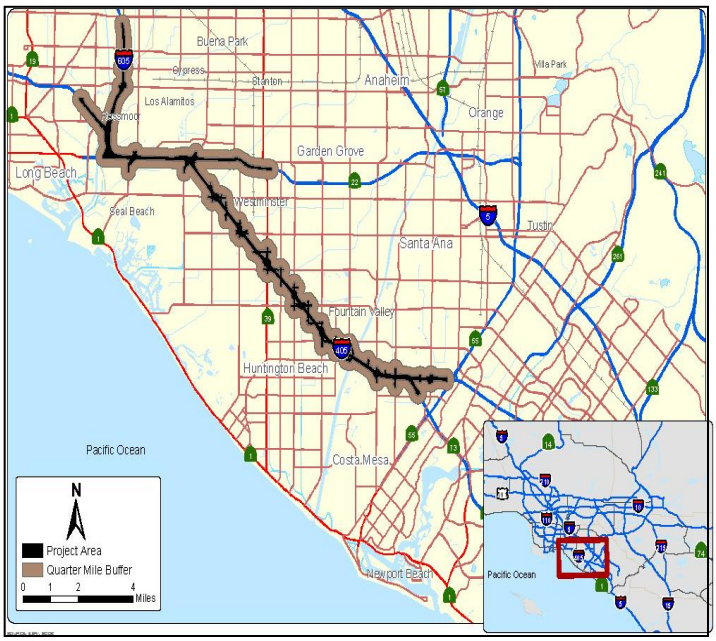
I-405 Improvement Project: Supplemental NADR



Supplemental
Noise Abatement Decision Report

Noise Study Report Amendment 1, May 2012

Noise Study Report Amendment 3, July 2014

I-405 Improvement Project
In Orange and Los Angeles Counties from SR-73 to the
I-605 Interchange

12-ORA-405 PM 9.3/24.2 / 07-LA-405 PM 0.0/1.2
12-ORA-22 PM R0.7/R3.8 / 12-ORA-22 PM R0.5/R0.7
12-ORA-73 PM R27.2/R27.8 / 12-ORA-605 PM 3.5/R1.6
07-LA-605 PM R0.0/R1.2

EA 0H1000

December 2014

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12-ORA-73 PM R27.2/R27.8 / 12-ORA-605 PM 3.5/R1.6
07-LA-605 PM R0.0/R1.2

EA 0H1000

December 2014

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1. Introduction

This Supplemental Noise Abatement Decision Report (NADR) is being prepared to update the analysis and recommendation made in the Final NADR, approved in September 2011 for the Interstate 405 (I-405) Improvement Project. The purpose of this Supplemental NADR is to address the design changes between the Warner Avenue and Magnolia Street interchanges and changes to the number of benefited residences for Soundwall S1162 adjacent to the City of Seal Beach Tennis Court Center for the build alternatives considered for the project. The information provided in this report has been approved by a California licensed professional civil engineer. The Final Noise Study Report (NSR) dated June 2011, NSR Amendment 1 dated May 2012, and NSR Amendment 3 dated June 2014 prepared for this project are hereby incorporated by reference.

1.1. Noise Abatement Assessment Requirements

This Supplemental NADR is being prepared in conformance with Title 23, *Code of Federal Regulations* (CFR), Part 772 of the Federal Highway Administration (FHWA) Standards (23 CFR 772) and the Caltrans' Traffic Noise Analysis Protocol (Caltrans 2006).

1.2. Purpose of the Noise Abatement Decision Report

The purpose of this Supplemental NADR is to:

- Summarize the conclusion of NSR Amendments 1 and 3 relating to acoustical feasibility and the reasonable allowances for abatement evaluated;
- Present the engineer's cost estimate for evaluated abatement;
- Present the engineer's evaluation of non-acoustical feasibility issues;
- Present the noise abatement decision; and
- Present preliminary information on secondary effects of abatement (e.g., impacts on cultural resources, scenic views, hazardous materials, biology).

This Supplemental NADR does not address noise barriers or other noise-reducing treatments required as mitigation for significant adverse environmental effects identified under the California Environmental Quality Act (CEQA).

1.3. Project Description

The California Department of Transportation (Caltrans), in cooperation with Orange County Transportation Authority (OCTA), proposes to improve mainline freeway and interchanges on I-405 for approximately 16 miles (mi), as shown in Figure 1-1. Three build alternatives and a No Build Alternative have been considered in the Draft Environmental Impact Report/Environmental Impact Statement (DEIR/EIS). Alternative 1 proposes to add one general purpose (GP) lane in each direction. Alternative 2 proposes to add two GP lanes in each direction. Alternative 3 proposes to add one GP lane in each direction and a second lane in each direction to be managed jointly with existing High-Occupancy Vehicle (HOV) lanes as two tolled Express Lanes in each direction. In summer 2014, Alternative 3 was selected as the Preferred Alternative.

Per NSR Amendment 3, the design changes between the Warner Avenue and Magnolia Street interchanges for all of the build alternatives for the project are as follows for each direction of the freeway:

Southbound

In the southbound (SB) direction of I-405, the proposed braided ramps that would have grade separated the Magnolia Street loop on-ramp and the Warner Avenue loop off-ramp will be eliminated for all three build alternatives. In lieu of the braided ramp configuration, the Magnolia Street loop on-ramp will terminate at the freeway end, into a new auxiliary lane adjacent to the GP lanes, which will accommodate traffic exiting I-405 onto the Warner Avenue loop off-ramp. The auxiliary lane will terminate south of the off-ramp to Warner Avenue.

Northbound

In the northbound (NB) direction of I-405, the braided ramps are eliminated for all three build alternatives. A collector-distributor (C-D) road serving the Warner Avenue on-ramp to, and the Magnolia Street off-ramp from, NB I-405 will be provided. The off-ramp to Warner Avenue from NB I-405 will be served by a separate ramp departing the I-405 mainline upstream of the exit to the proposed C-D road. The loop on-ramp from NB Magnolia Street and the on-ramp from SB Magnolia Street will be joined together before entering the I-405 mainline downstream of the C-D road entrance to the freeway mainline.

1.4. Affected Land Uses

The land uses along the Warner Avenue NB loop off-ramp consist of commercial establishments, including one building that is occupied by El Dorado Preschool.

The land uses along SB I-405 between Warner Avenue and Magnolia Street consist of four commercial/recreational establishments, including Boomers, Days Inn Hotel, Fountain Valley Skating Center, and Sport Authority.

The land uses along NB I-405 between Warner Avenue and Magnolia Street consist of single-family residential homes and the Ocean View Channel, which is an Orange County Flood Control facility.

Study Area

Figure 1-1 Project Location Map

2. Results of the Noise Study Report

The Final NSR for this project was prepared by Parsons (June 2011) and approved by Caltrans Environmental Engineering Unit in June 2011. The NSR Amendment 1 was prepared and approved in May 2012 to reflect changes to the number of benefited residences for Soundwall S1162 under the build alternatives. Under further review, it was determined that because the length of tennis court area along I-405 is approximately 550 feet, a higher number of benefited residence can be considered for the noise analysis. The minimum height and location of Soundwall S1162 did not change under the NSR Amendment 1. Figures that show the minimum height and location of Soundwall S1162 are included in NSR Amendment 1.

The NSR Amendment 2 was prepared and approved in May 2012 to address the possible traffic noise impacts and abatement measures for the El Dorado pre-school located at the edge shoulder of the Warner Avenue NB loop off-ramp. However, due to design change between the Warner Avenue and Magnolia Street interchanges, this location was re-analyzed in the NSR Amendment 3. Therefore, Amendment 2 was not incorporated into this Supplemental NADR since it would be superseded by NSR Amendment 3.

The NSR Amendment 3 was prepared and approved in June 2014, to reflect the design that does not include braided ramps between Warner Avenue and Magnolia Street in both directions in any build alternatives. The braided ramps in the NB direction were replaced with a C-D road system. The braided ramps in the SB direction were replaced with an auxiliary lane between the Magnolia Street SB loop on-ramp and the Warner Avenue SB loop off-ramp. The minimum heights and locations of the soundwalls that provide feasible abatement are shown graphically in the figures of NSR Amendment 3.

Table 2-1 presents feasible soundwalls relating to the design changes and summarizes the data used to assess the abatement cost allowances at each of the considered barrier heights for Alternative 1.

Table 2-1 Summary of Feasible & Recommended Soundwalls from Noise Study Report Amendments 1 and 3 (Alternative 1)

Barrier No.	Location	Barrier Station[1]	Height (feet)	Acoustically Feasible?	Number of Benefited Residences	Reasonable Allowance per Residence	Total Resonable Allowance
S776	ROW (NB)	774+00 to 776+50	8	Yes	1	$37,000	$37,000
			10	Yes	1	$39,000	$39,000
			12	Yes	1	$39,000	$39,000
			14	Yes	1	$39,000	$39,000
			16	Yes	1	$39,000	$39,000
S786/790 (4)	ROW (NB)	785+02 to 790+27(5)	8	No	N/A	N/A	N/A
			10	No	N/A	N/A	N/A
			12	No	N/A	N/A	N/A
			14	No	N/A	N/A	N/A
			16	Yes	3	$43,000	$129,000
S795	Shoulder (SB)	790+00 to 801+00	8	Yes	31	$45,000	$1,395,000
			10	Yes	31	$45,000	$1,395,000
			12	Yes	53	$45,000	$2,385,000
			14	Yes	53	$45,000	$2,385,000
			16	Yes	53	$45,000	$2,385,000
S1162	Shoulder (NB)	1157+00 to 1164+00	8	No	N/A	N/A	N/A
			10	No	N/A	N/A	N/A
			12	Yes	3	$43,000	$129,000
			14	Yes	3	$43,000	$129,000
			16	No	N/A	N/A	N/A

1- Stations are approximate and correspond to I-405 mainline.
2- In-kind replacement of an existing soundwall at new location with same height.
3- Replacement of existing soundwall at same location with new height.
4- Replacement of existing soundwall at new location with new height.
5- Stations are approximate and correspond to ramp station line.

Table 2-2 presents feasible soundwalls relating to the design changes and summarizes the data used to assess the abatement cost allowances at each of the considered barrier heights for Alternative 2.

Table 2-2 Summary of Feasible & Recommended Soundwalls from Noise Study Report Amendments 1 and 3 (Alternative 2)

Barrier No.	Location	Barrier Station[1]	Height (feet)	Acoustically Feasible?	Number of Benefited Residences	Reasonable Allowance per Residence	Total Resonable Allowance
S776	ROW (NB)	774+00 to 776+50	8	Yes	1	$39,000	$39,000
			10	Yes	1	$41,000	$41,000
			12	Yes	1	$41,000	$41,000
			14	Yes	1	$41,000	$41,000
			16	Yes	1	$41,000	$41,000
S786/790 (4)	ROW (NB)	785+02 to 790+27(5)	8	No	NA	NA	NA
			10	No	NA	NA	NA
			12	No	NA	NA	NA
			14	Yes	3	$45,000	$135,000
			16	Yes	3	$47,000	$141,000
S795	Shoulder (SB)	790+00 to 801+00	8	Yes	31	$43,000	$1,333,000
			10	Yes	31	$45,000	$1,395,000
			12	Yes	53	$45,000	$2,385,000
			14	Yes	53	$45,000	$2,385,000
			16	Yes	53	$45,000	$2,385,000
S1162	Shoulder (NB)	1157+00 to 1164+00	8	No	N/A	N/A	N/A
			10	No	N/A	N/A	N/A
			12	Yes	3	$43,000	$129,000
			14	No	N/A	N/A	N/A
			16	No	N/A	N/A	N/A

1- Stations are approximate and correspond to I-405 mainline.
2- In-kind replacement of an existing soundwall at new location with same height.
3- Replacement of existing soundwall at same location with new height.
4- Replacement of existing soundwall at new location with new height.
5- Stations are approximate and correspond to ramp station line.

Table 2-3 presents feasible soundwalls relating to the design changes and summarizes the data used to assess the abatement cost allowances at each of the considered barrier heights for Alternative 3 (Preferred Alternative).

Table 2-3 Summary of Feasible & Recommended Soundwalls from Noise Study Report Amendments 1 and 3 (Alternative 3)

Barrier No.	Location	Barrier Station[1]	Height (feet)	Acoustically Feasible?	Number of Benefited Residences	Reasonable Allowance per Residence	Total Resonable Allowance
S776	ROW (NB)	774+00 to 776+50	8	Yes	1	$39,000	$39,000
			10	Yes	1	$41,000	$41,000
			12	Yes	1	$41,000	$41,000
			14	Yes	1	$41,000	$41,000
			16	Yes	1	$41,000	$41,000
S786/790 (4)	ROW (NB)	785+02 to 790+27(5)	8	No	NA	NA	NA
			10	No	NA	NA	NA
			12	No	NA	NA	NA
			14	Yes	3	$45,000	$135,000
			16	Yes	3	$47,000	$141,000
S795	Shoulder (SB)	790+00 to 801+00	8	Yes	31	$45,000	$1,395,000
			10	Yes	31	$45,000	$1,395,000
			12	Yes	31	$45,000	$1,395,000
			14	Yes	53	$45,000	$2,385,000
			16	Yes	53	$45,000	$2,385,000
S1162	Shoulder (NB)	1157+00 to 1164+00	8	No	N/A	N/A	N/A
			10	No	N/A	N/A	N/A
			12	Yes	6	$45,000	$270,000
			14	Yes	6	$45,000	$270,000
			16	No	N/A	N/A	N/A

1- Stations are approximate and correspond to I-405 mainline.
2- In-kind replacement of an existing soundwall at new location with same height.
3- Replacement of existing soundwall at same location with new height.
4- Replacement of existing soundwall at new location with new height.
5- Stations are approximate and correspond to ramp station line.

3. Preliminary Noise Abatement Decision

3.1. Summary of Key Information

The NSR Amendments 1 and 3 analyze noise barriers with heights from 8 to 16 feet to determine the feasibility of noise abatement. Tables 3-1, 3-2, and 3-3 summarize the preliminary noise abatement decision for Build Alternatives 1, 2, and 3 (Preferred Alternative), respectively. The preliminary noise abatement decision is based on investigating acoustical feasibility, number of benefited residences, the total reasonableness allowance, engineer's cost estimate for the abatement, and comparison of cost versus allowance.

Wall construction cost estimates are based on masonry walls in accordance with Caltrans' standard plans and specifications. Costs estimates are derived from the Caltrans Cost Database (CCD) (Caltrans, 2008-2010), which calculates an average unit cost of construction-related items from recent state transportation projects. For this project, cost estimates were based on 2008-2010 Caltrans Contract Cost data. Cost calculations for soundwalls include the cost of the wall, piles, earthwork and traffic control. The final cost estimate also includes a 10 percent contingency. Tables in Appendix B summarize the engineer's cost estimate for constructing the walls discussed in the NSR Amendment 3. Wall construction cost estimate for Soundwall S1162, discussed in the NSR Amendment 1, is in the tables provided in Appendix B of the Final NSR.

Costs of related activities, such as clearing and grubbing, landscaping, and typical aesthetic treatments, have not been estimated because these items are variable and could change substantially depending on several project-per-project factors.

Tables 3-1 through 3-3 summarize key abatement information, including reasonableness allowances and estimated construction cost, for Build Alternatives 1, 2, and 3 (Preferred Alternative).

3.2. Non-acoustical Factors Relating to Feasibility

Based on the preliminary project and abatement design, no non-acoustical factors related to feasibility have been identified that would be considered out of the ordinary for soundwall construction. The non-acoustical factors considered are: geometric standards (e.g., sight distances), safety, maintenance, security, geotechnical issues, and utility relocations. Some of these non-acoustical factors, including geotechnical issues, will have to be investigated during the design phase.

Soundwall S790 would be constructed along the right-of-way adjacent to private properties; therefore, all of the residences behind these barriers would need to grant temporary construction easements prior to the beginning of construction. Temporary construction easements are considered typical for soundwall construction.

3.3. Preliminary Recommendation and Decision

The preliminary noise abatement decision presented in this section is based on preliminary project alignments and profiles, which may be subject to change. As such, the physical characteristics of noise abatement described herein also may be subject to change. If pertinent parameters change substantially during the final project design, the preliminary noise abatement decision may be changed to include abatement in the final project design. A final decision on whether and how to construct noise abatement would be made upon completion of the project design.

Based on the information summarized in Table 3-1 and noise reductions specified in NSR Amendments 1 and 3, the following discussion presents the engineer's recommendation on the proposed height and reasonableness of feasible and proposed soundwalls within the design change areas for Alternative 1:

- **Soundwall S776:** Soundwall S776 would be 251 feet long and located along the right-of-way along the Warner Avenue NB loop off-ramp. The minimum required wall height and length for Soundwall S776 required to meet the feasibility criterion is shown in Figure 10 of NSR Amendment 3. The estimated total construction cost of Soundwall S776 would be $82,000 for 12-foot high noise barrier, which exceeds the reasonable allowance of $39,000. However, the predicted peak-hour noise level at this location is above 75 A-weighted decibels (dBA) without a soundwall in place, which is considered severely impacted. Therefore, Soundwall S776 is recommended. Figure 10 on page A-7 of Appendix A1 shows the recommended height and location of Soundwall S776.
- **Soundwall S786/S790:** Soundwall S786/S790 would act as one system and would be located along the right-of-way of the Warner Avenue NB on-ramp. Soundwall S786 would be 332 feet long and Soundwall S790, which replaces a portion of the existing 12-foot soundwall, would be 115 feet long. Figure 10 of NSR Amendment 3 shows the minimum heights and lengths of Soundwall S786/S790 required to provide feasible abatement. With consideration of the acoustic benefit and the incremental cost, Soundwall S786 is recommended to be a 16-foot-high wall and Soundwall S790 is recommended to be a 14-foot-high wall. The estimated total construction cost of Soundwall S786 and the incremental cost for Soundwall S790 is $134,000 for the proposed heights, which is higher than the reasonable allowance of $129,000; therefore, it is not recommended. The portion of the existing 12-foot high soundwall

along the northbound on-ramp from Warner Avenue where impacted by the project improvements will be replaced in kind while the unaffected portion will be maintained. Figure 10 on page A-7 of Appendix A1 shows the height and location of Soundwall S790.

- **Soundwall S795:** Soundwall S795 would be 1,100 feet long and located along the edge of shoulder of SB I-405 between Warner Avenue and Magnolia Street. The minimum required wall heights and length for Soundwall S795 required to meet the feasibility criterion is shown in Figures 10 and 11 of NSR Amendment 3. As shown in Table 3-1, the estimated total construction cost of Soundwall S795 at a height of 12 feet would be $356,000, which is less than the reasonable allowance of $2,385,000. There would also be an acoustic benefit by increasing the height of the 8- and 10- foot portions of Soundwall S795. Therefore, with consideration of the additional acoustic benefit and the estimated total construction cost, Soundwall S795 is recommended for construction at a height of 12 feet. Figures 10 and 11 on pages A-7 and A-9 of Appendix A1 show the height and location of this soundwall.
- **Soundwall S1162:** Soundwall S1162 would be located at the edge of shoulder along the NB side of I-405 and would extend an existing soundwall 700 feet to the north. Upon further review of Soundwall S1162, a higher number of benefited residences can be considered for noise analysis. As indicated in the NSR Amendment 1, the number of benefited residences increased from 1 to 3, resulting in a higher total reasonable allowance of $129,000. The minimum required wall height and length for Soundwall S1162 required to meet the feasibility criterion is shown in Figure 23 of NSR Amendment 1. As shown in Table 3-1, the total construction cost of this wall is estimated to be $225,000 for the proposed 12-foot height, which exceeds the reasonable allowance of $129,000. With consideration of the incremental cost and no additional acoustic benefit, construction of Soundwall S1162 is not reasonable; therefore, it is not recommended. However, as shown by Figure 23 on page A-11 of Appendix A1, this area is already partially protected by a 7- to 8-foot-high private wall on top of a berm, which will be maintained.

Table 3-1 Summary of Abatement Key Information – Alternative 1

Barrier	Height (feet)	Acoustically Feasible?	Number of Benefited Residences	Total Reasonable Allowance	Masonry Estimated Construction Cost	Cost Less than Allowance?
S776	8	Yes	1	$37,000	$64,000	No
	10	Yes	1	$39,000	$73,000	No
	12	Yes	1	$39,000	$82,000	No
	14	Yes	1	$39,000	$91,000	No
	16	Yes	1	$39,000	$99,000	No
S786/S790(4)	8	No	N/A	N/A	N/A	N/A
	10	No	N/A	N/A	N/A	N/A
	12	No	N/A	N/A	N/A	N/A
	14	No	N/A	N/A	N/A	N/A
	16	Yes	3	$129,000	$134,000	No
S795	8	Yes	31	$1,395,000	$278,000	Yes
	10	Yes	31	$1,395,000	$317,000	Yes
	12	Yes	53	$2,385,000	$356,000	Yes
	14	Yes	53	$2,385,000	$395,000	Yes
	16	Yes	53	$2,385,000	$430,000	Yes
S1162	8	No	N/A	N/A	N/A	N/A
	10	No	N/A	N/A	N/A	N/A
	12	Yes	3	$129,000	$225,000	No
	14	Yes	3	$129,000	$250,000	No
	16	No	N/A	N/A	N/A	N/A

1- Stations are approximate and correspond to I-405 mainline
2- In-kind replacement of an existing soundwall at new location with same height.
3- Replacement of existing soundwall at same location with new height.
4- Replacement of existing soundwall at new location with new height.
5- Stations are approximate and correspond to ramp station line.

Based on the information summarized in Table 3-2 and noise reductions specified in the NSR Amendments 1 and 3, the following discussion presents the engineer's recommendation on the proposed height and reasonableness of feasible and proposed soundwalls within the design change areas for Alternative 2:

- **Soundwall S776:** Soundwall S776 would be 251 feet long and located along the right-of-way of the Warner Avenue NB loop off-ramp. The minimum required wall height and length for Soundwall S776 required to meet the feasibility criterion is shown in Figure 10 of NSR Amendment 3. The estimated total construction cost of Soundwall S776 would be $82,000 for the proposed 12-foot height, which exceeds the reasonable allowance of $41,000. However, the predicted peak-hour noise level at this location is above 75 dBA without a soundwall in place, which is considered severely impacted. Therefore, Soundwall S776 is recommended. Figure 10 on page A-13 of Appendix A1 shows the recommended height and location of Soundwall S776.
- **Soundwall S786/S790:** Soundwall S786/S790 would act as one system and would be located along the right-of-way of the Warner Avenue NB on-ramp. Soundwall S786 would be 332 feet long and Soundwall S790, which replaces a portion of the existing 12-foot soundwall, would be 115 feet long. Figure 10 of NSR Amendment 3 shows the minimum heights and lengths of Soundwall S786/S790 required to provide feasible abatement. With consideration of the acoustic benefit and the incremental cost, Soundwall S786/S790 is recommended to be a 14-foot-high wall. The estimated total construction cost of Soundwall S786 and the incremental cost for Soundwall S790 is $124,000 for a 14-foot high noise barrier, which is less than the reasonable allowance of $135,000; therefore, it is recommended. Figure 10 on page A-13 of Appendix A1 shows the recommended heights and location of these soundwalls.
- **Soundwall S795:** Soundwall S795 would be 1,100 feet long and located along the edge of shoulder of SB I-405 between Warner Avenue and Magnolia Street. The minimum required wall heights and length for Soundwall S795 required to meet the feasibility criterion is shown in Figures 10 and 11 of NSR Amendment 3. As shown in Table 3-2, the estimated total construction cost of Soundwall S795 at a height of 12 feet would be $356,000, which is less than the reasonable allowance of $2,385,000. There would also be an acoustic benefit by increasing the height of the 8- and 10- foot portions of Soundwall S795. Therefore, with consideration of the additional acoustic benefit and the estimated total construction cost, Soundwall S795 is recommended for construction at a height of 12 feet. Figures 10 and 11 on pages A-13 and A-15 of Appendix A1 show the height and location of this soundwall.
- **Soundwall S1162:** Soundwall S1162 would be located at the edge of shoulder along the northbound side of I-405 and would extend an existing soundwall 700 feet to the north. Upon further review of Soundwall S1162, a higher number of benefited

residences can be considered for noise analysis. As indicated in the NSR Amendment 1, the number of benefited residences increased from 1 to 3 resulting in a higher total reasonable allowance of $129,000. The minimum required wall height and length for Soundwall S1162 required to meet the feasibility criterion is shown in Figure 23 of NSR Amendment 1. Table 3-2 shows that the total construction cost of this wall is estimated to be $225,000 for a 12-foot height, which exceeds the reasonable allowance of $129,000. With consideration of the incremental cost and no additional acoustic benefit, construction of S1162 is not reasonable; therefore, it is not recommended. However, as shown by Figure 23 on page A-17 of Appendix A1, this area is already partially protected by a 7- to 8-ft-high private wall on top of a berm, which will be maintained.

Table 3-2 Summary of Abatement Key Information – Alternative 2

Barrier	Height (feet)	Acoustically Feasible?	Number of Benefited Residences	Total Reasonable Allowance	Masonry Estimated Construction Cost	Cost Less than Allowance?
S776	8	Yes	1	$39,000	$64,000	No
	10	Yes	1	$41,000	$73,000	No
	12	Yes	1	$41,000	$82,000	No
	14	Yes	1	$41,000	$91,000	No
	16	Yes	1	$41,000	$99,000	No
S786/S790(4)	8	No	N/A	N/A	N/A	N/A
	10	No	N/A	N/A	N/A	N/A
	12	No	N/A	N/A	N/A	N/A
	14	Yes	3	$135,000	$124,000	Yes
	16	Yes	3	$141,000	$138,000	Yes
S795	8	Yes	31	$1,333,000	$278,000	Yes
	10	Yes	31	$1,395,000	$317,000	Yes
	12	Yes	53	$2,385,000	$356,000	Yes
	14	Yes	53	$2,385,000	$395,000	Yes
	16	Yes	53	$2,385,000	$430,000	Yes
S1162	8	No	N/A	N/A	N/A	N/A
	10	No	N/A	N/A	N/A	N/A
	12	Yes	3	$129,000	$225,000	No
	14	No	N/A	N/A	N/A	N/A
	16	No	N/A	N/A	N/A	N/A

1- Stations are approximate and correspond to I-405 mainline
2- In-kind replacement of an existing soundwall at new location with same height.
3- Replacement of existing soundwall at same location with new height.
4- Replacement of existing soundwall at new location with new height.
5- Stations are approximate and correspond to ramp station line.

Based on the information summarized in Table 3-3 and noise reductions specified in the NSR Amendments 1 and 3, the following discussion presents the engineer's recommendation on the proposed height and reasonableness of feasible and proposed soundwalls within the design change areas for Alternative 3:

- **Soundwall S776:** Soundwall S776 would be 251 feet long and located along the right-of-way of the Warner Avenue NB loop off-ramp. The minimum required wall height and length for Soundwall S776 required to meet the feasibility criterion is shown in Figure 10 of NSR Amendment 3. The estimated total construction cost of Soundwall S776 would be $82,000 for the proposed 12-foot height, which exceeds the reasonable allowance of $41,000. However, the predicted peak-hour noise level at this location is above 75 dBA without a soundwall in place, which is considered severely impacted. Therefore, Soundwall S776 is recommended. Figure 10 on page A-19 of Appendix A1 shows the recommended height and location of Soundwall S776.
- **Soundwall S786/S790:** Soundwall S786/S790 would act as one system and would be located along the right-of-way of the Warner Avenue NB on-ramp. Soundwall S786 would be 332 feet long and Soundwall S790, which replaces a portion of the existing 12-foot soundwall, would be 115 feet long. Figure 10 of NSR Amendment 3 shows the minimum heights and lengths of Soundwall S786/S790 required to provide feasible abatement. The estimated total construction cost of Soundwall S786 and the incremental cost for Soundwall S790 is $124,000 for the proposed 14-foot height, which is less than the reasonable allowance of $135,000; therefore, it is recommended. With consideration of the acoustic benefit and the incremental cost, Soundwall S786/S790 is recommended to be a 14-foot-high wall. Figure 10 on page A-19 of Appendix A1 shows the recommended heights and location of these soundwalls.
- **Soundwall S795:** Soundwall S795 would be 1,100 feet long and located along the edge of shoulder of SB I-405 between Warner Avenue and Magnolia Street. The minimum required wall height and length for Soundwall S795 required to meet the feasibility criterion is shown in Figures 10 and 11 of NSR Amendment 3. As shown in Table 3-3, the estimated total construction cost of Soundwall S795 at a height of 14 feet would be $395,000, which is less than the reasonable allowance of $2,385,000. There would also be an acoustic benefit by increasing the height of the 8- and 12- foot portions of Soundwall S795. Therefore, with consideration of the additional acoustic benefit and the estimated total construction cost, Soundwall S795 is recommended for construction at a height of 14 feet. Figures 10 and 11 on pages A-19 and A-21 of Appendix A1 show the height and location of this soundwall.
- **Soundwall S1162:** Soundwall S1162 would be located at the edge of shoulder along the northbound side of I-405 and would extend an existing soundwall 700 feet to the

north. Upon further review of Soundwall S1162, a higher number of benefited residences can be considered for noise analysis. As indicated in the NSR Amendment 1, the number of benefited residences increased from 2 to 6, resulting in a higher total reasonable allowance of $270,000. The minimum required wall height and length for Soundwall S1162 required to meet the feasibility criterion is shown in Figure 23 of NSR Amendment 1. As shown in Table 3-3, the total construction cost of this wall is estimated to be $225,000 for a 12-foot height, which is less than the reasonable allowance of $270,000; therefore, it is recommended. Figure 23 on page A-23 of Appendix A1 shows the recommended height and location of Soundwall S1162.

Table 3-3 Summary of Abatement Key Information – Alternative 3

Barrier	Height (feet)	Acoustically Feasible?	Number of Benefited Residences	Total Reasonable Allowance	Masonry Estimated Construction Cost	Cost Less than Allowance?
S776	8	Yes	1	$39,000	$64,000	No
	10	Yes	1	$41,000	$73,000	No
	12	Yes	1	$41,000	$82,000	No
	14	Yes	1	$41,000	$91,000	No
	16	Yes	1	$41,000	$99,000	No
S786/S790(4)	8	No	N/A	N/A	N/A	N/A
	10	No	N/A	N/A	N/A	N/A
	12	No	N/A	N/A	N/A	N/A
	14	Yes	3	$135,000	$124,000	Yes
	16	Yes	3	$141,000	$138,000	Yes
S795	8	Yes	31	$1,395,000	$278,000	Yes
	10	Yes	31	$1,395,000	$317,000	Yes
	12	Yes	31	$1,395,000	$356,000	Yes
	14	Yes	53	$2,385,000	$395,000	Yes
	16	Yes	53	$2,385,000	$430,000	Yes
S1162	8	No	N/A	N/A	N/A	N/A
	10	No	N/A	N/A	N/A	N/A
	12	Yes	6	$270,000	$225,000	Yes
	14	Yes	6	$270,000	$250,000	Yes
	16	No	N/A	N/A	N/A	N/A

1- Stations are approximate and correspond to I-405 mainline
2- In-kind replacement of an existing soundwall at new location with same height.
3- Replacement of existing soundwall at same location with new height.
4- Replacement of existing soundwall at new location with new height.
5- Stations are approximate and correspond to ramp station line.

4. Secondary Effects of Abatement

There are no additional impacts or secondary effects on cultural resources, scenic views, hazardous materials, biology, or other resources expected to occur.

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5. References

Caltrans, 2006. California Department of Transportation. Traffic Noise Analysis Protocol for New Highway Construction, Reconstruction and Barrier Retrofit Projects, August. (http://www.dot.ca.gov/hq/env/noise/pub/2006_protocol.pdf)

Caltrans, 2008-2010. Caltrans Contract Cost Database. Available at: (http://sv08data.dot.ca.gov/contractcost/)

Parsons, 2011. Final Noise Study Report: I-405 Improvement Project, June.

Parsons, 2011a. Final Noise Abatement Decision Report: I-405 Improvement Project, September.

Parsons, 2012. Amendment 1: I-405 Improvement Project Noise Study Report, May.

Parsons, 2012a. Amendment 2: I-405 Improvement Project Noise Study Report, May.

Parsons, 2014. Amendment 3: I-405 Improvement Project Noise Study Report, June.

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Appendix A Engineer's Recommendation

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TABLE A-1 - Noise Abatement Information (Alt-1)

Noise Barrier No.	Height (feet)	Acoustically Feasible?	Number of Benefited Residences	Total Reasonable Allowance	Estimated Construction Cost	Cost Less than Allowance	Preliminary Noise Abatement Decision
S776	12	Yes	1	$39,000	$82,000	No	Recommended (Severely Impacted)
S786	16	Yes	3	$129,000	$134,000	No	Not Reasonable
S790	14						Not Reasonable (Replace in-kind)
S795	12	Yes	53	$2,385,000	$356,000	Yes	Reasonable
S1162	12	Yes	3	$129,000	$225,000	No	Not Reasonable

TABLE A-2 - Noise Abatement Information (Alt-2)

Noise Barrier No.	Height (feet)	Acoustically Feasible?	Number of Benefited Residences	Total Reasonable Allowance	Estimated Construction Cost	Cost Less than Allowance	Preliminary Noise Abatement Decision
S776	12	Yes	1	$41,000	$82,000	No	Recommended (Severely Impacted)
S786	14	Yes	3	$135,000	$124,000	Yes	Reasonable
S790	14						Replace in-kind (Higher)
S795	12	Yes	53	$2,385,000	$356,000	Yes	Reasonable
S1162	12	Yes	3	$129,000	$225,000	No	Not Reasonable

TABLE A-3 - Noise Abatement Information (Alt-3)

Noise Barrier No.	Height (feet)	Acoustically Feasible?	Number of Benefited Residences	Total Reasonable Allowance	Estimated Construction Cost	Cost Less than Allowance	Preliminary Noise Abatement Decision
S776	12	Yes	1	$41,000	$82,000	No	Recommended (Severely Impacted)
S786	14	Yes	3	$135,000	$124,000	Yes	Reasonable
S790	14						Replace in-kind (Higher)
S795	14	Yes	53	$2,385,000	$395,000	Yes	Reasonable
S1162	12	Yes	6	$270,000	$225,000	Yes	Reasonable

Appendix A1 Recommended Barrier Heights and Locations

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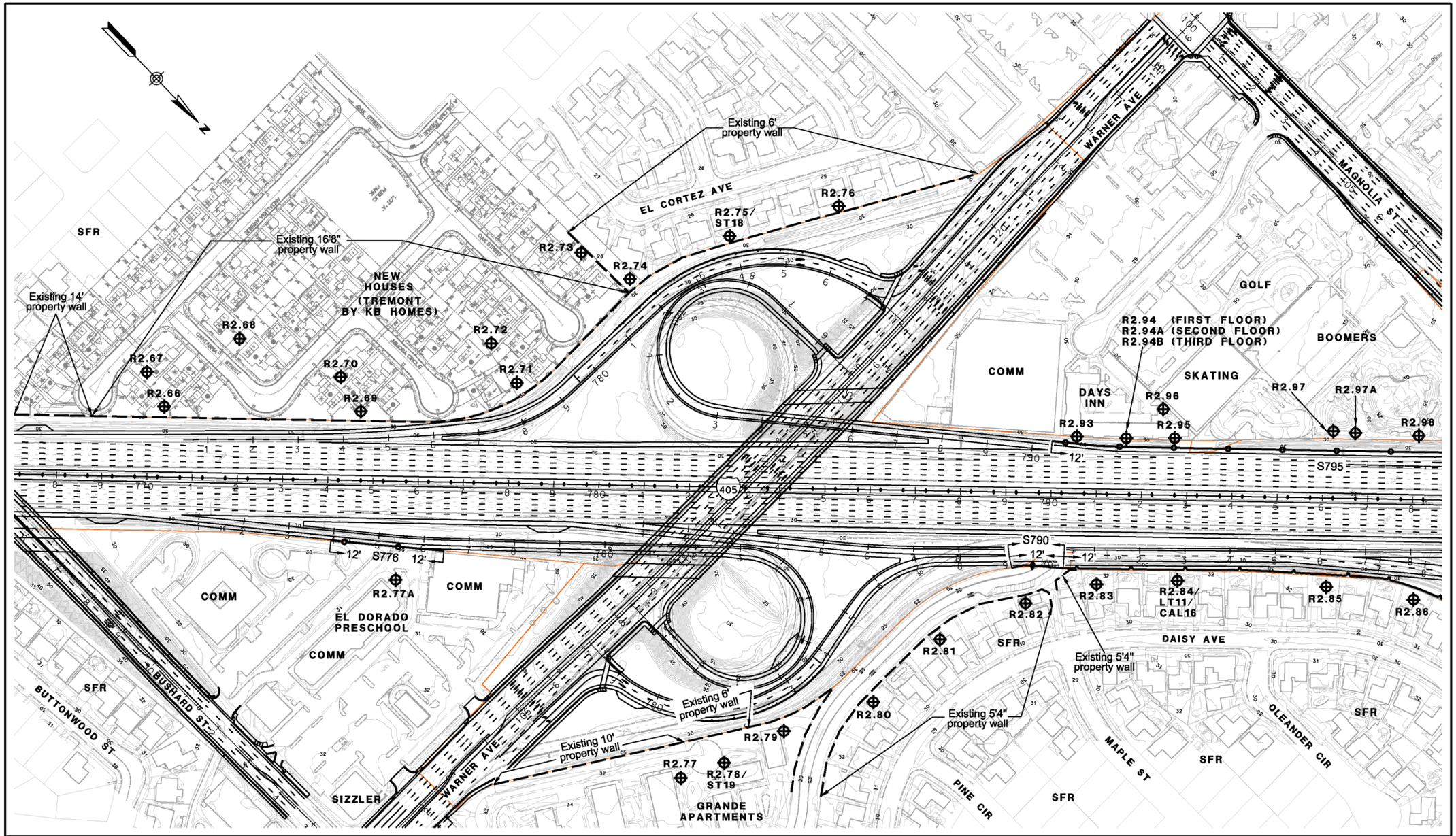

LEGEND

- RXX – RECEIVER SITE
- LT – LONGTERM MEASUREMENT
- ST – SHORTTERM MEASUREMENT
- CAL – CALIBRATION SITE
- EXISTING WALL
- SOUNDWALL
- EXISTING SOUNDWALL
- REPLACEMENT IN KIND SOUNDWALL
- SFR – SINGLE FAMILY RESIDENCE
- MFR – MULTI-FAMILY RESIDENCE
- COMM – COMMERCIAL

1in : 200ft

0 ft 100ft 200ft 300ft

PARSONS
100 WEST WALNUT ST.
PASADENA, CA 91124
(626) 440-6100

I-405 WIDENING PA/ED PROJECT NADR RECOMMENDED BARRIER HEIGHTS & LOCATIONS ALT1

FEBRUARY 17, 2015 | FIGURE 10

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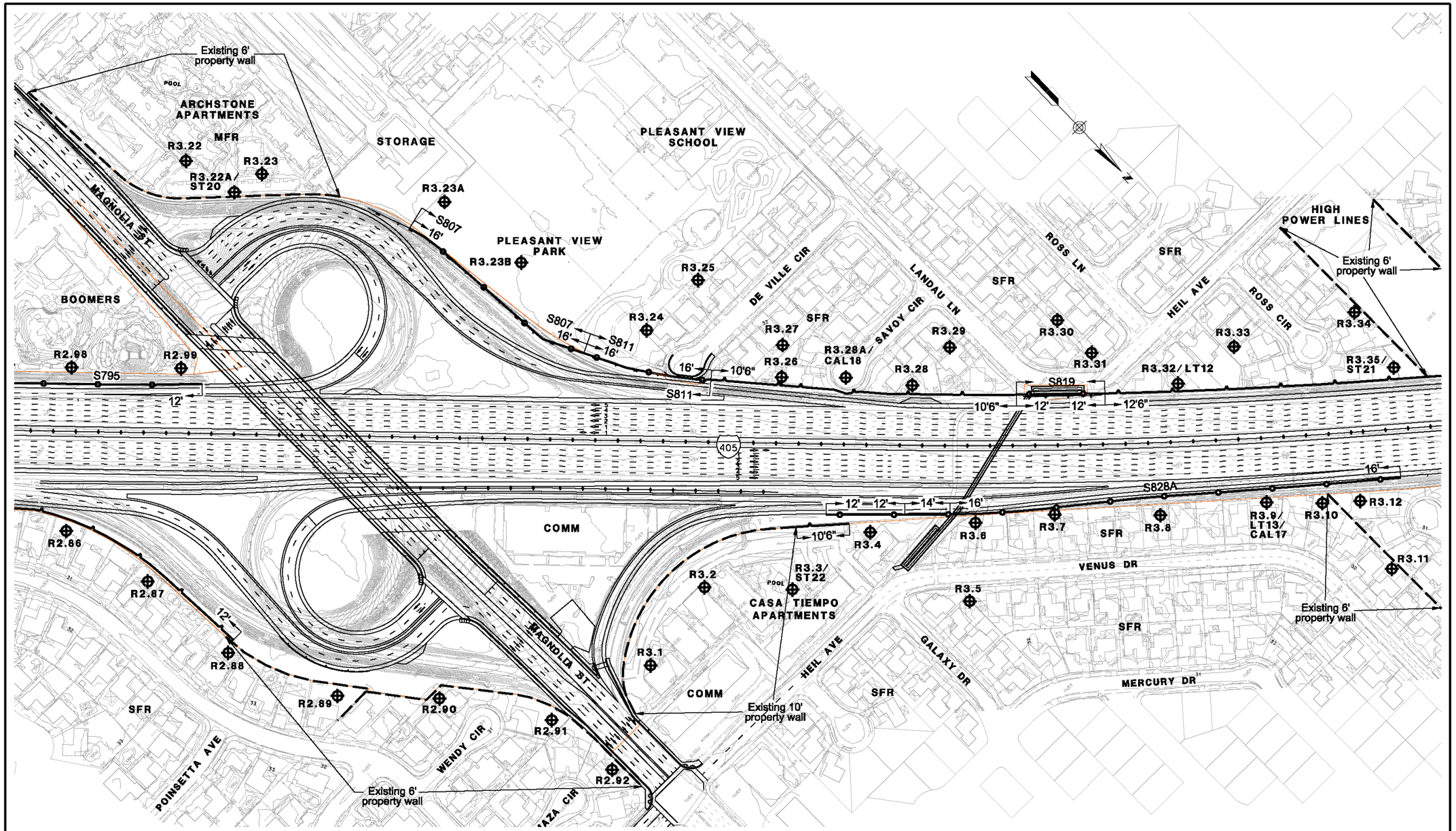

LEGEND

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1in : 200ft

0 ft 100ft 200ft 300ft

PARSONS
100 WEST WALNUT ST.
PASADENA, CA 91124
(626) 440-6100

I-405 WIDENING PA/ED PROJECT
NADR RECOMMENDED BARRIER HEIGHTS & LOCATIONS ALT1

FEBRUARY 17, 2015 | FIGURE 11

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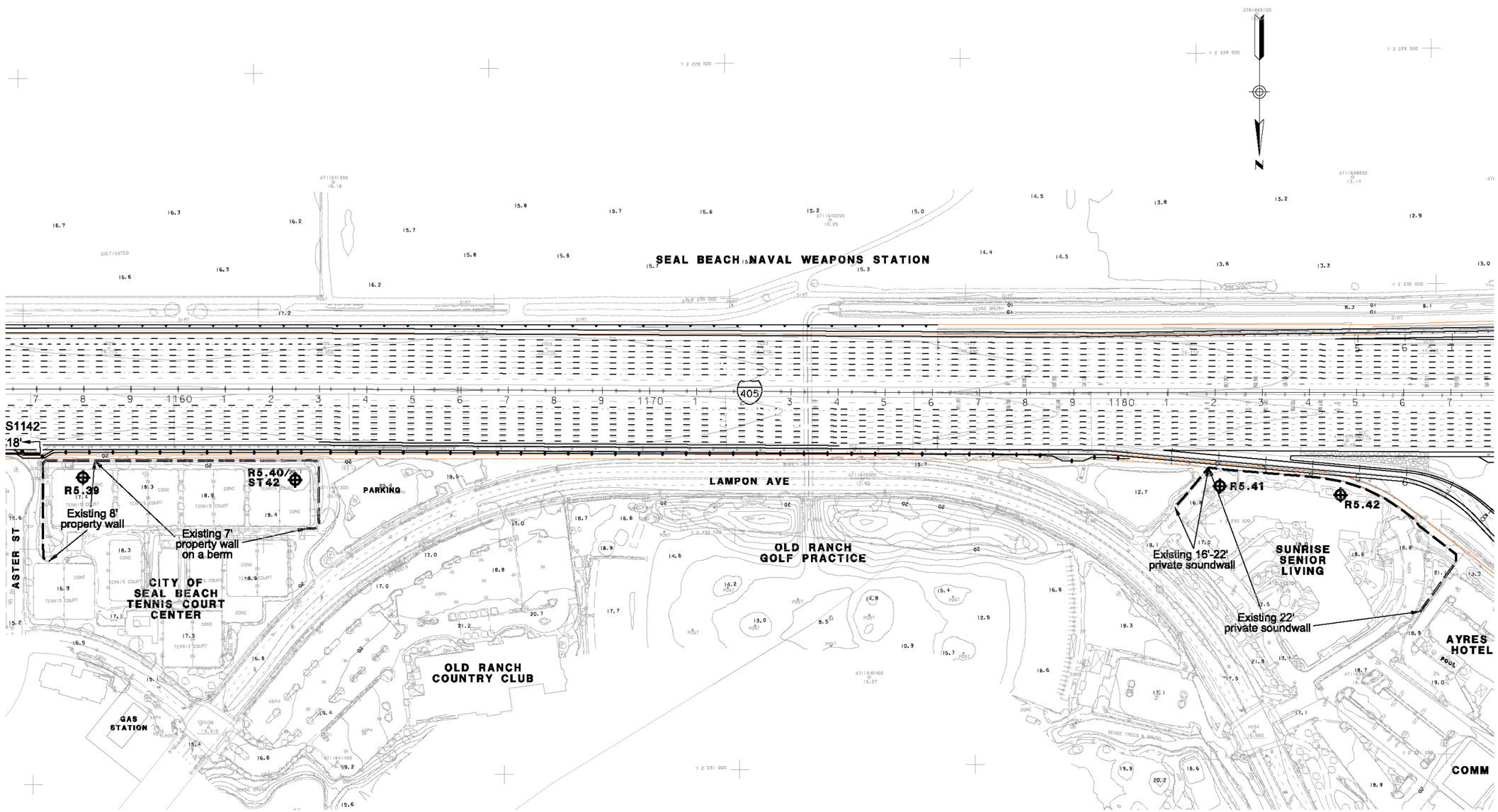

LEGEND

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1in : 200ft

0 ft 100ft 200ft 300ft

PARSONS
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PASADENA, CA 91124
(626) 440-6100

I-405 WIDENING PA/ED PROJECT
NADR RECOMMENDED BARRIER HEIGHTS & LOCATIONS ALT1

FEBRUARY 17, 2015 | FIGURE 23

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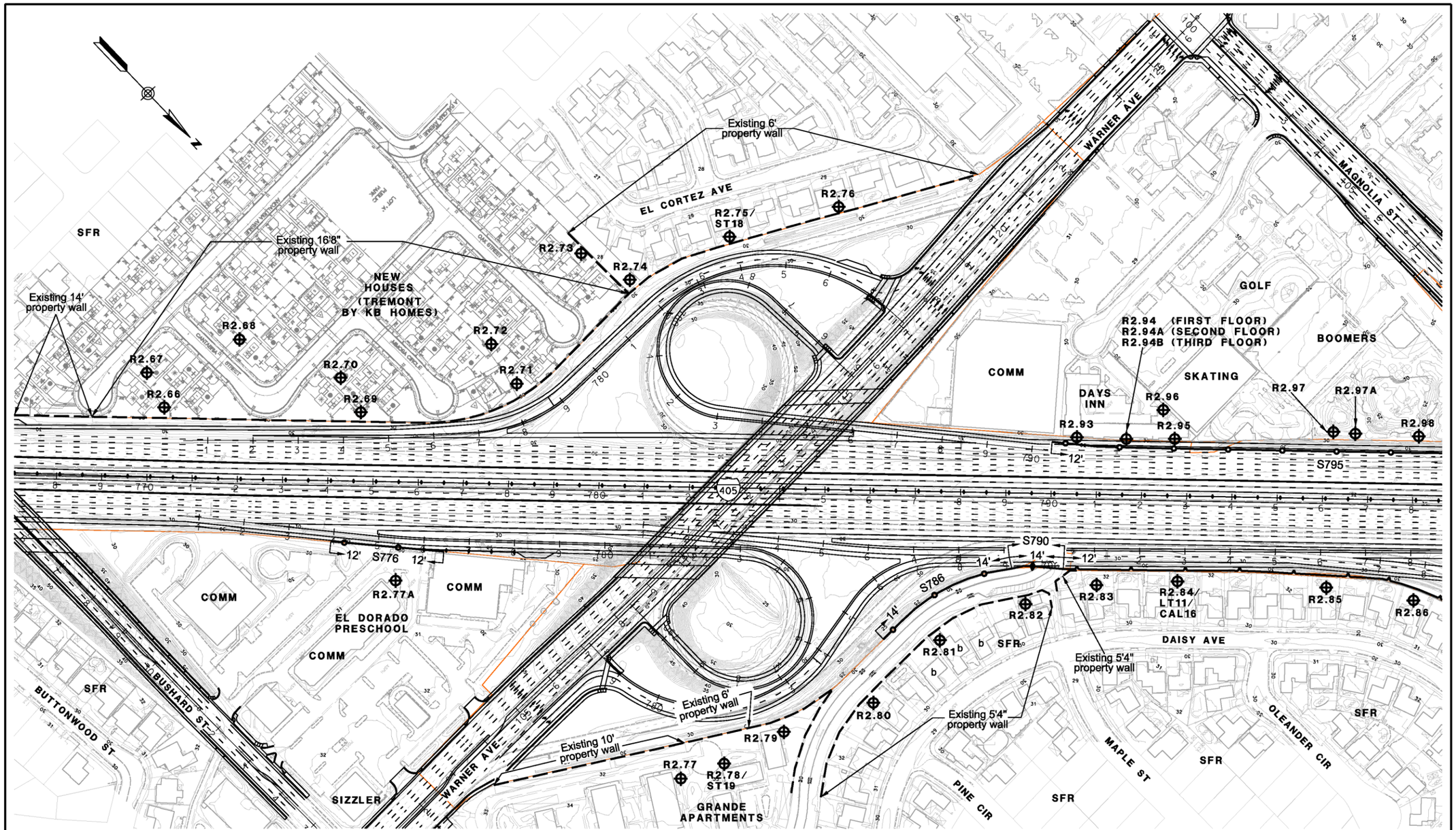
SFR
Existing 16'8" property wall
Existing 14' property wall
NEW HOUSES (TREMONT BY KB HOMES)
R2.67
R2.66
R2.68
R2.70
R2.69
R2.72
R2.71
R2.73
R2.74
Existing 6' property wall
EL CORTEZ AVE
R2.75/ ST18
R2.76
WARNER AVE
MAGNOLIA ST
COMM
GOLF
R2.94 (FIRST FLOOR)
R2.94A (SECOND FLOOR)
R2.94B (THIRD FLOOR)
BOOMERS
SKATING
DAYS INN
R2.96
R2.97
R2.97A
R2.93
R2.95
R2.98
12'
S795
405
S790
14'
S786
R2.83
R2.84/ LT11/ CAL16
R2.85
R2.86
R2.82
R2.81
SFR
DAISY AVE
Existing 5'4" property wall
Existing 5'4" property wall
R2.80
OLEANDER CIR
MAPLE ST
PINE CIR
SFR
12'
S776
12'
R2.77A
COMM
COMM
EL DORADO PRESCHOOL
COMM
SFR
BUSHARD ST
BUTTONWOOD ST
Existing 6' property wall
Existing 10' property wall
R2.79
R2.77
R2.78/ ST19
GRANDE APARTMENTS
SIZZLER
WARNER AVE
LEGEND
RXX – RECEIVER SITE
LT – LONGTERM MEASUREMENT
ST – SHORTTERM MEASUREMENT
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REPLACEMENT IN KIND SOUNDWALL
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MFR – MULTI-FAMILY RESIDENCE
COMM – COMMERCIAL
1in : 200ft
0 ft
100ft
200ft
300ft
PARSONS
100 WEST WALNUT ST.
PASADENA, CA 91124
(626) 440-6100
I-405 WIDENING PA/ED PROJECT
NADR RECOMMENDED BARRIER HEIGHTS & LOCATIONS ALT2
FEBRUARY 17, 2015
FIGURE 10

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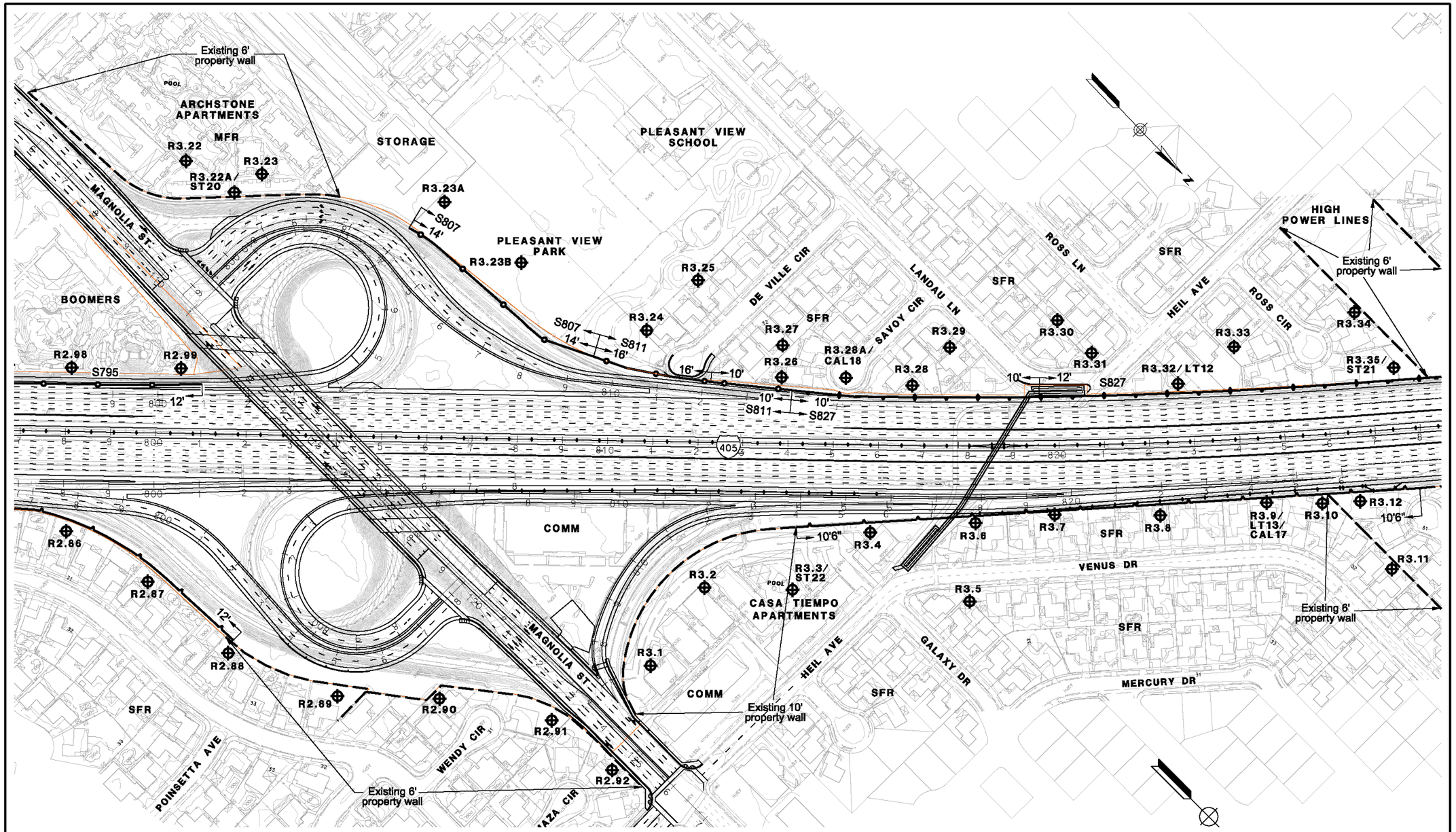

LEGEND

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- COMM – COMMERCIAL

1in : 200ft

0 ft 100ft 200ft 300ft

PARSONS
100 WEST WALNUT ST.
PASADENA, CA 91124
(626) 440-6100

I-405 WIDENING PA/ED PROJECT NADR RECOMMENDED BARRIER HEIGHTS & LOCATIONS ALT2

FEBRUARY 17, 2015 | FIGURE 11

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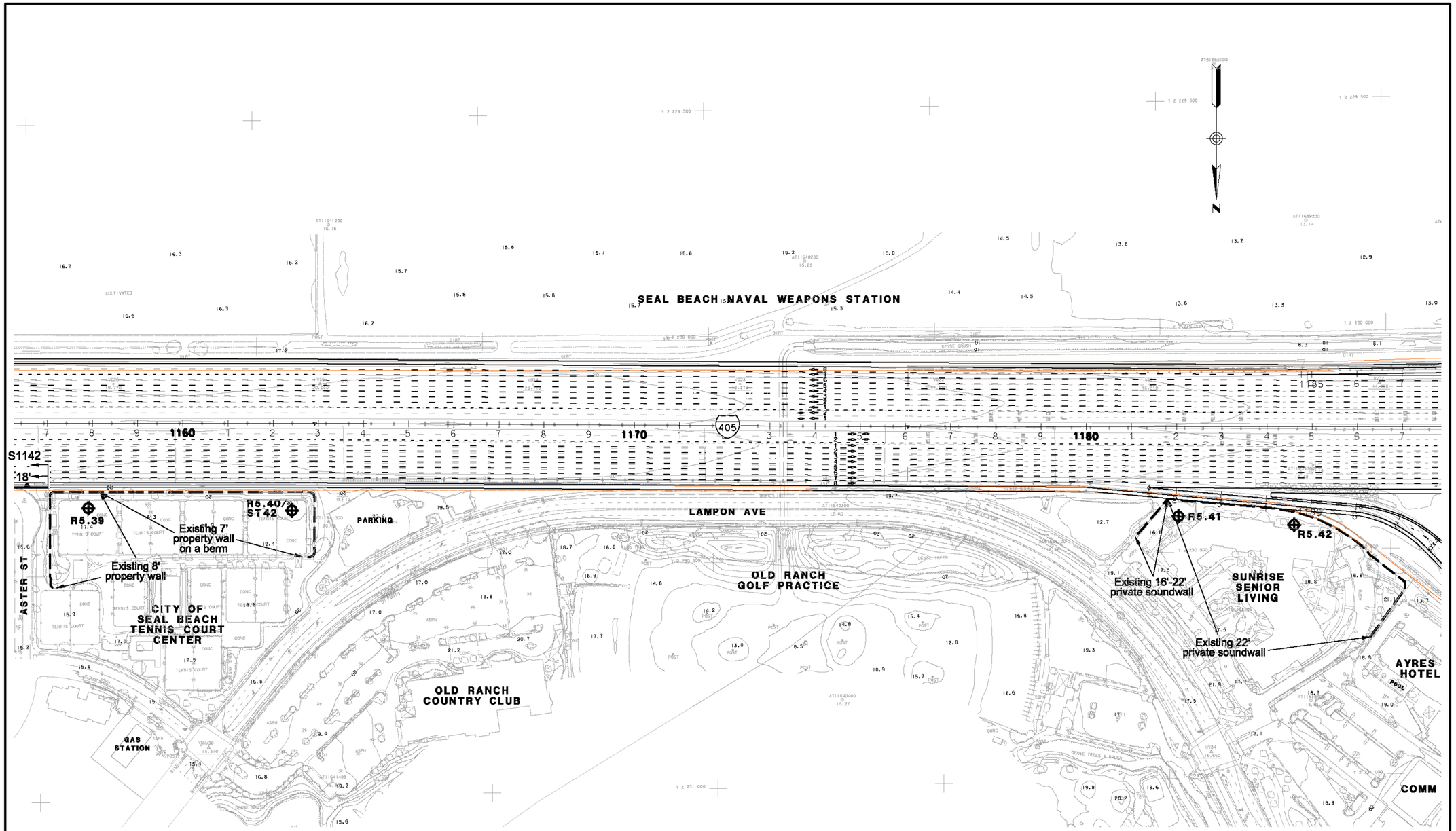

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- COMM – COMMERCIAL

1in : 200ft

0 ft 100ft 200ft 300ft

PARSONS
100 WEST WALNUT ST.
PASADENA, CA 91124
(626) 440-6100

I-405 WIDENING PA/ED PROJECT NADR RECOMMENDED BARRIER HEIGHTS & LOCATIONS ALT2

FEBRUARY 17, 2015 | FIGURE 23

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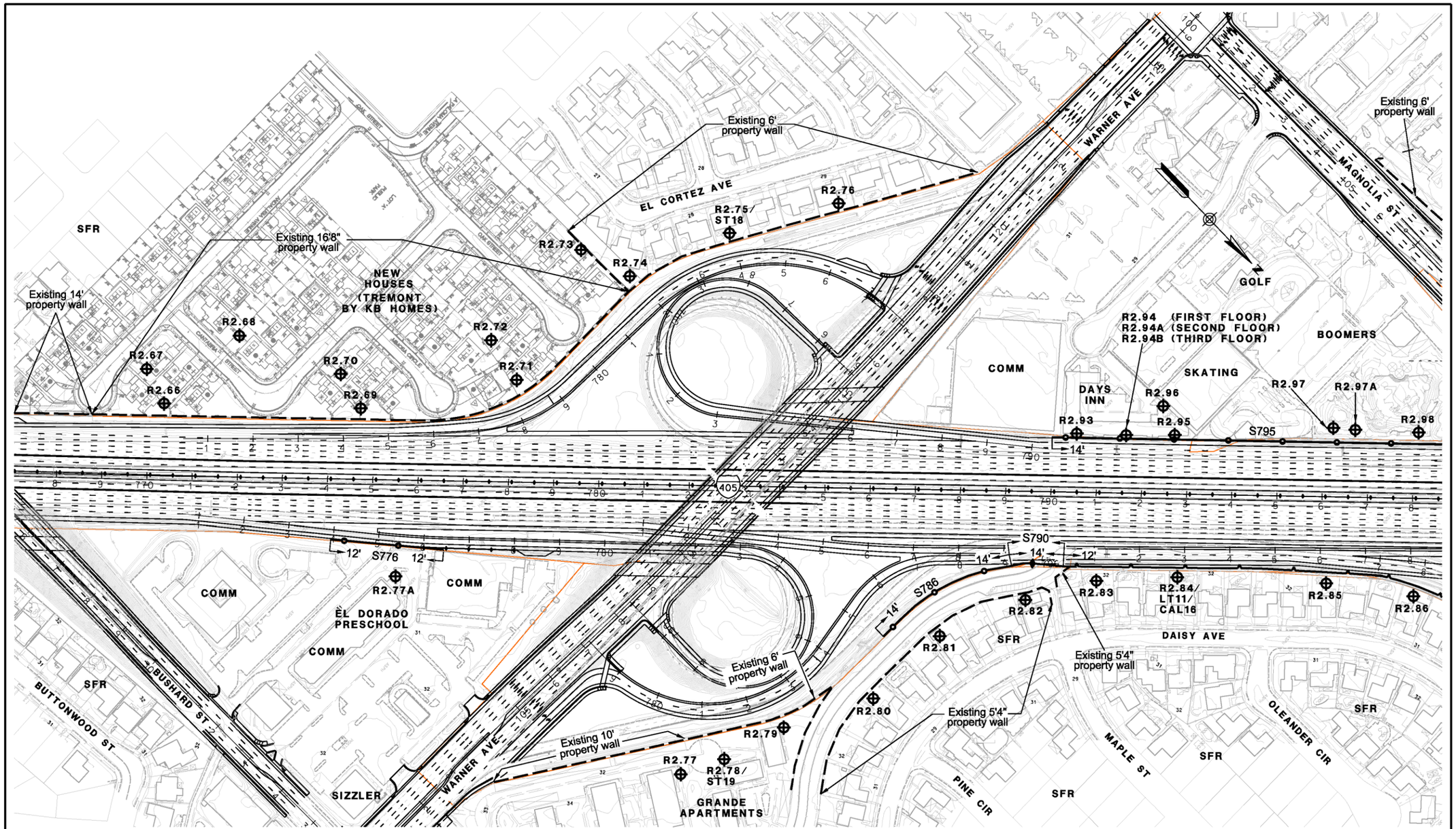

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1in : 200ft

0 ft 100ft 200ft 300ft

PARSONS
100 WEST WALNUT ST.
PASADENA, CA 91124
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I-405 WIDENING PA/ED PROJECT NADR RECOMMENDED BARRIER HEIGHTS & LOCATIONS ALT3

FEBRUARY 17, 2015 | FIGURE 10

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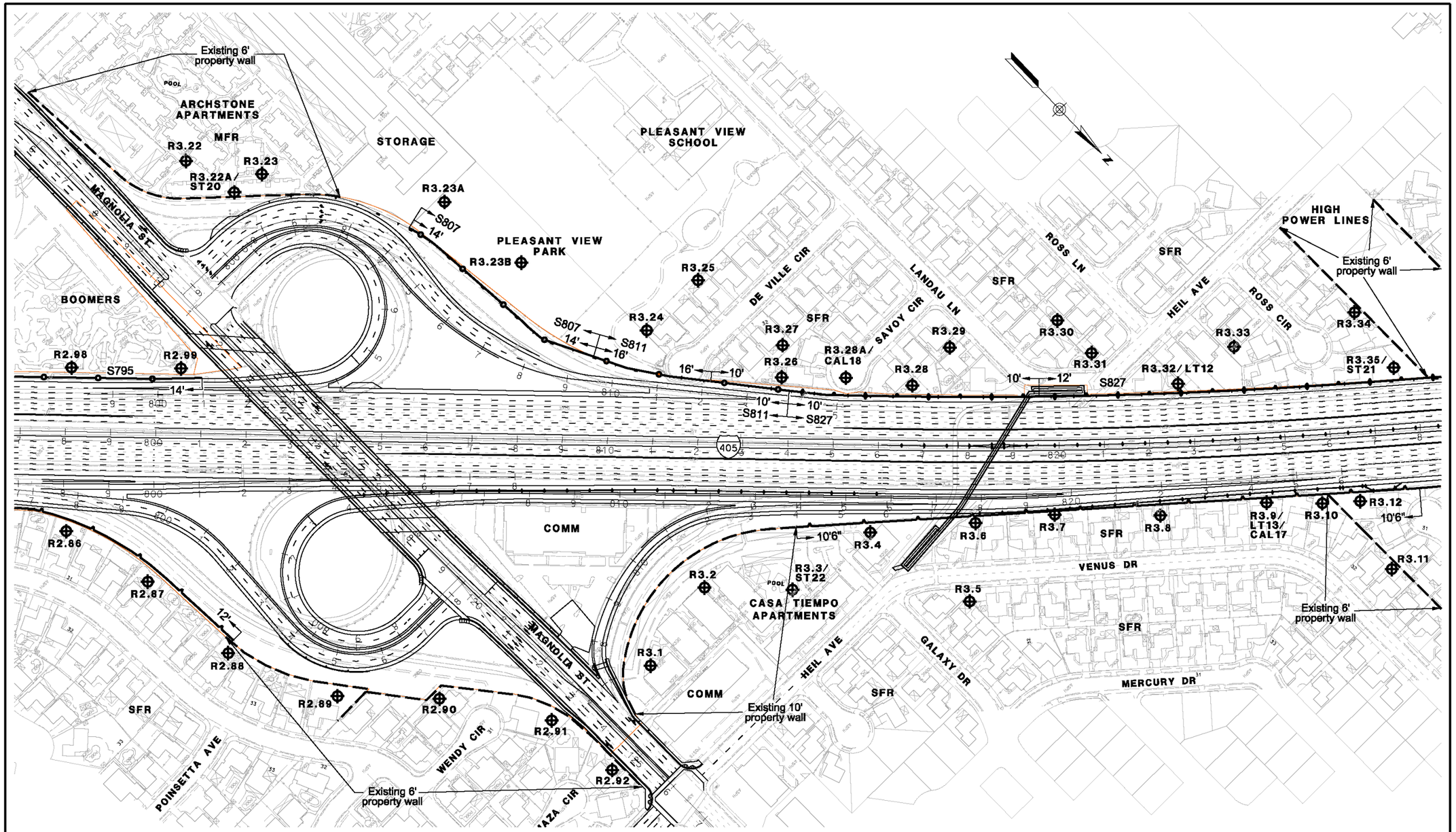

LEGEND

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- ST – SHORTTERM MEASUREMENT
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- SOUNDWALL
- EXISTING SOUNDWALL
- REPLACEMENT IN KIND SOUNDWALL
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- MFR – MULTI-FAMILY RESIDENCE
- COMM – COMMERCIAL

1in : 200ft

0 ft 100ft 200ft 300ft

PARSONS
100 WEST WALNUT ST.
PASADENA, CA 91124
(626) 440-6100

I-405 WIDENING PA/ED PROJECT NADR RECOMMENDED BARRIER HEIGHTS & LOCATIONS ALT3

FEBRUARY 17, 2015 | FIGURE 11

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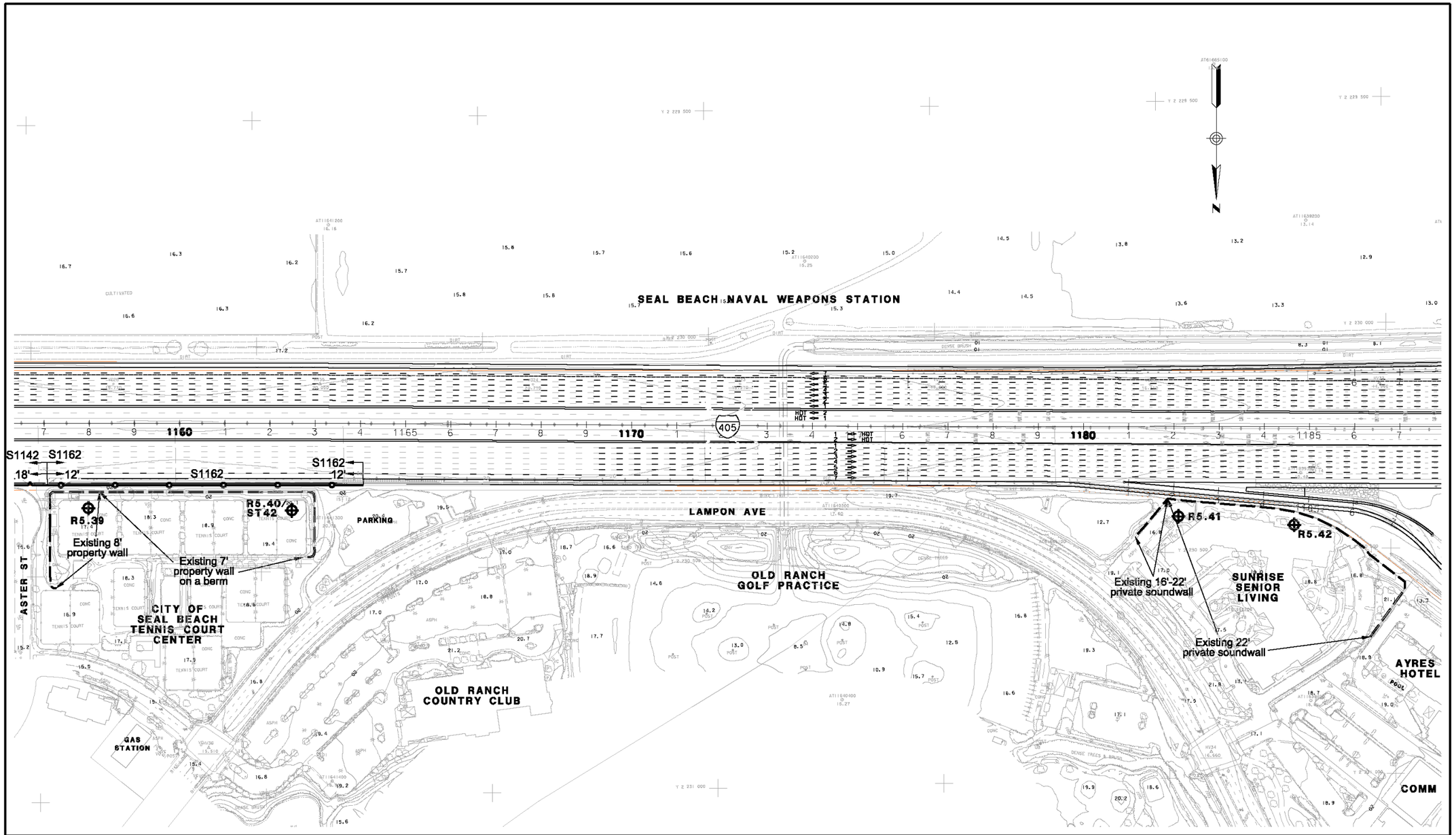

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1in : 200ft

0 ft 100ft 200ft 300ft

PARSONS
100 WEST WALNUT ST.
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I-405 WIDENING PA/ED PROJECT NADR RECOMMENDED BARRIER HEIGHTS & LOCATIONS ALT3

FEBRUARY 17, 2015 | FIGURE 23

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Appendix B Cost Analysis

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B-1 Cost Estimate for Barrier S776

Unit Cost[1]	Barrier Height, ft				
	8	10	12	14	16
# of Piles	26	26	26	26	26
Piles Length (ft)	248	274	300	326	339
Pile cost (Drill & Cast) [$50/LF]	$12,397.50	$13,702.50	$15,007.50	$16,312.50	$16,965.00
Sound Wall Area (SQFT)	1330	1832	2334	2836	3338
Masonry Cost[2] [$13/SQFT]	$17,293.90	$23,819.90	$30,345.90	$36,871.90	$43,397.90
Pile Volume (CY)	38.4	42.4	46.4	50.5	52.5
Structure Excavation (CY)	38.4	42.4	46.4	50.5	52.5
Structure Excavation Cost [$65/CY]	$2,492.84	$2,755.25	$3,017.65	$3,280.06	$3,411.26
Remove Exist Wall Cost [$4/LF]	$0.00	$0.00	$0.00	$0.00	$0.00
Barrier (Type 736S) [$90/LF]	$22,590.00	$22,590.00	$22,590.00	$22,590.00	$22,590.00
Wall Cost (Masonry)	$54,774.24	$62,867.65	$70,961.05	$79,054.46	$86,364.16
Traffic Control	$3,861.00	$3,861.00	$3,861.00	$3,861.00	$3,861.00
Contingencies (10%)	$5,477.42	$6,286.76	$7,096.11	$7,905.45	$8,636.42
Total Wall Cost (Masonry)	**$64,113**	**$73,015**	**$81,918**	**$90,821**	**$98,862**

Notes:

1- Estimates are based on Caltrans Database cost for 2008-2010.

2- Includes cost for masonry, steel, cell fill material, scaffolding and mobilization

B-2 Cost Estimate for Barrier S786

Unit Cost[1]	Barrier Height, ft				
	8	10	12	14	16
# of Piles	34	34	34	34	34
Piles Length (ft)	325	359	393	428	445
Pile cost (Drill & Cast) [$50/LF]	$16,245.00	$17,955.00	$19,665.00	$21,375.00	$22,230.00
Sound Wall Area (SQFT)	1760	2424	3088	3752	4416
Masonry Cost[2] [$13/SQFT]	$22,874.80	$31,506.80	$40,138.80	$48,770.80	$57,402.80
Pile Volume (CY)	50.3	55.5	60.8	66.1	68.8
Structure Excavation (CY)	50.3	55.5	60.8	66.1	68.8
Structure Excavation Cost [$65/CY]	$3,266.48	$3,610.32	$3,954.17	$4,298.01	$4,469.93
Remove Exist Wall Cost [$4/LF]	$0.00	$0.00	$0.00	$0.00	$0.00
Barrier (Type 736S) [$90/LF]	$29,880.00	$29,880.00	$29,880.00	$29,880.00	$29,880.00
Wall Cost (Masonry)	$72,266.28	$82,952.12	$93,637.97	$104,323.81	$113,982.73
Traffic Control	$4,752.00	$4,752.00	$4,752.00	$4,752.00	$4,752.00
Contingencies (10%)	$7,226.63	$8,295.21	$9,363.80	$10,432.38	$11,398.27
Total Wall Cost (Masonry)	**$84,245**	**$95,999**	**$107,750**	**$119,510**	**$130,130**

Notes:

1- Estimates are based on Caltrans Database cost for 2008-2010.

2- Includes cost for masonry, steel, cell fill material, scaffolding and mobilization

B-3 Cost Estimate for Barrier S790

Unit Cost[1]	Barrier Height, ft				
	8	10	12	14	16
# of Piles	13	13	13	13	13
Piles Length (ft)	119	131	144	156	163
Pile cost (Drill & Cast) [$50/LF]	$5,937.50	$6,562.50	$7,187.50	$7,812.50	$8,125.00
Sound Wall Area (SQFT)	610	840	1070	1300	1530
Masonry Cost[2] [$13/SQFT]	$7,923.50	$10,913.50	$13,903.50	$16,893.50	$19,883.50
Pile Volume (CY)	18.4	20.3	22.2	24.2	25.1
Structure Excavation (CY)	18.4	20.3	22.2	24.2	25.1
Structure Excavation Cost [$65/CY]	$1,193.89	$1,319.56	$1,445.24	$1,570.91	$1,633.74
Remove Exist Wall Cost [$4/LF]	$5,520.00	$5,520.00	$5,520.00	$5,520.00	$5,520.00
Barrier (Type 736S) [$90/LF]	$10,350.00	$10,350.00	$10,350.00	$10,350.00	$10,350.00
Wall Cost (Masonry)	$30,924.89	$34,665.56	$38,406.24	$42,146.91	$45,512.24
Traffic Control	$2,365.00	$2,365.00	$2,365.00	$2,365.00	$2,365.00
Contingencies (10%)	$3,092.49	$3,466.56	$3,840.62	$4,214.69	$4,551.22
Total Wall Cost (Masonry)	**$36,382**	**$40,497**	**$44,612**	**$48,727**	**$52,428**

Notes:

1- Estimates are based on Caltrans Database cost for 2008-2010.

2- Includes cost for masonry, steel, cell fill material, scaffolding and mobilization

B-4 Cost Estimate for Barrier S795

Unit Cost[1]	Barrier Height, ft				
	8	10	12	14	16
# of Piles	112	112	112	112	112
Piles Length (ft)	1064	1176	1288	1400	1456
Pile cost (Drill & Cast) [$50/LF]	$53,200.00	$58,800.00	$64,400.00	$70,000.00	$72,800.00
Sound Wall Area (SQFT)	5883	8103	10323	12543	14763
Masonry Cost[2] [$13/SQFT]	$76,479.00	$105,339.00	$134,199.00	$163,059.00	$191,919.00
Pile Volume (CY)	164.6	181.9	199.2	216.5	225.2
Structure Excavation (CY)	164.6	181.9	199.2	216.5	225.2
Structure Excavation Cost [$65/CY]	$10,697.26	$11,823.29	$12,949.31	$14,075.34	$14,638.35
Remove Exist Wall Cost [$4/LF]					
Barrier (Type 736S) [$90/LF]	$99,900.00	$99,900.00	$99,900.00	$99,900.00	$99,900.00
Wall Cost (Masonry)	$240,276.26	$275,862.29	$311,448.31	$347,034.34	$379,257.35
Traffic Control	$13,310.00	$13,310.00	$13,310.00	$13,310.00	$13,310.00
Contingencies (10%)	$24,027.63	$27,586.23	$31,144.83	$34,703.43	$37,925.74
Total Wall Cost (Masonry)	**$277,610**	**$316,760**	**$355,900**	**$395,050**	**$430,490**

Notes:

1- Estimates are based on Caltrans Database cost for 2008-2010.

2- Includes cost for masonry, steel, cell fill material, scaffolding and mobilization

B-5 Cost Estimate for Barrier S1162

Unit Cost[1]	Barrier Height, ft				
	8	10	12	14	16
# of Piles	71	71	71	71	71
Piles Length (ft)	675	746	817	888	923
Pile cost (Drill & Cast) [$50/LF]	$33,725.00	$37,275.00	$40,825.00	$44,375.00	$46,150.00
Sound Wall Area (SQFT)	3710	5110	6510	7910	9310
Masonry Cost[2] [$13/SQFT]	$48,230.00	$66,430.00	$84,630.00	$102,830.00	$121,030.00
Pile Volume (CY)	104.3	115.3	126.3	137.3	142.8
Structure Excavation (CY)	104.33	115.3	126.3	137.3	142.8
Structure Excavation Cost [$65/CY]	$6,781.30	$7,495.12	$8,208.94	$8,922.76	$9,279.67
Remove Exist Wall Cost [$4/LF]					
Barrier (Type 736S) [$90/LF]	$63,000.00	$63,000.00	$63,000.00	$63,000.00	$63,000.00
Wall Cost (Masonry)	$151,736.30	$174,200.12	$196,663.94	$219,127.76	$239,459.67
Traffic Control	$8,800.00	$8,800.00	$8,800.00	$8,800.00	$8,800.00
Contingencies (10%)	$15,173.63	$17,420.01	$19,666.39	$21,912.78	$23,945.97
Total Wall Cost (Masonry)	**$175,710**	**$200,420**	**$225,130**	**$249,840**	**$272,210**

Notes:

3- Estimates are based on Caltrans Database cost for 2008-2010.

4- Includes cost for masonry, steel, cell fill material, scaffolding and mobilization