

**FINAL DESIGN REPORT
FOR
WATER QUALITY BASIN
AT WOODSIDE AVENUE**

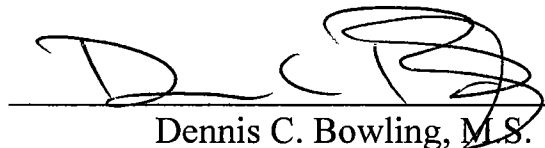
**Job Number 14804-B
December 10, 2004
Revised: December 30, 2004
Revised: March 23, 2005
Revised: April 20, 2005**



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Job Number 14804-B


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**FINAL DESIGN REPORT
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REVISION PAGE

April 20, 2005

This study presents a revision (and supersedes) the previous report with the following title and date:

“Final Design Report for Water Quality Basin at Woodside Avenue,”
with a revised date of March 23, 2005

This revision has been prepared to finalize this report based on the Final Grading Plans that were completed March 23, 2005. A draft version of the final report was prepared and dated March 23, 2005; however, final revisions were expected and are addressed within this final version.

**FINAL DESIGN REPORT
FOR
WATER QUALITY BASIN AT WOODSIDE AVENUE**

REVISION PAGE

March 23, 2005

This study presents a revision (and supersedes) the previous report with the following title and date:

“Preliminary Design for Water Quality Basin at Woodside Avenue,”
with a revised date of December 29, 2004

This revision has been prepared in order to address final design changes that occurred through the 50-percent and 100-percent plan preparation. Comments for the final report were received from the County on January 26, 2005, and they have also been addressed within this report. One important change that has occurred is that since the final design report was prepared, a field survey was performed by Rick Engineering Company (in February 2005), that provided a difference in existing elevations than those previously assumed from the available topography. As a result of those changes, the vertical constraints were tightened, and the final volumes contained within the basin have been reduced.

Refer to the enclosed report for all final engineering analyses, design data, and assumptions.

**FINAL DESIGN
FOR
WATER QUALITY BASIN AT WOODSIDE AVENUE**

REVISION PAGE

December 30, 2004

This study presents a revision (and supersedes) the previous report dated December 10, 2004 with the same title.

This revision has been prepared in order to provide Appendices D and E, which were intentionally left blank at the time of the December 10, 2004 report submittal to the County of San Diego.

1.0 INTRODUCTION

1.1 PROJECT DESCRIPTION

The County of San Diego Department of Public Works has received a grant agreement from the State Water Resources Control Board (State of California) that is identified as Agreement No. 04-067-559-0. The grant agreement calls for the design and construction of a water quality control basin and the removal of arundo on a vacant property. As a result of the grant agreement, this report has been prepared to summarize and provide the back-up data regarding hydraulics, hydrology, existing facility data, design criteria, specific design requirements, design constraints, assumptions, quantity and cost estimate support, and all engineering calculations and analyses in regards to the water quality control basin.

1.2 PROJECT LOCATION

The 1.7-acre project site is located on a vacant property upstream of Woodside Avenue in the Vicinity of Winter Gardens. The vacant property is East of Riverview Avenue and West of Winter Gardens Boulevard, APN 38207106.

A Vicinity Map for the project location has been provided as Appendix A. A copy of the basin layout is also shown in Appendix H of this report, and copies of Plan Sheets 2 through 5 are included for reference in Map Pocket 1 (these sheets depict specific details, project constraints, and the plan view).

1.3 TOPOGRAPHY AND LAND USE

The project area is characterized by mostly flat slopes, with what appears to be a large mound of fill that has been previously placed on-site. The property is vacant, covered by a mixture of barren (earthen) soils and some light vegetative cover (grasses). There are no buildings on-site, however, the two adjacent properties to the east and west are developed. A residential complex is located to the east, while an older industrial building and two residential lots are located to the

west. It appears that most of the upstream tributary drainage area is comprised of urbanized land, with a high quantity of impervious areas and development. The County of San Diego provided the topography that was used during the preliminary design, and additional field survey data (by Rick Engineering Company) has been used to supplement the topography during final design of the basin.

1.4 DRAINAGE CHARACTERISTICS

A large concrete channel conveys the majority of storm water runoff into the project site at the southeast corner. According to the "Channel Plans for: Riverview Farms Drainage Project," dated February 2, 1984, the size of the off-site channel is of the following dimensions: $b=18.0'$, $h=8.0'$, $z=0$. At the end of the large concrete channel, runoff is conveyed through a 40-foot riprap pad (per the plans – however, no longer visible) and transitions into an existing concrete (cobble) channel along the southern edge of the project site. The transition from the large off-site concrete channel to the smaller on-site concrete (cobble) channel is of the following approximate dimensions: $b=7.0'$, $h=6.0'$, $z=2$, $n=.035$ (as stated in the Flood Control Facilities Master Plan – Special Drainage Areas 5 and 6 for the County of San Diego - hereafter referred as the MDP, dated January 2004).

The existing concrete (cobble) channel conveys flow in a westerly direction along the southern edge of the project site until it turns 90-degrees to the north and flows along the western edge of the project site. At the northwest edge of the project site, the concrete (cobble) channel enters into an existing pair of 58-inch by 36-inch CMP culverts (via an existing headwall – below the existing sidewalk). The culverts (one oval, one squash) extend in a northwesterly direction under Woodside Avenue, and discharge into a 4'x6' Reinforced Concrete Box (RCB) culvert which immediately discharges into an open grass channel that runs westerly along the north edge of Woodside Ave. From there, storm water runoff flows through a series of existing underground storm drain pipe, open channels, and a triple box culvert (under Route 67) until runoff eventually discharges into Los Coches immediately upstream of its confluence with the San Diego River.

The project is intended to provide water quality treatment for the low flows passing through the project site. The water quality basin is not intended for flood control purposes, however, some

detention will occur that may help to reduce the magnitude of flooding occurrences. According to the MDP, the existing facilities located upstream of the site, through the site, and downstream of the site are all significantly undersized for the anticipated 100-year peak storm event. As a result, this project will not fix the potential flooding problems in the vicinity of the project, however, the basin will be designed in such a way as to prevent it from being worsened.

A copy of the AES Integrated Rational Method/UH Method computer program output that has been completed as part of the MDP has been provided in Appendix B for reference. Additionally, an 8.5" x 11" map is also included at the end of Appendix B that shows where the project site is in relation to the MDP drainage areas and node numbers. It is important to note that the latest MDP (available at the time of this report being finalized) provides two hydrologic calculations through the project site. The difference between the two separate analyses is that one incorporates a detention basin upstream that has not been built, while the other analysis does not incorporate the upstream detention basin. Based on conversations with the County of San Diego and the text of the MDP, it appears the detention basin that is modeled in the one analysis is considered a potential flood control-related project that may be designed/built in the future. However, at this time, it does not exist, and therefore will be ignored in the calculations for this water quality-related project.

The following portions of this report address the hydrology, water quality treatment, detention (hydrologic routing), hydraulics (i.e. spillways), and other design parameters in further detail.

2.0 HYDROLOGY

2.1 PRE-PROJECT HYDROLOGIC CHARACTERISTICS

The hydrologic characteristics for the project have been compiled from the Master Drainage Plan (MDP). This includes the 100-year peak storm event discharge rate, the tributary drainage area, and the time of concentration for flow entering the project site. The following table summarizes these values:

Table 2.1 - Summary of Pre-Project Hydrologic Characteristics for Water Quality Basin at Woodside Avenue

	At Upstream End of Basin (MDP Node 180266)	At Downstream End of Basin (MDP Node 180267)
100-Year Peak Runoff (Q_{100}), cfs:	1393	1404
Tributary Drainage Area (A), acres:	878	889
Time of Concentration (T_c), min:	19.9	20.2
Runoff Coefficient:	0.6 ¹	0.6 ¹

Note 1 - Not provided within the MDP, therefore an approximate value of $C = 0.6$ is used. This value was derived as a result of running the Rational Method Hydrograph program such that the program's output reflects the correct values for each of the known parameters from the modified rational method analysis (e.g. – the peak discharge 'Q', time of concentration ' T_c ', 6-hour precipitation ' P_6 ', and drainage area 'A').

A copy of the AES Integrated Rational Method/UH Method computer program output has been provided in Appendix B of this report. The AES output that is included in Appendix B provides the back-up for the numbers listed in Table 2.1 above, and does not reflect an upstream detention basin that may be built in the future (as it is proposed in the MDP). The MDP also included a separate analysis that does include an upstream detention basin that may be built, however, that analysis has not been provided within this report since it does not apply to existing conditions.

3.0 WATER QUALITY TREATMENT

3.1 WATER QUALITY TREATMENT CHARACTERISTICS

The water quality treatment characteristics that are desired per the numerical sizing criteria, established within the County of San Diego SUSMP, has been determined to be unattainable for the type of BMP proposed for this project. The constraints of the project size, 1.7 acres, and the available depth (as measured from the top of existing berm to the existing invert out) do not provide the desirable water quality treatment volume. The available depth during preliminary design was approximately 5.7-feet maximum, per the available topography. The available depth determined during final design (following the field survey data collection) is approximately 4.9-feet maximum (measured from top of curb at edge of roadway - EL 384.1, to lowest 58"x36" CMP invert out - EL 379.2). The table below summarizes the water quality treatment flowrate and volume that would be required to meet the numerical sizing criteria (per the SUSMP), as well as the water quality treatment that is actually proposed for the project:

Table 3.1 - Summary of Water Quality Treatment Characteristics for Water Quality Basin at Woodside Avenue

	Desirable per SUSMP (numerical sizing criteria)	Provided by Project
Water Quality Treatment Flowrate (Q_T), cfs:	142 cfs	n/a - volume based BMP
Water Quality Treatment Volume (WQ_V), acre-ft:	37.3 ac-ft	3.6 ac-ft ¹

Note 1 - Volume is measured from basin bottom (EL 379.5) to the lowest invert of the basin spillway (EL 383.1) that conveys overflow towards the existing 58-inch by 36-inch CMP culverts. This volume is used to size the low-flow orifice, such that the basin will drain in a 48-72 hour time frame.

Copies of the numerical sizing criteria calculations and the final proposed volumes (as computed using the Pondpack Computer Program) have been provided in Appendix C of this report for reference.

3.2 WATER QUALITY BASIN METHODOLOGY AND CRITERIA

The water quality basin will be constructed to function as a Dry Extended Detention Basin. This type of BMP was desirable for many reasons. Some of the advantages of an extended detention basin are listed in the California Stormwater Quality Association (CASQA) Stormwater Best Management Practice Handbook – New Development and Redevelopment, January 2003. The advantages are as follows:

- They are relatively easy and inexpensive to construct and operate.
- They can provide substantial capture of sediment and the toxics fraction associated with particulates.
- They can help with controlling channel erosion and can be used to provide flood control by including additional flood detention storage.

3.2.1 Drawdown Time and Low-flow Outlet Structure

The design of the basin does not include any areas of permanent pools. This has been done to allow the basin to fully drain and to help in the prevention/reduction of vector control concerns. As stated in CASQA, the low-flow outlet structure will be sized to allow for complete drawdown of the water quality volume within 48-72 hours. According to CASQA, a check should also be made to ensure that “no more than 50% of the water quality volume should drain from the facility within the first 24 hours.” Based on the final design for the basin, 50% of the water quality volume will drain in approximately 20 hours. In order to achieve the 24 hours, the total drawdown time would increase as well, nearing the threshold of 72-hours which was not desirable (based on conversations with the County).

An iterative procedure was used to determine what size would be required for the low-flow outlet structure to provide the desired drawdown time. The results of the final drawdown time calculation are summarized below:

Table 3.2.1 - Summary of Drawdown Time Calculation and Low-flow Outlet Structure

Diameter of Low-Flow Outlet Structure:	12-inch PVC, Steel Plated with 2" (wide) by 10" (high) vertical notch opening from flowline of outlet pipe, covered by a debris screen
Total Drawdown Time (T_{TOT}):	61.5 hours
Percent of Water Quality Volume Released in First 24 hours:	58%

The iterative process for sizing the low-flow outlet structure resulted in a final design that provides a steel plate that will be bolted over-top of a 12-inch PVC outlet pipe. The plate will be bolted directly in between the proposed debris screen and headwall. The plate will have a vertical notch with the following dimensions: 2" x 10" (width x height). This design was preferred over the use of a 4.5-inch circular opening, as it will allow the basin to drain in the event that several inches of sediment and/or debris bypass the debris screen and accumulate at the invert of the outlet pipe. The debris screen is discussed in further detail in Section 3.2.5.

A copy of the drawdown time calculation is provided in Appendix D.

3.2.2 Basin Configuration

The configuration of the project site provides a very desirable high aspect ratio, meaning, the length to width ratio far exceeds the minimum 1.5:1 (L:W) as stated in CASQA. The length to width ratio for the entire project site is approximately 5:1, which is also the length to width ratio based on the low-flow channel length versus the width of the basin. A low-flow channel has been provided to direct low flows in a meandering direction, from the edge of the gabion wall, to the downstream low-flow orifice structure.

The depth of the basin is approximately 4.6 feet at its largest depth. However, a depth of 3.6 feet is provided for the water quality volume, measured from the basin spillway crest elevation to the basin bottom. The basin spillway crest elevation has been set to match existing top of channel elevations at the desired spillway location, which (based on surveyed information) shows EL 383.1 at the lowest point and EL 383.2 at the highest point.

Note: Preliminary design had shown the basin spillway crest elevation at EL 384.0, which assumed existing top of channel elevations at EL 385.0, and assumed that the channel wall would be cut down 1-foot to provide the EL 384.0. Based on surveyed data during final design, these elevations were revised and resulted in a decreased depth and available water quality volume.

3.2.3 Pretreatment Sediment Forebay

A sediment forebay has been provided at the upstream end of the basin. The forebay will offer pretreatment for the inflow to the basin, and will help remove sediment from runoff prior to entering the basin. Overall maintenance for the basin will become easier as the majority of maintenance removals should be limited to the removal of sediment and debris from the forebay area. It is worth noting that the majority of overall recurring maintenance for a water quality basin is typically attributed to vegetation management and routine mowing.

Direct maintenance access to the sediment forebay has been provided with a maintenance access road that runs along the eastern side of the basin, ramps up and over the berm that separates the forebay from the main cell of the basin, and down into the forebay bottom. The access road will be built with a finished elevation two-feet higher than the bottom of the basin.

Several fixed vertical sediment depth markers will also be installed in the basin and the sediment forebay area to measure sediment deposition over time, and to help indicate when maintenance is needed. Each of the depth markers will extend 48-inches above the finished grade of the basin at each location. The markers that are proposed on the final plans are actually 48-inch Class 1 (Flexible Post) Delineators with below surface anchors – which are typically used as a traffic delineator/channelizer. Inspections will help indicate the amount of sediment deposition which is occurring over-time. When sediment removal maintenance is required, the originally designed grades should be reestablished by removing the deposited sediment to the top of the concrete anchors. Removal of sediment should occur when the deposited sediment falls within the range of 6-12 inches (or above).

3.2.4 Vegetation and Planting Plan

A planting plan has been prepared for the basin and is included within the final grading plans for the project. It is important to note that the final plan reflects that the low-lying basin floor will be planted with a variety of native grasses, while any larger plantings (i.e trees, shrubs) will be provided along the slopes and higher grounds.

According to CASQA, “mowing should be done at least annually to avoid establishment of woody vegetation, but may need to be performed much more frequently if aesthetics are an important consideration.”

3.2.5 Debris Screen for Low-flow Outlet Structure

As part of the final design for the basin, a debris screen has been added to the plans that will help reduce the chance and/or frequency of the low-flow outlet structure becoming clogged. It is more specifically a “Cast Iron Pipe Screen” for a 12-inch pipe. The dimensions of the debris screen are as follows: Height = 13 inches, Length = 18-inches, and Openings = 1-inch.

In addition to the debris screen, the headwall that has been provided for the 12-inch PVC pipe has been enlarged to provide the concrete slab that the screen will be bolted onto, and provides an additional 13.5-inches in length beyond the edge of the screen. This additional length of concrete will help to prevent vegetation from growing in the same location as the debris screen and/or 12-inch PVC pipe.

Please refer to the grading plans for additional details on the debris screen.

3.3 INSPECTION, OPERATION, AND MAINTENANCE OF BASIN

3.3.1 Initial Inspections

The long-term effectiveness of the basin will partially be dependent on the frequency of inspections and maintenance activities. It will be important to inspect the basin after the first large storm event to determine if the desired drawdown (residence) time is achieved and functioning properly (48-72 hours). If the drawdown time is not within the desired parameters, then modifications should be made to the low-flow orifice structure to better provide the desired timeframe. Close attention should also be made to the appearance of possible clogging to the low-flow structure and/or debris screen (refer to Section 3.2.5 above for additional information regarding the debris screen). If it appears that there may be a potential problem with clogging, then additional steps should be taken to help prevent such an occurrence (or increase the inspection frequency until a better comfort level is reached).

3.3.2 Periodic Inspections and Maintenance

As briefly mentioned earlier in this report, the majority of routine maintenance hours is typically spent for vegetation management, such as mowing. Mowing should be done at least annually to avoid establishment of woody vegetation, but may be required more often for aesthetics. According to CASQA, recent Caltrans studies have suggested an average of 72 hours of maintenance annually for similar basins. A significant amount of maintenance time has been attributed to vector control as a result of stilling basins installed as energy dissipaters. However, frequent removal of debris accumulations and vegetation management should help maintain a dewatering time of 48-72 hours, and therefore help prevent mosquito and other vector habitats.

The following list from CASQA details typical inspection and maintenance “activities and frequencies”:

- Schedule semiannual inspection for the beginning and end of the wet season for standing water, slope stability, sediment accumulation, trash and debris, and presence of burrows.

- Remove accumulated trash and debris in the basin and around the riser pipe during semiannual inspections. The frequency of this activity may be altered to meet specific site conditions.
- Trim vegetation at the beginning and end of the wet season and inspect monthly to prevent establishment of woody vegetation and for aesthetic and vector reasons.
- Remove sediment and regrade about every 10 years or when the accumulated sediment volume exceeds 10 percent of the basin volume. Inspect the basin each year for accumulated sediment volume.

Specifically, the basin and/or sediment forebay area should be maintained when 6-12 inches of sediment deposition has occurred. The five (5) sediment depth markers shown on the plans will help in determining the depth of deposited sediment. Specifically, the markers will extend 48-inches above the finished grade of the basin bottom.

According to CASQA, the typical “annual cost of routine maintenance is typically estimated at 3 to 5 percent of the construction cost.” An alternative cost estimate may be formed by summing the costs for the annual inspections, maintenance, vector control issues, administration, and materials that would be anticipated for the basin.

4.0 DETENTION

4.1 DETENTION CHARACTERISTICS

The purpose of this project is primarily for water quality; however, the creation of additional storage volume on the project site will also help reduce the magnitude of flooding to the adjacent property and Woodside Ave. The existing flooding characteristics of the site have been considered in the design layout of the basin and the several hydraulic conveyance systems that will be necessary to contain and/or convey both the low-flow and flood-sized storm events. The following table details the total volume of storage provided prior to overtopping of the basin, and also shows the amount of runoff that is expected to discharge from the project site during both the pre-project and post-project 100-year peak storm events:

Table 4.1 - Summary of Detention Characteristics for Water Quality Basin at Woodside Avenue

Total Detention Volume (V_{TOT}), acre-ft:	5.2 ¹
Pre-project 'Undetained' 100-Year Peak Runoff (Q_{100}), cfs:	1404
Post-project 'Detained by WQ basin' 100-Year Peak Runoff (Q_{100}), cfs:	1371

Note 1 - This is the total volume that can be credited for storage during larger, flood-sized storm events, prior to overflow occurring at an elevation of 384.1. The volume is measured from basin bottom to the invert of the existing berm (which will act as an emergency spillway), at approximately 384.1, which allows overflow to Woodside Ave located to the north. It is important to note that overflow also occurs over the top of the existing concrete (cobble) channel located along the western edge of the property that allows overflow to the adjacent properties located to the west (overflow towards this area begins to occur at approximately 384.2 – based on the lowest adjacent grade).

The reduction in peak runoff from pre-project to post-project conditions is minor since the basin begins to fill during the initial stages of rainfall and when the peak in runoff occurs, the storage volume within the basin has already been filled.

A copy of the final proposed volume computations is provided as part of Appendix C.

4.2 DETENTION METHODOLOGY AND CRITERIA

A modified rational method hydrograph synthesizing procedure was used to generate an inflow hydrograph for the water quality basins based on the modified rational method results. The United States Army Corps of Engineers' HEC-1 hydrologic model was used to analyze the actual detention that occurs due to the basin.

4.2.1 Rational Method Hydrograph Synthesizing Procedure Methodology and Criteria:

The flood-control effectiveness of a detention facility requires an inflow hydrograph to obtain the amount of runoff that will be detained based on the provided storage volume. The modified rational method only yields a peak discharge and time of concentration, and does not yield a hydrograph. In order to convert the peak discharge and time of concentration into a hydrograph, a modified rational method hydrograph synthesizing procedure was used. The modified rational method hydrograph synthesizing procedure methodology and criteria that were used are described in Section 6.0, Rational Method Hydrograph Procedure, of the *San Diego County Hydrology Manual June 2003*.

A copy of the results for the synthesizing procedure is included at the back of Appendix E.

4.2.2 HEC-1 Methodology and Criteria:

The 100-year 6-hour storm event hydrograph was used in the HEC-1 hydrologic model to perform routing calculations for the detention basin. The results of the analysis show a reduction in peak runoff from the pre-project discharge ($Q_{100} = 1404$ cfs), to the post-project discharge ($Q_{100} = 1371$ cfs).

A copy of the results for the HEC-1 detention analysis is included in Appendix E.

5.0 HYDRAULICS

There are several components of the basin that require hydraulic considerations. As discussed throughout this report, flooding has been a problem under pre-project conditions and will still continue to be a problem in the vicinity of the project site under post-project conditions. However, as part of the basin design, each spillway (and/or conveyance system) has been designed in order to convey the required amount of runoff such that the magnitude and frequency of flooding will not be worsened for any of the surrounding areas. As discussed in Section 4.0 of this report, the amount of flooding will actually decrease as a result of an increase in storage volume on-site.

5.1 FOREBAY SPILLWAY – Into Water Quality Basin

The forebay has been separated from the rest of the basin by the installation of a gabion wall. The gabion wall will allow ponded water within the forebay to filter through the gabions and into the basin. However, during larger storm events, the ponded water will reach a set elevation where it will begin to overtop the gabion wall and flow directly into the basin. The top of the gabion wall will act as an overflow spillway (weir), and is sized to convey most of the 100-year peak storm event without allowing overtopping of the exterior berm surrounding the forebay and basin. However, the weir length and amount of head provided above the proposed gabion wall and maintenance access road fall slightly short of what would actually convey the entire 100-year peak storm event (1404 cfs). The small difference (1364 cfs versus 1404 cfs) is not significant since the entire basin would already be full and spilling over due to the backwater effects from the undersized twin culverts located at the downstream end of the basin.

A copy of the weir calculation has been provided in Appendix F.

5.2 BASIN SPILLWAY – Into Existing Channel and Culverts

A spillway has been provided at the downstream end of the basin that will convey a specified flow into the existing concrete (cobble) channel and into the existing pair of CMP culverts (under Woodside Ave.). The main criterion that has been used to size this spillway is the limited conveyance available through the existing culverts. According to the MDP, the two culverts have a combined capacity of 236 cfs. However, utilizing the inlet control charts issued by the Bureau of Public Roads, the two culverts combine for a “inlet control” capacity of 200 cfs (assuming the available head is 4.9-feet; 384.1 minus 379.2). Since the MDP capacity of 236 cfs is greater, the basin spillway has been sized to pass this larger amount of peak runoff.

Under both the pre-project and post-project conditions, once the two culverts reach their capacity under the maximum available head, overtopping begins to occur towards both the western property and onto Woodside Ave. Therefore, the spillway into the portion of the existing channel that will remain, has been sized to provide conveyance of 236 cfs under 1-foot of head. The top of the spillway has been set at EL 383.1 (based on the existing top of channel elevations – per the field survey performed by Rick Engineering Company), while the adjacent sides to the north and west of the spillway are at existing minimum elevations of EL 384.1.

A copy of the weir calculation has been provided in Appendix F.

5.3 EX. EMERGENCY SPILLWAY – On to Western Property and Woodside Ave.

The project currently proposes to leave the adjacent grades to the west and north (Woodside Ave) as-is. When flooding on-site reaches an elevation of EL 384.1, overtopping of the basin will continue to occur as it does under pre-project conditions. It was apparent during a field visit that the northern edge of the basin property functions as an emergency spillway under pre-project conditions. The existing berm, sidewalk, and roadway will continue to receive overflow from the project site as it does today. However, as discussed earlier in this report, the magnitude and frequency of flooding should be decreased (although only slightly for large storm events) as a result of the additional storage provided as part of this project.

6.0 CONCLUSION

The design of the water quality basin was based on maximizing the available volume on-site without creating a permanent pool. A permanent pool was undesirable, as they tend to cause problems with vector control issues (i.e. mosquito breeding). Important constraints with which the design was based upon included the existing inflow and outflow invert elevations and the existing elevations surrounding the project site (along the edge of the vacant property). It is well known that flooding is a major problem in the vicinity of the project (as documented within the MDP), therefore, since this project provides a significant amount of sediment removal and will create additional storage volume on-site, detention will help to reduce the magnitude and frequency of flooding (although only slightly).

The extended detention basin has been designed to include a sediment forebay that will be separated from the main portion of the basin with a gabion wall. The gabion wall has a height of 2-feet that will help retain accumulated sediment and debris while letting low-flows trickle through. During larger storm events, overflow of the gabion wall will occur, therefore, 2.5-feet of additional height has been provided above the wall to provide the necessary conveyance of the 100-year peak storm event (as determined during the MDP by the County of San Diego).

The main portion of the basin will be graded such that there will be a defined pilot channel that will direct low-flows in a meandering pattern and eventually to the low-flow orifice structure at the downstream end of the basin. The entire basin bottom will be vegetated with native grasses and other low-lying, easily maintained vegetation. Larger plantings and trees will be provided along the slopes and upper portions of the surrounding berms.

The low-flow orifice has been designed to drain the basin in 48-72 hours for a combination of maximizing water quality treatment while minimizing vector control influences. An access road has been provided for maintenance purposes. Inspections and maintenance activities will occur on a frequent basis, as recommended by CASQA and/or additional agencies.

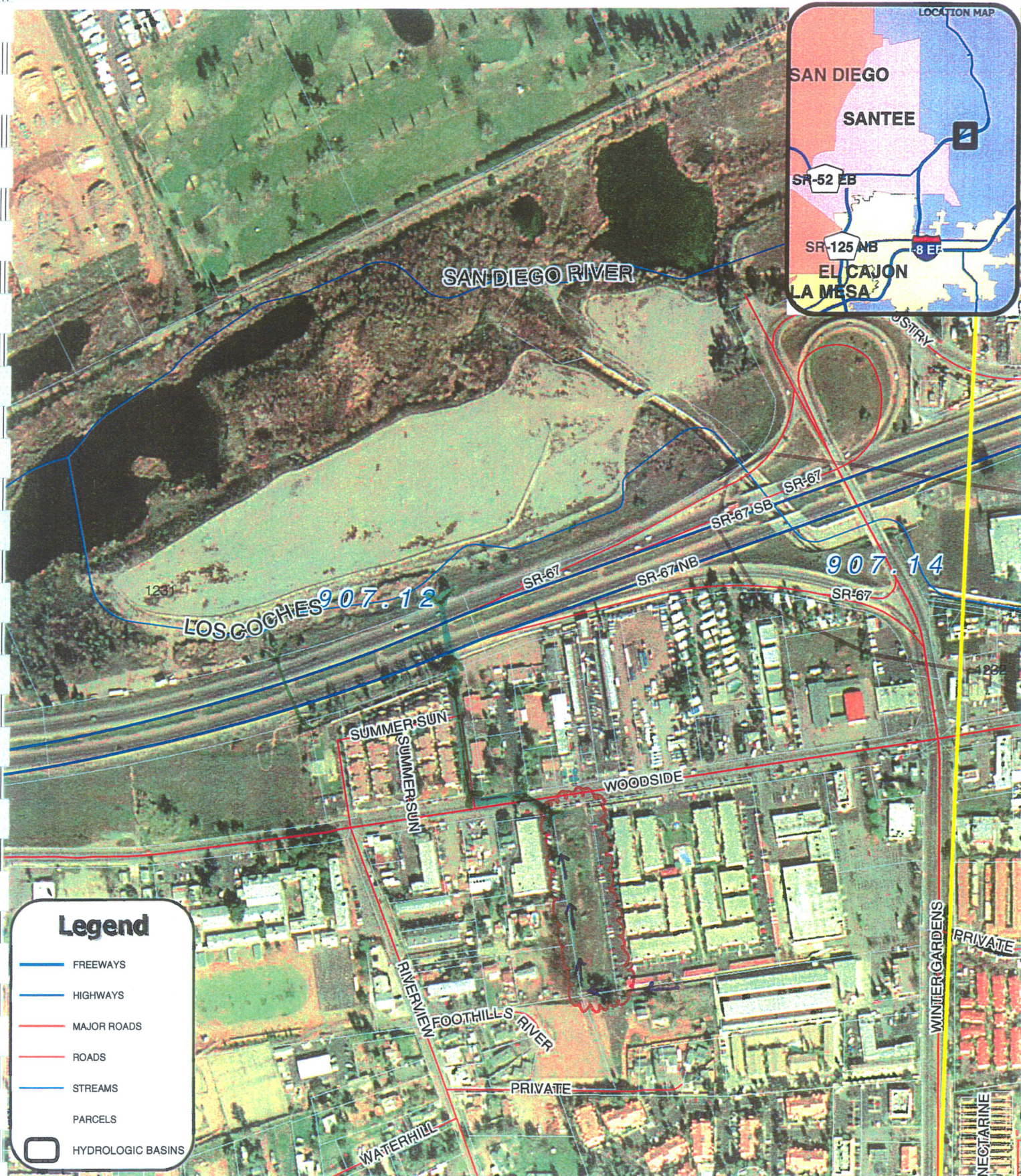
Large storm events will still cause overtopping of the existing concrete channel wall along the western boundary and of the existing berm along the northern edge of the property (Woodside Ave.). While the project will reduce the magnitude and frequency of flooding to these areas, flooding will still occur in the post-project condition.

Overall, the proposed project will provide a combination of water quality and flood control benefits (primarily water quality). As part of the project, any existing arundo on-site will be removed as part of the grading process. The effects of the water quality treatment will be seen over the years to come as part of an ongoing monitoring and sampling plan that is currently under final design as part of the project.

Copies of Grading Plan Sheets 2 through 5 have been provided in Map Pocket 1 of this report (for reference only). The sheets include some of the relevant details, constraints, and plan view information as they pertain to this report.

APPENDIX A

Vicinity Map



APPENDIX B

Copy of AES

Integrated Rational Method/UH Method

Computer program output,

and

8.5" x 11" Master Drainage Plan Exhibit

PAGE 1
OF
ANALYSIS

INTEGRATED RATIONAL METHOD/UH METHOD HYDROLOGY COMPUTER PROGRAM PACKAGE
Reference: SAN DIEGO COUNTY FLOOD CONTROL DISTRICT

1985, 1981 HYDROLOGY MANUAL
(c) Copyright 1982-2001 Advanced Engineering Software (aes)
Ver. 1.5A Release Date: 01/01/2001 License ID 1549

Analysis prepared by:

" WITHOUT DETENTION "

- Reflects the existing
conditions at the
time of the Woodside Ave
Water Quality Basin project.

FILE NAME: SF1802ZZ.Z11
TIME/DATE OF STUDY: 16:23 01/20/2005

USER SPECIFIED HYDROLOGY AND HYDRAULIC MODEL INFORMATION:

1985 SAN DIEGO MANUAL CRITERIA

USER SPECIFIED STORM EVENT(YEAR) = 100.00
6-HOUR DURATION PRECIPITATION (INCHES) = 2.670
SPECIFIED MINIMUM PIPE SIZE(INCH) = 18.00
SPECIFIED PERCENT OF GRADIENTS(DECIMAL) TO USE FOR FRICTION SLOPE = 0.85
SAN DIEGO HYDROLOGY MANUAL "C"-VALUES USED FOR RATIONAL METHOD
NOTE: ONLY PEAK CONFLUENCE VALUES CONSIDERED

USER-DEFINED STREET-SECTIONS FOR COUPLED PIPEFLOW AND STREETFLOW MODEL

NO.	HALF- WIDTH (FT)	CROWN TO CROSSFALL (FT)	STREET-CROSSFALL: IN- / OUT-/PARK- SIDE / SIDE/ WAY	CURB HEIGHT (FT)	GUTTER-GEOMETRIES:			MANNING FACTOR (n)
					WIDTH (FT)	LIP (FT)	HIKE (FT)	
1	44.0	20.0	0.020/0.020/0.020	0.67	2.00	0.0313	0.167	0.0160
2	32.0	20.0	0.020/0.020/0.020	0.67	2.00	0.0313	0.167	0.0160
3	34.0	20.0	0.020/0.020/0.020	0.67	2.00	0.0313	0.167	0.0160
4	26.0	20.0	0.020/0.020/0.020	0.67	2.00	0.0313	0.167	0.0160
5	32.0	20.0	0.020/0.020/0.020	0.50	1.50	0.0313	0.125	0.0160
6	20.0	15.0	0.020/0.020/0.020	0.50	1.50	0.0313	0.125	0.0160
7	18.0	10.0	0.020/0.020/0.020	0.50	1.50	0.0313	0.125	0.0160
8	54.0	20.0	0.020/0.020/0.020	0.67	2.00	0.0313	0.167	0.0160
9	42.0	20.0	0.020/0.020/0.020	0.67	2.00	0.0313	0.167	0.0160

GLOBAL STREET FLOW-DEPTH CONSTRAINTS:

1. Relative Flow-Depth = 0.00 FEET
as (Maximum Allowable Street Flow Depth) - (Top-of-Curb)
2. (Depth)*(Velocity) Constraint = 6.0 (FT*FT/S)

*SIZE PIPE WITH A FLOW CAPACITY GREATER THAN

OR EQUAL TO THE UPSTREAM TRIBUTARY PIPE.*

*USER-SPECIFIED MINIMUM TOPOGRAPHIC SLOPE ADJUSTMENT NOT SELECTED

UNIT-HYDROGRAPH MODEL SELECTIONS/PARAMETERS:

WATERSHED LAG = 0.80 * TC

S.C.S. S-GRAPH USED.

TYPE B: 6-HOUR DESIGN STORM USED.

TYPE B: 24-HOUR DESIGN STORM USED.

ANTECEDENT MOISTURE CONDITION (AMC) III ASSUMED FOR UNIT HYDROGRAPH METHOD

FLOW PROCESS FROM NODE SF180200.0 TO NODE SF180201.0 IS CODE = 21

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<

SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .4500

SOIL CLASSIFICATION IS "B"

S.C.S. CURVE NUMBER (AMC II) = 80

INITIAL SUBAREA FLOW-LENGTH = 492.15

UPSTREAM ELEVATION = 850.00

DOWNSTREAM ELEVATION = 675.62

ELEVATION DIFFERENCE = 174.38

URBAN SUBAREA OVERLAND TIME OF FLOW(MINUTES) = 7.904

*CAUTION: SUBAREA SLOPE EXCEEDS COUNTY NOMOGRAPH

DEFINITION. EXTRAPOLATION OF NOMOGRAPH USED.

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 5.236

SUBAREA RUNOFF(CFS) = 7.30

TOTAL AREA(ACRES) = 3.10 TOTAL RUNOFF(CFS) = 7.30

OF

ANALYSIS

SF1802ZZ.RF1

FLOW PROCESS FROM NODE SF180264.0 TO NODE SF180264.0 IS CODE = 11

>>>>CONFLUENCE MEMORY BANK # 1 WITH THE MAIN-STREAM MEMORY<<<<<

** MAIN STREAM CONFLUENCE DATA **

STREAM NUMBER	RUNOFF (CFS)	TC (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	398.44	31.13	2.163	360.51

LONGEST FLOWPATH FROM NODE 180121.00 TO NODE 180264.00 = 11125.56 FEET.

** MEMORY BANK # 1 CONFLUENCE DATA **

STREAM NUMBER	RUNOFF (CFS)	TC (MIN.)	INTENSITY (INCH/HOUR)	AREA (ACRE)
1	542.09	19.02	2.972	478.70

LONGEST FLOWPATH FROM NODE 180220.00 TO NODE 180264.00 = 11003.19 FEET.

** PEAK FLOW RATE TABLE **

STREAM NUMBER	RUNOFF (CFS)	TC (MIN.)	INTENSITY (INCH/HOUR)
1	832.03	19.02	2.972
2	792.92	31.13	2.163

COMPUTED CONFLUENCE ESTIMATES ARE AS FOLLOWS:

PEAK FLOW RATE(CFS) = 832.03 TC(MIN.) = 19.02
 TOTAL AREA(ACRES) = 839.21

FLOW PROCESS FROM NODE SF180264.0 TO NODE SF180264.0 IS CODE = 71

>>>>PEAK FLOW RATE ESTIMATOR CHANGED TO UNIT-HYDROGRAPH METHOD<<<<<

>>>>USING TIME-OF-CONCENTRATION OF LONGEST FLOWPATH<<<<<

UNIT-HYDROGRAPH DATA:

S-GRAPH: S.C.S.=100.0%;VALLEY(DEV.)= 0.0%;FOOTHILL= 0.0%;DESERT= 0.0%
 TC(HR) = 0.32; LAG(HR) = 0.25

AREA-AVERAGED CURVE NUMBER = 94. MINIMUM LOSS RATE(INCH/HOUR) = 0.04

COUNTY OF SAN DIEGO DEPTH-AREA FACTORS USED WITH AMC III CONDITION.

UNIT-INTERVAL(MIN) = 5.00 TOTAL AREA(ACRES) = 839.21

LONGEST FLOWPATH FROM NODE 180121.00 TO NODE 180264.00 = 11125.56 FEET.

EQUIVALENT BASIN FACTOR (VERSUS Lca/L RATIO) APPROXIMATIONS:

Lca/L=0.3,n=.0269;Lca/L=0.4,n=.0241;Lca/L=0.5,n=.0221;Lca/L=0.6,n=.0207

RAINFALL(INCH):6H= 2.66 for Type B Storm.

TIME OF PEAK FLOW(HR) = 2.58 RUNOFF VOLUME(AF) = 135.55

RAINFALL(INCH):24H= 5.83 for Type B Storm.

TIME OF PEAK FLOW(HR) = 9.58 RUNOFF VOLUME(AF) = 317.93

UNIT-HYDROGRAPH PEAK FLOW RATE(CFS): 6H = 1351.08; 24H = 902.22

UNIT-HYDROGRAPH METHOD PEAK FLOW RATE(CFS) = 1351.08

RATIONAL METHOD PEAK FLOW RATE(CFS) = 832.03

(UPSTREAM NODE PEAK FLOW RATE(CFS) = 832.03)

PEAK FLOW RATE(CFS) USED = 1351.08

FLOW PROCESS FROM NODE SF180264.0 TO NODE SF180265.0 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<

>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

ELEVATION DATA: UPSTREAM(FEET) = 383.44 DOWNSTREAM(FEET) = 381.66

CHANNEL LENGTH THRU SUBAREA(FEET) = 493.05 CHANNEL SLOPE = 0.0036

CHANNEL BASE(FEET) = 18.00 "Z" FACTOR = 0.000

MANNING'S FACTOR = 0.015 MAXIMUM DEPTH(FEET) = 6.00

CHANNEL FLOW THRU SUBAREA(CFS) = 1351.08

FLOW VELOCITY(FEET/SEC) = 13.54 FLOW DEPTH(FEET) = 5.54

TRAVEL TIME(MIN.) = 0.61 TC(MIN.) = 19.63

LONGEST FLOWPATH FROM NODE 180121.00 TO NODE 180265.00 = 11618.61 FEET.

FLOW PROCESS FROM NODE SF180265.0 TO NODE SF180266.0 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<<

>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<<

ELEVATION DATA: UPSTREAM(FEET) = 381.66 DOWNSTREAM(FEET) = 380.50

CHANNEL LENGTH THRU SUBAREA(FEET) = 200.09 CHANNEL SLOPE = 0.0058

CHANNEL BASE(FEET) = 7.00 "Z" FACTOR = 2.000

MANNING'S FACTOR = 0.035 MAXIMUM DEPTH(FEET) = 6.00

*The following pages
include the areas
of the Woodside
Ave Water Quality
Basin project, &
the downstream
portion to the end
of the study

==>>WARNING: FLOW IN CHANNEL EXCEEDS CHANNEL
CAPACITY(NORMAL DEPTH EQUAL TO SPECIFIED MAXIMUM
ALLOWABLE DEPTH).
AS AN APPROXIMATION, FLOWDEPTH IS SET AT MAXIMUM
ALLOWABLE DEPTH AND IS USED FOR TRAVELTIME CALCULATIONS.

CHANNEL FLOW THRU SUBAREA(CFS) = 1351.08
FLOW VELOCITY(FEET/SEC) = 11.85 FLOW DEPTH(FEET) = 6.00
TRAVEL TIME(MIN.) = 0.28 Tc(MIN.) = 19.91

==>FLOWDEPTH EXCEEDS MAXIMUM ALLOWABLE DEPTH

LONGEST FLOWPATH FROM NODE 180121.00 TO NODE 180266.00 = 11818.70 FEET.

FLOW PROCESS FROM NODE SF180266.0 TO NODE SF180266.0 IS CODE = 81.

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<

=====

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 2.885
RURAL DEVELOPMENT RUNOFF COEFFICIENT = .4000
SOIL CLASSIFICATION IS "C"
S.C.S. CURVE NUMBER (AMC II) = 84
AREA(ACRES) = 16.20
COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8000
SOIL CLASSIFICATION IS "C"
S.C.S. CURVE NUMBER (AMC II) = 91
AREA(ACRES) = 9.40
RURAL DEVELOPMENT RUNOFF COEFFICIENT = .3500
SOIL CLASSIFICATION IS "B"
S.C.S. CURVE NUMBER (AMC II) = 78
AREA(ACRES) = 8.70
COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .7500
SOIL CLASSIFICATION IS "B"
S.C.S. CURVE NUMBER (AMC II) = 90
AREA(ACRES) = 4.00
COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8500
SOIL CLASSIFICATION IS "D"
S.C.S. CURVE NUMBER (AMC II) = 92
AREA(ACRES) = 0.10
SUBAREA AVERAGE RUNOFF COEFFICIENT = 0.5242
SUBAREA AREA(ACRES) = 38.40
UNIT-HYDROGRAPH DATA:
S-GRAPE: S.C.S.=100.0%;VALLEY(DEV.)= 0.0%;FOOTHILL= 0.0%;DESERT= 0.0%
Tc(HR) = 0.33; LAG(HR) = 0.27
AREA-AVERAGED CURVE NUMBER = 94. MINIMUM LOSS RATE(INCH/HOUR) = 0.04
COUNTY OF SAN DIEGO DEPTH-AREA FACTORS USED WITH AMC III CONDITION.
UNIT-INTERVAL(MIN) = 5.00 TOTAL AREA(ACRES) = 877.61
LONGEST FLOWPATH FROM NODE 180121.00 TO NODE 180266.00 = 11818.70 FEET.
EQUIVALENT BASIN FACTOR (VERSUS Lca/L RATIO) APPROXIMATIONS:
Lca/L=0.3,n=.0266;Lca/L=0.4,n=.0238;Lca/L=0.5,n=.0219;Lca/L=0.6,n=.0204
RAINFALL(INCH):6H= 2.66 for Type B Storm.
TIME OF PEAK FLOW(HR) = 2.58 RUNOFF VOLUME(AF) = 141.65
RAINFALL(INCH):24H= 5.82 for Type B Storm.
TIME OF PEAK FLOW(HR) = 9.58 RUNOFF VOLUME(AF) = 331.79
UNIT-HYDROGRAPH PEAK FLOW RATE(CFS): 6H = 1393.29; 24H = 941.41
TOTAL AREA(ACRES) = 877.61 PROGRAM PEAK FLOW(CFS) = 1393.29
Tc(MIN) = 19.91

SUBAREA AREA-AVERAGED RAINFALL DEPTH(INCH):
6HR = 2.65; 24HR = 5.70

FLOW PROCESS FROM NODE SF180266.0 TO NODE SF180267.0 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<
>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 380.50 DOWNSTREAM(FEET) = 379.40
CHANNEL LENGTH THRU SUBAREA(FEET) = 649.99 CHANNEL SLOPE = 0.0017
CHANNEL BASE(FEET) = 3.00 "Z" FACTOR = 1.000
MANNING'S FACTOR = 0.020 MAXIMUM DEPTH(FEET) = 5.00

==>>WARNING: FLOW IN CHANNEL EXCEEDS CHANNEL
CAPACITY(NORMAL DEPTH EQUAL TO SPECIFIED MAXIMUM
ALLOWABLE DEPTH).
AS AN APPROXIMATION, FLOWDEPTH IS SET AT MAXIMUM
ALLOWABLE DEPTH AND IS USED FOR TRAVELTIME CALCULATIONS.

CHANNEL FLOW THRU SUBAREA(CFS) = 1393.29
 FLOW VELOCITY(FEET/SEC) = 34.83 FLOW DEPTH(FEET) = 5.00
 TRAVEL TIME(MIN.) = 0.31 TC(MIN.) = 20.22

==>FLOWDEPTH EXCEEDS MAXIMUM ALLOWABLE DEPTH

LONGEST FLOWPATH FROM NODE 180121.00 TO NODE 180267.00 = 12468.69 FEET.

 FLOW PROCESS FROM NODE SF180267.0 TO NODE SF180267.0 IS CODE = 81

 >>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 2.857
 MULTI-UNITS DEVELOPMENT RUNOFF COEFFICIENT = .5000
 SOIL CLASSIFICATION IS "B"
 S.C.S. CURVE NUMBER (AMC II) = 82
 AREA(ACRES) = 4.20
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) = 92
 AREA(ACRES) = 3.90
 COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .7500
 SOIL CLASSIFICATION IS "B"
 S.C.S. CURVE NUMBER (AMC II) = 90
 AREA(ACRES) = 1.90
 MULTI-UNITS DEVELOPMENT RUNOFF COEFFICIENT = .6000
 SOIL CLASSIFICATION IS "C"
 S.C.S. CURVE NUMBER (AMC II) = 88
 AREA(ACRES) = 0.70
 RURAL DEVELOPMENT RUNOFF COEFFICIENT = .4000
 SOIL CLASSIFICATION IS "C"
 S.C.S. CURVE NUMBER (AMC II) = 84
 AREA(ACRES) = 0.30
 SUBAREA AVERAGE RUNOFF COEFFICIENT = 0.6709
 SUBAREA AREA(ACRES) = 11.00
 UNIT-HYDROGRAPH DATA:
 S-GRAPE: S.C.S.=100.0%;VALLEY(DEV.)= 0.0%;FOOTHILL= 0.0%;DESERT= 0.0%
 TC(HR) = 0.34; LAG(HR) = 0.27
 AREA-AVERAGED CURVE NUMBER = 94. MINIMUM LOSS RATE(INCH/HOUR) = 0.04
 COUNTY OF SAN DIEGO DEPTH-AREA FACTORS USED WITH AMC III CONDITION.
 UNIT-INTERVAL(MIN) = 5.00 TOTAL AREA(ACRES) = 888.61
 LONGEST FLOWPATH FROM NODE 180121.00 TO NODE 180267.00 = 12468.69 FEET.
 EQUIVALENT BASIN FACTOR (VERSUS Lca/L RATIO) APPROXIMATIONS:
 Lca/L=0.3,n=.0257;Lca/L=0.4,n=.0230;Lca/L=0.5,n=.0212;Lca/L=0.6,n=.0197
 RAINFALL(INCH):6H= 2.66 for Type B Storm.
 TIME OF PEAK FLOW(HR) = 2.58 RUNOFF VOLUME(AF) = 143.46
 RAINFALL(INCH):24H= 5.82 for Type B Storm.
 TIME OF PEAK FLOW(HR) = 9.58 RUNOFF VOLUME(AF) = 336.02
 UNIT-HYDROGRAPH PEAK FLOW RATE(CFS): 6H = 1403.64; 24H = 952.46
 TOTAL AREA(ACRES) = 888.61 PROGRAM PEAK FLOW(CFS) = 1403.64
 TC(MIN) = 20.22

SUBAREA AREA-AVERAGED RAINFALL DEPTH(INCH):
 6HR = 2.67; 24HR = 5.73

 FLOW PROCESS FROM NODE SF180267.0 TO NODE SF180268.0 IS CODE = 47

 >>>>COMPUTE CULVERT TRAVEL TIME THRU SUBAREA<<<<<
 >>>>USING USER-SPECIFIED CULVERT SIZE (EXISTING ELEMENT)<<<<<

=====

ELEVATION DATA: UPSTREAM(FEET) = 379.40 DOWNSTREAM(FEET) = 377.88
 FLOW LENGTH(FEET) = 153.12 MANNING'S N = 0.014

Notes:

1. Reference: "Hydraulic Charts for the Selection of Highway Culverts", Hydraulic Engineering Circular No. 5, December 1965, Federal Highway Administration.
 2. INLET control for all culvert Analysis.
 3. Headwater depth is ASSUMED to be 3 FEET above the culvert soffit.
- GIVEN BOX CULVERT HEIGHT(FEET) = 3.00
 GIVEN BOX CULVERT BASEWIDTH(FEET) = 7.60
 ESTIMATED BOX CULVERT BASEWIDTH(FEET) = 45.28

*NOTE: CULVERT-FLOW VELOCITY AND TRAVEL TIME
 ARE BASED ON ESTIMATED CULVERT SIZE.
 CULVERT-FLOW VELOCITY(FEET/SEC.) = 10.33
 CULVERT-FLOW(CFS) = 1403.64

SF1802ZZ.RF1
CULVERT-FLOW TRAVEL TIME(MIN.) = 0.25 Tc(MIN.) = 20.47
LONGEST FLOWPATH FROM NODE 180121.00 TO NODE 180268.00 = 12621.81 FEET.

FLOW PROCESS FROM NODE SF180268.0 TO NODE SF180268.0 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<
=====

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 2.835
COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .7500
SOIL CLASSIFICATION IS "B"
S.C.S. CURVE NUMBER (AMC II) = 90
AREA(ACRES) = 20.20
MULTI-UNITS DEVELOPMENT RUNOFF COEFFICIENT = .5000
SOIL CLASSIFICATION IS "B"
S.C.S. CURVE NUMBER (AMC II) = 82
AREA(ACRES) = 6.50
RURAL DEVELOPMENT RUNOFF COEFFICIENT = .4000
SOIL CLASSIFICATION IS "C"
S.C.S. CURVE NUMBER (AMC II) = 84
AREA(ACRES) = 1.50
COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .8500
SOIL CLASSIFICATION IS "D"
S.C.S. CURVE NUMBER (AMC II) = 92
AREA(ACRES) = 1.20
MULTI-UNITS DEVELOPMENT RUNOFF COEFFICIENT = .7000
SOIL CLASSIFICATION IS "D"
S.C.S. CURVE NUMBER (AMC II) = 90
AREA(ACRES) = 0.90
MULTI-UNITS DEVELOPMENT RUNOFF COEFFICIENT = .6000
SOIL CLASSIFICATION IS "C"
S.C.S. CURVE NUMBER (AMC II) = 88
AREA(ACRES) = 0.50
SUBAREA AVERAGE RUNOFF COEFFICIENT = 0.6802
SUBAREA AREA(ACRES) = 30.80
UNIT-HYDROGRAPH DATA:
S-GRAPE: S.C.S.=100.0%;VALLEY(DEV.)= 0.0%;FOOTHILL= 0.0%;DESERT= 0.0%
Tc(HR) = 0.34; LAG(HR) = 0.27
AREA-AVERAGED CURVE NUMBER = 94. MINIMUM LOSS RATE(INCH/HOUR) = 0.04
COUNTY OF SAN DIEGO DEPTH-AREA FACTORS USED WITH AMC III CONDITION.
UNIT-INTERVAL(MIN) = 5.00 TOTAL AREA(ACRES) = 919.41
LONGEST FLOWPATH FROM NODE 180121.00 TO NODE 180268.00 = 12621.81 FEET.
EQUIVALENT BASIN FACTOR (VERSUS Lca/L RATIO) APPROXIMATIONS:
Lca/L=0.3,n=.0257;Lca/L=0.4,n=.0230;Lca/L=0.5,n=.0212;Lca/L=0.6,n=.0198
RAINFALL(INCH):6H= 2.66 for Type B Storm.
TIME OF PEAK FLOW(HR) = 2.58 RUNOFF VOLUME(AF) = 148.40
RAINFALL(INCH):24H= 5.82 for Type B Storm.
TIME OF PEAK FLOW(HR) = 9.58 RUNOFF VOLUME(AF) = 347.22
UNIT-HYDROGRAPH PEAK FLOW RATE(CFS): 6H = 1446.29; 24H = 984.29
TOTAL AREA(ACRES) = 919.41 PROGRAM PEAK FLOW(CFS) = 1446.29
TC(MIN) = 20.47

SUBAREA AREA-AVERAGED RAINFALL DEPTH(INCH):
6HR = 2.66; 24HR = 5.69

FLOW PROCESS FROM NODE SF180268.0 TO NODE SF180269.0 IS CODE = 51

>>>>COMPUTE TRAPEZOIDAL CHANNEL FLOW<<<<

>>>>TRAVELTIME THRU SUBAREA (EXISTING ELEMENT)<<<<
=====

ELEVATION DATA: UPSTREAM(FEET) = 377.88 DOWNSTREAM(FEET) = 377.60
CHANNEL LENGTH THRU SUBAREA(FEET) = 109.01 CHANNEL SLOPE = 0.0026
CHANNEL BASE(FEET) = 6.00 "Z" FACTOR = 1.000
MANNING'S FACTOR = 0.035 MAXIMUM DEPTH(FEET) = 5.00

==>WARNING: FLOW IN CHANNEL EXCEEDS CHANNEL
CAPACITY(NORMAL DEPTH EQUAL TO SPECIFIED MAXIMUM
ALLOWABLE DEPTH).
AS AN APPROXIMATION, FLOWDEPTH IS SET AT MAXIMUM
ALLOWABLE DEPTH AND IS USED FOR TRAVELTIME CALCULATIONS.

CHANNEL FLOW THRU SUBAREA(CFS) = 1446.29
FLOW VELOCITY(FEET/SEC) = 26.30 FLOW DEPTH(FEET) = 5.00
TRAVEL TIME(MIN.) = 0.07 Tc(MIN.) = 20.53

==>FLOWDEPTH EXCEEDS MAXIMUM ALLOWABLE DEPTH

LONGEST FLOWPATH FROM NODE 180121.00 TO NODE 180269.00 = 12730.82 FEET.

 FLOW PROCESS FROM NODE SF180269.0 TO NODE SF180270.0 IS CODE = 42

>>>>COMPUTE PIPE-FLOW TRAVEL TIME THRU SUBAREA<<<<<
 >>USING USER-SPECIFIED PIPESIZE(PARALLEL/REPLACEMENT PIPESIZE ESTIMATED)<<
 =====

UPSTREAM NODE ELEVATION(FEET) = 377.60
 DOWNSTREAM NODE ELEVATION(FEET) = 376.00
 FLOW LENGTH(FEET) = 375.98 MANNING'S N = 0.014

USER SPECIFIED PIPE DIAMETER(INCH) = 54.00 NUMBER OF PIPES = 1
 USER SPECIFIED PIPE SYSTEM UNDER PRESSURE
 PIPE-FLOW VELOCITY(FEET/SEC.) = 6.90
 PIPE-FLOW(CFS) = 109.84
 PIPEFLOW TRAVEL TIME(MIN.) = 0.91 Tc(MIN.) = 21.44

*DEFICIENCY ANALYSIS(BASED ON REPLACEMENT SYSTEM HYDROLOGY):
 *REPLACEMENT PIPE SYSTEM (MANNING'S N = .0140):
 ESTIMATED PIPE DIAMETER(INCH) = 144.00 NUMBER OF PIPES = 1
 DEPTH OF FLOW IN 144.0 INCH PIPE IS 113.6 INCHES
 PIPE-FLOW VELOCITY(FEET/SEC.) = 15.12
 PIPE-FLOW(CFS) = 1446.29
 PIPEFLOW TRAVEL TIME(MIN.) = 0.41 Tc(MIN.) = 20.95

*PARALLEL PIPE SYSTEM (MANNING'S N = .0140):
 PIPE DIAMETER(INCH) = 138.00 NUMBER OF PIPES = 1
 LONGEST FLOWPATH FROM NODE 180121.00 TO NODE 180270.00 = 13106.80 FEET.

 FLOW PROCESS FROM NODE SF180281.0 TO NODE SF180282.0 IS CODE = 22

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<
 =====

SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .5500
 SOIL CLASSIFICATION IS "D"
 S.C.S. CURVE NUMBER (AMC II) = 88
 USER SPECIFIED Tc(MIN.) = 22.740
 100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 2.648
 SUBAREA RUNOFF(CFS) = 0.01
 TOTAL AREA(ACRES) = 0.01 TOTAL RUNOFF(CFS) = 0.01

SUBAREA AREA-AVERAGED RAINFALL DEPTH(INCH):
 6HR = 2.66; 24HR = 5.69

 FLOW PROCESS FROM NODE SF180282.0 TO NODE SF180282.0 IS CODE = 16

>>>>USER SPECIFIED CONSTANT SOURCE FLOW AT NODE<<<<<
 =====

USER-SPECIFIED CONSTANT SOURCE FLOW = 665.29(CFS)
 USER-SPECIFIED AREA ASSOCIATED TO SOURCE FLOW = 919.41(ACRES)
 * CUMULATIVE SOURCE FLOW DATA: FLOW(CFS) = 665.29 AREA(AC.) = 919.41
 * SUMMED DATA: FLOW(CFS) = 665.30 TOTAL AREA(ACRES) = 919.42

 FLOW PROCESS FROM NODE SF180282.0 TO NODE SF180283.0 IS CODE = 47

>>>>COMPUTE CULVERT TRAVEL TIME THRU SUBAREA<<<<<
 >>>>USING USER-SPECIFIED CULVERT SIZE (EXISTING ELEMENT)<<<<<
 =====

ELEVATION DATA: UPSTREAM(FEET) = 375.00 DOWNSTREAM(FEET) = 374.00
 FLOW LENGTH(FEET) = 186.06 MANNING'S N = 0.014

Notes:

1. Reference: "Hydraulic Charts for the Selection of Highway Culverts", Hydraulic Engineering Circular No. 5, December 1965, Federal Highway Administration.
 2. INLET control for all Culvert Analysis.
 3. Headwater depth is ASSUMED to be 3 FEET above the culvert soffit.
- GIVEN BOX CULVERT HEIGHT(FEET) = 3.00
 GIVEN BOX CULVERT BASEWIDTH(FEET) = 18.00
 ESTIMATED BOX CULVERT BASEWIDTH(FEET) = 21.46

*NOTE: CULVERT-FLOW VELOCITY AND TRAVEL TIME
 ARE BASED ON ESTIMATED CULVERT SIZE.
 CULVERT-FLOW VELOCITY(FEET/SEC.) = 10.33
 CULVERT-FLOW(CFS) = 665.30
 CULVERT-FLOW TRAVEL TIME(MIN.) = 0.30 Tc(MIN.) = 23.04
 * TOTAL SOURCE FLOW(CFS) = 665.29

SF1802ZZ.RF1

LONGEST FLOWPATH FROM NODE 180281.00 TO NODE 180283.00 = 249.17 FEET.

FLOW PROCESS FROM NODE SF180291.0 TO NODE SF180292.0 IS CODE = 22

>>>>RATIONAL METHOD INITIAL SUBAREA ANALYSIS<<<<<

=====

SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .5500
SOIL CLASSIFICATION IS "D"
S.C.S. CURVE NUMBER (AMC II) = 88
USER SPECIFIED TC(MIN.) = 22.740
100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 2.648
SUBAREA RUNOFF(CFS) = 0.01
TOTAL AREA(ACRES) = 0.01 TOTAL RUNOFF(CFS) = 0.01

SUBAREA AREA-AVERAGED RAINFALL DEPTH(INCH):
6HR = 2.66; 24HR = 5.69

FLOW PROCESS FROM NODE SF180292.0 TO NODE SF180292.0 IS CODE = 16

>>>>USER SPECIFIED CONSTANT SOURCE FLOW AT NODE<<<<<

=====

USER-SPECIFIED CONSTANT SOURCE FLOW = 781.00(CFS)
USER-SPECIFIED AREA ASSOCIATED TO SOURCE FLOW = 919.41(ACRES)
* CUMULATIVE SOURCE FLOW DATA: FLOW(CFS) = 781.00 AREA(AC.) = 919.41
* SUMMED DATA: FLOW(CFS) = 781.01 TOTAL AREA(ACRES) = 919.42

FLOW PROCESS FROM NODE SF180292.0 TO NODE SF180292.0 IS CODE = 81

>>>>ADDITION OF SUBAREA TO MAINLINE PEAK FLOW<<<<<

=====

100 YEAR RAINFALL INTENSITY(INCH/HOUR) = 2.648
SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .5500
SOIL CLASSIFICATION IS "D"
S.C.S. CURVE NUMBER (AMC II) = 88
AREA(ACRES) = 8.70
RURAL DEVELOPMENT RUNOFF COEFFICIENT = .4000
SOIL CLASSIFICATION IS "C"
S.C.S. CURVE NUMBER (AMC II) = 84
AREA(ACRES) = 4.20
RURAL DEVELOPMENT RUNOFF COEFFICIENT = .3500
SOIL CLASSIFICATION IS "B"
S.C.S. CURVE NUMBER (AMC II) = 78
AREA(ACRES) = 3.60
RURAL DEVELOPMENT RUNOFF COEFFICIENT = .4500
SOIL CLASSIFICATION IS "D"
S.C.S. CURVE NUMBER (AMC II) = 87
AREA(ACRES) = 2.40
SINGLE FAMILY DEVELOPMENT RUNOFF COEFFICIENT = .4500
SOIL CLASSIFICATION IS "B"
S.C.S. CURVE NUMBER (AMC II) = 80
AREA(ACRES) = 2.20
COMMERCIAL DEVELOPMENT RUNOFF COEFFICIENT = .7500
SOIL CLASSIFICATION IS "B"
S.C.S. CURVE NUMBER (AMC II) = 90
AREA(ACRES) = 0.90
SUBAREA AVERAGE RUNOFF COEFFICIENT = 0.4759
SUBAREA AREA(ACRES) = 22.00 SUBAREA RUNOFF(CFS) = 27.73
TOTAL AREA(ACRES) = 22.01 TOTAL RUNOFF(CFS) = 27.74
TC(MIN) = 22.74

SUBAREA AREA-AVERAGED RAINFALL DEPTH(INCH):
6HR = 2.64; 24HR = 5.64

* SOURCE FLOW DATA: FLOW(CFS) = 781.00 AREA(ACRES) = 919.41
* SUMMED DATA: FLOW(CFS) = 808.74 TOTAL AREA(ACRES) = 941.42

FLOW PROCESS FROM NODE SF180292.0 TO NODE SF180293.0 IS CODE = 47

>>>>COMPUTE CULVERT TRAVEL TIME THRU SUBAREA<<<<<
>>>>USING USER-SPECIFIED CULVERT SIZE (EXISTING ELEMENT)<<<<<

=====

ELEVATION DATA: UPSTREAM(Feet) = 374.00 DOWNSTREAM(Feet) = 373.00
FLOW LENGTH(Feet) = 184.13 MANNING'S N = 0.014

Notes:

1. Reference: "Hydraulic charts for the selection of

SF1802ZZ.RF1

Highway Culverts", Hydraulic Engineering Circular No. 5,
December 1965, Federal Highway Administration.

2. INLET control for all Culvert Analysis.

3. Headwater depth is ASSUMED to be 3 FEET above the culvert soffit.

GIVEN BOX CULVERT HEIGHT(FEET) = 3.00

GIVEN BOX CULVERT BASEWIDTH(FEET) = 18.00

ESTIMATED BOX CULVERT BASEWIDTH(FEET) = 26.09

*NOTE: CULVERT-FLOW VELOCITY AND TRAVEL TIME
ARE BASED ON ESTIMATED CULVERT SIZE.

CULVERT-FLOW VELOCITY(FEET/SEC.) = 10.33

CULVERT-FLOW(CFS) = 808.74

CULVERT-FLOW TRAVEL TIME(MIN.) = 0.30 Tc(MIN.) = 23.04

* TOTAL SOURCE FLOW(CFS) = 781.00

LONGEST FLOWPATH FROM NODE 180291.00 TO NODE 180293.00 = 691.21 FEET.

=====

END OF STUDY SUMMARY:

TOTAL AREA(ACRES) = 22.01 TC(MIN.) = 23.04

PEAK FLOW RATE(CFS) = 27.74

* CUMULATIVE SOURCE FLOW DATA: FLOW(CFS) = 781.00 AREA(AC.) = 919.41

* SUMMED DATA: FLOW(CFS) = 808.74 TOTAL AREA(ACRES) = 941.42

=====

END OF RATIONAL METHOD ANALYSIS

0

County Flood Control Master Plan



Facilities Map 17

Hydrologic Layout Legend

- Basin
- Facility (link)
- Recommended Facility
- Node
- Water Quality Basin
- Detention Basin
- Node ID number

Recommended Facilities

Node ID	Node Name	Node Type	Node Elevation (ft)	Node Area (sq ft)	Node Volume (cu ft)	Node Capacity (cu ft)	Node Status
1	101	Water Quality Basin	101	101	101	101	Active
2	102	Water Quality Basin	102	102	102	102	Active
3	103	Water Quality Basin	103	103	103	103	Active
4	104	Water Quality Basin	104	104	104	104	Active
5	105	Water Quality Basin	105	105	105	105	Active
6	106	Water Quality Basin	106	106	106	106	Active
7	107	Water Quality Basin	107	107	107	107	Active
8	108	Water Quality Basin	108	108	108	108	Active
9	109	Water Quality Basin	109	109	109	109	Active
10	110	Water Quality Basin	110	110	110	110	Active
11	111	Water Quality Basin	111	111	111	111	Active
12	112	Water Quality Basin	112	112	112	112	Active
13	113	Water Quality Basin	113	113	113	113	Active
14	114	Water Quality Basin	114	114	114	114	Active
15	115	Water Quality Basin	115	115	115	115	Active
16	116	Water Quality Basin	116	116	116	116	Active
17	117	Water Quality Basin	117	117	117	117	Active
18	118	Water Quality Basin	118	118	118	118	Active
19	119	Water Quality Basin	119	119	119	119	Active
20	120	Water Quality Basin	120	120	120	120	Active
21	121	Water Quality Basin	121	121	121	121	Active
22	122	Water Quality Basin	122	122	122	122	Active
23	123	Water Quality Basin	123	123	123	123	Active
24	124	Water Quality Basin	124	124	124	124	Active
25	125	Water Quality Basin	125	125	125	125	Active
26	126	Water Quality Basin	126	126	126	126	Active
27	127	Water Quality Basin	127	127	127	127	Active
28	128	Water Quality Basin	128	128	128	128	Active
29	129	Water Quality Basin	129	129	129	129	Active
30	130	Water Quality Basin	130	130	130	130	Active
31	131	Water Quality Basin	131	131	131	131	Active
32	132	Water Quality Basin	132	132	132	132	Active
33	133	Water Quality Basin	133	133	133	133	Active
34	134	Water Quality Basin	134	134	134	134	Active
35	135	Water Quality Basin	135	135	135	135	Active
36	136	Water Quality Basin	136	136	136	136	Active
37	137	Water Quality Basin	137	137	137	137	Active
38	138	Water Quality Basin	138	138	138	138	Active
39	139	Water Quality Basin	139	139	139	139	Active
40	140	Water Quality Basin	140	140	140	140	Active
41	141	Water Quality Basin	141	141	141	141	Active
42	142	Water Quality Basin	142	142	142	142	Active
43	143	Water Quality Basin	143	143	143	143	Active
44	144	Water Quality Basin	144	144	144	144	Active
45	145	Water Quality Basin	145	145	145	145	Active
46	146	Water Quality Basin	146	146	146	146	Active
47	147	Water Quality Basin	147	147	147	147	Active
48	148	Water Quality Basin	148	148	148	148	Active
49	149	Water Quality Basin	149	149	149	149	Active
50	150	Water Quality Basin	150	150	150	150	Active
51	151	Water Quality Basin	151	151	151	151	Active
52	152	Water Quality Basin	152	152	152	152	Active
53	153	Water Quality Basin	153	153	153	153	Active
54	154	Water Quality Basin	154	154	154	154	Active
55	155	Water Quality Basin	155	155	155	155	Active
56	156	Water Quality Basin	156	156	156	156	Active
57	157	Water Quality Basin	157	157	157	157	Active
58	158	Water Quality Basin	158	158	158	158	Active
59	159	Water Quality Basin	159	159	159	159	Active
60	160	Water Quality Basin	160	160	160	160	Active
61	161	Water Quality Basin	161	161	161	161	Active
62	162	Water Quality Basin	162	162	162	162	Active
63	163	Water Quality Basin	163	163	163	163	Active
64	164	Water Quality Basin	164	164	164	164	Active
65	165	Water Quality Basin	165	165	165	165	Active
66	166	Water Quality Basin	166	166	166	166	Active
67	167	Water Quality Basin	167	167	167	167	Active
68	168	Water Quality Basin	168	168	168	168	Active
69	169	Water Quality Basin	169	169	169	169	Active
70	170	Water Quality Basin	170	170	170	170	Active
71	171	Water Quality Basin	171	171	171	171	Active
72	172	Water Quality Basin	172	172	172	172	Active
73	173	Water Quality Basin	173	173	173	173	Active
74	174	Water Quality Basin	174	174	174	174	Active
75	175	Water Quality Basin	175	175	175	175	Active
76	176	Water Quality Basin	176	176	176	176	Active
77	177	Water Quality Basin	177	177	177	177	Active
78	178	Water Quality Basin	178	178	178	178	Active
79	179	Water Quality Basin	179	179	179	179	Active
80	180	Water Quality Basin	180	180	180	180	Active
81	181	Water Quality Basin	181	181	181	181	Active
82	182	Water Quality Basin	182	182	182	182	Active
83	183	Water Quality Basin	183	183	183	183	Active
84	184	Water Quality Basin	184	184	184	184	Active
85	185	Water Quality Basin	185	185	185	185	Active
86	186	Water Quality Basin	186	186	186	186	Active
87	187	Water Quality Basin	187	187	187	187	Active
88	188	Water Quality Basin	188	188	188	188	Active
89	189	Water Quality Basin	189	189	189	189	Active
90	190	Water Quality Basin	190	190	190	190	Active
91	191	Water Quality Basin	191	191	191	191	Active
92	192	Water Quality Basin	192	192	192	192	Active
93	193	Water Quality Basin	193	193	193	193	Active
94	194	Water Quality Basin	194	194	194	194	Active
95	195	Water Quality Basin	195	195	195	195	Active
96	196	Water Quality Basin	196	196	196	196	Active
97	197	Water Quality Basin	197	197	197	197	Active
98	198	Water Quality Basin	198	198	198	198	Active
99	199	Water Quality Basin	199	199	199	199	Active
100	200	Water Quality Basin	200	200	200	200	Active

Basemap Legend

- SDA Boundary
- USGS 40-ft Elevation Contours

MAP NOTES

Map Projection: NAD83
 Contour Interval: 10 ft
 Image Resolution: 4 ft

1 inch = 500 feet
 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000

NOTE
 Hironaka & Associates
 Planning, Engineering, and Construction

10/12/04

PROJECT SITE

APPENDIX C

Numerical Sizing Criteria Calculations and Final Proposed Volume Computations



RICK
ENGINEERING
COMPANY

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12/10/04
14804-B
1 of 1

NUMERIC SIZING CRITERIA CALCULATIONS :

Given : Tributary Area, A (acres) = 889 AC.

85% Map shows P (in) = 0.63 in.

Runoff Coefficient, C = 0.8 (assumed per highly developed tributary area)

Intensity, i (in/hr) = 0.2 in/hr

FLOW BASED

$$\begin{aligned} Q_T &= C i A \\ &= (0.8)(0.2 \text{ in/hr})(889 \text{ AC.}) \\ &= 142 \text{ cfs} \end{aligned}$$

VOLUME BASED

$$\begin{aligned} WQ_v &= C P A \\ &= (0.8)(0.63 \text{ in})(889 \text{ AC.}) \\ &= 448.1 \text{ AC-in.} \cdot \frac{1 \text{ ft}}{12 \text{ in}} = 37.3 \text{ AC-FT} \end{aligned}$$

Type.... Vol: Elev-Area
Name.... PROPOSED

Page 1.01

File.... C:\SCRATCH\14804B.PPK
Title... Proposed Volumes

Elevation (ft)	Planimeter (sq.in)	Area (acres)	A1+A2+sq(r(A1*A2)) (acres)	Volume (ac-ft)	Volume Sum (ac-ft)
379.50	-----	.0000	.0000	.000	.000
380.00	-----	.2350	.2350	.039	.039
381.00	-----	1.1700	1.9294	.643	.682
382.00	-----	1.3920	3.8382	1.279	1.962
383.00	-----	1.5200	4.3666	1.456	3.417
384.00	-----	1.6380	4.7359	1.579	4.996
384.10	-----	1.6380	4.9140	.164	5.160

→ TOTAL IN BASIN & BASIN SPELLWAY = 5.160 + 0.069 = 5.23 AC-FT
Elevations With Areas Interpolated From
The Closest Two Planimeter Readings

Elevation (ft)	Planimeter (sq.in)	Area (acres)	A1+A2+sq(r(A1*A2)) (acres)	Volume (ac-ft)	Volume Sum (ac-ft)
383.10	-----	1.5316	4.5774	.153	3.570

→ BASIN SPILLWAY ELEVATION
POND VOLUME EQUATIONS
WATER QUALITY VOLUME
WQ_v = 3.6 AC-FT.

* Incremental volume computed by the Conic Method for Reservoir Volumes.

$$\text{Volume} = (1/3) * (\text{EL2} - \text{EL1}) * (\text{Area1} + \text{Area2} + \text{sq.r.t.}(\text{Area1} * \text{Area2}))$$

where: EL1, EL2 = Lower and upper elevations of the increment
Area1, Area2 = Areas computed for EL1, EL2, respectively
Volume = Incremental volume between EL1 and EL2

Interpolated area from closest two given contour areas
is computed using the relationship:

$$\text{IA} = (\text{sq.r.t}(\text{Area1}) + ((\text{Ei} - \text{E1}) / (\text{E2} - \text{E1})) * (\text{sq.r.t}(\text{Area2}) - \text{sq.r.t}(\text{Area1}))) ** 2$$

where: E1, E2 = Closest two elevations with planimeter data
Ei = Elevation at which to interpolate area
Area1, Area2 = Areas computed for E1, E2, respectively
IA = Interpolated area for Ei

ALSO - FOR REC-1

$$385 = 5.23 \text{ AC-FT} + 1.579 + .02 = 6.83 \text{ AC-FT}$$

$$386 = 6.83 + 1.579 = 8.41 \text{ AC-FT}$$

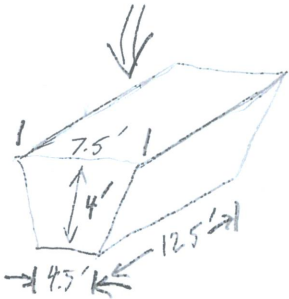
S/N: HOMOLO106049 Rick Engineering Company

Pond Pack Ver: 8-01-98 (61)

Compute Time: 10:43:56

Date: 03-23-2005

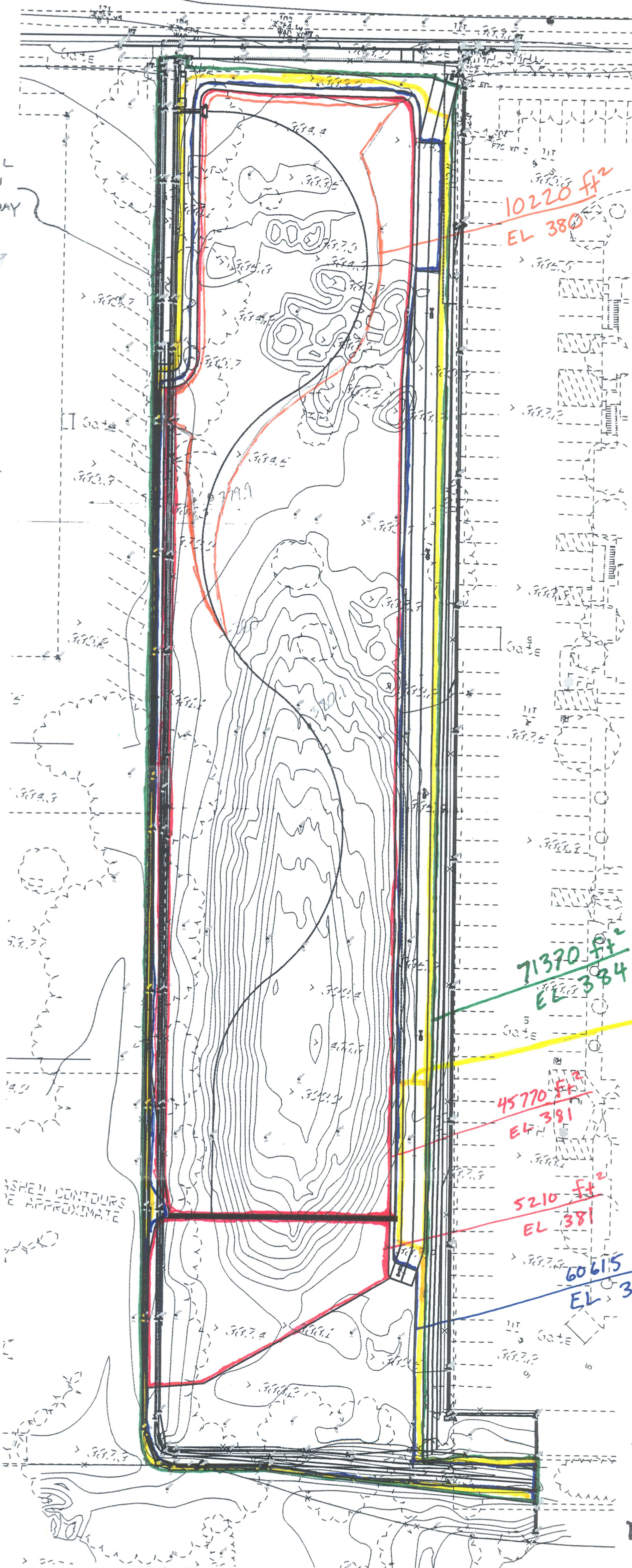
ADDITIONAL
VOLUME IN
BASIN SPILLWAY



$$(4')(6')(12.5')$$

$$= 3000 \text{ ft}^3$$

$$\approx .069 \text{ AC-FT}$$



10220 ft²
EL 380

71370 ft²
EL 384

66220 ft²
EL 383

45770 ft²
EL 381

5210 ft²
EL 381

60615 ft²
EL 382

ASHEN CONTOURS
APPROXIMATE

ELEV	Area (ft ²)	(Acres)
380	10220	0.235
381	50980	1.170
382	60615	1.392
383	66220	1.520
384	71370	1.638

1" = 40'
Water Quality Basin @
WOODSIDE AVE

"VOLUME EXHIBIT"

DATE: 03-23-05
J-14804-B

APPENDIX D

Drawdown Time Calculation

For

Water Quality Volume

DRAWDOWN TIME (with Low Flow Vertical Orifice):

Enter information in yellow boxes. All other information is self-generated.

Description of low flow outlet works:

12-inch PVC outlet pipe with Wing-type Headwall. Steel Plates bolted to headwall such that a 2-inch (wide) vertical notch extends vertically 10-inches from the flowline of the pipe.

Diameter of Outlet Pipe, D (in.):
Height of Weir, H_d (ft.):
Width of Weir, L (in.):

feet
1
0.833
ft

Radius
0.5
ft

Invert Elevation, Z (ft):

Step Increments for Drawdown Time (min):

0.6
Orifice

A_{orifice} =

Q_{orifice} =

CA(2gh)^{0.5}

Based on Rating Curve:

$$EL@V_{REM} = y = -7E-11x^2 + 3E-05x + 380$$

Water Surface Elevation, E	Volume, V (ft ³)	C	Area, A (ft ²)	Head, H _o (ft)	Discharge, Q _{out} (cfs)	Duration, T (min)	Volume Out, V _{out} (ft ³)	Volume Remaining, V _{rem} (ft ³)	Elevation at V _{rem}	Total Drawdown Time, T _{tot} (hours)
383.10	155509	0.6	0.14	3.18	1.19	10	716	154793	382.97	0.17
382.97	154793	0.6	0.14	3.05	1.17	10	701	154092	382.96	0.33
382.96	154092	0.6	0.14	3.04	1.17	10	700	153392	382.95	0.50
382.95	153392	0.6	0.14	3.04	1.17	10	699	152693	382.95	0.67
382.94	152693	0.6	0.14	3.03	1.16	10	699	151994	382.94	0.83
382.94	151994	0.6	0.14	3.03	1.16	10	698	151296	382.94	1.00
382.93	151296	0.6	0.14	3.02	1.16	10	697	150599	382.93	1.17
382.93	150599	0.6	0.14	3.01	1.16	10	697	149902	382.92	1.33
382.92	149902	0.6	0.14	3.01	1.16	10	696	149207	382.92	1.50
382.92	149207	0.6	0.14	3.00	1.16	10	695	148511	382.91	1.67
382.91	148511	0.6	0.14	2.99	1.16	10	694	147817	382.91	1.83
382.91	147817	0.6	0.14	2.99	1.16	10	694	147123	382.90	2.00
382.90	147123	0.6	0.14	2.98	1.15	10	693	146431	382.89	2.17
382.89	146431	0.6	0.14	2.98	1.15	10	692	145738	382.89	2.33
382.89	145738	0.6	0.14	2.97	1.15	10	691	145047	382.88	2.50
382.88	145047	0.6	0.14	2.96	1.15	10	691	144357	382.87	2.67
382.87	144357	0.6	0.14	2.96	1.15	10	690	143667	382.87	2.83
382.87	143667	0.6	0.14	2.95	1.15	10	689	142978	382.86	3.00
382.86	142978	0.6	0.14	2.94	1.15	10	688	142290	382.85	3.17
382.85	142290	0.6	0.14	2.93	1.15	10	687	141602	382.84	3.33
382.84	141602	0.6	0.14	2.93	1.14	10	687	140916	382.84	3.50
382.84	140916	0.6	0.14	2.92	1.14	10	686	140230	382.83	3.67
382.83	140230	0.6	0.14	2.91	1.14	10	685	139545	382.82	3.83
382.82	139545	0.6	0.14	2.91	1.14	10	684	138861	382.82	4.00
382.82	138861	0.6	0.14	2.90	1.14	10	683	138178	382.81	4.17
382.81	138178	0.6	0.14	2.89	1.14	10	682	137495	382.80	4.33
382.80	137495	0.6	0.14	2.88	1.14	10	682	136814	382.79	4.50
382.79	136814	0.6	0.14	2.88	1.13	10	681	136133	382.79	4.67
382.79	136133	0.6	0.14	2.87	1.13	10	680	135453	382.78	4.83
382.78	135453	0.6	0.14	2.86	1.13	10	679	134774	382.77	5.00
382.77	134774	0.6	0.14	2.86	1.13	10	678	134096	382.76	5.17
382.76	134096	0.6	0.14	2.85	1.13	10	677	133419	382.76	5.33
382.76	133419	0.6	0.14	2.84	1.13	10	676	132743	382.75	5.50
382.75	132743	0.6	0.14	2.83	1.13	10	675	132068	382.74	5.67
382.74	132068	0.6	0.14	2.82	1.12	10	674	131394	382.73	5.83
382.73	131394	0.6	0.14	2.82	1.12	10	673	130720	382.73	6.00
382.73	130720	0.6	0.14	2.81	1.12	10	672	130048	382.72	6.17
382.72	130048	0.6	0.14	2.80	1.12	10	672	129376	382.71	6.33
382.71	129376	0.6	0.14	2.79	1.12	10	671	128706	382.70	6.50
382.70	128706	0.6	0.14	2.78	1.12	10	670	128036	382.69	6.67
382.69	128036	0.6	0.14	2.78	1.11	10	669	127367	382.69	6.83
382.69	127367	0.6	0.14	2.77	1.11	10	668	126700	382.68	7.00
382.68	126700	0.6	0.14	2.76	1.11	10	667	126033	382.67	7.17
382.67	126033	0.6	0.14	2.75	1.11	10	666	125367	382.66	7.33
382.66	125367	0.6	0.14	2.74	1.11	10	665	124703	382.65	7.50

Water Surface Elevation, E	Volume, V (ft ³)	C	Area, A (ft ²)	Head, H _o (ft)	Discharge, Q _{out} (cfs)	Duration, T (min)	Volume Out, V _{out} (ft ³)	Volume Remaining, V _{REM} (ft ³)	Elevation at V _{REM}	Total Drawdown Time, T _{TOT} (hours)
382.65	124703	0.6	0.14	2.74	1.11	10	664	124039	382.64	7.67
382.64	124039	0.6	0.14	2.73	1.10	10	663	123376	382.64	7.83
382.64	123376	0.6	0.14	2.72	1.10	10	662	122715	382.63	8.00
382.63	122715	0.6	0.14	2.71	1.10	10	661	122054	382.62	8.17
382.62	122054	0.6	0.14	2.70	1.10	10	660	121394	382.61	8.33
382.61	121394	0.6	0.14	2.69	1.10	10	659	120736	382.60	8.50
382.60	120736	0.6	0.14	2.69	1.10	10	657	120078	382.59	8.67
382.59	120078	0.6	0.14	2.68	1.09	10	656	119422	382.58	8.83
382.58	119422	0.6	0.14	2.67	1.09	10	655	118767	382.57	9.00
382.58	118767	0.6	0.14	2.66	1.09	10	654	118112	382.57	9.17
382.57	118112	0.6	0.14	2.65	1.09	10	653	117459	382.56	9.33
382.56	117459	0.6	0.14	2.64	1.09	10	652	116807	382.55	9.50
382.55	116807	0.6	0.14	2.63	1.09	10	651	116156	382.54	9.67
382.54	116156	0.6	0.14	2.62	1.08	10	650	115506	382.53	9.83
382.53	115506	0.6	0.14	2.61	1.08	10	649	114857	382.52	10.00
382.52	114857	0.6	0.14	2.61	1.08	10	648	114210	382.51	10.17
382.51	114210	0.6	0.14	2.60	1.08	10	647	113563	382.50	10.33
382.50	113563	0.6	0.14	2.59	1.08	10	645	112918	382.50	10.50
382.50	112918	0.6	0.14	2.58	1.07	10	644	112273	382.49	10.67
382.49	112273	0.6	0.14	2.57	1.07	10	643	111630	382.48	10.83
382.48	111630	0.6	0.14	2.56	1.07	10	642	110988	382.47	11.00
382.47	110988	0.6	0.14	2.55	1.07	10	641	110347	382.46	11.17
382.46	110347	0.6	0.14	2.54	1.07	10	640	109708	382.45	11.33
382.45	109708	0.6	0.14	2.53	1.06	10	638	109069	382.44	11.50
382.44	109069	0.6	0.14	2.52	1.06	10	637	108432	382.43	11.67
382.43	108432	0.6	0.14	2.51	1.06	10	636	107796	382.42	11.83
382.42	107796	0.6	0.14	2.50	1.06	10	635	107161	382.41	12.00
382.41	107161	0.6	0.14	2.49	1.06	10	634	106527	382.40	12.17
382.40	106527	0.6	0.14	2.48	1.05	10	632	105895	382.39	12.33
382.39	105895	0.6	0.14	2.48	1.05	10	631	105263	382.38	12.50
382.38	105263	0.6	0.14	2.47	1.05	10	630	104633	382.37	12.67
382.37	104633	0.6	0.14	2.46	1.05	10	629	104005	382.36	12.83
382.36	104005	0.6	0.14	2.45	1.05	10	628	103377	382.35	13.00
382.35	103377	0.6	0.14	2.44	1.04	10	626	102751	382.34	13.17
382.34	102751	0.6	0.14	2.43	1.04	10	625	102126	382.33	13.33
382.33	102126	0.6	0.14	2.42	1.04	10	624	101502	382.32	13.50
382.32	101502	0.6	0.14	2.41	1.04	10	623	100879	382.31	13.67
382.31	100879	0.6	0.14	2.40	1.04	10	621	100258	382.30	13.83
382.30	100258	0.6	0.14	2.39	1.03	10	620	99638	382.29	14.00
382.29	99638	0.6	0.14	2.38	1.03	10	619	99019	382.28	14.17
382.28	99019	0.6	0.14	2.37	1.03	10	617	98402	382.27	14.33
382.27	98402	0.6	0.14	2.36	1.03	10	616	97786	382.26	14.50
382.26	97786	0.6	0.14	2.35	1.02	10	615	97171	382.25	14.67
382.25	97171	0.6	0.14	2.34	1.02	10	613	96558	382.24	14.83
382.24	96558	0.6	0.14	2.33	1.02	10	612	95945	382.23	15.00

Water Surface Elevation, E	Volume, V (ft ³)	C	Area, A (ft ²)	Head, H _o (ft)	Discharge, Q _{out} (cfs)	Duration, T (min)	Volume Out, V _{out} (ft ³)	Volume Remaining, V _{rem} (ft ³)	Elevation at V _{rem}	Total Drawdown Time, T _{tot} (hours)
382.23	95945	0.6	0.14	2.32	1.02	10	611	95335	382.22	15.17
382.22	95335	0.6	0.14	2.31	1.02	10	609	94725	382.21	15.33
382.21	94725	0.6	0.14	2.30	1.01	10	608	94117	382.20	15.50
382.20	94117	0.6	0.14	2.29	1.01	10	607	93510	382.19	15.67
382.19	93510	0.6	0.14	2.28	1.01	10	605	92905	382.18	15.83
382.18	92905	0.6	0.14	2.27	1.01	10	604	92301	382.17	16.00
382.17	92301	0.6	0.14	2.26	1.00	10	603	91698	382.16	16.17
382.16	91698	0.6	0.14	2.25	1.00	10	601	91097	382.15	16.33
382.15	91097	0.6	0.14	2.24	1.00	10	600	90497	382.14	16.50
382.14	90497	0.6	0.14	2.22	1.00	10	599	89898	382.13	16.67
382.13	89898	0.6	0.14	2.21	1.00	10	597	89301	382.12	16.83
382.12	89301	0.6	0.14	2.20	0.99	10	596	88706	382.11	17.00
382.11	88706	0.6	0.14	2.19	0.99	10	594	88111	382.10	17.17
382.10	88111	0.6	0.14	2.18	0.99	10	593	87518	382.09	17.33
382.09	87518	0.6	0.14	2.17	0.99	10	591	86927	382.08	17.50
382.08	86927	0.6	0.14	2.16	0.98	10	590	86337	382.07	17.67
382.07	86337	0.6	0.14	2.15	0.98	10	589	85748	382.06	17.83
382.06	85748	0.6	0.14	2.14	0.98	10	587	85161	382.05	18.00
382.05	85161	0.6	0.14	2.13	0.98	10	586	84576	382.04	18.17
382.04	84576	0.6	0.14	2.12	0.97	10	584	83991	382.03	18.33
382.03	83991	0.6	0.14	2.11	0.97	10	583	83409	382.02	18.50
382.02	83409	0.6	0.14	2.10	0.97	10	581	82827	382.01	18.67
382.01	82827	0.6	0.14	2.09	0.97	10	580	82248	382.00	18.83
381.99	82248	0.6	0.14	2.08	0.96	10	578	81669	381.98	19.00
381.98	81669	0.6	0.14	2.07	0.96	10	577	81092	381.97	19.17
381.97	81092	0.6	0.14	2.06	0.96	10	575	80517	381.96	19.33
381.96	80517	0.6	0.14	2.05	0.96	10	574	79943	381.95	19.50
381.95	79943	0.6	0.14	2.03	0.95	10	572	79371	381.94	19.67
381.94	79371	0.6	0.14	2.02	0.95	10	571	78800	381.93	19.83
381.93	78800	0.6	0.14	2.01	0.95	10	569	78231	381.92	20.00
381.92	78231	0.6	0.14	2.00	0.95	10	568	77663	381.91	20.17
381.91	77663	0.6	0.14	1.99	0.94	10	566	77097	381.90	20.33
381.90	77097	0.6	0.14	1.98	0.94	10	565	76532	381.89	20.50
381.89	76532	0.6	0.14	1.97	0.94	10	563	75969	381.88	20.67
381.88	75969	0.6	0.14	1.96	0.94	10	562	75408	381.86	20.83
381.86	75408	0.6	0.14	1.95	0.93	10	560	74848	381.85	21.00
381.85	74848	0.6	0.14	1.94	0.93	10	558	74290	381.84	21.17
381.84	74290	0.6	0.14	1.93	0.93	10	557	73733	381.83	21.33
381.83	73733	0.6	0.14	1.91	0.93	10	555	73178	381.82	21.50
381.82	73178	0.6	0.14	1.90	0.92	10	554	72624	381.81	21.67
381.81	72624	0.6	0.14	1.89	0.92	10	552	72072	381.80	21.83
381.80	72072	0.6	0.14	1.88	0.92	10	550	71521	381.79	22.00
381.79	71521	0.6	0.14	1.87	0.91	10	549	70973	381.78	22.17
381.78	70973	0.6	0.14	1.86	0.91	10	547	70425	381.77	22.33
381.77	70425	0.6	0.14	1.85	0.91	10	546	69880	381.75	22.50
381.75	69880	0.6	0.14	1.84	0.91	10	544	69336	381.74	22.67
381.74	69336	0.6	0.14	1.83	0.90	10	542	68793	381.73	22.83
381.73	68793	0.6	0.14	1.82	0.90	10	541	68253	381.72	23.00
381.72	68253	0.6	0.14	1.80	0.90	10	539	67714	381.71	23.17
381.71	67714	0.6	0.14	1.79	0.90	10	537	67176	381.70	23.33
381.70	67176	0.6	0.14	1.78	0.89	10	536	66641	381.69	23.50
381.69	66641	0.6	0.14	1.77	0.89	10	534	66106	381.68	23.67
381.68	66106	0.6	0.14	1.76	0.89	10	532	65574	381.67	23.83
381.67	65574	0.6	0.14	1.75	0.88	10	531	65043	381.66	24.00
381.66	65043	0.6	0.14	1.74	0.88	10	529	64514	381.64	24.17
381.64	64514	0.6	0.14	1.73	0.88	10	527	63987	381.63	24.33
381.63	63987	0.6	0.14	1.72	0.88	10	526	63461	381.62	24.50
381.62	63461	0.6	0.14	1.71	0.87	10	524	62937	381.61	24.67
381.61	62937	0.6	0.14	1.69	0.87	10	522	62415	381.60	24.83

{ 50% of Total
Water Quality Vol.
discharges in
≈ 20 HRS }

← At 24 HRS,
58% of WQV
has drained out

Water Surface Elevation, E	Volume, V (ft ³)	C	Area, A (ft ²)	Head, H _e (ft)	Discharge, Q _{out} (cfs)	Duration, T (min)	Volume Out, V _{out} (ft ³)	Volume Remaining, V _{rem} (ft ³)	Elevation at V _{rem}	Total Drawdown Time, T _{tot} (hours)
381.60	62415	0.6	0.14	1.68	0.87	10	521	61894	381.59	25.00
381.59	61894	0.6	0.14	1.67	0.86	10	519	61376	381.58	25.17
381.58	61376	0.6	0.14	1.66	0.86	10	517	60858	381.57	25.33
381.57	60858	0.6	0.14	1.65	0.86	10	515	60343	381.56	25.50
381.56	60343	0.6	0.14	1.64	0.86	10	514	59829	381.54	25.67
381.54	59829	0.6	0.14	1.63	0.85	10	512	59318	381.53	25.83
381.53	59318	0.6	0.14	1.62	0.85	10	510	58807	381.52	26.00
381.52	58807	0.6	0.14	1.61	0.85	10	508	58299	381.51	26.17
381.51	58299	0.6	0.14	1.59	0.84	10	507	57792	381.50	26.33
381.50	57792	0.6	0.14	1.58	0.84	10	505	57287	381.49	26.50
381.49	57287	0.6	0.14	1.57	0.84	10	503	56784	381.48	26.67
381.48	56784	0.6	0.14	1.56	0.84	10	501	56283	381.47	26.83
381.47	56283	0.6	0.14	1.55	0.83	10	500	55783	381.46	27.00
381.46	55783	0.6	0.14	1.54	0.83	10	498	55286	381.44	27.17
381.44	55286	0.6	0.14	1.53	0.83	10	496	54790	381.43	27.33
381.43	54790	0.6	0.14	1.52	0.82	10	494	54295	381.42	27.50
381.42	54295	0.6	0.14	1.51	0.82	10	492	53803	381.41	27.67
381.41	53803	0.6	0.14	1.49	0.82	10	491	53313	381.40	27.83
381.40	53313	0.6	0.14	1.48	0.81	10	489	52824	381.39	28.00
381.39	52824	0.6	0.14	1.47	0.81	10	487	52337	381.38	28.17
381.38	52337	0.6	0.14	1.46	0.81	10	485	51852	381.37	28.33
381.37	51852	0.6	0.14	1.45	0.81	10	483	51368	381.36	28.50
381.36	51368	0.6	0.14	1.44	0.80	10	481	50887	381.35	28.67
381.35	50887	0.6	0.14	1.43	0.80	10	480	50407	381.33	28.83
381.33	50407	0.6	0.14	1.42	0.80	10	478	49930	381.32	29.00
381.32	49930	0.6	0.14	1.41	0.79	10	476	49454	381.31	29.17
381.31	49454	0.6	0.14	1.40	0.79	10	474	48980	381.30	29.33
381.30	48980	0.6	0.14	1.38	0.79	10	472	48508	381.29	29.50
381.29	48508	0.6	0.14	1.37	0.78	10	470	48037	381.28	29.67
381.28	48037	0.6	0.14	1.36	0.78	10	468	47569	381.27	29.83
381.27	47569	0.6	0.14	1.35	0.78	10	467	47102	381.26	30.00
381.26	47102	0.6	0.14	1.34	0.77	10	465	46638	381.25	30.17
381.25	46638	0.6	0.14	1.33	0.77	10	463	46175	381.24	30.33
381.24	46175	0.6	0.14	1.32	0.77	10	461	45714	381.23	30.50
381.23	45714	0.6	0.14	1.31	0.76	10	459	45255	381.21	30.67
381.21	45255	0.6	0.14	1.30	0.76	10	457	44798	381.20	30.83
381.20	44798	0.6	0.14	1.29	0.76	10	455	44343	381.19	31.00
381.19	44343	0.6	0.14	1.28	0.76	10	453	43889	381.18	31.17
381.18	43889	0.6	0.14	1.27	0.75	10	451	43438	381.17	31.33
381.17	43438	0.6	0.14	1.25	0.75	10	449	42989	381.16	31.50
381.16	42989	0.6	0.14	1.24	0.75	10	447	42541	381.15	31.67
381.15	42541	0.6	0.14	1.23	0.74	10	446	42096	381.14	31.83
381.14	42096	0.6	0.14	1.22	0.74	10	444	41652	381.13	32.00
381.13	41652	0.6	0.14	1.21	0.74	10	442	41210	381.12	32.17
381.12	41210	0.6	0.14	1.20	0.73	10	440	40771	381.11	32.33
381.11	40771	0.6	0.14	1.19	0.73	10	438	40333	381.10	32.50
381.10	40333	0.6	0.14	1.18	0.73	10	436	39897	381.09	32.67
381.09	39897	0.6	0.14	1.17	0.72	10	434	39464	381.07	32.83

Water Surface Elevation, E	Volume, V (ft ³)	C	Area, A (ft ²)	Head, H _o (ft)	Discharge, Q _{out} (cfs)	Duration, T (min)	Volume Out, V _{out} (ft ³)	Volume Remaining, V _{rem} (ft ³)	Elevation at V _{rem}	Total Drawdown Time, T _{tot} (hours)
381.07	39464	0.6	0.14	1.16	0.72	10	432	39032	381.06	33.00
381.06	38932	0.6	0.14	1.15	0.72	10	430	38602	381.05	33.17
381.05	38602	0.6	0.14	1.14	0.71	10	428	38174	381.04	33.33
381.04	38174	0.6	0.14	1.13	0.71	10	426	37748	381.03	33.50
381.03	37748	0.6	0.14	1.12	0.71	10	424	37324	381.02	33.67
381.02	37324	0.6	0.14	1.11	0.70	10	422	36902	381.01	33.83
381.01	36902	0.6	0.14	1.10	0.70	10	420	36482	381.00	34.00
381.00	36482	0.6	0.14	1.08	0.70	10	418	36065	380.99	34.17
380.99	36065	0.6	0.14	1.07	0.69	10	416	35649	380.98	34.33
380.98	35649	0.6	0.14	1.06	0.69	10	414	35235	380.97	34.50
380.97	35235	0.6	0.14	1.05	0.68	10	412	34823	380.96	34.67
380.96	34823	0.6	0.14	1.04	0.68	10	410	34413	380.95	34.83
380.95	34413	0.6	0.14	1.03	0.68	10	408	34005	380.94	35.00
380.94	34005	0.6	0.14	1.02	0.68	10	406	33600	380.93	35.17
380.93	33600	0.6	0.14	1.01	0.67	10	404	33196	380.92	35.33
380.92	33196	0.6	0.14	1.00	0.67	10	402	32794	380.91	35.50
380.91	32794	0.6	0.14	0.99	0.67	10	400	32395	380.90	35.67
380.90	32395	0.6	0.14	0.98	0.66	10	398	31997	380.89	35.83
380.89	31997	0.6	0.14	0.97	0.66	10	396	31602	380.88	36.00
380.88	31602	0.6	0.14	0.96	0.66	10	393	31208	380.87	36.17
380.87	31208	0.6	0.14	0.95	0.65	10	391	30817	380.86	36.33
380.86	30817	0.6	0.14	0.94	0.65	10	389	30427	380.85	36.50
380.85	30427	0.6	0.14	0.93	0.65	10	387	30040	380.84	36.67
380.84	30040	0.6	0.14	0.92	0.64	10	385	29655	380.83	36.83
380.83	29655	0.6	0.14	0.91	0.64	10	383	29272	380.82	37.00
380.82	29272	0.6	0.14	0.90	0.63	10	381	28891	380.81	37.17
380.81	28891	0.6	0.14	0.89	0.63	10	379	28512	380.80	37.33
380.80	28512	0.6	0.14	0.88	0.63	10	377	28135	380.79	37.50
380.79	28135	0.6	0.14	0.87	0.62	10	375	27761	380.78	37.67
380.78	27761	0.6	0.14	0.86	0.62	10	373	27388	380.77	37.83
380.77	27388	0.6	0.14	0.85	0.62	10	370	27018	380.76	38.00
380.76	27018	0.6	0.14	0.84	0.61	10	368	26649	380.75	38.17
380.75	26649	0.6	0.14	0.83	0.61	10	366	26283	380.74	38.33
380.74	26283	0.6	0.14	0.82	0.61	10	364	25919	380.73	38.50
380.73	25919	0.6	0.14	0.81	0.60	10	362	25557	380.72	38.67
380.72	25557	0.6	0.14	0.80	0.60	10	360	25197	380.71	38.83
380.71	25197	0.6	0.14	0.79	0.60	10	358	24839	380.70	39.00
380.70	24839	0.6	0.14	0.78	0.59	10	356	24484	380.69	39.17
380.69	24484	0.6	0.14	0.77	0.59	10	353	24130	380.68	39.33
380.68	24130	0.6	0.14	0.76	0.58	10	351	23779	380.67	39.50
380.67	23779	0.6	0.14	0.75	0.58	10	349	23430	380.66	39.67
380.66	23430	0.6	0.14	0.74	0.57	10	347	23083	380.65	39.83
380.65	23083	0.6	0.14	0.73	0.57	10	345	22738	380.64	40.00
380.64	22738	0.6	0.14	0.72	0.57	10	343	22395	380.63	40.17
380.63	22395	0.6	0.14	0.71	0.56	10	340	22055	380.62	40.33
380.62	22055	0.6	0.14	0.70	0.56	10	338	21717	380.61	40.50
380.61	21717	0.6	0.14	0.69	0.56	10	336	21380	380.60	40.67
380.60	21380	0.6	0.14	0.68	0.55	10	334	21047	380.59	40.83
380.59	21047	0.6	0.14	0.67	0.55	10	332	20715	380.58	41.00
380.58	20715	0.6	0.14	0.67	0.55	10	330	20385	380.57	41.17
380.57	20385	0.6	0.14	0.66	0.54	10	327	20058	380.56	41.33
380.56	20058	0.6	0.14	0.65	0.54	10	325	19733	380.55	41.50
380.55	19733	0.6	0.14	0.64	0.53	10	323	19410	380.54	41.67
380.54	19410	0.6	0.14	0.63	0.53	10	321	19089	380.53	41.83
380.53	19089	0.6	0.14	0.62	0.53	10	319	18770	380.52	42.00
380.52	18770	0.6	0.14	0.61	0.52	10	316	18454	380.51	42.17
380.51	18454	0.6	0.14	0.60	0.52	10	314	18140	380.50	42.33
380.50	18140	0.6	0.14	0.59	0.51	10	312	17828	380.49	42.50
380.49	17828	0.6	0.14	0.58	0.51	10	310	17518	380.48	42.67
380.48	17518	0.6	0.14	0.57	0.51	10	308	17210	380.47	42.83
380.47	17210	0.6	0.14	0.56	0.51	10	305	16905	380.46	43.00

"FINAL DESIGN FOR WATER QUALITY BASIN AT WOODSIDE AVENUE"

WATER QUALITY BASIN @ WOODSIDE AVE.
J-14804-B
DATE: April 20, 2005

Water Surface Elevation, E	Volume, V (ft ³)	C	Area, A (ft ²)	Head, H _s (ft)	Discharge, Q _{out} (cfs)	Duration, T (min)	Volume Out, V _{out} (ft ³)	Volume Remaining, V _{rem} (ft ³)	Elevation at V _{rem}	Total Drawdown Time, T _{tot} (hours)
380.49	16905	0.6	0.14	0.57	0.51	10	303	16602	380.48	43.17
380.48	16602	0.6	0.14	0.56	0.50	10	301	16301	380.47	43.33
380.47	16301	0.6	0.14	0.55	0.50	10	299	16003	380.46	43.50
380.46	16003	0.6	0.14	0.55	0.49	10	296	15706	380.45	43.67
380.45	15706	0.6	0.14	0.54	0.49	10	294	15412	380.45	43.83
380.45	15412	0.6	0.14	0.53	0.49	10	292	15120	380.44	44.00
380.44	15120	0.6	0.14	0.52	0.48	10	290	14831	380.43	44.17
380.43	14831	0.6	0.14	0.51	0.48	10	287	14543	380.42	44.33
380.42	14543	0.6	0.14	0.50	0.48	10	285	14258	380.41	44.50
380.41	14258	0.6	0.14	0.50	0.47	10	283	13975	380.41	44.67
380.41	13975	0.6	0.14	0.49	0.47	10	281	13695	380.40	44.83
380.40	13695	0.6	0.14	0.48	0.46	10	278	13416	380.39	45.00
380.39	13416	0.6	0.14	0.47	0.46	10	276	13140	380.38	45.17
380.38	13140	0.6	0.14	0.47	0.46	10	274	12867	380.37	45.33
380.37	12867	0.6	0.14	0.46	0.45	10	271	12595	380.37	45.50
380.37	12595	0.6	0.14	0.45	0.45	10	269	12326	380.36	45.67
380.36	12326	0.6	0.14	0.44	0.44	10	267	12059	380.35	45.83
380.35	12059	0.6	0.14	0.43	0.44	10	265	11795	380.34	46.00
380.34	11795	0.6	0.14	0.43	0.44	10	262	11532	380.34	46.17
380.34	11532	0.6	0.14	0.42	0.43	10	260	11272	380.33	46.33
380.33	11272	0.6	0.14	0.42	0.43	10	258	11014	380.32	46.50
380.32	11014	0.6	0.14	0.41	0.42	10	255	10759	380.31	46.67
380.31	10759	0.6	0.14	0.41	0.42	10	251	10508	380.31	46.83
380.31	10508	0.6	0.13	0.41	0.41	10	248	10259	380.30	47.00
380.30	10259	0.6	0.13	0.40	0.41	10	245	10015	380.29	47.17
380.29	10015	0.6	0.13	0.40	0.40	10	242	9773	380.29	47.33
380.29	9773	0.6	0.13	0.40	0.40	10	239	9534	380.28	47.50
380.28	9534	0.6	0.13	0.39	0.39	10	235	9299	380.27	47.67
380.27	9299	0.6	0.13	0.39	0.39	10	232	9067	380.27	47.83
380.27	9067	0.6	0.13	0.39	0.38	10	229	8837	380.26	48.00
380.26	8837	0.6	0.13	0.38	0.38	10	226	8611	380.25	48.17
380.25	8611	0.6	0.13	0.38	0.37	10	223	8387	380.25	48.33
380.25	8387	0.6	0.12	0.38	0.37	10	221	8167	380.24	48.50
380.24	8167	0.6	0.12	0.37	0.36	10	218	7949	380.23	48.67
380.23	7949	0.6	0.12	0.37	0.36	10	215	7734	380.23	48.83
380.23	7734	0.6	0.12	0.37	0.35	10	212	7522	380.22	49.00
380.22	7522	0.6	0.12	0.36	0.35	10	210	7312	380.22	49.17
380.22	7312	0.6	0.12	0.36	0.34	10	207	7105	380.21	49.33
380.21	7105	0.6	0.12	0.36	0.34	10	204	6901	380.20	49.50
380.20	6901	0.6	0.12	0.35	0.34	10	202	6699	380.20	49.67
380.20	6699	0.6	0.12	0.35	0.33	10	199	6499	380.19	49.83
380.19	6499	0.6	0.12	0.35	0.33	10	197	6303	380.19	50.00
380.19	6303	0.6	0.11	0.35	0.32	10	194	6108	380.18	50.17
380.18	6108	0.6	0.11	0.34	0.32	10	192	5916	380.18	50.33
380.18	5916	0.6	0.11	0.34	0.32	10	190	5727	380.17	50.50
380.17	5727	0.6	0.11	0.34	0.31	10	187	5539	380.16	50.67
380.16	5539	0.6	0.11	0.33	0.31	10	185	5354	380.16	50.83
380.16	5354	0.6	0.11	0.33	0.30	10	183	5172	380.15	51.00
380.15	5172	0.6	0.11	0.33	0.30	10	181	4991	380.15	51.17
380.15	4991	0.6	0.11	0.33	0.30	10	178	4813	380.14	51.33
380.14	4813	0.6	0.11	0.32	0.29	10	176	4637	380.14	51.50
380.14	4637	0.6	0.11	0.32	0.29	10	174	4463	380.13	51.67
380.13	4463	0.6	0.11	0.32	0.29	10	172	4291	380.13	51.83
380.13	4291	0.6	0.10	0.32	0.28	10	170	4121	380.12	52.00
380.12	4121	0.6	0.10	0.31	0.28	10	168	3953	380.12	52.17
380.12	3953	0.6	0.10	0.31	0.28	10	166	3787	380.11	52.33
380.11	3787	0.6	0.10	0.31	0.27	10	164	3623	380.11	52.50
380.11	3623	0.6	0.10	0.31	0.27	10	162	3461	380.10	52.67
380.10	3461	0.6	0.10	0.30	0.27	10	160	3301	380.10	52.83
380.10	3301	0.6	0.10	0.30	0.26	10	158	3143	380.09	53.00
380.09	3143	0.6	0.10	0.30	0.26	10	156	2987	380.09	53.17

Water Surface Elevation, E	Volume, V (ft ³)	C	Area, A (ft ²)	Head, H _o (ft)	Discharge, Q _{out} (cfs)	Duration, T (min)	Volume Out, V _{out} (ft ³)	Volume Remaining, V _{rem} (ft ³)	Elevation at V _{rem}	Total Drawdown Time, T _{tot} (hours)
380.09	2987	0.6	0.10	0.30	0.26	10	154	2832	380.08	53.33
380.08	2832	0.6	0.10	0.29	0.25	10	153	2679	380.08	53.60
380.08	2679	0.6	0.10	0.29	0.25	10	151	2529	380.08	53.67
380.08	2529	0.6	0.10	0.29	0.25	10	149	2379	380.07	53.83
380.07	2379	0.6	0.10	0.29	0.25	10	147	2232	380.07	54.00
380.07	2232	0.6	0.09	0.29	0.24	10	146	2086	380.06	54.17
380.06	2086	0.6	0.09	0.28	0.24	10	144	1942	380.06	54.33
380.06	1942	0.6	0.09	0.28	0.24	10	142	1800	380.05	54.50
380.05	1800	0.6	0.09	0.28	0.23	10	141	1659	380.05	54.67
380.05	1659	0.6	0.09	0.28	0.23	10	139	1519	380.05	54.83
380.05	1519	0.6	0.09	0.27	0.23	10	138	1382	380.04	55.00
380.04	1382	0.6	0.09	0.27	0.23	10	136	1246	380.04	55.17
380.04	1246	0.6	0.09	0.27	0.22	10	135	1111	380.03	55.33
380.03	1111	0.6	0.09	0.27	0.22	10	133	978	380.03	55.50
380.03	978	0.6	0.09	0.27	0.22	10	132	846	380.03	55.67
380.03	846	0.6	0.09	0.26	0.22	10	130	716	380.02	55.83
380.02	716	0.6	0.09	0.26	0.21	10	129	588	380.02	56.00
380.01	588	0.6	0.09	0.26	0.21	10	127	460	380.01	56.17
380.01	460	0.6	0.09	0.26	0.21	10	126	335	380.01	56.33
380.01	335	0.6	0.08	0.26	0.21	10	124	210	380.01	56.50
380.01	210	0.6	0.08	0.26	0.21	10	123	87	380.00	56.67
380.00	87	0.6	0.08	0.25	0.20	10	122	35	380.00	56.83
380.00	35	0.6	0.08	0.25	0.20	10	120	155	380.00	57.00
380.00	155	0.6	0.08	0.25	0.20	10	119	274	380.00	57.17
379.99	274	0.6	0.08	0.25	0.20	10	118	392	379.99	57.33

Drandown Duration
from EL 383.1
to EL 380.0

TOTAL DRAWDOWN TIME
IS ≈ 61.5 HRS

Q_{out} at EL 380 = 0.20 cfs
∴ Avg Q_{out} from EL 380 to EL 379.5 ≈ 0.10 cfs

∴ Duration from " " "

$$is = \left[\frac{(Vol \text{ at EL } 380)}{(0.10 \text{ cfs})} \right] \times \left(\frac{1 \text{ HR}}{3600 \text{ s}} \right)$$

$$= 1699 \text{ ft}^3$$

$$= 4.7 \text{ HRS}$$

$$(56.75) + (4.7) = 61.5 \text{ HRS}$$

Stage vs Storage Rating Curve:

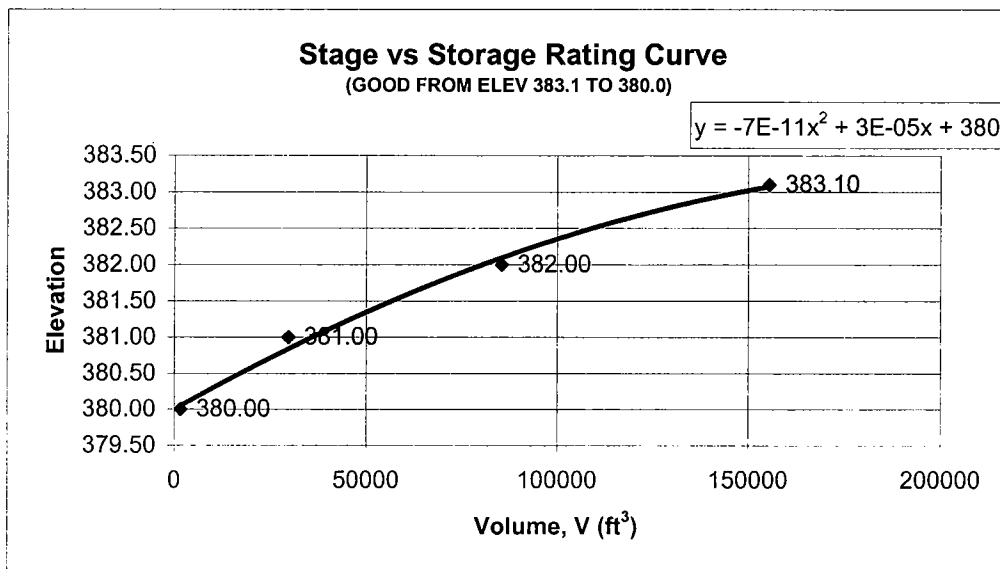
Support Information for creating a Stage vs. Storage Rating Curve.

An equation can be determined from the relationship, which is then used as part of the Drawdown Time computation.

Known elevations and volumes (from Pondpack):

Water Surface Elevation, E	Volume, V (ac-ft)	Volume, V (ft ³)
379.50	0.000	0
380.00	0.039	1699
381.00	0.682	29708
382.00	1.962	85465
383.10	3.570	155509

Plot of known values, with best-fit trendline and equation:



APPENDIX E

Detention Analyses Computer Outputs

```

*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
*      JUN 1998                    *
*      VERSION 4.1                 *
*
* RUN DATE 20APR05 TIME 13:40:29 *
*
*****

```

```

*****
*
* U.S. ARMY CORPS OF ENGINEERS
* HYDROLOGIC ENGINEERING CENTER
*      609 SECOND STREET
*      DAVIS, CALIFORNIA 95616
*      (916) 756-1104
*
*****

```

```

X      X XXXXXXXX XXXXX      X
X      X X      X      X      XX
X      X X      X      X      X
XXXXXXX XXXX      X      XXXXX X
X      X X      X      X      X
X      X X      X      X      X
X      X XXXXXXXX XXXXX      XXX

```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
 THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
 NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
 DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
 KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

*** FREE ***

*DIAGRAM

```

1
2 ID *****
3 ID WATER QUALITY BASIN AT WOODSIDE AVENUE
4 ID DETENTION ANALYSIS FOR THE PROPOSED CONDITION
5 ID 100 YEAR - 6 HOUR STORM EVENT
6 ID DETERMINED INPUT PARAMETERS FROM MDP HYDROLOGIC ANALYSIS
7 ID FNAME: WQBasin.HC1 J-14804B April 20, 2005
8 ID *****
9 ID 12-inch PVC outlet pipe with plated front, only 2-inch wide vert notch
10 ID Low-flow outlet works allows flow out from EL 379.5 to EL 383.1
11 ID Basin spillway at EL 383.1 allows flow towards existing two culverts
12 ID Existing two culverts allow outflow of 236 cfs at EL 385
13 ID Overflow of adjacent (western) property and Woodside Ave. at EL 384.1
14 ID *****
15 IT 1 01JAN90 1200 300
16 IO 3

17 KK100_bsnB.hc1
18 KM RUN DATE 4/3/2005
19 KM RATIONAL METHOD HYDROGRAPH PROGRAM
20 KM COPYRIGHT 1992, 2001, RICK ENGINEERING COMPANY
21 KM 6HR RAINFALL IS 2.67 INCHES
22 KM RATIONAL METHOD RUNOFF COEFFICIENT IS 0.6
23 KM RATIONAL METHOD TIME OF CONCENTRATION IS 20 MIN.
24 KM FOR THIS DATA TO RUN PROPERLY THIS IT CARD MUST BE ADDED TO YOUR HEC-1
25 KM IT 2 01JAN90 1200 200
26 BA 1.3885
27 IN 20 01JAN90 1150
28 QI 0 86 89.3 97.1 101.6 112.7 119.5 137 148.6 181.6
29 QI 206.8 303.7 558.1 1403.64 243.6 163 127.5 106.8 93 0
30 QI 0 0 0 0 0 0 0 0 0 0

31 KK DETAIN
32 KM DETENTION FOR BASIN
33 KO 0 2
34 RS 1 STOR -1
35 SV 0 .039 .682 1.96 3.42 3.57 5.23 6.83 8.41
36 SQ 0 0.2 0.7 0.97 1.17 1.19 200 236 1403.64
37 SE 379.5 380 381 382 383 383.1 384.1 385 386
38 ZZ

```

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT

LINE	(V) ROUTING	(--->) DIVERSION OR PUMP FLOW
NO.	(.) CONNECTOR	(<---) RETURN OF DIVERTED OR PUMPED FLOW
17	100_bsnB	
	V	
	V	
31	DETAIN	

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION


```

*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* JUN 1998
* VERSION 4.1
*
* RUN DATE 20APR05 TIME 13:40:29
*
*****

```

```

*****
*
* U.S. ARMY CORPS OF ENGINEERS
* HYDROLOGIC ENGINEERING CENTER
* 609 SECOND STREET
* DAVIS, CALIFORNIA 95616
* (916) 756-1104
*
*****

```

*** HEC-1 ERROR 1 *** INVALID CARD IDENTIFICATION CODE OR CARD OUT OF SEQUENCE
CARD NO. 1

```

*****
WATER QUALITY BASIN AT WOODSIDE AVENUE
DETENTION ANALYSIS FOR THE PROPOSED CONDITION
100 YEAR - 6 HOUR STORM EVENT
DETERMINED INPUT PARAMETERS FROM MDP HYDROLOGIC ANALYSIS
FNAME: WQBasin.HC1 J-14804B April 20, 2005
*****
12-inch PVC outlet pipe with plated front, only 2-inch wide vert notch
Low-flow outlet works allows flow out from EL 379.5 to EL 383.1
Basin spillway at EL 383.1 allows flow towards existing two culverts
Existing two culverts allow outflow of 236 cfs at EL 385
Overflow of adjacent (western) property and Woodside Ave. at EL 384.1
*****

```

16 IO OUTPUT CONTROL VARIABLES

```

IPRNT      3 PRINT CONTROL
IPLOT      0 PLOT CONTROL
QSCAL      0. HYDROGRAPH PLOT SCALE

```

IT HYDROGRAPH TIME DATA

```

NMIN      1 MINUTES IN COMPUTATION INTERVAL
IDATE     1JAN90 STARTING DATE
ITIME     1200 STARTING TIME
NQ        300 NUMBER OF HYDROGRAPH ORDINATES
NDDATE    1JAN90 ENDING DATE
NDTIME    1659 ENDING TIME
ICENT     19 CENTURY MARK

```

```

COMPUTATION INTERVAL .02 HOURS
TOTAL TIME BASE      4.98 HOURS

```

ENGLISH UNITS

```

DRAINAGE AREA      SQUARE MILES
PRECIPITATION DEPTH INCHES
LENGTH, ELEVATION  FEET
FLOW               CUBIC FEET PER SECOND
STORAGE VOLUME     ACRE-FEET
SURFACE AREA       ACRES
TEMPERATURE        DEGREES FAHRENHEIT

```

*** **

* *
17 KK * 100_bsnB * .hcl
* *

RUN DATE 4/3/2005
RATIONAL METHOD HYDROGRAPH PROGRAM
COPYRIGHT 1992, 2001, RICK ENGINEERING COMPANY
6HR RAINFALL IS 2.67 INCHES
RATIONAL METHOD RUNOFF COEFFICIENT IS 0.6
RATIONAL METHOD TIME OF CONCENTRATION IS 20 MIN.
FOR THIS DATA TO RUN PROPERLY THIS IT CARD MUST BE ADDED TO YOUR HEC-1
IT 2 01JAN90 1200 200

27 IN TIME DATA FOR INPUT TIME SERIES
JXMIN 20 TIME INTERVAL IN MINUTES
JXDATE 1JAN90 STARTING DATE
JXTIME 1150 STARTING TIME

SUBBASIN RUNOFF DATA

26 BA SUBBASIN CHARACTERISTICS
TAREA 1.39 SUBBASIN AREA

*** *** *** *** ***

HYDROGRAPH AT STATION 100_bsnB

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
(CFS)	(HR)	6-HR	24-HR	72-HR	4.98-HR
1404.	4.17	(CFS) 263.	263.	263.	263.
		(INCHES) 1.462	1.462	1.462	1.462
		(AC-FT) 108.	108.	108.	108.

CUMULATIVE AREA = 1.39 SQ MI

*** **

* *
31 KK * DETAIN *
* *

DETENTION FOR BASIN

33 KO OUTPUT CONTROL VARIABLES
IPRNT 3 PRINT CONTROL
IPLOT 2 PLOT CONTROL
QSCAL 0. HYDROGRAPH PLOT SCALE

HYDROGRAPH ROUTING DATA

34 RS	STORAGE ROUTING									
	NSTPS	1	NUMBER OF SUBREACHES							
	ITYP	STOR	TYPE OF INITIAL CONDITION							
	RSVRIC	-1.00	INITIAL CONDITION							
	X	.00	WORKING R AND D COEFFICIENT							
35 SV	STORAGE	.0	.0	.7	2.0	3.4	3.6	5.2	6.8	8.4
36 SQ	DISCHARGE	0.	0.	1.	1.	1.	1.	200.	236.	1404.
37 SE	ELEVATION	379.50	380.00	381.00	382.00	383.00	383.10	384.10	385.00	386.00

HYDROGRAPH AT STATION DETAIN

PEAK FLOW	TIME	MAXIMUM AVERAGE FLOW			
(CFS)	(HR)	6-HR	24-HR	72-HR	4.98-HR
1371.	4.18	(CFS) 259.	259.	259.	259.
		(INCHES) 1.442	1.442	1.442	1.442
		(AC-FT) 107.	107.	107.	107.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
(AC-FT)	(HR)	6-HR	24-HR	72-HR	4.98-HR
8.	4.18	5.	5.	5.	5.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
(FEET)	(HR)	6-HR	24-HR	72-HR	4.98-HR
385.97	4.18	384.18	384.18	384.18	384.18

CUMULATIVE AREA = 1.39 SQ MI

STATION DETAIN

(I) INFLOW, (O) OUTFLOW

0. 200. 400. 600. 800. 1000. 1200. 1400. 1600. 0. 0. 0. 0

(S) STORAGE

0. 0. 0. 0. 0. 0. 2. 4. 6. 8. 10. 0. 0

DAHRMN PER

| | | | | | | | | | | | | |
|-------|-----|----|---|---|---|---|---|---|---|---|---|---|
| 11200 | 1. | I | | | | | | | S | | | |
| 11201 | 2. | I | . | . | . | . | . | . | S | . | . | . |
| 11202 | 3. | OI | . | . | . | . | . | . | S | . | . | . |
| 11203 | 4. | OI | . | . | . | . | . | . | S | . | . | . |
| 11204 | 5. | OI | . | . | . | . | . | . | S | . | . | . |
| 11205 | 6. | OI | . | . | . | . | . | . | S | . | . | . |
| 11206 | 7. | I | . | . | . | . | . | . | S | . | . | . |
| 11207 | 8. | OI | . | . | . | . | . | . | S | . | . | . |
| 11208 | 9. | OI | . | . | . | . | . | . | S | . | . | . |
| 11209 | 10. | OI | . | . | . | . | . | . | S | . | . | . |
| 11210 | 11. | OI | . | . | . | . | . | . | S | . | . | . |
| 11211 | 12. | OI | . | . | . | . | . | . | S | . | . | . |
| 11212 | 13. | I | . | . | . | . | . | . | S | . | . | . |
| 11213 | 14. | I | . | . | . | . | . | . | S | . | . | . |
| 11214 | 15. | I | . | . | . | . | . | . | S | . | . | . |
| 11215 | 16. | I | . | . | . | . | . | . | S | . | . | . |
| 11216 | 17. | I | . | . | . | . | . | . | S | . | . | . |
| 11217 | 18. | I | . | . | . | . | . | . | S | . | . | . |
| 11218 | 19. | I | . | . | . | . | . | . | S | . | . | . |
| 11219 | 20. | I | . | . | . | . | . | . | S | . | . | . |
| 11220 | 21. | I | . | . | . | . | . | . | S | . | . | . |
| 11221 | 22. | I | . | . | . | . | . | . | S | . | . | . |
| 11222 | 23. | I | . | . | . | . | . | . | S | . | . | . |
| 11223 | 24. | I | . | . | . | . | . | . | S | . | . | . |
| 11224 | 25. | I | . | . | . | . | . | . | S | . | . | . |
| 11225 | 26. | I | . | . | . | . | . | . | S | . | . | . |
| 11226 | 27. | I | . | . | . | . | . | . | S | . | . | . |
| 11227 | 28. | I | . | . | . | . | . | . | S | . | . | . |
| 11228 | 29. | I | . | . | . | . | . | . | S | . | . | . |
| 11229 | 30. | I | . | . | . | . | . | . | S | . | . | . |
| 11230 | 31. | I | . | . | . | . | . | . | S | . | . | . |
| 11231 | 32. | I | . | . | . | . | . | . | S | . | . | . |
| 11232 | 33. | OI | . | . | . | . | . | . | S | . | . | . |
| 11233 | 34. | OI | . | . | . | . | . | . | S | . | . | . |
| 11234 | 35. | OI | . | . | . | . | . | . | S | . | . | . |
| 11235 | 36. | OI | . | . | . | . | . | . | S | . | . | . |
| 11236 | 37. | OI | . | . | . | . | . | . | S | . | . | . |
| 11237 | 38. | OI | . | . | . | . | . | . | S | . | . | . |
| 11238 | 39. | I | . | . | . | . | . | . | S | . | . | . |
| 11239 | 40. | I | . | . | . | . | . | . | S | . | . | . |
| 11240 | 41. | I | . | . | . | . | . | . | S | . | . | . |
| 11241 | 42. | I | . | . | . | . | . | . | S | . | . | . |
| 11242 | 43. | I | . | . | . | . | . | . | S | . | . | . |
| 11243 | 44. | I | . | . | . | . | . | . | S | . | . | . |
| 11244 | 45. | I | . | . | . | . | . | . | S | . | . | . |
| 11245 | 46. | I | . | . | . | . | . | . | S | . | . | . |
| 11246 | 47. | I | . | . | . | . | . | . | S | . | . | . |
| 11247 | 48. | I | . | . | . | . | . | . | S | . | . | . |
| 11248 | 49. | I | . | . | . | . | . | . | S | . | . | . |
| 11249 | 50. | I | . | . | . | . | . | . | S | . | . | . |
| 11250 | 51. | I | . | . | . | . | . | . | S | . | . | . |
| 11251 | 52. | I | . | . | . | . | . | . | S | . | . | . |
| 11252 | 53. | I | . | . | . | . | . | . | S | . | . | . |

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|-------|------|-----|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 11253 | 54. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11254 | 55. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11255 | 56. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11256 | 57. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11257 | 58. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11258 | 59. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11259 | 60. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11300 | 61. | .I. | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11301 | 62. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11302 | 63. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11303 | 64. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11304 | 65. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11305 | 66. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11306 | 67. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11307 | 68. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11308 | 69. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11309 | 70. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11310 | 71. | .I. | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11311 | 72. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11312 | 73. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11313 | 74. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11314 | 75. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11315 | 76. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11316 | 77. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11317 | 78. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11318 | 79. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11319 | 80. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11320 | 81. | .I. | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11321 | 82. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11322 | 83. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11323 | 84. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11324 | 85. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11325 | 86. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11326 | 87. | OI | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11327 | 88. | OI | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11328 | 89. | OI | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11329 | 90. | OI | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11330 | 91. | .OI | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11331 | 92. | OI | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11332 | 93. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11333 | 94. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11334 | 95. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11335 | 96. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11336 | 97. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11337 | 98. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11338 | 99. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11339 | 100. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11340 | 101. | .I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11341 | 102. | I | . | . | . | . | . | . | . | . | . | S | . | . | . | . |
| 11342 | | | | | | | | | | | | | | | | |

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|-------|------|--------------|-------------|
| 11353 | 114. | I | S |
| 11354 | 115. | I | S |
| 11355 | 116. | I | S |
| 11356 | 117. | I | S |
| 11357 | 118. | I | S |
| 11358 | 119. | I | S |
| 11359 | 120. | I | S |
| 11400 | 121. | I | S |
| 11401 | 122. | I | S |
| 11402 | 123. | OI | S |
| 11403 | 124. | OI | S |
| 11404 | 125. | OI | S |
| 11405 | 126. | OI | S |
| 11406 | 127. | OI | S |
| 11407 | 128. | OI | S |
| 11408 | 129. | I | S |
| 11409 | 130. | I | S |
| 11410 | 131. | I | S |
| 11411 | 132. | I | S |
| 11412 | 133. | I | S |
| 11413 | 134. | I | S |
| 11414 | 135. | I | S |
| 11415 | 136. | I | S |
| 11416 | 137. | I | S |
| 11417 | 138. | I | S |
| 11418 | 139. | I | S |
| 11419 | 140. | I | S |
| 11420 | 141. | I | S |
| 11421 | 142. | I | S |
| 11422 | 143. | I | S |
| 11423 | 144. | I | S |
| 11424 | 145. | I | S |
| 11425 | 146. | I | S |
| 11426 | 147. | I | S |
| 11427 | 148. | I | S |
| 11428 | 149. | I | S |
| 11429 | 150. | I | S |
| 11430 | 151. | I | S |
| 11431 | 152. | OI | S |
| 11432 | 153. | OI | S |
| 11433 | 154. | OI | S |
| 11434 | 155. | OI | S |
| 11435 | 156. | OI | S |
| 11436 | 157. | I | S |
| 11437 | 158. | I | S |
| 11438 | 159. | I | S |
| 11439 | 160. | I | S |
| 11440 | 161. | I | S |
| 11441 | 162. | I | S |
| 11442 | 163. | I | S |
| 11443 | 164. | OI | S |
| 11444 | 165. | OI | S |
| 11445 | 166. | OI | S |
| 11446 | 167. | OI | S |
| 11447 | 168. | OI | S |
| 11448 | 169. | OI | S |
| 11449 | 170. | I | S |
| 11450 | 171. | I | S |
| 11451 | 172. | I | S |
| 11452 | 173. | I | S |

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|------------|---|---|---|-----|---|---|---|---|---|---|---|---|
| 11553 234. | . | . | . | O I | . | . | . | . | S | . | . | . |
| 11554 235. | . | . | . | O I | . | . | . | . | S | . | . | . |
| 11555 236. | . | . | . | O I | . | . | . | . | S | . | . | . |
| 11556 237. | . | . | . | O I | . | . | . | . | S | . | . | . |
| 11557 238. | . | . | . | O I | . | . | . | . | S | . | . | . |
| 11558 239. | . | . | . | O I | . | . | . | . | S | . | . | . |
| 11559 240. | . | . | . | O I | . | . | . | . | S | . | . | . |
| 11600 241. | . | . | . | O I | . | . | . | . | S | . | . | . |
| 11601 242. | . | . | . | O I | . | . | . | . | S | . | . | . |
| 11602 243. | . | . | . | O I | . | . | . | . | S | . | . | . |
| 11603 244. | . | . | . | O I | . | . | . | . | S | . | . | . |
| 11604 245. | . | . | . | O I | . | . | . | . | S | . | . | . |
| 11605 246. | . | . | . | O I | . | . | . | . | S | . | . | . |
| 11606 247. | . | . | . | O I | . | . | . | . | S | . | . | . |
| 11607 248. | . | . | . | O I | . | . | . | . | S | . | . | . |
| 11608 249. | . | . | . | O I | . | . | . | . | S | . | . | . |
| 11609 250. | . | . | . | O I | . | . | . | . | S | . | . | . |
| 11610 251. | . | . | . | O I | . | . | . | . | S | . | . | . |
| 11611 252. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11612 253. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11613 254. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11614 255. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11615 256. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11616 257. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11617 258. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11618 259. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11619 260. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11620 261. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11621 262. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11622 263. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11623 264. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11624 265. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11625 266. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11626 267. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11627 268. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11628 269. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11629 270. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11630 271. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11631 272. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11632 273. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11633 274. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11634 275. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11635 276. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11636 277. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11637 278. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11638 279. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11639 280. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11640 281. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11641 282. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11642 283. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11643 284. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11644 285. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11645 286. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11646 287. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11647 288. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11648 289. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11649 290. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11650 291. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11651 292. | . | . | . | I O | . | . | . | . | S | . | . | . |
| 11652 293. | . | . | . | I O | . | . | . | . | S | . | . | . |

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| 11653 | 294. | I | . | O | . | . | . | . | . | . | . | S | . | . | . | . |
| 11654 | 295. | I | . | O | . | . | . | . | . | . | . | S | . | . | . | . |
| 11655 | 296. | I | . | O | . | . | . | . | . | . | . | S | . | . | . | . |
| 11656 | 297. | I | | O | . | . | . | . | . | . | . | S | . | . | . | . |
| 11657 | 298. | I | | O | . | . | . | . | . | . | . | S | . | . | . | . |
| 11658 | 299. | I | | O | . | . | . | . | . | . | . | S | . | . | . | . |
| 11659 | 300. | I | - | O | - | - | - | - | - | - | - | S | - | - | - | - |

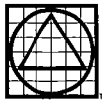
RUNOFF SUMMARY
 FLOW IN CUBIC FEET PER SECOND
 TIME IN HOURS, AREA IN SQUARE MILES

| OPERATION | STATION | PEAK
FLOW | TIME OF
PEAK | AVERAGE FLOW FOR MAXIMUM PERIOD | | | BASIN
AREA | MAXIMUM
STAGE | TIME OF
MAX STAGE |
|---------------|----------|--------------|-----------------|---------------------------------|---------|---------|---------------|------------------|----------------------|
| | | | | 6-HOUR | 24-HOUR | 72-HOUR | | | |
| HYDROGRAPH AT | 100_bsnB | 1404. | 4.17 | 263. | 263. | 263. | 1.39 | | |
| ROUTED TO | DETAIN | 1371. | 4.18 | 259. | 259. | 259. | 1.39 | 385.97 | 4.18 |

*** 1 ERROR(S) DETECTED BY HEC-1 ***

APPENDIX F

Hydraulic Calculations for “Weir” Spillway Sizing



04-20-05

14804-B

1 OF 2

HYDRAULIC CALCULATIONS FOR "WEIR" SPILLWAY SIZING:

FOREBAY SPILLWAY - Into Water Quality Basin

Originally sized to convey $Q_{100} = 976$ cfs $\Rightarrow$ yielded $L_{min} = 75'$

Should be sized to convey $Q_{100} = 1404$ cfs

$$Q = CLH^{3/2}, C = 3.3 \text{ (sharp-crested weir with a height greater than } \frac{1}{5} \text{ the head, per "Design of Small Dams" p. 369)}$$

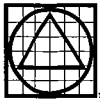
$$L_{min} = \frac{Q}{CH^{3/2}} = \frac{1404}{(3.3)(2.5)^{3/2}} \quad H = 2.5, (385.0 - 382.5) \\ = 107.6'$$

Length provided = 100' at ELEV 382.5
plus 10' Access Road at ELEV 383.5

$$\therefore \text{Total } Q_{WEIR} = (3.3)(100)(2.5)^{1.5} + (3.3)(10)(1.5)^{1.5}$$

$$= 1304 \text{ cfs} + 60 \text{ cfs}$$

$$= 1364 \text{ cfs} \quad [\text{NOTE: The weir has full capacity of } 1404 \text{ cfs at EL} = 385.2]$$



(CONT'D)

BASIN SPILLWAY - Into Existing Channel and Culverts

* Sized to convey Q_{capacity} of Both 58" x 36" CMP Culverts

- per MDP, $Q_{\text{CAPACITY}} = 236$ cfs (Total for Both Culverts)

$$Q_{\text{WEIR}} = C L H^{3/2}, \quad C = 3.3 \quad (\text{see Page 1 of 2})$$
$$H = 1.0 \quad (384.1' - 383.1')$$

$$\therefore L_{\text{MIN}} = \frac{Q}{C H^{3/2}} = \frac{(236)}{(3.3)(1)^{3/2}} = 71.5'$$

Length provided $\approx 105'$, $\therefore$ okay

APPENDIX G

Back-up Information for Quantities and Cost Estimate Calculations



*Woodside Avenue
Opinion of Probable Construction Costs
Job Number 14804-B
Revised: April 20, 2005*

| Item | Quantity | Unit | @ | Unit Price | Subtotal |
|---|----------|------|---|-------------|--------------|
| Water Pollution Control | 1 | LS | @ | \$15,000.00 | \$15,000.00 |
| Project Identification Sign | 1 | LS | @ | \$1,000.00 | \$1,000.00 |
| Field Orders | 1 | LS | @ | \$10,000.00 | \$10,000.00 |
| Prepare Storm Water Pollution Prevention Plan | 1 | LS | @ | \$10,000.00 | \$10,000.00 |
| Clearing & Grubbing | 1 | LS | @ | \$9,540.00 | \$9,540.00 |
| Excavation & Embankment | 50 | CY | @ | \$10.00 | \$500.00 |
| Excavation & Export | 18,500 | CY | @ | \$17.00 | \$314,500.00 |
| Erosion Control (Type D) | 8,222 | SY | @ | \$0.80 | \$6,577.60 |
| Move In - Move Out (Erosion Control) | 1 | LS | @ | \$2,500.00 | \$2,500.00 |
| Irrigation | 1 | LS | @ | \$40,781.00 | \$40,781.00 |
| Planting | 1 | LS | @ | \$29,630.00 | \$29,630.00 |
| Plant Establishment | 1 | LS | @ | \$6,162.00 | \$6,162.00 |
| Temporary Gravel Bags | 114 | EA | @ | \$2.00 | \$228.00 |
| Temporary Sand Bags | 1,800 | EA | @ | \$2.00 | \$3,600.00 |
| Traffic Control | 1 | LS | @ | \$10,000.00 | \$10,000.00 |
| 12" PVC Pipe | 12 | LF | @ | \$50.00 | \$600.00 |
| Concrete Minor Structure (Winged Headwall) | 1 | CY | @ | \$1,500.00 | \$1,500.00 |
| Concreted Cobble Bench | 1 | CY | @ | \$100.00 | \$100.00 |
| Concreted Minor Structure (Sill) | 31 | CY | @ | \$200.00 | \$6,200.00 |
| Minor Concrete (Access Road Thickened Edge) | 37 | CY | @ | \$250.00 | \$9,250.00 |
| Hesco Wall System | 101 | LF | @ | \$53.50 | \$5,403.50 |
| Debris Rack & Plate | 1 | LF | @ | \$1,000.00 | \$1,000.00 |
| Chain Link Fence - 6' | 114 | LF | @ | \$30.00 | \$3,420.00 |
| Chain Gate (L=6') | 2 | EA | @ | \$400.00 | \$800.00 |
| Temporary Concrete Washout (Portable) | 1 | LS | @ | \$1,000.00 | \$1,000.00 |
| Armor Flex Blanket | 4,104 | SF | @ | \$9.00 | \$36,936.00 |
| Minor Concrete (Sampling Pads) | 3 | EA | @ | \$200.00 | \$600.00 |
| 1" Meter | 1 | EA | @ | \$500.00 | \$500.00 |
| Kiosk | 1 | LS | @ | \$5,000.00 | \$5,000.00 |
| Sediment Post | 5 | EA | @ | \$200.00 | \$1,000.00 |
| Rip Rap | 2 | CY | @ | \$200.00 | \$400.00 |

Subtotal: \$533,728.10
15% Contingency: \$80,059.22
Total: \$613,787.32



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4/18/05
14804 b
1 of 2

Erosion Control $\frac{125' \times 592'}{9' / \text{sy}} = 8222 \text{ sy}$

Temp Sand Bags $570 \div 1.16 = 492 \times 3 \text{ high} = 1476$

Trans $30 \div 1.16 = 26 \times 5.5 \text{ avg} = 143$

Add bags for Trans $200 \div 1.16 = 172 \times 1 = 172$

1791
say 1800

Gravel Bags

$6 \times 5 \text{ ea} = 30$

$\left(\begin{array}{c} 9 \div 1.16 \\ 8 \end{array} \right) \times \left(\begin{array}{c} 3 \times 3 \\ 9 \end{array} \right) + 3(2) + 3 \times 2$
 $\begin{array}{c} 72 \\ + 6 \\ + 12 \end{array} = 84$

114

Wingwall

Fl. Sill $1.5 \times 2.67 \times .75 = 3$
 Wings $2(3.16 \times 2.2 \times .67) = 9.3$
 Headwall $3.8 \times 3 \times .67 = 7.64$

19.94 say 14 yd

Excav. Export - Surface generated

4.50 exc.
5.00 haul
6.00 dump fees
1.00 mob. demob

16.50 say 17.00

50 yd³ fill
18550 yd cut

18,500 export



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4/18/09
14804b
Zag 2

Blanket (Armor Fly) $513 \times 8 = 4104 \text{ sf}$.

Minor Conc. (Thickened Edge)

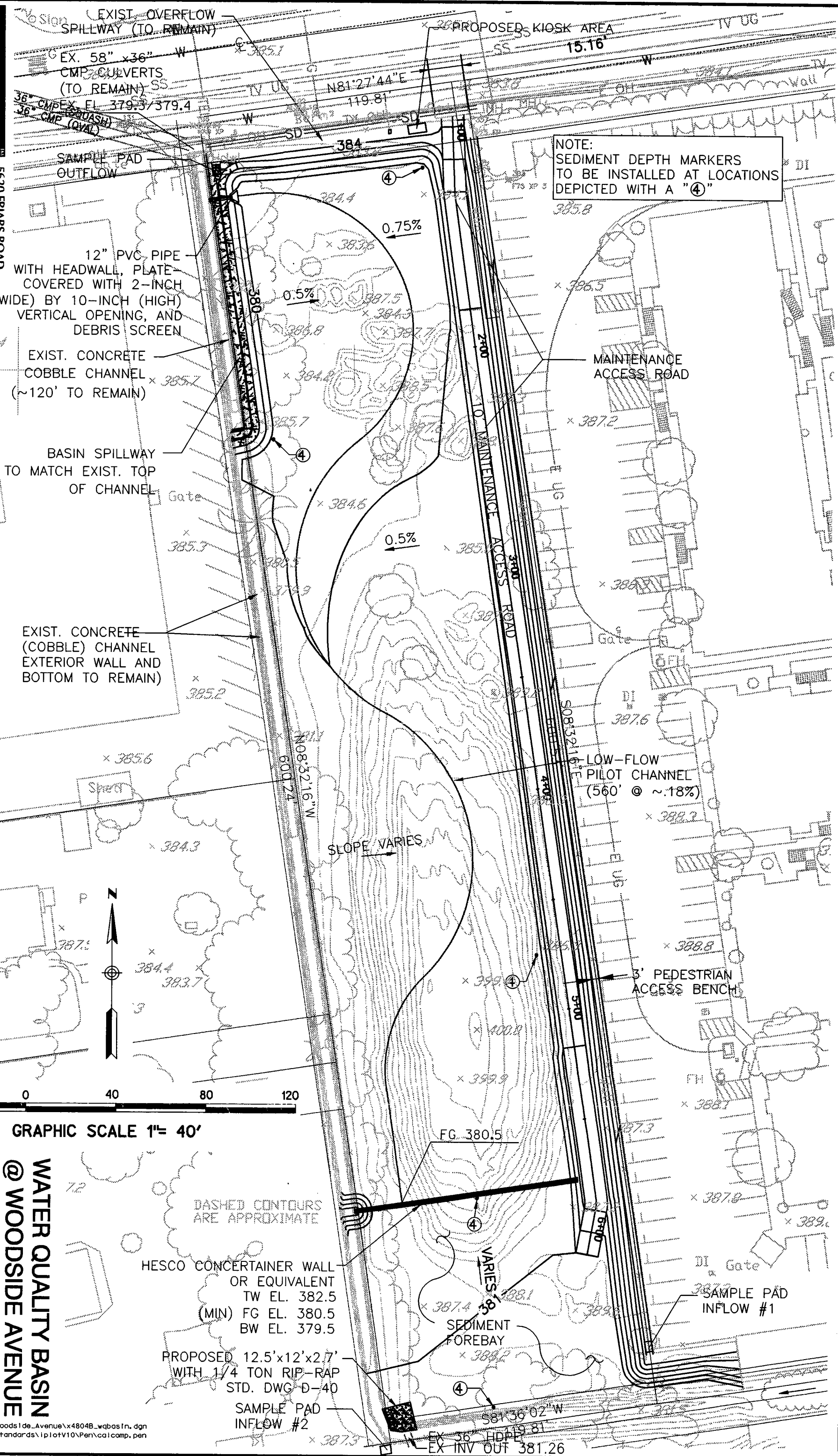
$$\frac{1' \times 2' \times 500'}{27} = 37 \text{ cy}.$$

APPENDIX H

Basin Layout for Water Quality Basin at Woodside Avenue

Tucson

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SAN DIEGO, CA 92110
619.291.0707
(FAX)619.291.4165



**WATER QUALITY BASIN
@ WOODSIDE AVENUE**

DATE: 04-20-05

J-14804-B

MAP POCKET 1

Copy of Sheets 2-5 of the Final Grading Plans

(For Reference Only)

PLANS

DESIGNED

CHECKED

DELINEATED

BY

BRENDAN HASTIE

CARL HEWINGS

BRIAN LEDGERWOOD

DATE

REGISTERED PROFESSIONAL ENGINEER

No. 33037

Exp. 8/30/06

CIVIL

SITE OF CALIFORNIA

RICK ENGINEERING

5620 FRIARS RD.

SAN DIEGO, CA. 92110

619-291-0707

REGISTERED CIVIL ENGINEER

DATE

This drawing is NOT in conformance with latest UBC and should be used with care.

SECTION A-A

U TYPE **WING TYPE**

ELEVATION **SECTION B-B**

| DIA. OF PIPE | DIMENSIONS | | | DOUBLE PIPE | | DOUBLE PIPE | |
|--------------|------------|------------|-----------|-------------|-----------|-------------|-----------|
| | L | E | F | U TYPE | WING TYPE | U TYPE | WING TYPE |
| Metric | 457mm | 689mm | 381mm | 571mm | 610mm | 443mm | 489mm |
| US | 18" | 2'-3 1/8" | 1'-3" | 1'-10 1/2" | 2'-0" | 1'-5 1/2" | 1'-6 3/4" |
| Metric | 610mm | 962mm | 533mm | 800mm | 762mm | 610mm | 678mm |
| US | 24" | 3'-10 1/8" | 2'-1 1/2" | 3'-1 1/2" | 3'-0" | 2'-4 1/2" | 2'-7 1/8" |
| Metric | 762mm | 1,247mm | 686mm | 1,030mm | 914mm | 711mm | 787mm |
| US | 30" | 4'-9 1/8" | 2'-7 1/8" | 4'-0 1/2" | 3'-6" | 2'-8 1/2" | 3'-1 1/8" |
| Metric | 914mm | 1,511mm | 838mm | 1,266mm | 1,076mm | 800mm | 889mm |
| US | 36" | 5'-11 1/8" | 3'-2 1/4" | 4'-1 1/2" | 4'-5" | 3'-2" | 3'-5 1/8" |

NOTES:

- Concrete shall be 332kg/m³ - C-22Mpa (560-C-3250).
- Exposed corners to be chamfered 3/4".
- Multiple pipes to be set a distance of 0/2, with a 305mm(1') minimum between outside diameters of.
- Top of headwall shall be placed approximately parallel to profile grade when the grade is 3% or more.
- Skewed pipes: Dimension W to be increased in width or length due to skew or multiple pipes.
- For pipe wall thickness greater than 76mm(3") use alternate Detail-C.

| Revision | By | Approved | Date | DESCRIPTION |
|------------|------------|----------|------|-------------------------------------|
| ORIGINAL | Kercheval | 2/7/05 | | SAN DIEGO REGIONAL STANDARD DRAWING |
| Add Metric | T. Stanton | 03/03 | | MODIFIED HEADWALL |

OUTLET PROTECTION ~ NEENAH R-7512-B1 OR EQUAL
CAST IRON PIPE SCREEN FOR 12" PIPE, DEBRIS RACK TO BE MOUNTED TO HEADWALL AND APRON

SIDE VIEW

FRONT VIEW
NTS

GALVANIZED STEEL PLATE

| WIDTH | HEIGHT | LENGTH | OPENING |
|-------|--------|--------|---------|
| 18" | 13" | 18" | 1" |

* SIX 3/4" HOLES FOR ANCHOR BOLTS

TOP VIEW

ELEVATION VIEW

END VIEW

SIDE VIEW

TOP VIEW

DETAIL A INTERLOCKING DETAIL
NTS

DETAIL B REMOVABLE LINER DETAIL
NTS

NOTE:

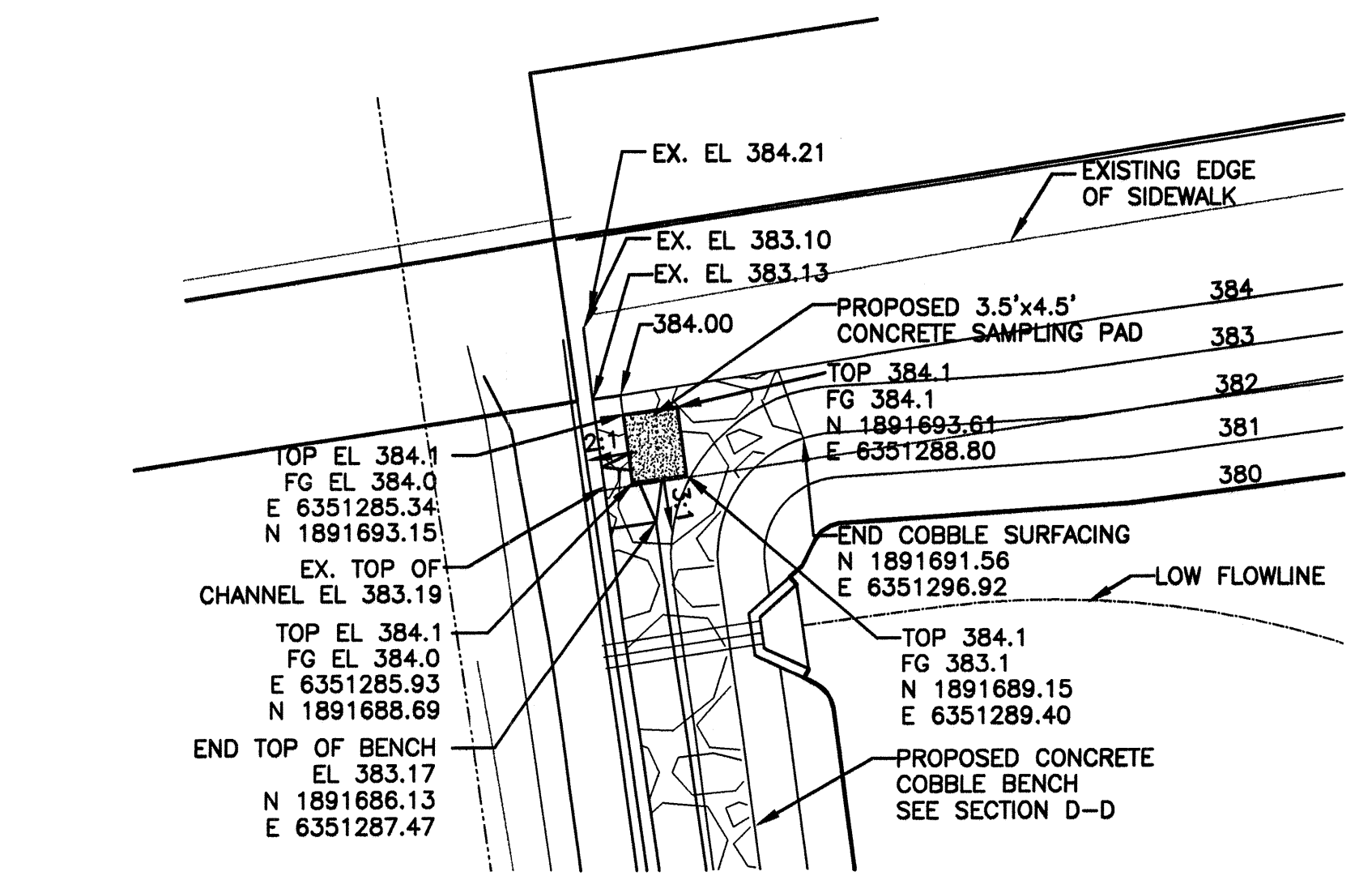
WHEN UNITS ARE JOINED WITH ZIP PINS, THE GEO LINER IS ROLLED BACK, ALLOWING CONTINUOUS 2" MINUS/ GRAVEL INFILL, EFFECTIVELY CREATING A CONTINUOUS BARRIER.

HESCO WALL SYSTEM (OR APPROVED EQUIVALENT) SHALL HAVE WIRE MESH TOP HINGED TO SYSTEM & SECURELY FASTENED.

4 HESCO WALL INSTALLATION DETAIL
NTS

48" CLASS 1 (FLEXIBLE POST) DELINEATOR WITH BELOW SURFACE ANCHOR
NTS

5 48" CLASS 1 (FLEXIBLE POST) DELINEATOR WITH BELOW SURFACE ANCHOR
NTS



3 DETAIL
SCALE 1" = 10'

W:\480A\480A-B_Woodside_Avenue\County\CS\SD\01-15-05-DET.dwg, 01/15/05 01:17:34 PM, gto

PLANS

DESIGNED

CHECKED

DELINEATED

BY

BRENDAN HASTIE

CARL HEWINGS

BRIAN LEDGERWOOD

DATE

REGISTERED PROFESSIONAL ENGINEER

No. 33037

Exp. 6/30/06

CIVIL

STATE OF CALIFORNIA

RICK ENGINEERING

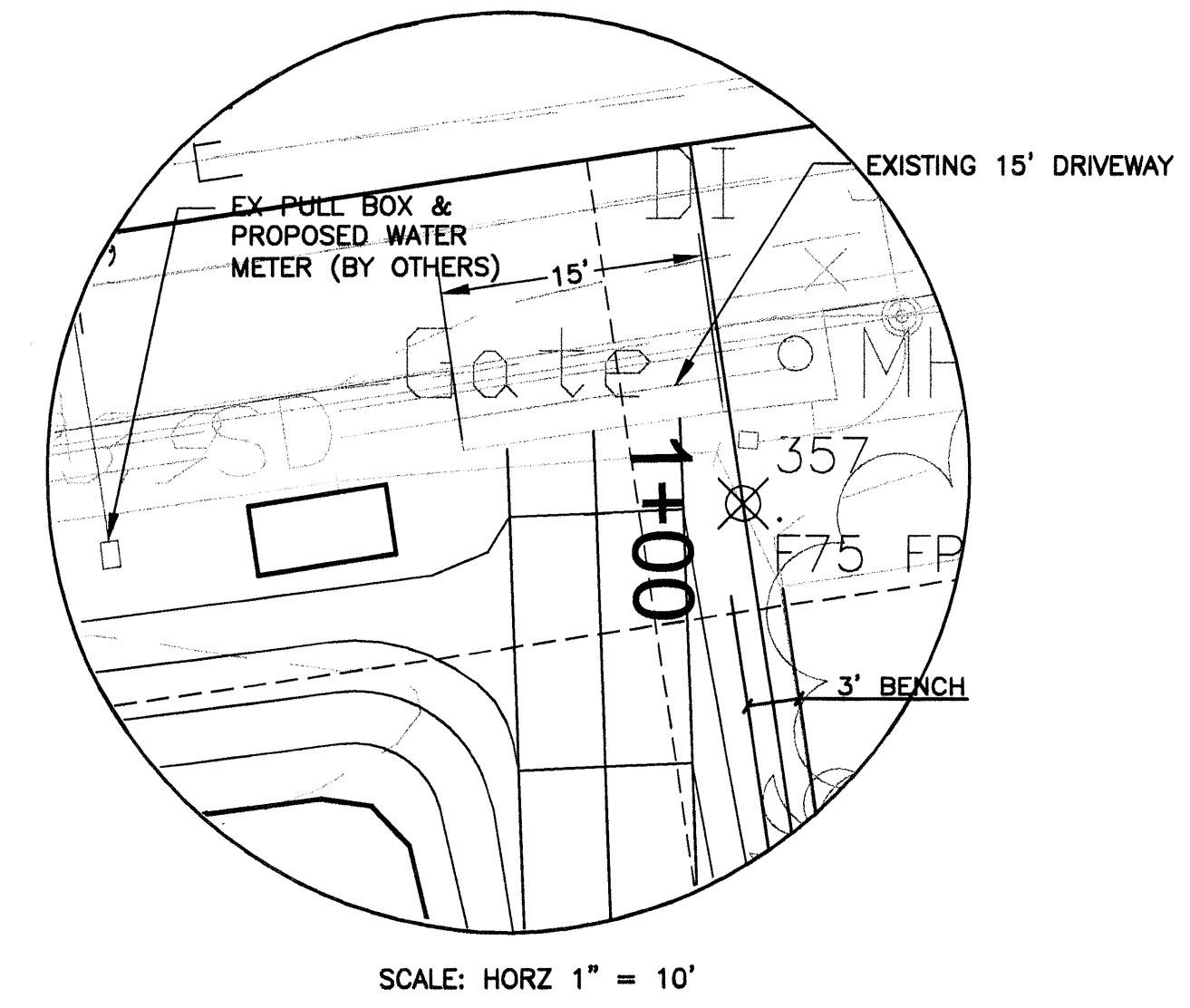
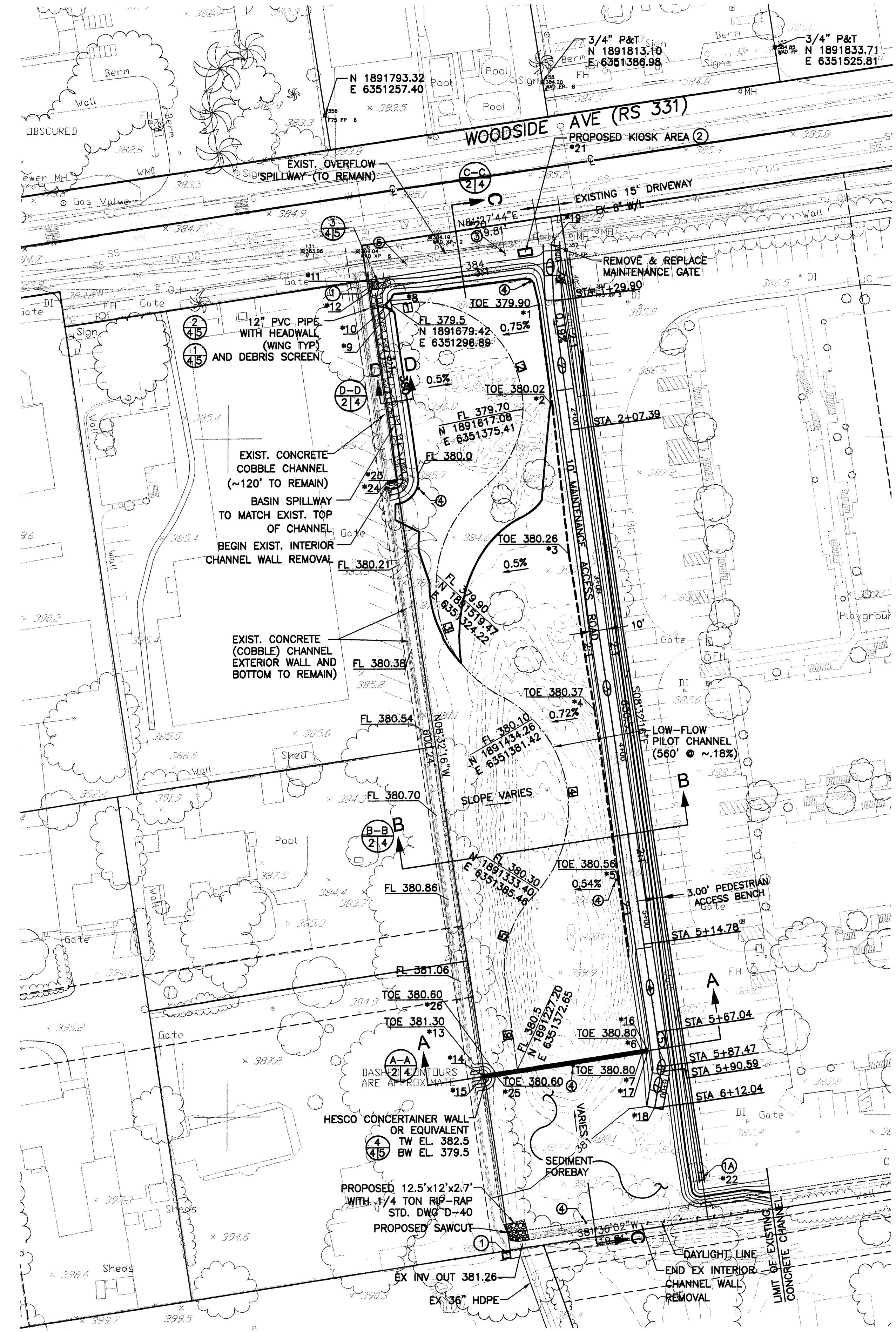
5620 FRIARS RD.

SAN DIEGO, CA. 92110

619-291-0707

REGISTERED CIVIL ENGINEER

DATE



- CONSTRUCTION NOTE:
- ① CONSTRUCT 3.5' x 4.5' CONCRETE PAD (4" THICK) FOR SAMPLING BOX.
 - ①A CONSTRUCT 3' x 4.5' CONCRETE PAD (4" THICK) FOR SAMPLING BOX.
 - ② CONTRACTOR TO PROVIDE AND INSTALL PREMANUFACTURED KIOSK BY BARCO PRODUCTS: MODEL KMCP3, SINGLE SIDED, DESERT TAN COLOR (OR EQUAL). DESIGNATED 4" SLAB AREA IS SHOWN AS 4' x 8'. LOCATE FACE OF SLAB ON FUTURE R/W
 - ASSUME KIOSK WILL HAVE DUAL 4"x4" POSTS TO BE PLACED IN 12" DIA, 30" DEEP CONCRETE FOOTING
 - ③ EXISTING 1" WATER SERVICE TO REMAIN AND 1" WATER METER TO BE INSTALLED BY OTHERS
 - ④ CONTRACTOR TO INSTALL SEDIMENT DEPTH MARKERS, MARKERS PER DETAIL ④B
 - ⑤ CONTRACTOR TO REMOVE EX FENCE AND GATE AND REPLACE WITH NEW VINYL COATED CHAIN LINK FENCE AND GATE PER STD DWG M-5, M-6. NEW FENCE AND GATE TO BE PLACED ON FUTURE R/W

| 10' MAINTENANCE ACCESS ROAD CENTERLINE DATA | | | | |
|---|--------------|--------|---------|---------|
| NO. | DELTA OR BRG | RADIUS | LENGTH | REMARKS |
| ① | S02°10'04"E | | 34.63' | |
| ② | S07°44'19"E | | 77.77' | |
| ③ | S08°20'13"E | | 307.39' | |
| ④ | S08°32'33"E | | 52.26' | |
| ⑤ | S07°34'05"E | | 27.42' | |
| ⑥ | Δ=17°51'23" | 10.00' | 3.12' | |
| ⑦ | S10°17'18"W | | 21.45' | |

| FLOWLINE DATA | | | | |
|---------------|--------------|--------|---------|---------|
| NO. | DELTA OR BRG | RADIUS | LENGTH | REMARKS |
| ① | S82°27'29"W | | 8.79' | |
| ② | Δ=148°39'45" | 62.33' | 161.73' | |
| ③ | Δ=115°36'37" | 73.00' | 147.30' | |
| ④ | Δ=106°28'54" | 74.58' | 138.61' | |
| ⑤ | Δ=54°14'23" | 59.64' | 56.46' | |
| ⑥ | N07°51'49"W | | 49.47' | |

| NO. | NORTHING | EASTING | REMARKS |
|-----|--------------|--------------|--|
| *1 | N 1891679.37 | E 6351384.54 | TOE |
| *2 | N 1891619.46 | E 6351392.96 | TOE |
| *3 | N 1891531.02 | E 6351403.04 | TOE |
| *4 | N 1891439.80 | E 6351418.79 | TOE |
| *5 | N 1891340.38 | E 6351433.07 | TOE |
| *6 | N 1891238.31 | E 6351447.21 | TOE |
| *7 | N 1891236.26 | E 6351447.36 | TOE |
| *8 | N 1891682.05 | E 6351296.51 | WING WALL |
| *9 | N 1891676.61 | E 6351297.29 | WING WALL |
| *10 | N 1891678.96 | E 6351294.29 | 12" PVC PIPE INVERT |
| *11 | N 1891688.69 | E 6351285.34 | SAMPLING PAD |
| *12 | N 1891688.69 | E 6351285.94 | SAMPLING PAD |
| *13 | N 1891232.05 | E 6351345.80 | TOE |
| *14 | N 1891223.91 | E 6351351.46 | NW CORNER OF HESCO WALL |
| *15 | N 1891222.13 | E 6351351.73 | SW CORNER OF HESCO WALL |
| *16 | N 1891238.81 | E 6351450.58 | NE CORNER OF HESCO WALL |
| *17 | N 1891237.02 | E 6351450.82 | SE CORNER OF HESCO WALL |
| *18 | N 1891204.40 | E 6351455.09 | END OF MAINTENANCE ACCESS ROAD |
| *19 | N 1891716.07 | E 6351392.23 | BEGIN OF MAINTENANCE ACCESS ROAD |
| *20 | N 1891709.04 | E 6351364.44 | EXISTING WATER SERVICE |
| *21 | N 1891710.47 | E 6351376.58 | KIOSK |
| *22 | N 1891164.12 | E 6351482.87 | SAMPLING PAD |
| *23 | N 1891574.84 | E 6351299.13 | BEGIN EXISTING INTERIOR CHANNEL WALL REMOVAL |
| *24 | N 1891574.26 | E 6351295.22 | BEGIN EXISTING INTERIOR CHANNEL WALL REMOVAL |
| *25 | N 1891223.39 | E 6351360.10 | TOE |
| *26 | N 1891225.17 | E 6351359.84 | TOE |

COUNTY OF SAN DIEGO
DEPARTMENT OF PUBLIC WORKS
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San Diego Riverside Sacramento Orange Phoenix Tucson

WOODSIDE AVENUE
WATER QUALITY BASIN
In the Vicinity of Lakeside

| REVISIONS | BY | APPROVED | DATE | COORDINATE INDEX |
|-----------|----|----------|------|------------------|
| | | | | 250 N 1785 E |
| | | | | CONST. COMPL |
| | | | | FIELD REVISIONS |

WOODSIDE AVENUE
WATER QUALITY BASIN
In the Vicinity of Lakeside

SCALE: HOR. 1"=40' VERT. N/A
W.A. YF1531 R.S. 331

GRADING PLAN

SHEET 4 OF 13



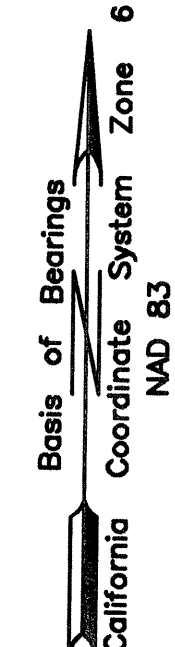
| PLANS | BY | DATE |
|------------|------------------|------|
| DESIGNED | BRENDAN HASTIE | |
| CHECKED | CARL HEWINGS | |
| DELINEATED | BRIAN LEDGERWOOD | |

RICK ENGINEERING
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SAN DIEGO, CA. 92110
619-291-0707

REGISTERED CIVIL ENGINEER

DATE

- NOTE:
- ① EXISTING 5' DRAINAGE DITCH EASEMENT TO COUNTY OF SAN DIEGO, BK. 831, P.191, O.R. REC. SEPT. 29, 1983
 - ② EXISTING 15' DRAINAGE CHANNEL EASEMENT TO SAN DIEGO COUNTY FLOOD CONTROL DISTRICT F/P 86-494409, O.R. REC. OCT 30, 1986
 - ③ EXISTING 35' EASEMENT FOR CHANNEL MAINTENANCE TO WOODSIDE LTD. F/P 83-397266, O.P. REC. NOV. 2, 1983
 - ④ EXISTING 15' DRAINAGE EASEMENT TO COUNTY OF SAN DIEGO PER DOC NO 1997-0475014 OR REC. SEPT. 25, 1997



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ABBREVIATIONS

| ABBREVIATION | DESCRIPTION |
|--------------|---|
| AB | AGGREGATE BASE |
| AC | ASPHALT CONCRETE |
| ACP | ASBESTOS CEMENT PIPE |
| BC | BEGINNING OF CURVE |
| BVC | BEGINNING OF VERTICAL CURVE |
| BW | BOTTOM OF WALL |
| C&G | CURB AND GUTTER |
| CFS | CUBIC FEET PER SECOND |
| CI | CAST IRON PIPE |
| CIP | CAST-IN-PLACE |
| CL | CENTERLINE |
| CO | CLASS |
| CONC | CONCRETE |
| CONST | CONSTRUCT |
| CONST'N | CONSTRUCTION |
| CSP | CORRUGATED STEEL PIPE |
| CSPA | CORRUGATED STEEL PIPE ARCH |
| CTSP | CALTRANS STANDARD PLANS |
| DE | DEAD END |
| Δ | DELTA |
| DRAIN | DRAINAGE |
| DWY | DRIVEWAY |
| EC | EDGE OF CURVE |
| EL | ELEVATION |
| EP | EDGE OF PAVEMENT |
| EVC | END OF VERTICAL CURVE |
| EX | EXISTING |
| EG | EXISTING GROUND |
| FG | FINISH GRADE |
| FL | FLOW LINE |
| HH | HANDHOLE |
| HWY | HIGHWAY |
| IE | INVERT ELEVATION |
| L | ARC LENGTH |
| LF | LINEAR FOOT |
| LT | LEFT |
| MH | MANHOLE |
| MIN | MINIMUM |
| NAD | NORTH AMERICAN DATUM |
| OG | ORIGINAL GROUND |
| OHD | OVERHEAD |
| PCC | PORTLAND CEMENT CONCRETE |
| PCR | POINT OF CURB/CURVE RETURN |
| PE | PEDESTRIAN |
| PI | POINT OF INTERSECTION/ANGLE POINT |
| PL | PLACE |
| P | PROPERTY LINE |
| PROF | PROFILE |
| PVI | POINT OF VERTICAL INTERSECTION |
| PVMT | PAVEMENT |
| Q | RATE OF FLOW |
| R | RADIUS |
| RCB | REINFORCED CONCRETE BOX |
| RCP | REINFORCED CONCRETE PIPE |
| RD | ROAD |
| RS | ROAD SURVEY |
| RSD | REGIONAL STANDARD DRAWING |
| RT | RIGHT |
| R/W | RIGHT-OF-WAY |
| SD | STORM DRAIN |
| SDCDS | SAN DIEGO COUNTY DESIGN STANDARD |
| S/W | SIDEWALK |
| S | SLOPE |
| ST | STREET |
| STA | STATION |
| SWR | SANITARY SEWER |
| T | TANGENT LENGTH |
| TC | TOP OF CURB |
| TELE | TELEPHONE |
| TW | TOP OF WALL |
| USC&GS | UNITED STATES COASTAL & GEODETIC SURVEY |
| VC | VERTICAL CURVE LENGTH |
| VCP | VITRIFIED CLAY PIPE |
| WTR | WATER |

HORIZONTAL CONTROL

ALL BEARINGS, DISTANCES, STATIONS AND COORDINATES ARE GRID AND BASED ON THE NORTH AMERICAN DATUM OF 1983(1991.35) CALIFORNIA COORDINATE SYSTEM, ZONE 6. AS DEFINED BY SECTIONS 8801 THROUGH 8819 OF THE CALIFORNIA PUBLIC RESOURCES CODE. CONTROL IS BASED ON FIRST ORDER CONTROL STATIONS 'FIT-2' & 'GF 25-92' PER ROS 16652.

AT STATION: "WAD XP 2"

NORTHING = 1891719.677
EASTING = 6351319.690
EL = 384.19
λ = 0°22'35.01"

THE COMBINATION FACTOR = 0.99997574

GROUND DISTANCE = $\frac{\text{GRID DISTANCE}}{\text{COMBINATION FACTOR}}$

BENCHMARKS

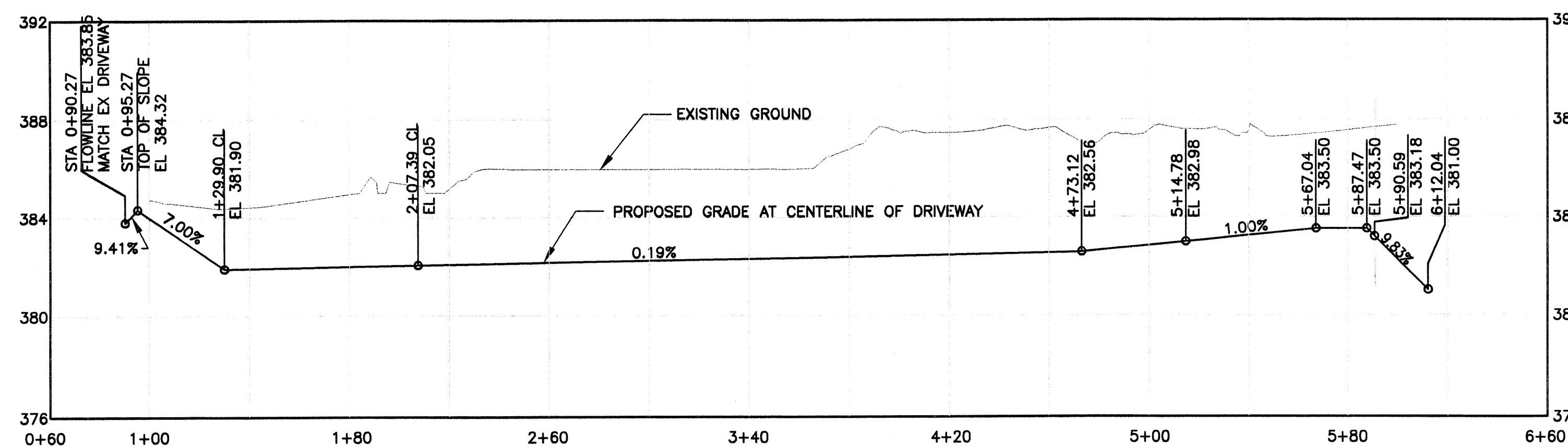
DESIGNATION: 0169

DESCRIPTION: BRASS DISK SET IN CONCRETE BELOW SURFACE

LOCATION: C/L MON ON WINTERGARDENS BLVD APPROX. 2674 FT. N'LY OF INT. OF GAY RIO DRIVE

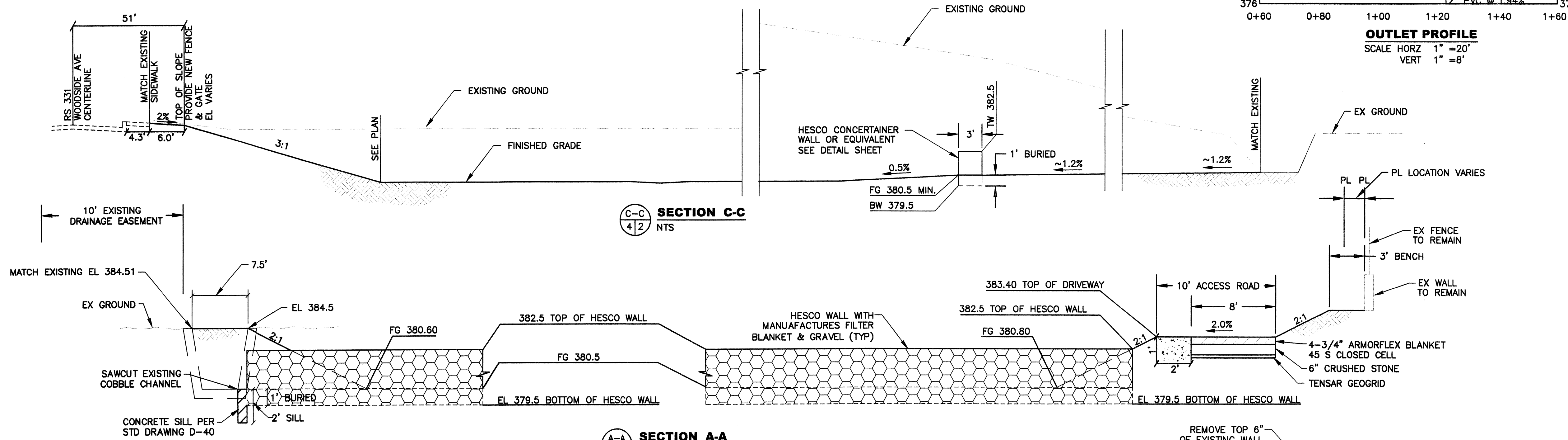
ELEVATION: 462.558'

DATUM: VERTICAL DATUM IS NGVD 1929.



10' MAINTENANCE ACCESS ROAD PROFILE

SCALE HORZ 1" = 40'
VERT 1" = 4'

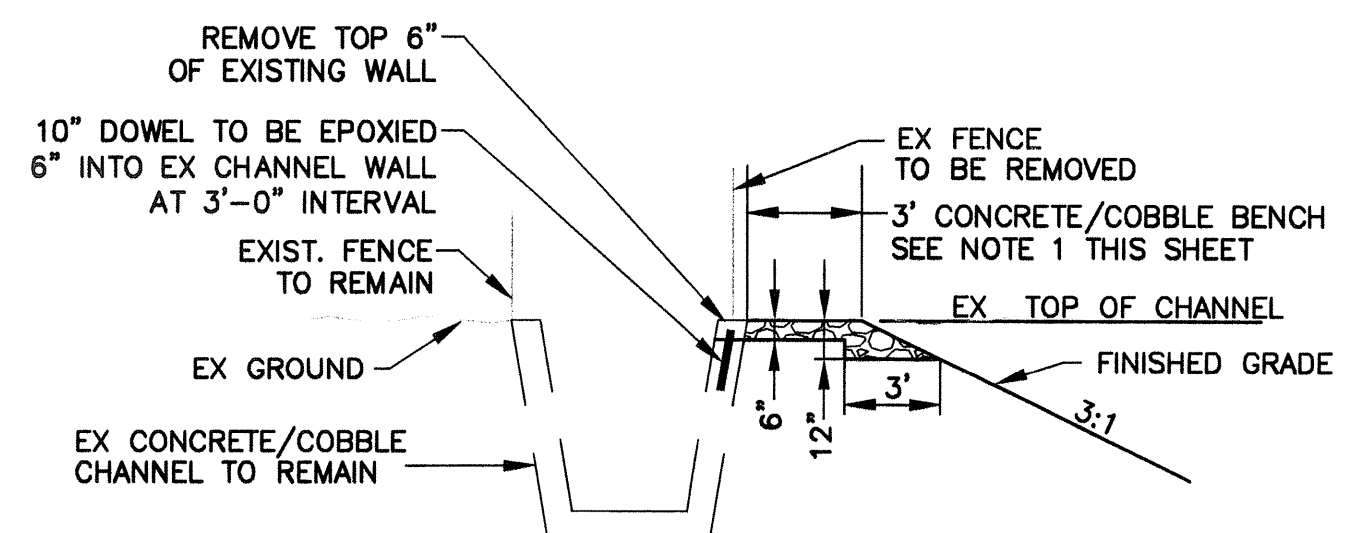
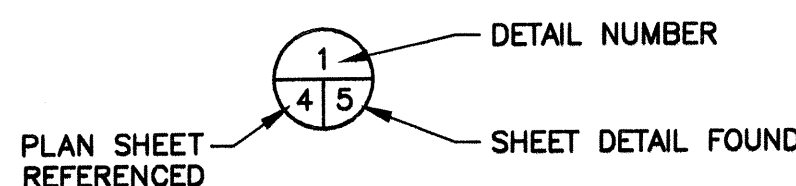


SECTION C-C
4/2 NTS

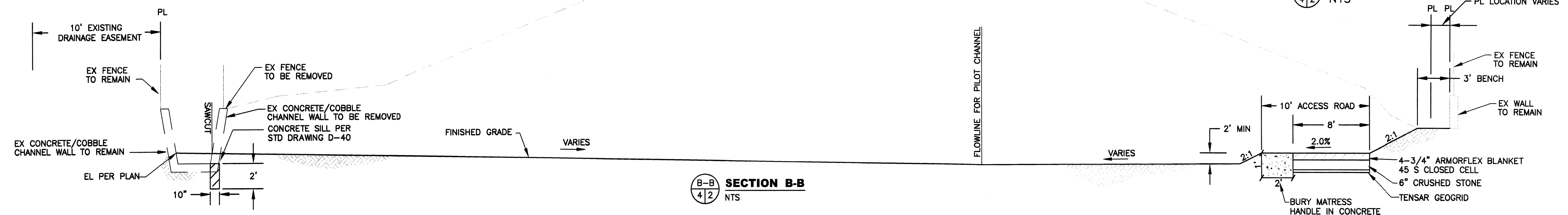
SECTION A-A
4/2 NTS

NOTES:

- USE PORTION OF EXISTING CHANNEL REMOVAL.

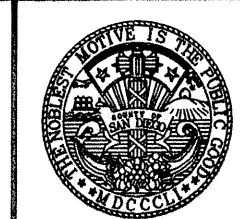


SECTION D-D
4/2 NTS



SECTION B-B
4/2 NTS

COUNTY OF SAN DIEGO
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| REVISIONS | BY | APPROVED | DATE | COORDINATE INDEX |
|-----------|----|----------|------|------------------|
| | | | | 250 N. 1785 E. |
| | | | | CONST. COMPL. |
| | | | | FIELD REVISIONS |

WOODSIDE AVENUE
WATER QUALITY BASIN
In the Vicinity of Lakeside
TYPICAL SECTIONS / ABBREVIATIONS

| | |
|---------------------------|------|
| SCALE: HOR. N/A VERT. N/A | DATE |
| W.A. YF1531 R.S. 331 | |
| SHEET 2 OF 13 | |

Basis of Bearings
Coordinate System Zone 6
California NAD 83