



FEMA Region 6
Upper Clear Fork Brazos, TX
QL2 0.7 Meter LiDAR

Contract No.: G10PC00093
Task Order: G14P01081

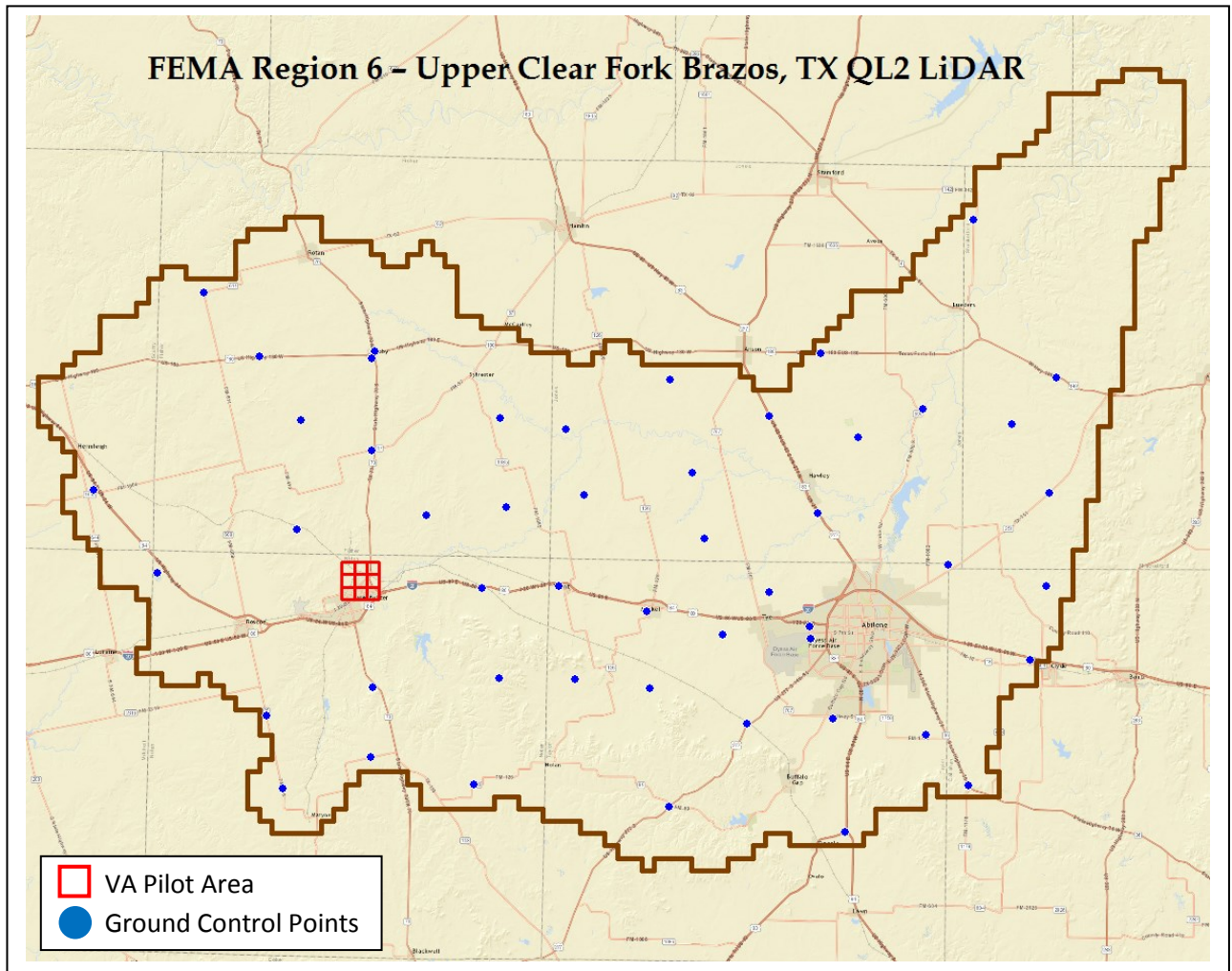
FVA Report

Prepared for:
USGS/NGTOC

Prepared by:
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This report documents the FVA reporting of the UNCLASSIFIED point cloud data for the FEMA Region 6 – Upper Clear Fork Brazos, TX LiDAR QL2 0.7 Meter LiDAR task order.

This task is for a high resolution data set of LiDAR at 0.7 meter nominal post spacing (NPS) for the Texas Area of the task order as shown below.

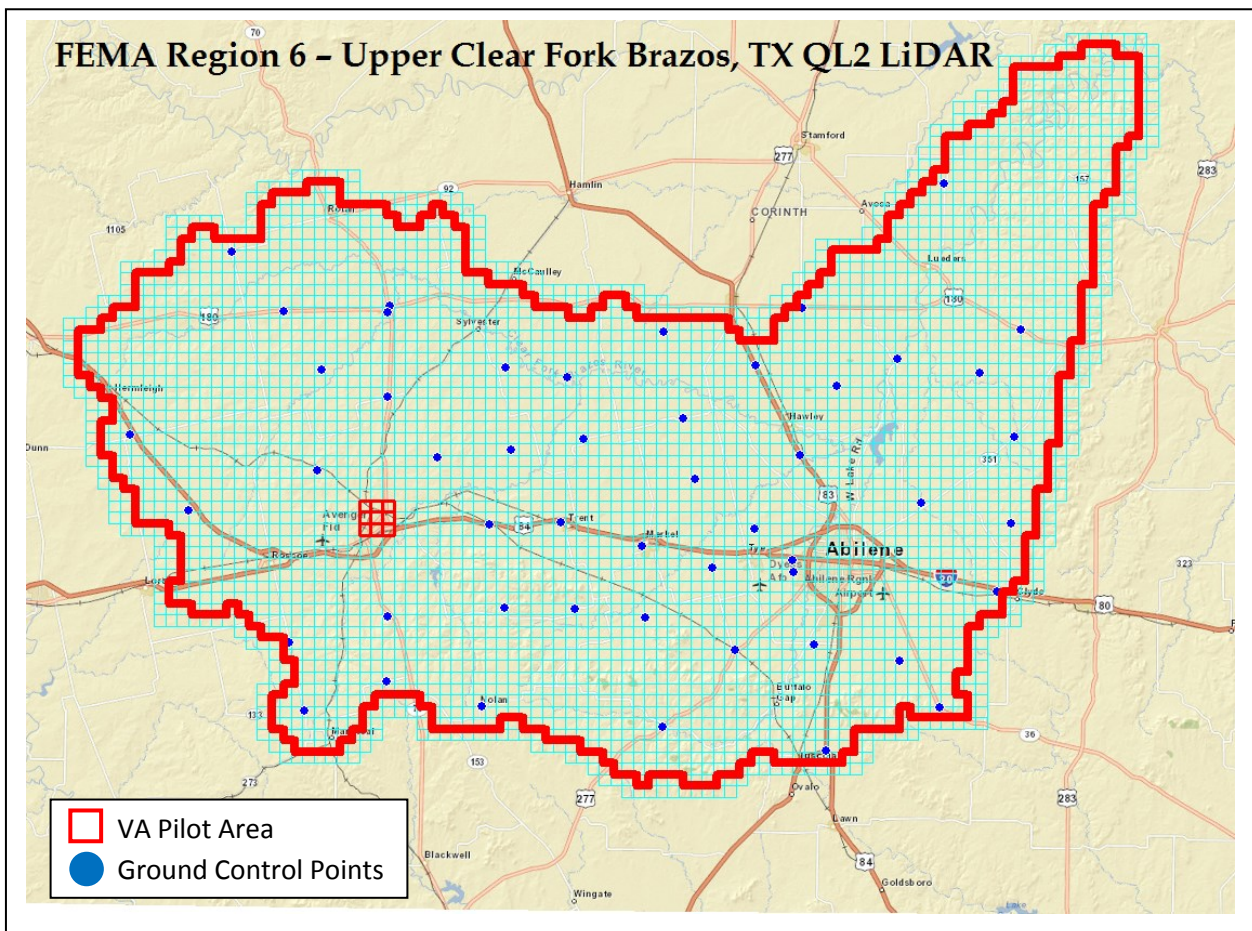


Positional Accuracy Validation:

The vertical accuracy of LiDAR is estimated by determining the root mean square error ($RMSE(z)$). $RMSE(z)$ is the square root of the average of the set of squared differences between dataset co-ordinate values and co- ordinate values from an independent source of higher accuracy for identical points. If those differences are normally distributed and average zero, 95 percent of any sufficiently large sample should be less than 1.96 times the $RMSE(z)$. Therefore 10cm $RMSE(z)$ is often referred to as 20cm accuracy at the 95-percent confidence level". Following that convention, the vertical accuracy of any data set is defined as 1.96 times the $RMSE(z)$ of linearly interpolated elevations in the LiDAR, as compared with known elevations from high- accuracy test points.

Required accuracy: $RMSE_z = 9.25$ cm
Tested accuracy: $RMSE_z = 3.10$ cm

The map below shows the location of supplemental ground control that was used in the FVA computation.





FVA RMSEz accuracy statistics recorded in meters.

| PID | Control-X | Control-Y | Control-Z | Lidar-Z | Delta Z |
|-------|------------|-------------|-----------|---------|---------|
| CPI6 | 384062.692 | 3595332.205 | 602.534 | 602.588 | -0.055 |
| CPI28 | 344580.825 | 3597188.373 | 723.584 | 723.638 | -0.054 |
| CPHS3 | 393430.025 | 3595601.423 | 586.519 | 586.571 | -0.052 |
| CPI36 | 413338.007 | 3589627.113 | 553.478 | 553.529 | -0.050 |
| CPI17 | 396518.665 | 3606604.009 | 565.967 | 566.017 | -0.049 |
| CPHS4 | 404136.722 | 3592455.493 | 571.987 | 572.034 | -0.047 |
| CPI34 | 395365.910 | 3584224.143 | 638.068 | 638.114 | -0.046 |
| CPBP1 | 424108.145 | 3589110.424 | 529.833 | 529.872 | -0.039 |
| CPI8 | 383061.162 | 3571471.946 | 761.185 | 761.222 | -0.037 |
| CPHS8 | 450816.284 | 3586598.619 | 617.444 | 617.475 | -0.031 |
| CPI44 | 362060.325 | 3615736.768 | 633.825 | 633.853 | -0.028 |
| CPI32 | 350187.043 | 3631256.190 | 645.325 | 645.353 | -0.028 |
| CPI37 | 429845.821 | 3613644.813 | 516.305 | 516.331 | -0.026 |
| CPI38 | 452717.698 | 3595540.934 | 617.797 | 617.819 | -0.023 |
| CPI47 | 371013.022 | 3624093.382 | 597.036 | 597.058 | -0.022 |
| CPI35 | 377257.803 | 3604227.484 | 637.834 | 637.854 | -0.020 |
| CPI21 | 437738.767 | 3617136.865 | 473.602 | 473.618 | -0.017 |
| CPC5 | 440856.094 | 3598193.352 | 527.689 | 527.704 | -0.015 |
| CPI14 | 411142.585 | 3601370.729 | 548.795 | 548.807 | -0.013 |
| CPI2 | 424969.553 | 3604402.060 | 503.866 | 503.878 | -0.012 |
| CPI20 | 448571.608 | 3615228.586 | 538.342 | 538.353 | -0.011 |



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|--------|------------|-------------|---------|---------|--------|
| CPI43 | 357797.875 | 3579855.432 | 770.455 | 770.465 | -0.010 |
| CPI27 | 357012.468 | 3623456.425 | 632.660 | 632.669 | -0.009 |
| CPI40 | 418973.808 | 3594836.176 | 545.533 | 545.539 | -0.006 |
| CPI26 | 404557.263 | 3583149.342 | 585.779 | 585.780 | -0.001 |
| CPC2 | 438057.673 | 3577493.661 | 555.914 | 555.914 | 0.000 |
| CPI33 | 370507.826 | 3574720.777 | 784.005 | 784.003 | 0.001 |
| CPI5 | 370664.227 | 3612111.102 | 611.189 | 611.185 | 0.004 |
| CPI4 | 453944.242 | 3620969.637 | 558.852 | 558.847 | 0.005 |
| CPI16 | 386232.009 | 3616000.792 | 566.219 | 566.212 | 0.007 |
| CPI31 | 409622.331 | 3609360.240 | 536.549 | 536.542 | 0.008 |
| CPI39 | 428299.796 | 3565656.582 | 603.348 | 603.335 | 0.013 |
| CPI45 | 386959.951 | 3605117.250 | 579.971 | 579.955 | 0.016 |
| CPC3 | 406817.634 | 3568743.135 | 666.702 | 666.686 | 0.016 |
| CPI48 | 423930.362 | 3590602.451 | 525.972 | 525.951 | 0.021 |
| CPI11 | 425245.062 | 3623891.122 | 530.926 | 530.904 | 0.022 |
| CPC4 | 416351.169 | 3578829.055 | 587.239 | 587.217 | 0.022 |
| CPI18 | 419058.329 | 3616249.151 | 538.311 | 538.289 | 0.022 |
| CPHS7 | 426766.655 | 3579498.161 | 557.322 | 557.297 | 0.025 |
| CPI25 | 386111.772 | 3584373.773 | 768.541 | 768.514 | 0.028 |
| CPI7 | 359797.836 | 3570890.264 | 782.723 | 782.693 | 0.029 |
| CPI30 | 361526.013 | 3602449.773 | 677.636 | 677.605 | 0.032 |
| CPI23 | 443922.221 | 3640174.115 | 473.455 | 473.422 | 0.033 |
| CPI1 | 406942.463 | 3620736.689 | 556.287 | 556.254 | 0.033 |
| CPHS10 | 370645.736 | 3623255.874 | 596.630 | 596.597 | 0.033 |



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|-------|------------|-------------|---------|---------|-------|
| CPI22 | 370746.992 | 3583225.151 | 692.475 | 692.432 | 0.043 |
| CPI29 | 394277.867 | 3614678.033 | 546.600 | 546.555 | 0.044 |
| CPI12 | 336774.723 | 3607228.976 | 731.591 | 731.535 | 0.056 |
| CPI13 | 453151.269 | 3606879.641 | 576.645 | 576.589 | 0.056 |
| CPC1 | 443331.578 | 3571351.954 | 627.212 | 627.155 | 0.057 |

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|------------------------------|--------------|
| RMSE(z): | 0.031 |
| Accuracy(z) (95% CI): | 0.061 |