APPENDIX E

MEMORANDUMS REGARDING 100-YEAR FLOODPLAIN AND STROMWATER FROM HDR AND INTER-FLUVE

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Memo

To:	Laurel Byer, P.E.		
From:	Shane Cline, P.E., Ryan Beaver, P.E.	Project:	Boeckman Floodplain Analysis
CC:			
Date:	November 13, 2005	Job No:	10333-20000

RE: Boeckman Floodplain Analysis - Modeling Results

1.0 Background

The purpose of this analysis is to estimate the effect regional detention facilities identified in the City of Wilsonville's Stormwater Master Plan (2001) will have on the downstream area of Coffee Lake Creek and the manmade portion of Seely Ditch. Based on previous analysis, the 100-yr floodplain in this vicinity encompasses approximately 213 acres. Specifically, facilities CLC-5 (South Tributary to Basalt Creek), CLC-9 (Basalt Creek at BNRR), and the proposed Villebois facilities were investigated. The area of potential impact is located within a significant wetland complex centered around the confluence of Coffee Lake Creek and Basalt Creek with no insurable structures. The purpose of this memorandum is to provide a summary of the results of this analysis.

2.0 Approach

As part of the Boeckman Road-Tooze Road Connector project, a Conditional Letter of Map Revision (CLOMR) was developed for submittal to FEMA. As part of this project, a steady-state HEC-RAS model was developed to meet the requirements of this submittal. This previously developed HEC-RAS model was modified to allow the use of hydrographs (unsteady state) as input to the hydraulic model. The objective of this additional modeling is to qualitatively determine if flood elevations in the Coffee Lake Creek floodplain will be significantly affected by the direct discharge of runoff from the adjacent developments.

Specifically, the City's goal was to compare the following scenarios:

- Scenario 1: Existing conditions with existing flows.
- Scenario 2: Future flows with proposed conveyance improvements and no detention facilities.
- Scenario 3: Future flows with construction of proposed ponds near the Villebois development.
- Scenario 4: Future flows with Villebois development ponds and regional facilities (CLC-5 and CLC-9).
- Scenario 5: Future flows with Villebois development ponds and CLC-9.

This work was divided into two separate phases. The first phase, identified as the Initial Investigation, included the model runs for the above four scenarios for 2-, 25-, and 100-year recurrence intervals. The second phase included the selection of more detailed scenarios that involved varying levels of detention from adjacent developments, e.g., future flows with Villebois ponds and without CLC-5.

3.0 Initial Investigation

PMA Engineering provided HDR with hydrographs to be used as the hydrologic input to the modified HEC-RAS model. These hydrographs were input at several locations along the Basalt Creek/Coffee Lake Creek network. Figures 1, 2, and 3 provide maps of the four scenarios for the 2-, 25-, and 100-year events, respectively. In addition to showing the approximate locations of the hydrograph inputs, these figures graphically illustrate the estimated impacts the presence of the regional detention facilities have on the Coffee Lake floodplain for each scenario. For comparison purposes, the 100-year flood plain elevation, as submitted for the FEMA CLOMR, is also shown.

Tabulated results for this analysis are also provided. Table 1, below, provides a summary of the total area inundated for each tax lot for the 2-year event for each scenario. Table 2 and 3 summarize the results of the 25-year and 100-year events, respectively, for each scenario.

Table 1. Estimate of Impacted Areas (2-Year Event)—See Figure 1

Table ID	Owner	Taxlot Area (sf)	Area of Impact: Existing (Scenario 1) (sf)	Future (Scenario 2) (sf)	Future (Villebois Ponds Only) (Scenario 3) (sf)	Future (Villebois Ponds and CLC-5 and CLC-9) (Scenario 4) (sf)	100-Yr Floodplain (sf)
1	JONES ROBERT STRATTON & SUSAN	92,190	-	-	-	-	-
2	PICULELL ARTHUR C JR & DEE W	910,390	-	-	-	-	28,360
3	PICULELL ARTHUR C JR & DEE W	1,063,230	-	-	-	-	-
4	TWO BEARS CO	223,270	120	120	120	120	4,950
5	PICULELL ARTHUR C JR & DEE W	248,150	15,960	16,390	16,390	16,390	146,280
6	DEARMOND THOMAS H	123,110	20	15,760	15,860	15,860	97,480
7	PICULELL ARTHUR C JR & DEE W	258,760	75,170	140,680	141,360	141,360	258,710
8	DEARMOND THOMAS H	310,800	-	-	-	-	77,460
9	DEARMOND THOMAS H	1,376,160	-	-	-	-	-
10	OUR ASSOCIATES	1,111,730	6,760	9,000	9,140	9,140	52,880
11	OLDCASTLE PRECAST INC	121,990	-	-	-	-	-
12	BREUER CHARLES F	144,650	-	900	900	900	7,090
13	OLDCASTLE PRECAST INC	120,090	-	-	-	-	-
14	METROPOLITAN SERV DISTRICT	164,180	121,570	154,470	154,470	154,470	164,180
15	METROPOLITAN SERV DISTRICT	597,600	454,240	553,720	553,720	553,720	584,210
16	BISCHOF DONALD E	121,920	121,810	121,810	121,810	121,810	121,940
17	BISCHOF DONALD E	1,841,490	286,050	361,270	361,270	361,270	558,200
18	SIMS T DWIGHT	44,020	27,760	33,480	33,480	33,480	43,940
19	YOUNG DAVID S 1/3	1,656,370	151,080	847,720	848,120	848,120	1,418,480
20	METROPOLITAN SERV DISTRICT	318,300	22,480	271,730	271,730	271,730	302,710
22	SIMS T DWIGHT	572,990	181,400	261,120	261,120	261,120	390,930
23	METRO	860,250	259,400	260,560	260,560	260,560	390,070
24	METRO	822,280	395,000	471,320	471,540	471,110	496,720
25	SIMS T DWIGHT	2,692,890	132,230	232,230	232,230	232,230	626,720
26	HARTFORD ROBERT W	1,121,530	9,410	13,060	13,060	13,060	410,450
27	METRO	1,160,400	111,830	272,800	272,980	264,660	400,550
28	METRO	775,570	310,840	389,240	389,240	387,970	408,360
29	ARRELL RICHARD G	1,094,400	15,320	18,120	18,120	18,120	407,350
30	SELANDER MELVIN W TRUSTEE	60,260	-	-	-	-	-
31	ARRELL RICHARD G	1,121,630	11,460	54,930	54,930	54,930	639,640
32	WEEDMAN MICHAEL J & JOYCE L	1,082,280	12,800	18,760	18,760	18,760	439,090
33	METROPOLITAN SERV DISTRICT	856,760	79,560	185,970	185,970	176,850	340,290
34	GARST RONALD L & KAREN L	254,850	4,150	4,480	4,480	4,480	130,530
35	METROPOLITAN SERV DISTRICT	1,656,780	5,400	5,400	5,400	5,400	343,800
Total (sf)		**24,981,270**	**2,811,820**	**4,715,040**	**4,716,760**	**4,697,620**	**9,291,370**
Total (acres)		**573**	**65**	**108**	**108**	**108**	**213**
Peak Flow at Outlet (cfs)			181.8	194.1	194.8	194.8	
Total Input Volume (ac-ft)			360.70	397.60	397.60	397.77	

Table 2. Estimate of Impacted Areas (25-Year Event)—See Figure 2

Table ID	Owner	Taxlot Area (sf)	Area of Impact: Existing (Scenario 1) (sf)	Future (Scenario 2) (sf)	Future (Villebois Ponds Only) (Scenario 3) (sf)	Future (Villebois Ponds and CLC-5 and CLC-9) (Scenario 4) (sf)	100-Yr Floodplain (sf)
1	JONES ROBERT STRATTON & SUSAN	92,190	-	-	-	-	-
2	PICULELL ARTHUR C JR & DEE W	910,390	6,610	10,920	10,720	10,720	28,360
3	PICULELL ARTHUR C JR & DEE W	1,063,230	-	-	-	-	-
4	TWO BEARS CO	223,270	900	930	930	930	4,950
5	PICULELL ARTHUR C JR & DEE W	248,150	121,890	135,380	134,710	134,710	146,280
6	DEARMOND THOMAS H	123,110	39,590	59,840	59,350	59,010	97,480
7	PICULELL ARTHUR C JR & DEE W	258,760	257,970	258,520	258,520	258,420	258,710
8	DEARMOND THOMAS H	310,800	21,800	39,960	39,560	39,460	77,460
9	DEARMOND THOMAS H	1,376,160	-	-	-	-	-
10	OUR ASSOCIATES	1,111,730	11,280	12,080	12,080	12,080	52,880
11	OLDCASTLE PRECAST INC	121,990	-	-	-	-	-
12	BREUER CHARLES F	144,650	1,000	1,160	1,160	1,160	7,090
13	OLDCASTLE PRECAST INC	120,090	-	-	-	-	-
14	METROPOLITAN SERV DISTRICT	164,180	156,740	162,080	161,920	161,860	164,180
15	METROPOLITAN SERV DISTRICT	597,600	556,690	571,570	571,570	571,480	584,210
16	BISCHOF DONALD E	121,920	121,810	121,810	121,810	121,810	121,940
17	BISCHOF DONALD E	1,841,490	368,900	408,050	406,610	406,180	558,200
18	SIMS T DWIGHT	44,020	33,840	34,920	34,920	34,920	43,940
19	YOUNG DAVID S 1/3	1,656,370	1,043,890	1,173,890	1,170,160	1,169,350	1,418,480
20	METROPOLITAN SERV DISTRICT	318,300	280,000	293,650	293,190	292,760	302,710
22	SIMS T DWIGHT	572,990	268,800	287,090	287,000	286,550	390,930
23	METRO	860,250	260,530	292,230	292,230	291,810	390,070
24	METRO	822,280	392,610	472,150	472,180	472,150	496,720
25	SIMS T DWIGHT	2,692,890	269,380	294,920	294,920	294,400	626,720
26	HARTFORD ROBERT W	1,121,530	156,930	164,790	164,790	166,440	410,450
27	METRO	1,160,400	192,980	298,690	298,900	285,460	400,550
28	METRO	775,570	361,670	398,880	398,880	395,720	408,360
29	ARRELL RICHARD G	1,094,400	242,720	249,220	249,220	249,410	407,350
30	SELANDER MELVIN W TRUSTEE	60,260	-	-	-	-	-
31	ARRELL RICHARD G	1,121,630	458,320	464,400	464,400	464,690	639,640
32	WEEDMAN MICHAEL J & JOYCE L	1,082,280	130,230	131,520	131,520	132,550	439,090
33	METROPOLITAN SERV DISTRICT	856,760	115,760	237,250	237,250	219,810	340,290
34	GARST RONALD L & KAREN L	254,850	17,670	17,970	17,970	17,970	130,530
35	METROPOLITAN SERV DISTRICT	1,656,780	5,750	5,750	5,750	5,750	343,800
Total (sf)		**24,981,270**	**5,896,260**	**6,599,620**	**6,592,220**	**6,557,560**	**9,291,370**
Total (acres)		**573**	**135**	**152**	**151**	**151**	**213**
Peak Flow at Outlet (cfs)			388.4	456.9	455.4	454.4	
Total Input Volume (ac-ft)			825.81	877.50	877.75	877.80	

Table 3. Estimate of Impacted Areas (100-Year Event)—See Figure 3

Table ID	Owner	Taxlot Area (sf)	Area of Impact: Existing (Scenario 1) (sf)	Future (Scenario 2) (sf)	Future (Villebois Ponds Only) (Scenario 3) (sf)	Future (Villebois Ponds and CLC-5 and CLC-9) (Scenario 4) (sf)	100-Yr Floodplain (sf)
1	JONES ROBERT STRATTON & SUSAN	92,190	-	-	-	-	-
2	PICULELL ARTHUR C JR & DEE W	910,390	11,320	16,210	16,760	16,500	28,360
3	PICULELL ARTHUR C JR & DEE W	1,063,230	-	-	-	-	-
4	TWO BEARS CO	223,270	930	930	930	930	4,950
5	PICULELL ARTHUR C JR & DEE W	248,150	136,040	139,360	139,880	139,680	146,280
6	DEARMOND THOMAS H	123,110	61,140	74,960	75,540	75,010	97,480
7	PICULELL ARTHUR C JR & DEE W	258,760	258,580	258,770	258,770	258,770	258,710
8	DEARMOND THOMAS H	310,800	43,170	51,510	52,180	51,800	77,460
9	DEARMOND THOMAS H	1,376,160	-	-	-	-	-
10	OUR ASSOCIATES	1,111,730	12,180	12,960	13,060	12,960	52,880
11	OLDCASTLE PRECAST INC	121,990	-	-	-	-	-
12	BREUER CHARLES F	144,650	1,160	1,650	1,750	1,650	7,090
13	OLDCASTLE PRECAST INC	120,090	-	-	-	-	-
14	METROPOLITAN SERV DISTRICT	164,180	162,130	163,510	163,510	163,510	164,180
15	METROPOLITAN SERV DISTRICT	597,600	572,320	577,650	577,890	577,650	584,210
16	BISCHOF DONALD E	121,920	121,810	121,810	121,810	121,810	121,940
17	BISCHOF DONALD E	1,841,490	412,210	454,290	456,900	454,290	558,200
18	SIMS T DWIGHT	44,020	35,190	35,800	36,130	35,800	43,940
19	YOUNG DAVID S 1/3	1,656,370	1,185,600	1,258,200	1,261,960	1,258,360	1,418,480
20	METROPOLITAN SERV DISTRICT	318,300	294,980	297,800	298,020	297,800	302,710
22	SIMS T DWIGHT	572,990	289,430	304,740	305,810	304,740	390,930
23	METRO	860,250	266,630	307,440	311,380	307,440	390,070
24	METRO	822,280	407,410	472,290	470,210	472,210	496,720
25	SIMS T DWIGHT	2,692,890	309,010	341,200	343,110	341,650	626,720
26	HARTFORD ROBERT W	1,121,530	212,370	218,320	218,320	218,720	410,450
27	METRO	1,160,400	214,820	303,160	284,260	296,500	400,550
28	METRO	775,570	370,070	399,910	399,780	398,370	408,360
29	ARRELL RICHARD G	1,094,400	284,600	285,860	285,860	285,860	407,350
30	SELANDER MELVIN W TRUSTEE	60,260	-	-	-	-	-
31	ARRELL RICHARD G	1,121,630	540,480	540,480	540,480	540,480	639,640
32	WEEDMAN MICHAEL J & JOYCE L	1,082,280	182,180	182,180	182,180	182,180	439,090
33	METROPOLITAN SERV DISTRICT	856,760	126,100	252,800	249,380	243,440	340,290
34	GARST RONALD L & KAREN L	254,850	25,410	25,410	25,410	25,410	130,530
35	METROPOLITAN SERV DISTRICT	1,656,780	5,780	5,780	5,780	5,780	343,800
Total (sf)		**24,981,270**	**6,543,050**	**7,104,980**	**7,097,050**	**7,089,300**	**9,291,370**
Total (acres)		**573**	**150**	**163**	**163**	**163**	**213**
Peak Flow at Outlet (cfs)			485.1	520.7	523.8	521.3	
Total Input Volume (ac-ft)			994.2	1,050.3	1,050.3	1,052.1	

It appears that even with regional detention facilities (as modeled in Scenario 4) the peak flow out of the system and the total input volume are slightly higher than those of the no-detention scenario (Scenario 2). These changes are approximately 0.11% higher for the peak flow at the outlet and 0.17% higher for the total volume. Given the magnitude of the results compared with the calculated change, and accounting for the complexity of the unsteady analysis, these changes are insignificant and are well within the expected error of this model. This error could also explain the minor increase in inundated area identified for Scenario 4. For the purposes of this analysis, it can be assumed the difference is negligible.

4.0 Conclusions

For a more detailed analysis, a fifth scenario was analyzed. This scenario included stormwater runoff with additional control of stormwater runoff from both the Villebois Ponds and CLC-9. The scenario does not include construction of CLC-5. Figure 4 provides a map of these results for the 100-year return period. The map visually shows that the detention ponds have little impact on the total inundated area. Table 5 provides a tabular summary of these results for each scenario.

As would be expected, the scenario using no regional detention (Scenario 2) results in the largest area of inundation. Construction of the Villebois Ponds (Scenario 3) results in a net decrease in inundated area of less than 0.12%; additional detention from CLC-5 or CLC-9 results in a net decrease of 0.22%.

Impacts to individual properties can be determined using the modified HEC-RAS model at individual locations. Average impacts to the floodplain can be estimated from the above tables. These tables of future flows with no detention provided (Scenario 2) can be compared with results from the future flows using the proposed detention facilities CLC-5, CLC-9, and the Villebois facilities (Scenario 4) for a given storm event. The following table summarizes the average impacts.

Table 4. Average Impact to Floodplain for 100-year Event

	100-year
Runoff Volume (Scenario 2) – Ac-ft	1050.3
Runoff Volume (Scenario 4) – Ac-ft	1052.1
Change In Runoff Volume – Ac-ft	1.8
Inundation Area (Scenario 2) – Ac	162.9
Inundation Area (Scenario 4) – Ac	163.1
Average Inundation Area – Ac	163.0
Estimated Average Change in Water Surface Elevation – ft	**0.01**

It should be noted that Table 4 only provides average impacts to the Coffee Lake floodplain and is not appropriate for use on individual properties. The impacts to individual properties can be estimated but results need to be obtained from more detailed results of the modified HEC-RAS model.

This analysis indicates that the use of the regional detention facilities impacts the downstream Coffee Lake Creek floodplain by 0.01 feet during the 100-year flooding event and negligible impacts for more frequent storm event.

Table 5. Comparison of Impacts with/without Detention Facilities)—See Figure 4

Table ID	Owner	Taxlot Area (sf)	Area of Impact: No Detention - (Scenario 2)	Villebois Ponds - (Scenario 3) (sf)	CLC-5, CLC-9, Villebois Ponds - (Scenario 4) (sf)	CLC-9, Villebois Ponds - (Scenario 5) (sf)	100-Yr Floodplain (sf)
1	JONES ROBERT STRATTON & SUSAN	92,190	-	-	-	-	-
2	PICULELL ARTHUR C JR & DEE W	910,390	16,210	16,760	16,500	16,210	28,360
3	PICULELL ARTHUR C JR & DEE W	1,063,230	-	-	-	-	-
4	TWO BEARS CO	223,270	930	930	930	930	4,950
5	PICULELL ARTHUR C JR & DEE W	248,150	139,360	139,880	139,680	139,220	146,280
6	DEARMOND THOMAS H	123,110	74,960	75,540	75,010	74,280	97,480
7	PICULELL ARTHUR C JR & DEE W	258,760	258,770	258,770	258,770	258,770	258,710
8	DEARMOND THOMAS H	310,800	51,510	52,180	51,800	50,980	77,460
9	DEARMOND THOMAS H	1,376,160	-	-	-	-	-
10	OUR ASSOCIATES	1,111,730	12,960	13,060	12,960	12,820	52,880
11	OLDCASTLE PRECAST INC	121,990	-	-	-	-	-
12	BREUER CHARLES F	144,650	1,650	1,750	1,650	1,650	7,090
13	OLDCASTLE PRECAST INC	120,090	-	-	-	-	-
14	METROPOLITAN SERV DISTRICT	164,180	163,510	163,510	163,510	163,460	164,180
15	METROPOLITAN SERV DISTRICT	597,600	577,650	577,890	577,650	577,380	584,210
16	BISCHOF DONALD E	121,920	121,810	121,810	121,810	121,810	121,940
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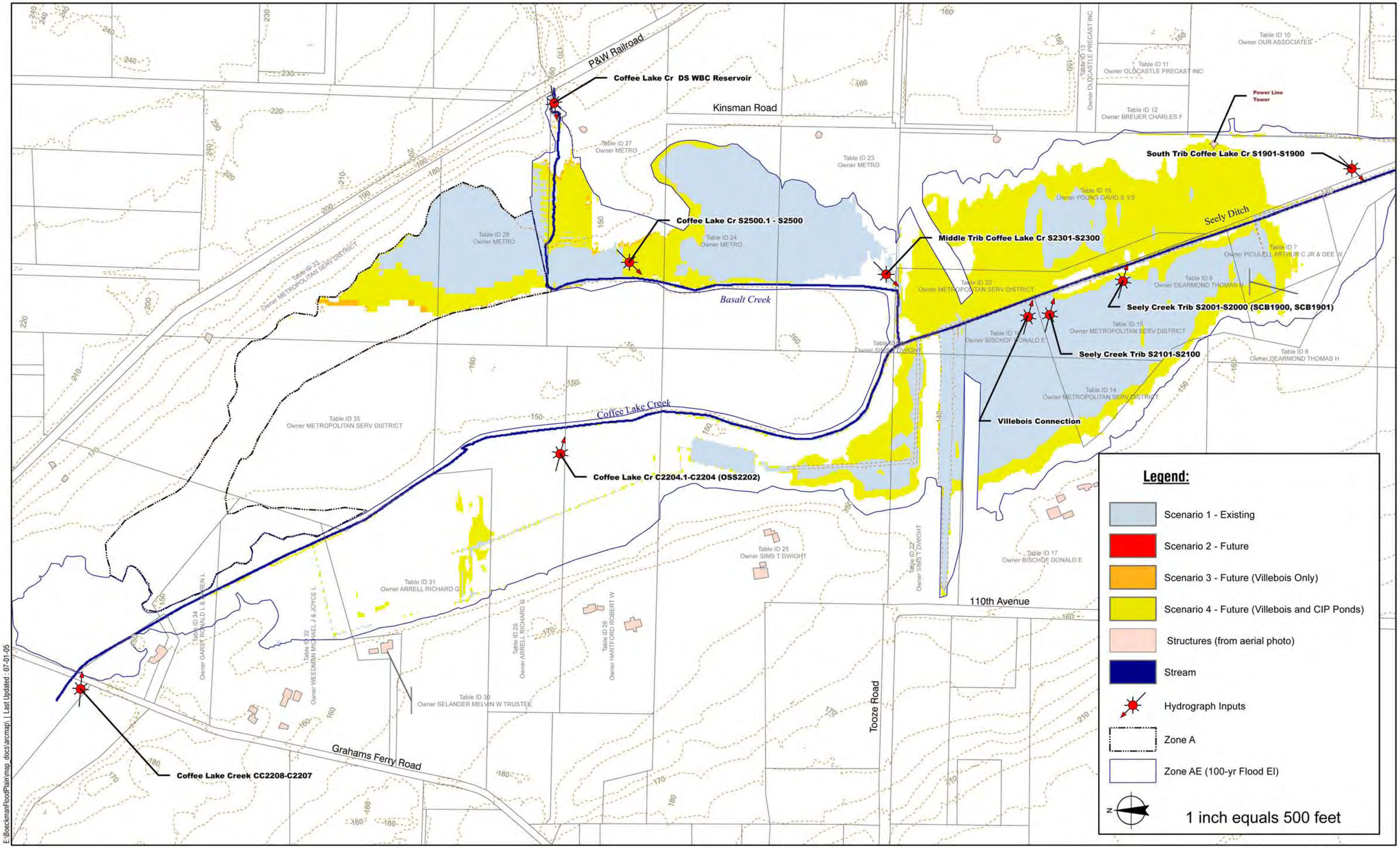
19	YOUNG DAVID S 1/3	1,656,370	1,258,200	1,261,960	1,258,360	1,255,480	1,418,480
20	METROPOLITAN SERV DISTRICT	318,300	297,800	298,020	297,800	297,800	302,710
22	SIMS T DWIGHT	572,990	304,740	305,810	304,740	303,430	390,930
23	METRO	860,250	307,440	311,380	307,440	306,660	390,070
24	METRO	822,280	472,290	470,210	472,210	472,200	496,720
25	SIMS T DWIGHT	2,692,890	341,200	343,110	341,650	338,840	626,720
26	HARTFORD ROBERT W	1,121,530	218,320	218,320	218,720	218,160	410,450
27	METRO	1,160,400	303,160	284,260	296,500	298,230	400,550
28	METRO	775,570	399,910	399,780	398,370	399,110	408,360
29	ARRELL RICHARD G	1,094,400	285,860	285,860	285,860	285,860	407,350
30	SELANDER MELVIN W TRUSTEE	60,260	-	-	-	-	-
31	ARRELL RICHARD G	1,121,630	540,480	540,480	540,480	540,480	639,640
32	WEEDMAN MICHAEL J & JOYCE L	1,082,280	182,180	182,180	182,180	182,180	439,090
33	METROPOLITAN SERV DISTRICT	856,760	252,800	249,380	243,440	246,000	340,290
34	GARST RONALD L & KAREN L	254,850	25,410	25,410	25,410	25,410	130,530
35	METROPOLITAN SERV DISTRICT	1,656,780	5,780	5,780	5,780	5,780	343,800
Total (sf)		**24,981,270**	**7,104,980**	**7,097,050**	**7,089,300**	**7,080,870**	**9,291,370**
Total (acres)		**573**	**163**	**163**	**163**	**163**	**213**
Peak Flow at Outlet			520.7	523.8	521.3	517.1	
Total Input Volume			1,050.3	1,050.3	1,052.1	1,051.7	



2 Year Storm Event

FIGURE 1

Boeckman Flood Plain | City of Wilsonville

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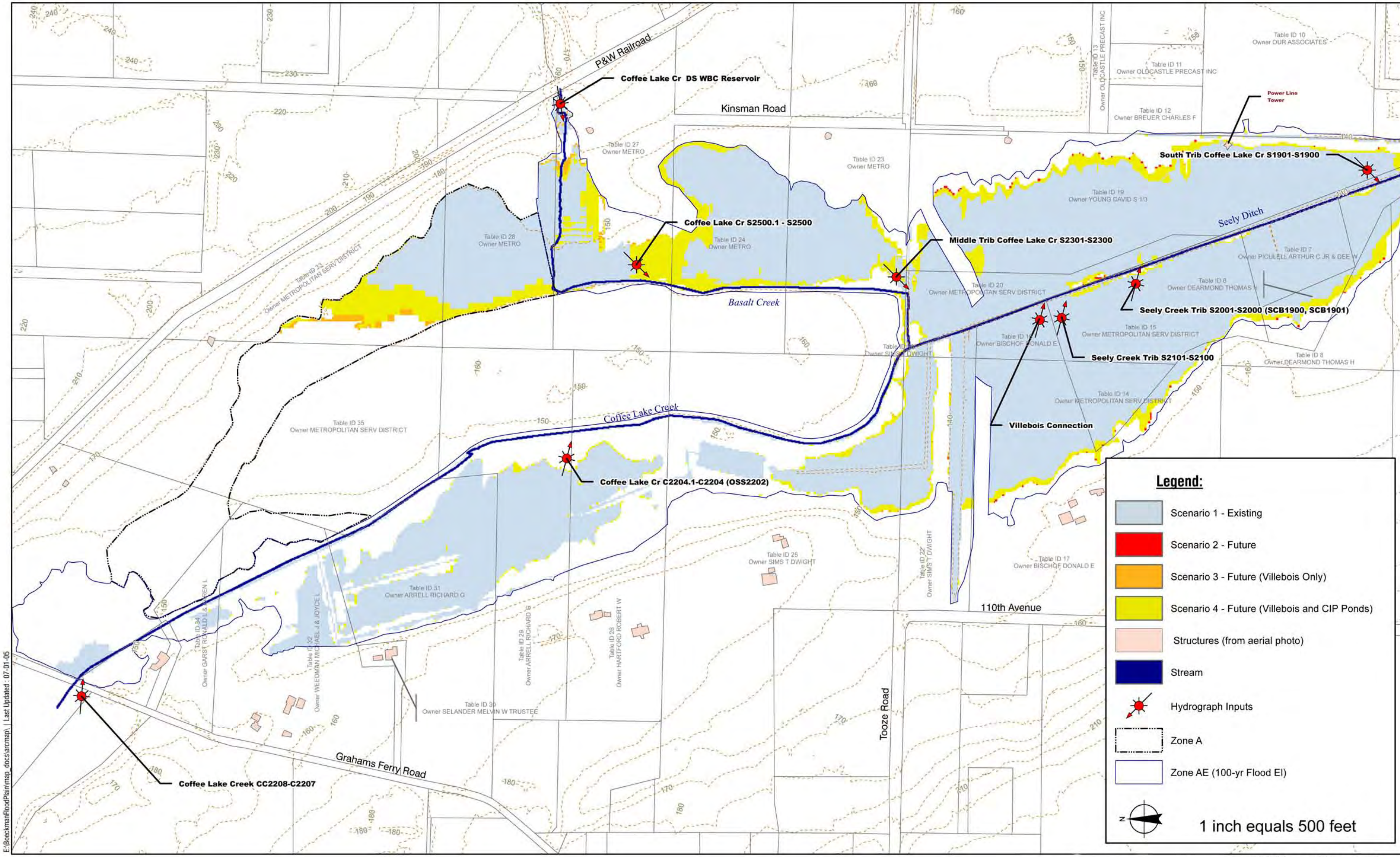

25 Year Storm Event

FIGURE 2

Boeckman Flood Plain | City of Wilsonville

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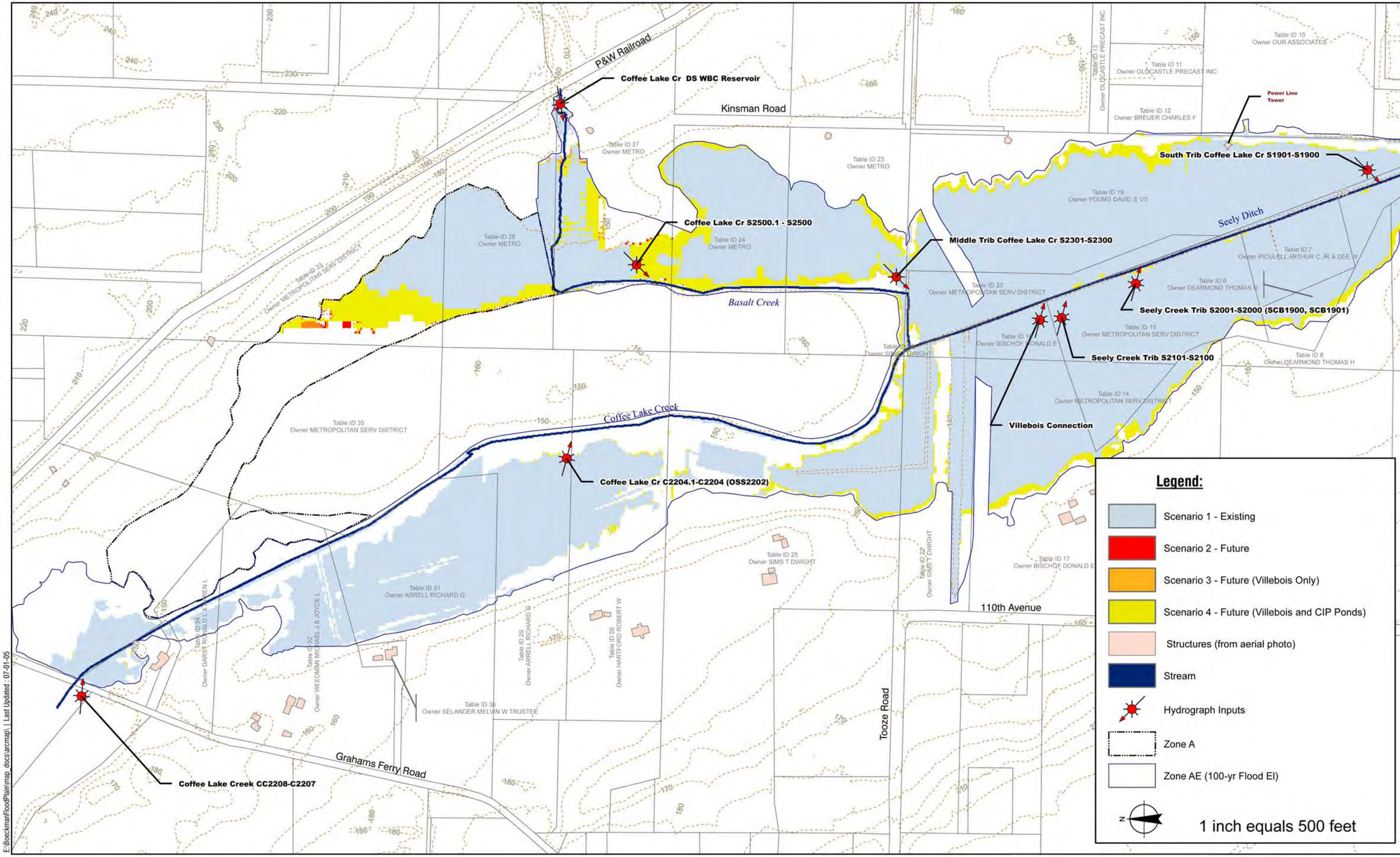

100 Year Storm Event

FIGURE 3

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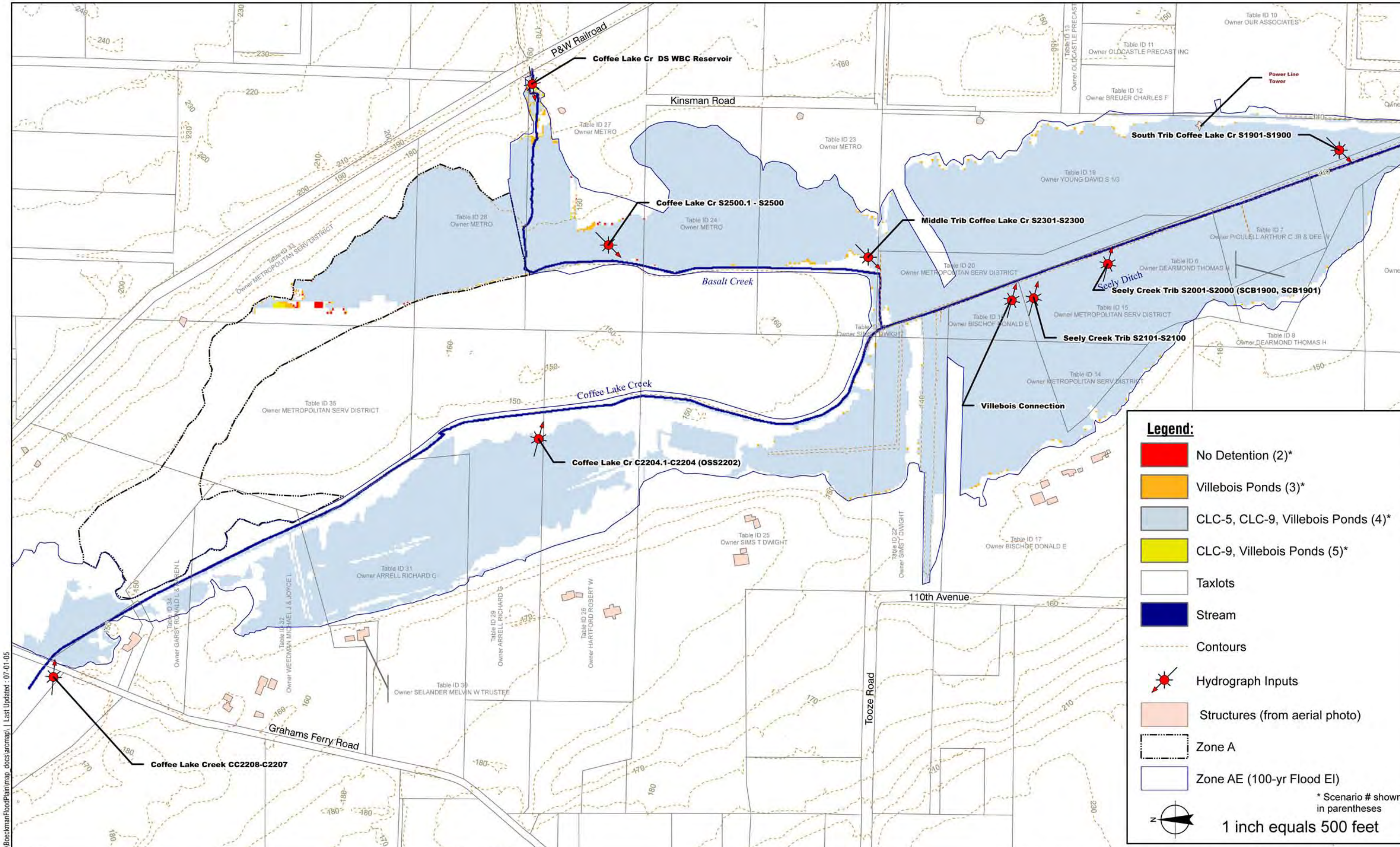
Boeckman Flood Plain | City of Wilsonville



Comparison of Impacts with/without CIP Ponds

FIGURE 4

Boeckman Flood Plain | City of Wilsonville

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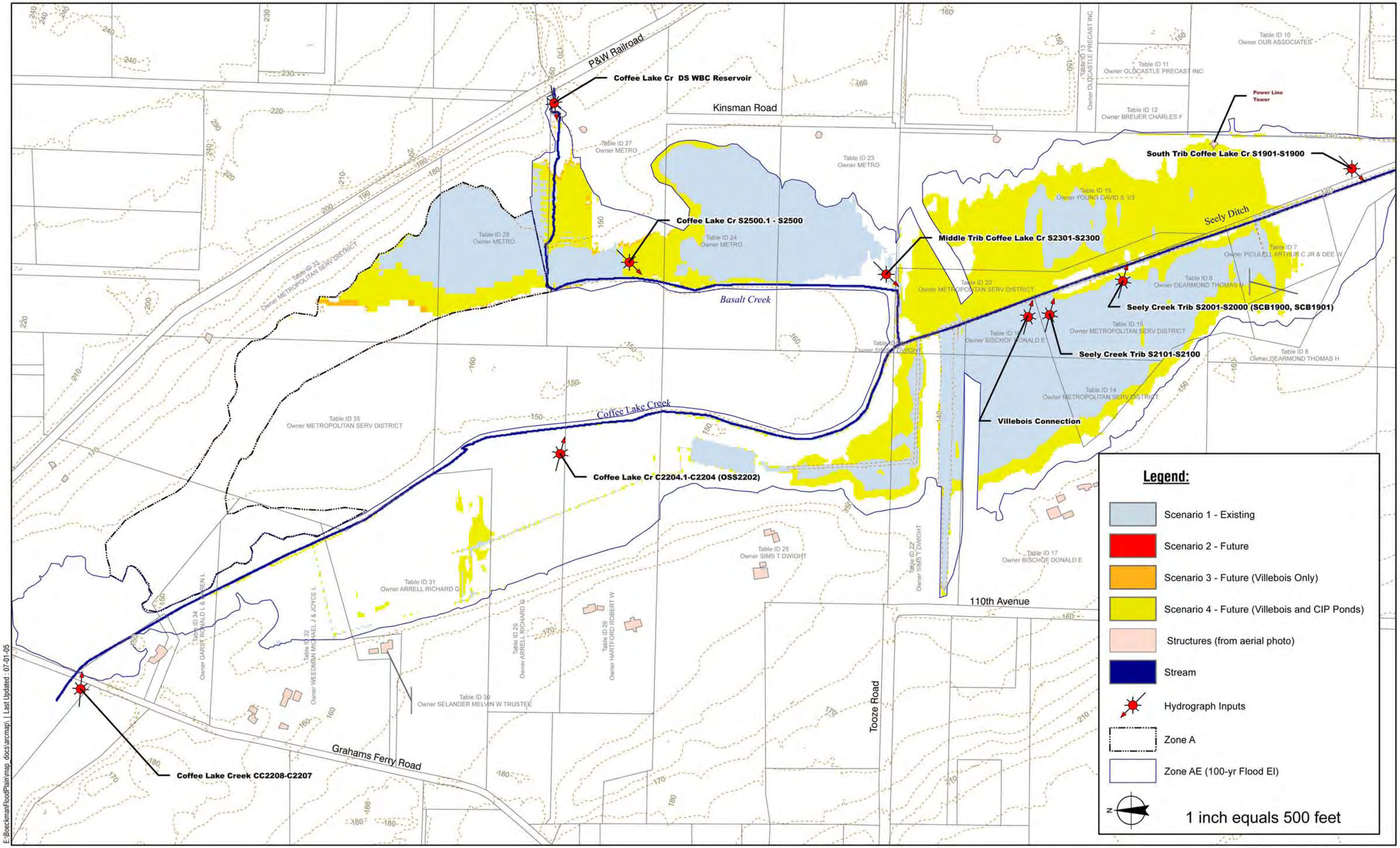
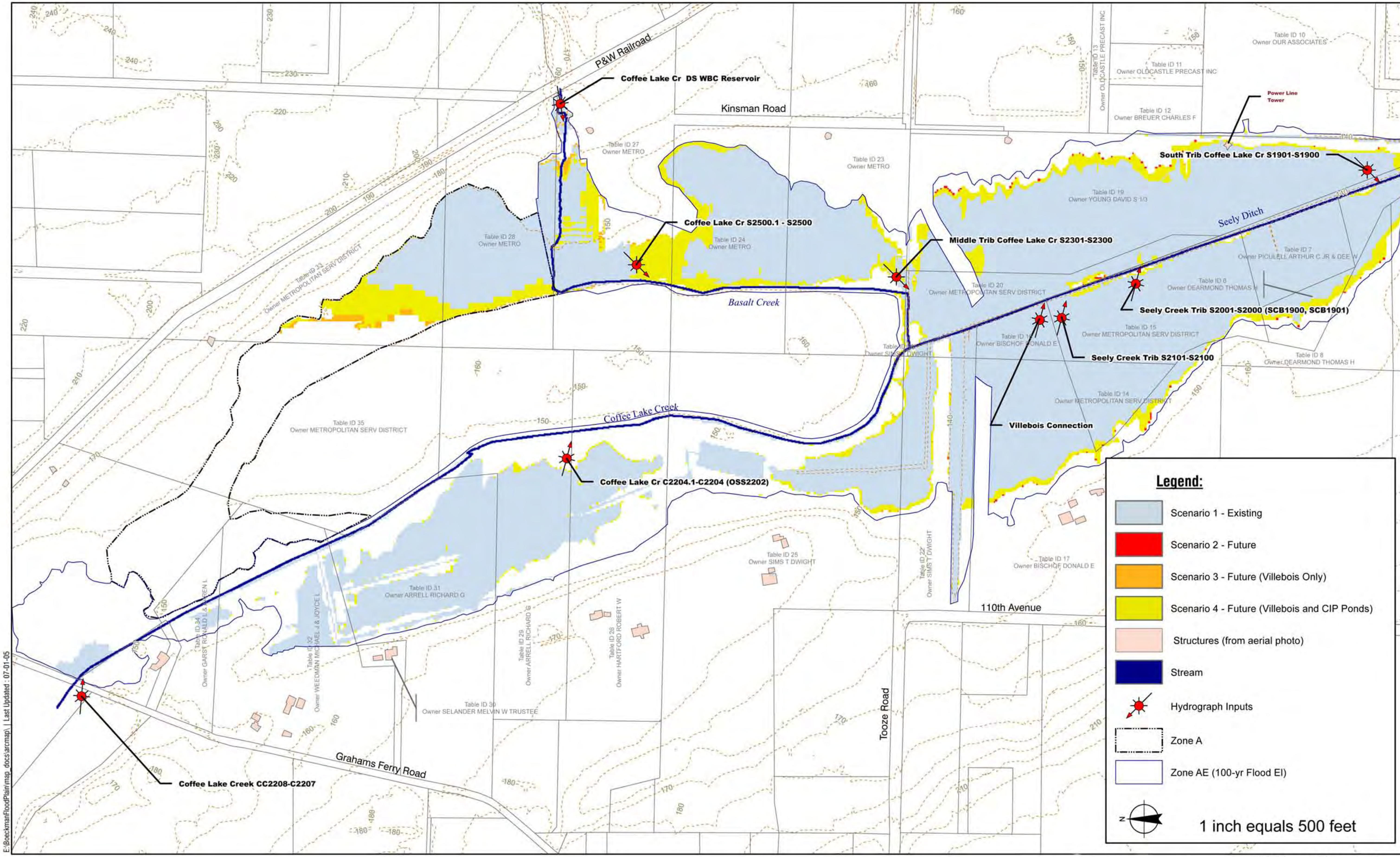


2 Year Storm Event

FIGURE 1

Boeckman Flood Plain | City of Wilsonville

HDR ONE COMPANY | Many Solutions™



25 Year Storm Event

FIGURE 2

Boeckman Flood Plain | City of Wilsonville

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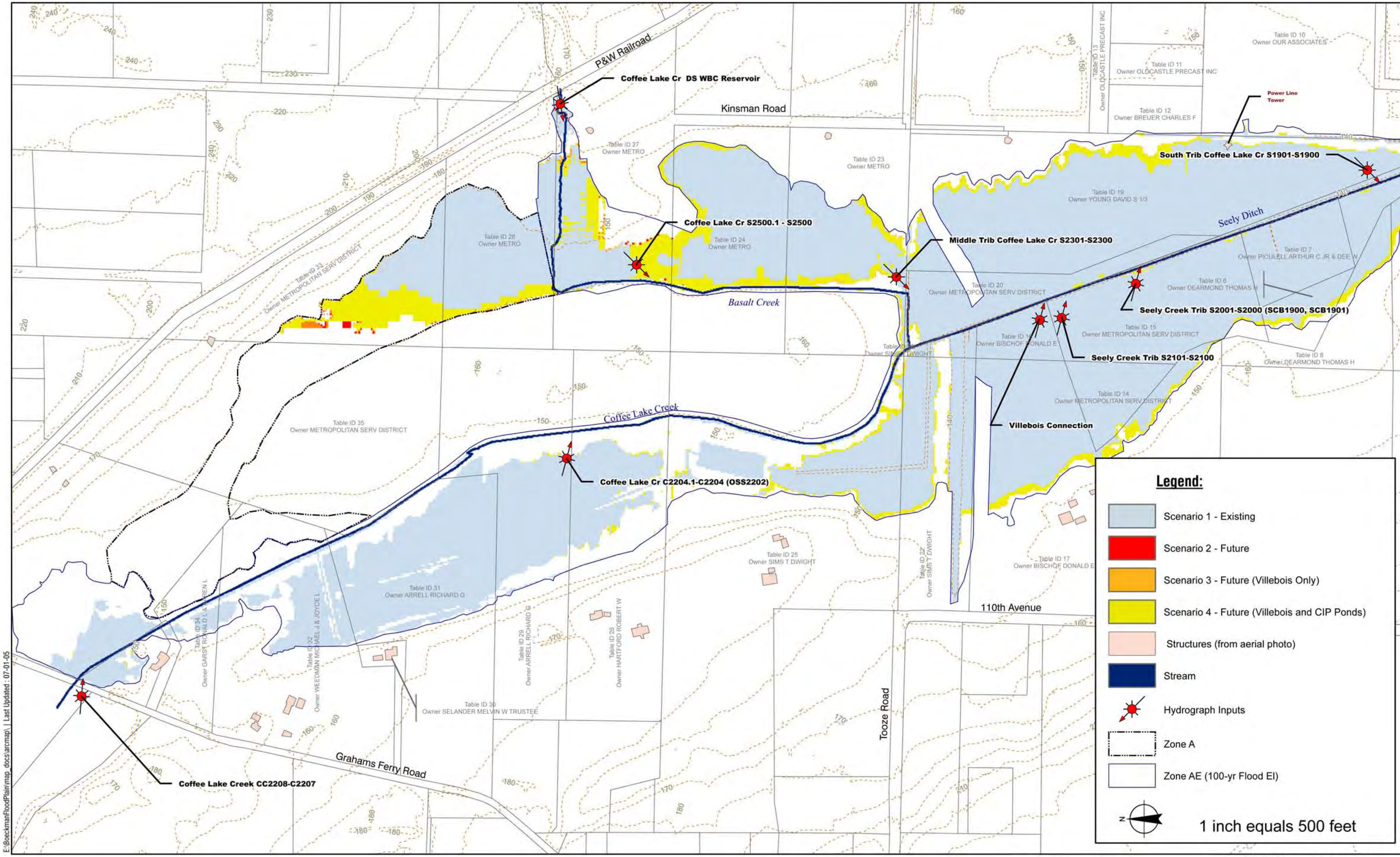

100 Year Storm Event

FIGURE 3

Boeckman Flood Plain | City of Wilsonville

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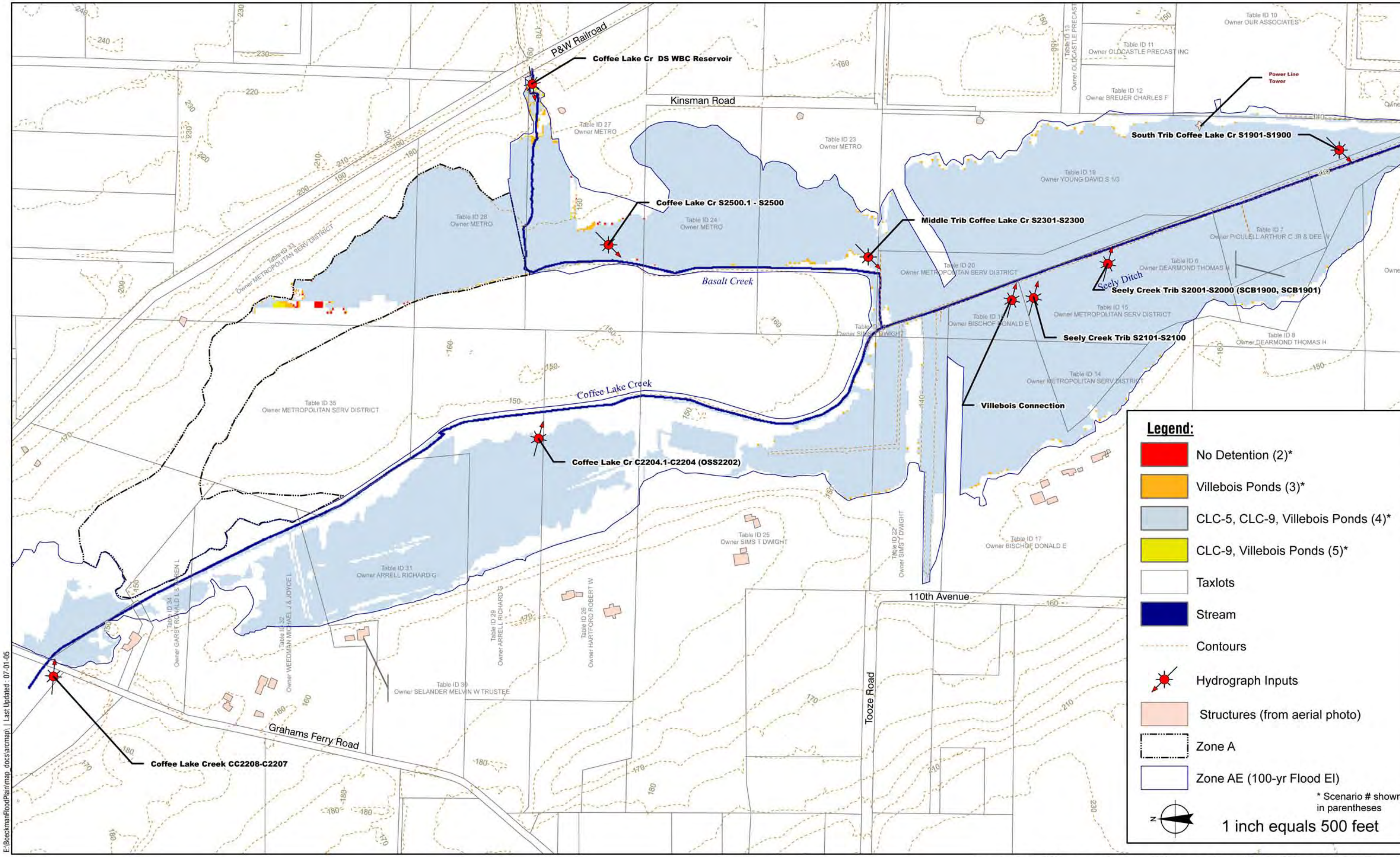

Comparison of Impacts with/without CIP Ponds

FIGURE 4

Boeckman Flood Plain | City of Wilsonville

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inter·fluve, inc.

Technical Memorandum

City of Wilsonville Stormwater Assessment

Task:	Review of surface water hydraulic modeling output
Title:	Comments on hydraulic modeling results
To:	Shane Cline, P.E.
From:	Michael Burke, P.E.
Date:	November 3, 2005

1 Introduction

Peak storm discharges and runoff volumes in the City of Wilsonville (City) are anticipated to increase under projected future development conditions. The City's Stormwater Management Plan (Master Plan, 2001) identified several alternatives for regional stormwater detention to mitigate these increases through construction of new detention facilities. HDR Engineering, Inc. was contracted by the City to perform surface water hydraulic modeling to estimate the effect the increased future flows and the proposed regional detention facilities will have on the downstream Coffee Lake Creek, Basalt Creek and Seely Ditch drainages. A proposed mitigation wetland is located within the floodplain wetland complex adjacent to the confluence of Basalt Creek and Coffee Lake Creek / Seely Ditch. As designer of the proposed Compensatory Mitigation Wetland (Mitigation Wetland), Inter-Fluve, Inc has been retained to review the output of the modeling conducted by HDR, and address the following topics based on the modeling output:

- Qualitatively summarize potential impacts to the Mitigation Wetland based on 1) a shift from current to future flows, and 2) development of additional regional detention facilities to mitigate the shift from current to future flows.
- Qualitatively summarize potential impacts to the Coffee Lake Creek Wetland Complex as a whole based on 1) a shift from current to future flows, and 2) development of additional regional detention facilities to mitigate the shift from current to future flows. , and
- Provide input as to whether it is worthwhile, from a stormwater management perspective, to create a mitigation wetland that is larger than required for wetland mitigation purposes.

We have reviewed the draft technical memorandum by HDR, Inc. (dated July 11, 2005) which communicates the modeling output and further discussed these topics with HDR and City Staff. Our comments are summarized in the following paragraphs.

2 Mitigation Wetland and Coffee Lake Creek Wetland Complex Background

The Mitigation Wetland Plan associated with the Boeckman Road – Tooze Road Connector Project consists of enhancement of approximately 16.8 acres of existing cropped and non-cropped wetlands on properties owned by Metro Parks and Greenspaces and private parties. The existing and proposed wetlands are in the Depressional – Outflow (DOF) hydrogeomorphic class (HDR, 2004), and occur in the Coffee Lake Creek – Basalt Creek - Seely Ditch floodplain (Coffee Lake Creek Wetland Complex). Hydrologic inputs to the existing and proposed wetlands consist of precipitation, groundwater inflow, and surface water inflow during over-bank flood events in the adjacent channels.

The enhancement plan includes excavation of three depressional wetlands, fill of existing portions of the ditched Basalt and Middle Fork Coffee Lake Creeks, re-establishment of the filled channels as naturally-designed meandering channels, and planting. This plan results in approximately 8,000 cubic yards (approximately 5 acre feet) of net excavation in the floodplain.

3 Modeling Background

HDR modeled 5 stormwater detention scenarios for unsteady flow conditions with the one-dimensional hydraulic model HEC-RAS. Among these scenarios are present conditions (Scenario 1), estimated future storm flows with no additional detention (Scenario 2), and estimated future flows with varying levels of increased detention (Scenarios 3-5). Of these 5 scenarios, we evaluated the model output for Scenario 1 (existing conditions), Scenario 2 (future flows with no additional detention) and Scenario 4 (future flows with addition of detention facilities CLC-5 and CLC-9, and the Villebois development ponds). Scenario 4 includes the maximum level of additional stormwater detention modeled in the HDR study.

4 Current to Future Flows - Impacts on Coffee Lake Creek Wetland Complex and Mitigation Wetland Ecology

Hydrology is the primary physical driver of freshwater wetland ecology. Characteristics such as annual timing and frequency of inundation, inundation depth or degree, duration of inundation, and water level rate of change influence the species communities that thrive in a particular freshwater wetland. Changes in these characteristics may cause shifts in the species that colonize or use a particular site within the same wetland class, or may contribute to a shift from one wetland class to a different wetland class.

HDR estimated increases in inundated area, peak flow and runoff volume resulting from projected increases from current (Scenario 1) to future storm runoff flow conditions (Scenario 2). The HDR memo did not report the estimated change in water surface elevations when compared to current conditions. The increases in inundated area, peak flow and runoff volume are summarized in Table 1 below. The Mitigation Wetland has been designed considering future flow conditions, and the shift from current to future flow conditions should not adversely impact the Mitigation Wetland design.

Table 1. Summary of change to inundated area, peak flow, and runoff volume resulting from a shift from current to future flow conditions

Return Period	Inundated Area		Peak Flow		Flow Volume	
	Change in acres	% change	Change in cfs	% change	Change in acre-ft	% change
2 year	+ 43	+ 66	+ 12.3	+ 7	+ 36.9	+ 10
25 year	+ 17	+ 13	+ 68.5	+ 17	+ 51.69	+ 6
100 year	+ 13	+ 9	+ 35.6	+ 7	+ 56.1	+ 6

With the anticipated increases in inundated area, peak flow and runoff volume, a number of responses are possible in the existing wetlands. In selected other systems, increases in peak flows resulting from urbanization have resulted in incision in existing stream channels. This occurs if the erosion resistance threshold of the bed is exceeded by the increased energy associated with higher flows. If incision occurs, groundwater levels in the adjacent wetlands may decrease with the decrease in base level due to the incision, and a net loss in wetland area may occur.

If incision is unlikely, it may be reasonable to assume that conditions in the subject wetland areas will be periodically wetter under future flow conditions, particularly associated with storm events, though the duration and extent of the wetter conditions are indeterminate at the present time. A number of responses to potentially wetter conditions are possible. These conditions may cause currently non-wetland areas to assume wetland functions. These conditions might also result in improved conditions in existing wetlands, cause shifts in vegetative species composition in the existing wetlands, or cause existing wetlands to shift to different wetland classes. More detailed evaluation of the potential for channel incision in the Coffee Lake Creek, Basalt Creek and Seely Ditch drainages, and specific modeling of the wetland areas of concern under unsteady flow conditions may provide further insights into the response of the Coffee Lake Creek Wetland Complex to the shift from current to future flow conditions.

5 Effect of Regional Stormwater Detention on Mitigation Wetland and Coffee Lake Creek Wetland Complex Ecology

When comparing the modeling results from Scenarios 2 and 4, HDR found that future peak flow magnitudes, runoff volumes, and inundation areas are impacted by less than 1% by the stormwater facilities for the 2-year, 25-year and 100-year storms. Additionally, HDR found that the average estimated change in water surface elevation for the Coffee Lake Creek floodplain is (-) 0.01 feet for the estimated future 100-year event. Differences in the storm time of concentration, duration and rate of recession were not reported, but are assumed to be negligible based on the results listed above. These results suggest that the detention facilities would have limited impact on storm runoff hydrology at the Mitigation Wetland site and in the Coffee Lake Creek Wetland Complex under estimated future conditions. Similarly, these results suggest that the detention facilities would have limited impact on the Mitigation Wetland site ecology and the Coffee Lake Creek Wetland Complex ecology during estimated future 2-year, 25-year and 100-year events.

While not included in the current study, flows that occur more frequently and with longer duration than the storms that were modeled are also very important ecologically for the Mitigation Wetland and the Coffee Lake Creek Wetland Complex. If the City chooses to pursue development of the detention facilities, we recommend evaluating the impacts of the detention facilities on these more frequent, longer duration flows as a part of the design process.

6 Stormwater Management Benefit from Mitigation Wetland Construction

In general, wetlands located in floodplain areas such as the Mitigation Wetland may provide stormwater management benefits locally and to downstream areas through off-channel storage, energy dissipation and water quality improvement.

As described above, the Mitigation Wetland plan includes excavation of approximately 5 acre-feet of material from the CLC-BC-SD floodplain. This volume is comparable to approximately 1.2 %, 0.6 % and 0.5 % of the estimated future storm runoff volumes for the 2-year, 25-year and 100-year events reported by HDR. It should be anticipated that the actual amount of excavated volume available for storage will be less than the percentages above since storms typically occur during the wet season when ponded water is usually present.

Specific comparisons between stormwater conditions before and after the wetland enhancement have not been modeled. However, it does appear that since the potential wetland storage is small relative to the storm runoff volumes, the current Mitigation Wetland plan provides limited stormwater storage. If the enhancement scope increased to include additional excavation from additional floodplain areas, the storage potential would likewise increase. The unsteady flow model developed by HDR would allow evaluation of the benefit of the increased storage on local and downstream water surface elevations if the storage areas were included in the model setup.

The proposed Mitigation Wetland plan will result in enhancement of approximately 12.2 acres (of 16.8 acres total) of wetland currently utilized for agriculture, including revegetation of the cultivated areas with native riparian and wetland plant species. This will result in floodplain wetland areas that are hydraulically rougher than the current condition. The plan also includes re-construction of approximately 2000 feet of Basalt and Middle Fork Coffee Lake Creeks as a naturally designed, meandering channel. This will allow storm flows to spread over the adjacent floodplain more frequently.

The increased frequency of flows encountering the hydraulically rougher floodplain will help dissipate stormwater energy through the Mitigation Wetland site, which may increase the time of concentration for peak flows downstream in Seely Ditch. If the enhancement area were increased, any additional increase in the dissipation of storm energy would be proportional to the amount of area added to the enhancement plan. The specific amount of energy dissipation provided by the proposed Mitigation Wetland plan, or by an expanded enhancement plan, have not been quantified through modeling to date.

Finally, stormwater quality will be improved as a result of the implementation of the Mitigation Wetland plan. As storm flows spread over the floodplain areas and through the wetlands, velocities will decrease allowing entrained sediment to settle out of the water column. Nutrients and other substances contained within the sediment may eventually be utilized by the wetland vegetation through uptake processes.

7 Conclusions

We have reviewed the results of the stormwater modeling and analysis concerning the CLC-BC-SD floodplain areas conducted by HDR Engineering, Inc, which were presented in their July 11 draft memo. The HDR analysis included an estimate of the increased inundated area, peak flow and runoff volume resulting from a shift from current to future storm runoff conditions. These increases may result in wetter conditions for the existing Coffee Lake Creek Wetland Complex, but this cannot be determined conclusively at the present time. The shift from current to future flow conditions are not expected to adversely impact Mitigation Wetland ecology.

The HDR analysis also involved evaluation of the stormwater management benefit provided by selected proposed regional stormwater detention facilities identified in the Master Plan. The results show that the modeled detention facilities provide limited benefits in estimated future storm events with 2-year, 25-year and 100-year return periods. Therefore, these detention facilities are unlikely to impact Mitigation Wetland ecology and Coffee Lake Creek Wetland Complex ecology during these storm events. The effects of the detention facilities on flows of lower magnitude and longer duration were not modeled, but could potentially impact Mitigation Wetland and Coffee Lake Creek Wetland Complex ecology. If planning for development of the detention facilities proceeds, we recommend completing an evaluation of the impact of the detention facilities on lower magnitude, longer duration flows as part of the design process.

Approximately 5 acre-feet of material will be excavated from the CLC-BC-SD floodplain as part of the Mitigation Wetland plan. This excavation volume appears minor relative to the estimated future 2-year, 25-year and 100-year storm runoff volumes. Additional excavation of off-channel depressions would be required to enhance the stormwater benefits of the Mitigation Wetland plan through off-channel storage. The benefit provided by additional excavation of off-channel depressions could be quantified with the unsteady flow model. The current Mitigation Wetland plan will provide benefits through storm runoff energy dissipation and water quality improvement. However, the benefit provided through energy dissipation and water quality processes has not been quantified.

Please contact me at 541.386.9003 or mburke@interfluve.com if you have comments or questions related to this memorandum.

8 References

City of Wilsonville, 2001. City of Wilsonville - Stormwater Master Plan. Prepared by Tetra Tech / KCM, Inc., June.

HDR Engineering, Inc., 2004. Memorandum: Boeckman Road – Tooze Road HGM Assessment, June 8.

HDR Engineering, Inc., 2005. Memorandum: Boeckman Floodplain Analysis – Modeling Results, July 11.