Appendix H2
Hydraulic Analysis

TECHNICAL MEMORANDUM

Water System Hydraulic Impact Study for Ocean Creek

Technical Memorandum

Subject	Water System Hydraulic Impact Study for Ocean Creek (Project Number D20-00004)
Client	City of Oceanside
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Date - *Draft*	April 7, 2022
Date - *FINAL*	

PURPOSE

The City of Oceanside (City) retained the service of Infrastructure Engineering Corporation (IEC)[1] to prepare a water system hydraulic impact study for the Ocean Creek Development (Project). Part of this Project includes abandonment of the existing 12-inch water main that runs east-west through the site. The purpose of this study is to determine the impact of proposed Project to the City's system and make recommendation of any off-site improvement as needed.

DISCUSSION

BACKGROUND

The Project site is located southwest of the intersection of Skylark Dr and Crouch St, as shown in Figure 1. The Project site is approximately 18 acres. The Project proposes 295 apartment units and 3,000 square feet (sf) of commercial space. The proposed off-site improvement includes the installation of a new 12-inch main in Oceanside Blvd/Skylark Dr that connects to the existing 10-inch line near Union Plaza Ct and the existing 8-inch main northeast of Crouch St. Four public fire hydrants are proposed to be installed off the new 12-inch main. In addition, the existing 12-inch main that runs through the Project site is proposed to be abandoned due to potential landslide concerns along Crouch St. The Project will be served off the Talone Zone which has a Hydraulic Grade Line (HGL) of 320 feet (ft).

Project Demand Calculation

The water demand factor of 400 gallons per day (gpd)/unit from the City's 2015 Water Master Plan (WMP) was used to estimate the Project residential demand. Since the 2015 WMP does not include a water demand factor that is based on building area for commercial use, the water demand factor of 130 gpd/1,000 sf from the Water Supply Assessment and Verification for Ocean Kamp, a recent study that IEC had prepared for the City in April 2020, was used to estimate the Project commercial demand. The Project demand is estimated to be 82.2 gallons per minute (gpm), as presented in Table 1.

Table 1. Water Demand Estimates for Ocean Creek

Proposed Land Use	Quantity	Water Unit Factor	Demand (gpd)	Demand (gpm)
Apartment	295 units	400 gpd/unit[1]	118,000	81.94
Commercial	3,000 sf	130 gpd/1000 sq. ft[2]	390	0.27
Total			118,390	82.22

1. Source: 2015 WMP, Carollo, June 2015
2. Source: Ocean Kamp Water Supply Assessment and Verification, IEC, April 2020

[1] An Ardurra Company in 2021

Legend

- Modelel Hydrant
- Modeled Project Node
- Model Node
- Proposed Abandoned Pipe
- Proposed New 12-inch Pipe
- Pipe within Talone Zone
- Model Pipe
- City Parcel
- Ocean Creek

N

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Vicinity Map

Figure 1

Hydraulic Analysis

Hydraulic analysis of this study was performed utilizing the City's existing water hydraulic model that was developed as part of the 2015 Water Master Plan. The system was evaluated under existing Maximum Day Demand plus Fire Flow (MDD+FF) condition with steady state simulation to determine: 1) whether the system can provide domestic and fire services to the proposed Project; 2) impacts of abandoning the existing 12-inch main that runs across the Project site within Talone Zone; and 3) off-site improvements needed to mitigate for any pressure losses.

The system was evaluated against the evaluation criteria provided in the City's 2015 WMP, including minimum pressure under MDD + FF of 20 pound per square inch (psi), maximum velocity under MDD + FF of 10 feet per second (fps), and fire flow requirement of 3,000 gallons per minute (gpm) for a multi-family residential landuse type. The flow can be split between two consecutive hydrants.

The proposed new public water main and proposed public hydrants were incorporated into the model based on provided exhibit from the City, included as Appendix A. Model simulations indicate that the City's existing water system can provide domestic and fire services to the Project with sufficient service pressure and adequate flow velocity. Table 2 presents the model results of residual pressures and available flows at the proposed hydrants. Results in Table 2 reflects one fire in the system at a time at the corresponding model hydrant.

Table 2. Model Results for Proposed Hydrants under Existing (2012) MDD + FF Condition

Model ID	Static Demand (gpm)	Static Pressure (psi)	Static Head (ft)	Fire-Flow Demand (gpm)	Residual Pressure (psi)	Hydrant Available Flow @ 20 psi/10 fps (gpm)	Hydrant Pressure at Available Flow (psi)
J74	0	111.23	296.71	3,000	99.54	4,743	89.73
J76	0	112.31	296.55	3,000	101.63	4,634	94.11
J78	0	112.97	296.45	3,000	101.75	4,952	91.84
J80	0	114	296.4	3,000	102.15	5,559	87.07

Notes:

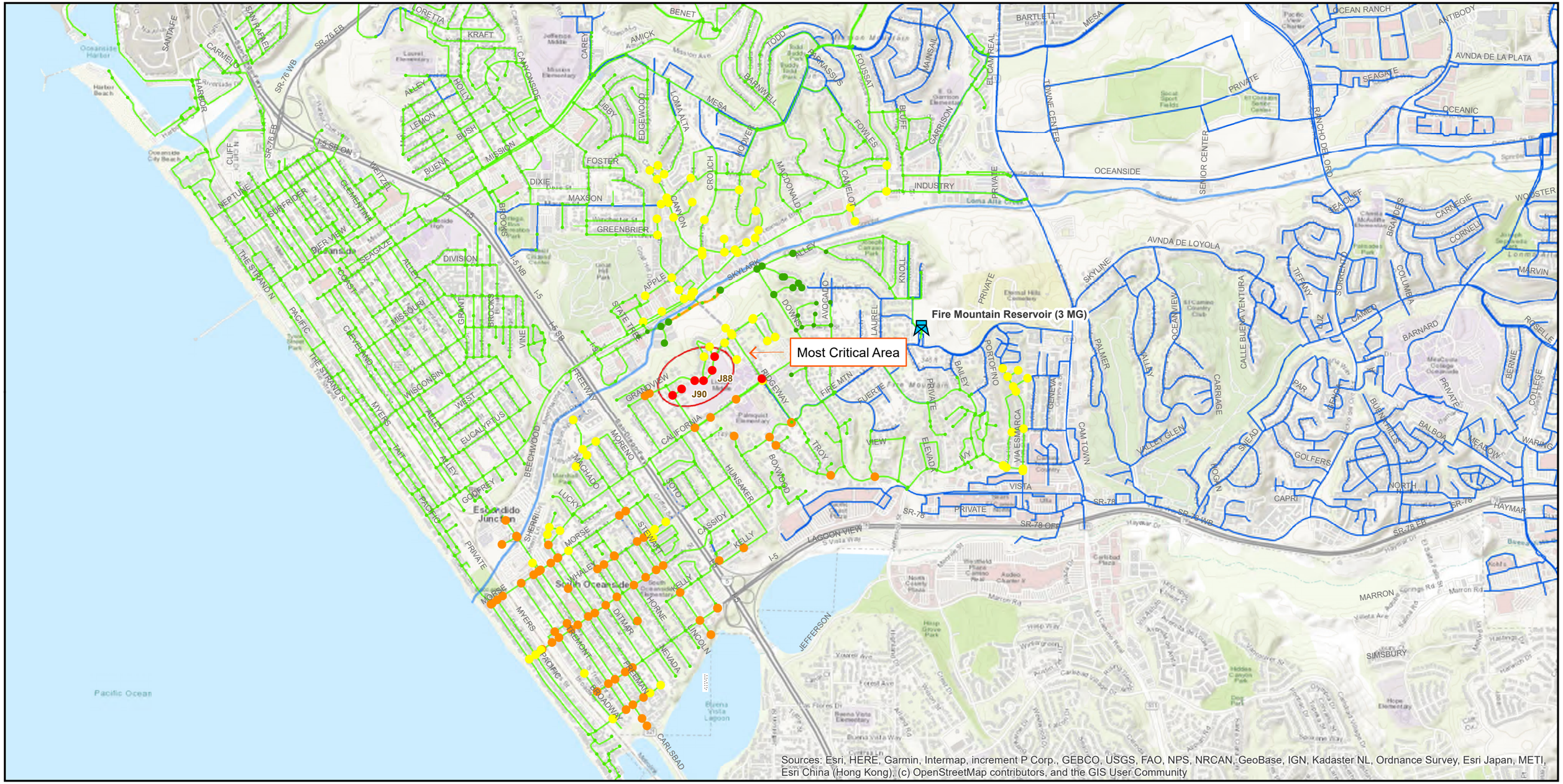
1. System was analyzed under existing (2012) MDD + FF condition with demand and facility set established in the 2015 WMP.
2. Hydrant available flow and hydrant pressure at available flow are results using the City's fire flow criteria of minimum residual pressure of 20 psi and maximum velocity of 10 fps.

Off-site Water System

This study also evaluated the impacts of the Project demands and proposed project improvements on the existing system. A comparative analysis was performed on the existing system under MDD + FF condition without the proposed Project and proposed system improvements and with the Project demand and proposed off-site improvements to compare residual pressure differences within the Talone Zone. Model results are included in Appendix B.

The existing 12-inch line crossing the Project site is a critical supply main in the Talone zone. For example, it is the only large (12-inch) connection within the Talone Zone that allows Fire Mountain Reservoir to serve areas north of the Loma Alta Creek. More importantly, it also allows water from multiple sources north of the Loma Alta Creek to serve the south side of the Talone zone.

Model results indicate that residual pressures improve between 5 to 30 psi in the vicinity northeast of Skylark Dr and Crouch St with the proposed off-site improvement, due to the installation of a new 12-inch main in Oceanside Blvd/Skylark Dr that allows water supplies from west of the connection, as shown in Figure 2.



Legend

Residual Pressure Difference (psi)

- -14.4 - -7.0
- -7 - -3.0
- -3 - -1.0
- -1 - 1.0
- 1 - 5.0
- 5 - 114.1

- Loma Alta Creek
- Existing Pipe in Talone Zone
- Proposed New Pipe
- Abandoned Pipe
- Model Pipe
- Model_Reservoirs_040722

Note: Comparision was made between residual pressures under existing MDD + FF condition with proposed Project to residual pressures under existing MDD + FF condition with existing system conditions.

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Comparable Analysis
for Residual Pressures under
Existing MDD + FF Condition
(Proposed Project)
Figure 2

However, due to the abandonment of the existing 12-inch line crossing the project site, areas west of Interstate-5 Highway (I-5) and south of Oceanside Blvd, as well as areas east of I-5 near California St, show pressure reduction between 3 to 7 psi. The model also predicts that the area southeast of the Project site near Lincoln Middle School will have the largest reduction in residual pressures, at 7-15 psi, and therefore is considered the most critical area. The two most critical model hydrant nodes are J88 and J90. These two nodes were further evaluated by splitting flows evenly between the two nodes. Pressure losses were predicted to be less than 1 psi for the remaining areas of the Talone Zone.

Improvement Alternatives

The following alternatives as shown in Figure 3 were tested in the model to mitigate the pressure losses due to abandonment of the existing 12-inch line crossing the Project Site.

1) upsizing the existing 8-inch line in Skylark Dr between Crouch St and Downs St to 12-inch line;

2) upsizing the 6-inch line in the alley north of Ridgeway St and south of Grandview St to 12-inch line and adding a new 12-inch line connecting the existing 12-inch line in Ridgeway St and the line in the alley;

3) Repairing/restoring the 12-inch abandoned line in Parkwood Ln between Beechwood Ln and Blue Springs;

4) Repairing/restoring the 8-inch abandoned pipe in Coast Highway connecting the existing 8-inch line near Whitherby St and the existing 8-inch pipe in Coast Highway north of Channel Ln as well as upsizing the existing 6-inch line in the alley north of Ridgeway St south of Grandview St and installing a new 8-inch line connecting the existing 12-inch line in Ridgeway St and the line in the alley.

Alternative 1

Model results indicate that upsizing ~900 linear feet (LF) of the existing 8-inch line on Skylark Dr between Crouch St and Downs St has minimal pressure improvements in the most critical area.

Alternative 2

Alternative 2 includes upsizing ~440 LF of the existing 6-inch line in the alley north of Ridgeway St south of Grandview St to 12-inch in size and installing ~200 LF of a new 12-inch line connecting the existing 12-inch line on Ridgeway St and the line in the lley. This alternative can mitigate the pressure losses locally of the two most critical hydrant (Nodes 1900 and 2635) near Grandview St and Crouch St, but it has minimum pressure improvements for the other areas.

Alternative 3

Alternative 3 includes repairing/restoring ~1,040 LF of the existing 12-inch abandoned line in Parkwood Ln between Beechwood Ln and Blue Springs Ln. The proposed 12-inch line in Parkwood Ln needs to cross the Loma Alta Creek. Model results indicate that majority of the pressure losses due to the abandonment of the 12-inch line crossing the Project site can be mitigated with this connection. Figure 4 shows the comparison of residual pressures under the existing MDD + FF condition with Alternative 3 to the existing system without the proposed Project.

Alternative 4

Alternative 4 includes repairing/restoring ~250 LF of the existing 8-inch abandoned line between Coast Hwy and Tremont St at Godfrey St, and upsizing ~440 LF of the existing 6-inch line in the alley north of Ridgeway St south of Grandview St to 8-inch in size, and installing ~200 LF of a new 8-inch line connecting the existing 12-inch line on Ridgeway St and the line in the alley. Model results indicate that this alternative can mitigate majority of the pressure losses of the surrounding Talone Zone due to the abandonment of the 12-inch line crossing the Project site, as shown in Figure 5. Although a few model hydrant nodes still show pressure losses, but they can meet the minimum pressure criteria of 20 psi under MDD + FF conditions with the required fire flow split on two consecutive hydrants.

Table 3 shows the model results under existing MDD + FF condition with the proposed Project, with the proposed Project plus Alternative 3, and with the proposed Project plus Alternative 4 at the two most critical nodes. A results table is included in Appendix B that shows the residual pressures and available flows of the model hydrant nodes within Talone Zone of the current system, the existing system with the proposed Project demand and Project improvement, the existing system with Alternative 3, and the existing system with Alternative 4. Node maps within the Talone Zone were also included.

Alternative 1: upsizing ~900 linear feet (LF) of the existing 8-inch line on Skylark Dr between Crouch St and Downs St

Alternative 2: upsizing ~440 LF of the existing 6-inch line on the alley north of Ridgeway St south of Grandview St to 12-inch in size, and installing ~200 LF of a new 12-inch line connecting the existing 12-inch line in Ridgeway St and the line in the alley.

Alternative 3: repairing/restoring ~1,040 LF of the existing 12-inch abandoned line in Parkwood Ln between Beechwood Ln and Blue Springs Ln

Alternative 4: repairing/restoring ~250 LF of the existing 8-inch abandoned line between Coast Hwy and Tremont St, and upsizing ~440 LF of the existing 6-inch line on the alley north of Ridgeway St south of Grandview St to 8-inch in size, and installing ~200 LF of a new 8-inch line connecting the existing 12-inch line on Ridgeway St and the line in the alley.

Legend

- Alternative 1
- Alternative 2
- Alternative 3
- Alternative 4
- Loma Alta Creek
- Existing Pipe in Talone Zone
- Proposed New Pipe
- Abandoned Pipe
- Model Pipe

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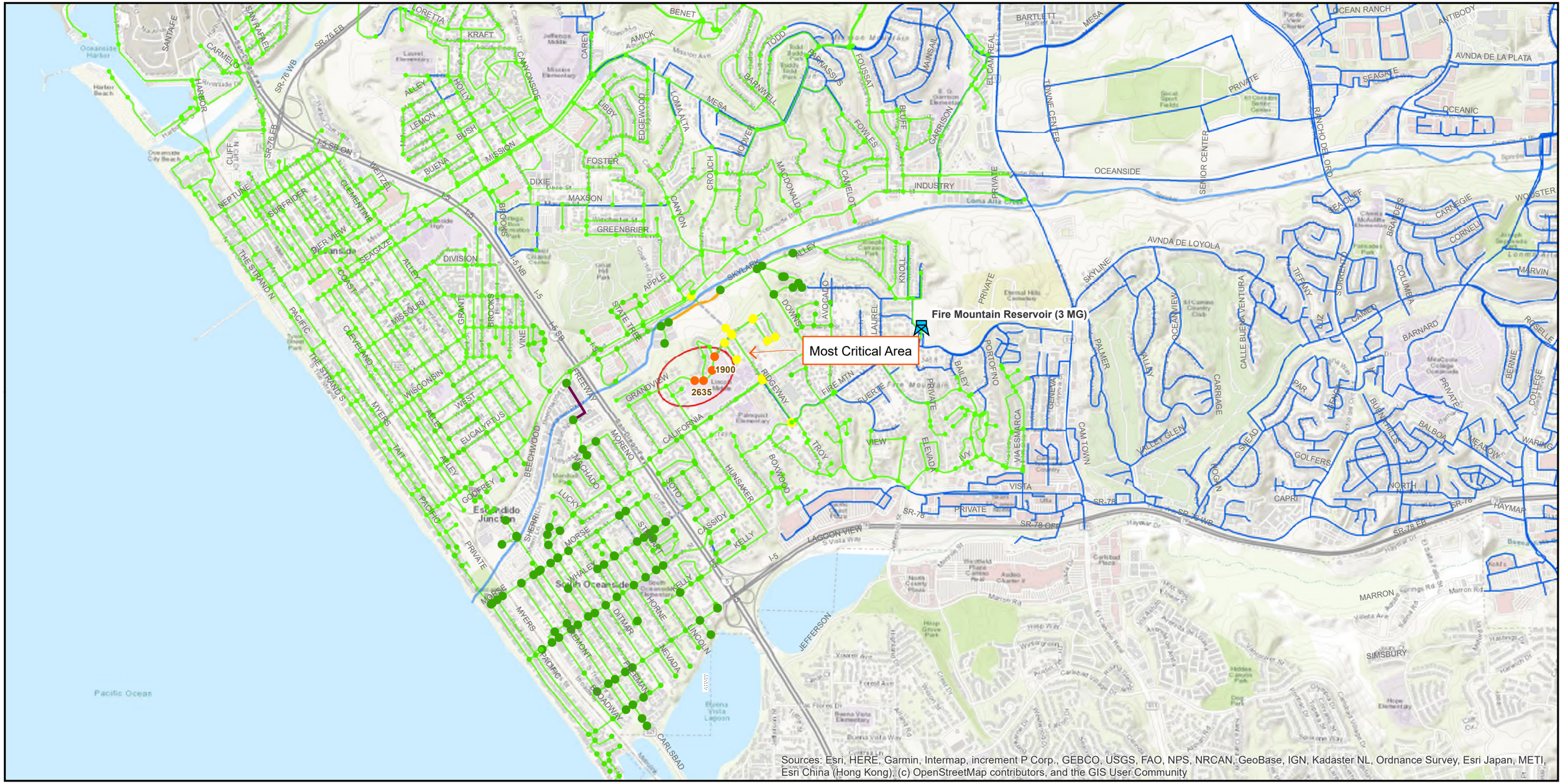
Tested Alternatives

Figure 3



Legend

Residual Pressure Difference (psi)

- -6.99999999 - -3.00000000
- -2.99999999 - -1.00000000
- -0.999999990 - 1.00000000
- 1.00000001 - 5.00000000
- 5.00000001 - 35.0000000

- Alternative 3
- Loma Alta Creek
- Existing Pipe in Talone Zone
- Proposed New Pipe
- Abandoned Pipe
- Model Pipe
- Model_Reservoirs_040722

Note: Comparision was made between residual pressures under existing MDD + FF condition with Alternative3 under existing MDD + FF condition with existing system conditions.

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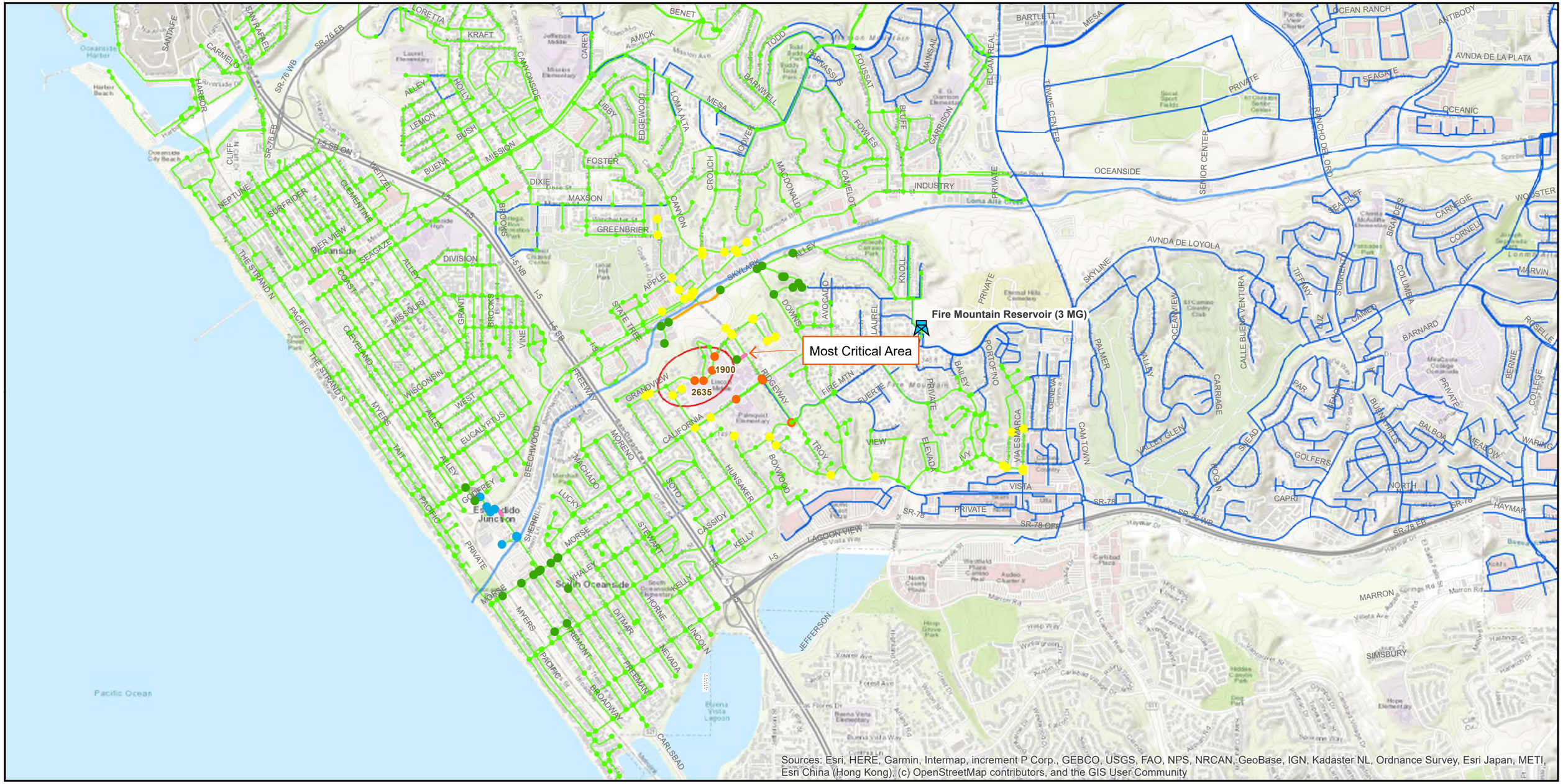
Comparable Analysis for Residual Pressures under Existing MDD + FF Condition (Alternative 3)
Figure 4



Legend

Residual Pressure Difference (psi)

- -6.99999999 - -3.00000000
- -2.99999999 - -1.00000000
- -0.999999990 - 1.00000000
- 1.00000001 - 5.00000000
- 5.00000001 - 35.0000000
- 35.0000001 - 103.630000

- Alterntative 4
- Loma Alta
- Existing Pipe in Talone Zone
- Proposed New Pipe
- Abandoned Pipe
- Model Pipe
- Model_Reservoirs_040722

Note: Comparision was made between residual pressures under existing MDD + FF condition with Alternative 4 under existing MDD + FF condition with existing system conditions.

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Water Utility Impact Study
for Ocean Creek
Comparable Analysis for Residual Pressures under Existing MDD + FF Condition (Alternative 4)
Figure 5

Table 3. Model Results for the Most Critical Nodes under Existing (2012) MDD + FF Condition

					Proposed Project		Proposed Project with Alternative 3		Proposed Project with Alternative 4	
Model ID	Static Demand (gpm)	Static Pressure (psi)	Static Head (ft)	Fire-Flow Demand (gpm)	Residual Pressure (psi)	Hydrant Available Flow @ 20 psi/10 fps (gpm)	Residual Pressure (psi)	Hydrant Available Flow @ 20 psi/10 fps (gpm)	Residual Pressure (psi)	Hydrant Available Flow @ 20 psi/10 fps (gpm)
J88	0	68.12	2000	2,000	15.4	2,200	22.06	2,300	22.67	2,409
J90	0	66.49	2000	2,000	14.55	1,557	21.27	1,782	21.58	1,698

Notes:

1. System was analyzed under existing (2012) MDD + FF condition with demand and facility set established in the 2015 WMP.
2. Hydrant available flow and hydrant pressure at available flow are results using the City's fire flow criteria of minimum residual pressure of 20 psi and maximum velocity of 10 fps.

Conclusion

Based on model results, both Alternative 3 and Alternative 4 can substantially mitigate the pressure losses caused by the abandonment of the existing 12-inch line. Alternative 3 requires construction of slightly longer and larger pipes than Alternative 4, and construction of the proposed 12-inch line in Parkwood needs to cross the Loma Alta Creek. Due to this, construction costs of Alternative 3 would probably be higher than Alternative 4. However, it provides generally more pressure increases to areas west of I-5 and south of Oceanside Blvd as well as the most critical area. Since the proposed abandoned 12-inch line is the only large connection within Talone Zone that allows water flow both directions crossing the Loma Alta Creek and is critical in terms of system operation, Alternative 3 is good as a replacement. On the other hand, Alternative 4 may be slightly less effective in pressure increases at the aforementioned areas, but the costs would be less.