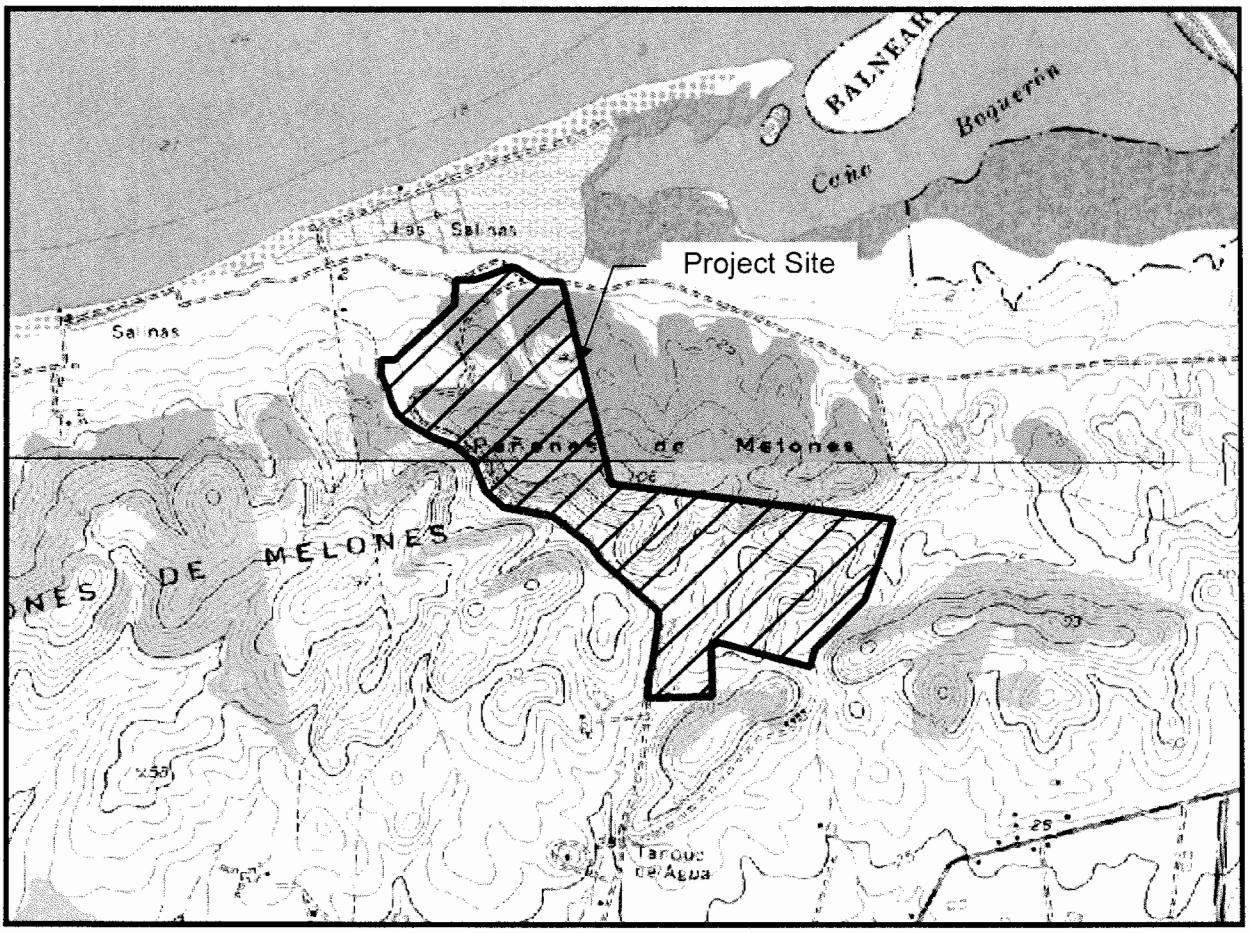
HYDROLOGIC-HYDRAULIC ANALYSIS
BAHÍA CAMPOMAR
CABO ROJO, PUERTO RICO



November 28, 2007

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BAHÍA CAMPOMAR
CABO ROJO, PUERTO RICO

1. INTRODUCTION

1.1 Project Description and Location

The Bahía Campomar development consists of approximately 163 acres, located south of Bahía de Boquerón and north of PR-312, in the municipality of Cabo Rojo. The proposed project will consist of hotel, golf course, recreational facilities, and residential area.

Figure 1 shows the location of the proposed development on the USGS topographic quadrangle. Figure 2 shows the project's master plan.

1.2 Scope and Purpose of Study

This document contains the results of the hydrologic and hydraulic study for the proposed project. This study establishes:

- Peak discharge produced by the site under pre-development and proposed conditions,
- Stormwater detention volume required to comply with Puerto Rico Planning Board Regulation #3, so that peak site runoff under post-development condition does not exceed existing condition peak discharge, and
- Hydraulic design parameters for three culvert crossings located along the project.

1.3 Report Limitations and Warnings

It shall be the responsibility of the site engineer or the project's geotechnical consultant to adapt the hydraulic design recommendations to the soil and other conditions at the site in any matters concerning slope stability, conflicts with other infrastructure, etc.

Site designer has the obligation to contact us if any questions arise concerning interpretation of recommendations given in this report.

1.4 Authorization

Arch. Miguel Calzada has authorized preparation of this report through a written agreement with Gregory Morris Engineering.

1.5 Personnel Involved in Project

Project Designer:	Arch. Miguel Calzada
Report Preparers:	Gregory L. Morris, P.E., Ph.D.
	José D. Miranda, P.E.
	Laisha Pomales

2. STUDY AREA DESCRIPTION

2.1 Topography and Water Bodies

Site topography consists of steep hills on the western portion of the property and a gently sloping valley on the eastern portion of the site (Figure 1). Elevations in the property range from 105 to 5 meters above sea level.

No perennial bodies of surface water or other well-defined channels were observed throughout the property. Offsite runoff enters the property from the hilltops located north. Figure 3 shows the topographic survey of the site.

2.2 Prior Studies

Figure 4 shows a portion of the FEMA FIRM map panels 1540H, 1545H, 1905H and 1910H dated April 19, 2005, where the project site is located. Flood levels at the project site have not been determined by FEMA.

2.3 Field Visit

The site was visited in March 2007. The following conditions were observed:

- Land conditions were observed to estimate hydraulic roughness coefficients. Grass cover was poor in most areas due to dryness. Trees and brush was observed throughout the site.
- No hydraulic structures were observed under the entrance road located on the southwestern corner of the property. Runoff that exits the property runs as surface flow south along the dirt road.
- A small gulley has formed along the western limit of the property due to the runoff generated by the hillside. This runoff flows northwest, out of the property, and into the "Salinas" area located north.

3. STUDY APPROACH AND METHODOLOGY

The hydraulic system for existing conditions was conceptualized as five on-site basins (representing the project site) draining to the downstream limit of the site, where the peak discharge generated was determined. For the post-development condition, land use was altered to account for the proposed site plan and change in hydrologic parameters.

Detention volume temporarily stores runoff and releases it more slowly through a hydraulic structure. Sizes of the required storage and hydraulic configuration of the outlet structure were determined by hydrologic and hydraulic modeling, comparing existing and proposed condition runoff hydrographs at the point of analysis.

A detention analysis requires the generation of storm hydrographs showing runoff variation over time. Runoff hydrographs in this analysis were generated using the Soil Conservation Service unit hydrograph methodology as implemented in the ICPR model.

The ICPR unsteady flow hydrologic-hydraulic modeling system (Streamline Technologies v3.0, Winter Park, Florida) dynamically routes stormwater through open channels, closed conduits and detention ponds. The program's solution algorithm allows it to simulate a variety of complex conveyance systems. Each node in ICPR represents a control volume. Change in storage for each node is calculated based on the difference between inflows and outflows at each time step during the simulation period. The change in storage is used to determine elevations at each node at the end of each time step. Flow through each link is calculated from the known elevations at each end of the link and the hydraulic properties of the link. The detention analysis was performed for 2- and 100- year events.

4. HYDROLOGIC ANALYSIS

4.1 Watershed Delimitation

The watershed limits shown in Figure 5 were established using detailed topography of the site and USGS topographic mapping. The watersheds cover the Bahia Campomar project site plus the offsite areas that drain into the property. Each of the five studied watersheds exits the site at different points along the property perimeter.

- Basin NW drains north into the "Salinas" area located adjacent to the ocean.
- Basin SW drains southwest into a gulley that has formed along the southern limit of the property due to erosion. Flow from this gulley runs northwest into the "Salinas" area located north of the site.
- Basin MID drains south towards the property's entrance dirt road. There are no hydraulic structures to convey flow from the property under the entrance road. Runoff reaches the road and flows superficially south.
- Basin NE and Basin SE both drain northeast and exit the site at the northeastern corner of the property.

Under proposed conditions each basin will drain into a separate detention pond before exiting the site.

Table 1: Drainage Area for Project Site.

Watershed	Offsite Area (acres)	Total Area (acres)
Basin NW	5	59
Basin SW	2	36
Basin MID	11	49
Basin NE	6	21
Basin SE	7	28

4.2 Rainfall Depths

A hyetograph was constructed using the 100-year rainfall depths as reported in National Oceanic and Atmospheric Administration (NOAA) Atlas 14 published October 26, 2006. This publication updates and replaces similar data contained in TP-42. The rainfall depths used to construct the hyetograph are shown in Table 2. Appendix A shows NOAA-14 rainfall data used in this analysis.

Table 2: 100-year Rainfall Depths, NOAA Atlas 14.

Duration (hrs)	Rainfall Depths	
	inches	mm
0.5	2.49	63
1	3.69	94
2	5.16	131
3	5.89	150
6	7.76	197
12	10.87	276
24	14.57	370

4.3 Soil Types and Curve Number

Curve number represents the runoff potential within a watershed and is estimated based on soil type (hydrologic soil group), land use and Antecedent Moisture Condition (AMC). In this study AMC-II was used. The soil types within the each sub-basin were obtained from Soil Survey Geographic data base (SSURGO), which contains the most detailed level of soil mapping performed by the Natural Resources Conservation Service (NRCS). Figure 6 shows the hydrologic soil groups within the analyzed watersheds.

Table 3 shows the proposed land use for each of the analyzed watersheds, calculated from the master plan shown in Figure 2. Impervious area at each basin, under post-development conditions, range from 14% to 21%. Table 4 shows weighted curve number for existing and post-development conditions. Curve Number computations are presented in Appendix B.

Table 3: Proposed Land Use for Analyzed Watersheds

Watershed	Paved area	Green area	Offsite area
Basin NW	9 acres, (16%)	45 acres, (76%)	5 acres, (8%)
Basin SW	7 acres, (21%)	27 acres, (74%)	2 acres, (5%)
Basin MID	8 acres, (15%)	30 acres, (63%)	11 acres, (22%)
Basin NE	3 acres, (14%)	12 acres, (57%)	6 acres, (29%)
Basin SE	4 acres, (14%)	17 acres, (60%)	7 acres, (26%)

Table 4: Weighted Curve Number for Existing and Post-development Conditions.

Watershed	Existing	Post-development
Basin NW	63	72
Basin SW	62	72
Basin MID	67	69
Basin NE	70	75
Basin SE	70	74

4.4 Time of Concentration

The time of concentration is the time required for a drop of water falling on the most distant point of the watershed to influence discharge at the watershed exit. The time of concentration was calculated using Soil Conservation method (TR-55). For sheet flow calculation the following equation was used:

$$t_c = \frac{0.007 * (n * L)^{0.8}}{P_2^{0.5} * S^{0.4}}$$

where:

t_c = time of concentration (minutes)

n = Manning's roughness coefficient

L = flow length (ft)

P_2 = 2-year, 24-hour rainfall, 4.58 in

S = slope of hydraulic grade line (land slope, ft/ft)

For shallow concentrated flow calculation the following equation was used:

$$t_c = \frac{L}{3600 * V}$$

where:

t_c = time of concentration (hrs)

L = flow length (ft)

V = average velocity of flow (ft/s)

3600 = conversion factor from seconds to hours

The time of concentration was estimated using flow lengths along the natural water-paths shown in site topography (Figure 3). Under post-development conditions these water-paths will remain unaltered, plus the grass cover on the project site will be improved by landscaping with irrigation. For this reason, the time of concentration was not modified for post-development conditions. Table 5 shows the time of concentration calculations for the analyzed watersheds. Time of Concentration computations are presented in Appendix C.

Table 5: Time of Concentration for Analyzed Watersheds.

Watershed	Time of Concentration (minutes)
Basin NW	16
Basin SW	29
Basin MID	16
Basin NE	16
Basin SE	14

4.5 Results of Hydrologic Analysis

The peak discharges in this analysis were computed by the Natural Resources Conservation Service's unit hydrograph methodology with a peaking factor of 484. Table 6 shows the project site peak discharge under existing and post-development conditions, without detention storage.

Table 6: Peak Discharges under Existing and Post-development Conditions (without detention).

Condition/ Watershed	Peak Discharge (ft^3/s)	
	2-year	100-year
EXISTING		
Basin NW	29	226
Basin SW	14	118
Basin MID	30	200
Basin NE	15	89
Basin SE	20	119
POST-DEVELOPMENT (without detention)		
Basin NW	46	255
Basin SW	24	137
Basin MID	33	205
Basin NE	18	94
Basin SE	23	123

4.6 Verification of Hydrology

Peak discharges obtained from ICPR computer model were verified using the Rational Method. The Rational Method equation has the following form:

$$Q = CiA$$

where:

Q = peak discharge (ft^3/s)

C = runoff coefficient

i = rainfall intensity (in/hr)

A = drainage area (acres)

The Rational Method is valid for drainage areas smaller than 150 acres. The value of rainfall intensity was obtained from "Precipitation-Frequency Atlas of United States" NOAA Atlas 14. The runoff coefficient parameter was obtained from "Normas de Diseño para Sistemas de Alcantarillado Pluvial" (Puerto Rico Planning Board, 1975).

Table 7 shows the parameters used for hydrology verification with the Rational Method, and compares peak discharges obtained with the Rational Method and ICPR modeling. The peak discharges obtained with the UH methodology were considered reasonable. Appendix C shows the parameters used in the Rational Method.

Table 7: Verification of 100-year Peak Discharge.

Condition/Watershed	C	i (in/hr)	Rational Method Q (ft^3/s)	ICPR Q (ft^3/s)
EXISTING				
Basin NW	0.65	6.1	233	226
Basin SW	0.65	5.0	117	118
Basin MID	0.65	6.0	171	200
Basin NE	0.65	7.0	95	89
Basin SE	0.65	6.5	118	119
POST-DEVELOPMENT				
Basin NW	0.75	6.1	270	255
Basin SW	0.75	5.0	135	137
Basin MID	0.75	6.0	198	205
Basin NE	0.75	7.0	110	94
Basin SE	0.75	6.5	136	123

5. DETENTION ANALYSIS

5.1 Model Prepared

Two ICPR models were prepared to study the effects of the proposed development on peak discharges generated by the project site:

1. Existing Condition Model. This model consists of five basins (representing the project site), where the peak discharges generated by each sub-basin were determined. A schematic layout of the link-node configuration for this model is shown in Figure 7. Input data and results of the Existing Condition Model are presented in Appendix D.

2. Proposed Condition Model. This model consists of five basins, each draining into their respective detention structures. A schematic layout of the link-node configuration for this model is shown in Figure 8. Input data and results of the Proposed Condition Model are presented in Appendix E.

5.2 Detention Analysis Results

The peak discharge generated at the downstream limit of each analyzed watershed was determined under existing and proposed conditions (with detention storage), as presented in Table 8.

Table 8: Peak Discharges under Existing and Proposed Conditions (with detention).

Condition/Watershed	Peak Discharge (ft^3/s)	
	2-year	100-year
EXISTING		
Basin NW	28	226
Basin SW	13	118
Basin MID	30	200
Basin NE	15	91
Basin SE	20	119
PROPOSED (with detention)		
Basin NW	28	198
Basin SW	13	86
Basin MID	30	190
Basin NE	15	76
Basin SE	19	108

5.3 Detention Structure Design Parameters

A total of five detention ponds located throughout the proposed project to will ensure post-development discharge does not exceed existing condition discharge. The ponds will be excavated in earth and will be incorporated into the golf courses landscape. All ponds have been designed with a 2:1 (H:V) side slopes, but a shallower side slope may be used if desired. Figure 9 shows the detention pond locations. Ponds are shown rectangles, but may be constructed in any shape as long as the top and bottom areas are at least as large as shown. Depth refers to 100-year maximum depth of water over dry bottom (or over normal water level in the case of a normally wet pond).

"Pond NW" will receive runoff from Basin NW (see Figure 5). Figure 10 shows a schematic drawing of "Pond NW", which will discharge north into the "Salinas" area. Table 9 shows the design parameters for "Pond NW".

Table 9: Proposed Detention Pond Parameters for "Pond NW".

Parameter	Value
POND	
Depth	2 meters
Top Area	4,213 m^2
Bottom Area	3,098 m^2
Top Elevation	7 m-msl
Bottom Elevation	5 m-msl
Maximum 100-year Water Level	7 m-msl
OUTLET STRUCTURE	
Orifice Invert Elevation	5.0 m-msl
Orifice Diameter	42 inches
Standpipe Invert Elevation	6.2 m-msl
Standpipe Diameter	54 inches
OUTLET PIPE	
Diameter	54 inches
Upstream Invert Elevation	3.6 m-msl
Downstream Invert Elevation	3.1 m-msl
Length	115 meters
Material	Concrete

Table 10 shows the parameters for detention pond "Pond SW", which will receive runoff from "Basin SW" (see Figure 5). Figure 11 shows the schematic drawing for detention pond called "Pond SW", which will discharge into the "Salinas".

Table 10: Proposed Detention Pond Parameters for "Pond SW"

Parameter	Value
DETENTION POND	
Depth	2 meters
Top Area	2,990 m^2
Bottom Area	1,908 m^2
Top Elevation	15 m-msl
Bottom Elevation	13 m-msl
Maximum 100-year Water Level	15 m-msl
OUTLET STRUCTURE	
Orifice Invert Elevation	13.0 m-msl
Orifice Diameter	21 inches
Standpipe Invert Elevation	13.7 m-msl
Standpipe Diameter	42 inches
OUTLET PIPE	
Diameter	48 inches
Upstream Invert Elevation	11.7 m-msl
Downstream Invert Elevation	11.4 m-msl
Length	375 meters
Material	Concrete

Table 11 shows the parameters for detention pond "Pond MID". This pond will receive runoff from "Basin MID" (see Figure 5), and will discharge south into a shallow swale that will flow towards the entrance road. A schematic drawing of detention pond "Pond MID" is shown in Figure 12.

Table 11: Proposed Detention Pond Parameters for "Pond MID"

Parameter	Value
POND	
Depth	2 meters
Top Area	1,391 m^2
Bottom Area	744 m^2
Top Elevation	42 m-msl
Bottom Elevation	40 m-msl
Maximum 100-year Water Level	41.9 m-msl
OUTLET STRUCTURE	
Orifice Invert Elevation	40.0 m-msl
Orifice Diameter	40 inches
Standpipe Invert Elevation	41.1 m-msl
Standpipe Diameter	54 inches
OUTLET PIPE	
Diameter	54 inches
Upstream Invert Elevation	38.5 m-msl
Downstream Invert Elevation	38.4 m-msl
Length	5 meters
Material	Concrete
DISCHARGE SWALE	
Depth of flow	0.6 meters
Top Width	8.3 meters
Bottom Width	3.5 meters
Swale Slope	0.02
Side Slopes (H:V)	4:1
100-yr Pond Discharge	5.4 m^3/s
Velocity of flow	1.6 m/s

Table 12 shows the parameters for proposed detention pond "Pond NE", which will receive runoff from "Basin NE" (Figure 5). Figure 13 shows the schematic drawing for detention pond called "Pond NE", which discharge into a shallow swale that will flow east towards the municipal road.

Table 12: Proposed Detention Pond Parameters for "Pond NE"

Parameter	Value
DETENTION POND	
Depth	2 meters
Top Area	1,280 m^2
Bottom Area	669 m^2
Top Elevation	22 m-msl
Bottom Elevation	20 m-msl
Maximum 100-year Water Level	21.85 m-msl
OUTLET STRUCTURE	
Orifice Invert Elevation	20.0 m-msl
Orifice Diameter	24.0 inches
Standpipe Invert Elevation	20.85 m-msl
Standpipe Diameter	33 inches
OUTLET PIPE	
Diameter	36 inches
Upstream Invert Elevation	18.9 m-msl
Downstream Invert Elevation	18.7 m-msl
Length	5 meters
Material	Concrete
DISCHARGE SWALE	
Depth of flow	0.6 meters
Top Width	5.8 meters
Bottom Width	1.0 meters
Swale Slope	0.02
Side Slopes (H:V)	4:1
100-yr Pond Discharge	2.2 m^3/s
Velocity of flow	1.4 m/s

Table 13 shows the parameters for proposed detention pond "Pond SE", which will receive runoff from "Basin SE". Figure 14 shows the schematic drawing for detention pond called "Pond SE", which discharge into a shallow swale that will flow east towards the municipal road.

Table 13: Proposed Detention Pond Parameters for "Pond SE"

Parameter	Value
DETENTION POND	
Depth	2 meters
Top Area	1,136 m^2
Bottom Area	558 m^2
Top Elevation	24 m-msl
Bottom Elevation	22 m-msl
Maximum 100-year Water Level	24 m-msl
OUTLET STRUCTURE	
Orifice Invert Elevation	22.0 m-msl
Orifice Diameter	24 inches
Standpipe Invert Elevation	22.9 m-msl
Standpipe Diameter	42 inches
OUTLET PIPE	
Diameter	42 inches
Upstream Invert Elevation	20.8 m-msl
Downstream Invert Elevation	20.5 m-msl
Length	5 meters
Material	Concrete
DISCHARGE SWALE	
Depth of flow	0.6 meters
Top Width	6.6 meters
Bottom Width	1.8 meters
Swale Slope	0.02
Side Slopes (H:V)	4:1
100-yr Pond Discharge	3.1 m^3/s
Velocity of flow	1.5 m/s

6. HYDRAULIC ANALYSIS FOR CULVERT CROSSINGS

Figure 15 shows the location of three culvert crossings proposed for the project. Culvert 1 and Culvert 2 will receive runoff from both offsite and onsite areas upstream of proposed detention pond "Pond MID". Culvert 3 will be located downstream of Pond MID's discharge swale. Table 14 presents the hydrologic parameters for the watersheds tributary to Culvert 1 and Culvert 2, and Figure 16 shows the watershed limits. Culvert 3 was designed for the 100-year discharge at the outlet of "Pond MID" (5.4 m^3/s, 190 ft^3/s). Curve Number and time of concentration calculations are included in Appendix B and Appendix C, respectively. Table 14 presents 100-year peak discharge at Culvert 1 and Culvert 2.

Table 14: Culvert 1 and Culvert 2 Hydrologic Parameters and 100-yr Peak Discharge of Analyzed Culvert

Watershed	Area (acres)	CN	TC (min)	Peak Discharge (ft^3/s)
Culvert 1	8	73	8	36
Culvert 2	4	73	9	53

Culvert sizing was performed using Haestad Methods CulvertMaster program. The analysis was performed for the 100-year event. Table 15 shows the design parameters for each proposed culvert. Input data and results of CulvertMaster program are presented in Appendix F.

Table 15: Hydraulic Design Parameters

Parameter	Culvert 1	Culvert 2	Culvert 3 Alternative 1	Culvert 3 Alternative 2
100-year discharge (ft^3/s)	36	53	190	190
Shape	Circular	Circular	Circular	Rectangular
Quantity	1	1	2	1
Dimensions	36 inch	42 inch	48 inch	7ft W x 4ft H
Length (ft)	20	20	29.6	29.6
Minimum Slope	0.02	0.02	0.02	0.02
Headwater Depth (m)[a/]	1.2	1.4	1.6	1.5
Material	Concrete	Concrete	Concrete	Concrete

[a/] Depth above upstream pipe invert.

7. SUMMARY, CONCLUSIONS AND RECOMENDATIONS

1. The detention structures have been sized for this project so that the existing condition peak discharges for the 2-, and 100-year events are not exceeded under post-development conditions.

2. "Pond NW" will receive runoff from Basin NW, "Pond SW" will receive runoff from Basin SW, "Pond MID" will receive runoffs from Basin MID, "Pond NE" will receive runoff from Basin NE, and "Pond SE" will receive runoffs from Basin SE (as seen in Figure 5).

3. All ponds located in the project site have been designed with 2:1 (H:V) side slopes, but a shallower side slope may be used if desired. Ponds are shown rectangles, but may be constructed in any shape as long as the top and bottom areas are at least as large as shown. Depth refers to 100-year maximum depth of water over dry bottom (or over normal water level in the case of a normally wet pond).

4. Detention ponds should be excavated rather than created using dikes or berms. Absent dikes or berms there is no free board requierement.

5. The detention pond outlet structure must be inspected periodically to avoid obstruction with debris. The pond should also be maintained periodically to remove accumulated sediment.

6. Detention pond should be constructed at the start of earth movement activities so it can serve as a sediment trap during construction.

8. CERTIFICATION

I hereby certify that the document "Hydrologic and Hydraulic, Bahía Campomar, Cabo Rojo, Puerto Rico" has been prepared in accordance with the best hydrologic and hydraulic practices as described in this document and that, based on the studies and field measurements provided by other parties, results are true and correct.

Certified today November 28, 2007

José D. Miranda, P.E.

9. REFERENCES

NOAA. 2006. "Precipitation-Frequency Atlas of the United States." National Oceanic and Atmospheric Administration Atlas 14, Washington DC.

Puerto Rico Planning Board, 1975. "Normas de Diseño para Sistemas de Alcantarillado Pluvial". San Juan PR.

Singhofen P.J., and L.M. Eaglin. 1995. "ICPR Advanced: User's Manual". Streamline Technologies Inc., Winter Park, FL

US Department of Agriculture, Soil Conservation Service. 1986. "Technical Release 55 (Urban Hydrology for Small Watersheds)". Washington DC.

Figures

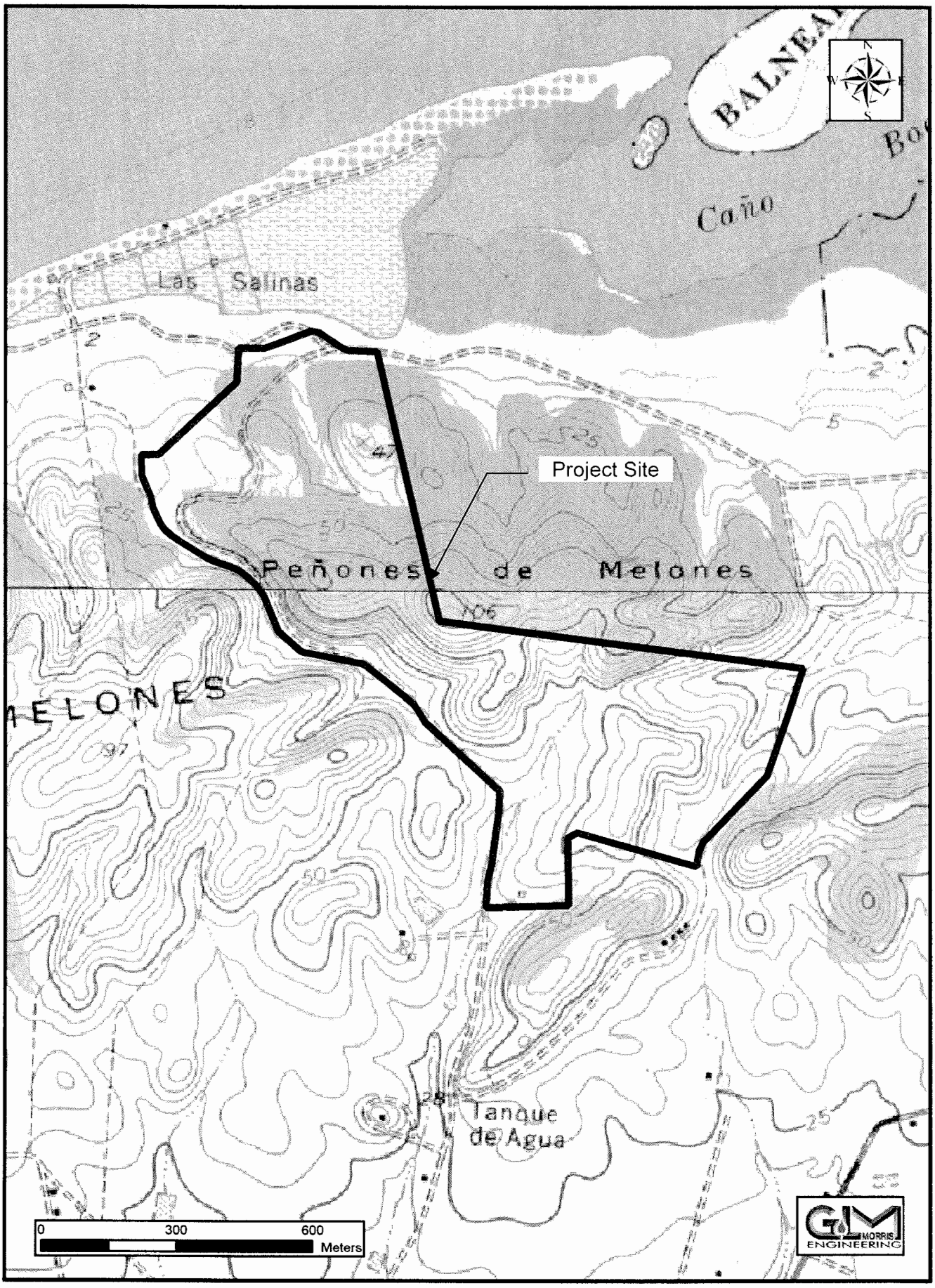


Figure 1: Location map (scale 1;12,000)

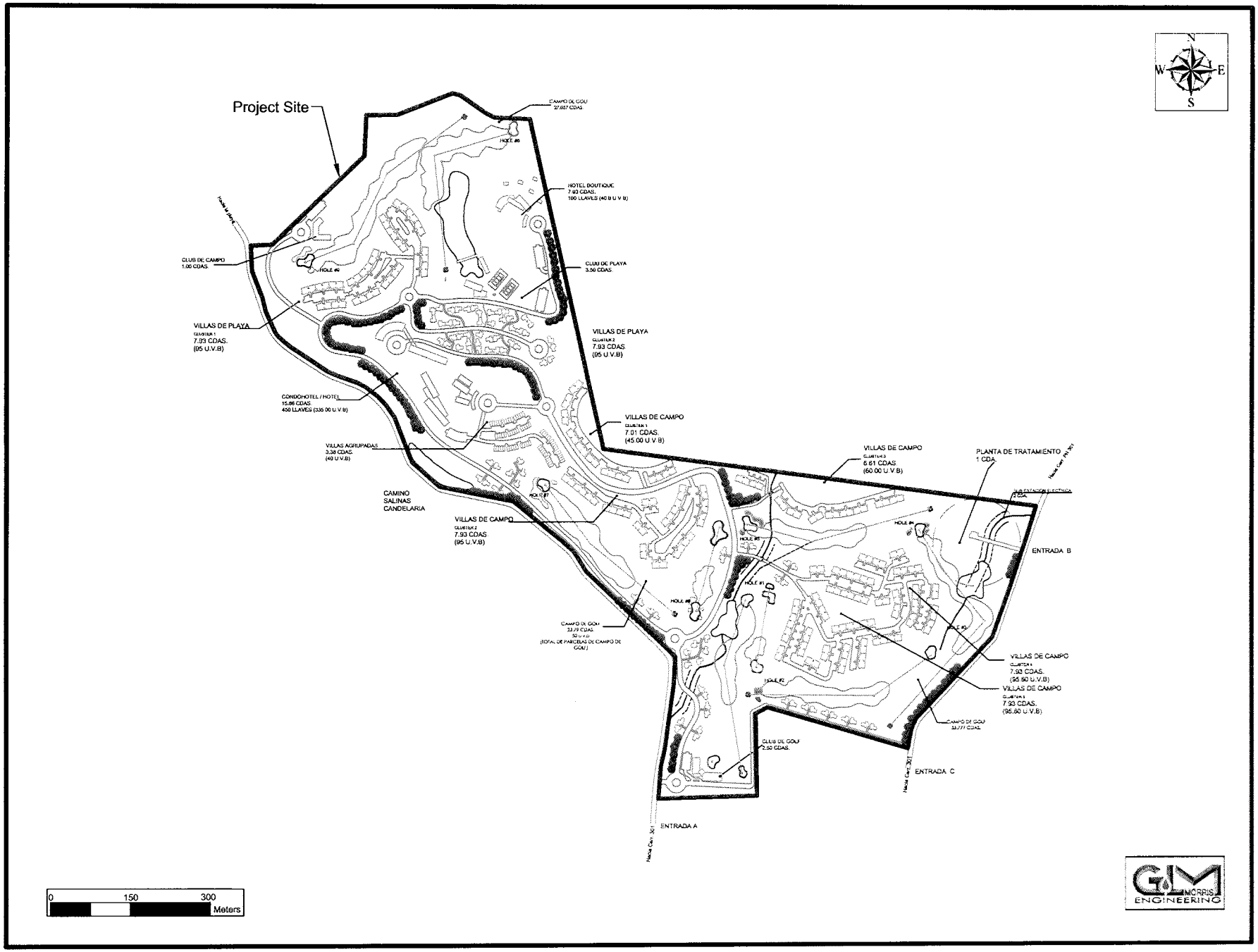


Figure 2: Master plan layout (scale 1:10,000)

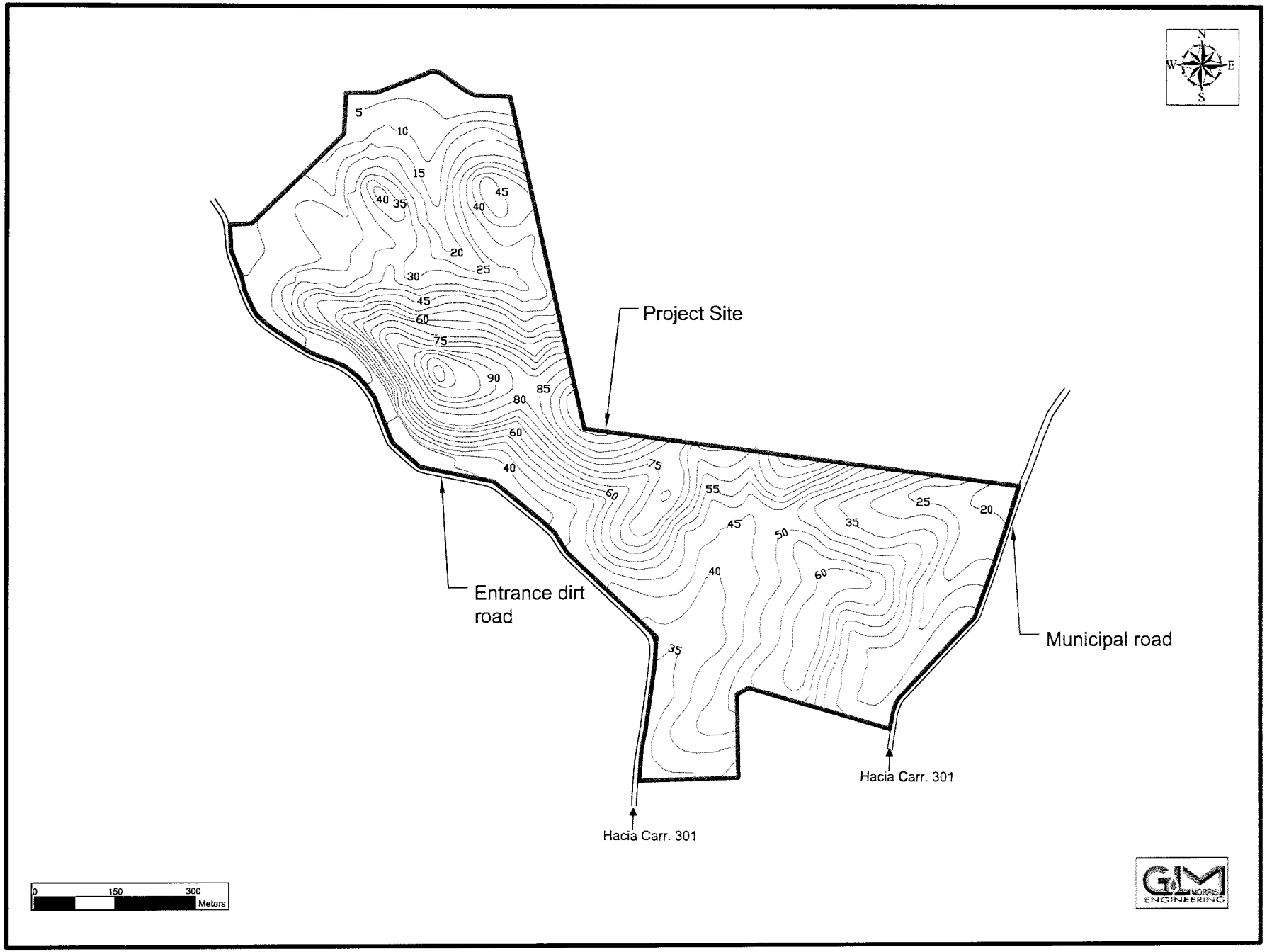


Figure 3: Topographic features of the site (scale 1:10,000)

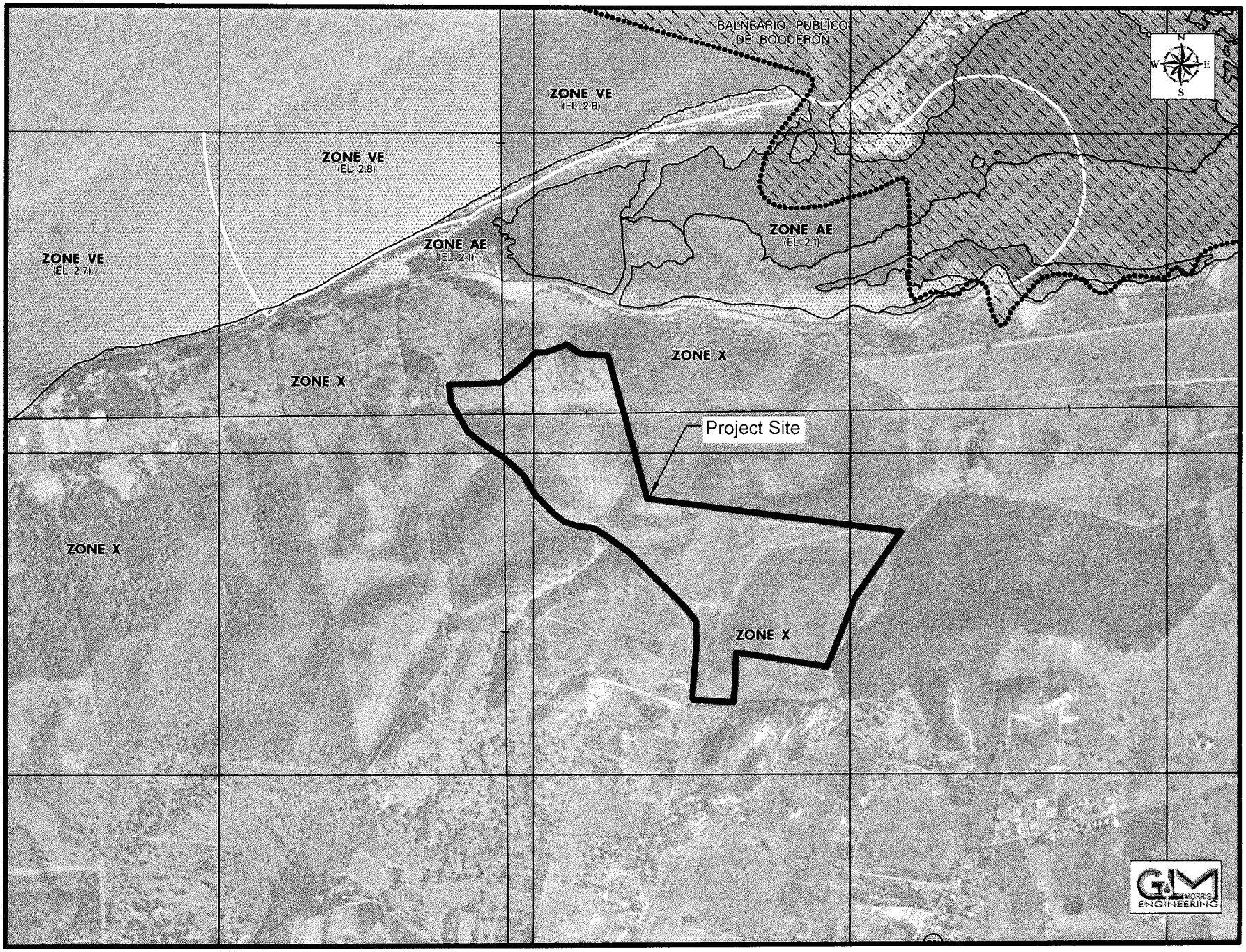


Figure 4: FEMA FIRM map, panels 1540H, 1545H, 1905H and 1910H, April 19, 2005 (Not to scale)

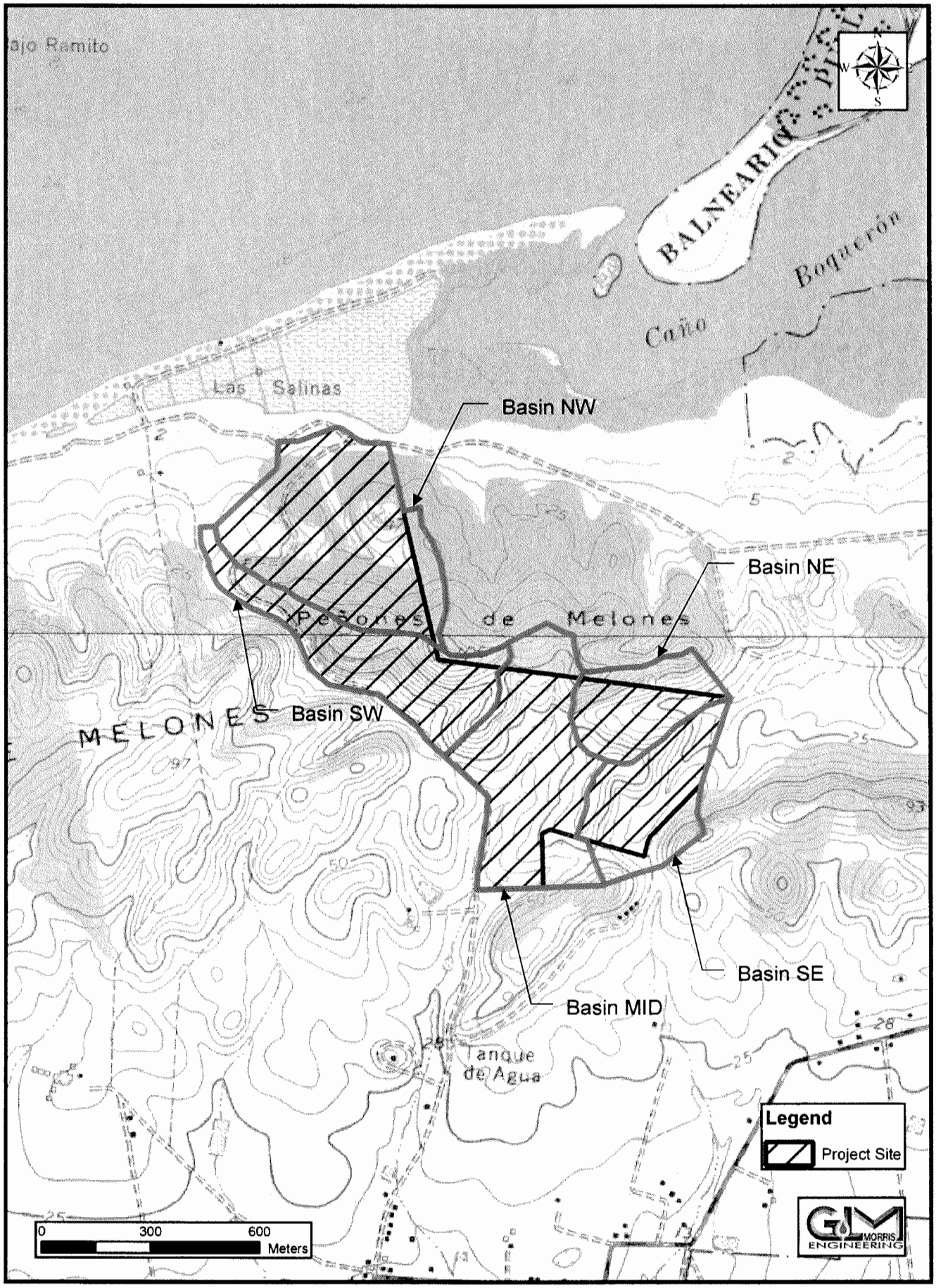


Figure 5: Watersheds limits for Analyzed Basins (scale 1:15,000)

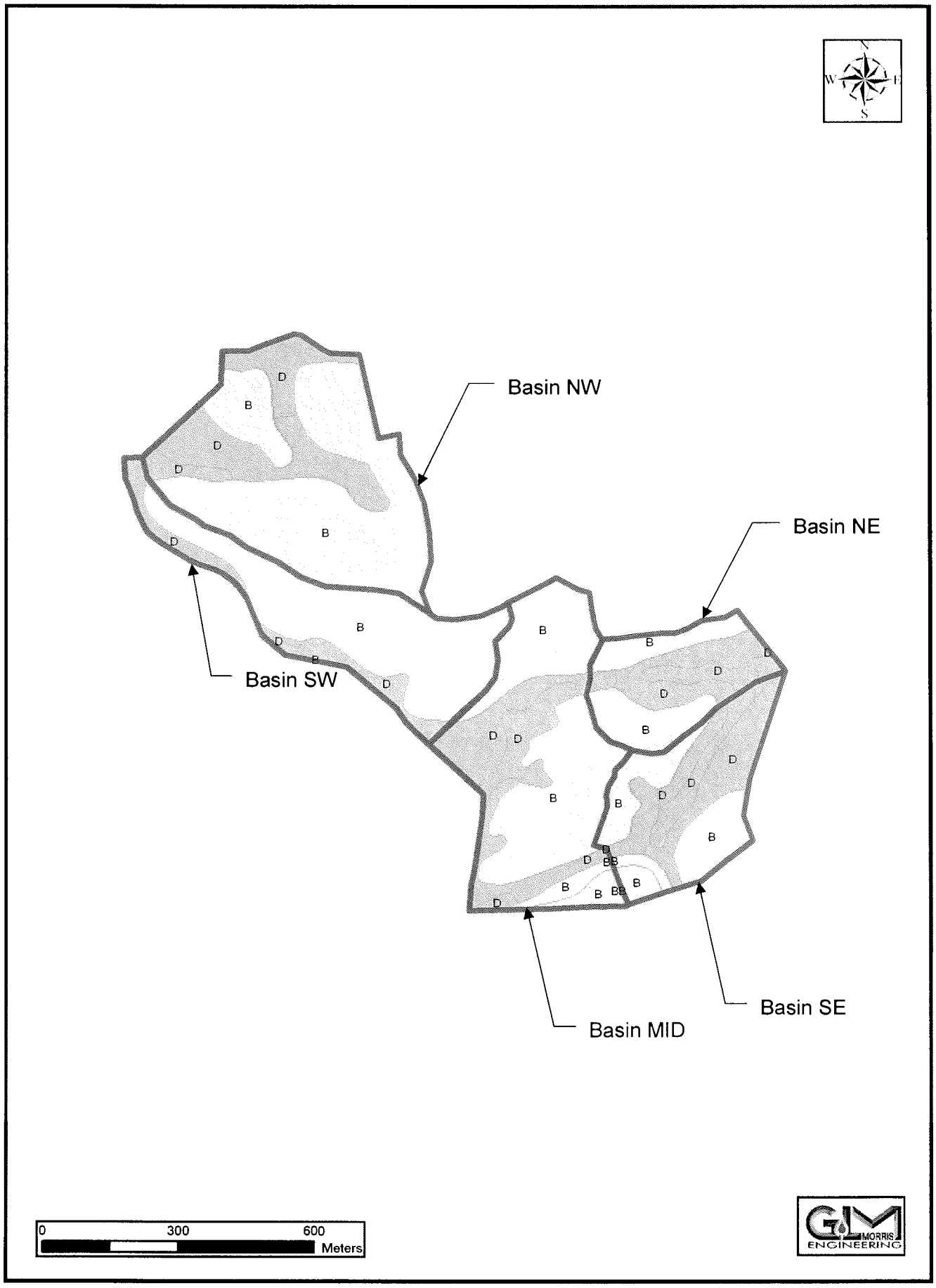
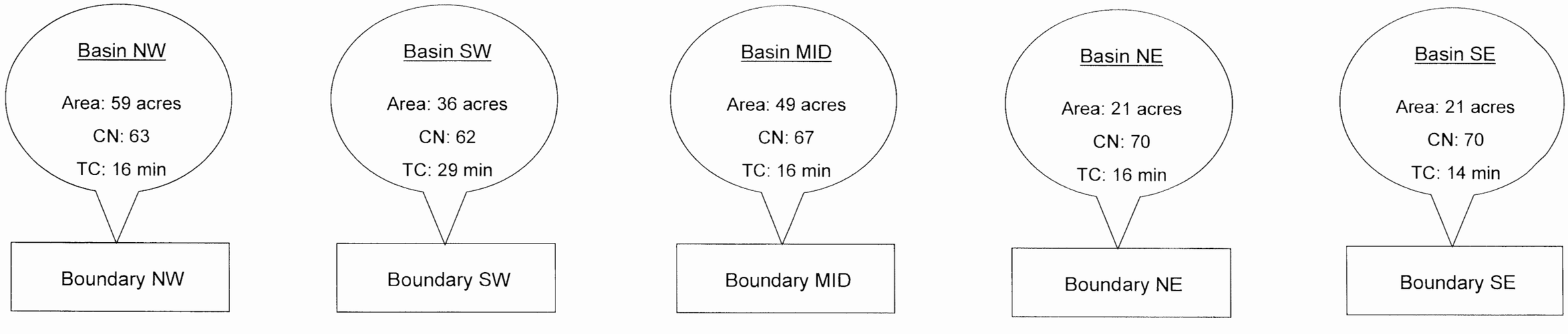


Figure 6: Hydrologic soil group found in the analyzed watersheds (scale 1:12,000)

Detention Analysis



Culvert Analysis

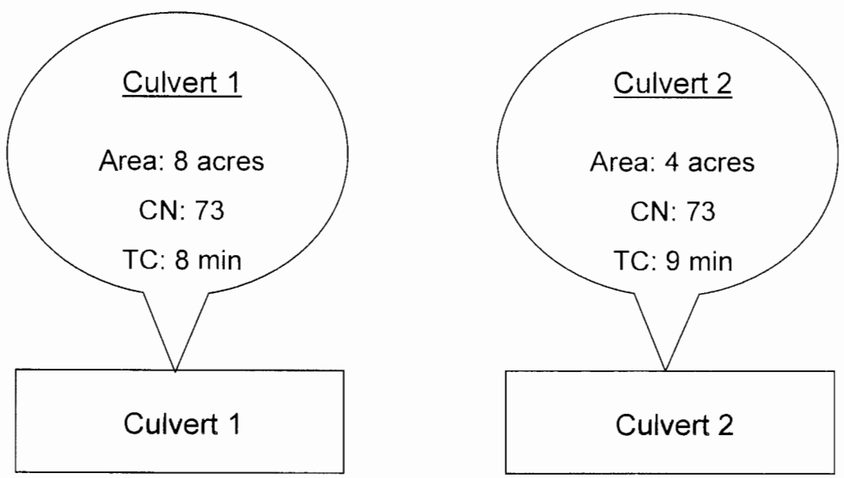


Figure 7: Existing condition model node/link diagram

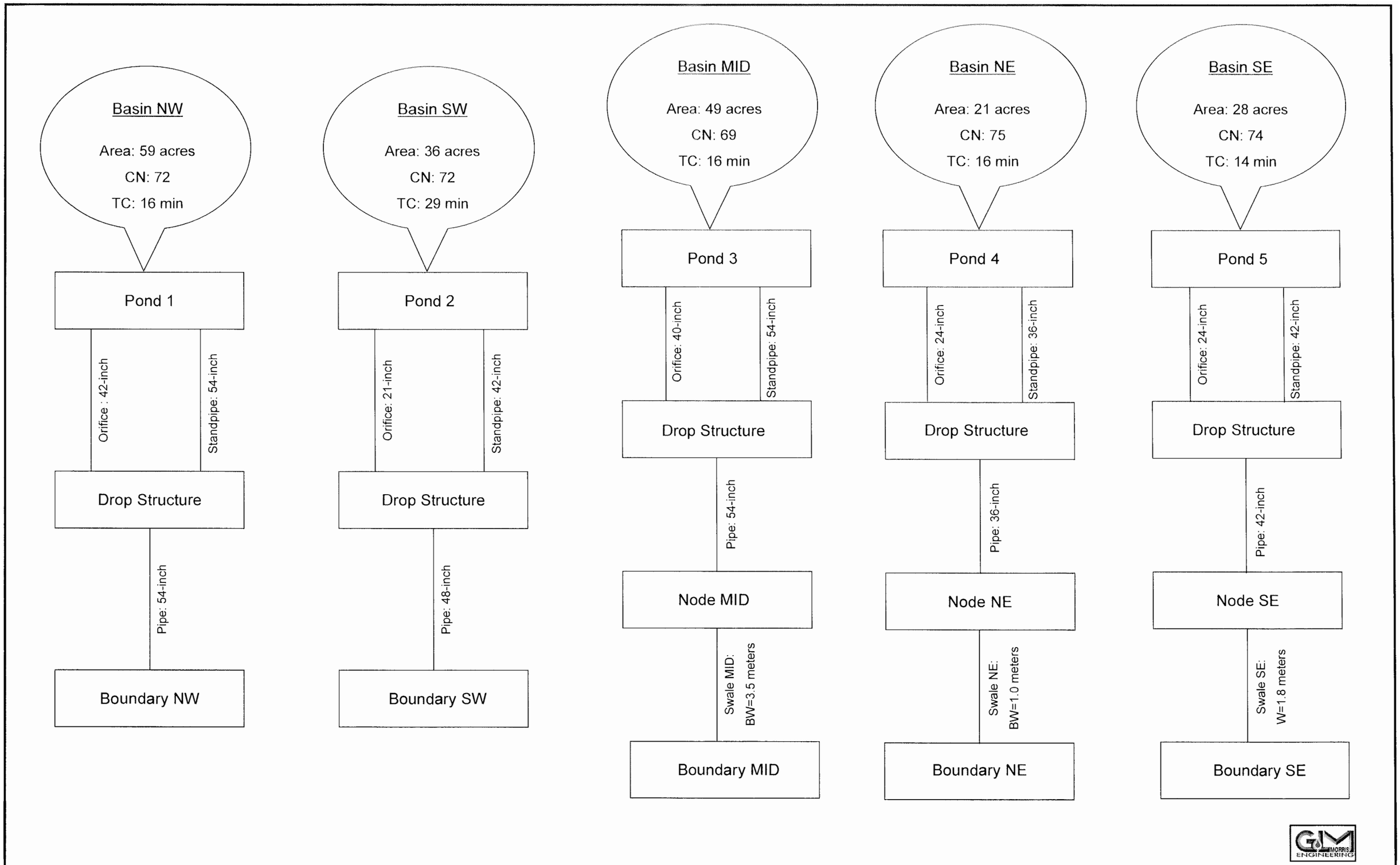


Figure 8: Proposed condition model node/link diagram

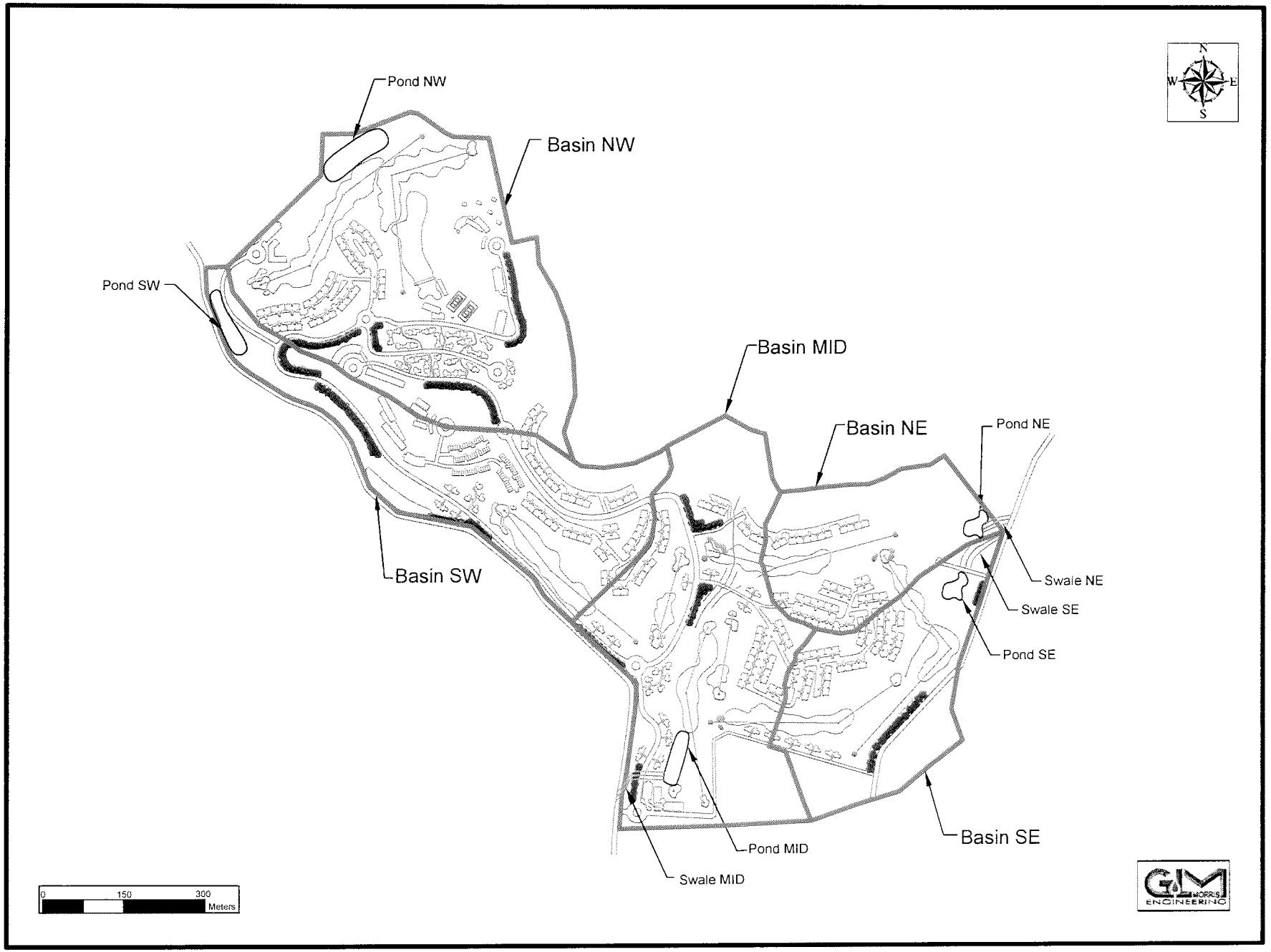


Figure 9: Detention structures location (scale 1:10,000)

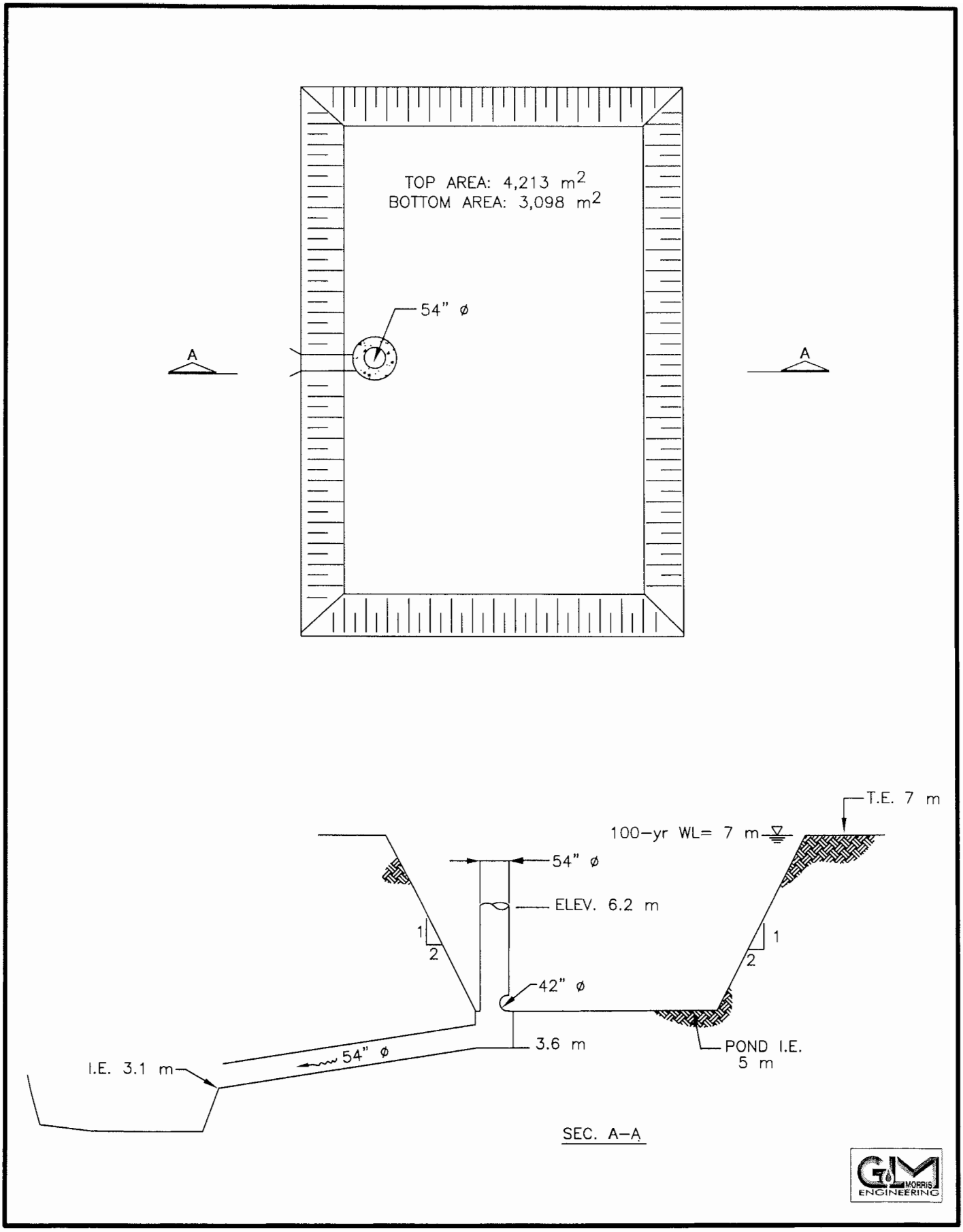


Figure 10: Schematic drawing of proposed detention pond and outlet structure for "Pond NW"

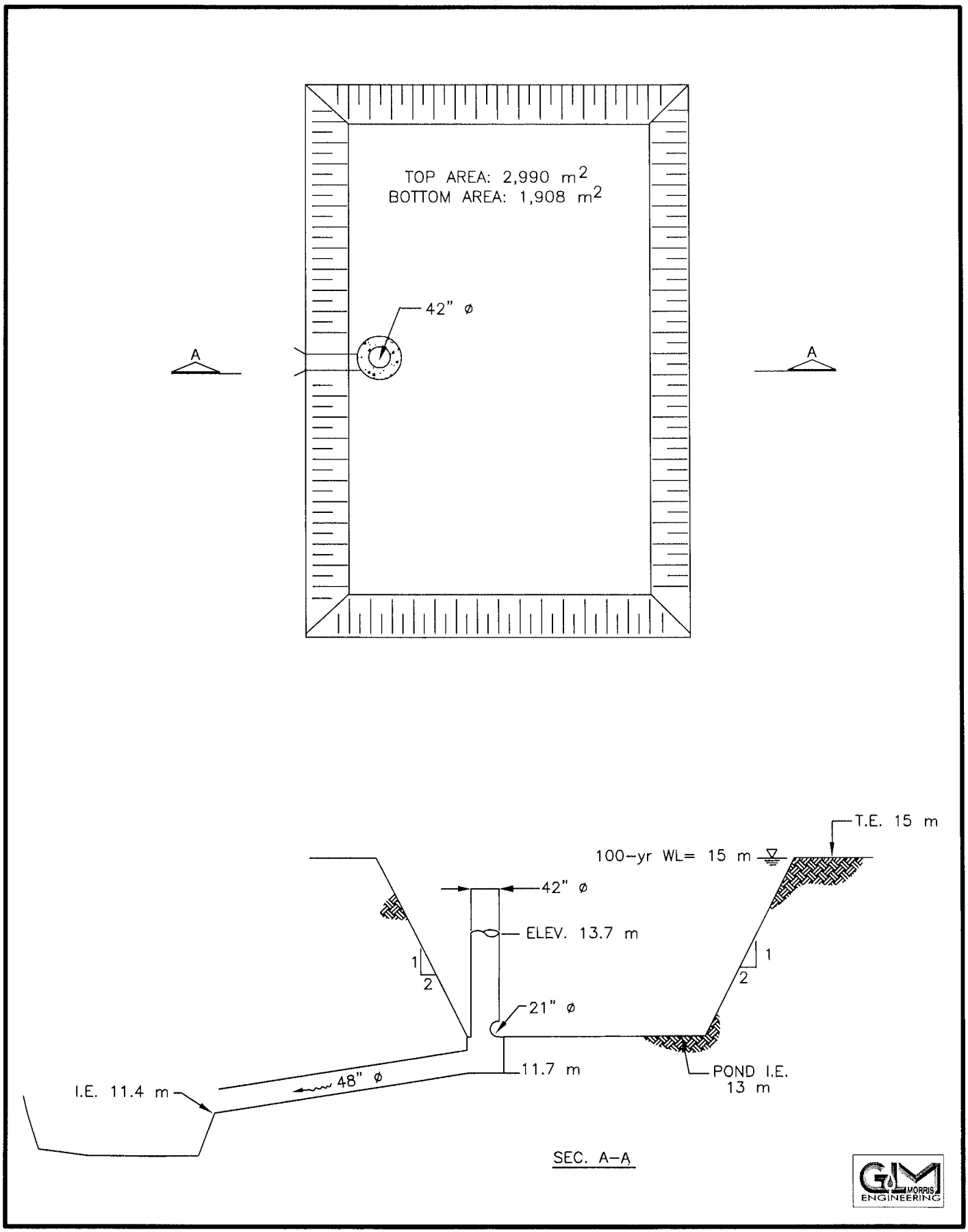


Figure 11: Schematic drawing of proposed detention pond and outlet structure for "Pond SW"

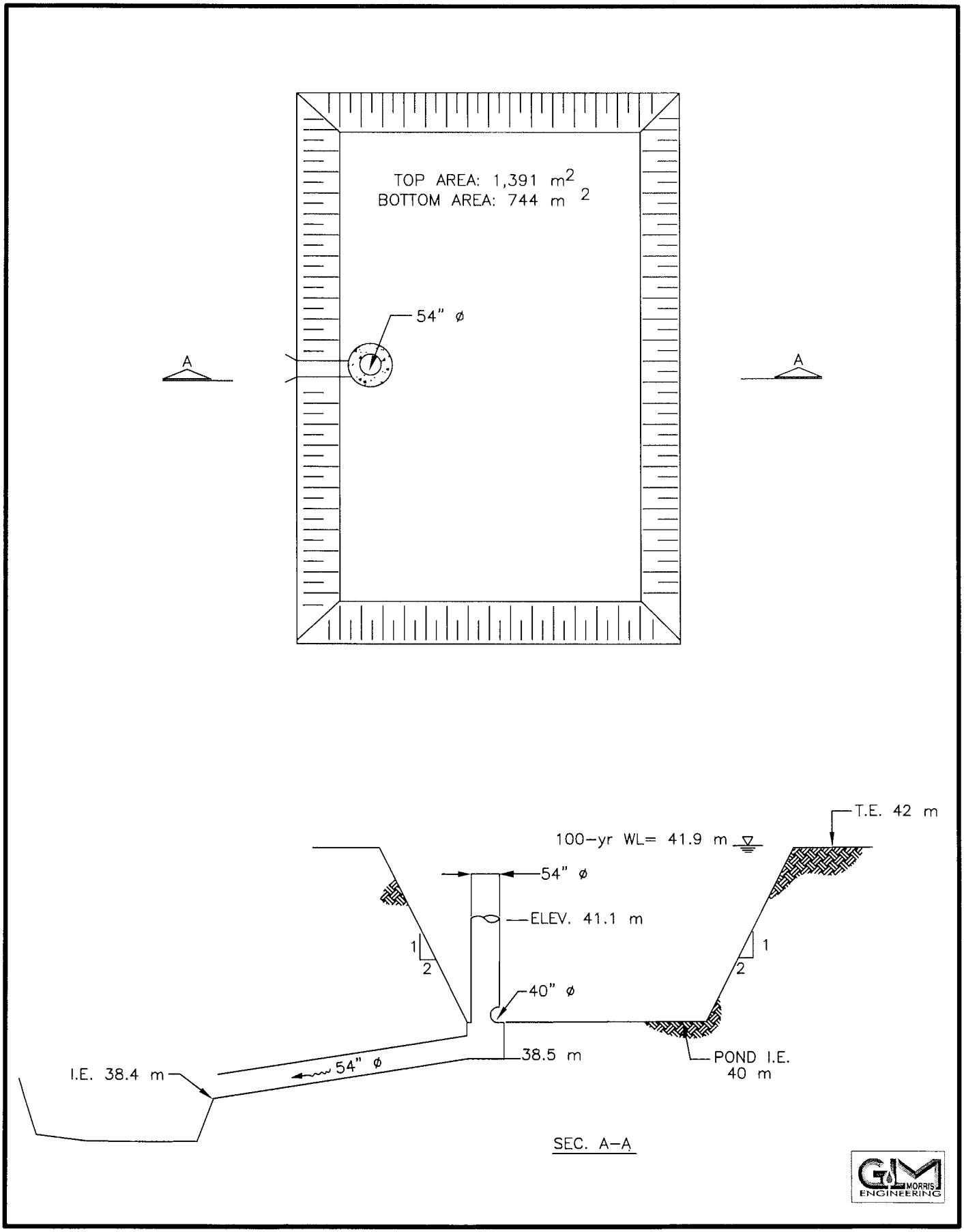


Figure 12: Schematic drawing of proposed detention pond and outlet structure for "Pond MID"

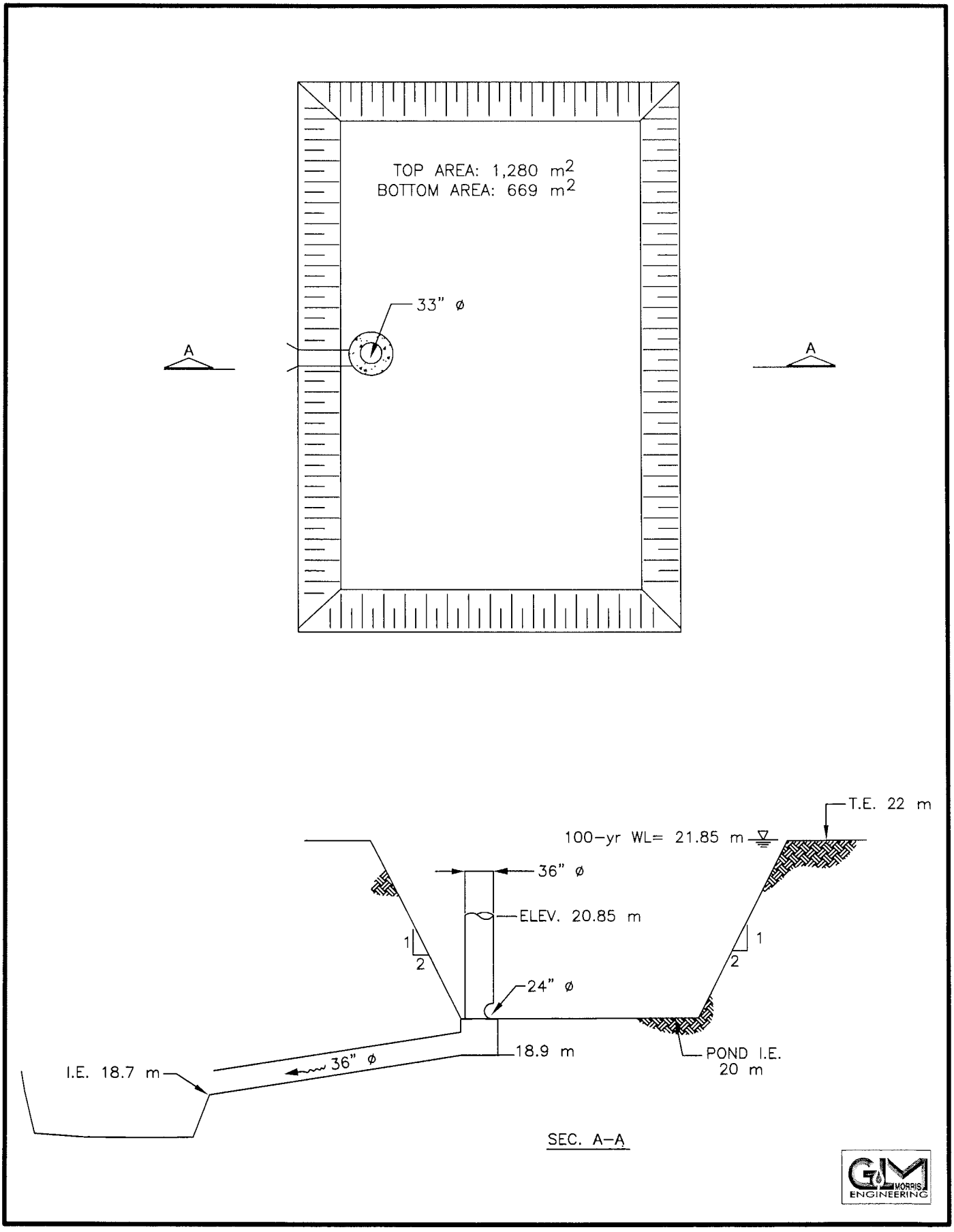


Figure 13: Schematic drawing of proposed detention pond and outlet structur for "Pond NE"

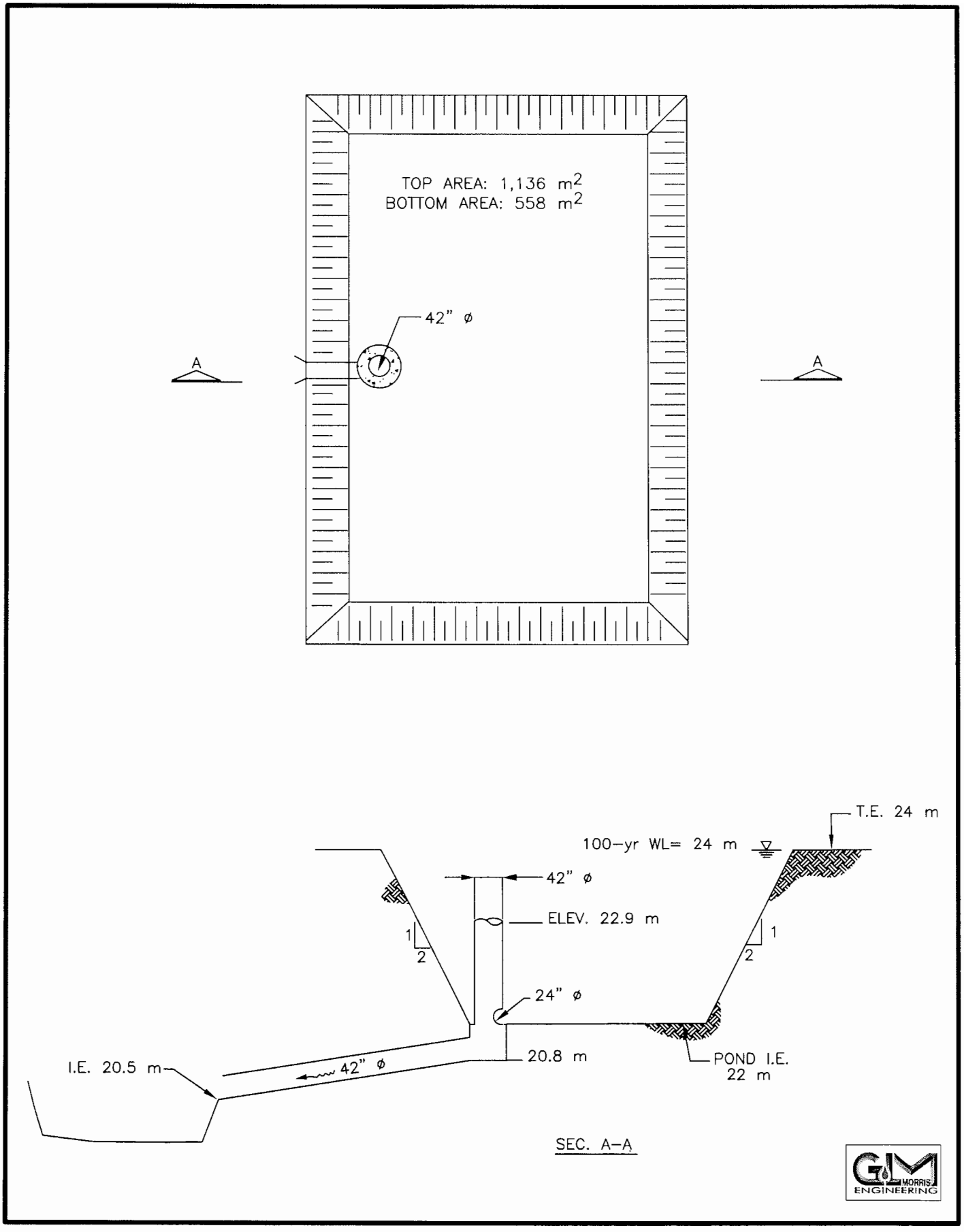


Figure 14: Schematic drawing of proposed detention pond and outlet structure for "Pond SE"

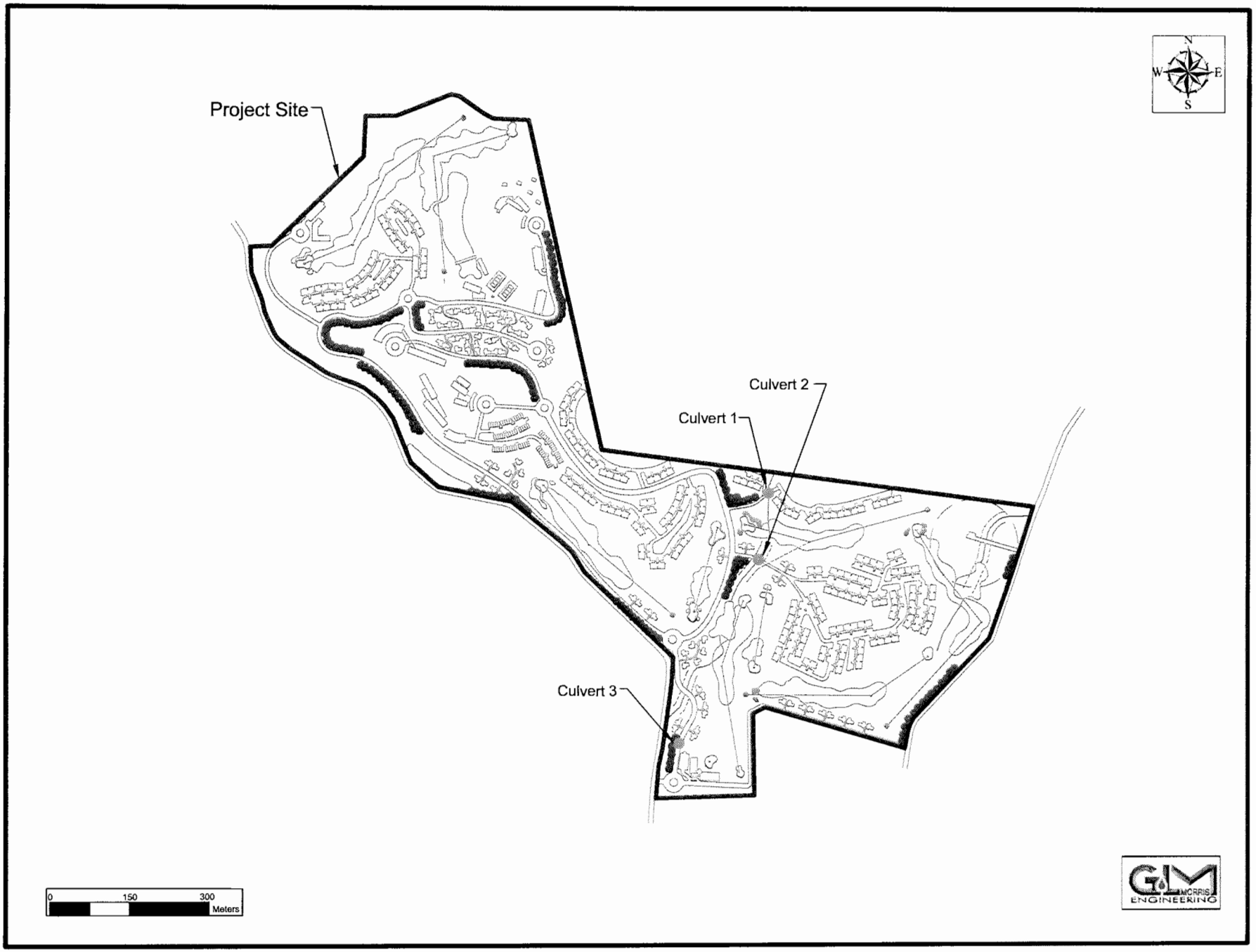


Figure 15: Location of proposed culverts crossing (scale 1:10,000)

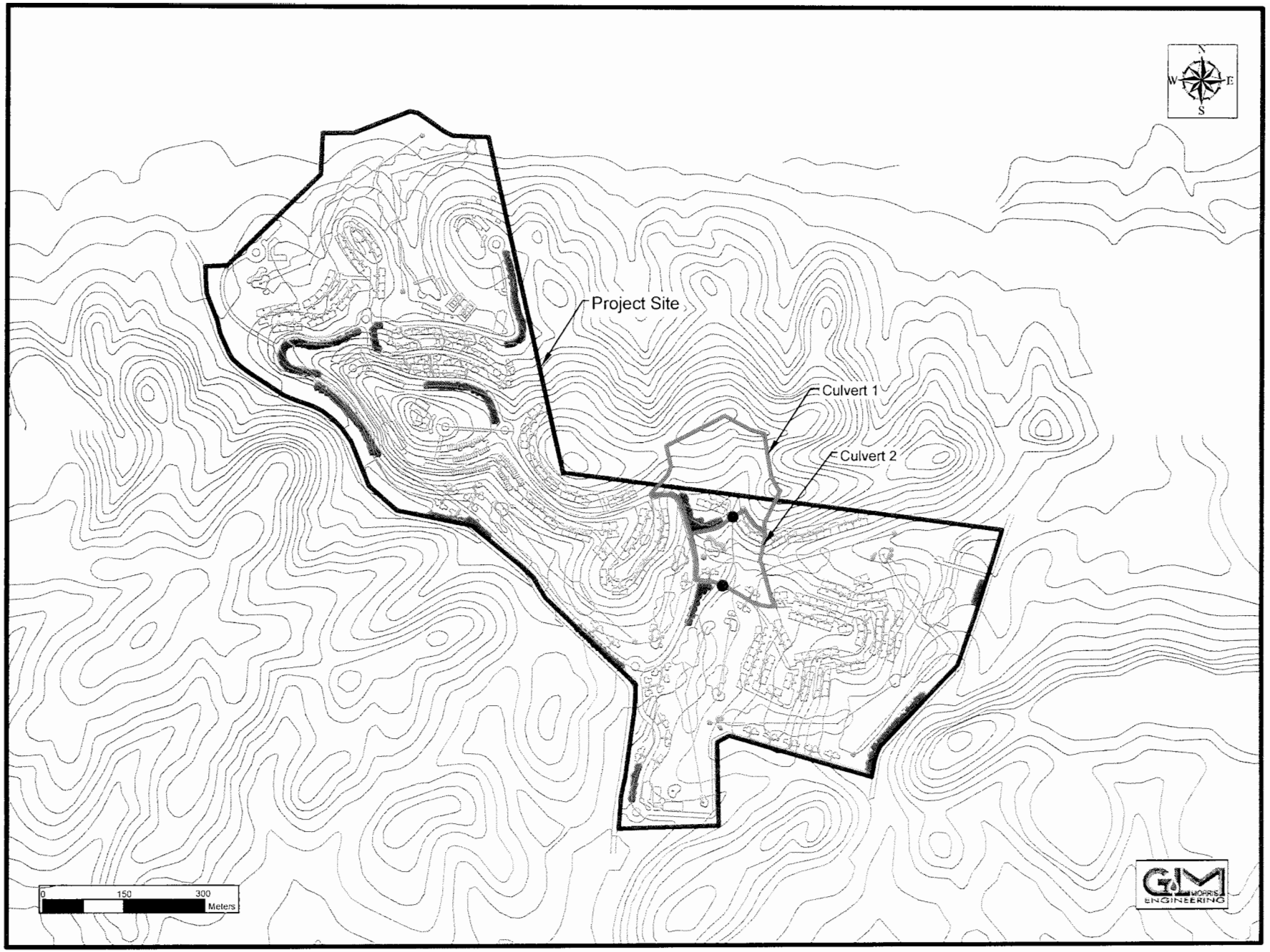


Figure 16: Watersheds tributary to proposed culverts (scale 1:10,000)

Appendix A

NOAA Atlas 14 Rainfall Data

POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14

Puerto Rico 18 N 67.18 W 16 feet

from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 3, Version 3
G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley
NOAA, National Weather Service, Silver Spring, Maryland, 2006

Extracted: Wed Oct 31 2007

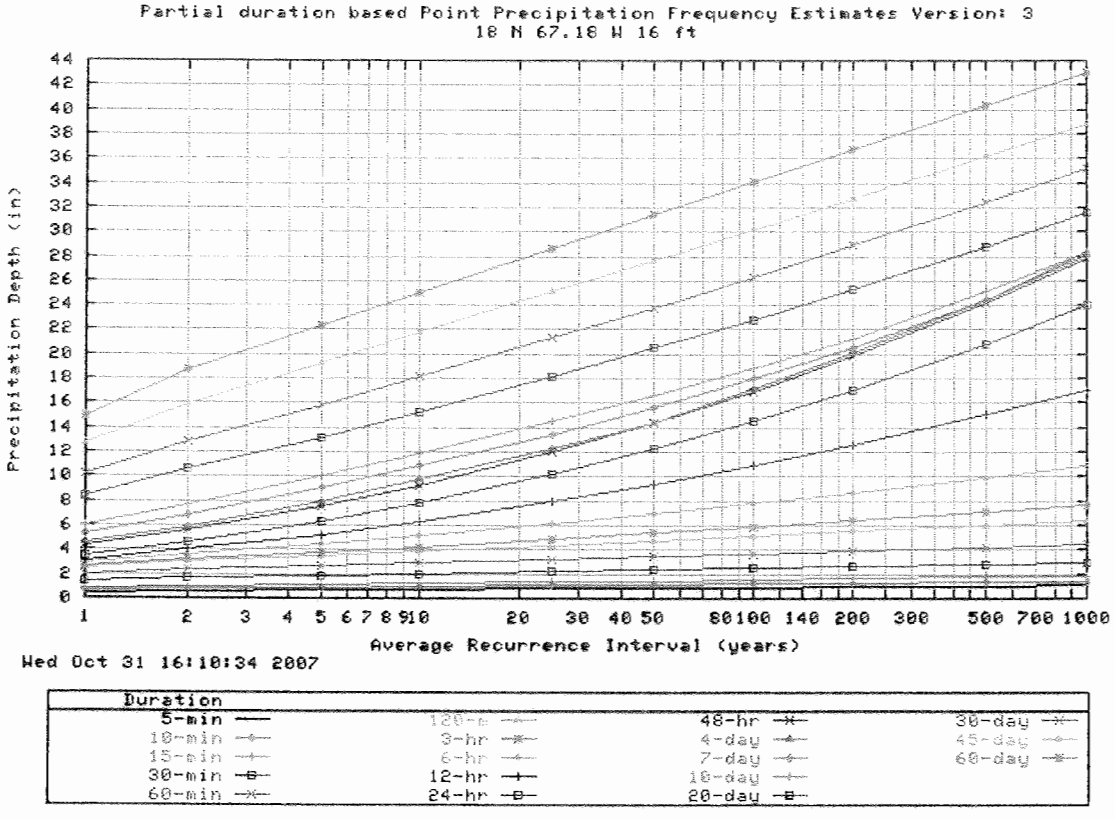
Confidence Limits | Seasonality | Location Maps | Other Info. | GIS data | Maps | Help | Docs | U.S. Map

Precipitation Frequency Estimates (inches)

ARI* (years)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
1	0.47	0.65	0.83	1.33	1.97	2.49	2.59	2.88	3.12	3.53	4.28	4.57	5.35	6.01	8.35	10.13	12.71	14.88
2	0.58	0.79	1.02	1.63	2.42	3.06	3.21	3.62	3.99	4.58	5.52	5.92	6.86	7.70	10.56	12.79	15.97	18.68
5	0.65	0.89	1.14	1.83	2.71	3.54	3.77	4.47	5.20	6.31	7.49	7.97	9.05	10.01	13.17	15.76	19.23	22.29
10	0.71	0.97	1.24	1.99	2.95	3.90	4.23	5.17	6.29	7.86	9.27	9.71	10.87	11.89	15.29	18.13	21.77	25.07
25	0.78	1.06	1.37	2.19	3.25	4.40	4.87	6.14	7.93	10.24	11.99	12.27	13.45	14.51	18.19	21.31	25.11	28.67
50	0.83	1.14	1.46	2.34	3.48	4.78	5.38	6.93	9.34	12.29	14.35	14.44	15.65	16.61	20.48	23.80	27.67	31.40
100	0.89	1.21	1.55	2.49	3.69	5.16	5.89	7.76	10.87	14.57	16.96	17.13	17.97	18.88	22.81	26.30	30.18	34.07
200	0.94	1.28	1.65	2.64	3.92	5.55	6.42	8.64	12.56	17.11	19.87	20.07	20.52	21.28	25.24	28.91	32.74	36.76
500	1.01	1.38	1.78	2.84	4.22	6.06	7.16	9.87	15.03	20.86	24.18	24.42	24.46	25.21	28.78	32.38	36.18	40.31
1000	1.07	1.46	1.87	2.99	4.44	6.45	7.73	10.85	17.08	24.03	27.82	28.10	28.38	28.39	31.54	35.25	38.77	43.00

Text version of table

* These precipitation frequency estimates are based on a partial duration series. ARI is the Average Recurrence Interval. Please refer to the documentation for more information. NOTE: Formatting forces estimates near zero to appear as zero.



POINT PRECIPITATION FREQUENCY ESTIMATES FROM NOAA ATLAS 14

Puerto Rico 18.00 N 67.18 W 16 feet

from "Precipitation-Frequency Atlas of the United States" NOAA Atlas 14, Volume 3, Version 3
G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M. Yekta, and D. Riley
NOAA, National Weather Service, Silver Spring, Maryland, 2006

Extracted: Wed Aug 22 2007

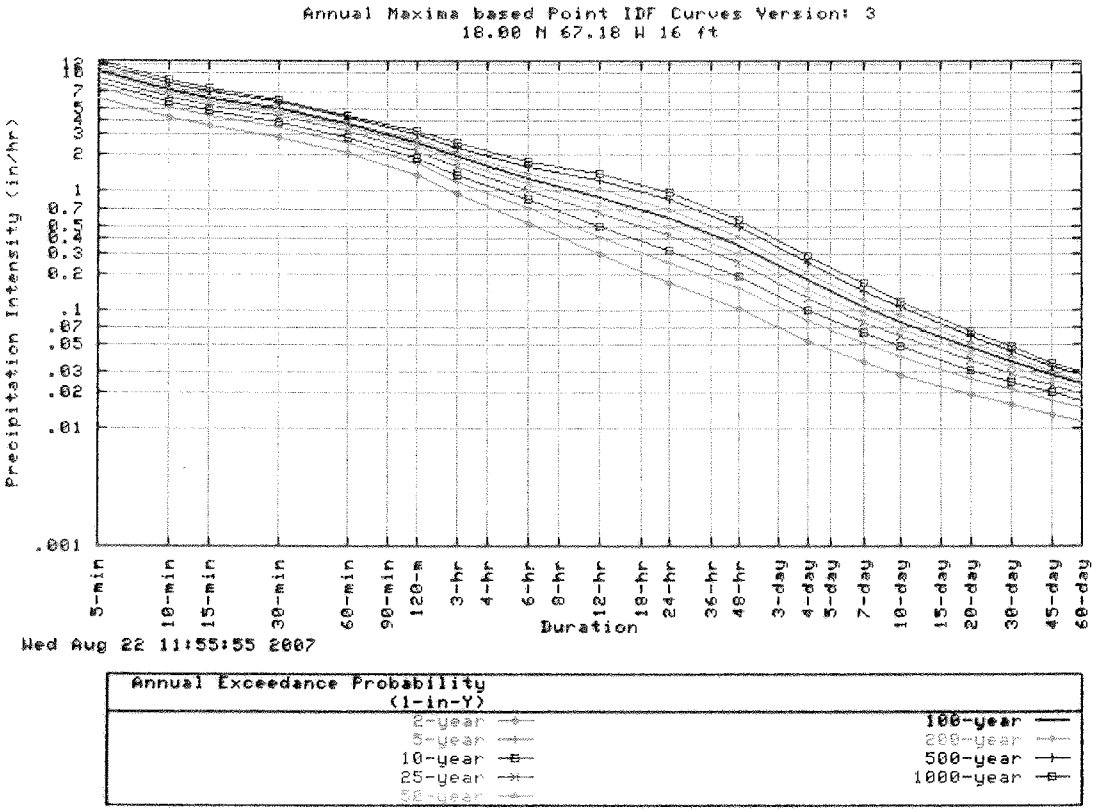
Confidence Limits | Seasonality | Location Maps | Other Info. | GIS data | Maps | Help | Docs | U.S. Map

Precipitation Intensity Estimates (in/hr)

AEP* (1-in-Y)	5 min	10 min	15 min	30 min	60 min	120 min	3 hr	6 hr	12 hr	24 hr	48 hr	4 day	7 day	10 day	20 day	30 day	45 day	60 day
2	6.14	4.20	3.59	2.88	2.13	1.35	0.94	0.53	0.29	0.17	0.10	0.05	0.04	0.03	0.02	0.02	0.01	0.01
5	7.48	5.11	4.38	3.50	2.60	1.70	1.20	0.72	0.41	0.25	0.15	0.08	0.05	0.04	0.03	0.02	0.02	0.01
10	8.29	5.67	4.85	3.88	2.88	1.90	1.37	0.84	0.51	0.32	0.19	0.10	0.06	0.05	0.03	0.02	0.02	0.02
25	9.22	6.30	5.39	4.32	3.20	2.17	1.60	1.01	0.65	0.42	0.25	0.13	0.08	0.06	0.04	0.03	0.02	0.02
50	9.89	6.76	5.78	4.63	3.43	2.36	1.77	1.14	0.77	0.51	0.30	0.15	0.09	0.07	0.04	0.03	0.03	0.02
100	10.54	7.20	6.16	4.93	3.66	2.56	1.94	1.28	0.89	0.60	0.35	0.18	0.11	0.08	0.05	0.04	0.03	0.02
200	11.17	7.63	6.53	5.23	3.88	2.75	2.12	1.43	1.03	0.71	0.41	0.21	0.12	0.09	0.05	0.04	0.03	0.03
500	12.02	8.22	7.03	5.63	4.18	3.00	2.36	1.63	1.24	0.86	0.50	0.25	0.14	0.10	0.06	0.04	0.03	0.03
1000	12.67	8.66	7.41	5.93	4.40	3.19	2.55	1.79	1.40	0.99	0.57	0.29	0.17	0.12	0.07	0.05	0.04	0.03

Text version of table

* These precipitation frequency estimates are based on an annual maxima series. AEP is the Annual Exceedance Probability. Please refer to the documentation for more information. NOTE: Formatting forces estimates near zero to appear as zero.



Confidence Limits -

*** Upper bound of the 90% confidence interval**
Precipitation Intensity Estimates (in/hr)

Appendix B

Curve Number Calculations

Existing Condition

Table 1: Curve Number Calculations for Basin NW

Hydrologic Soil Group	Land use	Area (acre)	CN
B	Pasture	9.4	61
B	Woods	32.9	55
D	Pasture	14.2	80
D	Woods	2.9	77
	Weighted Curve Number		63

Table 2: Curve Number Calculations for Basin SW

Hydrologic Soil Group	Land use	Area (acre)	CN
B	Pasture	9.5	61
B	Woods	18.8	55
D	Pasture	4.3	80
D	Woods	3.3	77
	Weighted Curve Number		62

Table 3: Curve Number Calculations for Basin MID

Hydrologic Soil Group	Land use	Area (acre)	CN
B	Pasture	27.7	61
B	Woods	5.4	55
D	Pasture	16.4	80
	Weighted Curve Number		67

Table 4: Curve Number Calculations for Basin NE

Hydrologic Soil Group	Land use	Area (acre)	CN
B	Pasture	7.6	61
B	Woods	3.0	55
D	Pasture	8.3	80
D	Woods	2.3	77
	Weighted Curve Number		70

Table 5: Curve Number Calculations for Basin SE

Hydrologic Soil Group	Land use	Area (acre)	CN
B	Pasture	7.5	61
B	Woods	5.6	55
D	Pasture	12.6	80
D	Woods	2.3	77
	Weighted Curve Number		70

Proposed Condition

Table 1: Curve Number Calculations for Basin NW

Hydrologic Soil Group	Land use	Area (acres)	CN
B	Woods	1.8	55
B	Pasture	35.8	61
D	Roads	5.9	98
D	Buildings	3.8	92
D	Lake	1.9	100
D	Pasture	10.1	80
	Weighted Curve Number		73

Table 2: Curve Number Calculations for Basin SW

Hydrologic Soil Group	Land use	Area (acres)	CN
B	Woods	1.0	55
B	Pasture	22.2	61
D	Roads	5.1	98
D	Buildings	2.5	92
D	Lake	0.7	100
D	Woods	0.4	77
D	Pasture	4.0	80
	Weighted Curve Number		72

Table 3: Curve Number Calculations for Basin MID

Hydrologic Soil Group	Land use	Area (acres)	CN
B	Woods	0.6	55
B	Pasture	33.5	61
D	Roads	5.1	98
D	Buildings	2.3	92
D	Lake	0.5	100
D	Woods	0.5	77
D	Pasture	6.7	80
	Weighted Curve Number		69

Table 4: Curve Number Calculations for Basin NE

Hydrologic Soil Group	Land use	Area (acres)	CN
B	Pasture	8.9	61
D	Roads	1.5	98
D	Buildings	1.6	92
D	Pasture	9.2	80
	Weighted Curve Number		75

Table 5: Curve Number Calculations for Basin SE

Hydrologic Soil Group	Land use	Area (acres)	CN
B	Woods	0.1	55
B	Pasture	12.6	61
D	Roads	2.2	98
D	Buildings	1.6	92
D	Lake	0.6	100
D	Woods	0.7	77
D	Pasture	10.2	80
		Weighted Curve Number	74

Appendix C

Time of Concentration Calculations

Detention Analysis

Table 1: Time of Concentration for Basin NW

Segment	Length (m)	U/S Elev (m)	D/S Elev (m)	Slope	2-yr Precipitation (in)	n-value	Paved? (Y or N)	Avg. Flow Depth (m)	Velocity (m/s)	Froude No	Tc (min)	Tc (hrs)
1 Sheet Flow (L<300 ft)	91.44	105	85	0.219	4.58	0.150	---	---	0.20	---	7.57	0.13
2 Shallow Conc. Flow	145.7	85	35	0.343	---	---	N	---	2.9	---	0.85	0.01
3 Shallow Conc. Flow	509	35	5	0.059	---	---	N	---	1.2	---	7.16	0.12
Total Distance	746									Total Time of Concentration	15.6	0.26

Table 2: Time of Concentration for Basin SW

Segment	Length (m)	U/S Elev (m)	D/S Elev (m)	Slope	2-yr Precipitation (in)	n-value	Paved? (Y or N)	Avg. Flow Depth (m)	Velocity (m/s)	Froude No	Tc (min)	Tc (hrs)
1 Sheet Flow (L<300 ft)	91.44	90	80	0.109	4.58	0.150	---	---	0.15	---	9.99	0.17
2 Shallow Conc. Flow	255	80	40	0.157	---	---	N	---	1.9	---	2.20	0.04
3 Shallow Conc. Flow	868	40	13	0.031	---	---	N	---	0.9	---	16.80	0.28
Total Distance	1,214									Total Time of Concentration	29.0	0.48

Table 3: Time of Concentration for Basin MID

Segment	Length (m)	U/S Elev (m)	D/S Elev (m)	Slope	2-yr Precipitation (in)	n-value	Paved? (Y or N)	Avg. Flow Depth (m)	Velocity (m/s)	Froude No	Tc (min)	Tc (hrs)
1 Sheet Flow (L<300 ft)	91.44	95	73	0.241	4.58	0.150	---	---	0.21	---	7.29	0.12
2 Shallow Conc. Flow	608	73	35	0.063	---	---	N	---	1.2	---	8.30	0.14
Total Distance	699									Total Time of Concentration	15.6	0.26

Table 4: Time of Concentration for Basin NE

Segment	Length (m)	U/S Elev (m)	D/S Elev (m)	Slope	2-yr Precipitation (in)	n-value	Paved? (Y or N)	Avg. Flow Depth (m)	Velocity (m/s)	Froude No	Tc (min)	Tc (hrs)
1 Sheet Flow (L<300 ft)	91.44	47	37.5	0.104	4.58	0.150	---	---	0.15	---	10.20	0.17
2 Shallow Conc. Flow	355	37.5	20	0.049	---	---	N	---	1.1	---	5.46	0.09
Total Distance	446									Total Time of Concentration	15.7	0.26

Table 5: Time of Concentration for Basin SE

Segment	Length (m)	U/S Elev (m)	D/S Elev (m)	Slope	2-yr Precipitation (in)	n-value	Paved? (Y or N)	Avg. Flow Depth (m)	Velocity (m/s)	Froude No	Tc (min)	Tc (hrs)
1 Sheet Flow (L<300 ft)	91.44	60	43	0.186	4.58	0.150	---	---	0.19	---	8.08	0.13
2 Shallow Conc. Flow	225	43	30	0.058	---	---	N	---	1.2	---	3.20	0.05
3 Channel Flow (Manning)	321	30	20	0.031	---	0.080	---	1.0	2.2	0.70	2.42	0.04
Total Distance	637									Total Time of Concentration	13.7	0.23

Culvert Analysis

Table 1: Time of Concentration for Basin Culvert 1

Segment	Length (m)	U/S Elev (m)	D/S Elev (m)	Slope	2-yr Precipitation (in)	n-value	Paved? (Y or N)	Avg. Flow Depth (m)	Velocity (m/s)	Froude No	Tc (min)	Tc (hrs)
1 Sheet Flow (L<300 ft)	91.44	95	74	0.230	4.58	0.150	---	---	0.21	---	7.43	0.12
2 Shallow Conc. Flow	106.4	74	60	0.132	---	---	N	---	1.8	---	1.00	0.02
Total Distance	198								Total Time of Concentration		8.4	0.14

Table 2: Time of Concentration for Basin Culvert 2

Segment	Length (m)	U/S Elev (m)	D/S Elev (m)	Slope	2-yr Precipitation (in)	n-value	Paved? (Y or N)	Avg. Flow Depth (m)	Velocity (m/s)	Froude No	Tc (min)	Tc (hrs)
1 Sheet Flow (L<300 ft)	91.44	60	44	0.175	4.58	0.150	---	---	0.18	---	8.28	0.14
2 Shallow Conc. Flow	34	44	43	0.029	---	---	N	---	0.8	---	0.68	0.01
Total Distance	125								Total Time of Concentration		9.0	0.15

Appendix D

Input data and Results of ICPR Pre-development Condition Model for Detention Analysis

==========
==== Basins ==========
==========

Name: Basin MID | Node: Boundary MID | Status: Onsite
Group: BASE | Type: SCS Unit Hydrograph

Unit Hydrograph: Uh484 | Peaking Factor: 484.0
Rainfall File: Dist. 2 Peñones | Storm Duration(hrs): 24.00
Rainfall Amount(in): 14.567 | Time of Conc(min): 16.00
Area(ac): 49.463 | Time Shift(hrs): 0.00
Curve Number: 67.00 | Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Name: Basin NE | Node: Boundary NE | Status: Onsite
Group: BASE | Type: SCS Unit Hydrograph

Unit Hydrograph: Uh484 | Peaking Factor: 484.0
Rainfall File: Dist. 2 Peñones | Storm Duration(hrs): 24.00
Rainfall Amount(in): 14.567 | Time of Conc(min): 16.00
Area(ac): 21.163 | Time Shift(hrs): 0.00
Curve Number: 70.00 | Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Name: Basin NW | Node: Boundary NW | Status: Onsite
Group: BASE | Type: SCS Unit Hydrograph

Unit Hydrograph: Uh484 | Peaking Factor: 484.0
Rainfall File: Dist. 2 Peñones | Storm Duration(hrs): 24.00
Rainfall Amount(in): 14.567 | Time of Conc(min): 16.00
Area(ac): 59.422 | Time Shift(hrs): 0.00
Curve Number: 63.00 | Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Name: Basin SE | Node: Boundary SE | Status: Onsite
Group: BASE | Type: SCS Unit Hydrograph

Unit Hydrograph: Uh484 | Peaking Factor: 484.0
Rainfall File: Dist. 2 Peñones | Storm Duration(hrs): 24.00
Rainfall Amount(in): 14.567 | Time of Conc(min): 14.00
Area(ac): 28.030 | Time Shift(hrs): 0.00
Curve Number: 70.00 | Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Name: Basin SW | Node: Boundary SW | Status: Onsite
Group: BASE | Type: SCS Unit Hydrograph

Unit Hydrograph: Uh484 | Peaking Factor: 484.0
Rainfall File: Dist. 2 Peñones | Storm Duration(hrs): 24.00
Rainfall Amount(in): 14.567 | Time of Conc(min): 29.00
Area(ac): 35.931 | Time Shift(hrs): 0.00
Curve Number: 62.00 | Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Name: Culvert 1 | Node: Culvert 1 | Status: Onsite
Group: BASE | Type: SCS Unit Hydrograph

```
        Unit Hydrograph: Uh484                    Peaking Factor: 484.0
          Rainfall File: Dist. 2 Peñones      Storm Duration(hrs): 24.00
    Rainfall Amount(in): 14.567                 Time of Conc(min): 8.00
              Area(ac): 7.982                     Time Shift(hrs): 0.00
          Curve Number: 73.00                Max Allowable Q(cfs): 999999.000
               DCIA(%): 0.00


-------------------------------------------------------------------------------------------------------------
         Name: Culvert 2                Node: Culvert 2              Status: Onsite
        Group: BASE                     Type: SCS Unit Hydrograph

        Unit Hydrograph: Uh484                    Peaking Factor: 484.0
          Rainfall File: Dist. 2 Peñones      Storm Duration(hrs): 24.00
    Rainfall Amount(in): 14.567                 Time of Conc(min): 9.00
              Area(ac): 3.901                     Time Shift(hrs): 0.00
          Curve Number: 73.00                Max Allowable Q(cfs): 999999.000
               DCIA(%): 0.00


===============================================================================================
==== Hydrology Simulations ====================================================================
===============================================================================================

         Name: 100-year
     Filename: P:\Cabo Rojo\Water Resources\Bahia Campomar\ICPR\Existing Condition\100-year.R32

      Override Defaults: No

Time(hrs)       Print Inc(min)
--------------- ---------------
10.000          10.00
13.000          1.00
24.000          10.00

-------------------------------------------------------------------------------------------------------------
         Name: 2-year
     Filename: P:\Cabo Rojo\Water Resources\Bahia Campomar\ICPR\Existing Condition\2-year.R32

      Override Defaults: Yes
    Storm Duration(hrs): 24.00
          Rainfall File: Dist. 2 Peñones
    Rainfall Amount(in): 4.61

Time(hrs)       Print Inc(min)
--------------- ---------------
10.000          10.00
13.000          1.00
24.000          10.00

===============================================================================================
==== Boundary Conditions ======================================================================
===============================================================================================
```

```
            Basin Name: Basin MID
            Group Name: BASE
            Simulation: 100-year
             Node Name: Boundary MID
            Basin Type: SCS Unit Hydrograph

       Unit Hydrograph: Uh484
         Peaking Fator: 484.0
  Spec Time Inc (min): 2.13
  Comp Time Inc (min): 2.13
         Rainfall File: Dist. 2 Peñones
Rainfall Amount (in): 14.567
Storm Duration (hrs): 24.00
               Status: Onsite
  Time of Conc (min): 16.00
    Time Shift (hrs): 0.00
           Area (ac): 49.463
Vol of Unit Hyd (in): 1.001
        Curve Number: 67.000
            DCIA (%): 0.000

      Time Max (hrs): 12.02
      Flow Max (cfs): 199.555
  Runoff Volume (in): 9.954
 Runoff Volume (ft3): 1787221.624


--------------------------------------------------------------------------------

            Basin Name: Basin NE
            Group Name: BASE
            Simulation: 100-year
             Node Name: Boundary NE
            Basin Type: SCS Unit Hydrograph

       Unit Hydrograph: Uh484
         Peaking Fator: 484.0
  Spec Time Inc (min): 2.13
  Comp Time Inc (min): 2.13
         Rainfall File: Dist. 2 Peñones
Rainfall Amount (in): 14.567
Storm Duration (hrs): 24.00
               Status: Onsite
  Time of Conc (min): 16.00
    Time Shift (hrs): 0.00
           Area (ac): 21.163
Vol of Unit Hyd (in): 1.000
        Curve Number: 70.000
            DCIA (%): 0.000

      Time Max (hrs): 12.02
      Flow Max (cfs): 88.791
  Runoff Volume (in): 10.431
 Runoff Volume (ft3): 801289.140


--------------------------------------------------------------------------------

            Basin Name: Basin NW
            Group Name: BASE
            Simulation: 100-year
             Node Name: Boundary NW
            Basin Type: SCS Unit Hydrograph

       Unit Hydrograph: Uh484
         Peaking Fator: 484.0
  Spec Time Inc (min): 2.13
  Comp Time Inc (min): 2.13
         Rainfall File: Dist. 2 Peñones
Rainfall Amount (in): 14.567
Storm Duration (hrs): 24.00
               Status: Onsite
  Time of Conc (min): 16.00
```

```
       Time Shift (hrs): 0.00
              Area (ac): 59.422
   Vol of Unit Hyd (in): 1.000
           Curve Number: 63.000
               DCIA (%): 0.000

         Time Max (hrs): 12.02
        Flow Max (cfs): 225.683
     Runoff Volume (in): 9.297
    Runoff Volume (ft3): 2005431.994
```

```
             Basin Name: Basin SE
             Group Name: BASE
             Simulation: 100-year
              Node Name: Boundary SE
             Basin Type: SCS Unit Hydrograph

         Unit Hydrograph: Uh484
           Peaking Fator: 484.0
    Spec Time Inc (min): 1.87
    Comp Time Inc (min): 1.87
          Rainfall File: Dist. 2 Peñones
   Rainfall Amount (in): 14.567
   Storm Duration (hrs): 24.00
                 Status: Onsite
     Time of Conc (min): 14.00
       Time Shift (hrs): 0.00
              Area (ac): 28.030
   Vol of Unit Hyd (in): 1.000
           Curve Number: 70.000
               DCIA (%): 0.000

         Time Max (hrs): 12.01
        Flow Max (cfs): 119.128
     Runoff Volume (in): 10.427
    Runoff Volume (ft3): 1060967.525
```

```
             Basin Name: Basin SW
             Group Name: BASE
             Simulation: 100-year
              Node Name: Boundary SW
             Basin Type: SCS Unit Hydrograph

         Unit Hydrograph: Uh484
           Peaking Fator: 484.0
    Spec Time Inc (min): 3.87
    Comp Time Inc (min): 3.87
          Rainfall File: Dist. 2 Peñones
   Rainfall Amount (in): 14.567
   Storm Duration (hrs): 24.00
                 Status: Onsite
     Time of Conc (min): 29.00
       Time Shift (hrs): 0.00
              Area (ac): 35.931
   Vol of Unit Hyd (in): 1.000
           Curve Number: 62.000
               DCIA (%): 0.000

         Time Max (hrs): 12.12
        Flow Max (cfs): 118.377
     Runoff Volume (in): 9.123
    Runoff Volume (ft3): 1189848.340
```

```
             Basin Name: Culvert 1
```

```
            Group Name: BASE
            Simulation: 100-year
             Node Name: Culvert 1
            Basin Type: SCS Unit Hydrograph

       Unit Hydrograph: Uh484
         Peaking Fator: 484.0
  Spec Time Inc (min): 1.07
  Comp Time Inc (min): 1.07
        Rainfall File: Dist. 2 Peñones
 Rainfall Amount (in): 14.567
 Storm Duration (hrs): 24.00
               Status: Onsite
   Time of Conc (min): 8.00
     Time Shift (hrs): 0.00
           Area (ac): 7.982
 Vol of Unit Hyd (in): 1.000
         Curve Number: 73.000
             DCIA (%): 0.000

       Time Max (hrs): 12.00
       Flow Max (cfs): 35.813
  Runoff Volume (in): 10.894
 Runoff Volume (ft3): 315683.239


--------------------------------------------------------------------------------

            Basin Name: Culvert 2
            Group Name: BASE
            Simulation: 100-year
             Node Name: Culvert 2
            Basin Type: SCS Unit Hydrograph

       Unit Hydrograph: Uh484
         Peaking Fator: 484.0
  Spec Time Inc (min): 1.20
  Comp Time Inc (min): 1.20
        Rainfall File: Dist. 2 Peñones
 Rainfall Amount (in): 14.567
 Storm Duration (hrs): 24.00
               Status: Onsite
   Time of Conc (min): 9.00
     Time Shift (hrs): 0.00
           Area (ac): 3.901
 Vol of Unit Hyd (in): 1.000
         Curve Number: 73.000
             DCIA (%): 0.000

       Time Max (hrs): 12.00
       Flow Max (cfs): 17.471
  Runoff Volume (in): 10.894
 Runoff Volume (ft3): 154274.743


--------------------------------------------------------------------------------

            Basin Name: Culvert 3
            Group Name: BASE
            Simulation: 100-year
             Node Name: Culvert 3
            Basin Type: SCS Unit Hydrograph

       Unit Hydrograph: Uh484
         Peaking Fator: 484.0
  Spec Time Inc (min): 2.00
  Comp Time Inc (min): 2.00
        Rainfall File: Dist. 2 Peñones
 Rainfall Amount (in): 14.567
 Storm Duration (hrs): 24.00
               Status: Onsite
   Time of Conc (min): 15.00
     Time Shift (hrs): 0.00
```

```
              Area (ac): 32.000
   Vol of Unit Hyd (in): 1.000
           Curve Number: 73.000
               DCIA (%): 0.000

         Time Max (hrs): 12.00
         Flow Max (cfs): 139.900
     Runoff Volume (in): 10.894
    Runoff Volume (ft3): 1265498.508
```

```
             Basin Name: Culvert 4
             Group Name: BASE
             Simulation: 100-year
              Node Name: Culvert 4
             Basin Type: SCS Unit Hydrograph

        Unit Hydrograph: Uh484
          Peaking Fator: 484.0
    Spec Time Inc (min): 1.60
    Comp Time Inc (min): 1.60
          Rainfall File: Dist. 2 Peñones
   Rainfall Amount (in): 14.567
   Storm Duration (hrs): 24.00
                 Status: Onsite
     Time of Conc (min): 12.00
       Time Shift (hrs): 0.00
              Area (ac): 26.945
   Vol of Unit Hyd (in): 1.000
           Curve Number: 76.000
               DCIA (%): 0.000

         Time Max (hrs): 12.00
         Flow Max (cfs): 123.275
     Runoff Volume (in): 11.346
    Runoff Volume (ft3): 1109722.640
```

```
             Basin Name: Basin MID
             Group Name: BASE
             Simulation: 2-year
              Node Name: Boundary MID
             Basin Type: SCS Unit Hydrograph

        Unit Hydrograph: Uh484
          Peaking Fator: 484.0
    Spec Time Inc (min): 2.13
    Comp Time Inc (min): 2.13
          Rainfall File: Dist. 2 Peñones
   Rainfall Amount (in): 4.606
   Storm Duration (hrs): 24.00
                 Status: Onsite
     Time of Conc (min): 16.00
       Time Shift (hrs): 0.00
              Area (ac): 49.463
   Vol of Unit Hyd (in): 1.001
           Curve Number: 67.000
               DCIA (%): 0.000

         Time Max (hrs): 12.05
         Flow Max (cfs): 30.003
     Runoff Volume (in): 1.532
    Runoff Volume (ft3): 275116.165
```

```
             Basin Name: Basin NE
             Group Name: BASE
```

```
            Simulation: 2-year
             Node Name: Boundary NE
            Basin Type: SCS Unit Hydrograph

       Unit Hydrograph: Uh484
         Peaking Fator: 484.0
  Spec Time Inc (min): 2.13
  Comp Time Inc (min): 2.13
        Rainfall File: Dist. 2 Peñones
 Rainfall Amount (in): 4.606
 Storm Duration (hrs): 24.00
               Status: Onsite
   Time of Conc (min): 16.00
     Time Shift (hrs): 0.00
            Area (ac): 21.163
 Vol of Unit Hyd (in): 1.000
         Curve Number: 70.000
             DCIA (%): 0.000

       Time Max (hrs): 12.05
       Flow Max (cfs): 14.905
  Runoff Volume (in): 1.747
  Runoff Volume (ft3): 134207.641


--------------------------------------------------------------------------------

            Basin Name: Basin NW
            Group Name: BASE
            Simulation: 2-year
             Node Name: Boundary NW
            Basin Type: SCS Unit Hydrograph

       Unit Hydrograph: Uh484
         Peaking Fator: 484.0
  Spec Time Inc (min): 2.13
  Comp Time Inc (min): 2.13
        Rainfall File: Dist. 2 Peñones
 Rainfall Amount (in): 4.606
 Storm Duration (hrs): 24.00
               Status: Onsite
   Time of Conc (min): 16.00
     Time Shift (hrs): 0.00
            Area (ac): 59.422
 Vol of Unit Hyd (in): 1.000
         Curve Number: 63.000
             DCIA (%): 0.000

       Time Max (hrs): 12.05
       Flow Max (cfs): 28.562
  Runoff Volume (in): 1.264
  Runoff Volume (ft3): 272636.218


--------------------------------------------------------------------------------

            Basin Name: Basin SE
            Group Name: BASE
            Simulation: 2-year
             Node Name: Boundary SE
            Basin Type: SCS Unit Hydrograph

       Unit Hydrograph: Uh484
         Peaking Fator: 484.0
  Spec Time Inc (min): 1.87
  Comp Time Inc (min): 1.87
        Rainfall File: Dist. 2 Peñones
 Rainfall Amount (in): 4.606
 Storm Duration (hrs): 24.00
               Status: Onsite
   Time of Conc (min): 14.00
     Time Shift (hrs): 0.00
            Area (ac): 28.030
```

```
   Vol of Unit Hyd (in): 1.000
           Curve Number: 70.000
               DCIA (%): 0.000

         Time Max (hrs): 12.04
        Flow Max (cfs): 20.157
     Runoff Volume (in): 1.746
    Runoff Volume (ft3): 177675.695


--------------------------------------------------------------------------------

              Basin Name: Basin SW
              Group Name: BASE
              Simulation: 2-year
               Node Name: Boundary SW
              Basin Type: SCS Unit Hydrograph

        Unit Hydrograph: Uh484
          Peaking Fator: 484.0
    Spec Time Inc (min): 3.87
    Comp Time Inc (min): 3.87
          Rainfall File: Dist. 2 Peñones
   Rainfall Amount (in): 4.606
   Storm Duration (hrs): 24.00
                 Status: Onsite
     Time of Conc (min): 29.00
       Time Shift (hrs): 0.00
              Area (ac): 35.931
   Vol of Unit Hyd (in): 1.000
           Curve Number: 62.000
               DCIA (%): 0.000

         Time Max (hrs): 12.18
        Flow Max (cfs): 13.599
     Runoff Volume (in): 1.199
    Runoff Volume (ft3): 156349.908


--------------------------------------------------------------------------------

              Basin Name: Culvert 1
              Group Name: BASE
              Simulation: 2-year
               Node Name: Culvert 1
              Basin Type: SCS Unit Hydrograph

        Unit Hydrograph: Uh484
          Peaking Fator: 484.0
    Spec Time Inc (min): 1.07
    Comp Time Inc (min): 1.07
          Rainfall File: Dist. 2 Peñones
   Rainfall Amount (in): 4.606
   Storm Duration (hrs): 24.00
                 Status: Onsite
     Time of Conc (min): 8.00
       Time Shift (hrs): 0.00
              Area (ac): 7.982
   Vol of Unit Hyd (in): 1.000
           Curve Number: 73.000
               DCIA (%): 0.000

         Time Max (hrs): 12.00
        Flow Max (cfs): 6.854
     Runoff Volume (in): 1.974
    Runoff Volume (ft3): 57186.160


--------------------------------------------------------------------------------

              Basin Name: Culvert 2
              Group Name: BASE
              Simulation: 2-year
```

```
             Node Name: Culvert 2
            Basin Type: SCS Unit Hydrograph

        Unit Hydrograph: Uh484
          Peaking Fator: 484.0
   Spec Time Inc (min): 1.20
   Comp Time Inc (min): 1.20
          Rainfall File: Dist. 2 Peñones
  Rainfall Amount (in): 4.606
  Storm Duration (hrs): 24.00
                Status: Onsite
    Time of Conc (min): 9.00
      Time Shift (hrs): 0.00
             Area (ac): 3.901
  Vol of Unit Hyd (in): 1.000
          Curve Number: 73.000
              DCIA (%): 0.000

        Time Max (hrs): 12.02
        Flow Max (cfs): 3.327
    Runoff Volume (in): 1.974
   Runoff Volume (ft3): 27946.939


--------------------------------------------------------------------------------

            Basin Name: Culvert 3
            Group Name: BASE
            Simulation: 2-year
             Node Name: Culvert 3
            Basin Type: SCS Unit Hydrograph

        Unit Hydrograph: Uh484
          Peaking Fator: 484.0
   Spec Time Inc (min): 2.00
   Comp Time Inc (min): 2.00
          Rainfall File: Dist. 2 Peñones
  Rainfall Amount (in): 4.606
  Storm Duration (hrs): 24.00
                Status: Onsite
    Time of Conc (min): 15.00
      Time Shift (hrs): 0.00
             Area (ac): 32.000
  Vol of Unit Hyd (in): 1.000
          Curve Number: 73.000
              DCIA (%): 0.000

        Time Max (hrs): 12.03
        Flow Max (cfs): 26.112
    Runoff Volume (in): 1.974
   Runoff Volume (ft3): 229245.620


--------------------------------------------------------------------------------

            Basin Name: Culvert 4
            Group Name: BASE
            Simulation: 2-year
             Node Name: Culvert 4
            Basin Type: SCS Unit Hydrograph

        Unit Hydrograph: Uh484
          Peaking Fator: 484.0
   Spec Time Inc (min): 1.60
   Comp Time Inc (min): 1.60
          Rainfall File: Dist. 2 Peñones
  Rainfall Amount (in): 4.606
  Storm Duration (hrs): 24.00
                Status: Onsite
    Time of Conc (min): 12.00
      Time Shift (hrs): 0.00
             Area (ac): 26.945
  Vol of Unit Hyd (in): 1.000
```

```
          Curve Number: 76.000
              DCIA (%): 0.000

         Time Max (hrs): 12.03
         Flow Max (cfs): 25.350
  Runoff Volume (in): 2.212
 Runoff Volume (ft3): 216354.242
```

Appendix E

Input data and Results of ICPR Proposed Condition Model for Detention Analysis

Basins

Name: Basin MID | Node: Pond MID | Status: Onsite
Group: BASE | Type: SCS Unit Hydrograph

Unit Hydrograph:	Uh484	Peaking Factor:	484.0
Rainfall File:	Dist. 2 Peñones	Storm Duration(hrs):	24.00
Rainfall Amount(in):	14.567	Time of Conc(min):	16.00
Area(ac):	49.421	Time Shift(hrs):	0.00
Curve Number:	69.00	Max Allowable Q(cfs):	999999.000
DCIA(%):	0.00		

Name: Basin NE | Node: Pond NE | Status: Onsite
Group: BASE | Type: SCS Unit Hydrograph

Unit Hydrograph:	Uh484	Peaking Factor:	484.0
Rainfall File:	Dist. 2 Peñones	Storm Duration(hrs):	24.00
Rainfall Amount(in):	14.567	Time of Conc(min):	16.00
Area(ac):	21.163	Time Shift(hrs):	0.00
Curve Number:	75.00	Max Allowable Q(cfs):	999999.000
DCIA(%):	0.00		

Name: Basin NW | Node: Pond NW | Status: Onsite
Group: BASE | Type: SCS Unit Hydrograph

Unit Hydrograph:	Uh484	Peaking Factor:	484.0
Rainfall File:	Dist. 2 Peñones	Storm Duration(hrs):	24.00
Rainfall Amount(in):	14.567	Time of Conc(min):	16.00
Area(ac):	59.422	Time Shift(hrs):	0.00
Curve Number:	72.00	Max Allowable Q(cfs):	999999.000
DCIA(%):	0.00		

Name: Basin SE | Node: Pond SE | Status: Onsite
Group: BASE | Type: SCS Unit Hydrograph

Unit Hydrograph:	Uh484	Peaking Factor:	484.0
Rainfall File:	Dist. 2 Peñones	Storm Duration(hrs):	24.00
Rainfall Amount(in):	14.567	Time of Conc(min):	14.00
Area(ac):	28.030	Time Shift(hrs):	0.00
Curve Number:	74.00	Max Allowable Q(cfs):	999999.000
DCIA(%):	0.00		

Name: Basin SW | Node: Pond SW | Status: Onsite
Group: BASE | Type: SCS Unit Hydrograph

Unit Hydrograph:	Uh484	Peaking Factor:	484.0
Rainfall File:	Dist. 2 Peñones	Storm Duration(hrs):	24.00
Rainfall Amount(in):	14.567	Time of Conc(min):	29.00
Area(ac):	35.931	Time Shift(hrs):	0.00
Curve Number:	72.00	Max Allowable Q(cfs):	999999.000
DCIA(%):	0.00		

Nodes

Name: Boundary MID Base Flow(cfs): 0.000 Init Stage(ft): 104.987
Group: BASE Warn Stage(ft): 0.000
Type: Time/Stage

Time(hrs)	Stage(ft)
0.00	104.987
24.00	104.987

Name: Boundary NE Base Flow(cfs): 0.000 Init Stage(ft): 55.774
Group: BASE Warn Stage(ft): 0.000
Type: Time/Stage

Time(hrs)	Stage(ft)
0.00	55.774
24.00	55.774

Name: Boundary NW Base Flow(cfs): 0.000 Init Stage(ft): 9.843
Group: BASE Warn Stage(ft): 0.000
Type: Time/Stage

Time(hrs)	Stage(ft)
0.00	9.843
24.00	9.843

Name: Boundary SE Base Flow(cfs): 0.000 Init Stage(ft): 59.055
Group: BASE Warn Stage(ft): 0.000
Type: Time/Stage

Time(hrs)	Stage(ft)
0.00	59.055
24.00	59.055

Name: Boundary SW Base Flow(cfs): 0.000 Init Stage(ft): 36.089
Group: BASE Warn Stage(ft): 0.000
Type: Time/Stage

Time(hrs)	Stage(ft)
0.00	36.089
24.00	36.089

Name: Node MID Base Flow(cfs): 0.000 Init Stage(ft): 125.984
Group: BASE Warn Stage(ft): 0.000
Type: Stage/Area

Stage(ft)	Area(ac)

Name: Node NE Base Flow(cfs): 0.000 Init Stage(ft): 61.352
Group: BASE Warn Stage(ft): 0.000
Type: Stage/Area

Stage(ft)	Area(ac)

Name: Node SE Base Flow(cfs): 0.000 Init Stage(ft): 67.257
Group: BASE Warn Stage(ft): 0.000
Type: Stage/Area

Stage(ft)	Area(ac)

Name: Pond MID Base Flow(cfs): 0.000 Init Stage(ft): 131.234
Group: BASE Warn Stage(ft): 137.795
Type: Stage/Area

Stage(ft)	Area(ac)
131.234	0.1838
137.795	0.3437

Name: Pond NE Base Flow(cfs): 0.000 Init Stage(ft): 65.617
Group: BASE Warn Stage(ft): 72.178
Type: Stage/Area

Stage(ft)	Area(ac)
65.617	0.1653
72.178	0.3163

Name: Pond NW Base Flow(cfs): 0.000 Init Stage(ft): 16.404
Group: BASE Warn Stage(ft): 22.966
Type: Stage/Area

Stage(ft)	Area(ac)
16.404	0.7655
22.966	1.0411

Name: Pond SE Base Flow(cfs): 0.000 Init Stage(ft): 72.178
Group: BASE Warn Stage(ft): 78.740
Type: Stage/Area

Stage(ft)	Area(ac)
72.178	0.1379
78.740	0.2807

Name: Pond SW Base Flow(cfs): 0.000 Init Stage(ft): 42.651
Group: BASE Warn Stage(ft): 49.213
Type: Stage/Area

Stage(ft)	Area(ac)

42.651	0.4715
49.213	0.7388

Pipes

Name:		From Node:	Length(ft):	0.00
Group:	BASE	To Node:	Count:	1
			Friction Equation:	Average Conveyance
	UPSTREAM	DOWNSTREAM	Solution Algorithm:	Automatic
Geometry:	Circular	Circular	Flow:	Both
Span(in):	0.00	0.00	Entrance Loss Coef:	0.00
Rise(in):	0.00	0.00	Exit Loss Coef:	0.00
Invert(ft):	0.000	0.000	Bend Loss Coef:	0.00
Manning's N:	0.000000	0.000000	Outlet Ctrl Spec:	Use dc or tw
Top Clip(in):	0.000	0.000	Inlet Ctrl Spec:	Use dn
Bot Clip(in):	0.000	0.000	Stabilizer Option:	None

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Channels

Name:	Swale MID	From Node:	Node MID	Length(ft):	324.80
Group:	BASE	To Node:	Boundary MID	Count:	1

	UPSTREAM	DOWNSTREAM	Friction Equation:	Average Conveyance
Geometry:	Trapezoidal	Trapezoidal	Solution Algorithm:	Automatic
Invert(ft):	125.984	119.423	Flow:	Both
TClpInitZ(ft):	9999.000	9999.000	Contraction Coef:	0.100
Manning's N:	0.050000	0.050000	Expansion Coef:	0.300
Top Clip(ft):	0.000	0.000	Entrance Loss Coef:	0.000
Bot Clip(ft):	0.000	0.000	Exit Loss Coef:	0.000
Main XSec:			Outlet Ctrl Spec:	Use dc or tw
AuxElev1(ft):			Inlet Ctrl Spec:	Use dn
Aux XSec1:			Stabilizer Option:	None
AuxElev2(ft):				
Aux XSec2:				
Top Width(ft):				
Depth(ft):				
Bot Width(ft):	11.483	11.483		
LtSdSlp(h/v):	4.00	4.00		
RtSdSlp(h/v):	4.00	4.00		

Name:	Swale NE	From Node:	Node NE	Length(ft):	173.88
Group:	BASE	To Node:	Boundary NE	Count:	1

	UPSTREAM	DOWNSTREAM	Friction Equation:	Average Conveyance
Geometry:	Trapezoidal	Trapezoidal	Solution Algorithm:	Automatic
Invert(ft):	61.352	57.743	Flow:	Both
TClpInitZ(ft):	9999.000	9999.000	Contraction Coef:	0.100
Manning's N:	0.050000	0.050000	Expansion Coef:	0.300
Top Clip(ft):	0.000	0.000	Entrance Loss Coef:	0.000
Bot Clip(ft):	0.000	0.000	Exit Loss Coef:	0.000
Main XSec:			Outlet Ctrl Spec:	Use dc or tw
AuxElev1(ft):			Inlet Ctrl Spec:	Use dn
Aux XSec1:			Stabilizer Option:	None
AuxElev2(ft):				
Aux XSec2:				
Top Width(ft):				

```
     Depth(ft):
 Bot Width(ft): 3.281          3.281
  LtSdSlp(h/v): 4.00           4.00
  RtSdSlp(h/v): 4.00           4.00
```

```
          Name: Swale SE            From Node: Node SE           Length(ft): 321.52
         Group: BASE                  To Node: Boundary SE            Count: 1

                UPSTREAM       DOWNSTREAM                Friction Equation: Average Conveyance
      Geometry: Trapezoidal    Trapezoidal               Solution Algorithm: Automatic
    Invert(ft): 67.257         60.696                                 Flow: Both
 TClpInitZ(ft): 9999.000       9999.000                 Contraction Coef: 0.100
   Manning's N: 0.050000       0.050000                   Expansion Coef: 0.300
  Top Clip(ft): 0.000          0.000                   Entrance Loss Coef: 0.000
  Bot Clip(ft): 0.000          0.000                       Exit Loss Coef: 0.000
     Main XSec:                                        Outlet Ctrl Spec: Use dc or tw
  AuxElev1(ft):                                         Inlet Ctrl Spec: Use dn
     Aux XSec1:                                       Stabilizer Option: None
  AuxElev2(ft):
     Aux XSec2:
 Top Width(ft):
     Depth(ft):
 Bot Width(ft): 5.906          5.906
  LtSdSlp(h/v): 4.00           4.00
  RtSdSlp(h/v): 4.00           4.00
```

==========

Drop Structures

==========

```
          Name: Standpipe MID       From Node: Pond MID          Length(ft): 16.40
         Group: BASE                  To Node: Node MID               Count: 1

                UPSTREAM       DOWNSTREAM                Friction Equation: Average Conveyance
      Geometry: Circular       Circular                  Solution Algorithm: Automatic
      Span(in): 54.00          54.00                                  Flow: Both
      Rise(in): 54.00          54.00                   Entrance Loss Coef: 0.500
    Invert(ft): 126.312        125.984                     Exit Loss Coef: 0.500
  Manning's N: 0.013000        0.013000                Outlet Ctrl Spec: Use dc or tw
 Top Clip(in): 0.000           0.000                    Inlet Ctrl Spec: Use dn
 Bot Clip(in): 0.000           0.000                      Solution Incs: 10

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall


*** Weir 1 of 2 for Drop Structure Standpipe MID ***
                                                                                TABLE
                  Count: 1                        Bottom Clip(in): 0.000
                   Type: Vertical: Mavis            Top Clip(in): 0.000
                   Flow: Both                    Weir Disc Coef: 3.200
               Geometry: Circular              Orifice Disc Coef: 0.600

               Span(in): 40.00                       Invert(ft): 131.234
               Rise(in): 40.00                  Control Elev(ft): 131.234

*** Weir 2 of 2 for Drop Structure Standpipe MID ***
                                                                                TABLE
                  Count: 1                        Bottom Clip(in): 0.000
                   Type: Horizontal                 Top Clip(in): 0.000
                   Flow: Both                    Weir Disc Coef: 3.200
               Geometry: Circular              Orifice Disc Coef: 0.600

               Span(in): 54.00                       Invert(ft): 134.843
```

Rise(in): 54.00 Control Elev(ft): 134.843

Name: Standpipe NE From Node: Pond NE Length(ft): 16.40
Group: BASE To Node: Node NE Count: 1

	UPSTREAM	DOWNSTREAM
Geometry:	Circular	Circular
Span(in):	36.00	36.00
Rise(in):	36.00	36.00
Invert(ft):	62.008	61.352
Manning's N:	0.013000	0.013000
Top Clip(in):	0.000	0.000
Bot Clip(in):	0.000	0.000

Friction Equation: Average Conveyance
Solution Algorithm: Automatic
Flow: Both
Entrance Loss Coef: 0.500
Exit Loss Coef: 0.500
Outlet Ctrl Spec: Use dc or tw
Inlet Ctrl Spec: Use dn
Solution Incs: 10

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

*** Weir 1 of 2 for Drop Structure Standpipe NE ***

TABLE

Count: 1 Bottom Clip(in): 0.000
Type: Vertical: Mavis Top Clip(in): 0.000
Flow: Both Weir Disc Coef: 3.200
Geometry: Circular Orifice Disc Coef: 0.600

Span(in): 24.00 Invert(ft): 65.617
Rise(in): 24.00 Control Elev(ft): 65.617

*** Weir 2 of 2 for Drop Structure Standpipe NE ***

TABLE

Count: 1 Bottom Clip(in): 0.000
Type: Horizontal Top Clip(in): 0.000
Flow: Both Weir Disc Coef: 3.200
Geometry: Circular Orifice Disc Coef: 0.600

Span(in): 33.00 Invert(ft): 68.406
Rise(in): 33.00 Control Elev(ft): 68.406

Name: Standpipe NW From Node: Pond NW Length(ft): 377.30
Group: BASE To Node: Boundary NW Count: 1

	UPSTREAM	DOWNSTREAM
Geometry:	Circular	Circular
Span(in):	54.00	54.00
Rise(in):	54.00	54.00
Invert(ft):	11.811	10.171
Manning's N:	0.013000	0.013000
Top Clip(in):	0.000	0.000
Bot Clip(in):	0.000	0.000

Friction Equation: Average Conveyance
Solution Algorithm: Automatic
Flow: Both
Entrance Loss Coef: 0.500
Exit Loss Coef: 0.500
Outlet Ctrl Spec: Use dc or tw
Inlet Ctrl Spec: Use dn
Solution Incs: 10

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

*** Weir 1 of 2 for Drop Structure Standpipe NW ***

TABLE

Count: 1 Bottom Clip(in): 0.000
Type: Vertical: Mavis Top Clip(in): 0.000
Flow: Both Weir Disc Coef: 3.200
Geometry: Rectangular Orifice Disc Coef: 0.600

```
              Span(in): 42.00                    Invert(ft): 16.404
              Rise(in): 42.00                Control Elev(ft): 16.404

*** Weir 2 of 2 for Drop Structure Standpipe NW ***
                                                                    TABLE
                 Count: 1                     Bottom Clip(in): 0.000
                  Type: Horizontal               Top Clip(in): 0.000
                  Flow: Both                  Weir Disc Coef: 3.200
              Geometry: Circular             Orifice Disc Coef: 0.600

              Span(in): 54.00                    Invert(ft): 20.341
              Rise(in): 54.00                Control Elev(ft): 20.341


-------------------------------------------------------------------------------------------------
        Name: Standpipe SE        From Node: Pond SE           Length(ft): 16.40
       Group: BASE                  To Node: Node SE                Count: 1

              UPSTREAM       DOWNSTREAM              Friction Equation: Average Conveyance
    Geometry: Circular       Circular               Solution Algorithm: Automatic
    Span(in): 42.00          42.00                              Flow: Both
    Rise(in): 42.00          42.00                 Entrance Loss Coef: 0.500
   Invert(ft): 68.241        67.257                    Exit Loss Coef: 0.500
  Manning's N: 0.013000      0.013000                Outlet Ctrl Spec: Use dc or tw
 Top Clip(in): 0.000         0.000                    Inlet Ctrl Spec: Use dn
 Bot Clip(in): 0.000         0.000                      Solution Incs: 10

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall


*** Weir 1 of 2 for Drop Structure Standpipe SE ***
                                                                    TABLE
                 Count: 1                     Bottom Clip(in): 0.000
                  Type: Vertical: Mavis          Top Clip(in): 0.000
                  Flow: Both                  Weir Disc Coef: 3.200
              Geometry: Circular             Orifice Disc Coef: 0.600

              Span(in): 24.00                    Invert(ft): 72.178
              Rise(in): 24.00                Control Elev(ft): 72.178

*** Weir 2 of 2 for Drop Structure Standpipe SE ***
                                                                    TABLE
                 Count: 1                     Bottom Clip(in): 0.000
                  Type: Horizontal               Top Clip(in): 0.000
                  Flow: Both                  Weir Disc Coef: 3.200
              Geometry: Circular             Orifice Disc Coef: 0.600

              Span(in): 42.00                    Invert(ft): 75.131
              Rise(in): 42.00                Control Elev(ft): 75.131


-------------------------------------------------------------------------------------------------
        Name: Standpipe SW        From Node: Pond SW           Length(ft): 1230.31
       Group: BASE                  To Node: Boundary SW            Count: 1

              UPSTREAM       DOWNSTREAM              Friction Equation: Average Conveyance
    Geometry: Circular       Circular               Solution Algorithm: Automatic
    Span(in): 48.00          48.00                              Flow: Both
    Rise(in): 48.00          48.00                 Entrance Loss Coef: 0.500
   Invert(ft): 38.386        37.402                    Exit Loss Coef: 0.500
  Manning's N: 0.013000      0.013000                Outlet Ctrl Spec: Use dc or tw
 Top Clip(in): 0.000         0.000                    Inlet Ctrl Spec: Use dn
 Bot Clip(in): 0.000         0.000                      Solution Incs: 10

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
```

Circular Concrete: Square edge w/ headwall

*** Weir 1 of 2 for Drop Structure Standpipe SW ***

TABLE

Count:	1	Bottom Clip(in):	0.000
Type:	Vertical: Mavis	Top Clip(in):	0.000
Flow:	Both	Weir Disc Coef:	3.200
Geometry:	Circular	Orifice Disc Coef:	0.600
Span(in):	21.00	Invert(ft):	42.651
Rise(in):	21.00	Control Elev(ft):	42.651

*** Weir 2 of 2 for Drop Structure Standpipe SW ***

TABLE

Count:	1	Bottom Clip(in):	0.000
Type:	Horizontal	Top Clip(in):	0.000
Flow:	Both	Weir Disc Coef:	3.200
Geometry:	Circular	Orifice Disc Coef:	0.600
Span(in):	42.00	Invert(ft):	44.948
Rise(in):	42.00	Control Elev(ft):	44.948

==== Weirs ====

Name:		From Node:	
Group:	BASE	To Node:	
Flow:	Both	Count:	1
Type:	Horizontal	Geometry:	Circular
Span(in):	0.00		
Rise(in):	0.00		
Invert(ft):	0.000		
Control Elevation(ft):	0.000		

TABLE

Bottom Clip(in):	0.000
Top Clip(in):	0.000
Weir Discharge Coef:	3.200
Orifice Discharge Coef:	0.600

==== Bridges ====

Name:		From Node:		Flow:	Both
Group:	BASE	To Node:		Run WSPRO:	No

XSEC TYPE	NAME	INV(ft)	STAT(ft)	SKEW(deg)	EXPAN	CON
Exit		0.000	0.00	0.000	0.500	0
Full Valley		0.000	0.00	0.000	0.500	0
Approach		0.000	0.00	0.000	0.500	0
Roadway		0.000	0.00	0.000		

Road Surface Material:	Paved
Road Embankment Top Width(ft):	0.00
Road Unsubmerged Weir Q Coef:	0.000

RATING CURVE CONTROL

TW(ft)	QMin(cfs)	QMax(cfs)	QInc(cfs)
0.000	0.000	0.000	0.000

==== Hydrology Simulations ====

```
         Name: 100-year
     Filename: P:\Cabo Rojo\Water Resources\Bahia Campomar\ICPR\Proposed Condition\Proposed 8 noviembre 07

      Override Defaults: No

Time(hrs)       Print Inc(min)
--------------- ---------------
10.000          10.00
13.000          1.00
24.000          10.00

--------------------------------------------------------------------------------------------------------------
         Name: 2-year
     Filename: P:\Cabo Rojo\Water Resources\Bahia Campomar\ICPR\Proposed Condition\Proposed 8 noviembre 07

      Override Defaults: Yes
    Storm Duration(hrs): 24.00
          Rainfall File: Dist. 2 Peñones
    Rainfall Amount(in): 4.61

Time(hrs)       Print Inc(min)
--------------- ---------------
10.000          10.00
13.000          1.00
24.000          10.00

==============================================================================================
==== Routing Simulations ======================================================================
==============================================================================================

         Name: 100-year           Hydrology Sim: 100-year
     Filename: P:\Cabo Rojo\Water Resources\Bahia Campomar\ICPR\Proposed Condition\Proposed 8 noviembre 07

      Execute: Yes         Restart: No            Patch: No
  Alternative: No

        Max Delta Z(ft): 0.98                    Delta Z Factor: 0.00500
    Time Step Optimizer: 0.000
        Start Time(hrs): 0.000                    End Time(hrs): 24.00
     Min Calc Time(sec): 1.0000               Max Calc Time(sec): 60.0000
        Boundary Stages:                         Boundary Flows:


Time(hrs)       Print Inc(min)
--------------- ---------------
10.000          10.000
13.000          1.000
24.000          10.000

Group           Run
--------------- -----
BASE            Yes


--------------------------------------------------------------------------------------------------------------
         Name: 2-year             Hydrology Sim: 2-year
     Filename: P:\Cabo Rojo\Water Resources\Bahia Campomar\ICPR\Proposed Condition\Proposed 8 noviembre 07

      Execute: Yes         Restart: No            Patch: No
  Alternative: No

        Max Delta Z(ft): 0.98                    Delta Z Factor: 0.00500
    Time Step Optimizer: 0.000
        Start Time(hrs): 0.000                    End Time(hrs): 24.00
     Min Calc Time(sec): 1.0000               Max Calc Time(sec): 60.0000
        Boundary Stages:                         Boundary Flows:


Time(hrs)       Print Inc(min)
```

10.000	10.000
13.000	1.000
24.000	10.000

Group	Run
BASE	Yes

Boundary Conditions

```
            Basin Name: Basin MID
            Group Name: BASE
            Simulation: 100-year
             Node Name: Pond MID
            Basin Type: SCS Unit Hydrograph

       Unit Hydrograph: Uh484
         Peaking Fator: 484.0
  Spec Time Inc (min): 2.13
  Comp Time Inc (min): 2.13
         Rainfall File: Dist. 2 Peñones
 Rainfall Amount (in): 14.567
 Storm Duration (hrs): 24.00
               Status: Onsite
   Time of Conc (min): 16.00
     Time Shift (hrs): 0.00
            Area (ac): 49.421
 Vol of Unit Hyd (in): 1.001
        Curve Number: 69.000
            DCIA (%): 0.000

      Time Max (hrs): 12.02
      Flow Max (cfs): 204.775
  Runoff Volume (in): 10.273
 Runoff Volume (ft3): 1843002.897


--------------------------------------------------------------------------------

            Basin Name: Basin NE
            Group Name: BASE
            Simulation: 100-year
             Node Name: Pond NE
            Basin Type: SCS Unit Hydrograph

       Unit Hydrograph: Uh484
         Peaking Fator: 484.0
  Spec Time Inc (min): 2.13
  Comp Time Inc (min): 2.13
         Rainfall File: Dist. 2 Peñones
 Rainfall Amount (in): 14.567
 Storm Duration (hrs): 24.00
               Status: Onsite
   Time of Conc (min): 16.00
     Time Shift (hrs): 0.00
            Area (ac): 21.163
 Vol of Unit Hyd (in): 1.000
        Curve Number: 75.000
            DCIA (%): 0.000

      Time Max (hrs): 12.02
      Flow Max (cfs): 93.813
  Runoff Volume (in): 11.197
 Runoff Volume (ft3): 860126.319


--------------------------------------------------------------------------------

            Basin Name: Basin NW
            Group Name: BASE
            Simulation: 100-year
             Node Name: Pond NW
            Basin Type: SCS Unit Hydrograph

       Unit Hydrograph: Uh484
         Peaking Fator: 484.0
  Spec Time Inc (min): 2.13
  Comp Time Inc (min): 2.13
         Rainfall File: Dist. 2 Peñones
 Rainfall Amount (in): 14.567
 Storm Duration (hrs): 24.00
               Status: Onsite
   Time of Conc (min): 16.00
```

```
       Time Shift (hrs): 0.00
              Area (ac): 59.422
   Vol of Unit Hyd (in): 1.000
          Curve Number: 72.000
              DCIA (%): 0.000

         Time Max (hrs): 12.02
        Flow Max (cfs): 255.240
     Runoff Volume (in): 10.741
    Runoff Volume (ft3): 2316937.060


--------------------------------------------------------------------------------

             Basin Name: Basin SE
             Group Name: BASE
             Simulation: 100-year
              Node Name: Pond SE
             Basin Type: SCS Unit Hydrograph

        Unit Hydrograph: Uh484
          Peaking Fator: 484.0
    Spec Time Inc (min): 1.87
    Comp Time Inc (min): 1.87
         Rainfall File: Dist. 2 Peñones
   Rainfall Amount (in): 14.567
   Storm Duration (hrs): 24.00
                 Status: Onsite
     Time of Conc (min): 14.00
       Time Shift (hrs): 0.00
              Area (ac): 28.030
   Vol of Unit Hyd (in): 1.000
          Curve Number: 74.000
              DCIA (%): 0.000

         Time Max (hrs): 12.01
        Flow Max (cfs): 124.528
     Runoff Volume (in): 11.043
    Runoff Volume (ft3): 1123591.974


--------------------------------------------------------------------------------

             Basin Name: Basin SW
             Group Name: BASE
             Simulation: 100-year
              Node Name: Pond SW
             Basin Type: SCS Unit Hydrograph

        Unit Hydrograph: Uh484
          Peaking Fator: 484.0
    Spec Time Inc (min): 3.87
    Comp Time Inc (min): 3.87
         Rainfall File: Dist. 2 Peñones
   Rainfall Amount (in): 14.567
   Storm Duration (hrs): 24.00
                 Status: Onsite
     Time of Conc (min): 29.00
       Time Shift (hrs): 0.00
              Area (ac): 35.931
   Vol of Unit Hyd (in): 1.000
          Curve Number: 72.000
              DCIA (%): 0.000

         Time Max (hrs): 12.12
        Flow Max (cfs): 136.950
     Runoff Volume (in): 10.734
    Runoff Volume (ft3): 1400070.811


--------------------------------------------------------------------------------

             Basin Name: Basin MID
```

```
            Group Name: BASE
            Simulation: 2-year
             Node Name: Pond MID
            Basin Type: SCS Unit Hydrograph

       Unit Hydrograph: Uh484
         Peaking Fator: 484.0
  Spec Time Inc (min): 2.13
  Comp Time Inc (min): 2.13
        Rainfall File: Dist. 2 Peñones
 Rainfall Amount (in): 4.606
 Storm Duration (hrs): 24.00
               Status: Onsite
   Time of Conc (min): 16.00
     Time Shift (hrs): 0.00
            Area (ac): 49.421
 Vol of Unit Hyd (in): 1.001
         Curve Number: 69.000
             DCIA (%): 0.000

       Time Max (hrs): 12.05
       Flow Max (cfs): 33.183
  Runoff Volume (in): 1.674
  Runoff Volume (ft3): 300339.269


--------------------------------------------------------------------------------

            Basin Name: Basin NE
            Group Name: BASE
            Simulation: 2-year
             Node Name: Pond NE
            Basin Type: SCS Unit Hydrograph

       Unit Hydrograph: Uh484
         Peaking Fator: 484.0
  Spec Time Inc (min): 2.13
  Comp Time Inc (min): 2.13
        Rainfall File: Dist. 2 Peñones
 Rainfall Amount (in): 4.606
 Storm Duration (hrs): 24.00
               Status: Onsite
   Time of Conc (min): 16.00
     Time Shift (hrs): 0.00
            Area (ac): 21.163
 Vol of Unit Hyd (in): 1.000
         Curve Number: 75.000
             DCIA (%): 0.000

       Time Max (hrs): 12.05
       Flow Max (cfs): 18.462
  Runoff Volume (in): 2.131
  Runoff Volume (ft3): 163715.496


--------------------------------------------------------------------------------

            Basin Name: Basin NW
            Group Name: BASE
            Simulation: 2-year
             Node Name: Pond NW
            Basin Type: SCS Unit Hydrograph

       Unit Hydrograph: Uh484
         Peaking Fator: 484.0
  Spec Time Inc (min): 2.13
  Comp Time Inc (min): 2.13
        Rainfall File: Dist. 2 Peñones
 Rainfall Amount (in): 4.606
 Storm Duration (hrs): 24.00
               Status: Onsite
   Time of Conc (min): 16.00
     Time Shift (hrs): 0.00
```

```
             Area (ac): 59.422
   Vol of Unit Hyd (in): 1.000
          Curve Number: 72.000
              DCIA (%): 0.000

         Time Max (hrs): 12.05
         Flow Max (cfs): 45.804
     Runoff Volume (in): 1.897
    Runoff Volume (ft3): 409129.970
```

```
             Basin Name: Basin SE
             Group Name: BASE
             Simulation: 2-year
              Node Name: Pond SE
             Basin Type: SCS Unit Hydrograph

         Unit Hydrograph: Uh484
           Peaking Fator: 484.0
    Spec Time Inc (min): 1.87
    Comp Time Inc (min): 1.87
          Rainfall File: Dist. 2 Peñones
   Rainfall Amount (in): 4.606
   Storm Duration (hrs): 24.00
                 Status: Onsite
     Time of Conc (min): 14.00
       Time Shift (hrs): 0.00
             Area (ac): 28.030
   Vol of Unit Hyd (in): 1.000
          Curve Number: 74.000
              DCIA (%): 0.000

         Time Max (hrs): 12.04
         Flow Max (cfs): 23.952
     Runoff Volume (in): 2.051
    Runoff Volume (ft3): 208665.893
```

```
             Basin Name: Basin SW
             Group Name: BASE
             Simulation: 2-year
              Node Name: Pond SW
             Basin Type: SCS Unit Hydrograph

         Unit Hydrograph: Uh484
           Peaking Fator: 484.0
    Spec Time Inc (min): 3.87
    Comp Time Inc (min): 3.87
          Rainfall File: Dist. 2 Peñones
   Rainfall Amount (in): 4.606
   Storm Duration (hrs): 24.00
                 Status: Onsite
     Time of Conc (min): 29.00
       Time Shift (hrs): 0.00
             Area (ac): 35.931
   Vol of Unit Hyd (in): 1.000
          Curve Number: 72.000
              DCIA (%): 0.000

         Time Max (hrs): 12.12
         Flow Max (cfs): 23.954
     Runoff Volume (in): 1.895
    Runoff Volume (ft3): 247162.940
```

Simulation	Basin	Group	Time Max hrs	Flow Max cfs	Volume in	Volume ft3
100-year	Basin MID	BASE	12.02	204.775	10.273	**********
100-year	Basin NE	BASE	12.02	93.813	11.197860	126.319
100-year	Basin NW	BASE	12.02	255.240	10.741	**********
100-year	Basin SE	BASE	12.01	124.528	11.043	**********
100-year	Basin SW	BASE	12.12	136.950	10.734	**********
2-year	Basin MID	BASE	12.05	33.183	1.674300	339.269
2-year	Basin NE	BASE	12.05	18.462	2.131163	715.496
2-year	Basin NW	BASE	12.05	45.804	1.897409	129.970
2-year	Basin SE	BASE	12.04	23.952	2.051208	665.893
2-year	Basin SW	BASE	12.12	23.954	1.895247	162.940

Name	Group	Simulation	Max Time Stage hrs	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Time Inflow hrs	Max Inflow cfs	Max Time Outflow hrs	Max Outflow cfs
Boundary MID	BASE	100-year	0.00	104.987	0.000	0.0000	93	12.11	190.040	0.00	0.000
Boundary NE	BASE	100-year	0.00	55.774	0.000	0.0000	14	12.15	76.368	0.00	0.000
Boundary NW	BASE	100-year	0.00	9.843	0.000	0.0000	0	12.16	197.924	0.00	0.000
Boundary SE	BASE	100-year	0.00	59.055	0.000	0.0000	47	12.12	108.636	0.00	0.000
Boundary SW	BASE	100-year	0.00	36.089	0.000	0.0000	0	12.46	85.883	0.00	0.000
Node MID	BASE	100-year	12.11	128.111	0.000	0.0027	4593	12.10	190.070	12.11	190.040
Node NE	BASE	100-year	12.15	63.255	0.000	0.0026	1654	12.15	76.342	12.15	76.368
Node SE	BASE	100-year	12.12	69.244	0.000	0.0025	3480	12.11	108.657	12.12	108.636
Pond MID	BASE	100-year	12.10	137.572	137.795	0.0049	14736	12.02	204.732	12.10	190.070
Pond NE	BASE	100-year	12.15	71.671	72.178	-0.0043	13269	12.02	93.797	12.15	76.342
Pond NW	BASE	100-year	12.16	22.811	22.966	0.0044	45066	12.02	255.191	12.16	197.924
Pond SE	BASE	100-year	12.11	78.697	78.740	0.0049	12187	12.00	124.350	12.11	108.657
Pond SW	BASE	100-year	12.46	49.186	49.213	-0.0049	32138	12.12	136.865	12.46	85.883
Boundary MID	BASE	2-year	0.00	104.987	0.000	0.0000	93	12.14	29.823	0.00	0.000
Boundary NE	BASE	2-year	0.00	55.774	0.000	0.0000	14	12.17	14.609	0.00	0.000
Boundary NW	BASE	2-year	0.00	9.843	0.000	0.0000	0	12.25	28.447	0.00	0.000
Boundary SE	BASE	2-year	0.00	59.055	0.000	0.0000	47	12.15	19.283	0.00	0.000
Boundary SW	BASE	2-year	0.00	36.089	0.000	0.0000	0	12.66	13.125	0.00	0.000
Node MID	BASE	2-year	12.14	126.812	0.000	0.0021	2965	12.13	29.856	12.14	29.823
Node NE	BASE	2-year	12.17	62.271	0.000	0.0020	991	12.17	14.614	12.17	14.609
Node SE	BASE	2-year	12.15	68.133	0.000	0.0020	2100	12.14	19.297	12.15	19.283
Pond MID	BASE	2-year	12.13	133.585	137.795	0.0049	10504	12.05	33.162	12.13	29.856
Pond NE	BASE	2-year	12.17	67.722	72.178	0.0037	9311	12.05	18.461	12.17	14.614
Pond NW	BASE	2-year	12.25	18.266	22.966	0.0039	36752	12.05	45.790	12.25	28.447
Pond SE	BASE	2-year	12.14	74.808	78.740	0.0049	8499	12.03	23.941	12.14	19.297
Pond SW	BASE	2-year	12.66	44.812	49.213	0.0045	24373	12.12	23.946	12.66	13.125

Appendix F

Input data and Results of Culvert Master

Culvert Calculator Report
Culvert #1

Solve For: Section Size

Culvert Summary					
Allowable HW Elevation	197.60	ft	Headwater Depth/ Height	1.10	
Computed Headwater Elevation	196.90	ft	Discharge	36.00	cfs
Inlet Control HW Elev	196.63	ft	Tailwater Elevation	196.20	ft
Outlet Control HW Elev	196.90	ft	Control Type	Outlet Control	

Grades					
Upstream Invert	193.60	ft	Downstream Invert	193.20	ft
Length	20.00	ft	Constructed Slope	0.020000	ft/ft

Hydraulic Profile					
Profile	S1		Depth, Downstream	3.00	ft
Slope Type	Steep		Normal Depth	1.29	ft
Flow Regime	Subcritical		Critical Depth	1.95	ft
Velocity Downstream	5.09	ft/s	Critical Slope	0.005085	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	3.00	ft
Section Size	36 inch		Rise	3.00	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev	196.90	ft	Upstream Velocity Head	0.48	ft
Ke	0.50		Entrance Loss	0.24	ft

Inlet Control Properties					
Inlet Control HW Elev	196.63	ft	Flow Control	N/A	
Inlet Type	Square edge w/headwall		Area Full	7.1	ft²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Calculator Report
Culvert #2

Solve For: Section Size

Culvert Summary					
Allowable HW Elevation	148.90	ft	Headwater Depth/ Height	1.11	
Computed Headwater Elevation	148.29	ft	Discharge	53.00	cfs
Inlet Control HW Elev	147.93	ft	Tailwater Elevation	147.50	ft
Outlet Control HW Elev	148.29	ft	Control Type	Outlet Control	

Grades					
Upstream Invert	144.40	ft	Downstream Invert	144.00	ft
Length	20.00	ft	Constructed Slope	0.020000	ft/ft

Hydraulic Profile					
Profile	S1		Depth, Downstream	3.50	ft
Slope Type	Steep		Normal Depth	1.48	ft
Flow Regime	Subcritical		Critical Depth	2.28	ft
Velocity Downstream	5.51	ft/s	Critical Slope	0.004835	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	3.50	ft
Section Size	42 inch		Rise	3.50	ft
Number Sections	1				

Outlet Control Properties					
Outlet Control HW Elev	148.29	ft	Upstream Velocity Head	0.54	ft
Ke	0.50		Entrance Loss	0.27	ft

Inlet Control Properties					
Inlet Control HW Elev	147.93	ft	Flow Control	N/A	
Inlet Type	Square edge w/headwall		Area Full	9.6	ft²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Calculator Report
Culvert #3 Alternative 1

Solve For: Section Size

Culvert Summary					
Allowable HW Elevation	119.30	ft	Headwater Depth/ Height	1.25	
Computed Headwater Elevation	119.21	ft	Discharge	190.00	cfs
Inlet Control HW Elev	119.13	ft	Tailwater Elevation	117.60	ft
Outlet Control HW Elev	119.21	ft	Control Type	Outlet Control	

Grades					
Upstream Invert	114.20	ft	Downstream Invert	113.60	ft
Length	29.60	ft	Constructed Slope	0.020270	ft/ft

Hydraulic Profile					
Profile	S1		Depth, Downstream	4.00	ft
Slope Type	Steep		Normal Depth	1.92	ft
Flow Regime	Subcritical		Critical Depth	2.96	ft
Velocity Downstream	7.56	ft/s	Critical Slope	0.005452	ft/ft

Section					
Section Shape	Circular		Mannings Coefficient	0.013	
Section Material	Concrete		Span	4.00	ft
Section Size	48 inch		Rise	4.00	ft
Number Sections	2				

Outlet Control Properties					
Outlet Control HW Elev	119.21	ft	Upstream Velocity Head	1.21	ft
Ke	0.50		Entrance Loss	0.60	ft

Inlet Control Properties					
Inlet Control HW Elev	119.13	ft	Flow Control	N/A	
Inlet Type	Square edge w/headwall		Area Full	25.1	ft²
K	0.00980		HDS 5 Chart	1	
M	2.00000		HDS 5 Scale	1	
C	0.03980		Equation Form	1	
Y	0.67000				

Culvert Calculator Report
Culvert #3 Alternativa 2

Solve For: Section Size

Culvert Summary			
Allowable HW Elevation	119.20 ft	Headwater Depth/ Height	1.24
Computed Headwater Elevation	119.17 ft	Discharge	190.00 cfs
Inlet Control HW Elev	119.03 ft	Tailwater Elevation	117.60 ft
Outlet Control HW Elev	119.17 ft	Control Type	Entrance Control

Grades			
Upstream Invert	114.20 ft	Downstream Invert	113.60 ft
Length	29.60 ft	Constructed Slope	0.020270 ft/ft

Hydraulic Profile			
Profile	CompositeS1S2	Depth, Downstream	4.00 ft
Slope Type	Steep	Normal Depth	1.58 ft
Flow Regime	N/A	Critical Depth	2.84 ft
Velocity Downstream	6.79 ft/s	Critical Slope	0.003840 ft/ft

Section			
Section Shape	Box	Mannings Coefficient	0.013
Section Material	Concrete	Span	7.00 ft
Section Size	7 x 4 ft	Rise	4.00 ft
Number Sections	1		

Outlet Control Properties			
Outlet Control HW Elev	119.17 ft	Upstream Velocity Head	1.42 ft
Ke	0.50	Entrance Loss	0.71 ft

Inlet Control Properties			
Inlet Control HW Elev	119.03 ft	Flow Control	N/A
Inlet Type	90 and 15 ° wingwall flares	Area Full	28.0 ft²
K	0.06100	HDS 5 Chart	8
M	0.75000	HDS 5 Scale	2
C	0.04000	Equation Form	1
Y	0.80000		