

Marconi Light Rail Station

Technical Background Report



COMMUNITY DEVELOPMENT DEPARTMENT
CITY OF SACRAMENTO

300 Richards Blvd.
Sacramento, CA 95811

Marconi Light Rail Station

Technical Background Report

Department of Community Development

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Max Fernandez, Department Director

David Kwong, Planning Director

PROJECT STAFF

Teresa Haenggli, Associate Planner

thaenggli@cityofsacramento.org

(916) 808-7554

Jim McDonald AICP, CFM, Senior Planner

jmcdonald@cityofsacramento.org

(916) 808-5723

Tom Pace, Long Range Manager

tpace@cityofsacramento.org

(916) 808-6848

Contributors

Melissa Anguiano, Economic Development Manager, Economic Development Department

Robert Armijo, Senior Engineer, Department of Utilities

Marti Brown, Senior Planner, Sacramento Housing and Redevelopment

Traci Canfield, Planner, Sacramento Regional Transit

Josh Cannon, GIS Specialist I, Department of Community Development

Ed Cox, Alternate Modes Coordinator, Department of Transportation

Mary de Beauvieres, Principle Planner, Department of Parks and Recreation

Martin Farber, Consultant, Department of Utilities

Samar Hajeer, Senior Engineer, Department of Transportation

Sparky Harris, Senior Planner, Department of Transportation

Chris Pahule, Assistant Director, Sacramento Housing and Redevelopment Agency



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Technical Background Report

TABLE OF CONTENTS

I. Marconi Station Study Area Map	1
II. Executive Summary	2
III. Marconi Station and Transit-Oriented-Development	
▪ Overview	5
▪ Existing Uses.....	6
▪ Photograph	
○ Existing Employment	8
○ Existing Neighborhoods	9
○ Design Enhancement Examples	10
○ Potential Re-use Examples	11
○ Transit-Oriented-Development	12
IV. Site Description	
▪ Marconi Light Rail Station	13
▪ Ben Ali and Hagginwood Neighborhoods.....	15
▪ Vacant Parcels	17
▪ Schools and Parks.....	19
V. Infrastructure	
▪ Complete Streets - Access.....	21
▪ Sidewalks and Streetlights	25
▪ City Utilities	27
VI. General Plan Land Use Designations	29
VII. Zoning.....	31
VIII. Planning Resources and Guides	33
IX. Recommendations	34

Marconi Light Rail Station

Technical Background Report

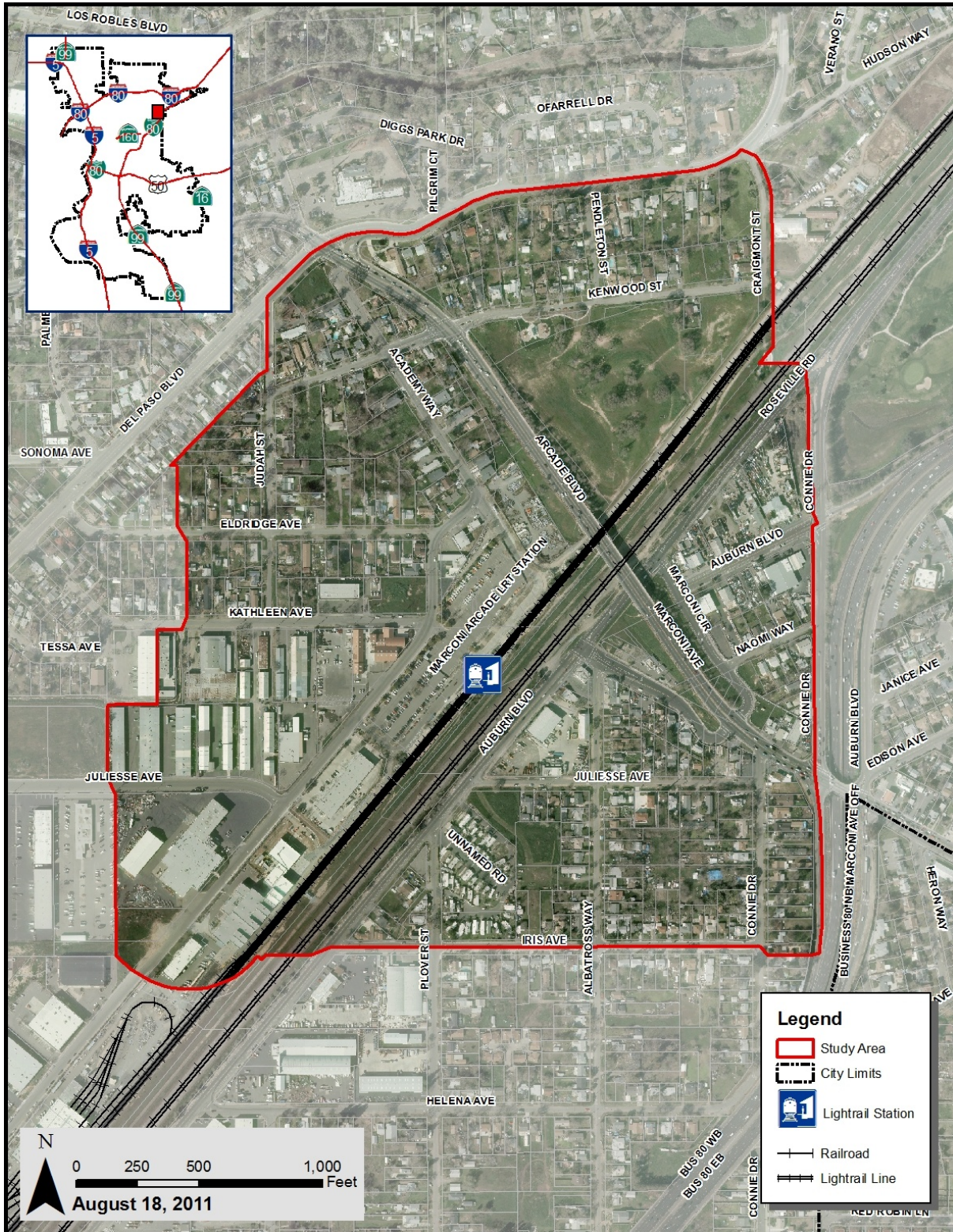
ATTACHMENTS

1. Existing Planning Resources and Guides.....	36
2. Existing Land Use Policies and Regulations.....	39
3. Light Rail Ordinance Summary.....	42
4. Transportation Programming Guide.....	43
5. Utilities Infrastructure.....	44
6. Drainage Basin 159 Study.....	46

Marconi Light Rail Station

Technical Background Report

I. MARCONI STATION STUDY AREA



Marconi Light Rail Station

Technical Background Report

II. EXECUTIVE SUMMARY

The Marconi Station Technical Background Report covers two distinct residential communities with active neighborhood associations (Ben Ali and Hagginwood), viable businesses that contribute to the city's economy, a neighborhood park, and a centrally located light rail station. The Marconi Light Rail Station is the only station on the Northeast Line without a comprehensive plan dedicated to its transition to transit-oriented development.

This Technical Background Report identifies opportunities and constraints for the Marconi Station study area that will inform future planning efforts. The report includes:

- A description of existing features
- Information about current infrastructure and recommended upgrades (where required)
- A summary of land use policies and regulations that supports Transit-Oriented Development
- Identification of Opportunities and Constraints
- Recommendations for short- and long-term actions to promote development.

Transforming an underutilized area near a light rail station into transit-oriented development (TOD) is a gradual process realized through well-timed and effective assistance from both the private and public sector. Strengthening existing assets is a vital first step. This report identifies the Marconi Station area's development and redevelopment.

Potential TOD Sites. Currently, the Marconi Station area includes a mix of manufacturing, single-family homes, and a few commercial and multi-family sites. While mostly built-out, the area has several vacant parcels. Most notably, the Sacramento Housing Authority (SHA) and Sacramento Regional Transit (RT) each own property on Academy Way. RT's Transit for Livable Communities document identifies the RT-owned property as an opportunity site for TOD. The city's

Marconi Station Study Area Quick Look

Opportunities

- Two vacant sites, owned by RT (5-acres) and the Sacramento Housing Authority (.7 acres), offer a significant opportunity for development.
- A critical site was recently rezoned from industrial to commercial.
- Existing buildings and infrastructure provide opportunities for re-use and economic development. Potential re-use could include a live/work arts district or a cluster of boutiques and unique retail uses.
- Roadways, sewer, and water supply are sufficient to support growth projected in the 2030 General Plan.

Constraints

- Access is inconvenient.
- Insufficient drainage causes local flooding in some areas.
- Light and heavy rail tracks separate the Hagginwood and Ben Ali neighborhoods.
- Marconi station sits on the Hagginwood side of the tracks; Ben Ali has no direct access to the station.
- Sidewalks and streetlights are in poor condition or absent.
- Market conditions do not currently support transit-oriented development at the Marconi site.

Marconi Light Rail Station

Technical Background Report

General Plan designated both the Sacramento Housing Authority (SHA) and RT sites as Urban Center Low and recently rezoned property adjacent to the RT site from light industrial to commercial. Both sites could provide mixed-use projects with housing and commercial uses that would serve the new residents, existing neighborhoods, and commuters who park at the station.

Existing Light Industrial Areas. Only the SHA and RT owned sites appear to be able to support TOD development in the near future. The existing industrial sites, however, offer many opportunities to transition the area. These uses, most prominent in the southwest quadrant of the project area, consist of several large buildings that have potential to host a variety of uses such as manufacturing, office, and retail. These uses could intensify activity, provide employment opportunities, and attract people to the area. Such re-use of the existing businesses, buildings, and infrastructure may act as a catalyst to future TOD supportive development.

Residential Areas. The established residential areas are predominantly single-family homes of diverse architecture that offer an appealing quality that should be preserved. Neighborhood improvements, such as sidewalks and streetlights would increase activity and safety for residents. Vacant property could be developed with new types of housing, such as condos and live-work spaces that would provide a range of housing while being sensitive to the existing community.

Market Opportunities and Constraints. As stated above, the SHA and RT properties compose the only sites in the Marconi Station area that are likely to see TOD development in the foreseeable future. This is mostly a result of market constraints. However, the Marconi Station area does have features that offset some of the market constraints. A summary of the market opportunities and constraints affecting the area are summarized below.

Market Opportunities

- The area is adjacent to the Capitol Freeway and near Highway 80.
- A light rail station has direct bus service and a parking lot, and is located in the center of the study area.
- Existing vacant buildings provide opportunities for re-use, or for existing, new or expanding businesses to move into the area.
- The area offers affordable housing.

Market Constraints

- Existing development, which is low intensity residential and industrial, does not support new retail or commercial uses.
- The light rail and heavy rail tracks creates a barrier that limits circulation.
- The area is not an active commercial corridor or center, and does not offer destination attractions.
- There is no prominent intersection.
- Other than the RT site, large development projects would require acquisition of several parcels owned by different property owners.

Marconi Light Rail Station

Technical Background Report

Section IX of this report provides several recommendations for the Marconi Station area. In general, the report's findings support delaying comprehensive planning effort for the Marconi Station area until market conditions are more favorable. Meanwhile, near- and mid-term actions can take place to position the area to be successfully responsive to the market when it improves.

Pages 6 through 10 provides photographs that illustrate what this transition may look like.

Community Outreach. This document is not intended to take the place of community outreach for future planning efforts. The Hagginwood and Ben Ali Associations should be consulted during future planning efforts because of their familiarity with issues in the study area.

Summary of Recommended Actions.

Short Term Actions (1 to 3 years)

- Provide a connection under the Marconi Avenue Overcrossing between the light rail station and Mackey Park.
- Incorporate greater flexibility in transitional uses in the Employment Center Low Rise designation in the Green Zoning Code (zoning code update).
- Reconfigure traffic lanes on the Marconi Avenue overcrossing to allow for bike lanes and safer pedestrian facilities.
- Address flexibility in land uses in the zoning code, including housing in light industrial areas, to assist in future development of this area.
- Rezone the Regional Transit site to allow mixed use development.

Mid-Term Actions (3 to 5 years)

- Construct sidewalks on key streets to provide safe pedestrian access to the Marconi Station.
- Work with Regional Transit to master plan the opportunity site at Kathleen Avenue and Academy Way.

Long-Term Actions (Market Driven, 5 years and beyond)

- Review the feasibility of developing a comprehensive plan that is responsive to the stronger market; Identify market demands and growth capacity. The comprehensive plan should be aligned with the strategies and implementation plans developed by the Economic Development Department.
- Consider establishing a Property and Business Improvement District (PBID) to fund and maintain streetscape and other improvements.
- Prepare design guidelines for transitional uses (e.g. warehousing, office, loft housing, etc.).

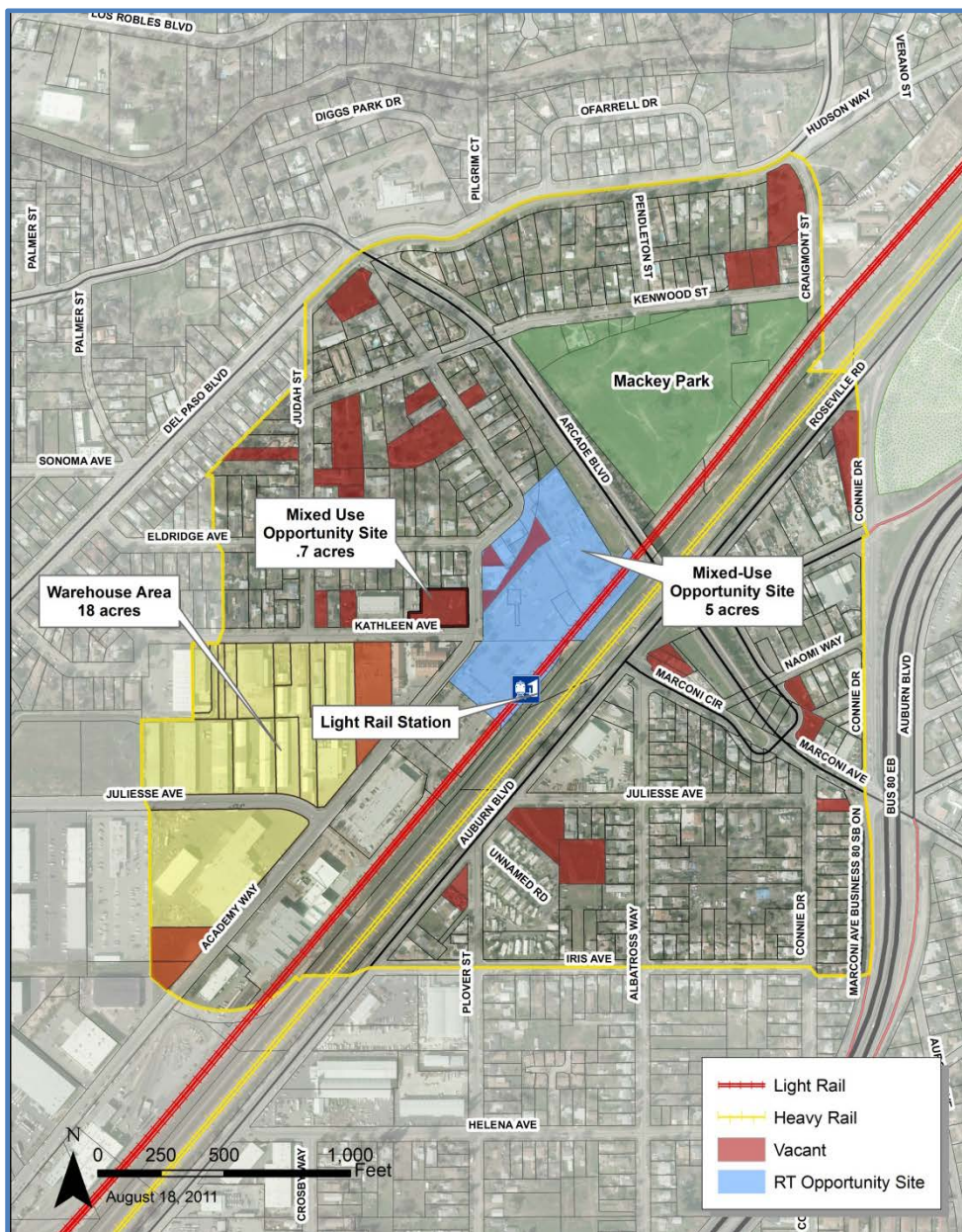
Marconi Light Rail Station

Technical Background Report

III. MARCONI STATION & TRANSIT-ORIENTED-DEVELOPMENT

Overview

The Marconi Station study area consists predominantly of light industrial businesses, single-family housing, and a park. These uses alone do not support public transit. Currently, the Marconi Station serves many passengers who use its parking lot and bus transfer services. The only sites that have potential for transit-oriented development are vacant lots owned by RT and the SHA. However, the existing industrial areas offer potential for job growth and a diversity of uses that could initiate near-term economic redevelopment activity that will help to revitalize the area and begin to improve transit ridership.



Existing Uses

The Marconi Station area includes a mix of existing single- and multi-family residential uses and two areas with a concentration of light industrial uses. A few auto-related and commercial uses are dispersed throughout the area.

Constraints

- The “curb appeal” of some of the existing commercial uses could be improved.
- There is a lack of neighborhood-serving commercial uses
- Existing uses don’t have the density/intensity required to support transit.

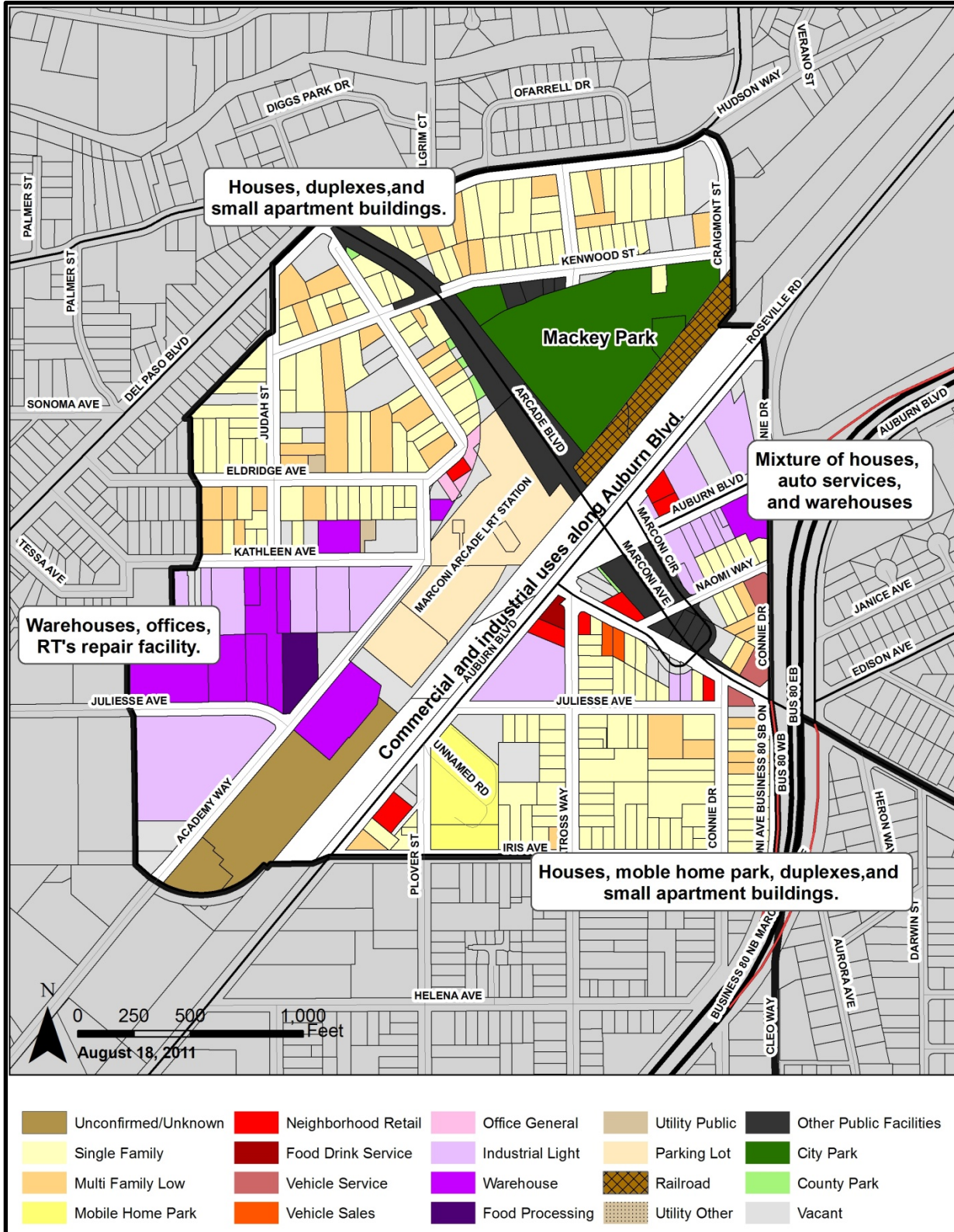
Opportunities

- The light industrial areas can increase capacity for employment by diversifying uses and offering more manufacturing, office, and retail.
- Potential re-use could include a live/work arts district or a cluster of boutiques and unique retail uses.

Marconi Light Rail Station

Technical Background Report

Existing Uses



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Technical Background Report

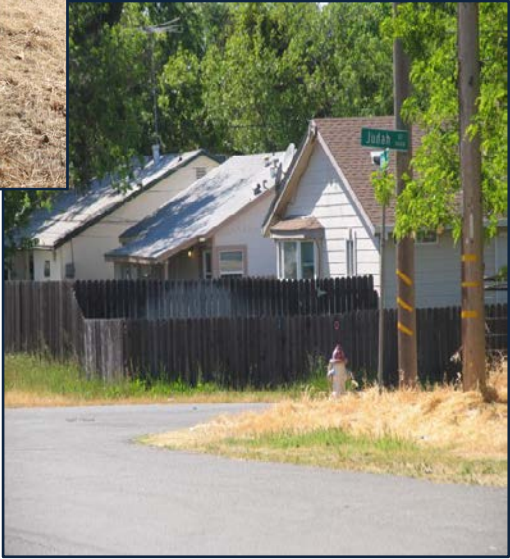
Existing Employment



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Technical Background Report

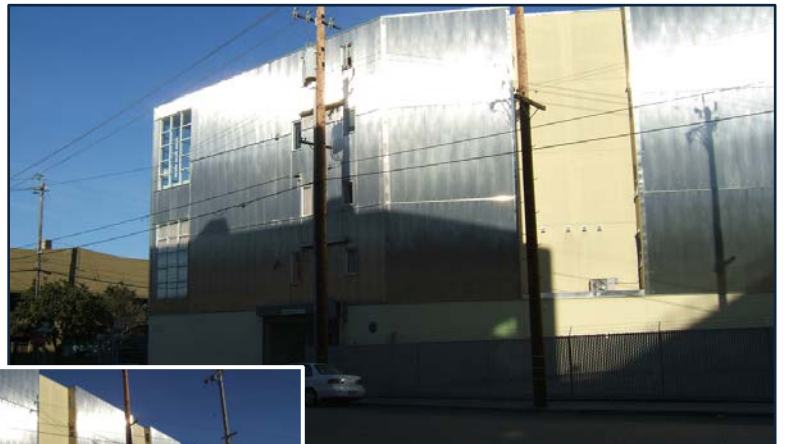
Existing Neighborhoods



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Potential Design Enhancement Examples



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Potential Re-Use Examples "The Lab", Costa Mesa, California



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Technical Background Report

TOD Examples



Marconi Light Rail Station

Technical Background Report

IV. Site Description

Marconi Light Rail Station

The Marconi station serves the residential and industrial areas to the north and west. It also offers a park and ride lot with approximately 400 parking spaces, and there is a bus and passenger drop-off at the platform. The station averages about 813 boardings* every weekday.

Sacramento Regional Transit (RT) owns approximately 17 acres of land at the Marconi Station. Approximately 4 acres of the RT property is dedicated to a repair facility, 5 acres to the tracks, and 8 acres to the parking lot. The northern portion of the parking lot is identified in the Transit for Livable Community document as a potential site for mixed-use development. The TLC document envisions a transit-oriented, mixed use development at the site.

RT's maintenance and repair facility is located on Academy way, adjacent to the northern edge of the stations parking lot.

The following page provides an aerial of the RT site.

Constraints

- The light rail and heavy rail tracks bisect the study area in half, which disrupts direct access from the east.

Opportunity

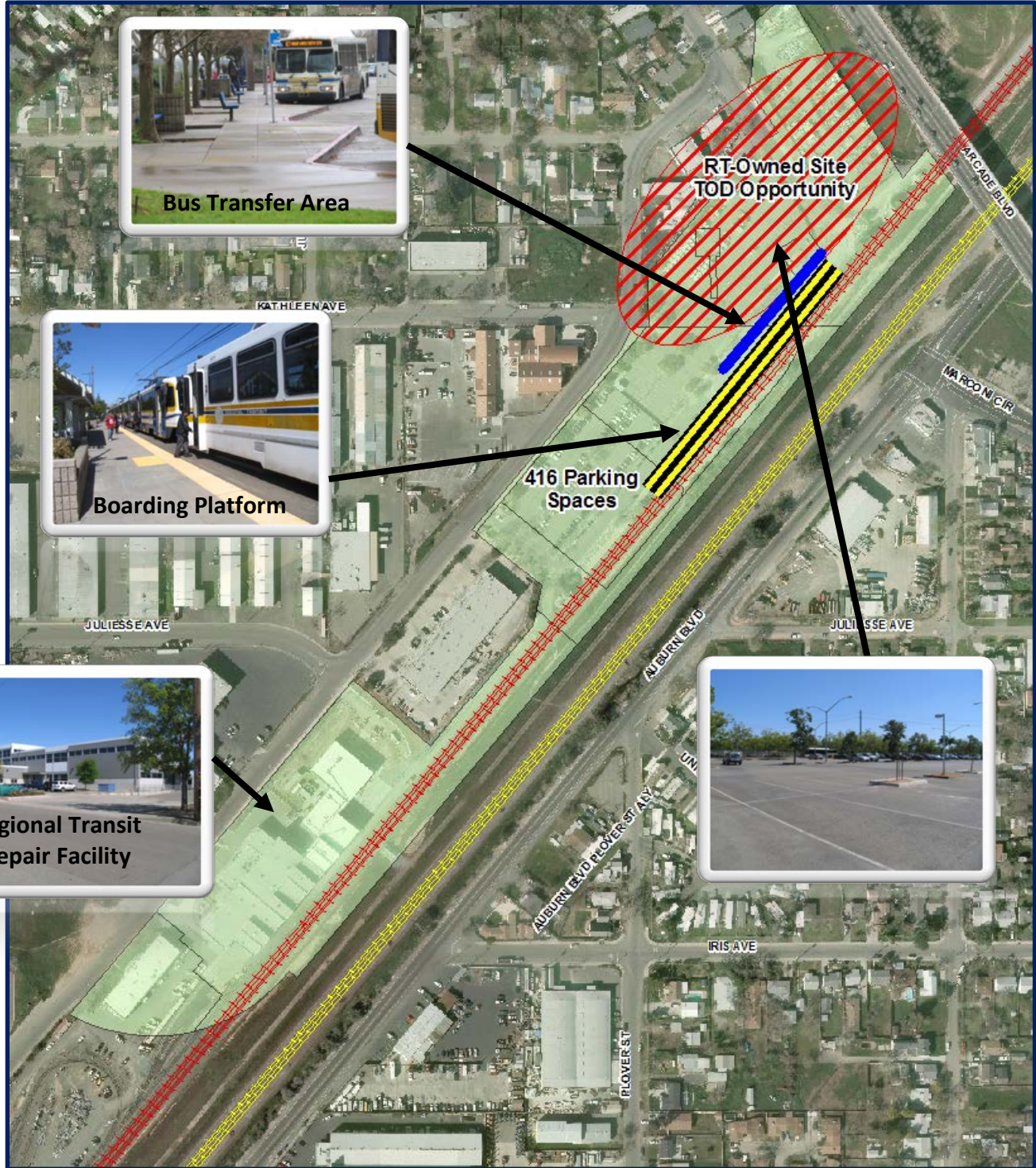
- The RT-owned site offers potential for a TOD project.
- The light rail station has direct bus service and a parking lot, making it a more versatile station than those without.

* Sacramento Regional Transit District, Table, "Weekday Light Rail Ridership by Station". The survey of boardings took place between July 1, 2010 and March 21, 2011.

Marconi Light Rail Station

Technical Background Report

Marconi Light Rail Station



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Technical Background Report

Nighborhood Connectivity Ben Ali and Hagginwood

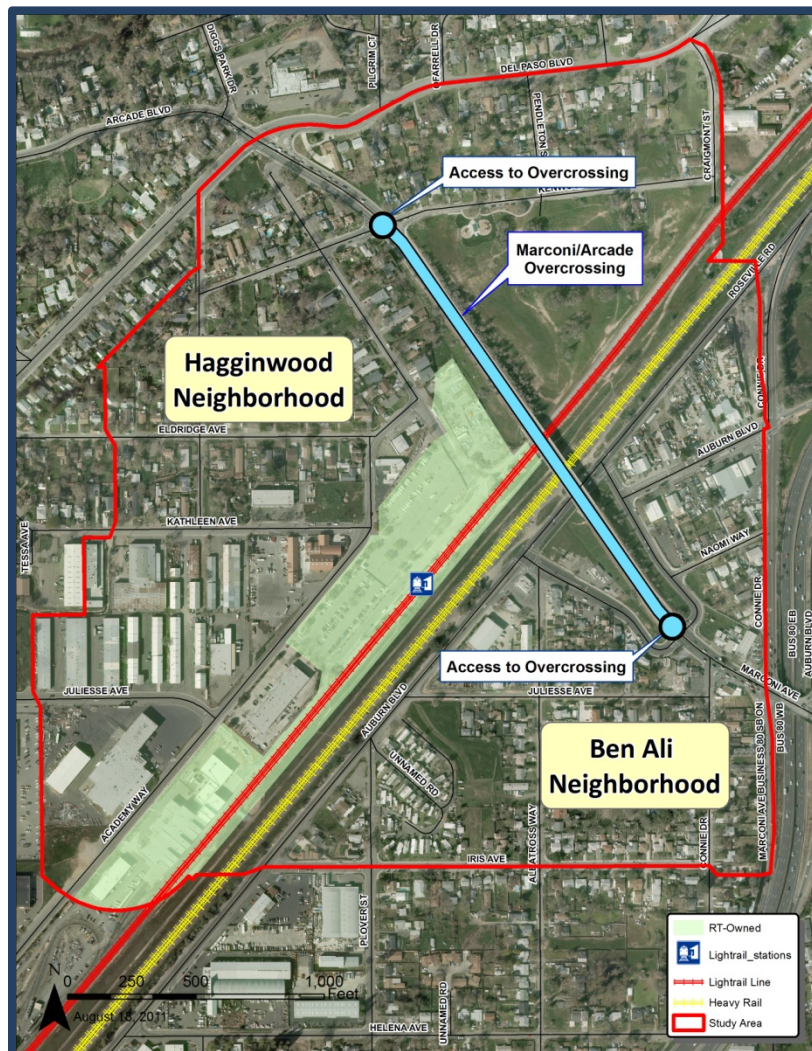
The Marconi Station area consists of two neighborhoods – Ben Ali and Hagginwood.

Constraints.

- Light- and heavy-rail lines prohibit at-grade crossings between the Hagginwood and Ben Ali Neighborhoods.
- Fencing has been constructed to prevent illegal crossings.
- The elevation of the Marconi/Arcade Overcrossing does not allow for direct access.

Opportunities

- Both neighborhoods have active community participation that can provide input and support in planning the area.
- Minor modifications such as bike lanes would improve connectivity.



Marconi Light Rail Station

Technical Background Report

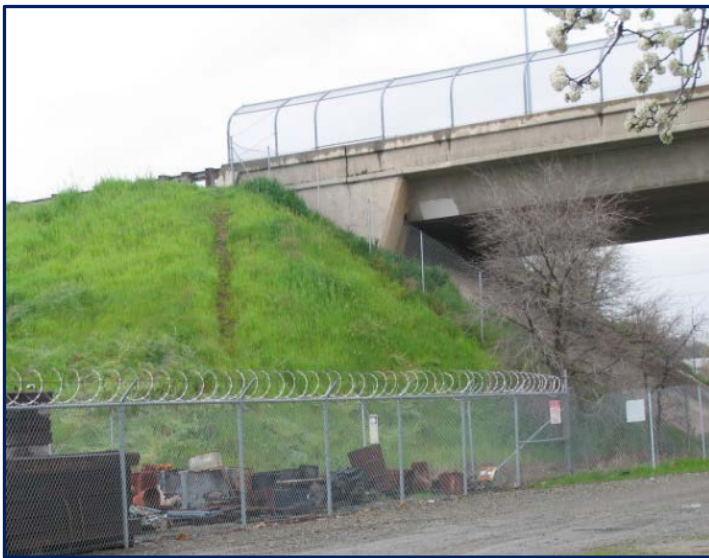
Barriers Between the Ben Ali and Hagginwood Neighborhoods



View of Marconi Station from Ben Ali looking towards Hagginwood



View of tracks from Hagginwood looking towards Ben Ali



Path from Marconi-Arcade Crossing near light rail station



Cut fence near light rail station

Marconi Light Rail Station

Technical Background Report

Vacant Parcels

The Marconi Station area consists of approximately 170 acres, of which approximately 12.5 acres are vacant: 4 acres of industrial, primarily in Hagginwood; 1.6 acres of commercial in Ben Ali; 1.15 acre of commercial in Hagginwood; and, with the exception of one small parcel in the Ben Ali area, the remaining 5.7 acres of residential is located in Hagginwood. Most of the future ridership will be generated in the Hagginwood neighborhood because it has more vacant property and much of this property is zoned for a higher intensity use.

Constraints

- Market conditions do not currently support transit oriented development for the Marconi Station study area.
- Much of the area is privately owned by many different entities which makes land assembly and large-scale, cohesive development difficult.
- The existing land uses bordering the Marconi Station are mostly industrial which generates a low number of employees and job opportunities.
- Some sites may require remediation of toxics in the soil.

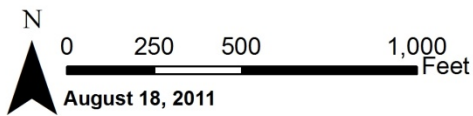
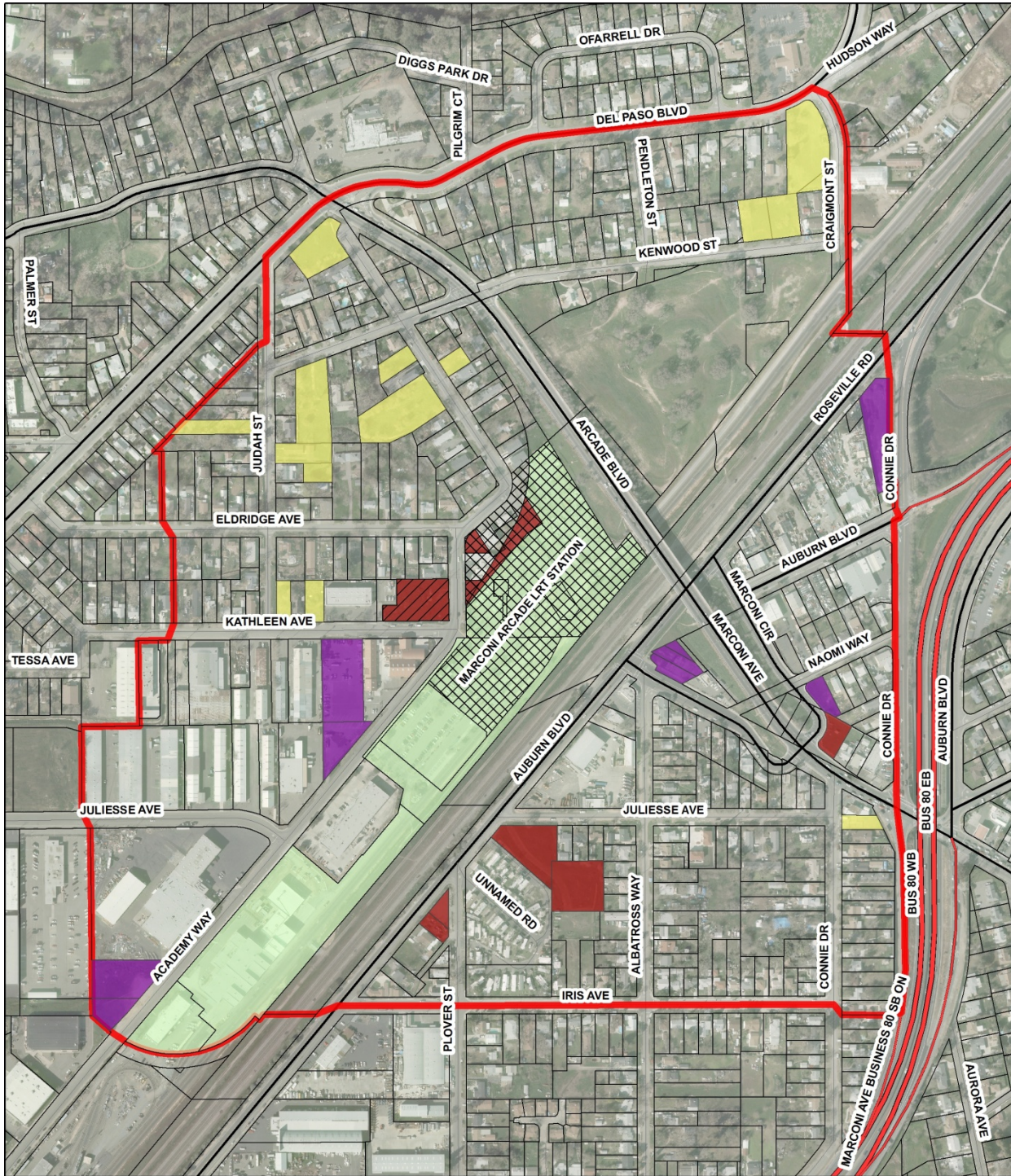
Opportunities

- The two most significant opportunities for transit oriented development are at the RT site, adjacent to station, and on a SHA-owned property near the RT site, on the northwest corner of Kathleen Avenue and Academy Way.
- The RT-owned site is identified in RT's "Transit for Livable Communities" as a potential TOD site.

Marconi Light Rail Station

Technical Background Report

Vacant Parcels



- RT-Owned Property
- Vacant Retail/Commercial
- SHRA site
- Vacant Residential
- RT Opportunity Site
- Vacant Industrial

Marconi Light Rail Station

Technical Background Report

Schools and Parks

There are two public elementary schools located within walking distance to the Marconi Station. Hagginwood Elementary serves the Hagginwood neighborhood, and the Higher Learning Academy serves Ben Ali. These schools have joint-use agreements with the City of Sacramento's Parks and Recreation Department to provide park amenities.

There is one park – the John Mackey Memorial Park – within the study area, and the Hagginwood Community Park to the northwest. The Haggin Oaks Golf Course (western end Del Paso Regional Park) is just east of the study boundary, but is fenced and not accessible to the public near the study area.

Constraints

- The Marconi/Arcade overcrossing and tracks prohibit direct access to the park.
- Sidewalks that lead to the schools and parks are in poor repair or incomplete.

Opportunities

- Improvements to the Marconi/ Arcade overcrossing would improve access to Mackey Park.
- Sidewalks can be constructed or improved to encourage walking to the schools and parks.
- Direct access to Mackey Park under the Marconi Station may be available with improvements through safe design.

Marconi Light Rail Station

Technical Background Report

Schools and Parks



Marconi Light Rail Station

Technical Background Report

V. INFRASTRUCTURE

Complete Streets - Access

Marconi/Arcade Overcrossing

The Marconi/Arcade overcrossing prevents direct access between the Ben Ali and Hagginwood neighborhoods. There is a traffic light at the western end of the overcrossing. Due to the lack of a traffic light on the eastern landing, access to and exiting from the overcrossing can be circuitous.

Existing Roadways

The residential streets within the study area currently have average daily trips (ADTs) of 200-600 vehicles per day, which is well below 4,500 vehicles per day, the City's average daily traffic threshold for local streets.

Academy Way, which is the frontage street for Marconi Light Rail Station has an average daily traffic count of 3,938 vehicles per day. Although Academy Way serves a mix of residential and industrial uses, this roadway is classified as a local roadway in the City's 2030 General Plan. Academy Way's ADT count is currently below the City's residential street average daily traffic threshold of 4,500 vehicles per day.

Arcade Boulevard is classified as a 2-lane major collector roadway and currently has an ADT of 5,918 vehicles per day, which is well within the City's average daily traffic threshold for 2-lane collector roadways.

Marconi Avenue is classified as a 4-lane major collector roadway and currently has an ADT of 17,119 vehicles per day which is within the City's average daily traffic threshold for 4-lane major collector roadways.

Currently, there are no ADT counts available for Del Paso Boulevard, a 4-lane collector roadway, or Auburn Boulevard, a 2-lane arterial roadway.

Capacity for Growth

Other than Academy Way, the roadways within the study area appear able to accommodate anticipated growth.

Academy Way currently has 60-ft to 70-ft of right-of-way and terminates into a cul-de-sac just south of the Arcade Blvd./Del Paso Blvd. intersection. Future development may necessitate the modification and reclassification of Academy Way into a minor collector street. Depending on the intensity level of new development, additional right-of-way may be required in the event that Academy Way is reclassified as a collector street.

Bike Lanes

Only Del Paso Blvd. and a portion of Auburn Blvd. have bike lanes. The City Bikeways and Pedestrian Master Plan does not identify a need for bike lanes within the study area.

Marconi Light Rail Station

Technical Background Report

Pedestrian/Bike Bridge for Connectivity.

The Ben Ali and Hagginwood communities have identified a new pedestrian/bike bridge as the preferred method of improving connectivity and access to the Marconi Station. This solution would present some issues that need to be fully considered as summarized below:

- Cost likely would not be justified because of lack of existing development intensity in the Ben Ali area.
- ADA compliance would require a grade that would span the bridge landings comparable to the size of the existing Marconi Crossing. This would require acquisition of a significant size of privately owned land.
- The alternative designs of a spiral or switch-back access presents safety issues because of the impaired sight lines.
- Other cities have had success using elevators for access to transportation facilities. However, the cost of general maintenance and mechanical repairs may be an issue that needs consideration.

Another potential solution, though not supported by the community, is a pedestrian tunnel under the tracks. While a tunnel would be costly and may present safety issues, it would not require a span as expansive as an overcrossing, allowing the access points to be closer to the station.

The community has cited a potential solution identified in the 2005 study, *Reinventing Marconi Avenue*. That study suggests establishing transit-oriented development of four stories or higher on both sides of heavy rail, and linking the two buildings with a pedestrian bridge to allow light rail users safe access to the station.

The community has emphasized that in developing solutions to provide connectivity to the light rail station, safety should be a priority consideration.

Constraints

- There are few sidewalks and no on-street bike lanes within the project area.
- The light- and heavy-rail tracks bisect the Hagginwood and Ben Ali Neighborhoods and limit internal circulation and access to the area.
- The Marconi/Arcade overcrossing is above grade, which causes further constraints on internal circulation.

Marconi Light Rail Station

Technical Background Report

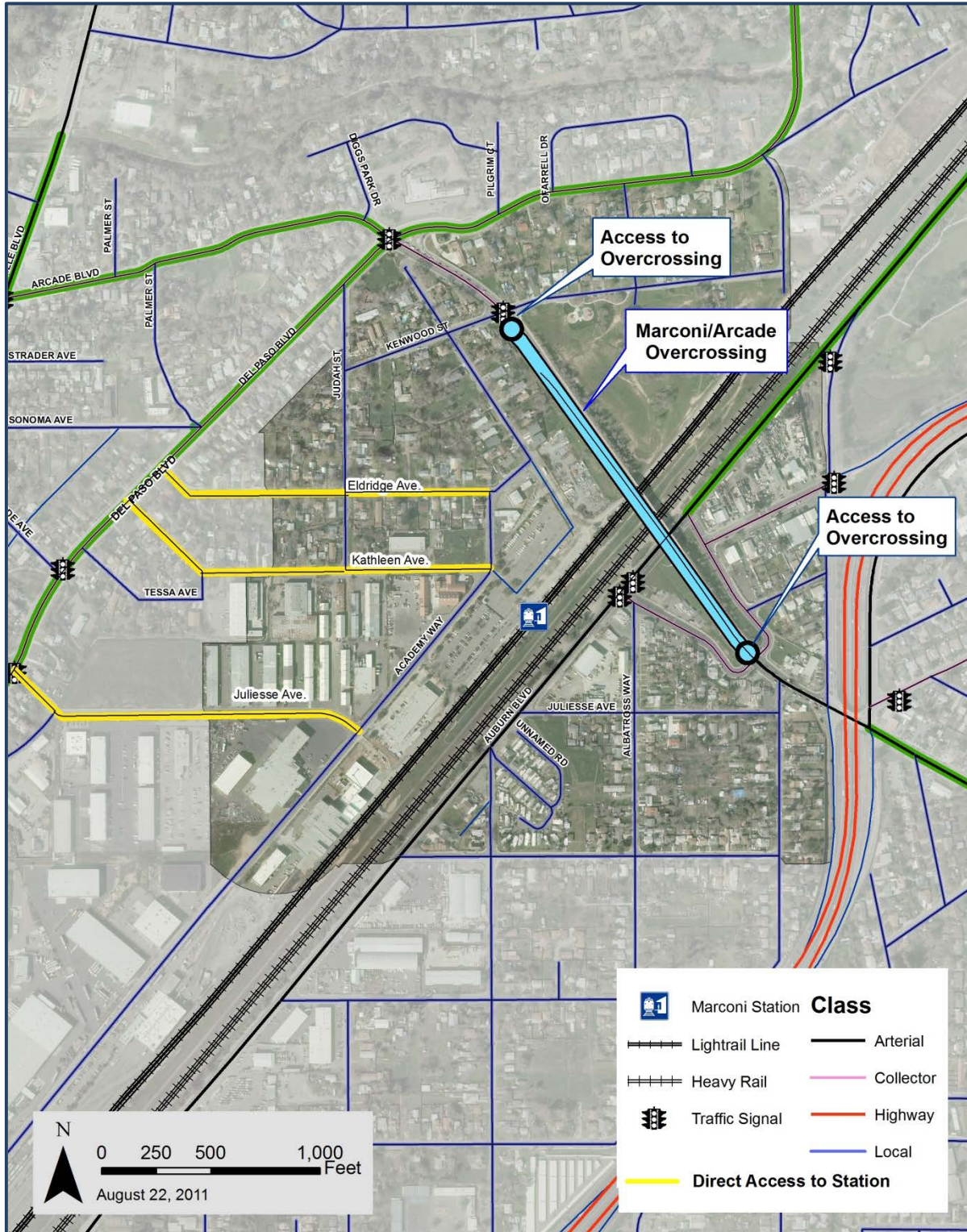
Opportunities.

- The overcrossing can be greatly improved with bicycle and pedestrian safety issues. These improvements would be relatively simple and low cost. The design of the improvements must address the community's concerns about pedestrian and bicycle safety which could be compromised by the high traffic volume.
- From the west (Del Paso Blvd.), Eldridge, Kathleen, and Juliesse Avenues provide the most direct access to the Marconi Station. Improvements to Eldridge and Kathleen Streets on the Department of Transportation's Programming Guide.
- As new development occurs, pedestrian connectivity should be required for easy access to transit and other destinations.
- Del Paso Blvd., on the western boarding of the Marconi Station study area, has bike lanes.
- The streets appear to have sufficient capacity for development and redevelopment of the area.

Marconi Light Rail Station

Technical Background Report

Complete Streets - Access



Sidewalks and Streetlights

The City's Pedestrian Master Plan identifies the Ben Ali neighborhood as highly deficient in sidewalks, curbs, and gutters. The Hagginwood area also lacks a complete sidewalk and street lighting system. The only streets that have consistent street lighting and sidewalks are Academy Way, Marconi/Arcade and Iris Avenue. Auburn Blvd. has street lighting, but no sidewalks.

Both the Ben Ali and Hagginwood neighborhood associations stated that, at a minimum, curbs and gutters should be installed to help with drainage issues. The associations also stated that replacing existing sidewalks that are in poor condition is important, but that it was not necessary to put new sidewalks on every street.

Constraints

- Many streets have incomplete or non-existing sidewalks. There are instances where the sidewalks are blocked by utility poles or other obstructions.
- Access into the Ben Ali area via the Marconi /Arcade overcrossing has substandard pedestrian and bicycle infrastructure.

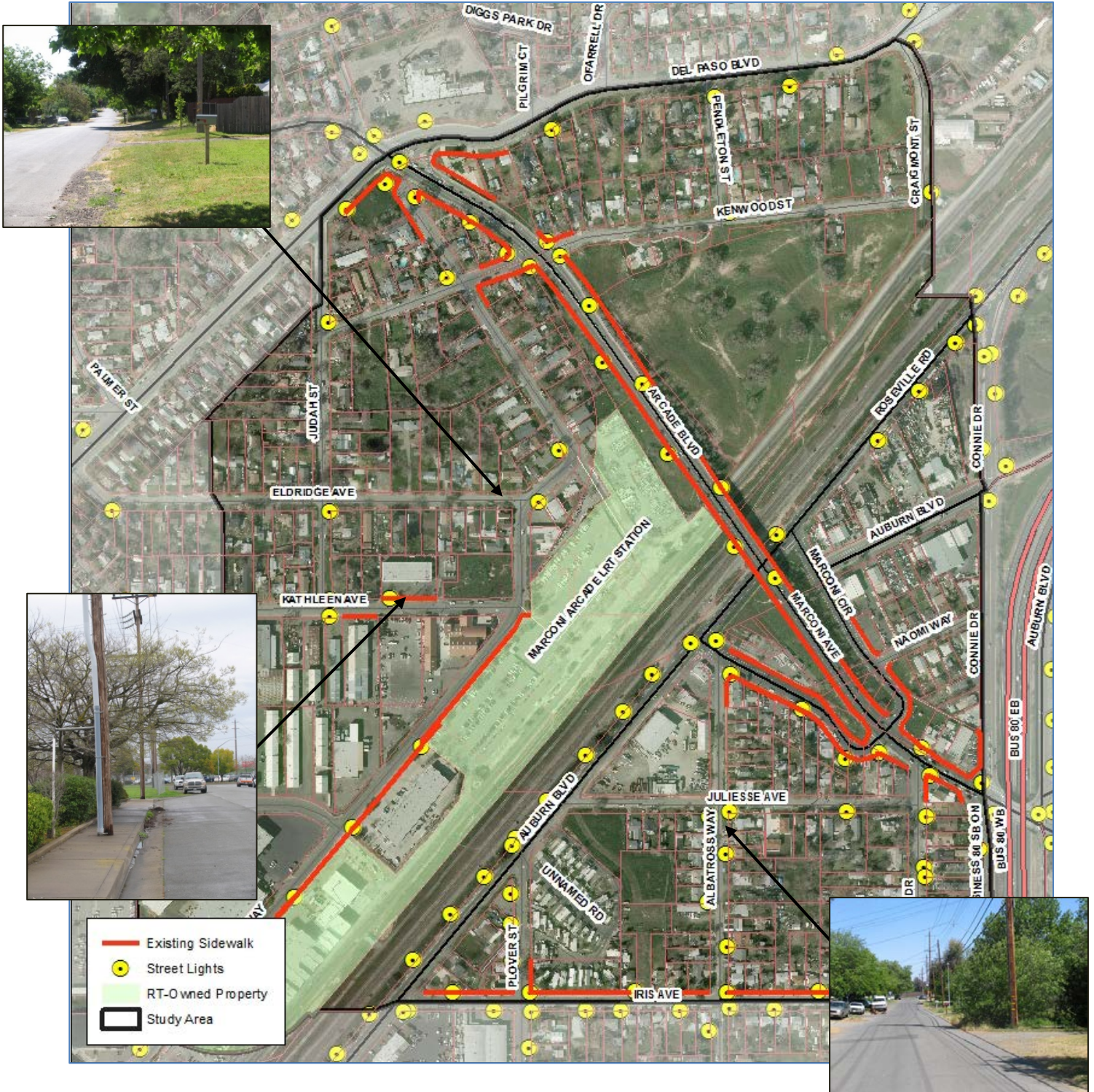
Opportunities

- Pedestrian and bike safety improvements are high on the prioritization list of the city's 2009 Transportation Programming Guide.

Marconi Light Rail Station

Technical Background Report

Sidewalks and Streetlights



Marconi Light Rail Station

Technical Background Report

City Utilities

The Marconi Station study area is served by City stormwater drainage, water, and sewer services. Of these utilities, only drainage presents a concern in this area.

Five drainage basins serve the area, of which two (Drainage Basins 151 and G209) have master plans. Two Basins, G201 and 152, serve only a small portion of the area. Nearly all the Hagginwood neighborhood within the study area is served by Basin 159. Mackey Park and Del Paso Regional Park, just east of the project area boundary, serve as detention basins for runoff from Hagginwood Creek.

The city's drainage system is maintained primarily by the Utilities Department. However, the Department of Transportation is responsible for maintaining facilities that directly affect street drainage such as gutters and roadside ditches.

More information on city utilities infrastructure is provided in Attachment 5.

Drainage Basin 159. A study of drainage of the portion of Basin 159 that serves the Marconi study area has been developed for this Technical Background Report (Attachment 6). Information provided in the study includes the following:

- Due to the study area being largely paved, new development would not increase the overall impervious land area and, therefore, may not have significant impact on the drainage system.
- For the 10-year storm, no street flooding hazard (defined as more than 0.5 feet deep) was found.
- For the hundred year storm, with Arcade Creek contained, no property flooding (defined as water level exceeding the finished floor elevations of structures, except for garages and shed) was found.
- For the hundred year storm, if Arcade Creek were not contained, property flooding may occur along Hagginwood Creek and potentially causing property flooding to roughly a dozen homes adjacent to Hagginwood Creek and cause overflow of culvert crossings at Kathleen Avenue, Eldridge, Avenue, and Judah Streets.
- In the absence of funding for drainage improvements, site improvements likely would be required as part of the entitlement and/or plan review process.

Constraints

- During 10-year storms, there is a potential for street flooding hazard (defined as more than .5 feet deep), and during 100-year storms, there may be property flooding (defined as water level exceeding the finished floor elevations of structures, except for garages and shed).
- There are no funds currently identified to make drainage improvements.

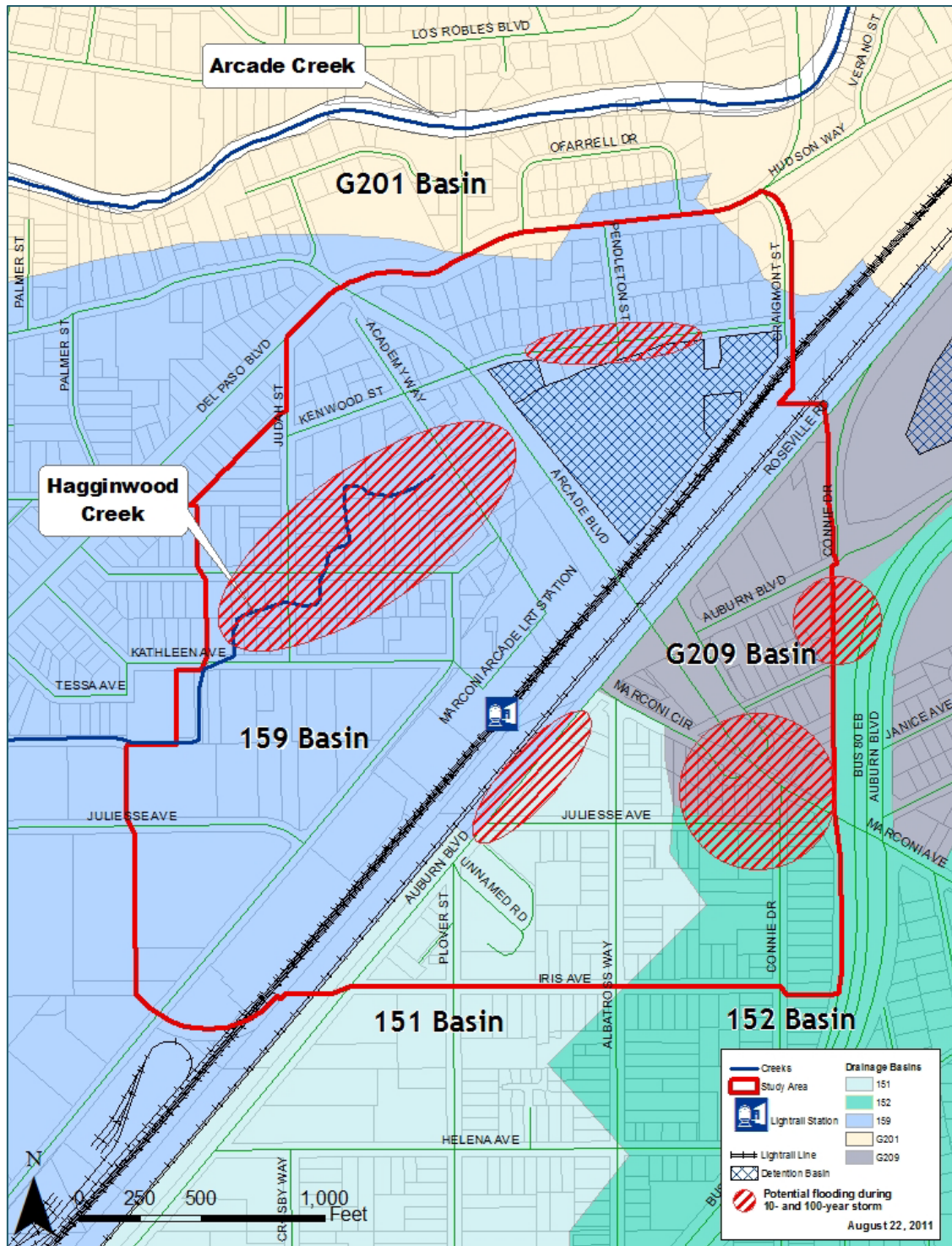
Opportunities

- Water pressure and potable water quality appear to be adequate for both existing uses and growth projected in the 2030 General Plan.
- Drainage from new development or redevelopment may be largely mitigated on-site.

Marconi Light Rail Station

Technical Background Report

Marconi Station - Drainage Map



VI. General Plan Land Use Designations

The 2030 General Plan designates the area near the Marconi Light Rail Station as Urban Center Low which is supportive of TOD. The remainder of the area has land use designations that reflect existing uses that are likely to continue for a number of years: The warehouse area south of Kathleen Avenue is Employment Center Low Rise; existing residential areas are designated either Suburban Neighborhood or Traditional Neighborhoods; and Suburban Center designation are located along Auburn Blvd. and Marconi Avenue.

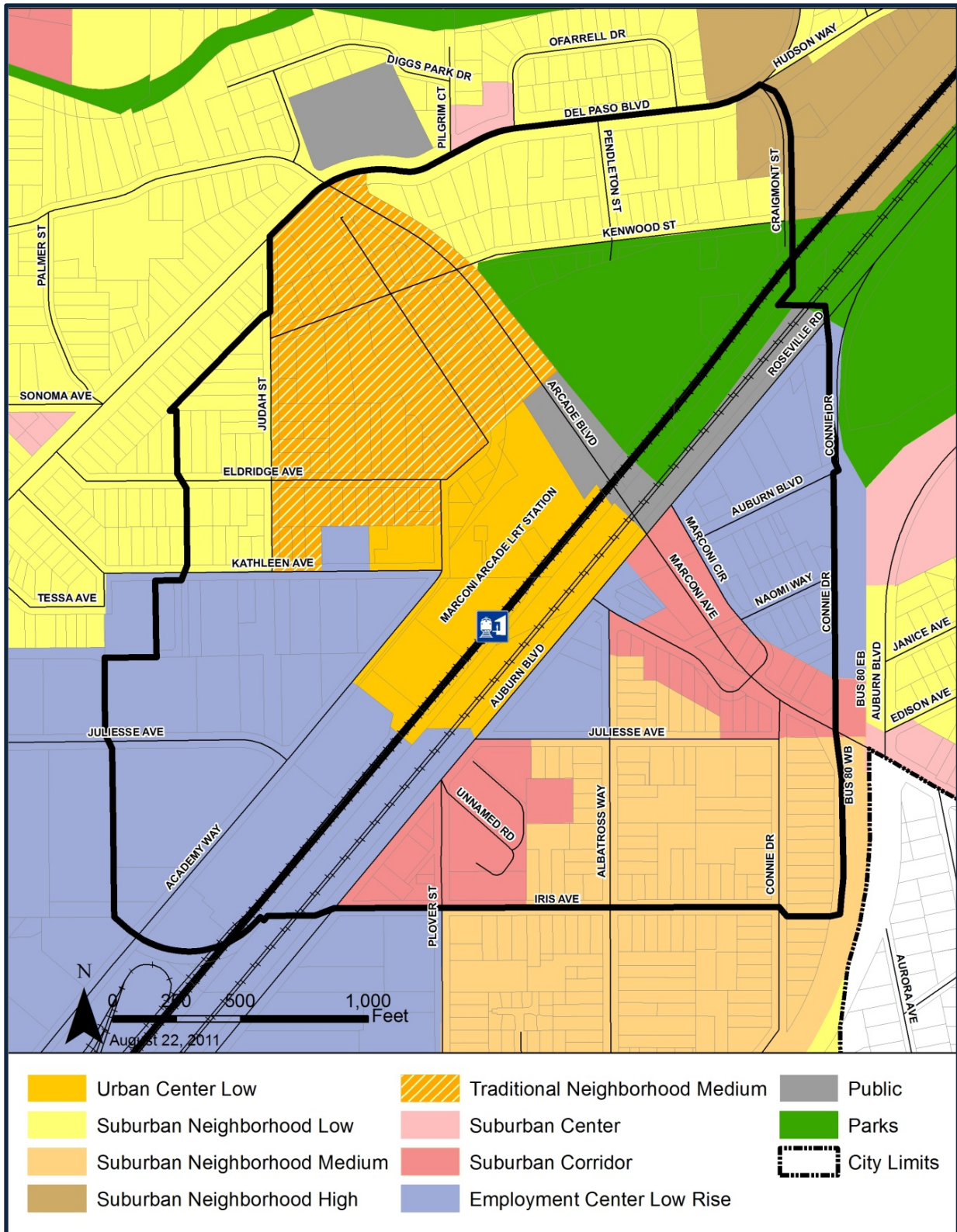
Opportunities

- The General Plan was recently adopted (March 2009) and was based on an extensive community outreach.
- The SHA/RT opportunity site is designated Urban Center Low. This designation allows for transit-oriented-development, including a density between 20-150 residential units per acre, or a floor-area-ratio of .4-4.0; two to seven story buildings; a mix of residential types; and neighborhood serving commercial uses.
- The General Plan Employment Center Low Rise designation allows for residential and commercial flex space (i.e. industrial structures converting to residential or commercial uses) in areas expected to transfer to urban development.

Marconi Light Rail Station

Technical Background Report

General Plan Land Use Designations



Marconi Light Rail Station

Technical Background Report

VII. Zoning

Zoning in the Marconi Station project area consists of a mix of low and medium density residential, general commercial, and light and heavy industrial zoning. The SHA-owned parcel on Academy Way, located directly across the street from the station, has the project area's only mixed use zoning.

In 2009 and 2010, the City rezoned property on Academy Way from M-1 to C-2 to bring the zoning into consistency with the General Plan Urban Center Low designated area near the RT/SHA opportunity site.

There are a few parcels with zoning that is inconsistent with General Plan, primarily at the RT site. In general, however, the zoning of the area supports the opportunities for redevelopment and economic development within the existing uses. Future city-initiated or project related rezones will bring the remaining parcels into consistency with the General Plan's vision of enhancing existing neighborhoods and businesses while promoting TOD development at the RT and SHA sites.

Constraints

- A few parcels remain inconsistent with the General Plan. These parcels will be brought into consistency either through city-initiated rezones or private development projects.

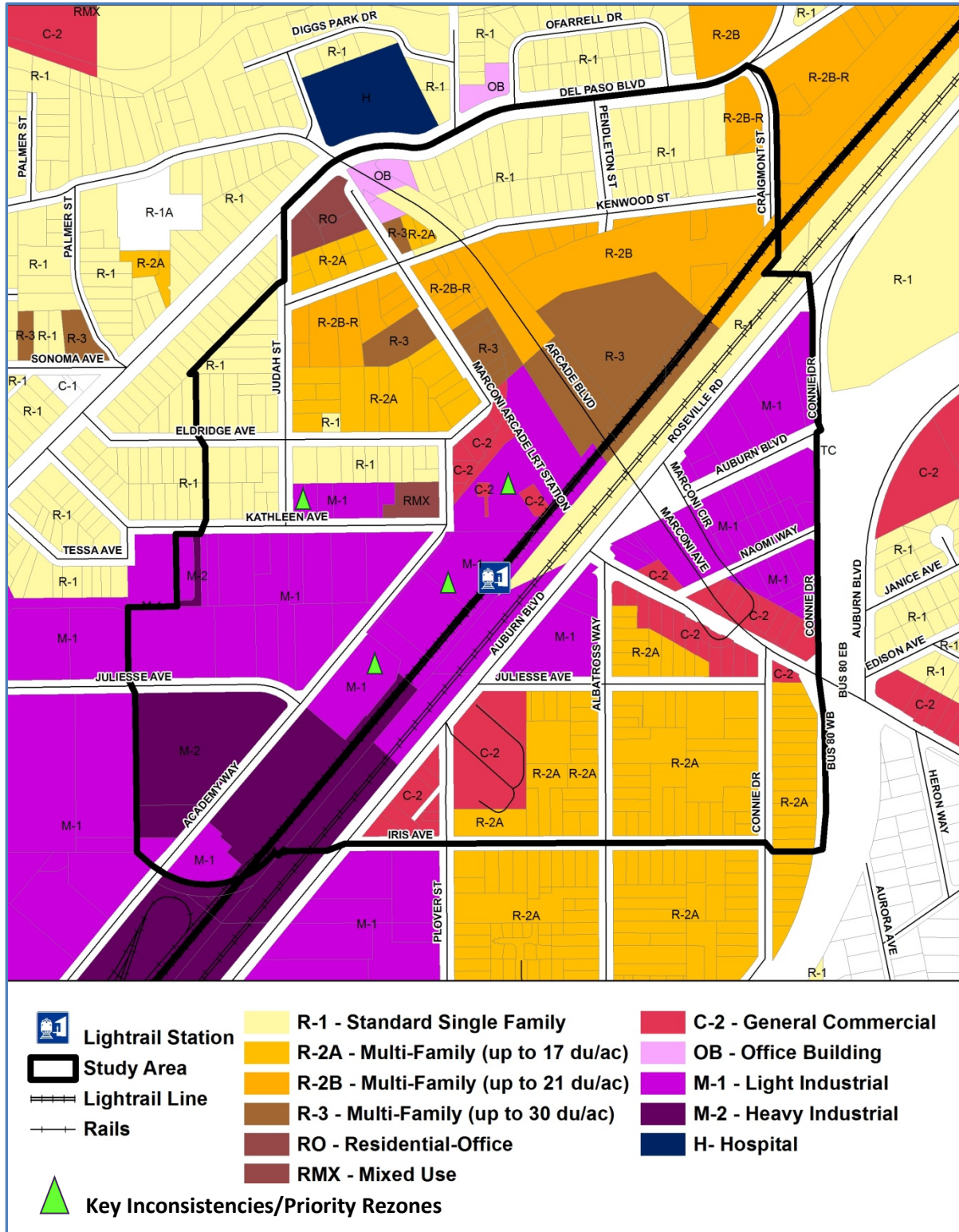
Opportunities

- All the privately owned parcels in the SHA/RT opportunity area are zoned C-2 which is consistent with the Urban Center Low land use.
- The city will explore allowing flexible uses, including housing and office space, in the light industrial zone.

Marconi Light Rail Station

Technical Background Report

Zoning



Marconi Light Rail Station

Technical Background Report

VIII. PLANNING RESOURCES AND GUIDES

Several planning, design, and development guides and standards affect either a portion or the entire Marconi Station study area. A table listing these resources, regulations and affected neighborhoods is provided below. Not all of the resources and regulations listed directly impact the study area, but they can inform and implement future planning efforts. More information on planning efforts that impact the study area is provided in Attachments 1 and 2.

		Hagginwood	Ben Ali
Resources and Guides	Transit for Livable Communities Project	Yes	Yes
	Northeast Line Light Rail Station Plan ▪ Northeast Line Implementation Plan	No	No
	Guide to TOD	Yes	Yes
	Swanston Station Specific Plan	No	No
	Design Review	North Sacramento Design Review Area	North Sac/South Sac/Ben Ali Design Review Ordinance
	Strategic Neighborhood Action Plans	Yes	Yes
	2030 General Plan/Community Plans	North Sacramento Community Plan	Arden/Arcade Community Plan
Policy and Regulation	Zoning Code (Title 17)	Yes	Yes
	Transit Overlay (TO) Zone [†]	No	No
	Light Rail Station Ordinance	Yes	No
	Residential Uses in Commercial Zone	Yes	Yes
	Residential Mixed Use (RMX) Zone	Yes	Yes

[†] Establishing a Transit Village Plan and rezoning property would be required to apply the TO zone in the Marconi Station study area.

Marconi Light Rail Station

Technical Background Report

IX. RECOMMENDATIONS

The following actions were identified to support and strengthen existing uses while positioning the area for a diversity of uses that will ultimately result in transit oriented development.

It is important to emphasize that outreach to the Hagginwood and Ben Ali neighborhood during project planning efforts is crucial in successfully revitalizing the area.

Short Term Actions (1-3 years)

- Provide a connection under the Marconi Avenue Overcrossing between the light rail station and Mackey Park.
- Incorporate greater flexibility in transitional uses in the Employment Center Low Rise designation in the Green Zoning Code (zoning code update).
- Reconfigure traffic lanes on the Marconi/Arcade overcrossing to allow for bike lanes and safer pedestrian facilities.
- Address flexibility in land uses in the zoning code, including housing in light industrial areas, to assist in future development of this area.
- Rezone the Regional Transit site to allow mixed use development.

Mid-Term Actions (3-5 years)

- Construct sidewalks on key streets to provide safe pedestrian access to the Marconi Station.
- Work with RT, developers and other public and private sector entities to plan and develop the RT-owned parcels at the Marconi Station.
- Work with the Parks and Recreation Department and the Police Department to design and construct safe passage under the Marconi-Arcade overcrossing from the Marconi Station to Mackey Park.
- Study the impacts of reclassifying Academy Way from a local to a minor collector street for future development.

Long-Term Actions - Market Driven (5-years +)

Develop a Comprehensive Plan

- Identify market demands and growth capacity. The comprehensive plan should be aligned with the strategies and implementation plans developed by the Economic Development Department.
- Identify additional facilities that will encourage alternative modes of transportation and use of the light rail, e.g. streetscapes that included bulb-outs, street humps, and other safety features; bike lockers and parking; street furniture and landscaping.

Marconi Light Rail Station

Technical Background Report

- Consider establishing a Property and Business Improvement District (PBID) to fund and maintain streetscape and other improvements.
- Develop parking standards.
- Consider establishing a Special Planning District to allow flexible development standards to encourage development during fluctuating economies.
- Establish additional design standards that ensure compatible integration of transit-oriented development in existing neighborhoods.
- Develop a phasing plan that takes into account the influence of funding availability, market capacity, need for in residential, and investment potential in the areas.

Attachment 1

EXISTING PLANNING RESOURCES AND GUIDES

Transit for Livable Communities

In 2002, Sacramento Regional Transit and the City of Sacramento collaborated to identify land use and policy changes to support transit for areas within a ¼ mile of light rail stations. This planning effort was called Transit for Livable Communities (TLC). The TLC project developed conceptual land use plans, joint development strategies, and implementation measures for twenty light rail stations throughout the Regional Transit (RT) system. The project emphasized walkable design, efficient use of land, and a mixture of residential, retail and office land uses, while supporting the preservation and enhancement of existing residential areas.

A Guide to Transit Oriented Development (TOD)

In 2009, the Sacramento Regional Transit's Board adopted the Guide to help promote Transit Oriented Development in Sacramento. The Guide provides flexible recommendations for policy and vision for development around transit in the following areas: Land use, community character, transportation, access and civic amenities.

Northeast Line Implementation Plan

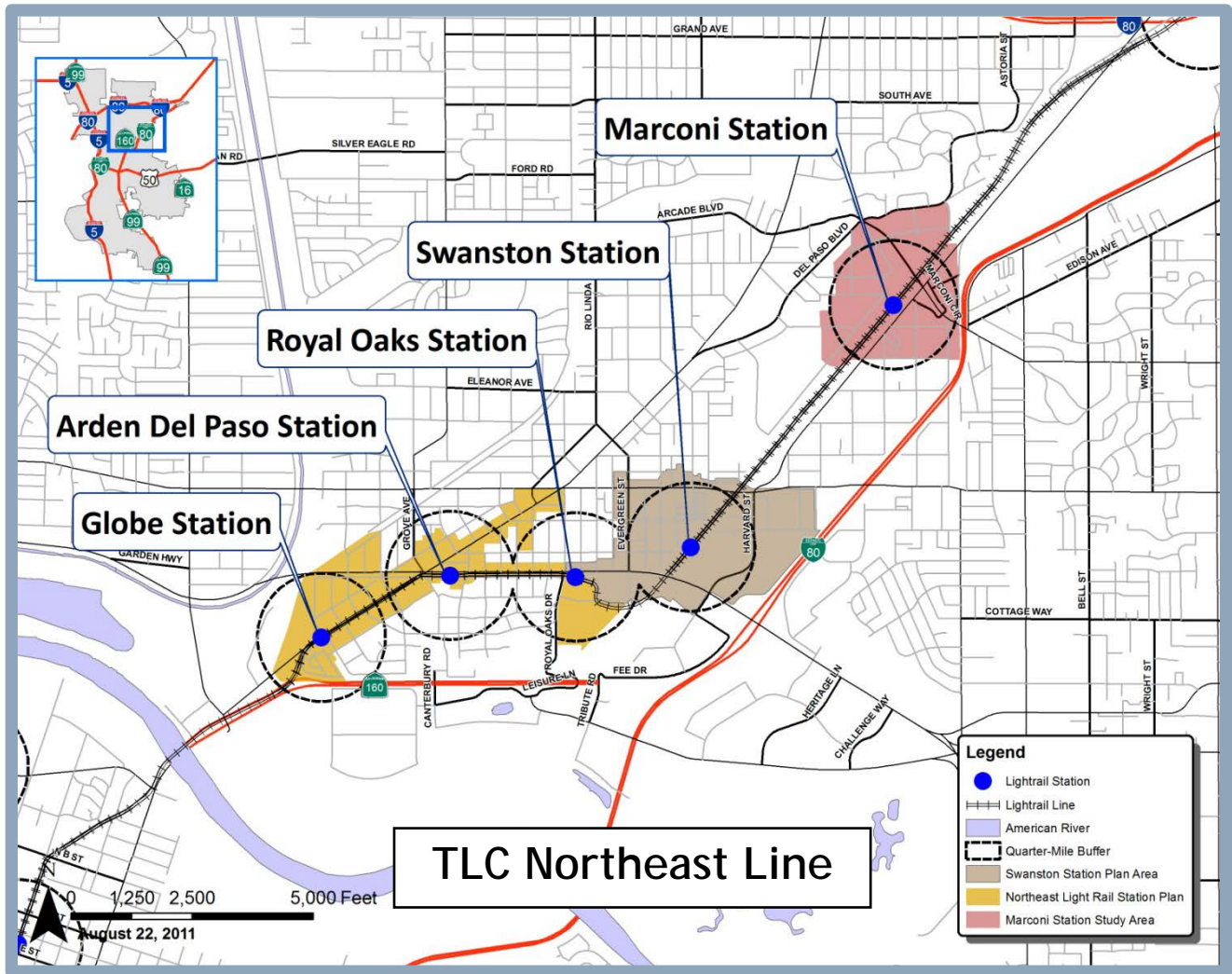
The Northeast Line Implementation Plan was approved by Council in March 2011. This plan reflects the City's effort to promote reinvestment, redevelopment, and revitalization along the light rail corridor at the Globe, Arden/Del Paso and Royal Oaks Stations. It included rezones, land use designation changes, amendments to the design review guidelines, and strategic financing of infrastructure.

Swanston Station Transit Village Plan

In a separate effort, the Swanston Station Plan was also approved by the Council in 2011. The Swanston Station Transit Village Plan included rezones, design review guidelines, and establishment of a transit village plan.

Marconi Light Rail Station

Technical Background Report

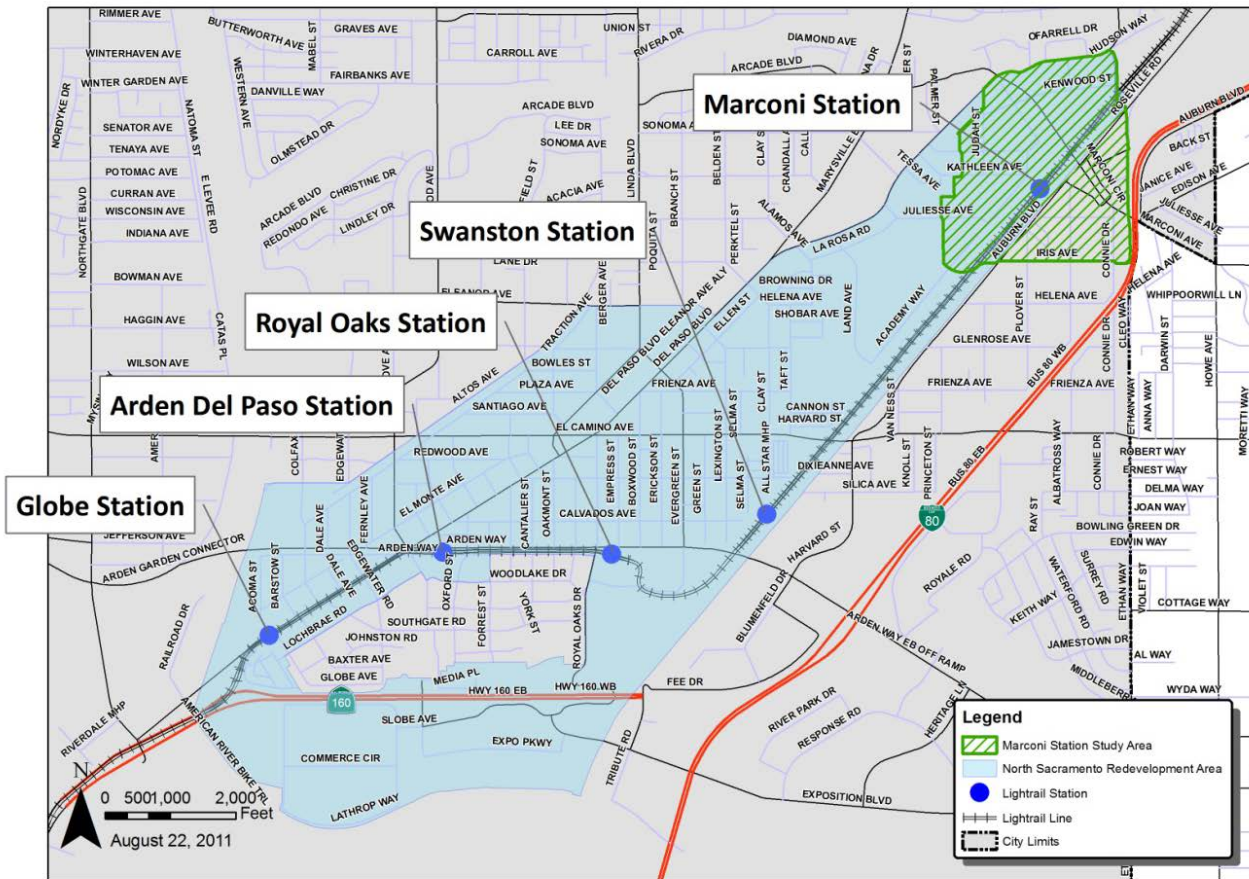


Northeast Line Light Rail Stations Plan

As a follow up to the TLC planning effort, the Northeast Line Light Rail Stations Plan was approved by the City Council in 2007. The Northeast line is one of three light rail lines addressed in the TLC and consists of five stations. This plan is predominately an urban design document that recommended streetscape improvements, revisions to the North Sacramento Design Guidelines, rezones, and urban design schemes for the Globe, Arden/Del Paso and Royal Oaks Station. The plan also analyzed the necessary infrastructure improvements to support 30 years of growth in project area.

Marconi Light Rail Station

Technical Background Report



Strategic Neighborhood Strategy Plans

A Strategic Neighborhood Action Plan (SNAP) is an action-oriented document developed with the neighborhoods that experience experiencing infrastructure deficiencies or other problems, as reported by neighborhood residents and property owners. A SNAP identifies a neighborhood vision, neighborhood issues, and goals and action strategies for neighborhood enhancement. Implementation of the SNAP is the joint responsibility of neighborhood residents and owners, City staff, and in some cases, other relevant local agencies or non-governmental organizations.

SNAPS were completed in 2009 for both the Hagginwood and Ben Ali areas. The two neighborhoods had similar goals, including the following:

- Connect the Hagginwood and Ben Ali neighborhoods with safe, adequate sidewalks, bike lanes, lighting, and signage.
- Ensure that infill development is compatible with the form and character of the neighborhood.
- Facilitate transit-oriented development around the Marconi Light Rail Station.

Marconi Light Rail Station

Technical Background Report

Attachment 2

EXISTING LAND USE POLICIES AND REGULATIONS

In the continuous effort to implement the Transit for Livable Communities project, the city has adopted several policies and ordinances that prepare areas near light rail stations for future development.

2030 General Plan

The 2030 General Plan, adopted in 2009, is the guiding document for the City of Sacramento's projected growth and change to 2030. The principles of sustainability are embedded throughout the General Plan. As a result, public transportation, preserving and enhancing existing neighborhood, and providing employment opportunities are reoccurring themes, and are particularly relevant to the area surrounding the Marconi Station.

Land Use and Urban Form Diagram. The 2030 General Plan includes a Land Use and Urban Form Diagram that establishes direction for both land use and urban form. The Diagram includes designations for allowed uses, population density, building intensity, and urban form criteria for the different neighborhoods, centers, and corridors throughout the city.

The Transit for Livable Communities document and Northeast Line Light Rail Stations Plan informed the selection of land use designations for near light rails stations. Minimum density and floor-area-ratios were established at an intensity that is intended to yield a sufficient number of jobs and/or housing development near the station, but is not so high that it discourages development.

The General Plan changed the land use designations in key opportunity areas, including light rail station areas and commercial corridors, to facilitate the revitalization of these areas. The City has been careful to designate urban land use designations of key locations near the light rail station to foster transit and community supportive commercial and residential development. Much of the area was designated Employment Center Low Rise (ECLR), recognizing the existing viable industry, heavy commercial, and office development. The ECLR contains policies that allow for a transition to urban transit supportive uses over time.

Community Plans. Community Plans are integrated into the General Plan and are comprised of goals and polices specific to the communities they represent. The Hagginwood neighborhood falls within the boundaries of the North Sacramento Community Plan, and Ben Ali in the Arden-Arcade Community Plan. Both plans identify the Marconi Station as a Transit Center Opportunity Area.

Marconi Light Rail Station

Technical Background Report

Policies specific to the Arden-Arcade Community Plan have not been developed yet. The North Sacramento Community Plan included policies that impact the Hagginwood community:

- Encourage infill development.
- Provide street improvements (sidewalks and street lighting).
- Develop assessment districts to fund improved utility improvements and services.

Future council adopted planning efforts within the Marconi Station study area will be amended into the text of the community plan.

Zoning

The City of Sacramento's zoning code (Title 17) regulates where specific uses are allowed and development standards for new development. Building standards include the building height, lot coverage, parking standards, landscaping or setback requirements that apply within a particular zone.

Zoning at the Marconi Station project area consists of low and medium residential, general commercial, and light and heavy industrial zoning (Figure IX). There is one mixed-use parcel on Academy Way directly across the street from the station.

In 2009 and 2010, the City rezoned several privately owned parcels from M-1 to C-2 in the Hagginwood area to bring the area's zoning into consistency with the General Plan's new land use designations.

Light Rail Station Ordinance

The Light Rail Station Ordinance encourages vacant or underutilized properties within $\frac{1}{4}$ mile of stations that were studied under the Transit for Livable Communities project to be developed with transit friendly uses. The Marconi Station is one of the stations to which the ordinance applies. Recognizing its barriers to the Marconi Station, however, the Ben Ali area was not included in this ordinance.

Most of the area along the light rail corridors have heavy commercial or industrial zoning, which allows uses that are not considered transit supportive. The Light Rail Station Ordinance requires a Planning Commission Special Permit for new commercial and industrial uses that were identified as not being transit supporting uses and were located within a quarter mile of light rail stations affected by this ordinance.

The Ordinance also allows, subject to a special permit, residential and office uses in heavy commercial and industrial zones and a partial parking waiver for housing/commercial mixed use development within $\frac{1}{4}$ mile of a light rail transit stations.

A summary of the Light Rail Ordinance is provided in Attachment 3.

Marconi Light Rail Station

Technical Background Report

North Sacramento Design Guidelines

The North Sacramento Design Guidelines apply to the Hagginwood area, but not Ben Ali. The North Sacramento Design Guidelines are intended to provide consistent design principles for residential and commercial structures that can contribute to the creation of neighborhoods with a strong, cohesive sense of place, and can improve the character of neighborhoods by making them more attractive and inviting places.

Any proposed new project or remodel, addition, or exterior modifications to existing buildings in the design review area must be review for consistency with the North Sacramento Design Guidelines.

The North/South Sacramento and Ben Ali Design Standards

The Sacramento City Council adopted, on an interim basis, design standards related to the massing of single- and two-family homes in the North Sacramento, portions of South Sacramento, and the Ben Ali areas. The ordinance establishes setbacks, step backs for second stories, and other exceptions that determine whether a single family, two-family, or second unit that is being constructed or remodeled must go through design review. The intent of the design standards is to prevent any detrimental impact, in terms of scale and massing of buildings, of new and remodeled homes.

Residential Uses in a Commercial Zone

In 2003, the Council approved the Commercial Corridor Revitalization Strategy. The strategy included an amendment to the zoning code that allowed for residential uses in the C-1 and C-2 commercial zone with a zoning administrator permit or a planning commission special permit, depending on the size of the proposed residential use.

Residential Mix Use (RMX) Zone

In 2011, the RMX zone was modified to allow for up to 100% commercial space with a zoning administrator's special permit. This provision allows for greater flexibility in permitting neighborhood supporting commercial uses while still emphasizing residential mixed use.

Attachment 3 LIGHT RAIL ORDINANCE SUMMARY

The ordinance includes the following regulations:

- The Light Rail Station Ordinance requires a Planning Commission Special Permit for a limited list of new commercial and industrial uses within a quarter mile of those stations on the Northeast and South Light Rail Lines that were studied under the Transit for Livable Communities project.
- The following land uses require a special permit in all zoned properties within ¼ mile of a light rail station (measured from the center of a station platform) along the Northeast and South Line corridors:
 - Auto Sales (new or used), service, repair, storage, or rental
 - Cleaning Plant (Commercial)
 - Equipment rental sales yard
 - Laundry Plant (Commercial)
 - Mini Storage/ Locker Building
 - Nursery
 - Service Station
 - Wholesale Stores and Distributors over 6400 square feet
- The ordinance includes approval criteria to determine if a Special Permit should be issued for a new use.
- All current, existing land uses affected by the ordinance area are exempt (except for expansions which will require a Planning Directors Plan Review) allowing the use to operate as long as it wishes.
- Expansions of new development, which have been issued a special permit under the ordinance, are allowed with a special permit modification.
- In the event of major damage, for example a fire, to an existing or new development, the building can be rebuilt, by right, for same use.
- The ordinance also includes, for uses that did not already have them, definitions for each of the listed land uses.
- The ordinance allows residential uses in C-4, M-1, M-1(s), M-2, and M-2(s) zones within ¼ mile of a light rail transit station; subject to a special permit.
- Office uses up to 10,000 square feet or that take less than 25% of a buildings total square footage, are now allowed by right in industrial zones. Office uses that have a floor area ratio of .4 and has a floor area of less than or equal to 40,000 square feet are now allowed in industrial zones by with a Planning Directors Plan Review.

Marconi Light Rail Station

Technical Background Report

Attachment 4

TRANSPORTATION PROGRAMMING GUIDE

Transportation Programming Guide. The City Department of Transportation uses its Transportation Programming Guide (TPG) to prioritize unfunded transportation projects every two years. The TPG is used to assist staff and the City Council in making project funding decisions.

In the TPG, transportation projects are ranked according to criteria that reflect the City's current policies and priorities. Criteria considerations include congestion, public safety, economic, public input, and infill development priorities.

The latest TPG, adopted by the City Council in June 2010, identifies street, bikeway, traffic light, and pedestrian improvements for the Marconi Station Study Area. Four categories address roadway needs: major street improvements, street maintenance, street reconstruction, and traffic signals. The projects are listed on the following page:

**City of Sacramento, Department of Transportation
2010 Transportation Programming Guide –
Project within or near the Marconi Station Study Area**

TPG Program	Project Name	Limits	Rank
Major Street Projects	Marconi Avenue at Business 80*		13 of 42
Street Reconstruction	Eldridge Ave.	Del Paso Blvd. to Academy Way	21 of 90
Street Reconstruction	Kathleen Ave.	Del Paso Blvd. to Academy Wey.	22 of 90
Street Reconstruction	Naomi Way	Marconi Circle to Connie Drive	37 of 90
On-Street Bikeway	Roseville Road	Auburn Blvd. to City Limits	3 of 47
Traffic Signal	Roseville Road	Roseville Road at Connie Drive	27 of 30
Pedestrian Improvements	Tessa/Kathleen Ave.	From Del Paso Blvd. to Academy Way	8 of 32

* This project, estimated to cost \$23,700,000, includes widening of northbound off-ramps and southbound on-ramps, reconstruction of intersection on east and west side of the interchange, modification of bridge structure to conform to new ramps and intersections, and include bike and pedestrian improvements.

Marconi Light Rail Station

Technical Background Report

Attachment 5 UTILITIES INFRASTRUCTURE

Drainage

The Marconi Station Study Area is primarily served by Drainage Basins 151, 152, G209, and 159. A very small portion at the study's northern boundary is served by Basin G201. Drainage Basins 151 and G209, which serve the Ben Ali neighborhood, have been master planned.

Without a master plan, it is difficult to identify local flooding that is caused by inadequate drainage facilities. Often drainage issues are an issue of facility maintenance, e.g. clogged pipes, and not capacity. The city's drainage system is maintained primarily by the Utilities Department. However, the Department of Transportation is responsible for maintaining facilities that directly affect street drainage such as gutters and roadside ditches.

Drainage Basins 151 and G209. The master plans for Basins 151 and G209 identified areas of potential flooding during 10- and 100- year floods at Iris Avenue and Auburn Boulevard, and near the heavy railroad tracks where Marconi Avenue crosses over. There is potential flooding at Marconi Avenue and Naomi Way during a 100-year storm, but not during a 10-year storm.

Future improvements to the drainage facilities include upsizing drainage pipes in Roseville Road and Auburn Boulevard. A new drainage main is planned for Kenwood Avenue. Due to lack of funding, no time frame has been identified for the implementation of these projects.

Drainage Basin 159. A drainage study for the portion of the Marconi Station study area that falls within Basin 159 was conducted for this Technical Background Report. The study identifies areas of potential flooding, provides recommendations for improvements, and assesses the impact of new development on drainage in the area. The Drainage Basin 159 study is provided in Attachment 6.

In the absence of funding for drainage improvements, site improvements likely would be required as part of the entitlement and/or plan review process. The Department of Utilities would require developers to mitigate the impact of their development according to the department's "do no harm" standard. These mitigations could include onsite detention ponds, sub-grade detention, flow control devices, and/or offsite public improvements.

Detention Basins. Mackey Park and Del Paso Regional Park, just east of the project area boundary, serve as detention basins for runoff from Hagginwood Creek.

Marconi Light Rail Station

Technical Background Report

Water Pressure

The water pressure appears to be adequate in the portion of the Marconi Station Study Area that is served by the City of Sacramento Utility Department. The City standard for pounds per square inch (PSI) is 30 at a maximum day – a day where water use is high, such as in the summer. The City's Water Book shows a pressure range of 36 PSI near Iris Avenue and Auburn Boulevard, and 46 PSI along Del Paso Boulevard

The Sacramento Suburban Water District (SSWD) serves the study area east of Albatross Way. Water pressure in this area is reported to be low.

Water Quality

Potable water in the study area is provided by the city water system and not wells. Testing of potable water in the study area has not indicated any harmful contaminants.

Sewer System.

The sewer system in the entire Marconi Light Rail Station study area has the capacity to serve existing development as well as growth projected out to year 2030.

Stormwater Quality

The City's Building and Construction Code (Title 15) addresses grading, erosion, and sediment control, and the Public Service Code (Title 13) addresses stormwater management and discharge. The purpose of these codes is to control non-stormwater discharges into the stormwater conveyance system by eliminating discharges from spills, dumping, or disposal of materials other than stormwater. The ordinances were also enacted to comply with the city's national pollution discharge elimination system (NPDES) permit.

Generally, new development projects are responsible for mitigating for impacts to stormwater quality on site. There are no identified opportunities to address stormwater quality through city-initiated planning efforts.

**Marconi Station Study Area Drainage and Flood Control
Basin 159 Flood Hazard Evaluation**

Prepared by Martin Farber, Consulting Engineer and
Robert Armijo, Senior Engineer

July 2011

SUMMARY

This report was written to document the Department of Utilities study of local drainage and flood risks in the portion of the Marconi Station planning area located in Basin 159. In the impacted area, street flooding is not considered excessive. Risk of property flooding adjacent to Hagginwood Creek was found for roughly a dozen existing homes, and another dozen vacant or underutilized properties. A public safety hazard was identified for culvert crossings at Kathleen Ave., Judah St., and Eldridge Ave.

The impact of redevelopment in the impacted area would be a marginal increase in peak discharge (about 4 cfs) and flood depth (about 0.03 feet). On the dozen or so vacant or underutilized parcels adjacent to Hagginwood Creek, it is recommended that new structures have finished floor elevations set above natural grade, by as much as 4 feet. In addition, new homes adjacent to the Creek are recommended to face the Creek from the front or side, rather than from the back.

The Community Development Department indicated development and redevelopment of certain vacant or underused parcels only in Basin 159. Drainage improvement and/or mitigation projects recommended to support redevelopment in the project area include:

- Install new drainage pipeline in Kathleen Avenue, Eldridge Avenue, Judah Street, and Del Paso Boulevard,
- Install new trash racks and floating booms on the upstream side of the culvert crossings at Academy Way, Eldridge Avenue, Judah Street, and Kathleen Avenue,
- Install a new water level gauge with telemetry at the outlet structure of the Mackey Park Detention Basin,
- Retrofit a gradually-flared expansion section in Hagginwood Creek immediately upstream from (north of) Kathleen Avenue,
- Fence off Hagginwood Creek at the culvert crossings at Kathleen Ave., Judah St., and Eldridge Ave., and
- Retrofit a new “summer pump” at Sump 159.

The aforementioned common drainage facilities may be implemented via block grants, a financing plan, area specific fees, fair-share agreements, and/or through other special financing arrangements. Such financial arrangement would require interdepartmental cooperation and coordination. The DOU does not expect these common drainage improvements to rank highly in terms of relative criticality. Therefore, these improvements would probably not compete well for extremely limited Capital Improvement Program drainage funds. In the absence of funding for these common drainage improvements, site specific improvements should be required as part of the entitlement and/or plan review process. The DOU should require developers to mitigate the impact of their development according to the DOU's "do no harm" standard. These mitigations could include onsite detention ponds, sub-grade detention, flow controls devices (e.g. orifice plates), and/or offsite public improvements.

BACKGROUND INFORMATION

Purpose and Authorization

This tech-memo will describe the drainage condition of the study area, the impact of proposed development, and mitigation measures. The study area is the portion of the Marconi Light Rail Station Study Area that is located in Drainage Basin 159. Teresa Haenggi, of Community Development Department, requested the study.

Location and Description

This tech-memo concerns the redevelopment of underutilized parcels within roughly one-fourth mile of the Marconi/Arcade RT Station. The location is on the east side of Academy Way, at its intersection with Kathleen Street. The nearest major intersection is the Marconi Avenue flyover at Roseville Road. This RT Station is a "park-n-ride" and a "transfer station," an existing light rail platform with a parking area and bus stop. [In the Department of Utilities' Sewer Book, tile U-21 is at the center of the study area.]

Drainage Systems in the Study Area

The study area may be divided into four discrete parts, each served by a separate stormwater drainage system. The part of the study area that lies south of Marconi Ave and east of the light rail corridor is divided into two parts. The western part is at the extreme NE ("upstream") end of Basin 151. The eastern part is at the extreme N ("upstream") end of Basin 152.

The part of the study area that lies north of Marconi Ave and east of the light rail corridor is at the extreme W (downstream) end of Basin G209. The part of the study area that lies west of the light rail corridor is at the extreme E (upstream) end of Basin 159. This area includes the existing stormwater detention basin in Mackey Park.

Drainage Models and Master Plans for the Study Area

Basin 151 has a model and a drainage master plan. The master plan study showed that the Basin 151 drainage system is substandard in performance. Of the drainage improvements recommended by this master plan, none have been implemented in or near the study area.

In Basin 152, a model is still being constructed. This model is incomplete, untested, and unusable. The drainage system in this part of the study area is likely to be substandard in performance, because, at the time it was designed and constructed, the performance standards were lower than they are now.

Basin G209 has a model and a master plan. Of the drainage improvements recommended by this master plan, two have been built. This includes the stormwater detention basin in Mackey Park, and another detention basin just east of the study area, in the Haggin Oaks Golf Complex. The master plan study showed that parts of the Basin G209 drainage system are substandard in performance. However, the main drainage pipeline, or “trunk” of this drainage system is compatible with the master plan; only some local drainage pipelines may need improvement.

Basin 159 was the subject of a pilot study in 1990-1. This study produced a flawed model and unreliable recommendations for drainage improvement, none of which were ever constructed. The performance of this drainage system is examined in greater detail in this report.

Locations and Drainage Systems Impacted by the Subject Project

The Community Development Department (CDD) indicated the (re)development of certain vacant or underused parcels in the Marconi Station project area. The CDD did not identify any development or redevelopment in Basins 151, 152, and G209, therefore the project will not aggravate any drainage problems in those basins. If development or redevelopment were to occur in Basins 151 or G209, then the corresponding drainage master plans may be useful for identifying drainage risks and mitigations.

Within Basin 159, the sub-area tributary to (upstream from) the Marconi Park Stormwater Detention Basin includes the part of Kenwood Street that is bounded by Marconi Ave on the west and Cragmont St on the east. This is the part of Kenwood street that forms the northern boundary of Mackey Park.

The small sub-area of Basin 159 that lies north of Mackey Park will be impacted by proposed single-family residential development on lots with frontage on this part of Kenwood. However, the detention basin was designed with the expectation that this development would occur as planned. Therefore the drainage impact of this proposed

development has already been anticipated and provided for.

When this sub-area is excluded, what remains is that portion of the study area that is entirely in Basin 159, and is not tributary to the Marconi-Kenwood Detention Basin. On the map, this is the part of the study area that is west of the RT corridor, excluding Mackey Park itself, and the properties with frontage on the part of Kenwood that is adjacent to Mackey Park.

Of the remaining area, the portion of Del Paso Blvd east of Arcade Blvd forms the northern boundary of the study area. Of the many properties with frontage on this part of Del Paso Blvd, only one parcel, at the extreme NE corner of the study area, is to be developed under this project. Due to its small size and remote location, it will be more cost-effective for the project to deal with the impact of development through onsite mitigation, rather than by making drainage-system improvements further downstream.

Also within this remaining area is the industrial-zoned sub-area bounded by Kathleen Ave on the north, the RT corridor on the east, and the study area boundary on the west and south. Several lots in this sub-area will be developed under this project. However, this is an area that is already paved. As a result, (re)development in this sub-area will not increase stormwater runoff. Similarly, the area of the existing Marconi Station RT platform and park-n-ride may be considered a zero-impact area because it is already paved.

When the aforementioned areas are excluded, what remains is that portion of the study area that lies in the residential area bounded by Arcade Blvd on the northeast, Academy Way on the east, Kathleen Ave on the south, and the project area boundary on the west. This "Impacted Area" will be the focus of this memo.

Impacted Area Drainage System

The main stem of the drainage system is known as the "middle reach" of Hagginwood Creek, which flows generally from NE to SW through the middle of the Impacted Area. This reach of Hagginwood Creek normally receives all its flow from local-area runoff. This is because the upper reach of Hagginwood Creek (to the east of the Impacted Area) has been diverted northward to Arcade Creek. Arcade Creek is located north of, and entirely outside of, the study area. The Upper Hagginwood Creek Diversion is a double-barrel pipeline located on Cragmont Street, at the extreme NE corner of the study area.

The Diversion is completely effective for all but the most extreme storm events. When extreme events overstress the Diversion, large amounts of stormwater bypass the Diversion, and spill into the Mackey Park Detention Basin. For this reason, most of the detention storage volume in the Detention Basin is dedicated to catching bypass flow from Upper Hagginwood. Some local runoff enters the Detention Basin as well, but its

volume is only a very small fraction of the bypass volume.

The Detention Basin is designed to hold the bypass flow from Upper Hagginwood for extreme events up to and including the 100-year storm. However, the Detention Basin was designed on the assumption that Upper Hagginwood bypass flow was its only major source of stormwater. At the time, it was known that there is a significant risk of additional flow escaping from Arcade Creek at the west end of the Alistair MacKenzie Golf Course (located NE of the study area) and pouring into Upper Hagginwood Creek. However, at the same time, the City and SAFCA were studying Arcade Creek, with the intent of ultimately containing the breakout flows.

The channel sections and culverts of Middle Hagginwood Creek were designed before the idea for a detention basin at Mackey Park was conceived. Consequently we would expect that, for all but the most extreme storm events, this reach of the channel will contain the flow without risk of flooding. However, for extreme events, without containment of Arcade Creek, the detention basin cannot contain the flow from extreme events, and the creek is expected to get out of bank.

In the Impacted Area, local runoff from individual lots reaches the streets, where the water is then diverted to the Creek through roadside swales or pipelines. In the Impacted Area, Marconi Avenue and Academy Way have drainage pipelines. The remaining streets have only roadside swales.

PROBLEM IDENTIFICATION

Basin 159 Flood Hazard Evaluation

Flood hazard is evaluated with respect to the City performance standards adopted by Council in 1993, and still in effect at this writing (2011). That is, a street flooding hazard is present if a 10-year storm causes street flooding more than 0.5 feet deep, and a property flooding hazard is present if a 100-year storm causes the water level to exceed the finished floor elevation of structures, except for garages and sheds. There is also a public safety performance standard, not considered by Council, but commonly used (by administrative action in the Department of Utilities) in drainage studies.

A simulation model, known as Sacramento-SWMM, or SSWMM, was used to test the 10- and 100-year storms in Basin 159 to determine the location and extent of flood hazards in the Impacted Area under both pre-project and post-project conditions, and ultimate future conditions. Arcade Creek breakout flows were assumed contained for any 10-year storm, and for the 100-year storm under ultimate future conditions. For existing and (near-term) post-project conditions, a 100-year breakout flow of 333 cfs (estimated by Ensign & Buckley for SAFCA, 3/8/99) was assumed to be uncontained.

For the 10-year storm, no street flooding hazard was found for any location in the Impacted Area under pre-project, post-project, or ultimate future conditions. For the 100-year storm, with Arcade Creek contained, no property flooding was found under the ultimate future condition. Stream flow depths and velocities in Hagginwood Creek were high enough to be called a public safety hazard, but only when casual access to the stream is available to the public.

For a 100-year storm with Arcade Creek uncontained, Hagginwood Creek will overflow its banks. In the Impacted Area, roughly a dozen homes adjacent to the Creek could be flooded, and street overflow at the culvert crossings at Kathleen Avenue, Eldridge Avenue, and Judah Street will create a traffic and public safety hazard. In addition, the dozen or so properties adjacent to the Creek identified as vacant or underutilized will be flooded, at least partially, to depths up to 3 feet.

In addition to these local flood hazards, it is necessary to consider conditions downstream from the Impacted Area in the Middle (Basin 159) and Lower (Basin 154) reaches of Hagginwood Creek. As noted above, our 1990-1 pilot study did not produce an adequate model of these downstream drainage systems. However, the pilot study did tend to validate long-standing concerns about the inadequacy of those drainage systems. Therefore, any increase in runoff caused by the subject project could aggravate flood hazards downstream, and may require mitigation.

Basin 159 Impact Evaluation

As noted above, the small sub-area of Basin 159 that lies north of Mackey Park will be impacted by proposed development, but the detention basin was designed with the expectation that this development would occur as planned. Therefore the drainage impact of this proposed development has already been anticipated and provided for. The following discussion is therefore limited to the area southwest of Mackey Park; that is, the Impacted Area described above, and the drainage systems further downstream.

The impact of the project to the local drainage system is caused by increased imperviousness. This new imperviousness is expected from new homes and other structures, driveways, parking areas, and walkways. Streets are already present; however, the existing streets are narrow, and usually lack curb, gutter, and sidewalk; therefore some increase in imperviousness can be expected from future street widening and new sidewalks.

For individual single-family lots of this size, effective imperviousness at ultimate future build-out conditions is estimated at 45 percent, and this includes the lot itself, plus the adjacent sidewalk and half of the street. Without new curb, gutter, and sidewalk, and widening of streets, developed-lot imperviousness is about 40 percent. For undeveloped lots, the imperviousness consists of sidewalks and half of the street. If standard street

cross-sections are assumed, average overall imperviousness in undeveloped areas is about 15 percent. However, in the project area, with narrow streets and no curb, gutter, or sidewalk, overall imperviousness for undeveloped areas is around 10 percent.

The impact of new imperviousness in the project area is mainly in smoothing the ground surface and straightening the path of runoff, which makes local runoff quicker, or "flashier." The flashier rainfall-runoff response results in quicker, higher peak runoff rates. New imperviousness also reduces infiltration, but in the tight soils of the project area, natural infiltration rates are low, so this particular effect has less impact. As a result of increased imperviousness, the total infiltration volume for the 10- and 100-year storms decreased by around 10 percent, and most of this reduction occurs during the off-peak period of the storm.

Within the Impacted Area, about 65 percent development has occurred, with the remaining 35 percent of lots identified as vacant or underutilized. Therefore, under pre-project conditions, if 35 percent of the lots are at 10 percent imperviousness, and 65 percent of the lots are 40 percent impervious, then the average pre-project imperviousness is about 30 percent.

As a result of the increased imperviousness, instantaneous peak runoff rates will be increased by roughly 20 percent, and total runoff will be increased by about 6 percent, for the 10-year storm in the Impacted Area. For the 100-year storm, instantaneous peak runoff rates increased by roughly 15 percent, and total runoff increased by about 3 percent.

Impact on local and downstream drainage systems can be expressed as the change in instantaneous peak flow in Hagginwood Creek at the downstream end of the Impacted Area (Kathleen Ave). This peak flow (with Arcade Creek contained) increased about 9 percent for the 10-year storm, from 45.1 cubic feet per second (cfs) to 49.0 cfs. For the 100-year storm, the peak flow increased about 4 percent, from 100.4 cfs to 104.3 cfs. This change would increase flood depth in Hagginwood Creek by a few hundredths of a foot.

CONCLUSIONS AND RECOMMENDATIONS

Basin 159 Flood Risk Management

Local runoff does not overstress the existing drainage system when the system is operating normally. Flows in Hagginwood Creek may get out of bank for extreme events, caused by breakout flow from Arcade Creek in Haggin Oaks Golf Complex. Solving this problem may be considered an ongoing long-term effort, beyond the scope of the subject project. For project purposes, it is only necessary to keep all new finished floor elevations at least one foot above the 100-year flood level in the Creek. This will

require building new homes on the dozen or so vacant or underutilized parcels with finished floor levels up to 4 feet above natural grade.

To further address this risk, a warning system could be installed, to detect any occurrence of high water levels in Mackey Park Detention Basin. The overflow weir at the Detention Basin's control structure would be the key to setting the high water alarm, because breakout flow from Arcade Creek cannot reach the Impacted Area until it first fills up the Detention Basin and overtops this weir. To provide some lead time, the alarm level could be set, say, one foot below the weir. The alarm could trigger street closings at the four culvert crossings.

An additional risk factor is debris plugging. This is an uncontrolled variable not considered in modeling, nor is it a part of the historical record. Debris plugging can be the result of a combination of naturally-occurring deposits, particularly larger, leafy tree limbs, and the dumping of green wastes and other trash. An effective (but not perfect) defense would be to place new trash racks on the upstream side of the four culvert crossings, viz: (from upstream to downstream) Academy Way, Eldridge Avenue, Judah Street, and Kathleen Avenue. These trash racks should be placed at a sharp angle to the vertical. I further recommend installation of a floating boom, to be placed a short distance upstream from the trash rack at a sharp angle to the flow line of the Creek. This is a low-cost add-on that can catch floating debris before it becomes enmeshed in a trash rack. As an example, a floating boom has been in service since about 2000 at the J Street Culvert in Basin155, where debris plugging was historically a constant problem.

Another risk factor is apparently the result of poor hydraulic design at the double-barrel culvert crossing at Kathleen Avenue. The 1991 pilot study of this system noted "very bad entrance condition for west [culvert] pipe." The troublesome pipe culvert appeared to be poorly aligned, with the approaching channel centered on the east culvert. Although there is no record to show it, this condition suggests that the east culvert was installed when Kathleen Avenue was built, and the west culvert was added at a later date. The analyst's notes go on to say that the troublesome culvert "cannot be more than 30-40% effective" due to the poor hydraulics. This risk could be addressed by adding a gradually flared expansion section to the channel immediately upstream from (north of) Kathleen Avenue.

For public safety, new fencing may be placed at any part of the Creek that is publicly accessible. For this coarse evaluation, it is assumed that the new fencing would be recommended only for the four culvert crossings, on both sides of the street, with these new fences to tie into private fencing on either side. Such fencing should be high enough to discourage passers-by from throwing trash and debris into the channel. A field walk-through should be performed before a final decision is made as to the location and extents of new fencing.

Basin 159 Local Drainage System Improvements

The only significant defect in the local drains that deliver runoff to Hagginwood Creek is that drainage pipelines are missing from some of the streets. City drainage design standards limit the length of surface flow in gutters to 500 feet. Therefore, if new curb and gutter are planned for the project area, then new pipeline will be needed for parts of Kathleen Avenue, Eldridge Avenue, Judah Street, and Del Paso Boulevard. The minimum allowable size, 12" diameter circular pipeline, is recommended for all these new pipelines. In addition, new curb, gutter, and sidewalk is expected for all streets that don't have them.

Basin 159 Mitigation Alternatives

The foregoing model study shows that, for both the 10- and 100-year storms, an increase in peak flow of about 4 cfs is expected in Hagginwood Creek as a result of new imperviousness. Because Hagginwood Creek and its tributary drainage pipelines were never designed to handle breakout flow from Arcade Creek, there is no surplus capacity available, so it is highly doubtful that any increase in runoff can be safely tolerated downstream. It seems fairly certain that this runoff would increase the depth of flooding at the downstream end of Hagginwood Creek at Sump 154, and existing flood problems in and around the entire creek corridor might be marginally impacted.

Without a new, detailed study of the entire downstream area of Hagginwood Creek (Drainage Basins 154 and 159), the extent (and expense) this impact is unknown. However, it is the ongoing practice of the Department of Utilities to condition new development to "do no harm" whenever unmitigated development is reasonably expected to aggravate a flood risk that is already either known from experience, or predicted by a valid model or other available data. In the case of Sumps 154 and 159, in addition to the flawed model from the 1991 pilot study, we also have reliable work done by for City, and later for SAFCA, by an engineering consultant that indicates at least some extreme-event flood risk in the Lower Hagginwood Creek area. Under these conditions, in my opinion, it would be prudent to consider possible mitigation measures.

Onsite mitigation could be considered at each underdeveloped lot. Re-grading and/or terracing could be used to flatten the ground slope and slow down the runoff. Lots could be graded to force runoff to follow a J-shaped path around structures, which would lengthen the path of sheet flow and slow down runoff. Non-standard street cross-sections could be used, so that, instead of widening the street, the available right-of-way on either side could be used for park strips, designed to work as shallow stormwater-management basins.

Offsite mitigation could also be considered. One possibility worth considering is to add 5 cfs (sic) to the nominal pumping capacity of Sump 159, by retrofitting a new "summer

pump" in the Sump. Such a retrofit project may be considered doubly beneficial. That is, most City pumping plants have retrofitted a small pump to complement the larger main pumps that were originally installed, in order to handle minor but frequent "nuisance" flows. This approach helps extend the service life of the main pumps, by allowing them to stay at rest for extended periods between rainfall events. [Frequent stops and starts shorten service life.]

Another offsite mitigation alternative would be to retrofit flow-measuring equipment at Sump 159. Arguably, flow-measuring equipment does nothing to improve nominal pumping capacity. However, *available* pumping capacity is highly dependent on maintenance. To date, pump maintenance has only occurred in the aftermath of an event that raises concern about the condition of the pumps. The result is that, by all accounts, the average output of City pumping plants is around 70 to 75 percent of the rated capacity of the pumps when new. In my opinion, with regular pump testing or monitoring, average pump output could be increased to about 90 percent of rated capacity. For this reason, virtually all of the City's Drainage Master Plan studies recommend that flow-measuring equipment be installed at pumping plants. Due to funding constraints, the Department of Utilities has not made these retrofit projects a priority.

So, given that the nominal pumping capacity of Sump 159 is 90 cfs, the available pumping capacity is around 68 cfs (75% of nominal capacity) without flow-measuring equipment and 81 cfs (90% of nominal capacity) with it. Therefore, a retrofit project would result in an increase in average available capacity of 13 cfs. Even though this approach was not implemented, the Department of Utilities did accept this approach to mitigation for a development project in Basin 141.

Environmental Considerations

The presence of an open channel in a residential area has both upside and downside potential, depending mainly on channel aesthetics and public uses. That is, when a channel is attractive (and regularly maintained to keep it that way), residents value it as an asset. An attractive riparian corridor increases property values and decreases abuses such as trash-dumping. This benefit is enhanced further when the channel has public uses, such as trails, benches, and picnic tables. However, when a channel is unattractive, poorly-maintained, and has little or no public uses, dumping increases, and property values go down.

In commercial, industrial, or institutional areas, open channels generally have no neighbors interested in their upkeep, and dumping can get out of control. This not only is very bad for the environment, it also aggravates flood risk from debris plugging of culverts. Unfortunately, the part of the Creek that is in the study area and south of Kathleen Avenue is in an industrial area.

Regrettably, the project-area reach of Hagginwood Creek is not maintained, either for aesthetics, public uses, or environmental values. Maintenance for flood control purposes is also challenging in this area, as the channel is confined to a very narrow corridor between properties and fence-lines.

On the positive side, such a badly degraded riparian area has significant upside potential for environmental restoration and enhancement. The character, extent, and price-tag of a cost-effective stream restoration project is beyond the scope of this memo. It is offered here for the reader's consideration because such a project could be used to address environmental mitigation needs (if any), to sustain and enhance property value and quality-of-life for residents, and to reduce flood risk from debris plugging.

An additional consideration is the orientation of new development on the boundary of the channel corridor. Guidelines for creek-side development were formalized during planning efforts for Historic Magpie Creek in the early 1990's. These guidelines say that "front-on" development next to a stream produces the best results, while side-on lots, though less effective, are still acceptable. Back-on lots are considered unacceptable, and this poses a challenge for the subject project, as the map shows 7 lots with the back lot-line at creek-side.

The difficulty with back-on lots is that, generally, the residents' view of the creek is blocked by solid fencing. Thus, the residents place little or no value on their creek-side lot. They may even regard the creek as a home-security problem. This tends to encourage trash-dumping. From the privacy of a back yard, dumping can be done anytime without being observed.