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Mr. Don Huml
Executive Director
Memorial City Redevelopment Authority / TIRZ 17
8955 Katy Freeway, Suite 215
Houston, Texas 77024

Re: Feasibility Analysis Report for Additional Detention West of Gessner Road
(CIP # T-1735, Detention Basins)

Dear Mr. Huml:

Klotz Associates was retained by the TIRZ 17 in reference to CIP # T-1735, for civil engineering services to prepare a Feasibility Analysis in support of the evaluation of a regional detention basin on an existing 9.5 acre apartment complex site near the intersection of Westview Drive and Conrad Sauer Drive. Originally scoped to evaluate multiple inflow / outflow pipe configurations for the 2-, 10-, and 100-year event along with mutliple detention basin layouts including potential amenity features, the scope was revised to assist in expediting the evaluation of this feasibility to meet the schedule of TIRZ 17.

Klotz Associates performed the evaluation for the 10- and 100-year event to identify the benefits to the system during larger, more impactful events, and evaluated a single basin configuration based on the current apartment property limits. Klotz Associates identified five (5) alternatives to determine the potential benefit along Gessner and Conrad Sauer, upstream of IH-10, from the diversion and detention of flows off Gessner. The nature of this feasiliblty report is to assist TIRZ 17 with their decision to acquire additional ROW to construct said basin based on cost/benefit analysis.

EVALUATION

Klotz Associates reviewed the Regional Drainage Study (RDS), as prepared by Lockwood, Andrews, & Newnam, Inc. (LAN), and assumed the RDS's Ultimate Condition model as the base Existing Conditions to evaluate impacts and benefits from an additional regional detention basin west of Gessner, along Westview. Klotz Associates developed the plan for the evaluation and sub-contracted with LAN to perform the modeling of five (5) specific inflow / outflow configurations in InfoWorks ICM. Klotz Associates reviewed the results, worked with LAN to model adjustments as necessary, and prepared this Feasibility Report to summarize the output and provide recommendations for the potential benefit of the proposed basin.

The detention basin layout was evaluated based on 4-foot horizontal to 1-foot vertical (4:1) side slopes with a 30-foot maintenance berms around the top of bank (TOB). Average depth in the basin was estimated to be approximately 12-feet (TOB ~ 82-ft and bottom ~ 70-ft), with a 1-foot deep pilot channel along the eastern toe of slope. The pond bottom is proposed to have a 0.75%

transverse slope to provide positive drainage towards the pilot channel while still allowing for amenities to be constructed in the large open area on the bottom.

The maximum volume to be obtained within the basin is estimated to be approximately 65 acre-feet at a maximum WSE of 81.5-feet (NAVD 1988 – 2001 Adj).

The five (5) alternatives evaluated for the 10- and 100-year storm events are as follows:

1. 36" reinforced concrete pipe (RCP) along Westview diverting flows from Gessner into the basin, and a separate 24" RCP along Westview taking flows back to Gessner,
2. 48" RCP along Westview diverting flows from Gessner into the basin, and a separate shorter 24" RCP outfall to Conrad Sauer,
3. Single 60" RCP connecting the basin to Gessner to allow the basin to "float" off the Gessner drainage system (Allows flow in both directions as needed),
4. 60" RCP along Westview diverting flows from Gessner into the basin, and a separate 24" RCP along Westview taking flows back to Gessner.
5. 60" RCP along Westview diverting flows from Gessner into the basin with a restrictor at Gessner to further divert flows, and a separate shorter 24" RCP outfall to Conrad Sauer.

The existing drainage system along Conrad Sauer is approximately 3-feet deeper than Gessner's drainage system, so a smaller pipe was added to Alternatives 1, 3, & 4 to maximize the available detention volume and deepen the overall system. This would allow the low flows to outfall to Conrad Sauer to maximize the basin volume, while a backflow preventer was modeled to prevent the basin from filling up with flows from Conrad Sauer.

Alternative 5 was added to the evaluation after initial modeling efforts revealed that by diverting water off Gessner, the WSE dropped enough to then not fully utilize the basin volume because of the lowered HGL between the Gessner and Conrad Sauer systems. A restrictor was added to the model just downstream of the Gessner & Westview interconnect to force water to be diverted down Westview and into the basin. The results of each alternative are below, with a summary of the ponded WSE reduction at nine (9) strategic locations, see Exhibit 1, included in Table 1 – 100-yr Summary and Table 2 – 10-yr Summary.

ALTERNATIVES

Alternative #1 – 36" RCP diversion w/ 24" outfall back to Gessner

This alternative consists of constructing approximately 650-feet of 36" RCP from Gessner along Westview to the proposed regional detention basin site near Conrad Sauer. A 24" RCP outfall will drain the waters back to Gessner along Westview. The layout of the pipes into and out of the basin will be configured to prevent short circuiting of the volume as part of the final design phase. After initial evaluation, this alternative had a small low-flow outfall to Conrad Sauer added to gain additional depth within the system.

This alternative didn't allow the basin to be fully utilized as it didn't allow enough flow to be diverted off Gessner. The maximum WSE in the basin for this alternative was 77.2-feet, leaving approximately 4.5-feet of volume unused. This alternative reduced the flows in Gessner at Westview from 325 cfs to around 275 cfs. The reduction in flows and ponded WSE along Gessner, Westview, and the adjoining neighborhood are shown in Tables 1 and 2. A layout of the benefits can be seen on Exhibit 2 – Alternative #1.

Alternative #2 – 48" RCP diversion w/ 24" outfall to Conrad Sauer
This alternative consists of constructing approximately 650-feet of 48" RCP from Gessner along Westview to the proposed regional detention basin site near Conrad Sauer. A 24" RCP outfall to Conrad Sauer will maintain the diversion of flows off Gessner and ultimately drain to the COH pumped detention along Mathewson Lane.

Again, this alternative didn't fully utilize the available volume in the basin as it didn't allow enough flow to be diverted off Gessner. The maximum WSE in the basin for this alternative was 79.0-feet, leaving approximately 3.0-feet of volume unused. This alternative reduced the flows at Gessner at Westview from 325 cfs to around 235 cfs. The reduction in flows and ponded WSE along Gessner, Westview, and the adjoining neighborhood are shown in Tables 1 and 2. A layout of the benefits can be seen on Exhibit 3 – Alternative #2.

Alternative #3 – 60" RCP equalizer pipe between Gessner and the Basin
This alternative consists of constructing approximately 650-feet of 60" RCP from Gessner along Westview to allow the basin to float off the Gessner system and have water flow both directions. After initial evaluation, this alternative had a small low-flow outfall to Conrad Sauer added to gain additional depth within the system.

This alternative appeared to fill the basin to within 1.0 foot of max WSE, but still did not fully utilize the available volume in the basin. Approximately 8 acre-feet of volume is unused in this alternative. This alternative reduced the flows at Gessner at Westview from 325 cfs to around 200 cfs. The reduction in flows and ponded WSE along Gessner, Westview, and the adjoining neighborhood are shown in Tables 1 and 2. A layout of the benefits can be seen on Exhibit 4 – Alternative #3.

Alternative #4 – 60" RCP diversion w/ 24" outfall back to Gessner
This alternative, similar to Alt #1, consists of constructing approximately 650-feet of 60" RCP from Gessner along Westview to the proposed regional detention basin site near Conrad Sauer. A 24" RCP outfall will drain the waters back to Gessner along Westview. The layout of the pipes into and out of the basin will be configured to prevent short circuiting of the volume as part of the final design phase. After initial evaluation, this alternative had a small low-flow outfall to Conrad Sauer added to gain additional depth within the system.

This alternative matched Alt #3 for max volume and WSE utilized, but again had approximately 8 acre-feet of volume unused. This alternative, however, reduced the flows at Gessner at Westview from 325 cfs to around 185 cfs. The reduction in flows and ponded WSE along Gessner, Westview, and the adjoining neighborhood are shown in Tables 1 and 2. A layout of the benefits can be seen on Exhibit 5 – Alternative #4.

Alternative #5 – 60" RCP diversion w/ 24" outfall to Conrad Sauer and Restrictor in Gessner
This alternative consists of constructing approximately 650-feet of 48" RCP from Gessner along Westview to the proposed regional detention basin site near Conrad Sauer. A 24" RCP outfall to Conrad Sauer will maintain the diversion of flows off Gessner and ultimately drain to the COH pumped detention along Mathewson Lane.

This alternative fully utilized the available volume in the basin at a maximum WSE of approximately 81.5-feet. This alternative reduced the flows at Gessner at Westview from 325 cfs to around 150 cfs. The reduction in flows and ponded WSE along Gessner, Westview, and the adjoining neighborhood are shown in Tables 1 and 2. A layout of the benefits can be seen on Exhibit 6 – Alternative #5.

ASSUMPTIONS

Several assumptions were made as part of the feasibility evaluation, and they are listed as follows:

1. The currently proposed improvement projects within TIRZ 17 have been constructed, including Briar Branch, Gessner, Bunker Hill Bridge, and the Straws.
2. The proposed site of the detention basin will be abandoned and cleaned out prior to start of demolition as part of this construction contract.
3. The site is clear of significant environmental, historical, and wetlands issues.
4. The demolition and removal of existing structures can be done without significant environmental issues (including lead paint).
5. The construction cost estimates do not included any park, trail, or other amenities.
6. The basin will be constructed to HCFCD standards for potential acceptance into the HCFCD Maintenance Program (30-ft maintenance berm, 4:1 side slopes, pilot channel, etc.)
7. Estimates an available average depth in the basin of 12-ft, with a usable depth for volume of 10-ft, subtracting 1-ft of freeboard and 1-ft deep pilot channel.

RESULTS

Based on initial evaluation of the five (5) alternatives discussed above, Klotz Associates summarized the benefits in terms of reduced ponded WSE at nine (9) strategic locations to get a sense of the impacts of each scenario. Each alternative was evaluated for the both the 100-year and 10-year events.

Table 1 - 100-year Summary (Depth of Ponding)

No.	Node	Existing	Alt #1	Alt #2	Alt #3	Alt #4	Alt #5
1	Gessner @ Westview	0.24	0.21	0.20	0.19	0.19	0.20
2	Gessner @ Larston	1.63	1.56	1.50	1.43	1.43	1.33
3	Gessner (U/S of IH-10)	2.22	2.23	2.18	2.11	2.11	2.01
4	Conrad @ Westview	0.13	0.12	0.12	0.11	0.11	0.11
5	Conrad @ Mathewson	0.93	0.91	0.91	0.88	0.88	0.87
6	Conrad (U/S of IH-10)	1.07	1.07	1.07	1.06	1.06	1.05
7	Cedardale (Near Witte)	2.25	2.19	2.15	2.08	2.08	1.98
8	Larston (Near Witte)	2.59	2.53	2.48	2.41	2.41	2.31
9	Demaret @ Cedardale	1.31	1.26	1.23	1.20	1.20	1.15

Table 2 - 10-year Summary (Depth of Ponding)

No.	Node	Existing	Alt #1	Alt #2	Alt #3	Alt #4	Alt #5
1	Gessner @ Westview	0.08	0.07	0.07	0.06	0.06	0.07
2	Gessner @ Larston	1.13	1.07	1.02	0.97	0.96	0.83
3	Gessner (U/S of IH-10)	1.59	1.56	1.48	1.38	1.38	1.20
4	Conrad @ Westview	0.00	0.00	0.00	0.00	0.00	0.00
5	Conrad @ Mathewson	0.17	0.16	0.16	0.16	0.16	0.16
6	Conrad (U/S of IH-10)	0.00	0.00	0.00	0.00	0.00	0.00
7	Cedardale (Near Witte)	1.48	1.39	1.31	1.19	1.19	1.01
8	Larston (Near Witte)	1.18	1.07	0.99	0.84	0.84	0.70
9	Demaret @ Cedardale	0.69	0.67	0.64	0.60	0.60	0.57

The additional benefits of this regional detention are a reduction in volume of sheet flow that would be conveyed down Gessner south of Westview. Alternative 5 provides for a diversion and reduction in approximately 28 acre-feet of water that would have been sheet flow down Gessner into the neighborhoods east of Westview and into the commercial areas along IH-10.

Alternative 5 appears to have the greatest benefit to the area and will be further discussed as the suggested layout / configuration.

COST

The construction cost estimates were prepared based on the demolition and excavation portions of the project are similar across all alternatives with the only variable being the inflow / outflow pipe configuration and associated appurtenances. The construction cost estimates, which include a 25% contingency, also include soft costs such as Engineering, Surveying, Geotech Investigation, Construction Phase Services, Field Project Representation, and Construction Material Testing during construction. The land cost for the 9.5 acre site is also estimated to be approximately $15,500,000. Total Project costs for the five alternatives ranged from **$20,706,000** to **$21,567,000**. Table 3A – Table 3E identify the potential costs for each respective alternative, and are summarized below:

Table 4 – Construction Cost Estimate Summary

Alt.	Pipe Configuration	Construction Cost	Soft Cost	Land Cost	Total Cost
1	36" Inflow from Gessner 24" Outfall to Gessner	$4,358,900	$959,100	$15,500,000	**$20,818,000**
2	48" Inflow from Gessner 24" Outfall to Conrad Sauer	$4,267,300	$938,800	$15,500,000	**$20,706,100**
3	60" Combined Inflow & Outfall to Gessner	$4,592,600	$1,010,400	$15,500,000	**$21,103,000**
4	60" Inflow from Gessner 24" Outfall to Gessner	$4,977,600	$1,095,100	$15,500,000	**$21,572,700**
5	60" Inflow w/ Restrictor 24" Outfall to Conrad Sauer	$4,617,300	$1,015,800	$15,500,000	**$21,133,100**

IMPACTS / BENEFITS

The benefits appear to be split between the areas north of IH-10 inside the TIRZ 17 boundaries and the neighborhood just north of Briar Branch, east of Westview. Based on Alternative 5, approximately 50 structures are shown to be removed from flooding in the 100-yr event, of which 15 are inside the TIRZ 17 boundaries and 35 are located north in the adjacent neighborhoods.

This calculation is based on estimated finished floor elevation as compared to ponded WSE. As seen in Tables 1 and 2, the amount of reduction is minimal in some areas, so the number of structures removed includes those that are removed by less than an inch, so for this feasibility evaluation, we estimated that 60% of those structures removed are of true benefit, with the remaining 40% still considered to have a strong potential of flooding.

Average "improvement" values were determined using Harris County Appraisal District (HCAD) parcel data for the areas inside and outside the TIRZ and an estimated total value of structures removed within each area was calculated. The potential benefit to the area inside the TIRZ was estimated to be **$3,600,000** worth of structures removed from the flooding potential and **$1,680,000** removed outside the TIRZ boundaries in the adjacent neighborhood.

Table 5 – Summary of Structures Benefitted

Area of Impact	# of Structures Removed	Average Value of Improvements (HCAD)	Estimated Value of Removed Structures
Inside TIRZ 17	9	$400,000	**$3,600,000**
Outside TIRZ 17	21	$80,000	**$1,680,000**

CONCLUSIONS

Based on the evaluation of these potential alternative configurations of inflow and outflow pipes, the proposed regional detention basin appears able to provide the maximum benefit with a large diversion pipe from Gessner, along with a restrictor to assist in "pushing" water down Westview and reducing the volume of water that sheet flows further south.

With the net reduction in ponding through the project area, as well as a decrease in peak flows at the outfalls at W151-00-00 and Briar Branch, this project will have no net impact on the system or the downstream areas. A comparison of the value of the structures removed from flooding to the overall project costs indicate *that this project cannot be justified on an economic basis*. The TIRZ 17 Board may have non-economic factors it wants to consider as part of the final decision.

We appreciate this opportunity to work with TIRZ 17 and helping you evaluate this interesting and potentially beneficial project for the area. We look forward to working with you again on the additional CIP projects in the coming months.

Sincerely,

Gary Struzick, P.E.
Vice-President

William Conlan, P.E.
Stormwater Department Manager