March 17, 2009

TYRRELL PARK

PROBLEM DESCRIPTION

The 131 acre watershed in the City of Beaumont, which is the subject of this application, experiences frequent structure flooding. The watershed is a developed subdivision known as the "Upper Ditch 200-B2 Watershed." The subdivision is known as Tyrrell Park and it lies in southern Beaumont, Texas. Some level of structure flooding occurs during rainfall events with a reoccurrence interval of five (5) years. The cause of the structure flooding is the fact that the finished floor elevations of the structures is right at natural ground elevation, and this natural ground is lower than the ground the outfall must cross on its way to Willow Marsh Bayou. The flow rates generated by the run-off from the 131 acres causes head loss through the crossings and ditches, and causes floodwaters to enter the houses in the area.

Latitude/Longitude	30º01'14" N	94º09'28" W
Firm / Yes	4854570040D	
Zone	X	

SCOPE OF WORK

The work scope for this project is to construct two small detention basins (14 acre feet), increase the size of a road crossing, and buyout five (5) homes which are the lowest in the area. The buyout area will be used for the detention basins. The net result of this effort will be a lower 100-year water surface in the area, and a significant reduction in flooding. By removing the lowest homes the design water surface can be increased.

TASK	START	STOP
Final Engineering	Week 1	Week 3
Property Acquisition	Week 3	Week 15
Demolition & Clearing	Week 16	Week 19
Excavation	Week 20	Week 28
Downspout Installation	Week 29	Week 33
Crossing Installation	Week 34	Week 35
Dress-up	Week 35	Week 40
Seeding	Week 41	Week 42

DECISION MAKING PROCESS

We are focusing on the area in our community that has the greatest potential for losses. On January 4, 2009, Tyrrell Park received 5.43" of rain in a 12 hour period. This equates to a 2-year rainfall event. Several homes were flooded and Jefferson County Drainage District No. 6 personnel were dispatched. The District's personnel witnessed the flooding and saw this relatively isolated problem area. Several of the citizens called and directed the District's attention to the problem. Given the relatively small amount of rain, the corresponding level of flooding, and the potential for more flooding, this area was given priority for a solution to be found. Additionally, repetitive loss structures are in the area and uninsured citizens are reporting multiple occurrences of flooding. The detention buyout alternative was chosen for economic reasons and the difficulty of increasing outfall capacity and the tailwater conditions in Willow Marsh Bayou will allow only very minimal head losses from the problem area to the bayou.

EXPLANATION AS TO WHY THIS PROJECT IS THE BET ALTERNATIVE

When analyzing the solution for the flooding problem, four alternatives were considered: 1) "no action," 2) channelization, 3) buyout, and 4)a combination of detention and buyout. Alternative 4 is by far the best alternative. The buyout alternative is unacceptable because of economic reasons. The proposed project provides some level of protection for 55 homes. Purchasing only half of these homes would cost over $2 million. Since this is less than $1 million project, we are getting more protection for the money using alternative 4.

In order to accomplish the needed benefit, buyouts of three (3) homes sitting a foot lower than the rest of the homes will be necessary. A project with enough detention or channelization that lowers the flood waters below these three houses is not cost effective. A channelization project would require widening a channel for 6900 linear feet and purchasing additional right-of-way. The cost of channelization would be slightly more and would require two gravity sewer line adjustments using inverted siphons which are a constant maintenance problem. Creating detention basins is the best alternative.

HYDROLOGIC AND HYDRAULIC ANALYSIS

The capacity of the existing and proposed drainage system was analyzed using computer programs based on the Manning Flow Equation for culverts and open channels. The volume of water stored in flooded areas was calculated using a contour map generated from collected field data. Also included was the volume of water stored in ditches and culverts.

The U.S. Army Corps of Engineers' program HEC-1 was utilized to calculate flows of various locations in the watershed. Inputs into the HEC-1 model were area, time of concentration, soil properties, amount of impervious cover, storage coefficients and rainfall distributions. The relationship of each sub-area to the other was also defined, as well as the flood hydrograph routes. The Modified-Puls Routing Method was used to analyze existing flooding, as well as, to size proposed detention basins. The storage, outflow, elevation relationship was carefully determined and inserted into the model.

The flow rates calculated were compared to the existing capacity and alternatives were analyzed providing the most practical, economical and environmentally appropriate solution to the problems. Downstream areas were taken into consideration and alternatives were chosen, which make sense for the entire area.

GROUND AND VEGETATION DISTURBANCE

This project involves demolishing five (5) houses, excavating 7.7 acres 4 feet deep, and laying a culvert along a public street. The ground to be disturbed is open yards and fields. A few small trees exist around the perimeter of the basins and will be saved if possible. Upon completion, the excavated area will be seeded with grass, and will become a permanent green space in the addition. No wetlands are affected by this project.

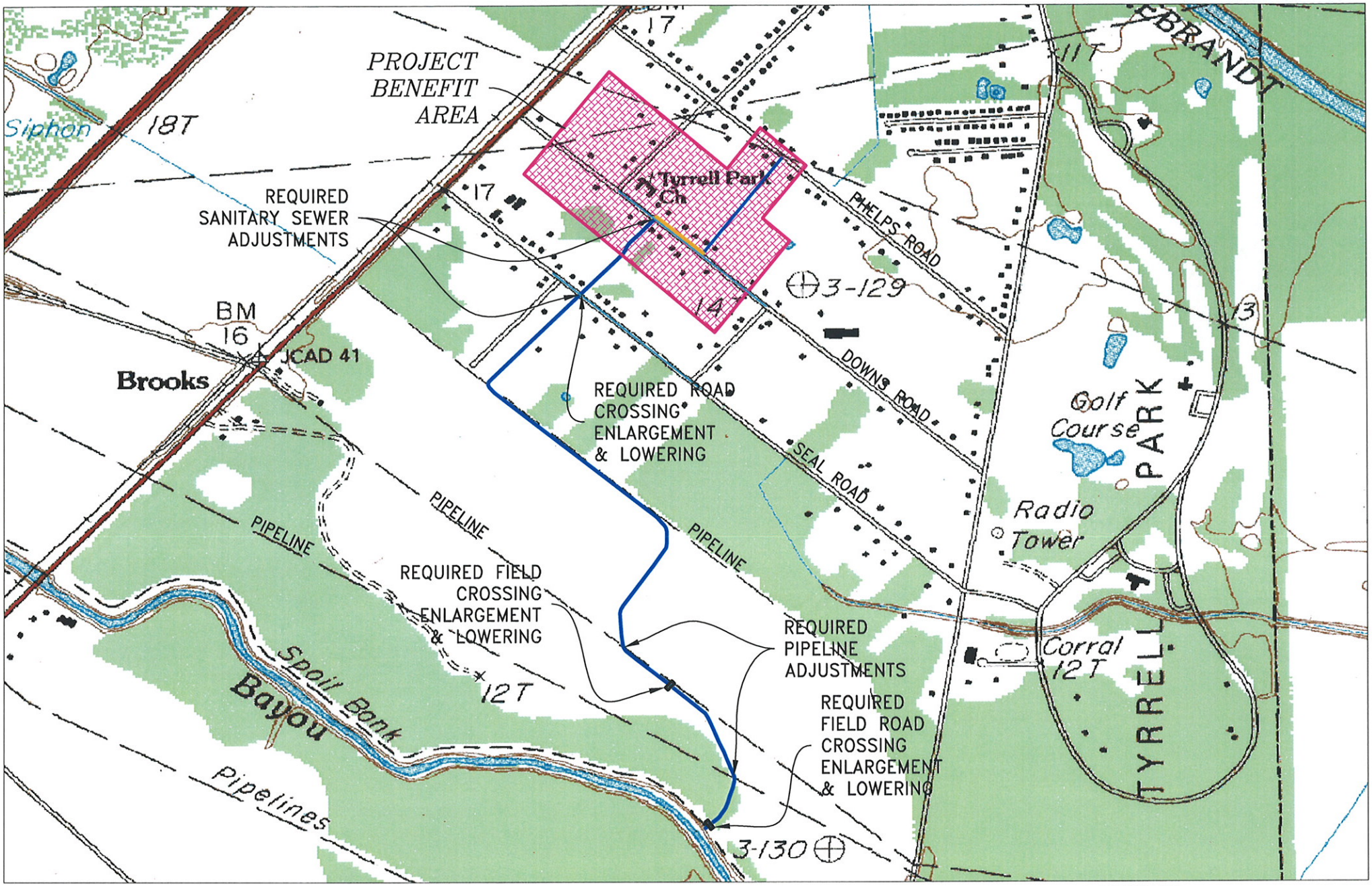
TYRRELL PARK — COST ESTIMATE

ITEM	QUANTITY UNIT	UNIT COST	TOTAL COST
House Acquisition	5 ea.	$75,000.00	$375,000.00
Property Acquisition	7 acres	$20,000.00	$140,000.00
Excavation	45,000 cu. yds.	$5.00	$225,000.00
30" Culvert	350 L.F.	$70.00	$24,500.00
Street Repair	800 sq. yds.	$50.00	$40,000.00
Downspout & Aprons	12 ea.	$1,400.00	$16,800.00
Seeding	9 acres	$500.00	$4,500.00
Dress-up	1 ea.	$5,000.00	$5,000.00
		SUB-TOTAL	$830,800.00

COST ESTIMATE	$830,800.00
5% ADMINISTRATIVE COSTS	$41,540.00
ENGINEERING COSTS	$25,000.00
TOTAL	**$897,340.00**

THE SOURCE AND TYPE OF PROBLEM

The heavy rains we experience, coupled with the flat topography of the area, are the sources of the problem. There is not enough elevation change from the problem area to the outfall to convey flood flows below ground economically.



LEGEND:

PROPOSED CHANNEL ENLARGEMENT

PROPOSED CROSSING IMPROVEMENTS

JEFFERSON COUNTY
DRAINAGE DISTRICT #6
TYRRELL PARK PROJECT & BENEFIT AREA
CHANNELIZATION ALTERNATIVE
ON USGS QUADRANGLES
FANNETT WEST & FANNETT EAST

Tyrrell Park 100yr. existing 1 of 4

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1*****************************************
 *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *               JUN   1998              *
 *            VERSION 4.1                *
 *                                       *
 *  RUN DATE   02MAR09  TIME  14:21:38   *
 *                                       *
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*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*          (916) 756-1104               *
*                                       *
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X     X  XXXXXXX   XXXXX           X
X     X  X        X     X         XX
X     X  X        X                X
XXXXXXX  XXXX     X        XXXXX   X
X     X  X        X                X
X     X  X        X     X          X
X     X  XXXXXXX   XXXXX           XXX
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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

1 HEC-1 INPUT PAGE 1

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

   1          ID   Tyrrell Park
   2          ID   6 Storms
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```
 3          ID
 4          IT      15  1JAN08    1200      96
 5          IO       5       0

 6          KK   SUB A
 7          KM   COMPUTE HYDROGRAPH AT SUB A NODE 1
 8          KM   EXP LOSS RATE CLARK UNIT HYDROGRAPH
            * PH    20       1    0.89    1.73    3.10    3.80    4.25    5.10    6.20    7.
            * PH    10       1    1.00    1.95    3.42    4.40    4.80    6.10    7.50    8.
            * PH     4       1    1.15    2.23    4.09    4.96    5.70    7.07    8.65   10.
            * PH     2       1    1.24    2.40    4.20    5.53    6.30    8.00    9.90   11.
 9          PH       1       1    1.37    2.66    4.70    6.20    7.00    8.80   11.00   13.00
            * PH    .2       1    1.64    3.15    5.64    7.44    8.40   10.56   13.20   15.
10          BA    .123
11          LE      .3       0      10      .7      10
12          UC    0.50      .8

13          KK     RES
14          RS       1    FLOW      -1
15          KM   Flooded Areas along Phelps and Seale
16          SV       0       5      11      15      30
17          SQ       0      33      66      86     130
18          SE      10    11.5    14.5    15.5      17
            * KM Excavate Detention Incraese flow from Phelps
            * SV     0       7      14      15      30
            * SQ     0      50     100      86     130
            * SE    10    12.0    13.5    14.5      16

19          KK   SUB B
20          BA    .083
21          LE      .3       0      10      .7      22
22          UC    0.50      .8

23          KK    COM2
24          HC       2

25          KK     RES
26          RS       1    FLOW      -1
27          KM   Flooded Area along Downs Rd.
28          SV       0       5      10      20      40
```

Tyrrell Park


```
           29           SQ       0      70     140     200     250
           30           SE      10    13.0    15.0    16.0      17
           31           ZZ
1*****************************************
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*                                       *
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Tyrrell Park
6 Storms

```
  5 IO          OUTPUT CONTROL VARIABLES
                      IPRNT           5  PRINT CONTROL
                      IPLOT           0  PLOT CONTROL
                      QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN          15  MINUTES IN COMPUTATION INTERVAL
                      IDATE      1JAN 8  STARTING DATE
                      ITIME        1200  STARTING TIME
                         NQ          96  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE      2JAN 8  ENDING DATE
                     NDTIME        1145  ENDING TIME
                     ICENT           19  CENTURY MARK

                  COMPUTATION INTERVAL      .25 HOURS
                       TOTAL TIME BASE    23.75 HOURS

        ENGLISH UNITS
             DRAINAGE AREA         SQUARE MILES
```

Tyrrell Park

100 yr existing 4 of 4

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

1

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 6-HOUR	24-HOUR	72-HOUR	BASIN AREA	MAXIMUM STAGE	TIME OF MAX STAGE
	HYDROGRAPH AT									
+		SUB A	264.	12.50	97.	34.	34.	.12		
	ROUTED TO									
+		RES	108.	13.75	86.	33.	33.	.12		
+									16.24	13.75
	HYDROGRAPH AT									
+		SUB B	181.	12.50	67.	24.	24.	.08		
	2 COMBINED AT									
+		COM2	265.	12.50	149.	57.	57.	.21		
	ROUTED TO									
+		RES	177.	13.75	145.	56.	56.	.21		
+									15.62	13.75

*** NORMAL END OF HEC-1 ***

Tyrrell Park

100 yr proposed 1 of 4

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1*****************************************
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*                                       *
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X     X  XXXXXXX   XXXXX           X
X     X  X        X     X         XX
X     X  X        X                X
XXXXXXX  XXXX     X        XXXXX   X
X     X  X        X                X
X     X  X        X     X          X
X     X  XXXXXXX   XXXXX           XXX
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1 HEC-1 INPUT PAGE 1

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```

Tyrrell Park 100yr. proposed 2 of 4

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3           ID
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6           KK   SUB A
7           KM   COMPUTE HYDROGRAPH AT SUB A NODE 1
8           KM   EXP LOSS RATE CLARK UNIT HYDROGRAPH
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15          KM   Excavate Detention Incraese flow from Phelps
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18          SE      10    12.0    13.5    14.5      16

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25          KK     RES
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```

Tyrrell Park 100 yr proposed 3 of 4

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            29           SQ       0      70     140     200     250
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            31           ZZ
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Tyrrell Park
6 Storms

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        ENGLISH UNITS
             DRAINAGE AREA         SQUARE MILES
```

Tyrrell Park 100yr proposed 4.14

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

1

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TIME IN HOURS, AREA IN SQUARE MILES

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+		RES	106.	13.75	88.	33.	33.	.12		
+									15.17	13.75
	HYDROGRAPH AT									
+		SUB B	181.	12.50	67.	24.	24.	.08		
	2 COMBINED AT									
+		COM2	280.	12.50	151.	57.	57.	.21		
	ROUTED TO									
+		RES	178.	13.75	147.	56.	56.	.21		
+									15.64	13.75

*** NORMAL END OF HEC-1 ***