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November 21, 2012

Mr. Roger Hansen – Airport Manager
Gillespie County Airport
101 W. Main – Unit 9
Fredericksburg, TX 78624

Re: Master Plan Drainage Report
City of Fredericksburg, TX
TxDOT CSJ 1214FRBRG
Klotz Associates Project No. 0500.036.000

Dear Mr. Hansen,

Klotz Associates, Inc. is pleased to submit the Master Plan Drainage Report for the future build out of the Gillespie County Airport, located just outside of Fredericksburg, see Exhibit 1 – Vicinity Map. The report outlines the near-term and long-term drainage improvement projects necessary to fully mitigate the proposed future development within the airport complex. The plan breaks the future development into three (3) phases as follows:

Phase 0 - Pre-Development Improvements (Interim)
Phase 1 – Near-Term Improvements (Proposed)
Phase 2 – Long-Term Improvements (Ultimate)

Gillespie County Airport encompasses approximately 201.4 acres, with approximately 143.9 additional acres being off-site. Runoff from both on-site and off-site areas drain towards its two outfalls. The report models the existing, interim, proposed, and ultimate conditions of the airport to define the flows (release rates) at the two outfalls leaving the property, see Exhibit 2a – Drainage Area Map (Existing). Outfall-1 is the existing 36-inch reinforced concrete pipe (RCP) that drains southwest into Lady Bird Johnson Municipal Park and Golf Course (Lady Bird Park). Outfall-2 is the existing dual three-foot by four-foot (2~3'x4') reinforced concrete box (RCB) that drains to the southeast under State Highway 16 (SH 16). This report defines the necessary on-site drainage and detention facilities to mitigate the developed flows from the revised drainage patterns and proposed increased impervious cover to below the existing condition allowable release rates.

Based on the current City of Fredericksburg drainage criteria, storm water detention ordinance, and conversations with the City's Engineering Department and TxDOT's Hydraulic Section, a hydrology study was developed comparing the pre- and post-development storm water runoff. A HEC-HMS model, Version 3.5, was developed for the existing condition, along with a proposed condition, and a fully built-out ultimate condition. An interim condition model was created to assist with the necessary improvements to mitigate the initial revised drainage patterns. An SCS Hydrograph, based on Curve Numbers, was developed to analyze the storm water runoff for the 2-, 10-, and 100-year storm events (see

Table 1 for the model input and Tables 3-5 for model output). The resulting storm water runoffs were routed through the existing and proposed detention facilities to determine the maximum storage elevation and peak outfall in each condition, as noted below.

EXISTING CONDITION

The majority of the existing development within the airport currently drains through an existing detention basin located north of the airport terminal apron, locally referred to as the "Buffalo Wallow," before flowing under the taxiway and runway and ultimately through the Lady Bird Park at Outfall-1, see Exhibit 3a – HMS Layout (Existing). Off-Site Areas #2 and #3 drain south through an existing swale along the airport's property line and combine with the southern half of the runway and taxiway and ultimately outfall at Outfall-2 under SH 16. The drainage area summary table, including the acreages, SCS Curve Numbers, and Lag Times are shown in Table 1 – HMS Input Summary.

During large rain events, the water in the Buffalo Wallow can also be diverted to the south along the taxiway through a 30-inch culvert under the cross taxiway, down the east side ditch, through a set of 24-inch RCPs and ultimately flow south into Outfall-2's system. The detention and diversion rating tables are shown in Table 1. The existing condition allowable release rates at the two outfalls are:

Storm Event	Outfall-1 (Lady Bird Park)	Outfall-2 (SH 16)
100-Year	312.8 cfs	1,127.9 cfs
10-Year	151.6 cfs	664.3 cfs
2-Year	58.4 cfs	319.1 cfs

PROPOSED CONDITION

Based on the recently updated "Airport Layout Plan" (ALP), several proposed improvements have been identified for future projects that are anticipated being constructed within the current boundaries of the airport, see Exhibit 4 – ALP Drainage Improvement Phasing. Additionally, the airport has a future plan to potentially expand outside of the current property boundaries, and will be considered as the ultimate condition model. The future development identified as proposed in the model is predominantly located within Drainage Areas (D.A.) A-1N, A-1S, A-3, A-4, and IP (Industrial Park), see Exhibit 2b – Drainage Area Map (Proposed) and Exhibit 3b – HMS Layout (Proposed). The increased impervious cover will be mitigated from two (2) proposed projects, namely the construction of Reservoir #1 and the modification to the Buffalo Wallow detention basin.

Reservoir #1 will be constructed to receive the developed flows from D.A. A-1N and IP directly, and outfall through a 30-inch RCP (Reach #4) into the regraded outfall swale south of Fair Drive at Junction #2. This is effectively a diversion of 48.2 acres that drained to Outfall-1 in the existing condition into the Outfall-2 system. This diversion will be offset by a berm placed near the outfall from the Buffalo Wallow to block the existing diversion into D.A. A-2 and contain the proposed flows within the Outfall-2 system. This removal of acreage and associated flows allows the construction of the proposed runway and

taxiway extension at the north end of the airport and a series of hangars within D.A. A-1S and A-3, without additional mitigation.

Additionally, the modifications to the Buffalo Wallow include reducing the footprint of the existing detention basin, and reclaiming approximately 2.5 acres of developable land along Airport Road for future apron and hangars. The volume will be modified through deepening the bottom to tie directly into the existing 36-inch RCP outfall by removing the inlet drop structure. This modification will reduce the volume within the basin from 14.7 acre-feet (ac-ft) to 5.0 ac-ft, but will still provide enough detention to control the proposed release rate at Outfall-1 to less than the existing condition.

Due to the reallocation of flow that will be diverted into Reservoir #1 and ultimately Outfall-2, approximately 4.3 acres will be allowed to be developed within Outfall-1's system once the culverts are removed under Airport Road without further mitigation, namely the Runway 14 extension and west hangar expansion. The remaining 9.3 acres of proposed development within the Outfall-1 system will be mitigated within the modified Buffalo Wallow. The Buffalo Wallow modification cannot be phased and will need to be constructed simultaneously with the final build out of this area.

D.A. A-1N and IP will drain directly into Reservoir #1 while the proposed improvements in D.A. A-4 will be mitigated from the over-detained release rate coming out of Reservoir #1. The detention volume needed to fully mitigate the 39.2 acres of future impervious cover within this system is 23.6 ac-ft. The total excavated volume to obtain 23.6 ac-ft of detention volume is approximately 47,600 cy, and this equates to a 0.75 ac-ft/ac detention factor for this area, or approximately 1,210 cubic yards (cy) of detention excavation for every acre of future impervious cover. By recommending the airport excavate the entire volume within Reservoir #1 as part of the Phase-0 improvements, an "Impact Fee" could be implemented for the purchase of detention capacity within the basin at a typical construction cost of $10.00 per cy, or $12,100 per acre of increased impervious cover.

The proposed condition release rates at the two outfalls are:

Storm Event	Outfall-1 (Lady Bird Park)	Outfall-2 (SH 16)
100-Year	246.0 cfs	1,074.4 cfs
10-Year	131.1 cfs	635.4 cfs
2-Year	57.0 cfs	305.6 cfs

ULTIMATE CONDITION

The ultimate condition model includes the potential improvements to the airport when additional land is acquired along the southeast edge of the taxiway, between Junction #2 and #3, see Exhibit 2c – Drainage Area Map (Ultimate) and Exhibit 3c – HMS Layout (Ultimate). The additional hangar and taxiway space will require mitigation to be provided within Reservoir #2 just downstream of Junction #2. Additionally, these improvements will require the realignment of the outfall drainage swale to run parallel to the future airport entrance drive.

The ultimate build out of the future improvements within D.A. A-4 and OF-3 will be mitigated by Reservoir #2, along with the relocated outfall channel along the future airport entrance drive to Junction #3. The detention volume needed to fully mitigate the 16.7 acres of future impervious cover within this system is 4.5 ac-ft. The excavated volume to obtain 4.5 ac-ft of detention volume equates to a 0.35 ac-ft/ac detention factor for this area, or approximately 565 cubic yards (cy) of detention excavation for every acre of future impervious cover.

Reservoir #2 will be constructed in phases just south of Fair Drive, adjacent to the existing channel flowing south along the airport's property line. This basin will intercept flows from D.A. OF-2, as well as the outfall from Reservoir #1. A proposed weir structure with low flow pipe will be designed and constructed at the southern end of the ultimate basin to control flows. The airport will be responsible for construction the future main access road, the channel realignment and the ultimate outfall structure for Reservoir #2. Each future development as part of the ultimate phase will be responsible for 0.35 ac-ft of excavation per acre of increased impervious cover.

The ultimate condition release rates at the two outfalls are:

Storm Event	Outfall-1 (Lady Bird Park)	Outfall-2 (SH 16)
100-Year	246.0 cfs	967.5 cfs
10-Year	131.1 cfs	505.9 cfs
2-Year	57.0 cfs	240.2 cfs

IMPLEMENTATION PLAN

This study has been prepared to establish a drainage plan to accommodate future growth at the Gillespie County Airport. As the airport development comes in, each system is proposed to have a specific detention factor associated with the future development within that area, based on the phasing of the improvement projects are shown in Exhibit 4 – ALP Phasing - Drainage Improvements. However, before any growth can take place, some improvements have to be made to the existing infrastructure. These improvements have been developed and referenced as Phase-0 (Interim). Exhibits 5a, 5b, 5c, and 5d document the general scope of work that is necessary to set the groundwork for future airport expansion. The Phase-0 (Interim) scope includes:

- Lower Airport Road (North) and install a 48" Culvert to drain D.A. A-1N towards Reservoir #1
- Construct full excavation within Reservoir #1 along Airport Road to Crosswind Lane
- Install 30-inch RCP storm sewer between Fair Drive and Airport Road
- Construct drainage ditch to convey flows to existing ditch, including improvements to deepen existing outfall channel, along eastern property line
- Plug and abandon existing storm sewer culverts under Airport Road at Buffalo Wallow
- Construct berm adjacent to taxiway to hydraulically separate the Buffalo Wallow from the existing diversion structure

These improvements will allow for the 100-yr flows from D.A. A-1N and IP to be moved from System #1 at Lady Bird Johnson Municipal Park and Golf Course to System #2 at SH 16 with no impact.

The estimated construction cost for the work noted above is $675,000, and with 15% contingency, the improvements are approximately $775,000. This does not include geotechnical or surveying for the project area, or design and construction oversight costs. A preliminary detailed cost estimate is provided in Table 2 – Phase-0 (Interim) Cost Estimate. Additionally, it was considered to phase the Phase-0 improvements by excavating a portion of the volume within Reservoir #1 and constructing a larger outfall pipe (estimated as a 66-inc RCP) to convey the higher flows from less detention, but the cost savings, approximately $50,000, were not significant enough to recommend phasing the excavation within Reservoir #1. The benefit of excavating the full volume at once is the proposed development can be constructed much quicker, the turf establishment and slope protection within the basin will not be impacted with repetitive excavation projects, and the outfall structure and pipe will not require incremental sizing reductions to restrict flows based on additional volume.

Once the Phase-0 (Interim) improvements are complete, approximately 4.3 acres will be allowed to be developed within Outfall-1's system, namely the Runway 14 extension and west hangar expansion. Additionally, all future development within the Outfall-2 system, as identified in the ALP as "proposed", will be allowed to develop by paying an impact fee to purchase mitigation capacity in the recently constructed Reservoir #1.

The modification to the Buffalo Wallow detention system and outfall will allow the development of approximately 9.3 acres of additional apron and hangars along Airport Road. These improvements should be constructed simultaneously and cannot be phased.

The ultimate build out of the airport will occur upon acquisition of the additional land at the southeast corner of the airport, within D.A. OF-3. The improvements will include additional hangars and aprons along the taxiway, a future main entrance drive, and realignment of the existing outfall channel. Reservoir #2 will be constructed to provide 4.5 ac-ft of mitigation for the 16.7 acres of increased impervious cover. The road will encompass approximately 1.2 acres, requiring approximately 675 cy of detention. The airport will be responsible for construction the road, the channel realignment and the ultimate outfall structure for Reservoir #2, along with 675 cy of volume. Each future development as part of the ultimate phase will be responsible for 0.35 ac-ft of excavation per acre of increased impervious cover.

The land currently set aside in the ALP for the ultimate detention, see Exhibit 2c, is larger than needed for the anticipated airport development. The potential for a partnership exists with the adjacent offsite areas to utilize a portion of this set aside area for future expansion to the detention basin, or to provide additional mitigation should the future development within the airport be constructed at an impervious cover greater than currently designed for.

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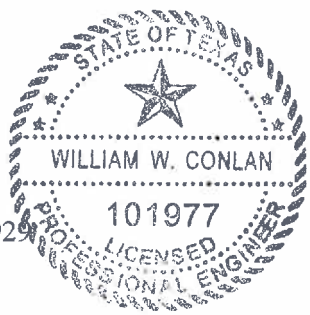
CONCLUSION

Based on a comparison of the hydrographs for the areas and at the two outfalls, there is no increased peak flow from the 2- through 100-year return period. Table 3 – 5 HMS Output Summary details the results from the HEC-HMS model. The 100-year water surface elevation in the pond is below the existing or proposed top of banks and conveyed within the proposed culverts.

Klotz Associates has prepared this Master Drainage Plan to assist with the future build-out of the Gillespie County Airport and to provide guidance for the drainage mitigation necessary for the design of the proposed improvements. Each future project will include a simplified validation of the phasing of this plan, including the detention factor calculation to effectively mitigate the proposed development, as defined with this report. Should you have any questions or require additional information, please feel free to contact me or Sheri Hollaway, P.E.

Sincerely,

William W. Conlan, P.E.
Project Engineer
Texas P.E. Firm Registration No. F-929



WWC:
Attachments

Cc: Mr. Harry Lorton, P.E. – TxDOT Aviation Division, Project Manager
Mr. Craig Wallendorf, P.E. – City of Fredericksburg - Director of Public Works
Mr. William Pearce – TxDOT Highway Division, Drainage Department
Ms. Sheri Hollaway, P.E. – Klotz Associates, Project Manger
Project File

TABLE 1 - HEC-HMS Input Summary

DA	Area		Existing				Proposed				Ultimate			
Node	Acre	Sq Mi	Ia	CN	% Imp	TC (Lag)	Ia	CN	% Imp	TC (Lag)	Ia	CN	% Imp	TC (Lag)
A-1N	21.54	0.0337	0.50	80	26.0	9.84	0.25	89	75.0	9.84	0.25	89	75.0	9.84
A-1S	30.01	0.0469	0.30	87	67.0	8.64	0.27	88	70.0	8.64	0.27	88	70.0	8.64
A-2	11.83	0.0185	0.20	91	85.0	5.40	0.15	93	94.0	5.40	0.15	93	94.0	5.40
A-3N	4.07	0.0064	0.67	75	5.0	8.50	0.50	80	28.0	8.50	0.50	80	28.0	8.50
A-3S	9.47	0.0148	0.63	76	7.0	11.30	0.63	76	7.0	11.30	0.63	76	7.0	11.30
A-4	21.24	0.0332	0.53	79	20.0	13.02	0.30	87	65.0	13.02	0.22	90	78.0	13.02
A-5	24.53	0.0383	0.56	78	18.0	6.30	0.53	79	24.0	6.30	0.47	81	32.0	6.30
A-6	21.67	0.0339	0.60	77	6.0	8.16	0.60	77	6.0	8.16	0.60	77	6.0	8.16
A-7	25.49	0.0398	0.63	76	10.0	15.60	0.60	77	12.0	15.60	0.60	77	12.0	15.60
IP	28.06	0.0438	0.50	80	16.0	13.32	0.27	88	75.0	13.32	0.27	88	75.0	13.32
OF-2	68.10	0.1064	0.47	81	36.0	9.36	0.47	81	36.0	9.36	0.47	81	36.0	9.36
OF-3	74.79	0.1169	0.70	74	7.0	16.20	0.70	74	7.0	16.20	0.53	79	23.0	16.20

Diversion	
Inflow	Divert
(cfs)	(cfs)
0	0
20	0
35	0
40	0
50	0
55	0
65	0
70	10
80	15
85	20
100	30
200	45
300	60
400	80
500	90

BW (Exist)		BW (Prop)	
Vol	Flow	Vol	Flow
(ac-ft)	(cfs)	(ac-ft)	(cfs)
0.0	0	0.0	0
0.5	2	0.7	4
1.6	5	1.5	9
3.0	12	2.2	16
4.6	30	2.9	30
6.6	60	3.6	42
9.0	100	4.4	55
11.7	200	**5.0**	**60**
14.7	300	5.3	160

Res 1 (Prop)		Res 2 (Ult)	
Vol	Flow	Vol	Flow
(ac-ft)	(cfs)	(ac-ft)	(cfs)
0.0	0	0.0	0
4.7	1	0.9	40
9.4	2	1.8	60
14.2	4	2.7	90
18.9	6	3.6	250
23.6	**10**	**4.5**	**500**
26.0	12	5.0	600

TABLE 2 - Phase-0 (Interim) Cost Estimate

Bid Item	Spec.	Description	Unit	Unit Cost	Quantity	Cost
1	P-100	Mobilization	LS	$65,492.49	1	$65,492.49
2	P-151	Remove Asphalt Pavement & Base	SY	$5.00	2,712	$13,557.78
3	P-151	Abandon Storm Pipe	LF	$10.00	100	$1,000.00
4	P-151	Relocate Maintenance Shed	EA	$15,000.00	1	$15,000.00
5	P-152	Unclassified Excavation	CY	$5.00	73,511	$367,555.00
6	P-155	6" Lime Treated Subgrade	SY	$2.50	863	$2,156.67
7	P-155	Lime	TON	$120.00	14	$1,677.02
8	P-156	SWPPP	LS	$10,000.00	1	$10,000.00
9	P-247	8" Aggregate Base Course (247 TY-A GR-2)	SY	$35.00	863	$30,193.33
10	P-403	2" Bituminous Surface	TON	$120.00	91	$10,891.34
11	D-432	Riprap (Stone Common)(Dry)(18")	CY	$50.00	389	$19,436.11
12	D-701	30" Reinforced Concrete Pipe (Class III)	LF	$125.00	692	$86,500.00
13	D-701	48" Reinforced Concrete Pipe (Class III)	LF	$150.00	59	$8,850.00
14	D-751	Pre-Cast Reinforced Concrete Inlets	EA	$5,000.00	1	$5,000.00
15	D-752	Safety End Treatment (SET) (4:1)	EA	$5,000.00	4	$20,000.00
16	T-901	Seeding	AC	$1,500.00	10	$15,000.00
17	T-904	Sodding	SY	$3.75	6,300	$23,625.00
18	T-905	Soil Retention Blanket - Class 1, Type B	SY	$1.50	16,322	$24,482.67

Construction Subtotal		$672,310
Contingency	15%	$100,846
Total Base Bid Construction Cost		$773,156
Design Phase	8%	$61,852
Survey/Geotech	5%	$38,658
Construction Phase & Closeout	6%	$46,389
Construction Material Testing	1%	$7,732
Oversight/RPR (Days)	60	$37,920
Total Base Bid Probable Project Cost		**$970,000**

TABLE 3 - HEC-HMS Output Summary (100-yr)

EXISTING (100-Yr)

NODE	DA (sq mi)	Peak Q (cfs)	Vol (in)
A-1N	0.0337	129.1	5.11
A-1S	0.0469	216.1	6.30
A-2	0.0185	99.3	6.64
A-3N	0.0064	22.0	4.11
A-3S	0.0148	46.7	4.27
A-4	0.0332	108.6	4.88
A-5	0.0383	159.9	4.75
A-6	0.0339	123.8	4.34
A-7	0.0398	107.7	4.35
Buffalo Wallow	0.1244	173.3	4.87
Diversion	0.1244	385.0	4.92
IP	0.0438	142.6	4.88
Junction-1	0.1456	214.2	4.77
Junction-2	0.1064	431.5	5.40
Junction-3	0.1581	712.3	5.87
Junction-4	0.3133	1062.2	5.06
OF-2	0.1064	431.5	5.40
OF-3	0.1169	291.8	4.08
Out-1 (RV)	0.1854	**312.8**	4.68
Out-2 (16)	0.3472	**1127.9**	4.99
Reach-0	0.0398	105.0	4.35
Reach-1	0.1456	214.0	4.77
Reach-2	0.0064	20.6	4.10
Reach-3	0.0337	127.2	5.09
Reach-4	0.0438	141.1	4.87
Reach-5	0.1064	427.0	5.40
Reach-6	0.0185	177.2	10.30
Reach-7	0.1581	702.1	5.86
Reach-8	0.3133	1062.2	5.06

	Vol (ac-ft)	In (cfs)	Out (cfs)
BW	11.0	385.0	173.3
	In (cfs)	**Out (cfs)**	**Divert (cfs)**
Diversion	472.2	385.0	87.2

INTERIM {Phase-0} (100-Yr)

NODE	DA (sq mi)	Peak Q (cfs)	Vol (in)
A-1N	0.0337	129.1	5.11
A-1S	0.0469	216.1	6.30
A-2	0.0185	99.3	6.64
A-3N	0.0064	22.0	4.11
A-3S	0.0148	46.7	4.27
A-4	0.0332	108.6	4.88
A-5	0.0383	159.9	4.75
A-6	0.0339	123.8	4.34
A-7	0.0398	107.7	4.35
Buffalo Wallow	0.0469	144.3	6.29
IP	0.0438	142.6	4.88
Junction-1	0.0681	189.7	5.64
Junction-2	0.1839	432.6	3.81
Junction-3	0.2356	632.0	4.18
Junction-4	0.3908	982.1	4.20
OF-2	0.1064	431.5	5.40
OF-3	0.1169	291.8	4.08
Out-1 (RV)	0.1079	**234.9**	5.17
Out-2 (16)	0.4247	**1049.1**	4.21
Reach-0	0.0398	105.0	4.35
Reach-1	0.0681	187.5	5.64
Reach-2	0.0064	20.6	4.10
Reach-3	0.0337	126.6	5.10
Reach-4	0.0775	4.8	1.63
Reach-5	0.1839	428.0	3.81
Reach-6	0.0185	96.4	6.64
Reach-7	0.2356	622.7	4.18
Reach-8	0.3908	982.1	4.20
Reservoir-1	0.0775	4.8	1.63

	Vol (ac-ft)	In (cfs)	Out (cfs)
BW	5.3	216.1	144.3
Res-1	16.2	268.6	4.8

PROPOSED (100-Yr)

NODE	DA (sq mi)	Peak Q (cfs)	Vol (in)
A-1N	0.0337	150.5	6.48
A-1S	0.0469	217.7	6.38
A-2	0.0185	99.9	6.75
A-3N	0.0064	26.0	5.15
A-3S	0.0148	46.7	4.27
A-4	0.0332	129.1	6.27
A-5	0.0383	165.4	4.98
A-6	0.0339	123.8	4.34
A-7	0.0398	110.9	4.50
Buffalo Wallow	0.0469	148.9	6.37
IP	0.0438	171.1	6.45
Junction-1	0.0681	198.0	5.80
Junction-2	0.1839	433.5	4.15
Junction-3	0.2356	653.7	4.65
Junction-4	0.3908	1006.7	4.51
OF-2	0.1064	431.5	5.40
OF-3	0.1169	291.8	4.08
Out-1 (RV)	0.1079	**246.0**	5.32
Out-2 (16)	0.4247	**1074.4**	4.49
Reach-0	0.0398	108.1	4.49
Reach-1	0.0681	195.6	5.80
Reach-2	0.0064	24.4	5.14
Reach-3	0.0337	147.9	6.47
Reach-4	0.0775	7.5	2.43
Reach-5	0.1839	428.8	4.14
Reach-6	0.0185	97.1	6.75
Reach-7	0.2356	645.1	4.64
Reach-8	0.3908	1006.7	4.51
Reservoir-1	0.0775	7.5	2.43

	Vol (ac-ft)	In (cfs)	Out (cfs)
BW	5.3	217.7	148.9
Res-1	20.6	318.7	7.5

ULTIMATE (100-Yr)

NODE	DA (sq mi)	Peak Q (cfs)	Vol (in)
A-1N	0.0337	150.5	6.48
A-1S	0.0469	217.7	6.38
A-2	0.0185	99.9	6.75
A-3N	0.0064	26.0	5.15
A-3S	0.0148	46.7	4.27
A-4	0.0332	132.3	6.54
A-5	0.0383	173.6	5.32
A-6	0.0339	123.8	4.34
A-7	0.0398	110.9	4.50
Buffalo Wallow	0.0469	148.9	6.37
IP	0.0438	171.1	6.45
Junction-1	0.0681	198.0	5.80
Junction-2	0.1839	407.6	4.14
Junction-3	0.0517	229.4	6.62
Junction-4	0.3908	926.9	4.82
OF-2	0.1064	431.5	5.40
OF-3	0.1169	343.3	4.95
Out-1 (RV)	0.1079	**246.0**	5.32
Out-2 (16)	0.4247	**967.5**	4.78
Reach-0	0.0398	108.1	4.49
Reach-1	0.0681	195.6	5.80
Reach-2	0.0064	24.4	5.14
Reach-3	0.0337	147.9	6.47
Reach-4	0.0775	7.5	2.43
Reach-5	0.1839	373.9	4.12
Reach-6	0.0185	97.1	6.75
Reach-7	0.0517	225.4	6.61
Reach-8	0.3908	926.9	4.81
Reservoir-1	0.0775	7.5	2.43
Reservoir-2	0.1839	407.6	4.14

	Vol (ac-ft)	In (cfs)	Out (cfs)
BW	5.3	217.7	148.9
Res-1	20.6	318.7	7.5
Res-2	4.2	433.5	407.6

TABLE 4 - HEC-HMS Output Summary (10-yr)

EXISTING (10-Yr)

NODE	DA (sq mi)	Peak Q (cfs)	Vol (in)
A-1N	0.0337	77.9	3.08
A-1S	0.0469	142.3	4.14
A-2	0.0185	66.7	4.45
A-3N	0.0064	12.0	2.25
A-3S	0.0148	25.9	2.38
A-4	0.0332	64.1	2.89
A-5	0.0383	93.9	2.78
A-6	0.0339	69.5	2.43
A-7	0.0398	60.0	2.45
Buffalo Wallow	0.1244	74.2	3.04
Diversion	0.1244	234.9	3.08
IP	0.0438	84.1	2.88
Junction-1	0.1456	93.7	2.94
Junction-2	0.1064	266.7	3.34
Junction-3	0.1581	445.7	3.63
Junction-4	0.3133	631.0	3.00
OF-2	0.1064	266.7	3.34
OF-3	0.1169	157.1	2.23
Out-1 (RV)	0.1854	**151.6**	2.83
Out-2 (16)	0.3472	**664.3**	2.95
Reach-0	0.0398	58.4	2.45
Reach-1	0.1456	93.6	2.94
Reach-2	0.0064	11.2	2.25
Reach-3	0.0337	76.6	3.07
Reach-4	0.0438	83.2	2.87
Reach-5	0.1064	263.6	3.34
Reach-6	0.0185	118.6	6.61
Reach-7	0.1581	439.7	3.63
Reach-8	0.3133	631.0	3.00

	Vol (ac-ft)	In (cfs)	Out (cfs)
BW	7.5	234.9	74.2
	In (cfs)	**Out (cfs)**	**Divert (cfs)**
Diversion	294.0	234.9	59.1

INTERIM {Phase-0} (10-Yr)

NODE	DA (sq mi)	Peak Q (cfs)	Vol (in)
A-1N	0.0337	77.9	3.08
A-1S	0.0469	142.3	4.14
A-2	0.0185	66.7	4.45
A-3N	0.0064	12.0	2.25
A-3S	0.0148	25.9	2.38
A-4	0.0332	64.1	2.89
A-5	0.0383	93.9	2.78
A-6	0.0339	69.5	2.43
A-7	0.0398	60.0	2.45
Buffalo Wallow	0.0469	47.1	4.13
IP	0.0438	84.1	2.88
Junction-1	0.0681	68.3	3.57
Junction-2	0.1839	267.3	2.26
Junction-3	0.2356	392.3	2.51
Junction-4	0.3908	577.4	2.45
OF-2	0.1064	266.7	3.34
OF-3	0.1169	157.1	2.23
Out-1 (RV)	0.1079	**123.3**	3.16
Out-2 (16)	0.4247	**610.7**	2.45
Reach-0	0.0398	58.4	2.45
Reach-1	0.0681	68.2	3.57
Reach-2	0.0064	11.2	2.25
Reach-3	0.0337	76.3	3.08
Reach-4	0.0775	2.3	0.76
Reach-5	0.1839	264.3	2.25
Reach-6	0.0185	64.6	4.45
Reach-7	0.2356	386.3	2.51
Reach-8	0.3908	577.4	2.45
Reservoir-1	0.0775	2.3	0.77

	Vol (ac-ft)	In (cfs)	Out (cfs)
BW	3.8	142.3	47.7
Res-1	10.1	160.4	2.3

PROPOSED (10-Yr)

NODE	DA (sq mi)	Peak Q (cfs)	Vol (in)
A-1N	0.0337	100.2	4.30
A-1S	0.0469	144.1	4.21
A-2	0.0185	67.5	4.55
A-3N	0.0064	15.8	3.12
A-3S	0.0148	25.9	2.38
A-4	0.0332	84.8	4.11
A-5	0.0383	99.0	2.98
A-6	0.0339	69.5	2.43
A-7	0.0398	62.7	2.57
Buffalo Wallow	0.0469	48.1	4.20
IP	0.0438	113.6	4.27
Junction-1	0.0681	72.0	3.70
Junction-2	0.1839	268.0	2.51
Junction-3	0.2356	414.4	2.89
Junction-4	0.3908	601.6	2.70
OF-2	0.1064	266.7	3.34
OF-3	0.1169	157.1	2.23
Out-1 (RV)	0.1079	**131.1**	3.28
Out-2 (16)	0.4247	**635.4**	2.68
Reach-0	0.0398	61.1	2.56
Reach-1	0.0681	72.0	3.70
Reach-2	0.0064	14.8	3.12
Reach-3	0.0337	98.7	4.29
Reach-4	0.0775	3.9	1.37
Reach-5	0.1839	264.9	2.51
Reach-6	0.0185	65.3	4.55
Reach-7	0.2356	408.4	2.89
Reach-8	0.3908	601.6	2.70
Reservoir-1	0.0775	3.9	1.38

	Vol (ac-ft)	In (cfs)	Out (cfs)
BW	4	144.1	48.1
Res-1	14.1	212.0	3.9

ULTIMATE (10-Yr)

NODE	DA (sq mi)	Peak Q (cfs)	Vol (in)
A-1N	0.0337	100.2	4.30
A-1S	0.0469	144.1	4.21
A-2	0.0185	67.5	4.55
A-3N	0.0064	15.8	3.12
A-3S	0.0148	25.9	2.38
A-4	0.0332	88.3	4.36
A-5	0.0383	106.7	3.26
A-6	0.0339	69.5	2.43
A-7	0.0398	62.7	2.57
Buffalo Wallow	0.0469	48.1	4.20
IP	0.0438	113.6	4.27
Junction-1	0.0681	72.0	3.70
Junction-2	0.1839	219.6	2.50
Junction-3	0.0517	153.6	4.43
Junction-4	0.3908	487.6	2.96
OF-2	0.1064	266.7	3.34
OF-3	0.1169	203.6	2.95
Out-1 (RV)	0.1079	**131.1**	3.28
Out-2 (16)	0.4247	**505.9**	2.92
Reach-0	0.0398	61.1	2.56
Reach-1	0.0681	72.0	3.70
Reach-2	0.0064	14.8	3.12
Reach-3	0.0337	98.7	4.29
Reach-4	0.0775	3.9	1.37
Reach-5	0.1839	198.3	2.49
Reach-6	0.0185	65.3	4.55
Reach-7	0.0517	151.1	4.42
Reach-8	0.3908	487.6	2.96
Reservoir-1	0.0775	3.9	1.38
Reservoir-2	0.1839	219.6	2.50

	Vol (ac-ft)	In (cfs)	Out (cfs)
BW	4	144.1	48.1
Res-1	14.1	212.0	3.9
Res-2	3.4	268.2	219.6

TABLE 5 - HEC-HMS Output Summary (2-yr)

EXISTING (2-Yr)

NODE	DA (sq mi)	Peak Q (cfs)	Vol (in)
A-1N	0.0337	38.1	1.54
A-1S	0.0469	82.1	2.39
A-2	0.0185	40.0	2.66
A-3N	0.0064	4.7	0.93
A-3S	0.0148	10.5	1.02
A-4	0.0332	30.0	1.40
A-5	0.0383	43.2	1.32
A-6	0.0339	28.9	1.05
A-7	0.0398	24.9	1.08
Buffalo Wallow	0.1244	27.6	1.64
Diversion	0.1244	115.5	1.66
IP	0.0438	39.0	1.37
Junction-1	0.1456	34.4	1.54
Junction-2	0.1064	137.1	1.75
Junction-3	0.1581	238.8	1.90
Junction-4	0.3133	307.6	1.46
OF-2	0.1064	137.1	1.75
OF-3	0.1169	60.3	0.93
Out-1 (RV)	0.1854	**58.4**	1.44
Out-2 (16)	0.3472	**319.1**	1.42
Reach-0	0.0398	24.1	1.07
Reach-1	0.1456	34.4	1.54
Reach-2	0.0064	4.3	0.93
Reach-3	0.0337	37.4	1.54
Reach-4	0.0438	38.7	1.37
Reach-5	0.1064	135.3	1.75
Reach-6	0.0185	73.8	3.63
Reach-7	0.1581	234.9	1.90
Reach-8	0.3133	307.6	1.46

	Vol (ac-ft)	In (cfs)	Out (cfs)
BW	4.4	115.5	27.6
	In (cfs)	Out (cfs)	Divert (cfs)
Diversion	153.5	115.5	38.0

INTERIM {Phase-0} (2-Yr)

NODE	DA (sq mi)	Peak Q (cfs)	Vol (in)
A-1N	0.0337	38.1	1.54
A-1S	0.0469	82.1	2.39
A-2	0.0185	40.0	2.66
A-3N	0.0064	4.7	0.93
A-3S	0.0148	10.5	1.02
A-4	0.0332	30.0	1.40
A-5	0.0383	43.2	1.32
A-6	0.0339	28.9	1.05
A-7	0.0398	24.9	1.08
Buffalo Wallow	0.0469	20.6	2.39
IP	0.0438	39.0	1.37
Junction-1	0.0681	27.5	1.95
Junction-2	0.1839	137.3	1.17
Junction-3	0.2356	203.9	1.31
Junction-4	0.3908	272.9	1.20
OF-2	0.1064	137.1	1.75
OF-3	0.1169	60.3	0.93
Out-1 (RV)	0.1079	**50.4**	1.63
Out-2 (16)	0.4247	**284.4**	1.19
Reach-0	0.0398	24.1	1.07
Reach-1	0.0681	27.5	1.95
Reach-2	0.0064	4.3	0.93
Reach-3	0.0337	37.2	1.54
Reach-4	0.0775	1.1	0.36
Reach-5	0.1839	135.6	1.16
Reach-6	0.0185	38.7	2.66
Reach-7	0.2356	200.4	1.31
Reach-8	0.3908	272.9	1.20
Reservoir-1	0.0775	1.1	0.36

	Vol (ac-ft)	In (cfs)	Out (cfs)
BW	2.3	82.1	24.9
Res-1	5.0	76.2	1.1

PROPOSED (2-Yr)

NODE	DA (sq mi)	Peak Q (cfs)	Vol (in)
A-1N	0.0337	59.0	2.53
A-1S	0.0469	83.9	2.45
A-2	0.0185	40.9	2.76
A-3N	0.0064	7.8	1.58
A-3S	0.0148	10.5	1.02
A-4	0.0332	48.7	2.37
A-5	0.0383	47.7	1.47
A-6	0.0339	28.9	1.05
A-7	0.0398	26.9	1.16
Buffalo Wallow	0.0469	21.6	2.45
IP	0.0438	66.6	2.51
Junction-1	0.0681	31.5	2.06
Junction-2	0.1839	137.8	1.29
Junction-3	0.2356	223.5	1.56
Junction-4	0.3908	294.0	1.36
OF-2	0.1064	137.1	1.75
OF-3	0.1169	60.3	0.93
Out-1 (RV)	0.1079	**57.0**	1.72
Out-2 (16)	0.4247	**305.6**	1.33
Reach-0	0.0398	26.1	1.16
Reach-1	0.0681	31.5	2.06
Reach-2	0.0064	7.2	1.57
Reach-3	0.0337	57.8	2.53
Reach-4	0.0775	1.8	0.66
Reach-5	0.1839	136.1	1.29
Reach-6	0.0185	39.5	2.75
Reach-7	0.2356	219.4	1.55
Reach-8	0.3908	294.0	1.36
Reservoir-1	0.0775	1.8	0.66

	Vol (ac-ft)	In (cfs)	Out (cfs)
BW	2.5	83.9	21.6
Res-1	8.5	124.4	1.8

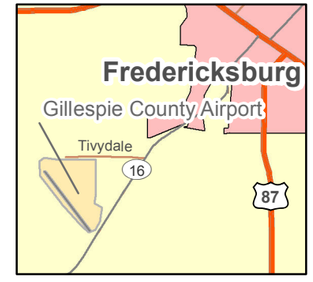
ULTIMATE (2-Yr)

NODE	DA (sq mi)	Peak Q (cfs)	Vol (in)
A-1N	0.0337	59.0	2.53
A-1S	0.0469	83.9	2.45
A-2	0.0185	40.9	2.76
A-3N	0.0064	7.8	1.58
A-3S	0.0148	10.5	1.02
A-4	0.0332	52.4	2.58
A-5	0.0383	54.3	1.69
A-6	0.0339	28.9	1.05
A-7	0.0398	26.9	1.16
Buffalo Wallow	0.0469	21.6	2.45
IP	0.0438	66.6	2.51
Junction-1	0.0681	31.5	2.06
Junction-2	0.1839	71.1	1.29
Junction-3	0.0517	91.7	2.64
Junction-4	0.3908	229.0	1.55
OF-2	0.1064	137.1	1.75
OF-3	0.1169	96.4	1.45
Out-1 (RV)	0.1079	**57.0**	1.72
Out-2 (16)	0.4247	**240.2**	1.51
Reach-0	0.0398	26.1	1.16
Reach-1	0.0681	31.5	2.06
Reach-2	0.0064	7.2	1.57
Reach-3	0.0337	57.8	2.53
Reach-4	0.0775	1.8	0.66
Reach-5	0.1839	69.2	1.28
Reach-6	0.0185	39.5	2.75
Reach-7	0.0517	90.0	2.64
Reach-8	0.3908	229.0	1.55
Reservoir-1	0.0775	1.8	0.66
Reservoir-2	0.1839	71.1	1.29

	Vol (ac-ft)	In (cfs)	Out (cfs)
BW	2.5	83.9	21.6
Res-1	8.5	124.4	1.8
Res-2	2.1	137.8	71.1

N

0 2,000
Feet



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VICINITY MAP

TXDOT AVIATION DIVISION
GILLESPIE COUNTY
AIRPORT DRAINAGE PLAN

KLOTZ PROJ. NO.: 0500.036.002	EXHIBIT 1
SCALE: 1 " = 2,000 '	
DATE: OCTOBER 2012	

Path: J:\0500.036.002\06.00 Work Products\Drainage Report\Exhibits\Exhibit - 01 Vicinity Map.mxd

N

0 500 Feet

OF-2
68.1-ac

OF-3
74.79-ac

IP
28.06-ac

A-1N
21.54-ac

A-1S
30.01-ac

A-2
11.83-ac

A-3N
4.07-ac

A-3S
9.47-ac

A-4
21.24-ac

A-5
24.53-ac

A-6
21.67-ac

A-7
25.49-ac

Buffalo Wallow
(existing)

BW

Diversion

J-2

J-3

J-4

Reach-0

Reach-1

Reach-2

Reach-3

Reach-4

Reach-5

Reach-6

Reach-7

Reach-8

Outfall - 1 (RV)

Flows (cfs)
100 Year: 312.8
10 Year: 151.6
2 Year: 58.4

Outfall - 2 (16)

Flows (cfs)
100 Year: 1127.9
10 Year: 664.3
2 Year: 319.1

Fair Dr

Airport Rd

Lady Bird Dr

Pavilion Dr

Recreation Loop

Campers Loop

Boos Ln

2093

16

Legend

- Drainage Areas
- Existing Improvements
- Existing Detention
- Flow Path

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EXISTING CONDITIONS DRAINAGE AREA MAP

TXDOT AVIATION DIVISION
GILLESPIE COUNTY
AIRPORT DRAINAGE PLAN

KLOTZ PROJ. NO.: 0500.036.002

SCALE: 1 " = 500 '

DATE: OCTOBER 2012

EXHIBIT
2a

Path: J:\0500.036.002\07.00 CADD\ALP Update\GIS\Exhibits\Exhibit - 02a Exisiting Drainage Area Map-wwc.mxd

N

0 500 Feet

OF-2
68.1-ac

OF-3
74.79-ac

IP
28.06-ac

A-1N
21.54-ac

A-1S
30.01-ac

A-2
11.83-ac

A-3N
4.07-ac

A-3S
9.47-ac

A-4
21.24-ac

A-5
24.53-ac

A-6
21.67-ac

A-7
25.49-ac

Reservoir-1
4.58-ac
23.5-acft

Buffalo Wallow
1.56-ac
5.03-acft

Reach-0
Reach-1
Reach-2
Reach-3
Reach-4
Reach-5
Reach-6
Reach-7
Reach-8

J-2
J-3
J-4
BW

Outfall - 1 (RV)

Flows (cfs)
100 Year: 246.0
10 Year: 131.1
2 Year: 57.0

Outfall - 2 (16)

Flows (cfs)
100 Year: 1,074.4
10 Year: 635.4
2 Year: 305.6

Fair Dr
Business Ct
Airport Rd
Crossvine Ln
Lady Bird Dr
Pavilion Dr
Recreation Loop
Campers Loop
Peashin Dr
Golf Course
2093

Legend

- Drainage Areas
- Existing Improvements
- Proposed Improvements
- Proposed Detention
- Flow Path

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PROPOSED CONDITIONS DRAINAGE AREA MAP

TXDOT AVIATION DIVISION
GILLESPIE COUNTY
AIRPORT DRAINAGE PLAN

KLOTZ PROJ. NO.: 0500.036.002	EXHIBIT 2b
SCALE: 1 " = 83,333 '	
DATE: OCTOBER 2012	

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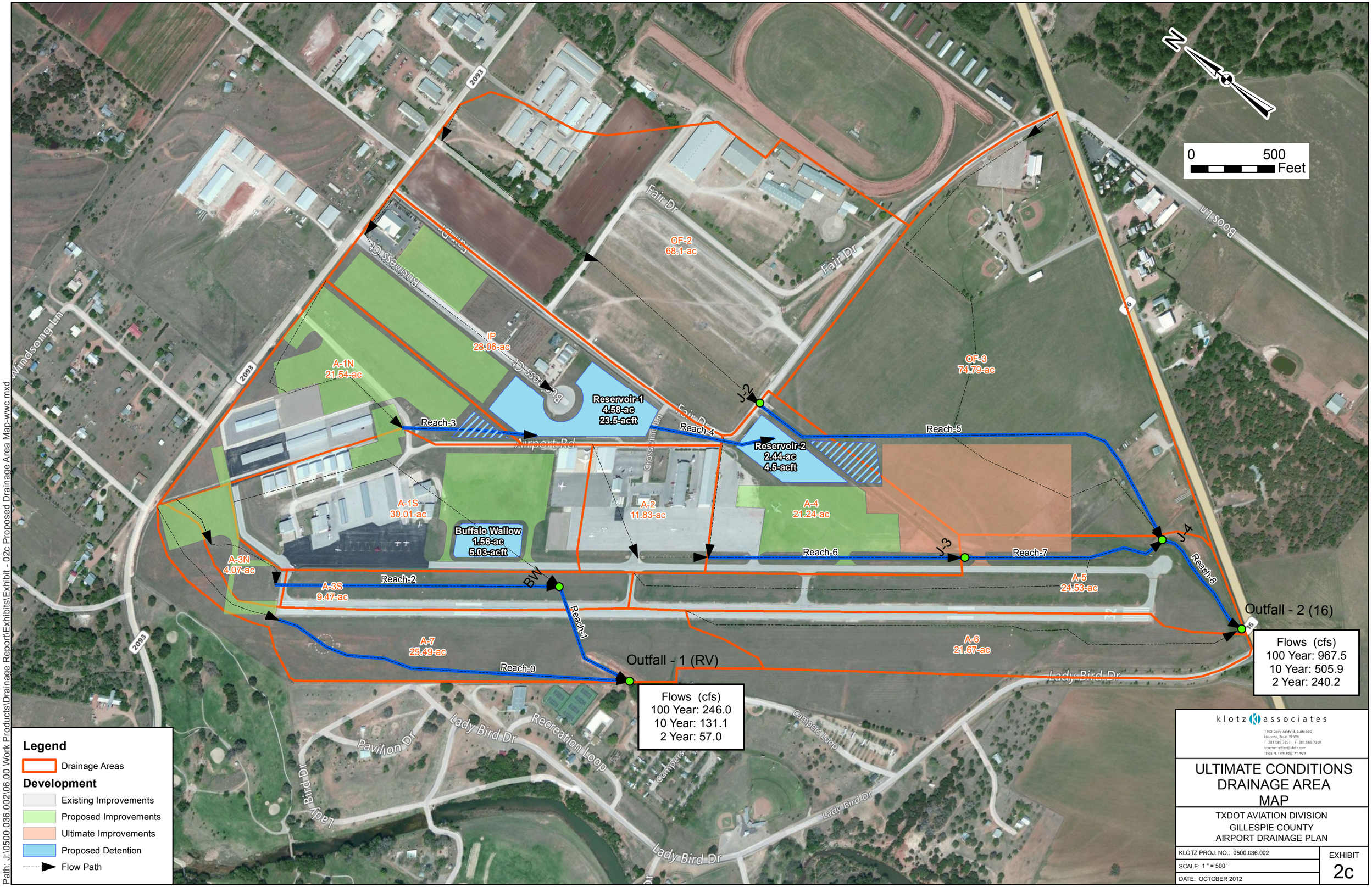

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Legend

- Drainage Areas

Development

- Existing Improvements
- Proposed Improvements
- Ultimate Improvements
- Proposed Detention
- Flow Path

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ULTIMATE CONDITIONS DRAINAGE AREA MAP

TXDOT AVIATION DIVISION
GILLESPIE COUNTY
AIRPORT DRAINAGE PLAN

KLOTZ PROJ. NO.: 0500.036.002	EXHIBIT 2c
SCALE: 1 " = 500 '	
DATE: OCTOBER 2012	

Exhibit 3a – HMS Layout (Existing)

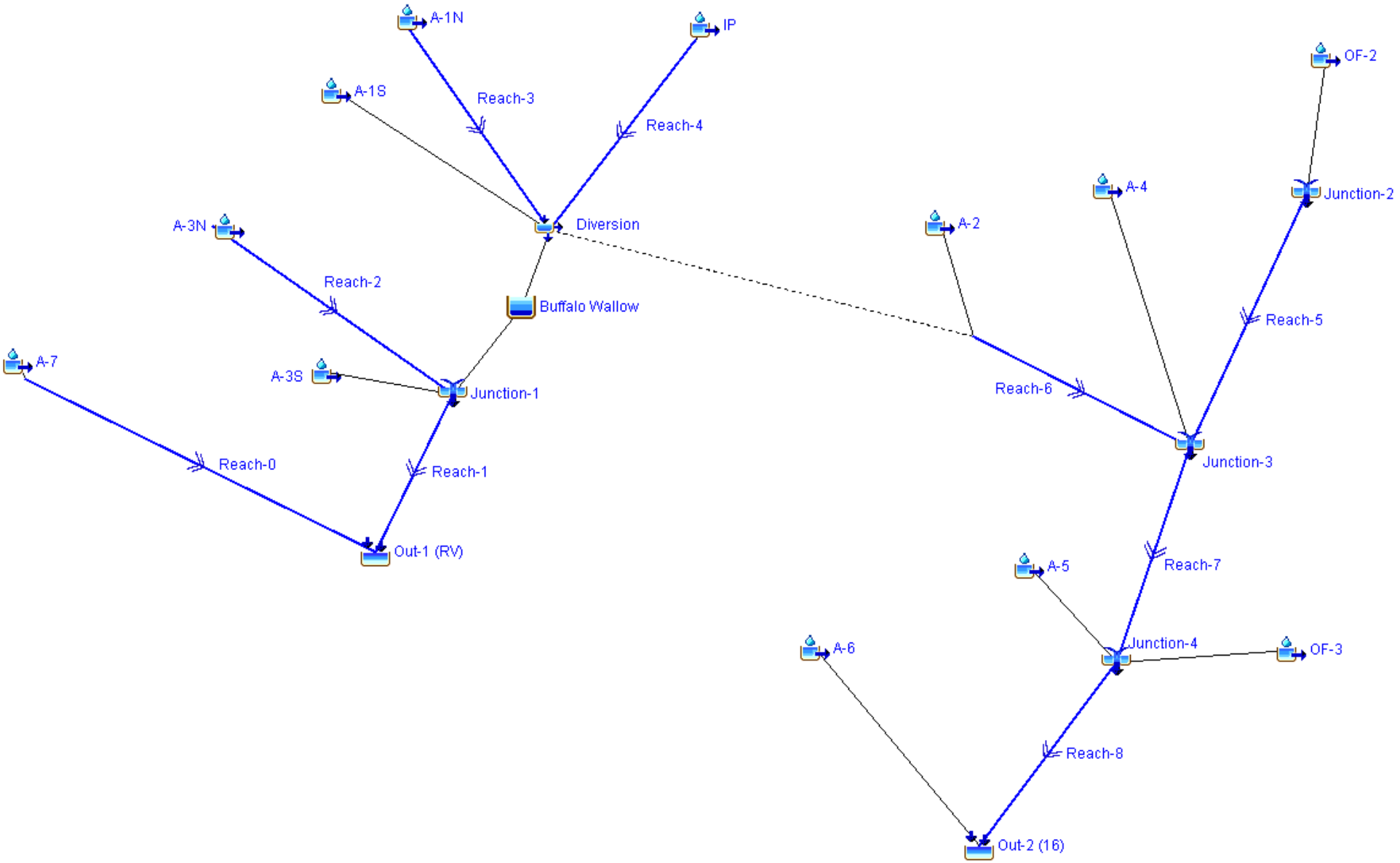

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Exhibit 3b – HMS Layout (Proposed)

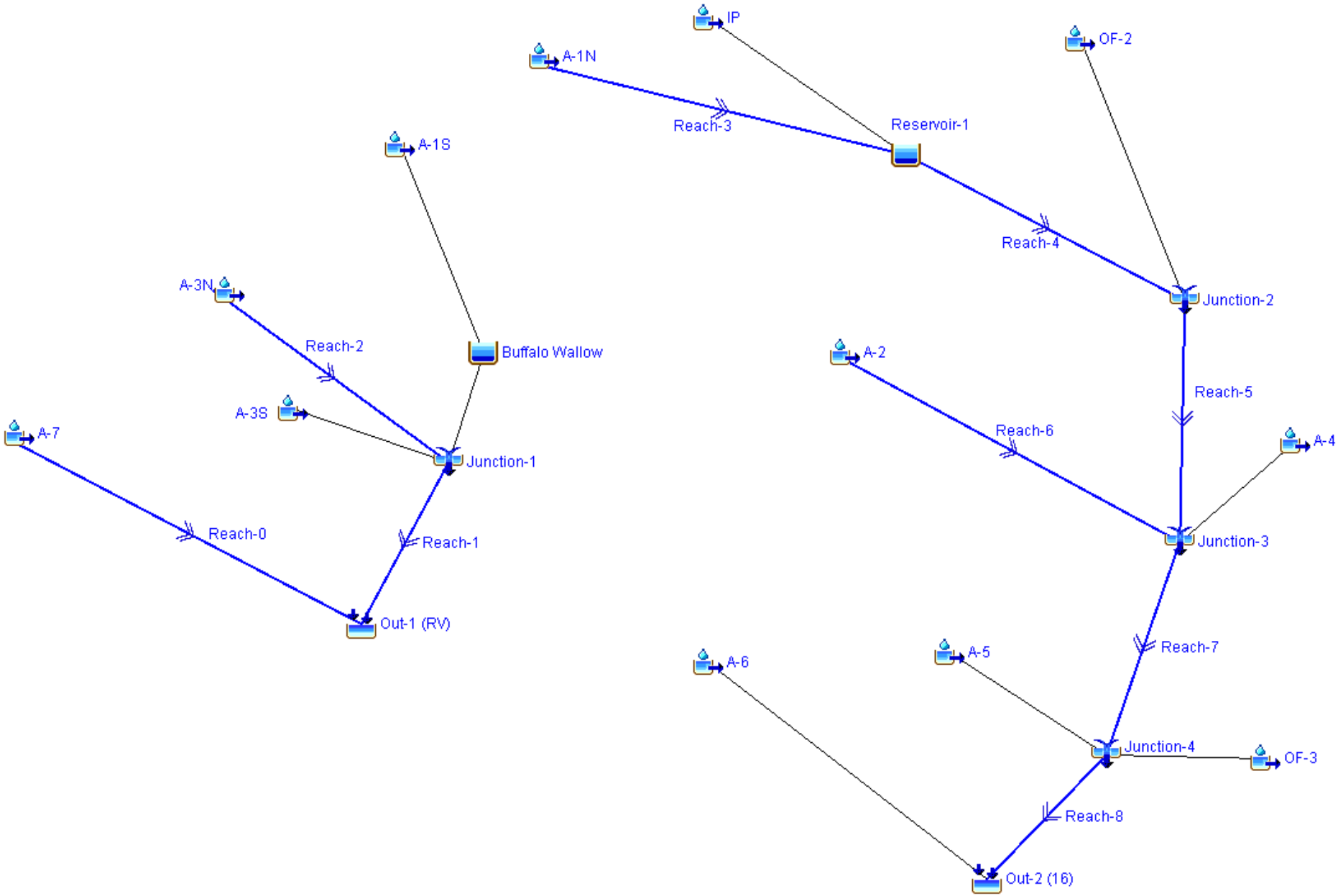
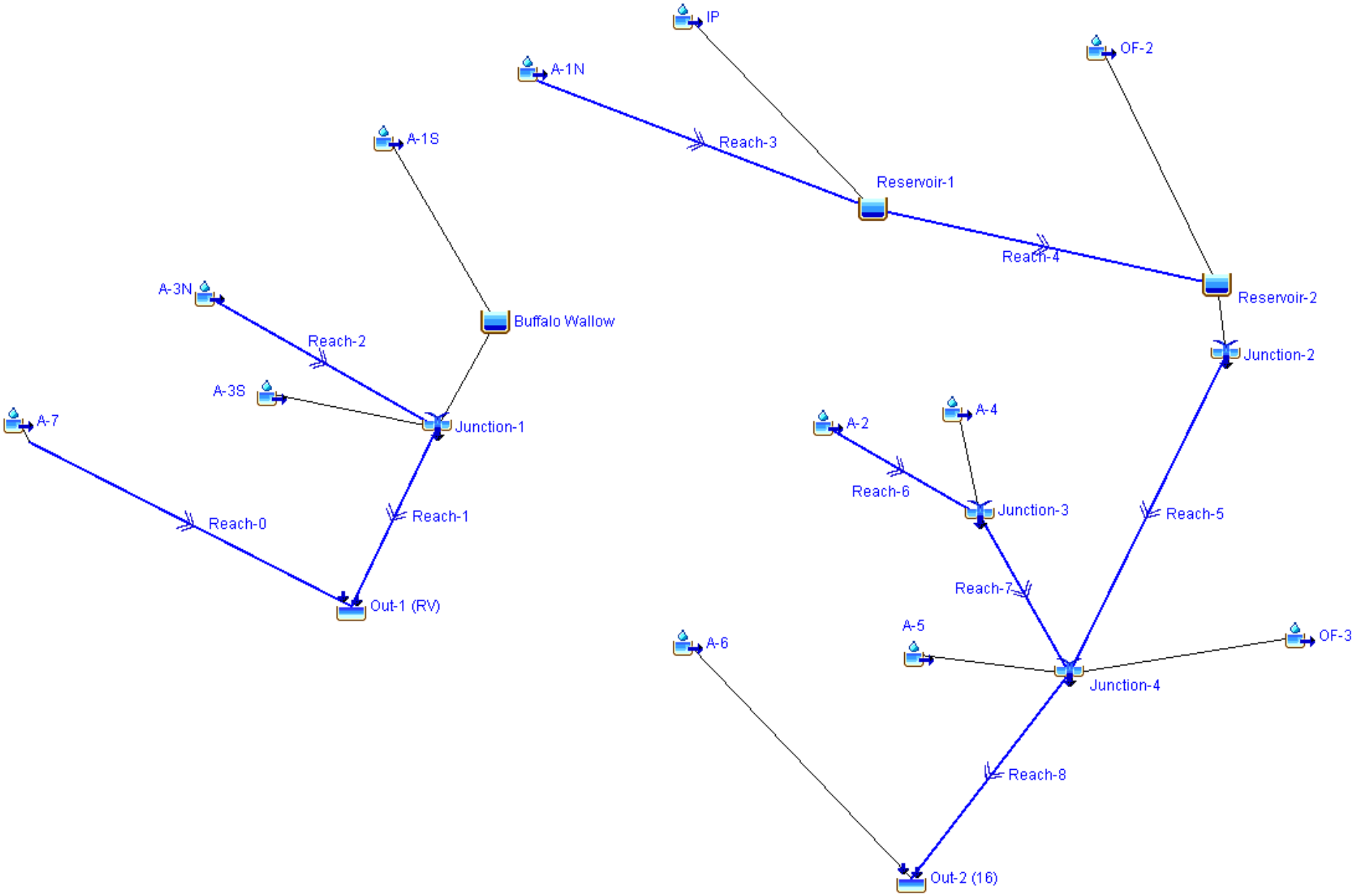
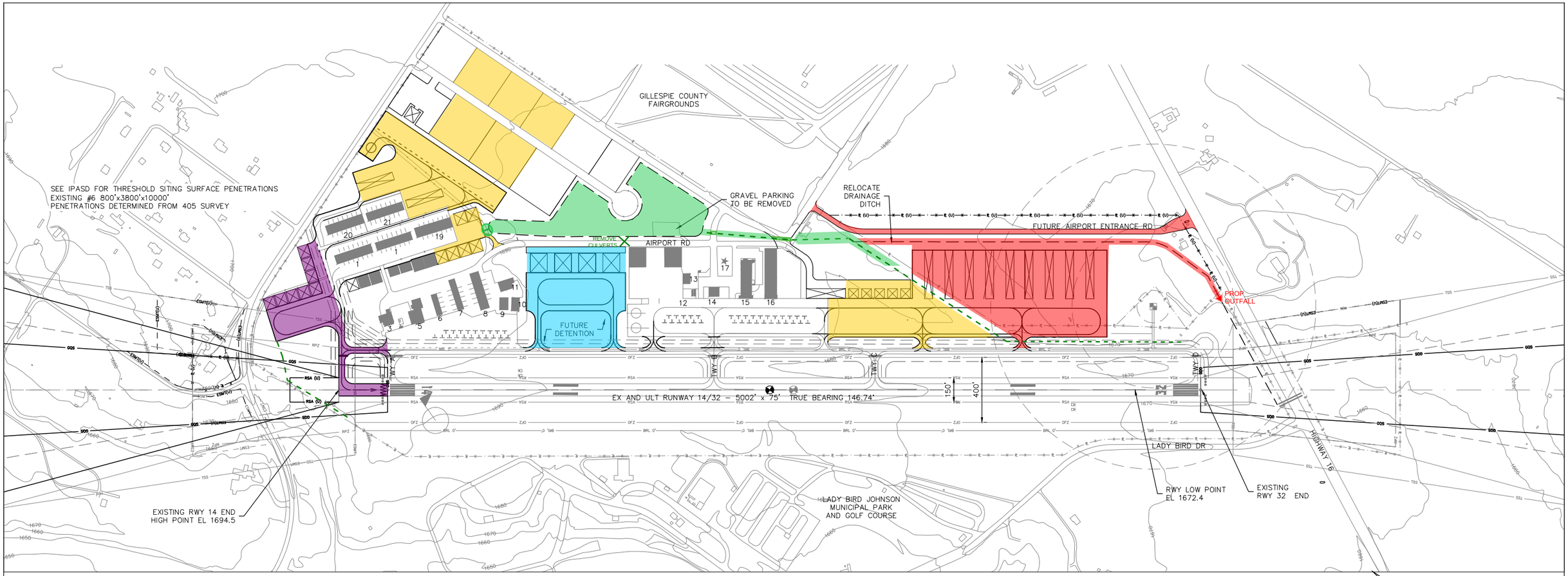


Exhibit 3c – HMS Layout (Ultimate)





BUILDING TABLE		
BLDG. #	DESCRIPTION	TOP ELEVATION
1	T-HANGAR	1708.6'
2	T-HANGAR	1707.2
3	EXECUTIVE HANGAR	1718.9'
4	SELF-SERVE FUEL ISLAND	1702.7'
5	EXECUTIVE HANGAR	1716.5'
6	T-HANGAR	1705.6'
7	T-HANGAR	1707.0'
8	T-HANGAR	1708.9'
9	EXECUTIVE HANGAR	1711.2'
10	EXECUTIVE HANGAR	1710.6'
11	EXECUTIVE HANGAR	1718.3'
12	MAINTENANCE	1699.5'
13	FUEL FARM	1691.7'
14	TERMINAL	1708.5'
15	HANGAR HOTEL	1718.5'
16	DINER	1713.6'
17	ROTATING BEACON	1740.4'
18	AWOS	
16	T-HANGAR	
17	T-HANGAR	
18	T-HANGAR	

ALD LEGEND		
FEATURE	EXISTING	ULTIMATE
RUNWAY/TAXIWAY OUTLINE		
RUNWAY/TAXIWAY TO BE REMOVED		
BUILDINGS/FACILITIES		
AIRPORT PROPERTY LINE		
AIRPORT PROPERTY LINE w/FENCE		
FENCE LINE		
BUILDING RESTRICTION LINE (BRL)		
AIRPORT REFERENCE POINT		
WND CONE & SEGMENTED CIRCLE		
THRESHOLD LIGHTS		
RW END IDENTIFIER LIGHTS (REILS)		
C&G BEACON		
VGSI		
HOLD POSITION AND SIGN		
ASOS/AWOS		
SURVEY MARKERS		
GROUND CONTOURS		
SIGNIFICANT OBJECT LOCATION		
TREES/BRUSH		
NONDIRECTIONAL BEACON (NDB)		
HELICOPTER PARKING		
RSA		
RUNWAY OBJECT FREE ZONE		
TSA		
TOFA		

PHASING

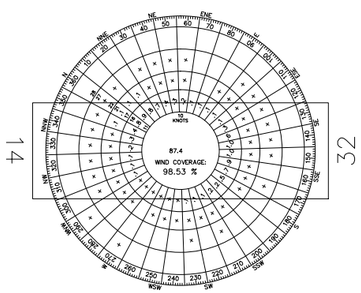
- PHASE 0 PRE-DEVELOPMENT
- PHASE 1
- PHASE 2
- PHASE 3
- PHASE 4 AS NEEDED

GENERAL NOTES

A 405 SURVEY WAS PERFORMED ON APRIL 26–27, 2004 BY GEODETIX, INC., SAN ANTONIO, TX.

THE EXISTING HEIGHT HAZARD ZONING ORDINANCE FOR THIS AIRPORT WAS ADOPTED ON 23 FEBRUARY 1979. ZONED 3800' x 75', OTHER THAN UTILITY, NPI.

ALL EXISTING COORDINATES AND ELEVATIONS SUPPLIED BY ASIS DATASHEET SYSTEM, http://avnwww.jccbi.gov/datasheet/.



SOURCE:
WEATHER REPORTING STATION
SAN ANTONIO INTERNATIONAL AIRPORT
SAN ANTONIO, TEXAS
13 KNOTS
OBSERVATIONS:
84,310 All Weather Observations
1988–1997

TEXAS DEPARTMENT OF TRANSPORTATION AVIATION DIVISION

ALP APPROVED ACCORDING TO FAA AC 150/5300-13 CHANGE 15 PLUS THE REQUIREMENTS OF A FAVORABLE ENVIRONMENTAL FINDING AND FAA NRA STUDY PRIOR TO THE START OF ANY LAND ACQUISITION OR CONSTRUCTION ON AIRPORT PROPERTY.

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DAVID FULTON, DIRECTOR, AVIATION DIVISION — DATE

AIRPORT SPONSOR

CURRENT AND FUTURE DEVELOPMENT DEPICTED ON THIS ALP IS APPROVED AND SUPPORTED BY AIRPORT SPONSOR

SPONSOR ACKNOWLEDGES APPROVAL OF ALP BY TXDOT DOES NOT CONSTITUTE A COMMITMENT TO FUNDING.

SIGNATURE — DATE

TITLE, AIRPORT SPONSOR'S REPRESENTATIVE

PREPARED BY:

TxDOT AVIATION
125 E. 11TH ST.
AUSTIN, TX 78701

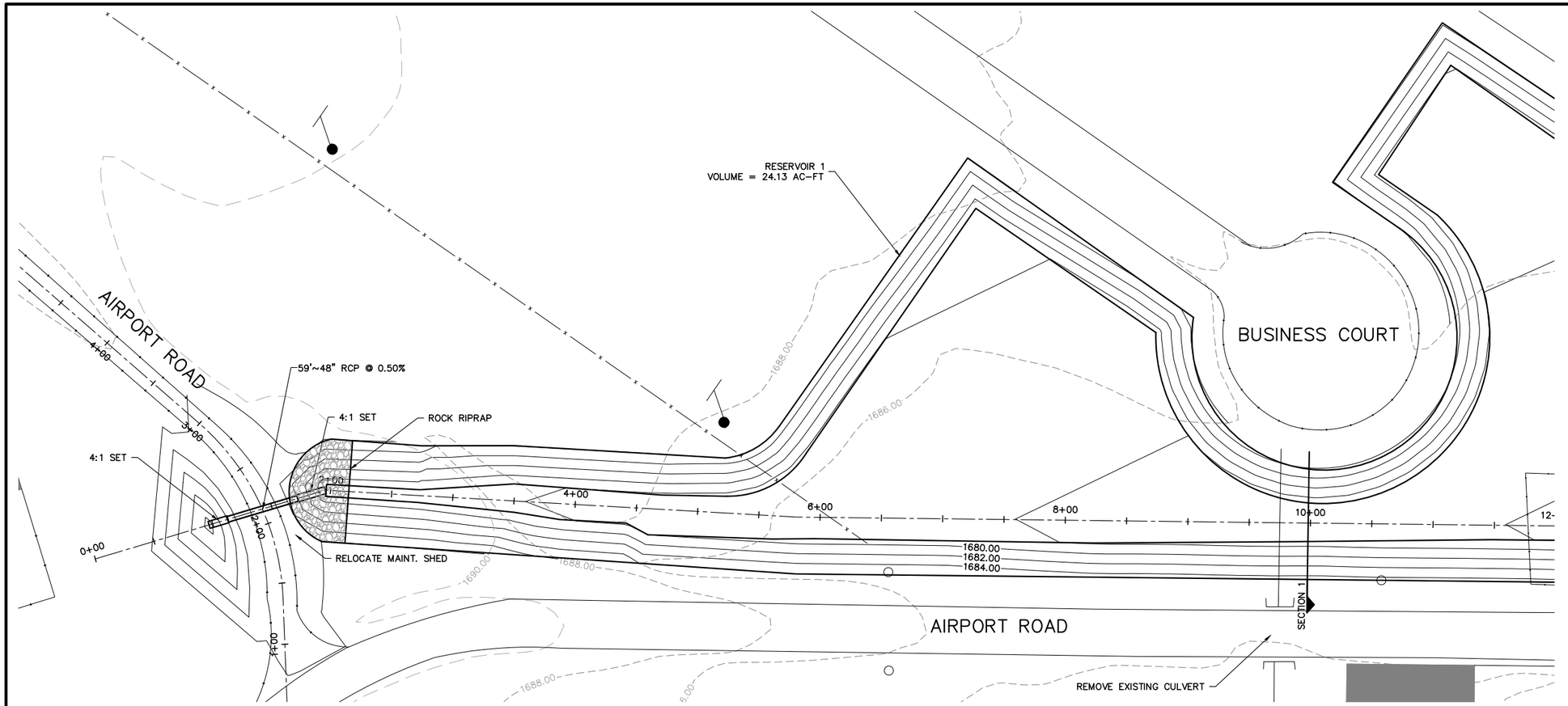
KLOTZ ASSOCAITES, INC. — DESIGNED BY — AUGUST 14, 2012 DATE

SHERI E. HOLLAWAY, PE — DRAWN BY — AUGUST 14, 2012 DATE

AIRPORT LAYOUT DRAWING
GILLESPIE COUNTY AIRPORT (T82)
FREDERICKSBURG, TEXAS

Texas Department of Transportation
Aviation Division

EXHIBIT 4



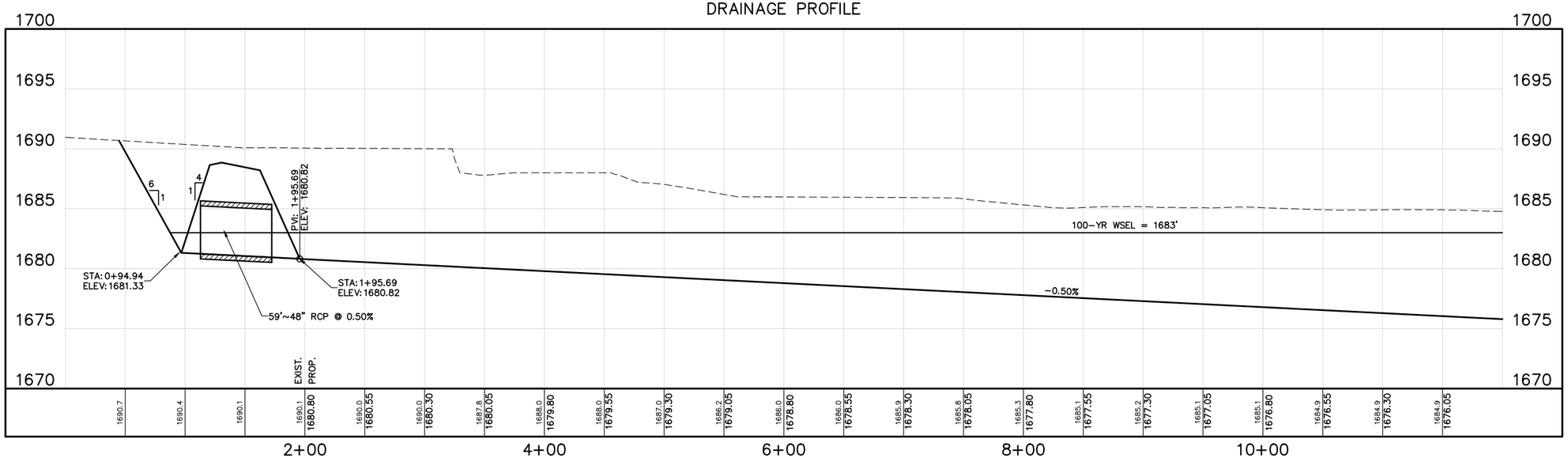
0 50 100
SCALE 1"=100'
SCALE 1"= 10'

LEGEND

1688.00 — EXISTING CONTOUR

1684.00 — PROPOSED CONTOUR

DRAINAGE PROFILE



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Houston, Texas 77079
T 281.589.7257 F 281.589.7309
houston.office@klotz.com
Texas PE Firm Reg. # F-929

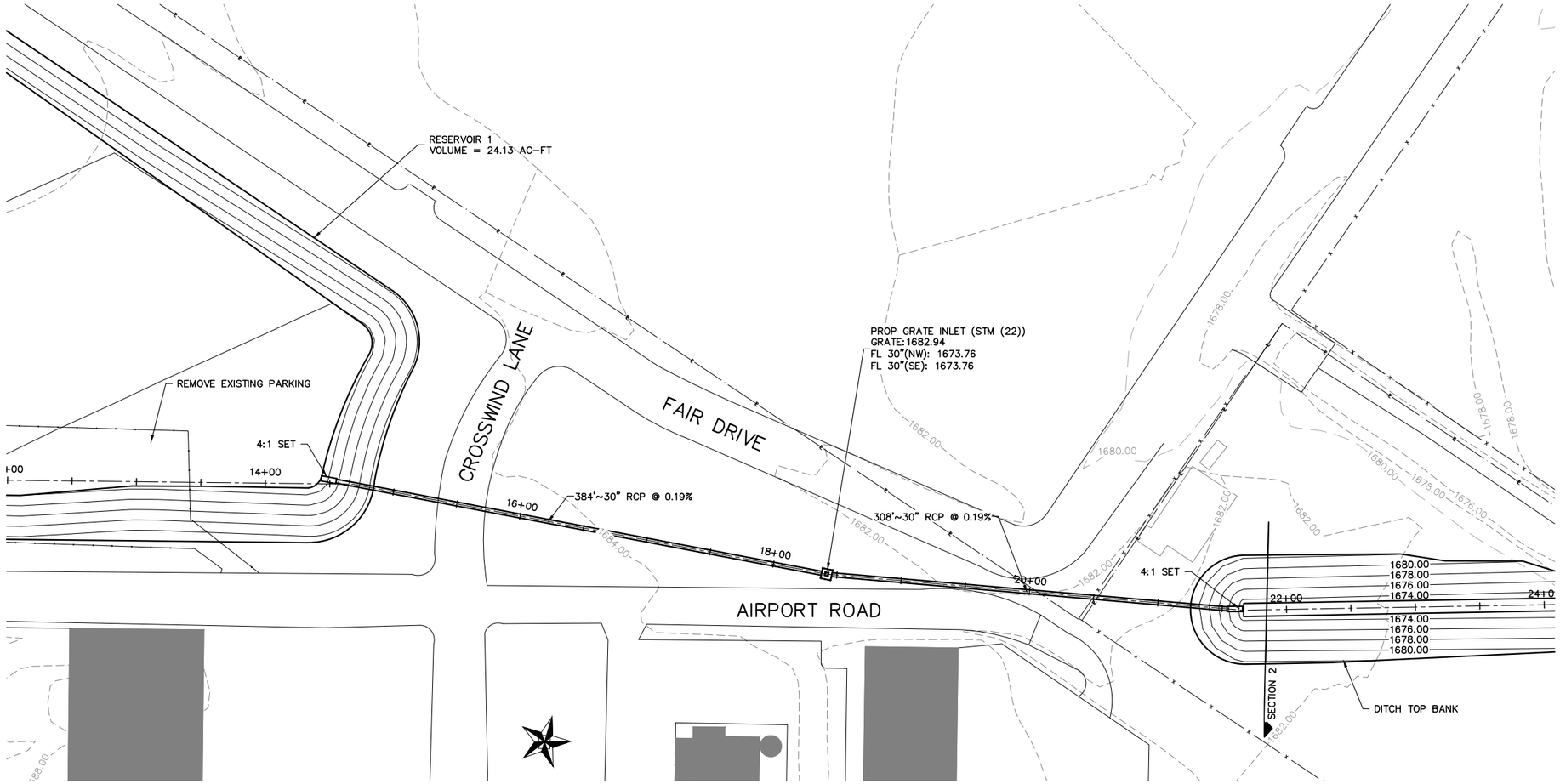
PHASE 0
PLAN & PROFILE 01

TXDOT AVIATION DIVISION
GILLESPIE COUNTY
AIRPORT DRAINAGE PLAN

KLOTZ PROJ. No: 0500.036.002
SCALE: 1"=100'(H) 1"=10'(V)
DATE: OCTOBER 2012

EXHIBIT
5a

J:\0500.036.002\07.00 CADD\ALP Update\CADD\Plan & Profile-REV 2.dwg Nov 20 2012



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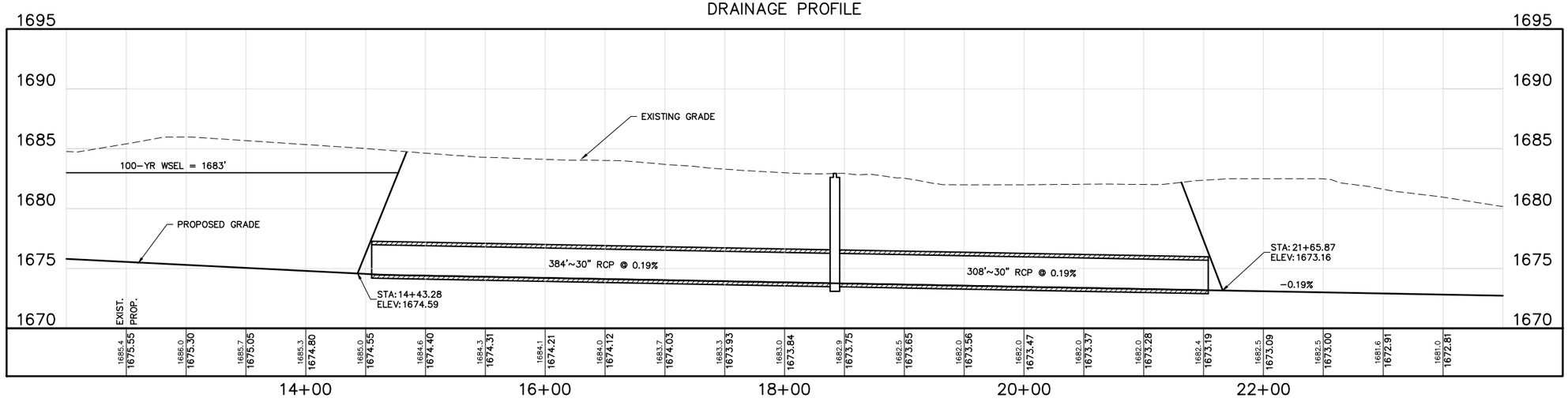
SCALE 1"=100'
SCALE 1"= 10'

LEGEND

1688.00 — EXISTING CONTOUR

1684.00 — PROPOSED CONTOUR

DRAINAGE PROFILE



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Texas PE Firm Reg. # F-929

PHASE 0
PLAN & PROFILE 02

TXDOT AVIATION DIVISION
GILLESPIE COUNTY
AIRPORT DRAINAGE PLAN

KLOTZ PROJ. No: 0500.036.002
SCALE: 1"=100'(H) 1"=10'(V)
DATE: OCTOBER 2012

EXHIBIT
5b

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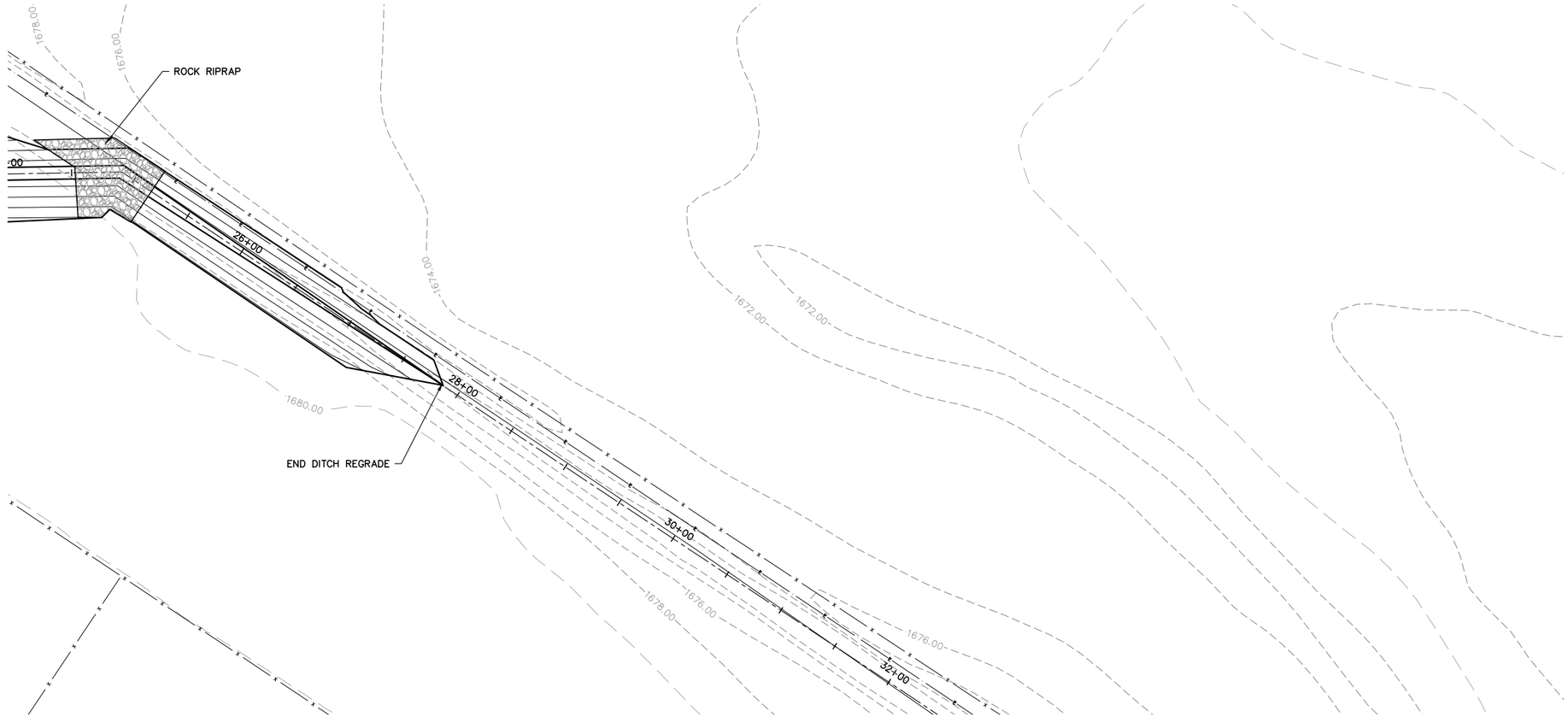


0 50 100

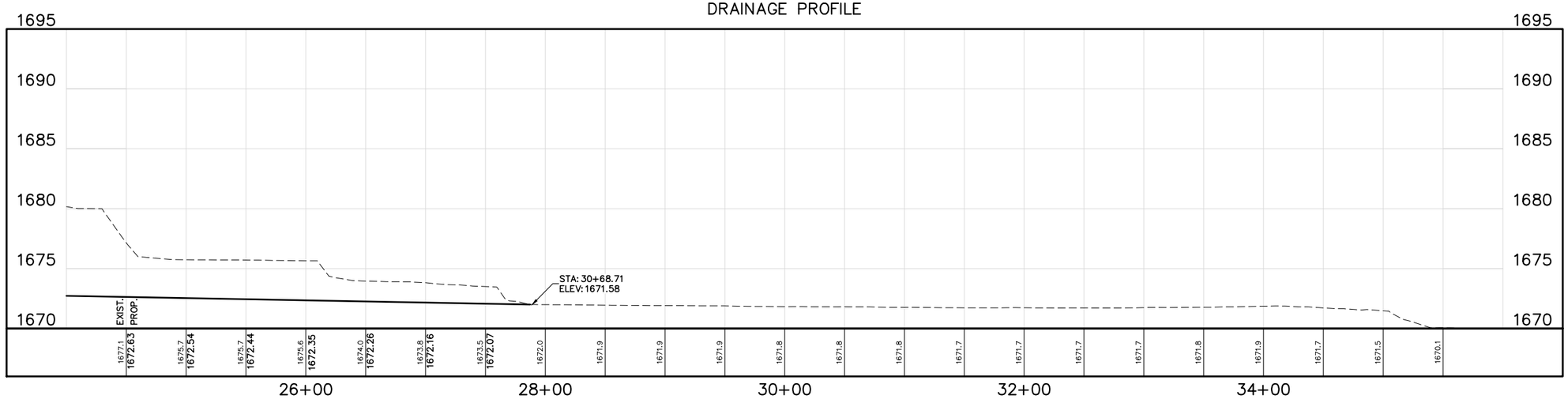
SCALE 1"=100'
SCALE 1"= 10'

LEGEND

1688.00 — EXISTING CONTOUR

1684.00 — PROPOSED CONTOUR

DRAINAGE PROFILE



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PHASE 0
PLAN & PROFILE 03

TXDOT AVIATION DIVISION
GILLESPIE COUNTY
AIRPORT DRAINAGE PLAN

KLOTZ PROJ. No: 0500.036.002
SCALE: 1"=100'(H) 1"=10'(V)
DATE: OCTOBER 2012

EXHIBIT 5c

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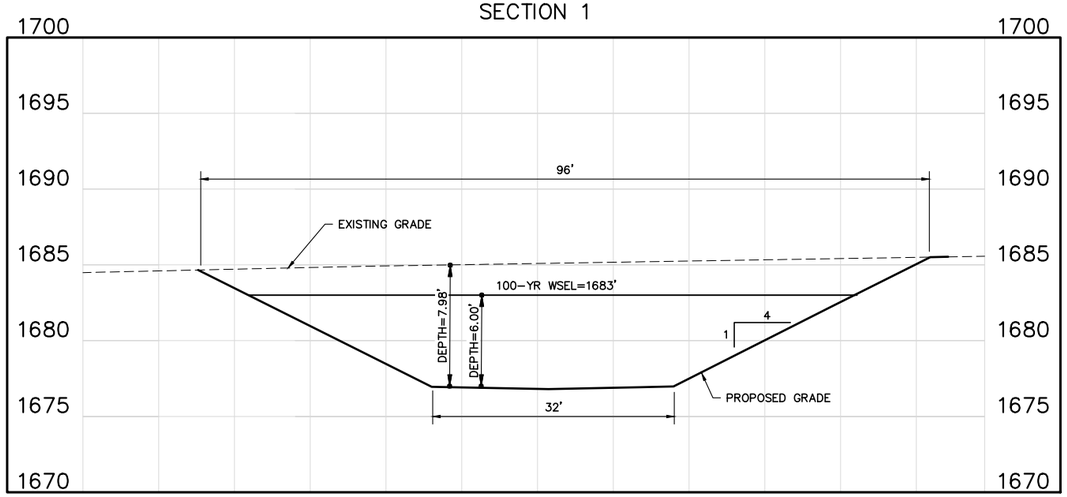
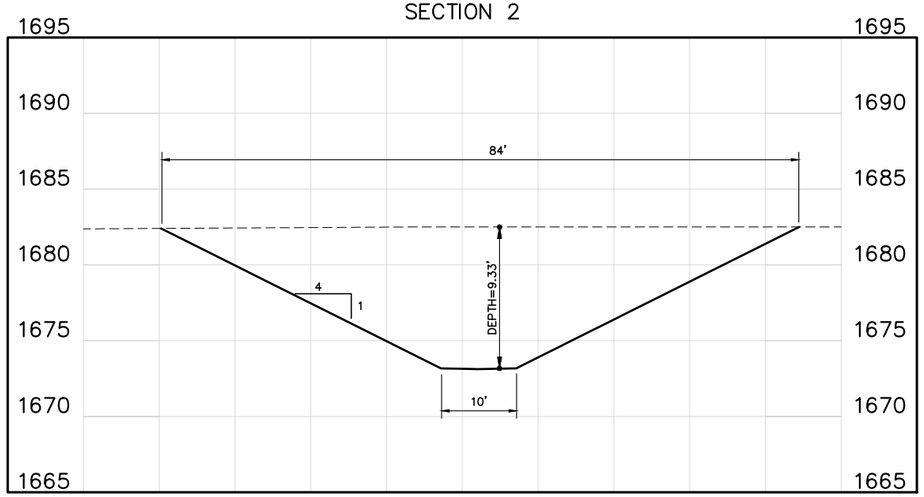
SECTION 1



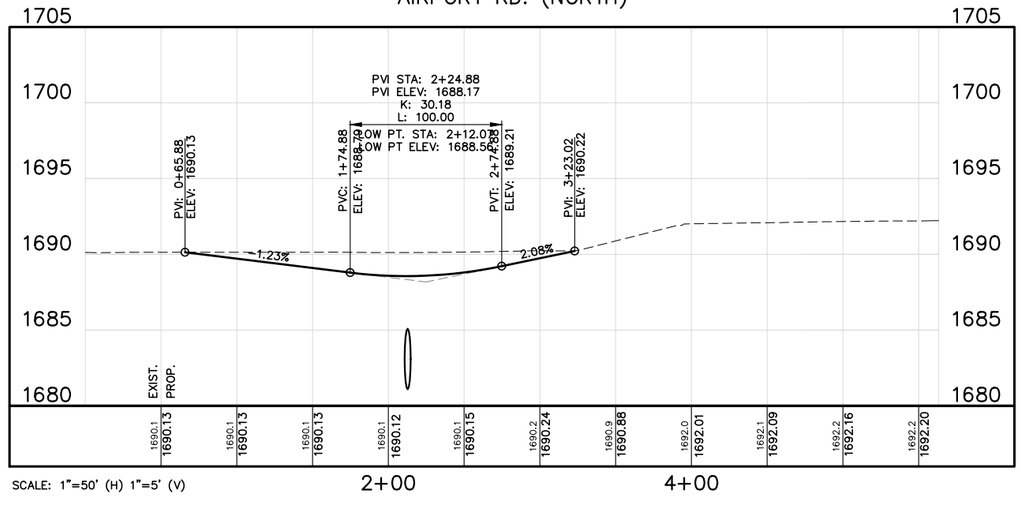
SCALE: 1"=20' (H) 1"=10' (V)

SECTION 2



SCALE: 1"=20' (H) 1"=10' (V)

AIRPORT RD. (NORTH)



SCALE: 1"=50' (H) 1"=5' (V)

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PHASE 0
SECTIONS

TXDOT AVIATION DIVISION
GILLESPIE COUNTY
AIRPORT DRAINAGE PLAN

KLOTZ PROJ. No: 0500.036.002
SCALE: AS SHOWN
DATE: OCTOBER 2012

EXHIBIT
5d

J:\0500.036.002\07.00 CADD\ALP Update\CADD\Plan & Profile-REV 2.dwg Nov 20 2012