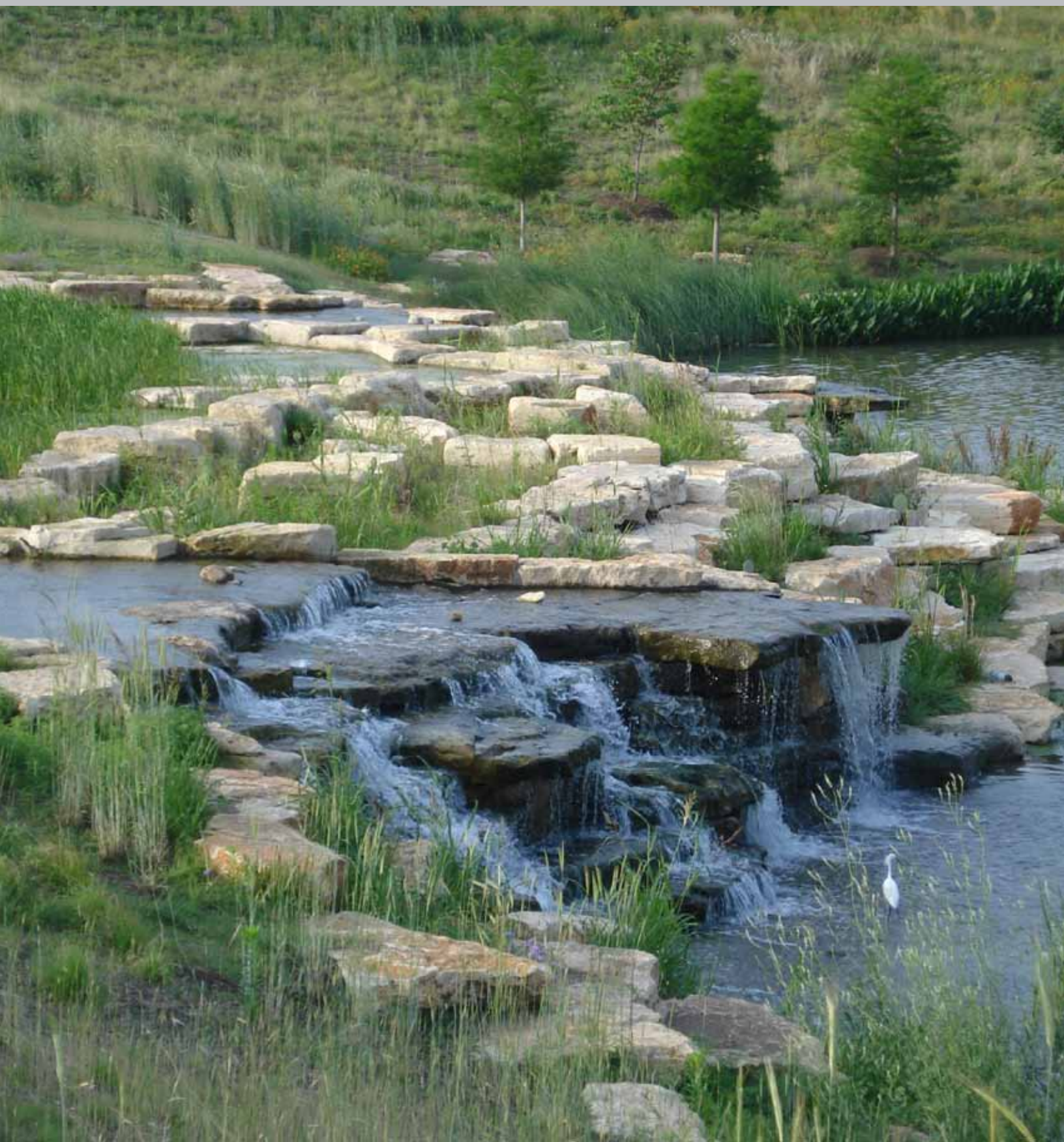
New Braunfels Stormwater Management Strategy

New Braunfels, Texas

Phase I Report

March 2012

DESIGNWORKSHOP



Contents

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Phase I Report

Staff Kick Off

A staff kick off was held on January 12, 2011. Representatives from Design Workshop, LAN and the City were there. City officials present included the representative from City Manager, Planning, Engineering, Building, Public Works, and River Activities departments.

The agenda covered

1. Vision and Critical Success Factors
2. Study Area Boundary
3. Project Management Plan
4. Final Deliverables
5. Metrics
6. Immediate Policy Changes
7. Public Engagement Plan
8. Watershed by Watershed Issues

Key Findings

Key findings that came out of the Staff Kick Off included:

- Vision is for a state of the art stormwater management plan that is practical, economical, and forward thinking.
- Stormwater planning goes beyond city limits and is driven by watershed boundaries. Strategies need to work for this geographic range.
- Specific watersheds with concerns include:
  - Alligator and Geronimo Creek | There are many approved but unbuilt subdivisions with no water quality mechanisms in place, even with 303d listing for e-coli and phosphorous.
  - Dry Comal | Testing indicates e-coli levels should continue to be monitored and Best Management Practices (BMP's) developed to maintain levels below appropriate recreation standards.
  - Comal | Springs, lakes , mill race and river have endangered species issues and river recreation issues.
  - Old Channel of the Comal | Tourism relies on this waterway and water quality is critical for tourism and endangered species.
  - Blieders Creek | This watershed outfalls at Landa Lake. There is a large development working through the City that would greatly impact this watershed, which is already suffering from erosion and sedimentation.
  - Guadalupe | There is various infrastructure that relies on this watershed, including surface water plant and recreation.
- The immediate policy changes include establishing drainage improvement plans that are bonded by developer for two years and construction of drainage improvements sufficient to mitigate development as it occurs.
- In May 2011, City Council increased mitigation through detention retention or some other technique must be designed, constructed and maintained to reduce the post-development discharge to below that of pre-development for the 2-year, 10-year, 25-year and 100-year design storms. Participation in neighborhood or regional mitigation is an acceptable option. The stormwater master plan should support this.
- Public engagement needs to include key stakeholders who have water rights on the rivers, like Schlitterbahn, as well as the general public.
- The Watershed Advisory Committee, or steering committee, needs to be made up of a diverse group of people and will play a critical role in the review of the Stormwater Management Plan, Drainage Criteria Manual and the Federally Mandated Municipal Separate Storm Sewer (FM MS4) Permit process. They may or may not be a long term watershed advisory group.

Watershed Advisory Committee

The selection of the Watershed Advisory Committee (WAC) began in February 2011 and continued through June 2011. The schedule and progress of the plan was adjusted to accommodate the appointment of the WAC.

Project Site Tour

On July 12th, WAC, City of New Braunfels, Design Workshop and LAN participated in a site tour looking at stormwater issues and opportunities around the City. The site tour included the following:

- Review of green infrastructure management practices using native lowland prairie, wetland benches and wet ponds as a form of water quality and water quantity needs for a retail project.
- Review of traditional stormwater management practices of water quality and water detention ponds in a residential development currently under construction.
- Review of New Braunfels Utilities site conditions and adjacent runoff near one of the Comal Springs with endangered species.
- Review of Landa Park, associated springs, Panther Canyon and human impact to water edge conditions including discussions of the impact to Landa Park after the June 2010 storm event.
- Review of the Dry Comal and adjacent development impact to water quality including discussions on e-coli levels and the creek assessment completed by LAN and Design Workshop in the spring of 2010.

These five reviews offered the WAC an opportunity to see firsthand a variety of stormwater issues and opportunities that play a role in the economic, environment, community and aesthetic value in the community.

Key Findings

During the tour, it was observed that stormwater management has to consistently be analyzed at a macro and micro scale, from regional to site specific solutions. Also observed was the need to understand issues associated with stormwater quality and stormwater quantity as it relates to New Braunfels, since the natural beauty plays such a significant role in the recreational tourism but also the health and safety of the community.

Goals and Metrics

Goals for the Stormwater Management Plan are in line with DW Legacy Design® methodology that creates special places that meet today's needs, and are sustainable environments for all time. This process seeks to imbue every project with the perfect balance between environmental sensitivity, community connections, artistic beauty and economic viability. Projects that achieve this harmony are enduring places that make a difference in society, the well being of the planet and leave a legacy for future generations.

Each goal has one or multiple metrics that are used to measure progress toward the goal. Each metric has a baseline and target to create the foundation of the measure-

Goal	Metric	Target/ Objective	Baseline
Encourage development patterns that improve stormwater management opportunities.	Metric 1: Woodlands and Grasslands	Target: Increase the acreage of woodland or grasslands designated for stormwater management in the study area by X%.	***City*** Total percentage of the study area in Woodland = 10.95% (3104.1 ac) Total percentage of the study area in Grassland = 33.5% (9536.37 ac) ***Watershed*** Total percentage of the study area in Woodland = 29.8% (99544.2 ac) Total percentage of the study area in Grassland = 38.5% (128658.7 ac)
	Metric 2: Floodplain and Stream Setback	Target: 100 % of the floodplain is designated as open space or parkland. 100% of the stream setback is protected with no buildings in the stream setback.	***City*** Total percentage of the floodplain protected = 94.5% (253.3 ac) Total percentage of the stream setback protected = 93.2% (1150 ac) ***Watershed*** Total percentage of the floodplain protected = 99.1% (16297 ac) Total percentage of the stream setback protected = 97.3% (9177 ac)
	Metric 3: Compressed Development	Target: Increase density in areas that are appropriate for development x% higher than the rest of New Braunfels.	***City Core*** Average density of block groups in the city core = 2.0 units/ acre ***City*** Average density of city = 1.2 units/ acre ***Watershed*** Average density of watershed study area outside the city limits = .2 units/ acre

ment. The baseline is the existing condition of the study area. Targets for New Braunfels will be defined over the course of the project by looking at existing conditions, relevant case studies, third party sources (studies, rating systems, etc.) and public acceptance.

Through the establishment of goals and metrics in each of the four Legacy categories, the Stormwater Management Plan will meet the vision of a plan that is practical, economical and sustainable.

Goal	Metric	Target/ Objective	Baseline
Minimize impervious surfaces	Metric 4: Impervious Surfaces	Target: Reduce impervious surface area per parcel. Target: Have a ratio of impervious surface per person below the average of other cities at a similar density to New Braunfels.	***City*** Average impervious cover per parcel within City Limits= 26% Pervious surface / person in the City Limits = 0.037 acres People / acres in the City Limits = 2.6
Prevent flooding and erosion caused by stormwater runoff.	Metric 5: Flooding	Target: Reduce structures within the 100-year floodplain and eliminate ALL structures in the floodway. Prevent all future structures from developing in the floodplain.	***City*** Number of structures in the FEMA 100 year flood plain = 560 Number of structures in the floodway = 315
	Metric 6: Erosion	Target: Increase amount of stabilized stream banks.	***City*** Total miles of river or creek bank = 35 miles ***Watershed*** Total miles of river or creek bank = 496 miles
Protect water quality of receiving waters particularly the streams and Landa Lake.	Metric 7: Pollutant Total Load Reduction	Target: Reduce measured pollutants.	TBD
Ensure construction does not create environmental degradation (even on a temporary basis).	Metric 8: Construction Activity Pollution Prevention	Target: The plan must conform to the erosion and sedimentation requirements of the TCEQ storm water permit for construction. In addition to statewide requirements, plan must also follow Edwards Aquifer Protection Program requirements when in the Edwards.	TBD

Goal	Metric	Target/ Objective	Baseline
Ensure stakeholder buy-in on stormwater strategies.	Metric 9: Stakeholder Communication	Target: 80% of the participants feel that there was a good public process with a diversity of viewpoints present.	TBD
Make sure responsibility for operations and management of stormwater infrastructure is clear.	Metric 10: Operations and Maintenance	Target: Develop a plan ensuring operations and maintenance of all stormwater facilities.	TBD
Utilize parks and open space for stormwater storage and infiltration.	Metric 11: Parks/ Open Space	Target: Increase stormwater facilities in parks and open space.	City Total park acreage = 583 acres of parkland.
Align the city's tourism industry practices with sensible stormwater management.	Metric 12: Tourism Industry Practices	Target: Create guidelines balancing the protection of the water quality and natural resources with access , specifically in areas of valued tourism such as Landa Park as an event space, the Guadalupe River as a water recreation site, the downtown as a heritage tourism attraction, the Comal River and Schlitterbahn as a family-oriented entertainment venue.	Number of Tourist Outfitters along the rivers and creeks = TBD
Develop stronger stormwater standards without stifling growth and development.	Metric 13: Incentives	Target: Increase in the number of times the public incentive options are used.	City Number of existing incentives available =
Ensure that public investment in infrastructure proves to have a positive ROI for the community.	Metric 14: Return on Public Investment	Target: Revenue per capita of the stormwater user-fee goes down.	TBD
Stormwater infrastructure should be visually pleasing.	Metric 15: Visual Appearance	Target: Perception of the scenic quality of rivers and creeks increases	TBD
Ensure craftsmanship of stormwater infrastructure will result in permanence.	Metric 16: Durability	Target: Structural material should have a life-cycle of at least 50 years.	TBD

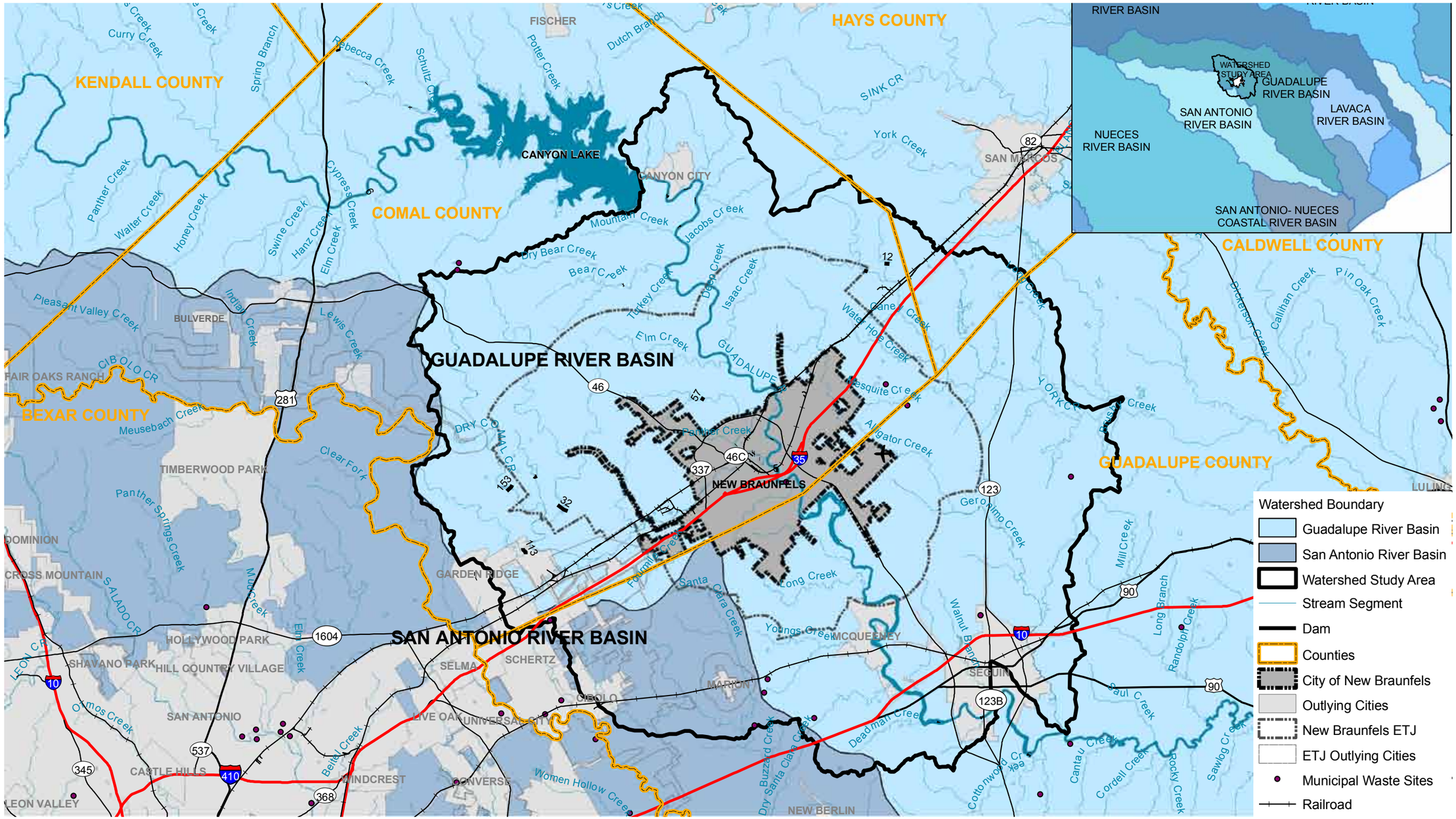
Existing Conditions

Using GIS analysis, the existing conditions in the New Braunfels area watersheds were mapped and used as measuring tools for the baseline conditions of the Goals and Metrics.

Information collected included:

- Watersheds
- Land Use
- Drainage (Digital Elevation Model and Slope Analysis)
- Impervious Surface
- Parks and Open Space
- Flooding
- Aquifers
- Land Cover and Vegetation
- Soils

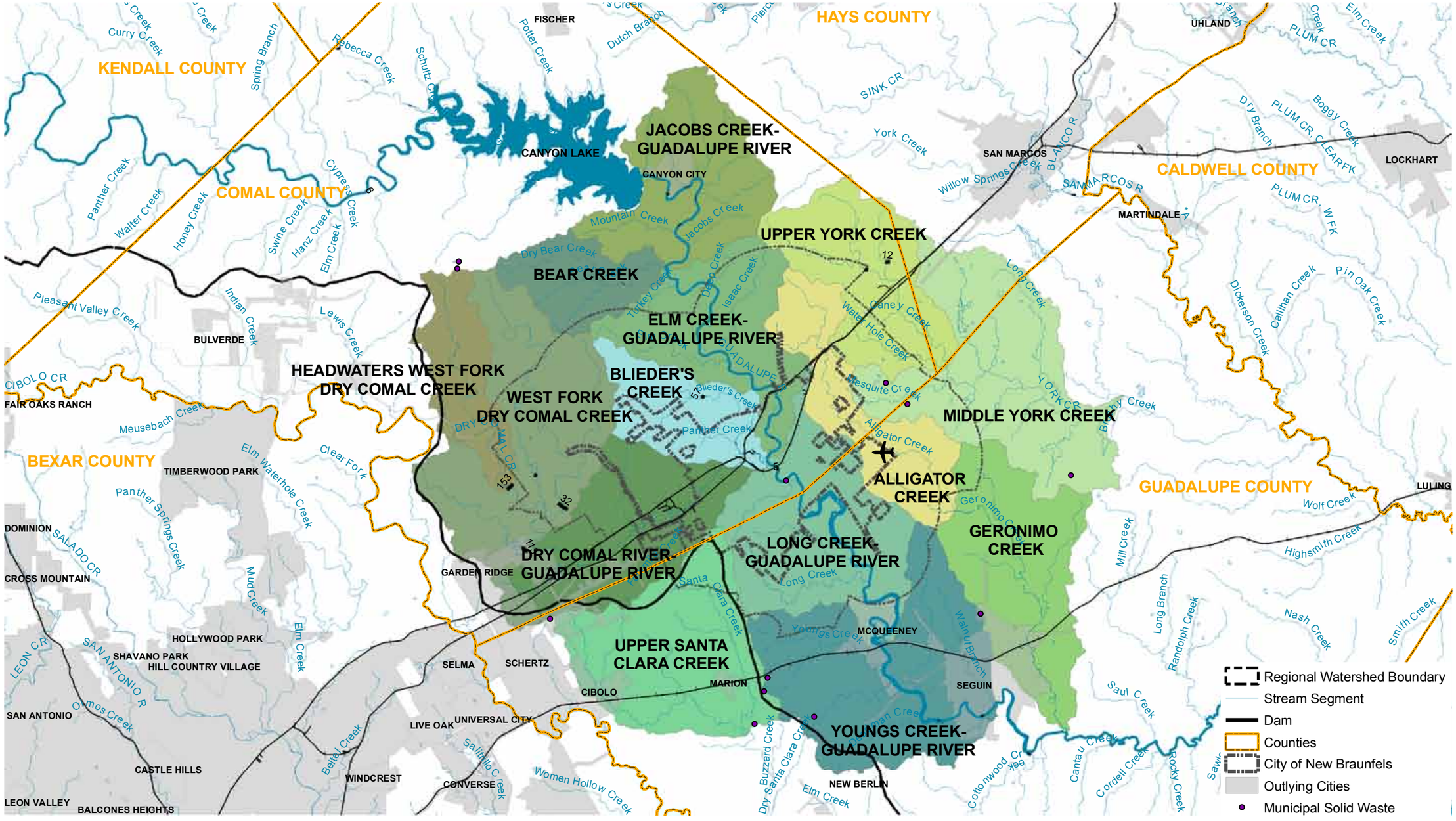
Information will continue to be collected based upon specific strategies recommended for the Plan.



NEW BRAUNFELS STORMWATER MASTER PLAN

REGIONAL WATERSHEDS - DRAFT 1.27.11

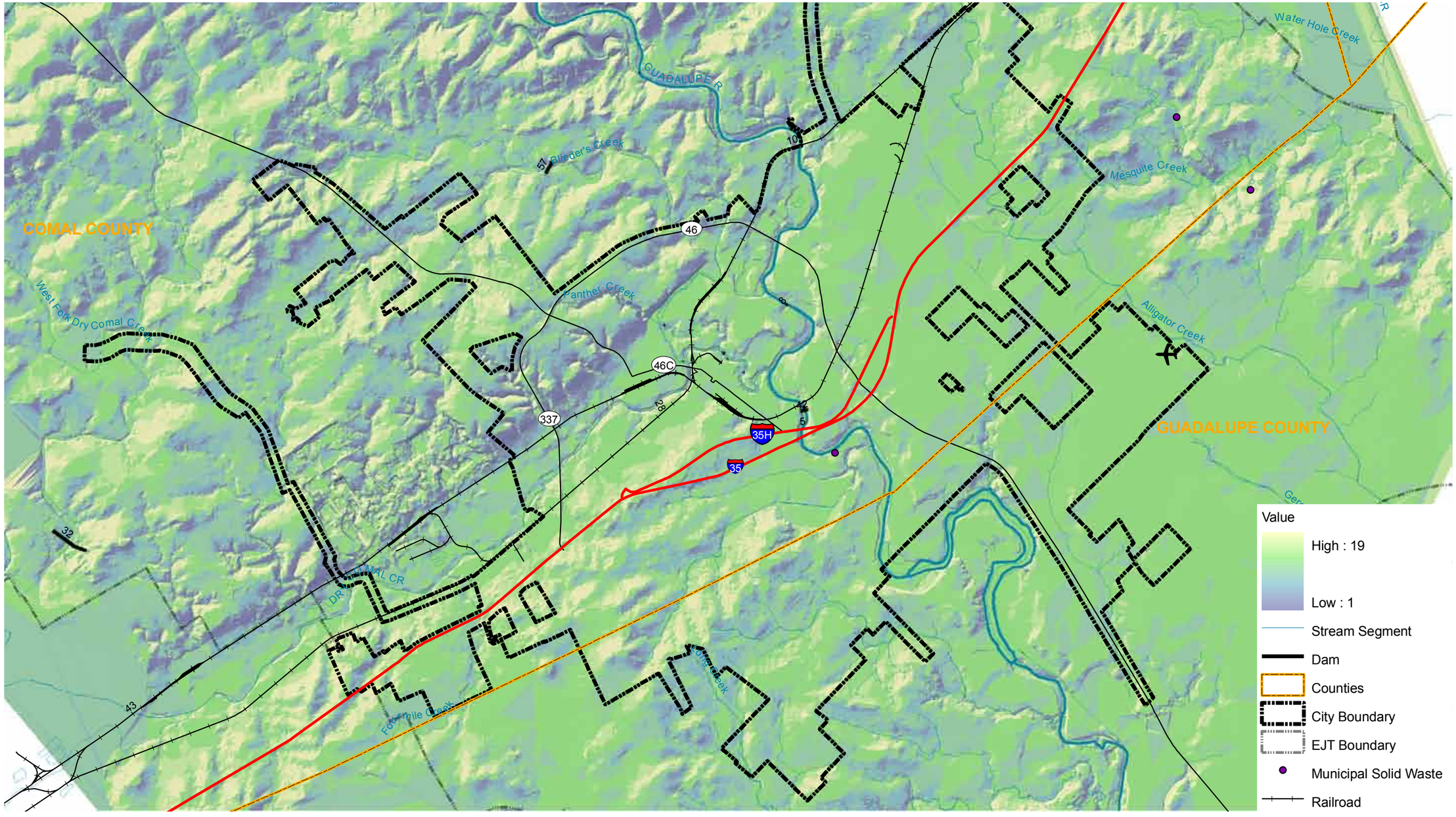
Data Sources: City of New Braunfels, TX Natural Resources Information System,



NEW BRAUNFELS STORMWATER MASTER PLAN

SUB WATERSHEDS - DRAFT 1.27.11

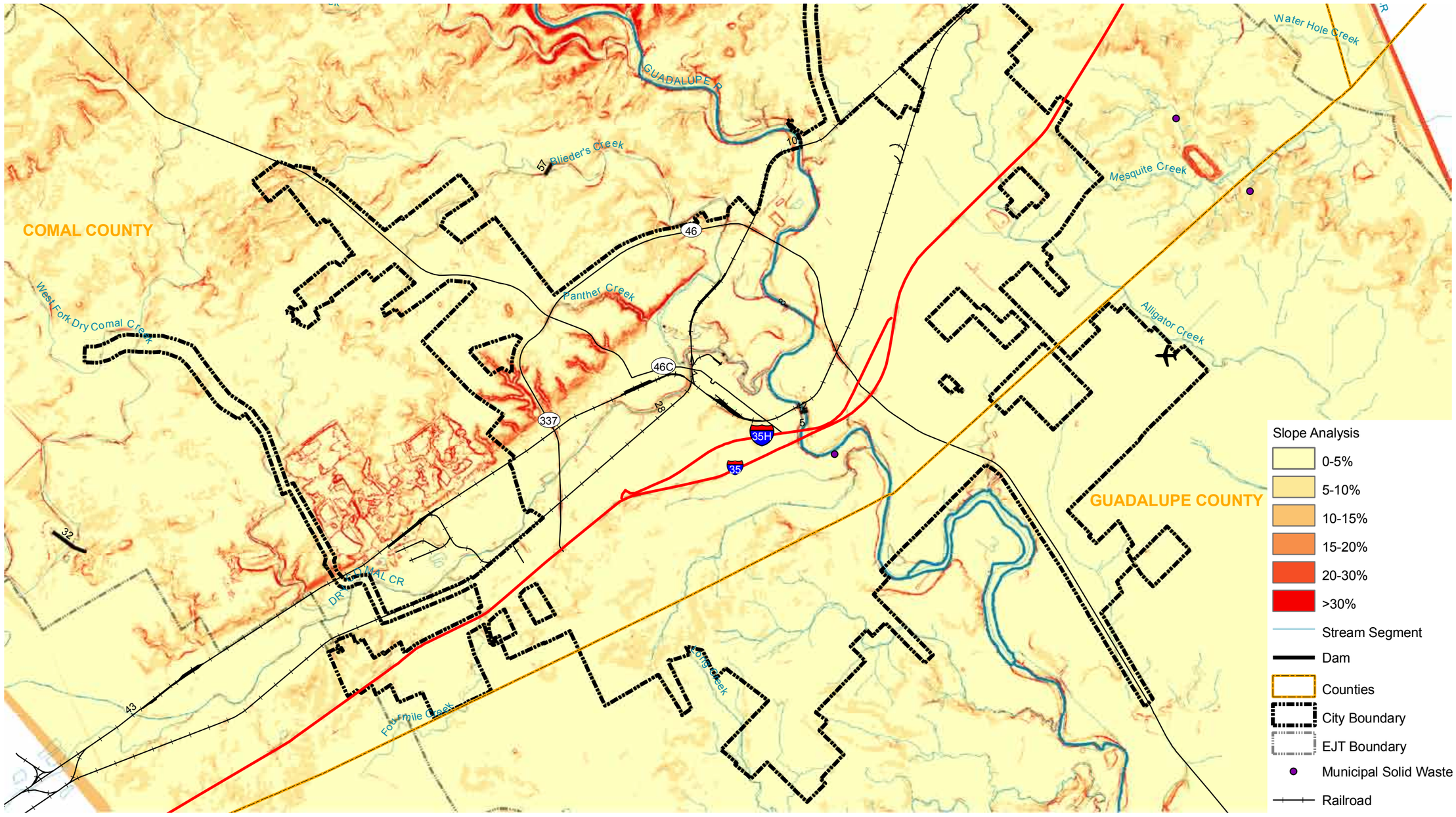
Data Sources: City of New Braunfels,
TX Natural Resources Information System,



NEW BRAUNFELS STORMWATER MASTER PLAN

ELEVATION MODEL - DRAFT 1.27.11

Data Sources: City of New Braunfels, TCEQ, USGS, Comal County

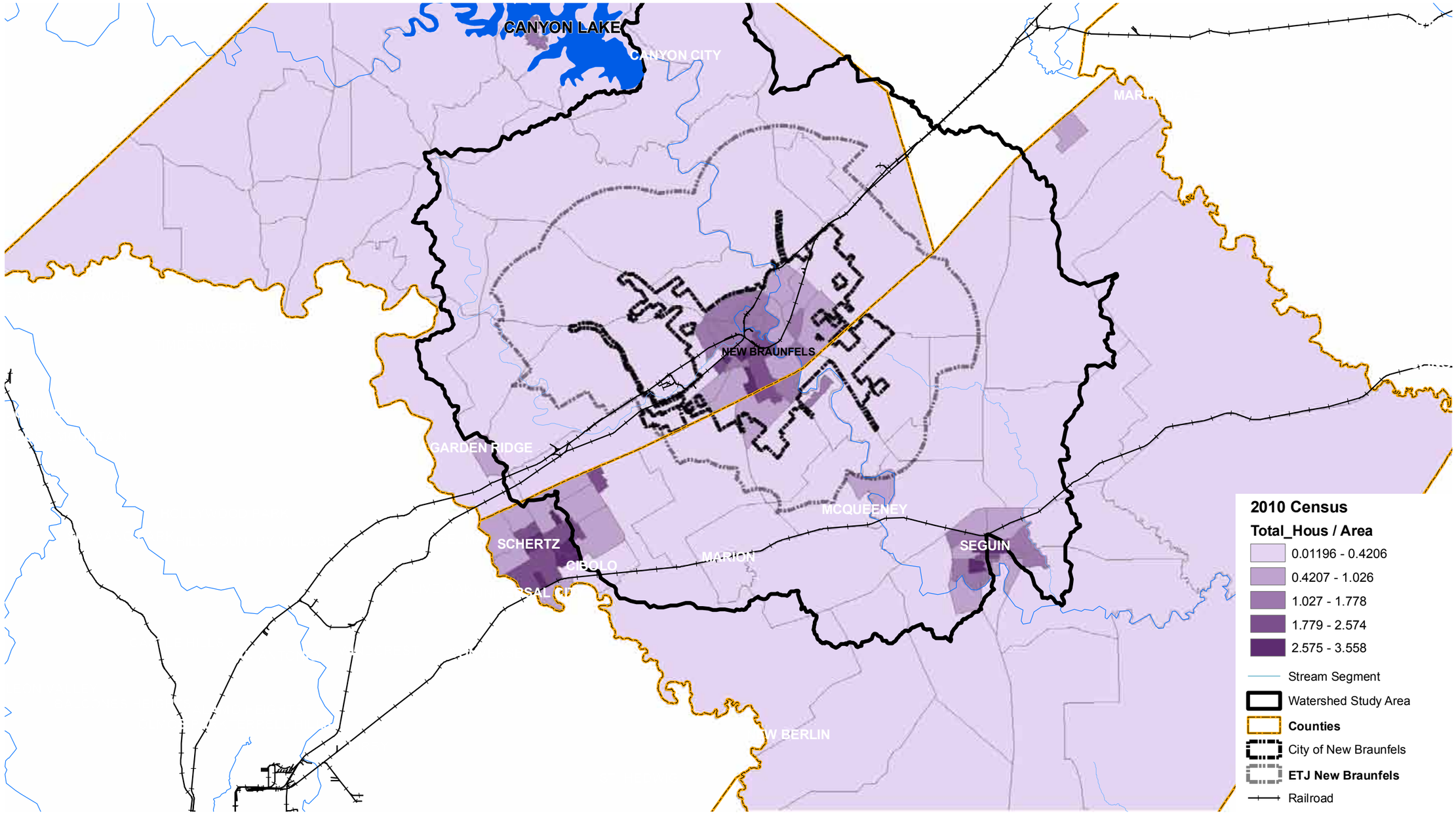


0 3,000 6,000 12,000 18,000 Feet

NEW BRAUNFELS STORMWATER MASTER PLAN

SLOPE ANALYSIS - DRAFT 1.27.11

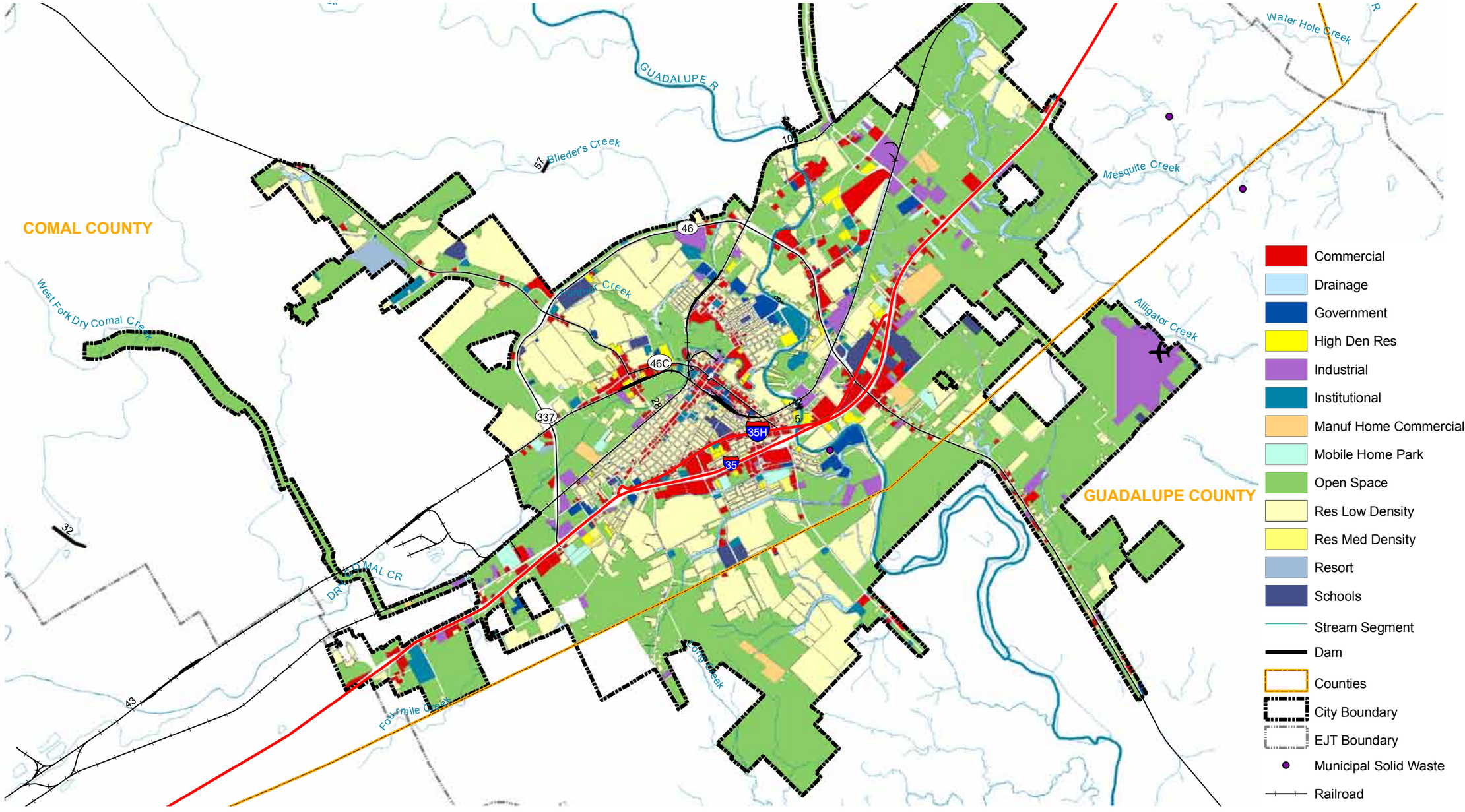
Data Sources: City of New Braunfels, TX Comm. Env. Quality, USGS, Comal County



NEW BRAUNFELS STORMWATER MASTER PLAN

HOUSING UNITS/ ACRE - DRAFT 08/25/11

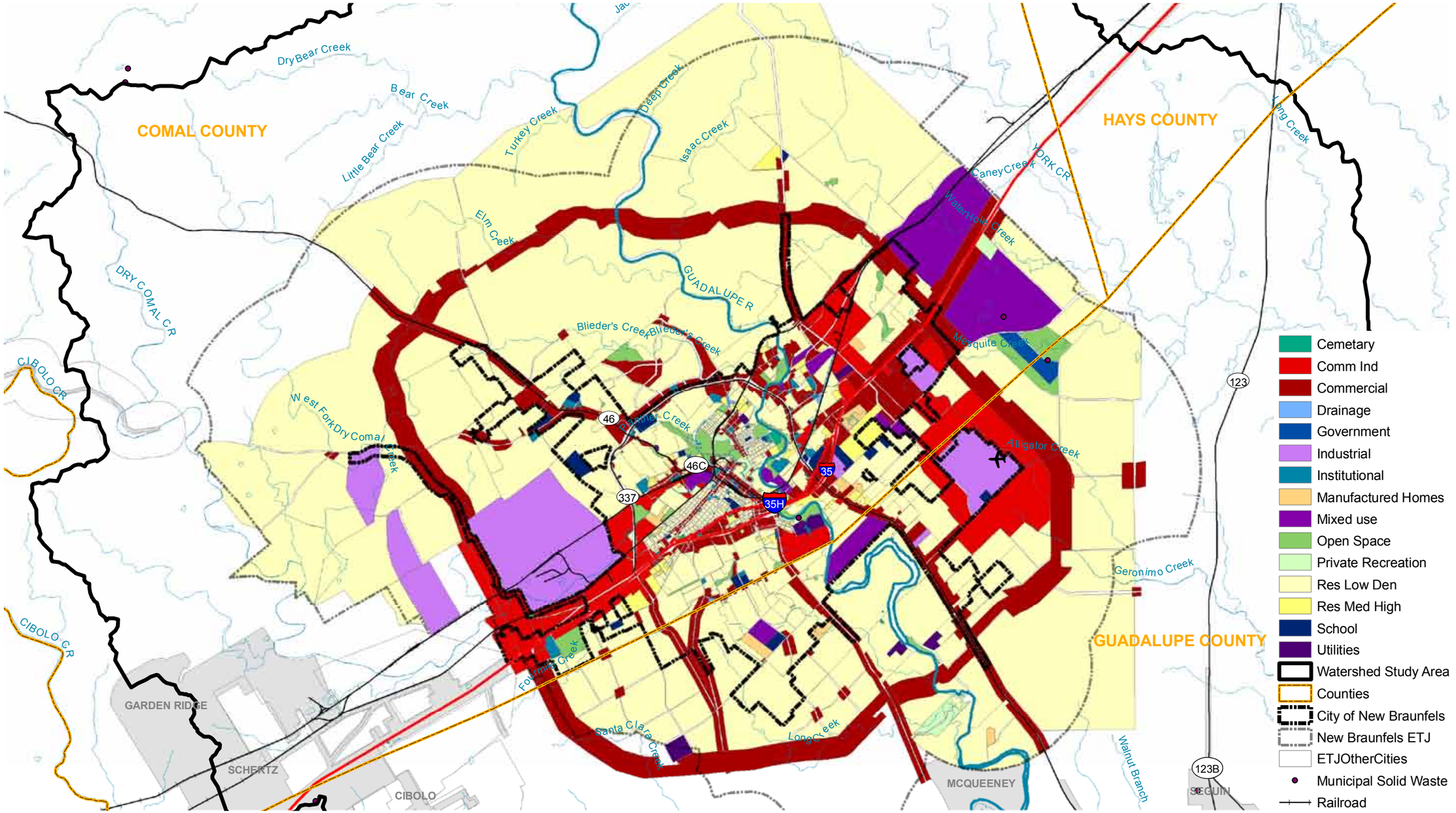
Data Sources: City of New Braunfels,
TX Natural Resources Information System,



NEW BRAUNFELS STORMWATER MASTER PLAN

EXISTING LAND USE - DRAFT 1.27.11

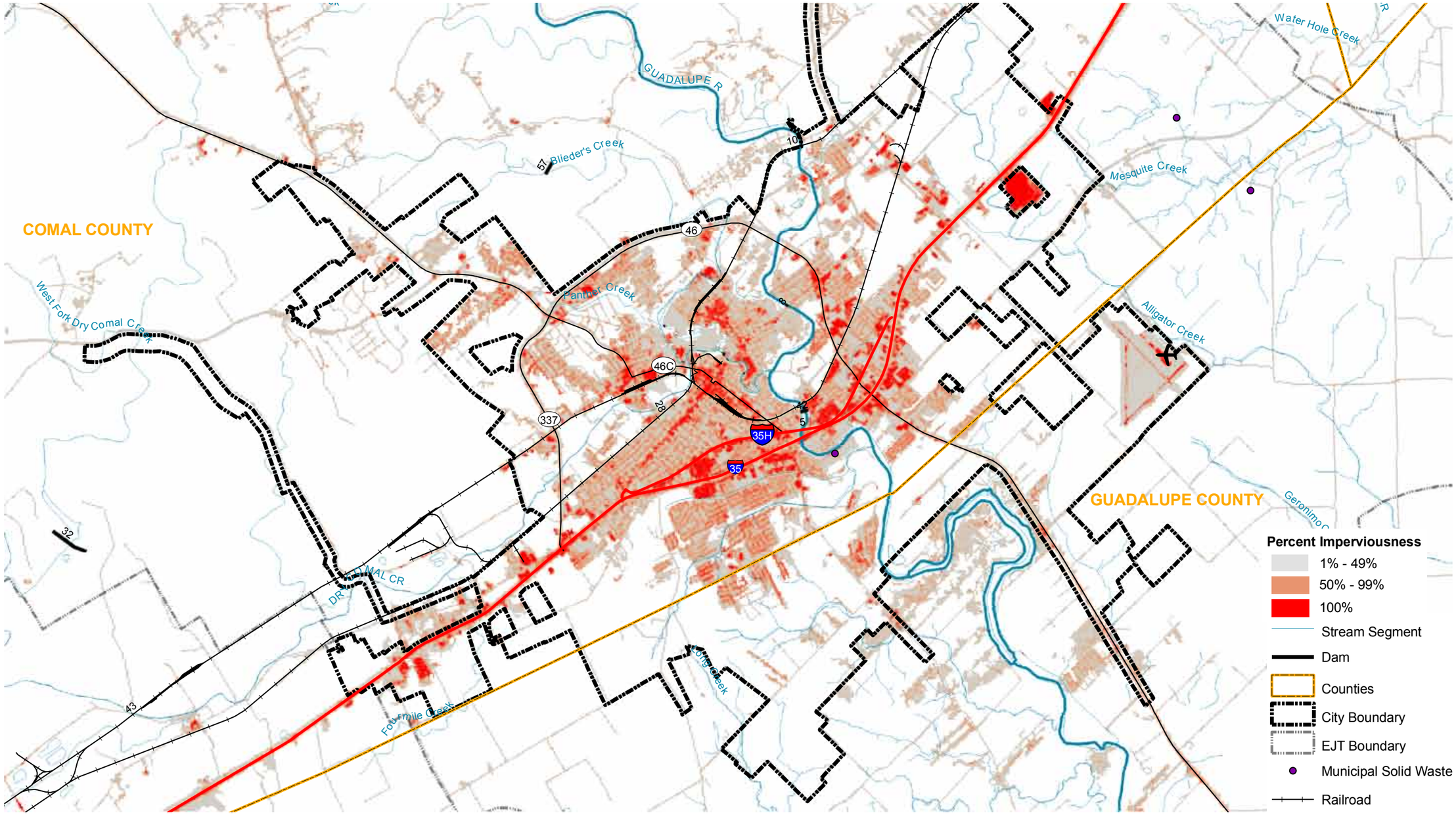
Data Sources: City of New Braunfels, TX Comm. Env. Quality, USGS, Comal County



NEW BRAUNFELS STORMWATER MASTER PLAN

FUTURE LAND USE - DRAFT 1.27.11

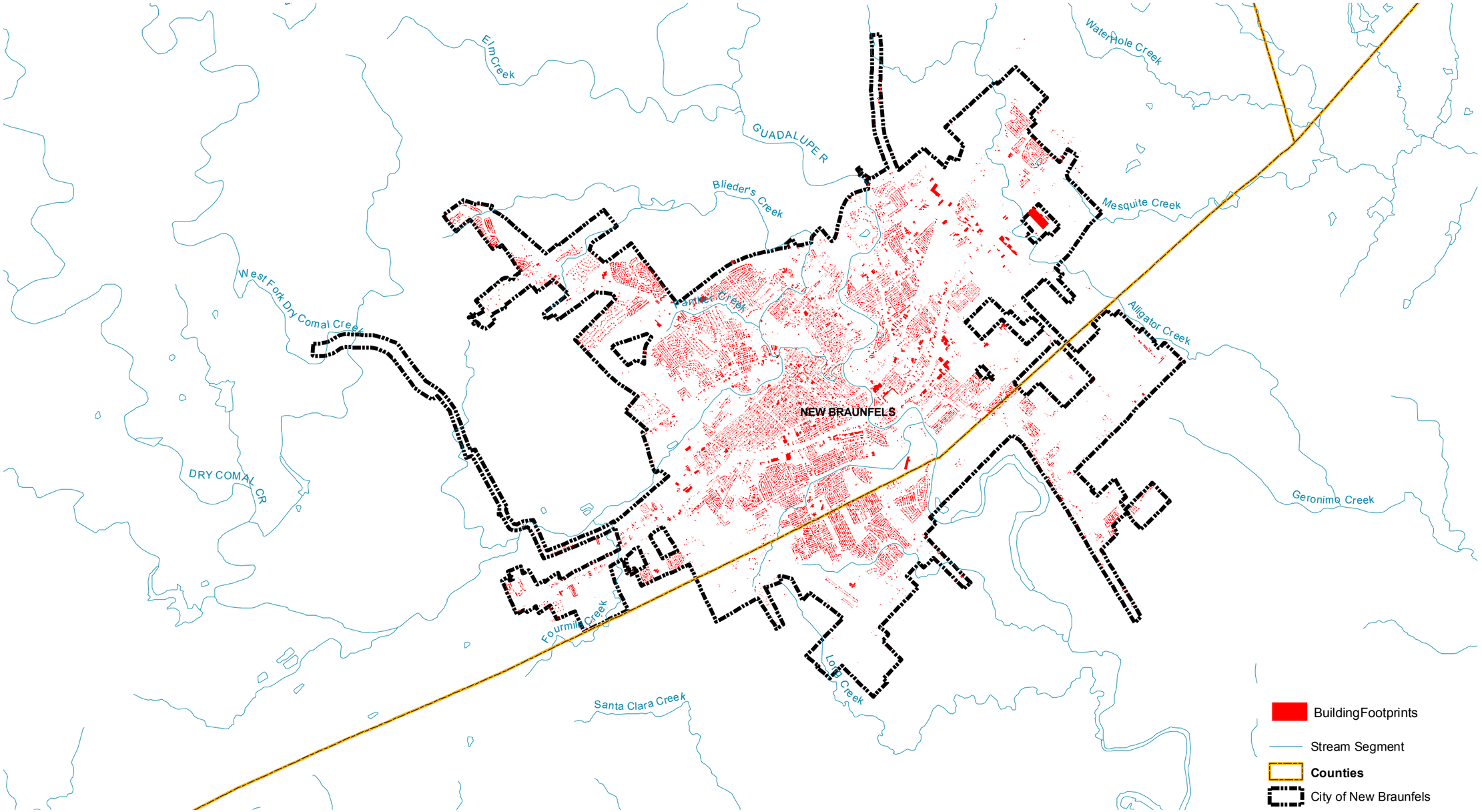
Data Sources: City of New Braunfels,
TX NRIS, TX DOT, USGS, State of Texas, TCEQ



NEW BRAUNFELS STORMWATER MASTER PLAN

IMPERVIOUS SURFACES - DRAFT 1.27.11

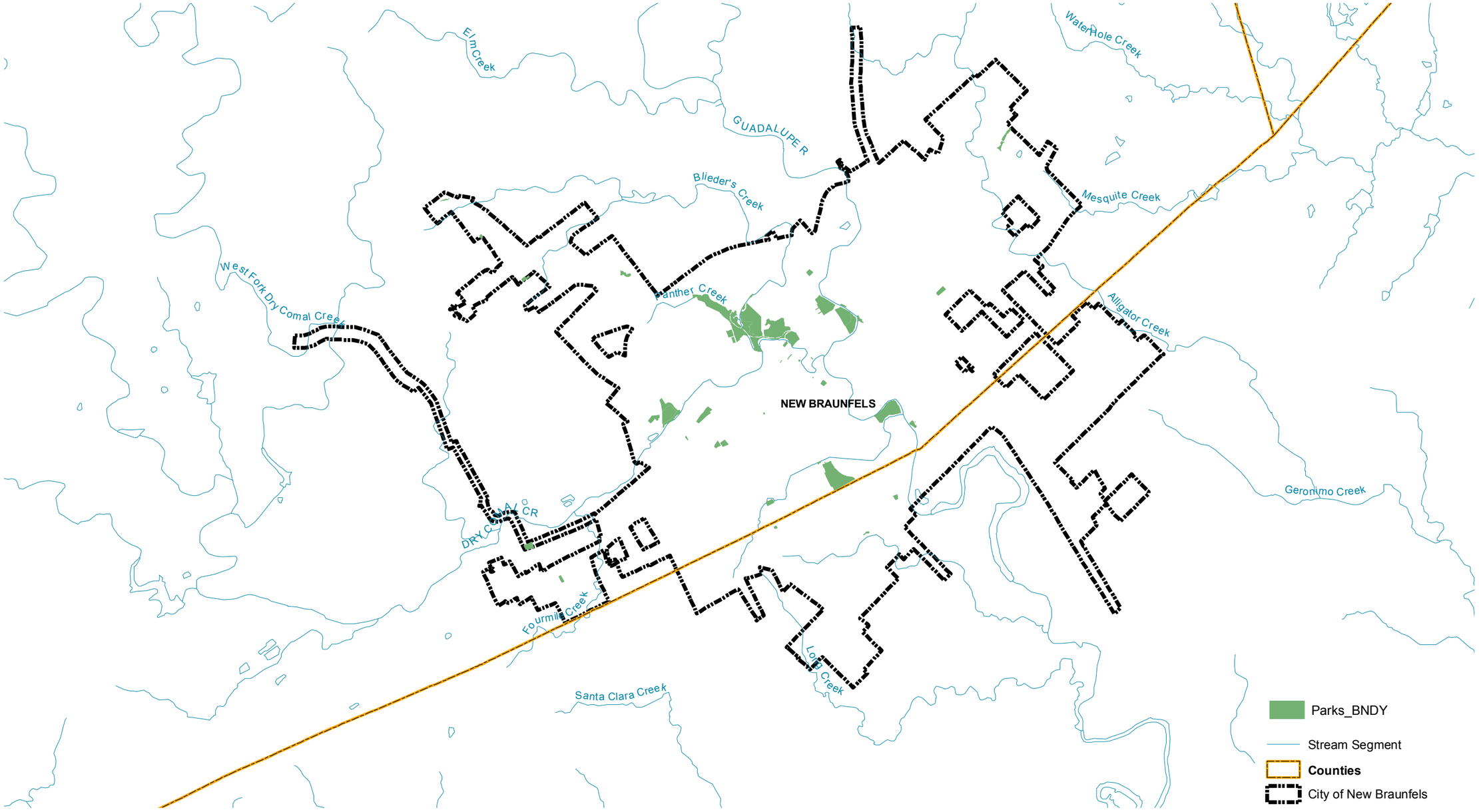
Data Sources: City of New Braunfels, TNRIS, TXDOT, USGS



NEW BRAUNFELS STORMWATER MASTER PLAN

BUILDING FOOTPRINTS - DRAFT 08/25/11

Data Sources: City of New Braunfels,
TX Natural Resources Information System,
TX DOT, USGS, State of Texas, TX Comm Env Quality

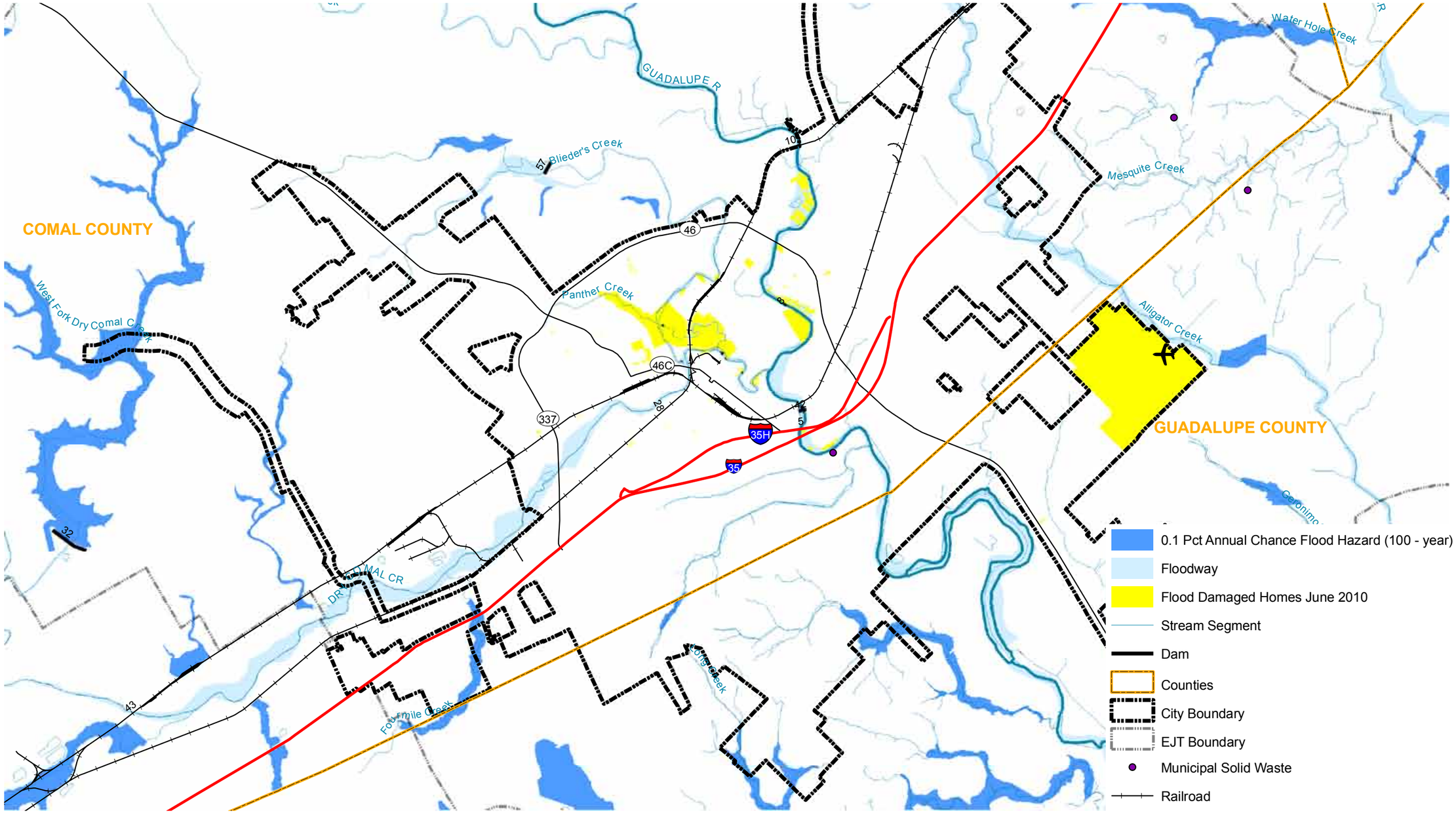


0 4,200 8,400 16,800 25,200 Feet

NEW BRAUNFELS STORMWATER MASTER PLAN

PARKS AND OPEN SPACE - DRAFT 08/25/11

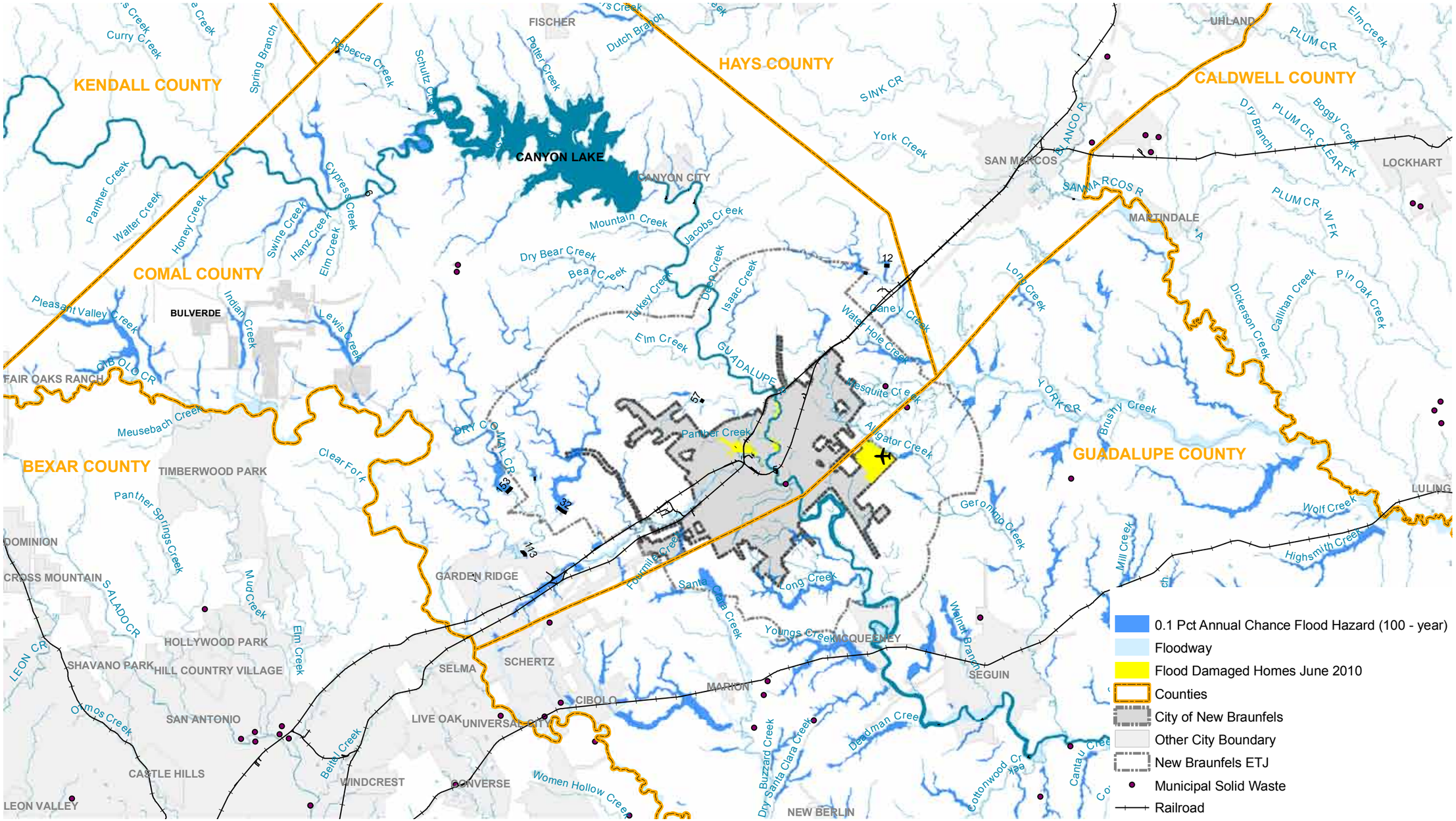
Data Sources: City of New Braunfels,
TX Natural Resources Information System,
TX DOT, USGS, State of Texas, TX Comm Env Quality



NEW BRAUNFELS STORMWATER MASTER PLAN

HYDROLOGY AND FLOODPLAINS - DRAFT 1.27.11

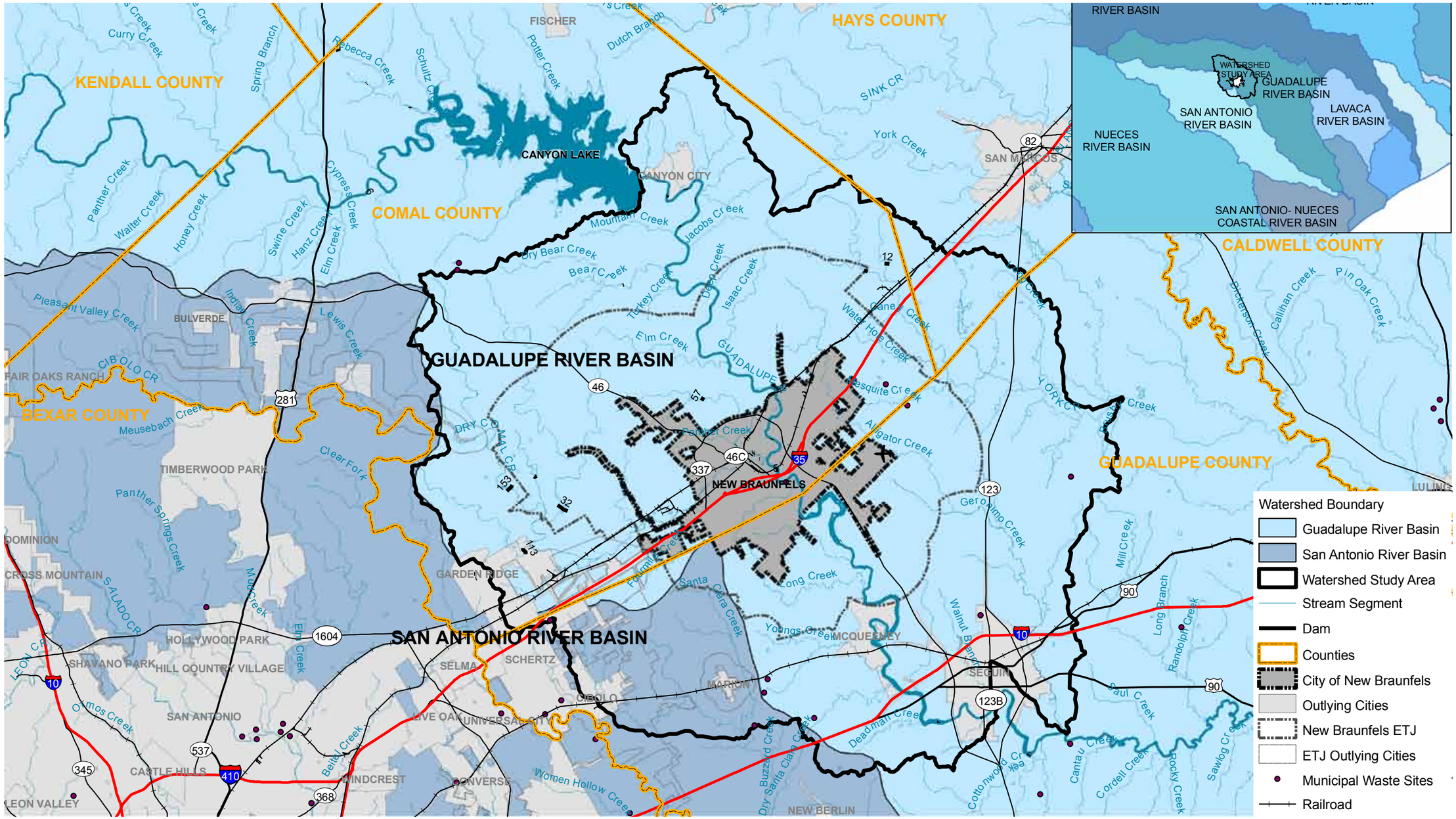
Data Sources: City of New Braunfels, TX Comm. Env. Quality, USGS, Comal County



NEW BRAUNFELS STORMWATER MASTER PLAN

HYDROLOGY AND FLOODPLAINS - DRAFT 1.27.11

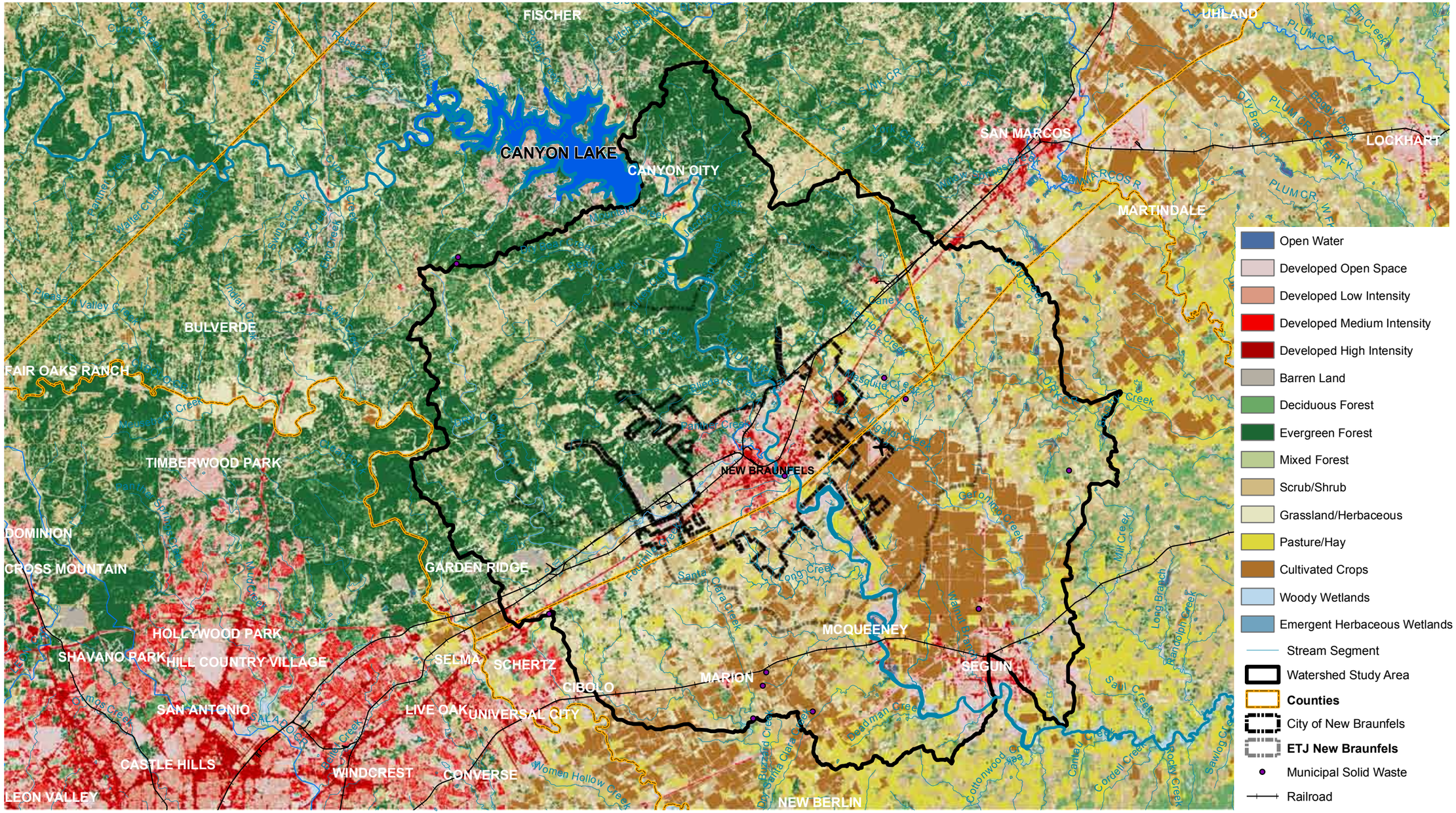
Data Sources: City of New Braunfels,
TX Commission for Environmental Quality,



NEW BRAUNFELS STORMWATER MASTER PLAN

REGIONAL WATERSHEDS - DRAFT 1.27.11

Data Sources: City of New Braunfels,
TX Natural Resources Information System,

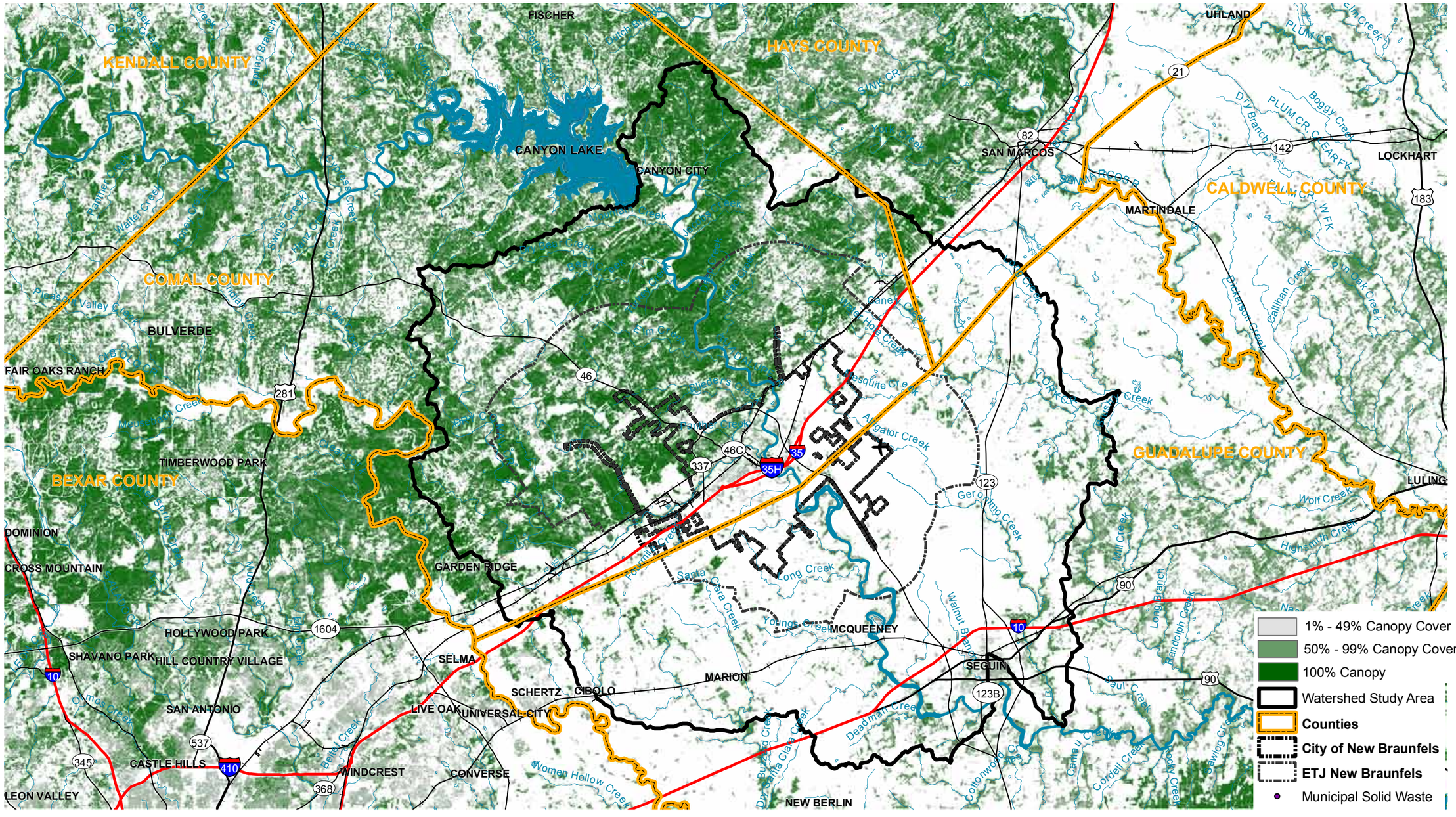


0 10,000 20,000 40,000 60,000 Feet

NEW BRAUNFELS STORMWATER MASTER PLAN

LAND COVER - DRAFT 1.27.11

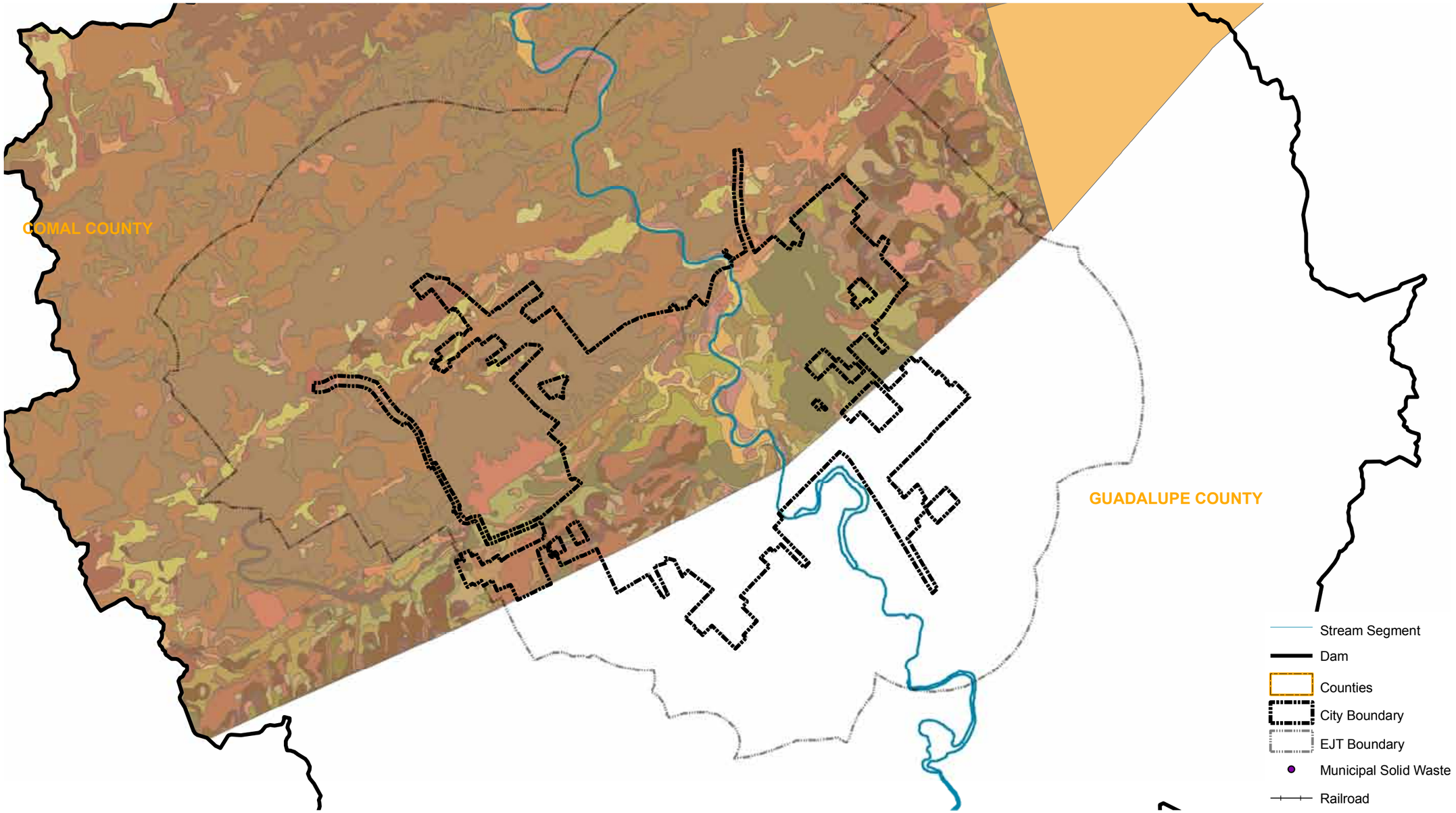
Data Sources: City of New Braunfels,
TX Natural Resources Information System,



NEW BRAUNFELS STORMWATER MASTER PLAN

TREE CANOPY - DRAFT 1.27.11

Data Sources: City of New Braunfels, TX Natural Resources Information System, TX DOT, USGS, TX Comm Env. Quality



NEW BRAUNFELS STORMWATER MASTER PLAN

SOILS - DRAFT 1.27.11

Data Sources: City of New Braunfels, TNRIS, TXDOT, USGS

Existing Code and Planning Documents

Existing land use and development code was reviewed for stormwater related issues such as stream setback, impervious coverage, parking requirements, landscape, water course protection, water harvesting/ conservation, and reuse/ recharge. In addition, City standards on landscaping, maintenance of parks and roads right of ways were reviewed. Finally, existing studies done on watersheds in New Braunfels, including EARIP, Alligator Creek Watershed Study and TCEQ Edward's Aquifer Stormwater Regulations were reviewed to incorporate components or ensure compatibility.

Review of these reports and documents were compiled into a excel database spreadsheet and tracked by specific code and page. This detailed data will be used as recommendations are made for the Stormwater Management Plan and Drainage Control Manual updates to ensure compatibility among City code, regulations and previous studies findings.

Below is a summary of the documents reviewed and application to the Stormwater Management Plan and DCM.

Document Summaries

TPDES Phase II Existing Stormwater Management

1. The New Braunfels TPDES Phase II - Storm Water Management Plan addresses the Texas Pollutant Discharge Elimination System (TPDES) program that designates New Braunfels as subject to regulation under Phase II storm water permitting requirements. This document contains valuable data that can relate to metrics.

Water Quality Documents

2. TCEQ: Complying with the Edwards Aquifer Rules - Technical Guidance on Best Management Practices was reviewed for the requirements that address activities that threaten the water quality in the Edwards Aquifer, including aquifer fed wells and springs and upland drainage areas. This document outlines the minimum requirements for water quality but the City of New Braunfels can be more stringent if desired.

3. The Edwards Aquifer Authority Act was reviewed because the EAA may develop their own best management practices for stormwater within Edwards Aquifer zones. For now the TCEQ is the main resource for this information.

4. Comal River Review shows a decrease in levels of bacterial contamination from the late 1990s to the mid 2000s. There was an increased reporting of elevated levels in 2008 and 2009.

5. E-Coli Samples were reviewed for baseline e-coli conditions.

6. High Priority Restoration and Mitigation Actions for the Comal and San Marcos Springs Ecosystems was reviewed for information on the restoration and mitigation projects in the New Braunfels area.

City Ordinances and Permitting

7. Ordinance Chapter 14: The Building Code and Building Regulation Ordinance was review for consistency with best stormwater management practices. Building permit requirements for fences specifically should not obstruct flows up to and including the 100-year peak flow.

8. Ordinance Chapter 58: The Flood Damage Prevention Ordinance was updated in 2010 and was reviewed to confirm regulations for development in floodways and for floodway variance. The document covers variance procedures, flood hazard reduction, residential construction, non-residential construction, enclosures and manufactured homes in designated in the 2009 Flood Insurance Rate Maps and/or Flood Boundary-Floodway Maps (FIRM and/or FBFM) as Floodways or FEMA Flood Zone A. The City of New Braunfels Building Department provided additional outreach after the 2010 flood to help homeowners navigate the permitting process for repairs due to flood damage.

9. Ordinance Chapter 83: The Parks and Recreation Ordinance was reviewed for information relating to river access and fees. It is an offense and a violation of this section for any person to enter any lake, river, stream or waterway by jumping, diving or doing any other dangerous act on or off any bridge, street, highway, appurtenance, publicly owned land or public right-of-way.

10. Ordinance Chapter 114: The Streets and Sidewalks Ordinance was reviewed for potential opportunities to incorporate Low Impact Design stormwater techniques into the road networks. Landscaping in street right-of-ways is regulated by the City and NBU. Efforts should be taken to ensure LID type of vegetation is allowed and supported.

11. Ordinance Chapter 118: The Platting Ordinance addresses water, sewer, drainage facilities and flood hazards for subdivisions. This document was reviewed for requirements related to drainage and runoff. Natural waterways and channels should be used to carry runoff, whenever practical. Landscape features are encouraged in locations where future street improvement, sidewalks, drainage improvements or utilities would not be located.

12. Ordinance Chapter 130: The Public Utilities Ordinances is the section implementing the TPDES and discusses wastewater and discharge. Illicit discharge is also regulated in Chapter 110 and 142 of the Ordinance Code.

13. Ordinance Chapter 143: The Drainage System Ordinance was reviewed for minimum building requirements relating to drainage improvements, setbacks, and impact analysis. The ordinance states that owners must provide a study of downstream impact and the city's drainage system's capacity to accept stormwater. Municipal Drainage Utility System Ordinance is reviewed in more detail as part of the more specific DCM review following this code review.

14. Ordinance Chapter 144: The Zoning Ordinance was reviewed for potential metrics and conflicts to stormwater. Topics reviewed include common open space, overhang easement, roof runoff, construction and pollution prevention and drainage and fences. The following sections relate to stormwater management.

    - Section 5.1 Parking paving requirements may create additional impervious cover.
    - Section 5.2 Landscaping should take into consideration stormwater LID features. Fences may not be lower in elevation than the highest point on either side of a drainage easement.
    - Section 5.8 Agriculture uses should have some regulation specific to drainage ways.
    - Section 5.20 The use of human-scaled elements on buildings could be rain harvesting.

Watershed Related Studies

15. The Watershed Management Fee Implementation Study (2003) was reviewed for potential policies and the methodology for applying costs associated with drainage and stormwater related expenses. This study recommended a fee based upon impervious cover for parcels for watershed and stormwater management and identified potential funding sources. In April 2011, the City of New Braunfels proposed a potential fee to the City Council and supported the creation of the Watershed Advisory Committee.

16. Geronimo and Alligator Creek Protection Strategies was reviewed for urban stormwater and wastewater management practices that could provide baseline material for metrics. Outreach education programs and funding partnerships are explored as mechanisms to protect water quality. Nutrient management training to interested parties is recommended. Sanitary sewers are proposed for areas served by septic systems.

17. Stream Assessment Deliverable 01 provides the methodology from which stream assessments will be conducted. It provides basic rules and guidelines for assessment teams. This document was reviewed for best management practices and techniques.

18. River Expenses were reviewed for actual costs of river expenditures including police, streets, parks, management, litter, and anti-litter campaigns. This data is useful for baselines of metrics.

19. The Impact of Tourism on Comal County measures the economic impact of tourism, which includes a specific measurement of river tourism. Obvious economic benefits are outlined as well as non-measurable impacts. The conclusion suggests that spending decisions influencing this sector be seen in a broad context. The data in this document is useful for baselines of metrics.

20. New Braunfels CIP Costs and Proposed Projects document was reviewed for understanding of previous drainage projects completed by the City of New Braunfels. Consideration for future projects should be made for potential increased costs due to stricter regulation sin the 2012-2017 FM MS4 implementation.

DCM Review

A detailed review of the existing Drainage Control Manual was completed by the consultants and City Staff in January and March. This review identified key issues related to the stormwater plan for New Braunfels and prioritization of completing changes. The detailed changes outlined in this review are below.

TOPIC	Prior.	PG #	SECT	TABLE	DW/LAN COMMENT	STAFF COMMENT
Page Numbering	0	69	1.0		Why does page numbering start with page 69?	
Variance from DCM requirements	3	69	1.1 B)		Consider elevating variances from DCM to higher than City Engineer	Strongly disagree. Ordinance should contain requirements which are not subject to interpretation and City Engineer should be allowed to interpret this document.
Type 1 Development Requirements	3	70	2.1.1		Require detention or fee-in-lieu for Type 1 Development	
Type 2 Development Requirements	3	70	2.1.2		Require detention or fee-in-lieu for Type 2 Development	
Digital Submissions	3	70	2.1		Require digital submission for some or all drainage report. Format to be worked out. Especially useful for drainage easement (aka future maintenance) locations.	
Design Storm Frequencies	2	71	2.1.3 B.1		Add 2-yr storm in range of design storm frequency requirements	50% storm in range of design storm frequency requirements
Drainage Mitigation Design Points	2	71	2.1.3 B.1		Add language that specifies mitigating peak flow downstream beyond requestor's property line some points TBD	
Water Quality	3	72	2.2		Update language to include Ph II, MS4 planned updates	
Stream Setback	2	72	2.3 A		Create a stream and riparian corridor setback requirement. Setback limits can very per watershed size of creek	
Tree Mitigation	3	72	2.3 B		Require tree mitigation to some degree. Keep it simple, perhaps a fixed replacement ratio for native trees above a certain size.	Tree mitigation really belongs somewhere else? Why have it as part of drainage?
Land Use Definition	1	72	2.4		Remove requirement to use 1997 aerial. Replace with latest available aerial (and require aerial submission with date of aerial provided)	Need to keep reference to old aerial. In fact, 1997 is not old enough to capture "pre-development" conditions.
Drainage Mitigation Design Points	2	72	2.5.1.A-C		Expand on discussion to not transfer problem downstream. Explain in more detail how calculations should be performed further downstream to prove it.	
Design Storm Frequencies	2	73	2.5.2.A		Add 2-yr storm in range of design storm frequency requirements	50% storm in range of design storm frequency requirements

TOPIC	Prior.	PG #	SECT	TABLE	DW/LAN COMMENT	STAFF COMMENT
Stormwater Infiltration	3	73	2.5.2.D		Look for ways to promote responsible infiltration to the EARZ.	
Lot Basins and slopes	0	73	2.5.2.F		Don't understand criteria	
Stormwater retention or detention facilities		74	2.5.2.G.4			Add a freeboard requirement
Pond Side Slopes	3	74	2.5.2.G.6		Change 2.5:1 max to 3:1 max, even consider requiring flatter over a certain depth	
Culvert Outlet Erosion	3	75	2.5.3.E		Define maximum velocity or shear requirements	
Sediment Accumulation in Culverts	3	75	2.5.3.F		Define minimum slope and/ or minimum velocity to avoid sedimentation	
Minimum Culvert Size	3	75	2.5.4.A.4		Change minimum culvert size to 18"	
Storm Drain Systems	1	76	2.5.5.A.2			Do we want to allow HDPE pipe?
Storm Drain Systems	1	76	2.5.5.A.7			300 foot spacing conflicts with Table 8.2
Channels	3	77	2.5.6.A		Reinforce from "encourage" to "require"	Reinforce from "encourage" to "require"
Channels	1	77	2.5.6.B			Does the language about encroachment in FEMA floodways really belong here?
Channels	3	78	2.5.6.B.3			Consider reduction of 12' maintenance access
Sediment Fencing	0	78	2.5.6.C.3		What criteria does the City use to qualify the use of fencing?	What criteria does the City use to qualify the use of fencing? - there isn't one.
Channel Design	3	78	2.5.6.E		Improve language with more specifics	
Diverse Channel Design	3	78	2.5.6.F		Improve language with more specifics	
Maintenance	3	79	2.7		Identify maintenance standards	
Freeboard requirements	3	79		Table 2-3	Update reference to wave action and SPF for channels	
Freeboard requirements	3	79		Table 2-3	Explain difference between channel and swale/ditch (watershed size?) or combine to one row	
CAD requirement	3	80	2.8.A		Update AutoCAD 14 reference	
Erosion Hazard Setback	2	83	2.9		Update write-up with more detail and specific setback requirements. Remove bank stabilization option.	
Finished Floor Elevation	1	83	2.10			Omit entire section. Building Official sets building slab elevation.
Ordinance vs. Manual	1	84	3.0		Update reference to Appendix D	

TOPIC	Prior.	PG #	SECT	TABLE	DW/LAN COMMENT	STAFF COMMENT
Rainfall Data	2	85	4.1 B	Table 4-1 (IDF) Coeff.	Update with new USGS data	
Software	1	85	4.4		Change HEC-1 reference to HEC-HMS	
Standard Project Precipitation (SPP)	3	85	4.3		Suggest removing any definitions here and only referring to USACE documentation	
Rainfall Data	2	86	4.1 B	Table 4-2 (IDF) Coeff.	Update with new USGS data (consider removing/combining with Table 4-1)	
Rainfall Data	2	86	4.4	Table 4-3 (DDF)	Update with new USGS data	
Proposed development accounting for fully developed upstream conditions	2	87	5.2		Further define this criteria and "fully developed conditions". Should project drainage assume no upstream detention?	
Use of Rational Method	3	87	5.3		Reduce Rational method down to 100ac or less	
Runoff Coefficients	2	88	5.3.2		Don't use ASCE 1969 reference for runoff coefficients. Use more recent TxDOT, FHWA, ASCE, or other reference	
Runoff Coefficients	2	88	5.3.2	Table 5-1	Add 50-yr K=1.2	Why? City doesn't require use of 50-year flow.
Time of Concentration	2	89	5.3.3		Update Shallow Concentrated Flow Equation	Errata sheet, sheet flow formula provides wrong units
Time of Concentration	2	89	5.3.3		Consider Kirby-Kirpitch or Lamar research for Tc	Look at method of calculating Tc - comments that the method described provides extremely high times
Antecedent Moisture	2	90	5.4.1 B		Why AMC III? Use AMC II or Hailey & McGill adjustment map	Mistake in manual
Manning's "n" for Overland Flow and Shallow Concentrated Flow	1	90		Table 5-4		Look at updating TR-55 provides a better detailed Manning's n table
Soil Types	1	90	5.4.1 B		Eliminate reference to Tom Green County, TX. Consider use of NRCS-WSS	
SCS/ NRCS Unit Hydrograph	1	92	5.4.1.C			Spelling "computed"
Use of FEMA flows	1	90	5.4.B		Delete this section. New Braunfels should not make a blanket statement to not use FEMA flows.	
Hydrologic Software	1	94	5.6		Update Hydrologic Computer Programs	

TOPIC	Prior.	PG #	SECT	TABLE	DW/LAN COMMENT	STAFF COMMENT
Street Flow	3	96-100	6.0		Consider simplifying this section with fewer equations and permutations of crown	
Flow Calculations for Parabolic Street Sections	1	97	6.3.2			Refer to table 6-4, no such table exists
Inlet Design	3	101-108	7.0		Consider deleting much of this section, keep only "local" inlets and otherwise refer to TxDOT/ FHWA/other	
Storm Sewer Design Size	3	109	8.1 A		Why sized for full flow?	
Maximum Manhole Spacing	3	110	8.1	Table 8-2	Reduce maximums. Consider using TxDOT or other reference	
Maximum Velocity in Storm Drains	3	110	8.1	Table 8-3	Update velocity maximums	
Critical Depth Calculation	3	111	8.1	Eq. 8-2	Yc should be solved for Channel not pipe	
Super Critical Flows	3	116	9		Provide more design criteria for super critical flows	
General "Weeds"	1	116	9		Remove reference to "weeds" throughout document	
Channel Design	3	116	9	Table 9-1	Add native vegetation coefficients and consider shear design	
Energy Dissipation	1	127	10.6.B			Verify formula (Eq. 10-6)
CN minimums for detention	3	128	11.1.C		Either delete this section or provide more clarity and justification for it	
Minimum Pond Floor Slope	3	128	11.2.A.1		Increase minimum pond slope from 0.25% to 1.0%	?
Security Fencing	1	128	11.2.4		Fix typo	
Maintenance Access	3	128	11.2.5		Consider reduction of 12' maintenance access	2.5.6.B.3 also
Silt Removal	3	128	11.2.7		Clearly define methods for silt removal based on vegetation	
Outlet Structure Design Equations	3	129	11.3		Update Outlet structure design equations	
Playa Lakes	1	129	11.4		Strike this entire section	
Lakes, Dam and Levees	1	130	12.0			Suggest some structural/ geotechnical requirement for these designs as well
Levees	3	133	12.2		Strongly discourage use of levees by making conservative criteria	
E&S During Construction	1	135	13		Update E&S for Construction to refer to new TCEQ / EPA regulations	
References to TNRCC	1	general			Update References to TNRCC to TCEQ	

TOPIC	Prior.	PG #	SECT	TABLE	DW/LAN COMMENT	STAFF COMMENT
Drainage Easement Dedication	3	general			Require drainage easement dedication for "fully developed, undetained" floodplain	
Pond Design	3	general			Need criteria for pond design and existing vegetation	
Vegetative Cover	3	general			Need criteria for proposed vegetation	
LID	3	general			Need to add a LID section	