

From: Julie and Jay TURNER <juliejayturner@gmail.com>
Sent: Tuesday, February 27, 2024 3:20 PM
To: City Clerk's Office
Subject: comment re HiT2
Attachments: Letter to PC re HiT2.pages.pdf

Dear City Clerk,

Please send out comment re HiT2 to each Council Member. I think I have sent a pdf this time - sorry for the previous error!

Julie Turner

Tacoma Planning Commission
747 Market Street
Tacoma, WA 09402

February 26, 2023

Dear Commissioners,

As I peruse the current material from the city's planners, I am feeling as if this version of HiT-2 goes beyond what the Legislature is recommending. There are now so many more homes and neighborhoods included in what the Planners now indicate as being UR-3; this seems inconsistent with what the State requires. What are you trying to do? Ruin Tacoma's old neighborhoods?

And way more new units are planned than what was indicated in HiT-1 as the way this program was headed. Staying consistent with what is planned for this massive project is important to gain the public's confidence in the whole plan. Why have you enlarged the number of homes included in the new version of HiT2?

My neighborhood is one of Tacoma's most dense neighborhoods, and we truly do not have more room for more houses crammed into our 50ft by 100ft lots. And, if you leave out parking requirements for new buildings, the excess cars park along the streets in our neighborhood, limiting our own parking.

This seems to be an unusual plan to ruin the livability of many of Tacoma's old neighborhoods.

Please, take a breath and think about what you might feel if you were living in a neighborhood with a sudden large apartment building with not enough parking for the new tenants, so they use the "free" neighborhood parking. Think of the implications of this: You can't unload your groceries, have visitors who can park in the same block where you live, and you may end up coping with many sometimes noisy folks living 5 feet from your property line!.

This doesn't make for a happy electorate.

Please reconsider the fall-out from any of the pieces of HiT2 that might upset the "feeling of home" that the property owners have. The implications of the U-3 provision in HiT2 should be a moment for stepping back a bit and following the Legislature's example: No U-3.

Sincerely,

Julie S. Turner
Jay R. Turner

From: Heidi <batlmaidn3@aol.com>
Sent: Monday, February 26, 2024 3:14 PM
To: Planning; City Clerk's Office
Subject: Re: Home in Tacoma Phase 2 Comments

Follow Up Flag: Flag for follow up
Flag Status: Flagged

To whom it may concern,

I again am opposed to this plan because single dwelling should continue to remain single family. I bought my home knowing that I would not have duplexes or apartments being able to be built right next door to me. Now I have to worry about noise and no parking along with less green space because this is what is being proposed. Families need space and building up and more in small spaces does not help. It hinders the quality of life, (*which is supposed to be maintained according to the Growth Management Act*) with more noise pollution, less green space. I also believe that if a City grows then Police, Fire, and medical needs to grow also. This is not happening, and we are short officers and medical personnel to care for sick, drug/alcohol addicted and the mentally ill.

Home ownership should be what the city is working on not more unaffordable tiny apartments with no place for children to play. Home ownership brings a sense of community and is a form of wealth for many that do not have big salaries. We have too many investors that live out of state and do not keep up their properties or charge way too much for crappy-built properties and with this plan it will continue to skyrocket rents and push up property values.

Again, I am opposed to the type of growth the planning commission has set forth in this plan.

Sincerely,

Heidi White, lifelong resident

From: Piotrowski, Hollyann (Legal)
Sent: Friday, February 23, 2024 4:07 PM
To: Waldron, Jasinda (Legal)
Cc: Wing, Elizabeth (Legal); Haigh, Susan (Legal)
Subject: Michele Reich- Letter
Attachments: Michele Reich Document for CC 20240227.pdf

Follow Up Flag: Flag for follow up
Flag Status: Flagged

Hello,

Just sending to all of you to make sure its covered. Michele Reich's letter is attached for the City Council meeting next Tuesday.

Thank you!



Hollyann Piotrowski
Office Assistant
City of Tacoma | City Clerk's Office
253-591-5505 | cityclerk@cityoftacoma.org

FEB 22, 2023

To: Mayor Woodcock, City Manager Pauli,
City Attorney Bacha and all members of
Tacoma City Council

Re: Tacoma Civil Defense Plan for Nuclear
Fallout?

"The U.S. has entered its 3rd year in its
proxy war in Ukraine with the Russian
 Federation. During the "Cold War" with
the former USSR, there were over a half
dozen "killing fields" of the Cold War - Korea,
Viet Nam, Afghanistan, Angola and others.
These were "limited war" conducted so as to
avoid a "NUCLEAR WAR". The US wants to keep
the war in Ukraine in Ukraine - but Ukraine
has other plans and is conducting forays
into Russia proper.

Although Russia has suffered tremendous
losses in its war in Ukraine in men and material -
its NUCLEAR FORCES, the target in the world - are
100% intact and ready! The four citizens last week,
that gave the City Council a warning about
the danger of nuclear war were the "conscience
in the coal mine". When the Council was
debating whether to allow them to speak as
to the pertinence of their topic, I withdrew
my talk to offer them support as I had
expertise on the subject having been a
"nuclear weapons security supervisor". Yesterday,
President Biden said: "The U.S. is under
threat of nuclear war", the City Council
of Tacoma better take these warnings seriously!

Michelle Reich

Jacoma Council Meeting Feb 27, 2024

Public Form

Liquefied Natural Gas Facilities ~~cannot~~ ^{are} prohibited ⁱⁿ ^{Jacoma}

I am asking the Jacoma Council call an immediate Emergency Decommission of the ^{Port of} Puget Sound Energy/PSE

Liquefied Natural Gas/LNG Facility Using a New Environmental Impact State/EIS using Former Jacoma Fire Chief Duggan's Explosion Modeling done on NOAA - ALOHA CAMO suite crossed over to EPA MAP PLOT, ^{for a catastrophic failure}

I am resubmitting ^{part of} the explosion map done by Former Jacoma Fire Chief Duggan, with Explosion Range of 12.6 miles and 3 mile Thermal Radiation ~~Appl~~ Application Exclusion zone that would ~~I~~ kill and severely injury everyone from Explosion

The PSE LNG is not the only illegal building the International Building Code Prohibits Building in any Liquefaction soil and Tsunami areas.

I am submitting submitting the Jacoma Fire Dept All Hazards Risk Assessment 2016 which did not include the PSE LNG and Must be included until decommission, ~~the~~ Hazard Risk

Assessment shows the earthquake faults, Liquefaction soil, Tsunami Hazard, Landslide Hazard / seiche, Volcano Eruption / Lahar / Mud Flow debris flow, Puyallup River Flood area.

I am submitting the Liquefaction Map ~~is~~ that is a no build area done by State ^{Division of} Geology and the Tsunami Hazard Map done by National Tsunami Expert Jim Walsh now Retire ^{from} state Division of Geology.

Jacoma Council Meeting Feb 27, 2024
Public Forum
Carole Sue Braaten

United State Geology Survey ^{magnitude} ^{7.1 Earthquake} Jacoma
Fault ~~and~~ ~~Earthquake~~ Zone Plausible
Scenario

None were included in the PSE LNG
F.E.I.S

Modeling done by Jarmer
 Tacoma Fire Chief Duggan on NOAA - ALOHA CAMEO Suite and EPA - MARPLOT
 Re-submitted by Carole Sue Braaten Professional Chemical Engineer
 From Storm Public Records Request

Jacoma Council Meeting Public Form
 Feb 27, 2024

Plume Results
 Liquefied natural gas (cryogenic liquid)
 CAS 74-82-8
 UN 1972 Guide 115 - GASES - FLAMMABLE (Including Refrigerated Liquids)

Initial Location and Time

901 e alexander
 47° 16' 35.72" N 122° 24' 1.56" W
 06/26/2016 20:49:15 GMT -07:00

Meteorology					
Temperature	70 °F	Wind Speed	2 mph	Wind Direction	270 °
Cloud Cover	25 %	Terrain	Urban/Forest	Stability/Theta	F/81.7°
Container (Large Storage)					
Diameter	95 ft	Length	140 ft	Orientation	Vertical
Percent Full	95 %	Volume	7423301 gal	Max Liquid Mass	24717803 lb
Source					
Source Type	Hole or Pipe Release	Hole Diameter	4 in	Hole Height	0 ft

Results				
Level of Concern	Downwind Distance	Max Crosswind Distance	Plume Arrival	Plume Duration
Initial Isolation Zone (ERG 2012)	300 ft (in all directions)		-----	-----
LEL 10% 5000 ppm	12.6 miles	969 yd	02h:14m	Continuous



Tacoma Council Meeting Feb 27, 2024
Public Form Re Submitted By Carol Sue
Braaten

Did the City of Tacoma Hide LNG Safety Documents from the Public?

For Immediate Release – August 7, 2019

Contact: Steve Storms, BSChE, PE (retired) , steve.storms.act@gmail.com

The City of Tacoma withheld emergency response planning models about Puget Sound Energy's (PSE) Liquefied Natural Gas (LNG) facility from the public. Advocates for a Cleaner Tacoma (ACT) recently obtained Public Disclosure Request (PDR) results (See Figures 1 and 2) that show the Tacoma Fire Department (TFD) ran emergency response planning models resulting in a zone up to 12.6 miles . TFD ran their emergency response models in 2016, more than 3 years ago, but did not disclose the information to the public. This is in contrast to the safety siting model completed by PSE that was used for siting new facilities, which resulted in a 550 foot radius zone.

Emergency response planning information was also withheld in 2015 when the TFD ran a different model (See Figure 3) which indicated the zone was up to one mile (5,280 feet), reaching into Northeast Tacoma. This model was run the day after the Final Environmental Impact Statement (FEIS) was filed, which kept it out of the FEIS. Again this was only discovered by a public disclosure request.

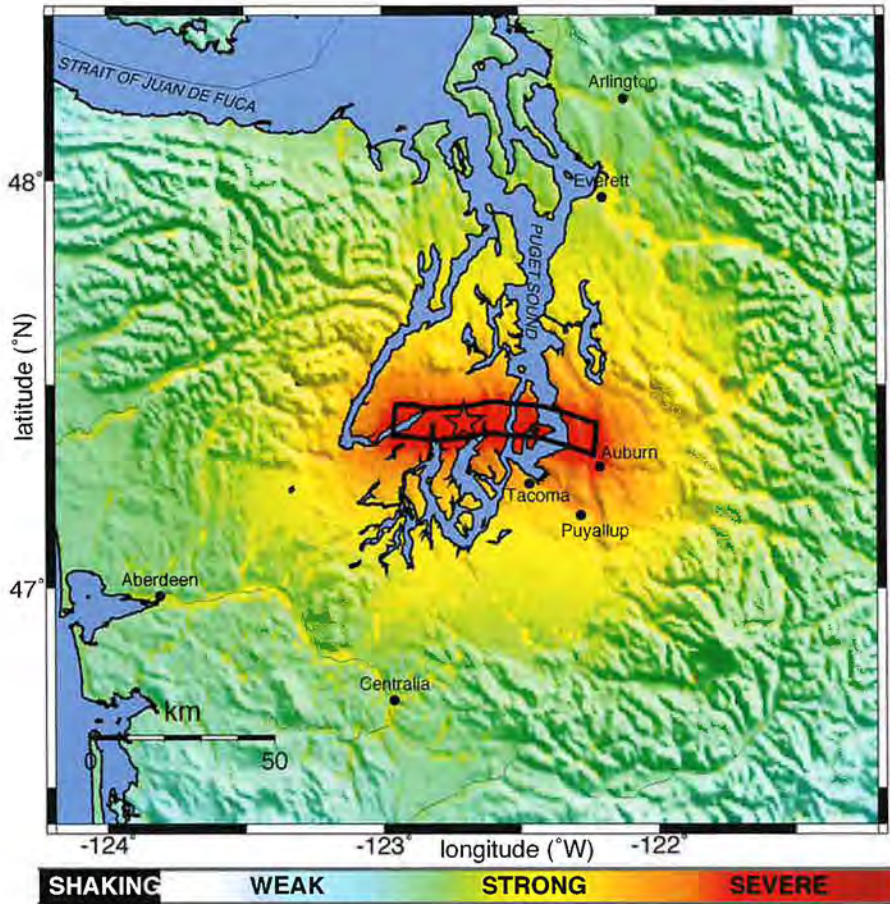
The City of Tacoma and TFD are required to share this safety information with residents. The Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986 compels industry and agencies to inform their communities of the potential risks in cases of hazardous and toxic chemical emergencies. The intent of EPCRA is to inform communities in advance of any exposures so that proper emergency plans can be developed.

Grant Ringel, Director, Customer Market Strategies and LNG spokesman for PSE stated in the Tacoma News Tribune in 2016, "It is required that we are able to demonstrate through that process that whatever happens on the site, whether it be a pipe break or whether it be a roof of the tank collapsing, whatever might happen there, we have to study that and demonstrate that it is contained within the fence line," He said. "If we can't prove that, we will not be able to operate the plant, and I think this is really important for that to be out there and to be considered." ACT does not believe that scenarios were studied to cover "whatever might happen", and agrees with Mr Ringel that the plant should not operate until such scenarios are studied and made public.

The City's failure to disclose critical safety information to the community violates the public trust. Citizens should not have to submit public disclosure requests to understand potential impacts to them from controversial industrial projects. These actions seem to demonstrate a trend to favor PSE and the LNG project instead of protecting the public safety. Tacoma citizens deserve better.

A Magnitude 7.1 Earthquake in the Tacoma Fault Zone— A Plausible Scenario for the Southern Puget Sound Region, Washington

The U.S. Geological Survey and cooperating scientists have recently assessed the effects of a magnitude 7.1 earthquake on the Tacoma Fault Zone in Pierce County, Washington. A quake of comparable magnitude struck the southern Puget Sound region about 1,100 years ago, and similar earthquakes are almost certain to occur in the future. The region is now home to hundreds of thousands of people, who would be at risk from the shaking, liquefaction, landsliding, and tsunamis caused by such an earthquake. The modeled effects of this scenario earthquake will help emergency planners and residents of the region prepare for future quakes.



Scientists with the U.S. Geological Survey (USGS) and cooperating organizations have recently simulated the shaking from a magnitude 7.1 earthquake in the Tacoma Fault Zone, in the southern Puget Sound region, Washington. This “scenario” models the ground-motion amplitudes for a hypothetical rupture along a fault plane that extends from the surface to 9 miles (15 km) deep and is 35 miles (56 km) in length, from Belfair through Vashon Island to near the city of Federal Way. These ground motions are derived using computer models with inputs from geological and geophysical observations specific to the region and the fault zone.

This scenario “ShakeMap” shows hypothetical horizontal ground motions for a magnitude 7.1 earthquake in the Tacoma Fault Zone. The strongest shaking (warm colors) occurs in a band close to the fault (black polygon) and in low-lying areas filled with sediments that amplify ground motions, such as the Tacoma Basin area located south of the fault zone. ShakeMaps show “instrumental” intensities, which are measures of the severity of shaking and its impacts. For real earthquakes, intensities are derived automatically by computers from the amplitudes of seismic waves recorded at monitoring stations located throughout the region affected by an earthquake. Although this ShakeMap is for a hypothetical earthquake, scientists have found evidence that a quake of similar magnitude struck the southern Puget Sound region about 1,100 years ago.

The Tacoma Fault Zone

Local and regional experts have identified several strands of the Tacoma Fault Zone in the southern Puget Sound region, although the eastern extent of the zone remains uncertain. Changes in

elevations of coastal marshes surrounding the Tacoma Fault Zone document a large, approximately magnitude 7 earthquake that occurred about 1,100 years ago. Studies are underway to identify evidence of earlier quakes and to more accurately describe the fault system. The ground

shaking and fault offset of several yards (meters) during a future major earthquake on the Tacoma Fault Zone would cause landsliding, liquefaction, and possibly a tsunami in Puget Sound. These effects are summarized below.

Ground Motions

Most earthquake hazards result from the shaking, or ground motions, caused by seismic waves that radiate out from a fault as it ruptures. Several factors affect the resulting pattern of shaking. Seismic waves transmit the energy released by the earthquake, and bigger quakes generate larger and longer lasting waves. The rock and sediment layers that the waves travel through affect their strength and duration. The pattern of shaking is affected by the dimensions and orientation of a fault and by the characteristics of the rapid slippage along it that occurs during an earthquake. The proximity of the rupture to the ground surface also significantly affects the strength and pattern of shaking. Deep quakes, like the magnitude 6.8 Nisqually, Washington, earthquake in 2001 and others like it in 1965 and 1949, tend to be much less damaging than shallow ones of comparable magnitude, like the surface-breaking scenario earthquake modeled in the Tacoma Fault Zone. This difference is primarily due to the fact that in deeper quakes the seismic waves have lost more energy by the time they reach the surface. Unlike deep earthquakes that usually have few to no aftershocks, a magnitude 7.1 earthquake like the one in this scenario would likely have many aftershocks, a few of which could be large enough to be damaging.

Other Earthquake Effects

Tsunamis—Scientists anticipate that a magnitude 7.1 earthquake in the Tacoma Fault Zone that ruptures a fault reaching the ground surface could offset the floor of Puget Sound and generate a tsunami. Delta failures and landslides caused by the shaking will also likely create or amplify tsunamis. Geological and



Map showing the location of several strands of the Tacoma Fault Zone (red lines) near Tacoma, Washington. The subsurface structure of the Tacoma Basin is shown by the depth of the unconsolidated sediments (green contours in meters; 1 m is about 3.28 ft); these sediments may amplify ground shaking during an earthquake. Star shows the epicenter of the 2001 Nisqually earthquake.



A magnitude 7 earthquake in the Tacoma Fault Zone could offset the floor of Puget Sound and generate a tsunami. Most of the low-lying areas in the Puyallup River delta will likely be subjected to flooding by tsunamis. The maximum tsunami runup for the simulated Tacoma Fault Zone quake shows water reaching an elevation of about 12 feet (~4 meters), and initial flooding in the Tacoma area would occur about 5 minutes after the earthquake. (Image courtesy of Washington Division of Geology and Earth Resources.)

historical evidence shows that landslides and failures of the sediments in river deltas have generated tsunamis within Puget Sound in the past.

Computer simulations of tsunami-generating earthquakes show that most of the low-lying areas in the Puyallup River delta are vulnerable to flooding by tsunamis. The maximum tsunami runup

for the simulated Tacoma Fault Zone quake shows water reaching an elevation of about 12 feet (~4 meters) and that initial flooding in the Tacoma area would occur about 5 minutes after the earthquake.

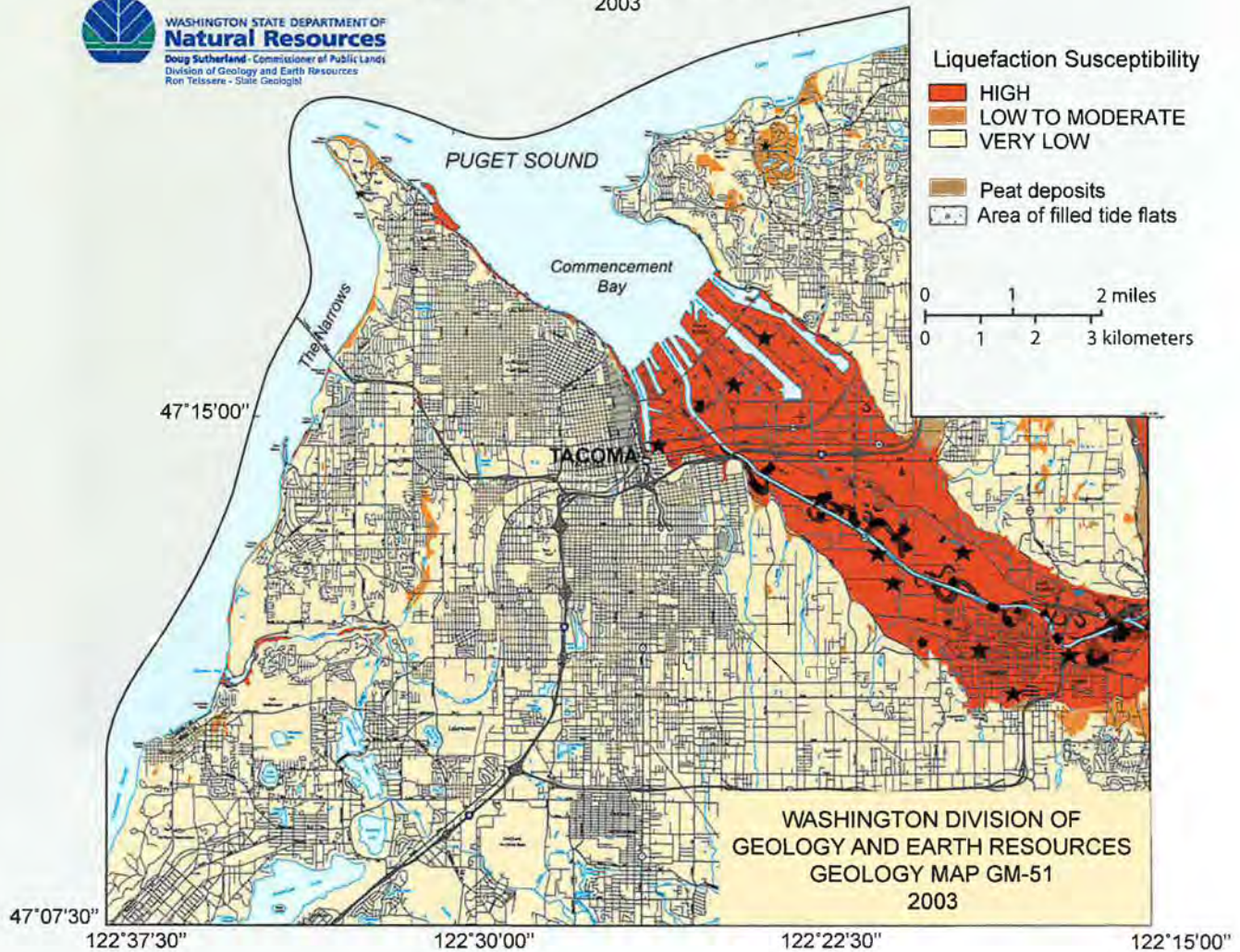
Liquefaction—Severe shaking during an earthquake can cause sediments to lose strength. In water-saturated sediments

LIQUEFACTION SUSCEPTIBILITY OF THE GREATER TACOMA URBAN AREA, PIERCE AND KING COUNTIES, WASHINGTON

by
Stephen P. Palmer, William J. Perkins, and W. Paul Grant
2003



WASHINGTON STATE DEPARTMENT OF
Natural Resources
Doug Sutherland - Commissioner of Public Lands
Division of Geology and Earth Resources
Ron Tellesse - State Geologist



Shaking during earthquakes can cause water-saturated sediments to fail in a process called "liquefaction," resulting in damage to overlying buildings and structures. This map shows liquefaction susceptibility for the greater Tacoma urban area. Some locations are particularly susceptible, such as the abandoned channels (short black meandering lines) of the Puyallup River and Wapato Creek, and have liquefied repeatedly in past earthquakes (stars show sites of past liquefaction). (Image courtesy of Washington Division of Geology and Earth Resources.)

strong shaking during an earthquake can disrupt the grain-to-grain contacts and cause the sediments to compact. When compaction occurs, pressure in water-filled pores (the water between sediment grains) increases, which causes the sediment to lose its strength. This sometimes results in small geyser-like eruptions of water and sediment called "sand blows."

Sediment in this condition is liquefied and behaves as a fluid. Buildings can sink and topple, and foundations can lose strength, causing structural collapse or severe damage. High liquefaction potential exists for areas covered by artificial fill, peat deposits, tidal flats, and stream sediments because they are often poorly consolidated. Some locations, such as

the abandoned channels of the Puyallup River and Wapato Creek, are particularly susceptible and have liquefied repeatedly in past earthquakes. Liquefaction failure from the 1949 earthquake killed two people at the Port of Tacoma, despite that quake's much greater depth and less severe shaking than the magnitude 7.1 quake modeled in this scenario.



Earthquake shaking may cause landslides on slopes, particularly where the ground is water saturated or has been modified (for example, by having stabilizing vegetation removed). This photograph shows landslides at Salmon Beach, near Tacoma, that were caused by the 2001 magnitude 6.8 Nisqually earthquake, which resulted in an estimated \$2 billion in damage and is one of the largest recorded quakes in Washington's history. Slopes along coastal areas of the southern Puget Sound region are particularly vulnerable to landsliding during powerful earthquakes.

Landslides—Earthquake shaking may cause landslides on slopes, particularly where the ground is water saturated or has been modified (for example, had stabilizing vegetation removed). Steeper slopes are most susceptible, but old, deep-seated landslides may be reactivated, even where gradients are as low as 15%. Catastrophic debris flows can move water-saturated materials rapidly and for long distances, mostly in mountainous regions. Underwater slides also have occurred in the Puyallup River delta in past earthquakes.

Although the magnitude 7.1 earthquake scenario for the Tacoma Fault Zone was modeled using the best scientific information available, it still represents

a simplified version of expected ground motions. The damage resulting from ground motions in an actual earthquake of similar magnitude is likely to be even more variable than that modeled, depending on the specific characteristics of each affected structure and its surrounding environment.

The information from this hypothetical but plausible earthquake scenario is being used to help better prepare residents of the southern Puget Sound region for future earthquakes in the Tacoma Fault Zone. The work of USGS scientists in the Puget Sound region is only part of the USGS Earthquake Hazards Program's ongoing efforts to protect people's lives and property from the earthquakes that are an inevitable part of life in the Pacific Northwest.

Joan Gomberg, Brian Sherrod, Craig Weaver, and Art Frankel

*Edited by James W. Hendley II
Graphic design by Judy Weathers*

COOPERATING ORGANIZATIONS
Pacific Northwest Seismic Network,
Dept. of Earth and Space Sciences,
University of Washington
Washington Department of Natural Resources

For more information contact:
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Dept. of Earth and Space Sciences,
Box 351310, Seattle, WA 98195
gomberg@usgs.gov
<http://earthquake.usgs.gov/>
This fact sheet and any updates to it are available
on line at
<http://pubs.usgs.gov/fs/2010/3023/>

Tacoma Council Meeting

Feb 27, 2024

Public
Form

submitted by Carol Sue Braaten



ALL-HAZARDS RISK ASSESSMENT—2016

TACOMA FIRE DEPARTMENT

MISSION: To protect people, property and the environment

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ALL-HAZARDS RISK ASSESSMENT

TACOMA FIRE DEPARTMENT

EXECUTIVE SUMMARY

Key findings in this risk assessment include:

FIRE RISK—Fire Management Zones (FMZs) with the highest number of moderate and high-risk fires:

- Downtown, Upper Tacoma, South West

EMS RISK—FMZs with the highest frequency of all EMS incidents:

- South West, Downtown, West End

SPECIALTY RISK—(Haz-Mat/Technical Rescue/Marine Firefighting and Rescue) FMZs with the highest overall specialty risk:

- Tideflats, South West

NATURAL RISK—(Earthquake/lahar/landslide/tsunami/flood/drought/wind) FMZs with the highest overall natural disaster risk:

- Tideflats, Fife/District 10
- Climate change: Locally, predictions for the Puget Sound Region include:
 - ✓ warming temperatures,
 - ✓ heavy rainfall in terms of frequency and intensity that could exacerbate flood risks in many watersheds,
 - ✓ rising sea level,
 - ✓ a greater proportion of winter precipitation to fall as rain rather than snow,
 - ✓ an increase in landslide risk, erosion, and sediment transport in fall, winter and spring,
 - ✓ general flooding

TECHNOLOGICAL—(Civil disturbance, epidemic, energy emergency) FMZs with the highest overall “human” caused risk:

- Tideflats, Downtown

RISKS

Each community has risks.

Risks are based on the probability of an event occurring and the consequences of that event.

Each creates different requirements in the community for a commitment of resources.

Effectively managing a fire department requires an understanding of how changes in resources will affect community outcomes regarding civilian injury and death; firefighter injury and death; and property loss.

CALL VOLUME INCREASE

Based on the predicted population growth of 127,000, and an estimated per capita call volume of 190 incidents per 1,000, it is projected that requests for emergency services will climb to 66,245 annually by the year 2040. This represents a 57% increase in calls over current rates and must be accounted for in future planning initiatives.

DAYTIME POPULATION

The concept of the daytime population refers to the number of people who are present in an area during normal business hours, including workers. This is in contrast to the resident population, which refers to people who reside in a given area and are typically present during the evening and nighttime hours.

Despite having only the fourth largest resident population totals (24,667), the South West FMZ jumps to the highest population total (63,817) using daytime estimate methodology.

The total daytime population estimate in our service area is 371,360.

VULNERABLE POPULATIONS

The Eastside FMZ (9.4%) and South West FMZ (8.8%) have the highest concentration of the population under the age of five, and the Point Defiance FMZ (25.7%) and West End (19.3%) have the highest concentration of the population above age 65.

FUTURE ANALYSIS

Future analysis will include work on a comprehensive inventory of assets and estimated losses related to the risk hazards identified in this plan within our service area. Additionally, creating an interactive on-line map book of this analysis will be developed.



Introduction

Each community has risks. Risks are based on the probability of an event occurring and the consequences of that event. Each creates different requirements in the community for a commitment of resources.

This document describes Tacoma Fire Departments (TFD) methodology for identifying, assessing, categorizing and classifying risk. A framework developed by the Federal Emergency Management Agency (FEMA) has been adapted for use by TFD to develop a comprehensive risk assessment. The four basic components of the risk assessment are: (1) identify hazards; (2) profile hazard events; (3) inventory assets and (4) estimate losses. This process measures the potential loss of life, personal injury, economic injury and property damage resulting from hazards by assessing the vulnerability of people, buildings, and infrastructure.

The goal of this document is to identify and profile the risks in the Tacoma Fire Department service area. Subsequent planning work will explore the final two components of the risk assessment.

OVERVIEW OF SERVICE AREA

The City of Tacoma was incorporated in 1884. From its humble origins of less than 1,000 residents, the city has grown in population to roughly 200,000 today. The city, like many established communities, is a mixture of old and new. Recently constructed high-rise condominium buildings contrast with century-old single-family residential neighborhoods. The city's economic base is comprised of a wide variety of industries—healthcare, education, retail, gaming, and the Port of Tacoma.



There are 62.1 square miles of land within the city limits and contract areas, along with 44 miles of shoreline, and 25 square miles of saltwater. The city is divided by Interstates 5 and 705 along with State Routes 16 and 509.

TFD also provides contracted fire and emergency medical service to the City of Fircrest and the City of Fife/District 10. The City of Fife/District 10 is TFD's second largest jurisdiction and stretches approximately 9.3 square miles. The City of Fife encompasses multiple land use zones that include residential, commercial, plus light and heavy industrial. The majority of the Fife area is in the lowlands of the region near similar elevations as the Port of Tacoma/Tideflats area of Tacoma. Fife is the home of numerous large-scale storage/warehouse buildings, multiple automobile dealerships, industrial manufacturing buildings, hotels, and residential areas.

The City of Fircrest is the smallest area served by TFD and covers approximately 1.5 square miles. Fircrest is a small suburban area that is comprised mostly of single-family homes with a few multifamily and commercial buildings. Fircrest is the home of an 18-hole private golf course with various areas of wildland interfaces.

Fire Management Zones

For planning purposes, TFD fire management planning zones (FMZs) are grouped by regional identifiers and then further broken down into smaller sub-zones by census tract. The following examination will focus on the hazards specific to our overall service area and to each of the FMZs.



Topography and Climate

Located along the shores of Commencement Bay in Southern Puget Sound in Pierce County, Tacoma is primarily situated on a plateau that rises approximately 400 feet up from the shoreline. The Cascade Mountains ascend to the east with Mount Rainier, the city's picturesque namesake (Mt. Tahoma), dominating the landscape. To the west, the distant spires of the Olympic Mountains emerge above the waters of the

sound. Tacoma lies approximately 32 miles south of Seattle, the state's largest city, and approximately 30 miles north of Olympia, the state capital.

The diverse topography and maritime influence create weather conditions that are among the most temperate in the world. Temperatures are mild with typical summer afternoon readings in the 70s and average winter daytime temperatures in the 40s. Most of the 39 inches of annual precipitation falls as rain from October through March with some short-lived accumulations of snow. Although the Tacoma area does not encounter the severe weather conditions seen in other parts of the country, such as hurricanes and tornadoes, it does experience occasional significant rain or wind-related damage from flooding, landslides, and downed trees. The Tacoma area also is susceptible to other, although less frequent, natural phenomena due to the surrounding geography. These phenomena include earthquakes, volcanic activity, lahars and tsunamis that pose a higher risk for casualties to citizens and damage to buildings and infrastructure.

Factors Unique to Tacoma

The Port of Tacoma is a seaport located within the Tideflats area of Tacoma and sits near an elevation of 12 to 14 feet above sea level. The Tideflats area consists primarily of maritime/heavy industrial activities that bring together heavy long-haul truck traffic, large ocean-going ships, and heavy rail traffic. Some of the major businesses in the Tideflats are U.S.

Oil & Refining, WestRock paper mill, and Targa flammable fuel storage.

Many of the manufacturing and storage buildings in the Tideflats were constructed near the turn of the century from heavy timber construction. A high percentage of these older warehouse buildings have been demolished to make way for ship container storage and trans-load operations. Multiple facilities process, store and distribute varying hazardous materials, ranging from flammable liquids/gasses,



cryogenics, and corrosives. Due to the extremely industrial nature of the Tideflats, no residential occupancies are located here, nor are there any current land use zoning that would allow for this. There is a large scale Immigration Enforcement Detention Facility, for 24/7 housing of up to 1,500 presumed illegal aliens waiting for legal processing by the federal government. A large percentage of the Tideflats is situated within the 100-year flood plain and is intersected by the Puyallup River, a major river within Pierce County. Tacoma's main wastewater treatment plant resides along the Puyallup River by a large dike.

The highly popular Point Defiance Park is a 760 acre, old-growth forested, Suburban Park located at the most northern tip of North Tacoma’s residential neighborhood and is considered a Wildland interface area. The park attracts over 3 million visitors annually. There are wildland interface areas throughout Tacoma, but especially adjacent to low-and-medium density residential areas and along the waterway borders. Some of these wildland areas abut directly to private properties and are very steep and difficult to access.



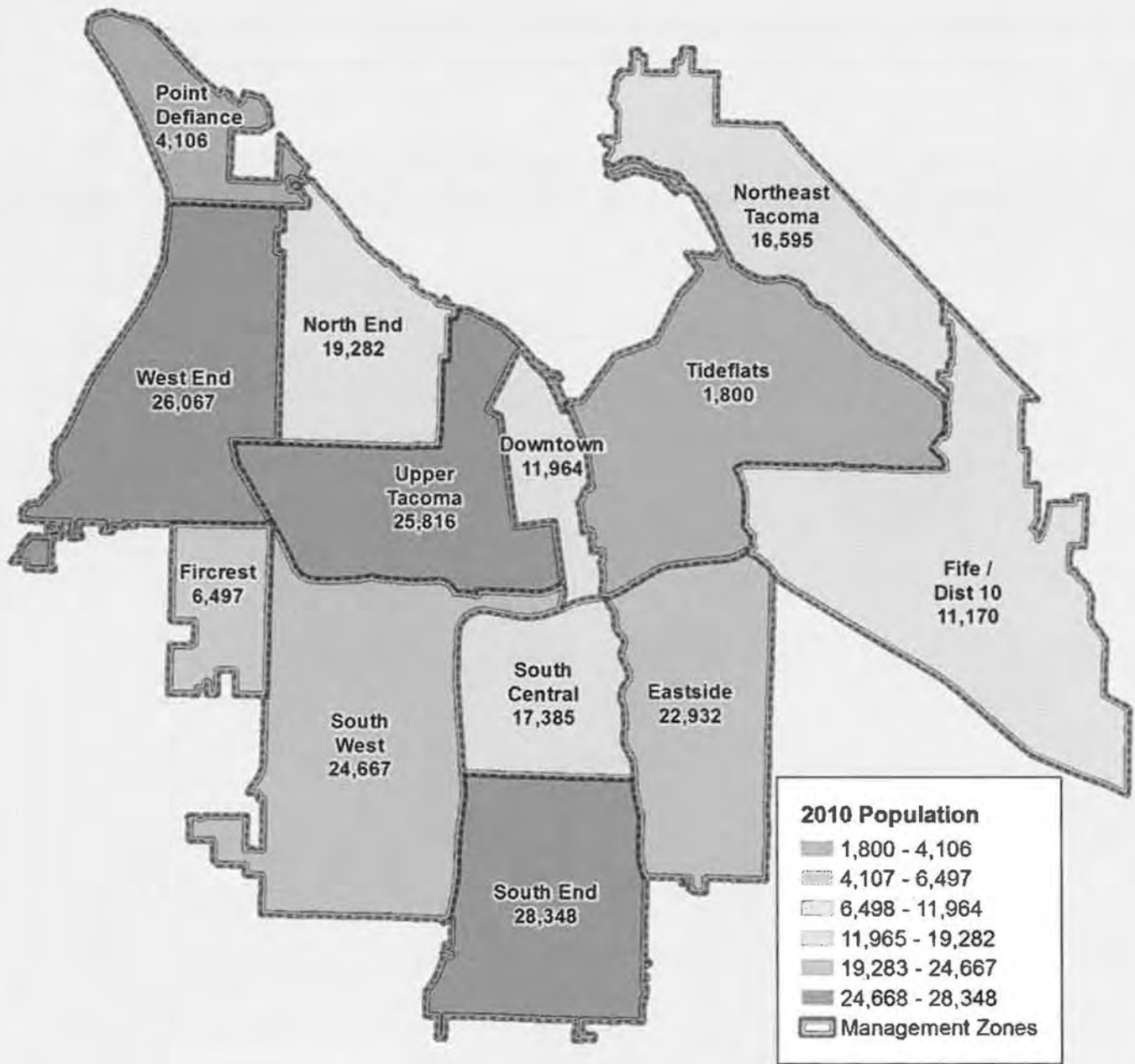
Demographics/Population¹

Based on 2010 census data, population estimates for the TFD service area is 215,915. Included is Tacoma, the state's third most populous city, and (per contracted services) the City of Fircrest and the City of Fife/District 10. The South End, Upper Tacoma, and West End FMZs have the highest concentration of resident population in our service area. See Appendix A for additional demographic details.

Table 1	Service Area	Washington
Population estimate	215,915	6,724,540
Persons under 5	7%	6.5%
Persons 65 years and over	11.3%	12.3%
Female persons	50.7%	50.2%
Male persons	49.3%	49.8%
Homeownership rate	54.1%	63.9%
Renter rate	45.9%	36.1%
Average household size	2.45	2.54

¹ U.S. Census Data, 2010

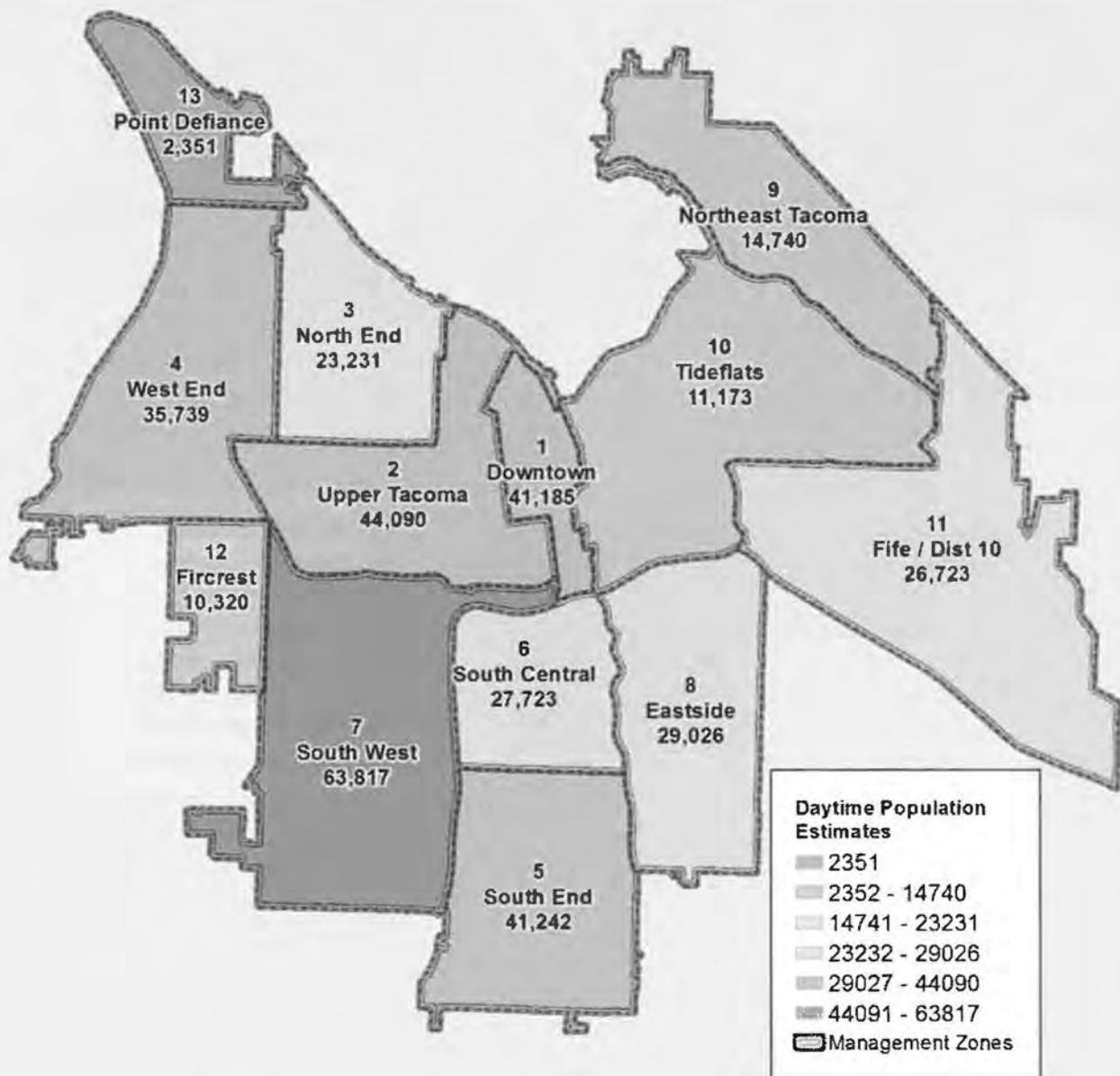
Population Totals by FMZ



Daytime Population²

The concept of the daytime population refers to the number of people who are present in an area during normal business hours, including workers. This is in contrast to the resident population, which refers to people who reside in a given area and are typically present during the evening and nighttime hours. Daytime population estimates help provide a fuller explanation of the number of people in a given portion of our service area.

Of note, despite having only the fourth largest resident population totals (24,667), the South West FMZ jumps to the highest population total (63,817) using daytime estimate methodology. The total daytime population estimate in our service area is 371,360.



² Puget Sound Regional Council, 2015

Growth Trends

The Puget Sound Region was home to almost 3.9 million people in 2014 and is continuing to grow due to natural increases in the population, as well as people moving here in pursuit of job opportunities and to enjoy the area's quality of life. The region has a relatively young and very well-educated labor force in comparison to the nation, which it attracts from other parts of the country and the world.

The region is forecast to reach a population of nearly 5 million people by 2040. King County is expected to receive the largest share of the forecast growth; however, if trends over the last 30 years continue to hold, an increasing share of the growth is likely to be absorbed by Kitsap, Pierce and Snohomish counties.

As part of the regional growth strategy, local jurisdictions are required to plan to accommodate an allocation of future regional population and employment growth. The City of Tacoma must plan for 127,000 additional residents and 97,000 jobs by 2040. This growth will place considerable demands on the city's existing infrastructure and land supply. <http://www.tacoma2040.com/>

Population Growth and Call Volume

Assuming population estimates hold true by 2040, TFD can expect a corresponding increase in the number of calls we respond to.

Using current per capita call volume of 186 calls per 1,000 people, (2014 call volume of 42,000 divided by a population estimate of 220,000, multiplied by 1,000) and the predicted growth of 127,000 residents, it is estimated that there will be 190 calls per 1,000 in 2040. This translates to an annual estimate of 66,245 calls, a 57% increase over current rates.

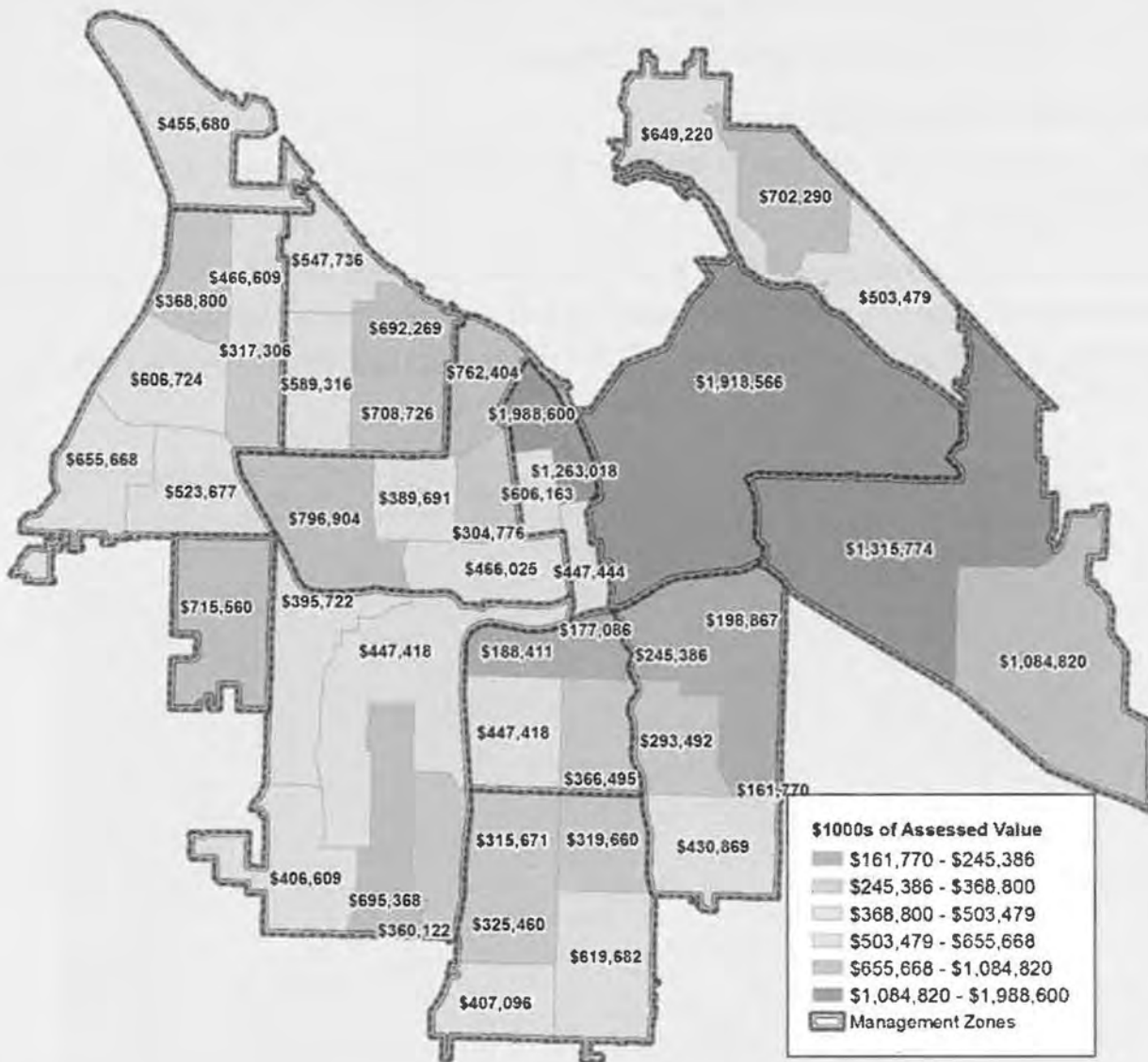


Parcels³

The following summarizes the number of land parcels in TFD's service area. See Appendix B for additional parcel information.

Table 2	# Parcels	Land Value	Average Land Value	Improved Value	Average Improved Value
Service area	81,519	\$9,227,925,000	\$113,199	\$19,424,069,000	\$238,277

Total Assessed Value	Average Assessed Value
\$28,651,994,000	\$351,476



Housing Summary^{4 5}

Of the approximately 90,000 housing units in our service area in 2010, 92% are occupied:

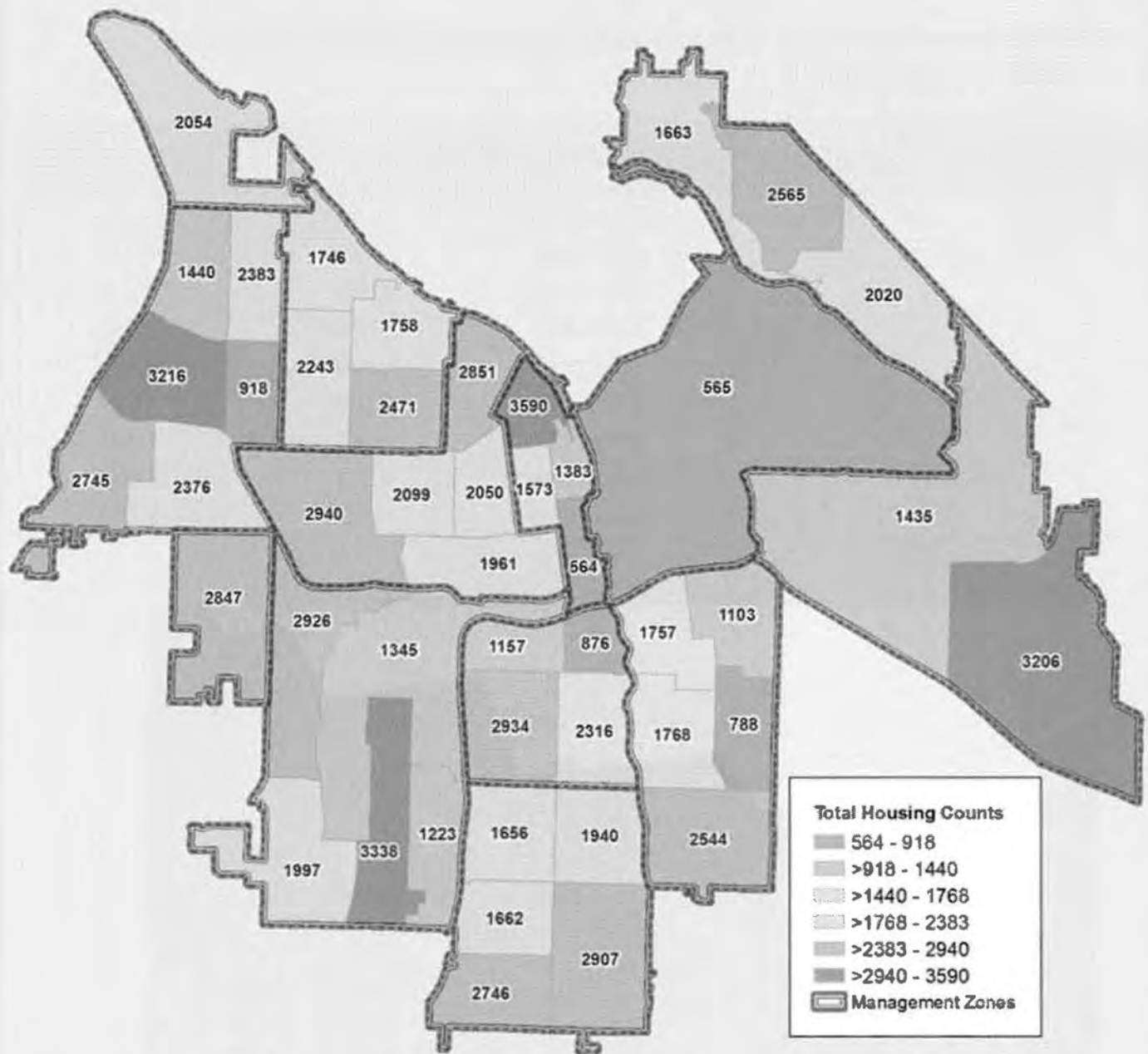
- Of the occupied housing units, 54.1% were owner occupied and 45.9% renter occupied.
- Average household size—2.45

Table 3	# Buildings	Year Built	Count	% of Total
Service area	89,884	1939 or before	28,499	31.7%
		1940-1949	10,955	12.1%
		1950-1959	9,668	10.7%
		1960-1969	8,650	9.6%
		1970-1979	7,963	8.8%
		1980-1989	7,039	7.8%
		1990-1999	6,965	7.7%
		2000-2009	8,142	9.0%
		2010 or after	2,003	2.2%



⁴ Pierce County Assessor Treasurer, 2015

⁵ U.S. Census Data, 2010



Portions of the Downtown, West End, South West and Fife/District 10 FMZ's have the highest concentration of housing units.

Thirty-one percent of all housing units in the service area were built prior to 1939.

HAZARDS IDENTIFICATION AND PROFILE

A hazard or risk is a situation that poses a threat to life, health, property, or the environment. Historically, the fire service has focused its efforts on the suppression and prevention of fires. Modern practices have been expanded to examine and account for risks from a variety of sources that affect public safety. The following overview details the risks that exist in our service area with those the fire department typically responds to presented first.

Fire

Fire risk is defined as the characteristics of the community that generate fire risk persistently over time. Our response area has a diverse blend of structures that pose a fire risk. All buildings have been designated as a low, moderate, and high risk for structure fire based on factors like required fire flow, the number of stories and the life safety threat posed. Generally, low-risk structures are those that require a single company response. These include dumpster fires, sheds, or small detached garages. Examples of moderate risk structures are single-family dwellings, multifamily dwellings less than two-stories, and small commercial buildings. High-risk structures include multifamily buildings over two stories, commercial structures that include hazardous operations/materials, hospitals, schools, and unsprinklered multifamily dwellings.



FMZ BUILDING FIRE RISK DISTRIBUTION

Table 4 Management Zones	High	Moderate	Low	Total
Downtown	1,412	986	446	2,844
Upper Tacoma	977	8,346	2,722	12,045
North End	220	7,566	2,974	10,760
West End	1,342	7,291	773	9,406
South End	421	8,659	1,935	11,015
South Central	339	6,180	2,414	8,933
South West	1,092	6,412	1,898	9,402
Eastside	274	7,123	1,360	8,757
Northeast Tacoma	189	5,591	206	5,986
Tideflats	610	310	136	1,056
Fife/District 10	533	2,907	331	3,771
Fircrest	133	2,306	175	2,614
Point Defiance	90	1,227	303	1,620
Total	7,632	64,904	15,673	88,209

An analysis of the fire risk distribution throughout our response area reveals the following:

High Risk

- The distribution of high-risk heavy industry and large commercial/retail structures follows main transport corridors, mostly railways, and interstate or state routes.
- High-risk large commercial, retail and multifamily structures are mostly located near a major arterial, highway or near downtown.
- Trends to watch in Upper Tacoma, South End, Eastside and Downtown planning zones:
 - Increasing vertical density in areas where older, single-family homes are being replaced by newer, multifamily structures which may or may not be sprinklered.
- Emerging risk:
 - Point Ruston: 800-900 residential units; combined single-family, multifamily, and high-rise in an area that lies partly in the TFD service area and partly outside of it in Ruston.
 - Continuing Port of Tacoma expansion carries with it the additional risk of decreased road access through the Tideflats planning zone.
 - The likely development of a natural gas production, cross load, and liquefaction facility along with significant bulk storage capability will provide a substantial new risk in the Tideflats zone.

- U.S. Oil & Refining has constructed a receiving system to simultaneously offload 100-unit rail tank car shipments of Bakken crude oil from the Midwest. They have also been expanding their storage capacity. Targa Sound Terminal has initiated a substantial expansion of their fuel mixing, distribution and storage facilities that now include rail delivery of petroleum products. These changes will increase the risk profile for both areas of the Tideflats zone.



Moderate Risk

- Two planning zones have emerging areas of high-density moderate risk
 - Fire/Fire District 10 with significant development of single-family homes in proximity to the high-risk Industrial planning zone.
- Continuing urbanization and the impact of the State’s Growth Management Act have encouraged densification and infill of formerly single-family dwelling neighborhoods. This has resulted in more multi-story buildings with smaller clearances between them, closer placement to property lines, and parking limitations. All of these changes complicate the ability of TFD to respond to incidents in these areas.

Fire Risk Summary

Overall analysis of Fire risk was conducted according to the following criteria:

- Population
- Number of moderate (M) and high (H) risk structures
- Number of moderate (M) and high (H) risk fires
- Presence of--
 - Geographical and/or access issues (G/A)
 - Wildland/urban interface (W/U)
 - Critical infrastructure (CI)—utilities, transportation, health, education, government
 - Heavy industry (IND)
 - Potential for significant economic impact (EI)
 - Historical/cultural value (HV)

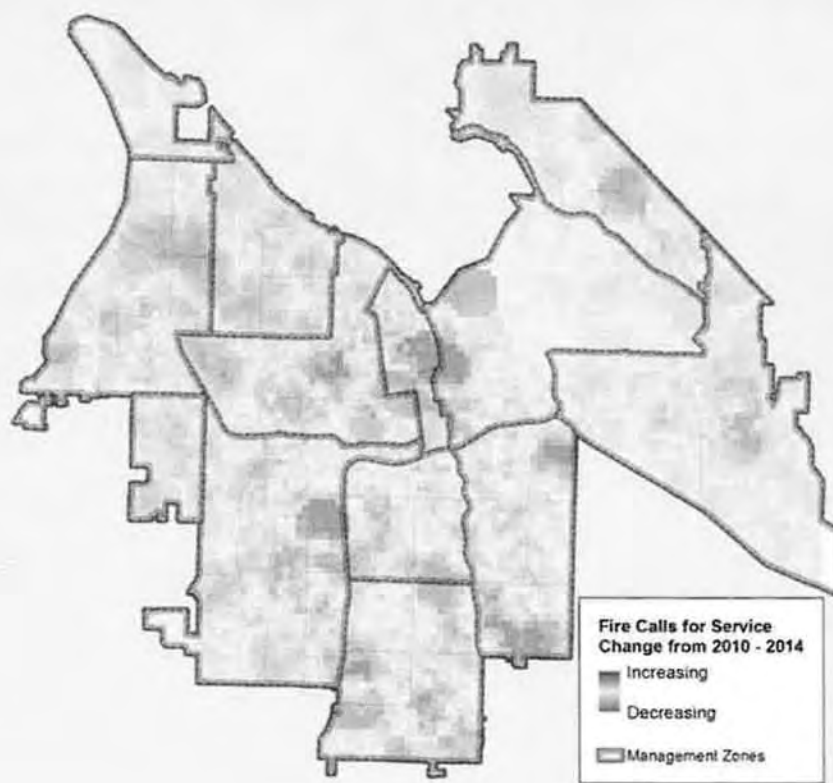
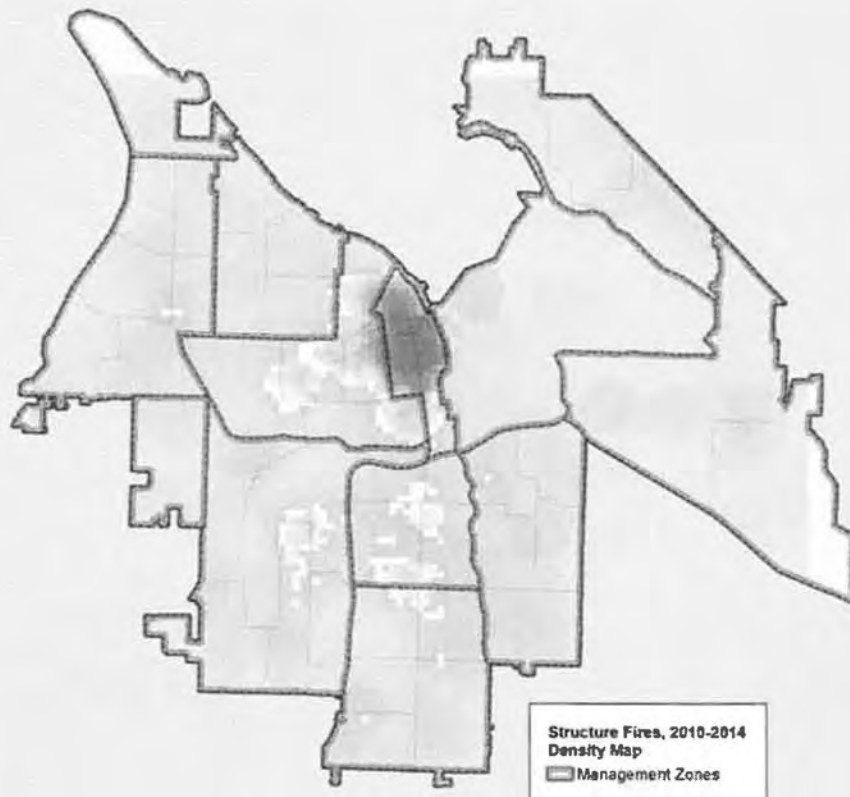
The zone-by-zone Fire risk analysis based on the above criteria is shown in Table 5.

Table 5—Zone-by-Zone Fire Risk Analysis

FMZ	Area	Pop	Density	Structures			Fires			Presence of				
	(sq. miles)		(pop/sq miles)	M	H	L	M	H	G/A	W/U	CI	IND	EI	HV
Downtown	1.52	11,964	7,871	986	1,412	466	29	246	X	---	X	---	X	X
Eastside	4.75	22,904	4,821	7,123	274	1,360	121	43	X	X	X	---	X	X
Fircrest	1.64	6,497	3,961	2,306	133	175	20	9	---	---	X	---	X	---
Fire District 10	8.61	11,190	1,299	2,907	533	331	28	50	X	X	X	X	X	---
North End	3.59	19,282	5,371	7,566	220	2,974	74	9	X	X	X	---	X	X
NE Tacoma	4.43	16,606	4,625	5,591	206	189	43	15	X	X	X	---	---	---
South Central	2.93	17,385	5,933	6,180	339	2,414	106	33	X	X	X	---	X	---
South End	5.02	28,348	5,647	8,659	421	1,935	132	52	X	X	--	---	---	X
South West	7.62	24,699	3,241	6,412	1,092	1,898	86	141	X	X	X	X	X	---
Tideflats	7.52	1,800	239	310	610	136	3	58	X	X	X	X	X	---
Upper Tacoma	4.88	25,816	5,290	8,346	977	2,722	136	106	X	---	X	---	X	---
West End	5.88	26,067	4,433	7,291	1,342	773	56	82	X	X	X	---	X	---
Point Defiance	1.97	3,357	1,704	1,227	90	303	13	2	X	X	---	---	---	X

Based on all of the preceding information, the following conclusions can be drawn regarding fire risk in the TFD service area:

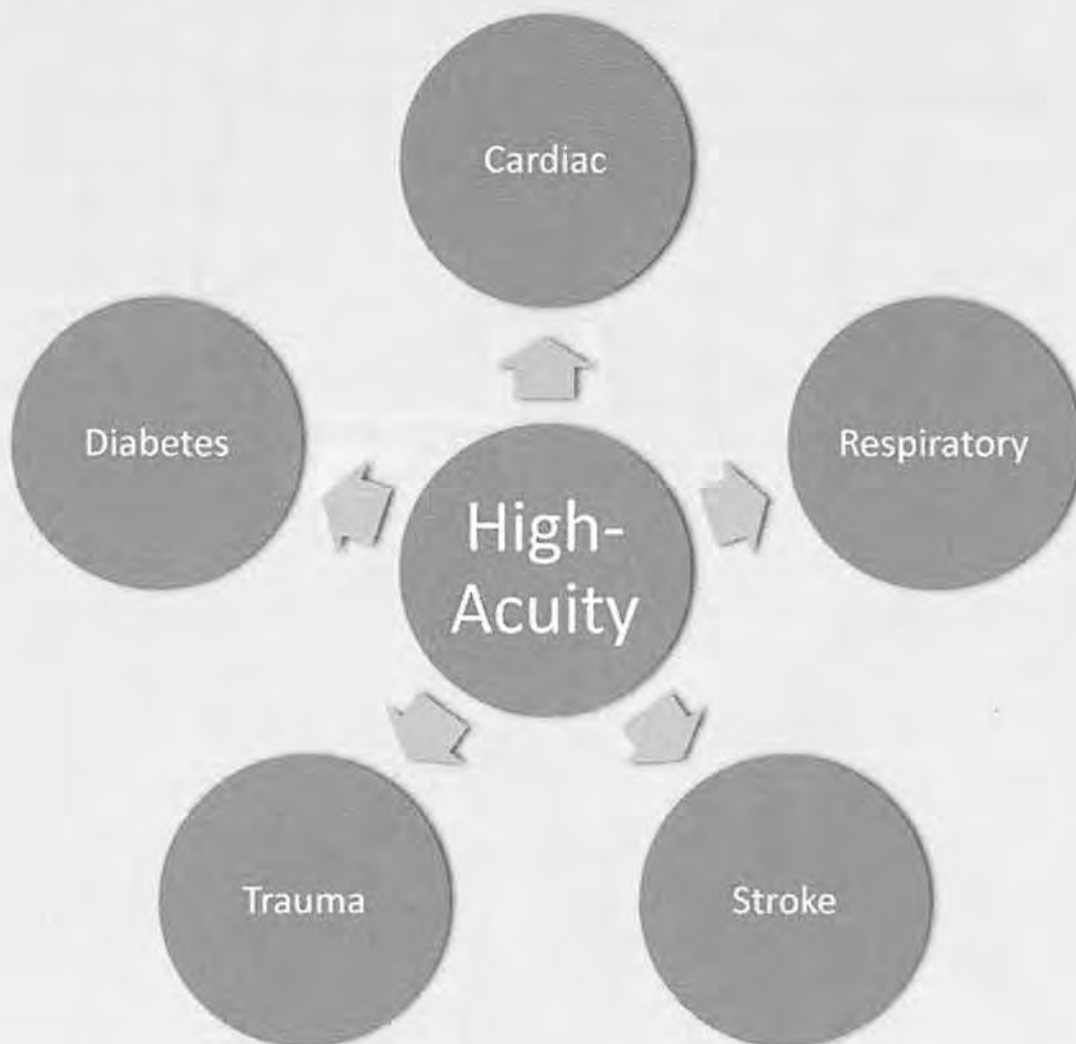
- Planning zones with the highest number of moderate and high-risk fires
 - Downtown
 - Upper Tacoma
 - South West
- Planning zones with highest fire risk based on presence of high-risk structures and other indicators
 - Tideflats—has 5 of 6 other risk indicators
 - Downtown—has 4 of 6 other risk indicators
- Areas to monitor for increasing fire risk based on number of incidents and/or presence of other risk factors
 - South West
 - Upper Tacoma
- Planning zones with lowest fire risk
 - Fircrest—has 2 of 6 other risk indicators
 - NE Tacoma—has 3 of 6 other risk indicators



Emergency Medical Services

EMS risk is defined as the correlation between the frequency of high-acuity medical conditions and community characteristics to determine the need for shorter times to treatment. The goal for EMS risk mitigation is to intervene before damage from the medical condition or traumatic injury becomes irreversible and to decrease the risk of mortality.

The high-acuity medical conditions considered for our community are:



Key contributing factors for EMS acuity include:

- Age of population
- Population density
- Per capita frequency

Table 6—EMS Risk Frequency All Incidents

Management Zone	2010	2011	2012	2013	2014	Total
South West	3,553	3,527	3,594	3,566	3,854	18,094
Downtown	3,314	3,319	3,376	3,592	3,849	17,450
West End	2,958	2,957	3,364	3,473	3,846	16,598
Upper Tacoma	3,218	3,190	3,198	3,329	3,500	16,435
South End	2,977	2,917	3,150	3,228	3,535	15,807
Eastside	2,700	2,698	2,902	2,820	2,867	13,987
South Central	1,991	2,058	2,028	1,904	1,969	9,950
Fife/District 10	1,331	1,399	1,450	1,582	1,617	7,379
North End	1,093	1,084	1,128	1,267	1,350	5,922
Northeast Tacoma	521	583	598	604	614	2,920
Tideflats	519	489	499	609	696	2,812
Point Defiance	401	393	473	442	480	2,189
Fircrest	421	437	397	428	424	2,107
Total	24,997	25,051	26,157	26,844	28,601	131,650

Table 7—EMS Risk Frequency—High-Acuity Incidents
(Cardiac, Stroke, Respiratory, Diabetes, Trauma)

Management Zone	2010	2011	2012	2013	2014	Total
South West	773	847	838	735	669	3,862
Upper Tacoma	760	846	803	687	695	3,791
West End	714	698	728	791	738	3,669
South End	759	792	794	663	607	3,615
Downtown	732	754	754	679	661	3,580
Eastside	671	726	781	641	546	3,365
South Central	457	501	482	418	327	2,185
Fife/District 10	298	272	320	343	303	1,536
North End	209	225	236	224	215	1,109
Northeast Tacoma	138	141	156	150	126	711
Tideflats	117	112	112	130	119	590
Point Defiance	88	101	116	84	85	474
Fircrest	92	101	88	102	69	452
Total	5,808	6,116	6,208	5,647	5,160	28,939

AGE OF POPULATION

The following table delineates the population by age groups throughout the FMZ's. The Point Defiance, Fircrest and West End FMZ's have the highest concentration of population over 65. The Eastside, South West and Fife/District 10 have the highest concentration of the population below age 5.

Table 8—Population Age Groups⁶

FMZ	Age 0-4	Age 5-14	Age 15-24	Age 25-49	Age 50-64	Age 65+	Total Pop
South End	2,220	3,788	4,162	9,899	5,137	3,142	28,348
% of total	7.8%	13.3%	14.7%	35%	18.1%	11.1%	100%
West End	1,426	2,631	3,230	8,262	5,461	5,057	26,067
	5.5%	10.1%	12.4%	31.7%	21%	19.3%	100%
Upper Tacoma	1,805	3,065	3,403	10,158	4,516	2,869	25,816
	6.7%	11.9%	13.2%	39.4%	17.5%	11.3%	100%
South West	2,165	3,370	4,120	9,402	3,722	1,920	24,699
	8.8%	13.6%	16.6%	38.1%	15.1%	7.8%	100%
Eastside	2,145	3,858	3,293	8,091	3,494	2,023	22,904
	9.4%	16.8%	14.4%	35.3%	15.3%	8.8%	100%
North End	1,068	1,917	3,767	6,440	4,123	1,967	19,282
	5.5%	9.9%	19.7%	33.3%	21.4%	10.2%	100%
South Central	1,305	2,260	2,216	6,794	3,174	1,636	17,385
	7.5%	13%	12.7%	39.1%	18.3%	9.4%	100%
Northeast Tacoma	1,000	2,440	2,194	5,827	3,583	1,562	16,606
	6%	14.7%	13.2%	35.1%	21.6%	9.4%	100%
Downtown	501	607	1,874	5,636	2,130	1,216	11,964
	4.2%	5.1%	15.6%	47.2%	17.7%	10.2%	100%
Fire District 10	972	1,495	1,543	4,688	1,699	793	11,190
	8.7%	13.3%	13.8%	41.9%	15.2%	7.1%	100%
Fircrest	368	829	718	2,063	1,332	1,187	6,497
	5.7%	12.7%	11.1%	31.8%	20.4%	18.3%	100%
Point Defiance	154	280	289	1,033	733	868	3,357
	4.6%	8.4%	8.6%	30.8%	21.9%	25.7%	100%
Industrial	11	23	376	1,057	247	86	1,800
	.6%	1.3%	20.8%	58.8%	13.7%	4.8%	100%

POPULATION DENSITY/PER CAPITA FREQUENCY

In order to compare EMS rates between the zones, a per capita analysis is necessary. When the EMS frequency of use per 1,000/population is observed in each FMZ and is compared with the high-acuity incidents, the Tideflats zone rises to the top of both tables. Additionally, the Tideflats zone leads significantly in the specific high-acuity risk categories of cardiac, stroke and trauma, whereas the Downtown zone leads in respiratory. However, it should be noted that the Tideflats and Point Defiance zones have the lowest population totals of all zones, and accurate per capita analysis becomes problematic with such a small number.

⁶ Census Data, 2010

Table 9—EMS Risk Frequency per 1,000 Resident Population—All Incidents

Zone	2010	2011	2012	2013	2014	Total
Tideflats	288	272	277	338	387	312
Downtown	277	277	282	300	322	292
South West	144	143	146	145	156	147
Fife/District 10	119	125	130	142	145	132
West End	113	113	129	133	148	127
Upper Tacoma	125	124	124	129	136	127
Eastside	118	118	127	123	125	122
South Central	115	118	117	110	113	114
South End	105	103	111	114	125	112
Point Defiance	98	96	115	108	117	107
Fircrest	65	67	61	66	65	65
North End	57	56	59	66	70	61
NE Tacoma	31	35	36	36	37	35
Grand Total	115	116	121	124	132	122

Table 10—EMS Risk Frequency per 1000 Resident Population/High-Acuity Incidents

Zone	CARD	DIAB	ENVIR	NEURO	RESP	TRAUMA	Total
Tideflats	33	3	1	9	7	15	12
Downtown	28	3	1	9	15	5	10
South West	11	2	0	5	9	3	5
Upper Tacoma	12	2	0	5	9	2	5
Eastside	11	3	0	4	9	2	5
West End	12	1	0	5	8	2	5
Fife/District 10	13	1	0	4	7	3	5
South End	9	2	0	4	8	2	4
South Central	9	2	0	4	8	3	4
Point Defiance	7	3	0	5	6	2	4
Fircrest	6	1	0	3	3	1	2
North End	4	1	0	3	3	1	2
Northeast Tacoma	3	1	0	2	2	1	1
Total	11	2	0	4	8	2	5

Analysis of EMS risk was conducted according to the following criteria:

- Resident population
- Percentage of resident population over age 65
- High frequency: all EMS, high-acuity conditions
- Frequency per 1,000 resident population: all EMS, high-acuity conditions
- Consistent and emerging trends

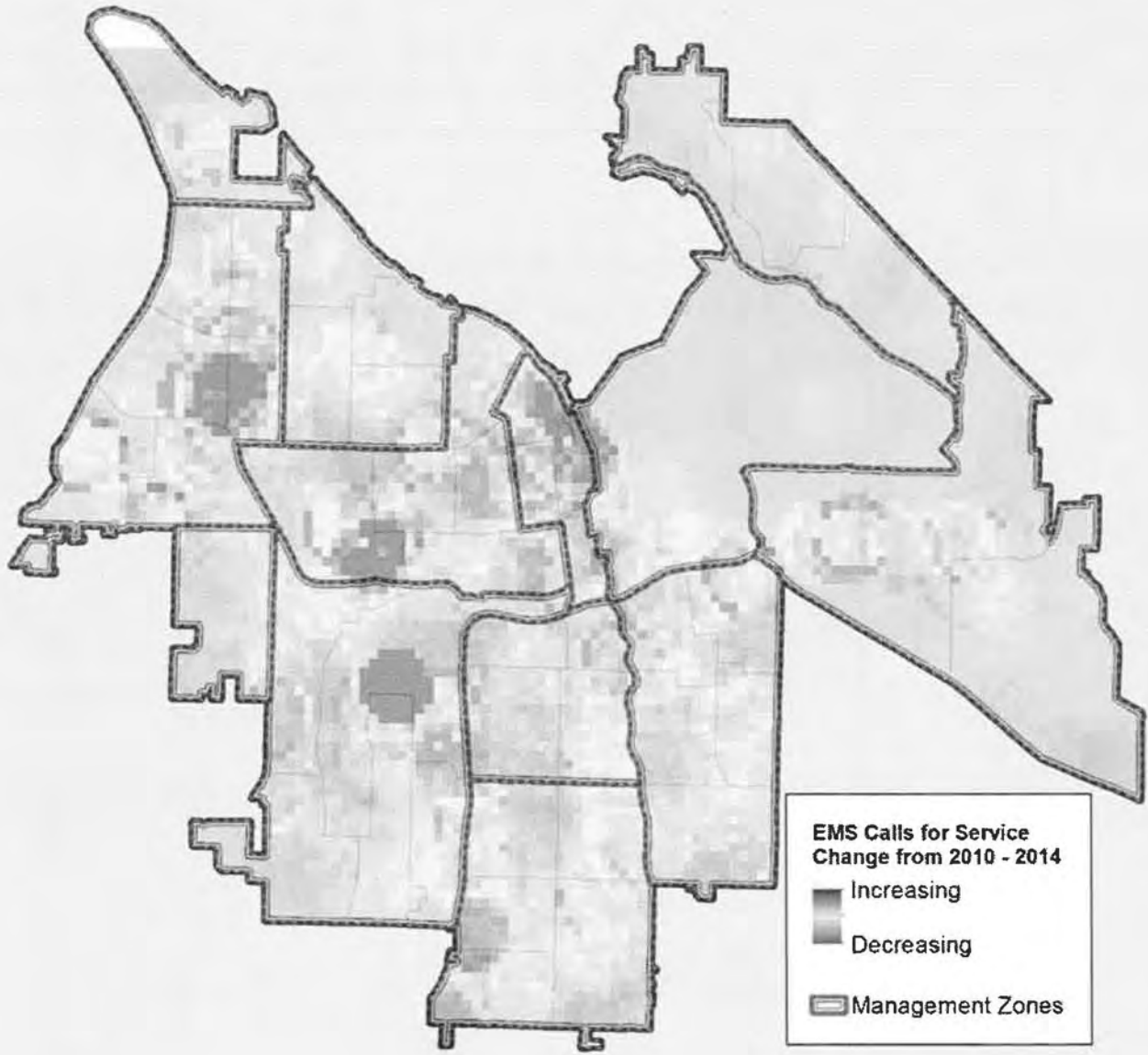
Table 11—Zone-by-Zone EMS Risk Analysis

Zone	Pop. Total	Pop. Density	% Age 65+	Frequency		Frequency		Frequency 1000	
				All EMS		High Acuity		All Calls	High Acuity
Downtown	11,964	7,871	17.7%	17,450	13.2%	3,580	12.3%	292	10
Eastside	22,904	4,821	8.8%	13,987	10.6%	3,365	11.6%	122	5
Fircrest	6,497	3,961	20.4%	2,107	1.6%	452	1.5%	65	2
Fife/District10	11,190	1,299	15.2%	7,379	5.6%	1,536	5.3%	132	5
North End	19,282	5,371	34.0%	5,922	4.4%	1,109	3.8%	61	2
NE Tacoma	16,606	4,625	21.6%	2,920	2.2%	711	2.4%	35	1
South Central	17,385	5,933	18.3%	9,950	7.5%	2,185	7.5%	114	4
South End	28,348	5,647	11.1%	15,807	12%	3,615	12.4%	112	4
South West	24,699	3,241	7.8%	18,094	13.7%	3,862	13.3%	147	5
Industrial	1,800	239	4.8%	2,812	2.1%	119	23%	312	12
Upper Tacoma	25,816	5,290	11.3%	16,435	12.4%	3,791	13%	127	5
West End	26,067	4,433	19.3%	16,598	12.6%	3,669	12.6%	127	5
Pt. Defiance	3,357	1,704	25.7%	2,189	1.6	474	1.6	107	4

The zone-by-zone EMS risk analysis based on the above criteria is shown in Table 11. Based on all of the preceding information, the following conclusions can be drawn regarding EMS risk in the TFD service area:

- FMZ's with the highest frequency of all EMS incidents:
 - South West
 - Downtown
 - West End
- FMZ's with the most high-acuity incidents per 1,000 incidents:
 - Tideflats
 - Downtown



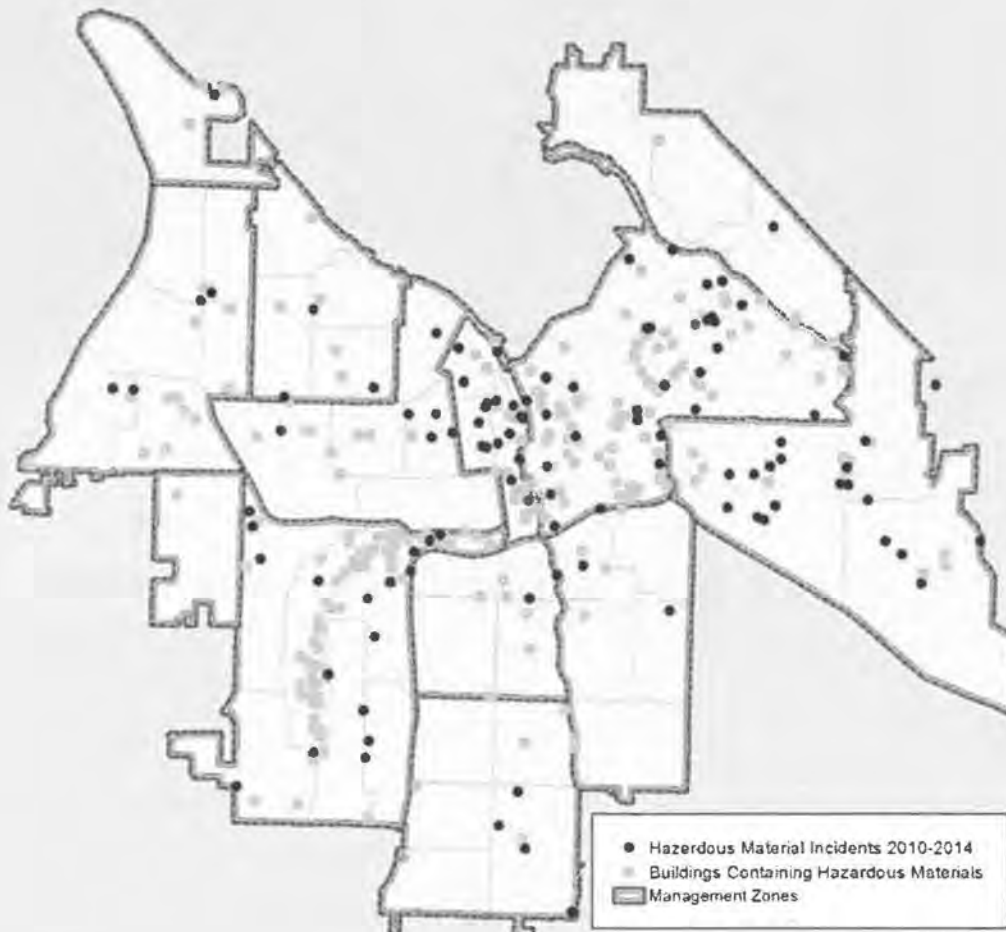


Specialty Risk

Specialty risk is defined as the structural and geographical characteristics of the community that over time persistently generate risk to life safety and/or the environment. The goal for specialty risk mitigation is to keep emergencies from escalating to prevent life and property loss and/or adverse impact on the environment. TFD provides specialty risk mitigation via its Hazardous Materials, Technical Rescue and Marine Firefighting and Rescue services.

HAZARDOUS MATERIALS

Any substance which may pose an unreasonable risk to health and safety of operating or emergency personnel, the public, and/or the environment if not properly controlled during handling, storage, manufacture, processing, packaging, use, disposal, or transportation.



TECHNICAL RESCUE

Defined as any operation that requires the use of specialized tools and skills to rescue patients and ensure the safety of first responders. For TFD, this includes rope rescue, structural collapse, confined space rescue, trench rescue and technical extrication.

MARINE

Marine risk is defined as the risks found in Commencement Bay and Port of Tacoma including but not limited to water rescue/evacuation, emergency medical services, ship/boat fires, oil/fuel spills, and ship-to-shore firefighting.

Table 12—Marine Firefighting and Rescue—All Incidents

Year	2010	2011	2012	2013	2014	Total
Incident Total	131	70	148	111	121	581

Overall analysis of special risk was conducted according to the following criteria:

- Population
- Number of specialty incidents
- Presence of:
 - Geographical and/or access issues (G/A)
 - Wildland/urban interface (W/U)
 - Critical infrastructure (CI): utilities, transportation, health, education, government
 - Heavy industry (IND)
 - Potential for significant economic impact (EI)
 - Historical/cultural value (HV)



The zone-by-zone specialty risk analysis based on the above criteria is shown in Table 13.

Table 13—Zone-by-Zone Specialty Risk Analysis 2010-2014

FMZ	Population	Density (pop/miles)	Presence Of							
			Tech Rescue	Hazmat	G/A	W/U	CI	IND	EI	HV
Downtown	11,964	7,871	17	19	---	---	X	---	X	X
Eastside	22,904	4,821	23	2	X	X	X	---	X	X
Fircrest	6,497	3,961	6	0	---	---	X	---	X	---
Fire District 10	11,190	1,299	13	18	X	X	X	X	X	---
North End	19,282	5,371	18	4	X	X	X	---	X	X
Northeast Tacoma	16,606	4,625	6	0	X	X	X	---	---	---
South Central	17,385	5,933	12	3	X	X	X	---	X	---
South End	28,348	5,647	7	3	X	X	---	---	---	---
South West	24,699	3,241	29	20	X	X	X	X	X	---
Tideflats	1,800	239	62	42	X	X	X	X	X	---
Upper Tacoma	25,816	5,290	26	9	---	---	X	---	X	---
West End	26,067	4,433	19	4	X	X	X	---	X	---
Pt. Defiance	3,357	1,704	33	1	X	X	---	---	---	X

Based on all of the preceding information, the following conclusions can be drawn regarding specialty risk in the TFD service area:

- FMZs with the highest overall specialty risk
 - Tideflats
 - South West
- FMZs with highest HazMat risk based on number of incidents
 - Tideflats—also has 5 of 6 other risk indicators
 - South West—also has 5 of 6 other risk indicators
- FMZs with highest Tech Rescue risk based on number of incidents
 - Tideflats—also has 5 of 6 other risk indicators
 - Point Defiance—also has 3 of 6 other risk indicators
 - South West—also has 5 of 6 other risk indicators
- FMZs with lowest Specialty risk
 - Fircrest—has 2 of 6 other risk indicators
 - NE Tacoma—has 3 of 6 other risk indicators
- Marine fire risk
 - Possible emerging risk in Port of Tacoma area with proposed development



Natural & Technological

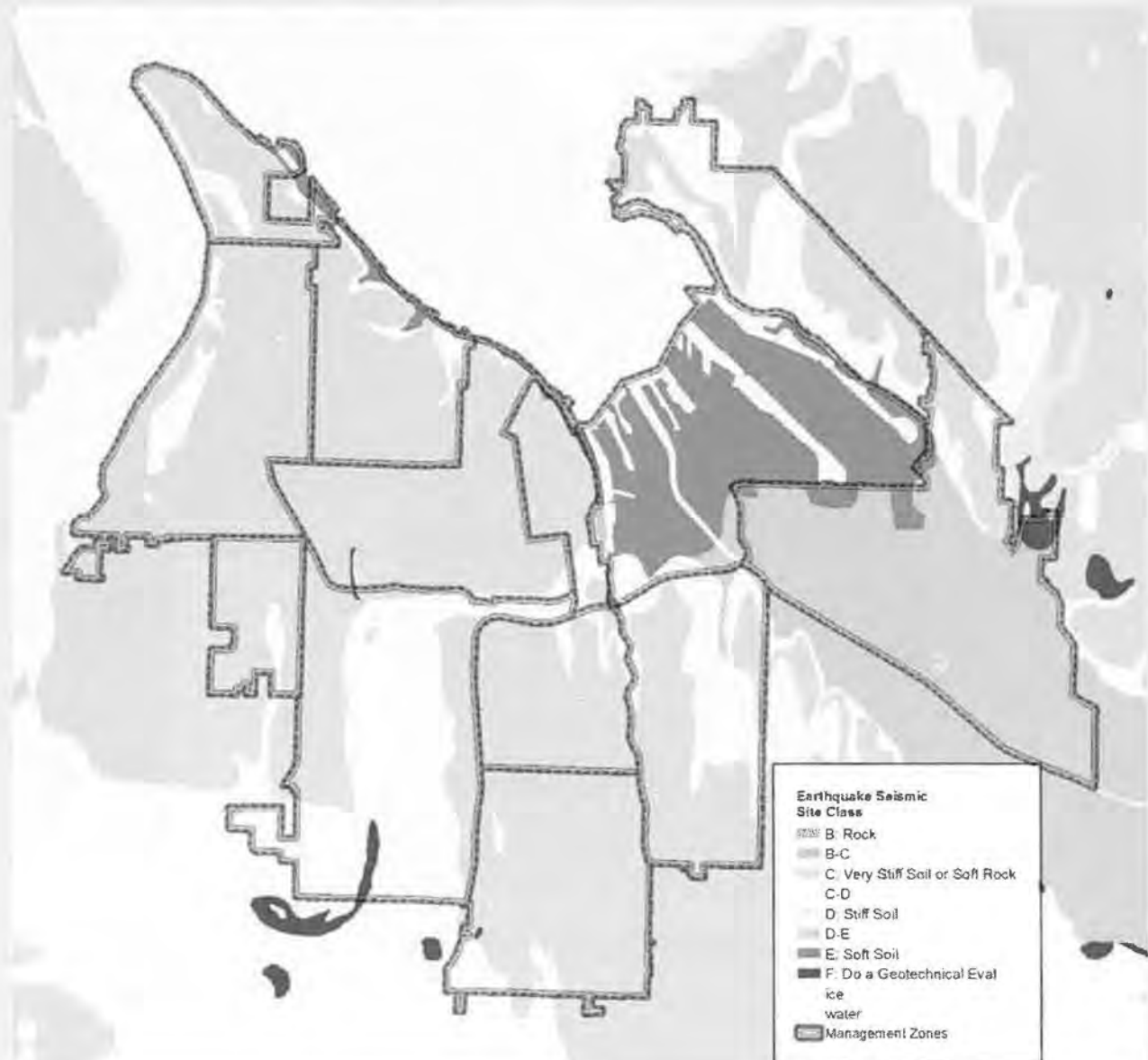
In addition to traditional risks that the department responds to, are natural and human-caused disasters. Given numerous stakeholders (Federal Emergency Management Association, local emergency managers, Universities, etc.) have conducted extensive research in most of these areas, references will direct the reader to a more in-depth analysis by subject matter experts.

GEOLOGICAL HAZARDS

This category identifies the major hazards that are typically associated with the movement of the earth's crust that pose a threat to life and property.

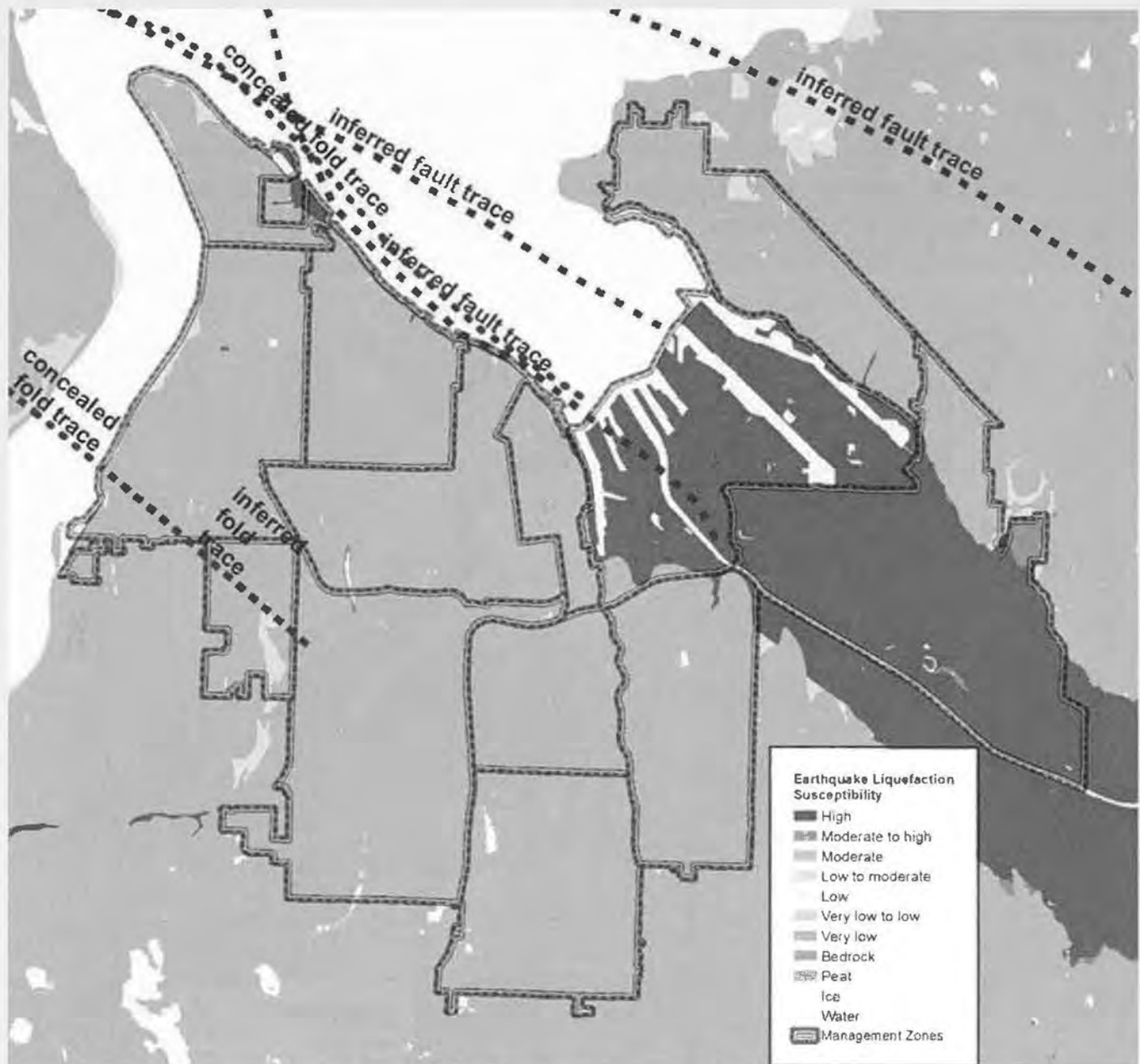
Earthquake/Liquefaction

Potentially the most catastrophic of all natural disasters, the threat of a significant seismic event in our response district is most prominent in the area identified on the map below. Type B (rock) having the least amplification and Type E (soft soil) the most.



Liquefaction

Soil liquefaction describes a phenomenon whereby a saturated or partially saturated soil substantially loses strength and stiffness in response to an applied stress, usually earthquake shaking, causing it to behave like a liquid. This process has been responsible for tremendous amounts of damage in historical earthquakes around the world.

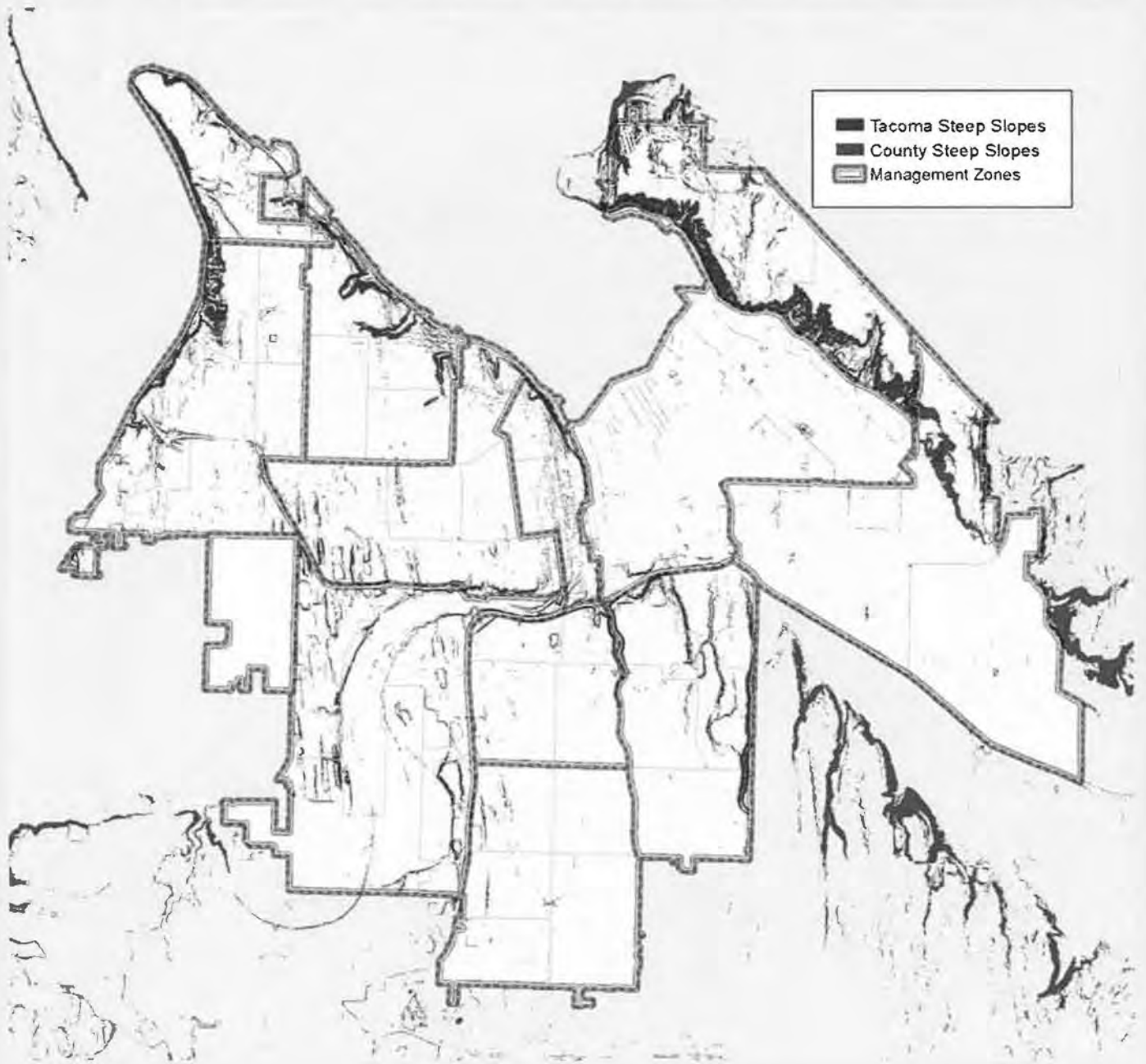


More details about Liquefaction are available from the University of Washington.

<http://www.ce.washington.edu/~liquefaction/html/main.html>

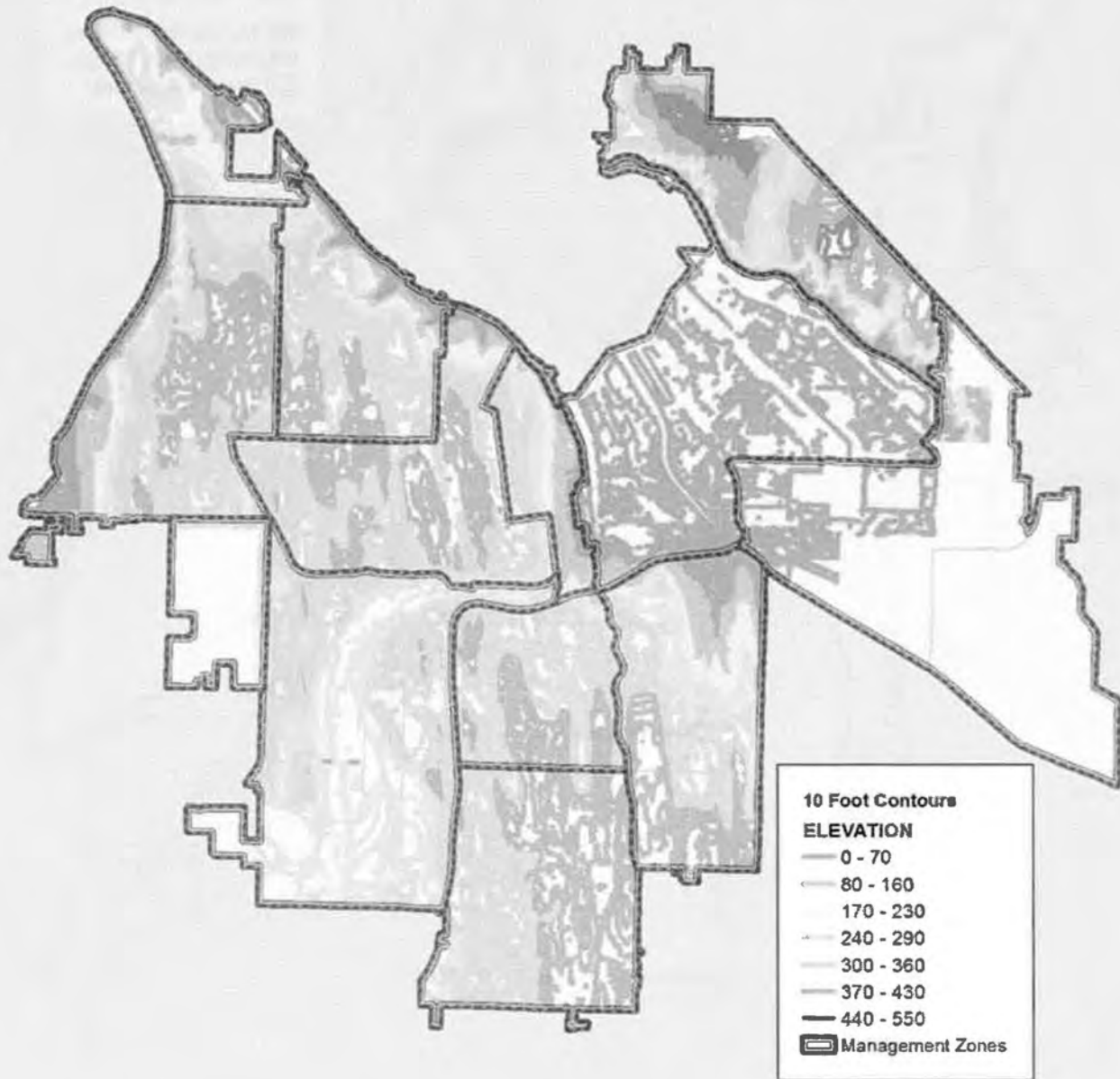
Steep Slopes

Our region's hilly terrain combined with high levels of rainfall could trigger significant landslides in the region.



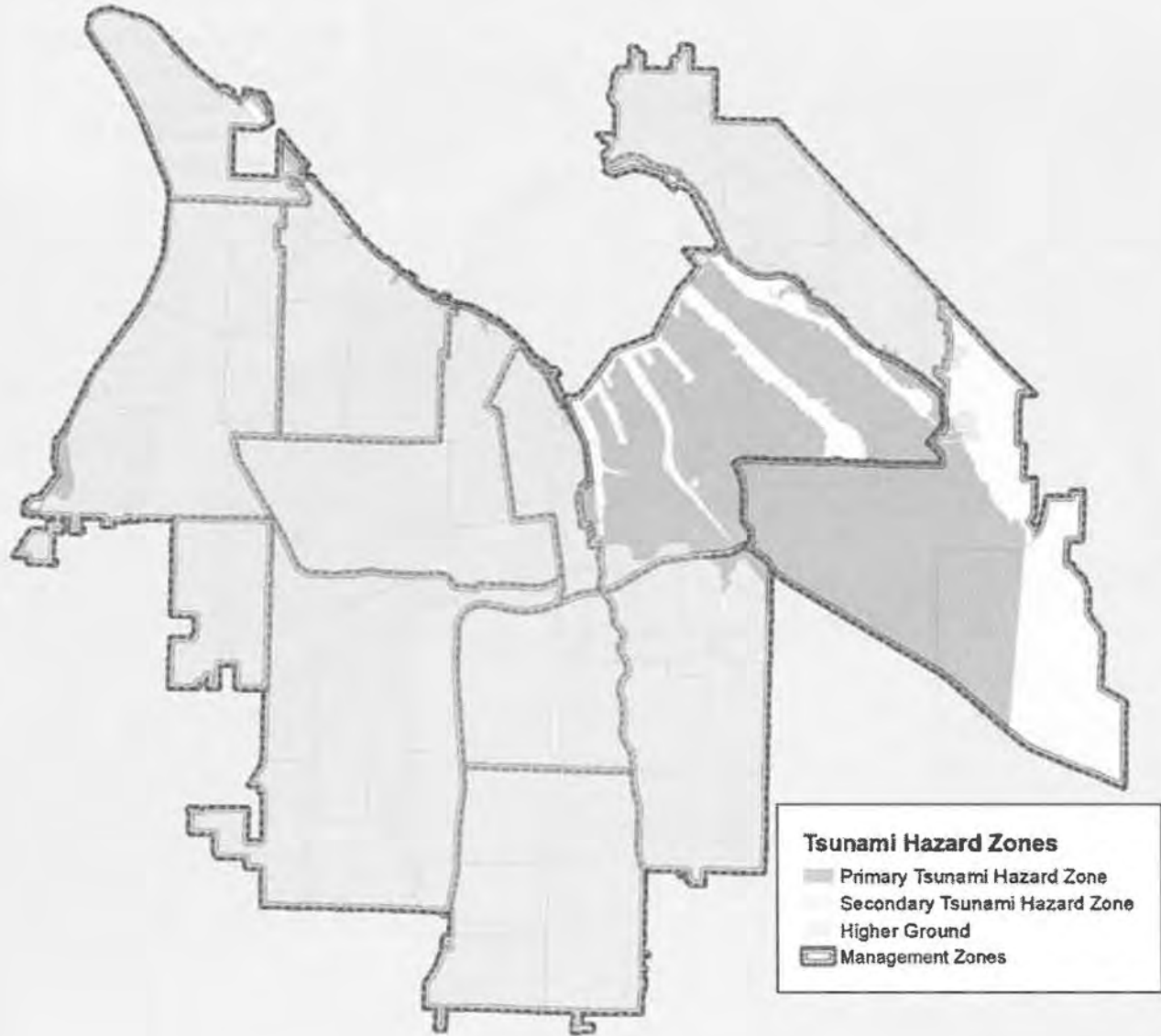
Contour Map

This map illustrates the various contours (hilly terrain and slopes) throughout and the service area.



Tsunami

Triggered by a seismic event, a tsunami is possible in the areas adjacent to Commencement Bay.



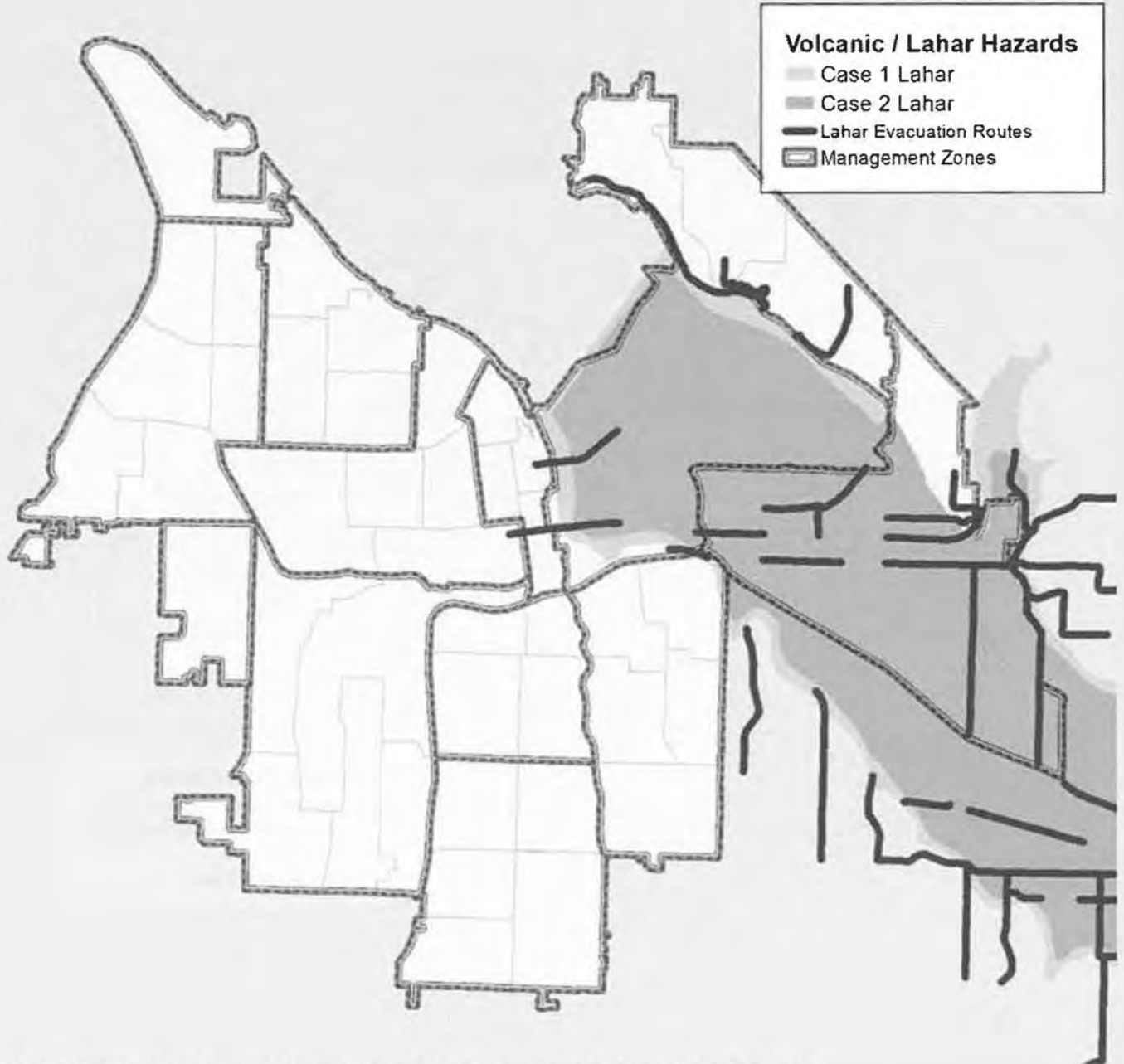
Detailed Tsunami information is available from the Washington State Department of Natural Resources.

<http://www.dnr.wa.gov/programs-and-services/geology/geologic-hazards/tsunamis>

Volcanic/Lahar

Proximity to Mt. Rainier, adds a threat of an eruption event that could cause a lahar in our response area.

A lahar is a type of mudflow or debris flow that typically follows a river valley.



Detailed information about Mt. Rainier and Lahar is available from Pierce County.

<http://www.piercecountywa.org/activevolcano>

METEOROLOGICAL

Weather events present several hazards in our response area. The impacts of global climate change have garnered much research in the last decade. Greenhouse gas scenarios have been developed by climate modeling centers for use in modeling global and regional climate impacts. Locally, predictions for the Puget Sound Region include:

- warming temperatures,
- heavy rainfall in terms of frequency and intensity that could exacerbate flood risks in many watersheds,
- rising sea level,
- a greater proportion of winter precipitation to fall as rain rather than snow,
- an increase in landslide risk, erosion, and sediment transport in fall, winter and spring,
- general flooding

For a detailed description of impacts please see the 2015 University of Washington College of the Environment report, "State of Knowledge: Climate Change in Puget Sound." <https://cig.uw.edu/resources/special-reports/ps-sok/>

Drought and Wildland Urban Interface

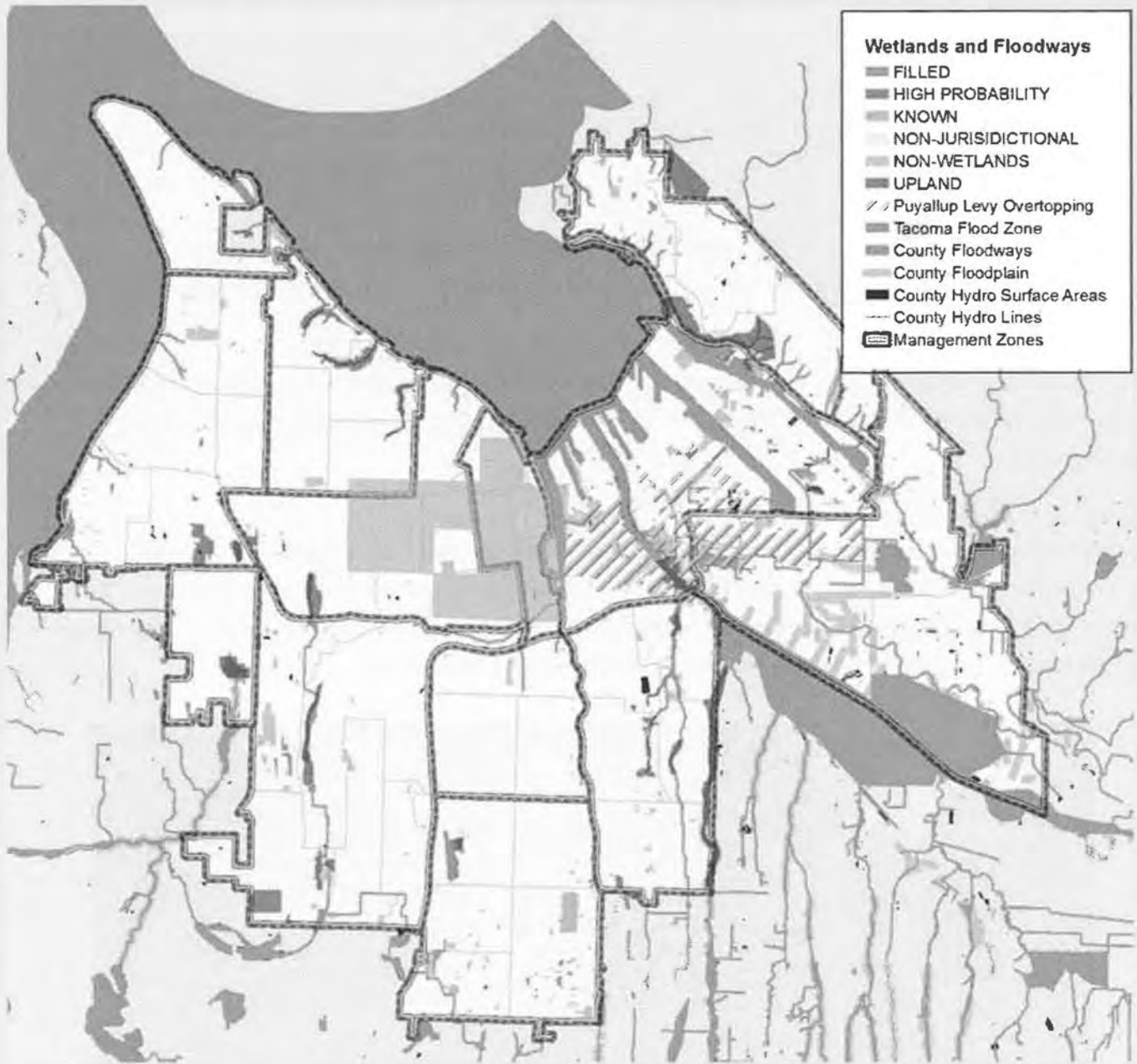
A sustained period without precipitation could increase the fire danger in our wildland-urban interfaces. The area's most likely at risk are Point Defiance Park, Swan Creek Park, West Slope and NE Tacoma areas. As mentioned, climate change predictive models continue to point to hotter and dryer summers in our region that may lead to "Eastern Washington type wildfires" in Western Washington.



FIGURE 1 FIRE - SWAN CREEK PARK - AUGUST 12, 2015

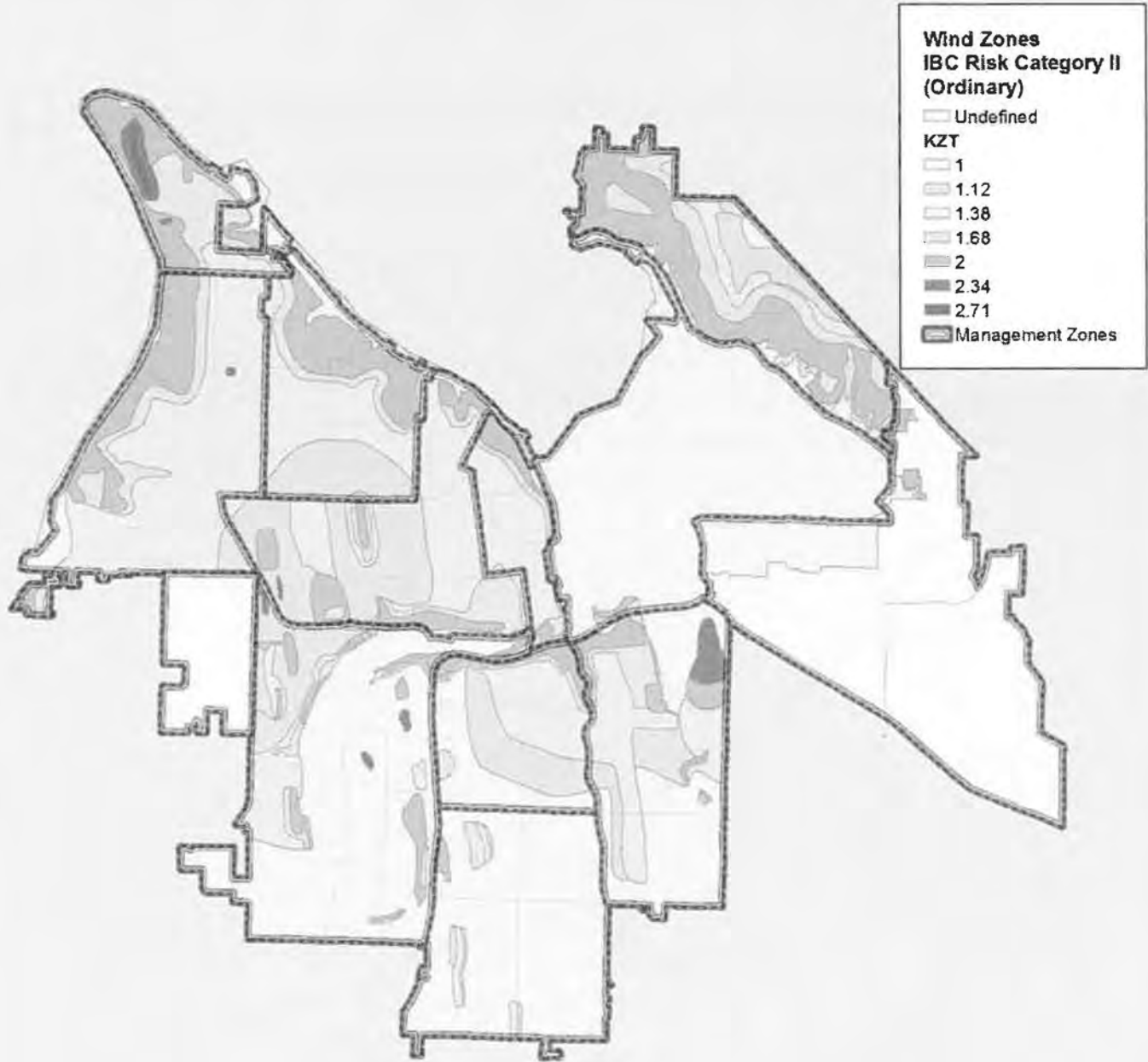
Flood

Floods are one of the most common meteorological threats occurring in our service area.



High Wind

As illustrated below, the northern portion of our response area is prone to higher wind loads. Wind storms often result in falling trees that knockout power, fall on structures/automobiles and create traffic hazards in our service area. "KZT" is a topographic wind speed-up factor.



TECHNOLOGICAL

There are some human-made disasters that can occur with some warning, such as knowing a dam is weak and, without proper mitigation, it will break releasing a flood. However, most of the serious human-caused disasters are the result of unexpected accidents or deliberate acts of terrorism.

Civil Disturbance

Forms of protest against society could result in a mass casualty incident.

Epidemic/Outbreak

Pandemic flu or another type of event could create a disaster for the community and first responders alike.

- Center for Disease Control—<http://www.cdc.gov/flu/pandemic-resources/>

Energy Emergency

The creation and transportation of energy-related products pose a threat in our service area.

Rail Lines

Increased transportation of crude oil by rail has developed as an emerging risk in our response area. The State Department of Ecology has several resources regarding this topic.

<http://www.ecy.wa.gov/programs/spills/OilMovement/index.html>



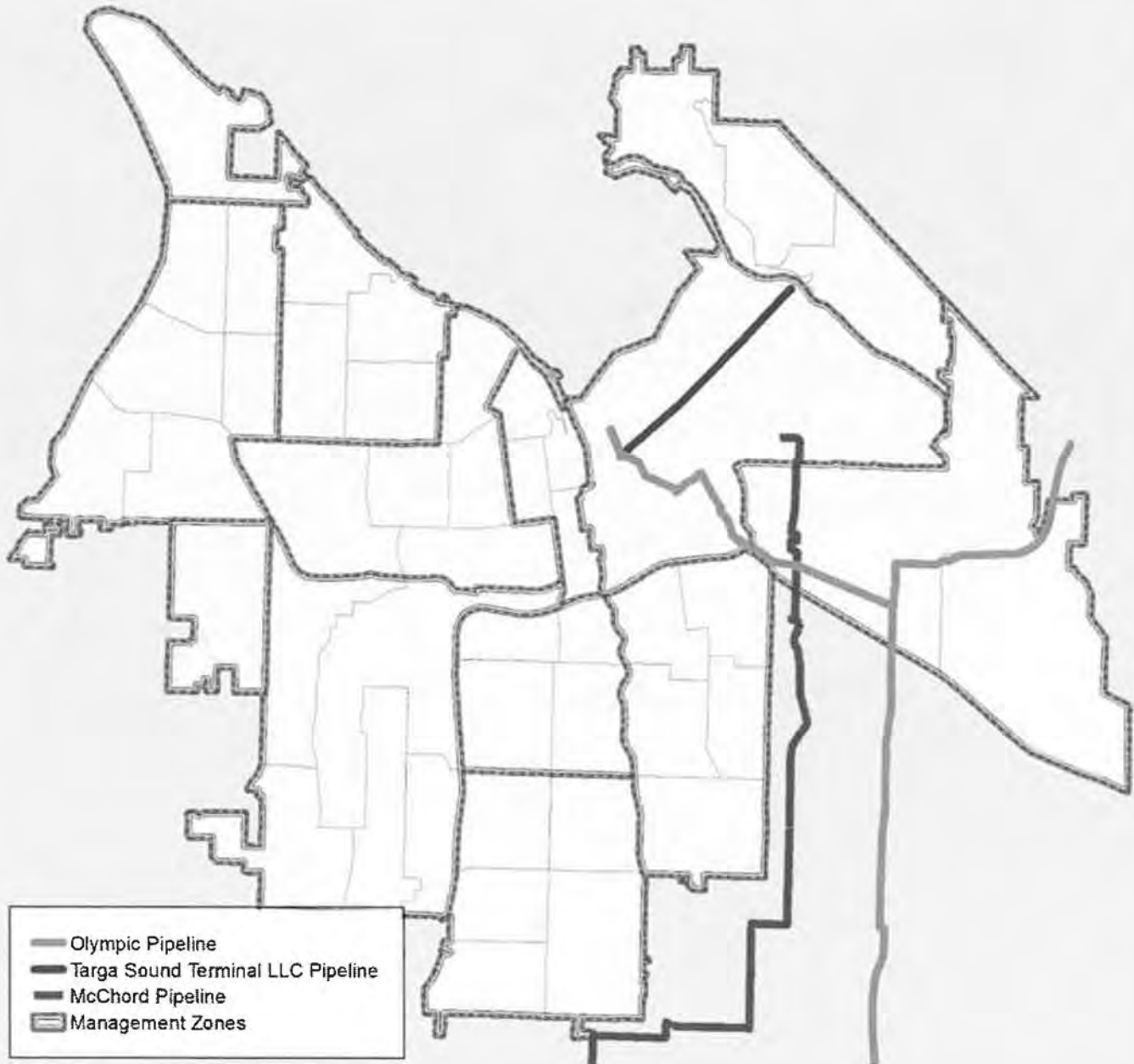
Pipelines

Pipelines are regulated by the Washington Utilities and Transportation Commission.

<http://www.utc.wa.gov/regulatedIndustries/transportation/pipeline/Pages/default.aspx>

Olympic Pipeline—<http://www.olympicpipeline.com/>

McChord Pipeline—<http://www.mcchordpipeline.com/>

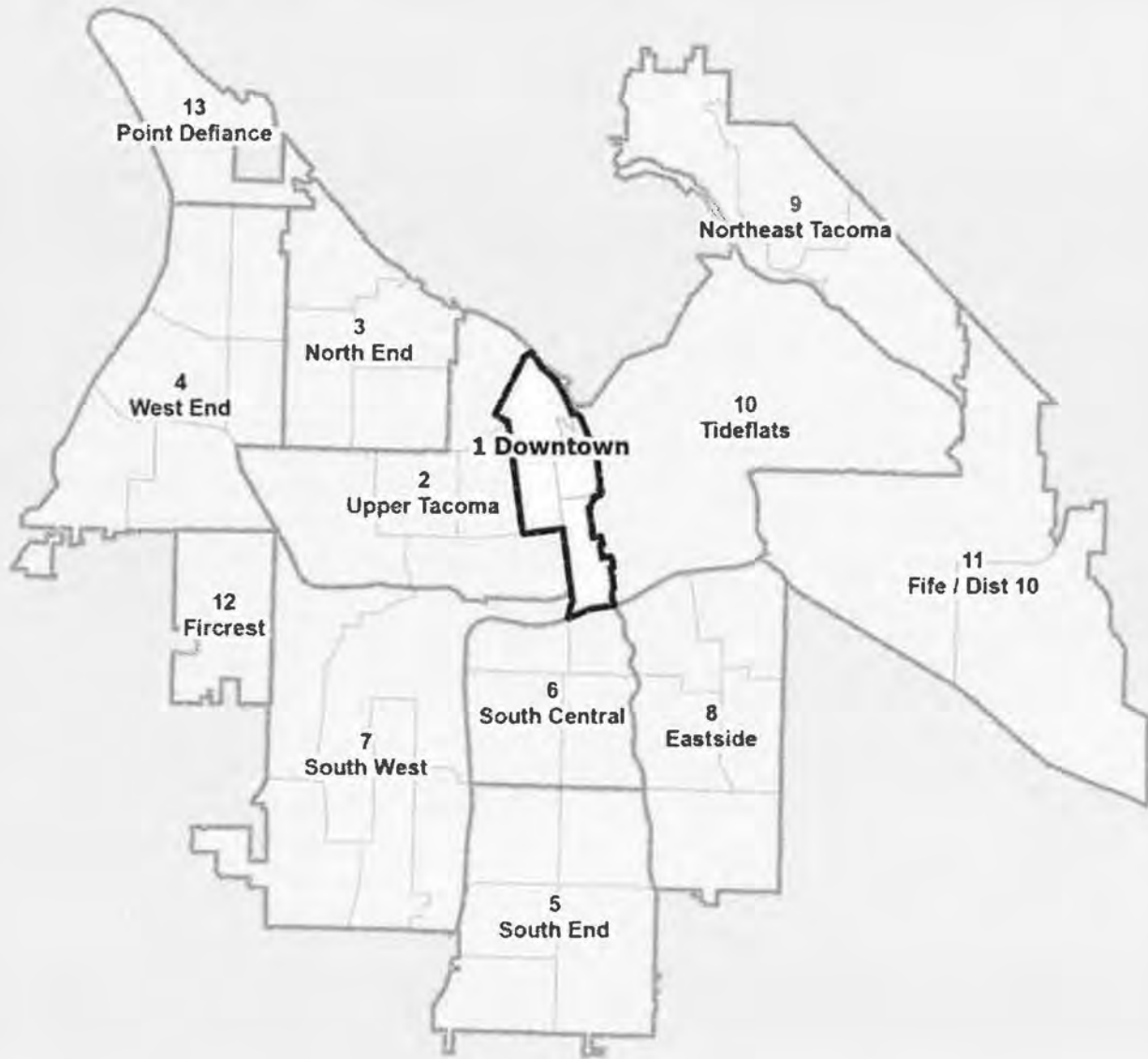


FIRE MANAGEMENT ZONE DETAILS

The following analysis will focus on the hazards specific to each of the FMZs.



Downtown Fire Management Zone



FMZ Demographic Snapshot

	Sub-zone	Response Area
Population estimate	11,964	215,915
Persons under 5	4.2%	7%
Persons 65 years and over	10.2%	11.3%
Female persons	43.8%	50.7%
Male persons	56.2%	49.3%
Homeownership rate	10.9%	54.1%
Renter rate	89.1%	45.9%
Average household size	1.58	2.45

TFD Resources

Station	Apparatus	Personnel
1	Engine 1/Ladder 1	6
2	Engine2/Battalion 2	4

DOWNTOWN FIRE MANAGEMENT ZONE SUMMARY

FIRE RISK

HAZARDS	SPECIAL HAZARDS	RISK ANALYSIS
<ul style="list-style-type: none"> • Concentration of high density unsprinklered condos and high-rise buildings • Marinas and docks (west side of Foss Waterway) • Low-rise sprawling complexes • Large unsprinklered vacant buildings • Concentration of high value older, historic homes along Yakima Ave going into Old Town • Hotels 	<ul style="list-style-type: none"> • Three hospitals • Museums • Government buildings • UW Tacoma • Convention Center • Jail • Historic Stadium High School • Theater district • Landmark Convention Center • Grain elevator • Railroad • Electrical vaults • Fire Communications Center • SR 509 • I-705 • Qwest switch • Historic buildings • Bates Tech College 	<ul style="list-style-type: none"> • Highest concentration of high-risk structures in the TFD service area • High-value historic homes have access limited by narrow roads, hilly topography • Several large assembly facilities in older buildings • Presence of critical infrastructure; all of which require high fire flow—utilities, transportation, health care, public safety • No water on elevated roadways (SR 509 and I-705) • Large vacant buildings present life exposure risk to surrounding structure

EMS RISK (based on resident population)

- 2nd in frequency for all incidents
- 4th in frequency for all high-acuity incidents
- 2nd in frequency of ems per 1,000
- 1st in frequency per 1,000 for high-acuity risks of respiratory and stroke

SPECIALTY RISK

- | | | |
|--|--|---|
| <ul style="list-style-type: none"> • Construction sites • Marinas • Docks • Grain elevator | <ul style="list-style-type: none"> • Three hospitals • Museums • Government buildings • UW Tacoma • Convention Center | <ul style="list-style-type: none"> • One of the highest risk for tech rescue; mostly steep angle, rope, and trench incidents |
|--|--|---|

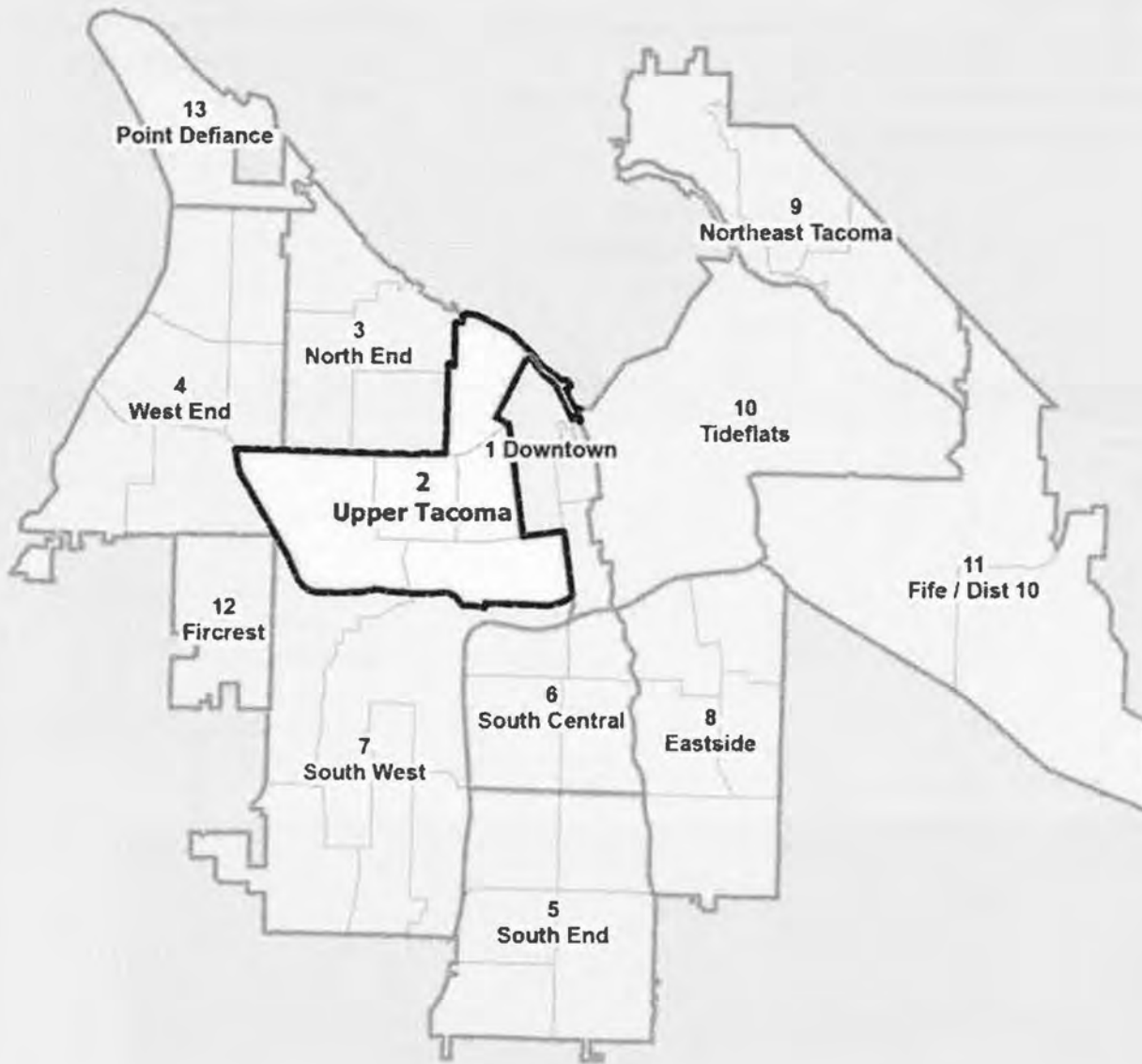
- Railroad
- Electrical vaults
- Large vacant buildings
- Low-rise sprawling complexes
- Concentration of high-density condos and high rise buildings
- Jail
- Historic Stadium High School
- Theater district
- Landmark Convention Center
- Jail
- Fire Communication Center
- SR 509 and I-705
- Qwest switch
- Historic buildings
- Bates Tech College
- Grain elevator
- Railroad
- Electrical vaults
- The risk remains consistent with ongoing construction activity in the zone
- The risk remains consistent with the topography in the zone

NATURAL AND TECHNOLOGICAL RISK

- Liquefaction
- Landslide
- Tsunami
- High wind
- Rail traffic
- Small portion of the FMZ along the Thea Foss is susceptible to the impacts from Liquefaction and Tsunami
- Steep slopes and high rainfall amounts have resulted in landslides in the Northeast portion of the zone around Schuster Parkway and Stadium High School



Upper Tacoma



FMZ

Demographic Snapshot

	Sub-zone	Response Area
Population estimate	25,816	215,915
Persons under 5	7%	7%
Persons 65 years and over	11.1%	11.3%
Female persons	51.8%	50.7%
Male persons	48.2%	49.3%
Homeownership rate	52.3%	54.1%
Renter rate	47.7%	45.9%
Average household size	2.35	2.45

TFD Resource List

Station	Apparatus	Personnel
4	Engine 4/Medic 4	5
9	Engine 9/ Battalion 1	4

UPPER TACOMA FIRE MANAGEMENT ZONE SUMMARY

FIRE RISK

HAZARDS	SPECIAL HAZARDS	RISK ANALYSIS
<ul style="list-style-type: none"> • Older, unsprinklered commercial development along Union Ave, 6th Ave • Several older, unsprinklered residential high-rise buildings • High density of older residential structures • Life Center; church, school, residential • Annie Wright; residential school • Concentration of high value older homes • In the glide path for McChord AFB 	<ul style="list-style-type: none"> • Cheney Stadium • Elks Lodge • Historic homes • Annie Wright School • Allenmore Hospital • Schools 	<ul style="list-style-type: none"> • Higher concentration of schools • Life Center primary residential structures unsprinklered • Higher concentration of older construction multifamily residential; many are unsprinklered • Concentration of high-value older and/or historic homes with limited access ("pie" between Division and 6th Avenue)

EMS RISK (based on resident population)

- 4th in frequency for all ems incidents
- 5th in frequency per 1,000 for all ems incidents

SPECIALTY RISK

<ul style="list-style-type: none"> • Commercial development along Union Ave, 6th Ave • Residential high-rise buildings • Detached single-family dwellings • In the glide path for McChord AFB 	<ul style="list-style-type: none"> • Cheney Stadium • Elks Lodge • Historic homes • Allenmore Hospital • Schools 	<ul style="list-style-type: none"> • 4th highest frequency for calls for tech rescue; mostly steep angle and rope incidents • Consistent with topography of the zone
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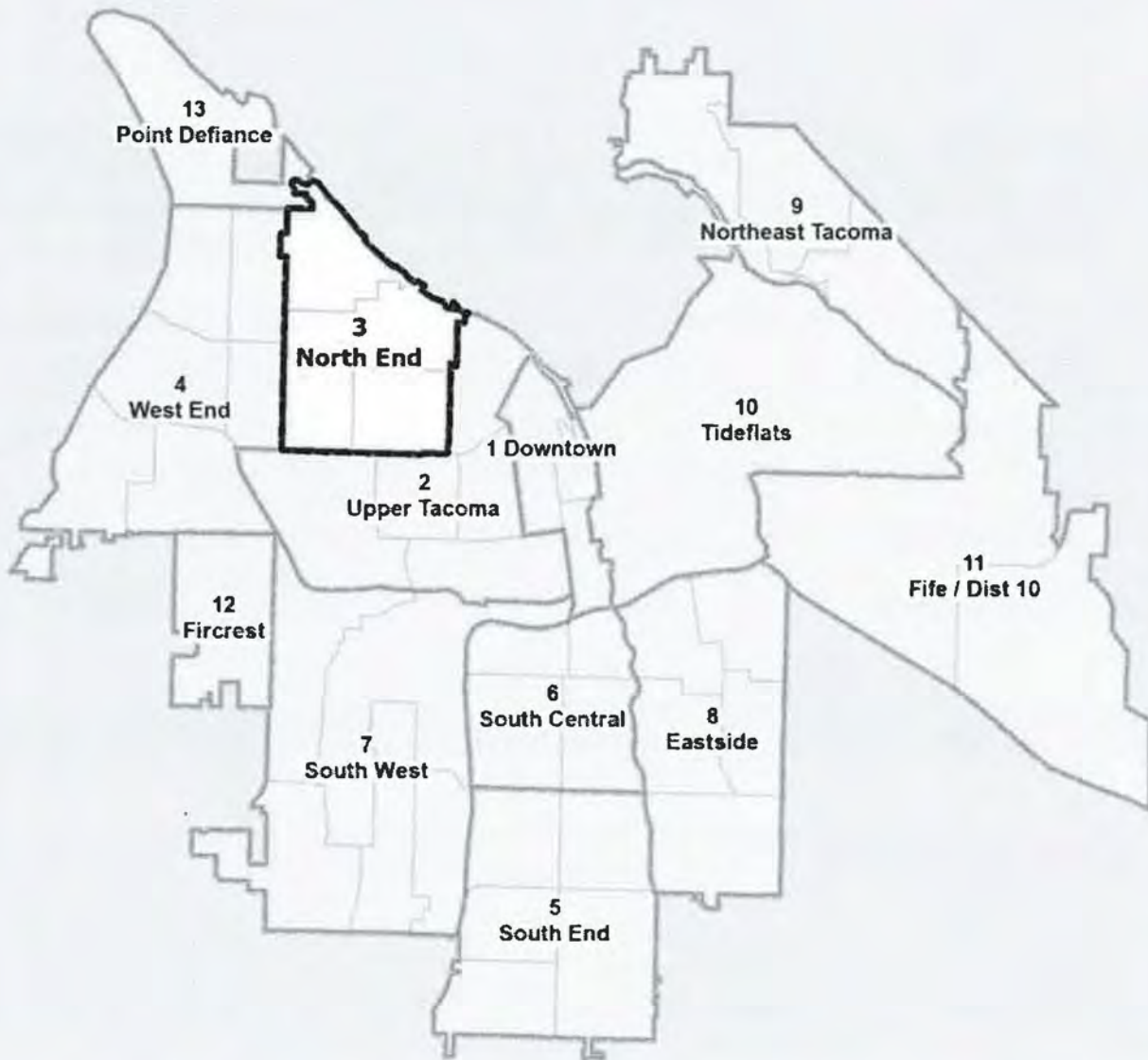
NATURAL AND TECHNOLOGICAL RISK

<ul style="list-style-type: none"> • Tsunami • High wind • Rail traffic 	<ul style="list-style-type: none"> • Tsunami risk along the northern portion of the FMZ where "Old Town" area meets Commencement Bay
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- Moderate risk to high wind events
- Rail traffic through populated area along Ruston Way/Schuster Parkway



North End



FMZ

Demographic Snapshot

	Sub-zone	Response Area
Population estimate	19,282	215,915
Persons under 5	5.5%	7%
Persons 65 years and over	10.2%	11.3%
Female persons	48%	50.7%
Male persons	52%	49.3%
Homeownership rate	73.3%	54.1%
Renter rate	26.7%	45.9%
Average household size	2.36	2.45

TFD Resource List

Station	Apparatus	Personnel
13	Squad13/Ladder 3	5
14	Engine 14	3

NORTH END FIRE MANAGEMENT ZONE SUMMARY

FIRE RISK

HAZARDS	SPECIAL HAZARDS	RISK ANALYSIS
<ul style="list-style-type: none"> • Marinas • Nursing homes and retirement communities • Concentration of older, unsprinklered commercial buildings along 6th Ave, waterfront, Old Town, Proctor • Prospect Hill • In the glide path for McChord AFB • Hotel 	<ul style="list-style-type: none"> • Old Town • University of Puget Sound • Schools • Ferry dock • Railroad along waterfront • Railroad tunnel • Designated historic homes 	<ul style="list-style-type: none"> • High concentration of cultural and historical structures • High concentration of high-value and/or historic homes • Topographical challenges; high-value homes built on hillsides and/or narrow streets that limit access, some too steep for ladder access

EMS RISK (based on resident population)

- 5th in vulnerable population 65 and over

SPECIALTY RISK

<ul style="list-style-type: none"> • Commercial development along Union Ave, 6th Ave • Residential high-rise buildings • Detached single-family dwellings • In the glide path for McChord AFB 	<ul style="list-style-type: none"> • Cheney Stadium • Elks Lodge • Historic homes • Allenmore Hospital • Schools 	<ul style="list-style-type: none"> • Seventh highest frequency for calls for tech rescue; mostly steep angle and rope incidents • Consistent with topography of the zone
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NATURAL AND TECHNOLOGICAL RISK

<ul style="list-style-type: none"> • Stiff/soft soil/earthquake • Liquefaction • Tsunami • High wind 	<ul style="list-style-type: none"> • Liquefaction and stiff/soft soil in North portion of the FMZ near Commencement Bay • Tsunami risks near Commencement Bay • Moderate risk to high wind events
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West End



FMZ Demographic Snapshot

	Sub-zone	Response Area
Population estimate	26,067	215,915
Persons under 5	5.5%	7%
Persons 65 years and over	19.4%	11.3%
Female persons	53%	50.7%
Male persons	47%	49.3%
Homeownership rate	52.1%	54.1%
Renter rate	47.9%	45.9%
Average household size	2.11	2.45

TFD Resource List

Station	Apparatus	Personnel
16	Engine 16/Medic 1	5

WEST END FIRE MANAGEMENT ZONE SUMMARY

FIRE RISK

HAZARDS	SPECIAL HAZARDS	RISK ANALYSIS
<ul style="list-style-type: none"> • Several nursing homes and retirement communities • Marina • Several older, unsprinklered multifamily units • Commercial development • Juvenile detention facility • High-value homes • Narrows Bridges 	<ul style="list-style-type: none"> • Narrows Bridges • Schools • Tacoma Community College • Railroad along shoreline • Westridge Apartment Complex • Wildland/urban interface—hillside along shoreline 	<ul style="list-style-type: none"> • Risk dispersed overall; highest concentration along major arterials—Pearl St., 6th Ave. • Concentration of high-value homes overlooking water • Narrows Bridges are critical transportation and economic infrastructure; increased fire risk due to no water supply on the old bridge • Westridge—limited access, concentration of older, unsprinklered multifamily residences • 1 ladder has good access; 2nd ladder delayed response due to distance—increases risk for commercial response

EMS RISK (based on resident population)

		<ul style="list-style-type: none"> • 3rd in frequency of all ems incidents • Tied for 5th in frequency of high-acuity ems incidents • 5th in frequency per 1000 for all ems incidents • 4th in frequency per 1000 for high-acuity risk of cardiac
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SPECIALTY RISK

<ul style="list-style-type: none"> • Narrows Bridges • Railroad along shoreline • Marinas • Commercial development • Detached single-family dwellings 	<ul style="list-style-type: none"> • Narrows Bridges • Schools • Tacoma Community College • Railroad along shoreline • Wildland/urban interface—hillside along shoreline 	<ul style="list-style-type: none"> • Narrows Bridges represent critical transportation and economic infrastructure • 1st ladder has good access; 2nd ladder delayed response due to distance • Fireboat response for marinas, wildland/urban interface also
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delayed due to distance and potentially to staffing

- Limited access to wildland urban interface areas

NATURAL AND TECHNOLOGICAL RISK

- Steep slopes/landslides
- Tsunami
- High wind
- Rail traffic
- Steep slopes along western portion of FMZ
- Higher risk for Tsunami impacts along Commencement Bay
- Moderate to high risk for high wind event
- Rail line travels length of the FMZ

South End



FMZ Demographic Snapshot

	Sub-zone	Response Area
Population estimate	28,348	215,915
Persons under 5	7.8%	7%
Persons 65 years and over	11.1%	11.3%
Female persons	51%	50.7%
Male persons	49%	49.3%
Homeownership rate	60.2%	54.1%
Renter rate	39.8%	45.9%
Average household size	2.75	2.45

TFD Resource List

Station	Apparatus	Personnel
10	Engine 10	3

SOUTH END FIRE MANAGEMENT ZONE SUMMARY

FIRE RISK

HAZARDS	SPECIAL HAZARDS	RISK ANALYSIS
<ul style="list-style-type: none"> Commercial corridor with older construction along Pacific Ave, South Hosmer High density, older single and unsprinklered multifamily residential Nursing homes Large vacant buildings 	<ul style="list-style-type: none"> Wildland/urban interface along southern edge of zone 	<ul style="list-style-type: none"> Limited access to wildland/urban interface areas High concentration of older commercial and residential

EMS RISK (based on resident population)

- 5th in frequency for all ems incidents
- 4th in frequency for high-acuity incidents
- Tied for 4th in frequency per 1000 for high-acuity incidents of respiratory and trauma

SPECIALTY RISK

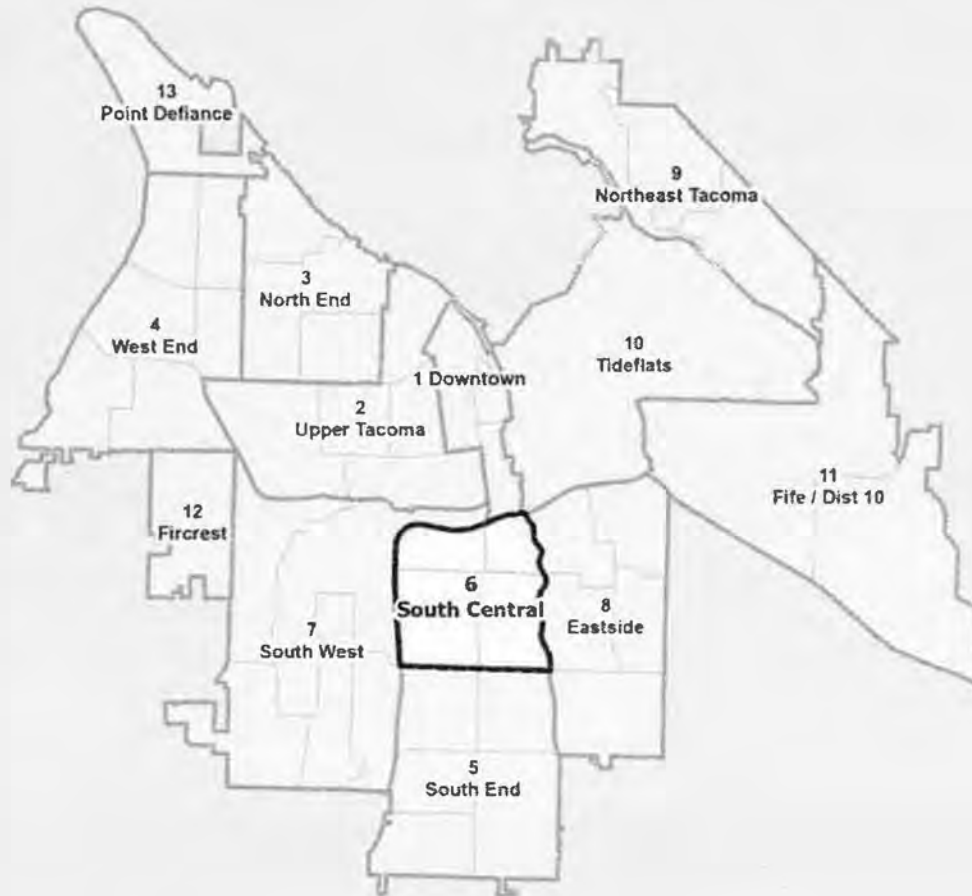
<ul style="list-style-type: none"> Detached single-family dwellings Commercial corridor along Pacific Ave, So. Hosmer Construction sites 	<ul style="list-style-type: none"> Wildland/urban interface along southern edge of zone 	<ul style="list-style-type: none"> Limited access to wildland urban interface areas
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- Railroad

NATURAL AND TECHNOLOGICAL RISK

- Stiff Soil/Earthquake
- Earthquake magnitude risk higher due to stiff soil in the Southwest area of the FMZ

South Central



FMZ Demographic Snapshot

	Sub-zone	Response Area
Population estimate	17,385	215,915
Persons under 5	7.5%	7%
Persons 65 years and over	9.4%	11.3%
Female persons	51%	50.7%
Male persons	49%	49.3%
Homeownership rate	61.9%	54.1%
Renter rate	38.1%	45.9%
Average household size	2.6	2.45

TFD Resource List

Station	Apparatus	Personnel
8	Engine 8/Ladder 2/Medic 2 Battalion 3/Tech Rescue	8

SOUTH CENTRAL FIRE MANAGEMENT ZONE SUMMARY

FIRE RISK

HAZARDS	SPECIAL HAZARDS	RISK ANALYSIS
<ul style="list-style-type: none"> • Concentration of high-density residential • Commercial corridor along Pacific Ave., So. 38th • Some high-rise 	<ul style="list-style-type: none"> • Government buildings • I-5 • Railroad • Wildland/urban interface—gully along eastern border 	<ul style="list-style-type: none"> • I-5 has limited access and water supply, tanker hazards • High concentration of high-density residential structures • Railroad has grade issues in this zone; brakes cause sparks which cause fire in dry season • Limited access to wildland/urban interface areas

EMS RISK (based on resident population)

	<ul style="list-style-type: none"> • 7th in frequency for all ems incidents and high-acuity incidents • Tied for 3rd in high-acuity risk for trauma • Tied for 2nd and 3rd in the high acuity risks of diabetes and respiratory
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SPECIALTY RISK

<ul style="list-style-type: none"> • Commercial corridor along Pacific, So. 38th • Some high rise • Construction sites • Railroad • Single-family dwellings 	<ul style="list-style-type: none"> • Government buildings • I-5 • Railroad • Wildland/urban interface—gully along eastern border 	<ul style="list-style-type: none"> • Concentration of high density single-family residential • Limited access to wildland urban interface areas
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NATURAL AND TECHNOLOGICAL RISK

<ul style="list-style-type: none"> • Stiff Soil/Earthquake • Steep Slope/Landslide • High Wind 	<ul style="list-style-type: none"> • Stiff soil in the Northern portion of the FMZ • Steep slopes along the North and North East portion of the FMZ • Moderate risk high for high wind events
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South West



FMZ Demographic Snapshot

	Sub-zone	Response Area
Population estimate	24,699	215,915
Persons under 5	8.8%	7%
Persons 65 years and over	7.8%	11.3%
Female persons	51.3%	50.7%
Male persons	48.7%	49.3%
Homeownership rate	38.4%	54.1%
Renter rate	61.6%	45.9%
Average household size	2.51	2.45

TFD Resource List

Station	Apparatus	Personnel
1	Engine 7	3

SOUTH WEST FIRE MANAGEMENT ZONE SUMMARY

FIRE RISK

HAZARDS	SPECIAL HAZARDS	RISK ANALYSIS
<ul style="list-style-type: none"> • Tacoma Mall • High-density multifamily residential • Industrial and old retail structures along South Tacoma Way, through the Nalley Valley • General Plastics • Unsprinklered large vacant or storage buildings • In the glide path for McChord AFB 	<ul style="list-style-type: none"> • Tacoma Mall • Schools • Public Safety buildings • Government buildings • Tacoma Public Utilities building • Railroad • Bates Tech College • I-5 • Java Jive (historic restaurant) • Wildland/urban interface—S. 35th to S. 56th and S. Tyler to South Tacoma Way 	<ul style="list-style-type: none"> • Third highest concentration of high-risk structures; follow Nalley Valley and South Tacoma Way • Concentration of critical infrastructure—public safety, government, transportation, utilities • I-5 has limited access and water supply, tanker hazards • Some high-density residential; multifamily residential has limited access • Large vacant/storage buildings present life safety and/or exposure risk to surrounding structures • Limited access to wildland/urban interface areas

EMS RISK (based on resident population)

- 1st in frequency for all ems incidents
- 1st in frequency of high-acuity incidents
- 3rd in frequency per 1000 for high-acuity incidents of stroke
- 2nd in frequency per 1000 for high-acuity incidents of respiratory

SPECIALTY RISK

<ul style="list-style-type: none"> • Tacoma Mall • Industrial and retail structures along South Tacoma Way, through the Nalley Valley • General Plastics 	<ul style="list-style-type: none"> • Tacoma Mall • Schools • Public Safety Government buildings • Tacoma Public Utilities building 	<ul style="list-style-type: none"> • Second highest risk for HazMat • Location of incidents follows the historical railway lines through the Nalley Valley
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- Large vacant or storage buildings
- In the glide path for McChord AFB
- Railroad
- Multi-story multifamily dwellings with access challenges
- Railroad
- Bates Tech College
- I-5
- Java Jive
- Wildland/urban interface— S. 35th to S. 56th and S. Tyler to South Tacoma Way
- Mostly potential gas leaks and combustible flammable liquid spills/leaks
- Limited access to wildland urban interface areas

NATURAL AND TECHNOLOGICAL RISK

- Stiff Soil/Earthquake
- Steep Slopes/Landslide
- High Wind
- Rail Traffic
- Majority of the zone is Stiff Soil
- Steep Slopes throughout the FMZ
- Moderate risk for high wind event
- Rail line extends the length of the zone



Eastside



FMZ Demographic Snapshot

	Sub-zone	Response Area
Population estimate	22,904	215,915
Persons under 5	9.4%	7%
Persons 65 years and over	8.8%	11.3%
Female persons	50.6%	50.7%
Male persons	49.4%	49.3%
Homeownership rate	58.5%	54.1%
Renter rate	41.5%	45.9%
Average household size	3.1	2.45

TFD Resource List

Station	Apparatus	Personnel
11	Engine 11/Medic 5	5
15	Squad 15	2

EASTSIDE FIRE MANAGEMENT ZONE SUMMARY

FIRE RISK

HAZARDS	SPECIAL HAZARDS	RISK ANALYSIS
<ul style="list-style-type: none"> • High density of older residential structures • High assembly occupant loads tent at Emerald Queen Casino • Champion Center • Older, unsprinklered commercial corridor • Older, unsprinklered multifamily residences • Retirement/nursing homes • Tribal Clinic 	<ul style="list-style-type: none"> • Buddhist Temple • Emerald Queen Casino • Schools • Railroad • Wildland/urban interface—gully with limited access • Railroad runs through gully • Tribal land 	<ul style="list-style-type: none"> • 4th highest population overall • Significant population for whom English is a second language; impacts problem identification and prevention efforts • Topography challenges create access issues • Tribal land is unregulated from fireworks code enforcement perspective

EMS RISK (based on resident population)

	<ul style="list-style-type: none"> • 6th in frequency for all ems incidents • 6th in frequency of high-acuity incidents • 6th in frequency per 1000 for ems incidents
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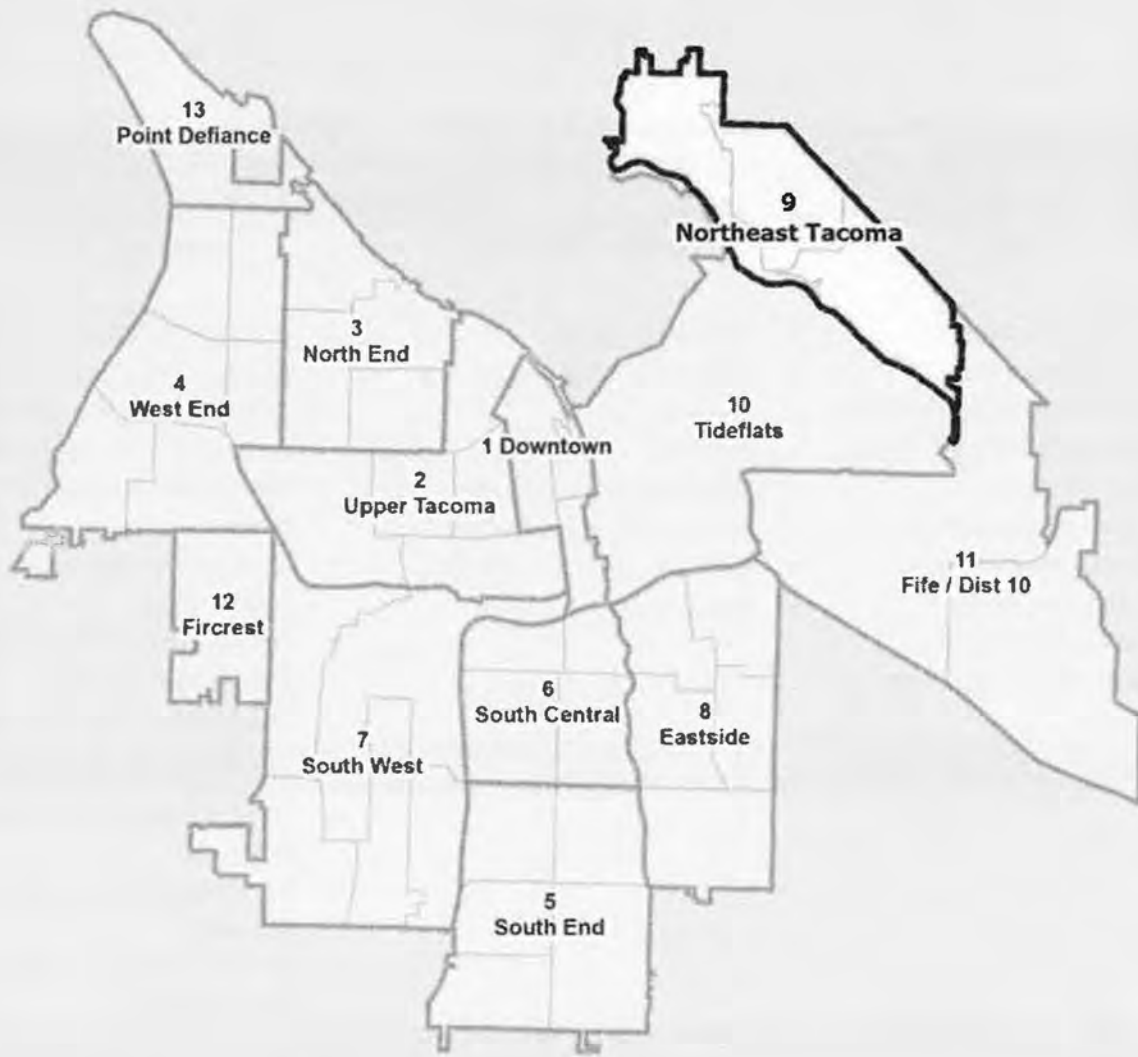
SPECIALTY RISK

<ul style="list-style-type: none"> • Construction sites • Railroad 	<ul style="list-style-type: none"> • Buddhist Temple • Emerald Queen Casino • Schools • Wildland/urban interface—gully with limited access • Railroad runs through gully 	<ul style="list-style-type: none"> • Topography challenges create access issues • High density of single-family dwellings and overall population
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NATURAL AND TECHNOLOGICAL RISK

<ul style="list-style-type: none"> • Soft Soil/Earthquake • Steep Slopes/Landslide • Flooding 	<ul style="list-style-type: none"> • Stiff/Soft soil conditions in central and east portion of the FMZ • Eastside of the FMZ susceptible to landslides • Flood hazards in NE portion of the FMZ
--	--

Northeast



FMZ Demographic Snapshot

	Sub-zone	Response Area
Population estimate	16,606	215,915
Persons under 5	6%	7%
Persons 65 years and over	9.4%	11.3%
Female persons	50.9%	50.7%
Male persons	49.1%	49.3%
Homeownership rate	78.4%	54.1%
Renter rate	21.6%	45.9%
Average household size	2.77	2.45

TFD Resource List

Station	Apparatus	Personnel
3	Engine 3	3

NORTHEAST FIRE MANAGEMENT ZONE SUMMARY

FIRE RISK

HAZARDS	SPECIAL HAZARDS	RISK ANALYSIS
<ul style="list-style-type: none"> • Unsprinklered multifamily residential structures • Center at Norpoint • Small commercial development • Ashley House; long-term care for critically ill children • Concentration of high-value, single-family homes 	<ul style="list-style-type: none"> • Center at Norpoint • Ashley House; long-term care for critically ill children • Schools • Wildland/urban interface • Tribal land • Seabury School 	<ul style="list-style-type: none"> • Bedroom community with irregular street grid; not the usual numbering system; makes it hard to locate incident sites, particularly for additional responding units • Most remote from City Center • Delayed response beyond the first-in company • Tribal land is unregulated from a fireworks code enforcement perspective

EMS RISK (based on resident population)

- 10th lowest frequency for all ems incidents
- The lowest frequency for high-acuity ems and per 1000 incidents of all zones

SPECIALITY RISK

<ul style="list-style-type: none"> • Construction sites • Detached single-family dwellings • Small commercial development 	<ul style="list-style-type: none"> • Center at Norpoint • Ashley House (long-term care for critically ill children) • Schools • Wildland/urban interface 	<ul style="list-style-type: none"> • Slide prone area • Bedroom community with irregular street grid; not the usual numbering system; makes it hard to locate incident sites—particularly for additional responding companies • Most remote from City Center; access challenged by tideflats
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NATURAL AND TECHNOLOGICAL RISK

<ul style="list-style-type: none"> • Stiff/Soft soil/Earthquake • Steep Slopes/Landslide • Tsunami • Volcanic/Lahar 	<ul style="list-style-type: none"> • Large portion of the FMZ is Stiff soil • Landslide hazard along the southern and western portion of the FMZ
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- High Winds

- Tsunami and Lahar risk along the adjacent to Commencement Bay
- Moderate risk for high wind

Tideflats

This zone includes the Port of Tacoma and the area surrounding it.



FMZ Demographic Snapshot

	Sub-zone	Response Area
Population estimate	1,800	215,915
Persons under 5	.6%	7%
Persons 65 years and over	4.8%	11.3%
Female persons	19.9%	50.7%
Male persons	80.1%	49.3%
Homeownership rate	45.1%	54.1%
Renter rate	54.9%	45.9%
Average household size	1.69	2.45

TFD Resource List

Station	Apparatus	Personnel
0	0	0

TIDEFLATS FIRE MANAGEMENT ZONE SUMMARY

FIRE RISK

HAZARDS	SPECIAL HAZARDS	RISK ANALYSIS
<ul style="list-style-type: none"> • Refineries • Piers/Docks • Marinas • Storage warehouses • Casino • Hotels • Shipyards • Industrial structures • Tank farm supplied by Olympic fuel pipeline from refineries • Pipeline from US Oil to McChord • Pipeline from Blair Waterway to US Oil • Older unsprinklered commercial structures along Puyallup Ave. • Stacked container and log yards • Indoor stacked boat storage • Low-rise sprawling complexes • Manufacturing structures • Material reclamation yards 	<ul style="list-style-type: none"> • Railroad, including commuter line • Crude oil by rail • Tacoma Dome • Port of Tacoma • Detention facility • Wildland/urban interface along Marine View Drive 	<ul style="list-style-type: none"> • Access to area limited by waterways, rail lines and failing bridge infrastructure • Low residential population but high daytime population • High concentration of large unsprinklered buildings/yards with high fire load • Dependent on private hydrants for water supply at the end of some waterways • Access to wildland/urban interface areas limited by topography; area is prone to landslides • Presence of pipelines increases risk of conflagration • Hard to shut off pipeline quickly, increased risk to the environment • Presence of gas with decreased ability to detect ignition source also increases fire risk • Potential for huge economic impact • Marinas in fairly remote location so land response is longer; not quickly or easily accessible by water routes either • Decreased water supply and presence of derelict vessels also increases fire risk • Limited access due to development and street closures

EMS RISK (based on resident population)

- 1st in frequency per 1000 for all high-acuity ems incidents
- 1st in frequency high-acuity risk of cardiac
- 1st in frequency high-acuity risk of diabetes, trauma, and stroke (note-this is likely due to the low resident population in the zone)

SPECIALTY RISK

- Construction sites
- Railroad, including commuter line
- Port of Tacoma
- Marinas
- Refineries
- Piers/Docks
- Marinas
- Storage warehouses
- Shipyards
- Industrial structures
- Tank farm supplied by Olympic fuel pipeline from refineries
- Pipeline from US Oil to McChord
- Pipeline from Blair Waterway to US Oil
- Commercial structures along Puyallup Ave.
- Low rise sprawling complexes
- Manufacturing structures
- Tacoma Dome
- Detention facility
- Railroad, including commuter line
- Port of Tacoma
- Casino
- Hotels
- Wildland/urban interface along Marine View Drive
- Highest risk zone for HazMat incidents
- Location of incidents spread out through entire zone
- Risk and location consistent with industrial nature of the zone
- Mostly chemical releases and combustible/flammable liquid spills/leaks
- Access to area limited by waterways, rail
- Low residential population but high daytime worker population
- Access to wildland/urban interface areas limited by topography; area is prone to landslides
- Presence of pipelines increases risk
- Hard to shut off pipeline quickly, increased risk to the environment
- Presence of gas with decreased ability to detect ignition source also increases fire risk
- Potential for huge economic impact
- Marinas in fairly remote location so land response is longer

NATURAL AND TECHNOLOGICAL RISK

- Earthquake
- Liquefaction
- Tsunami
- Lahar
- Rail Traffic
- Pipeline
- Flood
- Detention Facility
- Large quantities of stored flammable liquids
- This FMZ has the most Natural and Technological hazards in TFD's service area

Fife/District 10



FMZ Demographic Snapshot

	Sub-zone	Response Area
Population estimate	11,190	215,915
Persons under 5	8.7%	7%
Persons 65 years and over	7.1%	11.3%
Female persons	49.5%	50.7%
Male persons	50.5%	49.3%
Homeownership rate	46.3%	54.1%
Renter rate	53.7%	45.9%
Average household size	2.55	2.45

TFD Resource List

Station	Apparatus	Personnel
12	Engine 12/Ladder 4 Medic 2/HazMat	8

FIFE/DISTRICT 10 FIRE MANAGEMENT ZONE SUMMARY

FIRE RISK

HAZARDS	SPECIAL HAZARDS	RISK ANALYSIS
<ul style="list-style-type: none"> • Older, unsprinklered hotels/motels • Multifamily residential complexes; most unsprinklered • Large warehouses • Bulk oxygen producing plant • Multiple casinos • Fabulich Center; multi-story building • Olympic pipeline into the Industrial FMZ • Commercial corridor • Manufacturing • Stacked container yard 	<ul style="list-style-type: none"> • I-5 • Hwy. 99 • Railroad • Poodle Dog (historic restaurant) • Business corridor along Hwy 99 and 20th St. E. • Schools • Government buildings • Fife Heights • Wildland/urban interface • Rural residential development • Tribal land 	<ul style="list-style-type: none"> • Lower population density overall • Long response times due to topography (Fife Heights) and/or remoteness • Water supply challenges • Higher flood risks area • Rural residential developments have hundreds of homes with limited access; hard to get apparatus into them AND close spacing; essentially row houses from a firefighting perspective • Concentrated business district; huge economic impact • Tribal land is unregulated from a building and fireworks code enforcement perspective

EMS RISK (based on resident population)

- 8th in frequency of all incidents and in high-acuity incidents
- 3rd in population for ages 0-4

SPECIALITY RISK

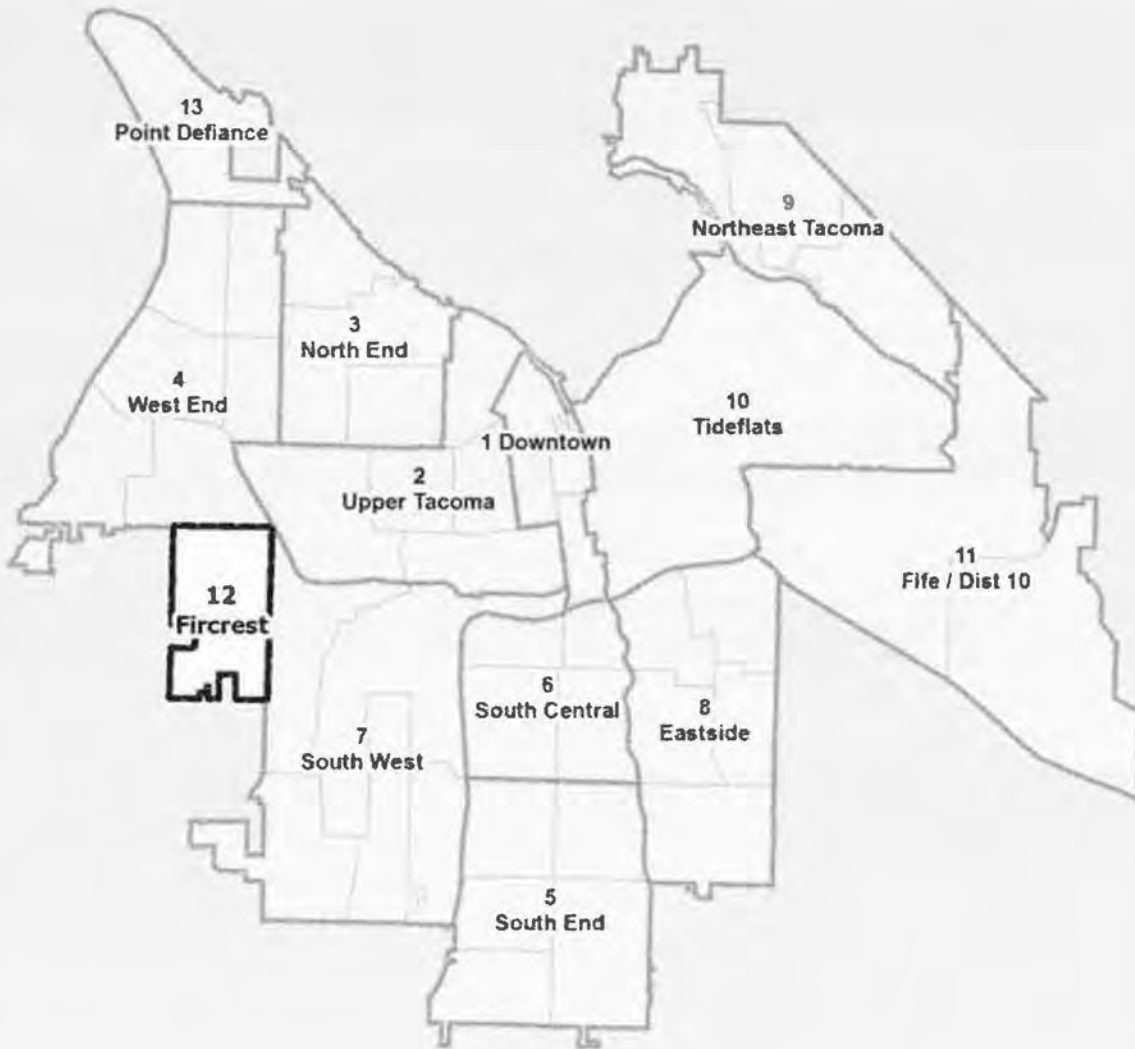
<ul style="list-style-type: none"> • Large warehouses • Bulk oxygen producing plant • Olympic pipeline into the Industrial zone • Manufacturing • Construction sites • Fabulich Center—multi-story building 	<ul style="list-style-type: none"> • I-5 and Hwy. 99 • Railroad • Business corridor along Hwy 99 and 20th St. E. • Schools • Government buildings • Wildland/urban interface 	<ul style="list-style-type: none"> • Higher flood risks area • 4th highest risk for HazMat • Incidents in area adjacent to the Tideflats zone • Mostly combustible flammable liquid release/spills • Long response times due to topography and/or remoteness
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- Rural residential developments have hundreds of homes—some with limited access
- Concentrated business district

NATURAL AND TECHNOLOGICAL RISK

- Earthquake
- Liquefaction
- Tsunami
- Lahar
- Rail traffic
- Pipeline
- Landslide
- Flood
- Second highest concentration of Natural and Technological risk in service area

Fircrest



FMZ Demographic Snapshot

	Sub-zone	Response Area
Population estimate	6,497	215,915
Persons under 5	5.7%	7%
Persons 65 years and over	7.1%	11.3%
Female persons	46.4%	50.7%
Male persons	53.6%	49.3%
Homeownership rate	69.4%	54.1%
Renter rate	30.6%	45.9%
Average household size	2.39	2.45

TFD Resource List

Station	Apparatus	Personnel
1	Engine 17	3

FIRCREST FIRE MANAGEMENT ZONE SUMMARY

FIRE RISK

HAZARDS	SPECIAL HAZARDS	RISK ANALYSIS
<ul style="list-style-type: none"> Light commercial development along So. 19th and Regents Blvd. Some multifamily residential Predominately single family homes 	<ul style="list-style-type: none"> Schools Government buildings 	<ul style="list-style-type: none"> Primarily single-family residential; not too densely populated Highest risk concentrated along major corridors—So.19th, Regents Blvd.

EMS RISK (based on resident population)

- 13th in frequency of all incidents
- 13th in high-acuity incidents

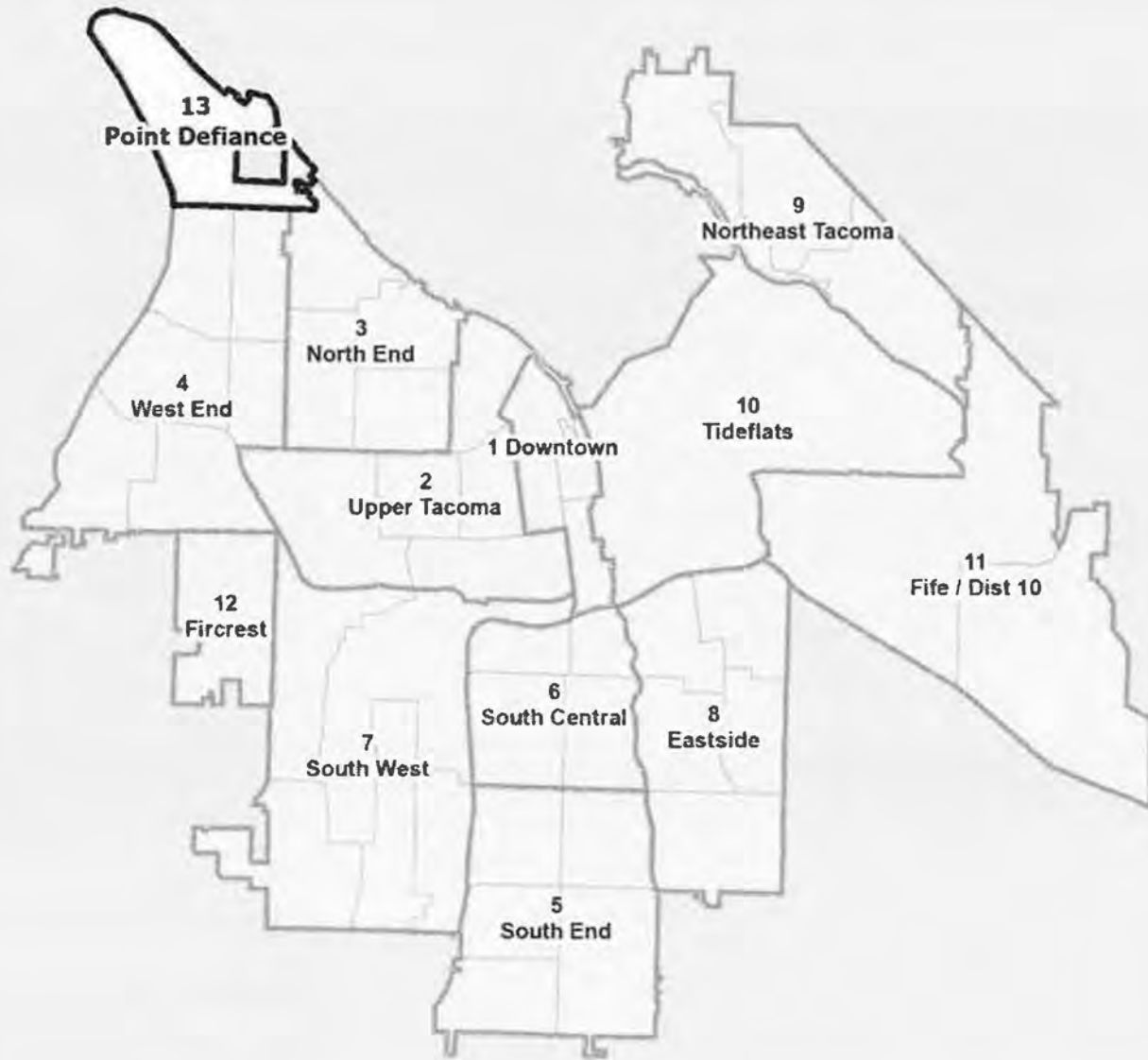
SPECIALTY RISK

- | | | |
|--|---|--|
| <ul style="list-style-type: none"> Construction sites | <ul style="list-style-type: none"> Schools Government buildings | <ul style="list-style-type: none"> Primarily single-family residential; not too densely populated |
|--|---|--|

NATURAL AND TECHNOLOGICAL RISK

- | | |
|-----------------------|--|
| Stiff Soil/Earthquake | <ul style="list-style-type: none"> Small portion of the central and south portion of the FMZ has stiff soil |
|-----------------------|--|

Point Defiance



FMZ Demographic Snapshot

	Sub-zone	Response Area
Population estimate	4,106	215,915
Persons under 5	4.6%	7%
Persons 65 years and over	25.9%	11.3%
Female persons	53%	50.7%
Male persons	47%	49.3%
Homeownership rate	65.5%	54.1%
Renter rate	34.5%	45.9%
Average household size	2.18	2.45

TFD Resource List

Station	Apparatus	Personnel
0	0	0

POINT DEFIANCE FIRE MANAGEMENT ZONE SUMMARY

FIRE RISK

HAZARDS	SPECIAL HAZARDS	RISK ANALYSIS
<ul style="list-style-type: none"> 760-acre natural park 	<ul style="list-style-type: none"> Old growth forest Point Defiance Zoo Marina 	<ul style="list-style-type: none"> Primarily single-family residential; not too densely populated Wildfire risks at the park. Improved water supply. Remote access.

EMS RISK (based on resident population)

	<ul style="list-style-type: none"> 12th in frequency of all incidents 12th in high-acuity incidents Emerging risk with the development of Point Ruston.
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SPECIALTY RISK

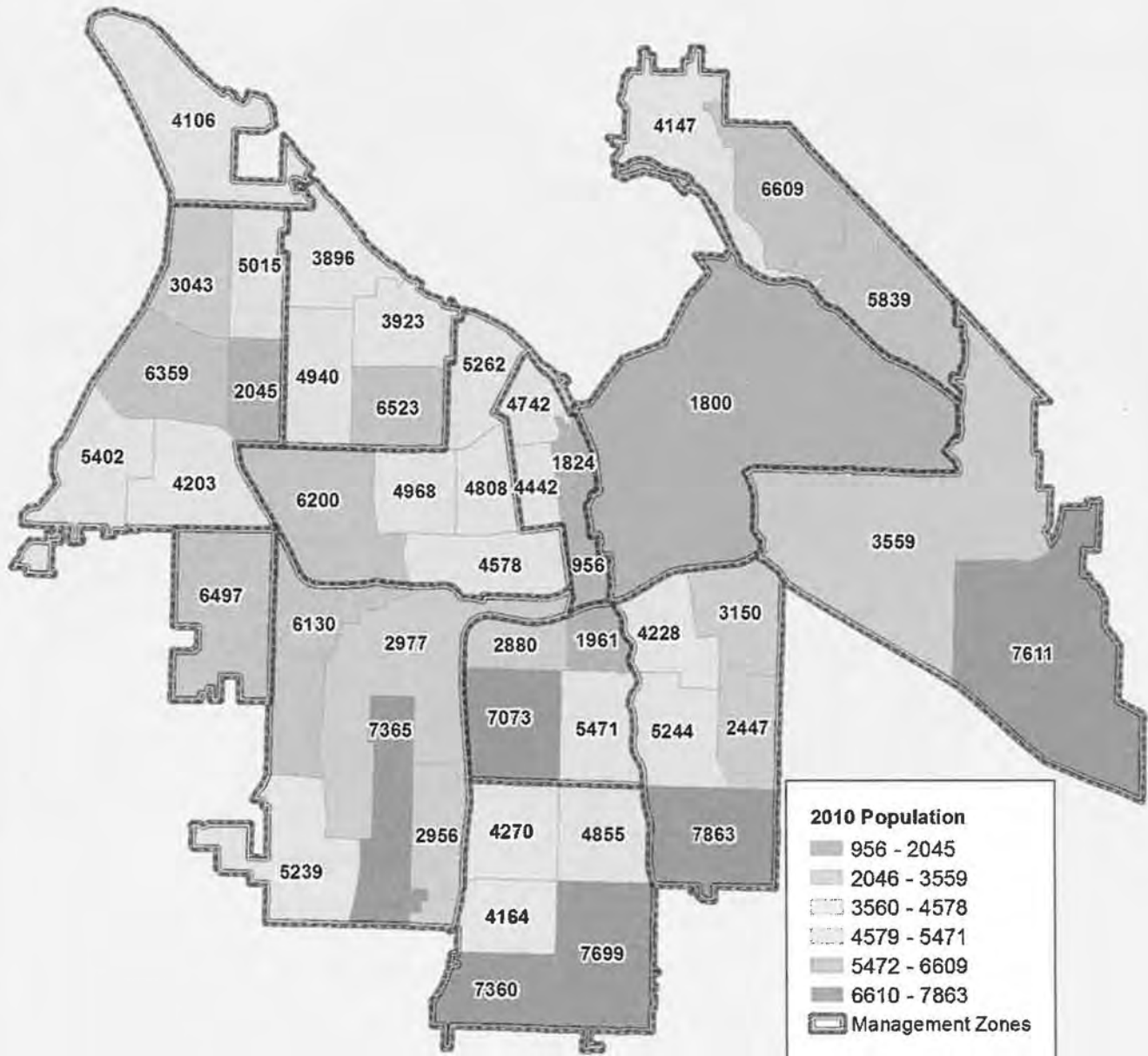
<ul style="list-style-type: none"> Wildland urban interface 	<ul style="list-style-type: none"> Point Defiance Park and Zoo Vertical bluffs up to 250 feet high in some places 	<ul style="list-style-type: none"> Second highest risk for tech rescue; mostly steep angle and rope incidents Consistent with topography of the zone 84 homes on Salmon Beach accessible only by two sets of 200+ step staircases, a dirt path or the water Ruston incorporated and heavily dependent on mutual aid Limited access to wildland urban interface
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NATURAL AND TECHNOLOGICAL RISK

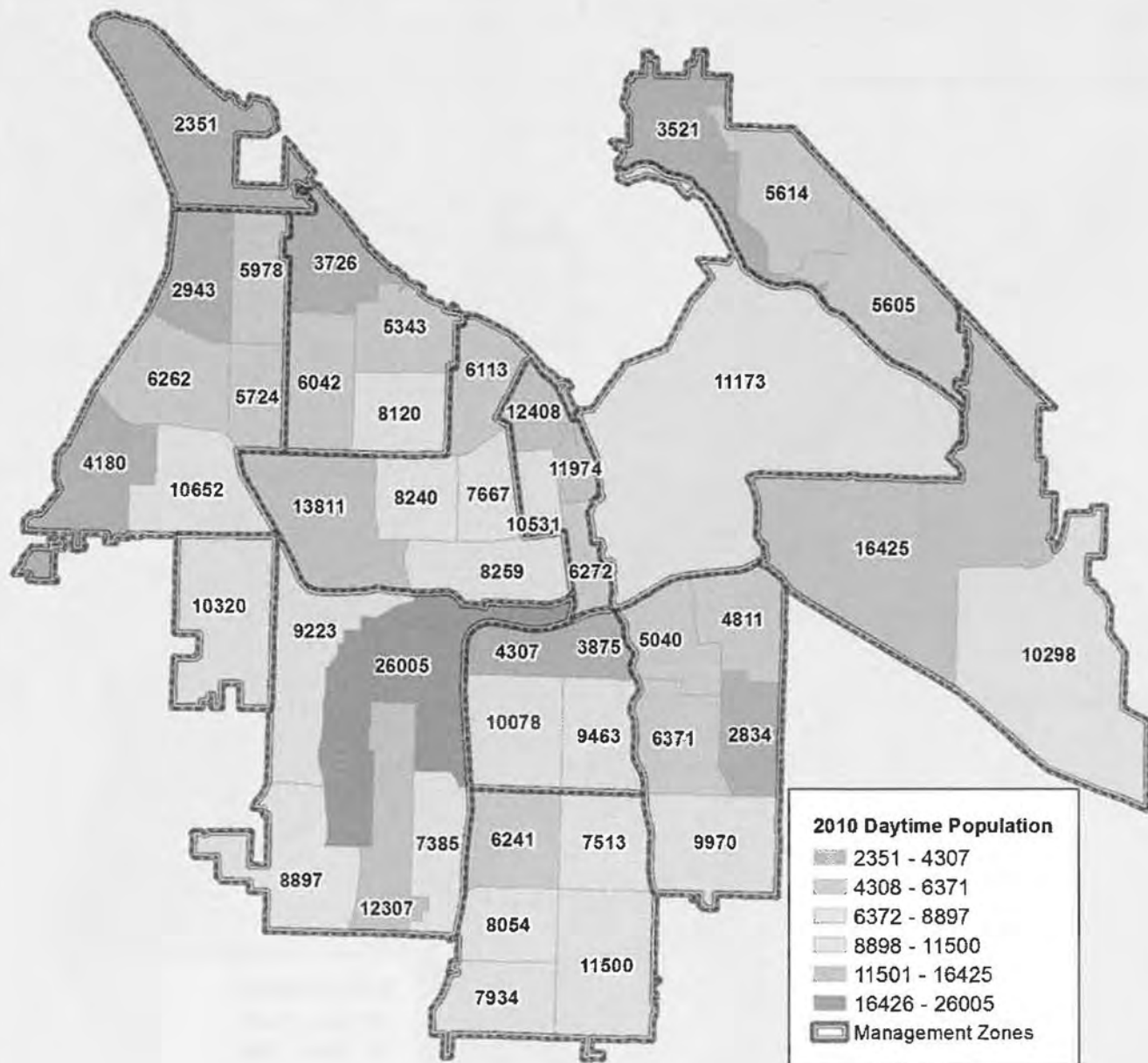
<ul style="list-style-type: none"> Liquefaction Steep Slopes/Landslides High Wind Tsunami Rail traffic 	<ul style="list-style-type: none"> Increased risk for Tsunami and liquefaction where land is adjacent to Commencement Bay Moderate to high risk for strong wind events Lengthy rail tunnel
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APPENDIX A—DEMOGRAPHIC DATA

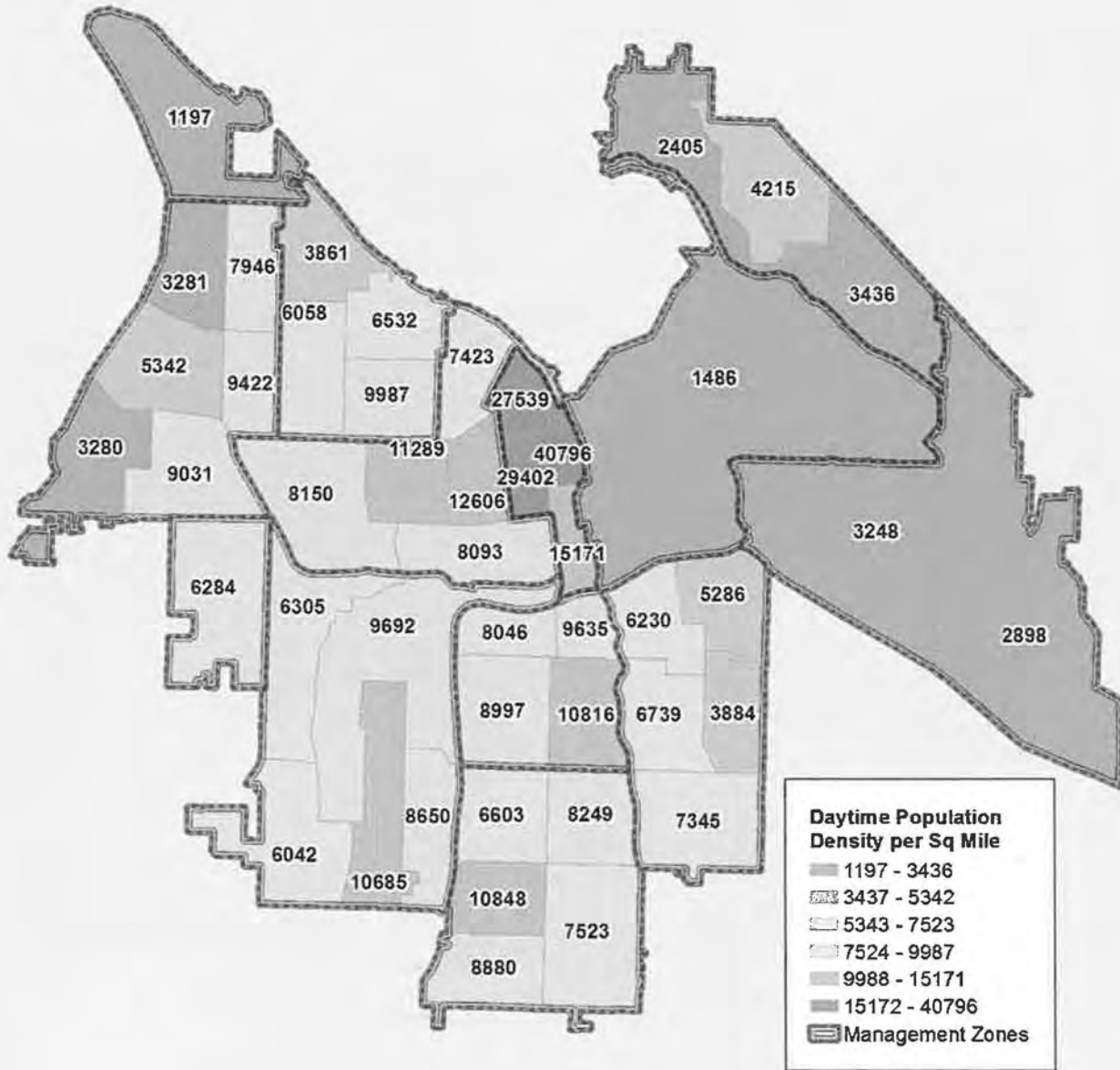
RESIDENT POPULATION BY SUB-ZONE



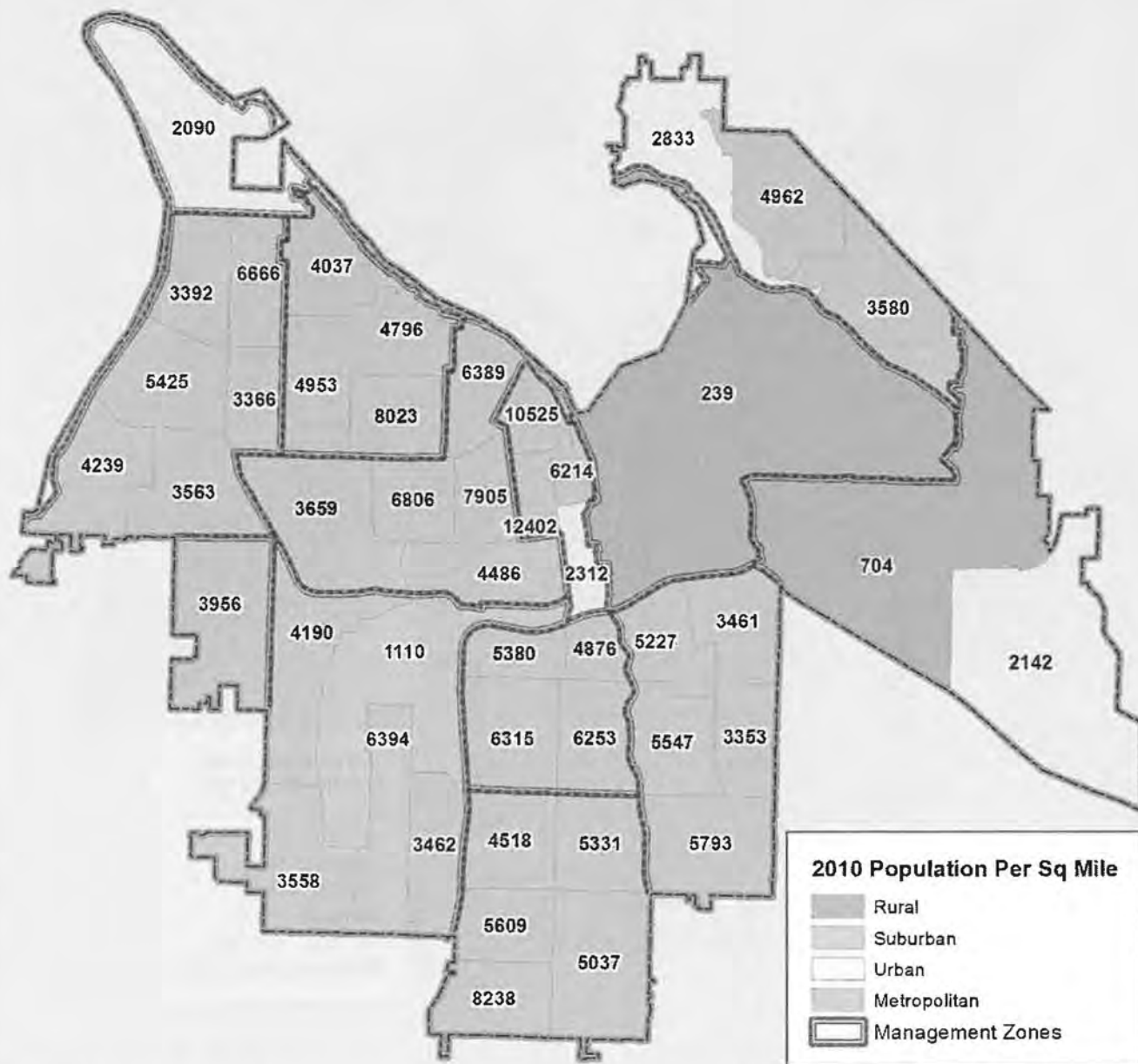
DAYTIME POPULATION ESTIMATE BY SUB-ZONE



DAYTIME POPULATION DENSITY PER SQUARE MILE



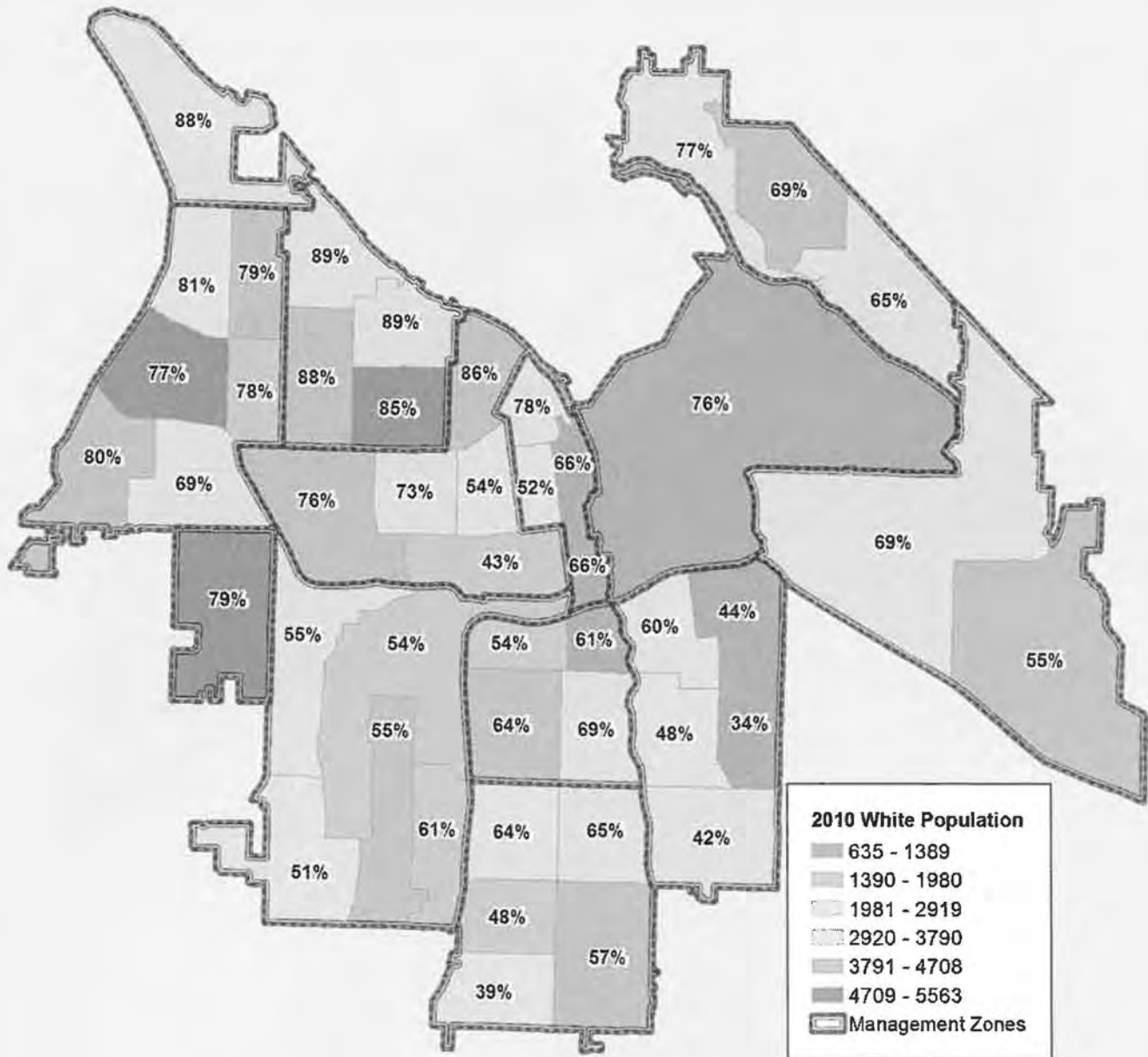
POPULATION DENSITY BASED ON THE COMMISSION ON FIRE ACCREDITATION INTERNATIONAL DESIGNATION



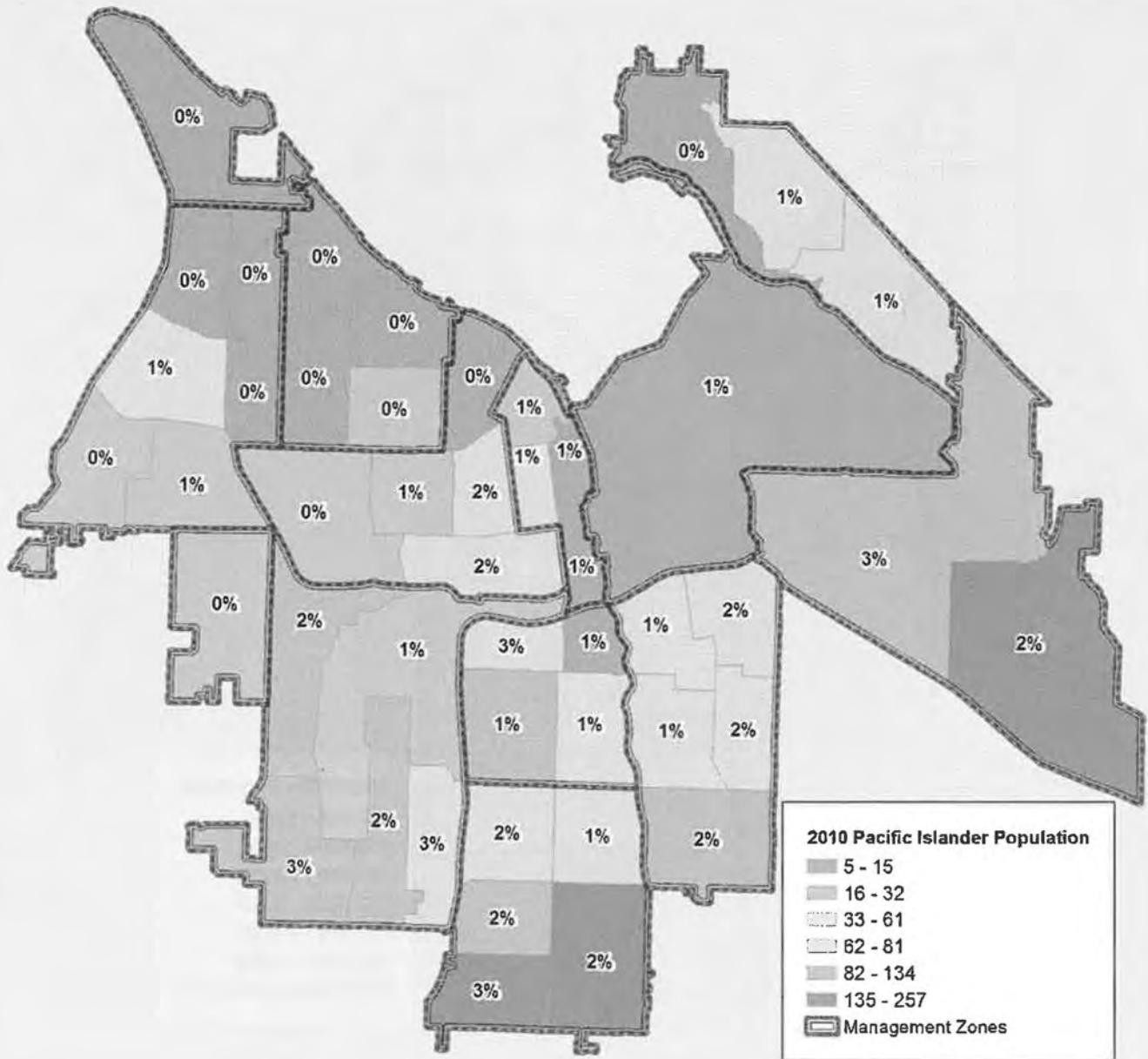
The Commission on Fire Accreditation International (FASSEM, 8th Edition) recommends dividing a jurisdiction into fire management zones based on population density. The following illustrates population density throughout our service area.

- Metropolitan: >3k per square mile
- Urban: >2k per square mile
- Suburban: 1k-2k per square mile
- Rural: 1k per square mile

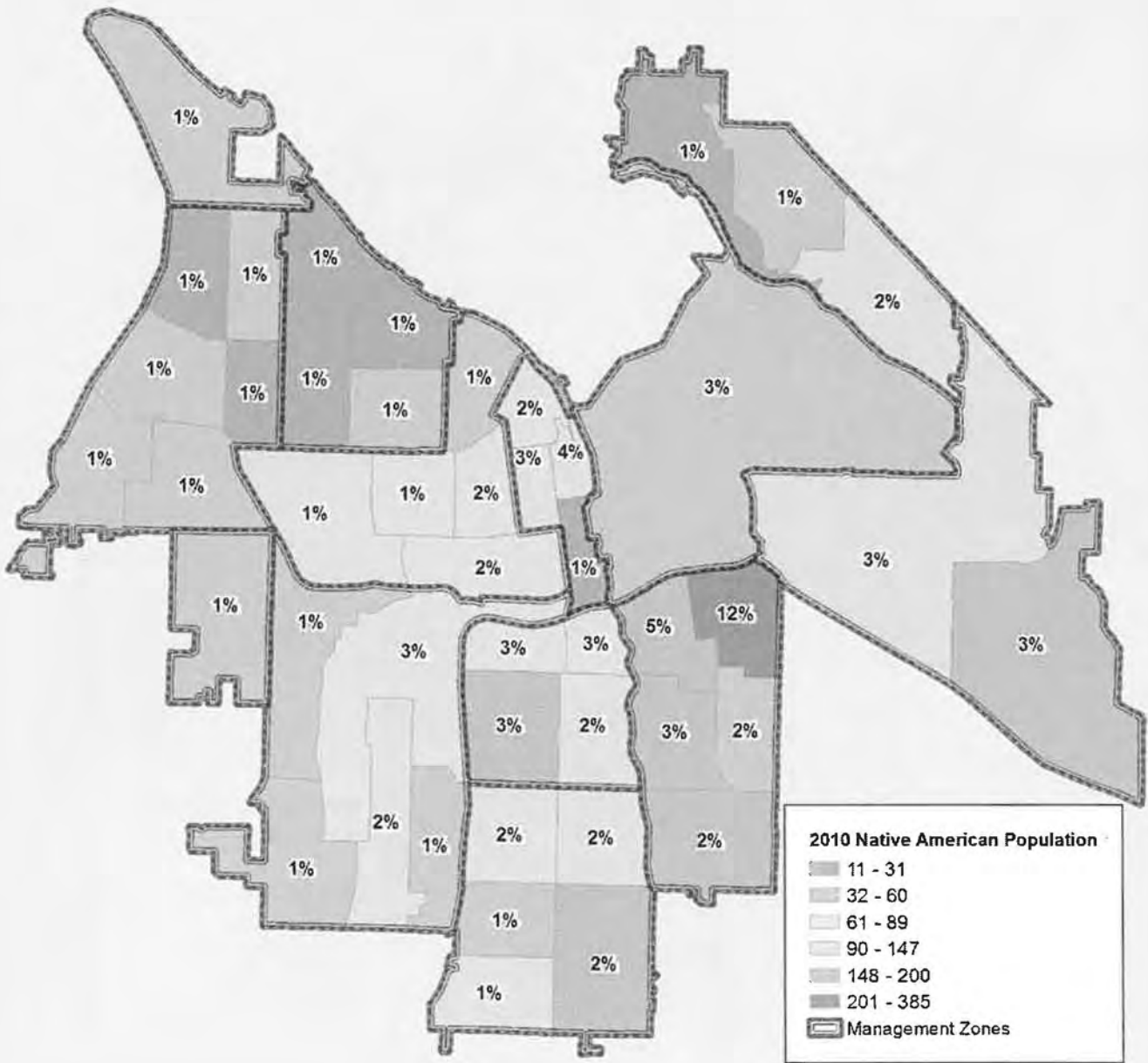
POPULATION DISTRIBUTION BY RACE—WHITE



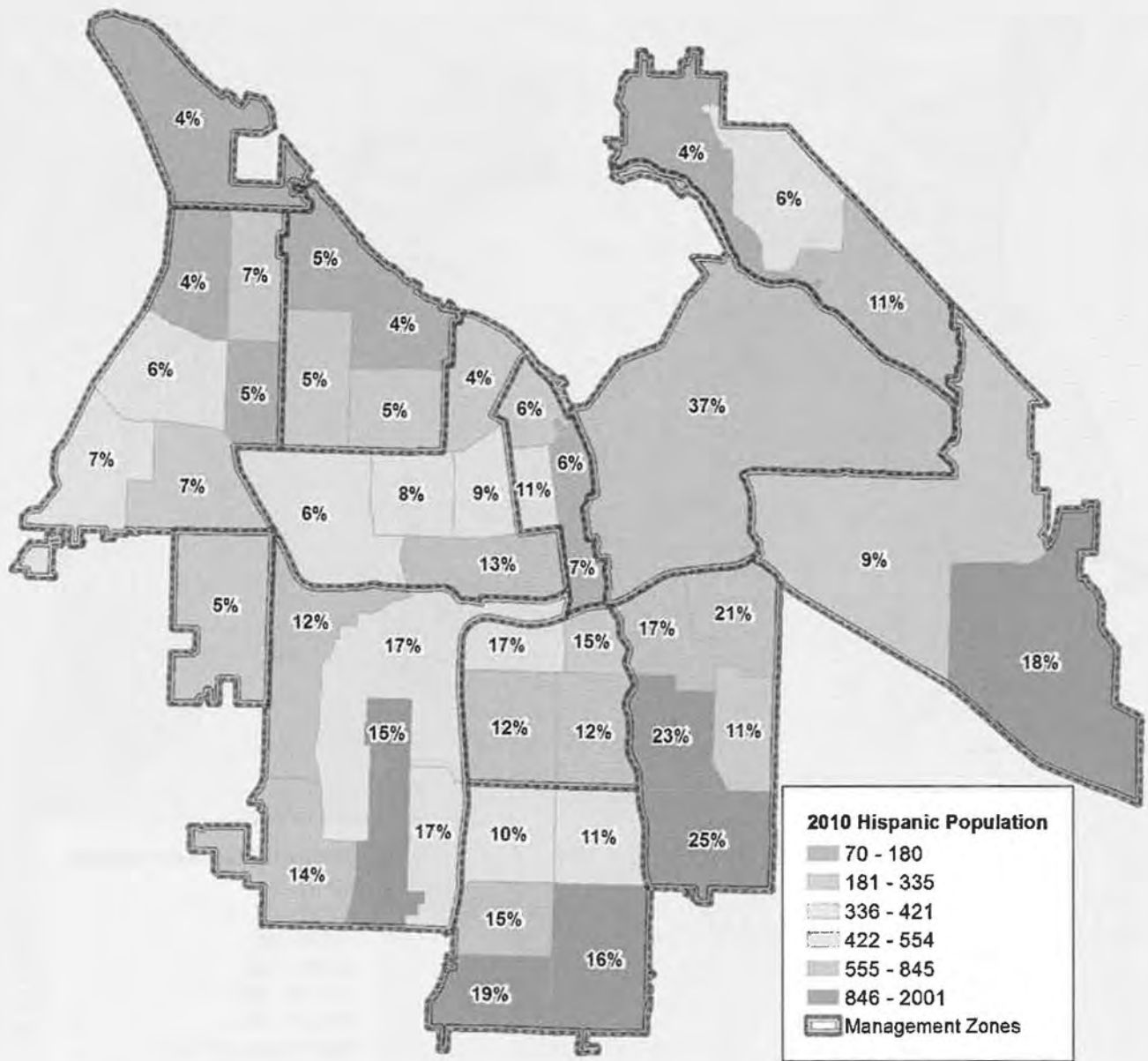
PACIFIC ISLANDER



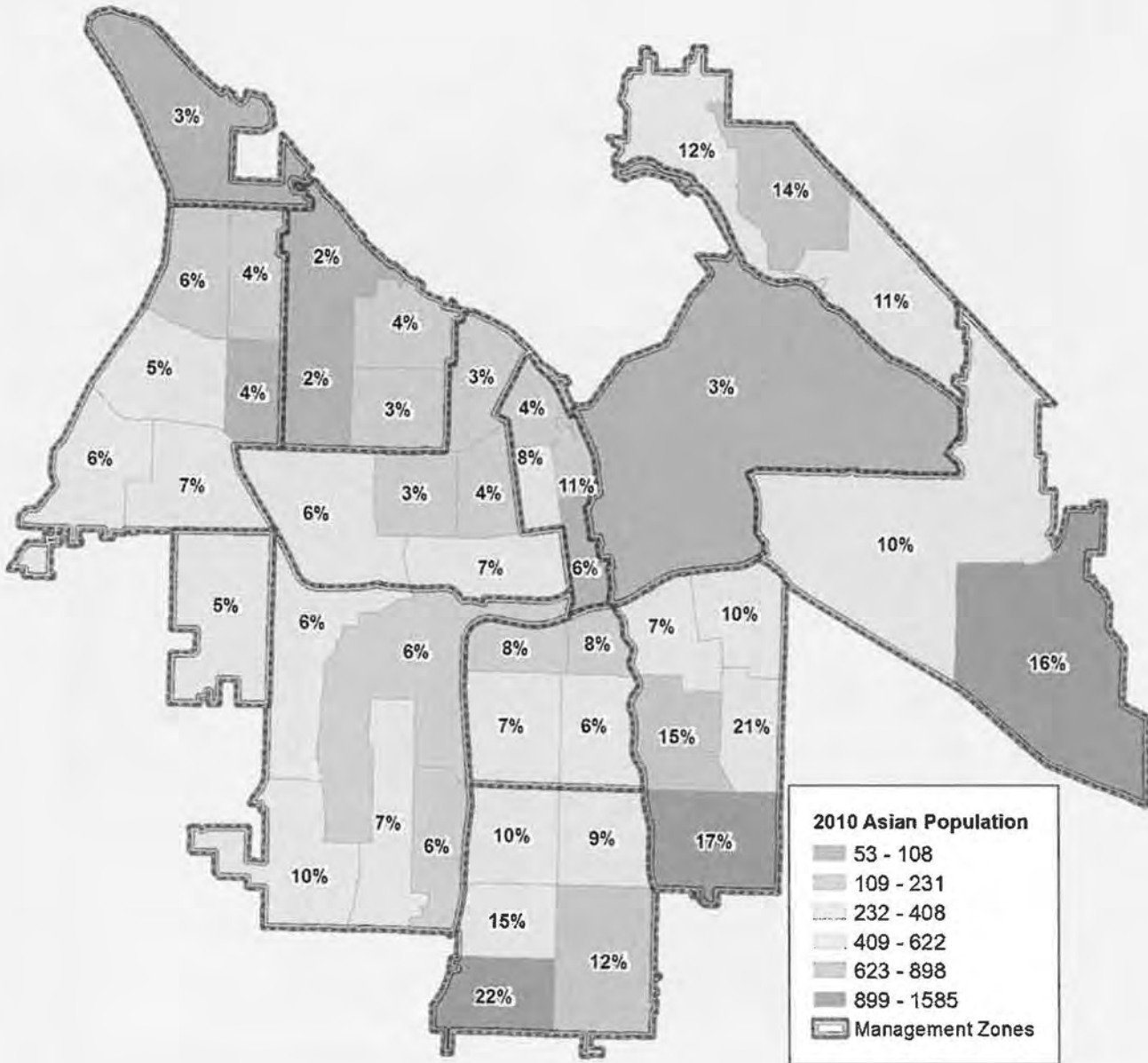
NATIVE AMERICAN



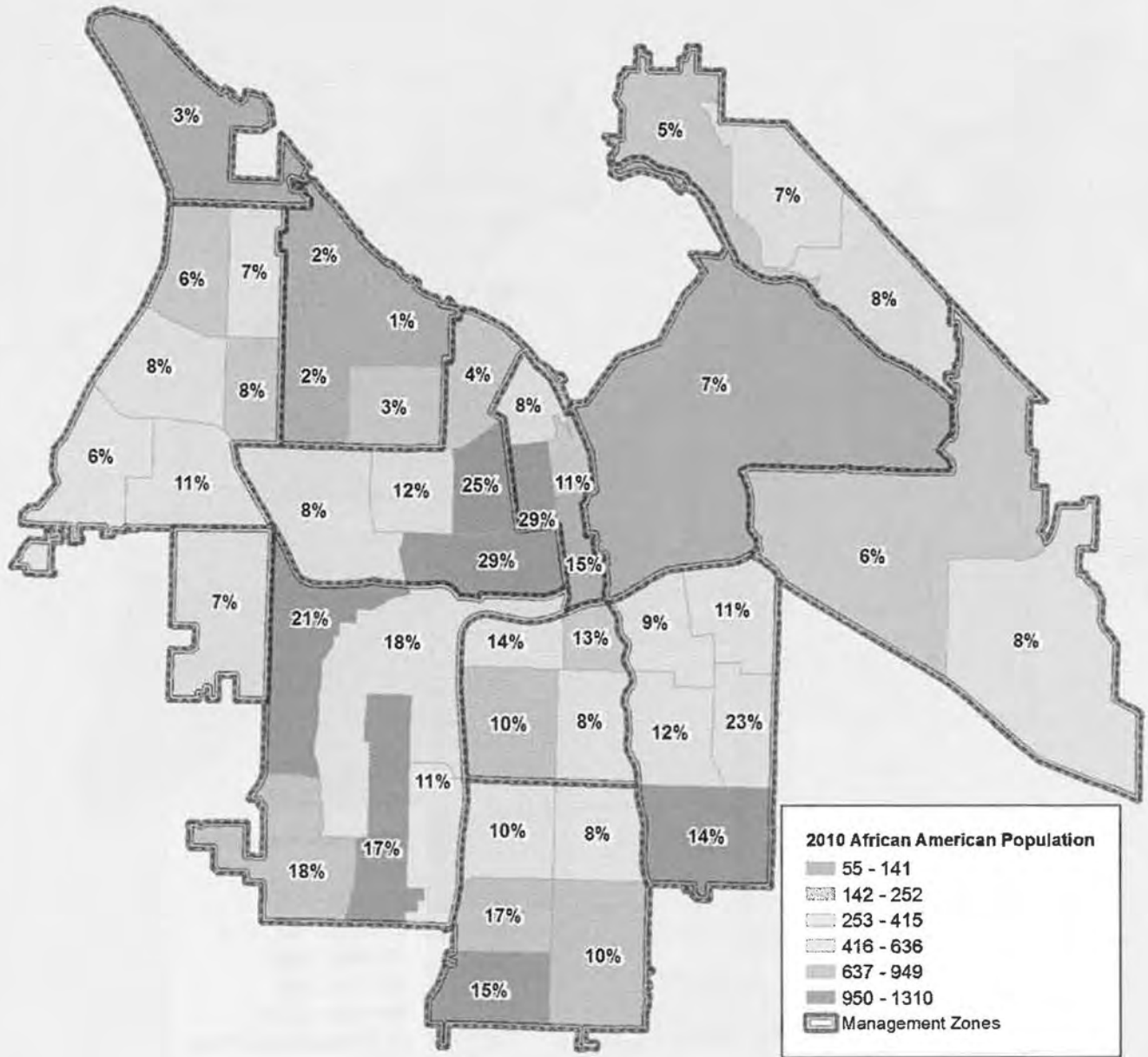
HISPANIC



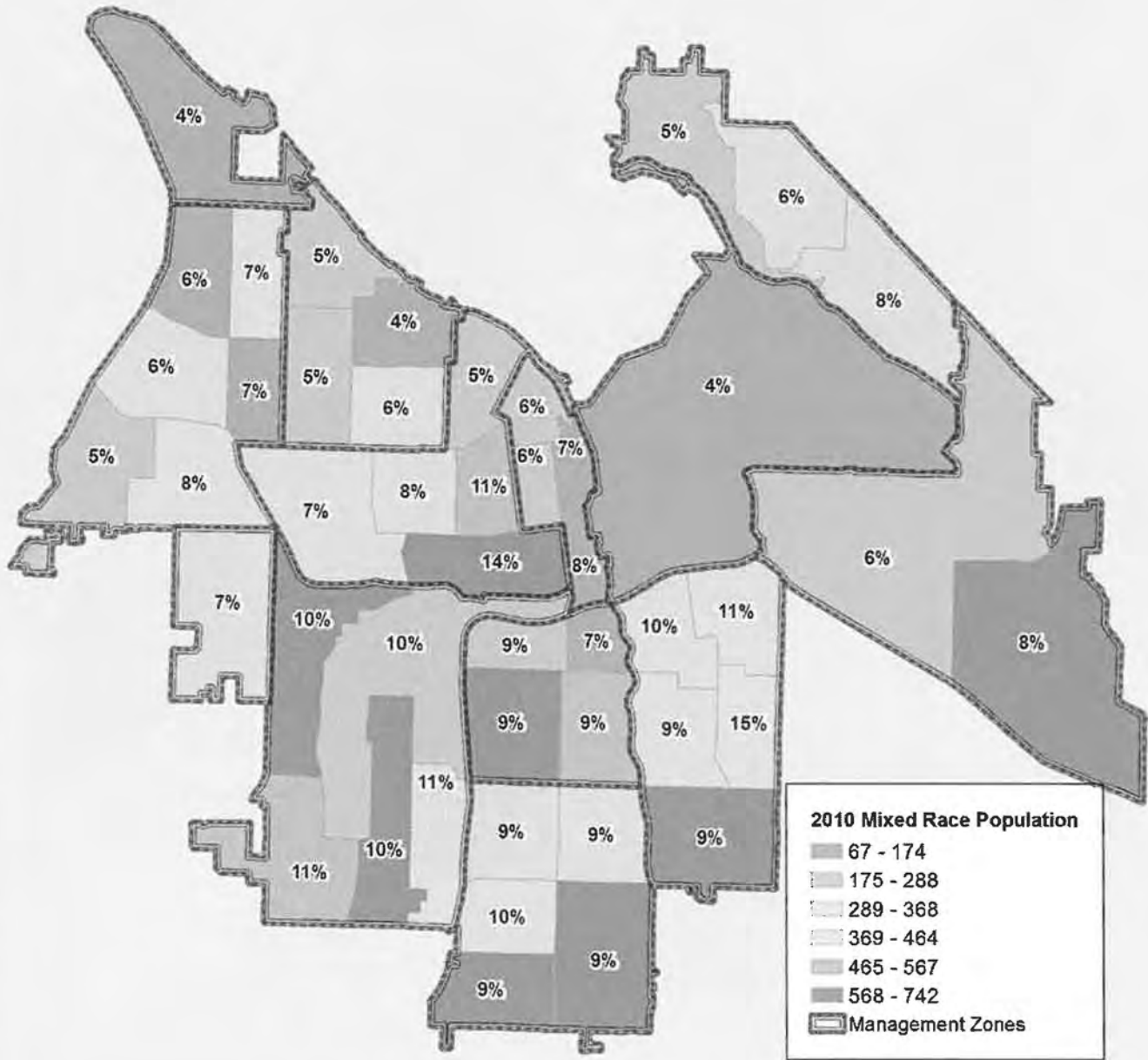
ASIAN



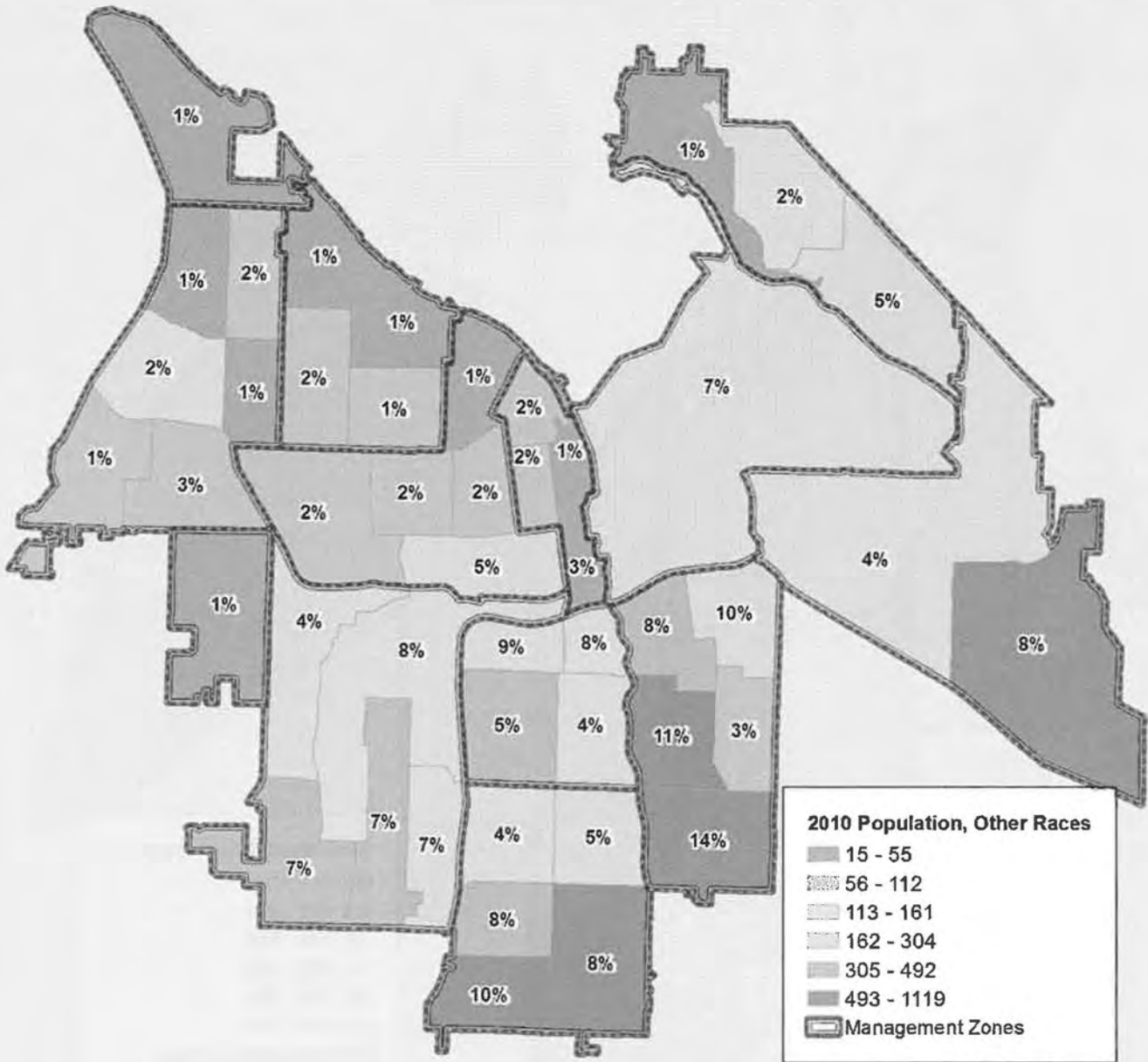
AFRICAN AMERICAN



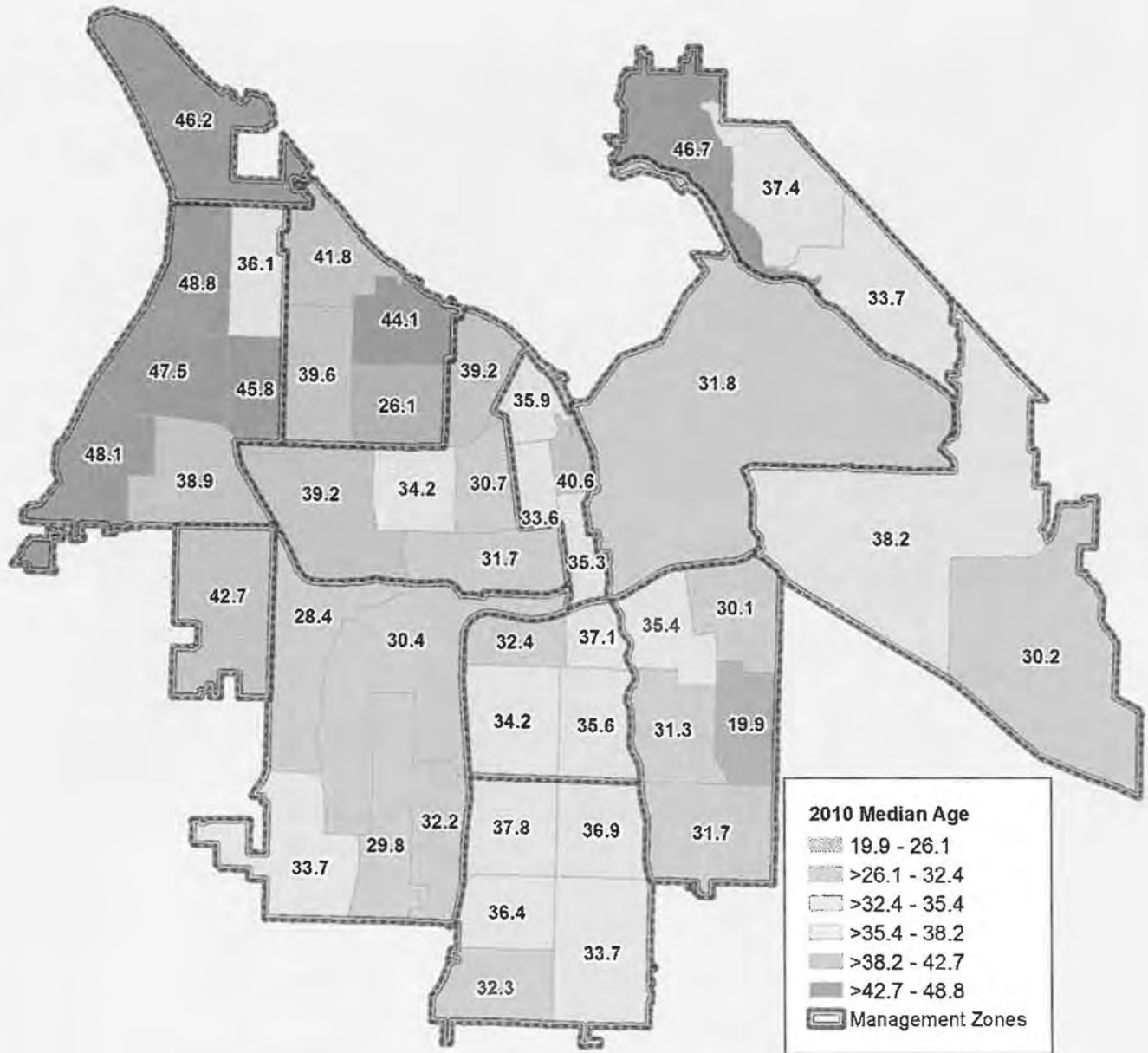
MIXED RACE



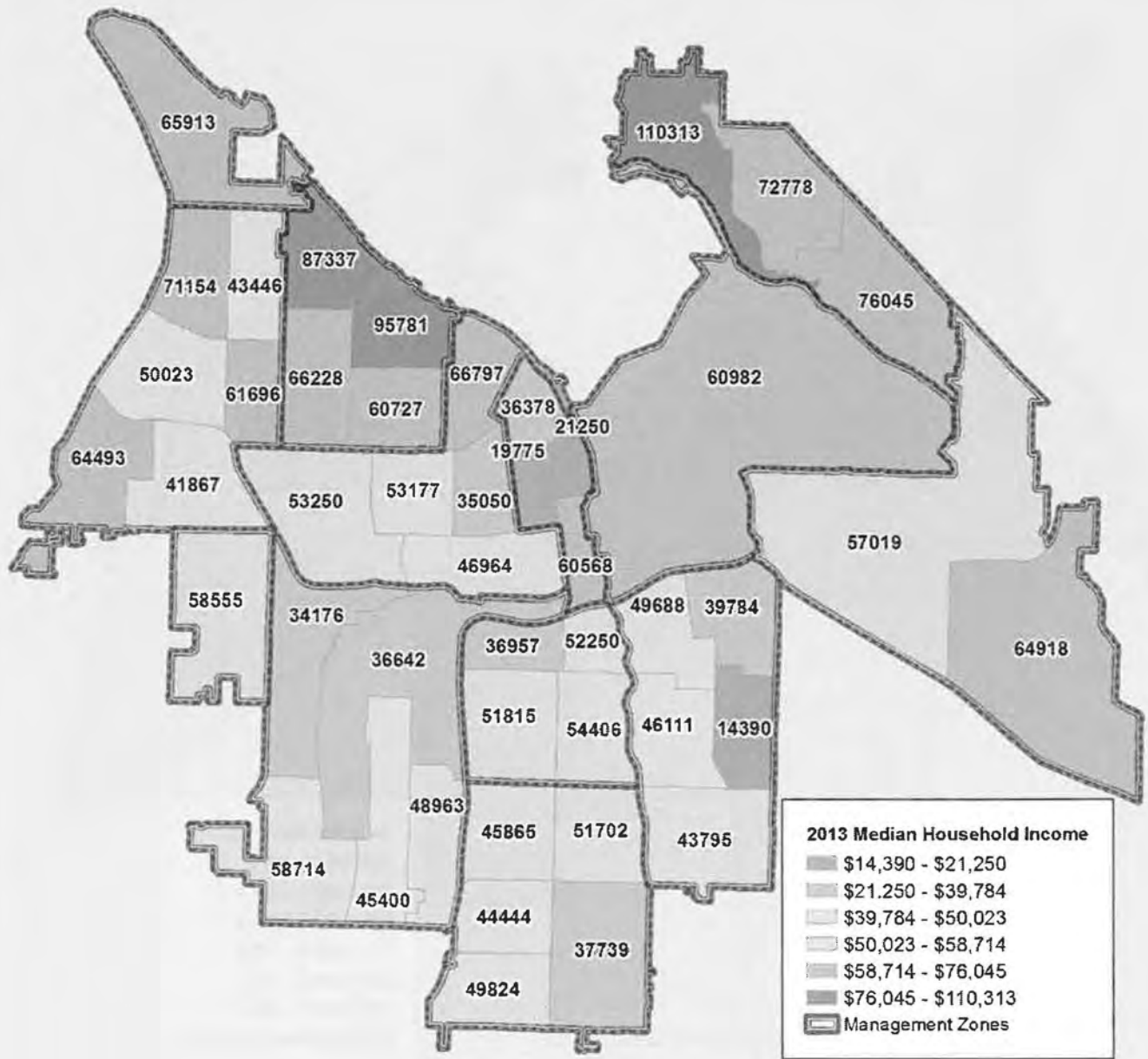
OTHER RACES



MEDIAN AGE BY SUB-ZONE

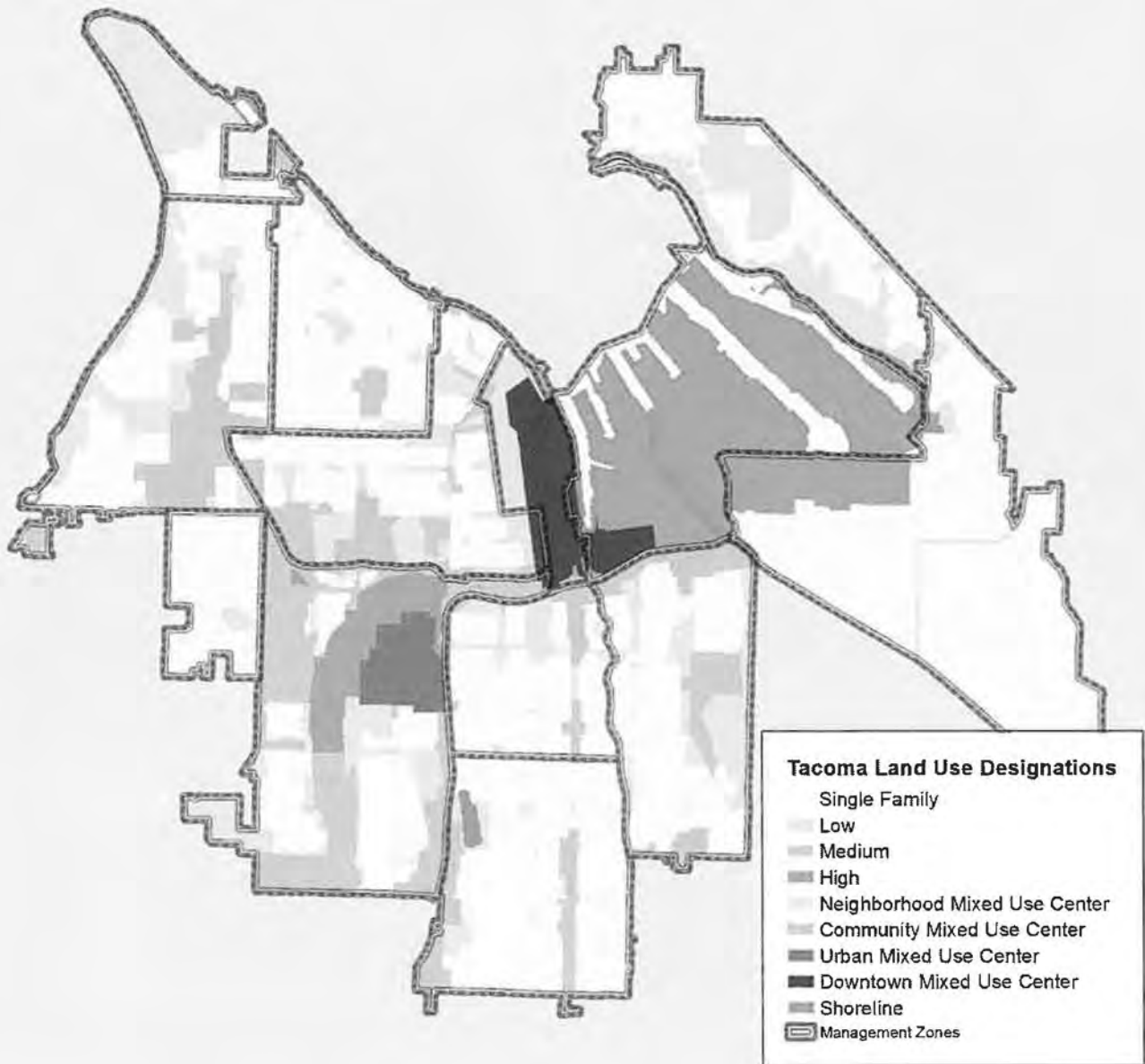


MEDIAN HOUSEHOLD INCOME BY SUB-ZONE (2013)

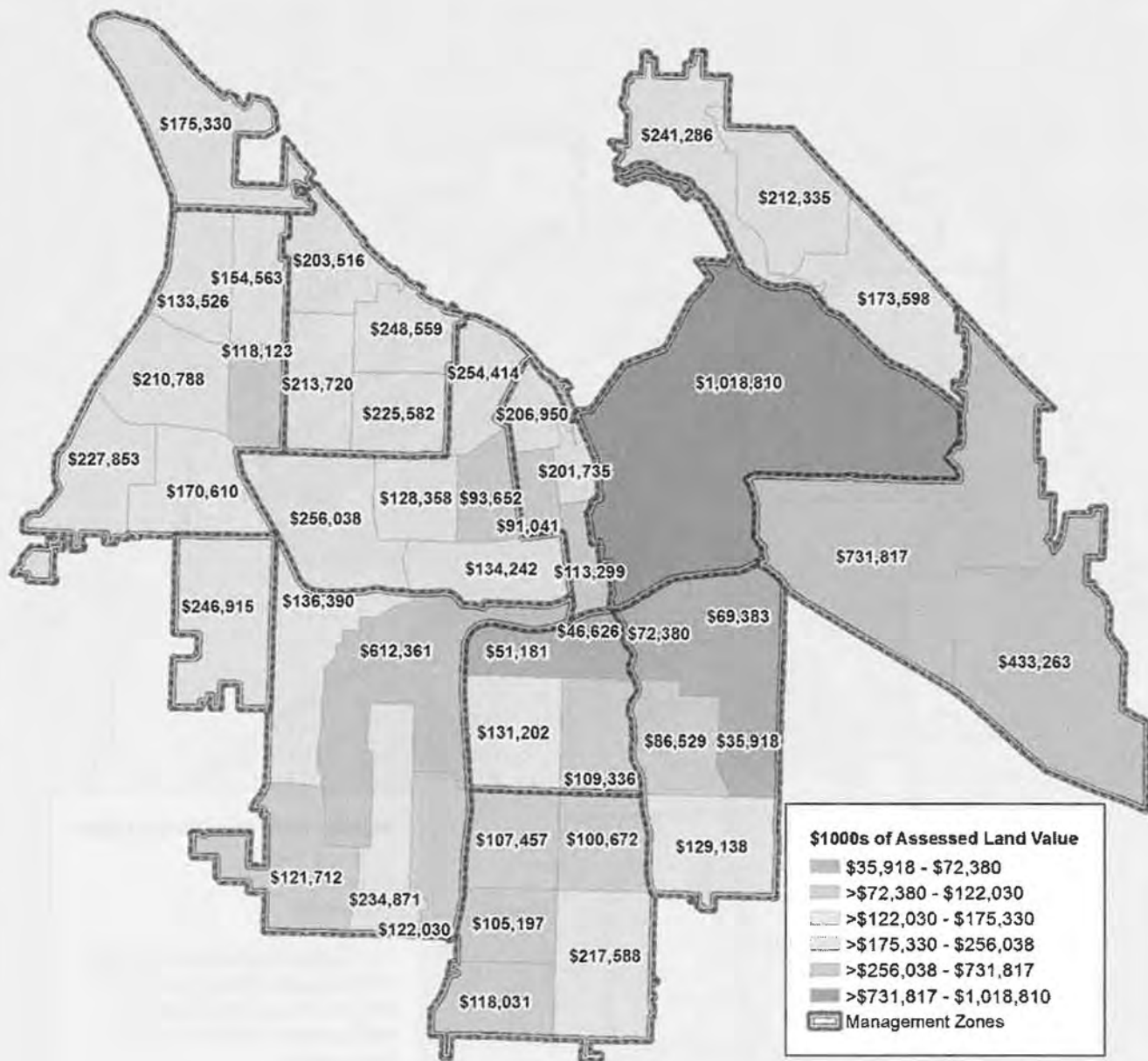


APPENDIX B—LAND USE/BORDERS/INFRASTRUCTURE

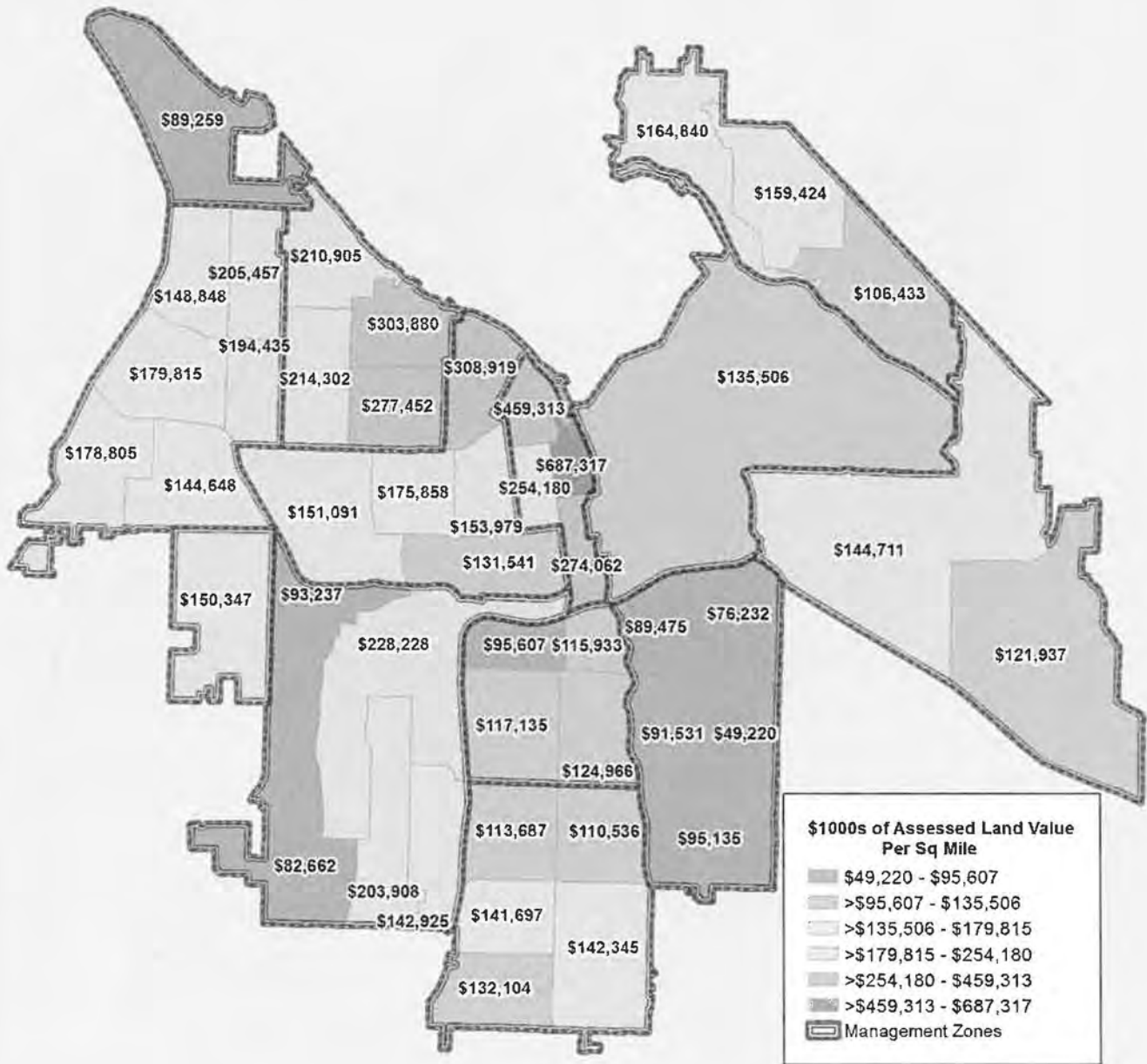
LAND USE



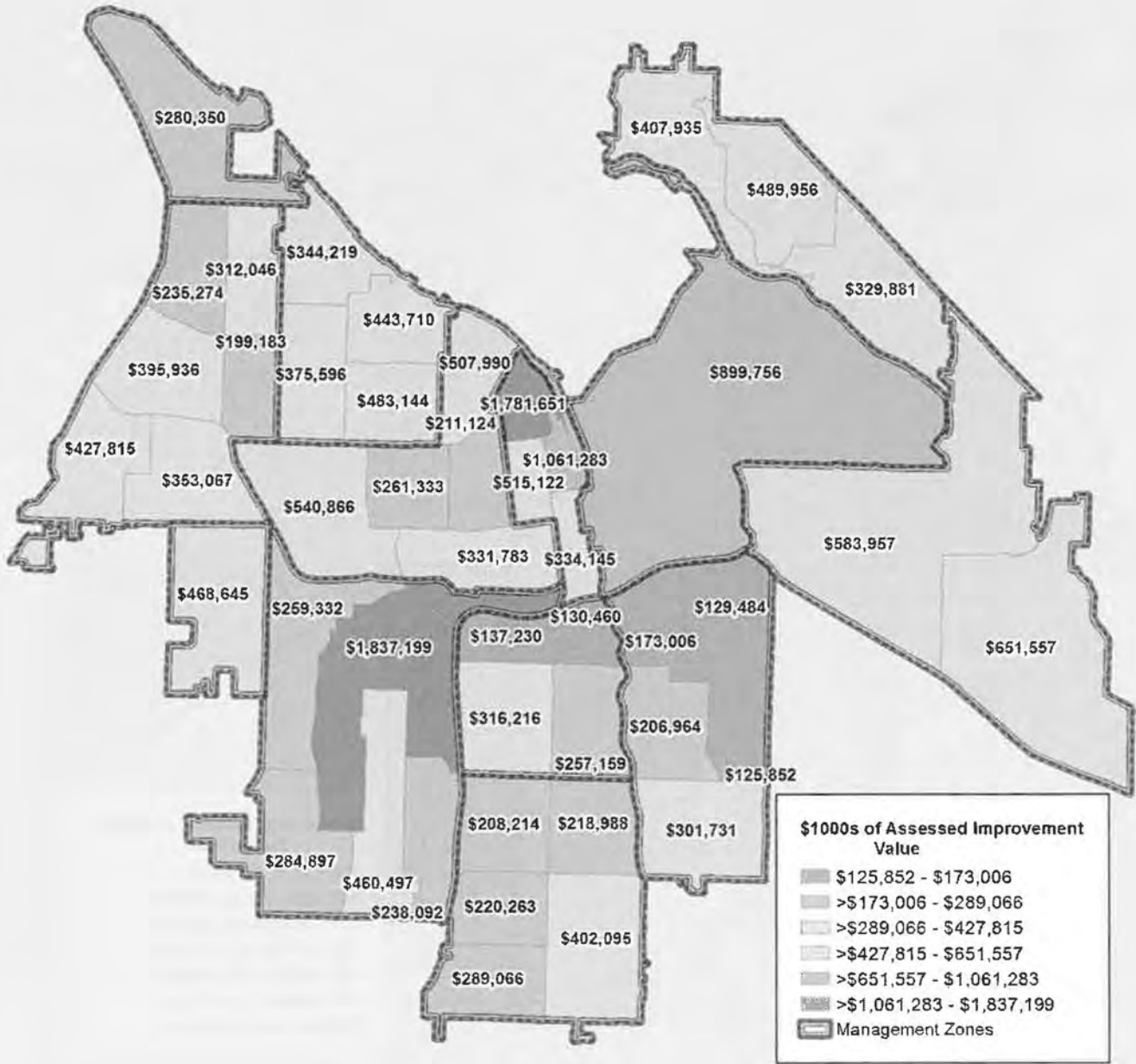
ASSESSED LAND VALUE



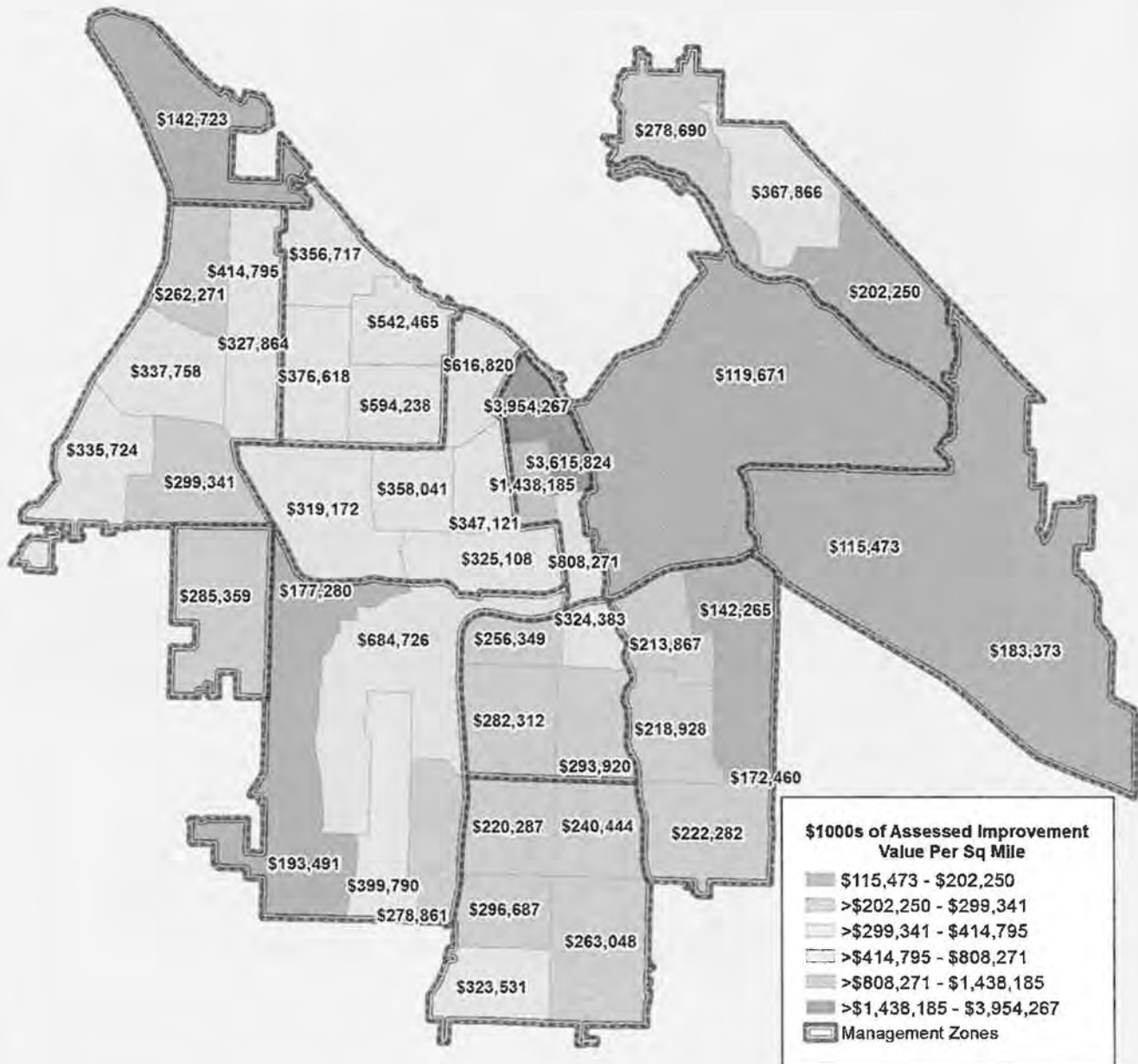
ASSESSED LAND VALUE DENSITY



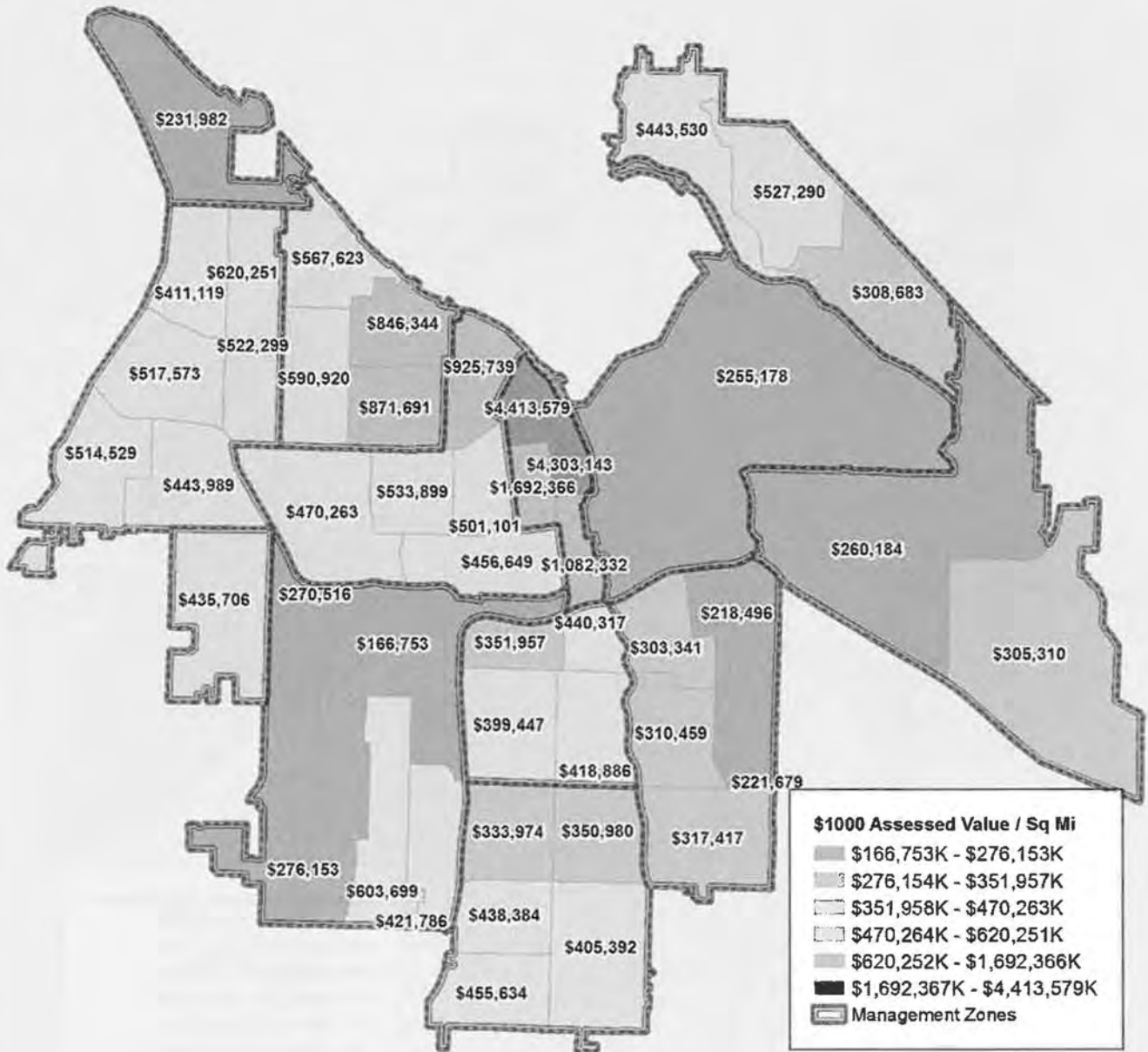
ASSESSED VALUE WITH IMPROVEMENTS



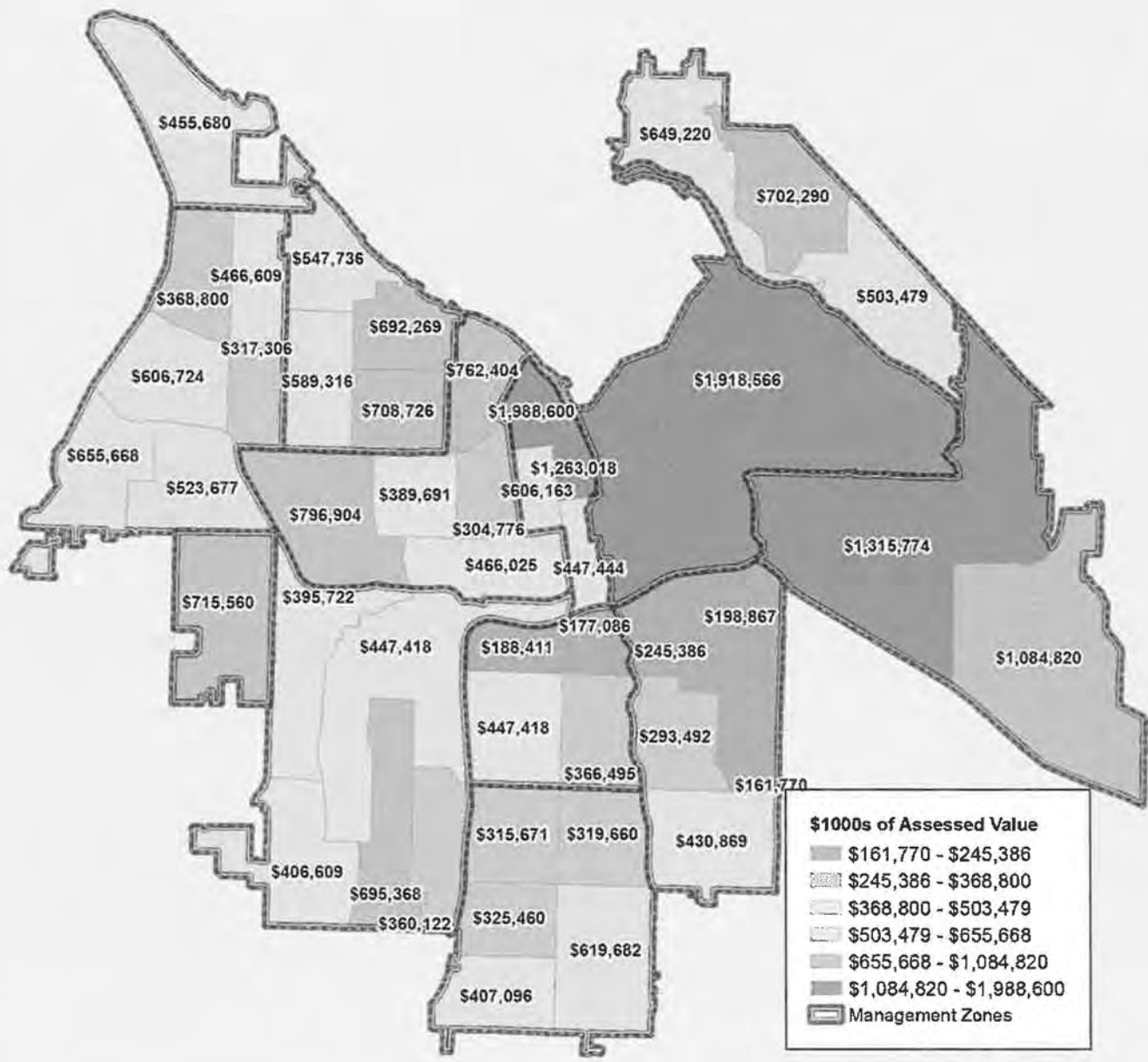
ASSESSED VALUE WITH IMPROVEMENTS BY DENSITY



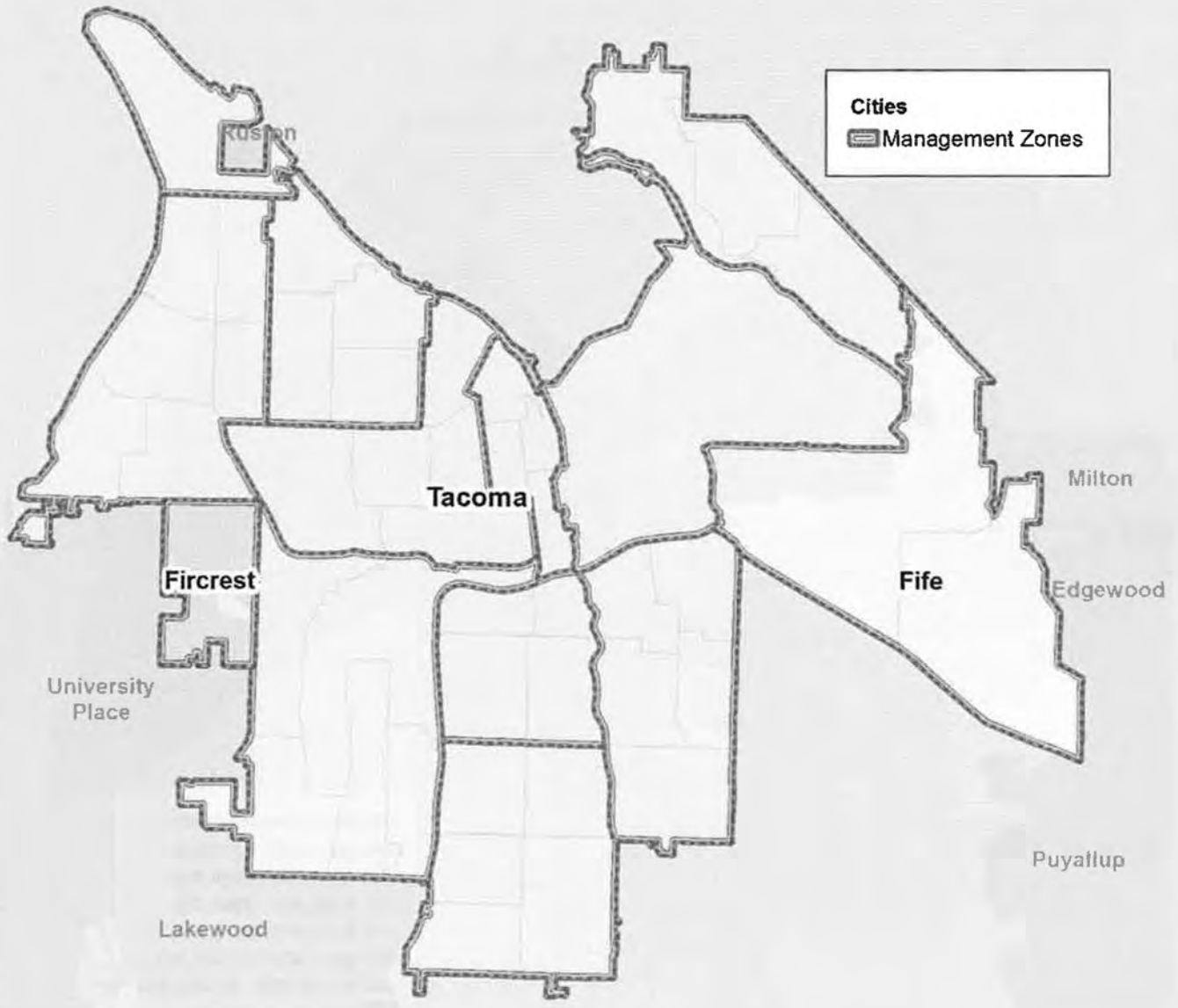
ASSESSED VALUE PER SQUARE MILE (IN 1,000'S)



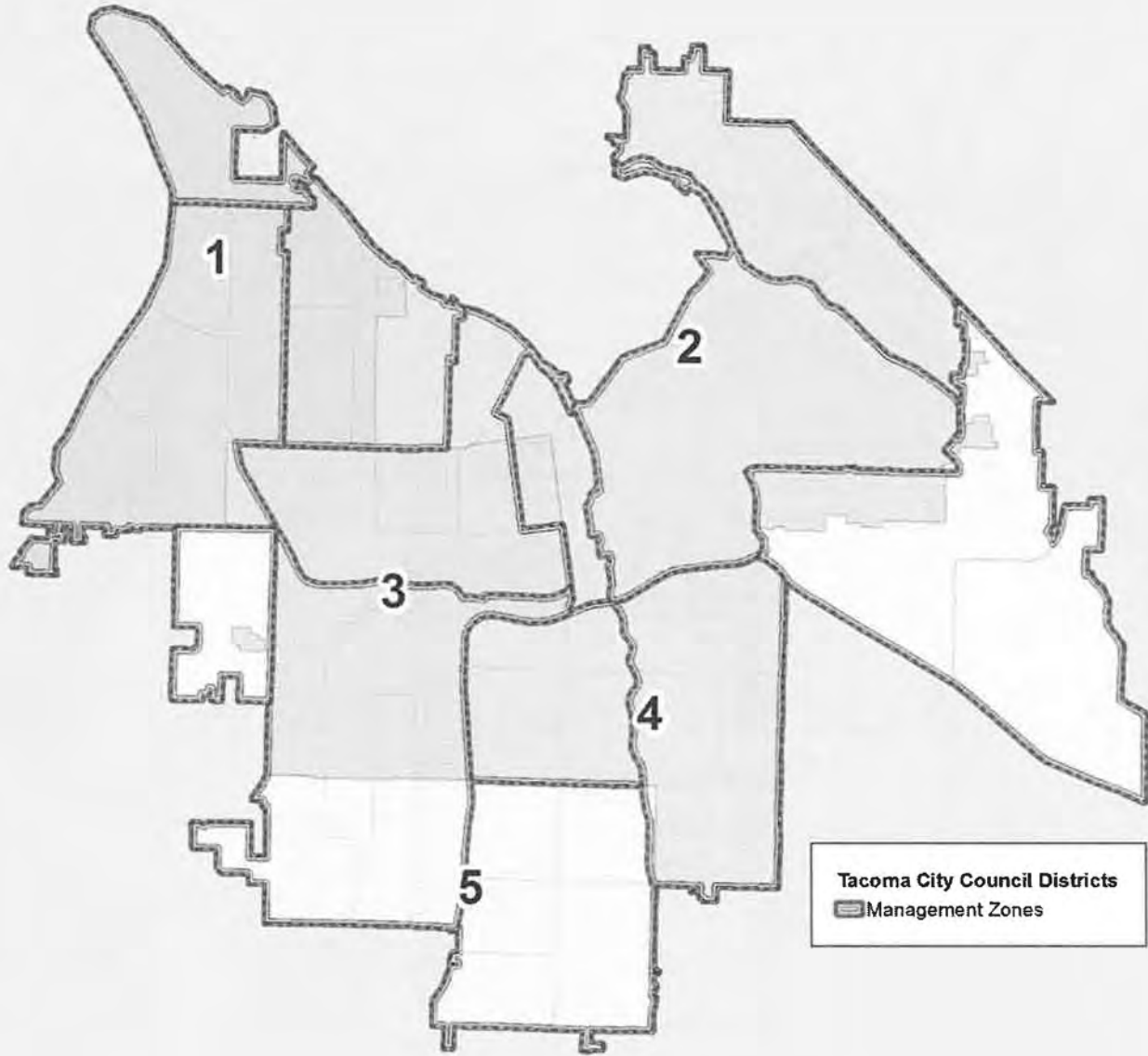
ASSESSED VALUE TOTAL



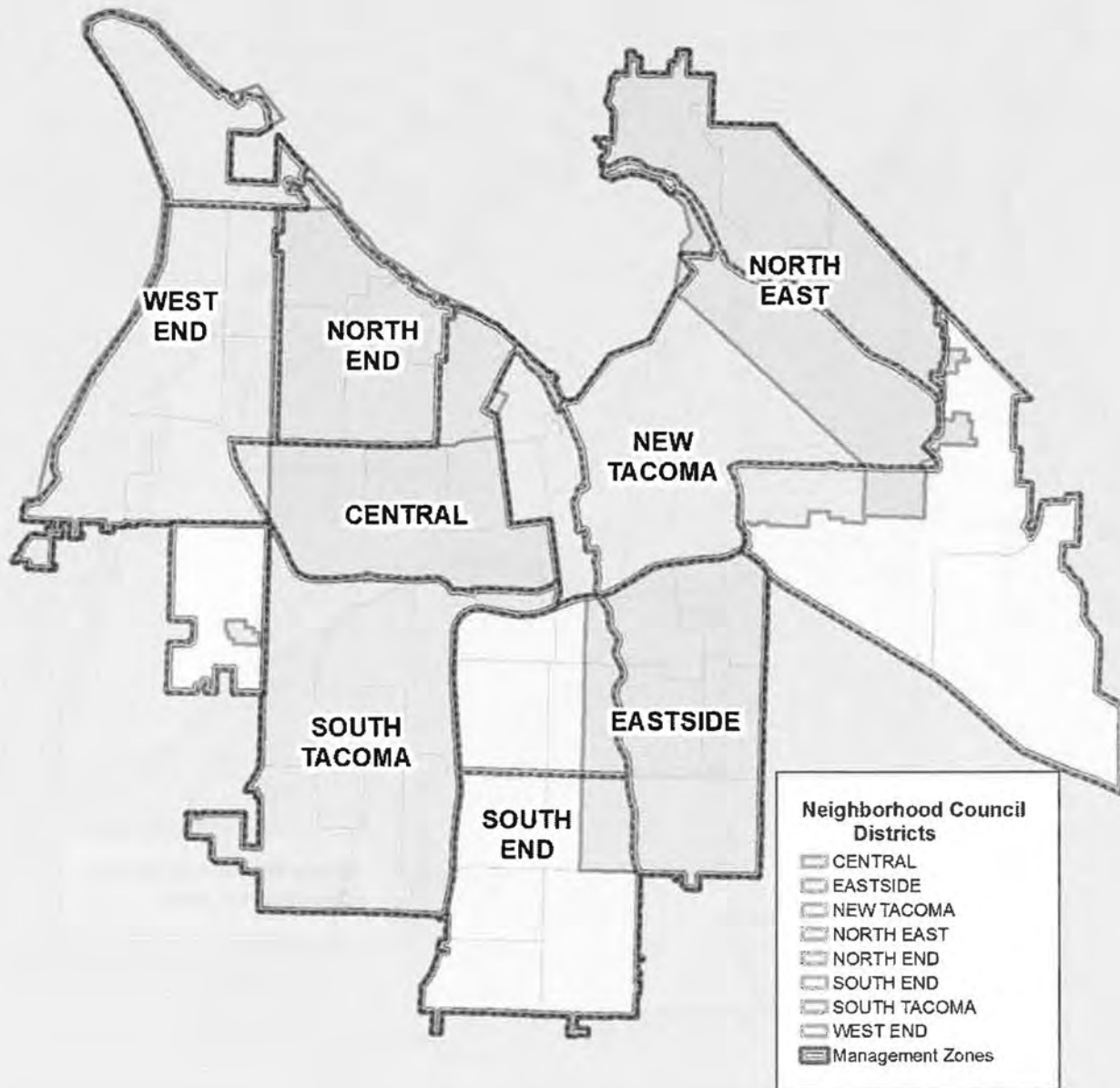
CITY BOUNDARIES



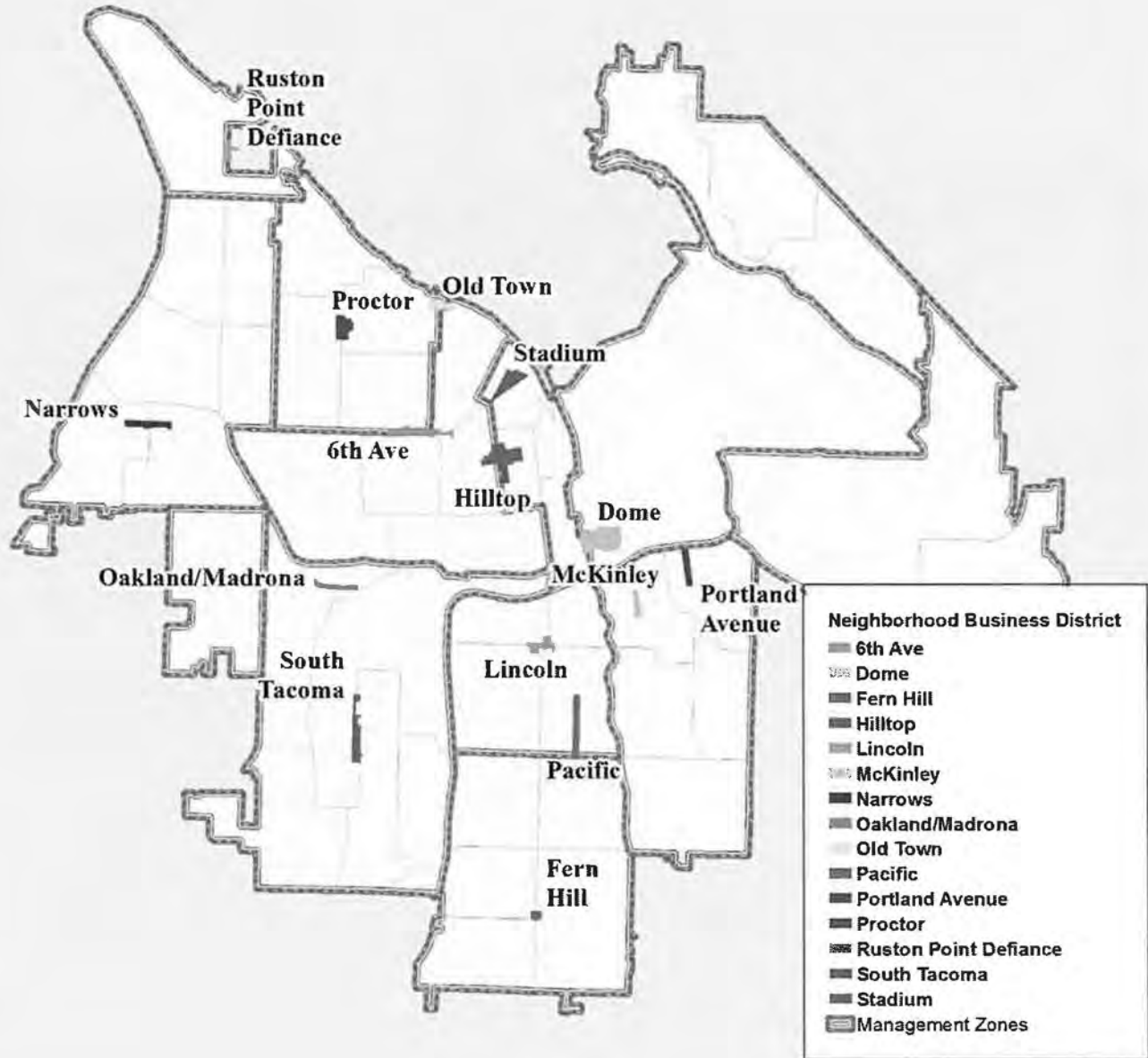
TACOMA CITY COUNCIL DISTRICTS



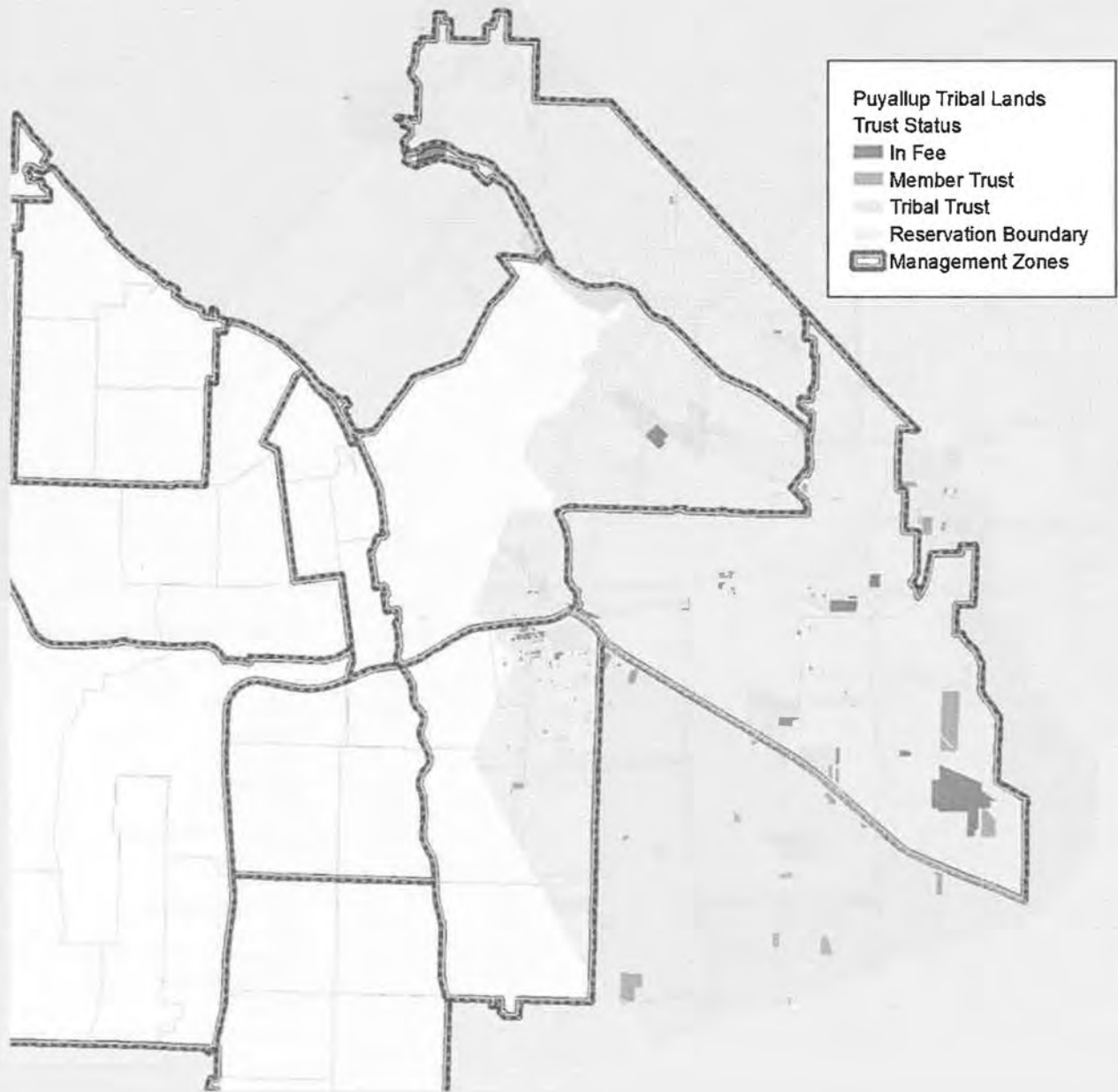
CITY OF TACOMA NEIGHBORHOOD COUNCIL DISTRICTS



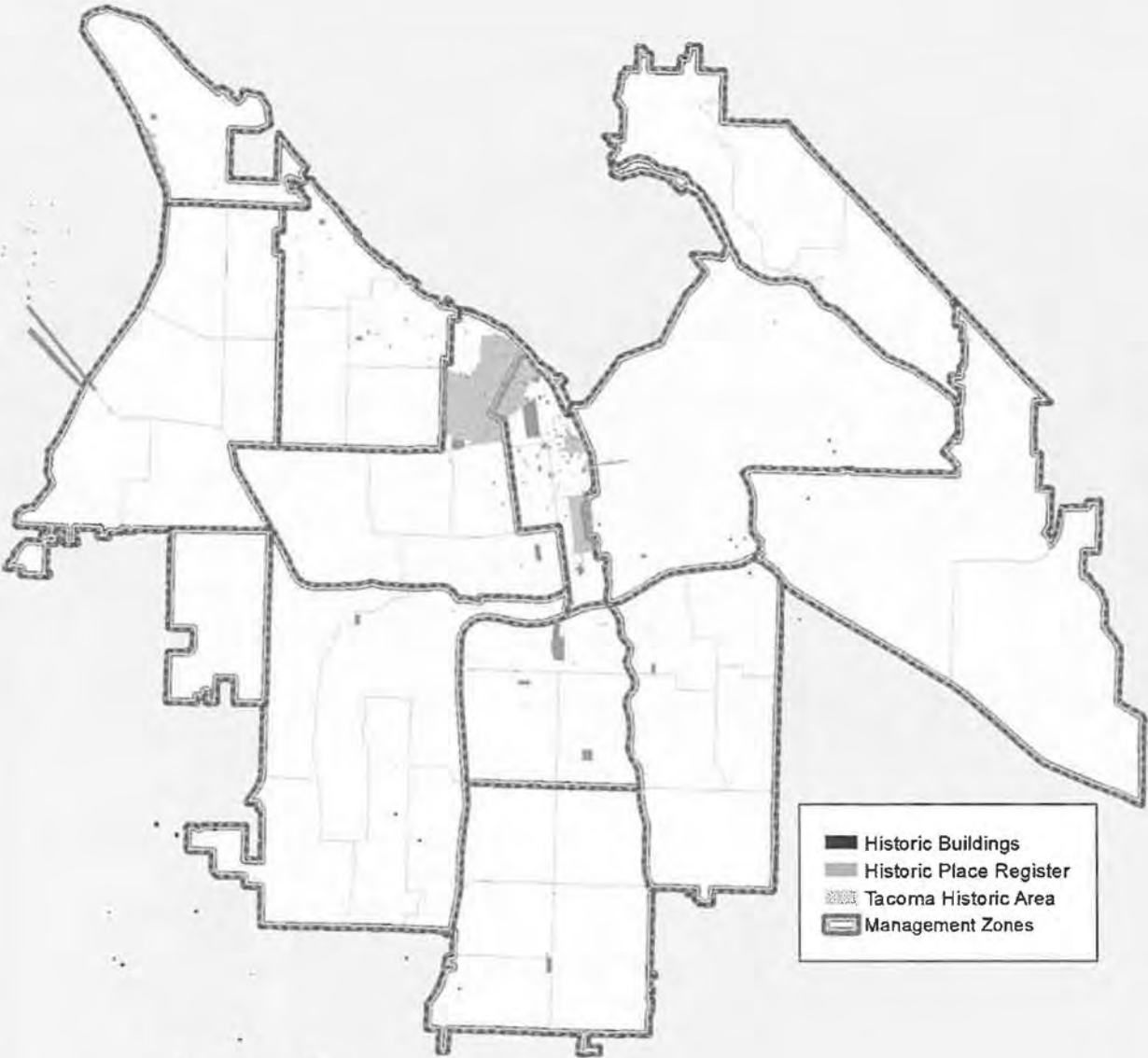
CITY OF TACOMA NEIGHBORHOOD BUSINESS DISTRICTS



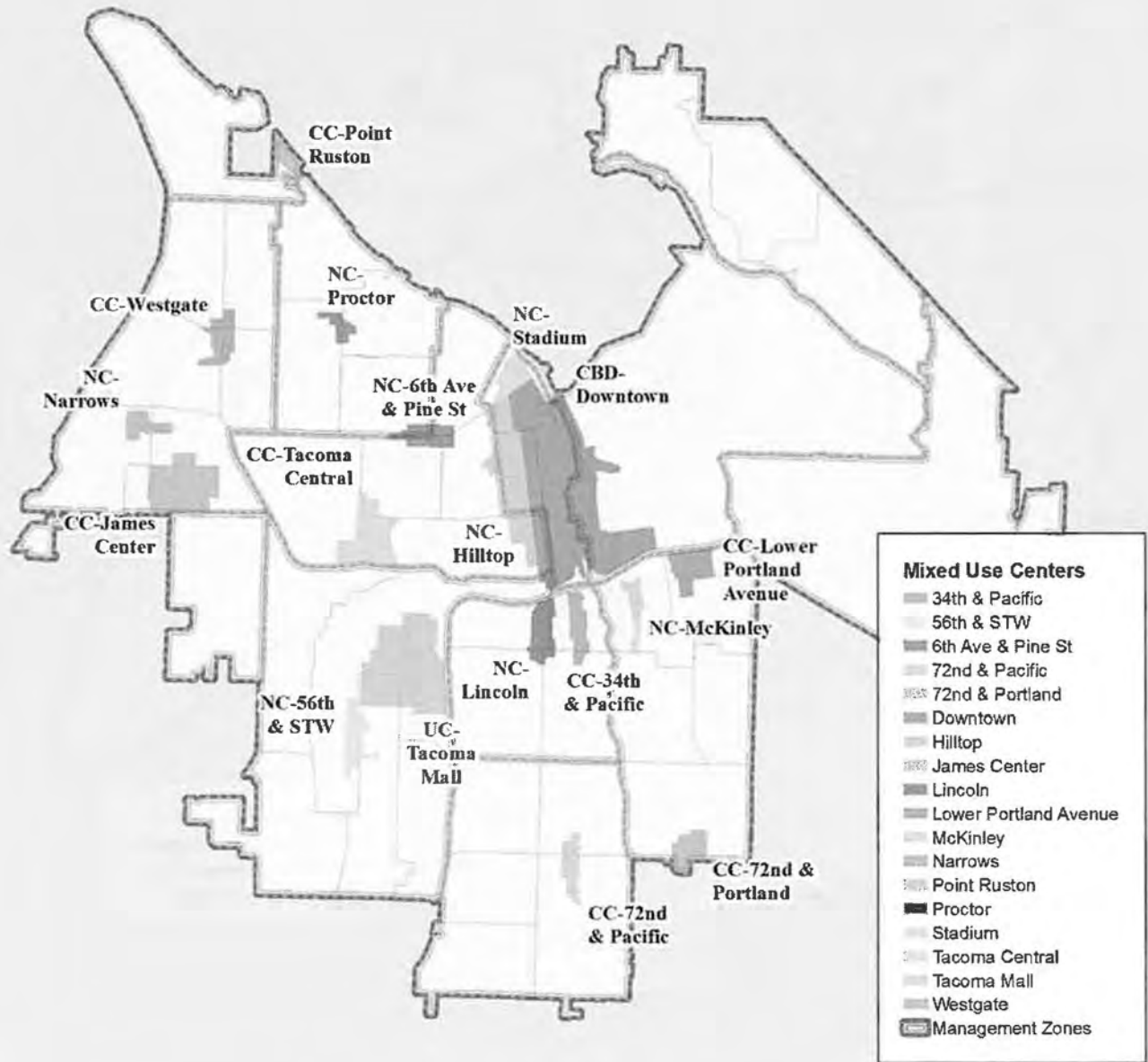
PUYALLUP TRIBAL LANDS



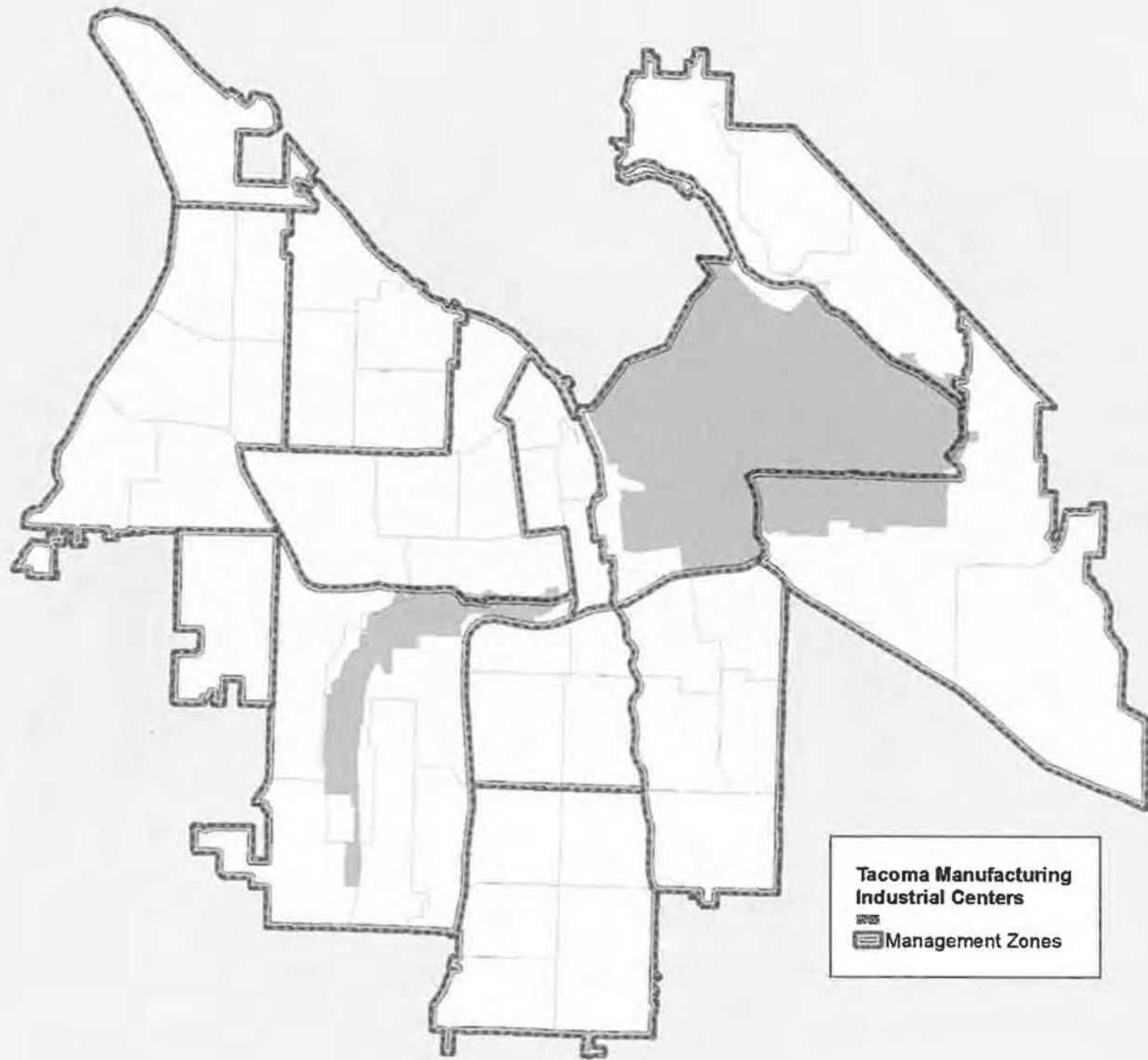
CITY OF TACOMA HISTORIC AREAS



THE CITY OF TACOMA MIXED USE CENTERS

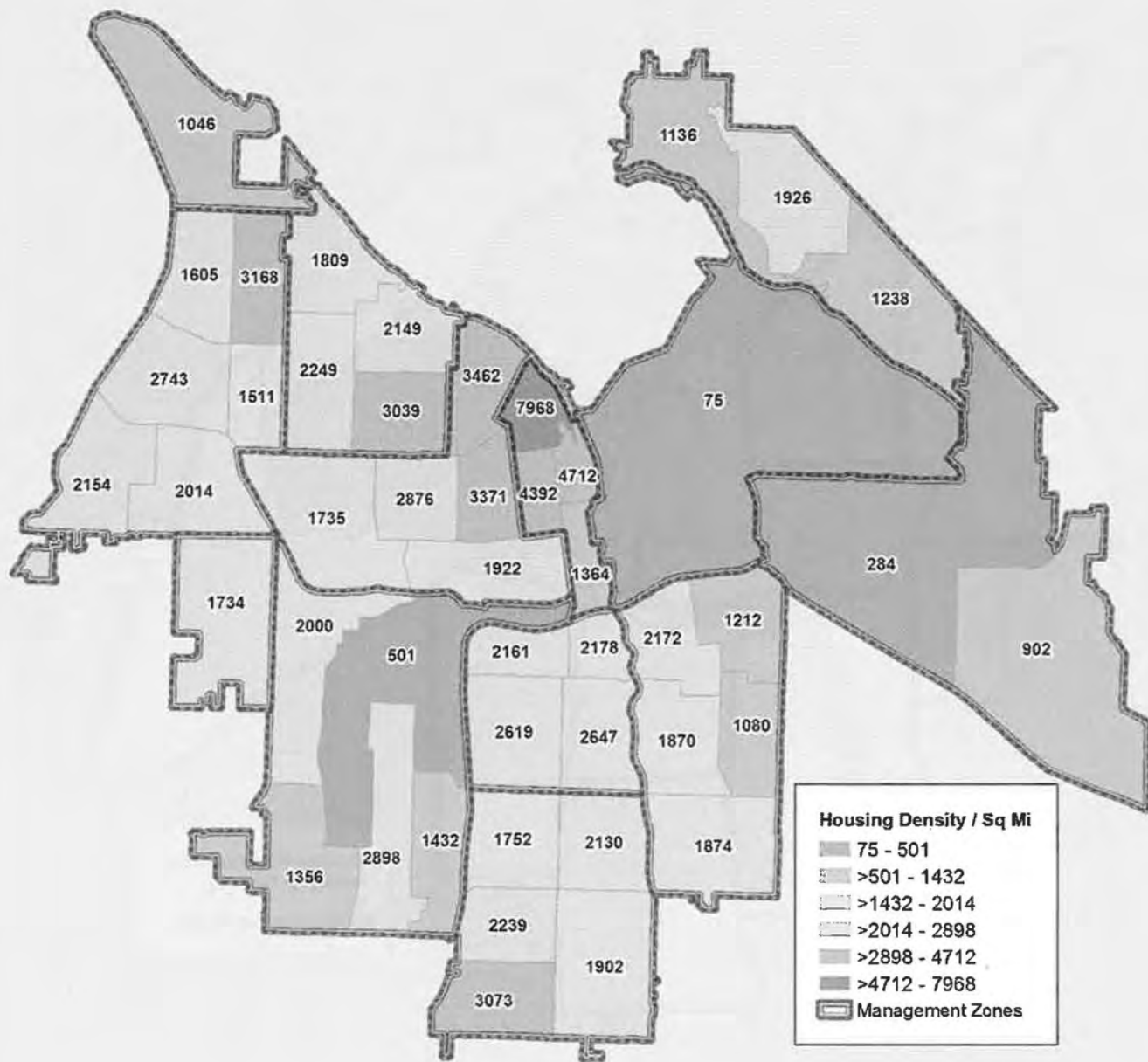


CITY OF TACOMA MANUFACTURING/INDUSTRIAL CENTERS

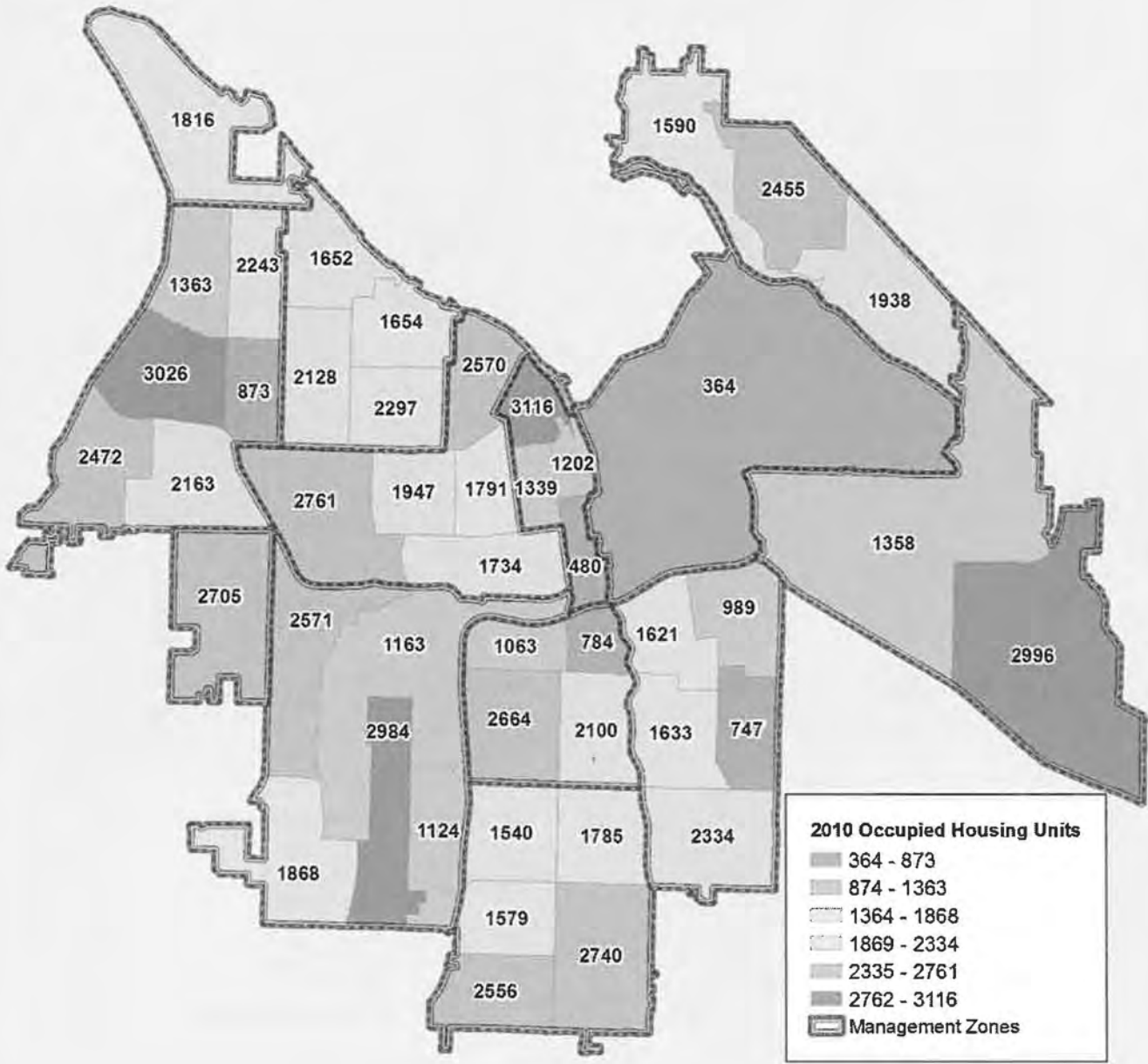


**Tacoma Manufacturing
Industrial Centers**
--- Management Zones
■ Industrial Centers

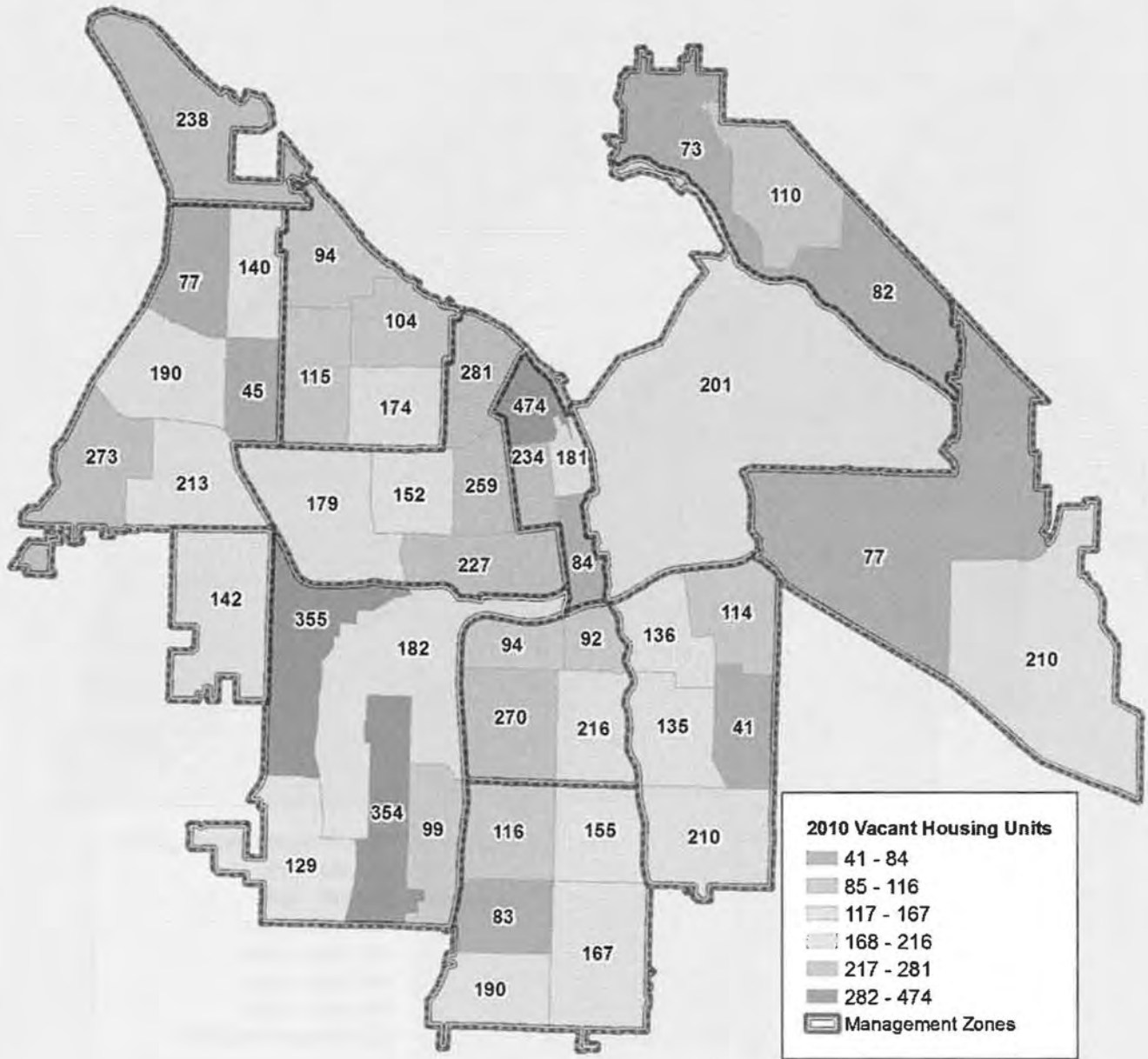
HOUSING DENSITY



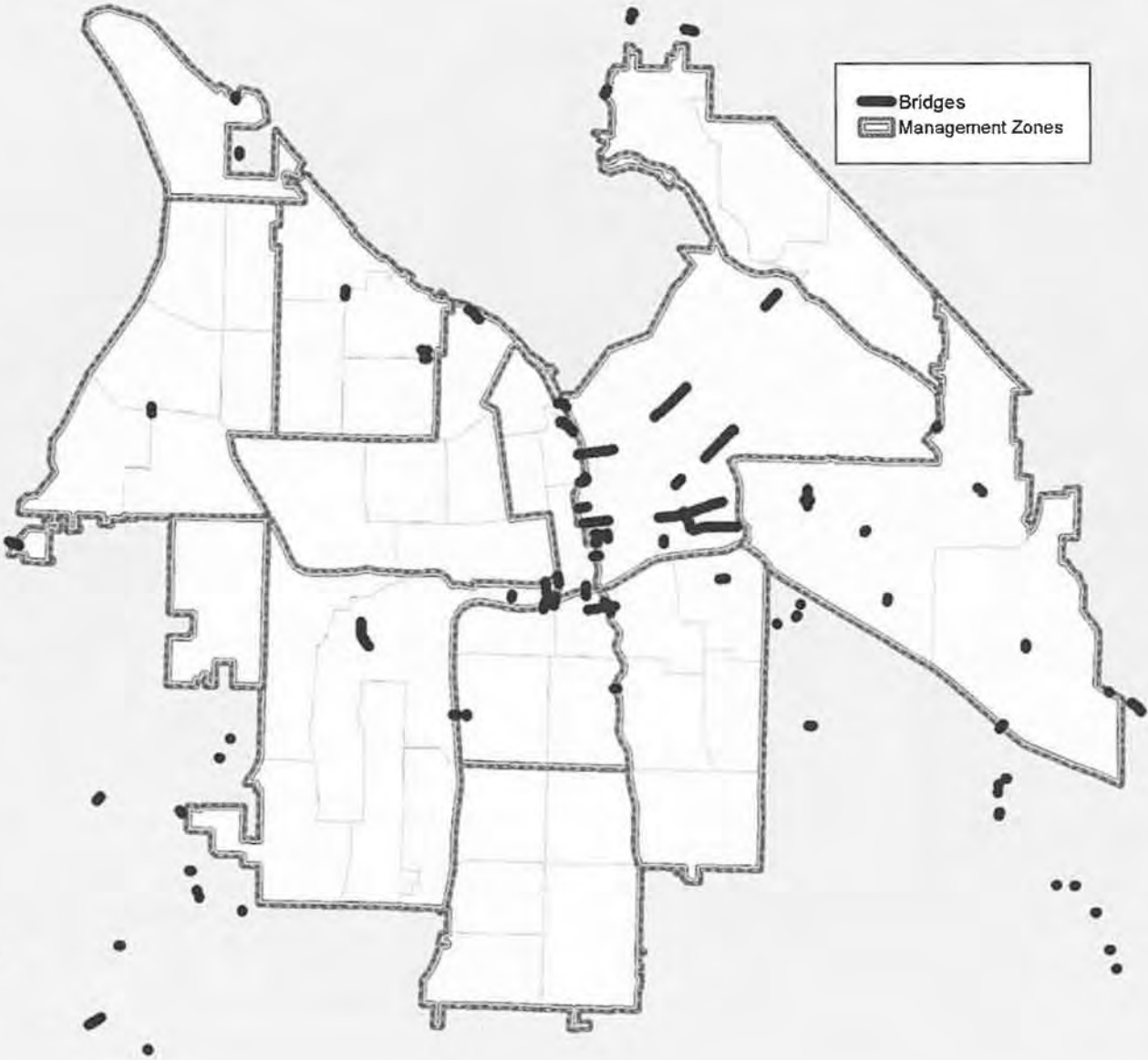
OCCUPIED HOUSING UNITS



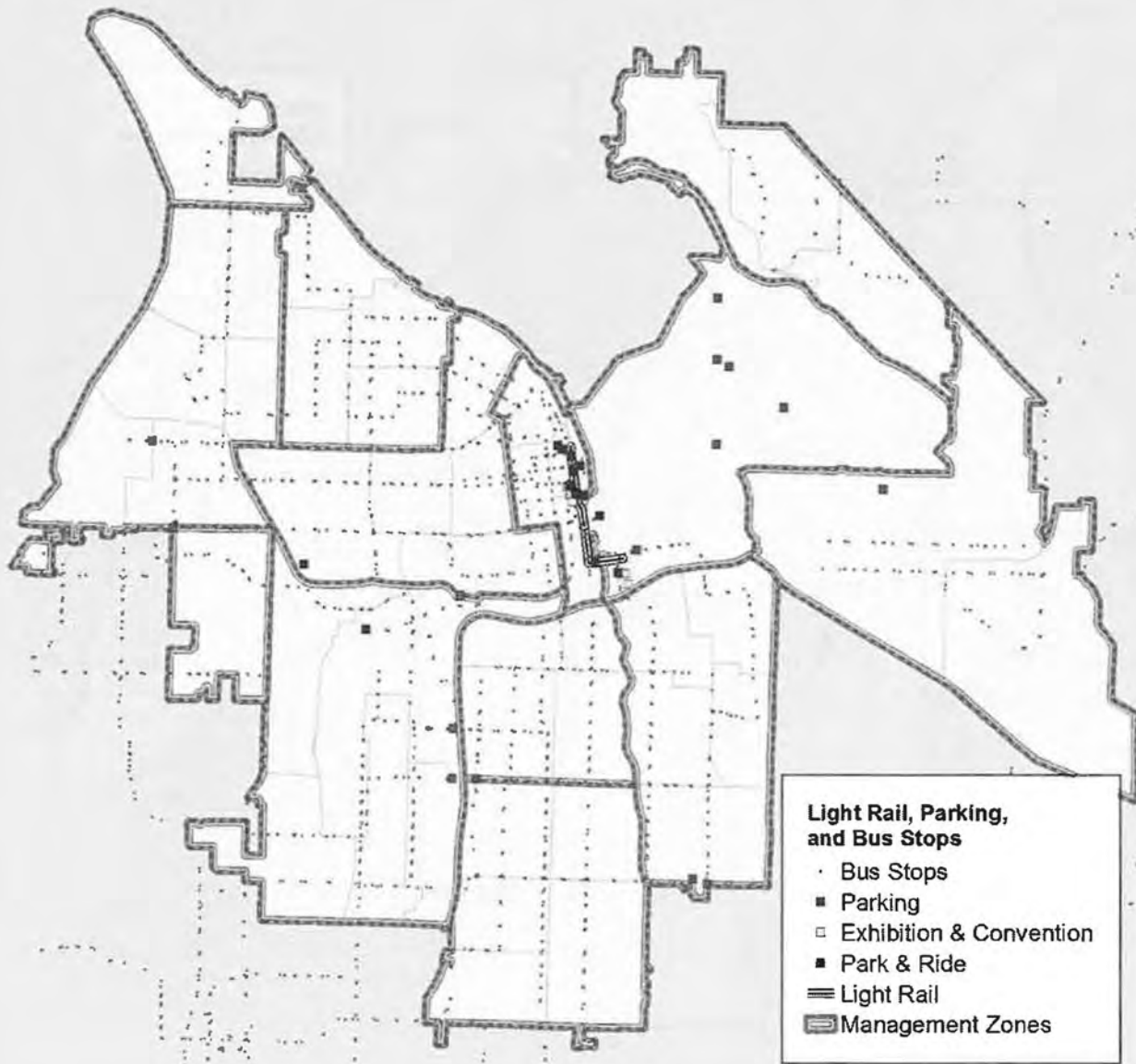
VACANT HOUSING UNITS



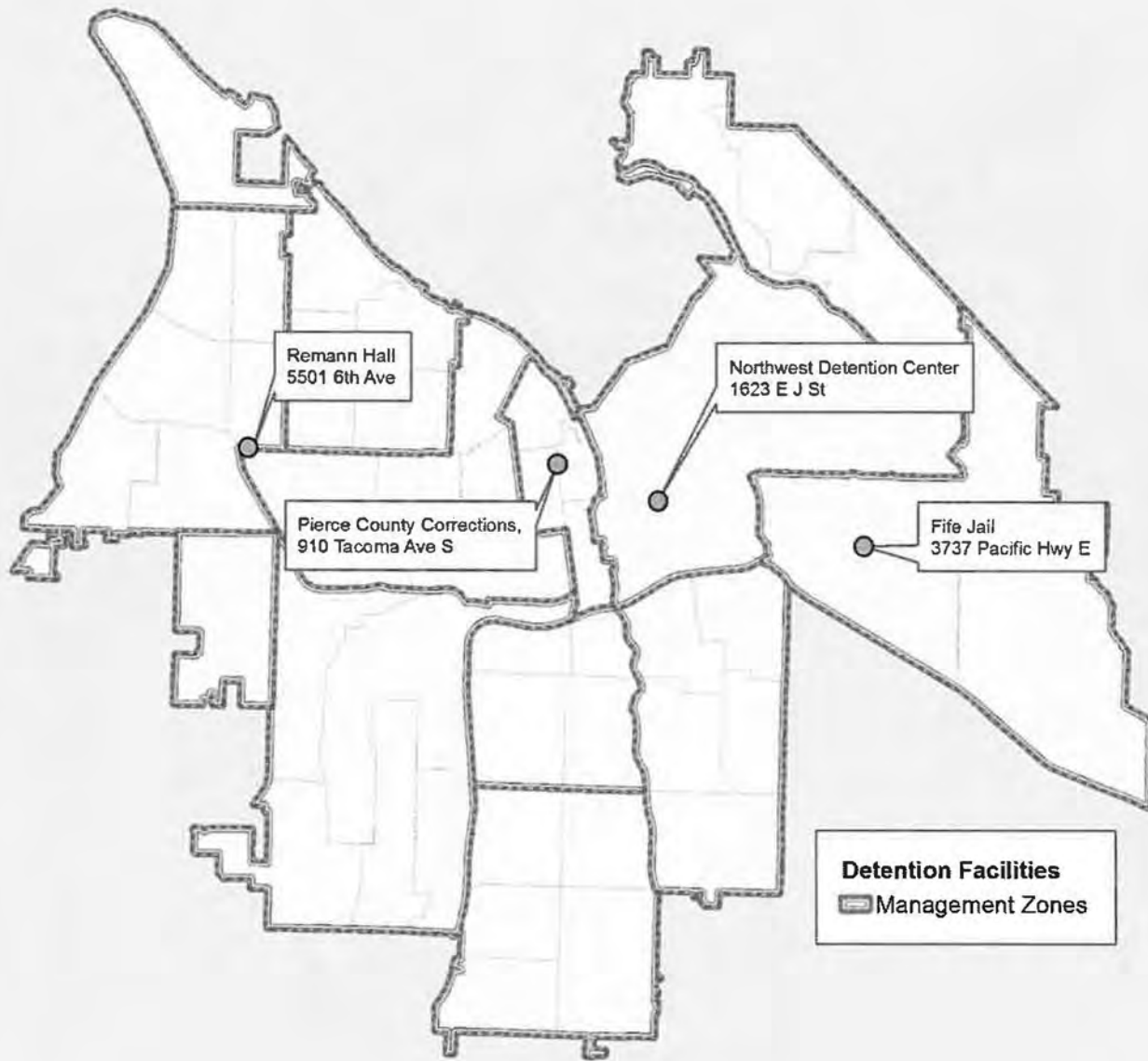
AREA BRIDGES



LIGHT RAIL FACILITIES



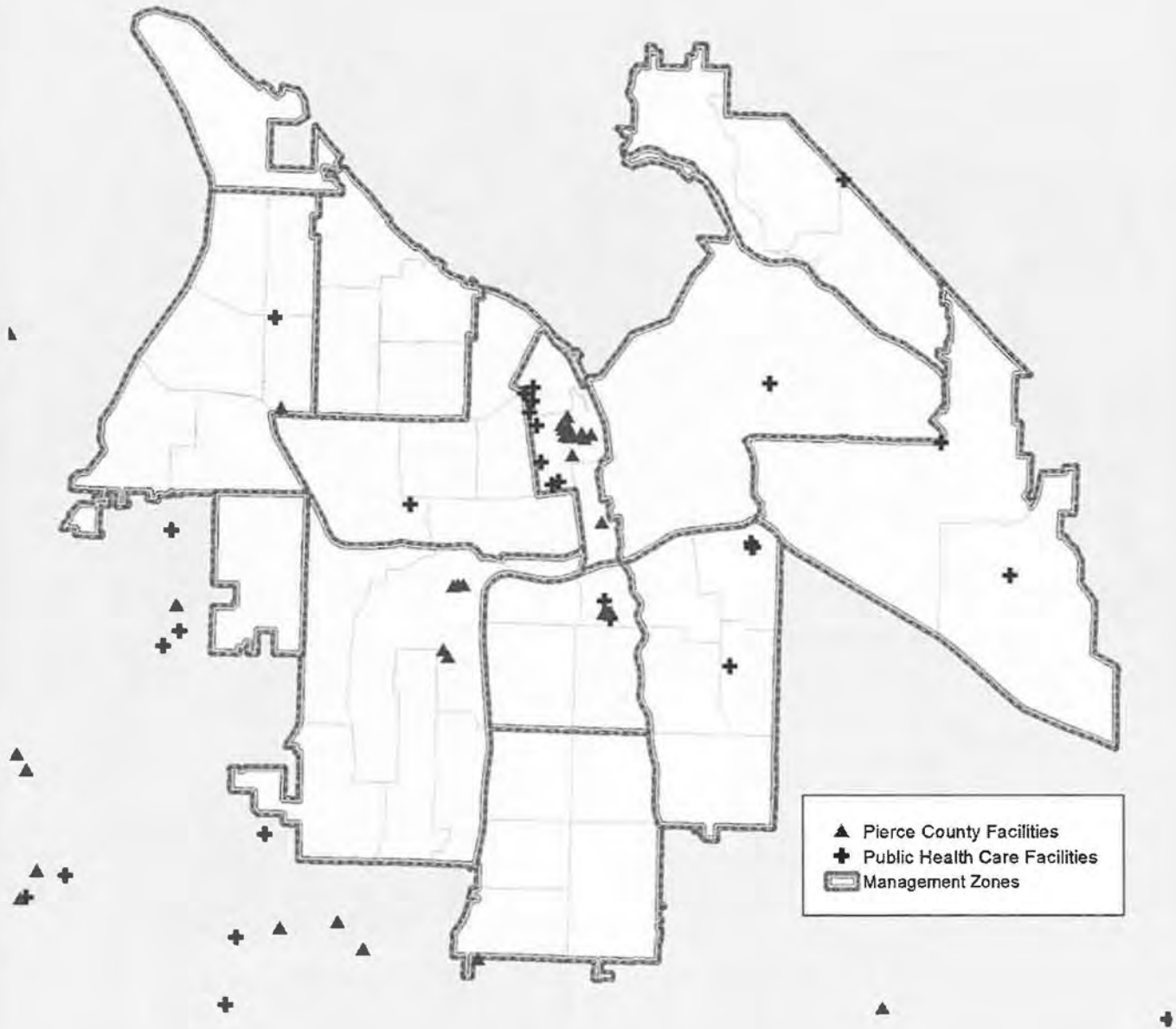
DETENTION FACILITIES



LIBRARIES/PARKS/SCHOOLS



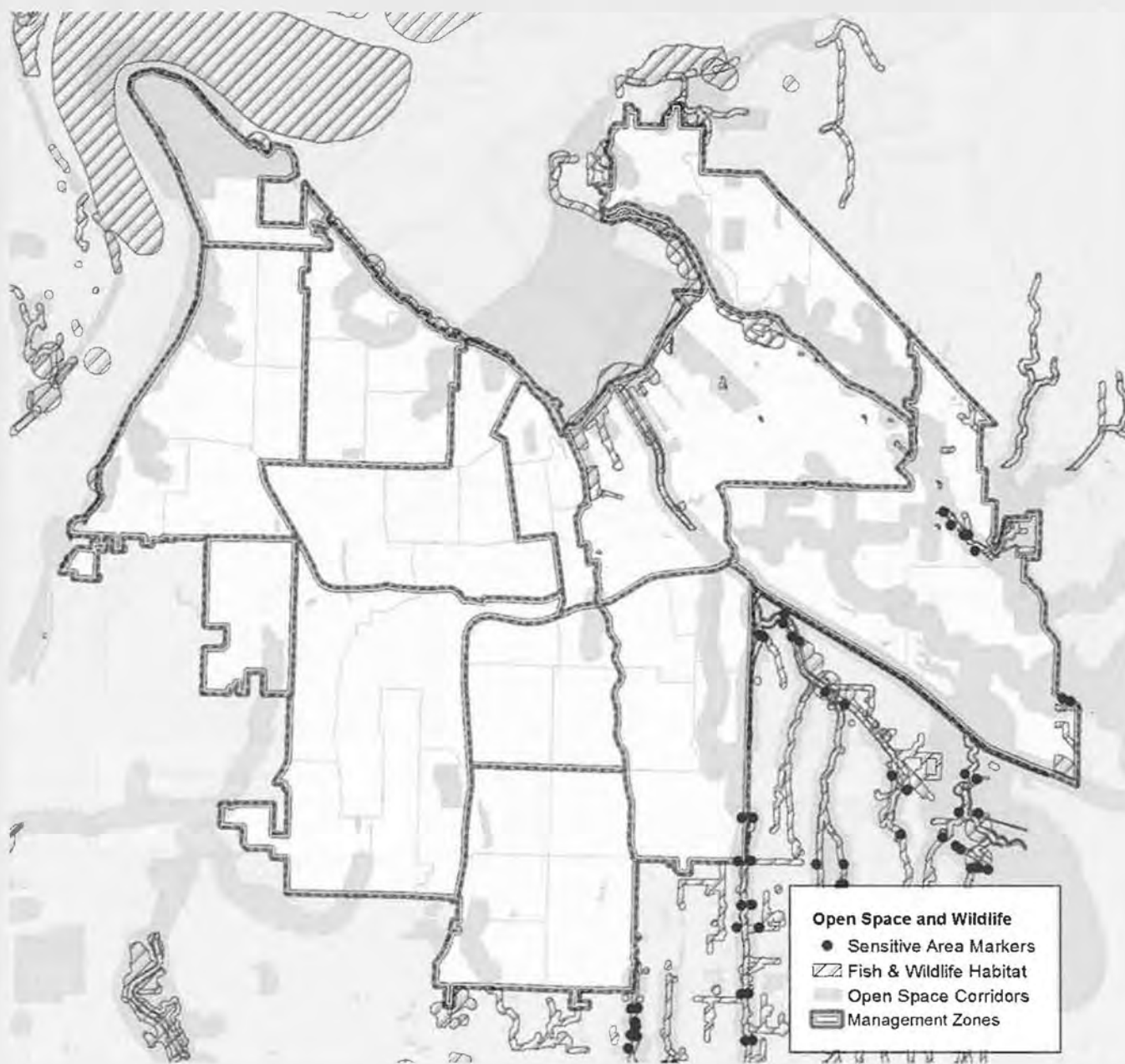
HEALTH CARE FACILITIES



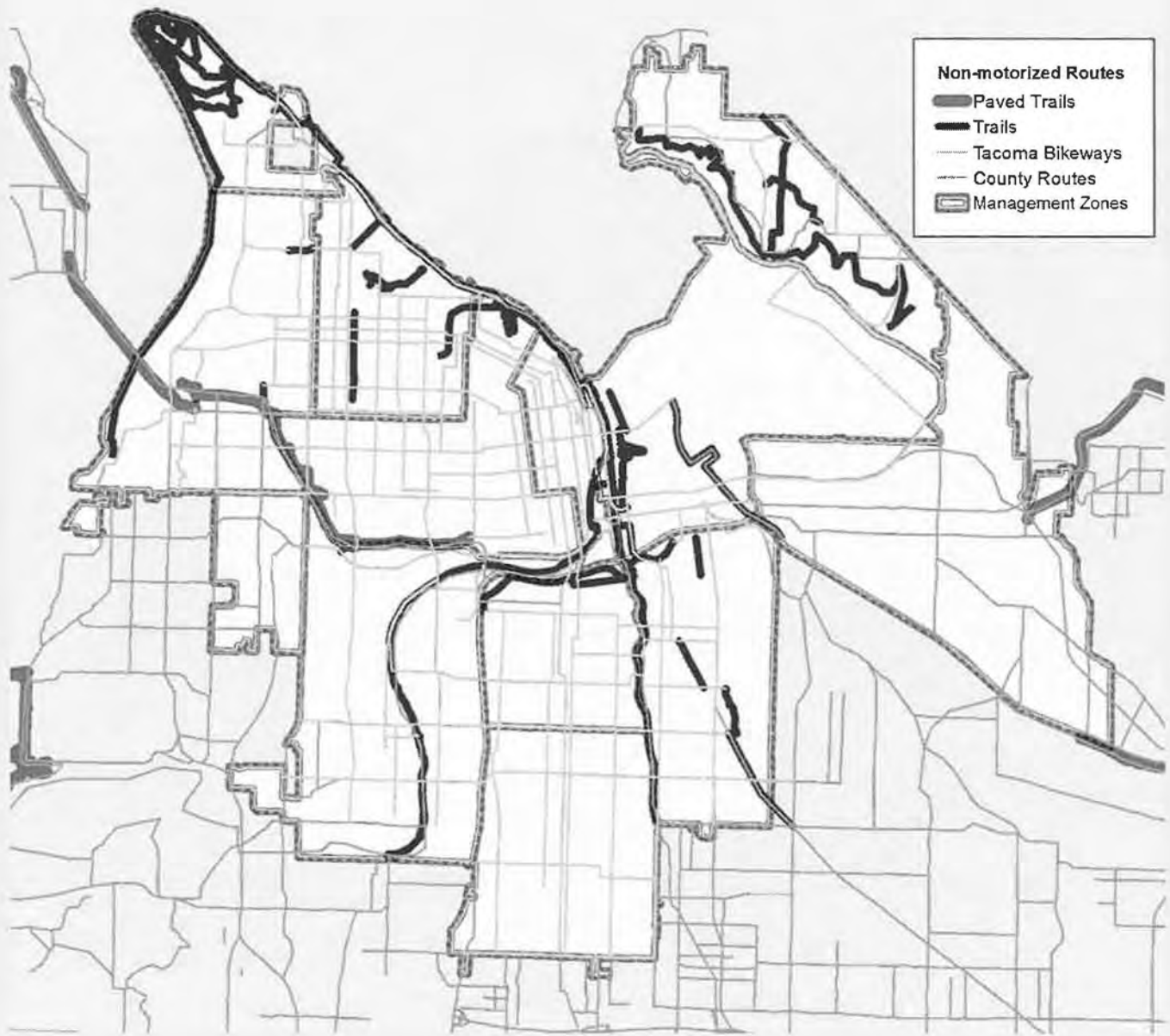
▲ Pierce County Facilities
+ Public Health Care Facilities
▭ Management Zones

APPENDIX C—ADDITIONAL ENVIRONMENTAL CONDITIONS

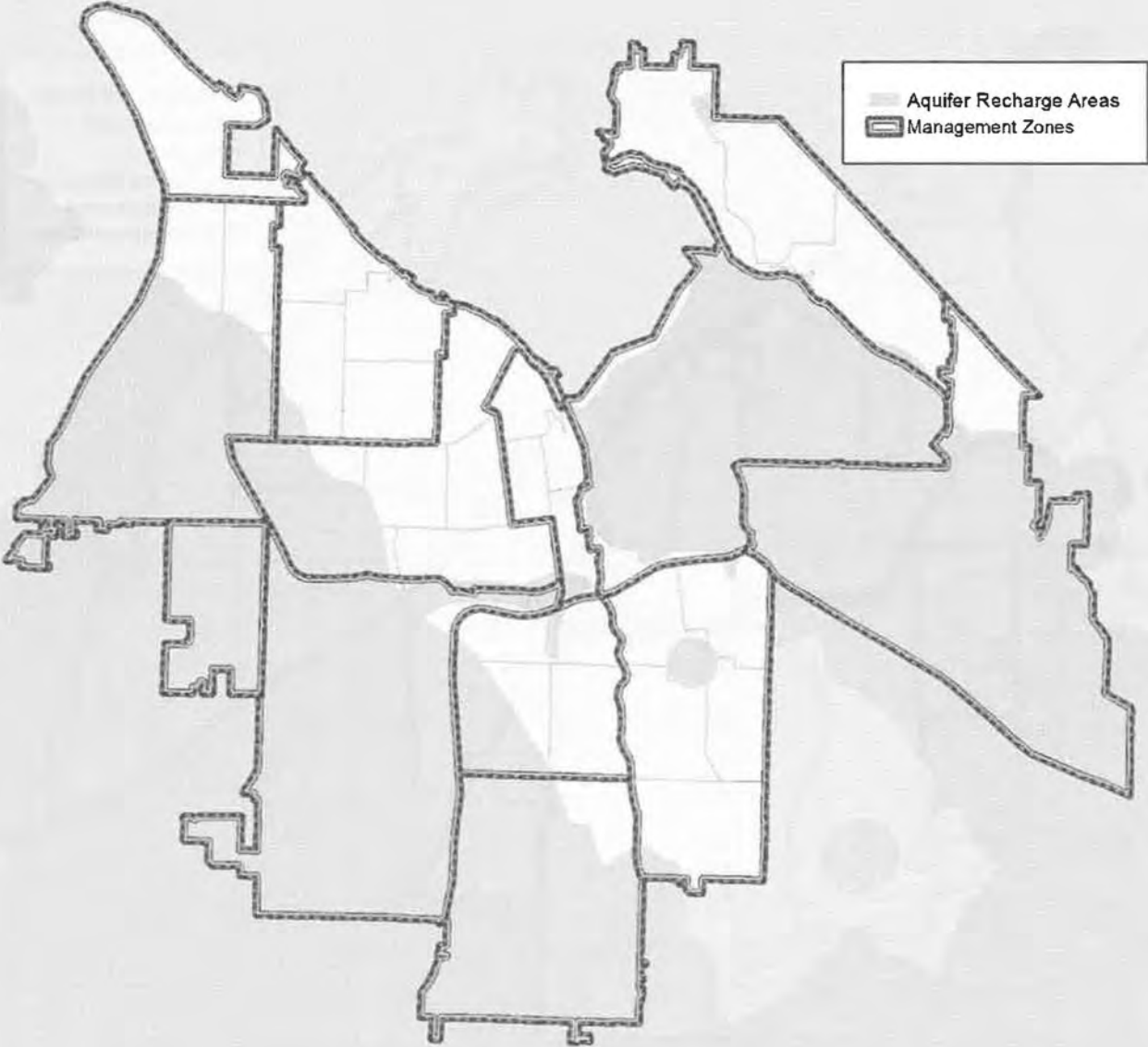
OPEN SPACES



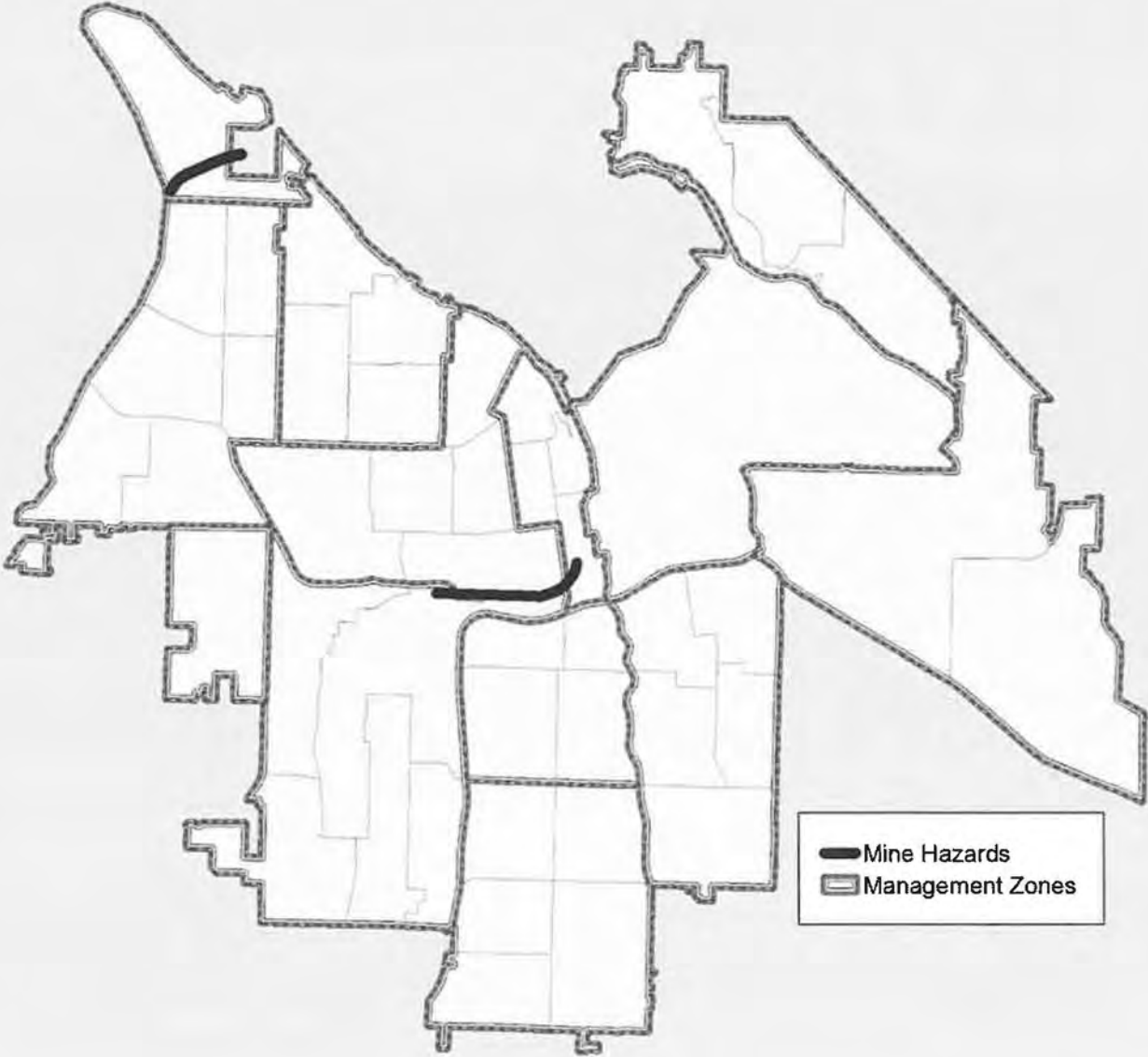
TRAILS



AQUIFER RECHARGE AREAS



UNDERGROUND HAZARDS



REFERENCES

Map	Page Number	Sources
10 Foot Contours, Elevation	31	City of Tacoma
2010 African American Population	79	US Census Bureau; Pierce County GIS Portal; Tacoma Fire Department Analysis
2010 Asian Population	78	US Census Bureau; Pierce County GIS Portal; Tacoma Fire Department Analysis
2010 Daytime Population	71	Puget Sound Regional Council preliminary estimates; Tacoma Fire Department Analysis to pro-rate counts by area
2010 Hispanic Population	77	US Census Bureau; Pierce County GIS Portal; Tacoma Fire Department Analysis
2010 Median Age	82	US Census Bureau; Pierce County GIS Data Portal
2010 Mixed Race Population	80	US Census Bureau; Pierce County GIS Portal; Tacoma Fire Department Analysis
2010 Native American Population	76	US Census Bureau; Pierce County GIS Portal; Tacoma Fire Department Analysis
2010 Occupied Housing Units	100	US Census Bureau; Pierce County GIS Data Portal; Tacoma Fire Department Analysis
2010 Pacific Islander Population	75	US Census Bureau; Pierce County GIS Portal; Tacoma Fire Department Analysis
2010 Population	8	US Census Bureau; Pierce County GIS Portal; Tacoma Fire Department Analysis
2010 Population, Other Races	81	US Census Bureau; Pierce County GIS Portal; Tacoma Fire Department Analysis
2010 Vacant Housing Units	101	US Census Bureau; Pierce County GIS Data Portal; Tacoma Fire Department Analysis
2010 White Population	74	US Census Bureau; Pierce County GIS Portal; Tacoma Fire Department Analysis
2013 Median Household Income	83	US Census Bureau; Pierce County GIS Data Portal
Aquifer Recharge Areas	109	Pierce County, WA, GIS Data Portal

Assessed Land Value	85	Pierce County Assessor GIS Parcels; Tax Account Table; TFD Management & Sub-Zones
Assessed Value Density per Square Mile	86	Pierce County Assessor GIS Parcels; Tax Account Table; TFD Management & Sub-Zones
Assessed Value Totals	11 & 89	Pierce County Assessor GIS Parcels; Tax Account Table; TFD Management & Sub-Zones
Assessed Value, Improvement Value	87	Pierce County Assessor GIS Parcels; Tax Account Table; TFD Management & Sub-Zones
Assessed Value, Improvement Value Per Sq. Mile Density	88	Pierce County Assessor GIS Parcels; Tax Account Table; TFD Management & Sub-Zones
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Daytime Population Estimates	9	Tacoma Fire Department Incident Database; Puget Sound Regional Council preliminary estimates; Tacoma Fire Department pro-rated area calculations
Earthquake Hazards Seismic Site Class	28	Washington State Department of Natural Resources, Liquefaction Susceptibility and Site Class Maps of Washington State, by County; Palmer, Magsino, Bilderback, Poelstra, Folger, and Niggemann; GER Portal Seismogenic Features
Earthquake Liquefaction Susceptibility	29	Washington State Department of Natural Resources, Liquefaction Susceptibility and Site Class Maps of Washington State, by County; Palmer, Magsino, Bilderback, Poelstra, Folger, and Niggemann; GER Portal Seismogenic Features
EMS Calls for Service, Change From 2010—2014	24	Tacoma Fire Department Incident Database

Fire Calls for Service, Change from 2010—2014	18	Tacoma Fire Department Incident Database
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Historic Buildings, Historic Place Register, Tacoma Historic Area	96	City of Tacoma, Community & Economic Development Dept., Pierce County GIS Data Portal
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Jails	104	Tacoma Fire Department; Google
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Light Rail, Parking, and Bus Stops	103	City of Tacoma, Community & Economic Development Dept., Pierce County GIS Data Portal, Pierce Transit
Management Zones	5	Tacoma Fire Department
Mine Hazards	110	City of Tacoma, Community & Economic Development Dept.
Mixed Use Centers	97	City of Tacoma, Community & Economic Development Dept.
Neighborhood Business Districts	94	City of Tacoma, Community & Economic Development Dept.
Neighborhood Council Districts	93	City of Tacoma, Community & Economic Development Dept.
Oil Pipelines	38	City of Tacoma; Washington Utilities and Transportation Commission map on https://wutc.maps.arcgis.com/home/webmap/viewer.html?webmap=0d3ae3c8eff94a2bbe462e1a8eadd139
Open Space and Wildlife	107	Pierce County GIS Data Portal
Pierce County Facilities, Public Health Care Facilities	106	City of Tacoma, Community & Economic Development Dept., Pierce County GIS Data Portal, Pierce Transit
Puyallup Tribal Lands	95	Puyallup Tribe GIS & City of Tacoma, Community & Economic Development Dept.
Population by Sub-Zone (resident)	70	US Census Bureau; Pierce County GIS Portal; Tacoma Fire Department Analysis
Railroads	37	Port of Tacoma; Pierce County GIS Data Portal

Steep Slopes	30	City of Tacoma, Community & Economic Development Dept.; Pierce County GIS Data Portal
Structure Fires, 2010-2014, Density Map	18	Tacoma Fire Department Incident Database
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Total Housing Counts	13	US Census Bureau; Pierce County GIS Data Portal; Tacoma Fire Department Analysis
Trails	108	Pierce County, WA, GIS Data Portal
Tsunami Hazard Area maps	32	Tacoma Fire Department; Pierce County GIS Data Portal; NOAA http://www.pmel.noaa.gov/pubs/PDF/vent2981/vent2981.pdf ; Tacoma, Washington, Tsunami Hazard Mapping Project: Modeling Tsunami Inundation from Tacoma and Seattle Fault Earthquakes; Venturato, Arcas, Titov, Mofjeld, Chamberlin, and Gonzalez
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Tacoma Council Meeting Public Form Feb 27, 2024
 submitted by Carol Sue Braten



The research was supported by the U.S. Geological Survey (USGS) under award number W142CR0073. The views and conclusions contained in this document are those of the authors and should not be interpreted as necessarily representing the official policies, either expressed or implied, of the U.S. Government. Additional support was provided by the Washington Department of Natural Resources.

EXAMPLES OF HISTORIC LIQUEFACTION EFFECTS
 The strong ground shaking that occurs during an earthquake can cause loose, sandy soil layers to become more compacted as the sand grains rearrange themselves. This is similar to the effect of shaking a sugar container to make more space at the top. Liquefaction occurs in the spaces between the sand grains as water saturated at the time of the earthquake. As the sand layers compact during the earthquake, the ground-water is expelled under pressure and will often vent to the surface.

The following two photographs document liquefaction effects in a residential neighborhood in Puyallup, WA that were caused by the 1915 Clinton earthquake. In the upper photograph, the street is flooded with standing water over two feet deep. This is the ground water expelled from the underlying loose soil as a result of liquefaction; there were no reported breakages in the water lines serving the area. The lower photograph shows that expelled ground water can cause significant amounts of liquefied sand to be ejected from the ground surface, depositing it in cone shaped piles called sand boils.



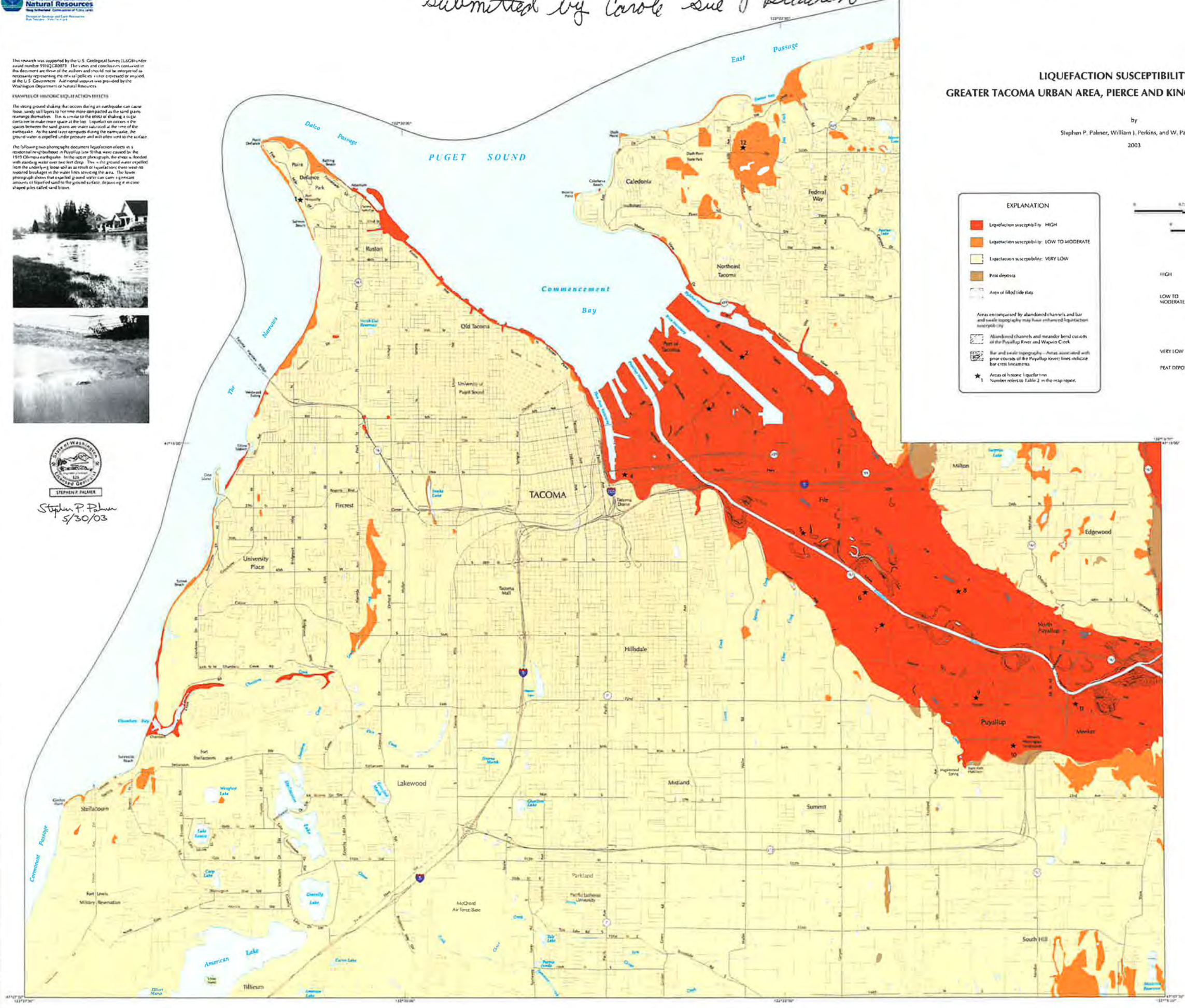
STEPHEN P. PALMER
 5/30/03



WASHINGTON DEPARTMENT OF GEOLOGY AND EARTH RESOURCES
 GEOLOGIC MAP 04-11

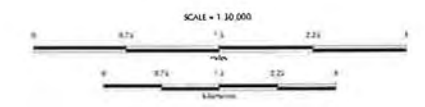
LIQUEFACTION SUSCEPTIBILITY OF THE GREATER TACOMA URBAN AREA, PIERCE AND KING COUNTIES, WASHINGTON

by
 Stephen P. Palmer, William J. Perkins, and W. Paul Grant
 2003



EXPLANATION

- Liquefaction susceptibility: HIGH
- Liquefaction susceptibility: LOW TO MODERATE
- Liquefaction susceptibility: VERY LOW
- Peat deposits
- Area of lifted tide stage
- Areas encompassed by abandoned channels and bar and swale topography may have enhanced liquefaction susceptibility.
- Abandoned channels and meander bend cut-offs of the Puyallup River and Wapich Creek
- Bar and swale topography - Areas associated with prior courses of the Puyallup River; lines indicate bar cross lineaments.
- ★ Areas of historic liquefaction. Number refers to Table 2 in the map report.



HIGH Areas underlain by recent (Holocene) deposits of the Puyallup River and major streams (such as Chambers Creek).

LOW TO MODERATE Areas underlain by recent (Holocene) beach and landward deposits and sandy outwash, glacial lake, and ice contact deposits from the recession of the latest Pleistocene continental glaciation (Washouli Stage) of the Fraser Glaciation. The liquefaction susceptibility of these sandy glacial deposits is greatest where they are disturbed by grab- and in areas with a shallow ground water table.

VERY LOW Areas underlain by all other Pleistocene glacial and nonglacial deposits.

PEAT DEPOSITS Areas underlain by recent (Holocene) peat deposits, mostly in the Puyallup Valley. Peat is not susceptible to liquefaction but may undergo permanent displacement or loss of strength as a result of earthquake shaking. Also, sand boils within the peat deposits may be liquefiable.

WHAT IS LIQUEFACTION?
 LIQUEFACTION is a phenomenon in which strong earthquake shaking causes a soil to rapidly lose its strength and behave like quicksand. Liquefaction typically occurs in artificial fill and areas of loose sandy soils that are saturated with water, such as low lying coastal areas, lake shores, and river valleys. When soil strength is lost during liquefaction, the consequences can be catastrophic. Movement of liquefied soils can rupture pipelines, move large structures and road and railway alignments, and pull apart the foundations and walls of buildings.

Ground movement resulting from liquefaction caused massive damage to highways and railways through the southern Alaska during the 1964 Good Friday earthquake. Liquefaction was a contributing factor to the serious building damage that occurred in the Marina District of San Francisco during the 1906 Loma Prieta earthquake. Control of the resulting fires in the Marina District was severely hampered because water lines in the area were broken by liquefaction induced ground movement. Damage caused by liquefaction to the port area of Kobe, Japan, during the 1995 earthquake resulted in billions of dollars in reconstruction costs and lost business.

WHAT IS A LIQUEFACTION SUSCEPTIBILITY MAP?
 A LIQUEFACTION SUSCEPTIBILITY MAP provides an estimate of the likelihood that the soil will liquefy as a result of earthquake shaking. This type of map depicts the relative hazard in terms of high, moderate, or low liquefaction susceptibility. The hazard zones shown on this map were determined using geologic mapping and quantitative analysis of data from more than 300 geotechnical borings drilled in the study area.

HOW CAN THIS MAP BE USED?
 LIQUEFACTION HAZARD MAPS such as this can be used for many different purposes by a variety of users. For example:

- Emergency managers can determine which critical facilities and lifelines are located in hazardous areas.
- Building officials and engineers can select areas where detailed geotechnical studies should be performed before new construction or retrofitting older structures.
- Facilities managers can assess the vulnerability of corporate and public facilities - including schools, and recommend actions required to minimize earthquake damage and loss.
- Insurance providers can determine relative seismic risk to and in their calculations of insurance ratings and premiums.
- Land use planners can recommend appropriate zoning and land use in high hazard areas to promote long term resilience of earthquake losses by reducing vulnerability.
- Private property owners can guide their decisions on retaining, purchasing, and upgrading their properties.

This map is meant only as a general guide to indicate areas prone to liquefaction. It is not a substitute for site specific studies to assess the potential for liquefaction for any development project. Because the data used in the liquefaction susceptibility assessment have been subdivided on the basis of regional geologic mapping, this map cannot be used to determine the presence or absence of liquefaction soils beneath any specific location. This determination requires a site-specific geotechnical investigation performed by a qualified geotechnical engineer. For additional information, write to the technical map report.



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 Website: www.dnr.wa.gov
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Tsunami Hazard Map of Tacoma, Washington: Model Results for Seattle Fault and Tacoma Fault Earthquake Tsunamis

by
Timothy J. Walsh¹, Diego Arcas², Angie J. Venturato², Vasily V. Titov², Harold O. Mofjeld², Chris C. Chamberlin², and Frank I. González²
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²NOAA Center for Tsunami Research, NOAA/PMEL-JWJ/JIASO, 7600 Sand Point Way NE, Seattle, WA 98115

Modeled Inundation from a Seattle Fault Tsunami



Modeled Inundation from a Tacoma Fault (left) and a Tacoma-Rosedale Fault (right) Tsunami

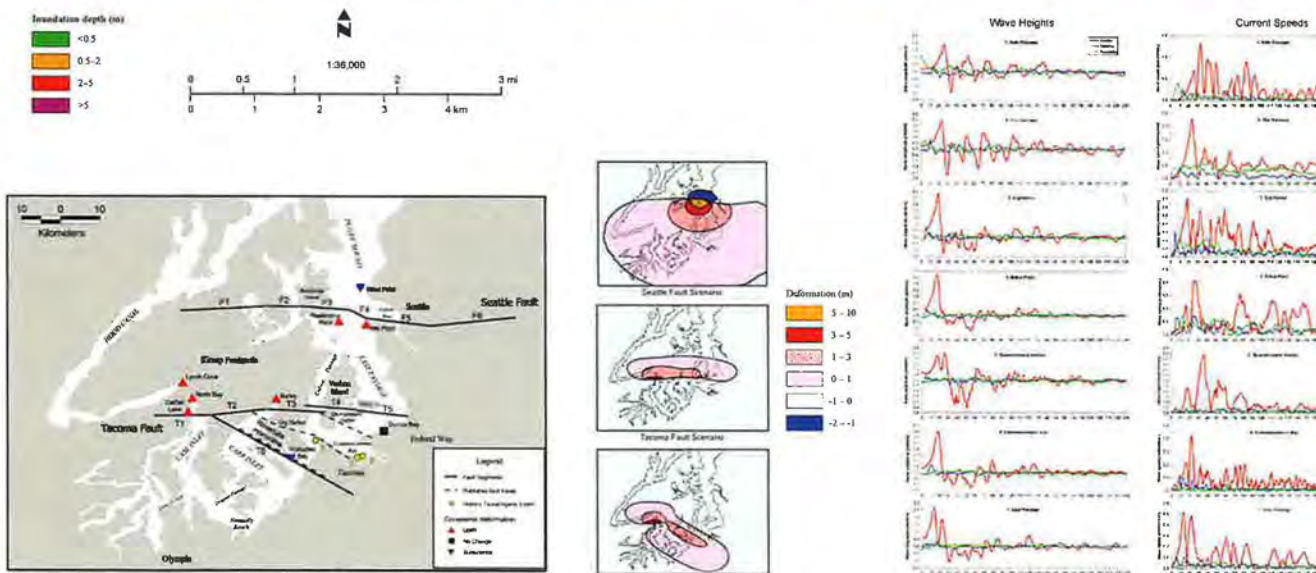


Figure 2. Deformation models for the three scenarios used in this study. From Venturato and others (2007).

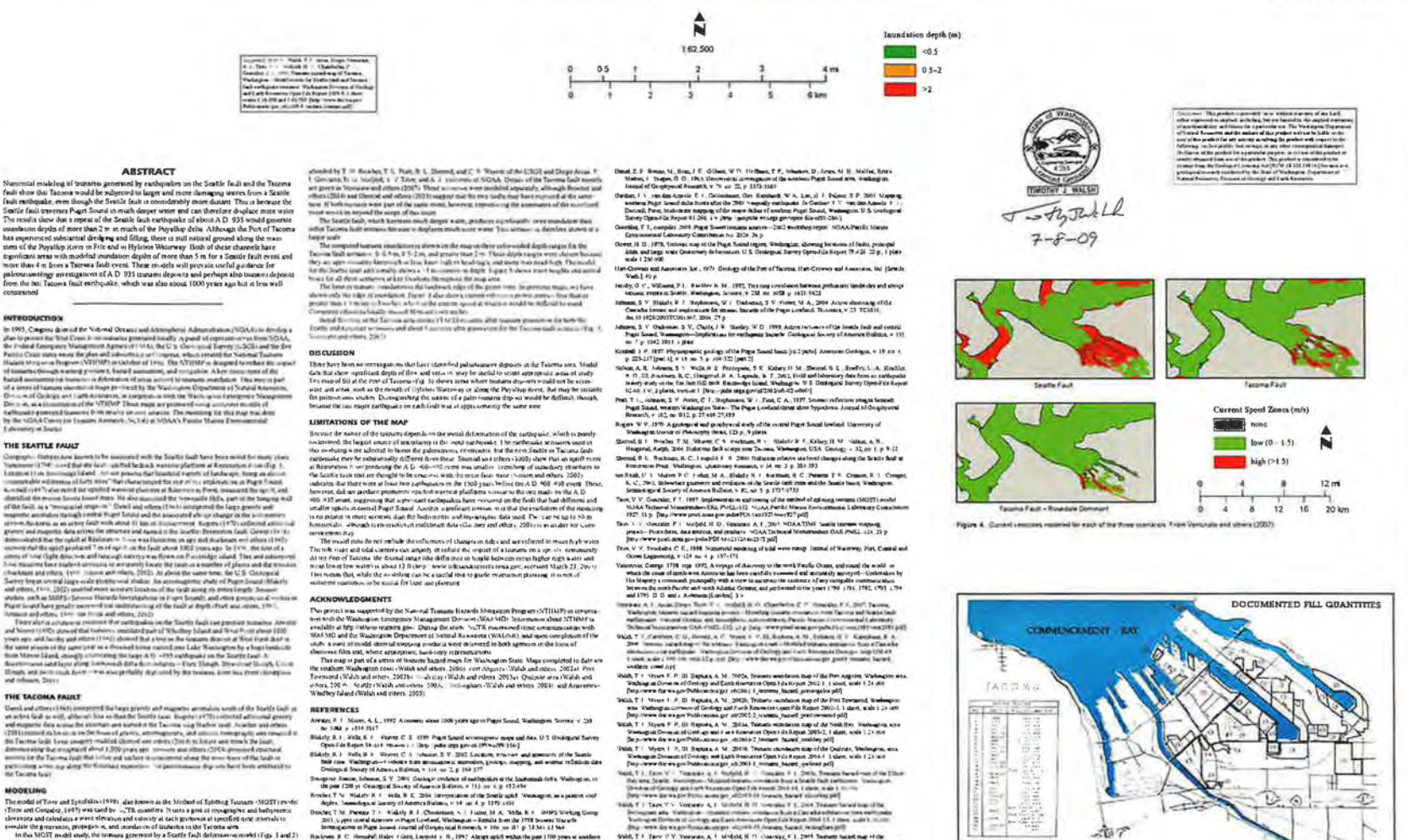


Figure 3. Time series of tsunami wave heights and current speeds at several sites of the study region. Relative peak elevations are shown. Negative elevations are wave troughs or tsunamis when water is flowing out to sea. From Venturato and others (2007).

ABSTRACT
Statistical modeling of tsunamis generated by earthquakes on the Seattle fault and the Tacoma fault show that Tacoma would be subjected to larger and more damaging waves from a Seattle fault earthquake, even though the Seattle fault is considerably more distant. This is because the Seattle fault tsunami propagates toward Tacoma from the north, and the Tacoma fault tsunami propagates toward Tacoma from the south. The results show that a repeat of the Seattle fault earthquake of about A.D. 925 would generate inundation depths of more than 2 m in much of the Puget Bay delta. Although the Port of Tacoma has experienced substantial diking and filling, there is still unraised ground along the western margin of the Puget Bay delta and in Hyacinth Wharves. Both of these channels have significant areas with potential inundation depths of more than 1 m for a Seattle fault event and more than 0.5 m for a Tacoma fault event. These models will provide useful guidance for planning and engineering of A.D. 925 tsunami deposits and perhaps also tsunami deposits from the Tacoma fault earthquake, which was also about 1000 years ago but is less well constrained.

INTRODUCTION
In 1995, Congress directed the National Oceanic and Atmospheric Administration (NOAA) to develop a plan to assess the threat from tsunamis generated locally, a goal of approximately 100 years (NOAA, 1995). The National Oceanic and Atmospheric Administration (NOAA) and the United States Geological Survey (USGS) and the Pacific Coastal States have the plan and submitted a report, which covered the Tacoma Tsunami Hazard Study in the Puget Sound region of western Washington. The USGS developed the hazard study of tsunamis through a series of studies, hazard assessment, and mitigation. A key element of the hazard assessment was the determination of wave arrival times to various locations. This was part of a series of tsunami studies in the Puget Sound region of western Washington, including the Tacoma Tsunami Hazard Study, which was completed in 2007. The Tacoma Tsunami Hazard Study was a continuation of the Tacoma Tsunami Hazard Study, which was completed in 2007. The Tacoma Tsunami Hazard Study was a continuation of the Tacoma Tsunami Hazard Study, which was completed in 2007. The Tacoma Tsunami Hazard Study was a continuation of the Tacoma Tsunami Hazard Study, which was completed in 2007.

THE SEATTLE FAULT
The Seattle fault zone is associated with the Seattle fault and has been well studied since the late 1970s. The Seattle fault zone is a strike-slip fault that extends for about 100 km along the western margin of the Puget Sound region. The Seattle fault zone is a strike-slip fault that extends for about 100 km along the western margin of the Puget Sound region. The Seattle fault zone is a strike-slip fault that extends for about 100 km along the western margin of the Puget Sound region.

THE TACOMA FAULT
The Tacoma fault zone is associated with the Tacoma fault and has been well studied since the late 1970s. The Tacoma fault zone is a strike-slip fault that extends for about 100 km along the western margin of the Puget Sound region. The Tacoma fault zone is a strike-slip fault that extends for about 100 km along the western margin of the Puget Sound region. The Tacoma fault zone is a strike-slip fault that extends for about 100 km along the western margin of the Puget Sound region.

ACKNOWLEDGMENTS
This project was supported by the National Oceanic and Atmospheric Administration (NOAA) through the Pacific Coastal States Tsunami Hazard Study. The project was supported by the National Oceanic and Atmospheric Administration (NOAA) through the Pacific Coastal States Tsunami Hazard Study. The project was supported by the National Oceanic and Atmospheric Administration (NOAA) through the Pacific Coastal States Tsunami Hazard Study.

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Arcas, D., Titov, V. V., and Mofjeld, H. O., 2007. Tsunami hazard assessment of the Puget Sound region, Washington State, U.S.A. *Journal of Geophysical Research*, 112, B03307, doi:10.1029/2006JB004601.
Chamberlin, C. C., Titov, V. V., and Mofjeld, H. O., 2007. Tsunami hazard assessment of the Puget Sound region, Washington State, U.S.A. *Journal of Geophysical Research*, 112, B03307, doi:10.1029/2006JB004601.
González, F. I., Titov, V. V., and Mofjeld, H. O., 2007. Tsunami hazard assessment of the Puget Sound region, Washington State, U.S.A. *Journal of Geophysical Research*, 112, B03307, doi:10.1029/2006JB004601.

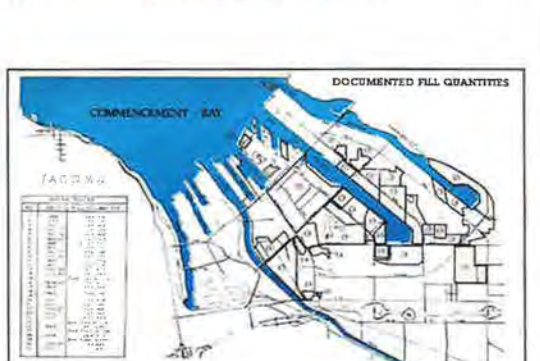
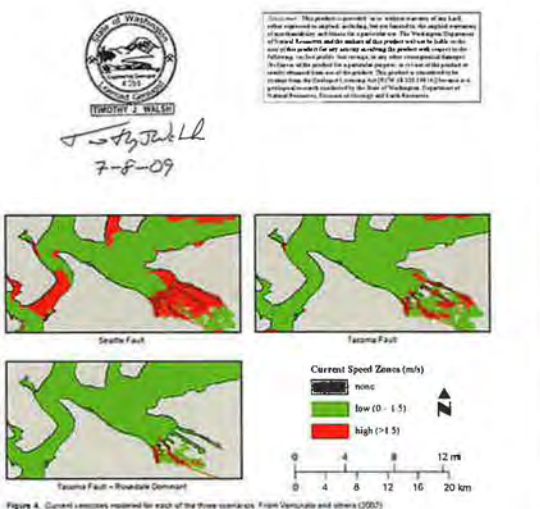
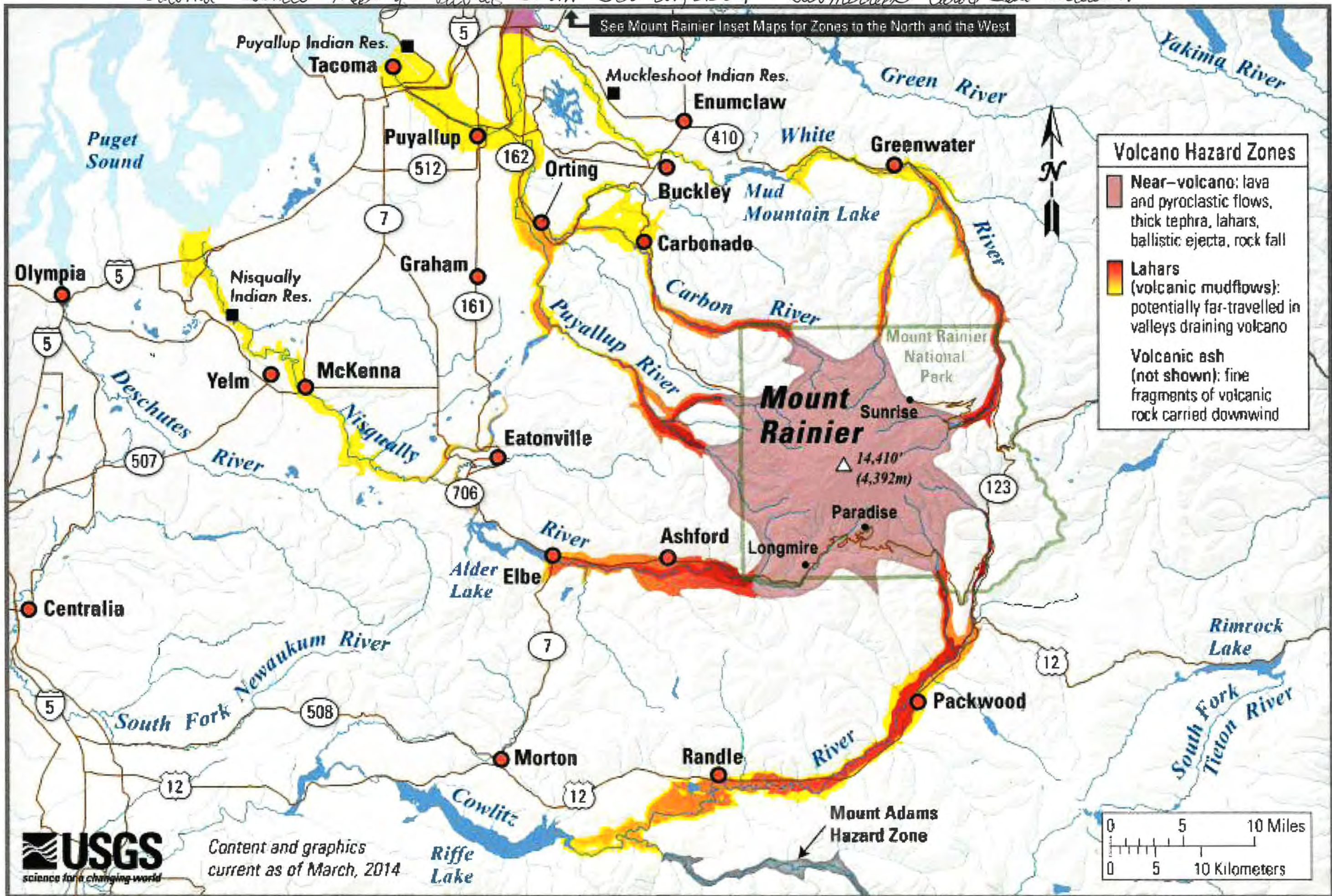


Figure 5. Cross-sections and dates of emplacement at the Port of Tacoma. From Hart-Crocker and Associates Inc. (1974).



From: City Clerk's Office
Sent: Friday, March 1, 2024 9:08 AM
To: Waldron, Jasinda (Legal)
Subject: Fw: An Open Letter to the City Council About Civility in City Council Meetings

Please see below.

Thank you,

Hollyann

City of Tacoma | City Clerk's Office
253-591-5505 | cityclerk@cityoftacoma.org

From: Emery, Nicole (Legal) <nemery@cityoftacoma.org>
Sent: Friday, March 1, 2024 8:14 AM
To: City Clerk's Office <cityclerk@cityoftacoma.org>
Subject: FW: An Open Letter to the City Council About Civility in City Council Meetings

From: Jessica Chandler <jchandlertac253@gmail.com>
Sent: Friday, March 1, 2024 5:58 AM
To: Emery, Nicole (Legal) <nemery@cityoftacoma.org>
Subject: Fwd: An Open Letter to the City Council About Civility in City Council Meetings

Please add this to the written comment for Tuesday's community forum. Thank you.

Begin forwarded message:

From: Jessica Chandler <jchandlertac253@gmail.com>
Date: February 29, 2024 at 5:47:29 PM PST
To: vwoodards@cityoftacoma.org, jhines1@cityoftacoma.org, jscott8@cityoftacoma.org,
kdaniels@cityoftacoma.org, jbushnell2@cityoftacoma.org, cushka@cityoftacoma.org, kwalker@cityoftacoma.org,
srumbaugh@cityoftacoma.org, odiaz@cityoftacoma.org
Cc: hkim2@cityoftacoma.org, kingsol@cityoftacoma.org, melanie.harding@cityoftacoma.org,
aclancy@cityoftacoma.org, rmyers@cityoftacoma.org, shallum@cityoftacoma.org, epauli@cityoftacoma.org
Subject: An Open Letter to the City Council About Civility in City Council Meetings

In an era marked by political polarization and rampant incivility, it is imperative that you reclaim the value of civil discourse in our local government setting. Council meetings, where you, our elected officials, deliberate on matters affecting our communities, should serve as exemplars of respectful and productive dialogue. Your last meeting was not, and you fully allowed it to happen.

Civil discourse fosters a welcoming and inclusive environment that encourages all voices to be heard and considered. What happened on Tuesday was not civil discourse. You allowed a few loud voices to limit other viewpoints from being heard and you are wholly to blame for allowing cancel culture to prevail. When differing viewpoints cannot be valued without resorting to personal attacks or verbal abuse, something is wrong.

Moreover, you should also realize that civil discourse enhances the quality of decision-making. By focusing on facts, evidence, and rational arguments, you as councilmembers can objectively assess issues and reach better-informed decisions that benefit the community as a whole. You cannot allow personal agendas or emotional outbursts to cloud the dialogue, as it becomes difficult to make sound judgments based on the best interests of

the people.

Do you think even care about making sound judgments? Unruly behavior, personal attacks, and a lack of civility undermine the very purpose of local government and the fact that you ALLOWED that to happen erodes public trust. It is essential that you address these issues and restore a culture of respectful communication.

By protecting civil discourse, you create a stronger and more inclusive democracy. Council meetings can actually become places where citizens can engage in meaningful dialogue, express their concerns, and participate in shaping their community's future without cancelling each other out.

We urge you to commit to upholding the principles of civil discourse. When these serial protestors return in a week or two what will you do?

Do better.

Jessica Chandler