

November 13, 2017

Wendy L. Marshall, PE
City of Oregon City
Development Projects Manager
625 Center Street
Oregon City, OR 97045

RE: Sanitary Sewer Service Capacity
Lindsay Anne Estates Too – 28 Lot Subdivision
Clackamas County Assessor's Information: Map 32E18, Tax Lot 1400
± 6.33 Acres

Wendy:

The purpose of this sanitary sewer analysis is to demonstrate the actual design wastewater flow from this development has the same (or less than) the predicted future wastewater flow (per the City of Oregon City Sanitary Sewer Master Plan dated November 2014).

Per the City of Oregon City Sanitary Sewer Master Plan dated November 2014, the wastewater flow calculation is based on the following:

- Gross area: 6.33 acres
- Net area: 5.06 acres (assuming 20% of the gross site area would be used for streets, easements, and other utilities)
- Number of lots: 25 (LDR = 5 dwellings per net acre)
- Total wastewater flow: 13.94 gpm (see attached Exhibit A-1)

Per the actual designed development, the wastewater flow calculation should be based on the following:

- Gross area: 6.33 acres
- Net area: 3.48 acres (actual net area after subtracting the streets, stormwater facility, and the area of the PGE transmission line easement – see attached Exhibit A-2)
- Number of lots: 28
- Total wastewater flow: 14.09 gpm (see attached Exhibit A-1)

Per the Future Developed Parcels Map (see attached Exhibit B) in the City of Oregon City Sanitary Sewer Master Plan November dated 2014, all future lots in the Anastyn Estates subdivision are assumed to flow to Settler's Point pump station. However, when Rian Park Development, Inc. developed Anastyn Estates (the same developer for Lindsay Anne Estates Too), the site was designed such that the wastewater flow for Lot 2 does not flow to the Settler's Point pump station (see attached Exhibits C and D). The predicted wastewater flow to Settler's Point pump station from Lot 2 of Anastyn Estates is available as extra wastewater flow for Lindsay Anne Estates Too.

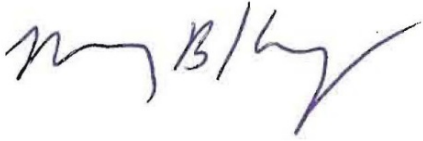
Wastewater flow calculation from Lot 2 of Anastyn Estates:

- Net area: 0.15 acres
- Number of lots: 1
- Total wastewater flow: 0.52 gpm (see attached Exhibit A-1)

The actual design wastewater flow for Lindsay Anne Estates Too is 13.57 gpm (14.09 gpm minus 0.52 gpm), which is less than the predicted future wastewater flow per the City of Oregon City Sanitary Sewer Master Plan dated November 2014.

Sincerely,

AKS ENGINEERING & FORESTRY, LLC

A handwritten signature in blue ink, appearing to read "MB/H", with a stylized flourish at the end.

Montgomery B. Hurley – PE, PLS, Principal

Sanitary Sewer Flow Calculation

	Lindsay Anne Estates Too (Per Sanitary Sewer Master Plan)	Lindsay Anne Estates Too (Actual Design Scenario)	Lot 2 of Anastyn Estates (Actual Built Scenario - Not Flow to Settler's PS)
Gross area (acre):	6.33		
Net area - 80% of Gross area ^a (acre):	5.06		
No. of lots ^a (5 lot per acre):	25		
Actual net area ^b (acre):		3.48	0.15
Actual No. of lots:		28	1
People per lot ^a : 2.5			
Unit flow ^a (gpcd): 80			
Peaking Factor ^a : 3			
I/I ^c (gpad): 1000			
Domestic Flow (gpm):	10.42	11.67	0.42
I/I Flow (gpm):	3.52	2.42	0.10
Total Wastewater Flow (gpm):	13.94	14.09	0.52

^a Per Section 3.5.1 Future Base Flows in the City of Oregon City Sanitary Sewer Master Plan dated November 2014

^b Per Attachment A - Future Development Flow Method - Analysis Step 21 in the City of Oregon City Sanitary Sewer Master Plan dated November 2014

^c Per Section 3.5.2 Future Wet Weather Flows in the City of Oregon City Sanitary Sewer Master Plan dated November 2014

Net Area Calculation

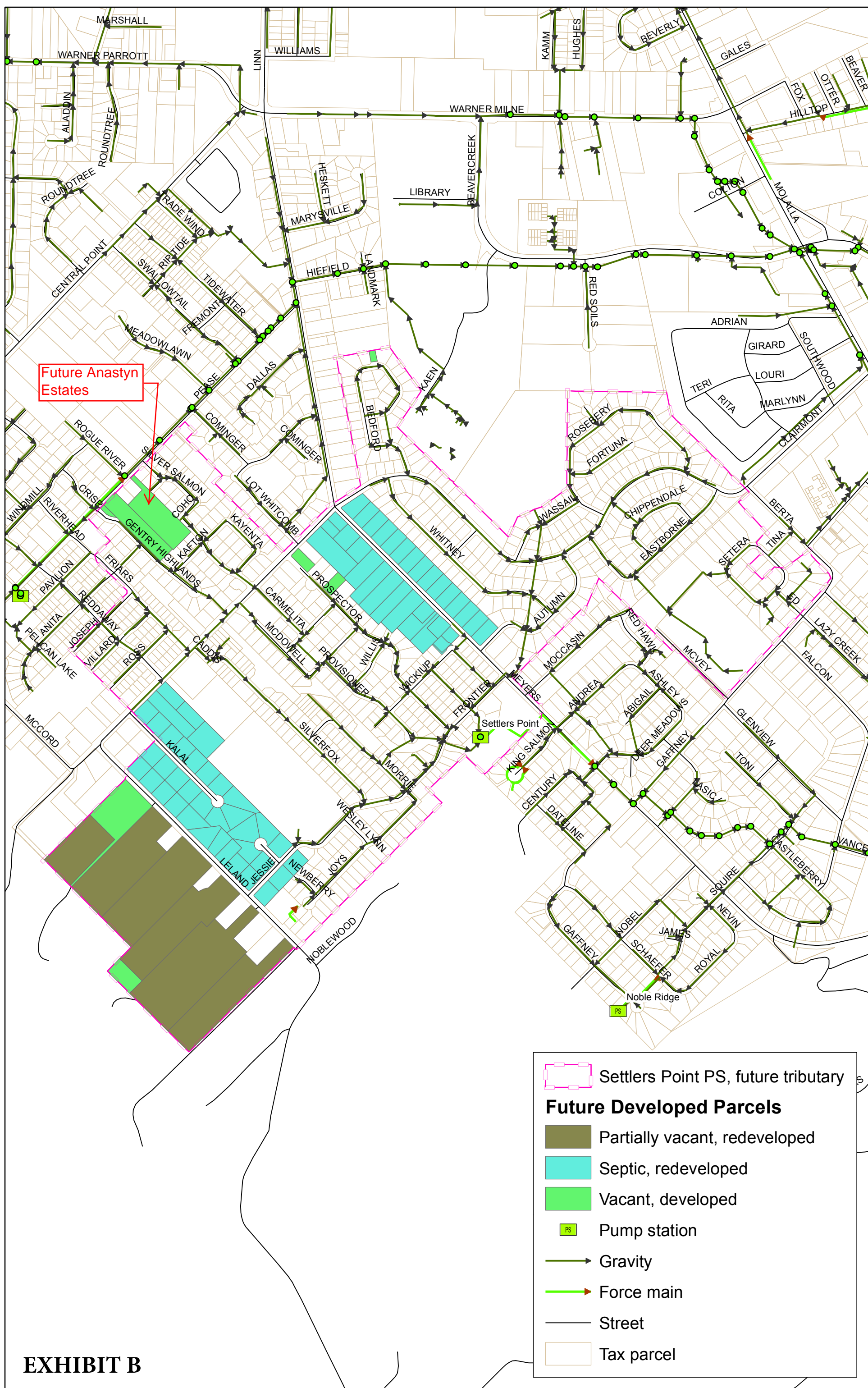
Lot	Area (sf)
1	4,860
2	4,998
3	29,075
4	5,054
5	4,914
6	5,500
7	5,500
8	5,500
9	5,054
10	4,914
11	4,873
12	5,012
13	5,013
14	4,966
15	5,100
16	5,117
17	5,005
18	5,054
19	5,551
20	5,549
21	5,550
22	5,054
23	5,010
24	6,491
25	5,049
26	5,338
27	5,822
28	16,721

Total Lot Area: 181,644 sf

Total PGE

Easement Area: 30,078 sf

Total Net Area: **151,566 sf**
3.48 acres

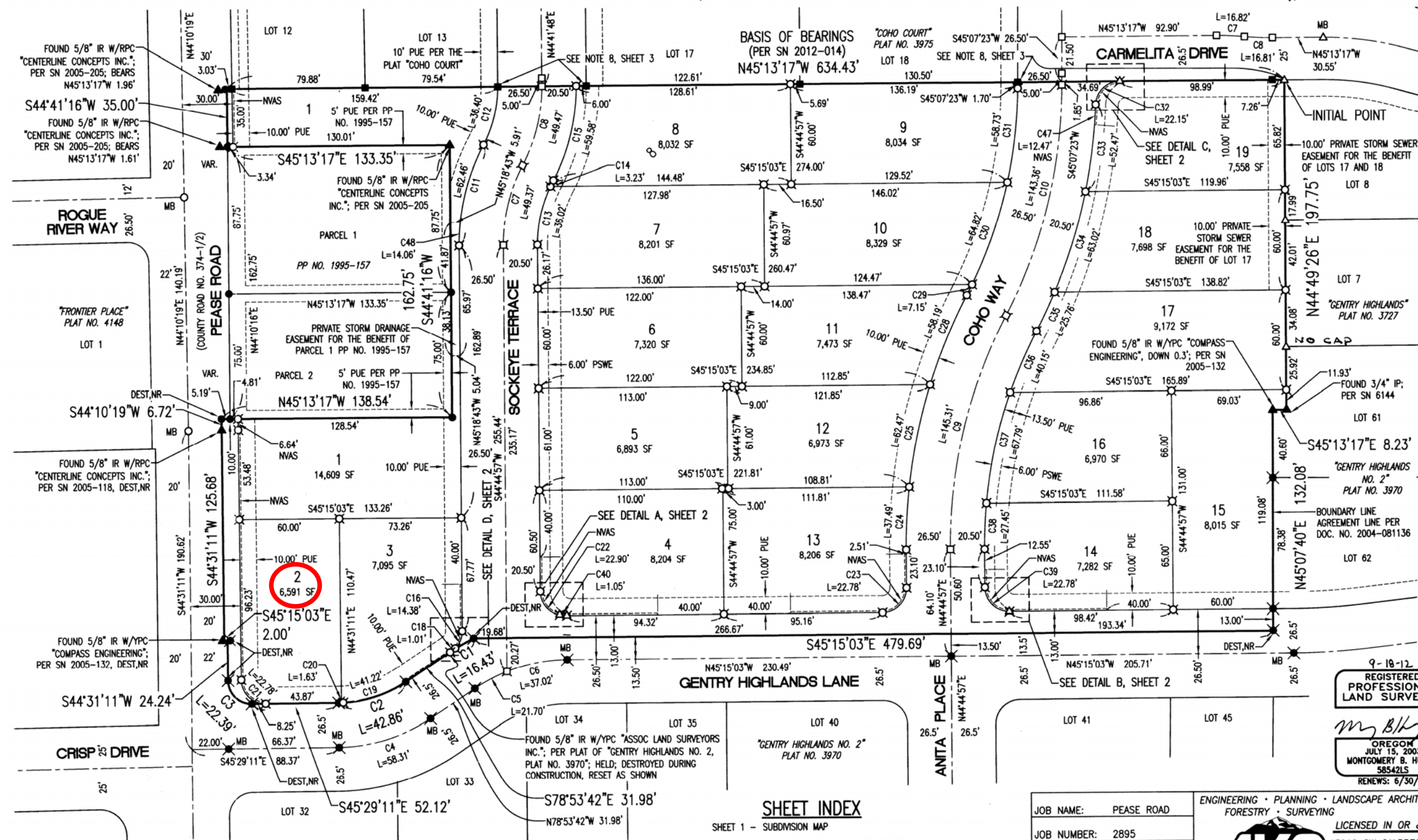
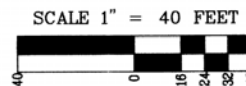


ANASTYN ESTATES

A REPLAT OF PARCEL 3 OF PARTITION PLAT NO. 1995-157, TRACT 'E' OF "GENTRY HIGHLANDS NO. 2" PLAT NO. 3970,
AND A TRACT OF LAND LOCATED IN THE NORTHEAST 1/4 OF SECTION 7, TOWNSHIP 3 SOUTH, RANGE 2 EAST,
WILLAMETTE MERIDIAN, CITY OF OREGON CITY, CLACKAMAS COUNTY, OREGON
CITY OF OREGON CITY CASE FILE NUMBER TP 11-02
SEPTEMBER 7, 2012

BOOK 143 PAGE 003
4351 SHEET 1 OF 3

PREPARED FOR
RIAN PARK DEVELOPMENT, INC.
15239 S. LAKERIDGE WAY
OREGON CITY, OR 97045



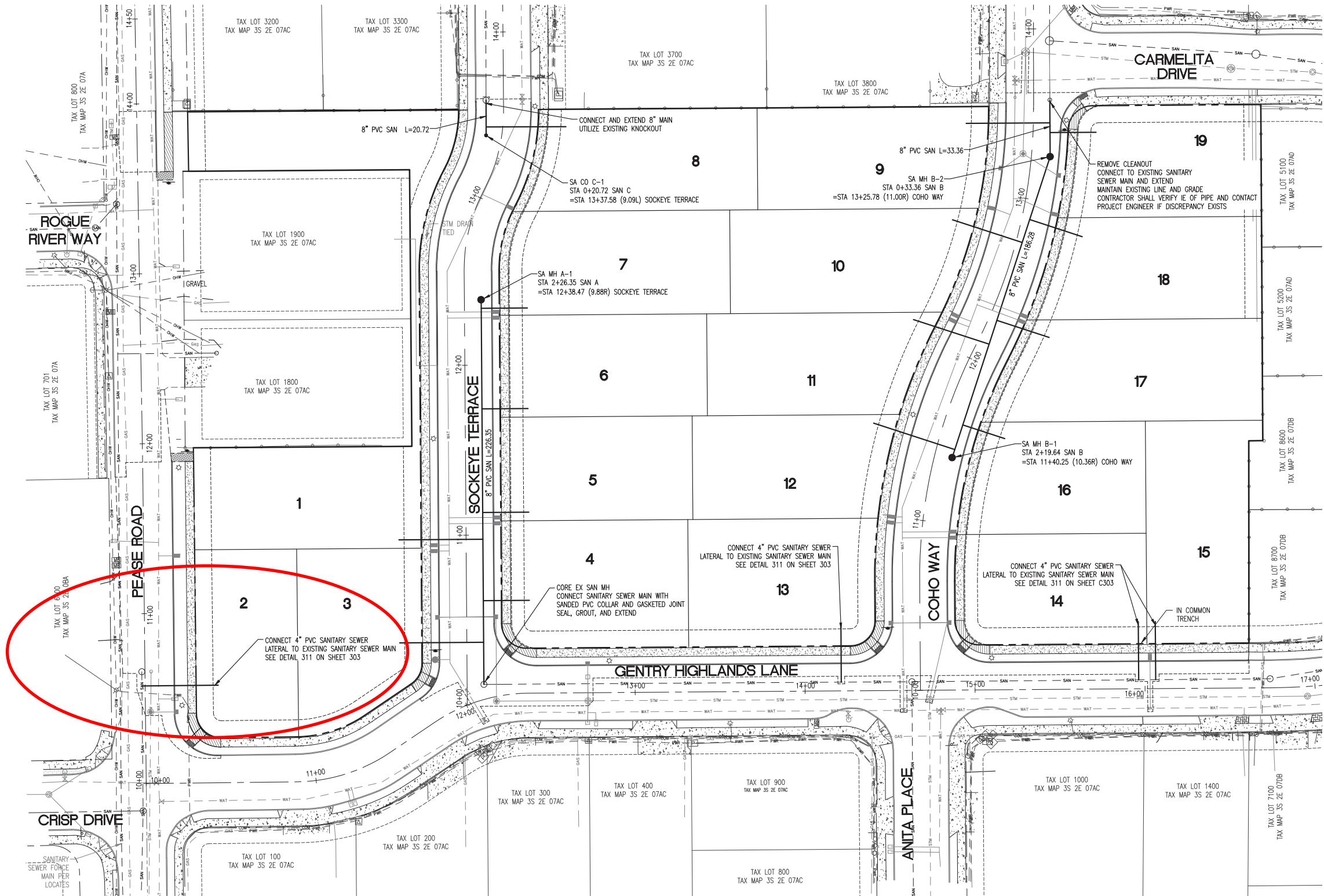
SEE SHEET 2 FOR LEGEND AND CURVE TABLE

SHEET INDEX

- SHEET 1 - SUBDIVISION MAP
- SHEET 2 - LEGEND, CURVE TABLE, DETAILS A-D
- SHEET 3 - CITY OF OREGON CITY APPROVALS, CLACKAMAS COUNTY APPROVALS, DECLARATION, ACKNOWLEDGEMENT, SURVEYOR'S CERTIFICATE, PLAT NOTES, CONSENT AFFIDAVIT, NARRATIVE

JOB NAME:	PEASE ROAD
JOB NUMBER:	2895
DRAWN BY:	JOH
CHECKED BY:	MBH
DRAWING NO.:	2895C-PLAT
ENGINEERING • PLANNING • LANDSCAPE ARCHITECTURE FORESTRY • SURVEYING	
AKS ENGINEERING & FORESTRY	
LICENSED IN OR & WA 13910 SW GALBREATH DRIVE, SUITE 100 SHERWOOD, OR 97140 PHONE: (503) 925-8799 FAX: (503) 925-8969	
OFFICES LOCATED IN SALEM, OR & VANCOUVER, WA	

EXHIBIT C



NOTES:

- SANITARY SEWER PIPE SHALL BE PVC, CONFORMING TO ASTM 3034 SDR 35.
- TRENCH BACKFILL SHALL BE CLASS B 3/4"-0" GRANULAR WITHIN THE STREET AND NATIVE OUTSIDE THE STREET.
- SANITARY SEWER LATERALS SHALL COMPLY WITH THE UNIFORM PLUMBING CODE.
- SANITARY SEWER LATERALS SHALL BE 4" PVC UNLESS OTHERWISE NOTED.
- INSTALL WATERTIGHT CAP AT SERVICE LATERAL END.

6. A 2"x4" WOOD MARKER SHALL BE PLACED AT THE LATERAL END FROM THE PIPE INVERT TO TWO FEET ABOVE THE GROUND. THE 2"x4" TOP SHALL BE PAINTED GREEN AND MARKED WITH AN "S" AND THE DEPTH OF THE LATERAL MEASURED FROM GROUND TO INVERT OF PIPE. CONTRACTOR WILL BE REQUIRED TO EXCAVATE SERVICE LATERAL ENDS FOR DEPTH VERIFICATION PRIOR TO PROJECT COMPLETION IF THE DEPTH TO INVERT IS NOT PROPERLY NOTED ON THE LATERAL MARKER. THE CURB LINE SHALL HAVE AN "S" STAMPED ON THE TOP OF THE CURB AT THE LATERAL CROSSING.

AS-BUILT DISCLAIMER:
AS-BUILT INFORMATION IS BASED ON A COMBINATION OF FIELD SURVEY INFORMATION, SPOT INSPECTION INFORMATION, CITY-PROVIDED INFORMATION, AND CONTRACTOR-PROVIDED INFORMATION. THE ENGINEER ONLY CERTIFIES INFORMATION WHICH COULD BE FIELD-VERIFIED AFTER CONSTRUCTION WAS COMPLETED.

EXHIBIT D

10170.20

ANASTYN ESTATES
SUBDIVISION AS-BUILTS
OREGON CITY
CLACKAMAS COUNTY TAX MAP 3S 2E 07AC
TAX LOTS 1500, 1600, 2000

ENGINEERING • PLANNING
SURVEYING • FORESTRY
13910 SW CALBREATH DR.,
SUITE 100 OR 97140
PHONE: (503) 925-8799
FAX: (503) 925-8869

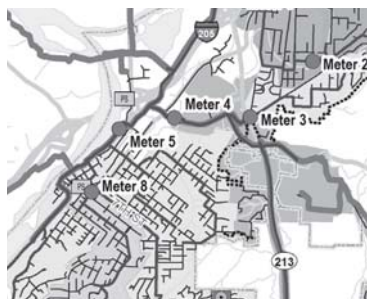
DESIGNED BY:	MBH
DRAWN BY:	BDT
CHECKED BY:	MBH
DRAWING NO.:	A1-C301
SCALE:	AS NOTED
PREPARED FOR: RIAN PARK DEVELOPMENT 15239 S LAKERIDGE WAY OREGON CITY, OR 97045	
DATE: 1-4-13	
JOB NUMBER	2895
SHEET	C301

SANITARY SEWR PLAN

Prepared for
City of Oregon City

Sanitary Sewer Master Plan

November 2014



Brown AND Caldwell

100% Environmental | Employee Owned | Offices Nationwide | BrownandCaldwell.com

3.5 Future Flows

Base flows and RDII from future developments were estimated and routed through the model to estimate future capacity deficiencies in the trunk sewer system. Three types of future development areas were included in the analysis:

- Large future development areas at the boundaries of the City's urban growth area: South End Road, Park Place, and Beaver Creek Road.
- Expected development areas within the city limits. This category includes all parcels identified by the City excluding those considered to be un-developable (e.g., existing parks) and lots considered not to have future development potential (e.g., small single residential lots with existing connections to the sewer system).
- Individual land parcels within the city limits with redevelopment potential. These consist of both vacant parcels and parcels where the existing land use is less dense than the parcel zoning. This category also includes individual parcels in unincorporated areas (within the urban growth area) with single family residential land use. It was assumed these parcels are currently serviced by onsite septic systems and will connect to the sanitary sewer system in the future.

3.5.1 Future Base Flows

Future average daily base flows were estimated from industry standard rates for each land use designation. For the large development areas, the proposed gross acreage for each land use designation was provided by the City. For parcels with areas greater than 1 acre, the net acreage was calculated assuming that 20 percent of the gross acreage would be used for local roads, easements, and other utilities. Table 3-2 lists the rates used to develop future base flows.

Table 3-2. Future Sewer Base Flow Unit Rates		
Land use	Unit type	Unit flow
Residential ^{a,b}	Gallons per capita per day	80
Commercial ^c	Gallons per acre per day (gpac)	1,000
Industrial ^c	gpac	2,000

^a An average of 2.5 people per household was assumed.

^b Development densities specified in the 2004 Oregon City Comprehensive Plan were used to determine the number of dwellings per acre. LDR = 5 dwellings per acre, MDR = 10 dwellings per acre, HDR = 22 dwellings per acre.

^c Unit flow rates for commercial and industrial areas were based on industry standard.

3.5.2 Future Wet Weather Flows

RDII from future areas was calculated by estimating the amount of future sewered areas and applying an infiltration/inflow (I/I) rate of 1,000 gpac. I/I was not applied to parcels within the city limits that are already developed, because it was assumed the I/I contribution from these parcels already would be accounted for in the existing conditions model.

16. ID those parcels located in concept plan areas
 - a. Add field, type string, named "CONCEPT"
 - b. Select by location parcels in "taxlot_model" with their centroid within any of the 3 concept plan polygons provided by the City.
 - c. Field calculate "CONCEPT"="YES"
17. Determine area of constrained land on each parcel
 - a. Union "taxlot_model" and selection of "All_Constraints" that intersects "BASE_UGB_Fill"
 - i. Resulting fc is named "taxlot_constrained_union"
 - ii. Note: Set definition query on "All_Constraints" of "Building" = 'N'. This omits buildings from the constrained layer.
 - b. Union "taxlot_constrained_union" and selection of "Vacant_Lands" that intersects "BASE_UGB_Fill"
 - i. Resulting fc is named "taxlot_cnstrnd_vacant_union"
 - c. Calculate vacant area slices
 - i. Add field, type double, named "AREA_CONSTR"
 - ii. Select features in "FID_All_Constraints" <> -1. This is all the constrained features.
 - iii. Calculate geometry of "AREA_CONSTR" attribute, which represents "constrained land" area
 - iv. Add field, type double, named "AREA_CONSTR_PRTL"
 - v. Select features in "FID_All_Constraints" = -1 AND "FID_Vacant_Lands"<> "-1". This is vacant land that is also constrained (i.e. vacant and constrained land overlap).
 - vi. Calculate geometry of "AREA_CONSTR_PRTL" attribute, which represents "constrained vacant land" area
 - d. Dissolve "taxlot_cnstrnd_vacant_union" based on "TLID" attribute
 - i. During dissolve, calculate sum of "AREA_CONSTR" and "AREA_CONSTR_PRTL" attributes.
 - ii. Resulting fc is named "taxlot_cnstrnd_vcnt_union_dissolv"
 - e. Transfer constrained land information to the "taxlot_model" fc
 - i. Add field to "taxlot_model" fc named "CONSTR_AREA" – type Double.
 - ii. Add field to "taxlot_model" fc named "CONSTR_VAC_AREA" – type Double.
 - iii. Join "taxlot_constrained_union_Dissolv" fc to "taxlot_model" fc based on "TLID" attribute
 - iv. Calculate "CONSTR_AREA" = "AREA_CONSTR"
 1. Select null values and set to 0
 - v. Calculate "CONSTR_VAC_AREA" = "AREA_CONSTR_PRTL"
 1. Select null values and set to 0
18. Estimate net developable acres
 - a. Add field to "taxlot_model", type double, named "NET_DEV_ACRES"
 - b. Select those parcels where only the vacant portion will be developed. Select features from "taxlot_model" where "DEV_MOD" = "YES_PARTIAL"
 - c. Field calculate "NET_DEV_ACRES" = ("AREA"* "PRCNT_VACANT"- "CONSTR_VAC_AREA") /43560
 - d. Switch the selection
 - e. Field calculate "NET_DEV_ACRES" = ([AREA]- ["CONSTR_AREA"])/43560
19. Identify Model Junction where development drains
 - a. Add field to "taxlot_model", type long, named "MANHOLE"
 - b. Use "Tax_parcel_redevelopment_5" as a start – join this fc based on Tlid
20. Flow assumptions
 - a. MFR is 5 units
21. Estimate ex and future flow

- a. Add fields to "taxlot model"
 - i. LU_UNIT_Q, type long
 - ii. LU_UNIT_Q_TYPE, type text
 - iii. EX_Q, type double
 - iv. ZONE_UNIT_Q, type long
 - v. ZONE_UNIT_Q_TYPE, type text
 - vi. FUT_Q, type double
 - vii. "AREA_RED", type double
 - b. Create lookup tables
 - c. Join tables
 - d. Estimate flow by following logic
 - i. Existing
 1. If gpd, then same
 2. if gpad, then unit q by area
 - ii. Future
 1. Select features with "NET_DEV_ACRES" > 1
 2. Field calc "AREA_RED" = 0.8
 3. Switch selection
 4. Field calc "AREA_RED" = 1.0
 5. if gpd, then unit q x ("NET_DEV_ACRES" x "AREA_RED" x 43560) / "ZONE_MINLOTSF"
 6. if gpad, then unit q x ("NET_DEV_ACRES" x "AREA_RED")
 - e. Identify areas where additional I/I could be expected (i.e. currently unsewered areas)
 - i. Add field named "II_GPD", type double
 - ii. Select "SEPTIC" = "SEPTIC" and "VACANT_ID" = "VACANT" and "LANDUSE_COMPILE" = "RUR" and "LANDUSE_COMPILE" = "FOR" and "LANDUSE_COMPILE" = "AGR"
 - iii. Field calc "II_GPD" = 1000 x "NET_DEV_ACRES"
 1. Assume 1,000 acre/day I/I
 - iv. Switch selection, and calculate "II_GPD" = 0
22. Estimate additional flow
- a. Add field named "ADD_FLOW_GPD", type double
 - i. Select "SEPTIC" = "SEPTIC" and "DVLPMNT_MOD" = 'YES_PARTIAL'
 - ii. Calc "ADD_FLOW_GPD" = "FUT_Q"
 - iii. Select all features with no value for "ADD_FLOW_GPD"
 - iv. Calc "ADD_FLOW_GPD" --


```

dim flow
if ([FUT_Q] + [II_GPD]) < [EX_FLOW] then
flow = 0
elseif ([FUT_Q] - [EX_FLOW]) < 0 then
flow = 0
else
flow = [FUT_Q] - [EX_FLOW]
end if
          
```