NOTICE OF MEETING OF THE GOVERNING BODY OF THE CITY OF NAVASOTA, TEXAS
MAY 8, 2023

Notice is hereby given that a Special Meeting of the governing body of the City of Navasota will be held on the 8th of May, 2023 at 4:30 PM at the City Hall in the City Council Chambers, Room No. 161, located at 200 E. McAlpine Street, Navasota, Texas 77868, at which time the following subjects will be considered, to wit:

To watch the City Council meeting live please visit the City of Navasota's Youtube here: https://www.youtube.com/channel/UCltnx7BQt0TCIYJRiZ14g5w

1 Call to Order.

2 Remarks of visitors: Any citizen may address the City Council on any matter. Registration forms are available on the podium and/or table in the back of the city council chambers. This form should be completed and delivered to the City Secretary by 4:15 p.m. Please limit remarks to three minutes. The City Council will receive the information, ask staff to look into the matter, or place the issue on a future agenda. Topics of operational concerns shall be directed to the City Manager.

3 Workshop item on presentation by OnPointe Insights related to a proposal to conduct a city-wide survey. [Jason Weeks, City Manager and Rayna Teicheira, Economic Development Director]

4 Workshop item to discuss results from R.W. Harden & Associates for the Groundwater Availability Study for the City of Navasota. [Jennifer Reyna, Public Works Director]

5 Adjourn.

DATED THIS THE 3RD OF MAY, 2023

/JW/

BY: JASON WEEKS, CITY MANAGER

I, the undersigned authority, do hereby certify that the above notice of meeting of the governing body of the CITY OF NAVASOTA, is a true and correct copy of said notice and that I posted a true and correct copy of said notice in the glass bulletin board, in the foyer, on the south side of the Municipal Building as well as in the bulletin board on the north side of the Municipal Building of the City of Navasota, Texas, a place convenient and readily accessible to the general public at all times, and said notice was posted on the 3rd of May, 2023 at 02:00 PM and will remain posted continuously for at least 72 hours preceding the scheduled time of said meeting. Agendas may be viewed at www.navasotatx.gov.

The City Council reserves the right to convene in Executive Session at any time deemed necessary for the consideration of confidential matters under the Texas Government Code, Sections 551.071-551.089.

DATED THIS THE 3RD OF MAY, 2023

/SMH/

BY: SUSIE M. HOMEYER, CITY SECRETARY

THIS FACILITY IS WHEELCHAIR ACCESSIBLE AND ACCESSIBLE PARKING SPACES ARE AVAILABLE. REQUESTS FOR ACCOMMODATIONS OR INTERPRETIVE SERVICES MUST BE MADE 48 HOURS PRIOR TO THIS MEETING. PLEASE CONTACT THE CITY SECRETARY'S OFFICE AT(936) 825-6475 OR (936) 825-6408 OR BY FAX AT (936) 825-2403.

REQUEST FOR CITY COUNCIL AGENDA ITEM #3

Agenda Date Requested: May 8, 2023
Requested By: Jason Weeks, City Manager
Department: Administration

(•) Report ( ) Resolution ( ) Ordinance

Exhibits: Proposal for Navasota Survey

Appropriation	
Source of Funds:	N/A
Account Number:	N/A
Amount Budgeted:	N/A
Amount Requested:	N/A
Budgeted Item:	(•) Yes ( ) No

AGENDA ITEM #3

Workshop item on presentation by OnPointe Insights related to a proposal to conduct a city-wide survey.

SUMMARY & RECOMMENDATION

Since the City of Navasota is in the process of developing a two-to-three-year Strategic Plan, staff reached out to several firms that provide city-wide survey services. The concept is to survey our residents and businesses to better understand areas of concern and prioritized focus during the budget process. Ron Gailey with OnPointe Insights will be attending the workshop remotely to provide a demo and presentation on his survey product and answer any questions or concerns City Council may have about the process and possible outcomes.

The survey is a tool built to help city leaders intuitively prioritize and focus their limited resources. The OnPointe team has experience with some of the world's largest companies such as Coca-Cola, KFC, Amazon, Netflix, major banks, and universities. As it relates to municipalities, they have experience working with several Texas cities such as Keller, Boerne, Coppell, Lago Vista, Richland Hills, Saginaw, and West University Place.

The survey will be designed with Navasota's goals in mind. The product will giver our citizens a voice, allow Council and staff to know where to prioritize funds, and allows us to move forward with confidence in those goals. What differentiates OnPointe Insights from other firms is that they provide clear, concise, and to the point questions. Many surveys we've seen are too long, ask similar things in different ways, and are difficult to analyze with clarity. OnPoint Insights surveys efficiently create clarity. First, they ask what is most important, then they only rate the city if important. The core survey is 7-8 minutes long, with time for city deep dives on other topics. Once completed the survey results can

be accessed through the online dashboard. This dashboard is clear, intuitive, and able to be shared on our website. Users will be able to easily filter any question by age, gender, time in the city, and any other relevant characteristics of our citizens.

OnPointe provides a flexible cost approach. Some cities wish to only do a one-time survey, which costs $19,960. However, OnPointe and the City of Navasota benefit if we are open to a longer relationship. For a 2-year commitment, the cost is $17,460 per year and for a 3-year commitment, the cost is $14,960 per year. The survey process takes about 7-8 weeks to complete. Depending on City Council feedback, staff could begin identifying funding to complete this year prior to the August budget retreat, or plan to include within next year's budget.

ACTION REQUIRED BY CITY COUNCIL

Provide feedback to City staff about moving forward with a city-wide survey.

Approved for the City Council meeting agenda.

Jason Weeks

Jason B. Weeks, City Manager

5/3/23

Date

City POV

Proposal
April 2023

Ron Gailey
ron@onpointe-insights.com

Onpointe insights

Bringing the Voice of Your Citizens to Life

/01 **Who is OnPointe Insights**
Who We Are and Why That Matters to Your City

/02 **How CityPOV Questions Are Different**
Our approach to make you successful.

/03 **Timing / How to Engage Citizens**
What it Takes to Get This Done

/04 **Demo**

For You, For the People.

Our Focus is on City Leader Needs

You're in city leadership to **do good**, **improve your city**, and **make a difference**—which means you must give citizens a voice. But key hurdles stand in your way. Complexity. Competing Requests. Designs by Committee.

We simplify the work of helping you connect with citizens and unite city leaders.

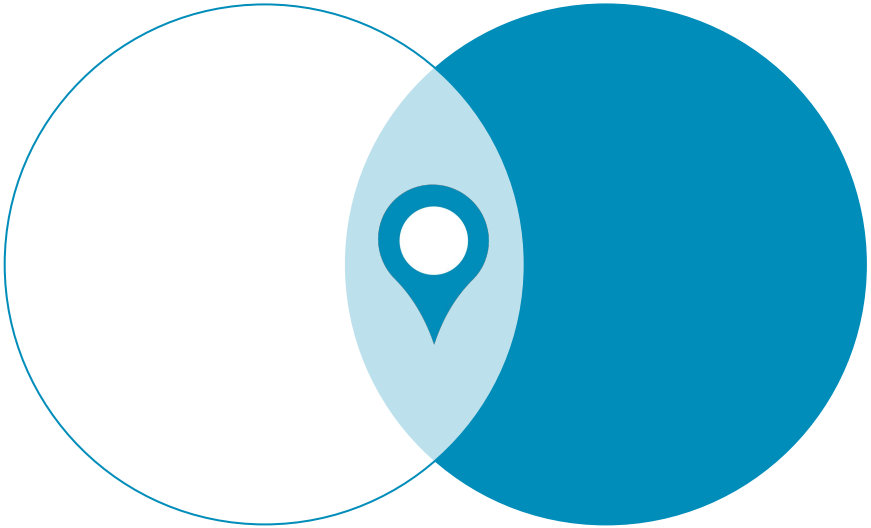
A Focused Approach for Better Results.

When we were first asked by a city manager to design and execute their citizen survey, we paused to lean on our experience in the business world. With a review of their previous survey (and others like it) we created a new plan to…

- Give them **4x the insights in half the length** of their prior survey
- Make it easy for people to take
- Design it for mobile (because 60%+ would take it on their phones)
- Give flexibility in how the survey was distributed
- Eliminate cheaters or ballot stuffers
- Create a process to rapidly develop a great survey with less effort
- Provide powerful, intuitive results in a dashboard that allows for exploration

The end result was CityPOV, a powerful citizen survey designed for success. It's a tool built to help city leaders intuitively prioritize and focus their limited resources.

And with its low price it's easy to do annually to adjust priorities and track progress.



Why OnPointe?

Fortune 100 Expertise for the Public Sector

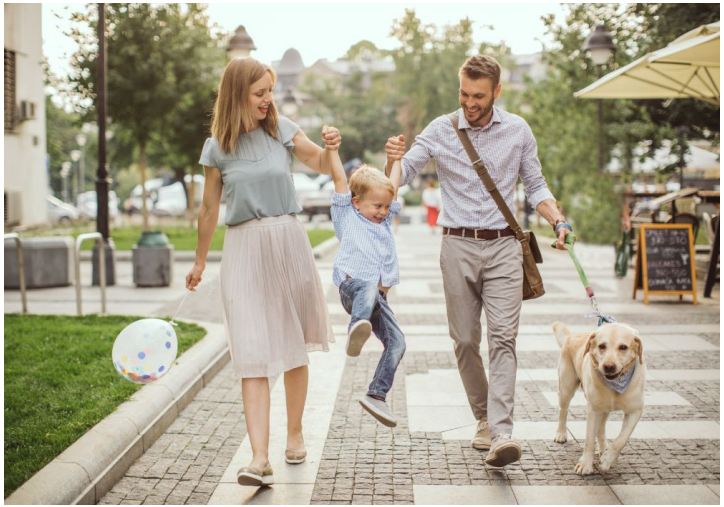
The team at OnPoint Insights is expert at delivering useful citizen surveys for city leaders. What makes the difference?

Experience with some of the world's largest companies. We know research. We've worked at and provided key insights to leaders at Coca-Cola, KFC, Amazon, Netflix, major banks and universities, and more.

A singular focus on helping cities and towns. After years working with global giants, we found fulfillment when we helped city leaders. We loved providing city leaders the citizen input they needed. Now, it's all we do.

Holistic, end-to-end solutions built for results. We design our surveys to ensure the final results are easy to digest and intuitive to apply, keeping your final analysis and key decisions in mind.

Designed With Your Goals in Mind



Give Your Citizens a Voice
CityPOV helps you discover what you don't know about how your citizens really feel so you can do the greatest good in your community.

Know Where to Prioritize
With CityPOV you'll gain an understanding of what should be prioritized so you can make the best decisions, despite competing voices. It's perfect for budgeting and planning.

Move Forward with Confidence
Unite your city leadership to ensure everyone is aligned and moving in the best direction based on citizen feedback.

Experience...

Ron Gailey, Founder

Ron Gailey established his research capabilities by directing research at two Fortune 500 banks. Then, for 8 fascinating years he led insights for Coca-Cola across Asia (China, Japan, Australia, India, Vietnam, Thailand, Indonesia, and more.)

His task... create the insights that senior leaders needed for strategic decisions, breakthrough marketing and improved performance.

Ron started his own research company in 2017. It quickly grew as they devoted their time to help leaders at Coca-Cola, T-Mobile, KFC, 1800 Contacts, Kellogg's, Essilor and others make smart decisions with well-designed research.

Along the way, Ron fell in love with research for cities and towns. He started OnPointe Insights, a company devoted to helping mayors, city managers, city councils and other civit leaders with their challenges. It's his way of using his experience and skills to support the local community and give back.

David Gailey, Co-Founder

David Gailey is the former Head of Research for Singularity Education Group where he led initiatives to learn how emerging technologies like AI and Virtual Reality could positively impact local and global communities.

He leveraged the latest in survey, digital, and neuroscience-based methods to find new insights.

At the survey tech giant, Qualtrics, David helped organizations like Amazon, Netflix, Uber, American Airlines, Bank of America, and the US Department of Health & Human Services build state-of-the-art research programs.

Along with holding an MBA from the A.C. Nielsen Center for Marketing Research at the University of Wisconsin, David built his research chops as a Corporate Researcher at SC Johnson and in quantitative and qualitative roles at the research agencies BrainJuicer (now System1) and TNS.

Recent City Clients

Keller, Texas

Boerne, Texas

Coppell, Texas

Lago Vista, Texas

Union City GA

Payson, Utah

American Fork, Utah

Marco Island, FL

Tremonton, Utah

Mapleton, Utah

Richland Hills TX

Saginaw, TX

Farmington, UT

West U, Texas

West Richland, WA

Why OnPointe's approach is better…

Casey Lucius
Deputy City Manager
Marco Island, FL

Click to watch video

How CityPOV Questions are Different

/02

Typical Survey Questions Create Confusion

How satisfied are you with . . . .

- Everyone is asked every question
- The lists are long and tedious
- Inconsistent: some ask satisfaction, others are agree/disagree, etc.

How do you feel about _____?

- Too many open-ended
- Word clouds that convey little
- Difficult to analyze and use
- People don't answer the question, but share what's on their mind

City surveys we've seen are too long, ask similar things in different ways, and are difficult to analyze with clarity.

OnPointe Surveys efficiently create clarity

First: What is MOST important?

- Important **Facilities/Amenities**
- Important **Benefits**
- Important **Growth issues**
- Important **Safety issues**
- Important **Operational issues**

Second: Only rate the City if important . . .

- (If Important) How well is the city doing?
- Overall priority of importance

The core survey is 7-8 minutes long, with time for city deep dives on other topics

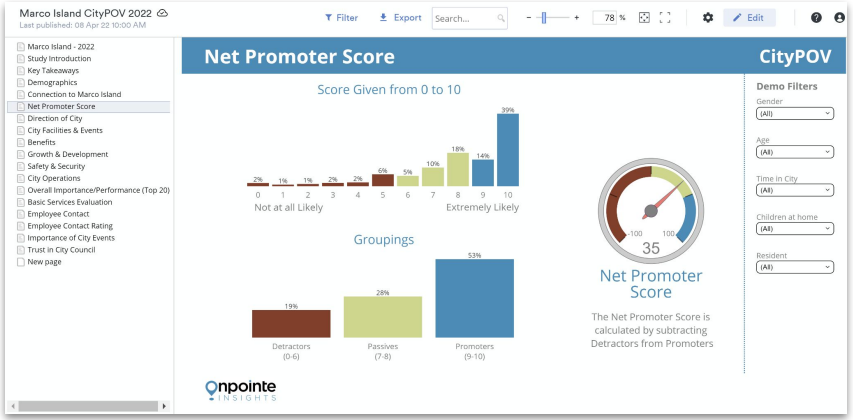
Access Insights Anywhere

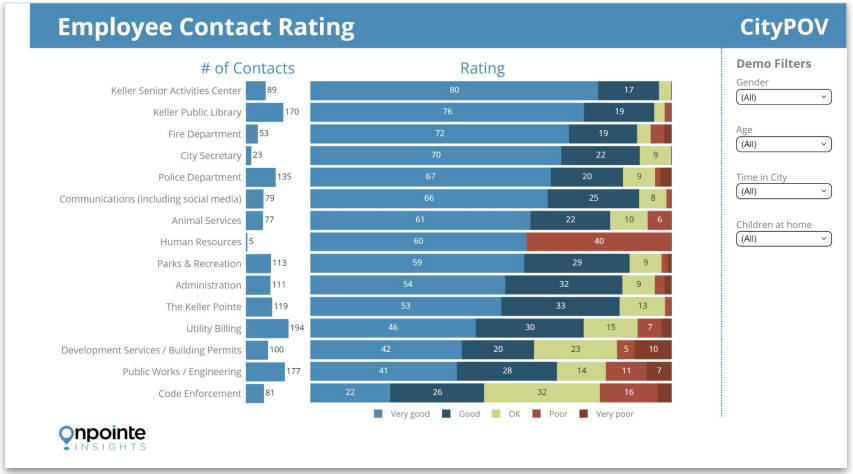
Through Rich, Online Dashboards

Gone are the days of searching your email or download folder for the powerpoint report or PDF that was filed away. We offer a vibrant and filterable online dashboard for you to view and share among leaders in your city.

Then, simply take a quick peek before a budget review or pull up data live in a council meeting.

We've got your covered.





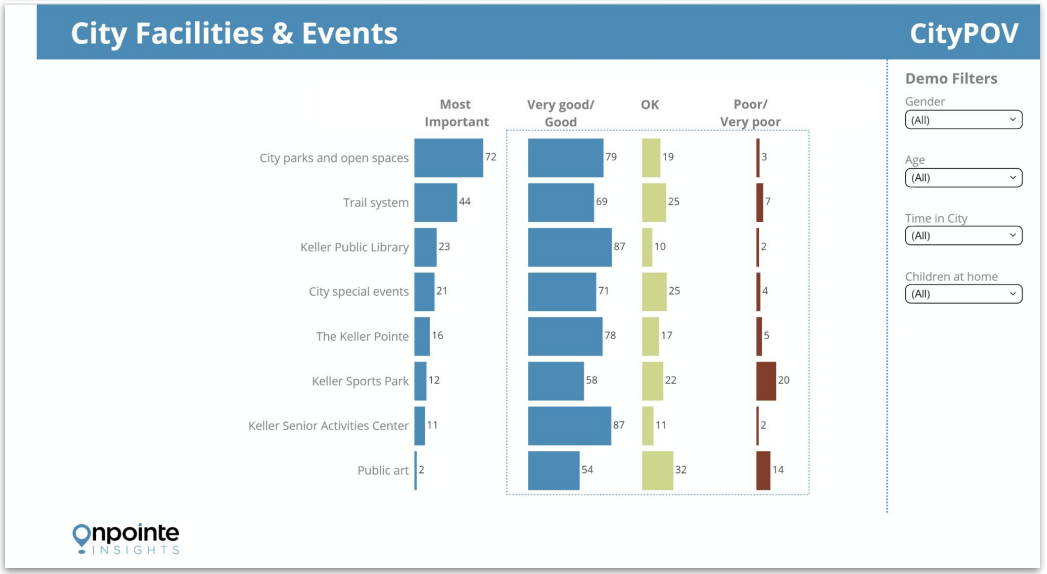
Getting the Nitty Gritty

How We Sift to Get Top Priorities

The **beautiful dashboard** is clear, intuitive, and able to be shared on your website. Most of our city clients post the results for all to see.

And, you can easily filter any question by age, gender, time in the city and other relevant characteristics of your citizens.

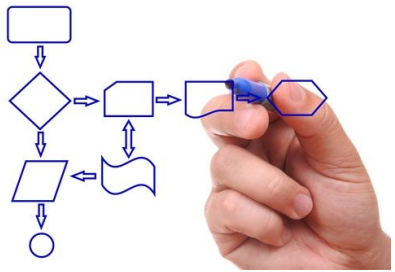
Powerful and Clear Visualizations



A Process you can Trust

A Streamlined, Proven Process

Our process has been proven to ensure you receive the quality insights you need with minimal effort from your team..



The Steps We'll Take

Working with you and your team, OnPointe Insights will do the following:

- Lead a 60-90 minute "virtual" kickoff session to align on study topics unique to you while sharing best practices from other cities
- Develop the initial survey draft, share it with you for internal sharing, and then quickly make refinements
- Program and test the survey, allowing your team to test also
- Give you the online survey URLs and/or QR codes to CityPOV, or you can provide us emails and we'll invite/remind them
- Collect, tabulate, and analyze the data
- Debrief your team on the findings and important areas of focus
- Introduce you to the powerful dashboard and teach you how to use it
- Provide a PowerPoint/PDF summary, Excel tables, raw data, if desired
- Present to your City Council, if desired

The Numbers/ Timing

/03

CityPOV Costs

OnPointe provides a flexible cost approach. Some cities only wish to do a one-time survey. Our cost is $19,960 for a single survey.

We both benefit if your city is open to a longer relationship.

For a 2 year commitment, the cost will be $17,460 per year.

For a 3-year commitment, the cost is just $14,960.

You also get a discount on any additional research we do with you for a commitment of 2 years or more.

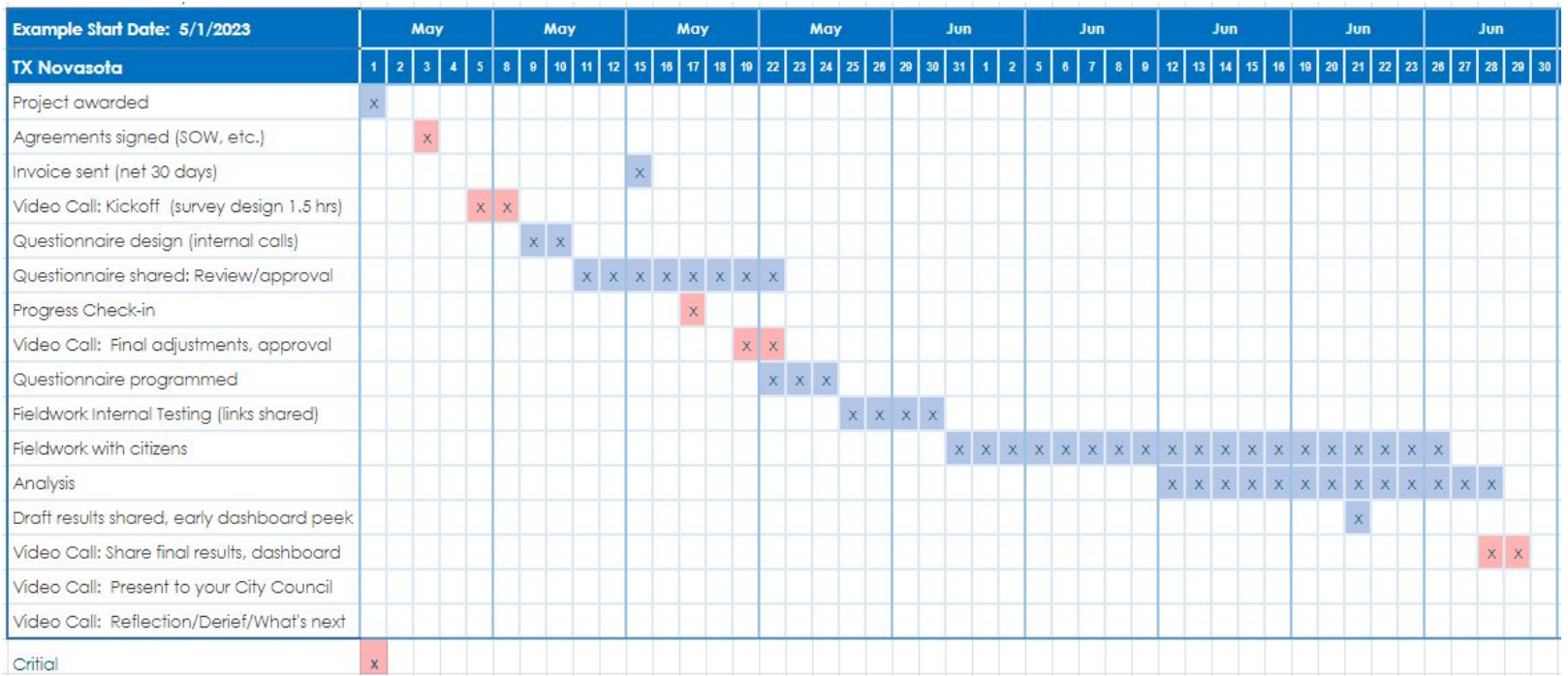
Relationships Matter

CityPOV Cost Details	Fees USD$
Project management	$2,060
Questionnaire Design/Programming	$1,790
Questionnaire technology fees	$950
Fieldwork & monitoring	$900
Data extraction	$510
Coding, Cleaning	$1,790
Analysis / Insights development / Report	$4,610
Dashboard tech fees / creation / Updating	$7,350
Total Research Investment (1-time)	**$19,960**
Discount for 2-year contract (per year)	($2,500)
2-year contract annual cost (per year)	**$17,460**
Discount for a 3-year contract (per year)	($5,000)
3-year contract annual cost (per year)	**$14,960**

OnPointe Timelines

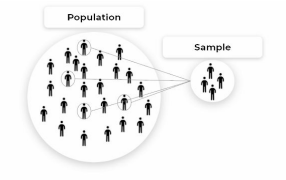
CityPOV projects take approximately 7-8 weeks to complete. This includes survey design, fielding, dashboard creation, and analysis. Every piece of the project is managed by OnPointe Insights with approval from City officials involved. You focus on running the city and we'll take as little of your time as possible.

If we work efficiently, timelines could be shorter.



Invitation Details

1



Sample Options

We typically get a 5% to 10% response rate to our CityPOV surveys. Using multiple contact methods, rates are even higher.

For cities with populations of 10K or more, we typically get 1,500 to 2,000 resident responses, far more than needed for 95% confidence of +/- 2.5%. We can get more.

2

Response Rate Influencers

Depending on your ability to communicate directly with residents, response rates will differ.

- Email - High response rate (from utility emails)
- SMS - High response rate
- Website posting - Fair rate
- Newsletter article - Fair rate
- Postcard mailing - Low rate and expensive (postage)

3

Survey Invite Links, etc.

OnPointe Insights will provide links and codes to make it easy for residents to get to the online survey.

- Email - A URL link
- SMS - A Short URL link
- Website posting - A QR Code
- Newsletter article - A QR Code
- Postcard mailing - A QR Code and Short URL link

Our website demo let's you see it in action. Scroll down one page to get to the demo.

CityPOV Demo

DEMO – The link above is a functioning demo of CityPOV. For a live demo. Contact ron@onpointe-insights.com

/04

Thank You

Contact:

ron@onpointe-insights.com

Onpointe insights

Appendix

/05

The appendix pages that follow have our FAQs and show actual examples of several dashboard pages you will receive. These results will provide you with the clarity you need to focus your efforts for the coming year. And, if done annually, you can monitor progress and refine your efforts and communications for residents of your city.

Frequently Asked Questions

FAQs – pg 1

You work with companies like Coca Cola, T-Mobile, and KFC. Why has OnPointe Insights chosen to work with the public sector?

While working with demanding senior executives at these firms, we learned how to design surveys that make next steps intuitive. They wouldn't waste time with long reports and they didn't just trust us to tell them what to do. They needed to see it with their own eyes. We know things about survey and analysis design others do not. That said, we love helping cities. It's far more fulfilling than selling more product. We give back by using our unique skills to help city leaders.

Why should we trust OnPointe Insights to help us in the public sector?

Experience. We are experts in survey design and in solving problems for demanding clients. The skill set we've developed allows us to solve things that couldn't be addressed by well-meaning people who haven't had that experience.

Why is CityPOV superior to other city surveys?

Most city surveys are a tangle of questions designed by committee. Most city surveys are either too simplistic or are fatiguing for residents who take them. Many are myopic on certain issues, trying to prove an internal opinion. Others are so broad they are not useful.

OnPointe Insights designs surveys that are intuitive and fast for residents to take (under 9 minutes), and yet provide a maximum of information for a city—that's the core difference. We design CityPOV with the final analysis and a dashboard in mind. You can easily view results and efficiently monitor trends over time. Plus, our costs are reasonable because of the thoughtful design of CityPOV.

We did a survey 3 or 4 years ago. Will the new survey use the same questions?

Our survey designs are built on an intuitive and powerful framework that accommodates most questions you've asked in the past, but we make it easier for residents to take, while allowing us to analyze results in a clearer and more visual way. We'll use all important questions from the past in a better framework. Because the core survey is short (about 7 minutes), we have room for unique questions you need. Having reviewed your prior survey, we're in good shape to cover nearly all questions.

FAQs – pg 2

Our city has unique needs. Can we customize CityPOV?

Yes. We've designed CityPOV for local customization. All cities we work with have chosen a blend of tried and trusted topics with practical customization where it makes sense.

Can CityPOV really be done in 6-8 weeks?

Definitely. However, there are some key decision points on your end. Leaders who deliver on the critical moments in a timely basis will get results in about 7 weeks. Internal delays sometimes make timelines stretch to 8-9 weeks, but we'll assure you meet your timelines.

How intuitive and accessible are the presented results?

The online dashboard is amazing. Results are presented in a way that is so clear you cannot misunderstand priorities and areas for focus. For those who wish to dig deeper, the ability to slice by demographics and other questions is obvious and simple. Anyone authorized from your city can access the beautiful charts and data. Plus, you can easily export slides into PowerPoint or save findings to Excel.

How often should we survey our residents?

CityPOV is designed for trend comparisons. You may survey residents annually or on a less frequent basis. Either way, you can compare progress and course correct. Most cities survey their residents annually because 3-year commitment costs for CityPOV are reasonable.

Does CityPOV address decreasing response rates?

Some surveys are simply too long and not enjoyable. Often, city leaders can't make sense of results, and citizens feel they were not heard. That causes participation to drop now and also in subsequent years. We designed CityPOV to be shorter and to work well on mobile phones and other devices so participation remains high. It's intuitive and easy. And your ability to use the data will make them feel heard.

FAQs – pg 3

How about quality assurance for who's taking our survey?

Garbage in, garbage out! You have to trust the quality of the data. That's why we have a minimum of a 4-step process to validate that participants are from your city and they don't take the survey several times. Step 1, choose your city/village from a list. Step 2, enter their zip code. Step 3, capture their IP address and will remove all who don't live in your city. Step 4, only 1 response per IP address. We can do more if required, but we have you covered on the quality front.

What about testing the survey by our team?

This is easy. We'll give you a link to test as soon as a draft survey is created. Once we have input from your team about any refinements, we'll make the tweaks, remove the test results and be ready to go live the next day.

Can CityPOV handle multiple languages?

Definitely. We make it easy for survey participants to choose their language. Data analysis is seamlessly done across languages, including comments and suggestions from survey participants.

What about benchmarks?

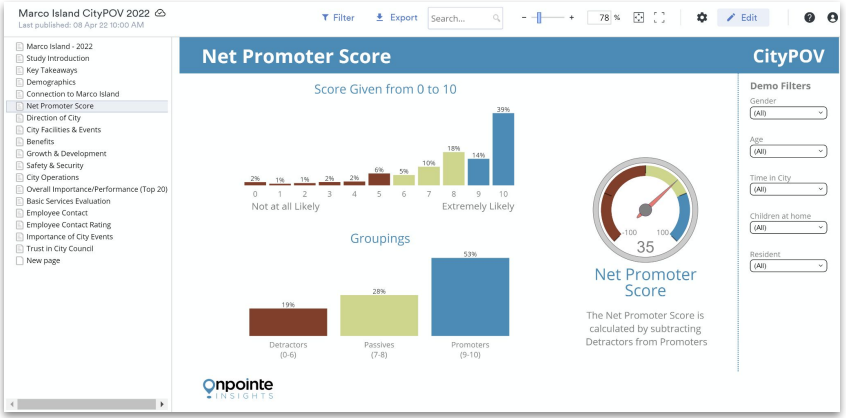
CityPOV allows for powerful benchmarking because of the consistent study design. Plus, it allows for annual benchmarking year-over-year for your city to track progress. We benchmark on NPS, city direction, place to live vs other cities, staff service, and other key questions.

Dashboard & Reporting Examples

City Evaluation

Net Promoter Score™

Are respondents Promoters or Detractors when thinking of your city. Great for comparing to other cities and industries.



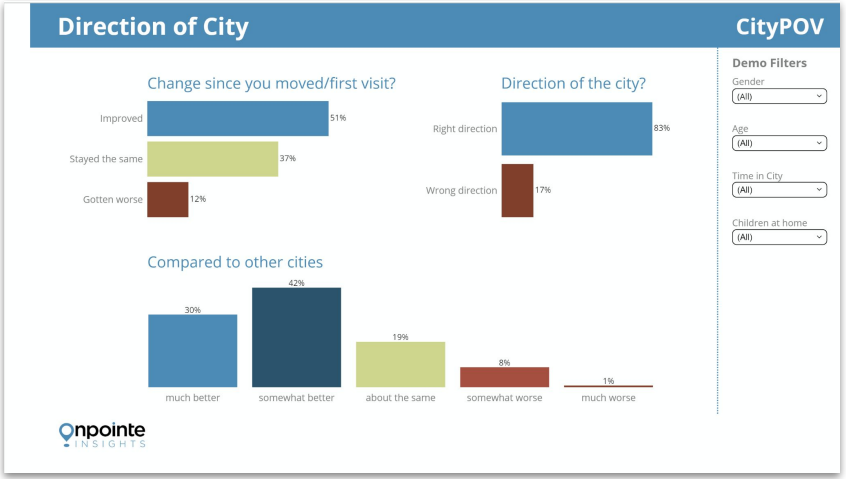
Direction of City

Is the city improving?

Heading in right direction?

Better than other cities?

Monitor these over time for clarity on your progress

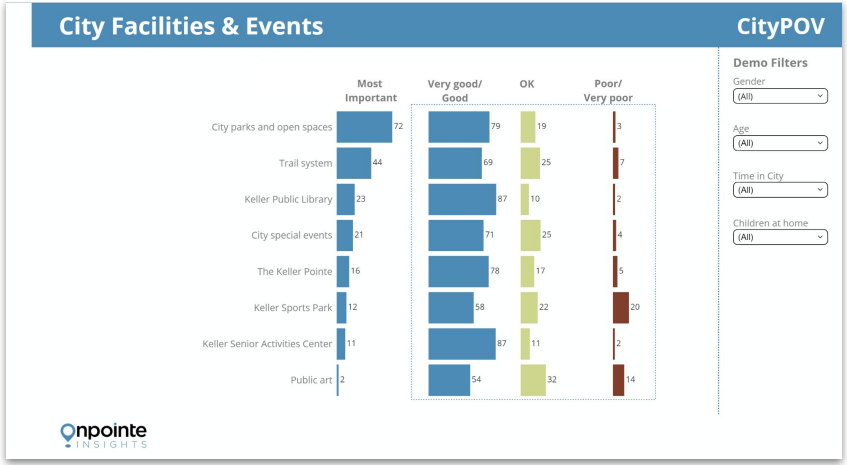


Amenities/Growth

City Facilities & Events Analysis

Of up to 10 amenities offered by the city, which ones are MOST and LEAST important? Aids with prioritization.

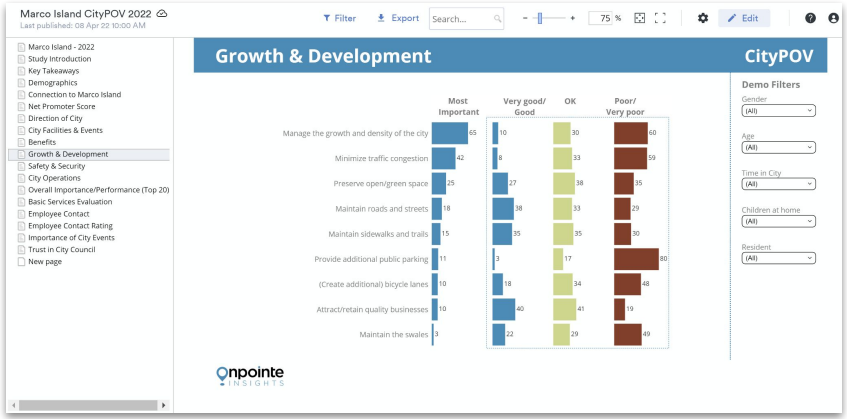
People select 2 MOST important and then 2 LEAST important.



Devel/Growth Analysis

Of up to 10 Development and Growth issues, which ones are MOST and LEAST important to residents?

NOTE: We do the same routine for Safety & Security and City Operations issues.



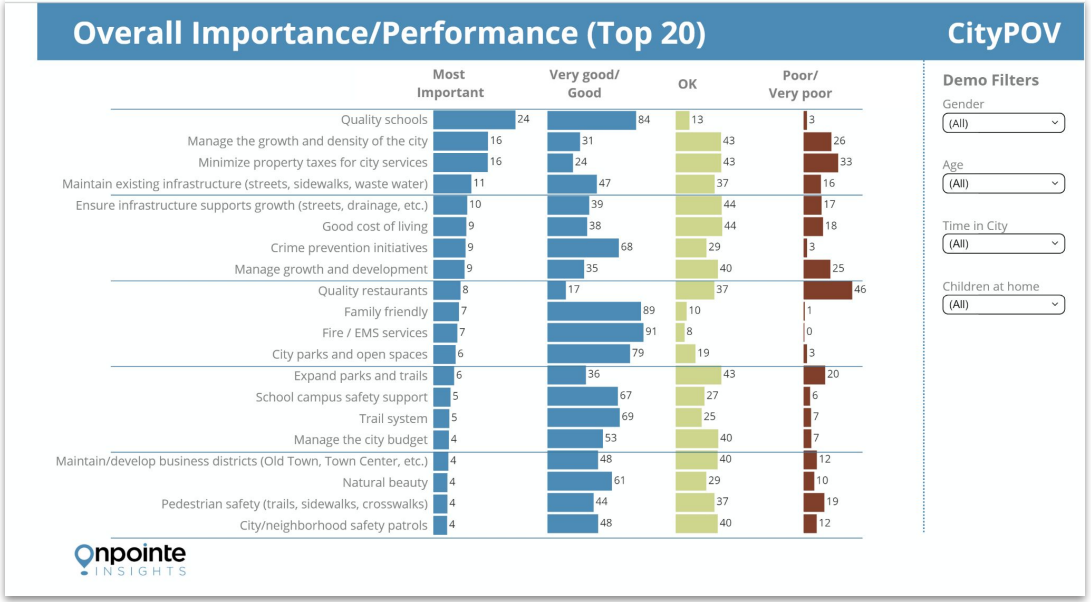
Evaluation of Things Most Important

Ratings of Most Important

For each attribute that people select as MOST IMPORTANT to them, we ask for ratings on a 5-point scale. Excellent, Very Good, Good, Fair and Poor.

For things rated as "very important", it's vital to know how residents feel about the city. It can bring powerful focus to things most important.

This is a vital question in the study.



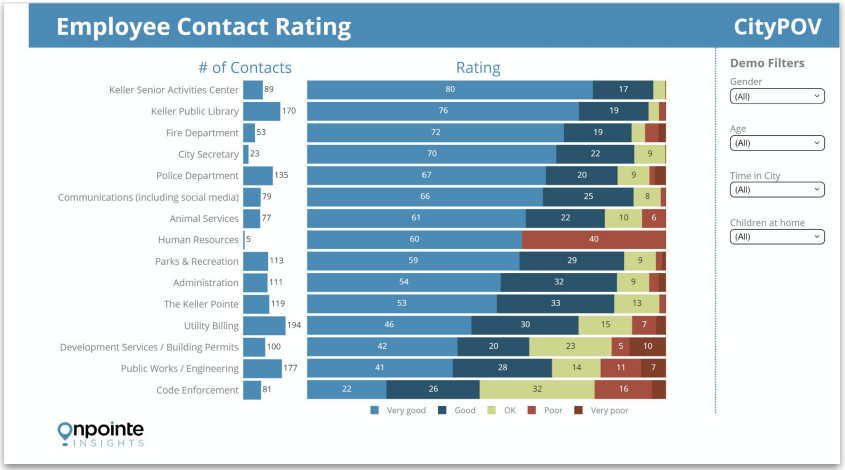
Contact with staff

Contact with Staff

How many residents contact city staff?

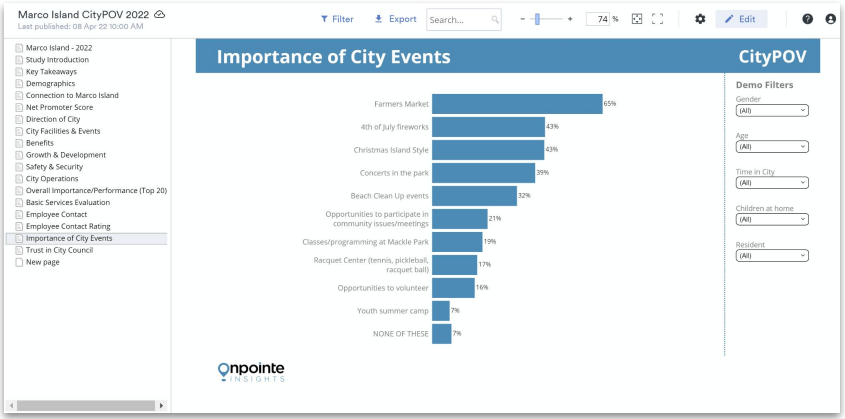
Why do residents contact city staff?

What ratings do they give?



Events Importance

Your city does many events. Which ones are most important to residents?



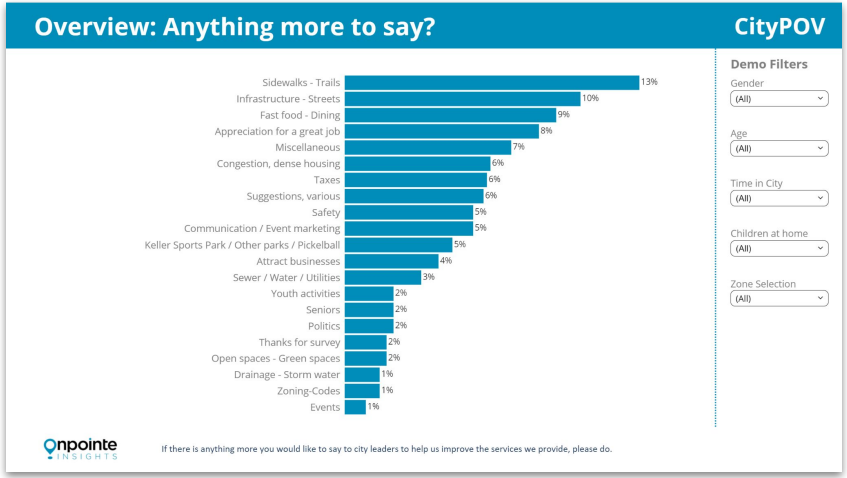
Comments

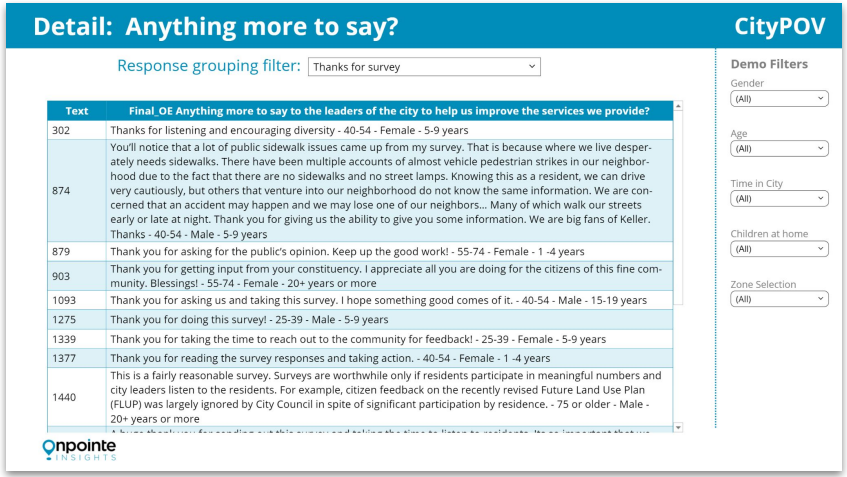
What comments?

We ask residents to share their comments about the city. Many are rather candid and most are constructive. We group comments so they can be visualized topically.

Comment examples

You can easily filter to get at comments on critical topics. The examples to the right show the depth of comments we get, including details about who said them (gender, age, years in city).





Text	Final_OE Anything more to say to the leaders of the city to help us improve the services we provide?
302	Thanks for listening and encouraging diversity - 40-54 - Female - 5-9 years
874	You'll notice that a lot of public sidewalk issues came up from my survey. That is because where we live desperately needs sidewalks. There have been multiple accounts of almost vehicle pedestrian strikes in our neighborhood due to the fact that there are no sidewalks and no street lamps. Knowing this as a resident, we can drive very cautiously, but others that venture into our neighborhood do not know the same information. We are concerned that an accident may happen and we may lose one of our neighbors... Many of which walk our streets early or late at night. Thank you for giving us the ability to give you some information. We are big fans of Keller. Thanks - 40-54 - Male - 5-9 years
879	Thank you for asking for the public's opinion. Keep up the good work! - 55-74 - Female - 1 -4 years
903	Thank you for getting input from your constituency. I appreciate all you are doing for the citizens of this fine community. Blessings! - 55-74 - Female - 20+ years or more
1093	Thank you for asking us and taking this survey. I hope something good comes of it. - 40-54 - Male - 15-19 years
1275	Thank you for doing this survey! - 25-39 - Male - 5-9 years
1339	Thank you for taking the time to reach out to the community for feedback! - 25-39 - Female - 5-9 years
1377	Thank you for reading the survey responses and taking action. - 40-54 - Female - 1 -4 years
1440	This is a fairly reasonable survey. Surveys are worthwhile only if residents participate in meaningful numbers and city leaders listen to the residents. For example, citizen feedback on the recently revised Future Land Use Plan (FLUP) was largely ignored by City Council in spite of significant participation by residence. - 75 or older - Male - 20+ years or more

OnPointe References

Here are our references. Contact any of them. If you know city leaders from cities listed on Page 8, feel free to contact them. Anyone will be a good reference for us.

/01 **Boerne, Texas**
Name: Ben Thatcher (City Manager)
Email: bthatcher@boerne-tx.gov
Phone: (830) 249-9511

/02 **Keller, Texas**
Name: Mark Hafner (City Manager)
Email: mhafner@cityofkeller.com
Phone: 817-743-4001

/03 **Marco Island, Florida**
Name: Casey Lucius (Asst City Manager)
Email: clucius@cityofmarcoisland.com
Phone: 239-389-3969

/04 **Saginaw, Texas**
Name: Gabe Reaume (City Manager)
Email: greaume@saginawtx.org
Phone: 817-230-0324

/05 **Payson, Utah**
Name: Dave Tuckett (City Manager)
Email: davet@payson.org
Phone: 801-465-5234

REQUEST FOR CITY COUNCIL AGENDA ITEM #4

Agenda Date Requested: May 8, 2023
Requested By: Jennifer Reyna, Director
Department: Public Works

(•) Report ( ) Resolution ( ) Ordinance

Exhibits: Study Results

Appropriation	
Source of Funds:	N/A
Account Number:	N/A
Amount Budgeted:	N/A
Amount Requested:	N/A
Budgeted Item:	( ) Yes (•) No

AGENDA ITEM #4

Workshop item to discuss results from R. W. Harden & Associates for the Groundwater Availability Study for the City of Navasota

SUMMARY & RECOMMENDATION

During the fiscal year 2022-23 budget process, City Council approved the addition of a new water well as part of the capital improvement plan (CIP) in the amount of $2 million. The City of Navasota needs additional water supplies ranging up to 1,200 gallons per minute (gpm). The focus of this hydrogeologic study was to determine if the additional capacity can be met with local groundwater resources and, if so, to estimate the number of water wells required to meet that demand. R. W. Harden & Associates understands staff has been working with Bleyl Engineering. Bleyl Engineering has provided a proposed a water well development site about one mile east of the City along Highway 90. R. W. Harden & Associates evaluated this site as well as the surrounding area within the City to identify potentially favorable production areas to meet the City's long-term water demands in terms of aquifer yield and quality of groundwater.

Representatives from R.W. Harden & Associates will be onsite for the workshop to present the results of the Groundwater Availability Study.

ACTION REQUIRED BY CITY COUNCIL

None

Approved for the City Council meeting agenda

Jason Weeks

Jason B. Weeks, City Manager

5/3/23

Date

R W HARDEN &ASSOCIATES INC
GROUNDWATER RESOURCE PROFESSIONALS
9009 Mountain Ridge Dr • Suite 100 • Austin Texas 78759 • ph (512) 345-2379 • fax (512) 338-9372

April 21, 2023

The Honorable Bert Miller
Mayor of the City of Navasota
PO Box 910
Navasota, Texas 77868

Re: Groundwater Availability Study — City of Navasota, Grimes County, Texas

Dear Mayor Miller,

On behalf of the City of Navasota (City), R.W. Harden & Associates, Inc. (RWH&A) performed a groundwater availability assessment of the hydrogeologic conditions beneath the area within and surrounding the City of Navasota, Grimes County, Texas. RWH&A understands the City is seeking additional water system capacity of approximately 1,200 gallons per minute (gpm) from potential new well site(s). RWH&A performed an evaluation of the feasibility of obtaining additional supplies from the local groundwater resources. Within this document, the term "study area" refers to the area within and surrounding the City limits, shown in Figure 1, and includes a proposed development site provided by Bleyl Engineering, which is also shown in Figure 1. In addition to hydrogeologic factors, the rules and policies promulgated by the Bluebonnet Groundwater Conservation District (BGCD) also affect groundwater production from the study area. RWH&A provides herein a summary of the anticipated BGCD permitting requirements for well drilling and operating of new non-exempt public supply wells. It should be noted that the results of this study are not intended to satisfy the regulatory requirements of the BGCD permitting; however, elements of this work will be incorporated into the BGCD Phase I Hydrogeologic Report (discussed in the Groundwater Regulation section below) under a separate scope of work when the City is ready to complete permit applications for additional groundwater capacity.

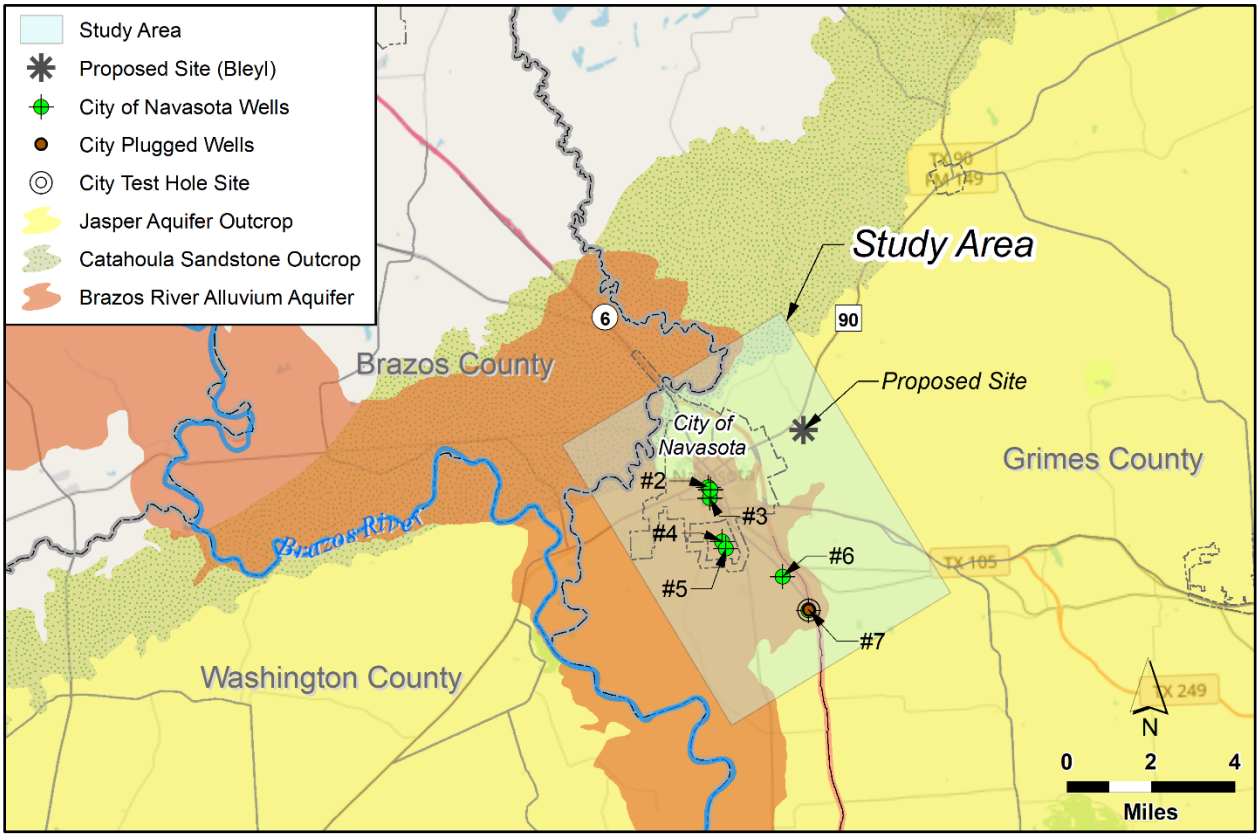
For this work, RWH&A compiled and reviewed available information pertaining to the geologic structure, lithologic composition, aquifer productivity, and water quality of the aquifers beneath the study area. RWH&A's evaluation included review of published and unpublished geologic maps and reports, well completion records, well testing records, geophysical logs, reported water quality results, and other applicable information. Data sources included the City, the Texas Water Development Board (TWDB), the Texas Department of Licensing and Regulation (TDLR), the University of Texas Bureau of Economic Geology (BEG), the Railroad Commission of Texas (RRC), the Texas Commission on Environmental Quality (TCEQ), the BGCD, Groundwater Management Area No. 14 (GMA-14), and RWH&A files. Using the information compiled from these sources, RWH&A generated numerical flow model simulations to estimate the long-term groundwater availability from local aquifers beneath the study area.

Hydrogeology

The study area is underlain by two regionally productive aquifers, the Gulf Coast Aquifer System and the Brazos River Alluvium (Alluvium). The Gulf Coast Aquifer System consists of (from youngest to oldest)

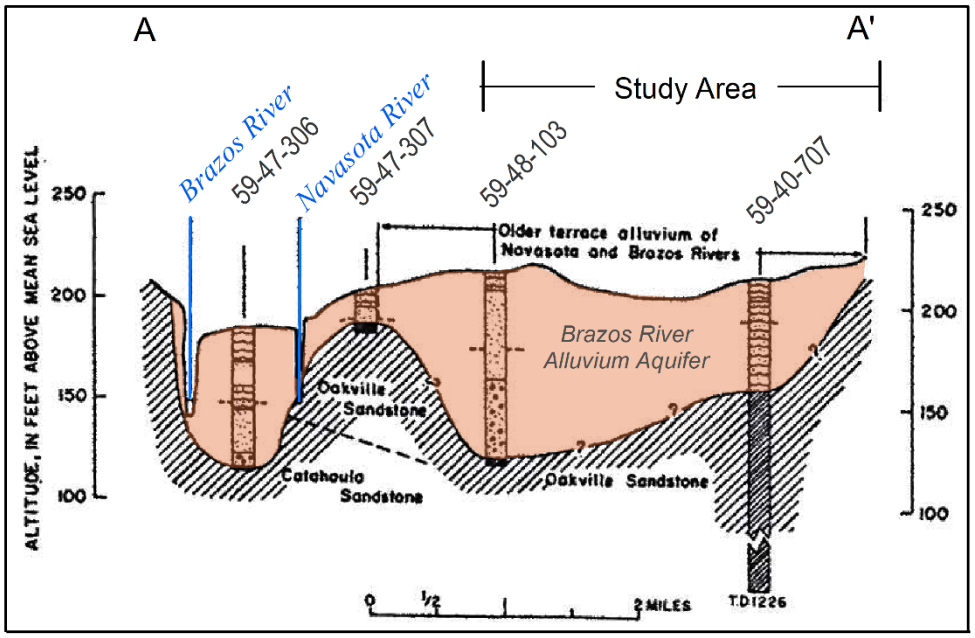
the Chicot, Evangeline, and Jasper aquifers. The shallower Chicot and Evangeline are not present in the study area and are therefore not discussed further within this report. The Jasper aquifer (Jasper) is the term applied to the lowermost unit of the Gulf Coast Aquifer System, which is equivalent to the Miocene age Fleming Formation. The Jasper outcrops at the surface across the southern portion of the study area and consists of alternating beds of fine to coarse sand, silt, and clay. Beneath the Jasper is the Catahoula Sandstone Formation (Catahoula), which locally yields small to moderate amounts of groundwater to wells. The Catahoula consists of alternating beds of sand and cemented sandstone, clay, and mudstone. The Alluvium is designated as a minor aquifer by the TWDB and is composed of clay, silt, sand, and gravel with coarser material typically occurring towards the base of the aquifer. The sand- and gravel-rich layers within these aquifers represent the productive aquifer zones, while the clay, mudstone, and silt layers act as barriers to groundwater flow. The aquifer outcrop areas are shown in Figure 1.

Figure 1. Study Area



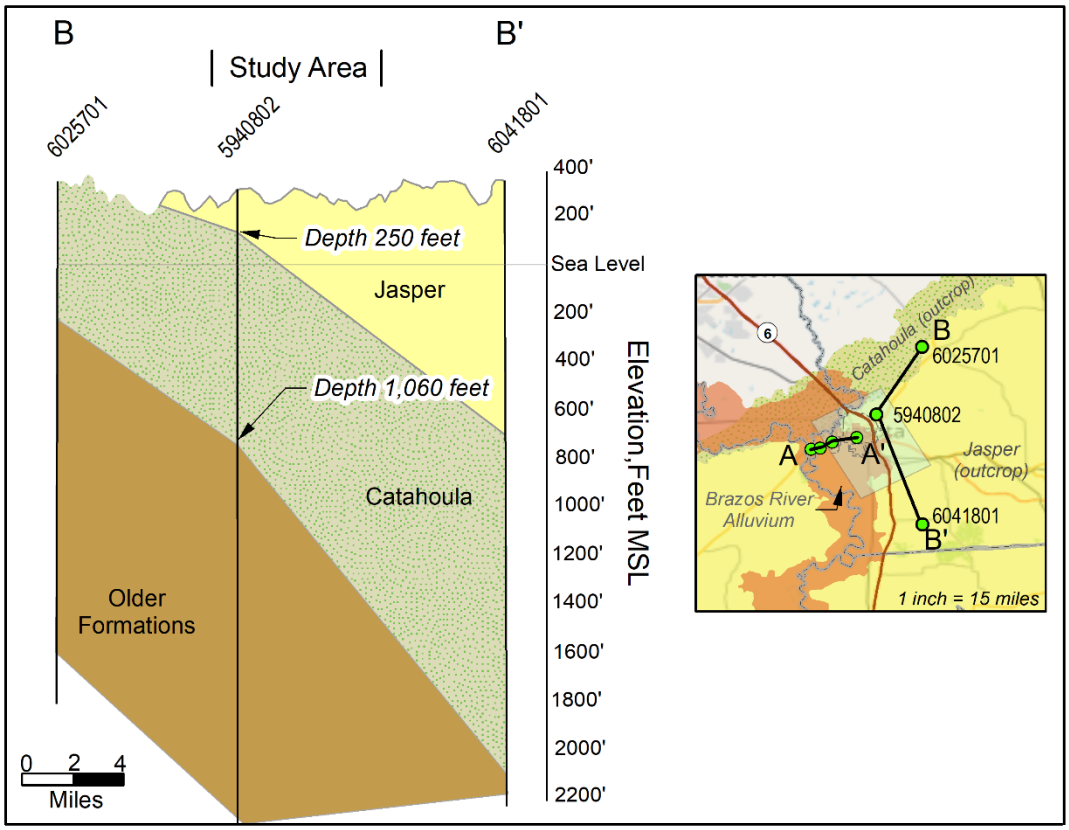
The Alluvium consists of floodplain and terrace deposits ranging up to about 7 miles wide and 120 feet thick that follow the course of the Brazos River. The saturated thickness of the Alluvium is highly variable and dependent on hydrologic and climatic conditions but averages about 30 feet beneath the study area. Figure 2 is a geologic cross-sectional diagram (depicting a vertical "slice" into the earth) of the subsurface geology and general structure of the Alluvium beneath the cross-sectional line depicted within the inset map of Figure 3. Figure 2 is modified from Figure 2.2.6.d of the TWDB Final Conceptual Model Report for the Brazos River Alluvium Aquifer Groundwater Availability Model (GAM) (p. 2.2-15, 2016). As shown, the width of the Alluvium beneath the study area is approximately 5 miles and its thickness ranges from less than 10 feet to about 100 feet.

Figure 2. A-A' Cross-Sectional Schematic Diagram



Modified from Figure 2.2.6.d, TWDB BRAA GAM Report (Ewing, et. al, 2016).

Figure 3. B-B' Cross-Sectional Schematic Diagram



Modified from Figure 3, TWDB Report 186 (Baker, et. al, 1974).

The Jasper and Catahoula outcrop at land surface in bands trending southwest to northeast across Texas and dip to the southeast at a rate of about 90 feet per mile and 110 feet per mile, respectively, beneath the study area. Figure 3 depicts the subsurface geology and general structure of the Jasper and Catahoula beneath the study area. The Jasper extends to depths of about 250 feet below ground level in the northern part of the study area and extends to about 740 feet below ground level in the southern area. In the northern part of the study area, the Catahoula extends to a depth of about 1,000 feet below ground level. Towards to southern part of the study area, the depth to the top of the Catahoula is approximately 740 feet below ground level and extends to about 1,600 feet below ground level. The overall thickness of the Catahoula is about 800 feet with a net sand thickness ranging from about 80 to 120 feet.

The water-bearing zones of the local aquifers are recharged by downward percolation of precipitation in outcrop areas through the pore spaces between individual sand grains that comprise the productive portions of each aquifer. The Alluvium also receives recharge in some areas when river stages are high relative to groundwater levels causing the gradient of flow back into the local aquifer. Although precipitation and aquifer recharge are key factors affecting shallow groundwater resources, site-specific aquifer hydraulic parameters and the amount of groundwater in storage are of more importance in defining long-term groundwater availability from the deeper Jasper and Catahoula aquifers. For reference, although aquifers are not limited by political subdivisions and expand beyond Grimes County, the TWDB has reported that the amount of groundwater in storage in the Gulf Coast Aquifer System within Grimes County is on the order of 35 million acre-feet of water.

Estimation of Groundwater Availability through Modeling

The availability of groundwater and production from individual wells is dependent upon several factors including, but not limited to 1) the site-specific aquifer hydraulic parameters, 2) the long-term available drawdown within a wellbore, 3) local and regional pumping by others from the same target aquifer zone, and 4) regulatory limits. The sections below summarize the estimated aquifer and well parameters, and the results of our evaluation of the availability of groundwater from the aquifers beneath the study area.

Production from individual Alluvium wells is dependent on site-specific factors including local saturated thickness (which fluctuates with climatic conditions), sediment grading and size, and the horizontal extent and hydraulic continuity of productive aquifer beds. In areas where the Alluvium is comprised of well sorted sand and/or pebbles to cobble-sized sediments that are laterally extensive, well production rates of more than 500 gpm can be expected. Conversely, little or no groundwater can be produced by wells that do not connect to laterally extensive flow path networks or are completed in poorly sorted or fine-grained sediments. Because of the highly variable and site-specific nature of flow through the Alluvium, groundwater modeling is not a useful tool for predicting long-term availability from individual well sites; consequently, the modeling performed for this evaluation focused exclusively on the Jasper and Catahoula. The sections below summarize the estimated aquifer characteristics and well parameters applied to the models used in this evaluation.

Aquifer Hydraulic Properties

An aquifer's productivity depends on its ability to store and transmit water to wells, which is determined by the aquifer's saturated thickness, artesian pressure, depth to static water levels, and hydraulic properties known as storativity, hydraulic conductivity, and transmissivity. Hydraulic conductivity, an intrinsic property of the aquifer sediments, is the ease with which water can flow through a porous medium and is similar to permeability. The transmissivity of an aquifer is a measure of its ability to transmit water through

a section of its full saturated thickness and is equal to the hydraulic conductivity times the saturated thickness for most aquifer types. All other aspects of the groundwater system being equal, an aquifer with twice the transmissivity of another aquifer can sustain about twice as much production.

The transmissivity of an aquifer is best estimated from data recorded during properly conducted, site-specific pumping tests conducted with wells completed in the target aquifers. However, due to the lack of pumping test data in the study area, RWH&A estimated the aquifer transmissivity through evaluations of parameters reported from local driller's reports, estimated from geophysical logs, TWDB and USGS datasets, literature, and RWH&A's experience. The aquifer transmissivity values are expressed in gallons per day per foot (gpd/ft). Table 1 provides a range of transmissivity values estimated from available data for the local aquifers.

Table 1. Estimates of Local Aquifer Tranmissivity

Aquifer	***Transmissivity***		
	Low	***Medium***	***High***
Jasper Aquifer	4,000 gpd/ft	8,800 gpd/ft	15,000 gpd/ft
Catahoula Sandstone	10,000 gpd/ft	18,000 gpd/ft	28,800 gpd/ft

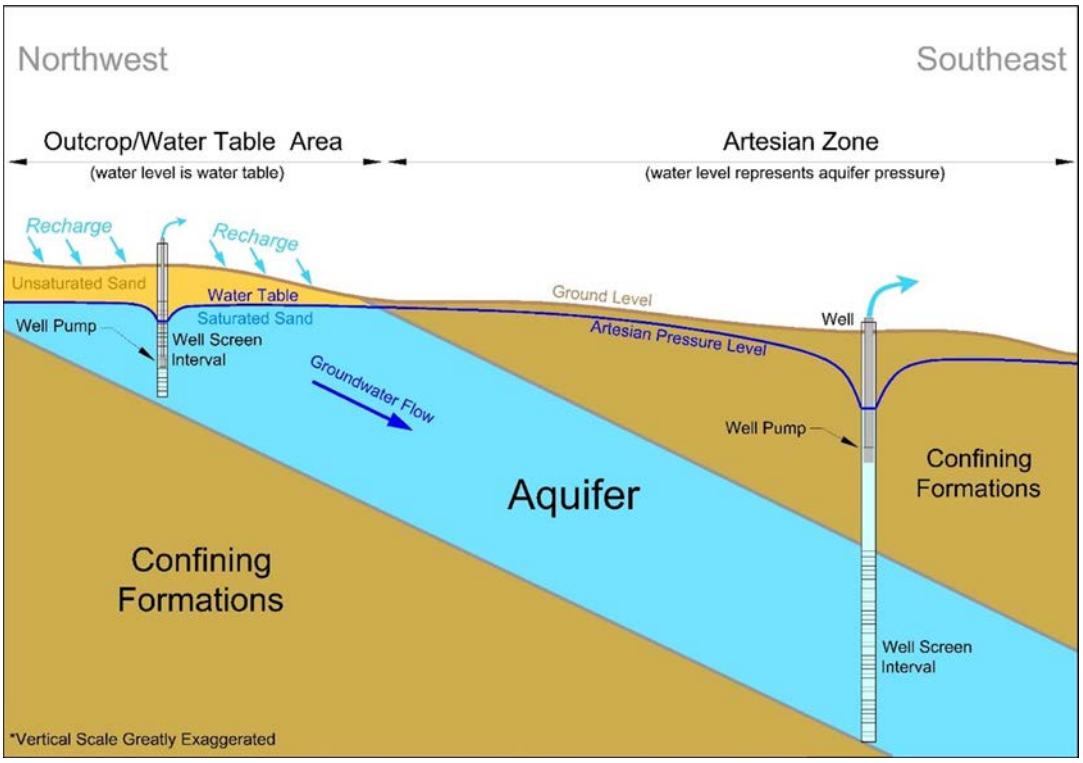
Aquifer storage coefficients (i.e., storativity and specific yield) influence short-term water level declines in pumping wells but are not critical when evaluating long-term groundwater availability. In practice, aquifer storage coefficients can be reliably estimated depending on the aquifer type. Specific yield for sand-based unconfined aquifers similar to the Alluvium generally ranges from 0.01 to 0.3 (unitless), while the storativity of confined aquifers similar to the deeper Jasper and Catahoula typically ranges from 0.001 to 0.00001 (unitless). For long-term groundwater availability modeling purposes, RWH&A assumed a storativity value of 0.0002 for confined portions of the aquifers.

Available Drawdown and Efficiencies

The potential maximum pumping rate from an individual well is proportional to the vertical distance between the static (non-pumping) water level and the maximum pumping water level desired within the wellbore, which is commonly termed "available drawdown". Similar to aquifer transmissivity discussed above, all other factors being equal, greater available drawdown in a wellbore equates to a proportionally higher production capacity. In general, the maximum desired pumping level is considered to be the top of the aquifer production zone, which remains constant through time, while the static water level in a well will typically decline through time in response to drawdown caused by the well itself and nearby wells pumping from the same aquifer zone. As the static water level declines and nearby pumpage increases, available drawdown decreases resulting in a corresponding reduction in the potential maximum production rate from individual wells.

The Jasper and Catahoula beneath the study area are under artesian conditions, meaning the static (non-pumping) water levels rise above the top of the aquifers due to hydraulic pressure. Although current static levels are locally unknown, extrapolating from regional available data and the GAM, the current static level in both the Jasper and Catahoula is estimated to be approximately 100 feet below ground level. Figure 4 diagrams the general hydraulic conditions within the target aquifers.

Figure 4. General Outcrop and Artesian Aquifer Diagram



There is inherent uncertainty involved in the actions of other users producing from the same aquifer zone over the lifespan of a well; therefore, when estimating the availability of groundwater through modeling RWH&A typically limits the simulated wellbore water level declines (drawdown) to approximately 50-percent of the total available drawdown. Limiting the amount of modeled drawdown provides a "safety factor" to account for unforeseen additional interference effects from future groundwater users, unknown aquifer boundaries, and to allow for higher peak production rates during summer months.

Well efficiency is a measure of how effectively a well transmits water from an aquifer to the surface and is the result of well design, construction, and development. Typical industry standard and acceptable well efficiencies for wells constructed for higher-capacity applications and/or produce from deeper, confined aquifers is a minimum of 70 percent. For this purpose, RWH&A assumed a well efficiency of 70-percent for the modeling scenarios described below.

Groundwater Modeling Results

RWH&A performed numerical modeling using the GAM to estimate long-term aquifer response to regional groundwater use. Analytical modeling using the Theis non-equilibrium solution was used to evaluate individual well production capacities and availability of groundwater from the local Jasper and Catahoula aquifers. A series of simulations were performed to evaluate potential aquifer and well performance from a) the updip area near the proposed site and b) in the downdip portion of the study area. Table 2 provides the parameters applied to the model scenarios. To bracket potential individual well productivity and the unknowns associated with site specific structural and hydraulic properties of the aquifers, scenarios with variable transmissivity were also evaluated. The modeled available drawdown was limited to 50-percent of the estimated artesian pressure in the updip area (lower value) and in the downdip area (higher value).

Table 2. Groundwater Modeling Scenario Parameters

Model Parameter	*Jasper*	*Catahoula*
Low Transmissivity (gpd/ft)	4,000	10,000
Average Transmissivity (gpd/ft)	8,800	18,000
High Transmissivity (gpd/ft)	15,000	28,000
Model Available Drawdown (feet)	100 to 175 feet	200 to 350 feet
Model Duration (years)	30	

The results of modeling are summarized in Table 3. The results indicate that potential individual well yields from the northern portion of the study area and near the proposed site could range from about 120 gpm to nearly 500 gpm from the Jasper aquifer, while production rates of about 200 gpm to 700 gpm can be expected in the downdip portions of the study area where larger available drawdowns may exist. Similarly, yields from individual wells producing from the Catahoula could range from about 400 gpm to 1,000 gpm in the updip areas near the proposed site. Model results indicate that Catahoula well yields in downdip areas will likely range from about 800 gpm to 1,500 gpm.

Table 3. Individual Well Yield Estimates

Aquifer	*Project Site / Updip Area*	*Downdip Area*
Jasper	120 to 500 gpm	200 to 700 gpm
Catahoula	400 to 1,000 gpm	800 to 1,500 gpm

It is important to note that individual well yields presented herein are estimated from regional information and may vary as a result of unknown site-specific hydrogeologic conditions and inherent unknowns relating to long-term regional use and effects from additional nearby users producing from the same zone(s). While the model results are based on available regional aquifer information, site-specific well yields can only be determined through a properly conducted drilling and testing program at a specific location. After site-specific aquifer parameters are obtained from a properly conducted drilling and testing program, the data would refine the model to improve predictions of long-term individual well yields and assist in well design of permanent production wells.

Groundwater Quality

The TCEQ regulates the quality of public water supplies using a defined set of primary and secondary drinking water standards for specific chemical constituents. Water with constituent concentrations above the Maximum Contaminant Levels (MCLs) defined by primary standards is considered a health hazard and must be treated and/or blended to bring the constituent levels below the identified MCLs prior to distribution. Constituent concentrations greater than secondary standards are not considered harmful but are an aesthetic nuisance. Where secondary standards are exceeded, a request for an exception to the secondary standard must be granted by the TCEQ before the water may be used for public supplies.

A general indicator of water quality is the concentration of total dissolved solids (TDS); water with a TDS concentration below 1,000 milligrams per liter (mg/L) is considered fresh, brackish water contains between 1,000 and 10,000 mg/L TDS, and water with a TDS concentration in excess of 10,000 mg/L TDS are typically regarded as saline. For reference, sea water exhibits a TDS concentration of about 35,000 mg/L.

RWH&A obtained reported water parameters from the TWDB from wells completed within the Alluvium, Jasper, and Catahoula in the study area and compared those values to the TCEQ's standards for public supply use, which are summarized Tables 4, 5, and 6, respectively. In addition, although not included in TCEQ drinking water standards, RWH&A provides values for constituents such as boron and silica that may cause issues during treatment.

Table 4. Reported Local Brazos River Alluvium Aquifer Groundwater Quality

Constituent	Average	Count	Min	Max	TCEQ Standard
Aluminum (mg/L)	0.004	1	—	—	0.2
Arsenic (mg/L)	0.0016	2	0.001	0.0023	0.01*
Boron (mg/L)	0.176	1	—	—	—
Chloride (mg/L)	61.12	5	10	109	300
Fluoride (mg/L)	0.29	3	0.18	0.4	2 (4*)
Hardness (mg/L)	351	5	66	713	—
Iron (mg/L)	**2.08**	2	0.006	**4.17**	0.03
Lead (mg/L)	0.003	2	0.001	0.005	0.01
Manganese (mg/L)	**0.98**	2	**0.59**	**1.37**	0.05
Nitrate as N (mg/L)	0.15	4	0.02	0.4	10*
Nitrite as N (mg/L)	0.01	1	—	—	1*
Silica (mg/L)	25.5	3	21	30	—
Sodium (mg/L)	48.35	4	14	69	—
Sulfate (mg/L)	58.6	5	18.2	147	300
TDS (mg/L)	473	5	71	940	1,000
Temperature (°C)	23.4	3	21.8	24.6	—
pH (SU)	7.06	3	6.81	7.2	6.5-8.5

Notes: Asterisk (*) indicates MCL for primary standard that is health hazard; values presented within the table highlighted in **red** exceed TCEQ standards; pH is measured in Standard Units (SU); and constituents with only one sample count, the reported value was noted in the "Average" column.

Table 5. Reported Local Jasper Aquifer Groundwater Quality

Constituent	Average	Count	Min	Max	TCEQ Standard
Aluminum (mg/L)	0.0047	17	0.0015	0.02	0.2
Arsenic (mg/L)	0.006	28	0.001	0.01	0.01*
Boron (mg/L)	0.30	30	0.01	1.05	—
Chloride (mg/L)	79	152	7.4	264	300
Fluoride (mg/L)	0.37	106	0.08	1	2 (4*)
Hardness (mg/L)	217	149	16	592	—
Iron (mg/L)	**0.28**	86	0.01	**2.7**	0.03
Lead (mg/L)	**0.02**	28	0.001	**0.05**	0.01
Manganese (mg/L)	0.04	32	0.001	**0.14**	0.05
Nitrate as N (mg/L)	4.13	128	< 0.001	**70**	10*
Nitrite as N (mg/L)	0.01	11	0.01	0.01	1*
Silica (mg/L)	38	99	1.5	76	—

Table 5 *continued*. Reported Local Jasper Aquifer Groundwater Quality

Constituent	Average	Count	Min	Max	TCEQ Standard
Sodium (mg/L)	102	121	4.8	464	—
Sulfate (mg/L)	15	150	< 0.001	93	300
TDS (mg/L)	498	121	49	**1,176**	1,000
Temperature (°C)	23.2	79	18	27.7	—
pH (SU)	7.32	128	**5.4**	8.1	6.5-8.5

Notes: Asterisk (*) indicates MCL for primary standard that is health hazard; values presented within the table highlighted in **red** exceed TCEQ standards; pH is measured in Standard Units (SU).

Table 6. Reported Local Catahoula Aquifer Groundwater Quality

Constituent	Average	Count	Min	Max	TCEQ Standard
Aluminum (mg/L)	0.0036	5	0.003	0.004	0.2
Arsenic (mg/L)	0.0085	10	0.002	**0.023**	0.01*
Boron (mg/L)	0.418	9	0.031	1.4	—
Chloride (mg/L)	145	39	11	**690**	300
Fluoride (mg/L)	0.38	32	0.04	1.6	2 (4*)
Hardness (mg/L)	175	38	14	452	—
Iron (mg/L)	**0.45**	26	0.01	**3.7**	0.03
Lead (mg/L)	0.025	10	0.001	0.05	0.01
Manganese (mg/L)	**0.097**	10	0.028	**0.338**	0.05
Nitrate as N (mg/L)	0.73	32	< 0.001	12	10*
Nitrite as N (mg/L)	0.01	4	0.01	0.01	1*
Silica (mg/L)	63	29	20	93	—
Sodium (mg/L)	162	34	4.8	478	—
Sulfate (mg/L)	42	39	< 0.001	150	300
TDS (mg/L)	630	34	49	**1,308**	1,000
Temperature (°C)	25.6	25	22	32.1	—
pH (SU)	7.2	35	**6.14**	7.9	6.5-8.5

Notes: Asterisk (*) indicates MCL for primary standard that is health hazard; values presented within the table highlighted in **red** exceed TCEQ standards; pH is measured in Standard Units (SU).

In summary, the results indicate that constituents within the groundwater from the aquifers can exceed TCEQ's primary and/or secondary drinking water standards for public supply use, specifically for iron and manganese. These higher constituents can be site-specific and therefore a testing and sampling program is warranted prior to construction of a permanent production well.

Groundwater Regulation

The Bluebonnet Groundwater Conservation District (BGCD or District) regulates groundwater production and well spacing in Grimes County. Therefore, prior to drilling, constructing, and operating a new well, the City must get approval by the BGCD Board. On April 13, 2023, the BGCD adopted new rules pertaining to hydrogeologic reporting requirements associated with permitting new production wells completed with an inside casing diameter of eight (8) inches or greater and wells part of an aggregated system, such as the

City's wells. Therefore, prior to drilling a new well, the City must complete and submit appropriate forms, fees, notices, and results of hydrogeologic reporting sealed by a Texas licensed professional geoscientist or engineer. The hydrogeologic reporting and permitting process of new wells includes the following steps: 1) completion and submittal of a Phase I Hydrogeologic Report to the BGCD for review and approval, 2) completion of a test well or production well including drilling, logging, aquifer testing and sampling, and 3) completion and submittal of a Phase II Hydrogeologic Report utilizing results of site-specific testing. At the completion of Phase II review by the BGCD Board, the Board will either approve or deny the requested operating permit or make changes to the requested production amounts and/or permit conditions.

The following summarizes the pertinent portions of the BGCD's rules regarding groundwater development and permitting:

- **Groundwater Permitting** – An operating permit is required to construct and produce groundwater from new (non-exempt) wells. Compilation of a Phase 1-a or Phase 1-b and Phase 2 Hydrogeologic Reports are required to document the impacts associated with the proposed permitted production including effects to nearby users, subsidence, and drawdown relative to the district's current "desired future condition" (DFC).

  A DFC is calculated as the average artesian pressure decline within an aquifer and subsidence over a specified time period. DFCs are redefined every five years by GMA-14, which are then used by the TWDB to calculate the "modeled available groundwater" (MAG) for each aquifer regulated by the member conservation districts. MAG values represent the maximum amount of pumpage that can be sustained resulting in aquifer impacts within DFC limits and are considered by the BGCD during the well permitting process. While MAGs are not considered to be regulatory pumpage caps, an application for groundwater production amounts that are large in comparison to established MAG values will require more effort to permit successfully.

  Phase 1 reports are required to be included in the initial permit application packet that is submitted prior to well construction. The contents of a Phase 1 report vary with the rate of withdrawal from the proposed well but generally includes performance of groundwater modeling of drawdown and subsidence and is generally based on available information but can be supplemented with site-specific data through a drilling and testing program.

  Phase 2 reports are required to be submitted following initial "approval" of the requested operating permit and subsequent well construction. Phase 2 reporting is based on site-specific information from testing performed on a completed well at the design and requested permitted rate. Depending on the results of the Phase 1 and 2 evaluations, the District may approve production at the requested rate or may reduce the permitted production rate or modify other permit terms for consistency with its interpretation of the DFC drawdown or subsidence limits.

- **Well Spacing –** Although a set spacing distance between wells producing from the same aquifer is not provided within the rules, spacing between wells is based on the results of Phase 1 and Phase 2 reporting, which is to "prevent interference between wells and impacts to neighboring wells and to prevent measurable subsidence and shall be determined based on a hydrogeological report required under Rule 8.5F."

- **Allowable Production and Limitations –** Groundwater allocation is regulated by the BGCD in a very general sense. The rules do not include a definitive formula or method of allocation (e.g., by

surface acreage allocation, or correlative rights) of groundwater to users in the district, but the rules do state that production can be limited based the acreage or tract size and that BGCD will limit production in order to manage depletion and preventing subsidence, which in a general sense could be limited to the current MAG. The district can also limit or impose more restrictive permit conditions on individual permits. If the district has reason to believe that a non-exempt well has the potential to cause measurable subsidence, then the district may limit production to address the potential subsidence.

GMA-14's current DFCs and corresponding MAG values were adopted on January 5, 2022. GMA-14 is currently in their fourth round of the 5-year joint planning cycle, during which updated DFCs/MAGs are generated. The member districts of GMA-14 are also working towards utilizing an updated GAM (GULF-2023 model) that is currently under final review by the TWDB. According to Mr. Zach Holland, the BGCD General Manager, the current permitted amount of groundwater from the Gulf Coast Aquifer System within Grimes County is approximately 10,100 acre-feet pear year (ac-ft/yr), while the current MAG for the Gulf Coast aquifers within Grimes County totals 51,487 ac-ft/yr, which is summarized in Table 7.

Table 7. Comparison of BGCD Permitted Production to Current MAG Amounts – Grimes County

Aquifer	*Current Permitted Amount (ac-ft/yr)*	*Current MAG (ac-ft/yr)*
Chicot Aquifer	10,103	0
Evangeline Aquifer		15,917
Jasper Aquifer		35,570

Although the Catahoula is not represented in the current GAM or resulting MAG values, the results assumed portions of the Catahoula were hydraulically connected and contributing to the Jasper aquifer; however, the updated GAM (GULF-2023 model) will provide separate layers and resulting in MAG values for the Jasper and Catahoula, independently. GMA-14 currently considers the Alluvium as "non-relevant" and, therefore, a MAG or resulting DFC is not provided.

As stated previously, while MAGs are not considered to be regulatory pumpage caps, an application for groundwater production amounts that are large in comparison to (unpermitted) MAG values will generally require more effort to permit successfully. However, as shown in Table 7, the BGCD's current permitted amount is relatively small in comparison to the current MAG, therefore, dependent upon site-specific hydrogeologic conditions, the request for additional permitted production from the Jasper and/or Catahoula aquifer may be relatively straight-forward.

Conclusions

RWH&A conducted an evaluation of the potential groundwater availability from the local aquifers beneath the City of Navasota. The following summarizes the results of our investigations:

- **Brazos River Alluvium Aquifer**
  - **Production Zones:** Productive Alluvium well sites are limited to a relatively narrow band near the course of the Brazos River. The width of the Alluvium west of the study area is about 5 miles and the depth ranges from less than 10 feet to about 100 feet. The thickness of the saturated sands is highly variable and dependent on local hydrologic and climatic conditions but averages about 30 feet beneath the study area.
  - **Water Quality:** Reported water quality from the Alluvium is sparse but indicates that the water is generally fresh and meets TCEQ's primary drinking water standards for public supply use but exceeds secondary standards for iron and manganese. Additionally, although not reported, it is possible that site-specific concentrations of nitrates/nitrites may exceed TCEQ public supply standards through infiltration of surface water that that has come into contact with fecal matter and/or fertilizers, which is common in agricultural areas. Similarly, shallow groundwater may be considered "under the influence of surface water" by TCEQ and require additional monitoring of micro-particulates and bacteriological constituents.
  - **Potential Production:** Potential production from the Alluvium is limited to the western side of the study area and is dependent upon climatic conditions and site-specific hydrogeologic conditions. Where wellbores terminate in well-sorted sand and/or pebbles to cobble-sized sediments that are laterally extensive, well production rates of more than 500 gpm can be expected. Conversely, little or no groundwater production can be expected from drilled boreholes that do not connect to laterally extensive flow path networks or are completed in poorly sorted material or fine-grained sediments. Because of the highly variable nature of flow through the Alluvium, site-specific drilling and testing is warranted to determine potential production. Geotechnical applications such as surficial resistivity imaging can be performed across proposed development sites, which may be more practical and economical than drilling and testing.
- **Jasper Aquifer**
  - **Production Zones**:
    - **Updip, Proposed Project Site** – The potential water-bearing zones within the Jasper aquifer occur between about 100 feet to 250 feet below ground level and are approximately 80 to 100 feet thick.
    - **Downdip Area** – Potential water-bearing zones within the Jasper aquifer are present in two general vertical intervals. The shallower productive interval lies at depths between about 350 feet to 450 feet below ground level and a second deeper zone occurs from about 600 feet to 750 feet below ground level. Each section has a net saturated thickness of about 80 feet.
  - **Water Quality**: Reported average concentrations of lead and iron exceed TCEQ drinking water standards. Reported manganese, nitrate, and TDS concentrations in groundwater

produced by some wells also exceed TCEQ standards for drinking water. Based on these results, it is likely that treatment and/or blending for public supply use may be required.

- **Potential Production**: Results of analytical modeling indicate that individual well yields will vary depending on location:
  - **Updip, Proposed Project Site** – Potential well yields range from approximately 120 gpm to 500 gpm.
  - **Downdip Area** – Potential well yields range from approximately 200 gpm to 700 gpm.

- **Catahoula Aquifer**
  - **Production Zones**:
    - **Updip, Proposed Project Site** – The potential water-bearing zones within the Catahoula aquifer exist between about 350 feet to 1,000 feet below ground level. The net saturated thickness of productive sands is approximately 100 to 120 feet.
    - **Downdip Area** – The potential water-bearing zones occur between about 800 feet to 1,600 feet below ground level. The net saturated thickness of productive sands is about 80 feet to 100 feet.
  - **Water Quality**: Reported average concentrations of iron and manganese exceed TCEQ drinking water standards. Reported concentrations of arsenic, chloride, and TDS in groundwater produced from some wells also exceed TCEQ standards for drinking water. Based on these results, it is likely that treatment and/or blending for public supply use may be required.
  - **Potential Production**: Results of analytical modeling indicate that individual well yields will vary depending on location:
    - **Updip, Proposed Project Site** – Potential well yields range from approximately 400 gpm to 1,000 gpm.
    - **Downdip Area** – Potential well yields range from approximately 800 gpm to 1,500 gpm.

- **BGCD Permitting**: Compliance with DFC limits and associated MAG values are typically key components of successful permitting efforts. The consistency of the impacts resulting from proposed pumpage with DFC limits is critical; projects that are forecasted to exceed DFCs are generally denied. As discussed below, the BGCD requires that applicants complete well testing and hydrogeologic modeling to determine whether the proposed pumpage is compliant with DFCs. While not as critical as DFC compliance, the consistency of proposed pumpage to MAG values is typically also important to district boards when considering whether to approve a permit.

  Based on recent correspondence with the BGCD's general manager, the current permitted amount of groundwater in Grimes County is approximately 10,100 ac-ft/yr. The current MAG for the combined Gulf Coast aquifer in Grimes County is 51,487 ac-ft/yr, while the MAG for the Jasper

is 35,570 ac-ft/yr. Although the BGCD does not specifically limit or cap production to the MAG, it is important to note that currently it appears there is ample room for additional permitted production from the Jasper aquifer indicating that the request for additional permitted production by the City may not require significant effort beyond what is presented herein. Currently, the reported MAG does not differentiate the Jasper and the Catahoula; however, it is likely that permitting of the Catahoula may be similar and not require additional effort beyond what is described herein.

For permitting of new production wells, the City will be required to complete a Phase I and Phase II Hydrogeologic Reports. In addition to completion of appropriate forms, fees, and notices, the general permitting process includes: 1) completion and submittal of a Phase I Hydrogeologic Report to the BGCD for review and approval utilizing inhouse data, 2) completion of a test well or production well including drilling, logging, aquifer testing and sampling, and 3) completion and submittal of a Phase II Hydrogeologic Report utilizing results of site-specific testing. At the completion of Phase II review by the BGCD Board, the Board will either approve or deny the requested operating permit or make changes to the requested production amounts and/or permit conditions.

Recommendations

In summary, it is likely that the City's desired additional demand capacity of 1,200 gpm can be obtained from one or more wells constructed within the Jasper and/or the Catahoula in the study area. It may be feasible to construct a Jasper well and a Catahoula well on the same property (spaced approximately 50 feet apart) without causing mutual interference drawdown effects, which in turn allows for a relatively small wellfield footprint. A small, dual-aquifer wellfield will yield savings in buried pipeline, associated above ground infrastructure (electrical, fencing, storage, etc.), and land acquisition costs.

Given the variability of aquifer conditions in the study area, RWH&A recommends implementing a test drilling and aquifer testing/sampling program to confirm aquifer productivity and groundwater quality at proposed well sites prior to public supply well construction. The results of a properly conducted drilling and testing program provide important information regarding expected long-term well production rates and groundwater quality that will facilitate proper production well and transmission/treatment system design. The results will also provide site-specific information to be utilized during the BGCD permitting process.

Drilling and aquifer testing programs are relatively simple in concept and provide a cost-effective method of obtaining information vital for development of efficient supply infrastructure. However, these programs require careful planning and vigilant oversight of the methods and materials used by drilling contractors to ensure that the data obtained are accurate and useful for the needs of the project. RWH&A has developed and implemented hundreds of successful test drilling and aquifer testing/sampling programs as well as design and completion of efficient large-capacity production wells over the past five decades and welcomes the opportunity to assist the City in design of a new production well and/or if it is decided that testing prior to BGCD permitting and production well design and construction is appropriate for this project. For completion of a new public supply well(s), RWH&A's work stops at the wellhead discharge flange and all work associated with above-ground infrastructure including water storage, transmission lines, treatment, electrical equipment (i.e., starters, circuits, transformers, etc.), roads, fencing, above-ground piping, valves, meters, walkways, and other equipment past the discharge flange of the well shall be provided by others. During this work, RWH&A will coordinate with the City and the City's engineer during the design of the

wellhead and surface slab/pump foundation such that the final design is consistent with above-ground piping, electrical, and SCADA infrastructure to be provided by others.

We appreciate the opportunity to provide you with this groundwater availability study on behalf of the City of Navasota. If you have any questions, please contact us.

The seal appearing on this document was authorized by Elizabeth Ferry, P.G. 11011 on April 21, 2023. R.W. Harden & Associates, Inc. TBPG Firm No. 50033.

Sincerely,

Elizabeth Ferry, P.G.
R. W. Harden & Associates, Inc.