VOLUME VII
HEGEWISCH MARSH
HYDROLOGIC ANALYSIS

CALUMET AREA HYDROLOGIC MASTER PLAN (HMP)

PROJECT SITE:

HEGEWISCH MARSH
CITY OF CHICAGO, COOK COUNTY, ILLINOIS

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APPENDICES

1. INTRODUCTION

V3 Companies of Illinois, Ltd. (V3) was retained by the City of Chicago Department of Environment (DOE) to provide professional science and engineering services to assist the evaluation of hydrologic conditions at Hegewisch Marsh. Achieving a greater understanding of these conditions was needed to support near and longer-term enhancement/rehabilitation of wetland environments at the site. This report addresses the surface water and groundwater conditions at Hegewisch Marsh. Particularly, this investigation includes the following items:

- (i) Development and execution of a groundwater and surface water monitoring plan for a one (1) year period
- (ii) Modeling of surface water conditions
- (iii) Characterization and analysis of surface water conditions
- (iv) Characterization and analysis of groundwater conditions
- (v) Groundwater and surface water interactions
- (vi) Recommendations for creating and maintaining optimal hydrologic conditions (as stated by DOE)

An overall groundwater evaluation has been conducted following the installation of four monitoring wells. Additionally, these monitoring wells, plus one existing well were surveyed into the project datum (NAVD 88; NAD 83). Surface water conditions were further analyzed by installing two automatic staff gages, which were equipped with Mini-troll pressure transducers that record water levels every fifteen minutes. These two staff gages were also surveyed into the project datum. Groundwater elevations were recorded and automatic staff gage uploads were performed on a monthly basis for a period of one year (October 6, 2004 –November 15, 2005).

Groundwater flow modeling was completed using the Surfer modeling program. Surface water hydroperiods for single rainfall events of various frequencies were determined using a TR-20 hydrologic model. V3 also utilized HSPF (Hydrologic Simulation Program-Fortran) to model and evaluate continuous water levels of an average year in the marsh. For both models, the study area was divided into a series of individual sub-basins and natural depressional areas, and was supplemented with groundwater data.

Hegewisch Marsh is a high quality natural area that is affected by dynamic hydrologic processes. The surface water and groundwater conditions at Hegewisch Marsh significantly influence ecological conditions, and an integrated understanding of hydrology is important for site planning and management activities.

This report incorporates research, site observations and a one year data record into a hydrologic understanding of Hegewisch Marsh.

The results of this study conclude that groundwater is a significant influence on hydroperiods at Hegewisch Marsh. Surface water is also significant, which is driven by on-site precipitation runoff, evapotranspiration and infiltration. Extreme dry conditions plagued the monitoring period (October 2004-November 2005) of this study, which created at least one month of full drought. An HSPF Modeled hydroperiod during an average precipitation year indicates that drought periods in the marsh do occur, however, the duration of drought is significantly lower. These drought conditions are due to low precipitation conditions that lower the water table and cease surface water input to the site.

2. STUDY AREA

Hegewisch Marsh is a 130 acre ecological area located in the City of Chicago neighborhood of Hegewisch, in Cook County, Illinois. Its location is adjacent to the Calumet River, south of 130th Street and west of Torrence Avenue. Hegewisch Marsh borders the Calumet River on the west and a 32 acre depressional area system is located at the North portion of the Site. A wetland delineation conducted by V3 in 2004 indicated that 111 acres of wetland were located on the site. Tire ruts combined with the hummocky terrain promote poor drainage throughout most of the site; this creates many ponded surface water and wetland areas at Hegewisch Marsh. Figure 2 illustrates the drainage patterns throughout the site. Elevations at the Site range from 588 feet msl (berm at North site boundary) to the low point of 579.5 feet of the regularly inudated marsh bottom.

3. SURFICIAL GEOLOGY AND GROUNDWATER

3.1. Site Geology

The general hydrogeologic and surficial geology characteristics are derived from boring data collected during well installation, and the annual record of water elevations in the wells. In order to understand the nature of the groundwater at Hegewisch Marsh, it is important to have a visualization of the processes that deposited the materials on site. The lowermost stratigraphic unit encountered during soil borings is a layer of sand that is continuous throughout the site. This sand layer is interpreted as a glacio-lacustrine or glacio-fluvial sequence of the Equality Formation (glacial lake environment or glacial stream channel environment). When originally deposited, this sand was likely beach or drainage origin. Above the sand layer, our limited site stratigraphy indicates that there were periods of backwater sedimentation/ponding, where occasional small flow events occurred. This unit indicates the retreat of a high energy fluvial system. Due to the nature of this backwater type of sedimentation, random (non-continuous) lenses of sand can exist within a unit that consists primarily of silty clay. Overlying a brief period of backwater sedimentation is a layer indicating a productive wetland system. However, as now is seen in the field, the stratigraphic record is much disturbed by man made fill that stretches to the land surface. The fill is primarily dredged river clays and silts, and it is evident that fill dumping has occurred on site in the past. This geologic description is complemented with the attached well borings and figure 4 provides a cartoon illustrating stratigraphy and hydrologic behavior.

The significant shallow water bearing zone on the site is located in the Equality formation sand layer. This sand contains a notable amount of water, and due to silty clay material that overlies the sand, the water table is pressurized higher than the sand layer. This aquifer generally flows northeast to southwest (Figure 3), and is hydrologically connected to the Calumet River. From here on, this shallow water bearing system will be referred to as the “sand aquifer”.

Above the sand aquifer there are perched zones of saturation in the silty clay layer (sand seams) and on the ground surface, however, their permeability and flow through the site are semi-confined. These perched areas slowly recharge the underlying sand aquifer when they become saturated. From an ecological perspective, these perched areas sustain shallow hydrology in smaller areas of the site, as represented by ASG 10.

Figure 7 illustrates the water level data on the sand aquifer from July 11, 2003 through April 13, 2004. This data was taken from well ISWS #21, which was formerly located at the corner of 130th Ave. and Torrence Ave. Although this well was not located directly on site, it is located within the same aquifer and shows general aquifer behavior and levels of fluctuation.

Figure 7 also shows that the sand aquifer at Hegewisch Marsh is always “losing” water into the Calumet River. In these conditions the river rarely supplements surface water onsite. This is an important conclusion that removes the possibility that the river influences surface water levels at Hegewisch Marsh. Subsurface processes between the river and the marsh may have influence on conditions such as groundwater flow gradients.

3.2. Groundwater Monitoring and Results

In order to further evaluate the function of the groundwater at Hegewisch Marsh, five (5) groundwater monitoring wells were installed and monitored by V3. The wells were screened into the shallow water sand bearing unit, which was generally encountered between 5 and 9 feet below the ground surface (bgs). Figure 1 shows the well locations and their respective names that are referred to in this report. Water levels from all five wells were recorded by V3 monthly from October 2004, through November 2005.

Monitoring wells installation (October 2004)

Table 1 shows the manual groundwater data collected over the one year monitoring period. Figure 5 graphically illustrates the monthly groundwater elevations from each well over the entire monitoring period. In addition this figure provides water depths below ground surface (bgs) at each well location and precipitation data from the Illinois State Water Survey (ISWS) Calumet rain gage network. For further reference, Lake Michigan water levels are also provided on this graph, however, the Lake Michigan data is incomplete for the period of record because the gage was disabled. Table 2 provides statistical analysis of the groundwater data collected.

3.3. Groundwater Behavior and Fluctuations

During the one year monitoring period, manually collected groundwater levels fluctuated between 7.61 and 9.82 feet (Table 2). The water table ranged from a shallow 0.1 feet bgs (MW-02) to a deep 11.87 feet bgs (MW-05) during the one-year monitoring period. These large fluctuations in the groundwater table are likely attributed to the extreme drought conditions of 2005. Figure 7 shows that the same aquifer, in a well adjacent to the site fluctuated only 3’ during the previous year.

The mean groundwater elevations at Hegewisch Marsh during the monitoring period ranged from 579.54 feet (4.61' bgs) at MW-05 to 582.11 feet (6.37' bgs) at MW-02 (Table 2). Figure 5 and table 2 further display groundwater behavior and statistics for reference. During the monitoring period, figures 5 and 6 shows that winter and spring groundwater levels average around five (5) feet higher than summer and fall groundwater levels. Winter and spring groundwater levels are maintained by seasonally higher amounts of precipitation (snow and rain).

Data provided for groundwater is collected monthly (Table 1, Figure 5), and specific fluctuation events for the monitoring period cannot not be assessed in detail. More descriptive behavior of typical groundwater fluctuations and responses to precipitation events can be assessed using the data record in Figure 7. This figure provides 15-minute data from ISWS well #21 which was formerly located just Northeast of Hegewisch Marsh, this well is located within the same aquifer but its data record runs from July 11, 2003 through April 13, 2004, which does not include the time series of our monitoring period. This data record provides valuable information as to how responsive the groundwater is to precipitation events and drought conditions.

All five (5) groundwater monitoring wells produced correlative data that suggests that the sand aquifer beneath the site is one uniformly behaving aquifer (Table A). The strongest influence on groundwater levels at Hegewisch Marsh is precipitation and the seasonal fluctuations of the water cycle. The aquifer is shallow, and depends primarily on precipitation for recharge. The groundwater response to a large precipitation event is almost immediate (Figure 7). Rapid rises in the groundwater table occur following a precipitation event, these rapid rises occur because the aquifer is shallow and due to the responsive porous and permeable nature of the sand medium. Figure 7 also shows that depending on the duration and magnitude of storm events, it can take anywhere from two weeks to three months for the groundwater to recover to pre-storm elevations. Other influences on groundwater elevations at Hegewisch Marsh include the Calumet River elevation; the surface water elevations in the marsh reservoirs and the amount of surface water recharge available directly to the site and up-gradient (groundwater) recharge locations. Local processes such as transpiration directly from the shallow groundwater can also play a significant role in depressing the water tables around the marsh.

Snowmelt events may also be responsible for rising water tables, especially when no precipitation event can be correlated to a rise in groundwater, this can be seen in Figure 7 when the groundwater rises at the end of February 2004. There is no attributed precipitation event to this rise, unless it was spatially isolated.

The seasonal variation in groundwater elevations is naturally occurring, and is a unique characteristic of phreatic shallow sand and gravel aquifers. It is believed that due to the drought conditions of 2005, that groundwater levels reached an extreme low during the summer and fall, which is not characteristic of average hydrogeologic conditions. Lastly, it is possible that the extreme groundwater fluctuations that have been observed at Hegewisch Marsh may be a function of porous and fractured subsurface strata that was not identified during the site investigation.

3.4. Groundwater Flow

The shallow nature of the sand aquifer, the unique geology at Hegewisch Marsh and seasonal precipitation differences create groundwater flow conditions that vary by season. Figure 3 shows groundwater flow during a "dry period" and a "wet period". Under both conditions, groundwater generally flows from Northeast to Southwest towards the Calumet River. Under dry conditions, a stagnation point is absent and seepage is promoted from the Marsh into the groundwater. In addition, the surface and soil water stored within the marsh recharges the dry aquifer. The water table under these conditions is lower than the bottom of the marsh reservoirs (580 feet msl). Figure 3 shows groundwater contours from a dry period and a wet period. It is important to note that that ASG 9 is not located at the lowest point in the marsh, so standing water was likely present in the marsh for periods that ASG 9 recorded drought.

Wet conditions and hummocky/poorly drained topography create a series of perched water zones throughout the Site that slowly recharge the underlying aquifer and marsh. In addition, once the water table around the marsh reaches 580 feet, a stagnation point develops beneath the marsh inhibiting seepage. This factor is very important as it allows the marsh to store the water that it collects from shallow subsurface drainage (interflow) and precipitation events. Under these conditions, it is common for the marsh water elevations to be slightly higher than the water table. Further, under extremely wet conditions when the water table rises higher than the surface water, the marsh will receive water from the groundwater.

Table A: Groundwater Correlation Table - Hegewisch Marsh 10/06/04 – 11/15/05

	MW-01	***MW-02***	***MW-03***	***MW-04***	***MW-05***
MW-01	1				
MW-02	0.98291817	1			
MW-03	0.99352197	0.993645554	1		
MW-04	0.98772702	0.98384807	0.995043659	1	
MW-05	0.97759289	0.981682421	0.979053181	0.966184606	1

4. SURFACE WATER

4.1. Site Hydrology

The Hegewisch Marsh study area can be viewed as several natural depressional areas, denoted as #11, #12, #13, and #15 in Figure 2, separated by some natural ridges. Figure 2 shows the watershed subbasin delineation that was conducted for the Hegewisch Marsh Site. Approximately 80 acres on-site drains to these depressional areas. Combined, the depressional areas form Hegewisch Marsh and are collectively referred to as the marsh. During rainfall events the Northern portion of the Hegewisch Marsh site drains into these natural depressional areas. A field investigation concluded that no offsite surface water inlets drained into the site. However, hidden tiles entering depressional area #12 may exist. Hegewisch Marsh lies directly adjacent to the Calumet River, just upstream of the O'Brien Lock and Dam. (*The O'Brien Lock and Dam facility suspended their gage network in the spring of 2004*). It would be unlikely that Calumet River water levels would ever overtop the banks and enter Hegewisch Marsh. Under these conditions, surface water can only enter the site through on-site precipitation and high groundwater tables that feed the marsh.

The Hegewisch Marsh Site is poorly drained and has hummocky topography which causes surface water to collect in smaller depressional areas and tire ruts throughout the Site. This type of hydrology is analyzed at ASG -10 (section 4.2). It is believed that some of the more expansive perched surface water areas are influenced by shallow perched groundwater fed by capillary fringe.

Under desirable surface hydrology conditions, the marsh water elevation should be higher than the top elevation of the natural berm separating depressional areas #11 and #12 (581.7 feet msl). Under this condition, a majority of the marsh (depressional area) is inudated. When the water elevation falls below 581.7 feet, the inundation area is significantly affected. This water elevation is further assessed in section 4.2.

HSPF Model

V3 developed an HSPF model (Hydrologic Simulation Program-Fortran) to model and evaluate continuous water levels of an average year in the marsh. Due to the extreme drought conditions of the monitoring year, V3 recognized the value of simulating marsh water levels during an average year of precipitation to supplement the record of “extreme dry” conditions. HSPF was chosen for its ability to simulate continuous events and incorporate seasonal groundwater influences. V3 performed statistical analyses on available rainfall data sets and determined that the 1973-74 data set was the closest match to average annual and quarterly rainfall depths for the City of Chicago. The HSPF model was calibrated with the data collected from ASG-9 and groundwater monitoring wells. After calibration, the model was run with the average year rainfall data set to investigate an average annual record of water levels within the main marsh. It is important to note the modeled hydroperiods most accurately display the anticipated range of water levels throughout an average precipitation year. The hydroperiods should be used only as a reference to derive average annual water elevations, maximums, minimums and average seasonal water levels. Developing water elevation predictions for any period of greater detail than a season is not within the confidence level of the model. Appendix 4 contains the model documentation.

The modeled average annual hydroperiod (Figure 8) provides the simulated range of water levels expected during an average precipitation year at Hegewisch Marsh. When compared to monitoring results from ASG-9 (Figure 6), one can expect the water levels to have a few higher peaking hydrographs due to larger precipitation events. In addition, during the average year the basin does not dry out for nearly as long (up to 2 week drought simulated during average year). Lastly the water elevations in the marsh are below the desired minimum water elevation conditions for approximately 3 months out of the year (Figure 8). Table B shows the comparisons between the monitored water levels at ASG-9 (extreme drought conditions) and the HSPF simulation (average precipitation year).

TR-20 MODEL

A hydrologic model (TR-20) was developed to simulate the potential water levels in the above-mentioned depressional areas for various rainfall events. The computations were performed for the conditions assuming that the depressional areas are dry (i.e. no open water). See appendix 2 and 4 for model documentation.

The results of the above-mentioned computations show that the ridge that separates Hegewisch Marsh and the Calumet River is never overtopped for the simulated rainfall events. This suggests that any water exchange between Hegewisch Marsh and the river occurs through groundwater exchange only.

4.2. Hydrology Monitoring and Results

In order to supplement the initial hydrology investigation and modeling, two automatic recording staff gages were installed at the Site in October 2004. ASG -9, located in the main marsh, provides the water elevations that are most important for ecological habitat for yellow-headed blackbirds. ASG-10 provides water levels from a perched area located south of the main marsh (Figure 1), the idea of this gage is to provide seasonal inundation periods for ponded areas that are abundant throughout the Site. Water elevations were recorded every 15 minutes for a one year period starting in October of 2004 and ending November 2005. Figure 6 graphically illustrates the water elevations from each gage and table 3 shows statistics regarding each gage for the period of record. The two staff gages produced data that is correlative (Figure 5). This suggests that similar hydrologic processes influence the water levels of both systems.

Surface Water Behavior and Fluctuations

Main Marsh (Depressional Areas) - ASG-9

The one year monitoring period, which can be termed as an "extreme" dry year is represented in the main marsh by automatic surface water levels from ASG-9. Water elevations at ASG-9 fluctuated 3.21 feet during the monitoring period. This fluctuation should be higher as the location of ASG-9 dried out at the end of July 2005 (Figure 6). ASG-9 is not located at the lowest elevation of the marsh, so it should be understood that when ASG-9 recorded dry conditions, there may have been inundation at the deeper portions of the marsh. Occasional rain events inudated the basin bottom at ASG-9 numerous times following July, however, sustainable water levels were not achieved for the remainder of the monitoring period (Figure 6). Looking at Figure 6, it is evident that the surface water elevation follows a seasonal trend which is influenced by precipitation and groundwater. The water elevation reached a maximum 584.14 feet in the marsh during the early spring, and then slowly receded throughout the entire summer to drought at the end of July 2005. The mean water elevation for the monitoring period was 582.68 feet and the median was 583.17 feet. Figure 6 and table 3 further display surface water behavior and statistics.

Data from ASG-9 (Figure 6) provides valuable information as to how surface water elevations respond to precipitation events and seasonal changes. For example, it is evident that long lasting cumulative rainfall events influence longer term changes in water levels, and large isolated rain events create short term jumps in water levels.

Perched Surface Water Zone – ASG 10

ASG-10 (Figure 1) provides a representation of water levels in an incised tire rutted area. The objective of ASG-10 is to provide an understanding of inundation periods and seasonal characteristics of the abundant perched surface water throughout the site. Water elevations at ASG-10 fluctuated 2.95 feet during the monitoring period. Like ASG-9, the location of ASG-10 reached drought conditions in the beginning of August 2005. ASG-10 is much more responsive to precipitation events than ASG-9 primarily because it is a much smaller water body. The maximum water elevation recorded from ASG-10 was 585.3 feet and the basin bottom is 582.35 feet. Figure 6 shows that the water levels follow a very similar trend as ASG-9, this is due to the similar hydrologic processes that are occurring in both the main marsh and the perched areas. Figure 6 and table 3 further display surface water behavior and statistics.

Desired Hydrologic Conditions

As discussed in section 4.1, desired surface water elevations in the marsh would be above 581.7 feet. During the 404 day record of surface water elevations at Hegewisch Marsh, the water elevation was below 581.7 for 133 days, or 33 % of the time. This statistic is discouraging, however, the drought conditions of 2005 created extremely prolonged periods of low water levels in Hegewisch Marsh during the monitoring period. The HSPF model shows that during an average year of precipitation the marsh water elevation is below 581.7 feet for up to 90 days of a 426 day record or 21% of the simulated time series. Table B below shows a numerical comparison between the monitoring record at ASG-9 (extreme drought) and the HSPF simulation for an average precipitation year. The pictures below illustrate high water elevations at the monitoring locations, note that both of these locations completely dried out.

Optimal hydrology in Hegewisch Marsh, May 2004: At north end of site looking south.

High water elevation conditions at ASG 10. May 2004.

Table B: Hegewisch Marsh: Average Year (HSPF) vs. Drought Year (ASG-9)

	ASG-9 (Main Marsh)	HSPF Simulation (Average Precip Year) Main Marsh
Maximum Elevation (feet)	584.14	584.52
Minimum Elevation (feet)	580.928	580
Days of Drought	> 30	7
Percentage of time series below 581.7 feet	33	21
Days below 581.7 feet	133	90
Days in Record	404	426

Note: gray tone indicates that ASG-9 was not located at the lowest elevation in the marsh; water elevations below 580.928 did occur but were not directly recorded.

5. SURFACE WATER AND GROUNDWATER INTERACTION

The connection between the main depressional areas #11, #12, #15 and the sand aquifer is not a direct connection. Using data extrapolated from well borings, it appears that the sand layer does not directly intersect the bottom elevations of the depressional areas. This is not to say that groundwater does not affect surface water elevations at Hegewisch Marsh. Groundwater plays an important role in the seasonal trends of surface water elevations at Hegewisch Marsh. Depending on the season and the hydrologic conditions, the groundwater table may be inhibiting seepage, it may be recharging the marsh or the marsh may be infiltrating/seeping into the groundwater.

The deepest area in reservoir #12 is very close to intersecting the sand aquifer, which means that the groundwater is separated from the surface water of reservoir #12 by a thin layer of non-permeable or semi-permeable material. This physical description is illustrated in Figure 4. Figure 4 shows the water table representing the sand aquifer as intersecting the reservoirs. With the exception of depressional areas #11 and #12, the existing silty clay layer lining under the study area generally prevents a *direct* connection between the groundwater and surface water.

As described in section 3.0, groundwater fluctuated up to 9.8 feet during the monitoring period. This drastic fluctuation indicates that the interaction between surface water and groundwater varies significantly. During the drier seasons, surface water from the site generally infiltrates/seeps into the ground through the depressional areas because the surface water is higher than the groundwater level. When groundwater elevations around the marsh are below 580 feet msl it appears that the magnitude of this infiltration/seepage process is very significant and the marsh cannot expect to hold water for any prolonged period of time. This elevation is intriguing, as it precisely represents the basin bottom of the marsh. As the head gradient becomes higher between surface water and groundwater elevation, the infiltration/seepage rates likely increase. During the one year of monitoring on record, these conditions occurred for approximately five months. Figure 6 illustrates this process occurring.

When the groundwater elevations surrounding the marsh reach and exceed 580 feet msl a stagnation point develops beneath the marsh. This stagnation point inhibits the infiltration and seepage processes and allows the marsh to withhold water that it receives from shallow subsurface drainage (interflow) and precipitation runoff. Under these conditions, the surface water in the marsh can be higher than surrounding groundwater elevations. This is due to storage within the marsh, and the phenomena of transpiration directly from the shallow groundwater that creates depressional cones (Doss 1993). Groundwater exceeded 580 feet for nearly 9 months of the 13 month monitoring period, Figure 6 shows the change in surface water behavior and stage once the groundwater reaches 580 msl.

Data from the monitoring period indicated that groundwater elevations around the marsh were higher than the marsh surface water elevations for up to four (4) months (Figure 6). Groundwater supplied the marsh with water and likely contributed to maintaining average water levels throughout the winter and spring.

Resulting from this study, the most important factor for maintaining optimal hydrologic conditions at Hegewisch Marsh is for the groundwater elevation surrounding Hegewisch marsh to stay at or above 580 feet msl. In order for this to occur, multi-day cumulative precipitation events need to frequently occur, such as seen through December and January of 2004 in Figure 6. These types of events need to occur at least once every couple of months for the system to resist drought conditions. Multi-day cumulative precipitation events are important for many reasons; they provide direct runoff to the marsh basins, they influence groundwater to rise for a prolonged period of time and they provide the soil strata with water needed to reach moisture capacity which then provides interflow and groundwater recharge to the system.

6. RECOMMENDATIONS

As mentioned in this report, the results of hydrologic modeling and field visits indicate that a sustained average water depth of 2 – 4 feet within the main depressional areas of the Hegewisch Marsh site is not achievable under existing conditions. Hydrologic modeling and monitoring data indicates that drought conditions will likely occur during an average year for a short period of time. The following preliminary recommendations review the possible options for increasing and maintaining water levels in the main depressional areas #11 and #12 at Hegewisch marsh, in order to improve the hydrologic conditions related to ecological management of the site:

(i) Obtain supplemental water from Calumet River through an on-site pump station (fixed or mobile). The pump station would likely be utilized only during dry seasons when water elevations are low. The proximity of Calumet River provides an optimal source of water with reasonable water quality. However, this option would also require an outlet into the Calumet River, which could be a water control structure or a naturalized overflow channel. Additionally, this recommendation can assist in opening other funding opportunities, in the context of recycling Calumet River water and improving its water quality. The Sidestream Elevated Pool Aeration (SEPA) program is an example where funding is obtained to oxygenate the Calumet River waterways. Cycling Calumet River water through Hegewisch Marsh would establish an improvement in dissolved oxygen.

(ii) Construct a lined wall or grouted wall on the down-gradient (groundwater) side of the marsh basin. This type of construction would have to sufficiently intersect the sand aquifer to back-up the groundwater flow and elevate groundwater elevations. This option would benefit from groundwater modeling to assist in design and benefit analysis.

(iii) Deepen or excavate significant pool areas in order to intersect the groundwater table year round. This option would be more feasible in the south perched areas. For the marsh itself, this would require a basin bottom coring analysis to assess possible surface water elevation changes as a result of deepening the basin bottom elevations.

(iv) Obtain supplemental water by diverting storm water from adjacent areas. A feasibility study could assess adjacent drainage basins that can be regarded/rerouted to supplement the hydrologic needs at Hegewisch Marsh. Taking into account the ecological objectives of this site, the water quality issues regarding the outside sources would also need to be addressed in this study. Additional funding opportunities may be available using this recommendation; providing stormwater is diverted into Hegewisch Marsh for pollution filtering that would otherwise feed directly into the Calumet River.

(v) Considering the monitoring record included in this report is during extreme drought conditions, V3 recommends continued monitoring of the staff gage in the marsh and the wells surrounding the marsh (ASG -09, MW-01, MW-02 and MW-03). These are the most important locations for understanding the unique hydrologic processes at Hegewisch Marsh.

7. REFERENCES

Doss, P.K., The nature of a dynamic water table in a system of non-tidal, freshwater coastal wetlands, *J. Hydrol., 141*(1-4), 107-126, 1993.

GLOSSARY

Automatic Staff Gage (ASG) : Apparatus installed to collect sufrace water elevations of water bodies at 15 minute intervals.

Anoxic : Water that contains little to no dissolved oxygen.

Conveyance Capacity : The maximum amount of water that can be transported downstream by a pipe or channel.

Discharge : The rate of water flowing out of a site.

Dredging : Process of removing sediment accumulation from lake and river bottoms.

Equality Formation : Tongues of glacial lake deposits that consist of silts, clays and sands.

Evapotranspiration : Proportion of waterbudget that is returned to the air through evaporation and transpiration (plant uptake).

Glacio-fluvial : Sediment or lithified sequence deposited from meltwater streams flowing from or within glaciers.

Glacio-lacustrine : Sediment or lithified sequence deposited within a glacial lake.

Gradient : Slope of a surface, generally pertaining to groundwater surfaces in these texts.

Headwater : The depth of water at the upstream end of a control structure or pipe.

HEC-RAS : Hydraulic Engineering Center – River Analysis System. A computation program widely used for developing water surface profiles for streams and ditches.

Hummock : Micro-topographic mounds that usually form from soil consolidation and poor surface water drainage.

Hydraulics : The determination of water surface elevations through relationships of flow and physical geography.

Hydrology : The determination of stormwater runoff rates and volumes for a study area based on rainfall data and physical geography.

Hydroperiod : A simulated or measured time duration of water elevations.

Infiltration : The downward movement of water through pores or small openings in soil or rock.

Inudation : Standing surface water.

Manual Staff Gage (MSG) : Apparatus installed within surface water body to visually observe surface water elevations (observations conducted once per month).

*All words are not necessarily referred to in text.

Mottles : Soil discolorations usually caused by chemical interactions between water and chemicals/minerals within the soil.

Orifice : A control structure ; a small opening, usually in a metal plate or wall, used to restrict the amount of water discharging from a site.

Permeability : The capacity of rock or sediment for transmitting fluid flow under unequal pressure.

Piezometer : A well installed into the ground that penetrates an underground water bearing unit – in which the groundwater elevation can be monitored along with its associated head.

Reduction : The removal of oxygen from soil or water.

Slag : Iron and steel manufacturing by-product. Waste material resulting from the impurities of mineral ore and ash from coke.

Stage-Discharge Rating Curve : A curve illustrating discharge rates for water leaving a site at given stages or elevations.

Seep : A location where groundwater discharges to the surface.

Stop Logs : Removable planks used to block water from leaving a site. The top stop log will set the normal pool level for a basin.

Stormwater Control Structure : A device, usually an orifice or a weir, used to regulate water discharge from a site.

Stratigraphy : The arrangement of rock and or soil types in chronologic order of sequence.

Submerged : Located entirely underwater.

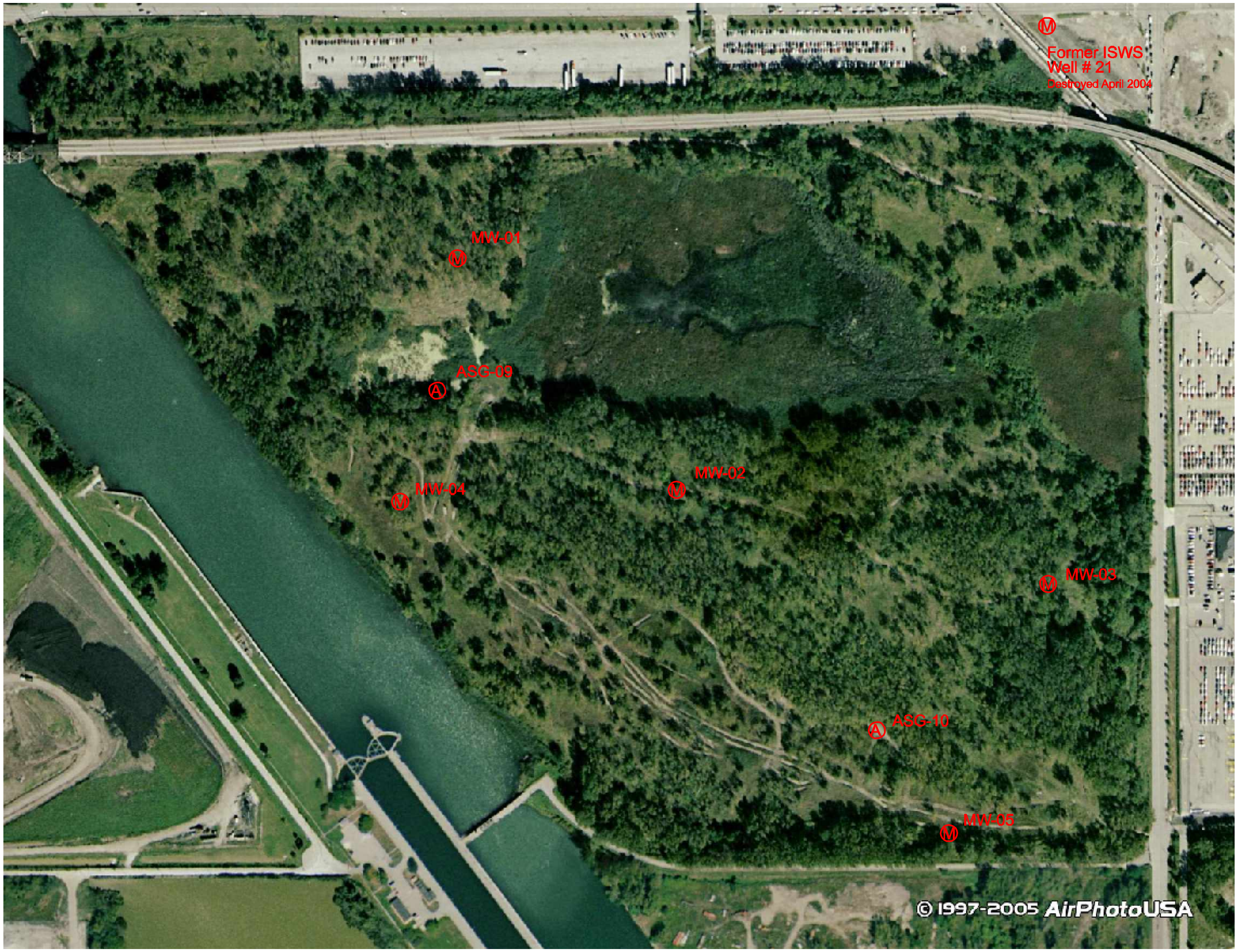
Tailwater : The depth of water at the downstream end of a control structure or pipe.

Watershed : The area the drains to a similar point location or water body.

Weir : A control structure that prevents discharge from a site until the headwater exceeds the overflow elevation.

*All words are not necessarily referred to in text.

FIGURES



V3 Companies
120 N. LaSalle St., Ste. 1550
Chicago, IL 60602
312.419.1985 phone
312.419.1986 fax
www.v3co.com

PROJ. NO.: 98216hmp.heg	DESIGNED BY: JKA
FILE NAME: monitoringlocationsexh	DRAWN BY: KJW
DATE: 02/07/06	CHECKED BY: JKA
SCALE: 1"=500'	PROJ. MAN.: KRO

Monitoring Station Locations

HEGEWISCH MARSH

CHICAGO ILLINOIS

Figure 1

E:\1998\98216\98216HMP\98216HMP.HEG\Drawings\Mstn\N40\GW 2-28-05\Monitoring Locations Exhibit.dgn 2/8/2006 2:31:57 PM

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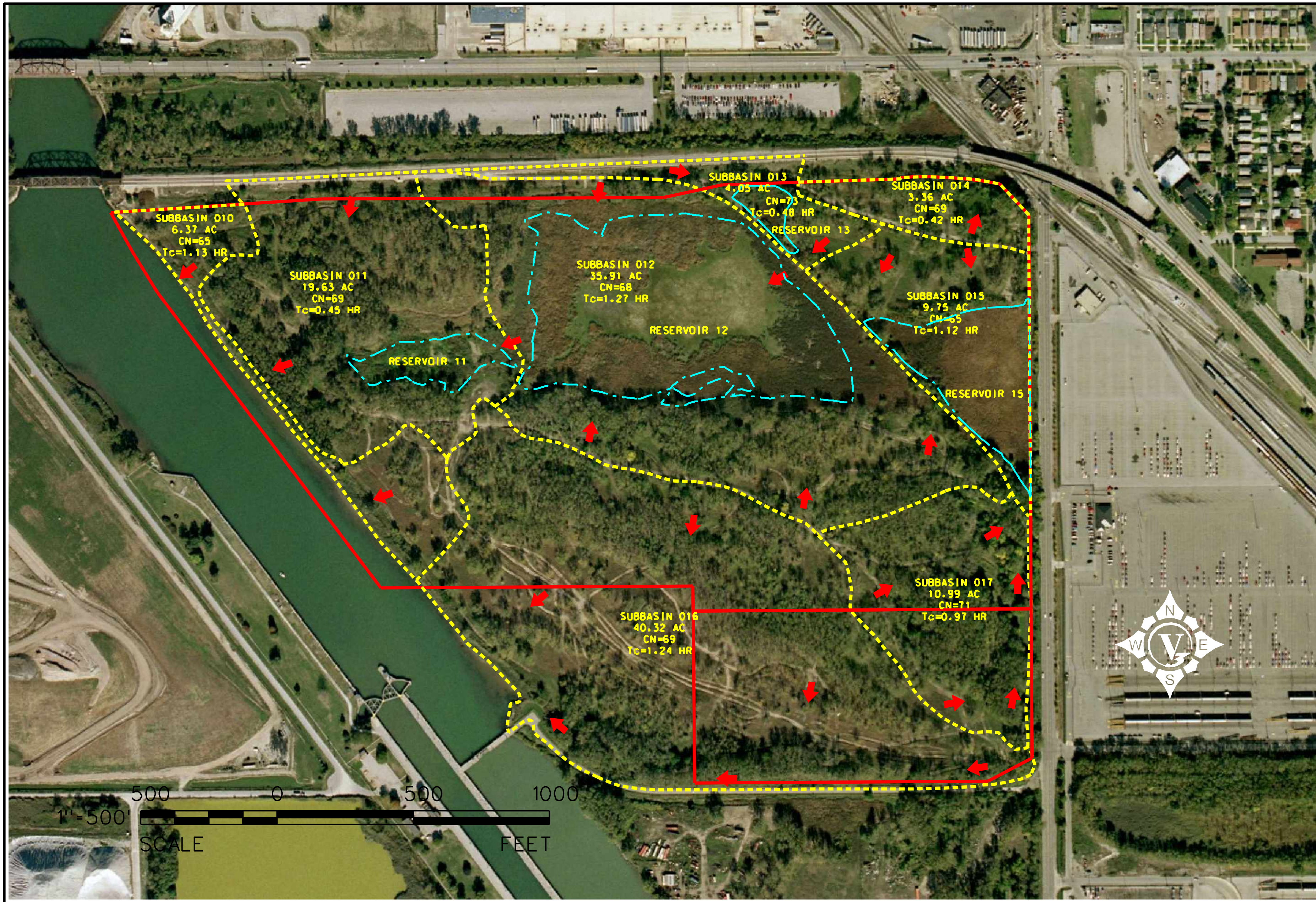

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PROJ. NO.:	DESIGNED BY:
98216hmp.heg	CAT
FILE NAME: watershedbndexh	DRAWN BY: CAT
DATE: 02/05/07	CHECKED BY: DD
SCALE: 1"=500'	PROJ. MAN.: KRO

EXISTING DRAINAGE BOUNDARIES

HEGEWISCH MARSH

CHICAGO ILLINOIS

FIGURE

2

E:\1998\98216\98216HMP\98216HMP.HEG\Drawings\Mstn\E01\watershed boundary exhibit.dgn 2/8/2006 2:45:37 PM

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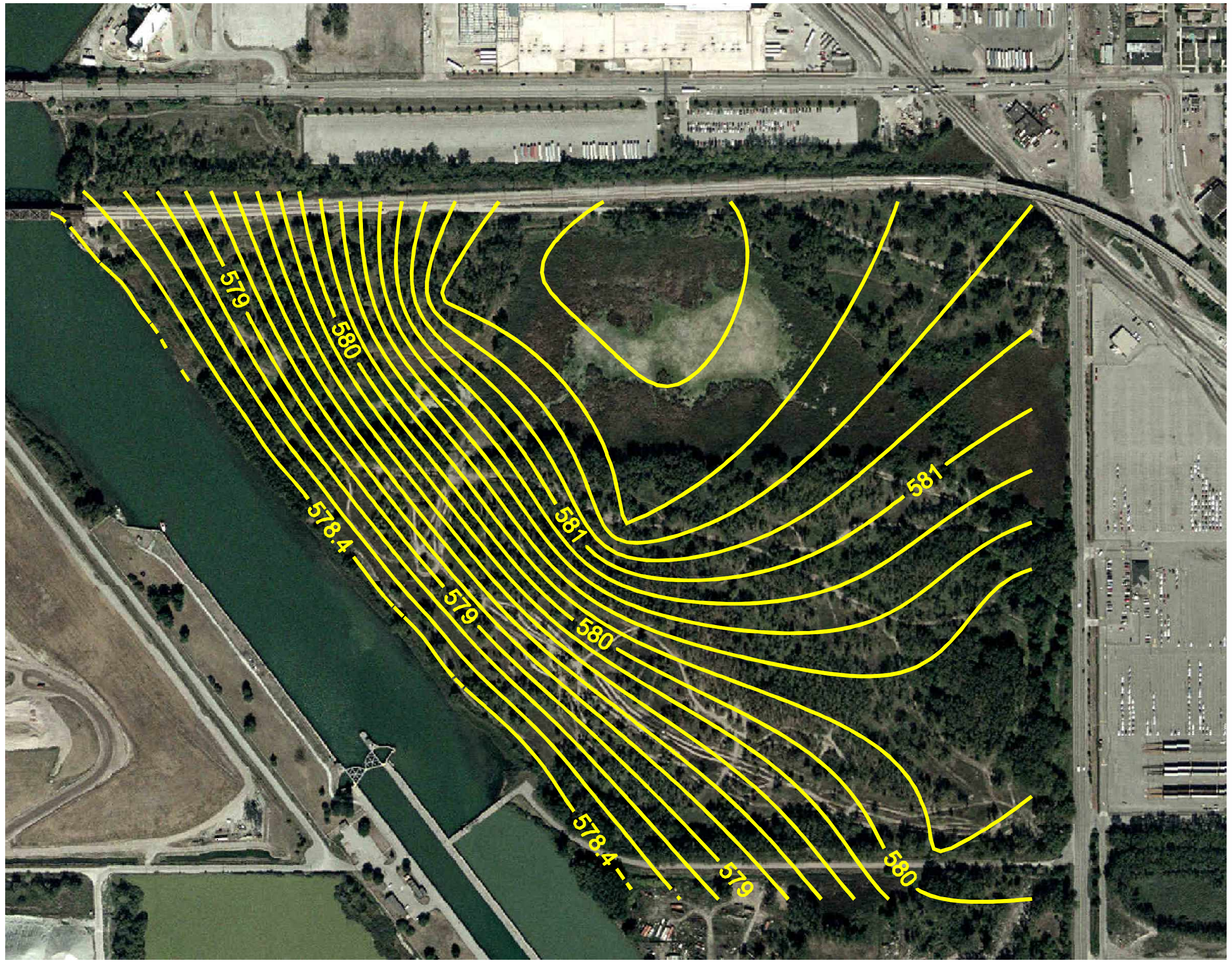
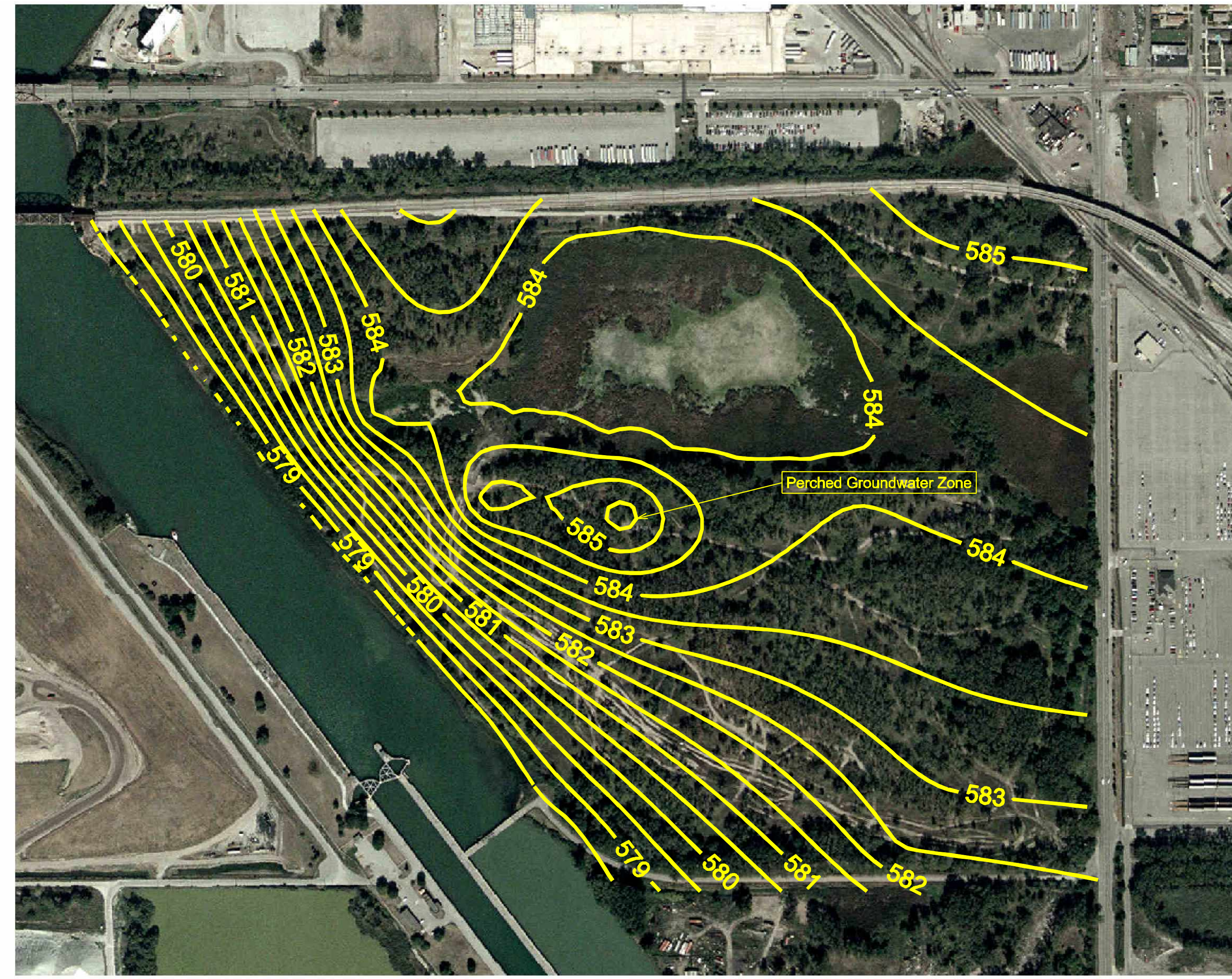


Dry Period Groundwater Flow
11/23/2004



Wet Period Groundwater Flow
2/28/2005

V3 Companies
120 N. LaSalle St, Suite 1550
Chicago, IL 60602
312.419.1985 phone
312.419.1986 fax
www.v3co.com

Visio, Vertere, Virtute... "The Vision to Transform with Excellence"

REVISIONS

NO.	DATE	DESCRIPTION

PROJECT NO.: 98216hmp.heg	DESIGNED BY: JKA
FILE NAME: 2groundwaterevents	DRAWN BY: KJW
DATE: 02/07/06	CHECKED BY: JKA
SCALE: 1"=500'	PROJECT MANAGER: KRO

HEGEWISCH MARSH

CHICAGO ILLINOIS

Groundwater Contour Map
11/23/2004 and 2/28/2005

DRAWING NO. 3

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...\2 groundwater events exhibit.dgn 3/14/2006 1:20:27 PM

Figure 4: Visualization of Hydrogeology at Hegewisch Marsh
(not to scale)

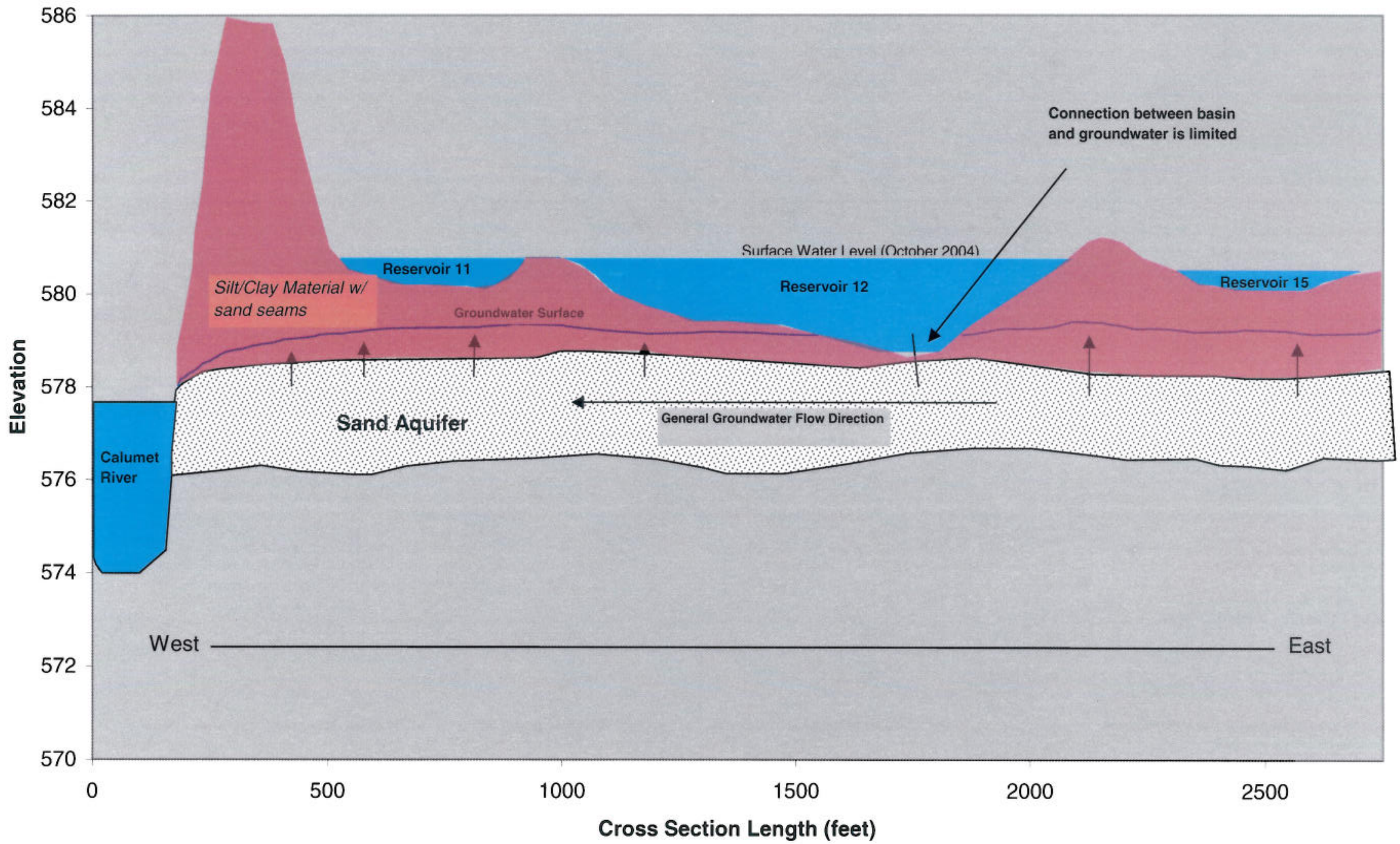


Figure 5: Hegewisch Marsh Groundwater Elevations 10/06/04 - 11/15/05

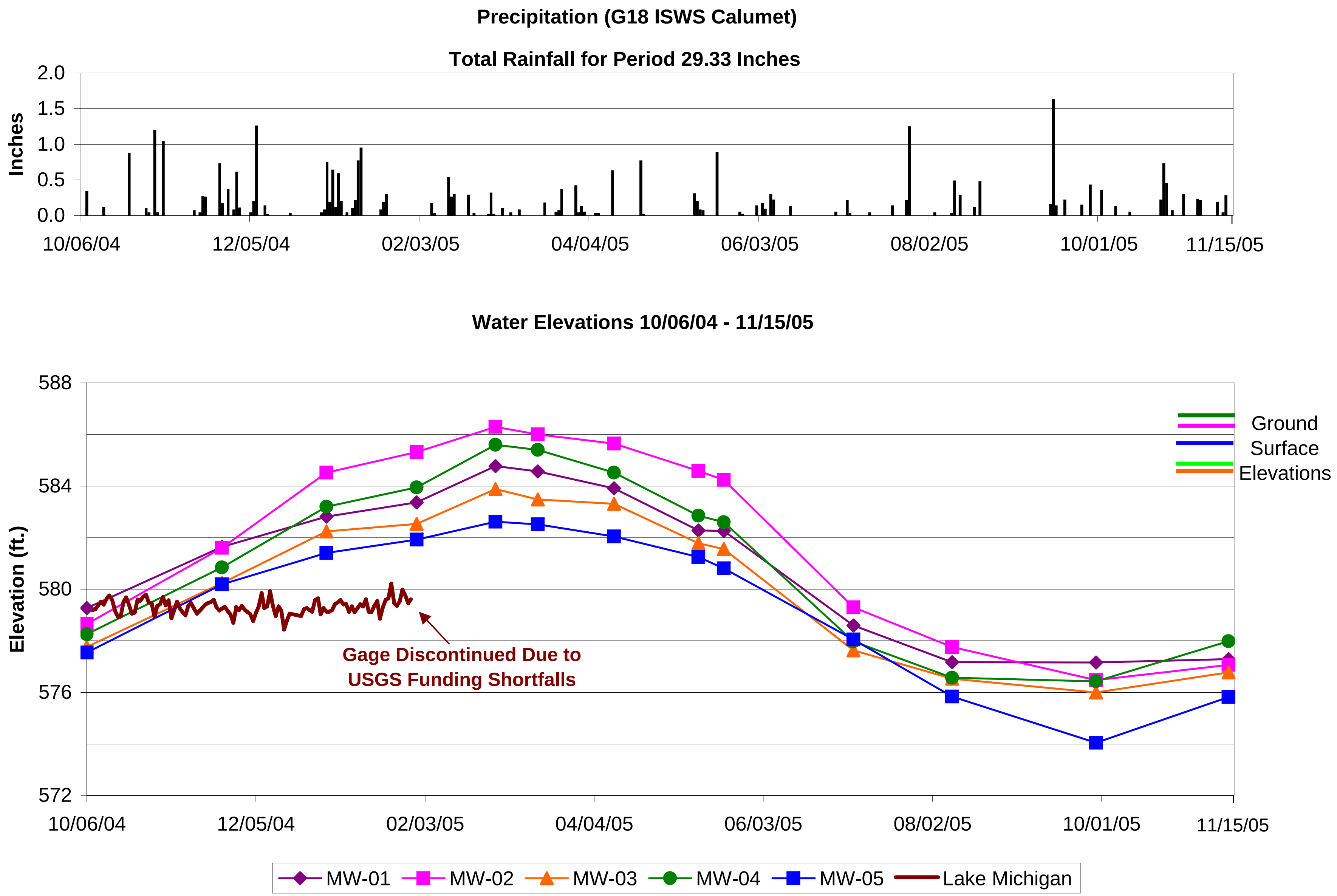


Figure 6: Hegewisch Marsh Surface Water Elevations 10/06/04 - 11/15/05

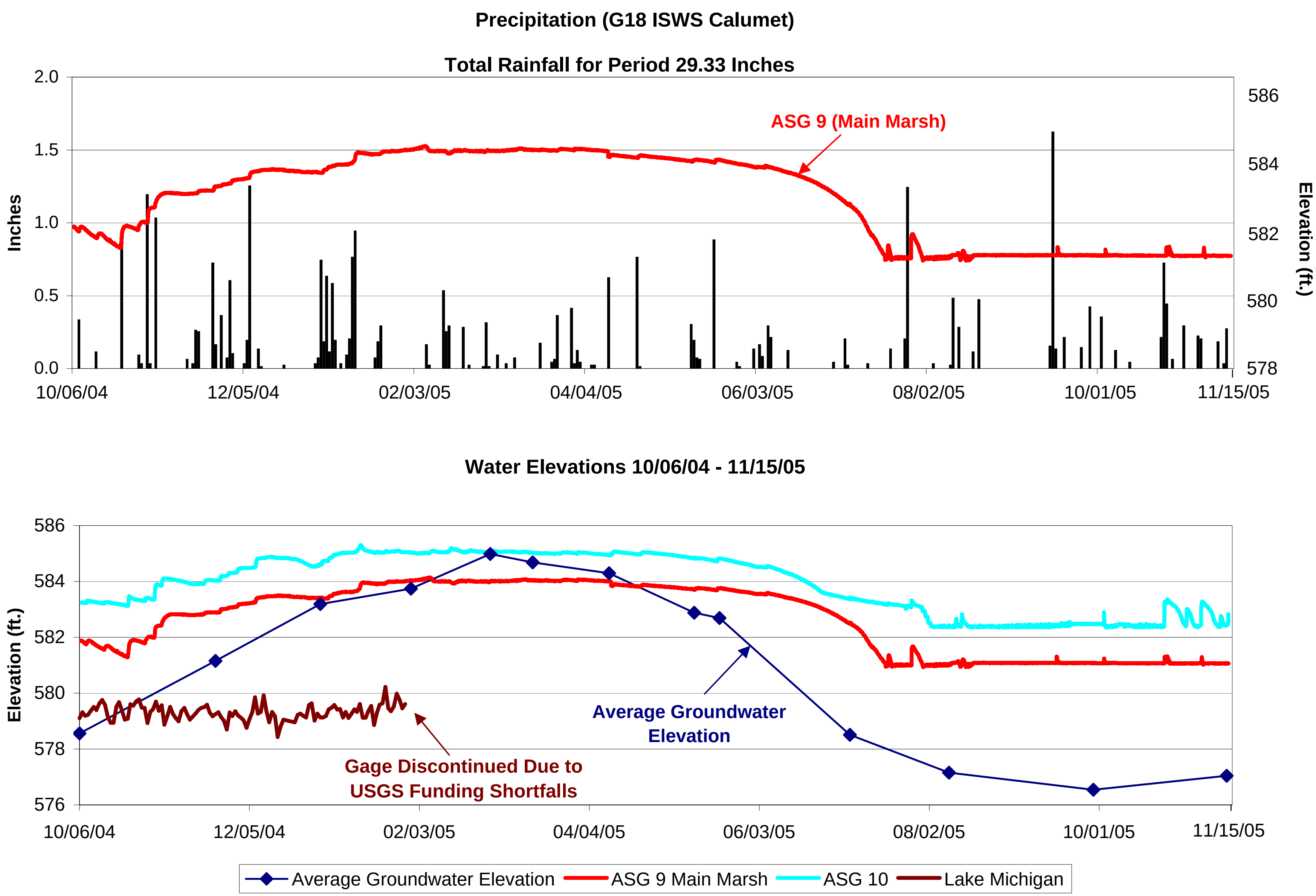
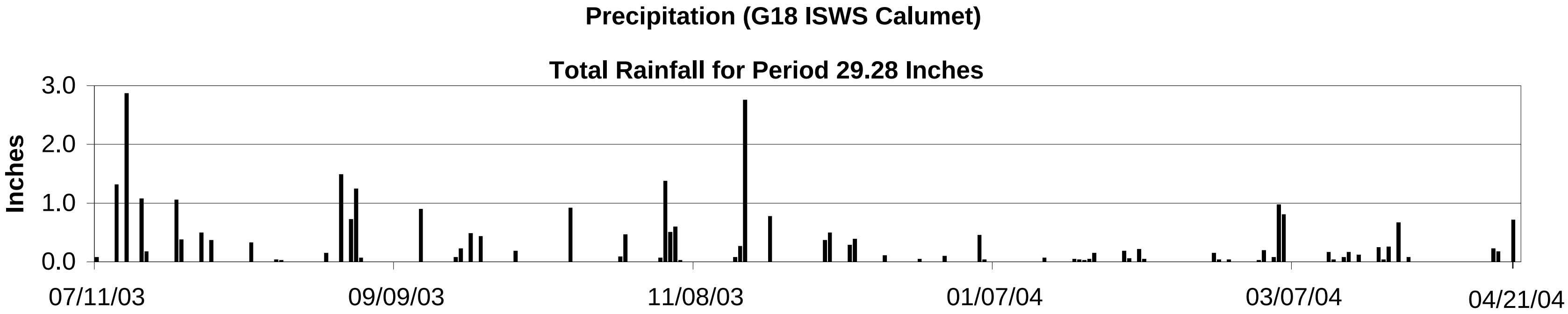


Figure 7: Water Level Graph: ISWS Well #21



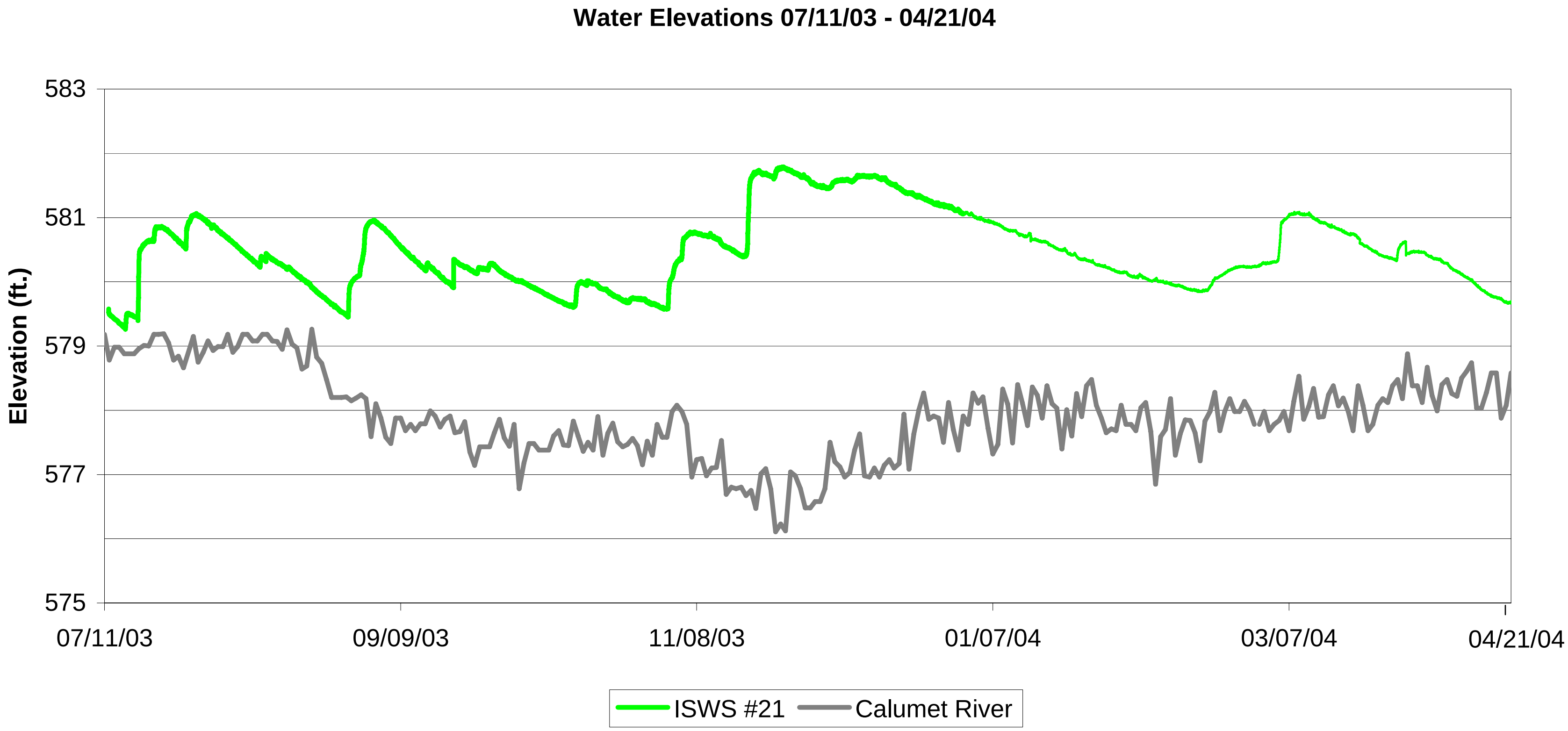
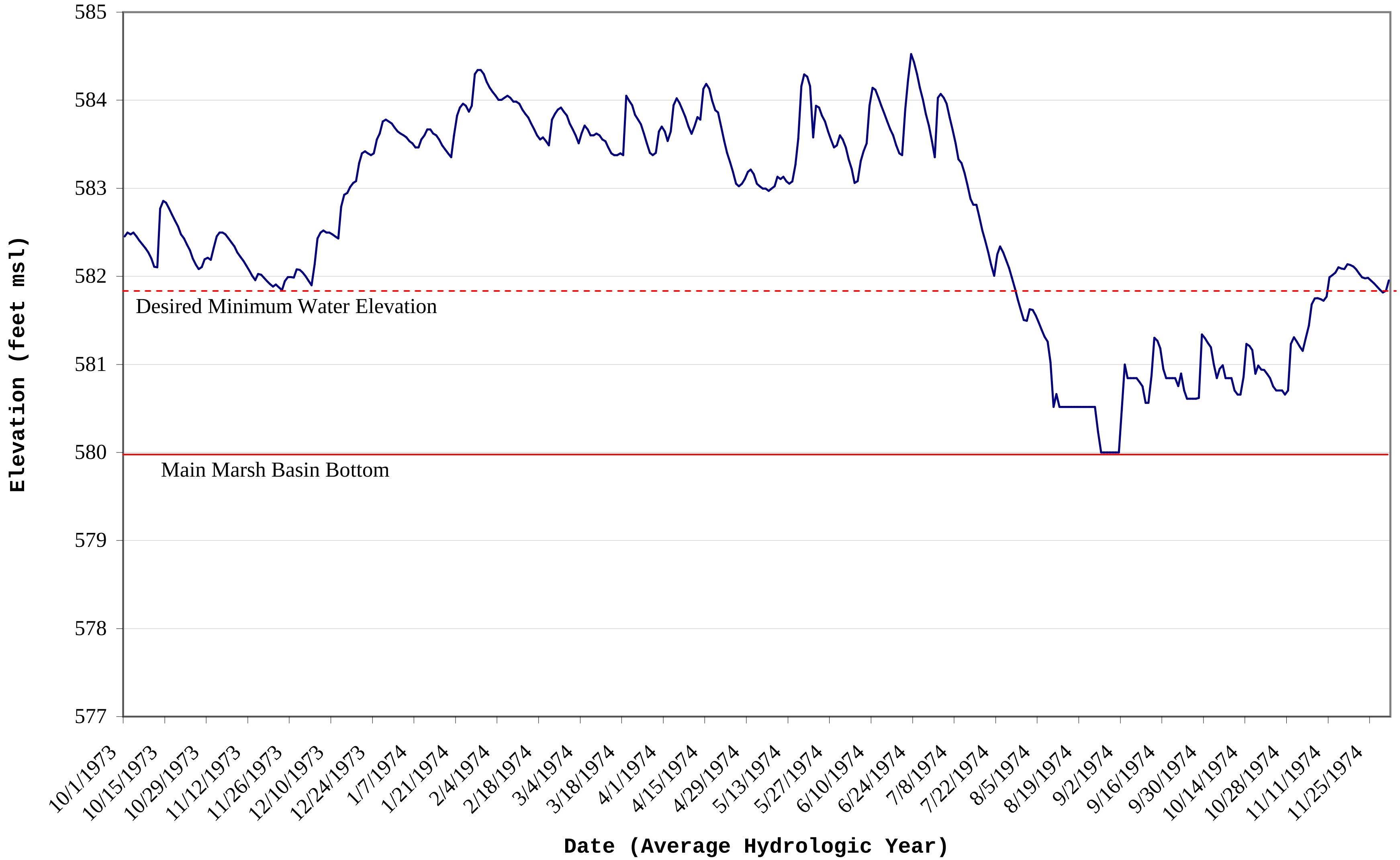


Figure 8: HSPF Simulation -Average Year Hydroperiods- Main Marsh



TABLES

Table 1: Hegewisch Marsh
Surface Water and Groundwater Levels
October 2004 thru
November 2005

					6-Oct-04		23-Nov-04		30-Dec-04		31-Jan-04		28-Feb-05		15-Mar-05		11-Apr-05		11-May-05		20-May-05		5-Jul-05		9-Aug-05		29-Sep-05		15-Nov-05	
	Well	Location	Ground Elevation at Well (ft. msl)	TOC Elevation (ft. msl)	Depth to Water (ft.)	Water Elevation (ft. msl)	Depth to Water (ft.)	Water Elevation (ft. msl)	Depth to Water (ft.)	Water Elevation (ft. msl)	Depth to Water (ft.)	Water Elevation (ft. msl)	Depth to Water (ft.)	Water Elevation (ft. msl)	Depth to Water (ft.)	Water Elevation (ft. msl)	Depth to Water (ft.)	Water Elevation (ft. msl)	Depth to Water (ft.)	Water Elevation (ft. msl)	Depth to Water (ft.)	Water Elevation (ft. msl)	Depth to Water (ft.)	Water Elevation (ft. msl)	Depth to Water (ft.)	Water Elevation (ft. msl)	Depth to Water (ft.)	Water Elevation (ft. msl)	Depth to Water (ft.)	Water Elevation (ft. msl)
Shallow Groundwater System	MW-01	Northwest site	585.77	587.17	7.90	579.27	5.53	581.64	4.36	582.81	3.8	583.37	2.4	584.77	2.6	584.57	3.26	583.91	4.89	582.28	4.91	582.26	8.58	578.59	10	577.17	10.01	577.16	9.88	577.29
	MW-02	South of Marsh	586.27	587.90	9.25	578.65	6.3	581.60	3.38	584.52	2.58	585.32	1.61	586.29	1.9	586.00	2.25	585.65	3.31	584.59	3.66	584.24	8.6	579.30	10.14	577.76	11.43	576.47	10.84	577.06
	MW-03	South of Marsh (East)	585.67	587.68	9.92	577.76	7.45	580.23	5.44	582.24	5.15	582.53	3.8	583.88	4.2	583.48	4.37	583.31	5.9	581.78	6.12	581.56	10.05	577.63	11.15	576.53	11.68	576.00	10.91	576.77
	MW-04	South of Marsh (West)	586.60	587.90	9.64	578.26	7.06	580.84	4.7	583.20	3.95	583.95	2.3	585.60	2.5	585.40	3.38	584.52	5.05	582.85	5.3	582.60	9.93	577.97	11.33	576.57	11.47	576.43	9.92	577.98
	MW-05	Southernmost well	585.91	588.41	10.87	577.54	8.22	580.19	7	581.41	6.49	581.92	5.79	582.62	5.9	582.51	6.37	582.04	7.16	581.25	7.6	580.81	10.36	578.05	12.57	575.84	14.37	574.04	12.59	575.82
Surface Water System	ASG9	Main Marsh	na	586.89	5.03	581.86	4.11	582.78	3.49	583.40	2.86	584.03	2.86	584.03	2.83	584.06	2.9	583.99	3.15	583.74	3.14	583.75	4.4	582.49	5.86	581.03	5.82	581.07	5.83	581.06
	ASG10	S. Perched Zone	na	587.90	4.67	583.23	3.87	584.03	3.25	584.65	2.84	585.06	2.80	585.10	2.85	585.05	2.96	584.94	3.05	584.85	3.10	584.80	4.48	583.42	5.53	582.37	5.47	582.43	5.43	582.47

Table 2
Hegewisch Marsh-Groundwater Statistics
(10/06/04 – 11/15/05)

	MW-01		*MW-02*		*MW-03*		*MW-04*		*MW-05*	
	Depth Below Ground	Groundwater Elevation	Depth Below Ground	Groundwater Elevation	Depth Below Ground	Groundwater Elevation	Depth Below Ground	Groundwater Elevation	Depth Below Ground	Groundwater Elevation
Mean	4.61	581.16	4.16	582.11	5.39	580.28	5.36	581.24	6.37	579.54
Median	3.51	582.26	2.03	584.24	4.11	581.56	4	582.6	5.1	580.81
Standard Deviation	2.88	2.88	3.74	3.74	2.93	2.93	3.39	3.39	2.93	2.93
Range	7.61	7.61	9.82	9.82	7.88	7.88	9.17	9.17	8.58	8.58
Minimum	1	577.16	0.1	576.47	1.79	576	1	576.43	3.29	574.04
Maximum	8.61	584.77	9.8	586.29	9.67	583.88	10.17	585.6	11.87	582.62
Count	13	13	13	13	13	13	13	13	13	13

Statistics for the period 10/06/2004 - 11/15/2005: Hard Data Shown in Table 1

All values in feet

Table 2
Hegewisch Marsh-Surface Water Statistics
(10/06/04 – 11/15/05)

	ASG 9 Surface Water Elevation	*ASG 10* Surface Water Elevation
Mean	582.68	583.93
Median	583.17	584.19
Mode	581.08	582.48
Standard Deviation	1.22	1.05
Range	3.21	2.95
Minimum	580.93	582.35
Maximum	584.142	585.3
Count	38884	38878

Statistics for the period 10/06/2004 - 11/15/2005:

Elevation Datum :NAVD 88; NAD 83 (feet)

APPENDICES

APPENDIX I:

BORING LOGS

SOIL BORING LOG

Hegewisch Marsh, Chicago IL

Boring: MW-01	Sheet No: 1 of 1
Project No: 98216HMP.HEG	

Date Started: 09/30/04	Completed: 09/30/2004	Logged by: James Adamson	
Total Depth (ft) 10.0	Water Table Depth (ft) 6.3	Location: Northwest corner of property N41°39.421' W87°34.036'	
Drilling Contr.: Geocon/Everest	Driller: Ken		
Drill Rig: CME 7570	Hammer: Direct Push	Ground Elev.: 585.8 ft (Elevation from V3 Survey)	

Depth (ft)	Elevation (ft)	Sample No	Sampler Type	Sample Interval Recovery	Blows / 6 in.	Penetrometer	Soil Descriptions	Lithology	Well	Notes and Observations (USCS Classification)
0.5		1	SS		NA	2.0	Friable, 10YR 5/3 (brown), **silt loam**, dry, medium subangular blocky. Common, distinct 5YR 6/6 (reddish yellow) mottles .			Soil Development CL
1	584.8				NA	NA	Oxidized root channels, and small rootlets			
1.5					NA	NA				
2	583.8				NA	NA				
2.5		2	SS		NA	1.3	Friable, 10YR 5/2 (brownish gray), **silt loam**, moist, large, subangular blocky. Common, prominent,2.5YR 4/6 (very dark red) mottles; common, distinct 10YR 7/1 (gray) mottles.			
3	582.8				NA	NA				CH/ML
3.5					NA	2.8	**Silt and clay mixed together (fill)**. Clay dark brownish gray, mod. Hard, dry. Silt gray, friable.			
4	581.8				NA	NA				
4.5		3	SS		NA	3.5	Hard, 2.5Y 5/1 (gray), **silty clay loam**, dry, medium plasticity, few, distinct orange mottles; common, fine limestone gravel, rounded. Clay films, few, distinct, dark brownish gray.			CL
5	580.8				NA	NA				
5.5					NA	NA				
6	579.8				NA	NA				
6.5		4	SS		1	NA	A/A			
7	578.8				1	3.8				
7.5					2	NA				
8	577.8				2	0.8	At 7.0 ft: Fine-medium, single grained, wet, **sand**, 2.5Y 5/1 (gray).			SP
8.5		5	SS		2	NA				
9	576.8				3	NA	A/A			
9.5					3	NA				CH
10	575.8				4	NA	Clay hit at end of Boring (approx 9.2 ft.)			

SOIL BORING LOG

Hegewisch Marsh, Chicago IL

V3 CONSULTANTS

Boring: MW-02	
Sheet No:	1 of 1
Project No:	98216HMP.HEG

Date Started:	09/30/04	Completed:	09/30/2004	Logged by:	James Adamson
Total Depth (ft)	13.0	Water Table Depth (ft)	8.1	Location:	South of Marsh, N41°39.307' W87°33.901'
Drilling Contr.:	Geocon/Everest	Driller:	Ken		
Drill Rig:	CME 7570	Hammer:	Direct Push	Ground Elev.: 586.3	ft (Elev. From V3 survey)

Depth (ft)	Elevation (ft)	Sample No	Sampler Type	Blows / 6 in.	Penetrometer	Soil Descriptions	Notes and Observations (USCS Classification)
0.5				NA	NA	Friable, 10YR 3/2 (very dark grayish brown), **silt loam**, dry, medium subangular blocky. Few, prominent 10YR 6/8 (brownish yellow) mottles . Wood chips common.	ML *Young soil development: Fill Parent Material*
1	585.3	1	SS	NA	NA		
1.5				NA	3.0	Hard, compact, 10YR 5/2, (grayish brown), **clay loam**, moist, medium subangular blocky. Common, prominent 5YR 4/6 (dark orangish red) mottles; fine gravel (limestone, rounded, angular) 3%.	MH
2	584.3			NA	NA		
2.5				4	1.3	2.0-2.25: Friable, 10YR 3/2 (very dark grayish brown), colour, **silt loam**, dry, medium, subangular blocky. Old, common fine rootlets.	SP
3	583.3	2	SS	5	NA	2.25: **Sand** seam 2cm thick. Abrupt boundary below and above	MH
3.5				6	1.8	2.25-4.0': Compact, medium plastic, 10YR 5/2 (grayish brown), **silty clay loam**. Common, prominent 10YR 5/8 (yellowish brown) mottles; common, distinct gray mottles	CL
4	582.3			6	NA		
4.5			SS	3	NA		
5	581.3	3		3	NA	A/A, increase in grey colour, moist. Large oxidized root channels, high plasticity.	CH
5.5				3	NA		
6	580.3			4	2.0		
6.5				2	NA	A/A At 6.3': Medium, single grained, wet, **sand seam**, 10YR 5/3 (brown) . 3 cm thick.	SP MH
7	579.3	4	SS	2	NA		
7.5				3	2.3	At 7.0': Soft, 10YR 2/1 (black), **silty clay loam**, moist, medium plasticity. Few, distinct 10YR 4/6 (dark yellowish brown) mottles.	CL *Buried Surface (old wetland); developed on fill material*
8	578.3			3	NA		MH
8.5				3	NA	Grades to Grayer Colour	
9	577.3	5	SS	2	NA	A/A w glass schards.	MH
9.5				2	NA		
10	576.3			2	0.5	At 9.25': Fine-Medium, 10YR 4/2 (dark grayish brown), single grain, wet, **sand.**	SP
10.5				1	NA	A/A to 11.5'	
11	575.3	6	SS	2	NA		*High energy fluvial depositional environment*
11.5				2	NA		
12	574.3			2	NA	END OF BORING	

SOIL BORING LOG

Hegewisch Marsh, Chicago IL

Boring:	MW-03
Sheet No:	1 of 1
Project No:	98216HMP.HEG

CONSULTANTS

Date Started:	09/30/04	Completed:	09/30/2004	Logged by:	James Adamson
Total Depth (ft)	10.0	Water Table Depth (ft)	7.5	Location:	South of Marsh, 50 meters from Torrence Ave. N41°39.261' W87°33.630'
Drilling Contr.:	Geocon/Everest	Driller:	Ken		
Drill Rig:	CME 7570	Hammer:	Direct Push	Ground Elev.:	585.7 ft (Elevation from V3 survey)

Depth (ft)	Elevation (ft)	Sample No	Sampler Type	Sample Interval Recovery	Blows / 6 in.	Penetrometer	Soil Descriptions	Lithology	Well	Notes and Observations (USCS Classification)
0.5					NA	0.8	Friable, 10YR 6/2 (light brownish gray), **silt loam**, dry, medium subangular blocky. Few, faint, 10YR 6/4 (light yellowish brown) mottles. Abundant, medium roots. Glass and pottery schards.			ML *Young soil development*
1	584.7	1	SS		NA	NA				
1.5					NA	NA	0.5' - 1.5': A/A, siltier 2.5Y 7/3 (pale yellow). **Compacted silt fill.**			
2	583.7				NA	1.0	1.5': Friable, 10YR 3/1 (very dark gray), **silt loam**, dry. Few, distinct yellowish brown mottles. Many, fine rootlets. Small subangular blocky structure.			Former Soil Surface at 1.5' *Fill*
2.5					10	NA				
3	582.7	2	SS		11	1.8	A/A Firm, 10YR 4/2 (dark grayish brown), **silty clay loam**, moist, medium plasticity. Glass, pottery schards.			CL *Fill with some soil development*
3.5					7	NA				
4	581.7				9	NA				
4.5					5	NA				CL
5	580.7	3	SS		4	2.0	A/A, Extremely Firm, compacted, **clay loam, medium plasticity.**			
5.5					5	NA				CL
6	579.7				5	NA	At 5.8': Friable, 10YR 2/1 (black)**, silt loam**. Small sand lenses present (< 1 cm). Fine, common rootlets.			*Buried A Horizon, wetland (before filling)*
6.5					5	NA				MH
7	578.7	4	SS		4	3.3	Firm, 2.5Y 3/2 (colour), **silty clay loam**, dry, medium plasticity, clay films; common, prominent 7.5YR 4/6 mottles.			CL *Fluvial deposition (low energy)*
7.5					5	NA				
8	577.7				6	0.5	At 7.5', Fine-medium, single grained, wet, **sand**, 5Y 5/2 (gray); common, prominent 10YR 5/6 (yellowish brown) mottles.			*High Energy Fluvial Deposit*
8.5					1	NA				SP
9	576.7	5	SS		1	NA	At 9' ; Fine-medium, single grained, wet, **sand**, 2.5Y 5/1 (gray).			
9.5					1	NA				
10	575.7				2	NA				

SOIL BORING LOG

Hegewisch Marsh, Chicago IL

CONSULTANTS

Boring: MW-04	
Sheet No:	1 of 1
Project No: 98216HMP.HEG	

Date Started:	09/30/04	Complete	09/30/2004	Logged by:	James Adamson
Total Depth (ft)	10.0	Water Table Depth (ft)	7.5	Location:	West side of Property, south of MW-01 N41°39.301' W87°34.089'
Drilling Contr.:	Geocon/Everest	Driller:	Ken		
Drill Rig:	CME 7570	Hammer:	Direct Push	Ground Elev.: 586.60 ft	(Approx Elev. from USGS Quad Map)

Depth (ft)	Elevation (ft)	Sample No	Sampler Type	Blows (6 in)	Penetrometer	Soil Descriptions	Notes and Observations (USCS Classification)
0.5		1	SS	NA	1.8	Hard, 10YR 4/4 (dark yellowish brown), **silt loam**, dry, medium subangular blocky. Common, prominent, 2.5Y 4/2 (dark grayish brown) mottles; fine, abundant rootlets.	ML *Young soil development*
1	585.6			NA	NA		
1.5				NA	NA	A/A. Fewer mottles. Siltier texture	More silt ML Silty with random gravel *(FILL)*
2	584.6			NA	NA		
2.5		2	SS	4	4.0	Firm, 10YR 4/2 (dark grayish brown), **clay loam**, moist, high plasticity. Common, distinct grey reduction.	CH
3	583.6			4	3.5	Firm, 10YR 4/4 (dark yellowish brown), **silty clay loam**, moist, medium plasticity; common, prominent, 2.5YR 4/6 (red) mottles; medium, common clay films (dark grayish blue). Small, common, rounded limestone gravel.	CL
3.5				6	NA		
4	582.6			6	NA		Seams of SP
4.5		3	SS	2	NA	Firm, 10YR 4/1 (brownish gray), **silty clay loam**, moist; few, small gravel; few, distinct, 5G 7/1 (bluish gray) gleying	CL
5	581.6			3	3.5	At 4.8' a schard of Kaolinite, or possibly gysum	
5.5				3	NA	**Sandy clay loam**, moist; common, prominent 2.5YR 4/6 (dark red) mottles; common, faint colour (gray) reduction.	SC
6	580.6			4	NA		
6.5		4	SS	NA	3.0	Firm, colour (more gray than above)(brownish **gray**), **silty clay loam**	CL
7	579.6			NA	NA	At 7', Fine-medium, single grained, wet, **sand**, 2.5Y 5/1. 0.5 ' thick.	SP
7.5				NA	1.8	Firm, 10YR 5/2 (more gray than above)(brownish gray), **sandy clay loam**, moist; medium plasticity, common, prominent, 2.5YR 4/6 (red) mottles	SC
8	578.6			NA	NA		
8.5		5	SS	1	0.5	Soft, 10YR 4/1 (dark gray), **sandy clay loam**, medium plasticity.	SC
9	577.6			1	NA		
9.5				1	NA	Grades to a **silty clay, with sand lenses (2 cm thick)**	CL
10	576.6			2	NA	**End of Boring**	

Lithology | Well | Sample Interval Recovery

APPENDIX II:

CALCULATION AND DATA SHEETS (TR-20 AND HSPF)

DISCHARGE CALCULATION WORKSHEET
NATURAL DEPRESSIONAL AREA 13

PROJECT: Hegewisch Marsh
V3 FILE NO.: 98216HMP.HEG
DATE: 12/10/2004
PREPARED BY: CAT

OVERFLOW WEIR INFORMATION

OVERFLOW ELEVATION............. 582.5
LENGTH OF CREST........................ 38
COEF. OF DISCHARGE.................. 2.63

POND B H_2O ELEVATION	$HEAD_{overflow}$ (ft)	$Q_{overflow}$ (cfs)
582.0	0.0	0.00
583.0	0.5	35.33

EQUATIONS

OVERFLOW WEIR:

$$Q = C \times L \times H^{3/2}$$

where:
C = COEFFICIENT OF DISCHARGE
L = EFFECTIVE LENGTH OF CREST
H = TOTAL HEAD ON CREST

DISCHARGE CALCULATION WORKSHEET
NATURAL DEPRESSIONAL AREA 15

PROJECT: Hegewisch Marsh
V3 FILE NO.: 98216HMP.HEG
DATE: 12/10/2004
PREPARED BY: CAT

OVERFLOW WEIR INFORMATION
OVERFLOW ELEVATION............. 582.4
LENGTH OF CREST........................ 37
COEF. OF DISCHARGE.................. 2.63

POND B H_2O ELEVATION	**$HEAD_{overflow}$ (ft)**	**$Q_{overflow}$ (cfs)**
581.0	0.0	0.00
582.0	0.0	0.00
583.0	0.6	45.23

EQUATIONS
OVERFLOW WEIR:

$$Q = C \times L \times H^{3/2}$$

where:
C = COEFFICIENT OF DISCHARGE
L = EFFECTIVE LENGTH OF CREST
H = TOTAL HEAD ON CREST

STAGE STORAGE CALCULATIONS WORKSHEET
NATURAL DEPRESSIONAL AREA 11 & 12

PROJECT: Hegewisch Marsh
V3 FILE NO.: 98216HMP.HEG
DATE: 12/10/2004
PREPARED BY: CAT

ELEVATION	AREA (acres)	AVERAGE AREA (acres)	STAGE VOLUME (acre-feet)	CUMULATIVE VOLUME (acre-feet)	COMMENT
579.5	0.00	0.00	0.00	0.00	
580.0	2.30	1.15	0.58	0.58	
581.0	16.59	9.45	9.45	10.02	
582.0	22.58	19.59	19.59	29.61	
583.0	24.20	23.39	23.39	53.00	
584.0	26.50	25.35	25.35	78.35	

STAGE STORAGE CALCULATIONS WORKSHEET
NATURAL DEPRESSIONAL AREA 11 & 12 (WITH GROUNDWATER)

PROJECT: Hegewisch Marsh
V3 FILE NO.: 98216HMP.HEG
DATE: 12/10/2004
PREPARED BY: CAT

ELEVATION	AREA (acres)	AVERAGE AREA (acres)	STAGE VOLUME (acre-feet)	CUMULATIVE VOLUME (acre-feet)	COMMENT
581.5	19.59	0.00	0.00	0.00	
582.0	22.58	21.09	10.54	10.54	
583.0	24.20	23.39	23.39	33.93	
584.0	26.50	25.35	25.35	59.28	

STAGE STORAGE CALCULATIONS WORKSHEET
NATURAL DEPRESSIONAL AREA 13

PROJECT: Hegewisch Marsh
V3 FILE NO.: 98216HMP.HEG
DATE: 12/10/2004
PREPARED BY: CAT

ELEVATION	AREA (acres)	AVERAGE AREA (acres)	STAGE VOLUME (acre-feet)	CUMULATIVE VOLUME (acre-feet)	COMMENT
582.0	0.02	0.00	0.00	0.00	
583.0	0.70	0.36	0.36	0.36	

STAGE STORAGE CALCULATIONS WORKSHEET
NATURAL DEPRESSIONAL AREA 15

PROJECT: Hegewisch Marsh
V3 FILE NO.: 98216HMP.HEG
DATE: 12/10/2004
PREPARED BY: CAT

ELEVATION	AREA (acres)	AVERAGE AREA (acres)	STAGE VOLUME (acre-feet)	CUMULATIVE VOLUME (acre-feet)	COMMENT
581.0	0.02	0.00	0.00	0.00	
582.0	4.50	2.26	2.26	2.26	
583.0	5.03	4.77	4.77	7.03	

STAGE STORAGE CALCULATIONS WORKSHEET
NATURAL DEPRESSIONAL AREA 15 (WITH GROUNDWATER)

PROJECT: Hegewisch Marsh
V3 FILE NO.: 98216HMP.HEG
DATE: 12/10/2004
PREPARED BY: CAT

ELEVATION	AREA (acres)	AVERAGE AREA (acres)	STAGE VOLUME (acre-feet)	CUMULATIVE VOLUME (acre-feet)	COMMENT
581.5	2.26	0.00	0.00	0.00	
582.0	4.50	3.38	1.69	1.69	
583.0	5.03	4.77	4.77	6.46	

Project:	98216HMP.HEG Hegewisch Marsh	By: CAT	Date: 12/10/2004
Location:	Chicago, Cook County, Illinois	Checked:	Date:

Circle One: Present Developed — Existing Conditions

Circle One: T_c — T_t through subareas — Subbasin 010

NOTES: Space for as many as two segments per flow type can be used for each worksheet
Include a map, schematic, or descpription of flow segments.

Sheet Flow (Applicable to T_c only)

Item	Unit	Segment ID		
1. Surface description (table 3-1)		Dense Grasses		
2. Manning's roughness coeff., n (table 3-1)		0.24		
3. Flow Length, L (total L < 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	3.04		
5. Land slope, s	ft / ft	0.004		
6. $T_t = \frac{0.007 (nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t	hr	1.12		1.12

Shallow Concentrated Flow

Item	Unit	Segment ID		
7. Surface Description (paved or unpaved)		Unpaved		
8. Flow Length, L	ft	100		
9. Watercourse slope, s	ft / ft	0.070		
10. Average velocity, V (figure 3-1)	ft / s	4.2		
11. $T_c = \frac{L}{3600 V}$ Compute T_c	hr	0.01		0.01

Channel Flow

Item	Unit	Segment ID		
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, P_w	ft			
14. Hydraulic radius, $r = a / P_w$ Compute r	ft			
15. Channel slope, s	ft / ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V	ft / s			
18. Flow length, L	ft			
19. $T_t = \frac{L}{3600 V}$ Compute T_t	hr			0.00

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) …… hr 1.13

67.5 minutes

E:\1998\98216\98216HMP\98216HMP.HEG\Calculations Data\Watershed\Storm\Hydrologic Calcs.xls

Project:	98216HMP.HEG Hegewisch Marsh	By:	CAT	Date:	12/10/2004
Location:	Chicago, Cook County, Illinois	Checked:		Date:	

Circle One: Present Developed — Existing Conditions

Circle One: T_c T_t through subareas — Subbasin 011 & 012

NOTES: Space for as many as two segments per flow type can be used for each worksheet
Include a map, schematic, or descpription of flow segments.

Sheet Flow (Applicable to T_c only)

		Unit	Segment ID		
1.	Surface description (table 3-1)……		Dense Grasses		
2.	Manning's roughness coeff., n (table 3-1)……		0.24		
3.	Flow Length, L (total L < 300 ft)……	ft	300		
4.	Two-yr 24-hr rainfall, P_2……	in	3.04		
5.	Land slope, s……	ft / ft	0.003		
6.	$Tt = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_t……	hr	1.26		1.26

Shallow Concentrated Flow

		Unit	Segment ID		
7.	Surface Description (paved or unpaved)……		Unpaved		
8.	Flow Length, L……	ft	140		
9.	Watercourse slope, s……	ft / ft	0.030		
10.	Average velocity, V (figure 3-1)……	ft / s	2.8		
11.	$T_c = \frac{L}{3600\,V}$ Compute T_c……	hr	0.01		0.01

Channel Flow

		Unit	Segment ID		
12.	Cross sectional flow area, a……	ft^2			
13.	Wetted perimeter, P_w……	ft			
14.	Hydraulic radius, $r = a / P_w$ Compute r……	ft			
15.	Channel slope, s……	ft / ft			
16.	Manning's roughness coeff., n……				
17.	$V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V……	ft / s			
18.	Flow length, L……	ft			
19.	$T_t = \frac{L}{3600\,V}$ Compute T_t……	hr			0.00

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)…… hr 1.27

76.1 minutes

Project:	98216HMP.HEG Hegewisch Marsh	By: CAT	Date: 12/10/2004
Location:	Chicago, Cook County, Illinois	Checked:	Date:

Circle One: Present Developed — Existing Conditions

Circle One: T_c T_t through subareas — Subbasin 013

NOTES: Space for as many as two segments per flow type can be used for each worksheet
Include a map, schematic, or descpription of flow segments.

Sheet Flow (Applicable to T_c only)

	Units	Segment ID		
1. Surface description (table 3-1)……		Dense Grasses		
2. Manning's roughness coeff., n (table 3-1)……		0.24		
3. Flow Length, L (total L < 300 ft)……	ft	282		
4. Two-yr 24-hr rainfall, P_2……	in	3.04		
5. Land slope, s……	ft / ft	0.030		
6. $Tt = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_t……	hr	0.48		0.48

Shallow Concentrated Flow

	Units	Segment ID		
7. Surface Description (paved or unpaved)……				
8. Flow Length, L……	ft			
9. Watercourse slope, s……	ft / ft			
10. Average velocity, V (figure 3-1)……	ft / s			
11. $T_c = \frac{L}{3600\,V}$ Compute T_c……	hr			0.00

Channel Flow

	Units	Segment ID		
12. Cross sectional flow area, a……	ft^2			
13. Wetted perimeter, P_w……	ft			
14. Hydraulic radius, $r = a / P_w$ Compute r……	ft			
15. Channel slope, s……	ft / ft			
16. Manning's roughness coeff., n……				
17. $V = \frac{1.49\, r^{2/3}\, s^{1/2}}{n}$ Compute V……	ft / s			
18. Flow length, L……	ft			
19. $T_t = \frac{L}{3600\,V}$ Compute T_t……	hr			0.00

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)…… hr 0.48

28.5 minutes

Project:	98216HMP.HEG Hegewisch Marsh	By:	CAT	Date:	12/10/2004
Location:	Chicago, Cook County, Illinois	Checked:		Date:	

Circle One: Present Developed — Existing Conditions

Circle One: T_c T_t through subareas — Subbasin 014

NOTES: Space for as many as two segments per flow type can be used for each worksheet
Include a map, schematic, or descpription of flow segments.

Sheet Flow (Applicable to T_c only)

	Unit	Segment 1	Segment 2	Total
Segment ID				
1. Surface description (table 3-1)……		Dense Grasses		
2. Manning's roughness coeff., n (table 3-1)……		0.24		
3. Flow Length, L (total L < 300 ft)……	ft	195		
4. Two-yr 24-hr rainfall, P_2……	in	3.04		
5. Land slope, s……	ft / ft	0.020		
6. $Tt = \frac{0.007\ (nL)^{0.8}}{P_2^{0.5}\ s^{0.4}}$ Compute T_t……	hr	0.42		0.42

Shallow Concentrated Flow

	Unit	Segment 1	Segment 2	Total
Segment ID				
7. Surface Description (paved or unpaved)……				
8. Flow Length, L……	ft			
9. Watercourse slope, s……	ft / ft			
10. Average velocity, V (figure 3-1)……	ft / s			
11. $T_c = \frac{L}{3600\ V}$ Compute T_c……	hr			0.00

Channel Flow

	Unit	Segment 1	Segment 2	Total
Segment ID				
12. Cross sectional flow area, a……	ft^2			
13. Wetted perimeter, P_w……	ft			
14. Hydraulic radius, $r = a / P_w$ Compute r……	ft			
15. Channel slope, s……	ft / ft			
16. Manning's roughness coeff., n……				
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V……	ft / s			
18. Flow length, L……	ft			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t……	hr			0.00

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)…… hr 0.42

25.0 minutes

Project: 98216HMP.HEG Hegewisch Marsh   By: CAT   Date: 12/10/2004
Location: Chicago, Cook County, Illinois   Checked: ______   Date: ______

Circle One: Present   Developed   Existing Conditions
Circle One: T_c T_t through subareas   Subbasin 015

NOTES: Space for as many as two segments per flow type can be used for each worksheet
Include a map, schematic, or descpription of flow segments.

Sheet Flow (Applicable to T_c only)

	Units	Segment ID		
1. Surface description (table 3-1)……		Dense Grasses		
2. Manning's roughness coeff., n (table 3-1)……		0.24		
3. Flow Length, L (total L < 300 ft)……	ft	300		
4. Two-yr 24-hr rainfall, P_2……	in	3.04		
5. Land slope, s……	ft / ft	0.004		
6. $T_t = \frac{0.007 (nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t……	hr	1.12		1.12

Shallow Concentrated Flow

	Units	Segment ID		
7. Surface Description (paved or unpaved)……		Unpaved		
8. Flow Length, L……	ft	32		
9. Watercourse slope, s……	ft / ft	0.100		
10. Average velocity, V (figure 3-1)……	ft / s	5		
11. $T_c = \frac{L}{3600 V}$ Compute T_c……	hr	0.002		0.002

Channel Flow

	Units	Segment ID		
12. Cross sectional flow area, a……	ft^2			
13. Wetted perimeter, P_w……	ft			
14. Hydraulic radius, $r = a / P_w$ Compute r……	ft			
15. Channel slope, s……	ft / ft			
16. Manning's roughness coeff., n……				
17. $V = \frac{1.49 r^{2/3} s^{1/2}}{n}$ Compute V……	ft / s			
18. Flow length, L……	ft			
19. $T_t = \frac{L}{3600 V}$ Compute T_t……	hr			0.00

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)…… hr 1.12
67.2 minutes

Project:	98216HMP.HEG Hegewisch Marsh	By: CAT	Date: 12/10/2004
Location:	Chicago, Cook County, Illinois	Checked:	Date:

Circle One: Present Developed — Existing Conditions

Circle One: T_c T_t through subareas — Subbasin 016

NOTES: Space for as many as two segments per flow type can be used for each worksheet
Include a map, schematic, or descpription of flow segments.

Sheet Flow (Applicable to T_c only)	Units	Segment ID		Total
1. Surface description (table 3-1)……		Dense Grasses		
2. Manning's roughness coeff., n (table 3-1)……		0.24		
3. Flow Length, L (total L < 300 ft)……	ft	300		
4. Two-yr 24-hr rainfall, P_2……	in	3.04		
5. Land slope, s……	ft / ft	0.006		
6. $Tt = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,s^{0.4}}$ Compute T_t……	hr	0.95		0.95

Shallow Concentrated Flow	Units	Segment ID		Total
7. Surface Description (paved or unpaved)……		Unpaved		
8. Flow Length, L……	ft	1250		
9. Watercourse slope, s……	ft / ft	0.006		
10. Average velocity, V (figure 3-1)……	ft / s	1.2		
11. $T_c = \frac{L}{3600\,V}$ Compute T_c……	hr	0.29		0.29

Channel Flow	Units	Segment ID		Total
12. Cross sectional flow area, a……	ft^2			
13. Wetted perimeter, P_w……	ft			
14. Hydraulic radius, $r = a / P_w$ Compute r……	ft			
15. Channel slope, s……	ft / ft			
16. Manning's roughness coeff., n……				
17. $V = \frac{1.49\,r^{2/3}\,s^{1/2}}{n}$ Compute V……	ft / s			
18. Flow length, L……	ft			
19. $T_t = \frac{L}{3600\,V}$ Compute T_t……	hr			0.00

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19)…… hr 1.24

74.4 minutes

Project: 98216HMP.HEG Hegewisch Marsh By: CAT Date: 12/10/2004
Location: Chicago, Cook County, Illinois Checked: ______ Date: ______

Circle One: Present Developed — Existing Conditions
Circle One: T_c T_t through subareas — Subbasin 017

NOTES: Space for as many as two segments per flow type can be used for each worksheet
Include a map, schematic, or descpription of flow segments.

Sheet Flow (Applicable to T_c only)

	Unit	Segment ID		Total
1. Surface description (table 3-1)		Dense Grasses		
2. Manning's roughness coeff., n (table 3-1)		0.24		
3. Flow Length, L (total L < 300 ft)	ft	300		
4. Two-yr 24-hr rainfall, P_2	in	3.04		
5. Land slope, s	ft / ft	0.007		
6. $Tt = \frac{0.007 (nL)^{0.8}}{P_2^{0.5} s^{0.4}}$ Compute T_t	hr	0.89		0.89

Shallow Concentrated Flow

	Unit	Segment ID		Total
7. Surface Description (paved or unpaved)		Unpaved		
8. Flow Length, L	ft	436		
9. Watercourse slope, s	ft / ft	0.009		
10. Average velocity, V (figure 3-1)	ft / s	1.6		
11. $T_c = \frac{L}{3600\ V}$ Compute T_c	hr	0.08		0.08

Channel Flow

	Unit	Segment ID		Total
12. Cross sectional flow area, a	ft^2			
13. Wetted perimeter, P_w	ft			
14. Hydraulic radius, $r = a / P_w$ Compute r	ft			
15. Channel slope, s	ft / ft			
16. Manning's roughness coeff., n				
17. $V = \frac{1.49\ r^{2/3}\ s^{1/2}}{n}$ Compute V	ft / s			
18. Flow length, L	ft			
19. $T_t = \frac{L}{3600\ V}$ Compute T_t	hr			0.00

20. Watershed or subarea T_c or T_t (add T_t in steps 6, 11, and 19) hr 0.97
58.2 minutes

Project: 98216HMP.HEG Hegewisch Marsh — By: CAT — Date: 12/10/2004
Location: Chicago, Cook County, Illinois — Checked: ____ — Date: ____

Circle One: Present Developed — Existing Conditions
Subbasin 010

1. Runoff Curve Number (CN)

Soil Name and hydrologic group (appendix A)			Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN[1/] Table 2-2	CN[1/] Fig. 2-3	CN[1/] Fig. 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
		C	Brush: Good Condition	65			6.37	414.1
						Totals =	6.37	414.1

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{414.05}{6.37}$ = 65.0;

Use CN = 65

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency……	yr			
Rainfall, P (24-hour)……	in			
Runoff, Q…… (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	in			

Project: 98216HMP.HEG Hegewisch Marsh | By: CAT | Date: 12/10/2004
Location: Chicago, Cook County, Illinois | Checked: ______ | Date: ______

Circle One: Present Developed | Existing Conditions
Subbasin 011 & 012

1. Runoff Curve Number (CN)

Soil Name and hydrologic group (appendix A)			Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN[1/] Table 2-2	CN[1/] Fig. 2-3	CN[1/] Fig. 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
		C	Impervious Area: Railroad	98			0.56	54.9
		C	Woods: Good Condition	72			25.07	1805.0
		C	Brush: Good Condition	65			29.91	1944.2
						Totals =	55.54	3804.1

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{3804.1}{55.54}$ = 68.5; Use CN = 68

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency……………………………………………	yr			
Rainfall, P (24-hour)…………………………………	in			
Runoff, Q……………………………………………… (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	in			

Project: 98216HMP.HEG Hegewisch Marsh   By: CAT   Date: 12/10/2004
Location: Chicago, Cook County, Illinois   Checked: ________   Date: ________

Circle One: Present Developed   Existing Conditions
Subbasin 013

1. Runoff Curve Number (CN)

Soil Name and hydrologic group (appendix A)			Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN[1/] Table 2-2	CN[1/] Fig. 2-3	CN[1/] Fig. 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
		C	Impervious Area: Railroad	98			0.67	65.7
		C	Woods: Good Condition	72			1.28	92.2
		C	Brush: Good Condition	65			2.10	136.5
						Totals =	4.05	294.3

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{294.32}{4.05}$ = 72.7;   Use CN = 73

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency…………………………………………	yr			
Rainfall, P (24-hour)…………………………………	in			
Runoff, Q……………………………………………… (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	in			

Project: 98216HMP.HEG Hegewisch Marsh | By: CAT | Date: 12/10/2004
Location: Chicago, Cook County, Illinois | Checked: | Date:

Circle One: Present Developed | Existing Conditions
Subbasin 014

1. Runoff Curve Number (CN)

Soil Name and hydrologic group (appendix A)			Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN[1/] Table 2-2	CN[1/] Fig. 2-3	CN[1/] Fig. 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
		C	Woods: Good Condition	72			1.68	121.0
		C	Brush: Good Condition	65			1.68	109.2
						Totals =	3.36	230.2

1/ Use only one CN source per line.

$$\text{CN (weighted)} = \frac{\text{total product}}{\text{total area}} = \frac{230.16}{3.36} = 68.5;$$

Use CN = 69

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency……………………………………………	yr			
Rainfall, P (24-hour)…………………………………	in			
Runoff, Q…………………………………………… (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	in			

Project: 98216HMP.HEG Hegewisch Marsh | By: CAT | Date: 12/10/2004
Location: Chicago, Cook County, Illinois | Checked: | Date:

Circle One: Present Developed | Existing Conditions
Subbasin 015

1. Runoff Curve Number (CN)

Soil Name and hydrologic group (appendix A)			Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN[1/] Table 2-2	CN[1/] Fig. 2-3	CN[1/] Fig. 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
		C	Brush: Good Condition	65			9.75	633.8
							Totals = 9.75	633.8

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{633.75}{9.75}$ = 65.0; Use CN = 65

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency………………………………………………	yr			
Rainfall, P (24-hour)…………………………………	in			
Runoff, Q……………………………………………… (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	in			

Project: 98216HMP.HEG Hegewisch Marsh By: CAT Date: 12/10/2004
Location: Chicago, Cook County, Illinois Checked: ________ Date: ________

Circle One: Present Developed Existing Conditions
Subbasin 016

1. Runoff Curve Number (CN)

Soil Name and hydrologic group (appendix A)			Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN[1/] Table 2-2	CN[1/] Fig. 2-3	CN[1/] Fig. 2-4	Area [x] acres [ ] mi^2 [ ] %	Product of CN x area
		C	Impervious Area: Road	98			0.20	19.6
		C	Woods: Good Condition	72			19.49	1403.3
		C	Brush: Good Condition	65			20.63	1341.0
						Totals =	40.32	2763.8

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{2763.8}{40.32}$ = 68.5; Use CN = 69

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency……………………………………………	yr			
Rainfall, P (24-hour)…………………………………	in			
Runoff, Q……………………………………………… (Use P and CN with table 2-1, fig. 2-1, or eqs. 2-3 and 2-4.)	in			

Project: 98216HMP.HEG Hegewisch Marsh | By: CAT | Date: 12/10/2004
Location: Chicago, Cook County, Illinois | Checked: ______ | Date: ______

Circle One: Present Developed

Existing Conditions
Subbasin 017

1. Runoff Curve Number (CN)

Soil Name and hydrologic group (appendix A)			Cover description (cover type, treatment, and hydrologic condition; percent impervious; unconnected/connected impervious area ratio)	CN[1/] Table 2-2	CN[1/] Fig. 2-3	CN[1/] Fig. 2-4	Area [x] acres [ ] mi² [ ] %	Product of CN x area
		C	Woods: Good Condition	72			9.75	702.0
		C	Brush: Good Condition	65			1.24	80.6
							Totals = 10.99	782.6

1/ Use only one CN source per line.

CN (weighted) = $\frac{\text{total product}}{\text{total area}} = \frac{782.6}{10.99}$ = 71.2; Use CN = 71

2. Runoff

		Storm #1	Storm #2	Storm #3
Frequency………………………………	yr			
Rainfall, P (24-hour)………………………	in			
Runoff, Q………………………………	in			

(Use P and CN with table 2-1, fig. 2-1,
or eqs. 2-3 and 2-4.)

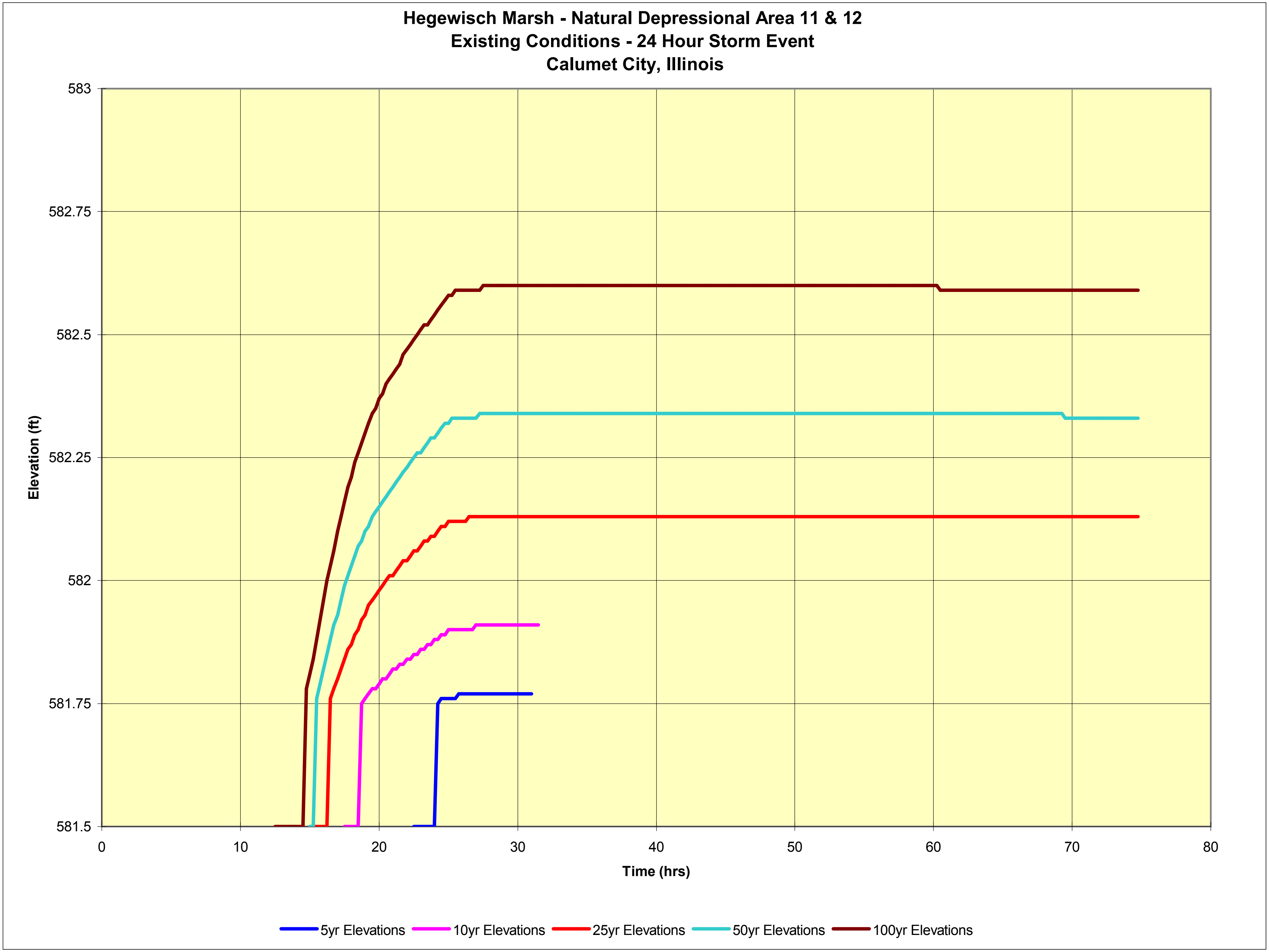
TABLE 2.0 - EXISTING CONDITIONS

ON-SITE WATERSHED DRAINAGE PARAMETERS

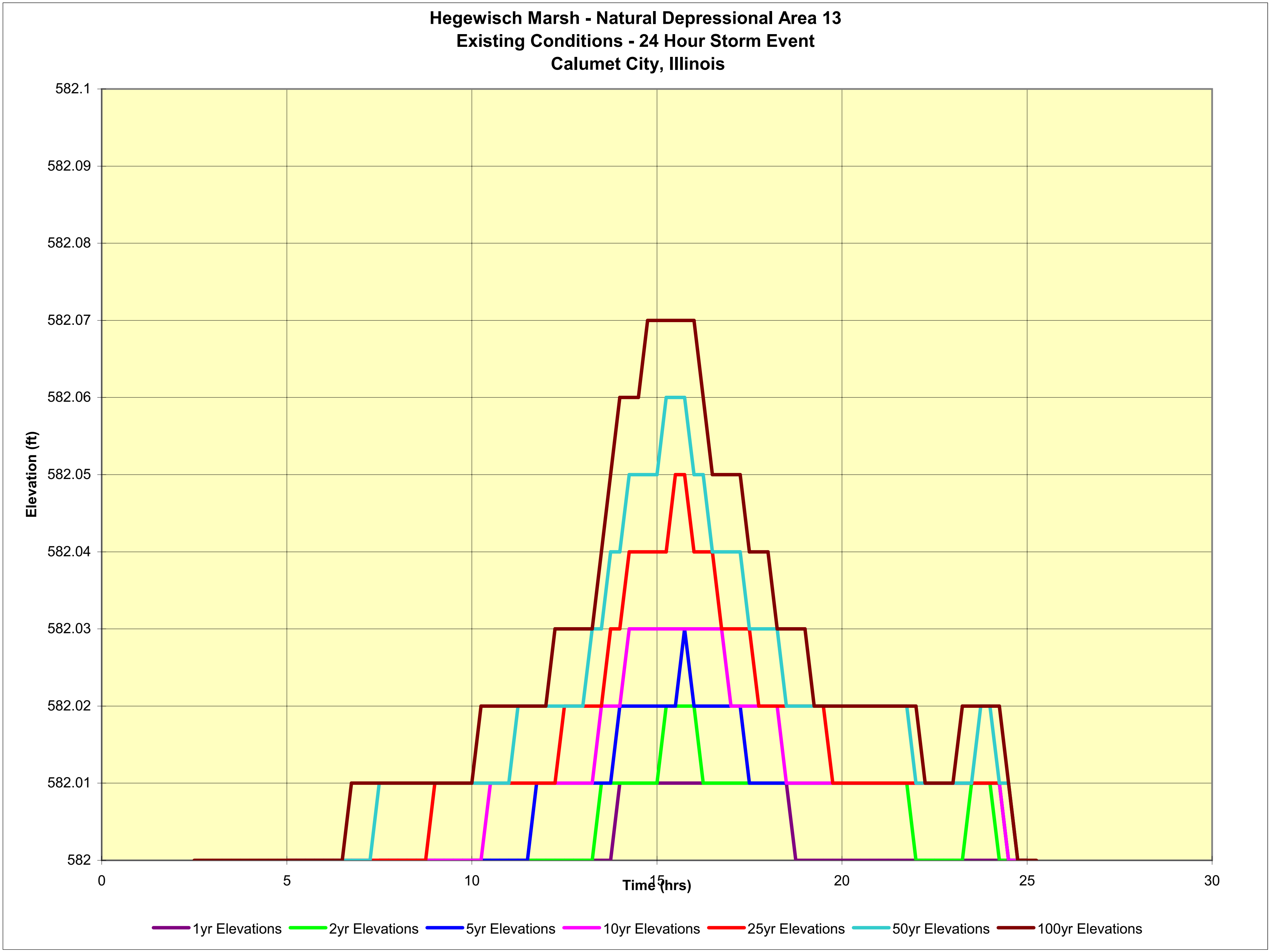
ON-SITE TRIBUTARY AREA				
AREA IDENTIFICATION	EXISTING CONDITION			
	TOTAL Drainage Area		SCS Curve Number	Time of Concentration
	(ac)	(sm)	CN	(hr)
010	6.37	0.0100	65	1.13
011 & 012	55.54	0.0868	68	1.27
013	4.05	0.0063	73	0.48
014	3.36	0.0053	69	0.42
015	9.75	0.0152	65	1.12
016	40.32	0.0630	69	1.24
017	10.99	0.0172	71	0.97
TOTAL	**130.4**	**0.2037**		

APPENDIX III:

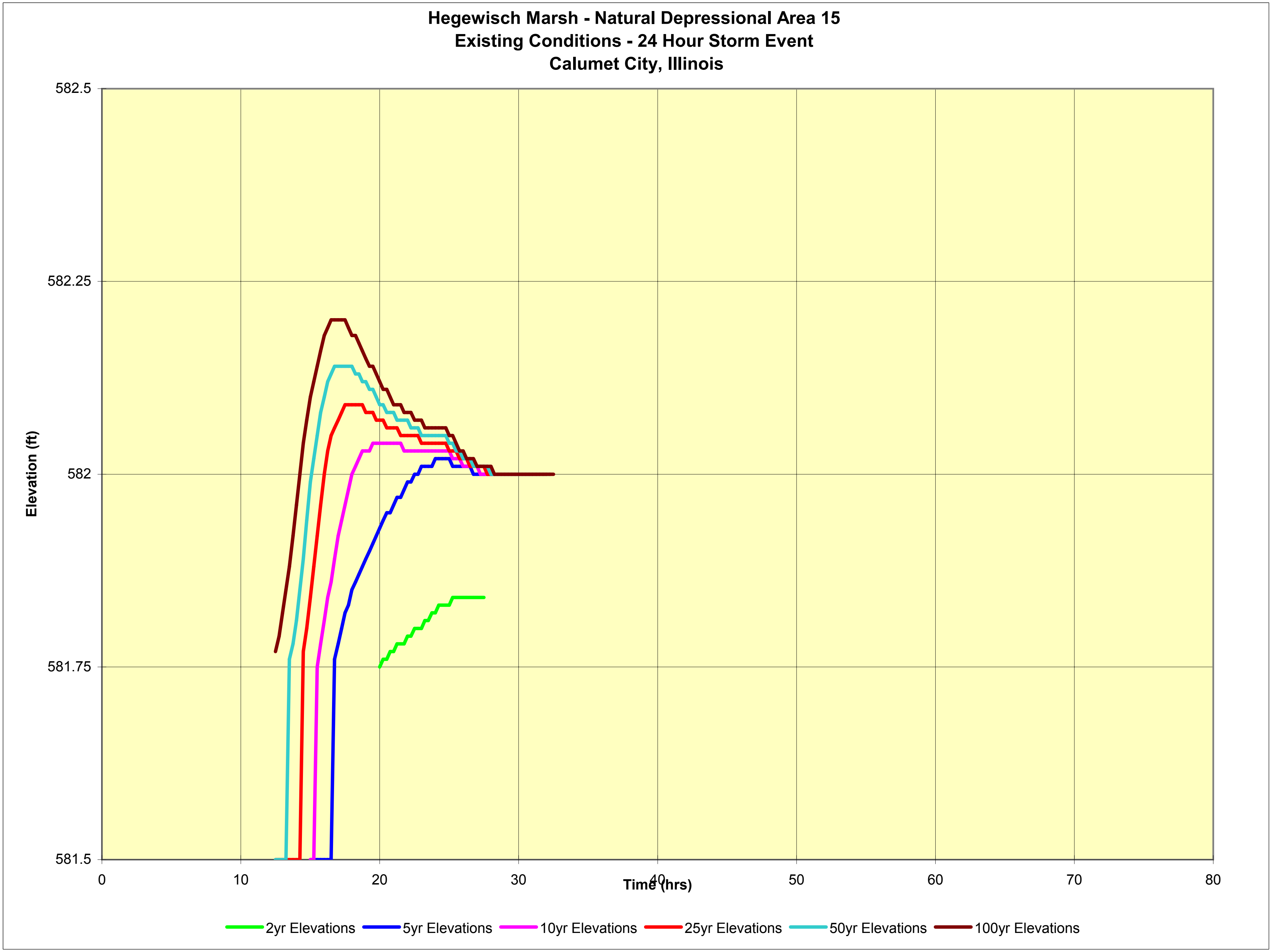
TR-20 HYDROGRAPHS

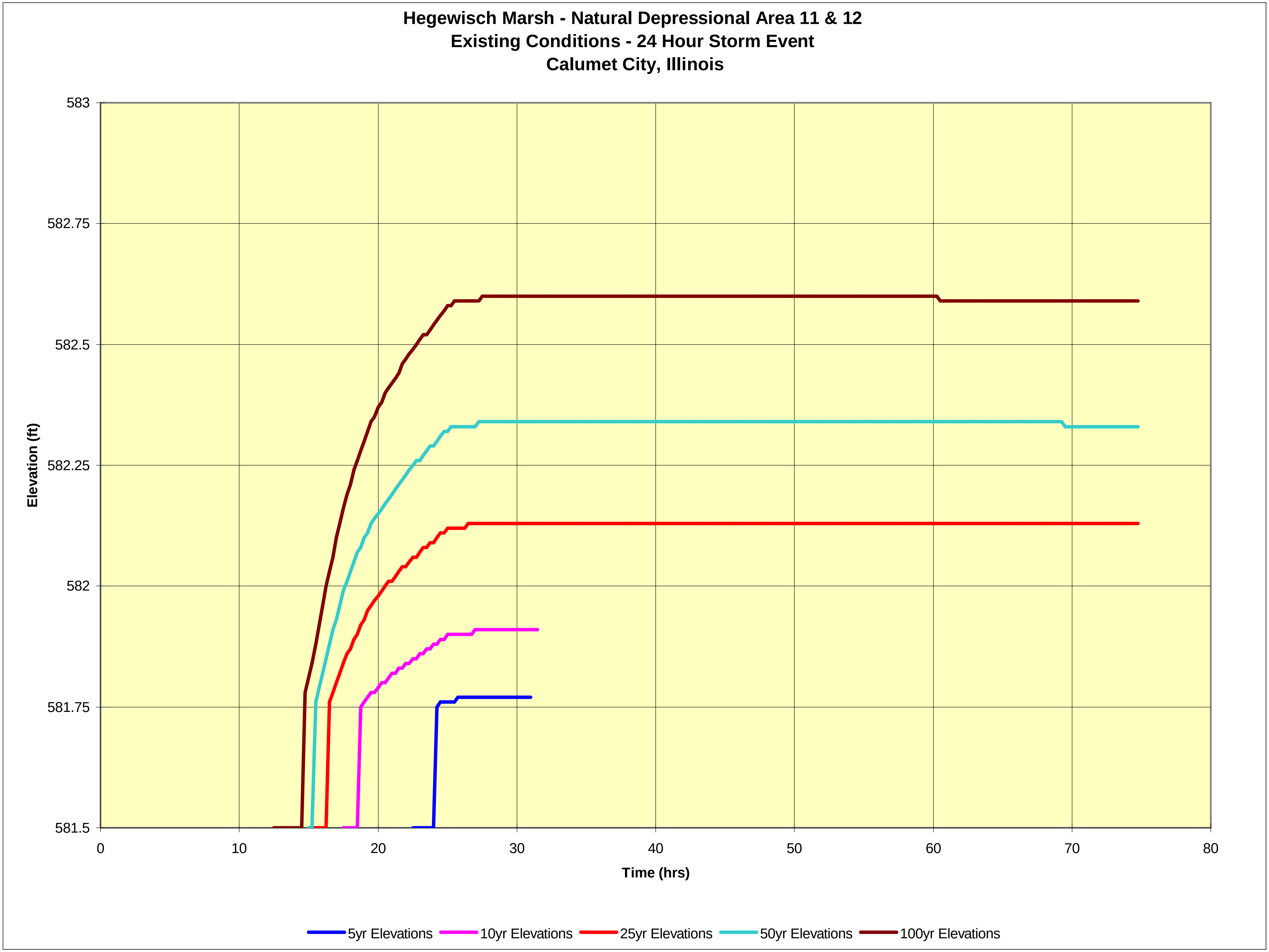


Hegewisch Marsh - Natural Depressional Area 11 & 12
Existing Conditions - 24 Hour Storm Event
Calumet City, Illinois
Elevation (ft)
583
582.75
582.5
582.25
582
581.75
581.5
0
10
20
30
40
50
60
70
80
Time (hrs)
5yr Elevations
10yr Elevations
25yr Elevations
50yr Elevations
100yr Elevations

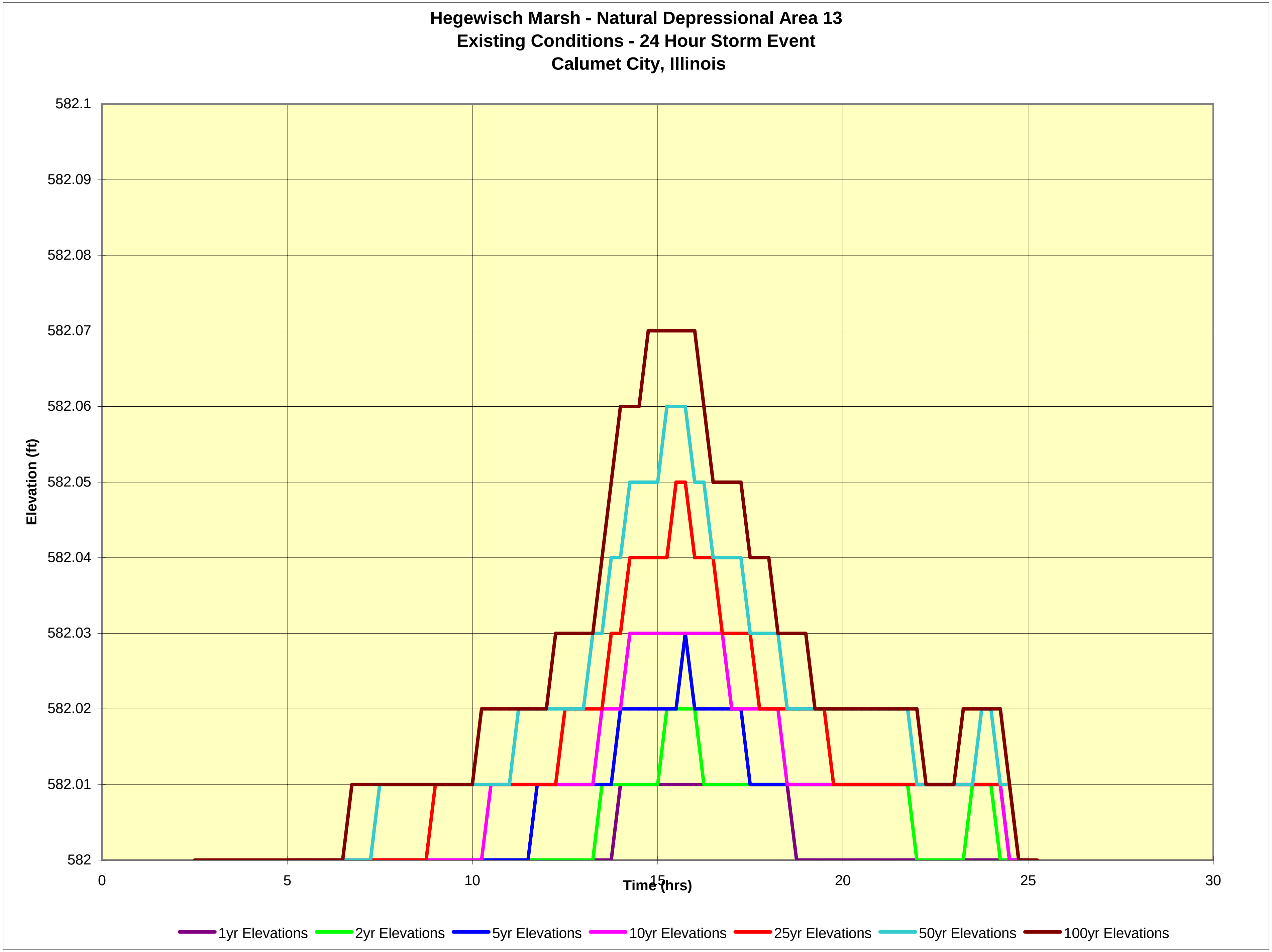


Hegewisch Marsh - Natural Depressional Area 13
Existing Conditions - 24 Hour Storm Event
Calumet City, Illinois
Elevation (ft)
582.1
582.09
582.08
582.07
582.06
582.05
582.04
582.03
582.02
582.01
582
0
5
10
15
20
25
30
Time (hrs)
1yr Elevations
2yr Elevations
5yr Elevations
10yr Elevations
25yr Elevations
50yr Elevations
100yr Elevations

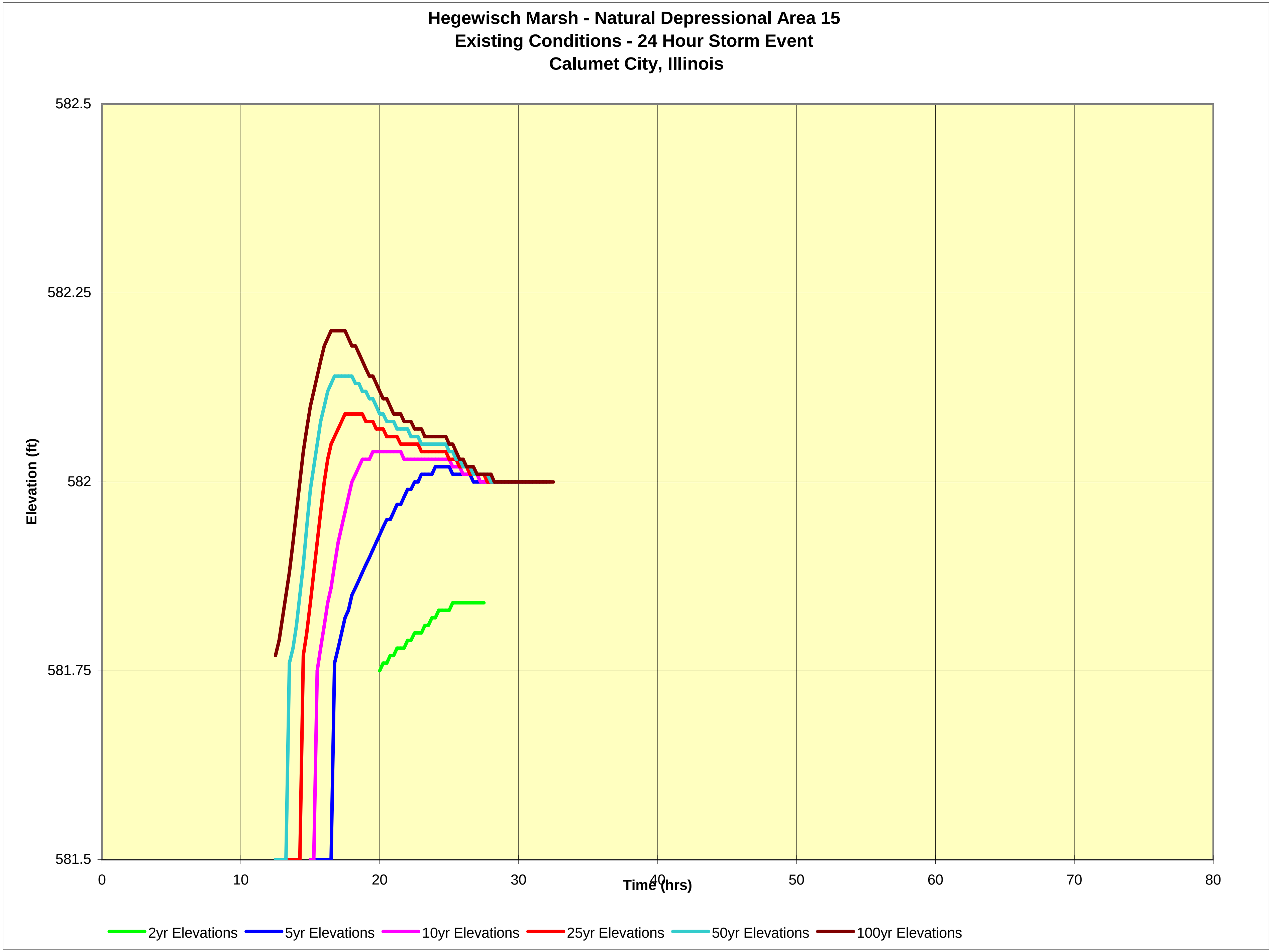

Hegewisch Marsh - Natural Depressional Area 15
Existing Conditions - 24 Hour Storm Event
Calumet City, Illinois
Elevation (ft)
582.5
582.25
582
581.75
581.5
0
10
20
30
40
50
60
70
80
Time (hrs)
2yr Elevations
5yr Elevations
10yr Elevations
25yr Elevations
50yr Elevations
100yr Elevations



Hegewisch Marsh - Natural Depressional Area 11 & 12
Existing Conditions - 24 Hour Storm Event
Calumet City, Illinois
Elevation (ft)
583
582.75
582.5
582.25
582
581.75
581.5
0
10
20
30
40
50
60
70
80
Time (hrs)
5yr Elevations
10yr Elevations
25yr Elevations
50yr Elevations
100yr Elevations



Hegewisch Marsh - Natural Depressional Area 13
Existing Conditions - 24 Hour Storm Event
Calumet City, Illinois
582.1
582.09
582.08
582.07
582.06
582.05
582.04
582.03
582.02
582.01
582
Elevation (ft)
0
5
10
15
20
25
30
Time (hrs)
1yr Elevations
2yr Elevations
5yr Elevations
10yr Elevations
25yr Elevations
50yr Elevations
100yr Elevations


Hegewisch Marsh - Natural Depressional Area 15
Existing Conditions - 24 Hour Storm Event
Calumet City, Illinois
582.5
582.25
582
581.75
581.5
Elevation (ft)
0
10
20
30
40
50
60
70
80
Time (hrs)
2yr Elevations
5yr Elevations
10yr Elevations
25yr Elevations
50yr Elevations
100yr Elevations

APPENDIX IV:

MODEL DOCUMENTATION

```
1


 *****************80-80 LIST OF INPUT DATA FOR TR-20 HYDROLOGY*****************

 JOB TR-20                                          SUMMARY   NOPLOTS
 TITLE 001 HEGEWISCH MARSH HYDROLOGY ANALYSIS-EXISTING CONDITIONS   FILE:EXGW.DAT
 TITLE     CALCS: V3 CONSULTANTS. W/HUFF-ISWS CIR.173/90       DATE:12/10/2004 CA
  3 STRUCT      11
  8                     581.5        0.00         0.0
  8                     582.0        0.01         10.54
  8                     583.0        0.02         33.93
  8                     584.0        0.03         59.28
  9 ENDTBL
  3 STRUCT      13
  8                     582.0        0.0          0.0
  8                     583.0        35.33        0.36
  9 ENDTBL
  3 STRUCT      15
  8                     581.5        0.0          0.0
  8                     582.0        0.01         1.69
  8                     583.0        45.23        6.46
  9 ENDTBL
  5 RAINFL 6            0.05                                            Storm T
  8           0.00      0.16        0.33        0.43        0.52        Huff
  8           0.60      0.66        0.71        0.75        0.79        1st
  8           0.82      0.84        0.86        0.88        0.90        Quartile
  8           0.92      0.94        0.96        0.97        0.98        at a
  8           1.00      1.00        1.00        1.00        1.00        Point
  9 ENDTBL
  5 RAINFL 7            0.05                                            Storm T
  8           0.00      0.03        0.08        0.12        0.16        Huff
  8           0.22      0.29        0.39        0.51        0.62        2nd
  8           0.70      0.76        0.81        0.85        0.88        Quartile
  8           0.91      0.93        0.95        0.97        0.98        at a
  8           1.00      1.00        1.00        1.00        1.00        Point
  9 ENDTBL
  5 RAINFL 8            0.05                                            Storm T
  8           0.00      0.03        0.06        0.09        0.12        Huff
  8           0.15      0.19        0.23        0.27        0.32        3rd
  8           0.38      0.45        0.57        0.70        0.79        Quartile
  8           0.85      0.89        0.92        0.95        0.97        at a
  8           1.00      1.00        1.00        1.00        1.00        Point
  9 ENDTBL
  5 RAINFL 9            0.05                                            Storm T
  8           0.00      0.02        0.05        0.08        0.10        Huff
  8           0.13      0.16        0.19        0.22        0.25        4th
  8           0.28      0.32        0.35        0.39        0.45        Quartile
  8           0.51      0.59        0.72        0.84        0.92        at a
  8           1.00      1.00        1.00        1.00        1.00        Point
  9 ENDTBL
1


 *********************80-80 LIST OF INPUT DATA (CONTINUED)*********************

  6 RUNOFF 1 014       1 .0053       69.         0.42
  6 RUNOFF 1 016       2 .0630       69.         1.24
  6 RUNOFF 1 017       3 .0172       71.         0.97
  6 RUNOFF 1 015       4 .0152       65.         1.12
  6 ADDHYD 4 100   3 4 5
```

```
  6 RESVOR 2    15 5   6                                         1 1 1 1 1 1
  6 RUNOFF 1 013       7 .0063       73.         0.48
  6 RESVOR 2    13 7   3                                         1 1 1 1 1 1
  6 ADDHYD 4 101   6 3 4
  6 RUNOFF 1 011       5 .0868       68.         1.27
  6 ADDHYD 4 103   4 5 6
  6 RESVOR 2    11 6   7                                         1 1 1 1 1 1
  6 RUNOFF 1 010       3 .0100       65.         1.13
  6 ADDHYD 4 104   7 3 4
    ENDATA
  7 INCREM 6             0.25                                                Output
  7 COMPUT 7 014   104               2.51        24.         8 2  01  24  1yr, 24
    ENDCMP 1                                                              Bull. 7
  7 COMPUT 7 014   104               3.04        24.         8 2  02  24  2yr, 24
    ENDCMP 1                                                              Bull. 7
  7 COMPUT 7 014   104               3.80        24.         8 2  05  24  5yr, 24
    ENDCMP 1                                                              Bull. 7
  7 COMPUT 7 014   104               4.47        24.         8 2  10  24  10yr, 2
    ENDCMP 1                                                              Bull.70
  7 COMPUT 7 014   104               5.51        24.         8 2  25  24  25yr, 2
    ENDCMP 1                                                              Bull. 7
  7 COMPUT 7 014   104               6.46        24.         8 2  50  24  50yr, 2
    ENDCMP 1                                                              Bull. 7
  7 COMPUT 7 014   104               7.58        24.         8 2  99  24  100yr,
    ENDCMP 1                                                              Bull.70
    ENDJOB 2
0********************************END OF 80-80 LIST********************************


 EXECUTIVE CONTROL OPERATION INCREM
                             RECORD ID  Output
+                                       MAIN TIME INCREMENT =   .25 HOURS


 EXECUTIVE CONTROL OPERATION COMPUT
                             RECORD ID  1yr, 24
+                                       FROM XSECTION  14
+                                                          TO XSECTION 104
         STARTING TIME =   .00    RAIN DEPTH =  2.51    RAIN DURATION= 24.00    RAIN
TABLE NO.= 8    ANT. MOIST. COND= 2
         ALTERNATE NO.= 1         STORM NO.=24    MAIN TIME INCREMENT =   .25 HOURS

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .10 CFS.

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .33 CFS.

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .21 CFS.

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .54 CFS.


 OPERATION RESVOR   STRUCTURE 15

                                ----- HYDROGRAPH CONTAINS NO FLOW -----


   RUNOFF VOLUME ABOVE BASEFLOW =   .00 WATERSHED INCHES,       .00 CFS-HRS,
.00 ACRE-FEET;   BASEFLOW =    .00 CFS

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .14 CFS.

          *** WARNING - STRUCTURE 13 DELTA T IS TOO LARGE.  O /2 >  S /DELTA T
OCCURED  1 TIMES STARTING WITH POINT102
```

```
 OPERATION RESVOR   STRUCTURE 13

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .14 CFS.

            PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK
ELEVATION(FEET)
               24.00                             .14                        582.00
               15.75                             .39                        582.01

 TIME(HRS)         FIRST HYDROGRAPH POINT =   .00 HOURS      TIME INCREMENT =  .25
HOURS      DRAINAGE AREA =    .01 SQ.MI.
   10.00    DISCHG          .00       .00       .00       .00       .01       .01
  .02       .03       .04       .05
   10.00      ELEV      582.00    582.00    582.00    582.00    582.00    582.00
582.00    582.00    582.00    582.00
   12.50    DISCHG          .06       .07       .08       .09       .12       .17
  .21       .24       .26       .29
   12.50      ELEV      582.00    582.00    582.00    582.00    582.00    582.00
582.01    582.01    582.01    582.01
   15.00    DISCHG          .32       .35       .37       .39       .37       .33
  .32       .32       .32       .28
   15.00      ELEV      582.01    582.01    582.01    582.01    582.01    582.01
582.01    582.01    582.01    582.01
   17.50    DISCHG          .25       .24       .24       .23       .20       .17
  .17       .17       .16       .14
   17.50      ELEV      582.01    582.01    582.01    582.01    582.01    582.00
582.00    582.00    582.00    582.00
   20.00    DISCHG          .13       .13       .13       .13       .13       .13
  .13       .13       .12       .10
   20.00      ELEV      582.00    582.00    582.00    582.00    582.00    582.00
582.00    582.00    582.00    582.00
1


 TR20 XEQ 12-07-04  10:53       HEGEWISCH MARSH HYDROLOGY ANALYSIS-EXISTING
CONDITIONS   FILE:EXGW.DAT             JOB  1   PASS   1
      REV PC 09/83(.2)          CALCS: V3 CONSULTANTS. W/HUFF-ISWS CIR.173/90
DATE:12/10/2004 CA                       PAGE   1


   22.50    DISCHG          .09       .09       .09       .11       .13       .13
  .14       .12       .06       .02
   22.50      ELEV      582.00    582.00    582.00    582.00    582.00    582.00
582.00    582.00    582.00    582.00
   25.00    DISCHG          .00
   25.00      ELEV      582.00

   RUNOFF VOLUME ABOVE BASEFLOW =   .57 WATERSHED INCHES,      2.32 CFS-HRS,
.19 ACRE-FEET;   BASEFLOW =    .00 CFS

                        --- HYDROGRAPH FOR STRUCTURE 13, ALTERNATE  1, STORM 24,
ADDED TO OUTPUT HYDROGRAPH FILE ---

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .14 CFS.


 OPERATION RESVOR   STRUCTURE 11

                                  ----- HYDROGRAPH CONTAINS NO FLOW -----
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```
   RUNOFF VOLUME ABOVE BASEFLOW =   .00 WATERSHED INCHES,       .00 CFS-HRS,
.00 ACRE-FEET;   BASEFLOW =    .00 CFS

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .14 CFS.

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .14 CFS.


 EXECUTIVE CONTROL OPERATION ENDCMP
                              RECORD ID  Bull. 7
+                                        COMPUTATIONS COMPLETED FOR PASS   1




 EXECUTIVE CONTROL OPERATION COMPUT
                              RECORD ID  2yr, 24
+                                        FROM XSECTION  14
+                                                           TO XSECTION 104
         STARTING TIME =   .00    RAIN DEPTH =  3.04    RAIN DURATION= 24.00    RAIN
TABLE NO.= 8    ANT. MOIST. COND= 2
         ALTERNATE NO.= 2         STORM NO.=24    MAIN TIME INCREMENT =   .25 HOURS

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .14 CFS.

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .46 CFS.

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .31 CFS.


 OPERATION RESVOR   STRUCTURE 15

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .01 CFS.

            PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK
ELEVATION(FEET)
               26.25                             .01                        581.84

 TIME(HRS)         FIRST HYDROGRAPH POINT =   .00 HOURS      TIME INCREMENT =  .25
HOURS      DRAINAGE AREA =    .03 SQ.MI.
   20.00    DISCHG         .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
1


 TR20 XEQ 12-07-04  10:53       HEGEWISCH MARSH HYDROLOGY ANALYSIS-EXISTING
CONDITIONS   FILE:EXGW.DAT             JOB  1   PASS   2
      REV PC 09/83(.2)          CALCS: V3 CONSULTANTS. W/HUFF-ISWS CIR.173/90
DATE:12/10/2004 CA                      PAGE   2


   20.00      ELEV      581.75    581.76    581.76    581.77    581.77    581.78
581.78    581.78    581.79    581.79
   22.50    DISCHG         .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   22.50      ELEV      581.80    581.80    581.80    581.81    581.81    581.82
581.82    581.83    581.83    581.83
   25.00    DISCHG         .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   25.00      ELEV      581.83    581.84    581.84    581.84    581.84    581.84
581.84    581.84    581.84    581.84
```

```
   27.50    DISCHG          .01
   27.50      ELEV      581.84

   RUNOFF VOLUME ABOVE BASEFLOW =   .00 WATERSHED INCHES,       .05 CFS-HRS,
.00 ACRE-FEET;   BASEFLOW =    .00 CFS

                        --- HYDROGRAPH FOR STRUCTURE 15, ALTERNATE  2, STORM 24,
ADDED TO OUTPUT HYDROGRAPH FILE ---

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .19 CFS.

          *** WARNING - STRUCTURE 13 DELTA T IS TOO LARGE.  O /2 >  S /DELTA T
OCCURED  1 TIMES STARTING WITH POINT102


 OPERATION RESVOR   STRUCTURE 13

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .19 CFS.

            PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK
ELEVATION(FEET)
               24.00                              .19                      582.01
               15.75                              .59                      582.02

 TIME(HRS)         FIRST HYDROGRAPH POINT =   .00 HOURS      TIME INCREMENT =  .25
HOURS      DRAINAGE AREA =    .01 SQ.MI.
    7.50    DISCHG          .00        .00        .00        .00        .00        .00
  .00        .00        .00        .01
    7.50      ELEV      582.00    582.00    582.00    582.00    582.00    582.00
582.00    582.00    582.00    582.00
   10.00    DISCHG          .02        .03        .03        .04        .05        .06
  .08        .09        .10        .11
   10.00      ELEV      582.00    582.00    582.00    582.00    582.00    582.00
582.00    582.00    582.00    582.00
   12.50    DISCHG          .13        .15        .16        .17        .22        .29
  .35        .39        .42        .46
   12.50      ELEV      582.00    582.00    582.00    582.00    582.01    582.01
582.01    582.01    582.01    582.01
   15.00    DISCHG          .51        .54        .57        .59        .55        .49
  .47        .47        .46        .41
   15.00      ELEV      582.01    582.02    582.02    582.02    582.02    582.01
582.01    582.01    582.01    582.01
   17.50    DISCHG          .36        .34        .34        .32        .28        .25
  .24        .23        .22        .20
   17.50      ELEV      582.01    582.01    582.01    582.01    582.01    582.01
582.01    582.01    582.01    582.01
   20.00    DISCHG          .18        .18        .18        .18        .18        .18
  .18        .18        .16        .14
   20.00      ELEV      582.01    582.01    582.01    582.01    582.01    582.01
582.01    582.01    582.00    582.00
   22.50    DISCHG          .13        .13        .13        .15        .18        .19
  .19        .16        .09        .03
   22.50      ELEV      582.00    582.00    582.00    582.00    582.01    582.01
582.01    582.00    582.00    582.00
   25.00    DISCHG          .01        .00
   25.00      ELEV      582.00    582.00

   RUNOFF VOLUME ABOVE BASEFLOW =   .88 WATERSHED INCHES,      3.58 CFS-HRS,
.30 ACRE-FEET;   BASEFLOW =    .00 CFS

                        --- HYDROGRAPH FOR STRUCTURE 13, ALTERNATE  2, STORM 24,
ADDED TO OUTPUT HYDROGRAPH FILE ---
```

```
 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .01 CFS.
1


 TR20 XEQ 12-07-04  10:53       HEGEWISCH MARSH HYDROLOGY ANALYSIS-EXISTING
CONDITIONS   FILE:EXGW.DAT              JOB  1   PASS   2
      REV PC 09/83(.2)          CALCS: V3 CONSULTANTS. W/HUFF-ISWS CIR.173/90
DATE:12/10/2004 CA                       PAGE   3



 OPERATION RESVOR   STRUCTURE 11

                                 ----- HYDROGRAPH CONTAINS NO FLOW -----


   RUNOFF VOLUME ABOVE BASEFLOW =   .00 WATERSHED INCHES,       .00 CFS-HRS,
.00 ACRE-FEET;   BASEFLOW =    .00 CFS

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .21 CFS.

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .21 CFS.


 EXECUTIVE CONTROL OPERATION ENDCMP
                              RECORD ID  Bull. 7
+                                        COMPUTATIONS COMPLETED FOR PASS   2




 EXECUTIVE CONTROL OPERATION COMPUT
                              RECORD ID  5yr, 24
+                                        FROM XSECTION  14
+                                                          TO XSECTION 104
         STARTING TIME =   .00    RAIN DEPTH =  3.80    RAIN DURATION= 24.00    RAIN
TABLE NO.= 8    ANT. MOIST. COND= 2
         ALTERNATE NO.= 5         STORM NO.=24    MAIN TIME INCREMENT =   .25 HOURS

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .20 CFS.

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .48 CFS.


 OPERATION RESVOR   STRUCTURE 15

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .81 CFS.

            PEAK TIME(HRS)             PEAK DISCHARGE(CFS)           PEAK
ELEVATION(FEET)
               24.50                            .81                       582.02

 TIME(HRS)         FIRST HYDROGRAPH POINT =   .00 HOURS      TIME INCREMENT =  .25
HOURS      DRAINAGE AREA =    .03 SQ.MI.
   15.00    DISCHG         .00       .00       .00       .00       .00       .00
  .00       .01       .01       .01
   15.00      ELEV      581.50    581.50    581.50    581.50    581.50    581.50
581.50    581.76    581.78    581.80
   17.50    DISCHG         .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   17.50      ELEV      581.82    581.83    581.85    581.86    581.87    581.88
```

```
581.89    581.90    581.91    581.92
   20.00    DISCHG         .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   20.00      ELEV      581.93    581.94    581.95    581.95    581.96    581.97
581.97    581.98    581.99    581.99
   22.50    DISCHG         .03       .18       .30       .40       .50       .60
  .69       .77       .81       .79
   22.50      ELEV      582.00    582.00    582.01    582.01    582.01    582.01
582.02    582.02    582.02    582.02
   25.00    DISCHG         .73       .65       .56       .47       .40       .33
  .27       .22       .18       .15
   25.00      ELEV      582.02    582.01    582.01    582.01    582.01    582.01
582.01    582.00    582.00    582.00
   27.50    DISCHG         .12       .10       .08       .07       .06       .05
  .04       .03       .03       .02
   27.50      ELEV      582.00    582.00    582.00    582.00    582.00    582.00
582.00    582.00    582.00    582.00
   30.00    DISCHG         .02       .01       .01       .01       .01
1


 TR20 XEQ 12-07-04  10:53       HEGEWISCH MARSH HYDROLOGY ANALYSIS-EXISTING
CONDITIONS   FILE:EXGW.DAT             JOB  1   PASS   3
      REV PC 09/83(.2)          CALCS: V3 CONSULTANTS. W/HUFF-ISWS CIR.173/90
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   30.00      ELEV      582.00    582.00    582.00    582.00    582.00

   RUNOFF VOLUME ABOVE BASEFLOW =   .12 WATERSHED INCHES,      2.47 CFS-HRS,
.20 ACRE-FEET;   BASEFLOW =    .00 CFS

                        --- HYDROGRAPH FOR STRUCTURE 15, ALTERNATE  5, STORM 24,
ADDED TO OUTPUT HYDROGRAPH FILE ---

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .27 CFS.

          *** WARNING - STRUCTURE 13 DELTA T IS TOO LARGE.  O /2 >  S /DELTA T
OCCURED  1 TIMES STARTING WITH POINT102


 OPERATION RESVOR   STRUCTURE 13

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .27 CFS.

            PEAK TIME(HRS)               PEAK DISCHARGE(CFS)           PEAK
ELEVATION(FEET)
               24.00                               .27                        582.01
               15.75                               .89                        582.03

 TIME(HRS)         FIRST HYDROGRAPH POINT =   .00 HOURS      TIME INCREMENT =  .25
HOURS      DRAINAGE AREA =    .01 SQ.MI.
    7.50    DISCHG         .00       .00       .01       .01       .02       .03
  .04       .05       .05       .06
    7.50      ELEV      582.00    582.00    582.00    582.00    582.00    582.00
582.00    582.00    582.00    582.00
   10.00    DISCHG         .08       .09       .10       .12       .13       .15
  .17       .19       .20       .22
   10.00      ELEV      582.00    582.00    582.00    582.00    582.00    582.00
582.00    582.01    582.01    582.01
   12.50    DISCHG         .25       .28       .29       .31       .38       .50
  .59       .65       .69       .74
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   12.50      ELEV      582.01    582.01    582.01    582.01    582.01    582.01
582.02    582.02    582.02    582.02
   15.00    DISCHG         .80       .84       .88       .89       .83       .73
  .69       .69       .68       .60
   15.00      ELEV      582.02    582.02    582.02    582.03    582.02    582.02
582.02    582.02    582.02    582.02
   17.50    DISCHG         .52       .49       .49       .47       .41       .36
  .34       .34       .32       .29
   17.50      ELEV      582.01    582.01    582.01    582.01    582.01    582.01
582.01    582.01    582.01    582.01
   20.00    DISCHG         .27       .26       .26       .26       .26       .26
  .26       .26       .23       .20
   20.00      ELEV      582.01    582.01    582.01    582.01    582.01    582.01
582.01    582.01    582.01    582.01
   22.50    DISCHG         .18       .18       .19       .22       .25       .26
  .27       .23       .13       .04
   22.50      ELEV      582.01    582.01    582.01    582.01    582.01    582.01
582.01    582.01    582.00    582.00
   25.00    DISCHG         .01       .00
   25.00      ELEV      582.00    582.00

   RUNOFF VOLUME ABOVE BASEFLOW =  1.38 WATERSHED INCHES,      5.63 CFS-HRS,
.46 ACRE-FEET;   BASEFLOW =    .00 CFS

                        --- HYDROGRAPH FOR STRUCTURE 13, ALTERNATE  5, STORM 24,
ADDED TO OUTPUT HYDROGRAPH FILE ---

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =        1.00 CFS.


 OPERATION RESVOR   STRUCTURE 11

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .01 CFS.
1



 TR20 XEQ 12-07-04  10:53       HEGEWISCH MARSH HYDROLOGY ANALYSIS-EXISTING
CONDITIONS   FILE:EXGW.DAT             JOB  1   PASS   3
      REV PC 09/83(.2)          CALCS: V3 CONSULTANTS. W/HUFF-ISWS CIR.173/90
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            PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK
ELEVATION(FEET)
               31.00                             .01                         581.77

 TIME(HRS)         FIRST HYDROGRAPH POINT =   .00 HOURS      TIME INCREMENT =  .25
HOURS      DRAINAGE AREA =    .13 SQ.MI.
   22.50    DISCHG         .00       .00       .00       .00       .00       .00
  .00       .01       .01       .01
   22.50      ELEV      581.50    581.50    581.50    581.50    581.50    581.50
581.50    581.75    581.76    581.76
   25.00    DISCHG         .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   25.00      ELEV      581.76    581.76    581.76    581.77    581.77    581.77
581.77    581.77    581.77    581.77
   27.50    DISCHG         .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   27.50      ELEV      581.77    581.77    581.77    581.77    581.77    581.77
581.77    581.77    581.77    581.77
   30.00    DISCHG         .01       .01       .01       .01       .01
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   30.00      ELEV      581.77    581.77    581.77    581.77    581.77

   RUNOFF VOLUME ABOVE BASEFLOW =   .00 WATERSHED INCHES,       .04 CFS-HRS,
.00 ACRE-FEET;   BASEFLOW =    .00 CFS

                        --- HYDROGRAPH FOR STRUCTURE 11, ALTERNATE  5, STORM 24,
ADDED TO OUTPUT HYDROGRAPH FILE ---

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .31 CFS.

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .01 CFS.


 EXECUTIVE CONTROL OPERATION ENDCMP
                             RECORD ID  Bull. 7
+                                       COMPUTATIONS COMPLETED FOR PASS   3




 EXECUTIVE CONTROL OPERATION COMPUT
                             RECORD ID  10yr, 2
+                                       FROM XSECTION  14
+                                                          TO XSECTION 104
         STARTING TIME =   .00    RAIN DEPTH =  4.47    RAIN DURATION= 24.00    RAIN
TABLE NO.= 8    ANT. MOIST. COND= 2
         ALTERNATE NO.=10         STORM NO.=24    MAIN TIME INCREMENT =   .25 HOURS

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .26 CFS.


 OPERATION RESVOR   STRUCTURE 15

            PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK
ELEVATION(FEET)
               24.27                           1.36                         582.03
               20.00                           1.71                         582.04

 TIME(HRS)         FIRST HYDROGRAPH POINT =   .00 HOURS      TIME INCREMENT =  .25
HOURS      DRAINAGE AREA =    .03 SQ.MI.
   15.00    DISCHG         .00       .00       .01       .01       .01       .01
  .01       .01       .01       .01
   15.00      ELEV      581.50    581.50    581.75    581.78    581.81    581.84
581.86    581.89    581.92    581.94
   17.50    DISCHG         .01       .01       .03       .56       .95      1.23
 1.42      1.55      1.64      1.69
   17.50      ELEV      581.96    581.98    582.00    582.01    582.02    582.03
582.03    582.03    582.04    582.04
   20.00    DISCHG        1.71      1.70      1.68      1.66      1.63      1.61
 1.60      1.58      1.56      1.53
   20.00      ELEV      582.04    582.04    582.04    582.04    582.04    582.04
582.04    582.03    582.03    582.03
   22.50    DISCHG        1.48      1.43      1.37      1.33      1.31      1.32
 1.34      1.36      1.34      1.27
1


 TR20 XEQ 12-07-04  10:53       HEGEWISCH MARSH HYDROLOGY ANALYSIS-EXISTING
CONDITIONS   FILE:EXGW.DAT             JOB  1   PASS   4
      REV PC 09/83(.2)          CALCS: V3 CONSULTANTS. W/HUFF-ISWS CIR.173/90
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   22.50      ELEV      582.03    582.03    582.03    582.03    582.03    582.03
582.03   582.03   582.03   582.03
   25.00    DISCHG        1.15      1.01       .86       .72       .60       .50
  .42       .34       .28       .23
   25.00      ELEV      582.03    582.02    582.02    582.02    582.01    582.01
582.01   582.01   582.01   582.00
   27.50    DISCHG         .19       .16       .13       .11       .09       .07
  .06       .05       .04       .03
   27.50      ELEV      582.00    582.00    582.00    582.00    582.00    582.00
582.00   582.00   582.00   582.00
   30.00    DISCHG         .03       .02       .02       .01       .01       .01
  .01
   30.00      ELEV      582.00    582.00    582.00    582.00    582.00    582.00
582.00

   RUNOFF VOLUME ABOVE BASEFLOW =   .55 WATERSHED INCHES,     11.53 CFS-HRS,
.95 ACRE-FEET;   BASEFLOW =    .00 CFS

                        --- HYDROGRAPH FOR STRUCTURE 15, ALTERNATE 10, STORM 24,
ADDED TO OUTPUT HYDROGRAPH FILE ---

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .34 CFS.


 OPERATION RESVOR   STRUCTURE 13

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .34 CFS.

         PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK
ELEVATION(FEET)
               24.00                             .34                        582.01
               15.75                            1.18                        582.03

 TIME(HRS)         FIRST HYDROGRAPH POINT =   .00 HOURS      TIME INCREMENT =  .25
HOURS      DRAINAGE AREA =    .01 SQ.MI.
    5.00    DISCHG         .00       .00       .00       .00       .00       .00
  .00       .00       .00       .01
    5.00      ELEV      582.00    582.00    582.00    582.00    582.00    582.00
582.00   582.00   582.00   582.00
    7.50    DISCHG         .03       .04       .05       .06       .07       .08
  .09       .10       .11       .12
    7.50      ELEV      582.00    582.00    582.00    582.00    582.00    582.00
582.00   582.00   582.00   582.00
   10.00    DISCHG         .14       .16       .18       .19       .21       .24
  .27       .29       .31       .33
   10.00      ELEV      582.00    582.00    582.01    582.01    582.01    582.01
582.01   582.01   582.01   582.01
   12.50    DISCHG         .37       .40       .42       .45       .53       .70
  .83       .89       .94      1.00
   12.50      ELEV      582.01    582.01    582.01    582.01    582.02    582.02
582.02   582.03   582.03   582.03
   15.00    DISCHG        1.07      1.12      1.16      1.18      1.09       .96
  .90       .90       .88       .78
   15.00      ELEV      582.03    582.03    582.03    582.03    582.03    582.03
582.03   582.03   582.02   582.02
   17.50    DISCHG         .67       .64       .63       .60       .52       .46
  .44       .43       .41       .37
   17.50      ELEV      582.02    582.02    582.02    582.02    582.01    582.01
582.01   582.01   582.01   582.01
   20.00    DISCHG         .34       .33       .33       .33       .33       .33
  .33       .33       .29       .25
   20.00      ELEV      582.01    582.01    582.01    582.01    582.01    582.01
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582.01    582.01    582.01    582.01
   22.50    DISCHG          .23        .23        .24        .28        .32        .33
  .34       .29       .16       .05
   22.50      ELEV      582.01    582.01    582.01    582.01    582.01    582.01
582.01    582.01    582.00    582.00
   25.00    DISCHG          .01        .00
   25.00      ELEV      582.00    582.00

   RUNOFF VOLUME ABOVE BASEFLOW =  1.87 WATERSHED INCHES,      7.61 CFS-HRS,
.63 ACRE-FEET;   BASEFLOW =    .00 CFS

                        --- HYDROGRAPH FOR STRUCTURE 13, ALTERNATE 10, STORM 24,
ADDED TO OUTPUT HYDROGRAPH FILE ---


 OPERATION RESVOR   STRUCTURE 11
1


 TR20 XEQ 12-07-04  10:53       HEGEWISCH MARSH HYDROLOGY ANALYSIS-EXISTING
CONDITIONS   FILE:EXGW.DAT             JOB  1   PASS   4
      REV PC 09/83(.2)          CALCS: V3 CONSULTANTS. W/HUFF-ISWS CIR.173/90
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 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .01 CFS.

            PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK
ELEVATION(FEET)
               31.50                            .01                        581.91

 TIME(HRS)         FIRST HYDROGRAPH POINT =   .00 HOURS      TIME INCREMENT =  .25
HOURS      DRAINAGE AREA =    .13 SQ.MI.
   17.50    DISCHG          .00        .00        .00        .00        .00        .01
  .01       .01       .01       .01
   17.50      ELEV      581.50    581.50    581.50    581.50    581.50    581.75
581.76    581.77    581.78    581.78
   20.00    DISCHG          .01        .01        .01        .01        .01        .01
  .01       .01       .01       .01
   20.00      ELEV      581.79    581.80    581.80    581.81    581.82    581.82
581.83    581.83    581.84    581.84
   22.50    DISCHG          .01        .01        .01        .01        .01        .01
  .01       .01       .01       .01
   22.50      ELEV      581.85    581.85    581.86    581.86    581.87    581.87
581.88    581.88    581.89    581.89
   25.00    DISCHG          .01        .01        .01        .01        .01        .01
  .01       .01       .01       .01
   25.00      ELEV      581.90    581.90    581.90    581.90    581.90    581.90
581.90    581.90    581.91    581.91
   27.50    DISCHG          .01        .01        .01        .01        .01        .01
  .01       .01       .01       .01
   27.50      ELEV      581.91    581.91    581.91    581.91    581.91    581.91
581.91    581.91    581.91    581.91
   30.00    DISCHG          .01        .01        .01        .01        .01        .01
  .01
   30.00      ELEV      581.91    581.91    581.91    581.91    581.91    581.91
581.91

   RUNOFF VOLUME ABOVE BASEFLOW =   .00 WATERSHED INCHES,       .10 CFS-HRS,
.01 ACRE-FEET;   BASEFLOW =    .00 CFS
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                       --- HYDROGRAPH FOR STRUCTURE 11, ALTERNATE 10, STORM 24,
ADDED TO OUTPUT HYDROGRAPH FILE ---

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .41 CFS.

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .01 CFS.


 EXECUTIVE CONTROL OPERATION ENDCMP
                             RECORD ID  Bull.70
+                                       COMPUTATIONS COMPLETED FOR PASS   4




 EXECUTIVE CONTROL OPERATION COMPUT
                             RECORD ID  25yr, 2
+                                       FROM XSECTION  14
+                                                           TO XSECTION 104
         STARTING TIME =   .00    RAIN DEPTH =  5.51    RAIN DURATION= 24.00    RAIN
TABLE NO.= 8    ANT. MOIST. COND= 2
         ALTERNATE NO.=25         STORM NO.=24    MAIN TIME INCREMENT =   .25 HOURS

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .35 CFS.


 OPERATION RESVOR   STRUCTURE 15

           PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK
ELEVATION(FEET)
              18.08                           4.16                          582.09
              24.23                           1.88                          582.04

 TIME(HRS)         FIRST HYDROGRAPH POINT =   .00 HOURS      TIME INCREMENT =  .25
HOURS      DRAINAGE AREA =    .03 SQ.MI.
   12.50    DISCHG         .00        .00        .00        .00        .00        .00
  .00       .00        .01        .01
1



 TR20 XEQ 12-07-04  10:53       HEGEWISCH MARSH HYDROLOGY ANALYSIS-EXISTING
CONDITIONS   FILE:EXGW.DAT             JOB  1   PASS   5
      REV PC 09/83(.2)          CALCS: V3 CONSULTANTS. W/HUFF-ISWS CIR.173/90
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   12.50      ELEV      581.50    581.50    581.50    581.50    581.50    581.50
581.50    581.50    581.77    581.80
   15.00    DISCHG         .01        .01        .01        .01        .05       1.25
 2.16      2.85      3.37      3.76
   15.00      ELEV      581.84    581.88    581.92    581.96    582.00    582.03
582.05    582.06    582.07    582.08
   17.50    DISCHG        4.00       4.12       4.16       4.15       4.10       4.00
 3.85      3.70      3.54      3.38
   17.50      ELEV      582.09    582.09    582.09    582.09    582.09    582.09
582.08    582.08    582.08    582.07
   20.00    DISCHG        3.22       3.05       2.90       2.76       2.64       2.54
 2.46      2.39      2.33      2.25
   20.00      ELEV      582.07    582.07    582.06    582.06    582.06    582.06
582.05    582.05    582.05    582.05
   22.50    DISCHG        2.15       2.05       1.96       1.88       1.85       1.84
 1.86      1.88      1.86      1.76
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   22.50      ELEV      582.05    582.05    582.04    582.04    582.04    582.04
582.04    582.04    582.04    582.04
   25.00    DISCHG        1.59      1.38      1.18      1.00       .83       .69
  .57       .47       .39       .32
   25.00      ELEV      582.03    582.03    582.03    582.02    582.02    582.02
582.01    582.01    582.01    582.01
   27.50    DISCHG         .26       .21       .18       .14       .12       .10
  .08       .07       .05       .04
   27.50      ELEV      582.01    582.00    582.00    582.00    582.00    582.00
582.00    582.00    582.00    582.00
   30.00    DISCHG         .04       .03       .02       .02       .02       .01
  .01       .01       .01
   30.00      ELEV      582.00    582.00    582.00    582.00    582.00    582.00
582.00    582.00    582.00

   RUNOFF VOLUME ABOVE BASEFLOW =  1.29 WATERSHED INCHES,     27.01 CFS-HRS,
2.23 ACRE-FEET;   BASEFLOW =    .00 CFS

                        --- HYDROGRAPH FOR STRUCTURE 15, ALTERNATE 25, STORM 24,
ADDED TO OUTPUT HYDROGRAPH FILE ---

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .45 CFS.


 OPERATION RESVOR   STRUCTURE 13

            PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK
ELEVATION(FEET)
               15.65                             1.65                        582.05

 TIME(HRS)         FIRST HYDROGRAPH POINT =   .00 HOURS      TIME INCREMENT =  .25
HOURS      DRAINAGE AREA =    .01 SQ.MI.
    5.00    DISCHG         .00       .00       .00       .00       .01       .02
  .03       .05       .07       .08
    5.00      ELEV      582.00    582.00    582.00    582.00    582.00    582.00
582.00    582.00    582.00    582.00
    7.50    DISCHG         .10       .11       .13       .14       .15       .17
  .18       .19       .20       .22
    7.50      ELEV      582.00    582.00    582.00    582.00    582.00    582.00
582.01    582.01    582.01    582.01
   10.00    DISCHG         .25       .28       .31       .33       .35       .39
  .43       .46       .48       .51
   10.00      ELEV      582.01    582.01    582.01    582.01    582.01    582.01
582.01    582.01    582.01    582.01
   12.50    DISCHG         .57       .62       .64       .67       .79      1.03
 1.21      1.29      1.35      1.42
   12.50      ELEV      582.02    582.02    582.02    582.02    582.02    582.03
582.03    582.04    582.04    582.04
   15.00    DISCHG        1.51      1.58      1.62      1.64      1.50      1.32
 1.24      1.23      1.20      1.06
   15.00      ELEV      582.04    582.04    582.05    582.05    582.04    582.04
582.04    582.03    582.03    582.03
   17.50    DISCHG         .91       .86       .85       .81       .70       .61
  .59       .58       .55       .49
   17.50      ELEV      582.03    582.02    582.02    582.02    582.02    582.02
582.02    582.02    582.02    582.01
   20.00    DISCHG         .45       .44       .44       .44       .44       .44
  .44       .44       .39       .33
   20.00      ELEV      582.01    582.01    582.01    582.01    582.01    582.01
582.01    582.01    582.01    582.01
   22.50    DISCHG         .31       .30       .31       .37       .42       .44
  .45       .39       .21       .06
   22.50      ELEV      582.01    582.01    582.01    582.01    582.01    582.01
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582.01    582.01    582.01    582.00
   25.00    DISCHG         .02       .00
   25.00      ELEV      582.00    582.00

   RUNOFF VOLUME ABOVE BASEFLOW =  2.68 WATERSHED INCHES,     10.91 CFS-HRS,
.90 ACRE-FEET;   BASEFLOW =    .00 CFS
1


 TR20 XEQ 12-07-04  10:53       HEGEWISCH MARSH HYDROLOGY ANALYSIS-EXISTING
CONDITIONS   FILE:EXGW.DAT             JOB  1   PASS   5
      REV PC 09/83(.2)          CALCS: V3 CONSULTANTS. W/HUFF-ISWS CIR.173/90
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                          --- HYDROGRAPH FOR STRUCTURE 13, ALTERNATE 25, STORM 24,
ADDED TO OUTPUT HYDROGRAPH FILE ---


 OPERATION RESVOR   STRUCTURE 11

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .01 CFS.

            PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK
ELEVATION(FEET)
               31.50                            .01                      582.13

 TIME(HRS)         FIRST HYDROGRAPH POINT =   .00 HOURS      TIME INCREMENT =  .25
HOURS      DRAINAGE AREA =    .13 SQ.MI.
   15.00    DISCHG         .00       .00       .00       .00       .00       .00
  .01       .01       .01       .01
   15.00      ELEV      581.50    581.50    581.50    581.50    581.50    581.50
581.76    581.78    581.80    581.82
   17.50    DISCHG         .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   17.50      ELEV      581.84    581.86    581.87    581.89    581.90    581.92
581.93    581.95    581.96    581.97
   20.00    DISCHG         .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   20.00      ELEV      581.98    581.99    582.00    582.01    582.01    582.02
582.03    582.04    582.05    582.05
   22.50    DISCHG         .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   22.50      ELEV      582.06    582.06    582.07    582.08    582.08    582.09
582.09    582.10    582.11    582.11
   25.00    DISCHG         .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   25.00      ELEV      582.12    582.12    582.12    582.12    582.12    582.12
582.13    582.13    582.13    582.13
   27.50    DISCHG         .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   27.50      ELEV      582.13    582.13    582.13    582.13    582.13    582.13
582.13    582.13    582.13    582.13
   30.00    DISCHG         .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   30.00      ELEV      582.13    582.13    582.13    582.13    582.13    582.13
582.13    582.13    582.13    582.13
   32.50    DISCHG         .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   32.50      ELEV      582.13    582.13    582.13    582.13    582.13    582.13
582.13    582.13    582.13    582.13
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   35.00    DISCHG          .01         .01         .01         .01         .01         .01
  .01       .01       .01       .01
   35.00      ELEV      582.13    582.13    582.13    582.13    582.13    582.13
582.13    582.13    582.13    582.13
   37.50    DISCHG          .01         .01         .01         .01         .01         .01
  .01       .01       .01       .01
   37.50      ELEV      582.13    582.13    582.13    582.13    582.13    582.13
582.13    582.13    582.13    582.13
   40.00    DISCHG          .01         .01         .01         .01         .01         .01
  .01       .01       .01       .01
   40.00      ELEV      582.13    582.13    582.13    582.13    582.13    582.13
582.13    582.13    582.13    582.13
   42.50    DISCHG          .01         .01         .01         .01         .01         .01
  .01       .01       .01       .01
   42.50      ELEV      582.13    582.13    582.13    582.13    582.13    582.13
582.13    582.13    582.13    582.13
   45.00    DISCHG          .01         .01         .01         .01         .01         .01
  .01       .01       .01       .01
   45.00      ELEV      582.13    582.13    582.13    582.13    582.13    582.13
582.13    582.13    582.13    582.13
   47.50    DISCHG          .01         .01         .01         .01         .01         .01
  .01       .01       .01       .01
   47.50      ELEV      582.13    582.13    582.13    582.13    582.13    582.13
582.13    582.13    582.13    582.13
   50.00    DISCHG          .01         .01         .01         .01         .01         .01
  .01       .01       .01       .01
   50.00      ELEV      582.13    582.13    582.13    582.13    582.13    582.13
582.13    582.13    582.13    582.13
   52.50    DISCHG          .01         .01         .01         .01         .01         .01
  .01       .01       .01       .01
   52.50      ELEV      582.13    582.13    582.13    582.13    582.13    582.13
582.13    582.13    582.13    582.13
   55.00    DISCHG          .01         .01         .01         .01         .01         .01
  .01       .01       .01       .01
   55.00      ELEV      582.13    582.13    582.13    582.13    582.13    582.13
582.13    582.13    582.13    582.13
   57.50    DISCHG          .01         .01         .01         .01         .01         .01
  .01       .01       .01       .01
   57.50      ELEV      582.13    582.13    582.13    582.13    582.13    582.13
582.13    582.13    582.13    582.13
   60.00    DISCHG          .01         .01         .01         .01         .01         .01
  .01       .01       .01       .01
1


 TR20 XEQ 12-07-04  10:53       HEGEWISCH MARSH HYDROLOGY ANALYSIS-EXISTING
CONDITIONS   FILE:EXGW.DAT             JOB  1   PASS   5
      REV PC 09/83(.2)          CALCS: V3 CONSULTANTS. W/HUFF-ISWS CIR.173/90
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   60.00      ELEV      582.13    582.13    582.13    582.13    582.13    582.13
582.13    582.13    582.13    582.13
   62.50    DISCHG          .01         .01         .01         .01         .01         .01
  .01       .01       .01       .01
   62.50      ELEV      582.13    582.13    582.13    582.13    582.13    582.13
582.13    582.13    582.13    582.13
   65.00    DISCHG          .01         .01         .01         .01         .01         .01
  .01       .01       .01       .01
   65.00      ELEV      582.13    582.13    582.13    582.13    582.13    582.13
582.13    582.13    582.13    582.13
   67.50    DISCHG          .01         .01         .01         .01         .01         .01
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  .01       .01       .01       .01
   67.50      ELEV      582.13    582.13    582.13    582.13    582.13    582.13
582.13    582.13    582.13    582.13
   70.00    DISCHG         .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   70.00      ELEV      582.13    582.13    582.13    582.13    582.13    582.13
582.13    582.13    582.13    582.13
   72.50    DISCHG         .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   72.50      ELEV      582.13    582.13    582.13    582.13    582.13    582.13
582.13    582.13    582.13    582.13

   RUNOFF VOLUME ABOVE BASEFLOW =   .01 WATERSHED INCHES,       .64 CFS-HRS,
.05 ACRE-FEET;   BASEFLOW =    .00 CFS

                        --- HYDROGRAPH FOR STRUCTURE 11, ALTERNATE 25, STORM 24,
ADDED TO OUTPUT HYDROGRAPH FILE ---


 EXECUTIVE CONTROL OPERATION ENDCMP
                             RECORD ID  Bull. 7
+                                       COMPUTATIONS COMPLETED FOR PASS   5




 EXECUTIVE CONTROL OPERATION COMPUT
                             RECORD ID  50yr, 2
+                                       FROM XSECTION  14
+                                                          TO XSECTION 104
         STARTING TIME =   .00    RAIN DEPTH =  6.46    RAIN DURATION= 24.00    RAIN
TABLE NO.= 8    ANT. MOIST. COND= 2
         ALTERNATE NO.=50         STORM NO.=24    MAIN TIME INCREMENT =   .25 HOURS

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .44 CFS.


 OPERATION RESVOR   STRUCTURE 15

           PEAK TIME(HRS)              PEAK DISCHARGE(CFS)          PEAK
ELEVATION(FEET)
              17.38                             6.52                       582.14
              24.22                             2.36                       582.05

 TIME(HRS)         FIRST HYDROGRAPH POINT =   .00 HOURS      TIME INCREMENT =  .25
HOURS      DRAINAGE AREA =    .03 SQ.MI.
   12.50    DISCHG         .00       .00       .00       .00       .01       .01
  .01       .01       .01       .01
   12.50      ELEV      581.50    581.50    581.50    581.50    581.76    581.78
581.81    581.85    581.89    581.94
   15.00    DISCHG         .01      1.06      2.43      3.60      4.58      5.32
 5.83      6.17      6.39      6.51
   15.00      ELEV      581.99    582.02    582.05    582.08    582.10    582.12
582.13    582.14    582.14    582.14
   17.50    DISCHG        6.51      6.40      6.24      6.06      5.85      5.60
 5.32      5.03      4.77      4.51
   17.50      ELEV      582.14    582.14    582.14    582.13    582.13    582.12
582.12    582.11    582.11    582.10
   20.00    DISCHG        4.26      4.01      3.78      3.59      3.41      3.27
 3.15      3.05      2.96      2.85
   20.00      ELEV      582.09    582.09    582.08    582.08    582.08    582.07
582.07    582.07    582.07    582.06
   22.50    DISCHG        2.73      2.59      2.47      2.37      2.32      2.32
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 2.34      2.36      2.32      2.20
   22.50       ELEV      582.06    582.06    582.05    582.05    582.05    582.05
582.05    582.05    582.05    582.05
   25.00    DISCHG         1.98      1.73      1.48      1.24      1.04       .86
  .71       .59       .48       .40
   25.00       ELEV      582.04    582.04    582.03    582.03    582.02    582.02
582.02    582.01    582.01    582.01
   27.50    DISCHG          .33       .27       .22       .18       .15       .12
  .10       .08       .07       .06
1


 TR20 XEQ 12-07-04  10:53       HEGEWISCH MARSH HYDROLOGY ANALYSIS-EXISTING
CONDITIONS   FILE:EXGW.DAT             JOB  1   PASS   6
      REV PC 09/83(.2)          CALCS: V3 CONSULTANTS. W/HUFF-ISWS CIR.173/90
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   27.50       ELEV      582.01    582.01    582.00    582.00    582.00    582.00
582.00    582.00    582.00    582.00
   30.00    DISCHG          .05       .04       .03       .03       .02       .02
  .01       .01       .01       .01
   30.00       ELEV      582.00    582.00    582.00    582.00    582.00    582.00
582.00    582.00    582.00    582.00

   RUNOFF VOLUME ABOVE BASEFLOW =  2.02 WATERSHED INCHES,     42.24 CFS-HRS,
3.49 ACRE-FEET;   BASEFLOW =    .00 CFS

                         --- HYDROGRAPH FOR STRUCTURE 15, ALTERNATE 50, STORM 24,
ADDED TO OUTPUT HYDROGRAPH FILE ---


 OPERATION RESVOR   STRUCTURE 13

            PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK
ELEVATION(FEET)
               15.64                            2.08                        582.06

 TIME(HRS)         FIRST HYDROGRAPH POINT =   .00 HOURS      TIME INCREMENT =  .25
HOURS      DRAINAGE AREA =    .01 SQ.MI.
    5.00    DISCHG          .00       .01       .02       .04       .05       .07
  .09       .12       .14       .16
    5.00       ELEV      582.00    582.00    582.00    582.00    582.00    582.00
582.00    582.00    582.00    582.00
    7.50    DISCHG          .18       .19       .21       .23       .24       .26
  .27       .29       .30       .32
    7.50       ELEV      582.01    582.01    582.01    582.01    582.01    582.01
582.01    582.01    582.01    582.01
   10.00    DISCHG          .36       .41       .44       .46       .49       .54
  .60       .64       .66       .70
   10.00       ELEV      582.01    582.01    582.01    582.01    582.01    582.02
582.02    582.02    582.02    582.02
   12.50    DISCHG          .76       .82       .86       .89      1.05      1.35
 1.57      1.67      1.74      1.83
   12.50       ELEV      582.02    582.02    582.02    582.03    582.03    582.04
582.04    582.05    582.05    582.05
   15.00    DISCHG         1.93      2.01      2.06      2.07      1.89      1.65
 1.55      1.54      1.49      1.32
   15.00       ELEV      582.05    582.06    582.06    582.06    582.05    582.05
582.04    582.04    582.04    582.04
   17.50    DISCHG         1.14      1.07      1.06      1.01       .87       .76
  .72       .72       .68       .61
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   17.50       ELEV      582.03    582.03    582.03    582.03    582.02    582.02
582.02    582.02    582.02    582.02
   20.00    DISCHG          .56       .55       .54       .54       .54       .54
  .55       .54       .48       .41
   20.00       ELEV      582.02    582.02    582.02    582.02    582.02    582.02
582.02    582.02    582.01    582.01
   22.50    DISCHG          .38       .37       .38       .45       .52       .54
  .55       .47       .26       .08
   22.50       ELEV      582.01    582.01    582.01    582.01    582.01    582.02
582.02    582.01    582.01    582.00
   25.00    DISCHG          .02       .00
   25.00       ELEV      582.00    582.00

   RUNOFF VOLUME ABOVE BASEFLOW =  3.47 WATERSHED INCHES,     14.11 CFS-HRS,
1.17 ACRE-FEET;   BASEFLOW =    .00 CFS

                        --- HYDROGRAPH FOR STRUCTURE 13, ALTERNATE 50, STORM 24,
ADDED TO OUTPUT HYDROGRAPH FILE ---


 OPERATION RESVOR   STRUCTURE 11

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .01 CFS.

            PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK
ELEVATION(FEET)
               31.50                              .01                      582.34

 TIME(HRS)         FIRST HYDROGRAPH POINT =   .00 HOURS      TIME INCREMENT =  .25
HOURS      DRAINAGE AREA =    .13 SQ.MI.
   15.00    DISCHG          .00       .00       .01       .01       .01       .01
  .01       .01       .01       .01
   15.00       ELEV      581.50    581.50    581.76    581.79    581.82    581.85
581.88    581.91    581.93    581.96
1



 TR20 XEQ 12-07-04  10:53       HEGEWISCH MARSH HYDROLOGY ANALYSIS-EXISTING
CONDITIONS   FILE:EXGW.DAT             JOB  1   PASS   6
      REV PC 09/83(.2)          CALCS: V3 CONSULTANTS. W/HUFF-ISWS CIR.173/90
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   17.50    DISCHG          .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   17.50       ELEV      581.99    582.01    582.03    582.05    582.07    582.08
582.10    582.11    582.13    582.14
   20.00    DISCHG          .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   20.00       ELEV      582.15    582.16    582.17    582.18    582.19    582.20
582.21    582.22    582.23    582.24
   22.50    DISCHG          .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   22.50       ELEV      582.25    582.26    582.26    582.27    582.28    582.29
582.29    582.30    582.31    582.32
   25.00    DISCHG          .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   25.00       ELEV      582.32    582.33    582.33    582.33    582.33    582.33
582.33    582.33    582.33    582.34
   27.50    DISCHG          .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   27.50       ELEV      582.34    582.34    582.34    582.34    582.34    582.34
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582.34    582.34    582.34    582.34
   30.00    DISCHG        .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   30.00      ELEV     582.34    582.34    582.34    582.34    582.34    582.34
582.34    582.34    582.34    582.34
   32.50    DISCHG        .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   32.50      ELEV     582.34    582.34    582.34    582.34    582.34    582.34
582.34    582.34    582.34    582.34
   35.00    DISCHG        .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   35.00      ELEV     582.34    582.34    582.34    582.34    582.34    582.34
582.34    582.34    582.34    582.34
   37.50    DISCHG        .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   37.50      ELEV     582.34    582.34    582.34    582.34    582.34    582.34
582.34    582.34    582.34    582.34
   40.00    DISCHG        .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   40.00      ELEV     582.34    582.34    582.34    582.34    582.34    582.34
582.34    582.34    582.34    582.34
   42.50    DISCHG        .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   42.50      ELEV     582.34    582.34    582.34    582.34    582.34    582.34
582.34    582.34    582.34    582.34
   45.00    DISCHG        .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   45.00      ELEV     582.34    582.34    582.34    582.34    582.34    582.34
582.34    582.34    582.34    582.34
   47.50    DISCHG        .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   47.50      ELEV     582.34    582.34    582.34    582.34    582.34    582.34
582.34    582.34    582.34    582.34
   50.00    DISCHG        .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   50.00      ELEV     582.34    582.34    582.34    582.34    582.34    582.34
582.34    582.34    582.34    582.34
   52.50    DISCHG        .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   52.50      ELEV     582.34    582.34    582.34    582.34    582.34    582.34
582.34    582.34    582.34    582.34
   55.00    DISCHG        .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   55.00      ELEV     582.34    582.34    582.34    582.34    582.34    582.34
582.34    582.34    582.34    582.34
   57.50    DISCHG        .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   57.50      ELEV     582.34    582.34    582.34    582.34    582.34    582.34
582.34    582.34    582.34    582.34
   60.00    DISCHG        .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   60.00      ELEV     582.34    582.34    582.34    582.34    582.34    582.34
582.34    582.34    582.34    582.34
   62.50    DISCHG        .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   62.50      ELEV     582.34    582.34    582.34    582.34    582.34    582.34
582.34    582.34    582.34    582.34
   65.00    DISCHG        .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   65.00      ELEV     582.34    582.34    582.34    582.34    582.34    582.34
582.34    582.34    582.34    582.34
   67.50    DISCHG        .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
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   67.50      ELEV       582.34    582.34    582.34    582.34    582.34    582.34
582.34    582.34    582.33    582.33
   70.00    DISCHG          .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   70.00      ELEV       582.33    582.33    582.33    582.33    582.33    582.33
582.33    582.33    582.33    582.33
   72.50    DISCHG          .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   72.50      ELEV       582.33    582.33    582.33    582.33    582.33    582.33
582.33    582.33    582.33    582.33

   RUNOFF VOLUME ABOVE BASEFLOW =   .01 WATERSHED INCHES,       .77 CFS-HRS,
.06 ACRE-FEET;   BASEFLOW =    .00 CFS
1


 TR20 XEQ 12-07-04  10:53       HEGEWISCH MARSH HYDROLOGY ANALYSIS-EXISTING
CONDITIONS   FILE:EXGW.DAT             JOB  1   PASS   6
      REV PC 09/83(.2)          CALCS: V3 CONSULTANTS. W/HUFF-ISWS CIR.173/90
DATE:12/10/2004 CA                      PAGE  13


                         --- HYDROGRAPH FOR STRUCTURE 11, ALTERNATE 50, STORM 24,
ADDED TO OUTPUT HYDROGRAPH FILE ---


 EXECUTIVE CONTROL OPERATION ENDCMP
                             RECORD ID  Bull. 7
+                                       COMPUTATIONS COMPLETED FOR PASS   6



 EXECUTIVE CONTROL OPERATION COMPUT
                             RECORD ID  100yr,
+                                       FROM XSECTION  14
+                                                          TO XSECTION 104
         STARTING TIME =   .00    RAIN DEPTH =  7.58    RAIN DURATION= 24.00    RAIN
TABLE NO.= 8    ANT. MOIST. COND= 2
         ALTERNATE NO.=99         STORM NO.=24    MAIN TIME INCREMENT =   .25 HOURS

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .54 CFS.


 OPERATION RESVOR   STRUCTURE 15

            PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK
ELEVATION(FEET)
               16.99                           9.16                       582.20
               24.21                           2.92                       582.06

 TIME(HRS)         FIRST HYDROGRAPH POINT =   .00 HOURS      TIME INCREMENT =  .25
HOURS      DRAINAGE AREA =    .03 SQ.MI.
   12.50    DISCHG          .01       .01       .01       .01       .01       .01
  .01       .19      1.74      3.13
   12.50      ELEV       581.77    581.79    581.82    581.85    581.88    581.92
581.96    582.00    582.04    582.07
   15.00    DISCHG         4.37      5.50      6.52      7.42      8.16      8.69
 8.98      9.12      9.16      9.11
   15.00      ELEV       582.10    582.12    582.14    582.16    582.18    582.19
582.20    582.20    582.20    582.20
```

```
   17.50    DISCHG         8.94      8.67      8.35      8.02      7.68      7.30
  6.89      6.49      6.12      5.77
   17.50      ELEV       582.20    582.19    582.18    582.18    582.17    582.16
582.15    582.14    582.14    582.13
   20.00    DISCHG         5.42      5.09      4.79      4.53      4.30      4.11
  3.95      3.82      3.70      3.56
   20.00      ELEV       582.12    582.11    582.11    582.10    582.09    582.09
582.09    582.08    582.08    582.08
   22.50    DISCHG         3.40      3.23      3.07      2.95      2.88      2.87
  2.89      2.92      2.87      2.72
   22.50      ELEV       582.07    582.07    582.07    582.06    582.06    582.06
582.06    582.06    582.06    582.06
   25.00    DISCHG         2.45      2.14      1.82      1.54      1.28      1.07
   .88       .73       .60       .49
   25.00      ELEV       582.05    582.05    582.04    582.03    582.03    582.02
582.02    582.02    582.01    582.01
   27.50    DISCHG          .40       .33       .27       .22       .18       .15
   .12       .10       .08       .07
   27.50      ELEV       582.01    582.01    582.01    582.00    582.00    582.00
582.00    582.00    582.00    582.00
   30.00    DISCHG          .06       .05       .04       .03       .03       .02
   .02       .01       .01       .01
   30.00      ELEV       582.00    582.00    582.00    582.00    582.00    582.00
582.00    582.00    582.00    582.00
   32.50    DISCHG          .01
   32.50      ELEV       582.00

   RUNOFF VOLUME ABOVE BASEFLOW =  2.92 WATERSHED INCHES,     61.14 CFS-HRS,
5.05 ACRE-FEET;   BASEFLOW =    .00 CFS

                        --- HYDROGRAPH FOR STRUCTURE 15, ALTERNATE 99, STORM 24,
ADDED TO OUTPUT HYDROGRAPH FILE ---


 OPERATION RESVOR   STRUCTURE 13
1



 TR20 XEQ 12-07-04  10:53       HEGEWISCH MARSH HYDROLOGY ANALYSIS-EXISTING
CONDITIONS   FILE:EXGW.DAT              JOB  1   PASS   7
      REV PC 09/83(.2)          CALCS: V3 CONSULTANTS. W/HUFF-ISWS CIR.173/90
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            PEAK TIME(HRS)               PEAK DISCHARGE(CFS)           PEAK
ELEVATION(FEET)
               15.63                               2.60                        582.07

 TIME(HRS)         FIRST HYDROGRAPH POINT =   .00 HOURS      TIME INCREMENT =  .25
HOURS      DRAINAGE AREA =    .01 SQ.MI.
    2.50    DISCHG          .00       .00       .00       .00       .00       .00
   .00       .00       .01       .03
    2.50      ELEV       582.00    582.00    582.00    582.00    582.00    582.00
582.00    582.00    582.00    582.00
    5.00    DISCHG          .04       .06       .08       .10       .11       .13
   .17       .21       .24       .26
    5.00      ELEV       582.00    582.00    582.00    582.00    582.00    582.00
582.00    582.01    582.01    582.01
    7.50    DISCHG          .28       .30       .32       .34       .36       .38
   .40       .41       .43       .45
    7.50      ELEV       582.01    582.01    582.01    582.01    582.01    582.01
```

```
582.01    582.01    582.01    582.01
   10.00    DISCHG         .50       .57       .61       .63       .67       .74
  .81       .85       .88       .92
   10.00      ELEV      582.01    582.02    582.02    582.02    582.02    582.02
582.02    582.02    582.02    582.03
   12.50    DISCHG        1.01      1.08      1.12      1.15      1.35      1.74
 2.02      2.14      2.21      2.31
   12.50      ELEV      582.03    582.03    582.03    582.03    582.04    582.05
582.06    582.06    582.06    582.07
   15.00    DISCHG        2.43      2.52      2.57      2.58      2.35      2.05
 1.92      1.90      1.84      1.63
   15.00      ELEV      582.07    582.07    582.07    582.07    582.07    582.06
582.05    582.05    582.05    582.05
   17.50    DISCHG        1.40      1.32      1.30      1.23      1.07       .93
  .89       .88       .83       .74
   17.50      ELEV      582.04    582.04    582.04    582.03    582.03    582.03
582.03    582.02    582.02    582.02
   20.00    DISCHG         .68       .67       .66       .66       .66       .66
  .67       .66       .59       .50
   20.00      ELEV      582.02    582.02    582.02    582.02    582.02    582.02
582.02    582.02    582.02    582.01
   22.50    DISCHG         .46       .45       .47       .55       .63       .66
  .67       .58       .31       .10
   22.50      ELEV      582.01    582.01    582.01    582.02    582.02    582.02
582.02    582.02    582.01    582.00
   25.00    DISCHG         .03       .01       .00
   25.00      ELEV      582.00    582.00    582.00

   RUNOFF VOLUME ABOVE BASEFLOW =  4.44 WATERSHED INCHES,     18.03 CFS-HRS,
1.49 ACRE-FEET;   BASEFLOW =    .00 CFS

                        --- HYDROGRAPH FOR STRUCTURE 13, ALTERNATE 99, STORM 24,
ADDED TO OUTPUT HYDROGRAPH FILE ---


 OPERATION RESVOR   STRUCTURE 11

 *** WARNING-NO PEAK FOUND, MAXIMUM DISCHARGE =         .02 CFS.

            PEAK TIME(HRS)              PEAK DISCHARGE(CFS)           PEAK
ELEVATION(FEET)
               31.50                                .02                        582.60

 TIME(HRS)         FIRST HYDROGRAPH POINT =   .00 HOURS      TIME INCREMENT =  .25
HOURS      DRAINAGE AREA =    .13 SQ.MI.
   12.50    DISCHG         .00       .00       .00       .00       .00       .00
  .00       .00       .00       .01
   12.50      ELEV      581.50    581.50    581.50    581.50    581.50    581.50
581.50    581.50    581.50    581.78
   15.00    DISCHG         .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   15.00      ELEV      581.81    581.84    581.88    581.92    581.96    582.00
582.03    582.06    582.10    582.13
   17.50    DISCHG         .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   17.50      ELEV      582.16    582.19    582.21    582.24    582.26    582.28
582.30    582.32    582.34    582.35
   20.00    DISCHG         .01       .01       .01       .01       .01       .01
  .01       .01       .01       .01
   20.00      ELEV      582.37    582.38    582.40    582.41    582.42    582.43
582.44    582.46    582.47    582.48
   22.50    DISCHG         .01       .01       .02       .02       .02       .02
  .02       .02       .02       .02
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   22.50       ELEV      582.49    582.50    582.51    582.52    582.52    582.53
582.54    582.55    582.56    582.57
1
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 TR20 XEQ 12-07-04  10:53       HEGEWISCH MARSH HYDROLOGY ANALYSIS-EXISTING
CONDITIONS   FILE:EXGW.DAT             JOB  1   PASS   7
      REV PC 09/83(.2)          CALCS: V3 CONSULTANTS. W/HUFF-ISWS CIR.173/90
DATE:12/10/2004 CA                       PAGE  15
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   25.00    DISCHG         .02       .02       .02       .02       .02       .02
  .02       .02       .02       .02
   25.00      ELEV      582.58    582.58    582.59    582.59    582.59    582.59
582.59    582.59    582.59    582.59
   27.50    DISCHG         .02       .02       .02       .02       .02       .02
  .02       .02       .02       .02
   27.50      ELEV      582.60    582.60    582.60    582.60    582.60    582.60
582.60    582.60    582.60    582.60
   30.00    DISCHG         .02       .02       .02       .02       .02       .02
  .02       .02       .02       .02
   30.00      ELEV      582.60    582.60    582.60    582.60    582.60    582.60
582.60    582.60    582.60    582.60
   32.50    DISCHG         .02       .02       .02       .02       .02       .02
  .02       .02       .02       .02
   32.50      ELEV      582.60    582.60    582.60    582.60    582.60    582.60
582.60    582.60    582.60    582.60
   35.00    DISCHG         .02       .02       .02       .02       .02       .02
  .02       .02       .02       .02
   35.00      ELEV      582.60    582.60    582.60    582.60    582.60    582.60
582.60    582.60    582.60    582.60
   37.50    DISCHG         .02       .02       .02       .02       .02       .02
  .02       .02       .02       .02
   37.50      ELEV      582.60    582.60    582.60    582.60    582.60    582.60
582.60    582.60    582.60    582.60
   40.00    DISCHG         .02       .02       .02       .02       .02       .02
  .02       .02       .02       .02
   40.00      ELEV      582.60    582.60    582.60    582.60    582.60    582.60
582.60    582.60    582.60    582.60
   42.50    DISCHG         .02       .02       .02       .02       .02       .02
  .02       .02       .02       .02
   42.50      ELEV      582.60    582.60    582.60    582.60    582.60    582.60
582.60    582.60    582.60    582.60
   45.00    DISCHG         .02       .02       .02       .02       .02       .02
  .02       .02       .02       .02
   45.00      ELEV      582.60    582.60    582.60    582.60    582.60    582.60
582.60    582.60    582.60    582.60
   47.50    DISCHG         .02       .02       .02       .02       .02       .02
  .02       .02       .02       .02
   47.50      ELEV      582.60    582.60    582.60    582.60    582.60    582.60
582.60    582.60    582.60    582.60
   50.00    DISCHG         .02       .02       .02       .02       .02       .02
  .02       .02       .02       .02
   50.00      ELEV      582.60    582.60    582.60    582.60    582.60    582.60
582.60    582.60    582.60    582.60
   52.50    DISCHG         .02       .02       .02       .02       .02       .02
  .02       .02       .02       .02
   52.50      ELEV      582.60    582.60    582.60    582.60    582.60    582.60
582.60    582.60    582.60    582.60
   55.00    DISCHG         .02       .02       .02       .02       .02       .02
  .02       .02       .02       .02
   55.00      ELEV      582.60    582.60    582.60    582.60    582.60    582.60
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582.60    582.60    582.60    582.60
   57.50    DISCHG         .02        .02        .02        .02        .02        .02
  .02       .02       .02        .02
   57.50      ELEV      582.60    582.60    582.60    582.60    582.60    582.60
582.60    582.60    582.60    582.60
   60.00    DISCHG         .02        .02        .02        .02        .02        .02
  .02       .02       .02        .02
   60.00      ELEV      582.60    582.60    582.59    582.59    582.59    582.59
582.59    582.59    582.59    582.59
   62.50    DISCHG         .02        .02        .02        .02        .02        .02
  .02       .02       .02        .02
   62.50      ELEV      582.59    582.59    582.59    582.59    582.59    582.59
582.59    582.59    582.59    582.59
   65.00    DISCHG         .02        .02        .02        .02        .02        .02
  .02       .02       .02        .02
   65.00      ELEV      582.59    582.59    582.59    582.59    582.59    582.59
582.59    582.59    582.59    582.59
   67.50    DISCHG         .02        .02        .02        .02        .02        .02
  .02       .02       .02        .02
   67.50      ELEV      582.59    582.59    582.59    582.59    582.59    582.59
582.59    582.59    582.59    582.59
   70.00    DISCHG         .02        .02        .02        .02        .02        .02
  .02       .02       .02        .02
   70.00      ELEV      582.59    582.59    582.59    582.59    582.59    582.59
582.59    582.59    582.59    582.59
   72.50    DISCHG         .02        .02        .02        .02        .02        .02
  .02       .02       .02        .02
   72.50      ELEV      582.59    582.59    582.59    582.59    582.59    582.59
582.59    582.59    582.59    582.59

   RUNOFF VOLUME ABOVE BASEFLOW =   .01 WATERSHED INCHES,       .93 CFS-HRS,
.08 ACRE-FEET;   BASEFLOW =    .00 CFS

                        --- HYDROGRAPH FOR STRUCTURE 11, ALTERNATE 99, STORM 24,
ADDED TO OUTPUT HYDROGRAPH FILE ---


 EXECUTIVE CONTROL OPERATION ENDCMP
                             RECORD ID  Bull.70
+                                       COMPUTATIONS COMPLETED FOR PASS   7


1



 TR20 XEQ 12-07-04  10:53       HEGEWISCH MARSH HYDROLOGY ANALYSIS-EXISTING
CONDITIONS   FILE:EXGW.DAT             JOB  1   PASS   8
      REV PC 09/83(.2)          CALCS: V3 CONSULTANTS. W/HUFF-ISWS CIR.173/90
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 EXECUTIVE CONTROL OPERATION ENDJOB
                             RECORD ID
1



 TR20 XEQ 12-07-04  10:53       HEGEWISCH MARSH HYDROLOGY ANALYSIS-EXISTING
CONDITIONS   FILE:EXGW.DAT             JOB  1   SUMMARY
      REV PC 09/83(.2)          CALCS: V3 CONSULTANTS. W/HUFF-ISWS CIR.173/90
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 SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS
IN THE ORDER PERFORMED
                      (A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES
INDICATES A FLAT TOP HYDROGRAPH
                       A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST
POINT.)

 SECTION/    STANDARD              RAIN  ANTEC  MAIN         PRECIPITATION
                      PEAK DISCHARGE
 STRUCTURE    CONTROL  DRAINAGE  TABLE  MOIST  TIME   -------------------------
RUNOFF    --------------------------------------
    ID      OPERATION    AREA      #    COND  INCREM  BEGIN    AMOUNT  DURATION
AMOUNT    ELEVATION   TIME       RATE       RATE
                         (SQ MI)                 (HR)   (HR)     (IN)     (HR)
(IN)        (FT)      (HR)       (CFS)      (CSM)


    ALTERNATE    1   STORM   24
+   ___________________________
 XSECTION  14  RUNOFF       .01      8      2     .25      .0     2.51    24.00
.42       ---      15.75        .25        47.2
 XSECTION  16  RUNOFF       .06      8      2     .25      .0     2.51    24.00
.42       ---      16.18       2.64        42.0
 XSECTION  17  RUNOFF       .02      8      2     .25      .0     2.51    24.00
.50       ---      16.00        .88        50.9
 XSECTION  15  RUNOFF       .02      8      2     .25      .0     2.51    24.00
.30       ---      17.00        .45        29.4
 XSECTION 100  ADDHYD       .03      8      2     .25      .0     2.51    24.00
.40       ---      16.00       1.32        40.6

 STRUCTURE 15  RESVOR       .03      8      2     .25      .0     2.51    24.00
.00       ---        .00        .00          .0
 XSECTION  13  RUNOFF       .01      8      2     .25      .0     2.51    24.00
.57       ---      15.75        .39        62.5
 STRUCTURE 13  RESVOR       .01      8      2     .25      .0     2.51    24.00
.57     582.01     15.75        .39        61.8
 XSECTION 101  ADDHYD       .04      8      2     .25      .0     2.51    24.00
.09       ---      15.75        .39        10.1
 XSECTION  11  RUNOFF       .09      8      2     .25      .0     2.51    24.00
.39       ---      16.26       3.34        38.5

 XSECTION 103  ADDHYD       .13      8      2     .25      .0     2.51    24.00
.30       ---      16.17       3.67        29.3
 STRUCTURE 11  RESVOR       .13      8      2     .25      .0     2.51    24.00
.00       ---        .00        .00          .0
 XSECTION  10  RUNOFF       .01      8      2     .25      .0     2.51    24.00
.30       ---      17.00        .29        29.4
 XSECTION 104  ADDHYD       .14      8      2     .25      .0     2.51    24.00
.02       ---      17.00        .29         2.2

    ALTERNATE    2   STORM   24
+   ___________________________
 XSECTION  14  RUNOFF       .01      8      2     .25      .0     3.04    24.00
.69       ---      15.75        .40        75.2
 XSECTION  16  RUNOFF       .06      8      2     .25      .0     3.04    24.00
.69       ---      16.07       4.32        68.5
 XSECTION  17  RUNOFF       .02      8      2     .25      .0     3.04    24.00
.78       ---      15.75       1.37        79.4
 XSECTION  15  RUNOFF       .02      8      2     .25      .0     3.04    24.00
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.52         ---        16.00          .80        52.7
 XSECTION 100  ADDHYD      .03       8        2     .25       .0     3.04    24.00
.66         ---        15.94         2.17        66.9

 STRUCTURE 15  RESVOR      .03       8        2     .25       .0     3.04    24.00
.00     581.84       26.25?          .01?          .2
 XSECTION  13  RUNOFF      .01       8        2     .25       .0     3.04    24.00
.88         ---        15.75          .59        93.6
 STRUCTURE 13  RESVOR      .01       8        2     .25       .0     3.04    24.00
.88     582.02        15.75          .59        93.1
 XSECTION 101  ADDHYD      .04       8        2     .25       .0     3.04    24.00
.15         ---        15.75          .59        15.2
 XSECTION  11  RUNOFF      .09       8        2     .25       .0     3.04    24.00
.65         ---        16.11         5.56        64.0

 XSECTION 103  ADDHYD      .13       8        2     .25       .0     3.04    24.00
.49         ---        16.05         6.09        48.5
 STRUCTURE 11  RESVOR      .13       8        2     .25       .0     3.04    24.00
.00         ---          .00          .00          .0
 XSECTION  10  RUNOFF      .01       8        2     .25       .0     3.04    24.00
.52         ---        16.00          .53        52.6
 XSECTION 104  ADDHYD      .14       8        2     .25       .0     3.04    24.00
.04         ---        16.00          .53         3.9

    ALTERNATE    5   STORM   24
+   ___________________________
 XSECTION  14  RUNOFF       .01       8        2     .25       .0     3.80    24.00
1.14         ---       15.50          .64       120.2
 XSECTION  16  RUNOFF      .06       8        2     .25       .0     3.80    24.00
1.14         ---       16.00         7.01       111.2
1


 TR20 XEQ 12-07-04  10:53       HEGEWISCH MARSH HYDROLOGY ANALYSIS-EXISTING
CONDITIONS   FILE:EXGW.DAT             JOB  1   SUMMARY
      REV PC 09/83(.2)          CALCS: V3 CONSULTANTS. W/HUFF-ISWS CIR.173/90
DATE:12/10/2004 CA                      PAGE  18


 SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS
IN THE ORDER PERFORMED
                   (A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES
INDICATES A FLAT TOP HYDROGRAPH
                    A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST
POINT.)

 SECTION/    STANDARD              RAIN  ANTEC  MAIN         PRECIPITATION
                   PEAK DISCHARGE
 STRUCTURE    CONTROL   DRAINAGE  TABLE  MOIST  TIME   -------------------------
RUNOFF    --------------------------------------
    ID       OPERATION    AREA      #    COND  INCREM  BEGIN    AMOUNT  DURATION
AMOUNT    ELEVATION   TIME       RATE       RATE
                        (SQ MI)                 (HR)   (HR)     (IN)     (HR)
(IN)       (FT)       (HR)       (CFS)      (CSM)


    ALTERNATE    5   STORM   24
+   ___________________________
 XSECTION  17  RUNOFF       .02       8        2     .25       .0     3.80    24.00
1.26         ---       15.81         2.16       125.6
 XSECTION  15  RUNOFF      .02       8        2     .25       .0     3.80    24.00
```

```
.91        ---       16.00          1.40       91.9
 XSECTION 100  ADDHYD       .03       8        2     .25       .0      3.80    24.00
1.10       ---       15.88           3.55       109.5
 STRUCTURE 15  RESVOR       .03       8        2     .25       .0      3.80    24.00
.12     582.02     24.50?          .81?       24.9
 XSECTION  13  RUNOFF       .01       8        2     .25       .0      3.80    24.00
1.38       ---       15.75            .89       141.8

 STRUCTURE 13  RESVOR       .01       8        2     .25       .0      3.80    24.00
1.38     582.03     15.75            .89       141.8
 XSECTION 101  ADDHYD       .04       8        2     .25       .0      3.80    24.00
.32        ---      24.25?         1.00?       25.7
 XSECTION  11  RUNOFF       .09       8        2     .25       .0      3.80    24.00
1.08       ---       16.03           9.17       105.6
 XSECTION 103  ADDHYD       .13       8        2     .25       .0      3.80    24.00
.85        ---       15.97         10.00        79.7
 STRUCTURE 11  RESVOR       .13       8        2     .25       .0      3.80    24.00
.00     581.77     31.00?          .01?         .0

 XSECTION  10  RUNOFF       .01       8        2     .25       .0      3.80    24.00
.91        ---       16.00           .92        91.7
 XSECTION 104  ADDHYD       .14       8        2     .25       .0      3.80    24.00
.07        ---       16.00           .92         6.8

    ALTERNATE   10   STORM   24
+   ___________________________
 XSECTION  14  RUNOFF       .01       8        2     .25       .0      4.47    24.00
1.58       ---       15.50            .87       163.6
 XSECTION  16  RUNOFF       .06       8        2     .25       .0      4.47    24.00
1.58       ---       15.96           9.59       152.2
 XSECTION  17  RUNOFF       .02       8        2     .25       .0      4.47    24.00
1.72       ---       15.79           2.91       168.9
 XSECTION  15  RUNOFF       .02       8        2     .25       .0      4.47    24.00
1.31       ---       15.94           1.98       130.2
 XSECTION 100  ADDHYD       .03       8        2     .25       .0      4.47    24.00
1.53       ---       15.84           4.87       150.4

 STRUCTURE 15  RESVOR       .03       8        2     .25       .0      4.47    24.00
.55     582.04     20.00          1.71        52.7
 XSECTION  13  RUNOFF       .01       8        2     .25       .0      4.47    24.00
1.87       ---       15.50           1.18       187.4
 STRUCTURE 13  RESVOR       .01       8        2     .25       .0      4.47    24.00
1.87     582.03     15.75           1.18       187.0
 XSECTION 101  ADDHYD       .04       8        2     .25       .0      4.47    24.00
.77        ---       19.75          2.06        53.1
 XSECTION  11  RUNOFF       .09       8        2     .25       .0      4.47    24.00
1.51       ---       15.98          12.65       145.8

 XSECTION 103  ADDHYD       .13       8        2     .25       .0      4.47    24.00
1.28       ---       15.93          13.77       109.7
 STRUCTURE 11  RESVOR       .13       8        2     .25       .0      4.47    24.00
.00     581.91     31.50?          .01?         .1
 XSECTION  10  RUNOFF       .01       8        2     .25       .0      4.47    24.00
1.31       ---       16.00           1.30       129.8
 XSECTION 104  ADDHYD       .14       8        2     .25       .0      4.47    24.00
.10        ---       16.00          1.30         9.6

    ALTERNATE   25   STORM   24
+   ___________________________
 XSECTION  14  RUNOFF       .01       8        2     .25       .0      5.51    24.00
2.33       ---       15.50           1.24       234.5
 XSECTION  16  RUNOFF       .06       8        2     .25       .0      5.51    24.00
2.33       ---       15.92          13.84       219.7
```

```
 XSECTION  17  RUNOFF       .02       8       2     .25       .0      5.51    24.00
2.51        ---       15.75        4.12       239.6
 XSECTION  15  RUNOFF       .02       8       2     .25       .0      5.51    24.00
2.00        ---       15.89        2.96       194.5
 XSECTION 100  ADDHYD       .03       8       2     .25       .0      5.51    24.00
2.27        ---       15.80        7.06       218.0

 STRUCTURE 15  RESVOR       .03       8       2     .25       .0      5.51    24.00
1.29     582.09      18.08        4.16       128.5
 XSECTION  13  RUNOFF       .01       8       2     .25       .0      5.51    24.00
2.69        ---       15.50        1.64       261.0
 STRUCTURE 13  RESVOR       .01       8       2     .25       .0      5.51    24.00
2.68     582.05      15.65        1.65       261.8
1


 TR20 XEQ 12-07-04  10:53       HEGEWISCH MARSH HYDROLOGY ANALYSIS-EXISTING
CONDITIONS   FILE:EXGW.DAT             JOB  1   SUMMARY
      REV PC 09/83(.2)          CALCS: V3 CONSULTANTS. W/HUFF-ISWS CIR.173/90
DATE:12/10/2004 CA                      PAGE  19


 SUMMARY TABLE 1 - SELECTED RESULTS OF STANDARD AND EXECUTIVE CONTROL INSTRUCTIONS
IN THE ORDER PERFORMED
                   (A STAR(*) AFTER THE PEAK DISCHARGE TIME AND RATE (CFS) VALUES
INDICATES A FLAT TOP HYDROGRAPH
                    A QUESTION MARK(?) INDICATES A HYDROGRAPH WITH PEAK AS LAST
POINT.)

 SECTION/    STANDARD              RAIN  ANTEC  MAIN        PRECIPITATION
                   PEAK DISCHARGE
 STRUCTURE    CONTROL   DRAINAGE  TABLE  MOIST  TIME   -------------------------
RUNOFF    --------------------------------------
    ID       OPERATION    AREA      #    COND  INCREM  BEGIN    AMOUNT  DURATION
AMOUNT    ELEVATION   TIME       RATE       RATE
                          (SQ MI)                 (HR)   (HR)     (IN)     (HR)
(IN)       (FT)      (HR)       (CFS)      (CSM)


    ALTERNATE   25   STORM   24
+   ___________________________
 XSECTION 101  ADDHYD       .04       8       2     .25       .0      5.51    24.00
1.52        ---       17.97        5.01       129.5
 XSECTION  11  RUNOFF       .09       8       2     .25       .0      5.51    24.00
2.25        ---       15.93       18.43       212.3
 XSECTION 103  ADDHYD       .13       8       2     .25       .0      5.51    24.00
2.02        ---       16.35       20.50       163.3
 STRUCTURE 11  RESVOR       .13       8       2     .25       .0      5.51    24.00
.01      582.13      31.50?       .01?         .1
 XSECTION  10  RUNOFF       .01       8       2     .25       .0      5.51    24.00
2.00        ---       15.90        1.94       194.3

 XSECTION 104  ADDHYD       .14       8       2     .25       .0      5.51    24.00
.15        ---       15.90        1.94       14.3

    ALTERNATE   50   STORM   24
+   ___________________________
 XSECTION  14  RUNOFF       .01       8       2     .25       .0      6.46    24.00
3.07        ---       15.50        1.60       301.8
 XSECTION  16  RUNOFF       .06       8       2     .25       .0      6.46    24.00
3.07        ---       15.89       17.90       284.1
```

```
 XSECTION  17  RUNOFF      .02       8       2    .25       .0      6.46    24.00
3.27       ---      15.73        5.27       306.3
 XSECTION  15  RUNOFF      .02       8       2    .25       .0      6.46    24.00
2.69       ---      15.86        3.90       256.5
 XSECTION 100  ADDHYD      .03       8       2    .25       .0      6.46    24.00
3.00       ---      15.78        9.16       282.6

 STRUCTURE 15  RESVOR      .03       8       2    .25       .0      6.46    24.00
2.02     582.14     17.38        6.52       201.3
 XSECTION  13  RUNOFF      .01       8       2    .25       .0      6.46    24.00
3.47       ---      15.53        2.08       330.0
 STRUCTURE 13  RESVOR      .01       8       2    .25       .0      6.46    24.00
3.47     582.06     15.64        2.08       330.8
 XSECTION 101  ADDHYD      .04       8       2    .25       .0      6.46    24.00
2.26       ---      17.07        7.89       203.8
 XSECTION  11  RUNOFF      .09       8       2    .25       .0      6.46    24.00
2.98       ---      15.90       23.95       276.0

 XSECTION 103  ADDHYD      .13       8       2    .25       .0      6.46    24.00
2.75       ---      16.07       30.41       242.3
 STRUCTURE 11  RESVOR      .13       8       2    .25       .0      6.46    24.00
.01     582.34      31.50?       .01?         .1
 XSECTION  10  RUNOFF      .01       8       2    .25       .0      6.46    24.00
2.69       ---      15.87        2.56       256.2
 XSECTION 104  ADDHYD      .14       8       2    .25       .0      6.46    24.00
.21       ---      15.87       2.57        19.0

    ALTERNATE   99   STORM   24
+   ___________________________
 XSECTION  14  RUNOFF      .01       8       2    .25       .0      7.58    24.00
3.99       ---      15.50        2.03       382.8
 XSECTION  16  RUNOFF      .06       8       2    .25       .0      7.58    24.00
3.99       ---      15.87       22.78       361.5
 XSECTION  17  RUNOFF      .02       8       2    .25       .0      7.58    24.00
4.21       ---      15.72        6.65       386.6
 XSECTION  15  RUNOFF      .02       8       2    .25       .0      7.58    24.00
3.55       ---      15.83        5.06       332.7
 XSECTION 100  ADDHYD      .03       8       2    .25       .0      7.58    24.00
3.90       ---      15.76       11.69       360.9

 STRUCTURE 15  RESVOR      .03       8       2    .25       .0      7.58    24.00
2.92     582.20     16.99        9.16       282.7
 XSECTION  13  RUNOFF      .01       8       2    .25       .0      7.58    24.00
4.44       ---      15.51        2.60       412.1
 STRUCTURE 13  RESVOR      .01       8       2    .25       .0      7.58    24.00
4.44     582.07     15.63        2.60       413.1
 XSECTION 101  ADDHYD      .04       8       2    .25       .0      7.58    24.00
3.17       ---      16.84       11.03       285.0
 XSECTION  11  RUNOFF      .09       8       2    .25       .0      7.58    24.00
3.88       ---      15.88       30.66       353.2

 XSECTION 103  ADDHYD      .13       8       2    .25       .0      7.58    24.00
3.66       ---      15.97       41.05       327.1
 STRUCTURE 11  RESVOR      .13       8       2    .25       .0      7.58    24.00
.01     582.60      31.50?       .02?         .1
 XSECTION  10  RUNOFF      .01       8       2    .25       .0      7.58    24.00
3.55       ---      15.84        3.32       332.3
 XSECTION 104  ADDHYD      .14       8       2    .25       .0      7.58    24.00
.27       ---      15.84       3.33        24.6
1
```

```
 TR20 XEQ 12-07-04  10:53       HEGEWISCH MARSH HYDROLOGY ANALYSIS-EXISTING
CONDITIONS   FILE:EXGW.DAT             JOB  1   SUMMARY
      REV PC 09/83(.2)          CALCS: V3 CONSULTANTS. W/HUFF-ISWS CIR.173/90
DATE:12/10/2004 CA                      PAGE  20


 SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND
ALTERNATES

 XSECTION/           DRAINAGE
 STRUCTURE             AREA       STORM NUMBERS..........
   ID                 (SQ MI)          24

0 STRUCTURE  15           .03
+___________________________
    ALTERNATE    2                      .01
    ALTERNATE    5                      .81
    ALTERNATE   10                     1.71
    ALTERNATE   25                     4.16
    ALTERNATE   50                     6.52

    ALTERNATE   99                     9.16
0 STRUCTURE  13           .01
+___________________________
    ALTERNATE    1                      .39
    ALTERNATE    2                      .59
    ALTERNATE    5                      .89
    ALTERNATE   10                     1.18
    ALTERNATE   25                     1.65

    ALTERNATE   50                     2.08
    ALTERNATE   99                     2.60
0 STRUCTURE  11           .13
+___________________________
    ALTERNATE    5                      .01
    ALTERNATE   10                      .01
    ALTERNATE   25                      .01
    ALTERNATE   50                      .01
    ALTERNATE   99                      .02
0 XSECTION   10           .01
+___________________________
    ALTERNATE    1                      .29
    ALTERNATE    2                      .53
    ALTERNATE    5                      .92
    ALTERNATE   10                     1.30
    ALTERNATE   25                     1.94

    ALTERNATE   50                     2.56
    ALTERNATE   99                     3.32
0 XSECTION   11           .09
+___________________________
    ALTERNATE    1                     3.34
    ALTERNATE    2                     5.56
    ALTERNATE    5                     9.17
    ALTERNATE   10                    12.65
1


 TR20 XEQ 12-07-04  10:53       HEGEWISCH MARSH HYDROLOGY ANALYSIS-EXISTING
CONDITIONS   FILE:EXGW.DAT             JOB  1   SUMMARY
      REV PC 09/83(.2)          CALCS: V3 CONSULTANTS. W/HUFF-ISWS CIR.173/90
```

SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES

XSECTION/ STRUCTURE ID	DRAINAGE AREA (SQ MI)	STORM NUMBERS.......... 24
0 XSECTION 11	.09	
ALTERNATE 25		18.43
ALTERNATE 50		23.95
ALTERNATE 99		30.66
0 XSECTION 13	.01	
ALTERNATE 1		.39
ALTERNATE 2		.59
ALTERNATE 5		.89
ALTERNATE 10		1.18
ALTERNATE 25		1.64
ALTERNATE 50		2.08
ALTERNATE 99		2.60
0 XSECTION 14	.01	
ALTERNATE 1		.25
ALTERNATE 2		.40
ALTERNATE 5		.64
ALTERNATE 10		.87
ALTERNATE 25		1.24
ALTERNATE 50		1.60
ALTERNATE 99		2.03
0 XSECTION 15	.02	
ALTERNATE 1		.45
ALTERNATE 2		.80
ALTERNATE 5		1.40
ALTERNATE 10		1.98
ALTERNATE 25		2.96
ALTERNATE 50		3.90
ALTERNATE 99		5.06
0 XSECTION 16	.06	
ALTERNATE 1		2.64
ALTERNATE 2		4.32
ALTERNATE 5		7.01
ALTERNATE 10		9.59
ALTERNATE 25		13.84
ALTERNATE 50		17.90

1

TR20 XEQ 12-07-04 10:53 HEGEWISCH MARSH HYDROLOGY ANALYSIS-EXISTING CONDITIONS FILE:EXGW.DAT JOB 1 SUMMARY
REV PC 09/83(.2) CALCS: V3 CONSULTANTS. W/HUFF-ISWS CIR.173/90
DATE:12/10/2004 CA PAGE 22

SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES

XSECTION/ STRUCTURE ID	DRAINAGE AREA (SQ MI)	STORM NUMBERS.......... 24
0 XSECTION 16	.06	
ALTERNATE 99		22.78
0 XSECTION 17	.02	
ALTERNATE 1		.88
ALTERNATE 2		1.37
ALTERNATE 5		2.16
ALTERNATE 10		2.91
ALTERNATE 25		4.12
ALTERNATE 50		5.27
ALTERNATE 99		6.65
0 XSECTION 100	.03	
ALTERNATE 1		1.32
ALTERNATE 2		2.17
ALTERNATE 5		3.55
ALTERNATE 10		4.87
ALTERNATE 25		7.06
ALTERNATE 50		9.16
ALTERNATE 99		11.69
0 XSECTION 101	.04	
ALTERNATE 1		.39
ALTERNATE 2		.59
ALTERNATE 5		1.00
ALTERNATE 10		2.06
ALTERNATE 25		5.01
ALTERNATE 50		7.89
ALTERNATE 99		11.03
0 XSECTION 103	.13	
ALTERNATE 1		3.67
ALTERNATE 2		6.09
ALTERNATE 5		10.00
ALTERNATE 10		13.77
ALTERNATE 25		20.50
ALTERNATE 50		30.41
ALTERNATE 99		41.05

1

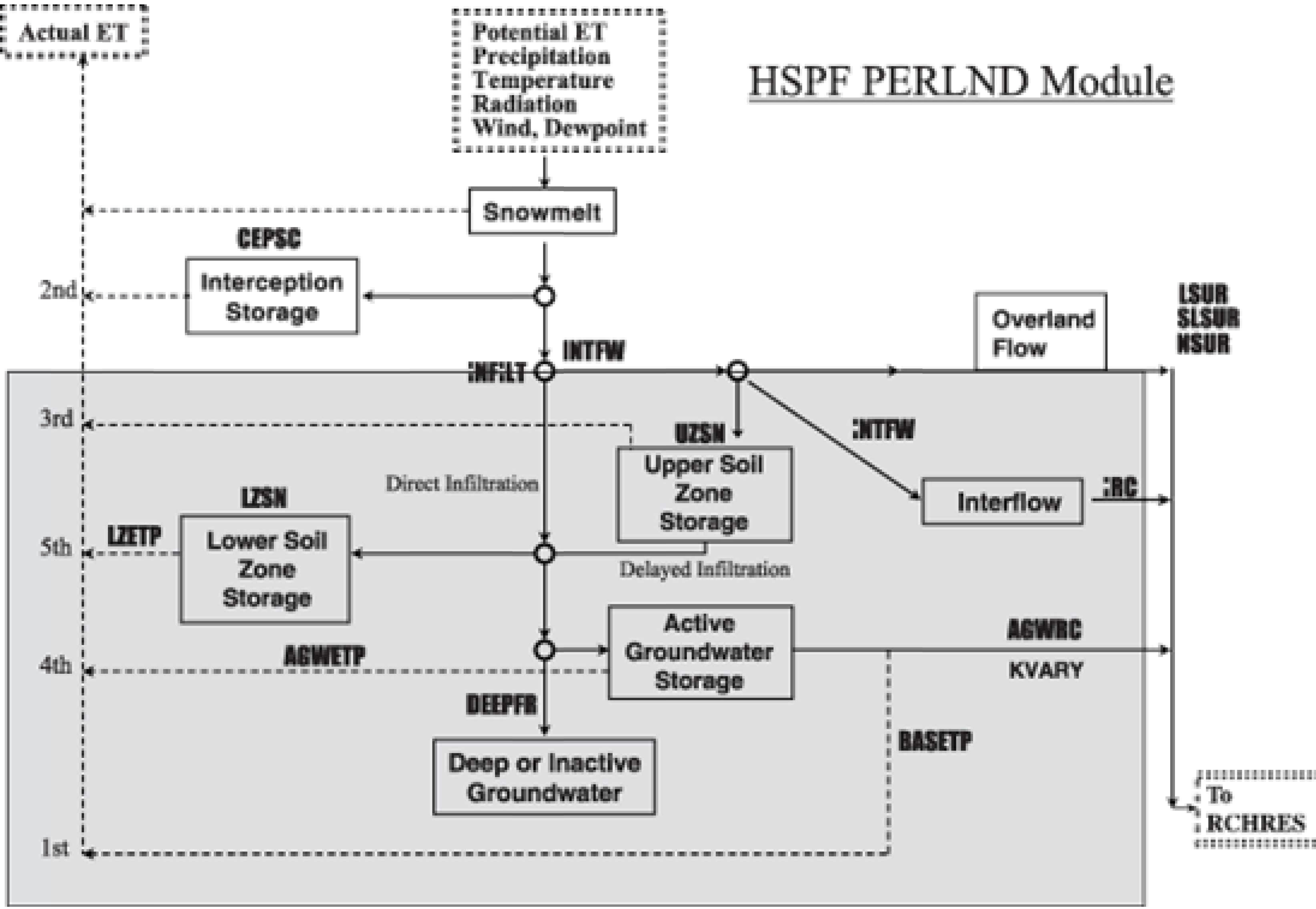
TR20 XEQ 12-07-04 10:53 HEGEWISCH MARSH HYDROLOGY ANALYSIS-EXISTING CONDITIONS FILE:EXGW.DAT JOB 1 SUMMARY
REV PC 09/83(.2) CALCS: V3 CONSULTANTS. W/HUFF-ISWS CIR.173/90
DATE:12/10/2004 CA PAGE 23

SUMMARY TABLE 3 - DISCHARGE (CFS) AT XSECTIONS AND STRUCTURES FOR ALL STORMS AND ALTERNATES

XSECTION/ STRUCTURE ID	DRAINAGE AREA (SQ MI)	STORM NUMBERS.......... 24
0 XSECTION 104	.14	
ALTERNATE 1		.29
ALTERNATE 2		.53
ALTERNATE 5		.92
ALTERNATE 10		1.30
ALTERNATE 25		1.94
ALTERNATE 50		2.57
ALTERNATE 99		3.33

1END OF 1 JOBS IN THIS RUN

HSPF PERLND Module



```
RUN

GLOBAL
  UCI Created by WinHSPF for hegewischhspf
  START       1973/10/01 00:00  END    1974/11/31 24:00
  RUN INTERP OUTPT LEVELS    1    0
  RESUME     0 RUN     1                          UNITS    1
END GLOBAL

FILES
<FILE>  <UN#>***<----FILE NAME------------------------------------------------->
MESSU       24   hegewischhspf1.ech
            91   hegewischhspf1.out
WDM1        25   hegewischhspf1.wdm
WDM2        26   ..\..\data\met_data\il.wdm
BINO        92   hegewischhspf1.hbn
END FILES

OPN SEQUENCE
    INGRP              INDELT 01:00
      PERLND     101
      PERLND     102
      IMPLND     101
      RCHRES       1
      RCHRES       2
    END INGRP
END OPN SEQUENCE

PERLND
  ACTIVITY
*** <PLS >               Active Sections                               ***
*** x -  x ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
  101  102    0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
*** < PLS>                       Print-flags                           PIVL  PYR
*** x  - x ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC
  101  102    4    4    4    4    4    4    4    4    4    4    4    4    1    9
  END PRINT-INFO

  BINARY-INFO
*** < PLS>               Binary Output Flags                           PIVL  PYR
*** x  - x ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC
  101  102    4    4    4    4    4    4    4    4    4    4    4    4    1    9
  END BINARY-INFO

  GEN-INFO
***             Name                  Unit-systems   Printer BinaryOut
*** <PLS >                                t-series Engl Metr Engl Metr
*** x -  x                                 in  out
  101     Urban or Built-up La             1    1    0    0   92    0
  102     Wetlands                         1    1    0    0   92    0
  END GEN-INFO

  PWAT-PARM1
*** <PLS >                   Flags
*** x -  x CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE IFFC  HWT IRRG IFRD
  101  102    0    1    1    1    0    0    0    0    1    1    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
*** < PLS>    FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
```

```
*** x  - x                (in)   (in/hr)      (ft)               (1/in)   (1/day)
  101             0          8      0.06       500     0.035          4      0.92
  102             1         15      0.16       500     0.035          4      0.88
  END PWAT-PARM2

  PWAT-PARM3
*** < PLS>    PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
*** x  - x   (deg F)   (deg F)
  101            40.       35.        2.        2.       0.1      0.02        0.
  102            40.       35.        2.        2.       0.2      0.08        0.
  END PWAT-PARM3

  PWAT-PARM4
*** <PLS >     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP
*** x -  x      (in)      (in)                       (1/day)
  101             2.     1.128       0.2     0.65        0.2       0.1
  102             2.     1.128       0.2     1.00        0.2       0.1
  END PWAT-PARM4

  PWAT-STATE1
*** < PLS>  PWATER state variables (in)
*** x  - x      CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
  101  102      0.01      0.01       0.3      0.01       1.5      0.01      0.01
  END PWAT-STATE1

  MON-INTERCEP
*** <PLS >  Interception storage capacity at start of each month (in)
*** x -  x  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC
  101  102  0.1  0.1  0.1  0.1  0.1  0.1  0.1  0.1  0.1  0.1  0.1  0.1
  END MON-INTERCEP

  MON-LZETPARM
*** <PLS >  Lower zone evapotransp   parm at start of each month
*** x -  x  JAN  FEB  MAR  APR  MAY  JUN  JUL  AUG  SEP  OCT  NOV  DEC
  101  102  0.2  0.2  0.3  0.3  0.4  0.4  0.4  0.4  0.4  0.3  0.2  0.2
  END MON-LZETPARM

END PERLND

IMPLND
  ACTIVITY
*** <ILS >               Active Sections
*** x -  x ATMP SNOW IWAT  SLD  IWG IQAL
  101         0    0    1    0    0    0
  END ACTIVITY

  PRINT-INFO
*** <ILS > ******** Print-flags ******** PIVL  PYR
*** x -  x ATMP SNOW IWAT  SLD  IWG IQAL *********
  101         4    4    4    4    4    4    1    9
  END PRINT-INFO

  BINARY-INFO
*** <ILS > **** Binary-Output-flags **** PIVL  PYR
*** x -  x ATMP SNOW IWAT  SLD  IWG IQAL *********
  101         4    4    4    4    4    4    1    9
  END BINARY-INFO

  GEN-INFO
***             Name             Unit-systems   Printer BinaryOut
*** <ILS >                           t-series Engl Metr Engl Metr
*** x -  x                            in  out
  101     Urban or Built-up La         1    1    0    0   92    0
```

```
  END GEN-INFO

  IWAT-PARM1
*** <ILS >        Flags
*** x -  x CSNO RTOP  VRS  VNN RTLI
  101         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
*** <ILS >      LSUR     SLSUR      NSUR     RETSC
*** x -  x      (ft)                          (in)
  101           500.     0.001      0.05       0.1
  END IWAT-PARM2

  IWAT-PARM3
*** <ILS >    PETMAX    PETMIN
*** x -  x   (deg F)   (deg F)
  101            40.        35.
  END IWAT-PARM3

  IWAT-STATE1
*** <ILS >  IWATER state variables (inches)
*** x -  x      RETS      SURS
  101           0.01      0.01
  END IWAT-STATE1

END IMPLND

RCHRES
  ACTIVITY
*** RCHRES  Active sections
*** x -  x HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG
    1    2    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
*** RCHRES  Printout level flags
*** x -  x HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR
    1    2    4    4    4    4    4    4    4    4    4    4    1    9
  END PRINT-INFO

  BINARY-INFO
*** RCHRES  Binary Output level flags
*** x -  x HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR
    1    2    4    4    4    4    4    4    4    4    4    4    1    9
  END BINARY-INFO

  GEN-INFO
***              Name        Nexits   Unit Systems   Printer
*** RCHRES                               t-series  Engl Metr LKFG
*** x -  x                                 in  out
    1    2                        1         1    1   91    0    0   92    0
  END GEN-INFO

  HYDR-PARM1
***         Flags for HYDR section
***RC HRES  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
*** x  - x  FG FG FG FG  possible   exit *** possible   exit     possible   exit
    1    2   0  1  1  1    4  0  0  0  0       0  0  0  0  0       1  1  1  1  1
  END HYDR-PARM1

  HYDR-PARM2
*** RCHRES FTBW FTBU       LEN     DELTH     STCOR        KS      DB50
```

```
*** x -  x             (miles)      (ft)      (ft)                (in)
    1        0.   1.      0.13         0.       3.2       0.5      0.01
    2        0.   2.      0.26         3.       3.2       0.5      0.01
  END HYDR-PARM2

  HYDR-INIT
***         Initial conditions for HYDR section
***RC HRES       VOL  CAT Initial value  of COLIND     initial  value  of OUTDGT
*** x  - x     ac-ft      for each possible   exit  for each possible exit,ft3
    1    2      0.01       4.2  4.5  4.5  4.5  4.2       2.1  1.2  0.5  1.2  1.8
  END HYDR-INIT

END RCHRES

FTABLES

  FTABLE      1
 rows cols                               ***
    3    4
     depth      area    volume  outflow1 ***
        0.      2.26        0.        0.
       0.5       4.5      1.69       0.1
       1.5      5.03      4.77     45.23
  END FTABLE  1

  FTABLE      2
 rows cols                               ***
    4    4
     depth      area    volume  outflow1 ***
       0.5     19.59        0.        0.
       1.5     22.58     10.54       0.1
       2.5      24.2     23.39       0.2
       3.5      26.5     25.35      100.
  END FTABLE  2
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member-> ***
<Name>   x <Name> x tem strg<-factor->strg <Name>   x   x        <Name> x x ***
*** Met Seg IL001577
WDM2    51 PREC     ENGLZERO          SAME PERLND 101 102 EXTNL  PREC
WDM2    53 ATEM     ENGL              SAME PERLND 101 102 EXTNL  GATMP
WDM2    57 DEWP     ENGL              SAME PERLND 101 102 EXTNL  DTMPG
WDM2    54 WIND     ENGL              SAME PERLND 101 102 EXTNL  WINMOV
WDM2    55 SOLR     ENGL              SAME PERLND 101 102 EXTNL  SOLRAD
WDM2    56 PEVT     ENGL              SAME PERLND 101 102 EXTNL  PETINP
*** Met Seg IL001577
WDM2    51 PREC     ENGLZERO          SAME IMPLND 101     EXTNL  PREC
WDM2    53 ATEM     ENGL              SAME IMPLND 101     EXTNL  GATMP
WDM2    57 DEWP     ENGL              SAME IMPLND 101     EXTNL  DTMPG
WDM2    54 WIND     ENGL              SAME IMPLND 101     EXTNL  WINMOV
WDM2    55 SOLR     ENGL              SAME IMPLND 101     EXTNL  SOLRAD
WDM2    56 PEVT     ENGL              SAME IMPLND 101     EXTNL  PETINP
*** Met Seg IL001577
WDM2    51 PREC     ENGLZERO          SAME RCHRES   1   2 EXTNL  PREC
WDM2    53 ATEM     ENGL              SAME RCHRES   1   2 EXTNL  GATMP
WDM2    57 DEWP     ENGL              SAME RCHRES   1   2 EXTNL  DEWTMP
WDM2    54 WIND     ENGL              SAME RCHRES   1   2 EXTNL  WIND
WDM2    55 SOLR     ENGL              SAME RCHRES   1   2 EXTNL  SOLRAD
WDM2    58 CLOU     ENGL              SAME RCHRES   1   2 EXTNL  CLOUD
WDM2    52 EVAP     ENGL              SAME RCHRES   1   2 EXTNL  POTEV
END EXT SOURCES
```

```
SCHEMATIC
<-Volume->                  <--Area-->     <-Volume->  <ML#> ***       <sb>
<Name>   x                  <-factor->     <Name>   x        ***        x x
PERLND 101                                 RCHRES   1      2
IMPLND 101                                 RCHRES   1      1
PERLND 102                          10     RCHRES   1      2
PERLND 101                                 RCHRES   2      2
IMPLND 101                                 RCHRES   2      1
PERLND 102                          26     RCHRES   2      2
RCHRES   1                                 RCHRES   2      3
END SCHEMATIC

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Aggr Amd ***
<Name>   x        <Name> x x<-factor->strg <Name>   x <Name>qf  tem strg strg***
RCHRES   2 HYDR   RO     1 1          AVER WDM1   101 FLOW   1 ENGL AGGR REPL
RCHRES   2 HYDR   STAGE  1 1          AVER WDM1  1001 STAGE  1 ENGL AGGR REPL
RCHRES   2 HYDR   DEP    1 1          AVER WDM1  1002 DEP    1 ENGL AGGR REPL
END EXT TARGETS

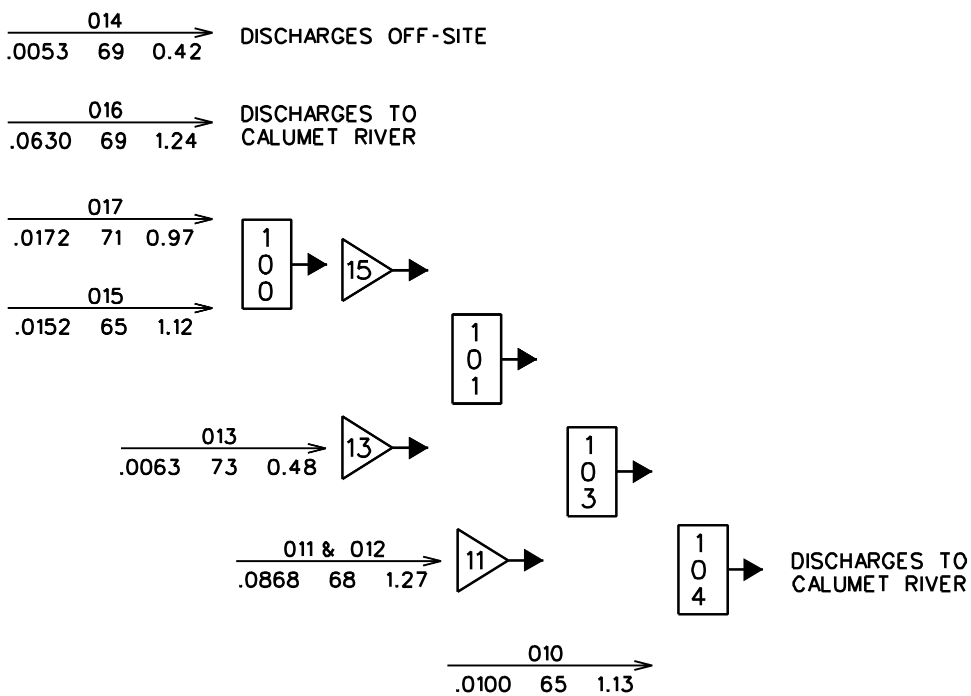
MASS-LINK

  MASS-LINK        2
<-Volume-> <-Grp> <-Member-><--Mult-->     <-Target vols> <-Grp> <-Member->  ***
<Name>            <Name> x x<-factor->     <Name>                <Name> x x  ***
PERLND     PWATER PERO       0.0833333     RCHRES         INFLOW IVOL
PERLND     PWTGAS PODOXM                   RCHRES         INFLOW OXIF   1
PERLND     PWTGAS POHT                     RCHRES         INFLOW IHEAT  1
PERLND     PQUAL  POQUAL 1                 RCHRES         INFLOW IDQAL  1
PERLND     PEST   POPST  1                 RCHRES         INFLOW IDQAL  1
PERLND     PEST   SOSDPS 1                 RCHRES         INFLOW ISQAL  1 1
PERLND     PEST   SOSDPS 1                 RCHRES         INFLOW ISQAL  2 1
PERLND     PEST   SOSDPS 1                 RCHRES         INFLOW ISQAL  3 1
PERLND     SEDMNT SOSED  1        0.05     RCHRES         INFLOW ISED   1
PERLND     SEDMNT SOSED  1        0.55     RCHRES         INFLOW ISED   2
PERLND     SEDMNT SOSED  1         0.4     RCHRES         INFLOW ISED   3
  END MASS-LINK    2

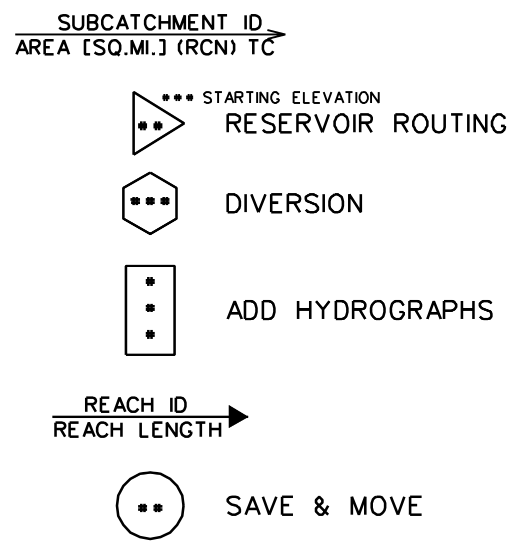
  MASS-LINK        1
<-Volume-> <-Grp> <-Member-><--Mult-->     <-Target vols> <-Grp> <-Member->  ***
<Name>            <Name> x x<-factor->     <Name>                <Name> x x  ***
IMPLND     IWATER SURO       0.0833333     RCHRES         INFLOW IVOL
IMPLND     IWTGAS SODOXM                   RCHRES         INFLOW OXIF   1
IMPLND     IWTGAS SOHT                     RCHRES         INFLOW IHEAT  1
IMPLND     IQUAL  SOQUAL 1                 RCHRES         INFLOW IDQAL  1
IMPLND     SOLIDS SOSLD  1        0.05     RCHRES         INFLOW ISED   1
IMPLND     SOLIDS SOSLD  1        0.55     RCHRES         INFLOW ISED   2
IMPLND     SOLIDS SOSLD  1         0.4     RCHRES         INFLOW ISED   3
  END MASS-LINK    1

  MASS-LINK        3
<-Volume-> <-Grp> <-Member-><--Mult-->     <-Target vols> <-Grp> <-Member->  ***
<Name>            <Name> x x<-factor->     <Name>                <Name> x x  ***
RCHRES     ROFLOW                          RCHRES         INFLOW
  END MASS-LINK    3
END MASS-LINK

END RUN
```



TR20 LEGEND



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