvements Total	To Be Determined

(4) 12% Cost Increase for Phasing of Construction ; Install New Outfalls; Extend Existing Burk Avenue Outfall; Install Collector Piping; Remove Four (4) Existing Outfalls.

FIGURE "A"

U.S.G.S MAP-WILDWOOD & STUDY AREA

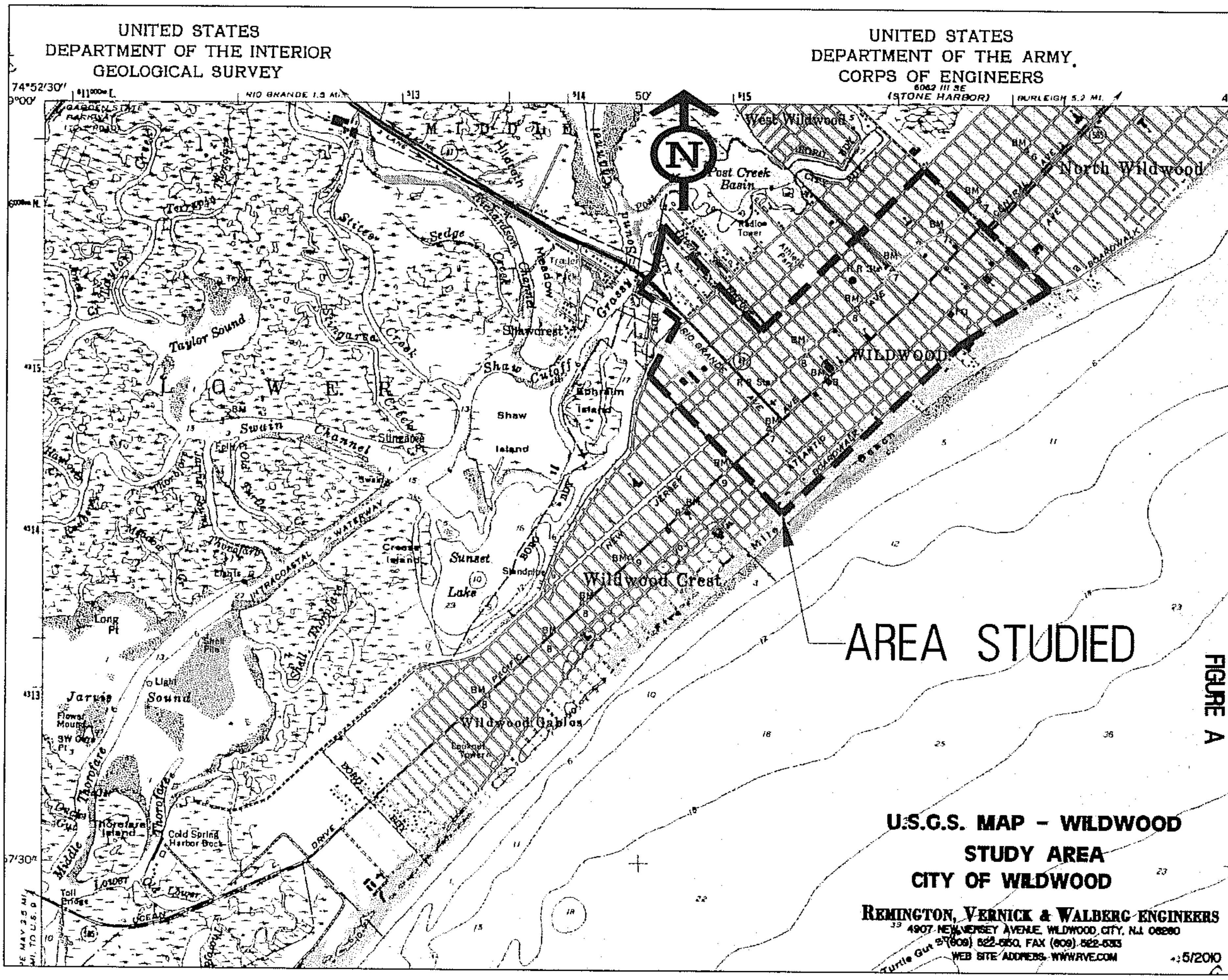

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY
UNITED STATES
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
N
West Wildwood
North Wildwood
Post Creek Basin
WILDWOOD
Taylor Sound
Shaw Island
Sunset Lake
Wildwood Crest
Wildwood Gables
Jarvis Sound
INTRACOASTAL WATERWAY
AREA STUDIED
U.S.G.S. MAP - WILDWOOD
STUDY AREA
CITY OF WILDWOOD
REMINGTON, VERNICK & WALBERG ENGINEERS
4907 NEW JERSEY AVENUE, WILDWOOD CITY, NJ 08260
(609) 522-5150, FAX (609) 522-5313
WEB SITE ADDRESS: WWW.RVE.COM
5/2010

FIGURE A

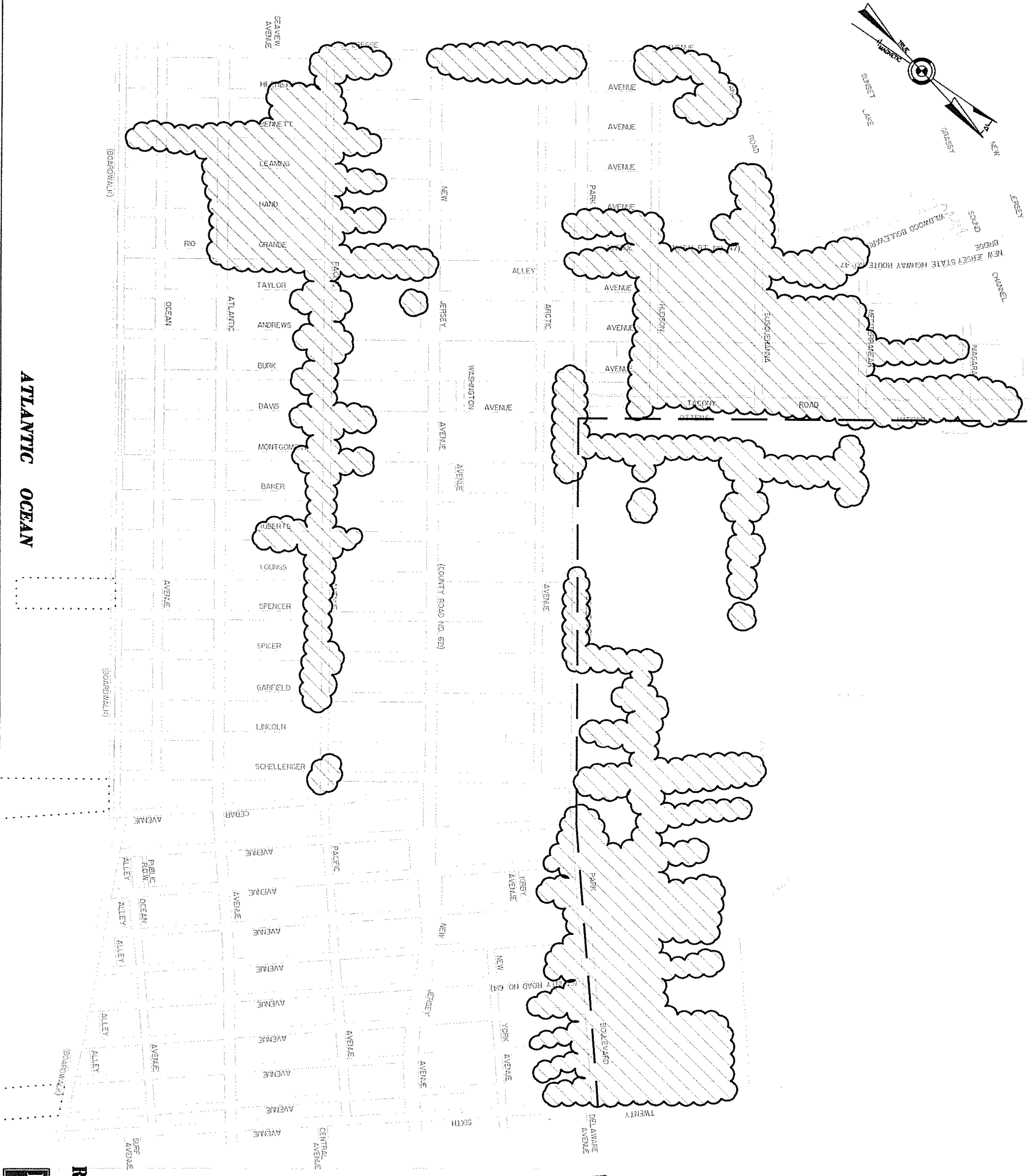
FIGURE "B"

EXISTING AERIAL PHOTOGRAPH


CITY OF WILDWOOD
Cape May County, New Jersey
STUDY AREA
FIGURE B
EXISTING AERIAL PHOTO
CITY OF WILDWOOD
REMINGTON, VERNICK & WALBERG ENGINEERS
4907 NEW JERSEY AVENUE WILDWOOD CITY, N.J. 08260
WEB SITE ADDRESS: WWW.RVE.COM
5/2010

FIGURE “C”

AREAS OF FREQUENT FLOODING



= AREAS OF FREQUENT FLOODING

= STUDY AREA

FIGURE C

AREAS OF FREQUENT FLOODING

RV&W

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FIGURE "D"

DRAINAGE AREA MAP

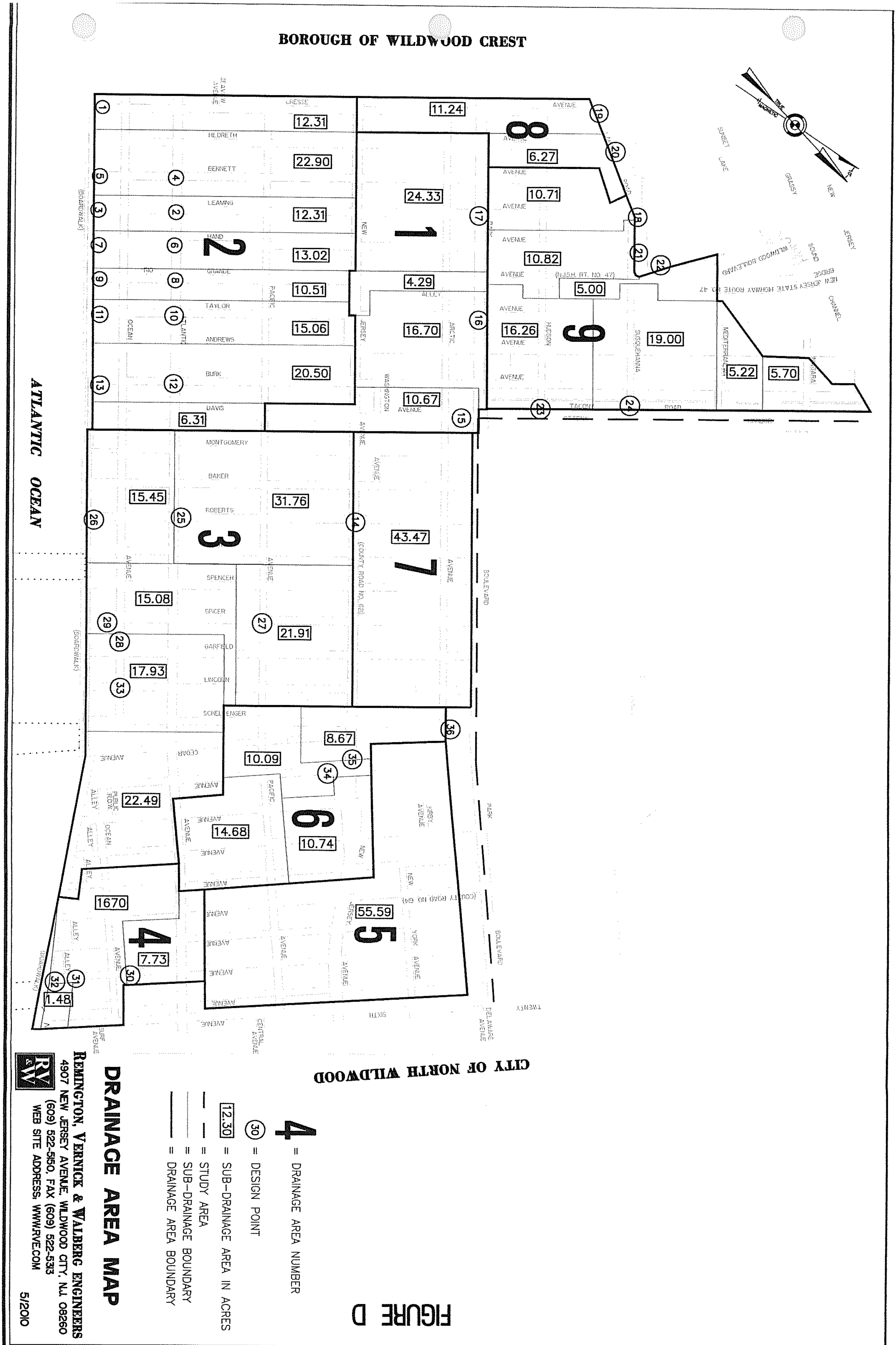

BOROUGH OF WILDWOOD CREST
ATLANTIC OCEAN
CITY OF NORTH WILDWOOD
FIGURE D
4 = DRAINAGE AREA NUMBER
30 = DESIGN POINT
12.30 = SUB-DRAINAGE AREA IN ACRES
= STUDY AREA
= SUB-DRAINAGE BOUNDARY
= DRAINAGE AREA BOUNDARY
DRAINAGE AREA MAP
REMINGTON, VERNICK & WALBERG ENGINEERS
4907 NEW JERSEY AVENUE, WILDWOOD CITY, NJ 08260
(609) 522-550, FAX (609) 522-533
WEB SITE ADDRESS: WWW.RVE.COM
5/2010

FIGURE "E"

TIDE CONTROL VALVE INSTALLATION

Tideflex® Technologies

Technical Data

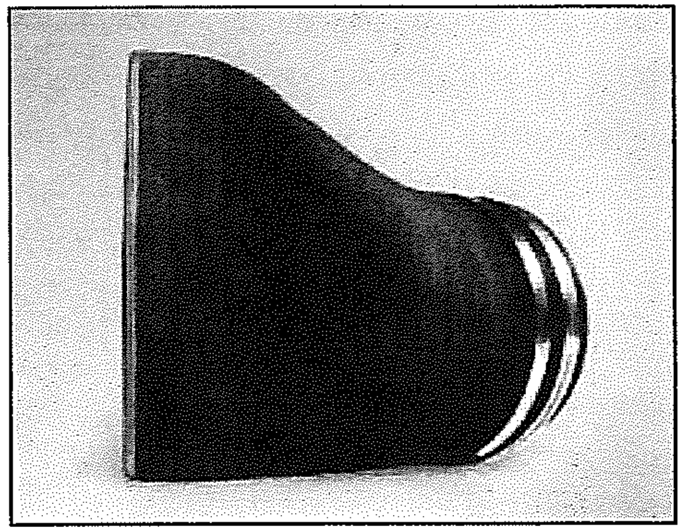
Series TF-1—Tideflex® Check Valve

Features & Benefits

- Ideal for manhole installations
- Lightweight, all-elastomer design
- Seals around entrapped solids
- Cost-effective, maintenance-free design

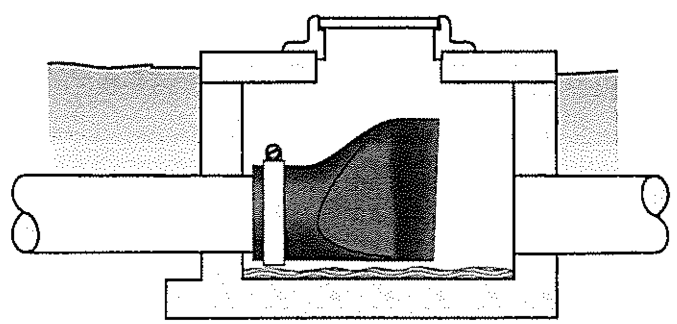
Materials of Construction

- Elastomers available in Pure Gum Rubber, Neoprene, Hypalon®, Chlorobutyl, Buna-N, EPDM, and Viton®



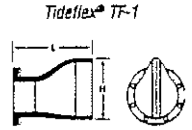
We are pleased to announce the introduction of the revolutionary TF-1 Check Valve. It functions and operates under the same simple principle of operation as the original TF-2 Tideflex®.

This design is ideal for existing manhole installations where the invert of the pipe is close to the floor of the vault. There are many check valves in interceptors, manholes, and vaults. These vaults are designed so that there would be a maximum gravity head; thus, the invert pipe is as close to the base as possible. The TF-1 allows installations in such applications.



The Tideflex® Technologies Series TF-1 Tideflex® Check Valve is designed for applications in manholes, where the bottom of the manhole is close to the invert of the pipe. The TF-1 configuration allows the valve to be properly installed without manhole modification, ensuring positive backflow prevention and a lifetime of maintenance-free performance.

Tideflex® TF-1



Flanged Style TF-1

Dimensions Series TF-1 Tideflex® Check Valve

The TF-1 slip-on connection is based on the O.D. of the mating Pipe. For in-between sizes, consult factory.

Pipe O.D.	Tideflex® TF-1 Cuff Slip-On Length A	TF-1 Flanged ANSI Flange Size	Maximum Length L	Maximum Height H
6"	2"	6"	14"	12"
8"	2"	8"	17-1/4"	15-1/4"
10"	3"	10"	21-1/2"	18-3/4"
12"	4"	12"	26"	22"
16"	5"	16"	32"	29"
20"	8"	20"	40"	36"
24"	8"	24"	46"	43"
30"	9"	30"	55-1/4"	54-3/4
36"	10"	36"	65"	69"
42"	10"	42"	59-1/2"	70-1/2
48"	10"	48"	71"	91"
60"	13"	60"	80-3/4"	95"

RV &W

FIGURE "E"

TIDE CONTROL VALVE INSTALLATION

City of Wildwood, Cape May County, New Jersey

FIGURE "F"

UNDERGROUND STREET STORAGE SYSTEM LAYOUT

Pipe Dia. (in)	Pipe Radius (ft)	Pipe Area (sq ft)	Pipe Lenth (ft)	Storage Volume (cf):	Storage Pipe + Inlet (cf):
15	0.63	1.23	1200	1471.88	1,903.875
18	0.75	1.77	1200	2119.50	2,551.500

"E" Inlet 4x4.5x4	"E" Inlet Number of:	Storage All inlets Gallon:
72	6	432

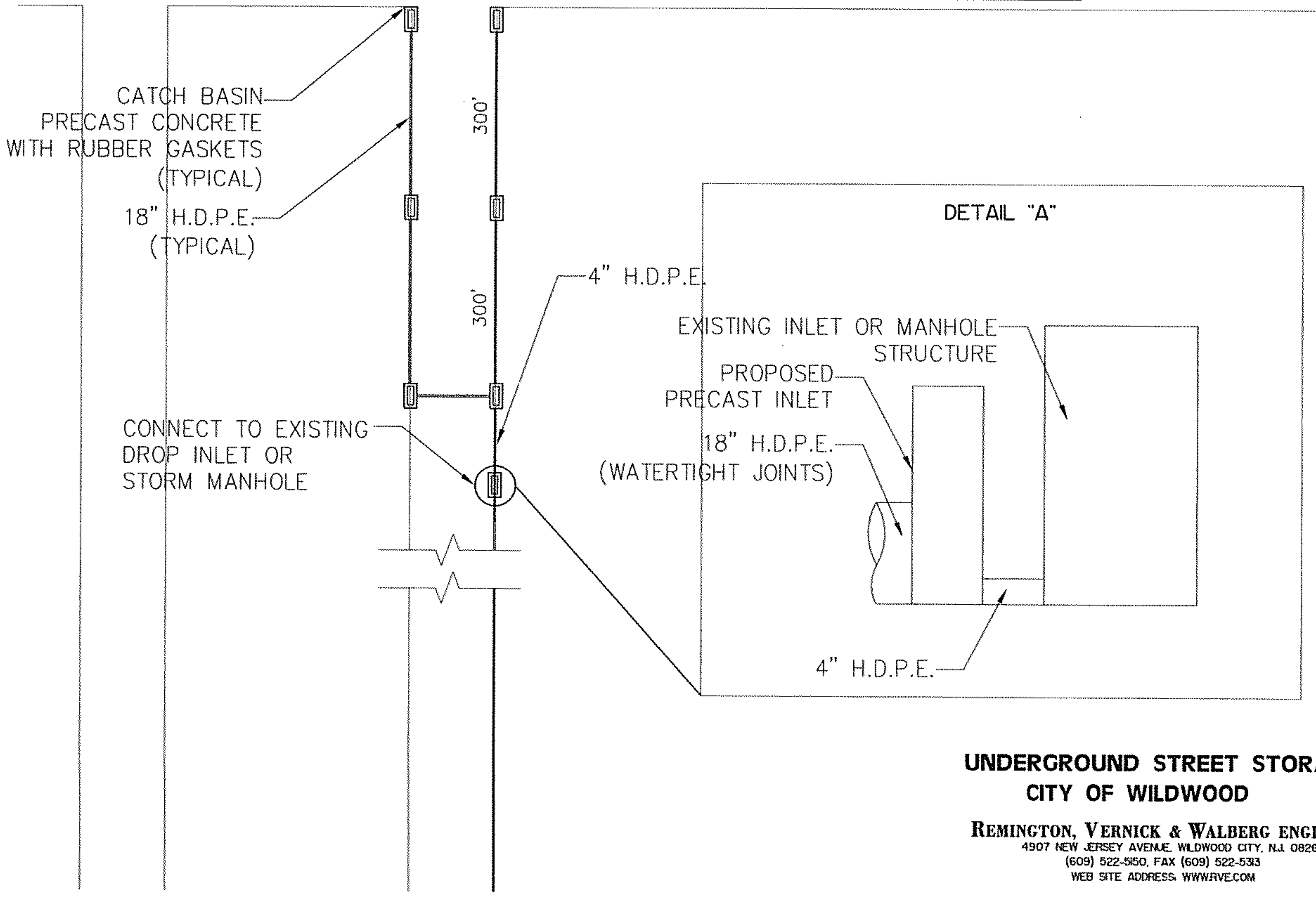


FIGURE F

UNDERGROUND STREET STORAGE
CITY OF WILDWOOD

REMINGTON, VERNICK & WALBERG ENGINEERS
4907 NEW JERSEY AVENUE, WILDWOOD CITY, N.J. 08260
(609) 522-5150, FAX (609) 522-5313
WEB SITE ADDRESS: WWW.RVE.COM

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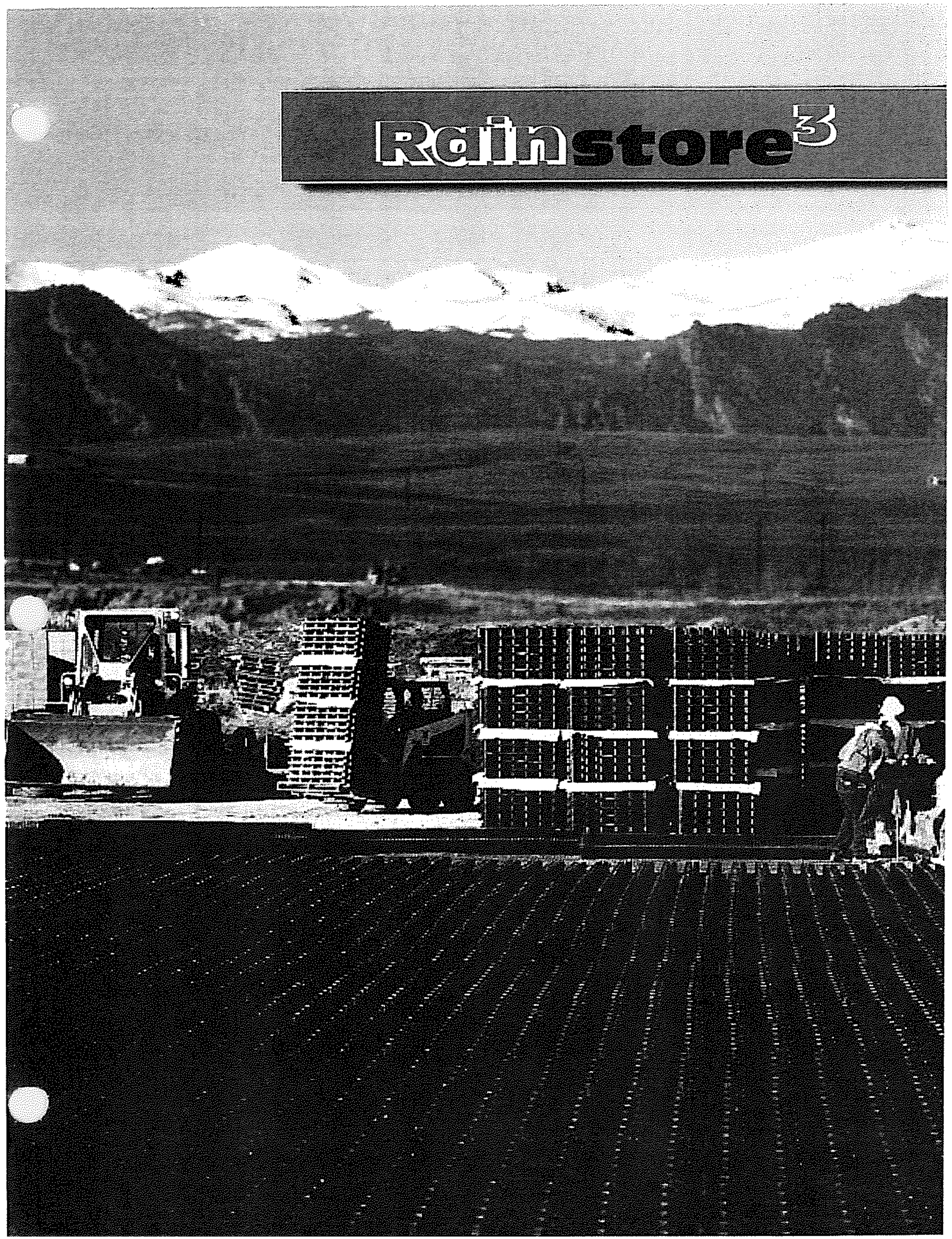
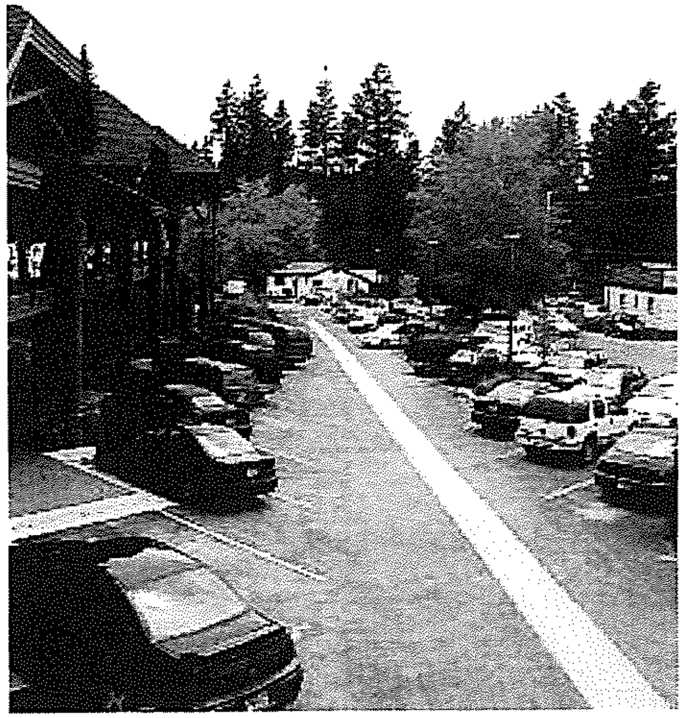
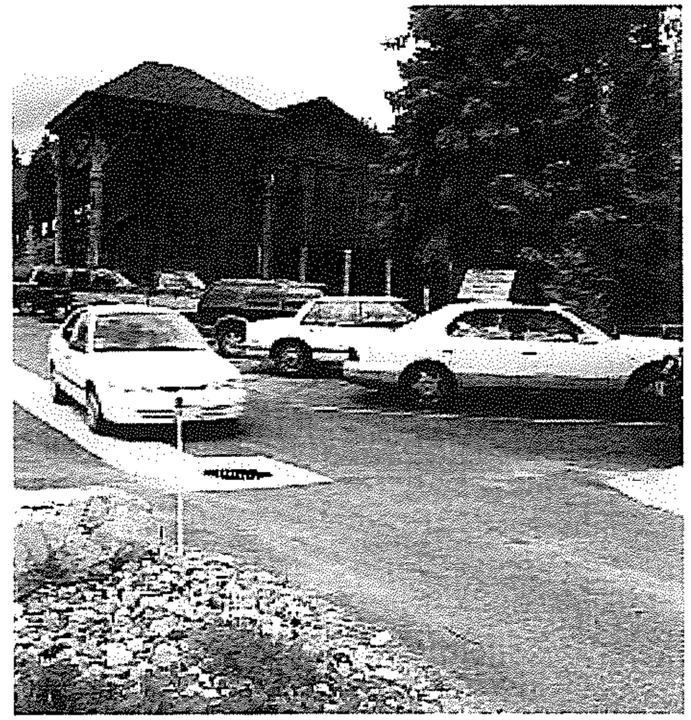
FIGURE “G”

MAJOR UNDERGROUND STORAGE FACILITY TECHNICAL DATA


Rainstore3

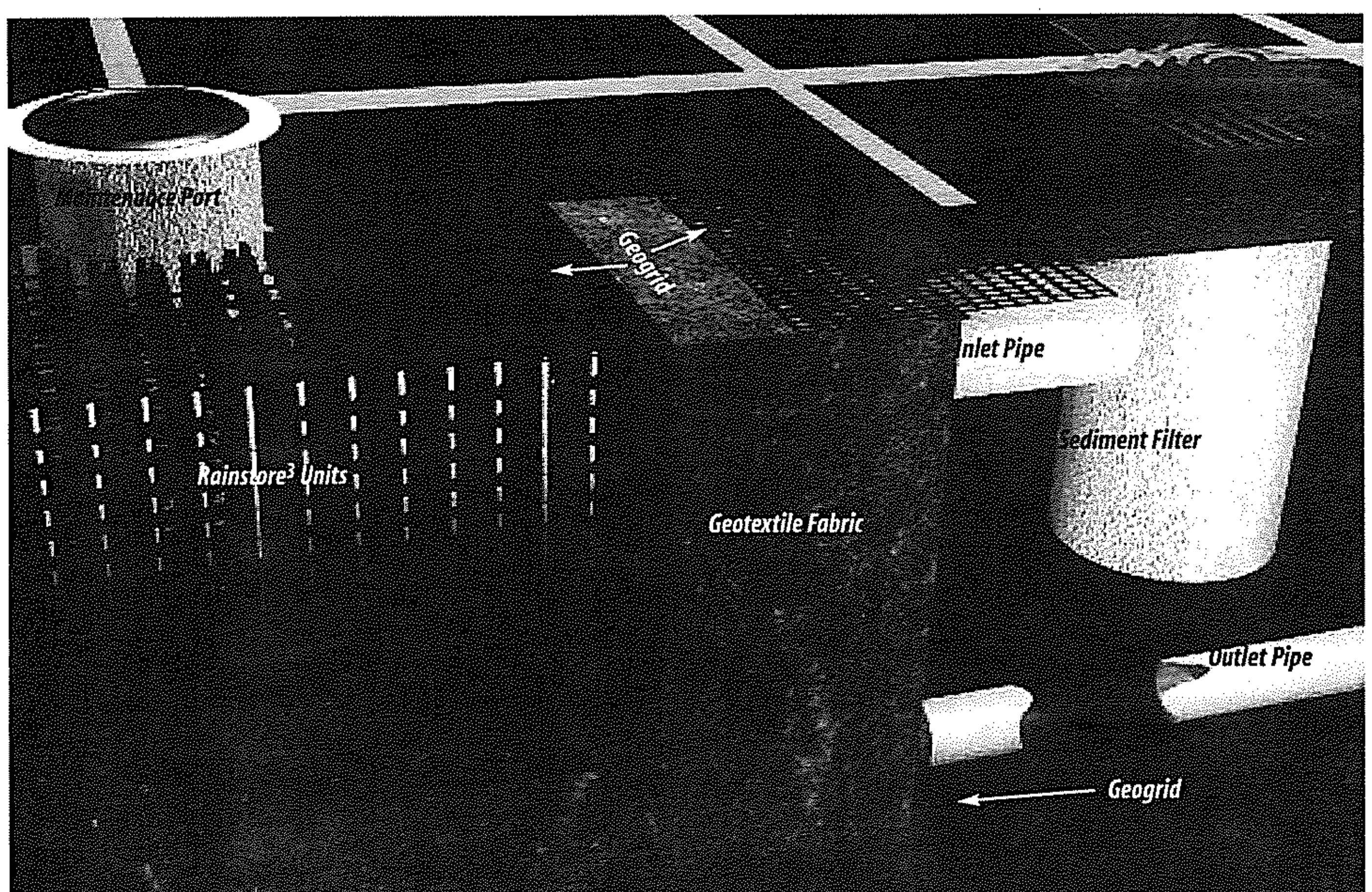




On the cover: Rainstore³ chamber under parking lot, Broomfield, CO. Without Rainstore³'s high water storage capacity at shallow depths, the flexibility in design, and the convenience of exfiltration, the owners of this site would have been unable to develop this site and would have been forced to find a different location for their new construction.

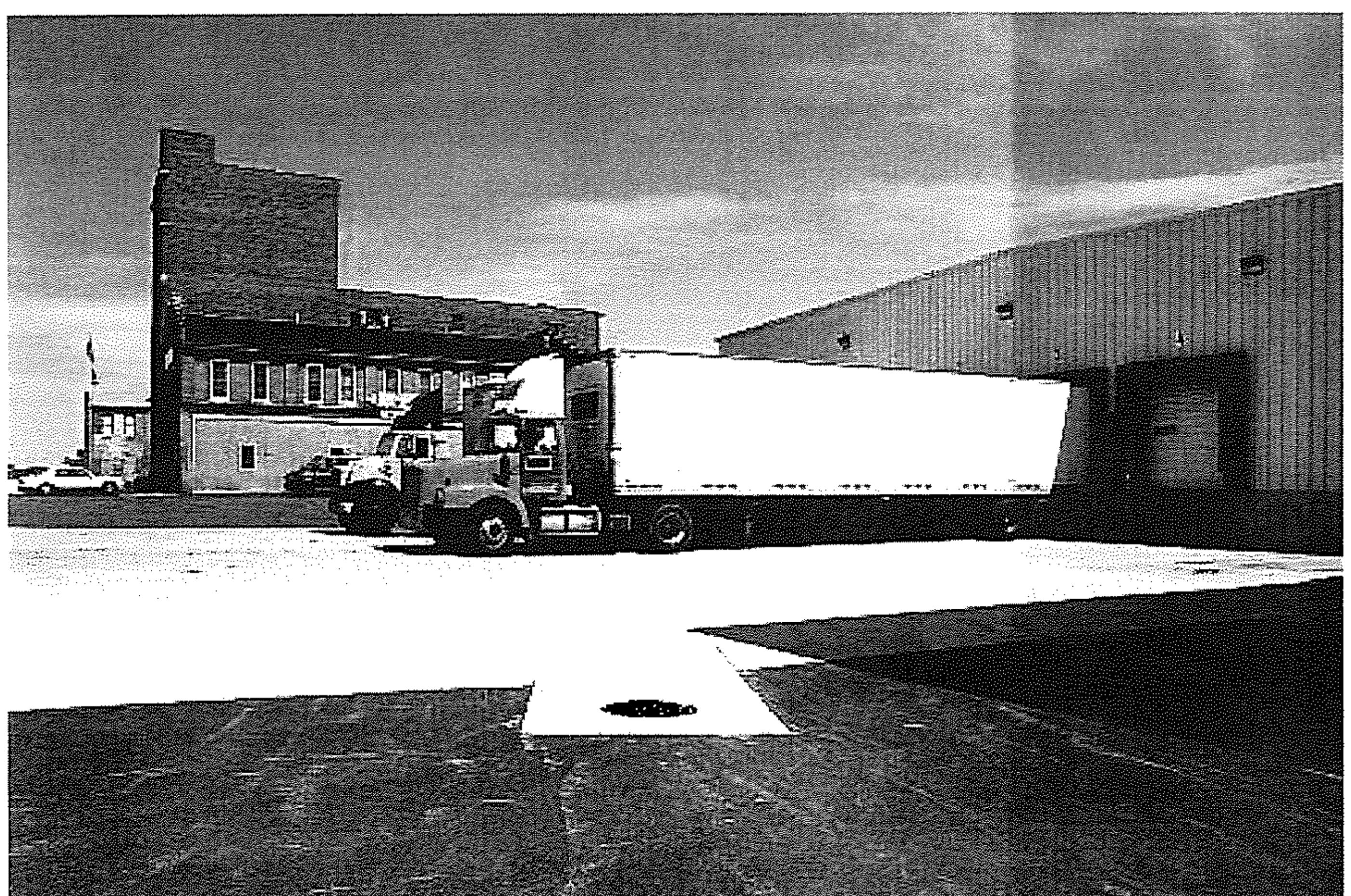
Above: Two views of a completed RS³ install under a parking lot in Big Fork, MT. Parking lot and off-street bays for approximately 48 cars, drains into a 26,250-gallon Rainstore³ stormwater detention structure. Diagonal parking is graded toward the center concrete strip, which drains toward the catch basin.

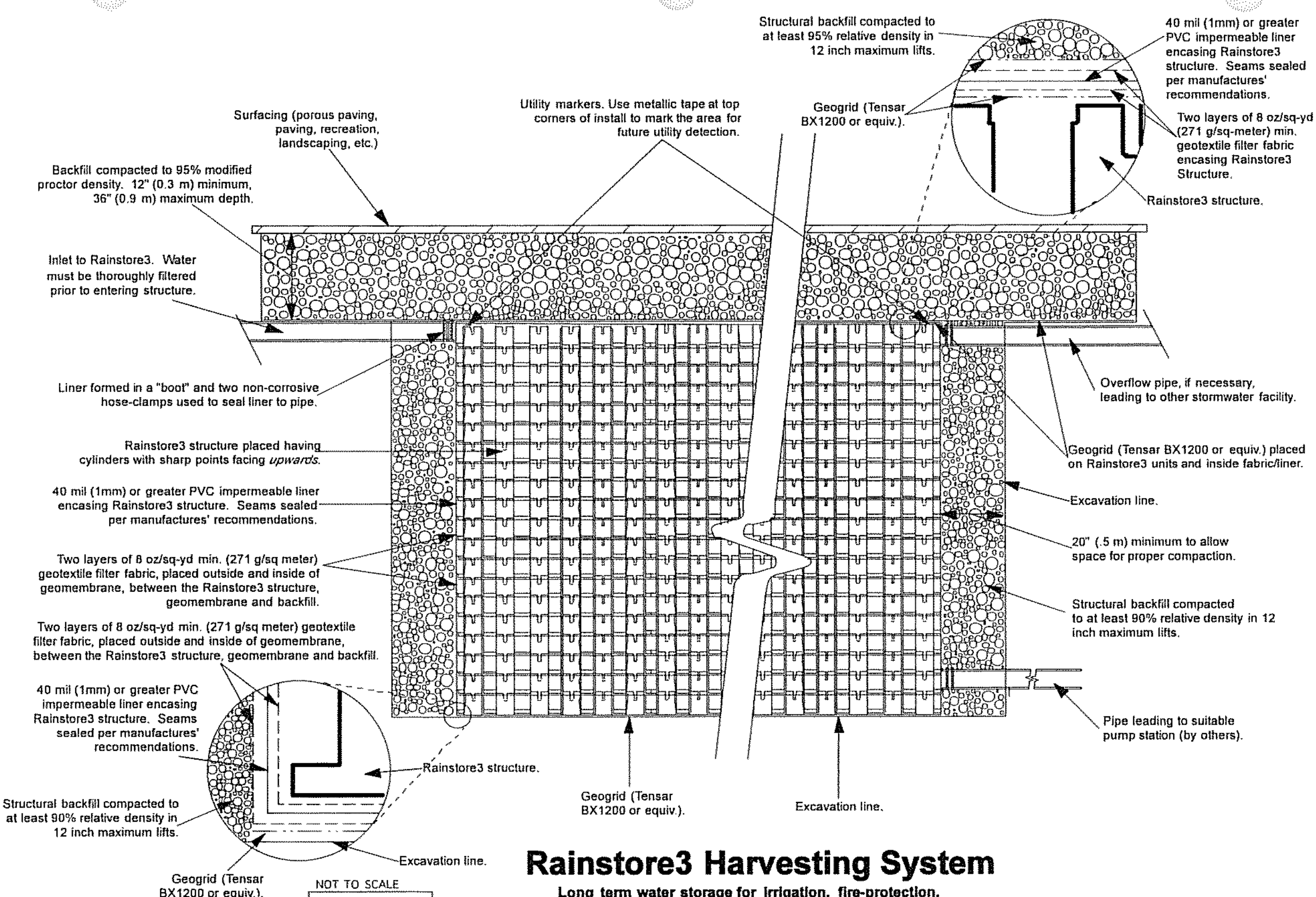
Below: Graphic representation of asphalt parking lot with Rainstore³ detention showing individual components. Drawing not to scale.



Left: Heavy equipment begins to put the cover material over an installed Rainstore³ chamber. Take extreme care when driving and/or compacting over the chamber and do not drive over exposed Rainstore³ units — wait until ALL the units are installed, the side backfill is complete, fabric and geogrid layers are completed, and an adequate amount of cover material is placed.

Below: A completed Rainstore³ installation at a chemical plant's loading dock in Chicago Heights, IL. Stormwater drains via multiple inlets to a Rainstore³ retention area beneath a concrete loading dock pad. The outflow into the city system is controlled by a shut off valve on a single 6" pipe. For safety, if there is a chemical spill, the valve can be closed, the contents can be pumped out, and the spill cleaned up.





Rainstore3 Harvesting System

Long term water storage for irrigation, fire-protection, non-potable applications or others

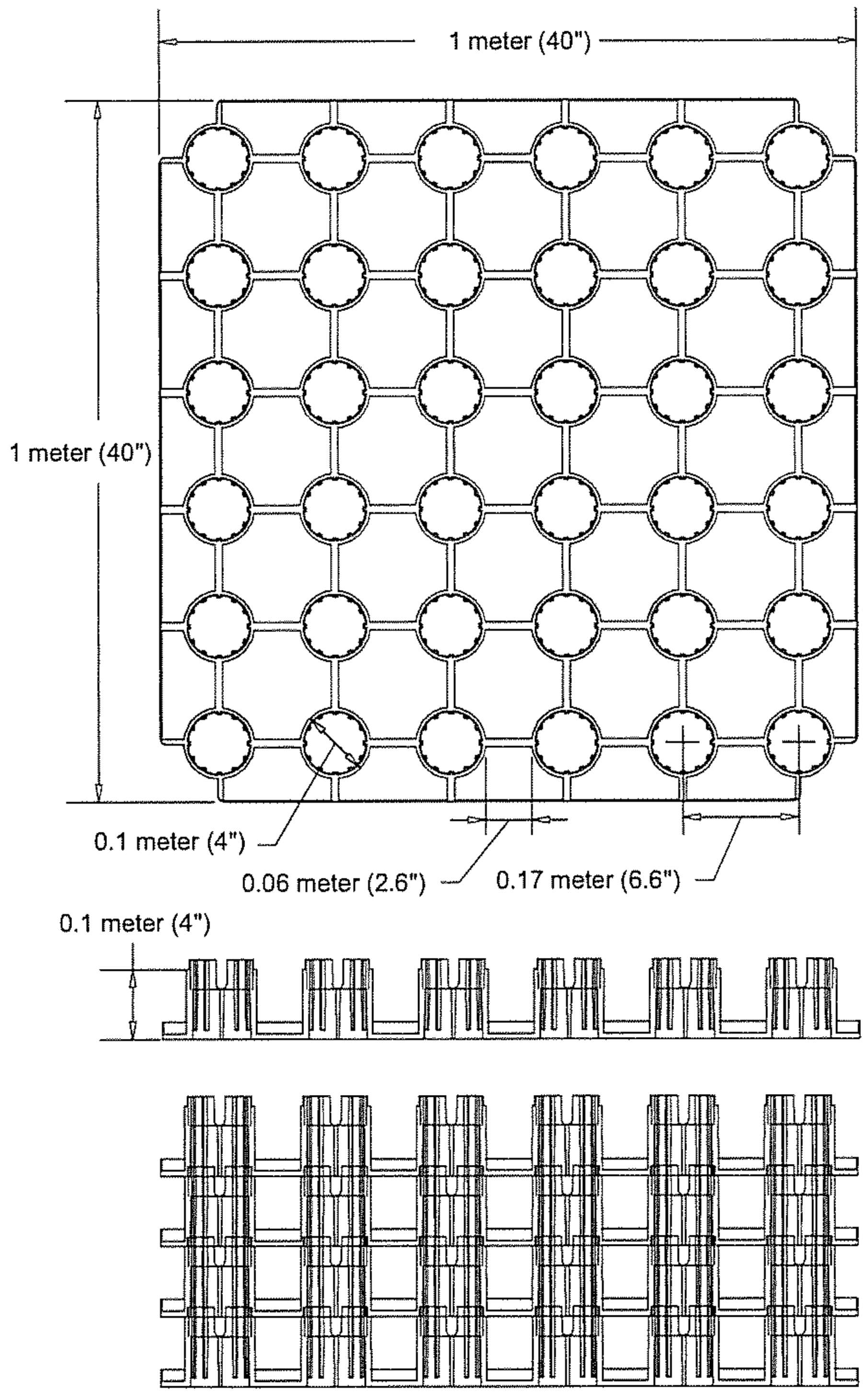
NOT TO SCALE

Invisible Structures, Inc.

RS3harvest.dwg

1600 Jackson Street., Suite 310
Golden, Colorado 80401
800-233-1510 FAX:800-233-1522
www.invisiblestructures.com rev05/2009

Rainstore3 Unit Dimensions



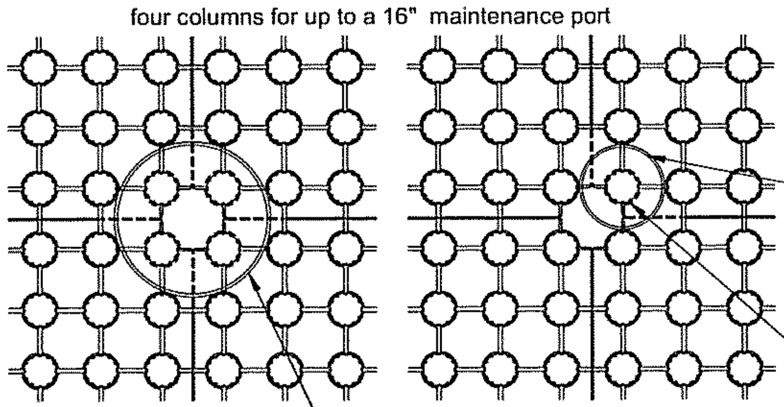
Rainstore3 Unit Detail

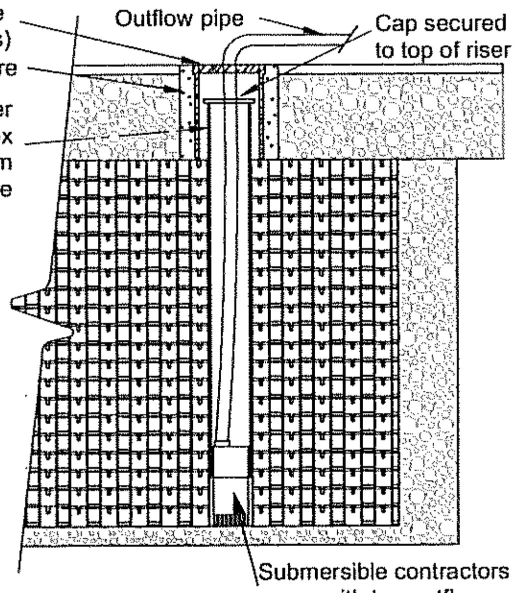
Single Rainstore3 injection molded unit geometry and dimensions

NOT TO SCALE

Invisible
Structures, Inc.
RS3detail.dwg

1600 Jackson St. Suite 310
Golden, Colorado 80401
800-233-1510 FAX: 800-233-1522
www.invisiblestructures.com 08/04





RS3 Maintenance Port

NOT TO SCALE

Method for providing inspection and cleanout access

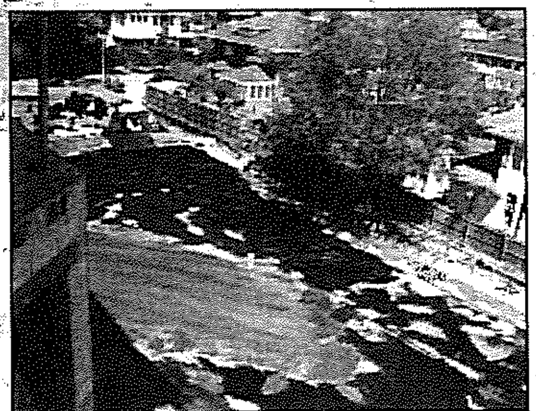
Invisible
Structures, Inc.

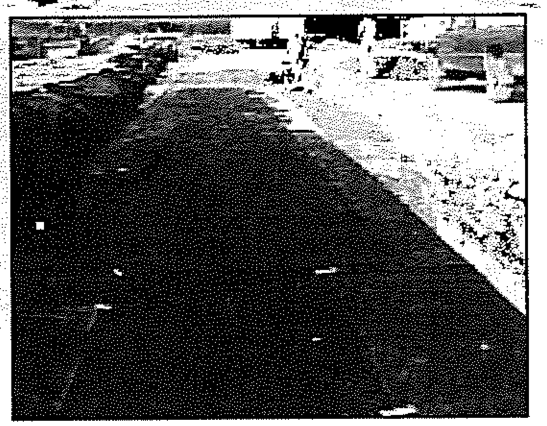
RS3maintenport.dwg

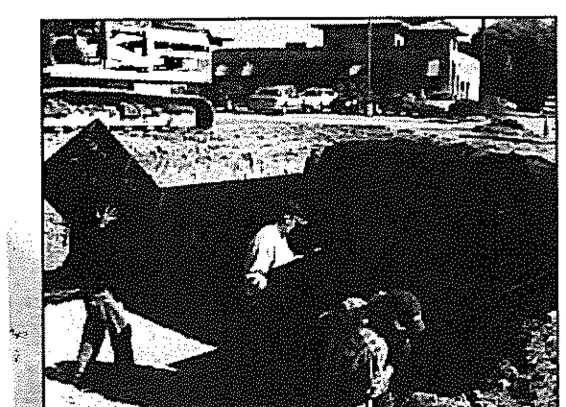
1600 Jackson Street, Suite 310
Golden, Colorado 80401
800-233-1510 FAX: 800-233-1522
www.invisiblestructures.com 02/04

RainTank

Storm Water Detention/Retention/Harvesting



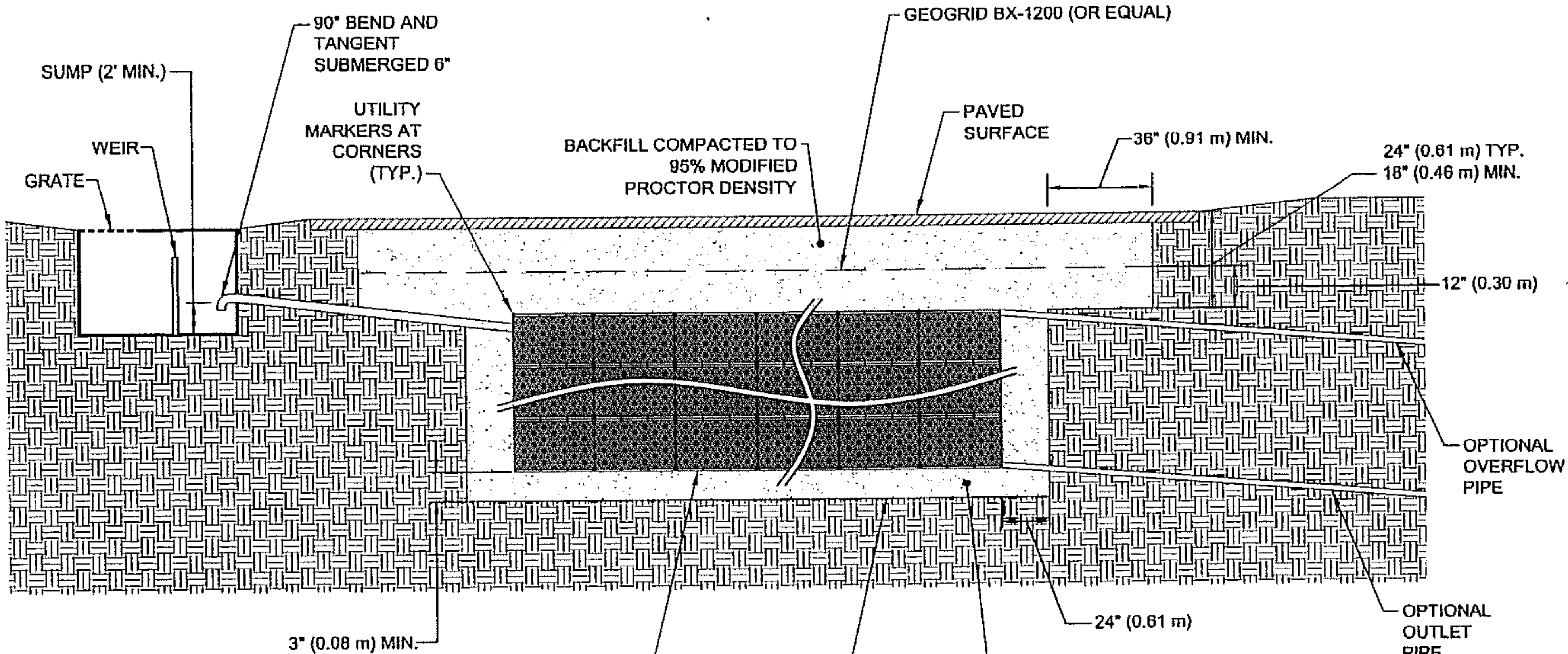




Environmental ACF

Atlantis
Water Management for Life

NOTE: FOR COMPLETE MODULE DATA, SEE APPROPRIATE RAINTANK™ SHEET (SINGLE MODULE, DOUBLE MODULE, TRIPLE MODULE, QUAD MODEL, OR PENTA MODEL).



Atlantis Water Management

"Water Management for Life"

D-RAINTANK™ - H20 LOADS WITH DROP STRUCTURES

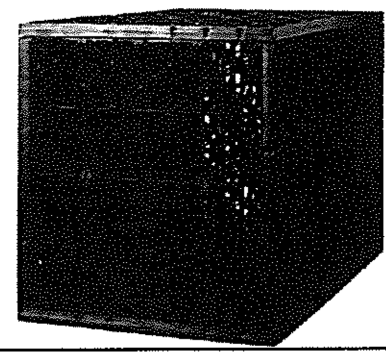
ACF

FOR ADDITIONAL INFORMATION PLEASE CONTACT: ACF ENVIRONMENTAL, 1-800-448-3636, www.acfenvironmental.com

Atlantis RainTank® storm water detention/retention and infiltration system.

Stormwater Solutions

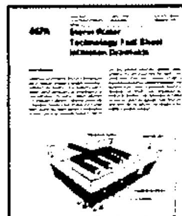
RainTank® is a subsurface water storage structure that provides up to 95% void area for storage volume.



1

Infiltration Drainfields to promote storm water retention, detention and infiltration into subsoils are an EPA recognized Storm Water Management BMP.

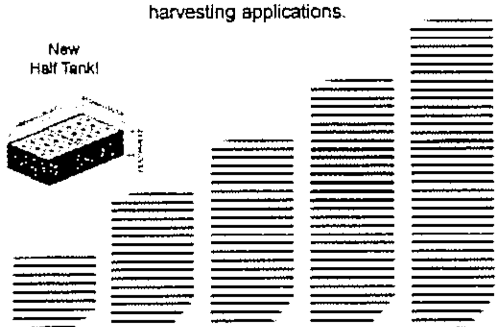
The RainTank system is an alternative to traditional pipe or arch chamber with stone systems.



2

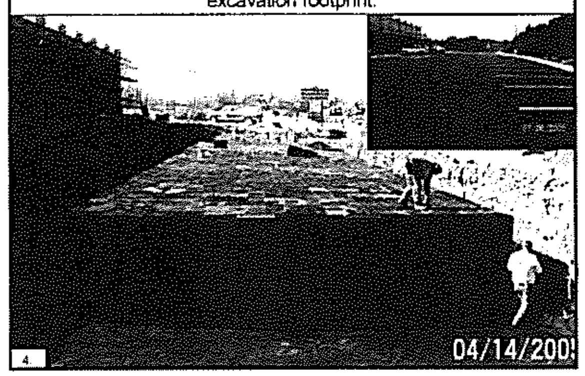
RainTank™ is a modular system that provides versatility in design and construction of storm water retention, detention and harvesting applications.

New Half Tank!



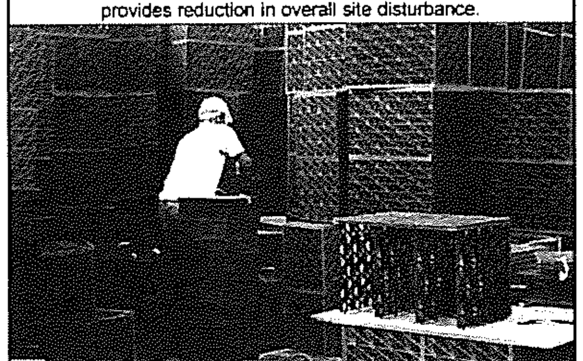
3

RainTank's 95% void space requires minimum excavation for maximum storage capacity, reducing overall site disturbance and excavation footprint.



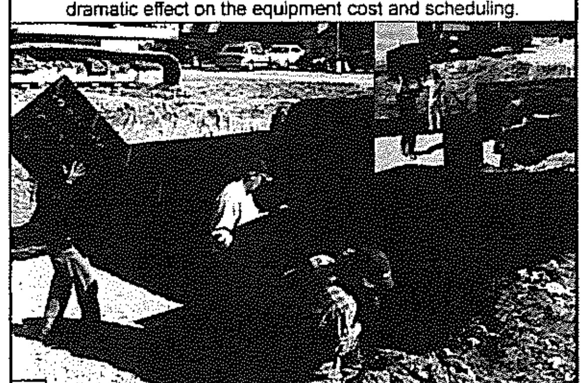
4

Lightweight Panels: Freight friendly – can be shipped whole or assembled on site for more savings. More efficient shipping provides reduction in overall site disturbance.



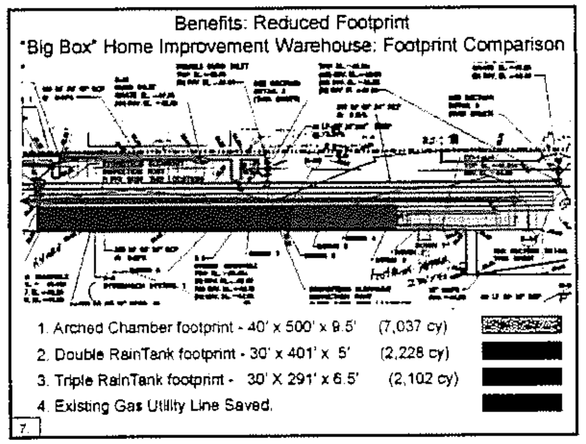
5

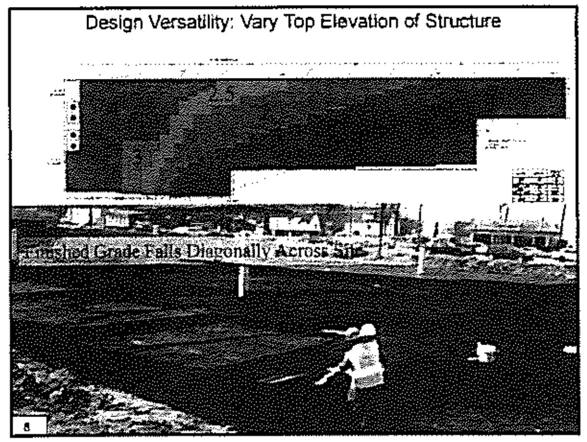
Lightweight Panels: Can be easily placed by hand, providing a dramatic effect on the equipment cost and scheduling.

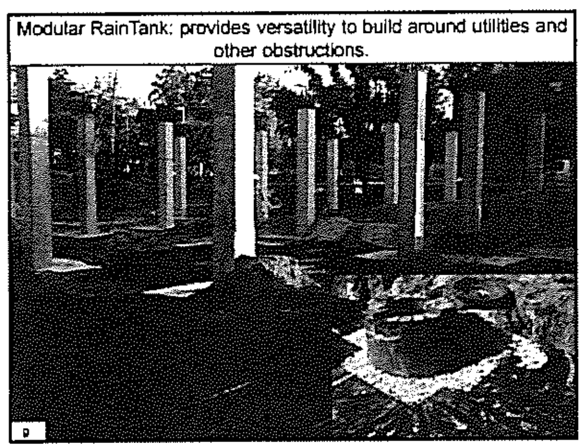


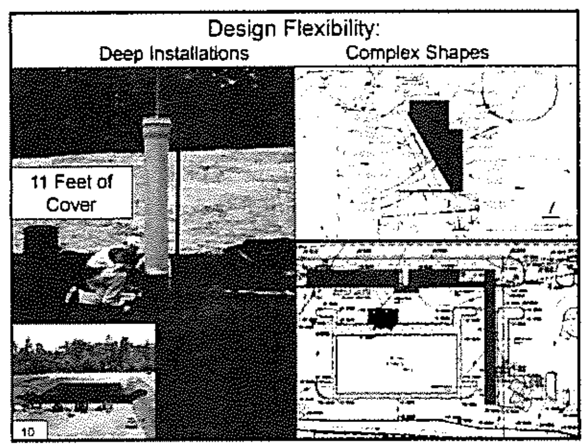
6

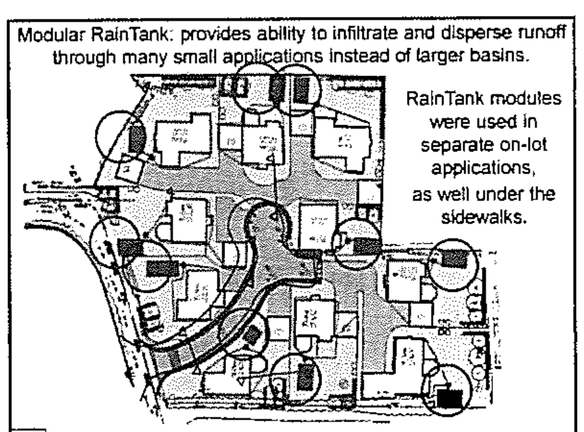
Atlantis RainTank® storm water detention/retention and infiltration system.

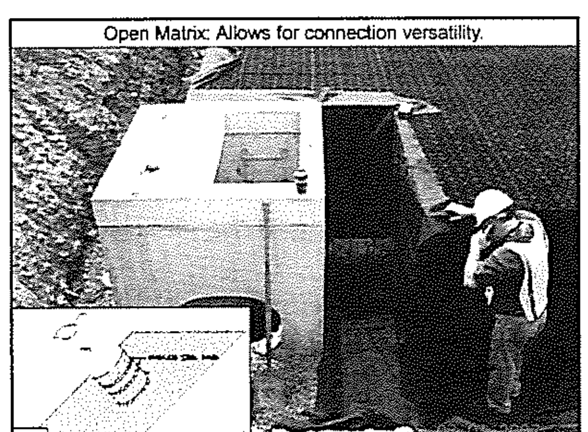






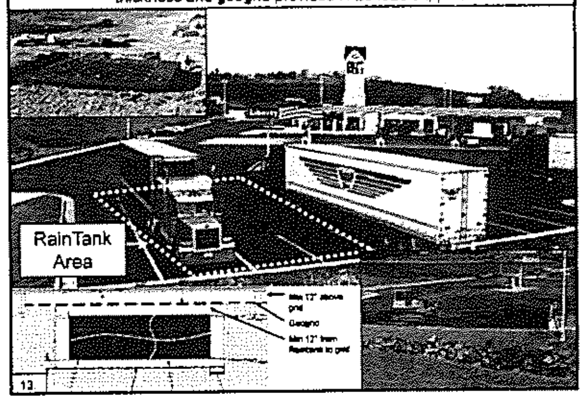






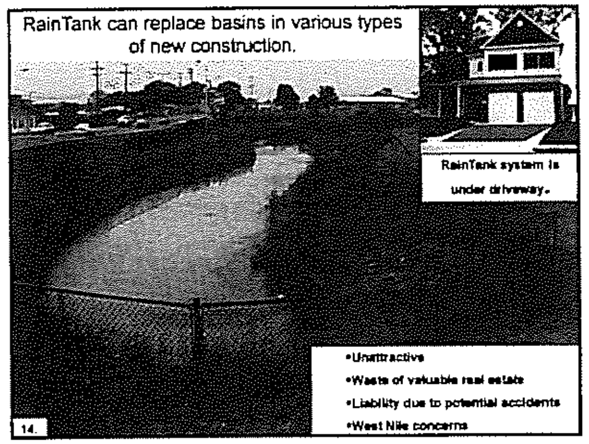
Atlantis RainTank® storm water detention/retention and infiltration system.

RainTank System Strength: RainTank's system approach using specific cover thickness and geogrid provides H-20 load support.



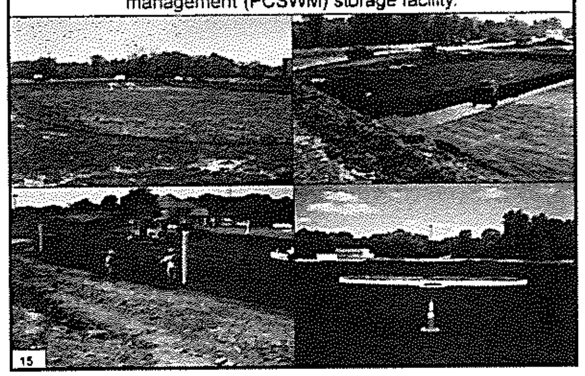
13

RainTank can replace basins in various types of new construction.



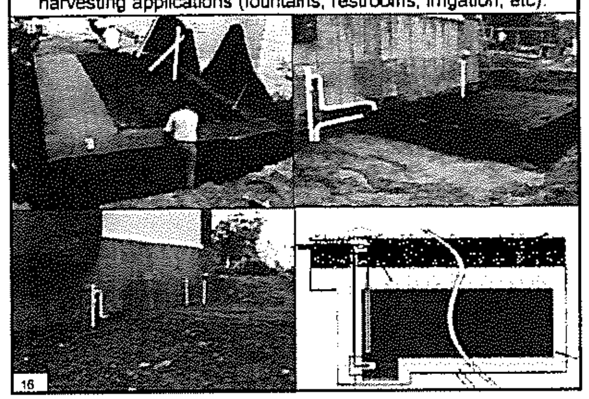
14

Raintank Storage System used for the conversion of a sediment basis into an underground post construction storm water management (PCSWM) storage facility.



15

The RainTank can be encapsulated in a PVC liner for storm water harvesting applications (fountains, restrooms, irrigation, etc).



16

Modular RainTank: provides ability for easy field modifications.

Example: Unanticipated high groundwater mandated field construction change.

Original Design: 3 Rows of Penta Tanks

Field Modified Design: 4 Rows of Quad Tanks

17

RainTank for LEED credits.

Thirteen Possible Credits!

LEED Visit the LEED Web Site:

- **Sustainable Sites – 4 Credits**
  - Maximize Open Space (5.1)
  - Minimize Development Footprint (5.2)
  - Reduce Stormwater Quantity (6.1)
  - Improve Stormwater Quality (6.2)
- **Water Efficiency – 5 Credits**
  - Recycle Stormwater (1.1, 1.2 & 2)
  - Reduce Demand on Potable Water (3.1 & 3.2)
- **Materials & Resources – 3 Credits**
  - Recycled Plastics (4.1 & 4.2)
  - Ship Flat and Assemble On Site (5.1)
- **Innovation & Design Process – 1 Credit**

18

RainTank Project

Villa Riva Condominiums - Jacksonville, Florida

Storm Water Detention beneath grass firelane

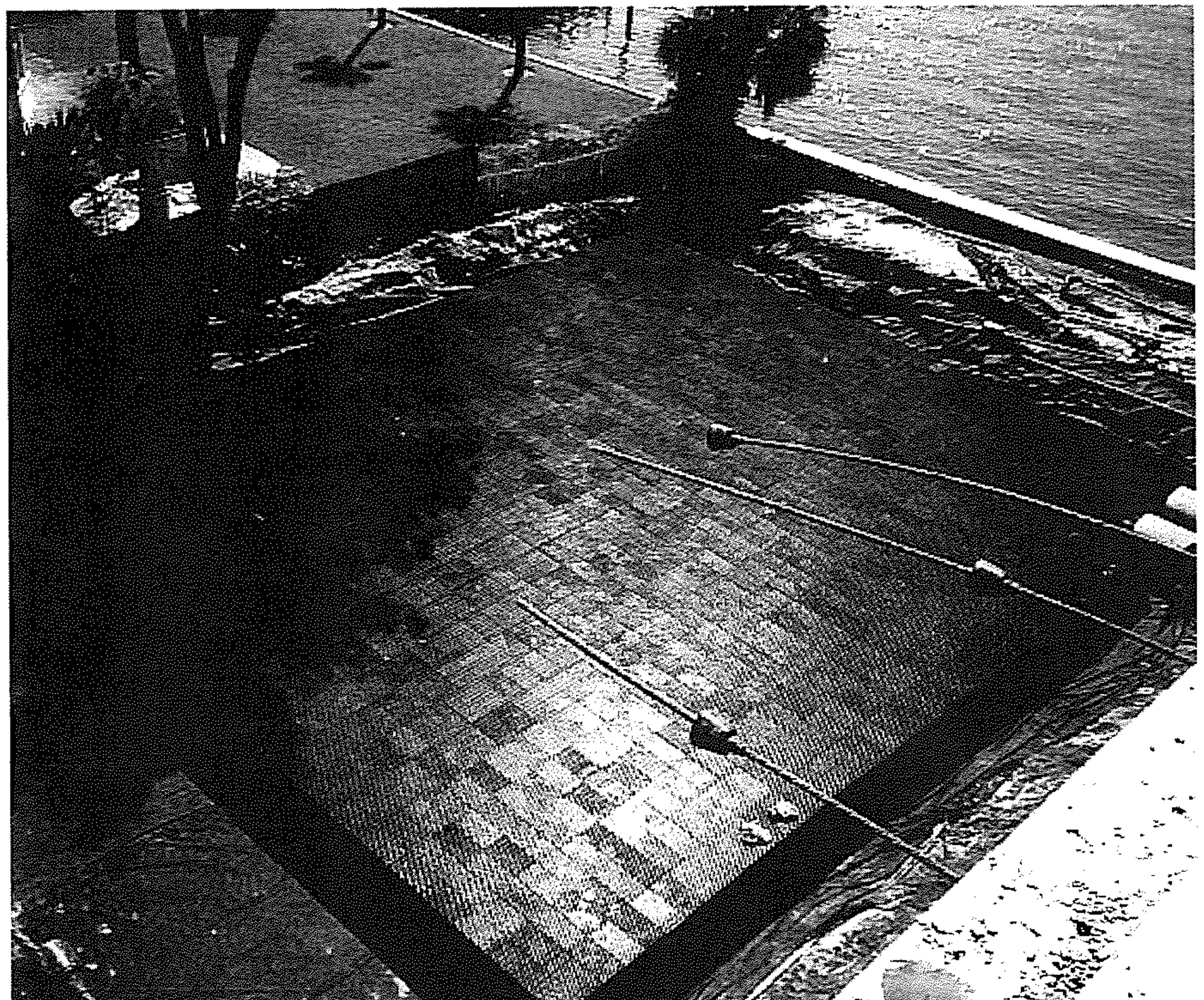
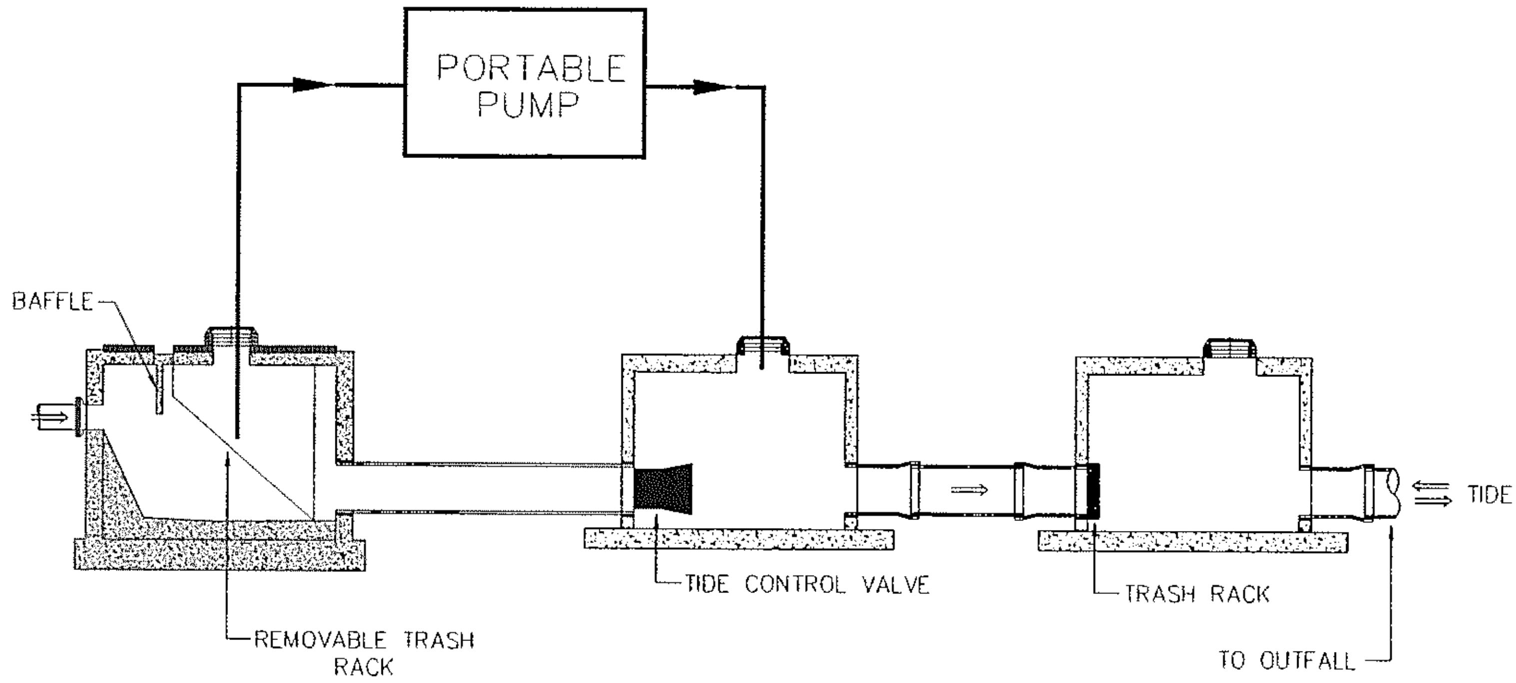
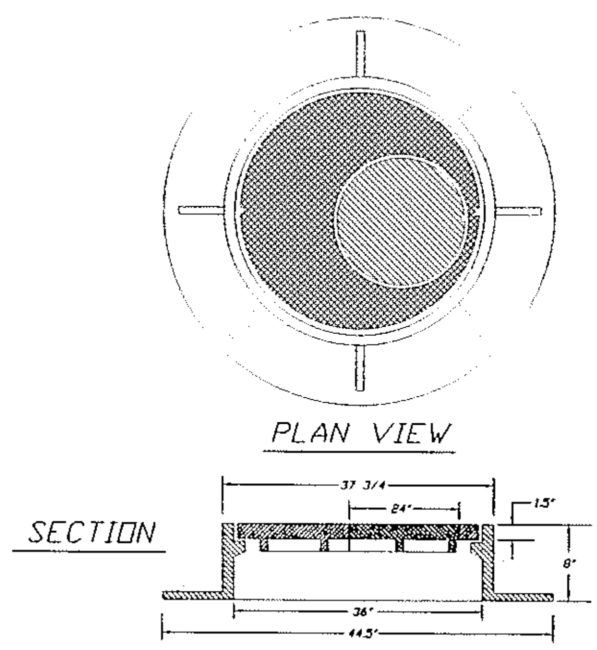


FIGURE “H”

SCHEMATIC STORM SYSTEM LAYOUT AT OUTFALLS





HEAVY DUTY MANHOLE FRAME AND COVER WITH ACCESS COVER

FIGURE H

SCHEMATIC STORM SYSTEM LAYOUT AT OUTFALLS
CITY OF WILDWOOD

REMINGTON, VERNICK & WALBERG ENGINEERS
4907 NEW JERSEY AVENUE, WILDWOOD CITY, N.J. 08260
(609) 522-5150, FAX (609) 522-5313
WEB SITE ADDRESS: WWW.RVE.COM

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FIGURE "I"

PROPOSED STORM SEWER SYSTEM MASTER PLAN

FIGURE I

✱ = TIE INTO PARK BOULEVARD SYSTEM

(15")= PROPOSED STORM SEWER
(SIZE BASED ON 5 YEAR STORM WITHOUT UNDERGROUND STORAGE)

= PROPOSED STREETS WITH UNDERGROUND STREET STORAGE SYSTEM

(15") = EXISTING STORM SIZE

PROPOSED STORM SEWER SYSTEM MASTER PLAN

REMINGTON, VERNICK & WALBERG ENGINEERS
4907 NEW JERSEY AVENUE, WILDWOOD CITY, N.J. 08260
(609) 522-5150, FAX (609) 522-5313
WEB SITE ADDRESS: WWW.RVE.COM

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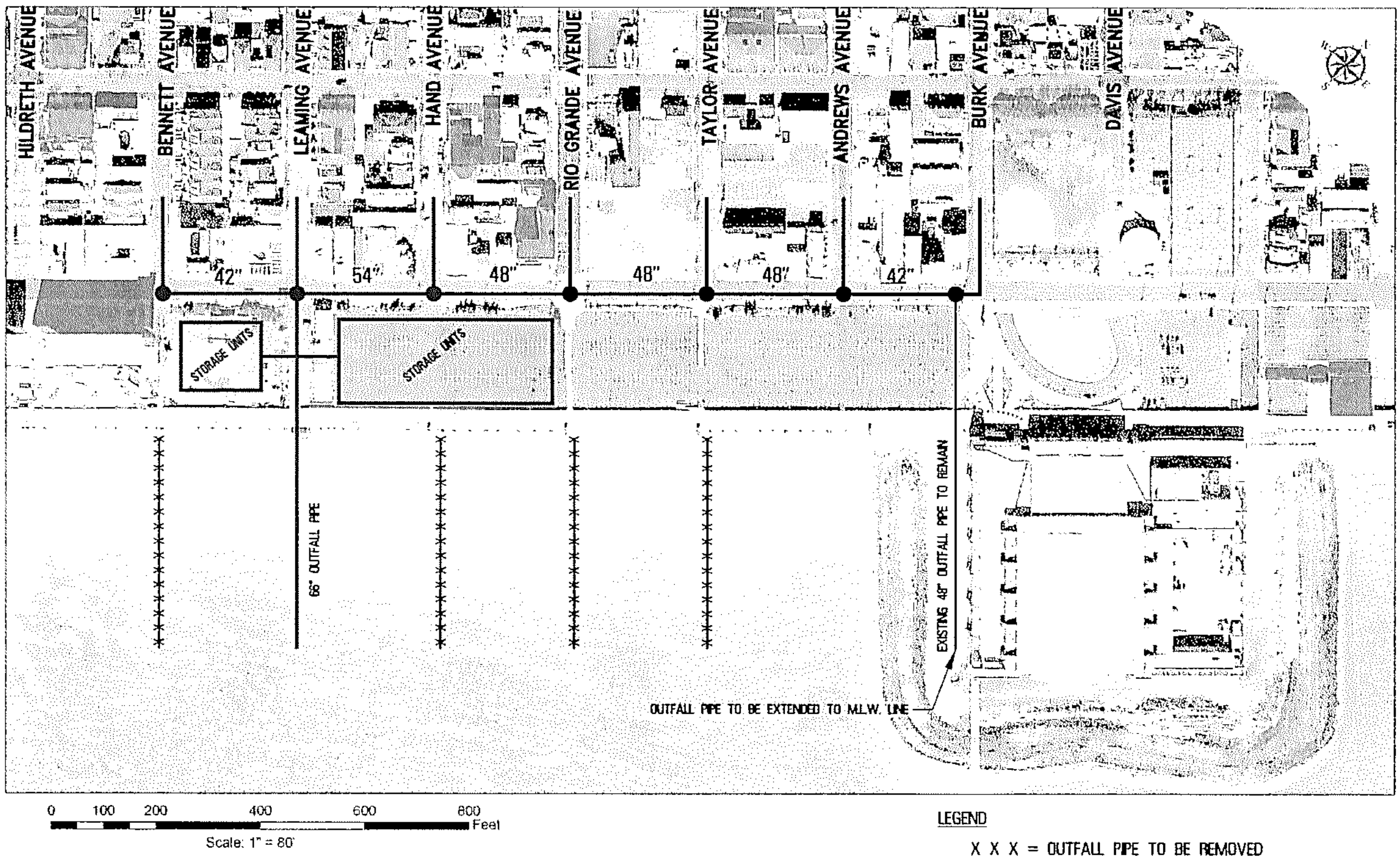
FIGURE “J”

SCHEMATIC MAJOR UNDERGROUND STORAGE FACILITY



LEGEND

X X X = OUTFALL PIPE TO BE REMOVED

EXHIBIT J - 1

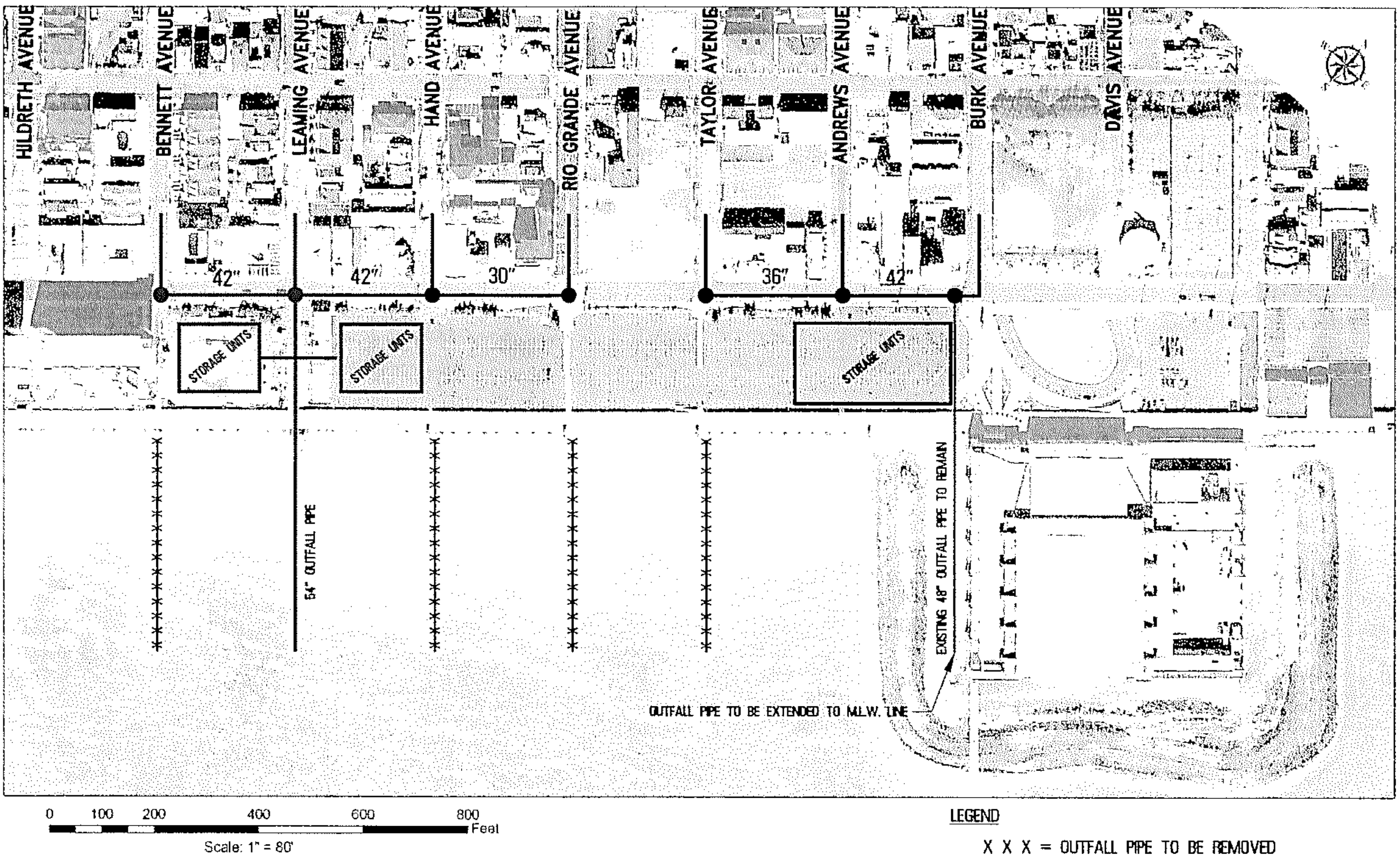
SCHEME "A"

(ELIMINATION OF FOUR EXISTING OUTFALLS)

MAJOR UNDERGROUND STORAGE FACILITY
CITY OF WILDWOOD

REMINGTON, VERNICK & WALBERG ENGINEERS

5/2010



SCHEME "B"

(ELIMINATION OF FOUR EXISTING OUTFALLS)

MAJOR UNDERGROUND STORAGE FACILITY
CITY OF WILDWOOD

REMINGTON, VERNICK & WALBERG ENGINEERS

5/2010

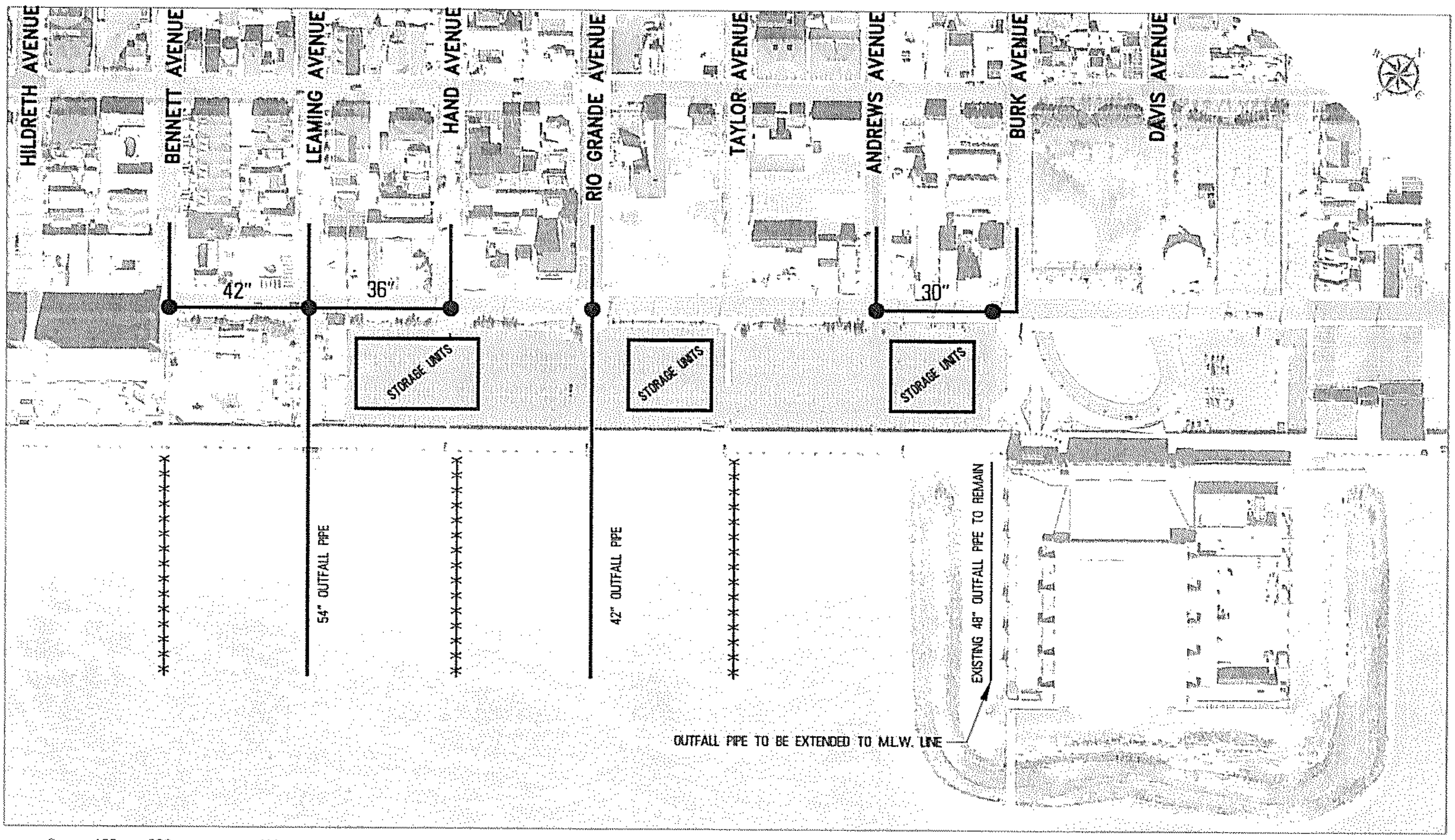


EXHIBIT J – 3

0 100 200 400 600 800 Feet

Scale: 1" = 80'

LEGEND

X X X = OUTFALL PIPE TO BE REMOVED

SCHEME "C"

(ELIMINATION OF THREE EXISTING OUTFALLS)

MAJOR UNDERGROUND STORAGE FACILITY
CITY OF WILDWOOD

REMINGTON, VERNICK & WALBERG ENGINEERS
4907 NEW JERSEY AVENUE, WILDWOOD CITY, NJ 08260
[illegible]
WEB SITE ADDRESS: WWW.RVE.COM

6/2010

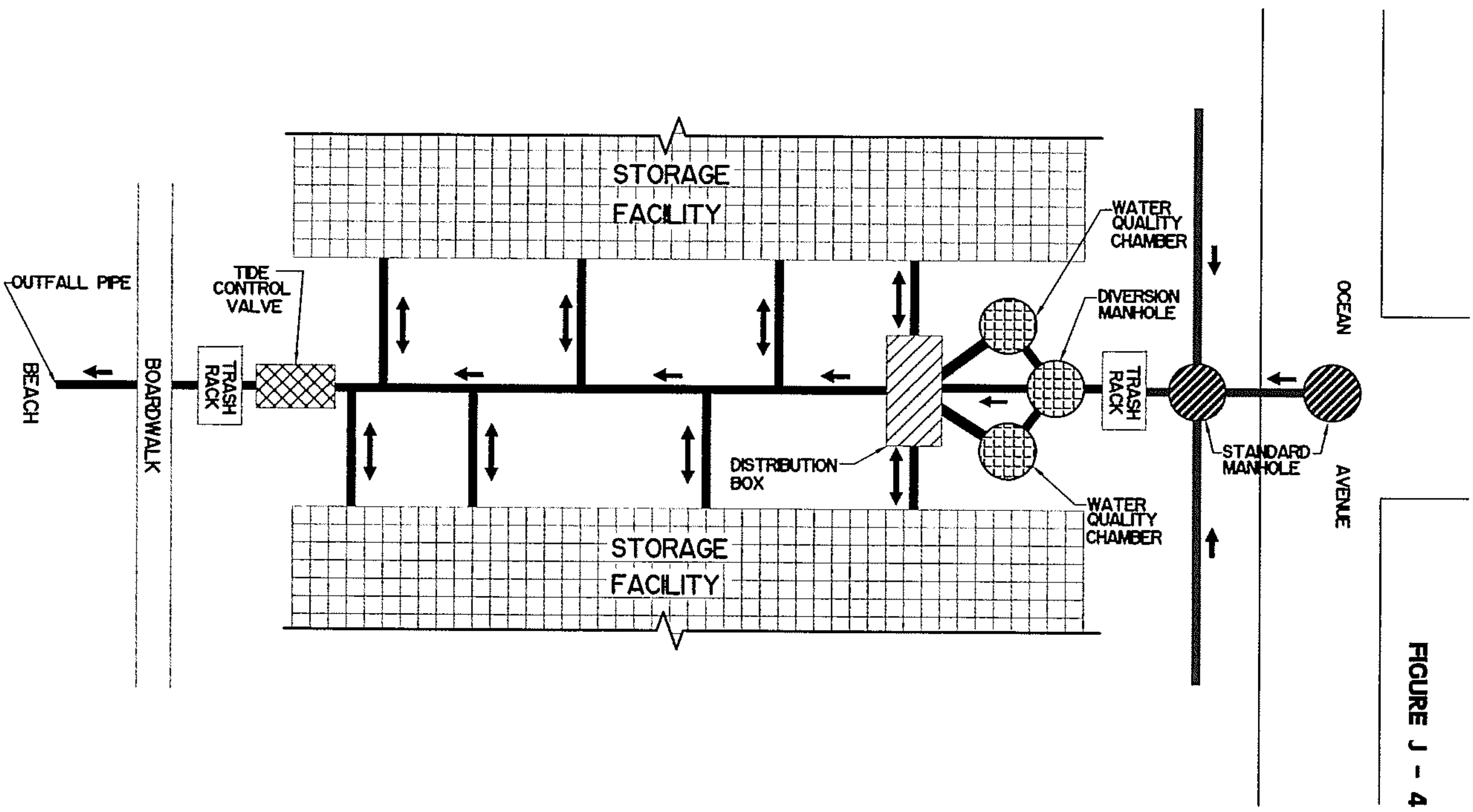


FIGURE J - 4

MAJOR UNDERGROUND STORAGE FACILITY
CITY OF WILDWOOD

REMINGTON, VERNICK & WALBERG ENGINEERS
4907 NEW JERSEY AVENUE, WILDWOOD CITY, N.J. 08260
(609) 522-5150, FAX (609) 522-5313
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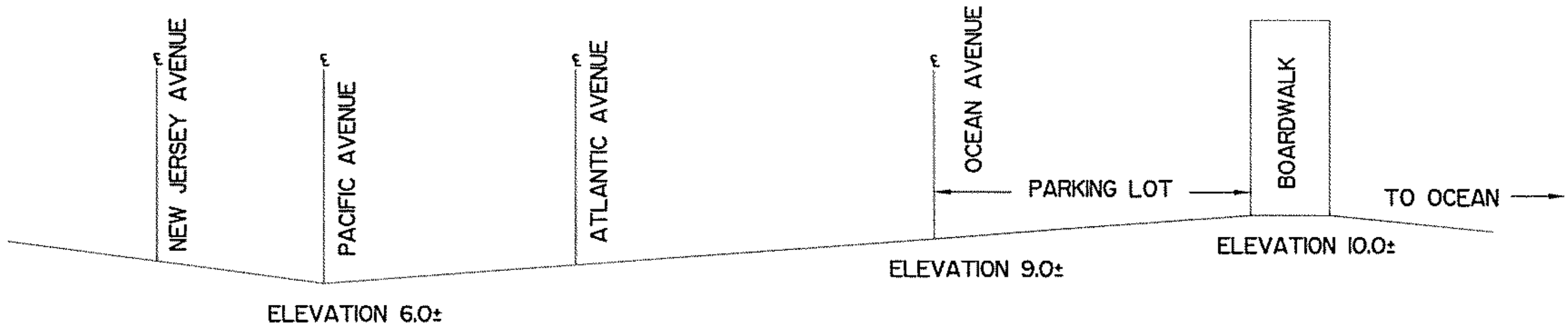

PROFILE VIEW
N.T.S.

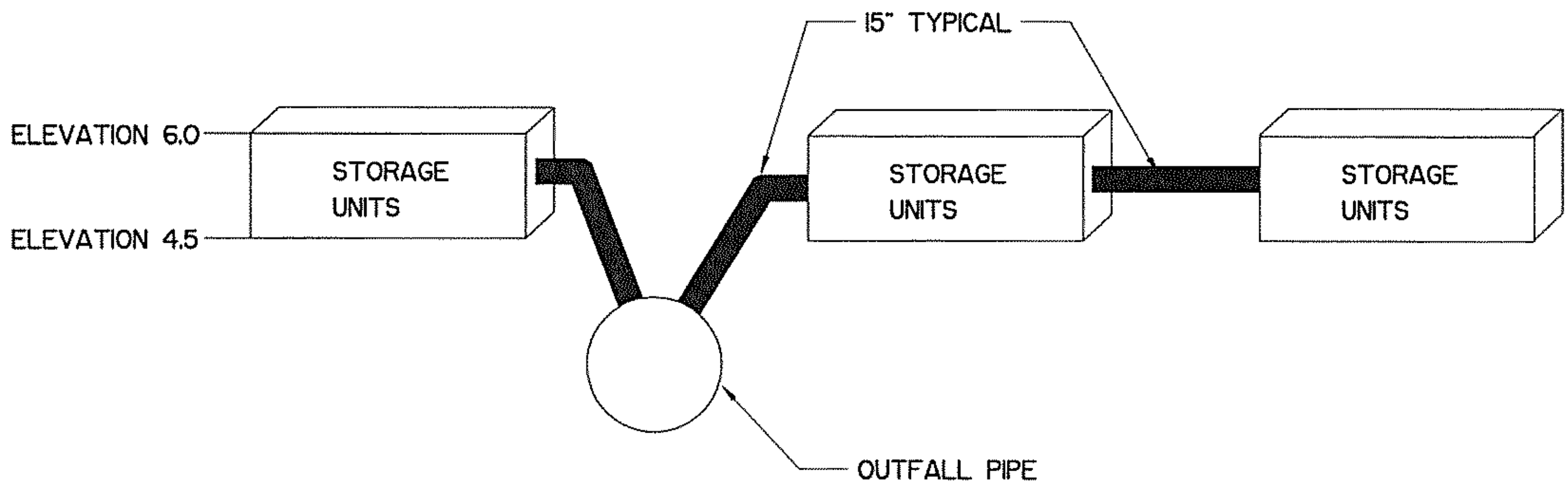

FIGURE J – 5

MAJOR UNDERGROUND STORAGE FACILITY
CITY OF WILDWOOD

CROSS SECTION VIEW
N.T.S.

REMINGTON, VERNICK & WALBERG ENGINEERS
4907 NEW JERSEY AVENUE, WILDWOOD CITY, N.J. 08260
(609) 522-5150, FAX (609) 522-533
WEB SITE ADDRESS: WWW.RVE.COM
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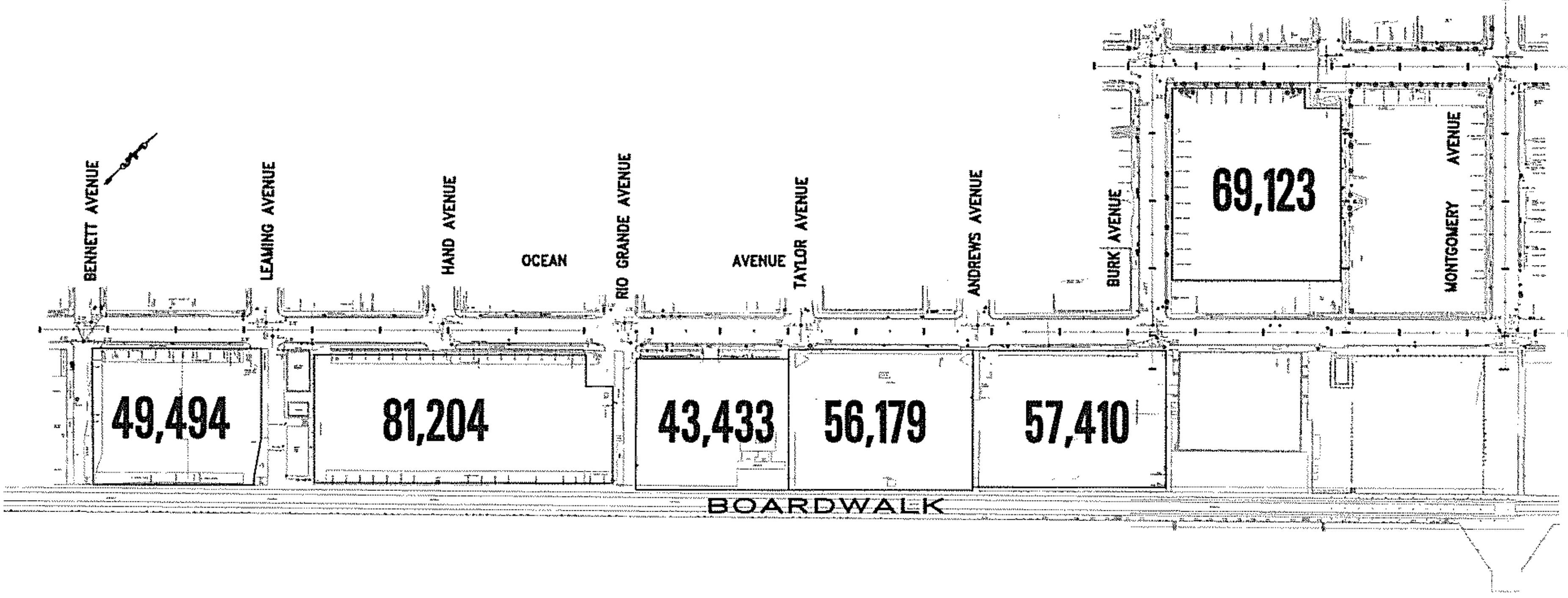

TOTAL AREA = 356,843 SQ FT

FIGURE J – 6

MAJOR UNDERGROUND STORAGE
CITY OF WILDWOOD

REMINGTON, VERNICK & WALBERG ENGINEERS
4907 NEW JERSEY AVENUE, WILDWOOD CITY, NJ 08260
(609) 522-5150, FAX (609) 522-5313
WEB SITE ADDRESS: WWW.RVE.COM

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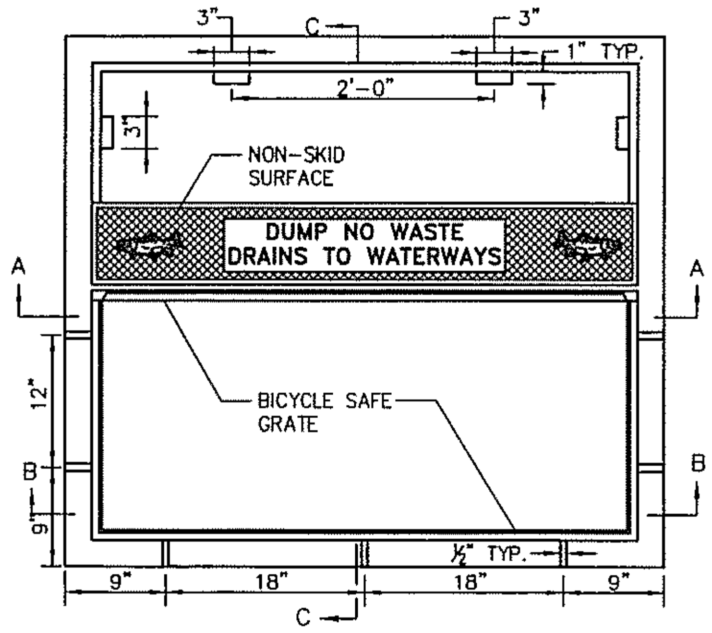
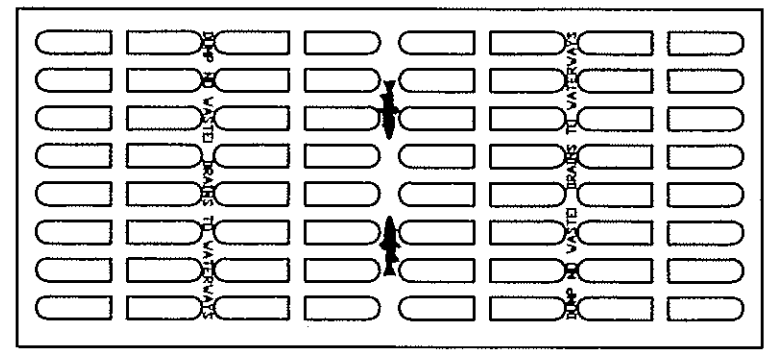
FIGURE “K”

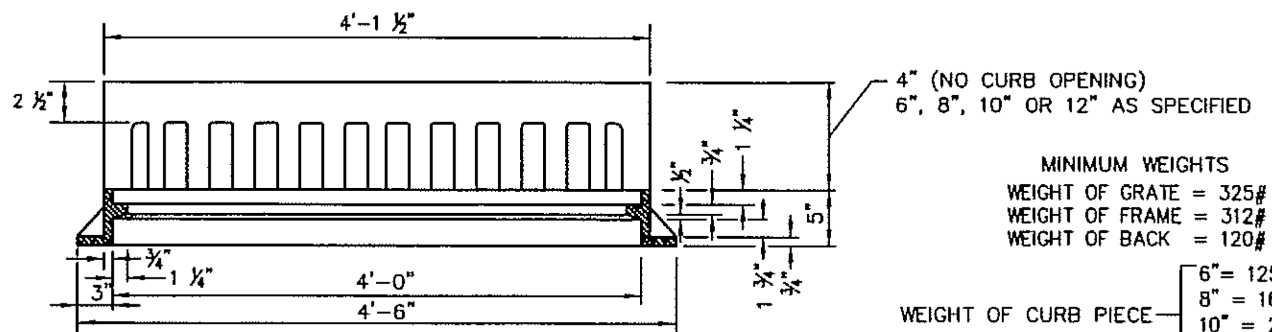
TYPICAL J-ECO CURB BOX, FRAME AND GRATE



TOP VIEW



BICYCLE SAFE GRATE



CURB PIECE

MINIMUM WEIGHTS

WEIGHT OF GRATE = 325#
WEIGHT OF FRAME = 312#
WEIGHT OF BACK = 120#

WEIGHT OF CURB PIECE	6" = 125#
	8" = 167#
	10" = 209#
	12" = 251#

FIGURE K

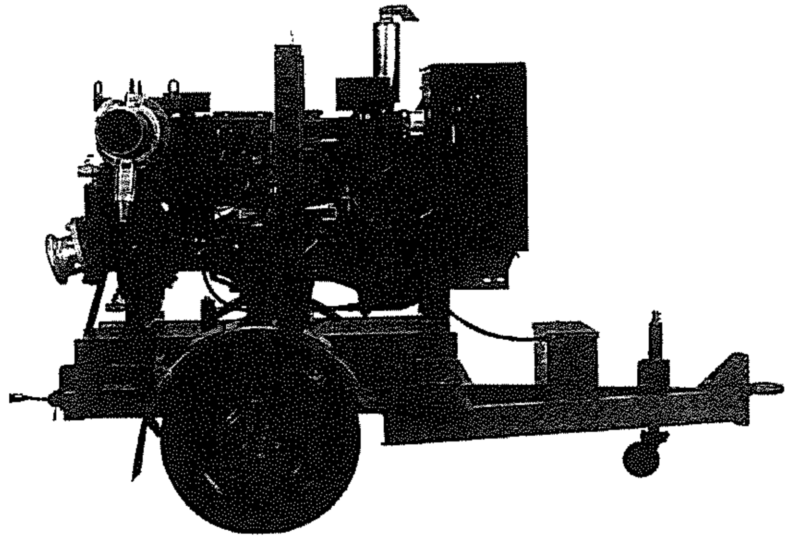
JECO CURB BOX AND GRATE
CITY OF WILDWOOD

REMINGTON, VERNICK & WALBERG ENGINEERS
4907 NEW JERSEY AVENUE, WILDWOOD CITY, N.J. 08260
(609) 522-5150, FAX (609) 522-5313
WEB SITE ADDRESS: WWW.RVE.COM 5/2010

FIGURE "L"
PORTABLE PUMP UNIT
CD150M DRI-PRIME PUMPS
BY
GODWIN PUMPS
(OR EQUAL)

CD150M Dri-Prime® Pumps

CD150M



The Godwin Dri-Prime 6" (150mm) CD150M automatic priming centrifugal pump is clearly the backbone of the temporary portable pumping industry. With solids-handling to 3" (75mm) in diameter, maximum flows of 1700 gallons per minute (107.3 l/sec.) and 160 feet (48.8M) of total dynamic head, and indefinite dry-running capabilities, the CD150M can be found in a wide variety of applications from straight dewatering to sewage bypassing. Mounted on a highway trailer, the CD150M is the most maneuverable and versatile portable pumping system available, making it a favorite of contractors, municipalities, industry and environmental companies across the country.

Features

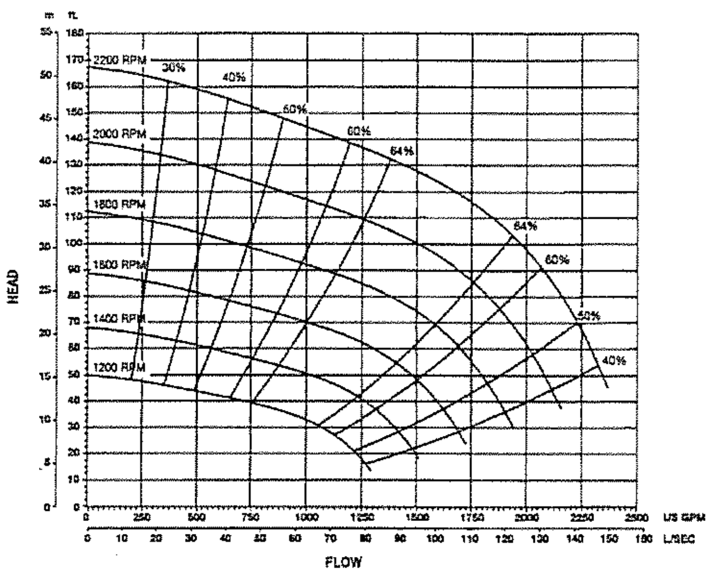
- Close coupled centrifugal pump with vacuum priming compressor mounted to a diesel engine. Also available in electric drive or as bare shaft pumpend.
- All cast iron construction with cast chromium steel impeller.
- Extensive application flexibility — will handle raw sewage, slurries and liquids with solids up to 3" (75mm) in diameter.
- Continuously operated "Godwin" air ejector priming device requiring no periodic adjustment or control.
- Dry running, oil bath, mechanical seal with abrasion resistant solid silicon carbide interfaces.
- Solids handling ball type Non Return Valve with renewable flexible rubber seat and quick release access feature.
- Compact unit mounted on skid base or two wheeled highway trailer both incorporating integral overnight running fuel tank.
- Simple maintenance — normally limited to checking engine and seal cavity oil levels.
- Standard John Deere 4045D or Caterpillar 3054NA engine. Also available with a variety of other engines including Hatz, Perkins and Deutz.
- Super-quiet critical silence pack version available for use in residential communities.

godwin pumps

RV &W

FIGURE "L"
CD150M DRI-PRIME PUMP
City of Wildwood, Cape May County, New Jersey

CD150M Performance Curve



Performance Table

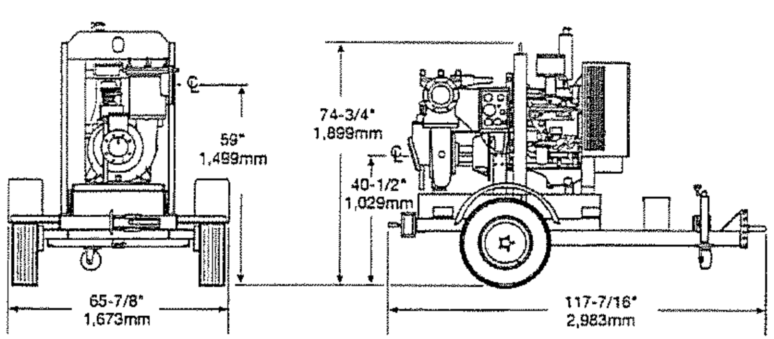
Diesel Set: John Deere 4045D, 71 hp @ 2200 rpm
Caterpillar 3054NA, 74 hp @ 2200 rpm
Impeller Diameter — 11.02" (280mm)

Total Suction Head — Feet	Total Delivery Head — Feet: 10	20	30	40	50
	Output — GPM				
10	1800	1780	1750	1700	1680
15	1700	1650	1600	1520	1400
20	1670	1590	1500	1380	1240
25	1500	1400	1340	1240	1100

Performance data listed in table and curves are based on water tests at sea level and 68° F (20° C). Larger diameter pipes may be required for maximum flows.

Dimensions

CD150M — shown with John Deere 4045D, GP60 Highway Trailer
Weight: 2800 lbs. (1,267 kg.)



Specifications

Maximum Operating Speed:
2200 rpm
Maximum Operating Temperature:
+212° F (100° C)
Maximum Working Pressure:
58.5 psi (4.0 BAR)
Maximum Suction Pressure:
40.0 psi (2.8 BAR)
Maximum Casing Test Pressure:
88.0 psi (6.1 BAR)
Fuel Tank Capacity:
30 to 100 gallons (60 gallon standard)
113.5 to 378.5 liters (227 liters standard)
Fuel Consumption (full load):
JD 4045D: 3.82 gph (14.46 lph) @ 2200 rpm
CAT 3054NA: 4.3 gph (16.28 lph) @ 2200 rpm
Pipe Connections:
6" (150mm) ASA 150#
Solids Handling:
3" (75mm) dia., standard impeller

Materials

Pump Casing, Suction Cover, Separation Tank and Wearplates:
Close grained cast iron
Impeller:
Cast chromium steel hardened to minimum Brinell 341 HB
Shaft:
1-1/2% nickel/chromium steel
Non Return Valve Body, Ejector Housing:
Close-grained cast iron
Non Return Valve – Ball and Seat:
High nitrile rubber
Mechanical Seal Faces:
Solid silicon carbide

godwin pumps

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E-mail: sales@godwinpumps.com
www.godwinpumps.com

BRANCH LOCATIONS:
Connecticut • Pennsylvania • New York • Ohio
Illinois • Maryland • Virginia • West Virginia
Georgia • South Carolina • North Carolina
Florida • Texas • Montana • California • Washington

GPASL.016.905

FIGURE “M”

CALCULATIONS

5 Year Storm 10 = 4.3 15 = 3.6 20 = 3.1

								slope .5%			
ZONE	Area Acres	C.O.R.	AC	AC * E	TIME	INTEN	CFS	cfs of pipe	Difference	existing pipe size	proposed pipe size
1	12.31	0.8	9.85	9.85	10	4.3	42.36	6.5	(35.86)	18	36
2	8.21	0.8	6.57	6.57	10	4.3	28.25	25	(3.25)	30	36
3	4.10	0.8	3.28	9.84	15	3.6	35.42	25	(10.42)	30	36
4	15.20	0.8	12.16	12.16	10	4.3	52.29	25	(27.29)	30	48
5	7.60	0.8	6.08	18.24	15	3.6	65.66	6.5	(59.16)	18	48
6	8.80	0.8	7.04	7.04	10	4.3	30.27	6.5	(23.77)	18	36
7	4.40	0.8	3.52	10.56	15	3.6	38.02	6.5	(31.52)	18	36
8	7.00	0.8	5.60	5.6	10	4.3	24.08	18	(6.08)	24	30
9	3.50	0.8	2.80	8.4	15	3.6	30.24	25	(5.24)	30	36
10	10.04	0.8	8.03	8.03	10	4.3	34.53	4	(30.53)	15	36
11	5.02	0.8	4.02	12.05	15	3.6	43.38	6.5	(36.88)	18	36
12	13.68	0.8	10.94	10.95	10	4.3	47.09	6.5	(40.59)	18	36
13	6.84	0.8	5.47	16.43	15	3.6	59.15	25	(34.15)	48	48
14	3.26	0.8	2.61	2.85	10	4.3	12.26	2.2	(10.06)	12	18
15	7.12	0.8	5.70	8.55	15	3.6	30.78	4	(26.78)	15	15
16	16.70	0.8	13.36	13.36	10	4.3	57.45	4	(53.45)	15	42
17	24.33	0.8	19.46	19.47	10	4.3	83.72	25	(58.72)	30	48
18	10.71	0.8	8.57	28.04	20	3.1	86.92	90	3.08	48	48
19	11.24	0.8	8.99	9	15	3.6	32.40	4	(28.40)	15	30
20	6.27	0.8	5.02	5.02	10	4.3	21.59	2.2	(19.39)	12	24
21	10.82	0.8	8.66	8.66	20	3.1	26.85	25	(1.85)	28	28
22	5.00	0.8	4.00	12.66	20	3.1	39.25	6.5	(32.75)	18	42
23	16.26	0.8	13.01	13.01	15	3.6	46.84	2.2	(44.64)	12	36
24	19.00	0.8	15.20	15.7	15	3.6	56.52	10	(46.52)	20	42
25	31.76	0.8	25.41	25.41	15	3.6	91.48	25	(66.48)	30	48
26	15.45	0.8	12.36	37.7	20	3.1	116.87	25	(91.87)	30	54
27	21.91	0.8	17.53	17.53	10	4.3	75.38	25	(50.38)	30	36
28	17.93	0.8	14.34	14.35	10	4.3	61.71	2.2	(59.51)	12	36
29	15.08	0.8	12.06	43.95	20	3.1	136.25	25	(111.25)	30	54
30	7.73	0.8	6.18	6.19	10	4.3	26.62	4	(22.62)	15	24
31	16.70	0.8	13.36	13.36	10	3.1	41.42	4	(37.42)	15	42
32	1.48	0.8	1.18	20.74	20	3.1	64.29	4	(60.29)	15	42
33	22.49	0.8	17.99	17.99	20	3.1	55.77	6.5	(49.27)	18	36
34	24.77	0.8	19.82	19.82	20	3.1	61.44	6.5	(54.94)	18	42
35	10.74	0.8	8.59	28.42	20	3.1	88.10	6.5	(81.60)	15	48
36	8.67	0.8	6.94	35.36	20	3.1	109.62	25	(84.62)	30	48

2 Year Storm 10 = 3.3 15 = 2.7 20 = 2.4

ZONE	Area Acre	C.O.R.	AC	AC * E	TIME	INTEN	CFS	slope .5% cfs of pipe	Difference	pipe size
A1	12.31	0.8	9.85	9.85	10	3.3	32.51	6.5	(26.01)	18
A	8.21	0.8	6.57	6.57	10	3.3	21.68	25	3.32	30
B	4.10	0.8	3.28	9.84	15	2.7	26.57	25	(1.57)	30
C	15.20	0.8	12.16	12.16	10	3.3	40.13	25	(15.13)	30
D	7.60	0.8	6.08	18.24	15	2.7	49.25	6.5	(42.75)	18
E	8.80	0.8	7.04	7.04	10	3.3	23.23	6.5	(16.73)	18
F	4.40	0.8	3.52	10.56	15	2.7	28.51	6.5	(22.01)	18
G	7.00	0.8	5.60	5.6	10	3.3	18.48	25	6.52	30
H	3.50	0.8	2.80	8.4	15	2.7	22.68	25	2.32	30
I	10.04	0.8	8.03	8.03	10	3.3	26.50	4	(22.50)	15
J	5.02	0.8	4.02	12.05	15	2.7	32.54	6.5	(26.04)	18
K	13.68	0.8	10.94	10.95	10	3.3	36.14	6.5	(29.64)	18
L	6.84	0.8	5.47	16.43	15	2.7	44.36	25	(19.36)	30
M	3.26	0.8	2.61	2.85	10	3.3	9.41	2.2	(7.21)	12
N	7.12	0.8	5.70	8.55	15	2.7	23.09	4	(19.09)	15
O	16.70	0.8	13.36	13.36	10	3.3	44.09	4	(40.09)	15
P	24.33	0.8	19.46	19.47	10	3.3	64.25	25	(39.25)	30
Q	10.71	0.8	8.57	28.04	20	2.4	67.30	90	22.70	48
1	11.24	0.8	8.99	9	15	2.7	24.30	4	(20.30)	15
2	6.27	0.8	5.02	5.02	10	3.3	16.57	2.2	(14.37)	12
3	10.82	0.8	8.66	8.66	20	2.4	20.78	2.2	(18.58)	12
4	5.00	0.8	4.00	12.66	20	2.4	30.38	6.5	(23.88)	18
5	16.26	0.8	13.01	13.01	15	2.7	35.13	2.2	(32.93)	12
6	19.00	0.8	15.20	15.7	15	2.7	42.39	10	(32.39)	20
7	31.76	0.8	25.41	25.41	15	2.7	68.61	25	(43.61)	30
8	15.45	0.8	12.36	37.7	20	2.4	90.48	25	(65.48)	30
9	21.91	0.8	17.53	17.53	10	3.3	57.85	25	(32.85)	30
10	17.93	0.8	14.34	14.35	10	3.3	47.36	2.2	(45.16)	12
11	15.08	0.8	12.06	43.95	20	2.4	105.48	25	(80.48)	30
12	7.73	0.8	6.18	6.19	10	3.3	20.43	4	(16.43)	15
13	16.70	0.8	13.36				0.00	4	4.00	15
13A	1.48	0.8	1.18	20.74	20	2.4	49.78	4	(45.78)	15
14	22.49	0.8	17.99	17.99	20	2.4	43.18	6.5	(36.68)	18
15	24.77	0.8	19.82	19.82	20	2.4	47.57	6.5	(41.07)	18
16	10.74	0.8	8.59	28.42	20	2.4	68.21	6.5	(61.71)	15
17	8.67	0.8	6.94	35.36	20	2.4	84.86	25	(59.86)	30

5 Year Storm 10 = 4.3 15 = 3.6 20 = 3.1

								slope .5%		
ZONE	Area Acre	C.O.R.	AC	AC * E	TIME	INTEN	CFS	cfs of pipe	Difference	pipe size
A1	12.31	0.8	9.85	9.85	10	4.3	42.36	6.5	(35.86)	18
A	8.21	0.8	6.57	6.57	10	4.3	28.25	25	(3.25)	30
B	4.10	0.8	3.28	9.84	15	3.6	35.42	25	(10.42)	30
C	15.20	0.8	12.16	12.16	10	4.3	52.29	25	(27.29)	30
D	7.60	0.8	6.08	18.24	15	3.6	65.66	6.5	(59.16)	18
E	8.80	0.8	7.04	7.04	10	4.3	30.27	6.5	(23.77)	18
F	4.40	0.8	3.52	10.56	15	3.6	38.02	6.5	(31.52)	18
G	7.00	0.8	5.60	5.6	10	4.3	24.08	25	0.92	30
H	3.50	0.8	2.80	8.4	15	3.6	30.24	25	(5.24)	30
I	10.04	0.8	8.03	8.03	10	4.3	34.53	4	(30.53)	15
J	5.02	0.8	4.02	12.05	15	3.6	43.38	6.5	(36.88)	18
K	13.68	0.8	10.94	10.95	10	4.3	47.09	6.5	(40.59)	18
L	6.84	0.8	5.47	16.43	15	3.6	59.15	25	(34.15)	30
M	3.26	0.8	2.61	2.85	10	4.3	12.26	2.2	(10.06)	12
N	7.12	0.8	5.70	8.55	15	3.6	30.78	4	(26.78)	15
O	16.70	0.8	13.36	13.36	10	4.3	57.45	4	(53.45)	15
P	24.33	0.8	19.46	19.47	10	4.3	83.72	25	(58.72)	30
Q	10.71	0.8	8.57	28.04	20	3.1	86.92	90	3.08	48
1	11.24	0.8	8.99	9	15	3.6	32.40	4	(28.40)	15
2	6.27	0.8	5.02	5.02	10	4.3	21.59	2.2	(19.39)	12
3	10.82	0.8	8.66	8.66	20	3.1	26.85	2.2	(24.65)	12
4	5.00	0.8	4.00	12.66	20	3.1	39.25	6.5	(32.75)	18
5	16.26	0.8	13.01	13.01	15	3.6	46.84	2.2	(44.64)	12
6	19.00	0.8	15.20	15.7	15	3.6	56.52	10	(46.52)	20
7	31.76	0.8	25.41	25.41	15	3.6	91.48	25	(66.48)	30
8	15.45	0.8	12.36	37.7	20	3.1	116.87	25	(91.87)	30
9	21.91	0.8	17.53	17.53	10	4.3	75.38	25	(50.38)	30
10	17.93	0.8	14.34	14.35	10	4.3	61.71	2.2	(59.51)	12
11	15.08	0.8	12.06	43.95	20	3.1	136.25	25	(111.25)	30
12	7.73	0.8	6.18	6.19	10	4.3	26.62	4	(22.62)	15
13	16.70	0.8	13.36				0.00	4	4.00	15
13A	1.48	0.8	1.18	20.74	20	3.1	64.29	4	(60.29)	15
14	22.49	0.8	17.99	17.99	20	3.1	55.77	6.5	(49.27)	18
15	24.77	0.8	19.82	19.82	20	3.1	61.44	6.5	(54.94)	18
16	10.74	0.8	8.59	28.42	20	3.1	88.10	6.5	(81.60)	15
17	8.67	0.8	6.94	35.36	20	3.1	109.62	25	(84.62)	30

10 Year Storm 10 = 5.0 15 = 4.2 20 = 3.8

ZONE	Area Acre	C.O.R.	AC	AC * E	TIME	INTEN	CFS	slope .5% cfs of pipe	Difference	pipe size
A1	12.31	0.8	9.85	9.85	10	5.0	49.25	6.5	(42.75)	18
A	8.21	0.8	6.57	6.57	10	5.0	32.85	25	(7.85)	30
B	4.10	0.8	3.28	9.84	15	4.2	41.33	25	(16.33)	30
C	15.20	0.8	12.16	12.16	10	5.0	60.80	25	(35.80)	30
D	7.60	0.8	6.08	18.24	15	4.2	76.61	6.5	(70.11)	18
E	8.80	0.8	7.04	7.04	10	5.0	35.20	6.5	(28.70)	18
F	4.40	0.8	3.52	10.56	15	4.2	44.35	6.5	(37.85)	18
G	7.00	0.8	5.60	5.6	10	5.0	28.00	25	(3.00)	30
H	3.50	0.8	2.80	8.4	15	4.2	35.28	25	(10.28)	30
I	10.04	0.8	8.03	8.03	10	5.0	40.15	4	(36.15)	15
J	5.02	0.8	4.02	12.05	15	4.2	50.61	6.5	(44.11)	18
K	13.68	0.8	10.94	10.95	10	5.0	54.75	6.5	(48.25)	18
L	6.84	0.8	5.47	16.43	15	4.2	69.01	25	(44.01)	30
M	3.26	0.8	2.61	2.85	10	5.0	14.25	2.2	(12.05)	12
N	7.12	0.8	5.70	8.55	15	4.2	35.91	4	(31.91)	15
O	16.70	0.8	13.36	13.36	10	5.0	66.80	4	(62.80)	15
P	24.33	0.8	19.46	19.47	10	5.0	97.35	25	(72.35)	30
Q	10.71	0.8	8.57	28.04	20	3.8	106.55	90	(16.55)	48
1	11.24	0.8	8.99	9	15	4.2	37.80	4	(33.80)	15
2	6.27	0.8	5.02	5.02	10	5.0	25.10	2.2	(22.90)	12
3	10.82	0.8	8.66	8.66	20	3.8	32.91	2.2	(30.71)	12
4	5.00	0.8	4.00	12.66	20	3.8	48.11	6.5	(41.61)	18
5	16.26	0.8	13.01	13.01	15	4.2	54.64	2.2	(52.44)	12
6	19.00	0.8	15.20	15.7	15	4.2	65.94	10	(55.94)	20
7	31.76	0.8	25.41	25.41	15	4.2	106.72	25	(81.72)	30
8	15.45	0.8	12.36	37.7	20	3.8	143.26	25	(118.26)	30
9	21.91	0.8	17.53	17.53	10	5.0	87.65	25	(62.65)	30
10	17.93	0.8	14.34	14.35	10	5.0	71.75	2.2	(69.55)	12
11	15.08	0.8	12.06	43.95	20	3.8	167.01	25	(142.01)	30
12	7.73	0.8	6.18	6.19	10	5.0	30.95	4	(26.95)	15
13	16.70	0.8	13.36				0.00	4	4.00	15
13A	1.48	0.8	1.18	20.74	20	3.8	78.81	4	(74.81)	15
14	22.49	0.8	17.99	17.99	20	3.8	68.36	6.5	(61.86)	18
15	24.77	0.8	19.82	19.82	20	3.8	75.32	6.5	(68.82)	18
16	10.74	0.8	8.59	28.42	20	3.8	108.00	6.5	(101.50)	15
17	8.67	0.8	6.94	35.36	20	3.8	134.37	25	(109.37)	30

Project: Wildwood Storm Study

Simulation Run: 5 Year Storm   Reservoir: Storage Area

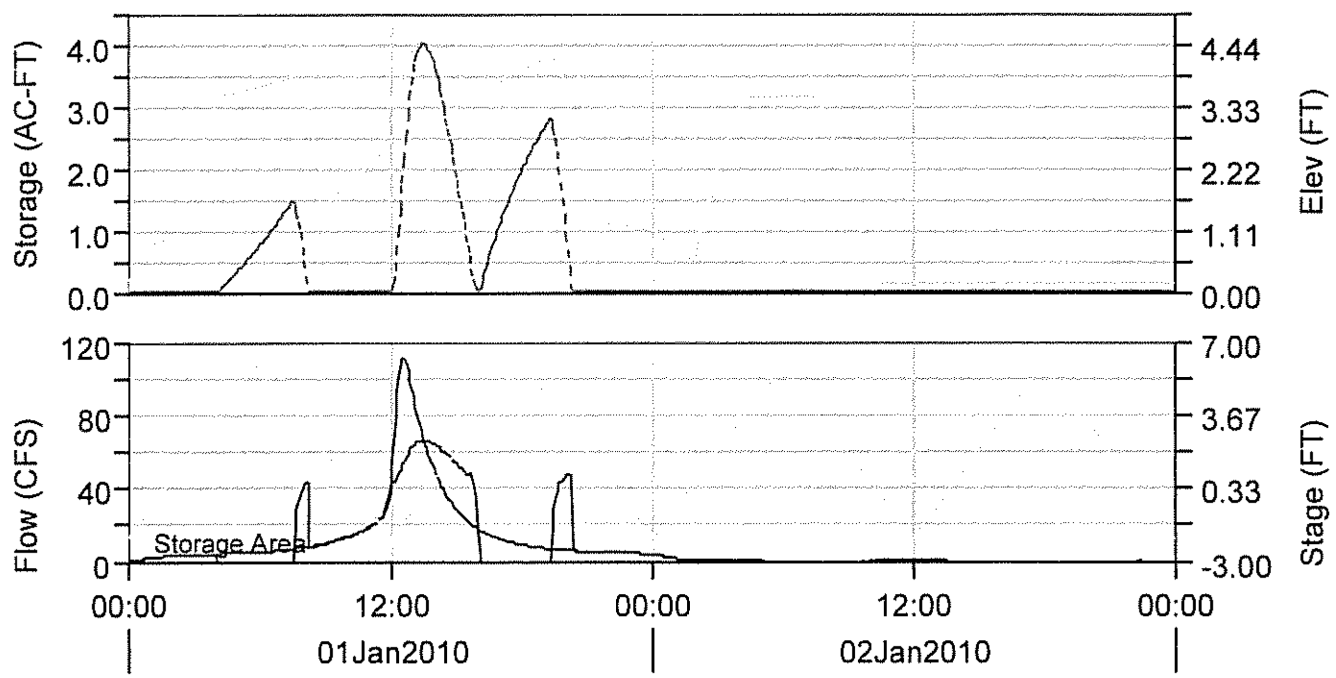
Start of Run:	01Jan2010, 00:00	Basin Model:	Basin1
End of Run:	03Jan2010, 00:00	Meteorologic Model:	5-yr Storm
Compute Time:	20May2010, 09:27:34	Control Specifications:	Time Window

Volume Units: AC-FT

Computed Results

Peak Inflow :	111.122 (CFS)	Date/Time of Peak Inflow :	01Jan2010, 12:35
Peak Outflow :	66.129 (CFS)	Date/Time of Peak Outflow :	01Jan2010, 13:35
Total Inflow :	31.373 (AC-FT)	Peak Storage :	4.015 (AC-FT)
Total Outflow :	31.339 (AC-FT)	Peak Elevation :	4.503 (FT)

Reservoir "Storage Area" Results for Run "5 Year Storm"



- - - - - - Run:5 Year Storm Element:STORAGE AREA Result:Storage

Run:5 Year Storm Element:STORAGE AREA Result:Pool Elevation

——— Run:5 Year Storm Element:STORAGE AREA Result:Outflow

— — — Run:5 Year Storm Element:STORAGE AREA Result:Combined Inflow

Run:5 YEAR STORM Element:STORAGE AREA Result:Tailwater Stage

Project: Wildwood Storm Study
Simulation Run: 5 Year Storm Reservoir: Storage Area

Start of Run: 01Jan2010, 00:00 Basin Model: Basin1
End of Run: 03Jan2010, 00:00 Meteorologic Model: 5-yr Storm
Compute Time: 20May2010, 09:27:34 Control Specifications: Time Window

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2010	00:00	0.000	0.000	0.000	0.000
01Jan2010	00:05	0.021	0.000	0.226	0.010
01Jan2010	00:10	0.080	0.000	0.282	0.050
01Jan2010	00:15	0.189	0.000	0.347	0.135
01Jan2010	00:20	0.353	0.000	0.418	0.271
01Jan2010	00:25	0.563	0.000	0.490	0.458
01Jan2010	00:30	0.797	0.000	0.559	0.680
01Jan2010	00:35	1.034	0.000	0.620	0.915
01Jan2010	00:40	1.256	0.000	0.673	1.145
01Jan2010	00:45	1.460	0.000	0.718	1.358
01Jan2010	00:50	1.646	0.000	0.756	1.551
01Jan2010	00:55	1.817	0.000	0.788	1.729
01Jan2010	01:00	1.973	0.000	0.818	1.901
01Jan2010	01:05	2.115	0.000	0.837	2.011
01Jan2010	01:10	2.245	0.000	0.866	2.188
01Jan2010	01:15	2.365	0.000	0.894	2.364
01Jan2010	01:20	2.475	0.000	0.911	2.475
01Jan2010	01:25	2.575	0.000	0.926	2.574
01Jan2010	01:30	2.667	0.000	0.940	2.668
01Jan2010	01:35	2.751	0.000	0.952	2.750
01Jan2010	01:40	2.829	0.000	0.963	2.830
01Jan2010	01:45	2.900	0.000	0.973	2.899
01Jan2010	01:50	2.965	0.000	0.982	2.966
01Jan2010	01:55	3.025	0.000	0.990	3.024
01Jan2010	02:00	3.080	0.000	0.997	3.081
01Jan2010	02:05	3.130	0.000	1.004	3.129
01Jan2010	02:10	3.177	0.000	0.982	3.179

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2010	02:15	3.221	0.000	1.047	3.178
01Jan2010	02:20	3.263	0.000	1.144	3.300
01Jan2010	02:25	3.305	0.000	1.246	3.300
01Jan2010	02:30	3.348	0.000	1.351	3.300
01Jan2010	02:35	3.391	0.000	1.458	3.300
01Jan2010	02:40	3.435	0.000	1.567	3.300
01Jan2010	02:45	3.479	0.000	1.676	3.301
01Jan2010	02:50	3.523	0.000	1.786	3.369
01Jan2010	02:55	3.566	0.000	1.898	3.715
01Jan2010	03:00	3.609	0.000	2.007	3.451
01Jan2010	03:05	3.651	0.000	2.117	3.488
01Jan2010	03:10	3.692	0.000	2.228	3.849
01Jan2010	03:15	3.734	0.000	2.338	3.572
01Jan2010	03:20	3.777	0.000	2.450	3.934
01Jan2010	03:25	3.820	0.000	2.561	3.939
01Jan2010	03:30	3.862	0.000	2.671	3.729
01Jan2010	03:35	3.903	0.000	2.782	3.730
01Jan2010	03:40	3.944	0.000	2.894	4.111
01Jan2010	03:45	3.985	0.001	3.005	4.116
01Jan2010	03:50	4.024	0.001	3.115	3.877
01Jan2010	03:55	4.064	0.001	3.226	4.016
01Jan2010	04:00	4.106	0.001	3.338	3.972
01Jan2010	04:05	4.148	0.001	3.449	4.089
01Jan2010	04:10	4.191	0.011	3.503	0.000
01Jan2010	04:15	4.235	0.040	3.510	0.000
01Jan2010	04:20	4.279	0.069	3.517	0.000
01Jan2010	04:25	4.324	0.099	3.525	0.000
01Jan2010	04:30	4.369	0.129	3.532	0.000
01Jan2010	04:35	4.414	0.159	3.540	0.000
01Jan2010	04:40	4.460	0.190	3.547	0.000
01Jan2010	04:45	4.507	0.220	3.555	0.000
01Jan2010	04:50	4.553	0.252	3.563	0.000
01Jan2010	04:55	4.597	0.283	3.571	0.000

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2010	05:00	4.640	0.315	3.579	0.000
01Jan2010	05:05	4.681	0.347	3.587	0.000
01Jan2010	05:10	4.723	0.379	3.595	0.000
01Jan2010	05:15	4.766	0.412	3.603	0.000
01Jan2010	05:20	4.812	0.445	3.611	0.000
01Jan2010	05:25	4.859	0.478	3.619	0.000
01Jan2010	05:30	4.907	0.512	3.628	0.000
01Jan2010	05:35	4.953	0.546	3.636	0.000
01Jan2010	05:40	4.997	0.580	3.645	0.000
01Jan2010	05:45	5.040	0.615	3.654	0.000
01Jan2010	05:50	5.082	0.650	3.662	0.000
01Jan2010	05:55	5.125	0.685	3.671	0.000
01Jan2010	06:00	5.168	0.720	3.680	0.000
01Jan2010	06:05	5.212	0.756	3.689	0.000
01Jan2010	06:10	5.259	0.792	3.698	0.000
01Jan2010	06:15	5.308	0.828	3.707	0.000
01Jan2010	06:20	5.360	0.865	3.716	0.000
01Jan2010	06:25	5.419	0.902	3.725	0.000
01Jan2010	06:30	5.484	0.940	3.735	0.000
01Jan2010	06:35	5.556	0.978	3.744	0.000
01Jan2010	06:40	5.635	1.016	3.754	0.000
01Jan2010	06:45	5.720	1.055	3.764	0.000
01Jan2010	06:50	5.811	1.095	3.774	0.000
01Jan2010	06:55	5.907	1.136	3.784	0.000
01Jan2010	07:00	6.008	1.177	3.794	0.000
01Jan2010	07:05	6.113	1.218	3.804	0.000
01Jan2010	07:10	6.222	1.261	3.815	0.000
01Jan2010	07:15	6.334	1.304	3.826	0.000
01Jan2010	07:20	6.450	1.348	3.837	0.000
01Jan2010	07:25	6.570	1.393	3.848	0.000
01Jan2010	07:30	6.692	1.439	3.859	0.000
01Jan2010	07:35	6.816	1.485	3.871	0.000
01Jan2010	07:40	6.944	1.458	3.864	21.576

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2010	07:45	7.072	1.329	3.832	28.806
01Jan2010	07:50	7.201	1.161	3.790	33.834
01Jan2010	07:55	7.332	0.965	3.741	37.413
01Jan2010	08:00	7.465	0.749	3.687	40.011
01Jan2010	08:05	7.604	0.519	3.630	41.827
01Jan2010	08:10	7.748	0.279	3.570	43.029
01Jan2010	08:15	7.897	0.034	3.508	43.616
01Jan2010	08:20	8.054	0.000	2.907	8.293
01Jan2010	08:25	8.219	0.000	2.797	8.287
01Jan2010	08:30	8.394	0.000	2.687	8.287
01Jan2010	08:35	8.582	0.000	2.578	8.287
01Jan2010	08:40	8.786	0.000	2.468	8.288
01Jan2010	08:45	9.004	0.000	2.361	8.555
01Jan2010	08:50	9.236	0.000	2.255	8.829
01Jan2010	08:55	9.479	0.000	2.157	9.813
01Jan2010	09:00	9.732	0.000	2.052	9.807
01Jan2010	09:05	9.995	0.000	1.949	9.807
01Jan2010	09:10	10.265	0.000	1.850	9.809
01Jan2010	09:15	10.539	0.000	1.779	10.796
01Jan2010	09:20	10.818	0.000	1.700	10.577
01Jan2010	09:25	11.101	0.000	1.754	10.888
01Jan2010	09:30	11.386	0.000	1.806	11.574
01Jan2010	09:35	11.677	0.000	1.799	11.490
01Jan2010	09:40	11.974	0.000	1.848	12.159
01Jan2010	09:45	12.276	0.000	1.843	12.091
01Jan2010	09:50	12.583	0.000	1.892	12.766
01Jan2010	09:55	12.896	0.000	1.888	12.714
01Jan2010	10:00	13.213	0.000	1.936	13.393
01Jan2010	10:05	13.532	0.000	1.933	13.352
01Jan2010	10:10	13.857	0.000	1.981	14.035
01Jan2010	10:15	14.194	0.000	1.979	14.016
01Jan2010	10:20	14.547	0.000	2.027	14.722
01Jan2010	10:25	14.923	0.000	2.029	14.748

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2010	10:30	15.325	0.000	2.079	15.498
01Jan2010	10:35	15.752	0.000	2.084	15.580
01Jan2010	10:40	16.205	0.000	2.135	16.375
01Jan2010	10:45	16.680	0.000	2.144	16.509
01Jan2010	10:50	17.177	0.000	2.197	17.346
01Jan2010	10:55	17.696	0.000	2.208	17.527
01Jan2010	11:00	18.234	0.000	2.261	18.400
01Jan2010	11:05	18.794	0.000	2.276	18.627
01Jan2010	11:10	19.390	0.000	2.332	19.555
01Jan2010	11:15	20.046	0.000	2.351	19.881
01Jan2010	11:20	20.793	0.000	2.414	20.956
01Jan2010	11:25	21.658	0.000	2.445	21.495
01Jan2010	11:30	22.661	0.000	2.518	22.789
01Jan2010	11:35	23.878	0.000	2.571	23.748
01Jan2010	11:40	25.490	0.000	2.642	25.042
01Jan2010	11:45	27.802	0.000	2.729	26.677
01Jan2010	11:50	31.092	0.000	2.872	29.429
01Jan2010	11:55	35.830	0.001	3.072	33.443
01Jan2010	12:00	43.019	0.001	3.358	39.476
01Jan2010	12:05	53.249	0.038	3.509	42.805
01Jan2010	12:10	65.857	0.151	3.538	43.434
01Jan2010	12:15	79.471	0.349	3.587	44.538
01Jan2010	12:20	92.315	0.628	3.657	46.113
01Jan2010	12:25	102.500	0.974	3.743	48.085
01Jan2010	12:30	108.819	1.363	3.841	50.323
01Jan2010	12:35	111.122	1.766	3.941	52.667
01Jan2010	12:40	110.240	2.157	4.039	54.969
01Jan2010	12:45	107.360	2.521	4.130	57.123
01Jan2010	12:50	103.335	2.846	4.211	59.066
01Jan2010	12:55	98.685	3.129	4.282	60.765
01Jan2010	13:00	93.825	3.369	4.342	62.209
01Jan2010	13:05	89.034	3.566	4.391	63.401
01Jan2010	13:10	84.424	3.723	4.431	64.355

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2010	13:15	80.008	3.844	4.461	65.087
01Jan2010	13:20	75.803	3.930	4.482	65.613
01Jan2010	13:25	71.844	3.985	4.496	65.950
01Jan2010	13:30	68.136	4.013	4.503	66.117
01Jan2010	13:35	64.666	4.015	4.503	66.129
01Jan2010	13:40	61.421	3.994	4.498	66.002
01Jan2010	13:45	58.388	3.953	4.488	65.752
01Jan2010	13:50	55.549	3.893	4.473	65.392
01Jan2010	13:55	52.884	3.818	4.454	64.934
01Jan2010	14:00	50.376	3.728	4.432	64.390
01Jan2010	14:05	48.014	3.626	4.406	63.769
01Jan2010	14:10	45.790	3.512	4.378	63.080
01Jan2010	14:15	43.696	3.388	4.347	62.333
01Jan2010	14:20	41.727	3.256	4.314	61.535
01Jan2010	14:25	39.871	3.116	4.279	60.693
01Jan2010	14:30	38.113	2.970	4.242	59.813
01Jan2010	14:35	36.442	2.817	4.204	58.903
01Jan2010	14:40	34.859	2.661	4.165	57.965
01Jan2010	14:45	33.359	2.500	4.125	57.006
01Jan2010	14:50	31.936	2.335	4.084	56.030
01Jan2010	14:55	30.583	2.168	4.042	55.040
01Jan2010	15:00	29.291	1.999	4.000	54.040
01Jan2010	15:05	28.050	1.827	3.957	53.032
01Jan2010	15:10	26.858	1.655	3.914	52.022
01Jan2010	15:15	25.722	1.481	3.870	51.022
01Jan2010	15:20	24.635	1.307	3.827	49.994
01Jan2010	15:25	23.592	1.132	3.783	48.987
01Jan2010	15:30	22.598	0.957	3.739	47.993
01Jan2010	15:35	21.672	0.782	3.695	46.986
01Jan2010	15:40	20.827	0.600	3.650	48.505
01Jan2010	15:45	20.054	0.410	3.602	46.889
01Jan2010	15:50	19.328	0.237	3.559	42.571
01Jan2010	15:55	18.636	0.095	3.524	36.182

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2010	16:00	17.978	0.001	3.373	13.409
01Jan2010	16:05	17.354	0.002	3.500	16.258
01Jan2010	16:10	16.769	0.079	3.520	0.000
01Jan2010	16:15	16.224	0.192	3.548	0.000
01Jan2010	16:20	15.711	0.302	3.575	0.000
01Jan2010	16:25	15.219	0.409	3.602	0.000
01Jan2010	16:30	14.747	0.512	3.628	0.000
01Jan2010	16:35	14.303	0.612	3.653	0.000
01Jan2010	16:40	13.890	0.709	3.677	0.000
01Jan2010	16:45	13.492	0.803	3.701	0.000
01Jan2010	16:50	13.102	0.895	3.724	0.000
01Jan2010	16:55	12.734	0.984	3.746	0.000
01Jan2010	17:00	12.380	1.070	3.767	0.000
01Jan2010	17:05	12.036	1.154	3.788	0.000
01Jan2010	17:10	11.680	1.236	3.809	0.000
01Jan2010	17:15	11.314	1.315	3.829	0.000
01Jan2010	17:20	10.979	1.392	3.848	0.000
01Jan2010	17:25	10.686	1.467	3.867	0.000
01Jan2010	17:30	10.416	1.539	3.885	0.000
01Jan2010	17:35	10.162	1.610	3.902	0.000
01Jan2010	17:40	9.926	1.679	3.920	0.000
01Jan2010	17:45	9.705	1.747	3.937	0.000
01Jan2010	17:50	9.493	1.813	3.953	0.000
01Jan2010	17:55	9.286	1.878	3.969	0.000
01Jan2010	18:00	9.082	1.941	3.985	0.000
01Jan2010	18:05	8.879	2.003	4.001	0.000
01Jan2010	18:10	8.682	2.063	4.016	0.000
01Jan2010	18:15	8.488	2.122	4.030	0.000
01Jan2010	18:20	8.300	2.180	4.045	0.000
01Jan2010	18:25	8.123	2.237	4.059	0.000
01Jan2010	18:30	7.958	2.292	4.073	0.000
01Jan2010	18:35	7.801	2.346	4.086	0.000
01Jan2010	18:40	7.655	2.400	4.100	0.000

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2010	18:45	7.517	2.452	4.113	0.000
01Jan2010	18:50	7.389	2.503	4.126	0.000
01Jan2010	18:55	7.270	2.554	4.138	0.000
01Jan2010	19:00	7.160	2.603	4.151	0.000
01Jan2010	19:05	7.057	2.652	4.163	0.000
01Jan2010	19:10	6.957	2.701	4.175	0.000
01Jan2010	19:15	6.858	2.748	4.187	0.000
01Jan2010	19:20	6.761	2.795	4.199	0.000
01Jan2010	19:25	6.664	2.769	4.192	20.877
01Jan2010	19:30	6.572	2.640	4.160	29.313
01Jan2010	19:35	6.488	2.463	4.116	34.922
01Jan2010	19:40	6.410	2.252	4.063	39.164
01Jan2010	19:45	6.336	2.014	4.003	42.568
01Jan2010	19:50	6.265	1.765	3.941	43.286
01Jan2010	19:55	6.194	1.504	3.876	44.982
01Jan2010	20:00	6.123	1.233	3.808	46.123
01Jan2010	20:05	6.054	0.954	3.738	46.858
01Jan2010	20:10	5.988	0.672	3.668	47.061
01Jan2010	20:15	5.928	0.389	3.597	46.721
01Jan2010	20:20	5.870	0.111	3.528	45.806
01Jan2010	20:25	5.811	0.000	2.788	6.081
01Jan2010	20:30	5.754	0.000	2.676	5.496
01Jan2010	20:35	5.695	0.000	2.566	5.496
01Jan2010	20:40	5.636	0.000	2.455	5.496
01Jan2010	20:45	5.578	0.000	2.345	5.496
01Jan2010	20:50	5.521	0.000	2.235	5.497
01Jan2010	20:55	5.467	0.000	2.126	5.497
01Jan2010	21:00	5.414	0.000	2.016	5.497
01Jan2010	21:05	5.365	0.000	1.907	5.491
01Jan2010	21:10	5.319	0.000	1.797	5.204
01Jan2010	21:15	5.274	0.000	1.689	5.205
01Jan2010	21:20	5.231	0.000	1.583	5.205
01Jan2010	21:25	5.189	0.000	1.480	5.205

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2010	21:30	5.147	0.000	1.379	5.139
01Jan2010	21:35	5.108	0.000	1.285	5.139
01Jan2010	21:40	5.069	0.000	1.208	5.045
01Jan2010	21:45	5.029	0.000	1.235	5.051
01Jan2010	21:50	4.992	0.000	1.226	4.971
01Jan2010	21:55	4.954	0.000	1.226	4.975
01Jan2010	22:00	4.917	0.000	1.218	4.898
01Jan2010	22:05	4.878	0.000	1.218	4.897
01Jan2010	22:10	4.837	0.000	1.209	4.819
01Jan2010	22:15	4.794	0.000	1.208	4.811
01Jan2010	22:20	4.751	0.000	1.200	4.735
01Jan2010	22:25	4.711	0.000	1.199	4.726
01Jan2010	22:30	4.672	0.000	1.192	4.658
01Jan2010	22:35	4.634	0.000	1.190	4.648
01Jan2010	22:40	4.598	0.000	1.183	4.587
01Jan2010	22:45	4.559	0.000	1.181	4.570
01Jan2010	22:50	4.517	0.000	1.174	4.510
01Jan2010	22:55	4.478	0.000	1.171	4.485
01Jan2010	23:00	4.438	0.000	1.165	4.431
01Jan2010	23:05	4.398	0.000	1.162	4.405
01Jan2010	23:10	4.358	0.000	1.156	4.351
01Jan2010	23:15	4.318	0.000	1.153	4.325
01Jan2010	23:20	4.278	0.000	1.146	4.271
01Jan2010	23:25	4.239	0.000	1.143	4.246
01Jan2010	23:30	4.201	0.000	1.137	4.194
01Jan2010	23:35	4.165	0.000	1.135	4.172
01Jan2010	23:40	4.130	0.000	1.129	4.123
01Jan2010	23:45	4.096	0.000	1.127	4.102
01Jan2010	23:50	4.062	0.000	1.121	4.055
01Jan2010	23:55	4.024	0.000	1.118	4.031
02Jan2010	00:00	3.985	0.000	1.112	3.979
02Jan2010	00:05	3.925	0.000	1.106	3.932
02Jan2010	00:10	3.828	0.000	1.104	3.914

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
02Jan2010	00:15	3.685	0.000	1.094	3.831
02Jan2010	00:20	3.494	0.000	1.062	3.574
02Jan2010	00:25	3.263	0.000	1.035	3.366
02Jan2010	00:30	3.010	0.000	1.003	3.124
02Jan2010	00:35	2.757	0.000	0.969	2.879
02Jan2010	00:40	2.518	0.000	0.934	2.634
02Jan2010	00:45	2.300	0.000	0.900	2.406
02Jan2010	00:50	2.100	0.000	0.868	2.198
02Jan2010	00:55	1.918	0.000	0.836	2.005
02Jan2010	01:00	1.751	0.000	0.806	1.831
02Jan2010	01:05	1.599	0.000	0.778	1.672
02Jan2010	01:10	1.459	0.000	0.751	1.527
02Jan2010	01:15	1.331	0.000	0.726	1.400
02Jan2010	01:20	1.214	0.000	0.701	1.276
02Jan2010	01:25	1.107	0.000	0.677	1.163
02Jan2010	01:30	1.008	0.000	0.654	1.060
02Jan2010	01:35	0.919	0.000	0.632	0.963
02Jan2010	01:40	0.836	0.000	0.611	0.877
02Jan2010	01:45	0.760	0.000	0.591	0.798
02Jan2010	01:50	0.691	0.000	0.572	0.726
02Jan2010	01:55	0.627	0.000	0.574	0.654
02Jan2010	02:00	0.569	0.000	0.675	0.647
02Jan2010	02:05	0.515	0.000	0.782	0.606
02Jan2010	02:10	0.466	0.000	0.890	0.321
02Jan2010	02:15	0.421	0.000	1.001	0.252
02Jan2010	02:20	0.380	0.000	1.112	0.452
02Jan2010	02:25	0.342	0.000	1.223	0.259
02Jan2010	02:30	0.307	0.000	1.334	0.383
02Jan2010	02:35	0.275	0.000	1.445	0.187
02Jan2010	02:40	0.245	0.000	1.556	0.187
02Jan2010	02:45	0.219	0.000	1.667	0.187
02Jan2010	02:50	0.194	0.000	1.778	0.187
02Jan2010	02:55	0.172	0.000	1.889	0.187

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
02Jan2010	03:00	0.152	0.000	2.000	0.185
02Jan2010	03:05	0.134	0.000	2.111	0.189
02Jan2010	03:10	0.118	0.000	2.222	0.172
02Jan2010	03:15	0.104	0.000	2.333	0.143
02Jan2010	03:20	0.091	0.000	2.444	0.116
02Jan2010	03:25	0.080	0.000	2.556	0.085
02Jan2010	03:30	0.070	0.000	2.667	0.071
02Jan2010	03:35	0.062	0.000	2.778	0.067
02Jan2010	03:40	0.054	0.000	2.889	0.119
02Jan2010	03:45	0.048	0.001	3.000	0.086
02Jan2010	03:50	0.042	0.001	3.111	0.072
02Jan2010	03:55	0.037	0.001	3.222	0.101
02Jan2010	04:00	0.033	0.001	3.244	0.000
02Jan2010	04:05	0.029	0.001	3.286	0.000
02Jan2010	04:10	0.025	0.001	3.500	0.000
02Jan2010	04:15	0.022	0.001	3.500	0.000
02Jan2010	04:20	0.019	0.001	3.500	0.000
02Jan2010	04:25	0.016	0.001	3.500	0.000
02Jan2010	04:30	0.014	0.001	3.500	0.000
02Jan2010	04:35	0.011	0.001	3.500	0.000
02Jan2010	04:40	0.010	0.001	3.500	0.000
02Jan2010	04:45	0.007	0.001	3.500	0.000
02Jan2010	04:50	0.006	0.001	3.500	0.000
02Jan2010	04:55	0.004	0.002	3.500	0.000
02Jan2010	05:00	0.003	0.002	3.500	0.000
02Jan2010	05:05	0.002	0.002	3.500	0.000
02Jan2010	05:10	0.001	0.002	3.500	0.000
02Jan2010	05:15	0.000	0.002	3.500	0.000
02Jan2010	05:20	0.000	0.002	3.500	0.000
02Jan2010	05:25	0.000	0.002	3.500	0.000
02Jan2010	05:30	0.000	0.002	3.500	0.000
02Jan2010	05:35	0.000	0.002	3.500	0.000
02Jan2010	05:40	0.000	0.002	3.500	0.000

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
02Jan2010	05:45	0.000	0.002	3.500	0.000
02Jan2010	05:50	0.000	0.002	3.500	0.000
02Jan2010	05:55	0.000	0.002	3.500	0.000
02Jan2010	06:00	0.000	0.002	3.500	0.000
02Jan2010	06:05	0.000	0.002	3.500	0.000
02Jan2010	06:10	0.000	0.002	3.500	0.000
02Jan2010	06:15	0.000	0.002	3.500	0.000
02Jan2010	06:20	0.000	0.002	3.500	0.000
02Jan2010	06:25	0.000	0.002	3.500	0.000
02Jan2010	06:30	0.000	0.002	3.500	0.000
02Jan2010	06:35	0.000	0.002	3.500	0.000
02Jan2010	06:40	0.000	0.002	3.500	0.000
02Jan2010	06:45	0.000	0.002	3.500	0.000
02Jan2010	06:50	0.000	0.002	3.500	0.000
02Jan2010	06:55	0.000	0.002	3.500	0.000
02Jan2010	07:00	0.000	0.002	3.500	0.000
02Jan2010	07:05	0.000	0.002	3.500	0.000
02Jan2010	07:10	0.000	0.002	3.500	0.000
02Jan2010	07:15	0.000	0.002	3.500	0.000
02Jan2010	07:20	0.000	0.002	3.500	0.000
02Jan2010	07:25	0.000	0.002	3.500	0.000
02Jan2010	07:30	0.000	0.002	3.500	0.000
02Jan2010	07:35	0.000	0.002	3.500	0.000
02Jan2010	07:40	0.000	0.002	3.500	0.000
02Jan2010	07:45	0.000	0.002	3.500	0.000
02Jan2010	07:50	0.000	0.002	3.500	0.000
02Jan2010	07:55	0.000	0.001	3.254	0.000
02Jan2010	08:00	0.000	0.001	3.254	0.000
02Jan2010	08:05	0.000	0.001	3.222	0.000
02Jan2010	08:10	0.000	0.001	3.111	0.000
02Jan2010	08:15	0.000	0.000	3.000	0.000
02Jan2010	08:20	0.000	0.000	2.889	0.000
02Jan2010	08:25	0.000	0.000	2.778	0.000

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
02Jan2010	08:30	0.000	0.000	2.667	0.000
02Jan2010	08:35	0.000	0.000	2.556	0.000
02Jan2010	08:40	0.000	0.000	2.444	0.000
02Jan2010	08:45	0.000	0.000	2.333	0.000
02Jan2010	08:50	0.000	0.000	2.222	0.000
02Jan2010	08:55	0.000	0.000	2.111	0.000
02Jan2010	09:00	0.000	0.000	2.000	0.000
02Jan2010	09:05	0.000	0.000	1.889	0.000
02Jan2010	09:10	0.000	0.000	1.778	0.000
02Jan2010	09:15	0.000	0.000	1.667	0.000
02Jan2010	09:20	0.000	0.000	1.556	0.000
02Jan2010	09:25	0.000	0.000	1.444	0.000
02Jan2010	09:30	0.000	0.000	1.333	0.000
02Jan2010	09:35	0.000	0.000	1.222	0.000
02Jan2010	09:40	0.000	0.000	1.111	0.000
02Jan2010	09:45	0.000	0.000	1.000	0.004
02Jan2010	09:50	0.000	0.000	0.889	0.000
02Jan2010	09:55	0.000	0.000	0.777	0.000
02Jan2010	10:00	0.000	0.000	0.667	0.000
02Jan2010	10:05	0.000	0.000	0.556	0.005
02Jan2010	10:10	0.000	0.000	0.444	0.005
02Jan2010	10:15	0.000	0.000	0.333	0.000
02Jan2010	10:20	0.000	0.000	0.223	0.003
02Jan2010	10:25	0.000	0.000	0.184	0.000
02Jan2010	10:30	0.000	0.000	0.182	0.000
02Jan2010	10:35	0.000	0.000	0.181	0.000
02Jan2010	10:40	0.000	0.000	0.181	0.000
02Jan2010	10:45	0.000	0.000	0.181	0.000
02Jan2010	10:50	0.000	0.000	0.181	0.000
02Jan2010	10:55	0.000	0.000	0.181	0.000
02Jan2010	11:00	0.000	0.000	0.181	0.000
02Jan2010	11:05	0.000	0.000	0.181	0.000
02Jan2010	11:10	0.000	0.000	0.181	0.000

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
02Jan2010	11:15	0.000	0.000	0.180	0.000
02Jan2010	11:20	0.000	0.000	0.180	0.000
02Jan2010	11:25	0.000	0.000	0.180	0.000
02Jan2010	11:30	0.000	0.000	0.180	0.000
02Jan2010	11:35	0.000	0.000	0.180	0.000
02Jan2010	11:40	0.000	0.000	0.180	0.000
02Jan2010	11:45	0.000	0.000	0.180	0.000
02Jan2010	11:50	0.000	0.000	0.180	0.000
02Jan2010	11:55	0.000	0.000	0.180	0.000
02Jan2010	12:00	0.000	0.000	0.180	0.000
02Jan2010	12:05	0.000	0.000	0.180	0.000
02Jan2010	12:10	0.000	0.000	0.180	0.000
02Jan2010	12:15	0.000	0.000	0.180	0.000
02Jan2010	12:20	0.000	0.000	0.180	0.000
02Jan2010	12:25	0.000	0.000	0.180	0.000
02Jan2010	12:30	0.000	0.000	0.180	0.000
02Jan2010	12:35	0.000	0.000	0.180	0.000
02Jan2010	12:40	0.000	0.000	0.180	0.000
02Jan2010	12:45	0.000	0.000	0.180	0.000
02Jan2010	12:50	0.000	0.000	0.180	0.000
02Jan2010	12:55	0.000	0.000	0.180	0.000
02Jan2010	13:00	0.000	0.000	0.180	0.000
02Jan2010	13:05	0.000	0.000	0.180	0.000
02Jan2010	13:10	0.000	0.000	0.180	0.000
02Jan2010	13:15	0.000	0.000	0.180	0.000
02Jan2010	13:20	0.000	0.000	0.180	0.000
02Jan2010	13:25	0.000	0.000	0.180	0.000
02Jan2010	13:30	0.000	0.000	0.180	0.000
02Jan2010	13:35	0.000	0.000	0.180	0.000
02Jan2010	13:40	0.000	0.000	0.180	0.000
02Jan2010	13:45	0.000	0.000	0.180	0.000
02Jan2010	13:50	0.000	0.000	0.180	0.000
02Jan2010	13:55	0.000	0.000	0.180	0.000

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
02Jan2010	14:00	0.000	0.000	0.180	0.000
02Jan2010	14:05	0.000	0.000	0.180	0.000
02Jan2010	14:10	0.000	0.000	0.180	0.000
02Jan2010	14:15	0.000	0.000	0.180	0.000
02Jan2010	14:20	0.000	0.000	0.180	0.000
02Jan2010	14:25	0.000	0.000	0.180	0.000
02Jan2010	14:30	0.000	0.000	0.180	0.000
02Jan2010	14:35	0.000	0.000	0.180	0.000
02Jan2010	14:40	0.000	0.000	0.180	0.000
02Jan2010	14:45	0.000	0.000	0.180	0.000
02Jan2010	14:50	0.000	0.000	0.180	0.000
02Jan2010	14:55	0.000	0.000	0.180	0.000
02Jan2010	15:00	0.000	0.000	0.180	0.000
02Jan2010	15:05	0.000	0.000	0.180	0.000
02Jan2010	15:10	0.000	0.000	0.180	0.000
02Jan2010	15:15	0.000	0.000	0.180	0.000
02Jan2010	15:20	0.000	0.000	0.180	0.000
02Jan2010	15:25	0.000	0.000	0.180	0.000
02Jan2010	15:30	0.000	0.000	0.180	0.000
02Jan2010	15:35	0.000	0.000	0.180	0.000
02Jan2010	15:40	0.000	0.000	0.180	0.000
02Jan2010	15:45	0.000	0.000	0.180	0.000
02Jan2010	15:50	0.000	0.000	0.180	0.000
02Jan2010	15:55	0.000	0.000	0.180	0.000
02Jan2010	16:00	0.000	0.000	0.180	0.000
02Jan2010	16:05	0.000	0.000	0.180	0.000
02Jan2010	16:10	0.000	0.000	0.180	0.000
02Jan2010	16:15	0.000	0.000	0.180	0.000
02Jan2010	16:20	0.000	0.000	0.180	0.000
02Jan2010	16:25	0.000	0.000	0.180	0.000
02Jan2010	16:30	0.000	0.000	0.180	0.000
02Jan2010	16:35	0.000	0.000	0.180	0.000
02Jan2010	16:40	0.000	0.000	0.180	0.000

Project: Wildwood Storm Study

Simulation Run: 10 Year Storm   Reservoir: Storage Area

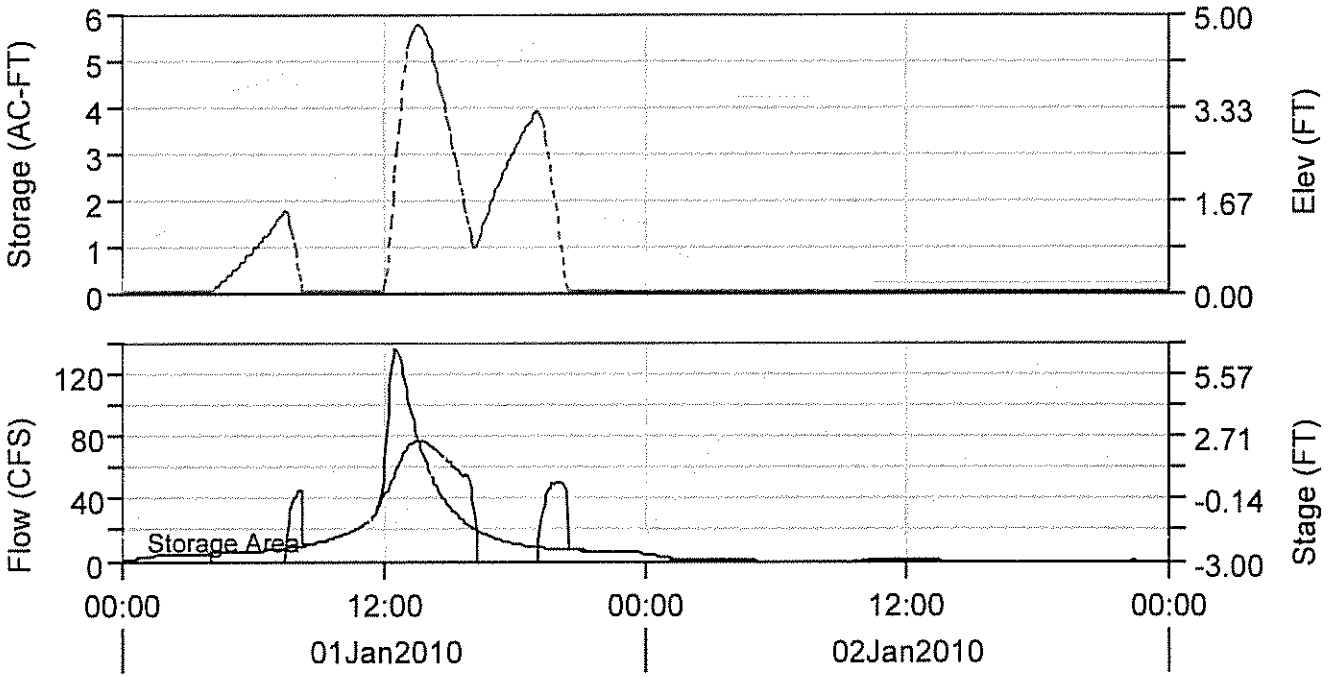
Start of Run:	01Jan2010, 00:00	Basin Model:	Basin1
End of Run:	03Jan2010, 00:00	Meteorologic Model:	10-yr Storm
Compute Time:	20May2010, 09:25:11	Control Specifications:	Time Window

Volume Units: AC-FT

Computed Results

Peak Inflow :	135.616 (CFS)	Date/Time of Peak Inflow :	01Jan2010, 12:35
Peak Outflow :	76.766 (CFS)	Date/Time of Peak Outflow :	01Jan2010, 13:40
Total Inflow :	38.139 (AC-FT)	Peak Storage :	5.750 (AC-FT)
Total Outflow :	37.945 (AC-FT)	Peak Elevation :	4.937 (FT)

Reservoir "Storage Area" Results for Run "10 Year Storm"



Run:10 Year Storm Element:STORAGE AREA Result:Storage
Run:10 Year Storm Element:STORAGE AREA Result:Pool Elevation
Run:10 Year Storm Element:STORAGE AREA Result:Outflow
Run:10 Year Storm Element:STORAGE AREA Result:Combined Inflow
Run:10 YEAR STORM Element:STORAGE AREA Result:Tailwater Stage

Project: Wildwood Storm Study
Simulation Run: 10 Year Storm Reservoir: Storage Area

Start of Run: 01Jan2010, 00:00 Basin Model: Basin1
End of Run: 03Jan2010, 00:00 Meteorologic Model: 10-yr Storm
Compute Time: 20May2010, 09:25:11 Control Specifications: Time Window

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2010	00:00	0.000	0.000	0.000	0.000
01Jan2010	00:05	0.025	0.000	0.230	0.012
01Jan2010	00:10	0.096	0.000	0.292	0.060
01Jan2010	00:15	0.227	0.000	0.363	0.161
01Jan2010	00:20	0.424	0.000	0.441	0.325
01Jan2010	00:25	0.675	0.000	0.520	0.549
01Jan2010	00:30	0.956	0.000	0.595	0.815
01Jan2010	00:35	1.240	0.000	0.663	1.098
01Jan2010	00:40	1.507	0.000	0.721	1.374
01Jan2010	00:45	1.751	0.000	0.770	1.629
01Jan2010	00:50	1.975	0.000	0.811	1.859
01Jan2010	00:55	2.179	0.000	0.847	2.073
01Jan2010	01:00	2.366	0.000	0.881	2.283
01Jan2010	01:05	2.537	0.000	0.900	2.408
01Jan2010	01:10	2.693	0.000	0.933	2.628
01Jan2010	01:15	2.837	0.000	0.964	2.837
01Jan2010	01:20	2.968	0.000	0.982	2.967
01Jan2010	01:25	3.089	0.000	0.999	3.089
01Jan2010	01:30	3.199	0.000	1.013	3.198
01Jan2010	01:35	3.300	0.000	1.027	3.301
01Jan2010	01:40	3.393	0.000	1.039	3.392
01Jan2010	01:45	3.478	0.000	1.050	3.479
01Jan2010	01:50	3.556	0.000	1.060	3.555
01Jan2010	01:55	3.628	0.000	1.069	3.629
01Jan2010	02:00	3.694	0.000	1.077	3.693
01Jan2010	02:05	3.755	0.000	1.085	3.756
01Jan2010	02:10	3.811	0.000	1.092	3.810

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2010	02:15	3.863	0.000	1.079	3.865
01Jan2010	02:20	3.914	0.000	1.159	3.864
01Jan2010	02:25	3.965	0.000	1.255	3.867
01Jan2010	02:30	4.015	0.000	1.358	3.870
01Jan2010	02:35	4.068	0.000	1.463	3.871
01Jan2010	02:40	4.120	0.000	1.574	4.282
01Jan2010	02:45	4.174	0.000	1.682	4.281
01Jan2010	02:50	4.226	0.000	1.790	4.114
01Jan2010	02:55	4.277	0.000	1.899	4.114
01Jan2010	03:00	4.329	0.000	2.009	4.115
01Jan2010	03:05	4.380	0.000	2.121	4.572
01Jan2010	03:10	4.429	0.000	2.230	4.238
01Jan2010	03:15	4.479	0.000	2.342	4.664
01Jan2010	03:20	4.530	0.000	2.451	4.336
01Jan2010	03:25	4.582	0.000	2.563	4.770
01Jan2010	03:30	4.633	0.000	2.673	4.435
01Jan2010	03:35	4.682	0.000	2.784	4.435
01Jan2010	03:40	4.731	0.000	2.895	4.902
01Jan2010	03:45	4.779	0.001	3.006	4.906
01Jan2010	03:50	4.827	0.001	3.117	4.682
01Jan2010	03:55	4.875	0.001	3.227	4.682
01Jan2010	04:00	4.925	0.001	3.338	4.683
01Jan2010	04:05	4.976	0.001	3.450	5.192
01Jan2010	04:10	5.027	0.012	3.503	0.000
01Jan2010	04:15	5.079	0.047	3.512	0.000
01Jan2010	04:20	5.133	0.082	3.520	0.000
01Jan2010	04:25	5.187	0.118	3.529	0.000
01Jan2010	04:30	5.240	0.154	3.538	0.000
01Jan2010	04:35	5.295	0.190	3.547	0.000
01Jan2010	04:40	5.350	0.227	3.556	0.000
01Jan2010	04:45	5.406	0.264	3.566	0.000
01Jan2010	04:50	5.461	0.301	3.575	0.000
01Jan2010	04:55	5.514	0.339	3.585	0.000

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2010	05:00	5.565	0.377	3.594	0.000
01Jan2010	05:05	5.615	0.415	3.604	0.000
01Jan2010	05:10	5.665	0.454	3.613	0.000
01Jan2010	05:15	5.717	0.493	3.623	0.000
01Jan2010	05:20	5.772	0.533	3.633	0.000
01Jan2010	05:25	5.829	0.573	3.643	0.000
01Jan2010	05:30	5.886	0.613	3.653	0.000
01Jan2010	05:35	5.941	0.654	3.663	0.000
01Jan2010	05:40	5.994	0.695	3.674	0.000
01Jan2010	05:45	6.046	0.737	3.684	0.000
01Jan2010	05:50	6.096	0.778	3.694	0.000
01Jan2010	05:55	6.147	0.821	3.705	0.000
01Jan2010	06:00	6.199	0.863	3.716	0.000
01Jan2010	06:05	6.252	0.906	3.726	0.000
01Jan2010	06:10	6.308	0.949	3.737	0.000
01Jan2010	06:15	6.366	0.993	3.748	0.000
01Jan2010	06:20	6.430	1.037	3.759	0.000
01Jan2010	06:25	6.500	1.081	3.770	0.000
01Jan2010	06:30	6.578	1.127	3.781	0.000
01Jan2010	06:35	6.665	1.172	3.793	0.000
01Jan2010	06:40	6.759	1.218	3.804	0.000
01Jan2010	06:45	6.861	1.265	3.816	0.000
01Jan2010	06:50	6.970	1.313	3.828	0.000
01Jan2010	06:55	7.085	1.361	3.840	0.000
01Jan2010	07:00	7.206	1.410	3.852	0.000
01Jan2010	07:05	7.332	1.461	3.865	0.000
01Jan2010	07:10	7.463	1.511	3.878	0.000
01Jan2010	07:15	7.598	1.563	3.891	0.000
01Jan2010	07:20	7.737	1.616	3.904	0.000
01Jan2010	07:25	7.880	1.670	3.917	0.000
01Jan2010	07:30	8.027	1.725	3.931	0.000
01Jan2010	07:35	8.176	1.728	3.932	15.162
01Jan2010	07:40	8.329	1.637	3.909	26.543

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2010	07:45	8.482	1.490	3.872	32.087
01Jan2010	07:50	8.638	1.313	3.828	36.449
01Jan2010	07:55	8.795	1.110	3.777	39.559
01Jan2010	08:00	8.954	0.891	3.722	41.876
01Jan2010	08:05	9.121	0.658	3.664	43.509
01Jan2010	08:10	9.294	0.418	3.604	44.540
01Jan2010	08:15	9.472	0.174	3.543	44.898
01Jan2010	08:20	9.661	0.000	2.915	9.926
01Jan2010	08:25	9.858	0.000	2.805	9.920
01Jan2010	08:30	10.069	0.000	2.696	9.921
01Jan2010	08:35	10.295	0.000	2.587	9.921
01Jan2010	08:40	10.539	0.000	2.486	10.914
01Jan2010	08:45	10.800	0.000	2.375	10.443
01Jan2010	08:50	11.078	0.000	2.268	10.445
01Jan2010	08:55	11.370	0.000	2.168	10.930
01Jan2010	09:00	11.674	0.000	2.081	12.112
01Jan2010	09:05	11.989	0.000	1.975	11.566
01Jan2010	09:10	12.313	0.000	1.911	12.728
01Jan2010	09:15	12.642	0.000	1.825	12.243
01Jan2010	09:20	12.976	0.000	1.814	12.255
01Jan2010	09:25	13.315	0.000	1.919	13.145
01Jan2010	09:30	13.658	0.000	1.966	13.826
01Jan2010	09:35	14.007	0.000	1.967	13.839
01Jan2010	09:40	14.363	0.000	2.014	14.528
01Jan2010	09:45	14.725	0.000	2.016	14.559
01Jan2010	09:50	15.094	0.000	2.062	15.257
01Jan2010	09:55	15.469	0.000	2.066	15.306
01Jan2010	10:00	15.849	0.000	2.111	16.010
01Jan2010	10:05	16.232	0.000	2.115	16.070
01Jan2010	10:10	16.622	0.000	2.161	16.781
01Jan2010	10:15	17.025	0.000	2.166	16.866
01Jan2010	10:20	17.450	0.000	2.213	17.607
01Jan2010	10:25	17.901	0.000	2.221	17.743

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2010	10:30	18.383	0.000	2.270	18.538
01Jan2010	10:35	18.895	0.000	2.283	18.739
01Jan2010	10:40	19.438	0.000	2.334	19.591
01Jan2010	10:45	20.008	0.000	2.349	19.853
01Jan2010	10:50	20.604	0.000	2.402	20.756
01Jan2010	10:55	21.226	0.000	2.421	21.074
01Jan2010	11:00	21.872	0.000	2.475	22.022
01Jan2010	11:05	22.544	0.000	2.496	22.393
01Jan2010	11:10	23.259	0.000	2.553	23.407
01Jan2010	11:15	24.046	0.000	2.580	23.896
01Jan2010	11:20	24.942	0.000	2.645	25.088
01Jan2010	11:25	25.980	0.000	2.684	25.832
01Jan2010	11:30	27.185	0.000	2.764	27.330
01Jan2010	11:35	28.654	0.000	2.824	28.507
01Jan2010	11:40	30.609	0.000	2.905	30.088
01Jan2010	11:45	33.426	0.001	3.004	32.070
01Jan2010	11:50	37.451	0.001	3.166	35.406
01Jan2010	11:55	43.259	0.001	3.398	40.346
01Jan2010	12:00	52.076	0.035	3.509	42.788
01Jan2010	12:05	64.621	0.140	3.535	43.372
01Jan2010	12:10	80.081	0.336	3.584	44.466
01Jan2010	12:15	96.772	0.633	3.658	46.139
01Jan2010	12:20	112.520	1.028	3.757	48.391
01Jan2010	12:25	125.013	1.503	3.876	51.134
01Jan2010	12:30	132.772	2.028	4.007	54.205
01Jan2010	12:35	135.616	2.568	4.142	57.403
01Jan2010	12:40	134.561	3.092	4.273	60.540
01Jan2010	12:45	131.060	3.579	4.395	63.483
01Jan2010	12:50	126.157	4.019	4.505	66.152
01Jan2010	12:55	120.487	4.404	4.601	68.504
01Jan2010	13:00	114.558	4.735	4.684	70.527
01Jan2010	13:05	108.713	5.012	4.753	72.228
01Jan2010	13:10	103.088	5.239	4.810	73.622

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2010	13:15	97.700	5.420	4.855	74.732
01Jan2010	13:20	92.569	5.557	4.889	75.578
01Jan2010	13:25	87.737	5.656	4.914	76.183
01Jan2010	13:30	83.211	5.718	4.929	76.569
01Jan2010	13:35	78.976	5.749	4.937	76.756
01Jan2010	13:40	75.015	5.750	4.937	76.766
01Jan2010	13:45	71.313	5.726	4.931	76.617
01Jan2010	13:50	67.847	5.679	4.920	76.325
01Jan2010	13:55	64.594	5.611	4.902	75.906
01Jan2010	14:00	61.533	5.524	4.881	75.373
01Jan2010	14:05	58.649	5.421	4.855	74.740
01Jan2010	14:10	55.934	5.303	4.826	74.017
01Jan2010	14:15	53.378	5.173	4.793	73.214
01Jan2010	14:20	50.974	5.031	4.758	72.343
01Jan2010	14:25	48.708	4.879	4.720	71.412
01Jan2010	14:30	46.561	4.719	4.680	70.429
01Jan2010	14:35	44.521	4.551	4.638	69.402
01Jan2010	14:40	42.587	4.376	4.594	68.336
01Jan2010	14:45	40.756	4.197	4.549	67.237
01Jan2010	14:50	39.018	4.012	4.503	66.113
01Jan2010	14:55	37.365	3.824	4.456	64.967
01Jan2010	15:00	35.787	3.632	4.408	63.804
01Jan2010	15:05	34.270	3.438	4.359	62.627
01Jan2010	15:10	32.814	3.242	4.310	61.444
01Jan2010	15:15	31.426	3.044	4.261	60.250
01Jan2010	15:20	30.097	2.845	4.211	59.057
01Jan2010	15:25	28.822	2.645	4.161	57.864
01Jan2010	15:30	27.608	2.445	4.111	56.673
01Jan2010	15:35	26.476	2.245	4.061	55.488
01Jan2010	15:40	25.443	2.046	4.011	54.311
01Jan2010	15:45	24.498	1.845	3.961	54.902
01Jan2010	15:50	23.611	1.631	3.907	54.841
01Jan2010	15:55	22.766	1.423	3.856	51.529

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2010	16:00	21.961	1.239	3.810	46.247
01Jan2010	16:05	21.199	1.093	3.773	39.296
01Jan2010	16:10	20.483	0.994	3.748	30.678
01Jan2010	16:15	19.817	0.959	3.740	19.135
01Jan2010	16:20	19.191	1.030	3.757	0.000
01Jan2010	16:25	18.590	1.160	3.790	0.000
01Jan2010	16:30	18.014	1.286	3.821	0.000
01Jan2010	16:35	17.471	1.409	3.852	0.000
01Jan2010	16:40	16.966	1.527	3.882	0.000
01Jan2010	16:45	16.479	1.642	3.910	0.000
01Jan2010	16:50	16.004	1.754	3.938	0.000
01Jan2010	16:55	15.553	1.863	3.966	0.000
01Jan2010	17:00	15.121	1.968	3.992	0.000
01Jan2010	17:05	14.700	2.071	4.018	0.000
01Jan2010	17:10	14.265	2.171	4.043	0.000
01Jan2010	17:15	13.818	2.268	4.067	0.000
01Jan2010	17:20	13.408	2.361	4.090	0.000
01Jan2010	17:25	13.050	2.452	4.113	0.000
01Jan2010	17:30	12.720	2.541	4.135	0.000
01Jan2010	17:35	12.410	2.628	4.157	0.000
01Jan2010	17:40	12.121	2.712	4.178	0.000
01Jan2010	17:45	11.851	2.795	4.199	0.000
01Jan2010	17:50	11.592	2.875	4.219	0.000
01Jan2010	17:55	11.339	2.954	4.238	0.000
01Jan2010	18:00	11.089	3.032	4.258	0.000
01Jan2010	18:05	10.842	3.107	4.277	0.000
01Jan2010	18:10	10.601	3.181	4.295	0.000
01Jan2010	18:15	10.364	3.253	4.313	0.000
01Jan2010	18:20	10.134	3.324	4.331	0.000
01Jan2010	18:25	9.918	3.393	4.348	0.000
01Jan2010	18:30	9.716	3.460	4.365	0.000
01Jan2010	18:35	9.524	3.527	4.382	0.000
01Jan2010	18:40	9.345	3.592	4.398	0.000

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2010	18:45	9.178	3.655	4.414	0.000
01Jan2010	18:50	9.021	3.718	4.429	0.000
01Jan2010	18:55	8.876	3.780	4.445	0.000
01Jan2010	19:00	8.741	3.840	4.460	0.000
01Jan2010	19:05	8.615	3.900	4.475	0.000
01Jan2010	19:10	8.493	3.913	4.478	13.396
01Jan2010	19:15	8.372	3.830	4.457	25.805
01Jan2010	19:20	8.253	3.684	4.421	32.691
01Jan2010	19:25	8.136	3.498	4.374	37.637
01Jan2010	19:30	8.023	3.281	4.320	41.505
01Jan2010	19:35	7.920	3.039	4.260	44.668
01Jan2010	19:40	7.825	2.776	4.194	47.323
01Jan2010	19:45	7.735	2.496	4.124	49.603
01Jan2010	19:50	7.648	2.213	4.053	49.102
01Jan2010	19:55	7.561	1.924	3.981	50.055
01Jan2010	20:00	7.475	1.629	3.907	50.569
01Jan2010	20:05	7.390	1.331	3.833	50.666
01Jan2010	20:10	7.310	1.034	3.758	50.290
01Jan2010	20:15	7.235	0.740	3.685	49.406
01Jan2010	20:20	7.165	0.455	3.613	47.807
01Jan2010	20:25	7.093	0.182	3.545	45.285
01Jan2010	20:30	7.023	0.000	2.681	6.797
01Jan2010	20:35	6.951	0.000	2.571	6.797
01Jan2010	20:40	6.879	0.000	2.461	6.797
01Jan2010	20:45	6.808	0.000	2.351	6.797
01Jan2010	20:50	6.739	0.000	2.242	6.797
01Jan2010	20:55	6.672	0.000	2.132	6.627
01Jan2010	21:00	6.608	0.000	2.023	6.627
01Jan2010	21:05	6.548	0.000	1.916	6.627
01Jan2010	21:10	6.492	0.000	1.809	6.621
01Jan2010	21:15	6.437	0.000	1.705	6.608
01Jan2010	21:20	6.384	0.000	1.597	6.226
01Jan2010	21:25	6.333	0.000	1.497	6.227

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
01Jan2010	21:30	6.282	0.000	1.403	6.227
01Jan2010	21:35	6.234	0.000	1.329	6.227
01Jan2010	21:40	6.186	0.000	1.352	6.192
01Jan2010	21:45	6.138	0.000	1.346	6.132
01Jan2010	21:50	6.092	0.000	1.342	6.098
01Jan2010	21:55	6.046	0.000	1.337	6.041
01Jan2010	22:00	6.001	0.000	1.333	6.006
01Jan2010	22:05	5.953	0.000	1.327	5.948
01Jan2010	22:10	5.902	0.000	1.324	5.908
01Jan2010	22:15	5.850	0.000	1.317	5.845
01Jan2010	22:20	5.798	0.000	1.313	5.803
01Jan2010	22:25	5.749	0.000	1.307	5.744
01Jan2010	22:30	5.702	0.000	1.304	5.707
01Jan2010	22:35	5.656	0.000	1.298	5.651
01Jan2010	22:40	5.611	0.000	1.294	5.616
01Jan2010	22:45	5.563	0.000	1.288	5.558
01Jan2010	22:50	5.513	0.000	1.283	5.518
01Jan2010	22:55	5.465	0.000	1.277	5.460
01Jan2010	23:00	5.416	0.000	1.273	5.421
01Jan2010	23:05	5.367	0.000	1.267	5.362
01Jan2010	23:10	5.318	0.000	1.263	5.323
01Jan2010	23:15	5.269	0.000	1.257	5.264
01Jan2010	23:20	5.220	0.000	1.252	5.225
01Jan2010	23:25	5.173	0.000	1.246	5.168
01Jan2010	23:30	5.126	0.000	1.242	5.131
01Jan2010	23:35	5.083	0.000	1.237	5.078
01Jan2010	23:40	5.039	0.000	1.233	5.044
01Jan2010	23:45	4.998	0.000	1.228	4.993
01Jan2010	23:50	4.956	0.000	1.224	4.961
01Jan2010	23:55	4.910	0.000	1.218	4.906
02Jan2010	00:00	4.863	0.000	1.214	4.867
02Jan2010	00:05	4.790	0.000	1.205	4.787
02Jan2010	00:10	4.671	0.000	1.192	4.675

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
02Jan2010	00:15	4.497	0.000	1.192	4.669
02Jan2010	00:20	4.263	0.000	1.158	4.367
02Jan2010	00:25	3.981	0.000	1.127	4.103
02Jan2010	00:30	3.673	0.000	1.092	3.817
02Jan2010	00:35	3.363	0.000	1.054	3.510
02Jan2010	00:40	3.073	0.000	1.015	3.212
02Jan2010	00:45	2.807	0.000	0.977	2.935
02Jan2010	00:50	2.563	0.000	0.941	2.681
02Jan2010	00:55	2.340	0.000	0.906	2.449
02Jan2010	01:00	2.137	0.000	0.874	2.236
02Jan2010	01:05	1.951	0.000	0.842	2.039
02Jan2010	01:10	1.780	0.000	0.812	1.862
02Jan2010	01:15	1.624	0.000	0.783	1.700
02Jan2010	01:20	1.481	0.000	0.756	1.551
02Jan2010	01:25	1.350	0.000	0.730	1.420
02Jan2010	01:30	1.231	0.000	0.705	1.294
02Jan2010	01:35	1.121	0.000	0.680	1.179
02Jan2010	01:40	1.020	0.000	0.657	1.073
02Jan2010	01:45	0.928	0.000	0.635	0.977
02Jan2010	01:50	0.843	0.000	0.613	0.885
02Jan2010	01:55	0.765	0.000	0.587	0.801
02Jan2010	02:00	0.694	0.000	0.679	0.797
02Jan2010	02:05	0.629	0.000	0.784	0.791
02Jan2010	02:10	0.569	0.000	0.891	0.539
02Jan2010	02:15	0.514	0.000	1.002	0.663
02Jan2010	02:20	0.463	0.000	1.111	0.208
02Jan2010	02:25	0.417	0.000	1.224	0.540
02Jan2010	02:30	0.374	0.000	1.334	0.544
02Jan2010	02:35	0.335	0.000	1.444	0.155
02Jan2010	02:40	0.299	0.000	1.556	0.155
02Jan2010	02:45	0.267	0.000	1.667	0.155
02Jan2010	02:50	0.237	0.000	1.778	0.154
02Jan2010	02:55	0.210	0.000	1.889	0.154

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
02Jan2010	03:00	0.186	0.000	2.000	0.151
02Jan2010	03:05	0.164	0.000	2.111	0.146
02Jan2010	03:10	0.144	0.000	2.222	0.147
02Jan2010	03:15	0.126	0.000	2.333	0.141
02Jan2010	03:20	0.111	0.000	2.444	0.124
02Jan2010	03:25	0.097	0.000	2.556	0.138
02Jan2010	03:30	0.085	0.000	2.667	0.137
02Jan2010	03:35	0.075	0.000	2.778	0.159
02Jan2010	03:40	0.066	0.000	2.889	0.140
02Jan2010	03:45	0.059	0.001	3.000	0.113
02Jan2010	03:50	0.052	0.000	2.948	0.000
02Jan2010	03:55	0.045	0.001	3.142	0.000
02Jan2010	04:00	0.040	0.001	3.278	0.000
02Jan2010	04:05	0.035	0.001	3.444	0.085
02Jan2010	04:10	0.031	0.001	3.500	0.000
02Jan2010	04:15	0.027	0.001	3.500	0.000
02Jan2010	04:20	0.023	0.001	3.500	0.000
02Jan2010	04:25	0.020	0.001	3.500	0.000
02Jan2010	04:30	0.017	0.001	3.500	0.000
02Jan2010	04:35	0.014	0.001	3.500	0.000
02Jan2010	04:40	0.012	0.001	3.500	0.000
02Jan2010	04:45	0.009	0.002	3.500	0.000
02Jan2010	04:50	0.007	0.002	3.500	0.000
02Jan2010	04:55	0.005	0.002	3.500	0.000
02Jan2010	05:00	0.004	0.002	3.500	0.000
02Jan2010	05:05	0.002	0.002	3.500	0.000
02Jan2010	05:10	0.001	0.002	3.500	0.000
02Jan2010	05:15	0.000	0.002	3.500	0.000
02Jan2010	05:20	0.000	0.002	3.500	0.000
02Jan2010	05:25	0.000	0.002	3.500	0.000
02Jan2010	05:30	0.000	0.002	3.500	0.000
02Jan2010	05:35	0.000	0.002	3.500	0.000
02Jan2010	05:40	0.000	0.002	3.500	0.000

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
02Jan2010	05:45	0.000	0.002	3.500	0.000
02Jan2010	05:50	0.000	0.002	3.500	0.000
02Jan2010	05:55	0.000	0.002	3.500	0.000
02Jan2010	06:00	0.000	0.002	3.500	0.000
02Jan2010	06:05	0.000	0.002	3.500	0.000
02Jan2010	06:10	0.000	0.002	3.500	0.000
02Jan2010	06:15	0.000	0.002	3.500	0.000
02Jan2010	06:20	0.000	0.002	3.500	0.000
02Jan2010	06:25	0.000	0.002	3.500	0.000
02Jan2010	06:30	0.000	0.002	3.500	0.000
02Jan2010	06:35	0.000	0.002	3.500	0.000
02Jan2010	06:40	0.000	0.002	3.500	0.000
02Jan2010	06:45	0.000	0.002	3.500	0.000
02Jan2010	06:50	0.000	0.002	3.500	0.000
02Jan2010	06:55	0.000	0.002	3.500	0.000
02Jan2010	07:00	0.000	0.002	3.500	0.000
02Jan2010	07:05	0.000	0.002	3.500	0.000
02Jan2010	07:10	0.000	0.002	3.500	0.000
02Jan2010	07:15	0.000	0.002	3.500	0.000
02Jan2010	07:20	0.000	0.002	3.500	0.000
02Jan2010	07:25	0.000	0.002	3.500	0.000
02Jan2010	07:30	0.000	0.002	3.500	0.000
02Jan2010	07:35	0.000	0.002	3.500	0.000
02Jan2010	07:40	0.000	0.002	3.500	0.000
02Jan2010	07:45	0.000	0.002	3.500	0.000
02Jan2010	07:50	0.000	0.002	3.500	0.000
02Jan2010	07:55	0.000	0.001	3.224	0.000
02Jan2010	08:00	0.000	0.001	3.224	0.000
02Jan2010	08:05	0.000	0.001	3.222	0.000
02Jan2010	08:10	0.000	0.001	3.111	0.000
02Jan2010	08:15	0.000	0.000	3.000	0.000
02Jan2010	08:20	0.000	0.000	2.889	0.000
02Jan2010	08:25	0.000	0.000	2.778	0.000

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
02Jan2010	08:30	0.000	0.000	2.667	0.000
02Jan2010	08:35	0.000	0.000	2.556	0.000
02Jan2010	08:40	0.000	0.000	2.444	0.000
02Jan2010	08:45	0.000	0.000	2.333	0.000
02Jan2010	08:50	0.000	0.000	2.222	0.000
02Jan2010	08:55	0.000	0.000	2.111	0.000
02Jan2010	09:00	0.000	0.000	2.000	0.000
02Jan2010	09:05	0.000	0.000	1.889	0.000
02Jan2010	09:10	0.000	0.000	1.778	0.000
02Jan2010	09:15	0.000	0.000	1.667	0.000
02Jan2010	09:20	0.000	0.000	1.556	0.000
02Jan2010	09:25	0.000	0.000	1.444	0.000
02Jan2010	09:30	0.000	0.000	1.333	0.000
02Jan2010	09:35	0.000	0.000	1.222	0.000
02Jan2010	09:40	0.000	0.000	1.111	0.000
02Jan2010	09:45	0.000	0.000	1.000	0.004
02Jan2010	09:50	0.000	0.000	0.889	0.000
02Jan2010	09:55	0.000	0.000	0.777	0.000
02Jan2010	10:00	0.000	0.000	0.667	0.000
02Jan2010	10:05	0.000	0.000	0.556	0.005
02Jan2010	10:10	0.000	0.000	0.444	0.005
02Jan2010	10:15	0.000	0.000	0.333	0.000
02Jan2010	10:20	0.000	0.000	0.223	0.003
02Jan2010	10:25	0.000	0.000	0.184	0.000
02Jan2010	10:30	0.000	0.000	0.182	0.000
02Jan2010	10:35	0.000	0.000	0.181	0.000
02Jan2010	10:40	0.000	0.000	0.181	0.000
02Jan2010	10:45	0.000	0.000	0.181	0.000
02Jan2010	10:50	0.000	0.000	0.181	0.000
02Jan2010	10:55	0.000	0.000	0.181	0.000
02Jan2010	11:00	0.000	0.000	0.181	0.000
02Jan2010	11:05	0.000	0.000	0.181	0.000
02Jan2010	11:10	0.000	0.000	0.181	0.000

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
02Jan2010	11:15	0.000	0.000	0.180	0.000
02Jan2010	11:20	0.000	0.000	0.180	0.000
02Jan2010	11:25	0.000	0.000	0.180	0.000
02Jan2010	11:30	0.000	0.000	0.180	0.000
02Jan2010	11:35	0.000	0.000	0.180	0.000
02Jan2010	11:40	0.000	0.000	0.180	0.000
02Jan2010	11:45	0.000	0.000	0.180	0.000
02Jan2010	11:50	0.000	0.000	0.180	0.000
02Jan2010	11:55	0.000	0.000	0.180	0.000
02Jan2010	12:00	0.000	0.000	0.180	0.000
02Jan2010	12:05	0.000	0.000	0.180	0.000
02Jan2010	12:10	0.000	0.000	0.180	0.000
02Jan2010	12:15	0.000	0.000	0.180	0.000
02Jan2010	12:20	0.000	0.000	0.180	0.000
02Jan2010	12:25	0.000	0.000	0.180	0.000
02Jan2010	12:30	0.000	0.000	0.180	0.000
02Jan2010	12:35	0.000	0.000	0.180	0.000
02Jan2010	12:40	0.000	0.000	0.180	0.000
02Jan2010	12:45	0.000	0.000	0.180	0.000
02Jan2010	12:50	0.000	0.000	0.180	0.000
02Jan2010	12:55	0.000	0.000	0.180	0.000
02Jan2010	13:00	0.000	0.000	0.180	0.000
02Jan2010	13:05	0.000	0.000	0.180	0.000
02Jan2010	13:10	0.000	0.000	0.180	0.000
02Jan2010	13:15	0.000	0.000	0.180	0.000
02Jan2010	13:20	0.000	0.000	0.180	0.000
02Jan2010	13:25	0.000	0.000	0.180	0.000
02Jan2010	13:30	0.000	0.000	0.180	0.000
02Jan2010	13:35	0.000	0.000	0.180	0.000
02Jan2010	13:40	0.000	0.000	0.180	0.000
02Jan2010	13:45	0.000	0.000	0.180	0.000
02Jan2010	13:50	0.000	0.000	0.180	0.000
02Jan2010	13:55	0.000	0.000	0.180	0.000

Date	Time	Inflow (CFS)	Storage (AC-FT)	Elevation (FT)	Outflow (CFS)
02Jan2010	14:00	0.000	0.000	0.180	0.000
02Jan2010	14:05	0.000	0.000	0.180	0.000
02Jan2010	14:10	0.000	0.000	0.180	0.000
02Jan2010	14:15	0.000	0.000	0.180	0.000
02Jan2010	14:20	0.000	0.000	0.180	0.000
02Jan2010	14:25	0.000	0.000	0.180	0.000
02Jan2010	14:30	0.000	0.000	0.180	0.000
02Jan2010	14:35	0.000	0.000	0.180	0.000
02Jan2010	14:40	0.000	0.000	0.180	0.000
02Jan2010	14:45	0.000	0.000	0.180	0.000
02Jan2010	14:50	0.000	0.000	0.180	0.000
02Jan2010	14:55	0.000	0.000	0.180	0.000
02Jan2010	15:00	0.000	0.000	0.180	0.000
02Jan2010	15:05	0.000	0.000	0.180	0.000
02Jan2010	15:10	0.000	0.000	0.180	0.000
02Jan2010	15:15	0.000	0.000	0.180	0.000
02Jan2010	15:20	0.000	0.000	0.180	0.000
02Jan2010	15:25	0.000	0.000	0.180	0.000
02Jan2010	15:30	0.000	0.000	0.180	0.000
02Jan2010	15:35	0.000	0.000	0.180	0.000
02Jan2010	15:40	0.000	0.000	0.180	0.000
02Jan2010	15:45	0.000	0.000	0.180	0.000
02Jan2010	15:50	0.000	0.000	0.180	0.000
02Jan2010	15:55	0.000	0.000	0.180	0.000
02Jan2010	16:00	0.000	0.000	0.180	0.000
02Jan2010	16:05	0.000	0.000	0.180	0.000
02Jan2010	16:10	0.000	0.000	0.180	0.000
02Jan2010	16:15	0.000	0.000	0.180	0.000
02Jan2010	16:20	0.000	0.000	0.180	0.000
02Jan2010	16:25	0.000	0.000	0.180	0.000
02Jan2010	16:30	0.000	0.000	0.180	0.000
02Jan2010	16:35	0.000	0.000	0.180	0.000
02Jan2010	16:40	0.000	0.000	0.180	0.000

REQUIRED SURFACE AREA FOR MAJOR UNDERGROUND STORAGE FACILITY

Parameters:

Storage Facility	18" deep
% Voids/Unit	95%

Required Capacity:

5 Year Storm	4.015 AC-FT
10 Year Storm	5.750 AC-FT

Required Surface Area:

5 Year Storm	122,732 SF rounded to 125,000 SF
10 Year Storm	176,132 SF rounded to 175,000 SF

FIGURE "N"

EXISTING STORM SEWER SYSTEM

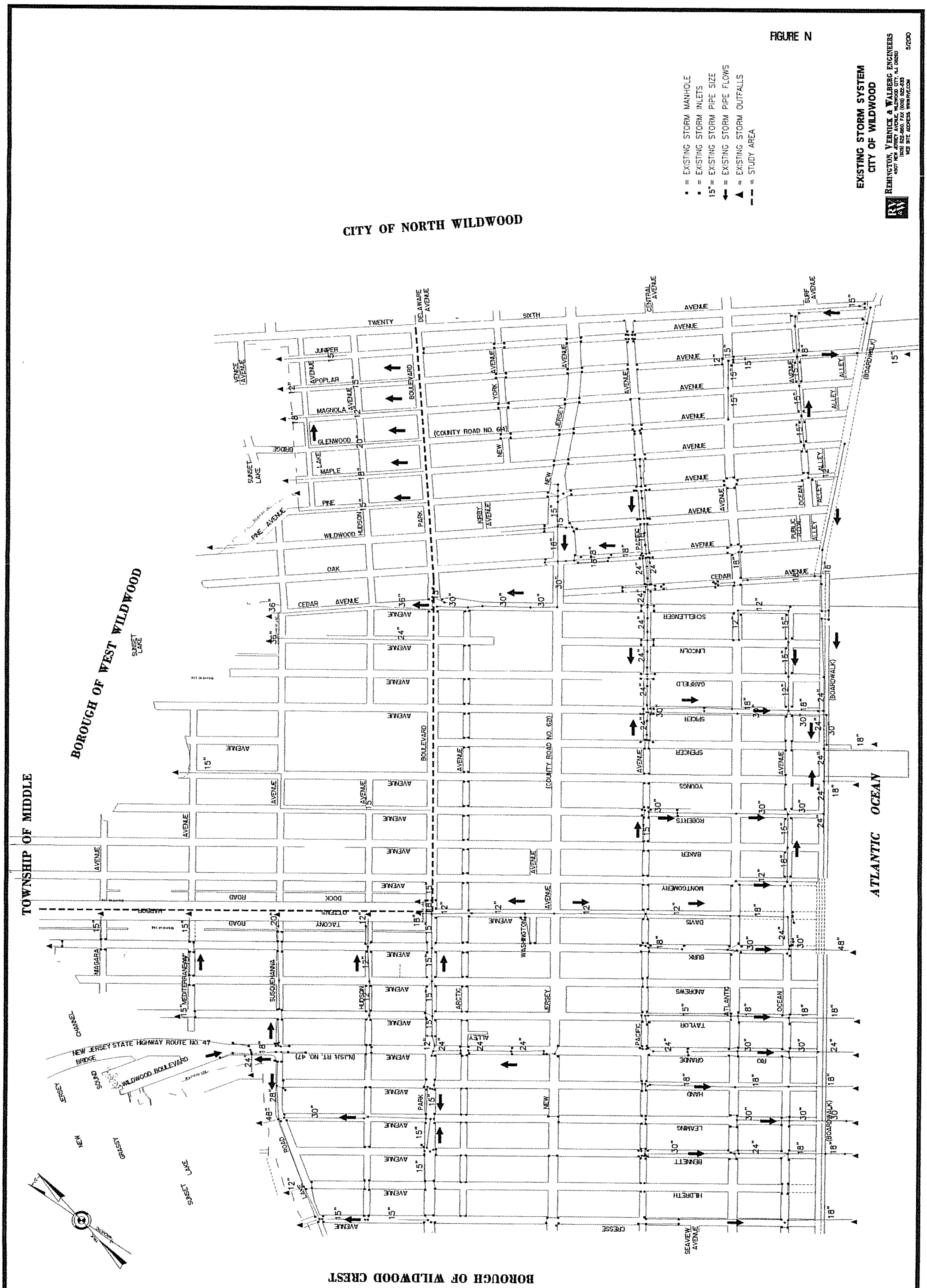


FIGURE N
• = EXISTING STORM MANHOLE
▪ = EXISTING STORM INLETS
15" = EXISTING STORM PIPE SIZE
= EXISTING STORM PIPE FLOWS
▲ = EXISTING STORM OUTFALLS
= STUDY AREA
EXISTING STORM SYSTEM
CITY OF WILDWOOD
REMINGTON, VERNICK & WALBERG ENGINEERS
5/2010
CITY OF NORTH WILDWOOD
BOROUGH OF WEST WILDWOOD
TOWNSHIP OF MIDDLE
ATLANTIC OCEAN
BOROUGH OF WILDWOOD CREST
NEW JERSEY STATE HIGHWAY ROUTE NO. 47
WILDWOOD BOULEVARD
(COUNTY ROAD NO. 621)
(COUNTY ROAD NO. 64)
(BOARDWALK)