NAWT

National Association of Wastewater Technicians

The Beginning Life and Design Principles of Onsite Wastewater Treatment Systems

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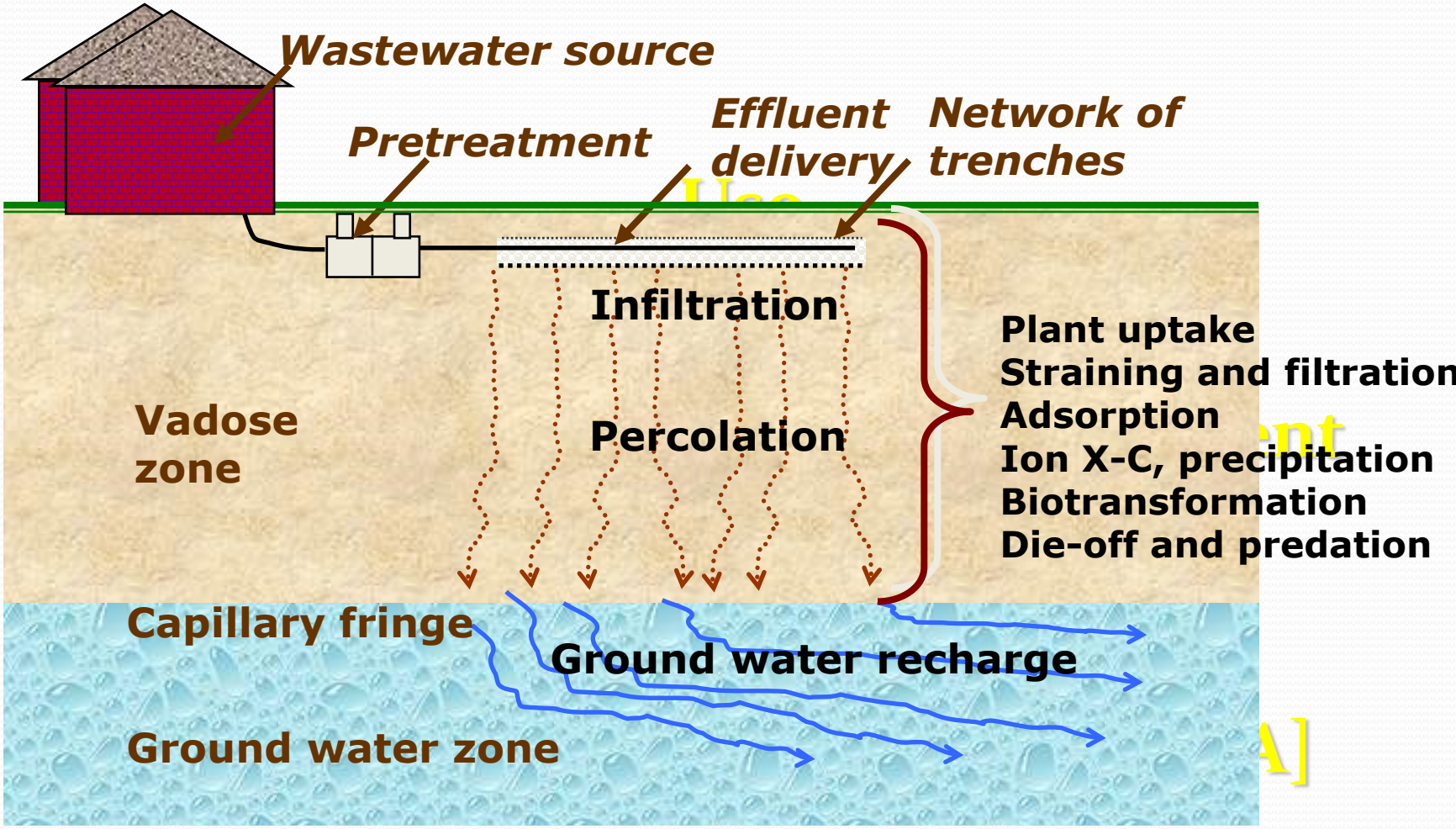
The materials being presented represent the speaker's own opinions and do NOT reflect the opinions of NOWRA or NAWT.

The Designer's Purpose

- Provide a design for a system that will treat wastewater to protect human and environmental health.
- Onsite wastewater treatment systems (OWTS)
  - Treat the wastewater at the source location and disperse back into the environment.
- Design Approaches
- Permitting
- Installation
- Operation and Maintenance
  - By the owner and/or a maintenance provider.

System Definition



New System

- **Permitting**
  - Establishes **Minimum** Requirements
  - Provides checks and balances
  - Provides Long-term Records
  - Insures Proper Installation
  - Establishes Required Maintenance

New System Permitting Process

- Site Evaluation
  - Site Characteristics
  - Subsurface investigation
- Design
  - Source Loading~ Flow & Strength
  - System selection/sizing
  - Operation & Maintenance Requirements
- Reporting
  - Design Documents
  - Permit record
- Review & Approval by the Permitting Authority

Permits Continues

- Operating Permits
  - O&M Requirements
  - Testing Requirements
- Title Transfer Permits
  - Provide an opportunity to ensure the system is functioning properly
  - Determine if the system sizing is still applicable.
  - Changes is use are identified.

Design Process

- Wastewater Characteristics
- Site
  - Site evaluation
  - Soil characteristics
- System Choice
  - Pretreatment
  - Soil Treatment Area
- Risk
- System Care

Design Approach

DETERMINE HYDRAULIC LOADING

Residential

- Standard
- Deviations

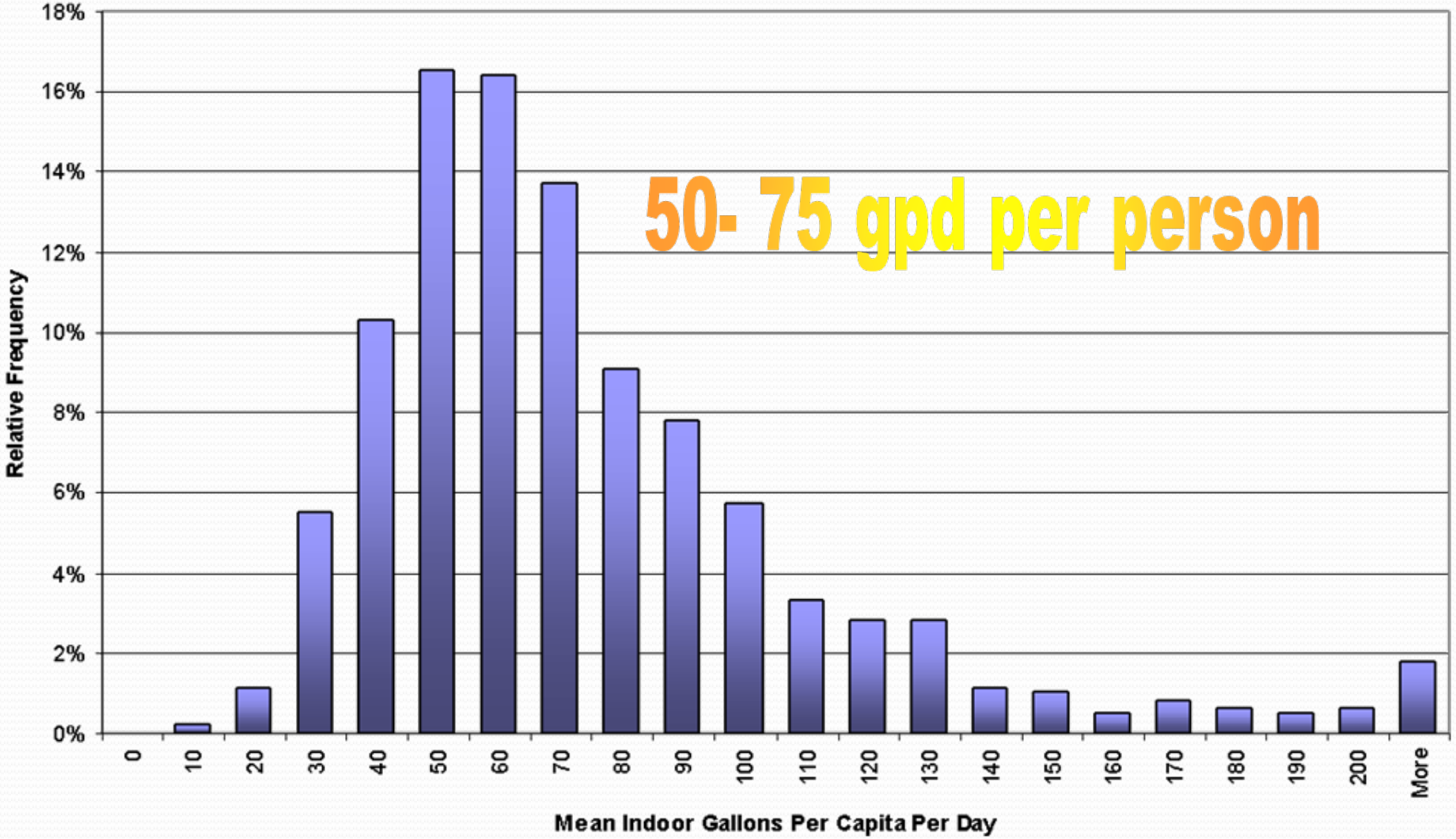
CDPHE Regulation 43

Table 6-1 Single-Family Residential Design Flows

# Bedrooms	Occupancy (# of Persons)	Wastewater Flow Per Person (gallons/day)	Design Flow (gallons/day)
2	4	75	300
3	6	75	450
4	7	75	525
5	8	75	600
6	9	75	675

- Specific to County regulations
  - 75 gpd vs. 100 gpd per person
  - Could be 2 people per bedroom for all bedrooms
  - Check local regulations

Distribution of mean household daily per capita indoor water use for 1,188 data-logged homes (EPA 2002: Onsite Wastewater Treatment System Manual)



- Water use varies widely from home to home
  - Distribution of mean indoor water use for the 1188 dwelling units included in the AWWARF study (EPA 2002 Fig 3-1)

Table 3-1. Summary of average daily residential wastewater flows[a]

Study	Number of residences	Study duration (months)	Study average (gal/pers/day)[b]	Study range (gal/pers/day)
Brown & Caldwell (1984)	210		66.2 (250.6)[b]	57.3–73.0 (216.9–276.3)[b]
Anderson & Siegrist (1989)	90	3	70.8 (268.0)	65.9–76.6 (249.4–289.9)
Anderson et al. (1993)	25	3	50.7 (191.9)	26.1–85.2 (98.9–322.5)
Mayer et al. (1999)	1188	1[c]	69.3 (262.3)	57.1–83.5 (216.1–316.1)
Weighted Average	153		68.6 (259.7)	

[a] Based on indoor water use monitoring and not wastewater flow monitoring.
[b] Liters/person/day in parentheses.
[c] Based on 2 weeks of continuous flow monitoring in each of two seasons at each home.

USEPA Onsite Wastewater Treatment Systems Manual

Avg. = 69.2 gpd per person

(2008 study of 17 households—45.2 gpd per person

Deviations

- Ask about “unusual” uses
  - Daycare
  - Short Term Rental
  - Other non-residential uses
- Water use records
- Especially important with repairs of failed systems.
  - Leaking Fixtures
  - Heavy water use

Design Approach

DETERMINE HYDRAULIC LOADING

Commercial

- Regulation
- Tables
- Metered Flows
  - Operational Facility
  - Comparable Facilities

CDPHE Reg 43

TABLE 6-2 For Design Purposes, the Estimated Daily Wastewater Flow and BOD_5 Load Per Person Unless Otherwise Noted

RESIDENTIAL WASTEWATER	GPD	BOD_5 IN POUNDS PER DAY
Single-family dwellings	75	.20
Auxiliary buildings, by fixture type		
Bath/Shower	14.7	.014
Dishwasher	1.8	.002
Kitchen sink with garbage grinder	5.8	.052
Laundry washer	19.5	.037
Lavatory	8.4	.021
Water closet (toilet)	24.8	.029
Hotels and motels per room	75	.15
Multiple-family dwellings or apartments	75	.20
Boarding and rooming houses (users absent during working hours)	50	.15
Tiny Homes[3], per unit	150	.40
Mobile home	75	.20
Mobile home park per space	300	.80

CDPHE Reg 43

TABLE 6-2 For Design Purposes, the Estimated Daily Wastewater Flow and BOD_5 Load Per Person Unless Otherwise Noted

COMMERCIAL WASTEWATER	GPD	BOD_5 IN POUNDS PER DAY
Facilities with short-term or transient visitors		
Examples: Airports or bus stations per passenger; fairgrounds per person attending; ball parks, race tracks, stadiums, theaters or auditoriums per seat	5	.02
Airport per employee	10	.06
Barber and beauty shops per chair	100	.70[1]
Bowling alleys per lane - toilet wastes only	5	.03[1]
Country club per member	30	.02
County club per employee	20	.06
Dentist offices per non-wet chair	50	.14[1]
Doctor offices per doctor	250	.80[1]
Factories and plants exclusive of industrial wastewater per employee per eight-hour shift – no showers	20	.05
Factories and plants exclusive of industrial wastewater per employee per eight-hour shift - showers provided	35	.08
Kennels per dog	30	.20
Laundries, self-service per commercial washer	400	.75
Office buildings per employee per eight-hour shift	15	.06
Service stations per toilet fixture	250	.50[1]
Stores and shopping centers per square foot of retail space	.1	.01[1]
Work or construction camps semi-permanent with flush toilets	50	.17
Work or construction camps semi-permanent without flush toilets	35	.02

Reference Tables

Table 3.12. Average daily water use rates from commercial and institutional developments (Crews and Miller 1983).

Type	Unit	gal/day per unit	Type	Unit	gal/day per unit
Barber shops	Chairs	54.6	Drive-in movies	Car stall	5.33
Beauty shops	Station	269	Nursing homes	Bed	133
Bus/rail depots	ft^2	3.33	New office buildings	ft^2	0.19
Car washes	Inside ft^2	4.78	Old office buildings	ft^2	0.14
Churches	Member	0.14	Jails and prisons	Person	133
Golf/swim clubs	Member	22.20	Restaurants	Seat	24.2
Bowling alleys	Alley	133	Drive-in restaurants	Car stall	109
Residential colleges	Student	106	Night clubs	Person served	1.33
Hospitals	Bed	346	Retail space	Sale ft^2	0.11
Hotels	ft^2	0.26	Elementary schools	Student	3.83
Laundromats	ft^2	2.17	High schools	Student	8.02
Laundry	ft^2	0.25	YMCA/YWCA	Person	33.3
Medical offices	ft^2	0.62	Service stations	Inside ft^2	0.25
Motels	ft^2	0.22	Theaters	Seat	3.33

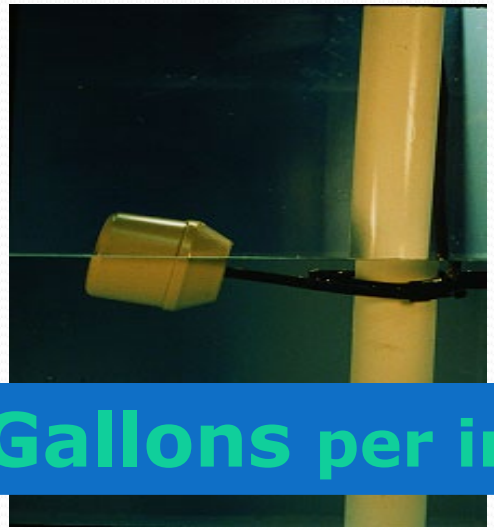
*Reference: Decentralized Water Reclamation Engineering – A Curriculum Workbook, Robert Siegrist 2017

Metered Flows

- Obtain Flows from an existing or similar facility
  - Potable water use data (consumptive use)
  - ETM, dose counter (account for drain back)
  - Magnetic flow meter (effluent in full pipe)
  - Ultrasonic flow meter (influent flow)

Measuring the Flow

- Control panels can include a dose counter (CT) and/or an elapsed time meter (ETM)
- Operator or owner must record data on pre-established frequency (daily, weekly, monthly)



Pump flow rate

Gallons per inch

Design Approach

DETERMINE ORGANIC LOADING

Residential

- Wastewater strengths typically assumed
- Deviations

Raw Wastewater – Regulation 43

TABLE 6-2 Estimate of Average Daily Wastewater Flow and BOD_5 Load Per Person Unless Otherwise Noted

RESIDENTIAL WASTEWATER	AVERAGE GPD	BOD_5 IN POUNDS PER DAY
Single-family dwellings	75	.20

*Reference: CPDHE Regulation 43

CDPHE Regulation 43 assumes an influent BOD5 = 318 mg/L

Raw Wastewater – Research Data

Table 3.14. Comparison of properties commonly of interest in wastewaters generated in DUs in the U.S. (from Lowe et al. 2009).

Constituent	Units	Lowe et al. 2009		USEPA 2002	C&T 1998
		Median	Range	Range	Range
Alkalinity	mg-$CaCO_3$/L	260	65 - 575	Not rept.	Not rept.
TS	mg/L	1028	252 - 3320	500 - 880	350 - 1200
TSS	mg/L	232	22 - 1690	155 - 330	100 - 350
$cBOD_5$	mg/L	420	112 - 1101	155 - 286	110 - 400
COD	mg/L	849	139 - 4584	500 - 660	250 - 1000
TOC	mg/L	184	35 - 738	Not rept.	80 - 290
DOC	mg/L	110	29 - 679	Not rept.	Not rept.
Total N	mg-N/L	60	9 - 240	26 - 75	20 - 85
Kjeldahl N	mg-N/L	57	16 - 248	Not rept.	Not rept.
Ammonium N	mg-N/L	14	2 - 94	4 - 13	12 - 50
Nitrate N	mg-N/L	1.9	BDL - 9	<1	0
Total P	mg-P/L	10.4	0.2 - 32	6 - 12	4 - 15

WERF = Water Environment Research Foundation; USEPA = U.S. Environmental Prot. Agency; C&T = Crites and Tchobanoglous.

Source: Table 3-7 in Lowe et al. 2009.

*Reference: Decentralized Water Reclamation Engineering – A Curriculum Workbook, Robert Siegrist 2017

Design Approach

DETERMINE ORGANIC LOADING

Commercial

- Regulation
- Estimates from tables
- Wastewater Sampling
  - Operational Facility
  - Comparable Facilities

Variability in Commercial Facilities

- High Strength Waste
  - Increased organic matter, fats, oils, and grease
  - Determine Mass Loading for Design, lbs of BOD per day
- Cleaning Products
- Pharmaceuticals

Commercial Establishments

Table 3.16. Wastewater composition determined through monitoring at 14 commercial and institutional sites in Colorado (Conn 2008).

Constituent	Units	Average	Median	Minimum	Maximum	Number
Alkalinity	mg-$CaCO_3$/L	390	410	20	75	40
pH	-	6.80	6.78	4.92	8.69	40
$cBOD_5$	mg/L	430	320	80	1200	27
TOC	mg/L	100	89	33	340	25
DOC	mg/L	87	77	21	230	25
Total N	mg-N/L	100	92	6	190	25
Ammonium N	mg-N/L	99	87	4	210	26
Nitrate N	mg-N/L	1.9	1.4	<0.5	9.5	24
Total P	mg-P/L	17	16	1.7	37	26
Fecal coliforms	CFU per 100mL	$4.19x10^6$	$6.75x10^5$	$1.50x10^5$	$3.34x10^7$	12

Source: Table 4-1 in Conn 2008. Nonresidential source types include commercial (2 restaurants, 1 bakery, 2 convenience stores, 3 retail) and institutional (2 schools, 1 church, 3 veterinary hospitals). Grab samples were taken at the inlet to the septic tanks at each site. Each site was sampled 3 times.

0

S3.42

*Reference: Decentralized Water Reclamation Engineering – A Curriculum Workbook, Robert Siegrist DRAFT 2015

Regulatory Table

TABLE 6-2 For Design Purposes, the Estimated Daily Wastewater Flow and BOD_5 Load Per Person Unless Otherwise Noted

FOOD SERVICE ESTABLISHMENT	**GPD**	**BOD_5 IN POUNDS PER DAY**
Restaurant open 1 or 2 meals per seat	50	.06/meal
24-hour restaurant per seat	75	.07/meal served
Restaurant with paper service only per seat	25	.01/meal served
Additional for bars and cocktail lounges per seat	30	.02
Drive-in restaurant per car space	50	.02
INSTITUTIONAL WASTEWATER WITHOUT KITCHENS UNLESS OTHERWISE NOTED	GPD	**BOD_5 IN POUNDS PER DAY**
Churches per seat; without any food service, or other uses	3.5	.01
Churches, per seat; warming kitchen only, no major food service	5	.01
Churches, per seat; with food service, per meal served[4]	4	.02
Hospitals per bed space	250	.20
Nursing homes; Group homes for developmentally disabled, per bed space	125	.20
Schools, Boarding per person	100	.17
Schools, Day without cafeteria, gym or showers	15	.04
Schools, Day with cafeterias, no gym or showers	20	.08
Schools, Day with cafeterias, gym and showers	25	.10
Schools, Day additional for school workers	15	.06

Organic Loading Calculations

- Mass Loading Example 1
- Assume an office building with 30 employees
  - Q = (30 people) X (0.06 pounds per person)
  - Table 6-2 Reg. 43
  - Mass Loading = 1.8 pounds per day
  - 482 mg/L
- This is used to design the pre-treatment system

Organic Loading Calculations

- Mass Loading Example 2
- Mass Loading Equation
  - **Mass (lb) = Q gpd x C mg/l x 0.00000834**
- Assume an office building with 30 employees
  - Q = (30 people) X (15 gpd per person) = 450 GPD
  - Table 6-2 Reg. 43
  - Mass Loading = (450 GPD) X (350 mg/l BOD similar facilities) X 0.00000834 = 1.3 pounds per day
- This is used to design the pre-treatment system

Non-Residential STE Composition

- Average composition of total wastewater STE (EPA 2002 Table 4-12)

Table 4-12. Average septic tank effluent concentrations of selected parameters from various commercial establishments[a]

Wastewater Type	BOD_5 (mg/L)	COD (mg/L)	TSS (mg/L)	TKN (mgN/L)	TP (mgP/L)	Oil/Grease (mg/L)	Temp (°C)	pH
Restaurant A	582	1196	187	82	24	101	8–22	5.6–6.4
Restaurant B	245	622	65	64	14	40	8–22	6.6–7.0
Restaurant C	880	1667	372	71	23	144	13–23	5.8–6.3
Restaurant D	377	772	247	30	15	101	16–21	5.7–6.8
Restaurant E	693	1321	125	78	28	65	4–26	5.5–6.9
Restaurant F	261	586	66	73	19	47	7–25	5.8–7.0
Motel	171	381	66	34	20	45	20–28	6.5–7.1
Country Club A	197	416	56	36	13	24	6–20	6.5–6.8
Country Club B	333	620	121	63	17	46	13–26	6.2–6.8
Country Club C	101	227	44	36	10	33	10–23	6.2–7.4
Bar/Grill	179	449	79	61	7	49	8–22	6.0–7.0

[a] Averages based on 2 to 9 grab samples depending on the parameter taken between March and September 1983.

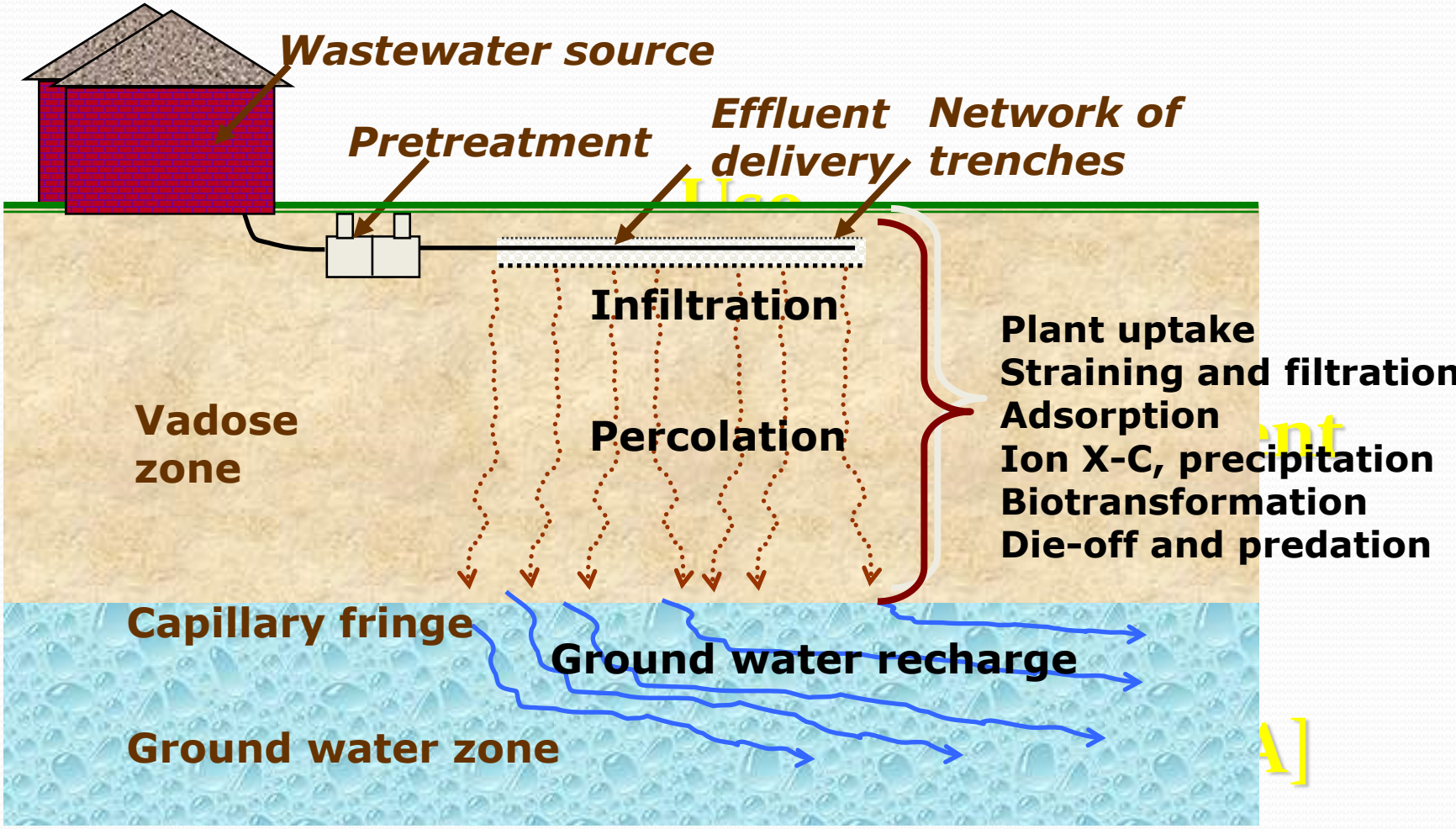
Source: Siegrist et al., 1985.

USEPA Onsite Wastewater Treatment Systems Manual

Wastewater Sampling

- Sampling of the wastewater from an existing facility to determine organic loading
  - BOD5
  - TSS
  - FOG
- Grab samples from last compartment of septic tank/dosing tank.
- How many samples do you need?

Design Approach

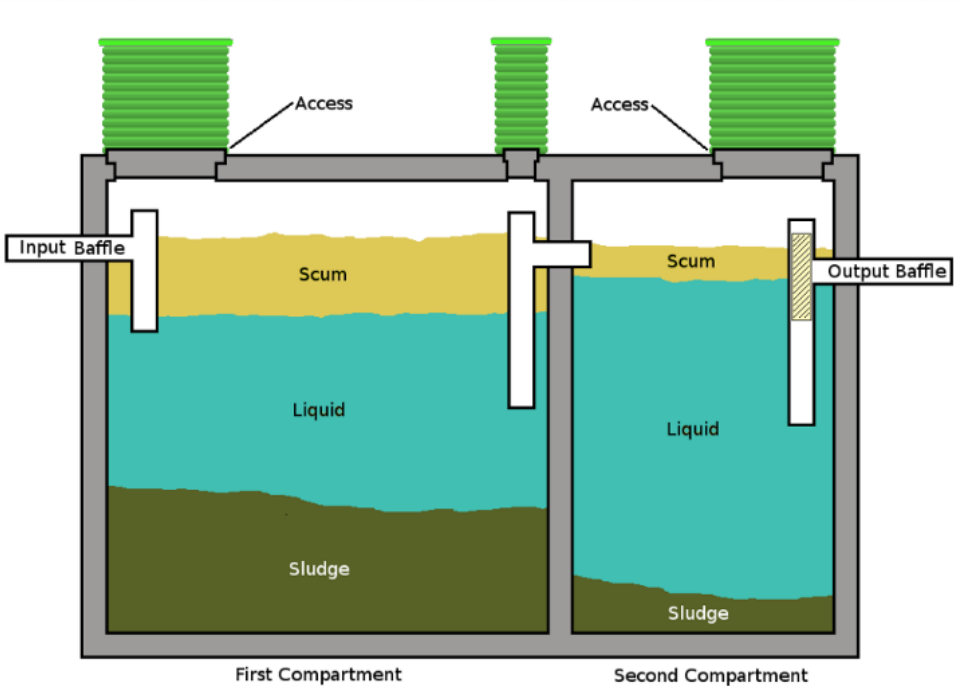


Collection & Storage

- Piping from facility with cleanout
  - Blackwater
  - Graywater
- Holding tanks
- Exciting Plumbing
  - Composting Toilets
  - Incinerating Toilets

Pretreatment Components

- Grease Interceptor Tank for Commercial Kitchens
- Septic Tank - Primary Treatment
- Effluent Screens
- Higher Level Treatment

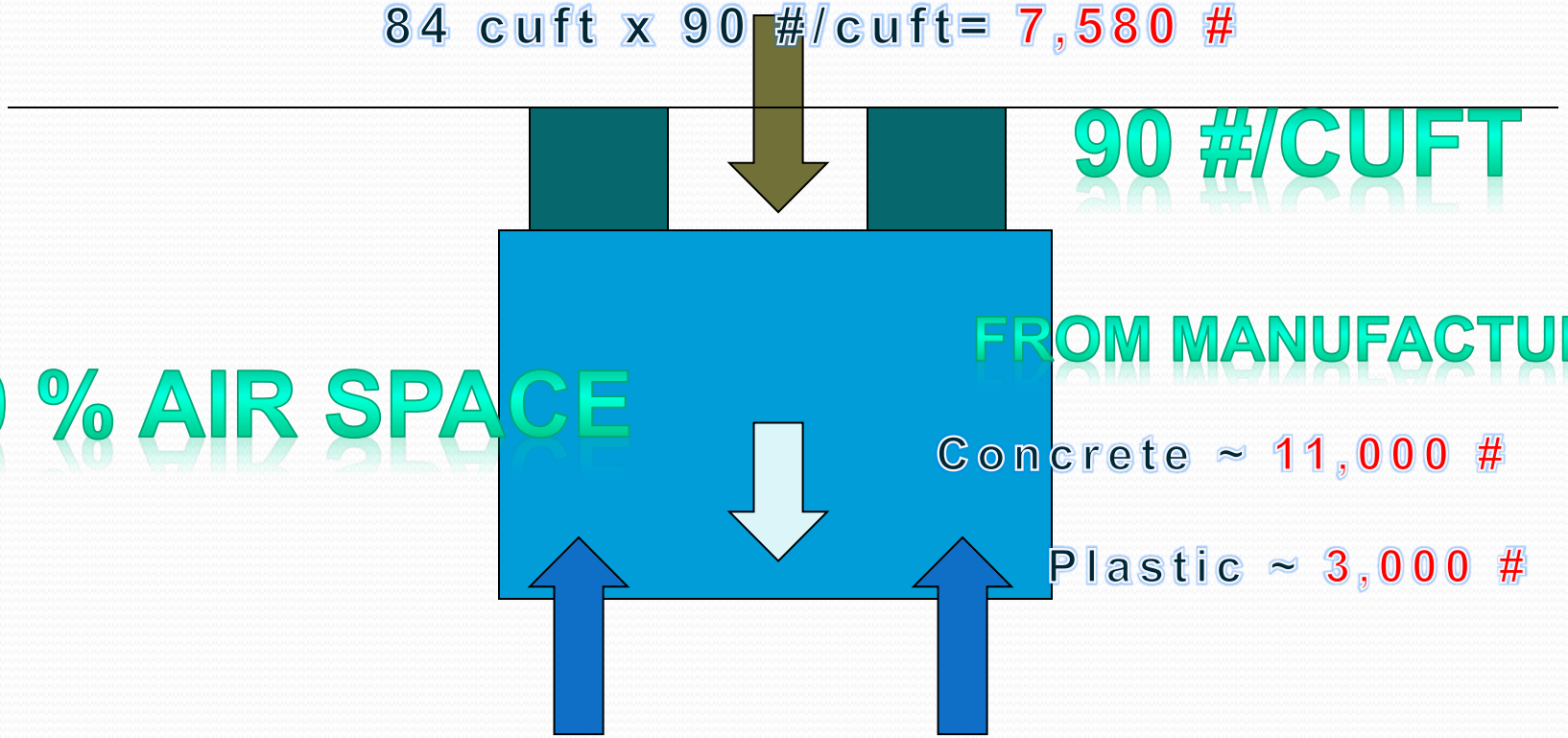


1,500 gal tank

4’ x 7’ = 28 sqft

28 sqft x 3 ft = 84 cuft

84 cuft x 90 #/cuft= 7,580 #



90 #/CUFT

FROM MANUFACTURE

30 % AIR SPACE

Concrete ~ 11,000 #

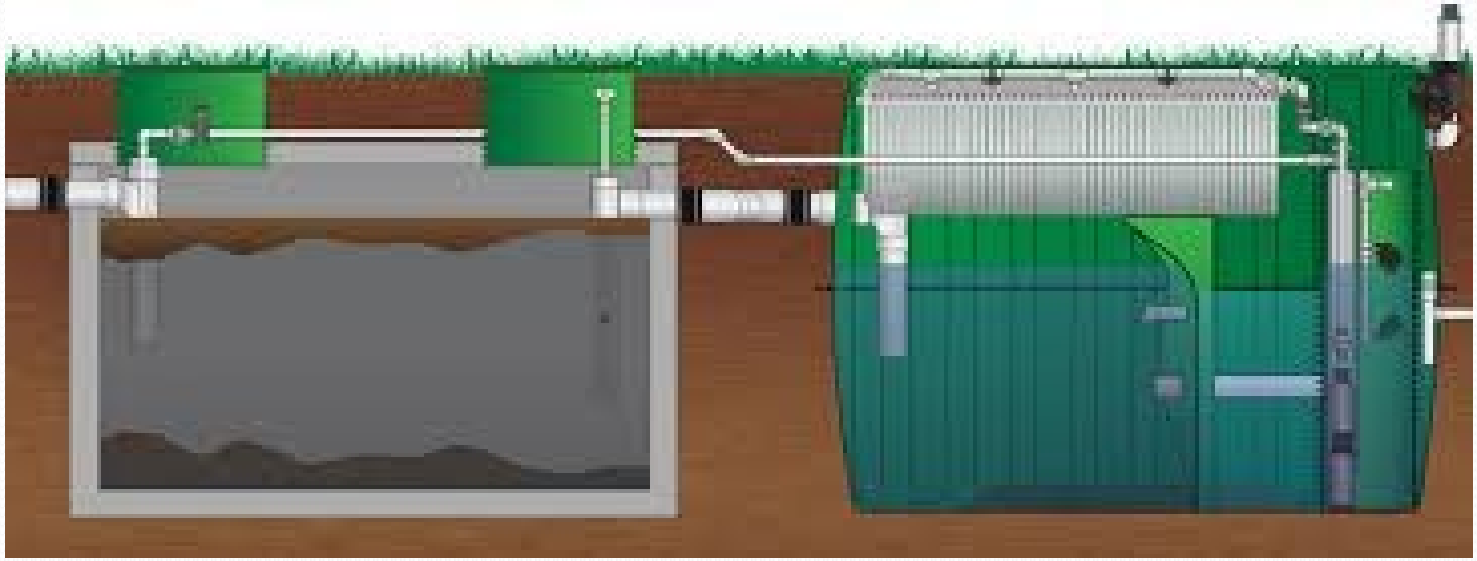
Plastic ~ 3,000 #

14,890 #

1,500 gal x 8.3 #/gal x 1.3 = 14,890 #

Pretreatment Components

- Septic tanks*
- Aerobic treatment units
- Media filters
- MBR

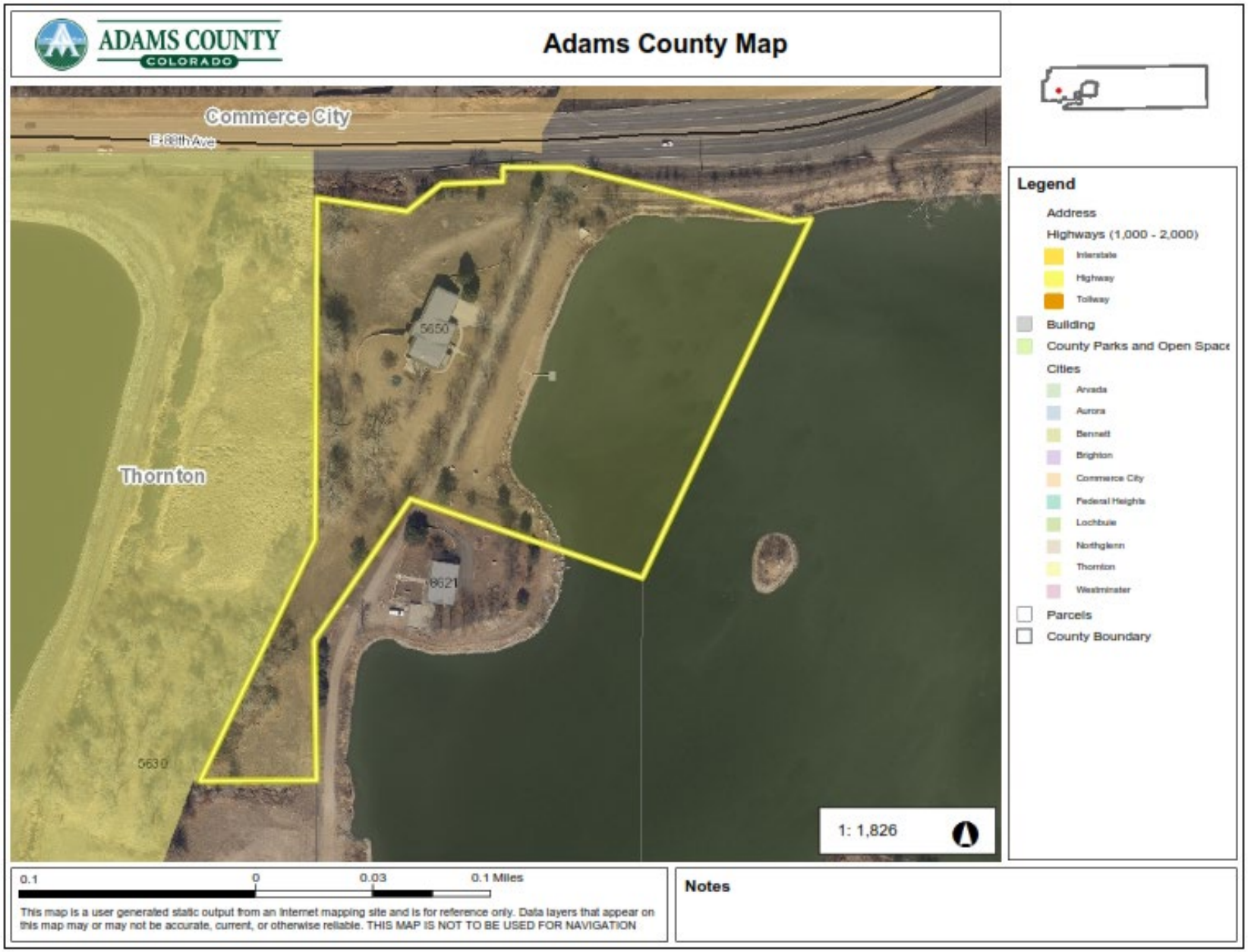


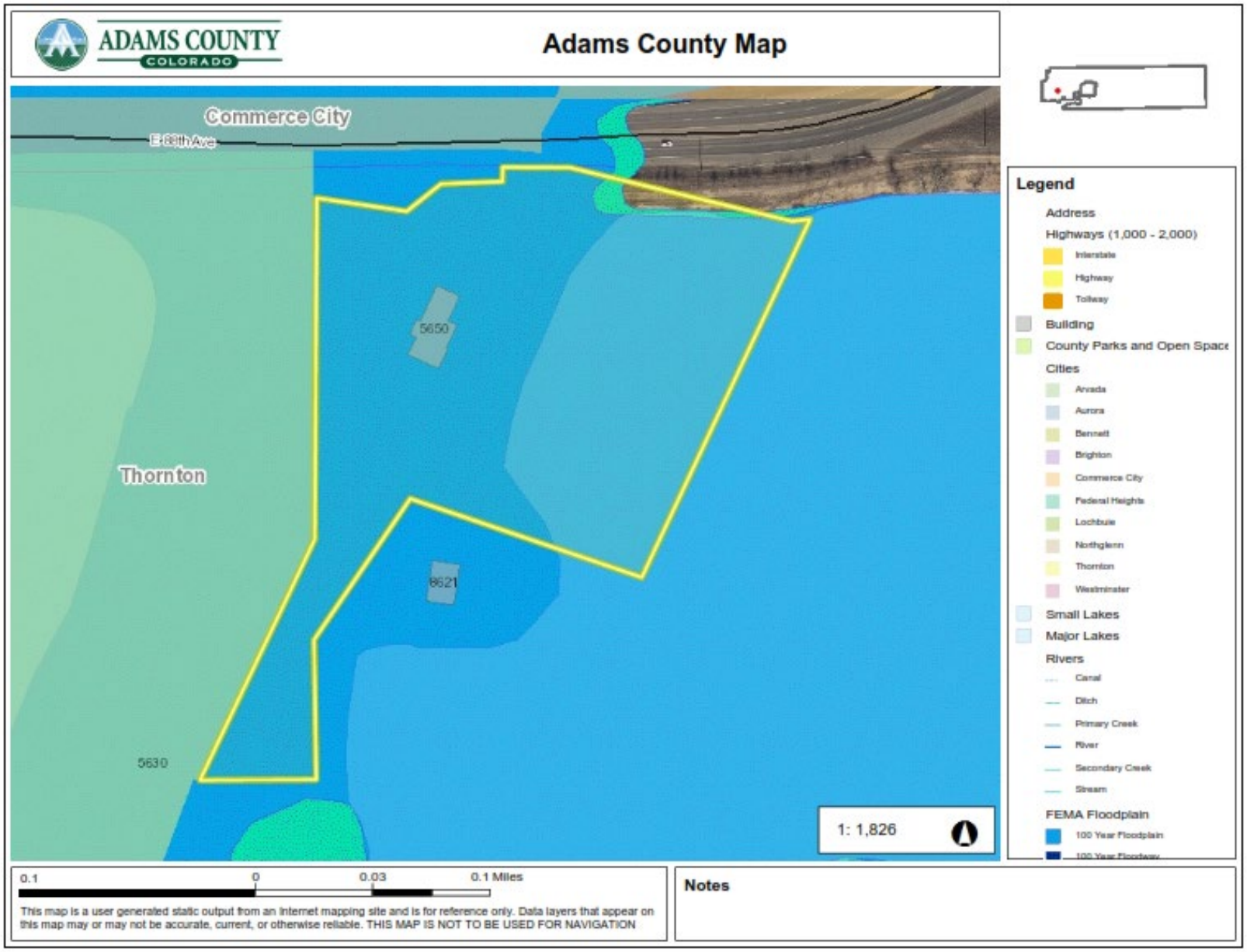
Site Evaluation

- Conduct a site evaluation
  - What are the environmental risks?
  - Consider regulatory setback requirements.
  - Where can the system be located?

Information Resources

- County Mapping Website
- National Wetlands Inventory
- https://www.fws.gov/wetlands/data/mapper.html
- County Assessors Office/Website
- County Records Office
- Site Survey or ILC
- State Well Records
  - Colorado Department of Natural Resources
  - https://dwr.state.co.us/Tools/WellPermits


ADAMS COUNTY
COLORADO
Adams County Map
Commerce City
E 88th Ave
Thornton
5650
8621
5630
1: 1,826
Legend
Address
Highways (1,000 - 2,000)
Interstate
Highway
Tollway
Building
County Parks and Open Space
Cities
Arvada
Aurora
Bennett
Brighton
Commerce City
Federal Heights
Lochbuie
Northglenn
Thornton
Westminster
Parcels
County Boundary
0.1
0
0.03
0.1 Miles
This map is a user generated static output from an Internet mapping site and is for reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable. THIS MAP IS NOT TO BE USED FOR NAVIGATION
Notes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Adams County Map
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Tollway
Building
County Parks and Open Space
Cities
Arvada
Aurora
Bennett
Brighton
Commerce City
Federal Heights
Lochbuie
Northglenn
Thornton
Westminster
Small Lakes
Major Lakes
Rivers
Canal
Ditch
Primary Creek
River
Secondary Creek
Stream
FEMA Floodplain
100 Year Floodplain
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0
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0.1 Miles
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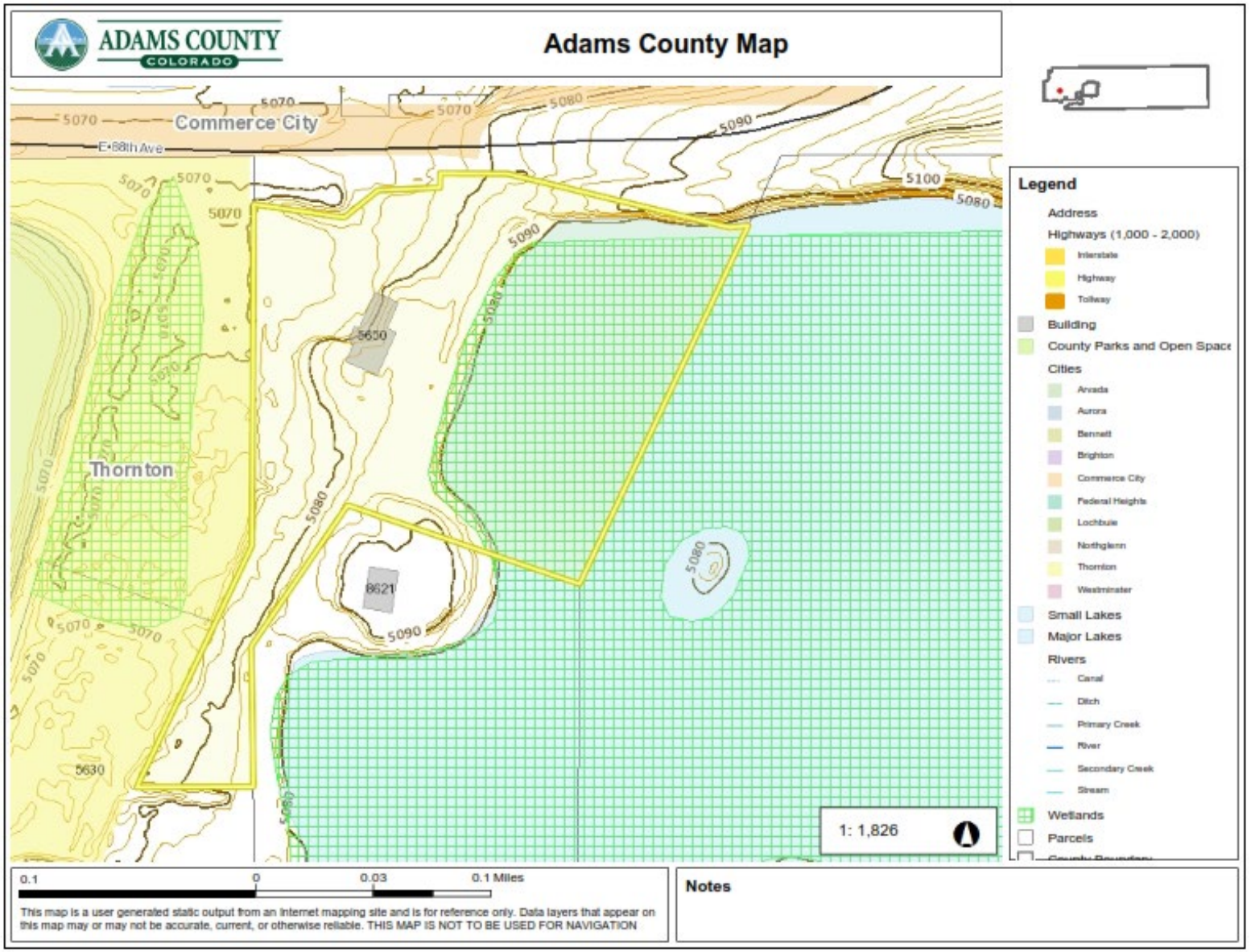
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Highway
Tollway
Building
County Parks and Open Space
Cities
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Aurora
Bennett
Brighton
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Federal Heights
Lochbuie
Northglenn
Thornton
Westminster
Small Lakes
Major Lakes
Rivers
Canal
Ditch
Primary Creek
River
Secondary Creek
Stream
Wetlands
Parcels
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U.S. Fish and Wildlife Service

National Wetlands Inventory

Wetlands

September 10, 2021

Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

National Wetlands Inventory (NWI)
This page was produced by the NWI mapper

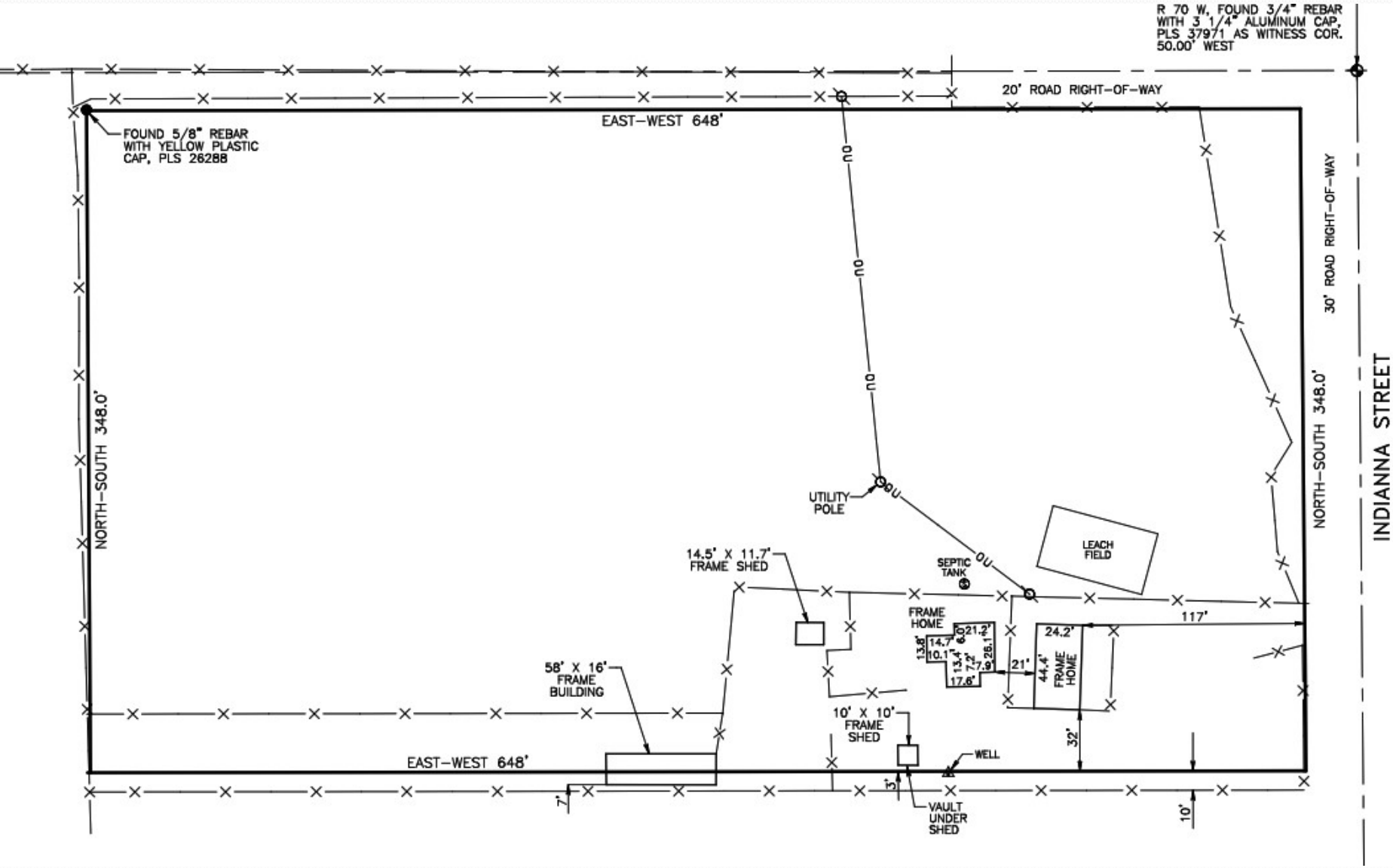
Assessors Records

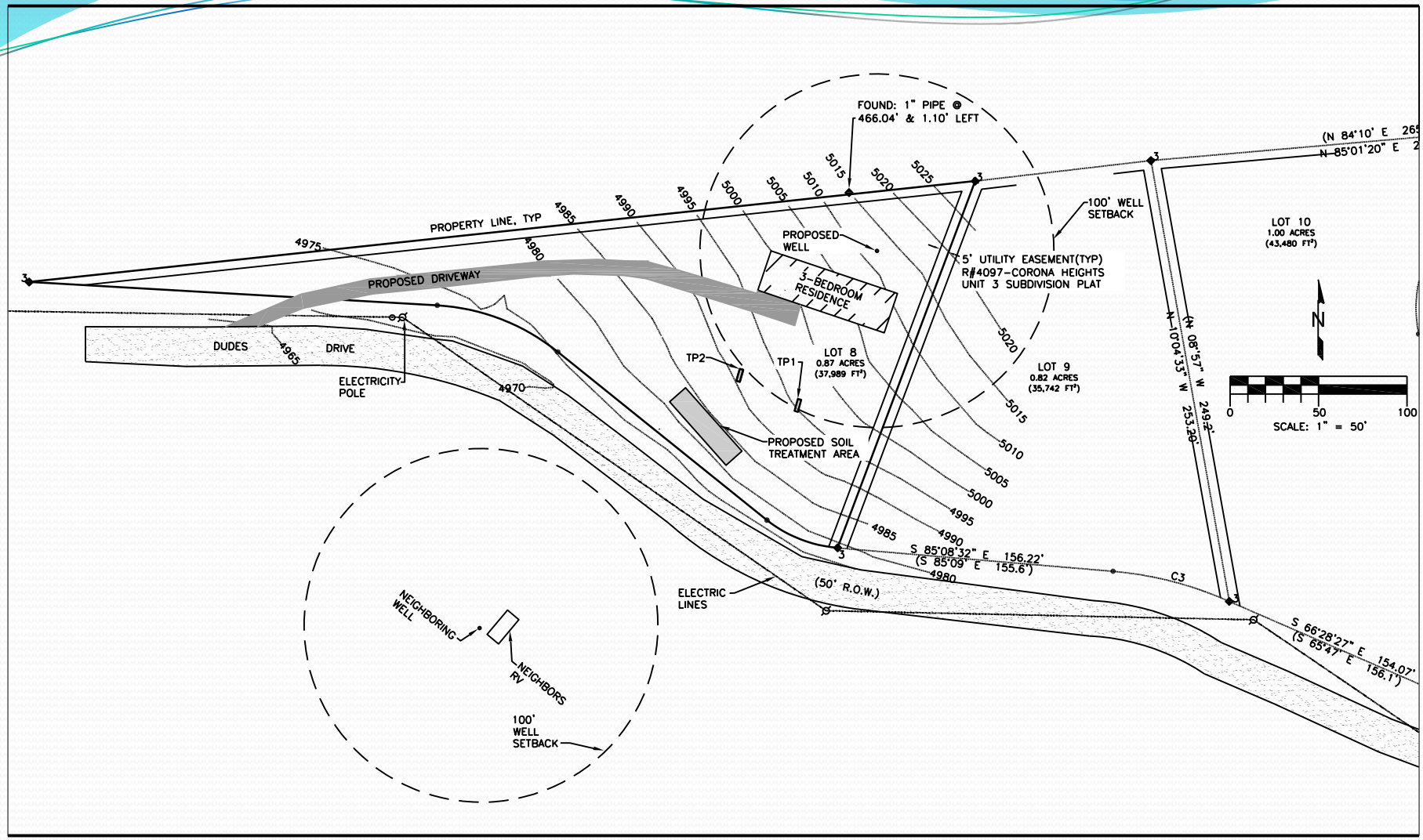
Land Valuation Summary

Account Number	Land Type	Unit of Measure	Number of Units
R0077411	Residential	Acres	6.3888
Land Subtotal:			

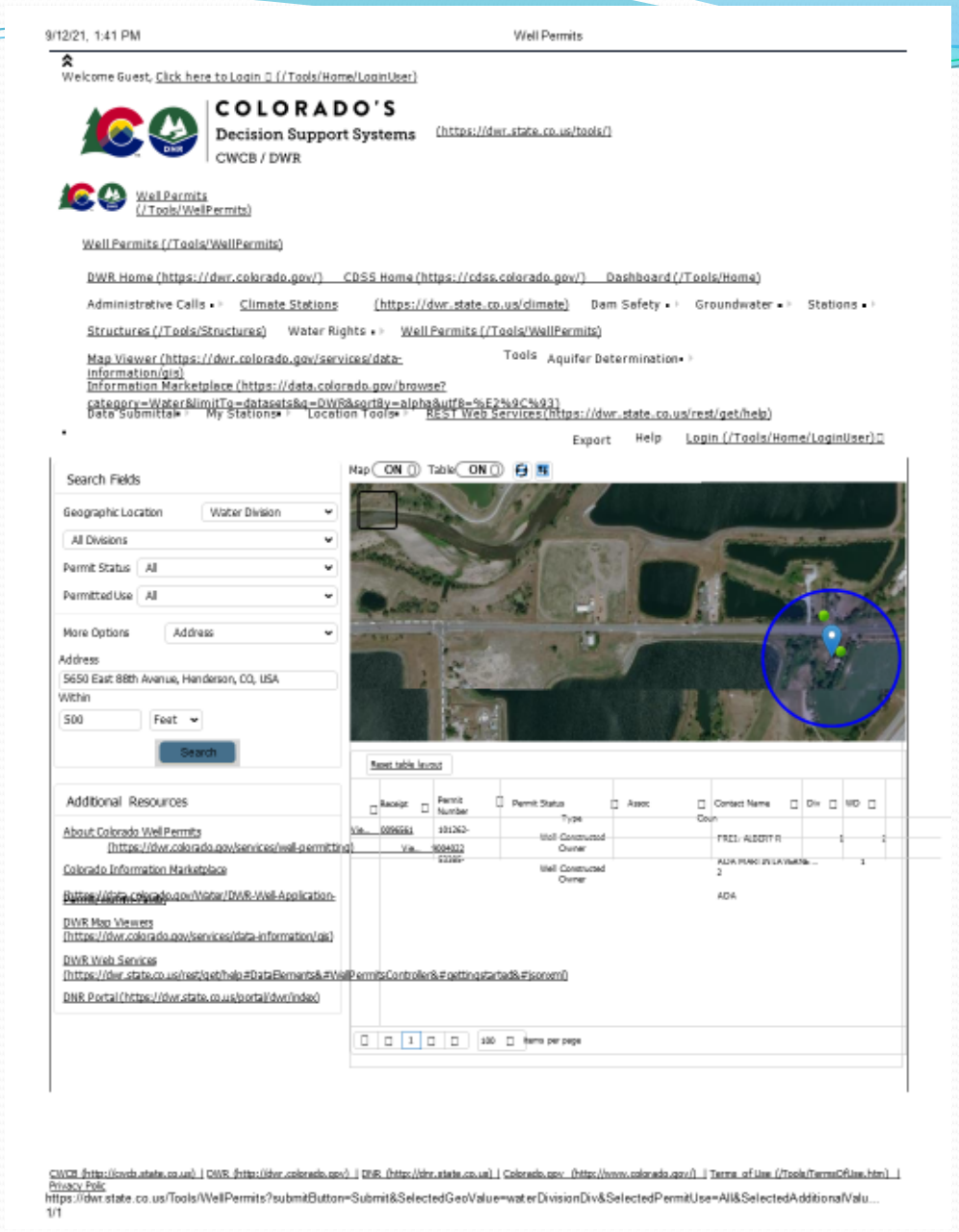
Built As:	Split Level
Year Built:	1979
Building Type:	Residential
Construction Type:	Frame Masonry Veneer
Built As SQ Ft:	3444
Number of Rooms:	9
Number of Baths:	5.00
Number of Bedrooms:	5
Attached Garage SQ Ft:	2088
Detached Garage Square Ft:	
Basement SQ Ft:	1204
Finished Basement SQ Ft:	

ILC Drawing


R 70 W, FOUND 3/4" REBAR
WITH 3 1/4" ALUMINUM CAP,
PLS 37971 AS WITNESS COR.
50.00' WEST
20' ROAD RIGHT-OF-WAY
EAST-WEST 648'
FOUND 5/8" REBAR
WITH YELLOW PLASTIC
CAP, PLS 26288
NORTH-SOUTH 348.0'
30' ROAD RIGHT-OF-WAY
NORTH-SOUTH 348.0'
INDIANNA STREET
UTILITY
POLE
OU
14.5' X 11.7'
FRAME SHED
SEPTIC
TANK
LEACH
FIELD
FRAME
HOME
21.2'
14.7'
10.1'
13.8'
13.4'
7.2'
7.9'
26.1'
17.6'
24.2'
117'
21'
44.4'
FRAME
HOME
58' X 16'
FRAME
BUILDING
10' X 10'
FRAME
SHED
32'
WELL
EAST-WEST 648'
7'
3'
VAULT
UNDER
SHED
10'


FOUND: 1" PIPE
466.04' & 1.10' LEFT
PROPERTY LINE, TYP
PROPOSED DRIVEWAY
PROPOSED WELL
3-BEDROOM RESIDENCE
100' WELL SETBACK
5' UTILITY EASEMENT(TYP)
R#4097-CORONA HEIGHTS
UNIT 3 SUBDIVISION PLAT
LOT 10
1.00 ACRES
(43,480 FT²)
LOT 8
0.87 ACRES
(37,989 FT²)
LOT 9
0.82 ACRES
(35,742 FT²)
TP1
TP2
PROPOSED SOIL
TREATMENT AREA
DUDES
DRIVE
ELECTRICITY
POLE
ELECTRIC
LINES
(50' R.O.W.)
NEIGHBORING
WELL
NEIGHBORS
RV
100'
WELL
SETBACK
S 85°08'32" E 156.22'
(S 85°09' E 155.6')
S 66°28'27" E 154.07'
(S 65°47' E 156.1')
N 10°04'33" W 253.26'
(N 08°57' W 249.2')
(N 84°10' E 265
N 85°01'20" E 2
SCALE: 1" = 50'
0
50
100
N

Site Survey



https://dwr.state.co.us/Tools/WellPermits

Reconnaissance Visit

Site Surface Features Assessment:

- Slope [%, Shape]
- Vegetation
- Natural & Cultural Features:
  - Existing Drainage Patterns
  - Surface Water
    - Streams, Ponds, Irrigation Ditches
    - If unlined irrigation ditch; check effects on seasonal high groundwater
  - Buried Utilities

Reconnaissance Visit

Site Surface Features Assessment:

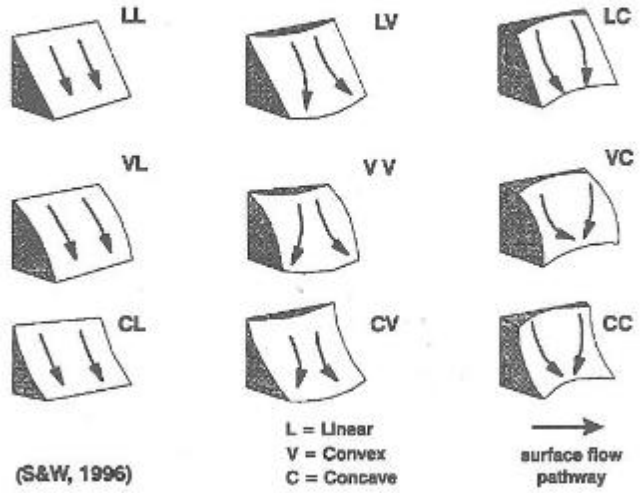
Slope Shape

Table 5-6. SWIS siting potential vs. landscape position features

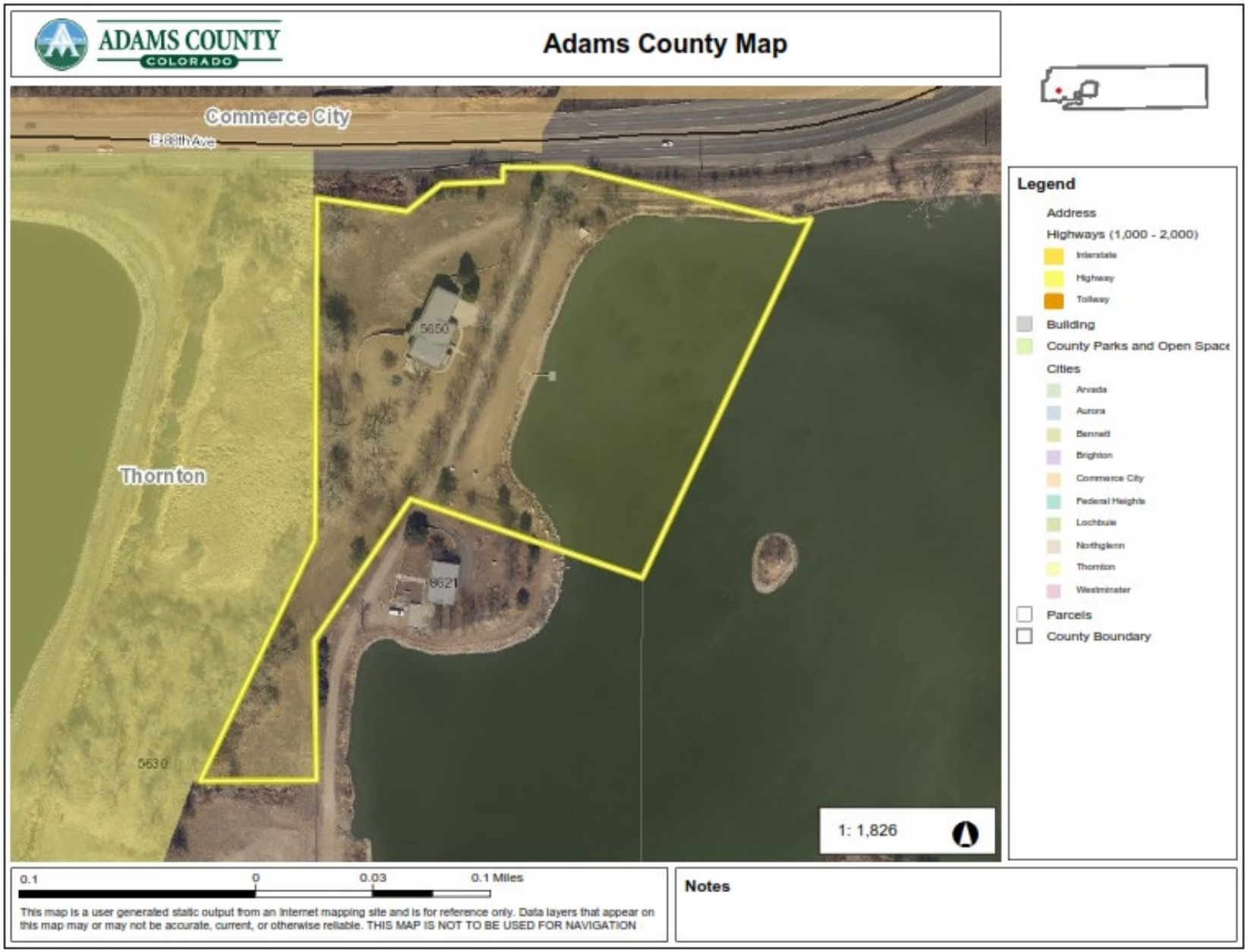
Landscape position	SWIS siting potential	Comments
LC VC CC	Poor	Converging flows could overload SWIS hydraulically
LV VV CV	Fair	Might not be able to add additional trench length later
LL VL CL	Best	Parallel flow across SWIS provides best siting potential

Figure 5-6. Landscape position features
(see table 5-6 for siting potential)

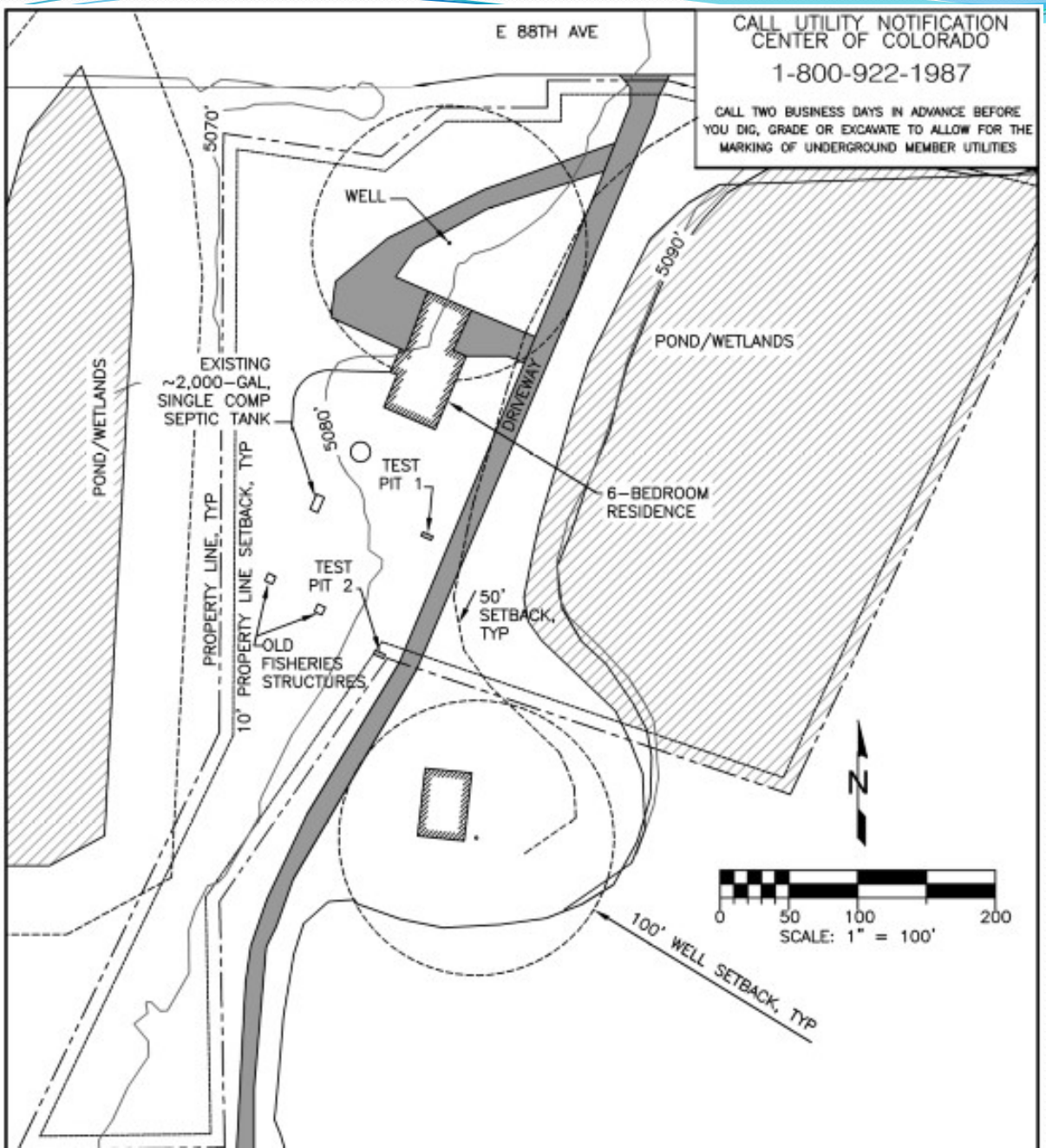
Slope Shape - Slope shape is described in two directions: up and down slope (perpendicular to the contour), and across slope (along the horizontal contour); e.g., *linear, convex,* or *LV*.



Hillslope - Profile Position (Hillslope Position in PDP) - Two-dimensional descriptions of parts of line segments (slope position) along a transect that runs up and down the slope; e.g., *backslope* or *BS*. This is best applied to transects or points, not areas.


ADAMS COUNTY
COLORADO
Adams County Map
Commerce City
E 88th Ave
Thornton
5650
8621
5630
1: 1,826
Legend
Address
Highways (1,000 - 2,000)
Interstate
Highway
Tollway
Building
County Parks and Open Space
Cities
Arvada
Aurora
Bennett
Brighton
Commerce City
Federal Heights
Lochbuie
Northglenn
Thornton
Westminster
Parcels
County Boundary
0.1
0
0.03
0.1 Miles
This map is a user generated static output from an Internet mapping site and is for reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable. THIS MAP IS NOT TO BE USED FOR NAVIGATION
Notes

Fisheries Structure


E 88TH AVE
CALL UTILITY NOTIFICATION CENTER OF COLORADO
1-800-922-1987
CALL TWO BUSINESS DAYS IN ADVANCE BEFORE YOU DIG, GRADE OR EXCAVATE TO ALLOW FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES
5070'
WELL
5090'
POND/WETLANDS
EXISTING ~2,000-GAL. SINGLE COMP SEPTIC TANK
5080'
DRIVEWAY
TEST PIT 1
6-BEDROOM RESIDENCE
POND/WETLANDS
PROPERTY LINE, TYP
10' PROPERTY LINE SETBACK, TYP
TEST PIT 2
50' SETBACK, TYP
OLD FISHERIES STRUCTURES
N
0
50
100
200
SCALE: 1" = 100'
100' WELL SETBACK, TYP

Reconnaissance Visit

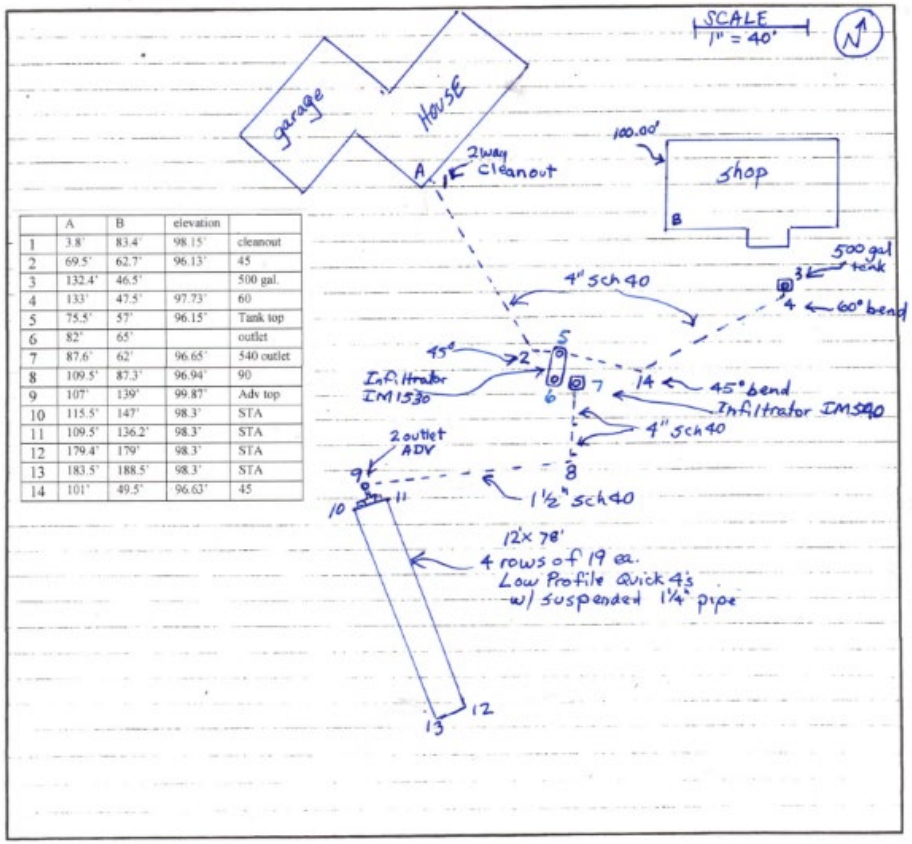
- Wells & Cisterns
- Buildings
- Improvements
- Property lines
- Existing STA
- Cut banks
- Fill areas
- Corrals

- Improved areas
- Interceptor drains
- Restrictions & setbacks
- Review areas for new STA
- Review areas for components
- Review proposed improvements characteristics
- Existing Drainage Patterns

VERIFICATION is important check mapped/surveyed locations against field observations

Upgrade & Repair Considerations

- Why did the system fail?
- Check functionality of existing system
  - Inspection report
- Records of existing OWTS
- MLS listing
- Additions
- Changes in use
- Is there adequate electrica power?
- Adequate breakers?



	A	B	elevation	
1	3.8'	83.4'	98.15'	cleanout
2	69.5'	62.7'	96.13'	45
3	132.4'	46.5'		500 gal.
4	133'	47.5'	97.73'	60
5	75.5'	57'	96.15'	Tank top
6	82'	65'		outlet
7	87.6'	62'	96.65'	540 outlet
8	109.5'	87.3'	96.94'	90
9	107'	139'	99.87'	Adv top
10	115.5'	147'	98.3'	STA
11	109.5'	136.2'	98.3'	STA
12	179.4'	179'	98.3'	STA
13	183.5'	188.5'	98.3'	STA
14	101'	49.5'	96.63'	45

Preliminary Soils Information

- **Preliminary Soils Information**
- **USDA NRCS Soil Survey**
  - https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx
- **Geological Maps, USGS**
  - https://ngmdb.usgs.gov/ngmdb/ngmdb_home.html
- **Existing records**
  - **Geotechnical report**
  - **Past reports – repair**
  - **Neighboring reports**

Subsurface Investigation

- Do a subsurface investigation in the area of the proposed soil treatment area.
- Evaluate soil profile test pit excavations, log soils, take samples.
- Does County Health Dept. need to observe holes?
- If holes are to be left open, secure them for safety.
- If percolation testing, load holes, comply with procedures, return after presoak period.

Subsurface Investigation

SOIL OBSERVATION LOG

Client/Address:	Legal Description	Date:
Soil Parent Material(s) (Circle all that apply) : Till Outwash Lacustrine Alluvium Loess Organic Matter Bedrock Notes:		
Landscape Position (Circle one) : Summit Back/Side slope Foot Slope Toe Slope Slope Shape: Notes:		
Vegetation:	Soil Survey Map Unit(s):	Slope (%):
Weather Conditions/Time of Day:	Location/Observation #/Method:	Elevation:

Depth (in)	Texture	Rock Frag%	Matrix color(s)	Mottle color(s)	Redox Kind(s)	Shape	Grade	Consistence
					Concentrations Depletions Gleyed	Granular Platy Blocky Prismatic Single Grain Massive	Weak Moderate Strong Loose	Loose Friable Firm Extremely Firm Rigid
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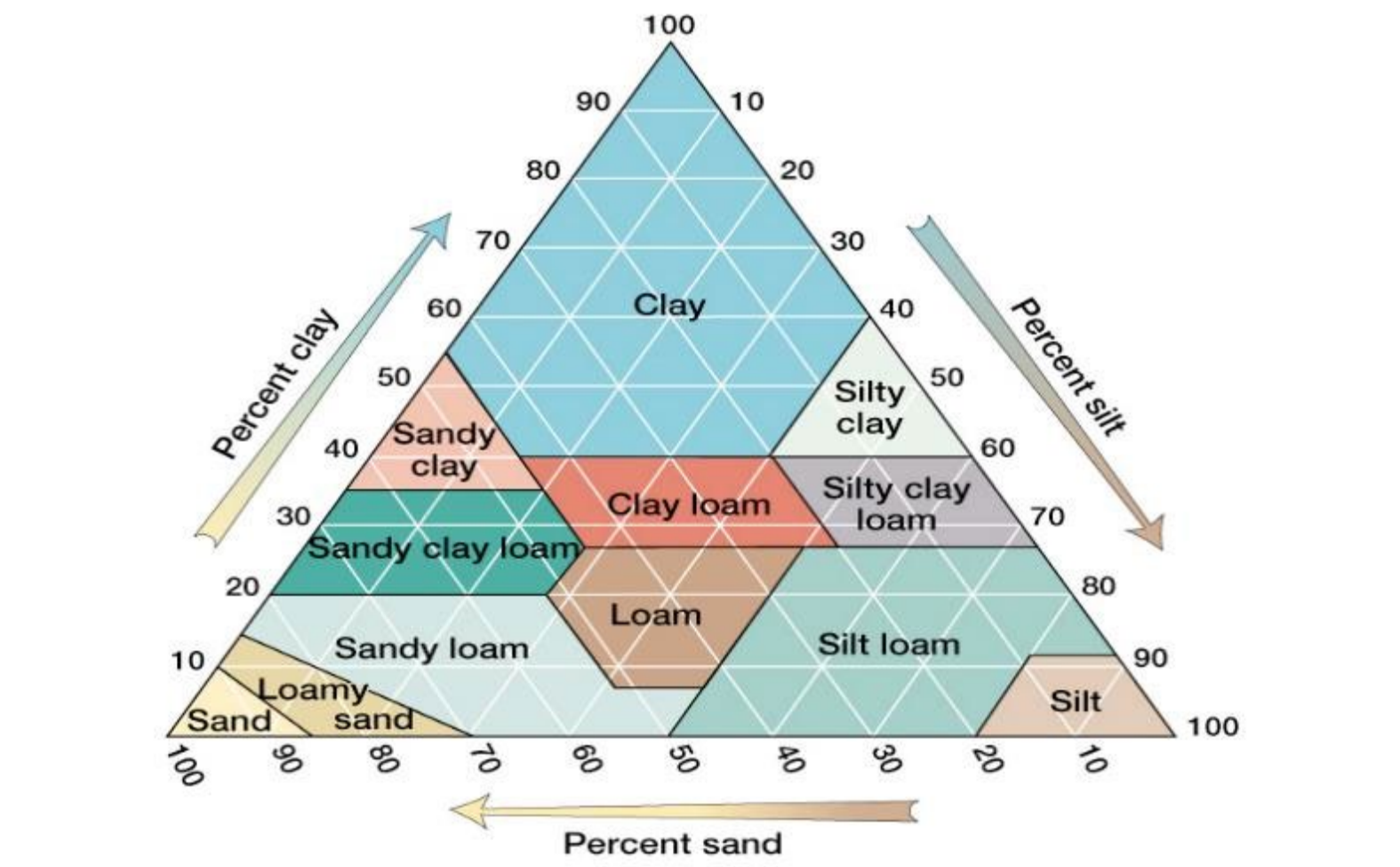
- https://www.cpow.net/publications-research/

Soil Texture Triangle



Subsurface Investigation

- Is the soil a suitable treatment media?
- Are there limiting conditions?
- Is it suitable to meet treatment goals or do we need to add a higher level treatment system?

Rock Content

Soil Treatment Area

- How much *infiltrative surface area* do we need?
- How should it be configured to accommodate site conditions?
  - To provide better treatment
  - To last longer
  - Consider Contour Loading Rate

Final Treatment and Dispersal Components

- Soil Treatment Area (STA)
  - Trench and bed geometry
  - Distribution options
    - Gravity
    - Pressure
    - Mound
    - Gravel
    - Manufactured Media
    - Drip Tubing

Operation & Maintenance (O&M)

- What it takes to work
- Taking care of the system

Owner

Service Provider

Management plans

- All Systems
- Homeowner O&M
- Professional O&M
- **Frequency of O&M**
- Monitoring with Operating Permit
- WEB tools for owners & service providers
  - www.h2oandm.com
  - Online RME

Operation & Maintenace

- Make all the components accessible for inspection and servicing.
- Outline Maintenance Requirements in Design Documents.
- Educate the homeowner/user on do's and don'ts
- Require a service contract.
- With routine maintenance, the system should last 30, 40, 50+ years.

Monitoring

- What is going to be checked?
- How often will it be checked?
- Required performance
  - When is it “Working”?
  - When is it “Broke”?

What should be monitored?

- Flow- Use
- Problems
  - Identified in the Operating Permit

Components

- Changes set O&M Timing
- Examples:
  - Smaller orifices in distribution laterals
    - Increase plugging
    - Shorter cleaning frequency
  - Screens and Filters

Technology

- Different technology has different care frequency
- ATU ~ Septic tank

6 months **3 years**

- Septic tank ~ Effluent Screen

3 years **< 3 years**

Operating Permits

- Relationship to regulator
- Monitoring requirements
- Process
  - Submittals
  - Timing
  - System performance
    - Pass/Fail
  - Enforcement

Questions?

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www.cpow.net

www.nawt.org

CPOW
Colorado Professionals in Onsite Wastewater

NAWT
National Association of Wastewater Technicians