SEWER STUDY

LINCOLN MEADOWS

City of Lincoln, California
November 23, 2015

Revised February 16, 2016

Prepared by:

Lisa Mattos
BAKER-WILLIAMS ENGINEERING GROUP
6020 Rutland Drive, Suite #19
Carmichael, California 95608

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I. Introduction

The purpose of this report is to determine the proposed sewer demand and establish the capacity requirements for the system. The capacity of the existing sewer outfall system will be verified to accommodate the flows from development of the Lincoln Meadows subdivision.

Location

The Lincoln Meadows project area is located on the northwest corner of the intersection of Virginatown Road and Hungry Hollow Road, in the City of Lincoln (See Figure 1). The project is approximately 40 acres in size and is proposed as a 148 lot single family residential subdivision.

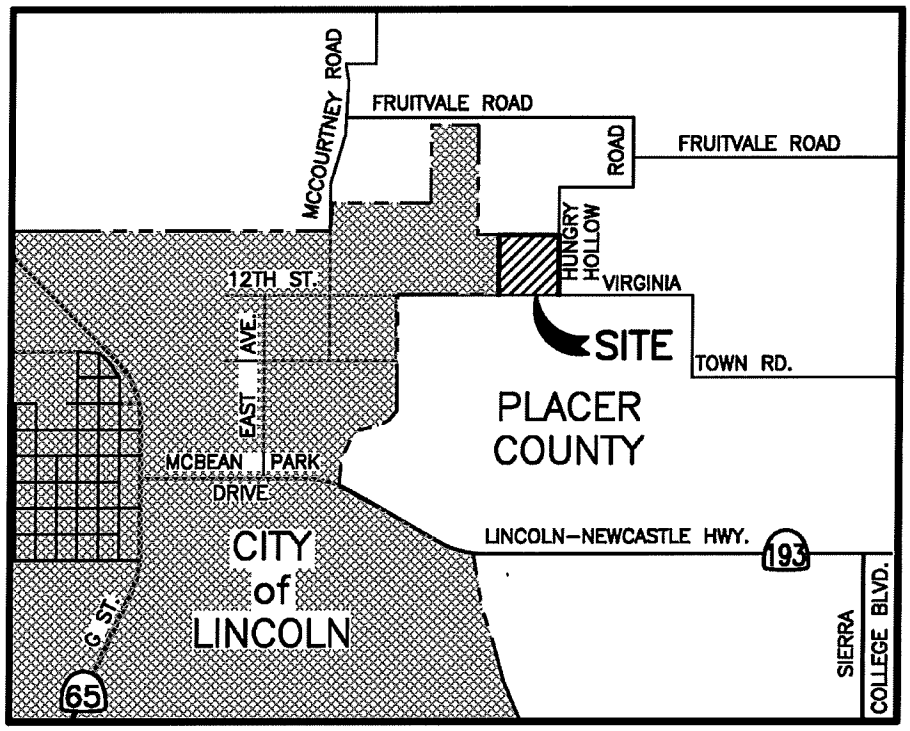


Figure 1 - Vicinity Map

II. Background

Conveyance of the sewer flows from the proposed subdivision is not a major concern as it will tie into the existing sewer main in Virginiatown Road which has been stubbed to the west boundary of Lincoln Meadows. This sewer was constructed with the Lincoln Highlands subdivision, which was required to build sewer and water to serve future development in this area. A new sewer main had to be constructed from an existing manhole at the intersection of 9th street and 'D' street, the alignment was: heading east down 9th Street, north down East Street, and east down 12th Street continuing onto Virginiatown Road to the eastern boundary of the Lincoln Highlands project. The City had contracted with the firm Eco:Logic Engineering to design the wastewater treatment plant and infrastructure in the proposed specific plan areas; Eco:Logic determined the shed boundaries that the proposed sewer would serve and the water main sizes to upgrade

the system in the McCourtney/ Virginatown Road area. A set of plans titled "Lincoln Highlands Offsite Sewer and Water" was designed for these improvements which were completed in 2008. A Zone of Benefit was created for all of the properties that would be served by the new sewer and water mains. Appendix 'C" contains exhibits of the sewer and water improvements, shed boundaries and the properties included in the Zone of Benefit.

III. Land Use and Flow Projections

The proposed project will be a 148 lot (R-1) single family subdivision. For this type of development the average daily flow is 250 gallons/day per single family residential unit according to the City of Lincoln Design Criteria and Procedures Manual, dated June 2004. The design flow is calculated by multiplying the average daily flow by the Peaking Factor, obtained from Figure SS-2 of the City of Lincoln Design Criteria Procedures Manual. Table 1 summarizes the estimated project flows including future development of the 40 acres to the north, APN 021-220-006 which has been estimated at an additional 158 lots, based on a previous lot layout, for a total build out of 306 lots.

Table 1 - Project Flows

Project	Number of EDU's	Flow/EDU (gal/day)	Ave. Daily Flow (gal/day)	Peak Factor Per Fig. SS-2	Max. Daily Flow (gal/day)
Lincoln Meadows	148	250	37,000	3.75	138,750
APN 021-220-006	158	250	39,500	3.7	146,150
TOTAL	306		76,500		284,900

IV. Existing and Proposed Sewer System

The existing sewer system was built as part of the Lincoln Highlands project and is maintained by the City of Lincoln. The existing sewer outfall, for Lincoln Meadows, consists of a 27" and 21"diameter pipe in 9th Street, an 18" diameter pipe in East Avenue, an 18" and 12" diameter pipe in 12th Street continuing onto Virginiatown Road where the main is reduced to a 10" diameter pipe near the McCourtney Road intersection. All outfall pipes were sized based on a Lincoln Meadows tentative map that, at that time, included 177 lots. Due to current wetland preservation requirements, the tentative map has been reduced to 148 lots. For this report, the 158 lots attributed to the development of APN 021-220-006 to the north, will remain. It is probable that all future developments in the Lincoln Highlands sewer shed will be at a lower density than the design density due to current environmental restrictions, which results in excess capacity in the existing sewer system.

The proposed sewer system will have pipes ranging in diameter from 6"-10" and will also be maintained by the City of Lincoln.
The Lincoln Meadows project area is relatively flat with the existing ground varying in elevation from approximately 217 feet to 198 feet based, on the NAV29 Datum. The 10" diameter outfall sewer invert is 180.50, which is 17.5 feet below the lowest elevation of the property; this provides sufficient grade for the minimum slopes required for the proposed sewer system.
An 8" diameter pipe will be stubbed to APN 021-220-006 for future development. Appendix 'A' has the pipe sizing calculations and Appendix 'B' has the shed map.

V. Project Phasing and Planned Sequence of Subdivisions

While the Lincoln Meadows project is proposed to be broken up in two phases: Phase 1 building 76 lots and Phase 2 building the remaining 72 lots, for the purpose of this report, the entire project is being analyzed as completely built out. The future 158 lots for APN 021-220-006 are included in the sizing of the sewer system through Lincoln Meadows.

VI. Conclusions

The existing outfall sewer system built with Lincoln Highlands, was designed to serve the 40 acre Lincoln Meadows parcel at a higher density of 4 units per acre, or 160 units. The proposed subdivision is 148 units, therefore the proposed project will not overburden the system, but instead, provide excess capacity.
The City of Lincoln Design Criteria and Procedures Manual, Chapter 9, will be used for the design of sanitary sewer system to insure that the flow and velocity rates minimize the maintenance required on the system.

APPENDIX A

Calculations

LINCOLN MEADOWS PRELIMINARY SEWER CALCULATIONS

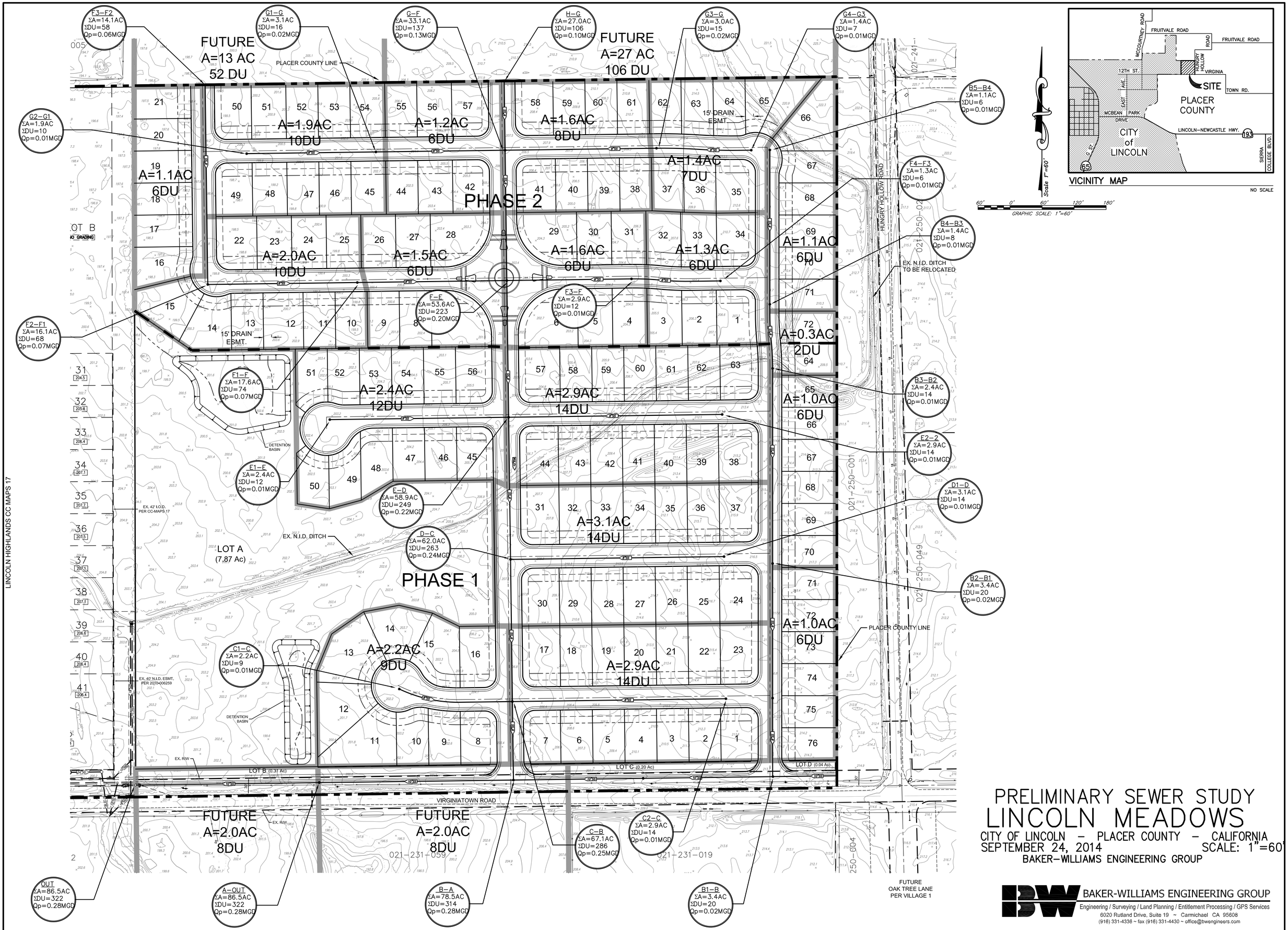
FLOW ACCUMULATIONS BASED ON PROPOSED AND FUTURE DEVELOPMENTS.

FROM	TO	AREA (Ac.)	Σ AREA (Ac.)	DRAIN UNITS (DU)	Σ DU	Qa (MGD)	PF	Qp (MGD)	LENGTH (FT)	SLOPE (FT/FT)	DIA. (IN.)	VEL. (FT/S)	INV. IN (FT)	INV. OUT (FT)	RIM ELEV. (FT)	DEPTH (FT)
H	G	27.0	27.0	106	106	0.0265	3.85	0.102	125	0.0035	8	2.0	188.44	188.34	209.00	20.7
G	F	0.0	33.0	0	136	0.0340	3.75	0.128	245	0.0035	8	2.0	187.90	187.80	207.00	19.2
F	E	0.0	53.6	0	222	0.0555	3.65	0.203	255	0.0035	8	2.0	186.94	186.84	203.00	16.2
E	D	0.0	59.1	0	248	0.0620	3.60	0.223	265	0.0035	8	2.0	185.95	185.85	205.00	19.2
D	C	0.0	62.1	0	262	0.0655	3.57	0.234	265	0.0035	8	2.0	184.92	184.82	206.00	21.2
C	B	0.0	67.2	0	285	0.0713	3.55	0.253	145	0.0035	8	2.0	183.89	183.79	205.00	21.2
B	A	8.0	78.9	8	314	0.0785	3.53	0.277	365	0.0035	10	2.4	183.29	183.19	203.00	19.8
A	OUT	8.0	86.9	8	322	0.0805	3.50	0.282	345	0.0035	10	2.4	181.91	181.81	197.00	15.2
OUT													180.60	180.50	202.00	21.5
G2	G1	1.9	1.9	10	10	0.0025	4.00	0.010	240	0.0070	8	2.9	190.64	190.54	200.00	9.5
G1	G	1.2	3.1	6	16	0.0040	3.95	0.016	245	0.0035	8	2.0	188.86	188.76	203.00	14.2
G													187.90	187.80		
G4	G3	1.6	1.6	8	8	0.0020	4.00	0.008	180	0.0070	8	2.9	190.34	190.24	215.00	24.8
G3	G	1.3	2.9	6	14	0.0035	3.95	0.014	280	0.0035	8	2.0	188.98	188.88	211.00	22.1
G													187.90	187.80		
F3	F2	14.1	14.1	58	58	0.0145	3.93	0.057	370	0.0035	8	2.0	190.50	190.40	198.00	7.6
F2	F1	2.0	16.1	10	68	0.0170	3.90	0.066	280	0.0035	8	2.0	189.10	189.00	200.00	11.0
F1	F	1.6	17.7	6	74	0.0185	3.87	0.072	280	0.0035	8	2.0	188.02	187.92	200.00	12.1
F													186.94	186.84		
F5	F4	1.5	1.5	7	7	0.0018	4.00	0.007	170	0.0070	8	2.9	189.15	189.05	208.00	18.9
F4	F	1.4	2.9	5	12	0.0030	3.97	0.012	235	0.0035	8	2.0	187.86	187.76	205.00	17.2
F													186.94	186.84		
E1	E	2.5	2.5	12	12	0.0030	3.97	0.012	335	0.0070	8	2.9	188.39	188.29	203.00	14.7
E													185.95	185.85		
E2	E	3.0	3.0	14	14	0.0035	3.97	0.014	400	0.0070	8	2.9	188.85	188.75	213.00	24.3
E													185.95	185.85		
D1	D	3.0	3.0	14	14	0.0035	3.97	0.014	400	0.0070	8	2.9	187.82	187.72	216.00	28.3
D													184.92	184.82		
C1	C	2.3	2.3	9	9	0.0023	4.00	0.009	220	0.0070	8	2.9	185.53	185.43	203.00	17.6
C													183.89	183.79		
C2	C	2.8	2.8	14	14	0.0035	3.97	0.014	400	0.0070	8	2.9	186.79	186.69	214.00	27.3
C													183.89	183.79		
B5	B4	1.1	1.1	6	6	0.0015	4.00	0.006	290	0.0070	8	2.9	190.52	190.42	216.00	25.6
B4	B3	0.7	1.8	4	10	0.0025	4.00	0.010	90	0.0035	8	2.0	188.39	188.29	207.00	18.7
B3	B2	0.9	2.7	5	15	0.0038	3.97	0.015	370	0.0035	8	2.0	187.98	187.88	208.00	20.1
B2	B1	1.0	3.7	6	21	0.0053	3.95	0.021	400	0.0035	8	2.0	186.58	186.48	216.00	29.5
B1	B	0.0	3.7	0	21	0.0053	3.95	0.021	485	0.0035	10	2.4	185.08	184.98	214.00	29.0
B													183.29	183.19		

Comments

APPENDIX B

Shed Map



PRELIMINARY SEWER STUDY
LINCOLN MEADOWS

CITY OF LINCOLN – PLACER COUNTY – CALIFORNIA
SEPTEMBER 24, 2014 SCALE: 1"=60'
BAKER–WILLIAMS ENGINEERING GROUP

BAKER-WILLIAMS ENGINEERING GROUP
Engineering / Surveying / Land Planning / Entitlement Processing / GPS Services
6020 Rutland Drive, Suite 19 ~ Carmichael CA 95608
(916) 331-4336 ~ fax (916) 331-4430 ~ office@bwengineers.com

S:\BWEG Jobs\2003 Jobs\03010\12 Lincoln Meadows\Engineering\Sewer Study\03010\12-PREL-Sewer Study.dwg, Sheet 1, 1/27/2015 7:43:06 PM, Survey

APPENDIX C

Lincoln Highlands Sewer Extension and Zone of Benefit Exhibits

BAKER-WILLIAMS ENGINEERING GROUP
6020 RUTLAND DRIVE, SUITE 19 CARMICHAEL, CA 95608
PHONE (916)331-4336~FAX # (916)331-4430~EMAIL:office@bwengineers.com

July 10, 2015

Lindy Childers
City of Lincoln
640 Fifth Street,
Lincoln, CA 95648

Subject: Lincoln Meadows Sewer Study-Outfall Pipe Sizing
Our File No. 03-01-012

Dear Lindy,

I have searched my files for information that was used to design the Offsite Sewer and Water Improvement Plans for Lincoln Highlands (LH) which demonstrate that the Lincoln Meadows property and the forty acres directly north comprise the eastern sewer shed boundary.

The LH tentative map required that trunk sewer main be constructed to serve LH and several other properties in the area, the size and alignment are shown on the attached exhibit. The City of Lincoln had hired Ecologic to do the Master sewer and water studies for the General Plan Amendment that was in process at that time; John Pedri, the City Engineer, directed me to work with an Ecologic engineer named Gabriel Aronow who was developing the master plans. Attached is a preliminary copy of the Master Sewer Plan, and Base Area Exhibit showing the service area for the design of the trunk sewer. I never received a draft or approved copy of the Master Sewer and Water Plans from Ecologic or it would be included in this submittal. The Sewer Master Plan has Hungry Hollow Road as the eastern boundary for the sewer line, attached is the sewer shed map which incorporates the applicable boundaries, the sizing of the sewer was based on this shed map.

The attached Reimbursement Agreement Exhibit clearly shows all of the properties included in the service area for the Offsite Sewer and Water built with the Lincoln Highlands subdivision and confirms that the Lincoln Meadows property is the eastern shed boundary.

If you have any questions or need additional information please call me at 331-4336, Ext. 11.

Very truly yours,

BAKER WILLIAMS ENGINEERING GROUP

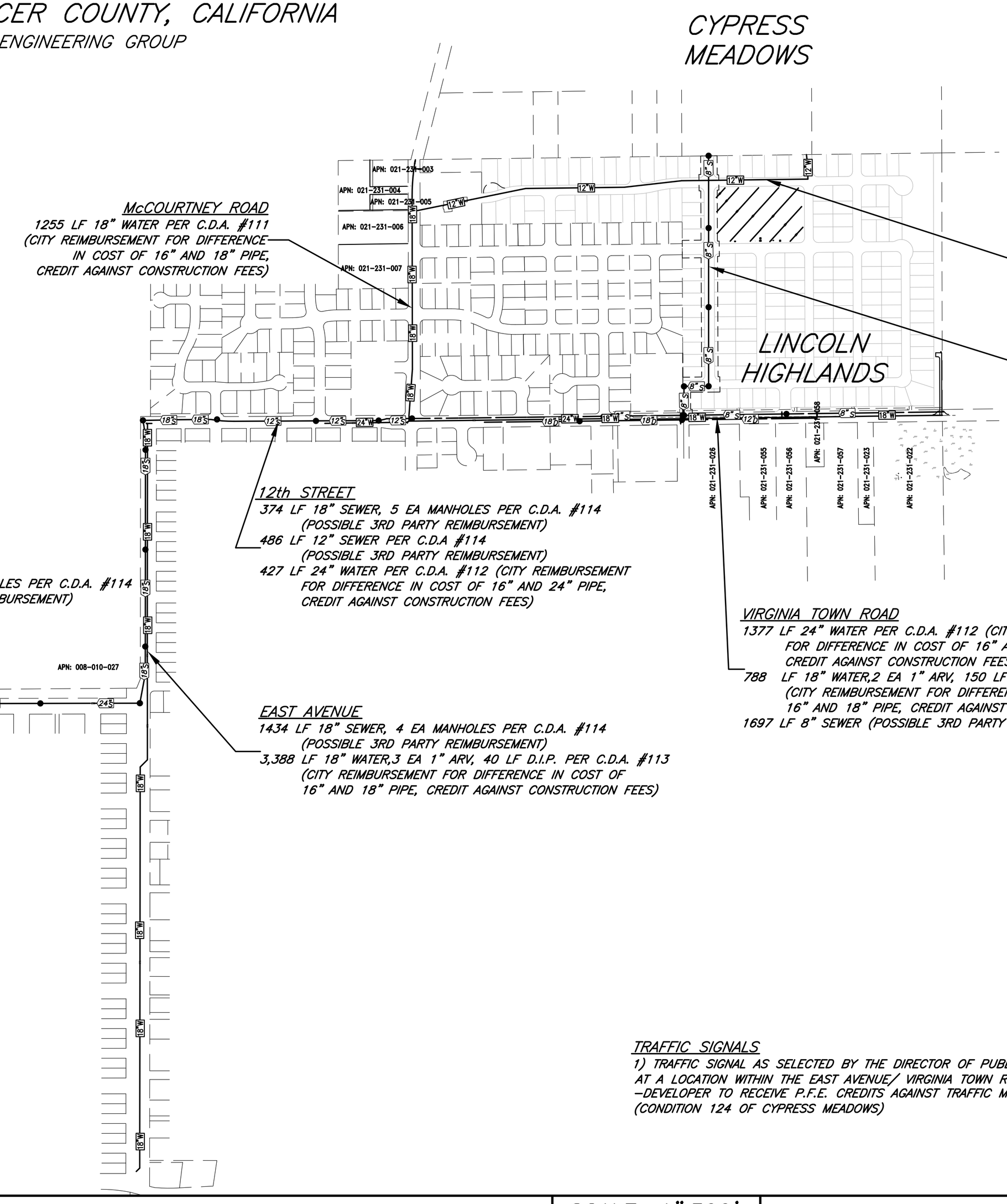
Lisa Mattos

Lisa Mattos

IMPROVEMENT EXHIBIT
LINCOLN HIGHLANDS OFFSITE
CITY OF LINCOLN, PLACER COUNTY, CALIFORNIA
BAKER–WILLIAMS ENGINEERING GROUP

SCALE:1"=300'

300' 0' 300' 600' 900'
GRAPHIC SCALE: 1"=300'



McCOURTNEY ROAD
1255 LF 18" WATER PER C.D.A. #111
(CITY REIMBURSEMENT FOR DIFFERENCE IN COST OF 16" AND 18" PIPE, CREDIT AGAINST CONSTRUCTION FEES)

12" WATER MAIN
2138 LF 12" WATER PER CDA #116

8" SEWER LINE
1436 LF 8" SEWER, 5 EA MANHOLES PER C.D.A. #117

12th STREET
374 LF 18" SEWER, 5 EA MANHOLES PER C.D.A. #114
(POSSIBLE 3RD PARTY REIMBURSEMENT)
486 LF 12" SEWER PER C.D.A #114
(POSSIBLE 3RD PARTY REIMBURSEMENT)
427 LF 24" WATER PER C.D.A. #112 (CITY REIMBURSEMENT FOR DIFFERENCE IN COST OF 16" AND 24" PIPE, CREDIT AGAINST CONSTRUCTION FEES)

9TH STREET
1260 LF 24" SEWER, 3 EA MANHOLES PER C.D.A. #114
(POSSIBLE 3RD PARTY REIMBURSEMENT)

VIRGINIA TOWN ROAD
1377 LF 24" WATER PER C.D.A. #112 (CITY REIMBURSEMENT FOR DIFFERENCE IN COST OF 16" AND 24" PIPE, CREDIT AGAINST CONSTRUCTION FEES)
788 LF 18" WATER,2 EA 1" ARV, 150 LF D.I.P. PER C.D.A #112
(CITY REIMBURSEMENT FOR DIFFERENCE IN COST OF 16" AND 18" PIPE, CREDIT AGAINST CONSTRUCTION FEES)
1697 LF 8" SEWER (POSSIBLE 3RD PARTY REIMBURSEMENT)

EAST AVENUE
1434 LF 18" SEWER, 4 EA MANHOLES PER C.D.A. #114
(POSSIBLE 3RD PARTY REIMBURSEMENT)
3,388 LF 18" WATER,3 EA 1" ARV, 40 LF D.I.P. PER C.D.A. #113
(CITY REIMBURSEMENT FOR DIFFERENCE IN COST OF 16" AND 18" PIPE, CREDIT AGAINST CONSTRUCTION FEES)

TRAFFIC SIGNALS
1) TRAFFIC SIGNAL AS SELECTED BY THE DIRECTOR OF PUBLIC WORKS AT A LOCATION WITHIN THE EAST AVENUE/ VIRGINIA TOWN ROAD CORRIDOR –DEVELOPER TO RECEIVE P.F.E. CREDITS AGAINST TRAFFIC MITIGATION FEES (CONDITION 124 OF CYPRESS MEADOWS)

LEGEND:

- PROP. SANITARY SEWER MAIN
- EXIST. SANITARY SEWER MAIN
- PROP. FLUSHER BRANCH
- EXIST. FLUSHER BRANCH
- PROP. SEWER SERVICE
- EXIST. SEWER SERVICE
- PROP. MANHOLE
- EXIST. MANHOLE
- PROP. STORM DRAIN
- EXIST. STORM DRAIN
- PROP. DROP INLET
- EXIST. DROP INLET
- PROP. WATER MAIN
- EXIST. WATER MAIN
- PROP. WATER SERVICE
- EXIST. WATER SERVICE
- PROP. WATER VALVE
- EXIST. WATER VALVE
- PROP. BLOW–OFF VALVE
- EXIST. BLOW–OFF VALVE
- PROP. AIR RELEASE VALVE
- EXIST. AIR RELEASE VALVE
- PROP. FIRE HYDRANT ASSEMBLY
- EXIST. FIRE HYDRANT ASSEMBLY
- PROP. STREET LIGHT
- EXIST. STREET LIGHT (150 W, 250 W)
- PROP. STREET BARRICADE
- EXIST. STREET BARRICADE
- PROP. HANDICAP RAMP
- PROP. STREET SIGN
- MONUMENT WELL
- SAVE OAK TREE. NO GRADING WITHIN PROTECTIVE FENCE.

BAKER-WILLIAMS ENGINEERING GROUP
Engineering / Surveying / Land Planning / Entitlement Processing / GPS Services
6020 Rutland Drive, Suite 19 ~ Carmichael, CA. 95608
(916) 331-4336 ~ fax (916) 331-4420 ~ office@bwengineers.com

SCALE: 1":300'
JOB#: 03–01–06
DATE: 7–19–04

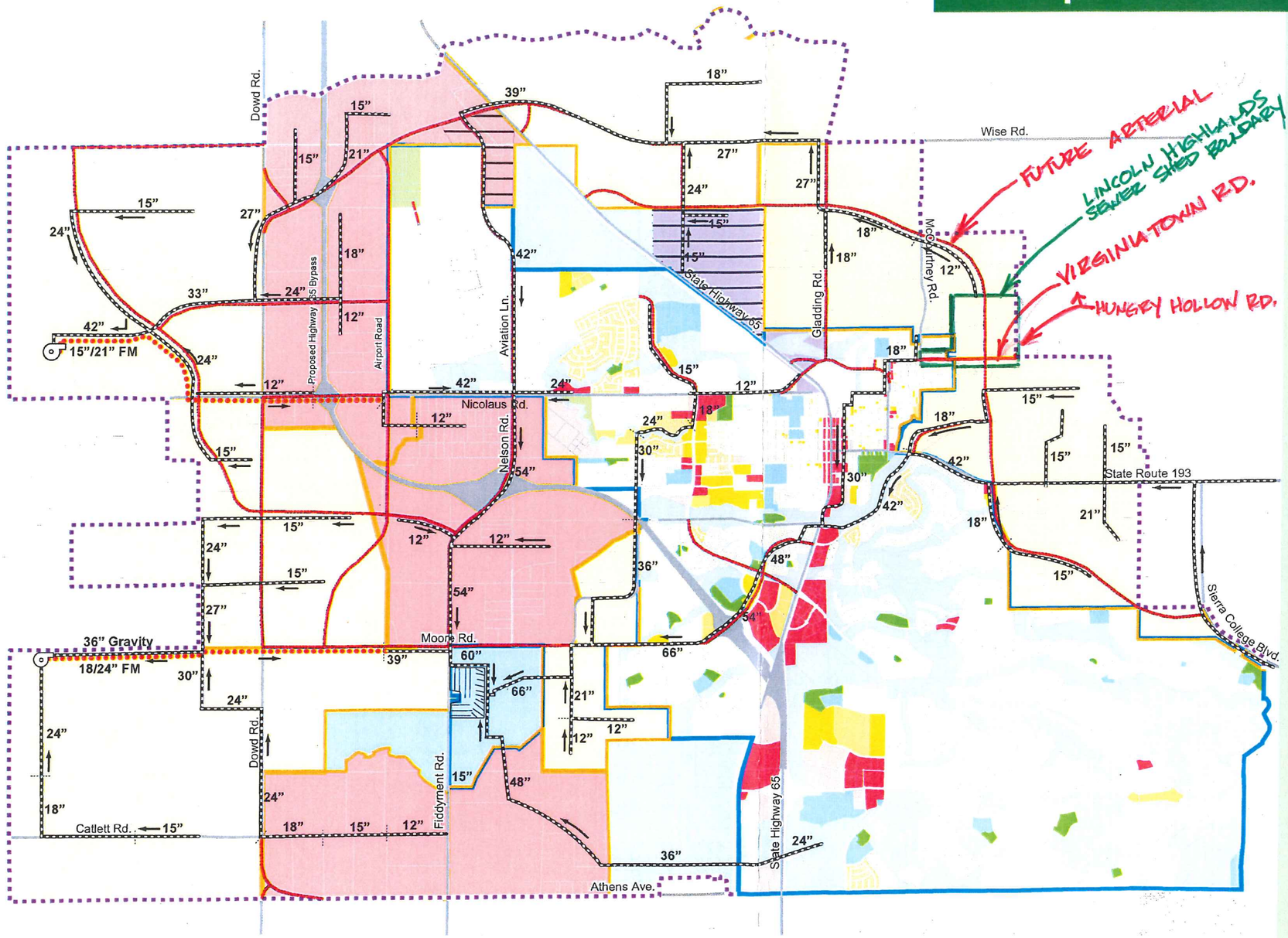
IMPROVEMENT EXHIBIT
FOR LINCOLN HIGHLANDS OFFSITE
CITY OF LINCOLN, PLACER COUNTY, CALIFORNIA

S:\BWEG Jobs\2003 Jobs\0301006 Lincoln Highlands\Exhibits\IMPROVEMENT OFFSITE-CVR-SHT.0301006.dwg, Layout1, 7/10/2015 12:51:30 PM, Lisa Mattos

NOT FOR PUBLIC RELEASE

City of Lincoln General Plan

Proposed Sewer Master Plan



Legend

BOUNDARIES

- City Limits
- Proposed Sphere of Influence
- Proposed Streets
- Airport Runway Expansion

LAND USE DESIGNATIONS

- Rural Residential (RR)
- Country Estates (CE)
- Low Density Residential (LDR)
- Medium Density Residential (MDR)
- High Density Residential (HDR)
- Planned Development (PD)
- Village (V)
- Neighborhood Commercial (NC)
- Community Commercial (CC)
- Mixed Use (MU)
- Regional Commercial (RC)
- Special Use District (SUD)
- Business and Professional (BP)
- Light Industrial (LI)
- Industrial (I)
- Industrial Planned Development (IPD)
- Park and Recreation (PR)
- Open Space (OS)
- Agriculture (AG)
- Public Facilities (PF)
- Other Industrial
- Sewer Trunks
- Force Main
- Size Change
- Flow Direction
- Pump Station

640 ac; 160 ac; 80 ac; 40 ac; 20 ac; 10 ac

0 2,000 4,000 6,000 8,000 Feet

August 25, 2005
Alternative3-LU-Dsheet-local-2005 08 25.mxd

Project_graphics/Lincoln/Gabe/Alternative_8_Changes_DEC_2005.ai cms 2/8/2006

ECO:LOGIC
Consulting Engineers

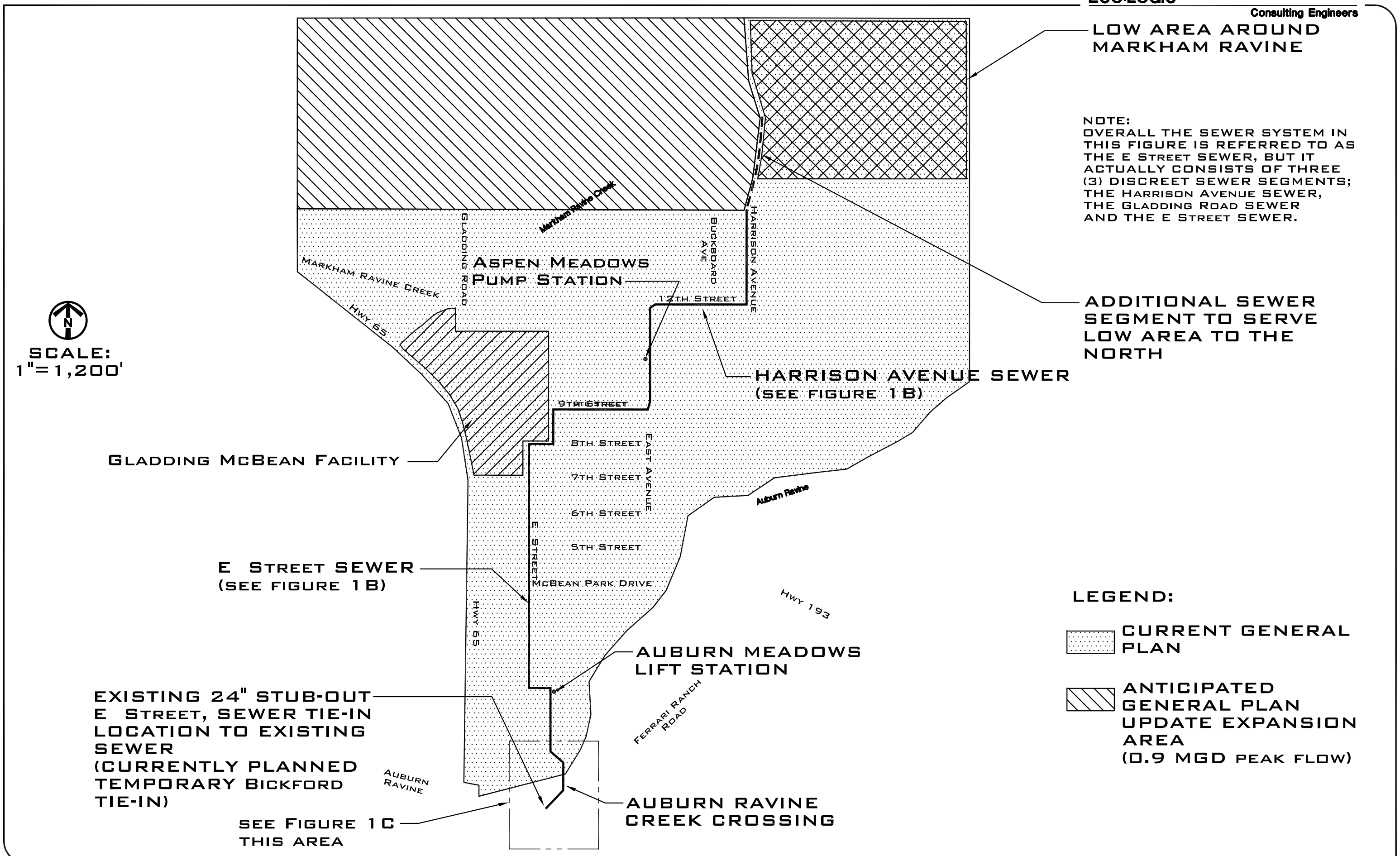
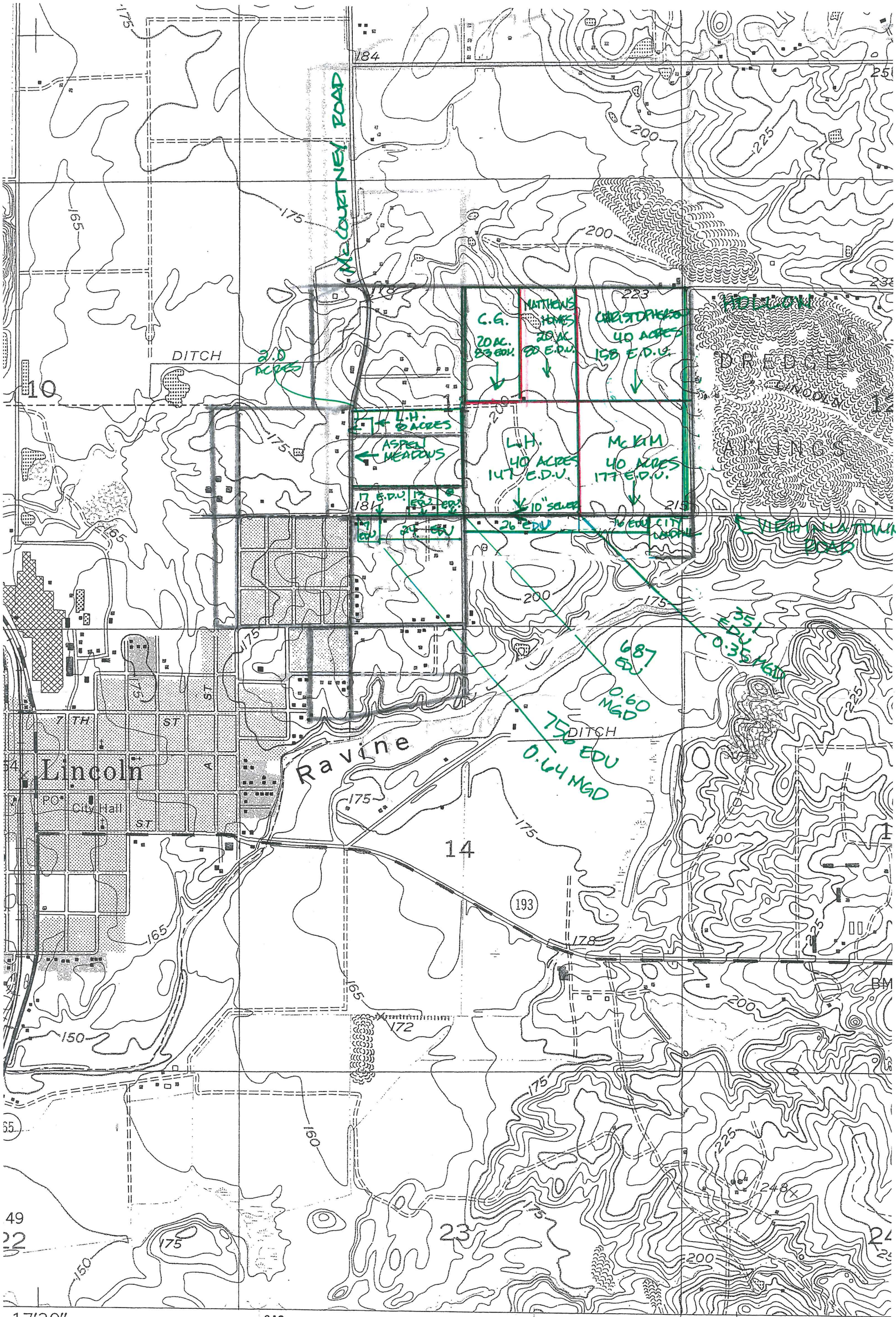


Figure 1A, E Street SEWER and GENERAL PLAN

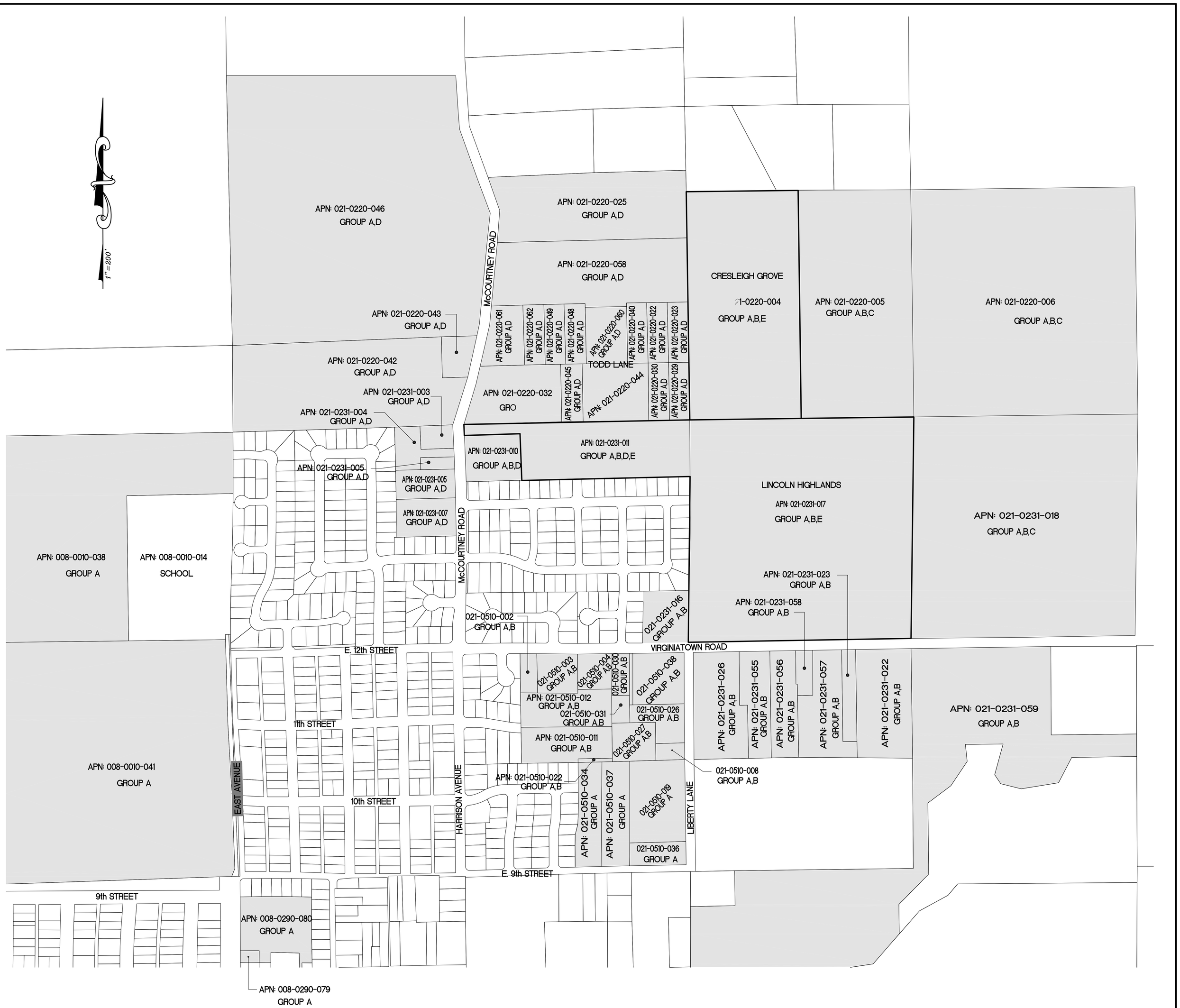
S:\BWEG Jobs\2003 Jobs\0301006 Lincoln Highlands\Files from Others\Ecologic6-30-04\Base Area r1.dwg, FIG 1A, 7/10/2015 12:57:44 PM, Lisa Mattos
S:\BWEG Jobs\2003 Jobs\0301006 Lincoln Highlands\Files from Others\Ecologic6-30-04\Base Area r1.dwg
Jul 10, 2015 - 12:57pm



C.G. = CRESLEIGH GROVE
L.H. = LINCOLN HIGHLANDS

SCALE 1" = 1000'

CAPACITY OF 10" SEWER @ S=0.0035 IS 0.71 MGD



LINCOLN HIGHLANDS

REIMBURSEMENT AGREEMENT EXHIBIT

CITY OF LINCOLN, PLACER COUNTY, CALIFORNIA

OCTOBER, 2006 SCALE: 1"=200'

SHEET 1 OF 1

BAKER-WILLIAMS ENGINEERING GROUP
Engineering / Surveying / Land Planning / Entitlement Processing / GPS Services
6020 Rutland Drive, Suite 19 ~ Carmichael, CA. 95608
(916) 331-4336 ~ fax (916) 331-4430 ~ office@bwengineers.com