



Basic Plan Reading

The Rosetta Stone for Source Control Inspectors

Webinar, December 9, 2020, 9:30 am – 11:30 am

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Acknowledgements:
Cassie Prudhel (retired) and Brenda Donald (SFPUC)
provided technical examples and support



Linda R. Leong, PE

Senior Engineer
San Francisco Public Utilities Commission (SFPUC)

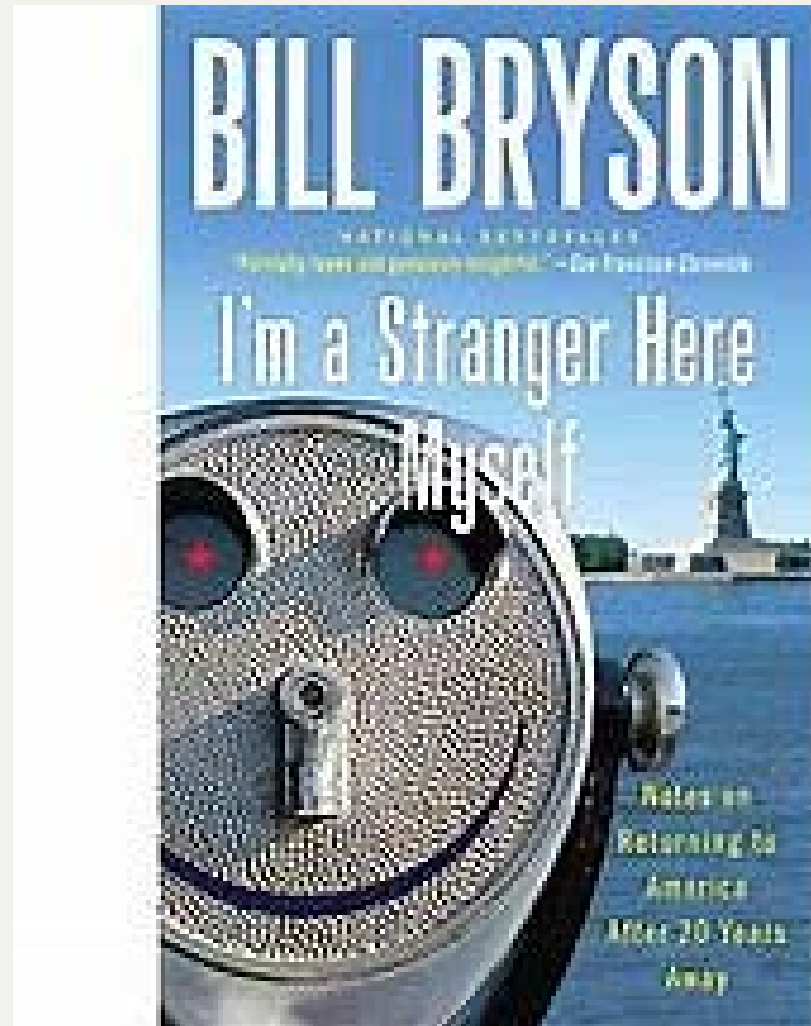
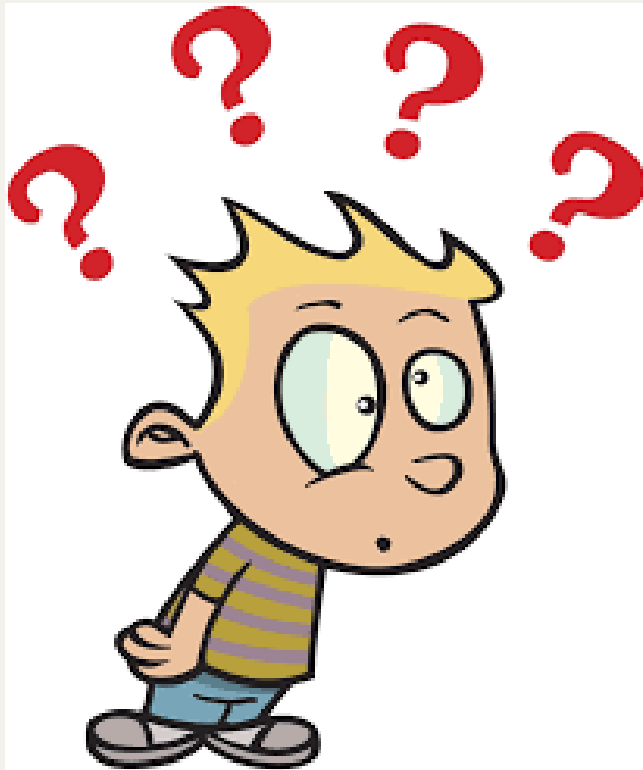


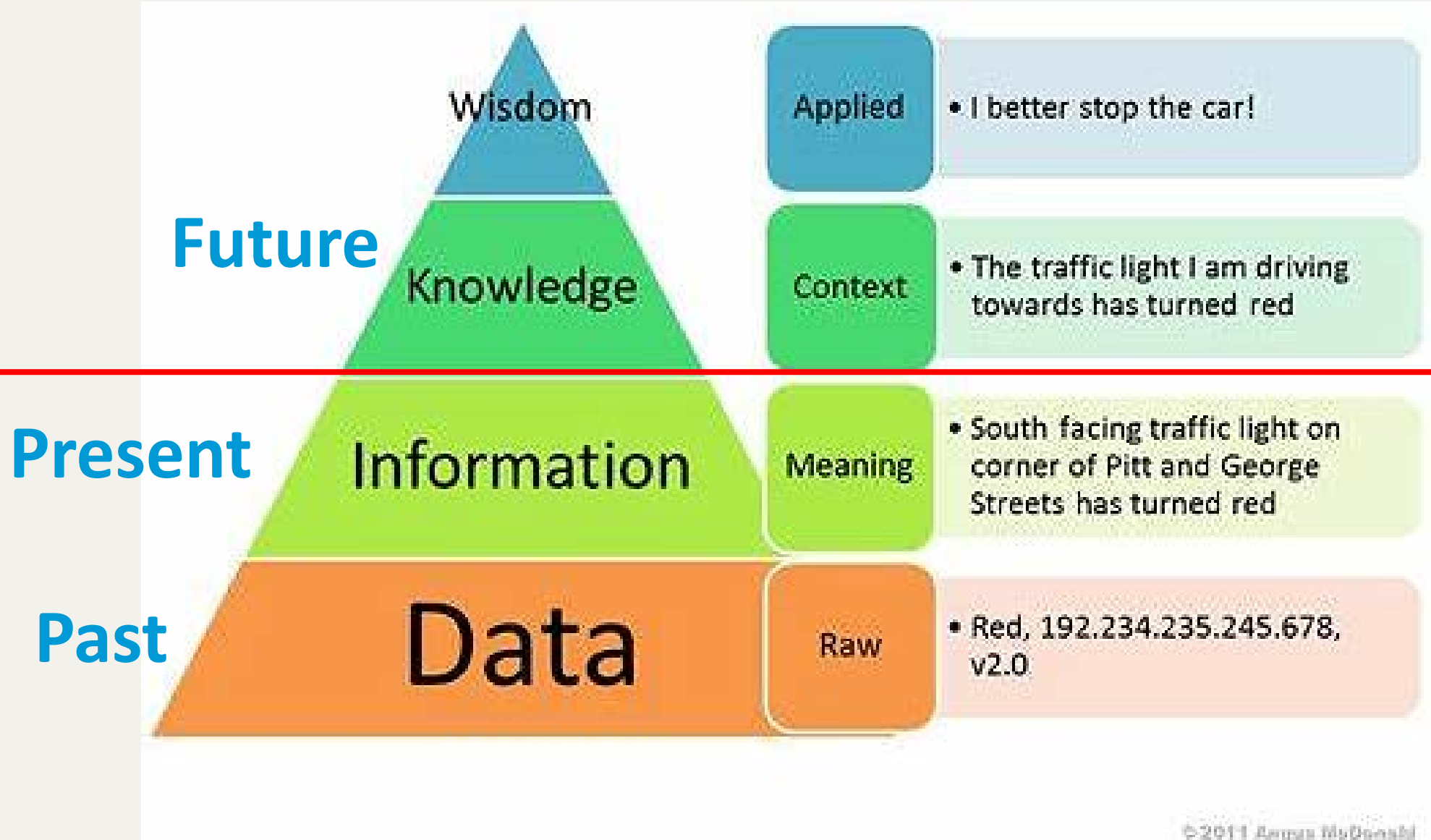
What industrial or commercial type of business was most difficult for you to inspect and why?

CHAT QUESTION

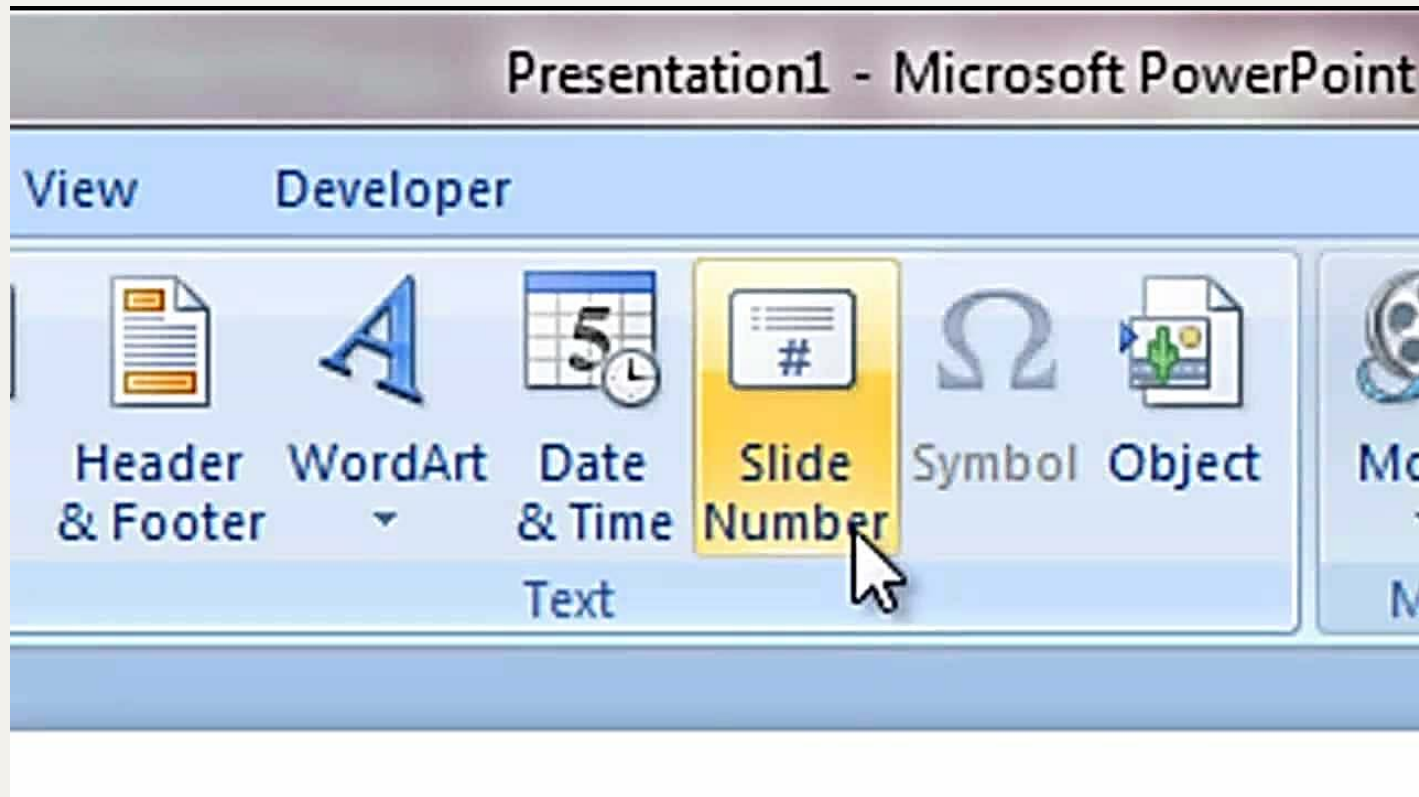
CWEA

Why Am I Presenting This Webinar?





Q&A Guidelines



What is a Rosetta Stone?

Rosetta Stone [rōˌzədəˈstōn]

- DEFINITION
 - an inscribed stone found near Rosetta (now called Rashid) on the western mouth of the Nile in Egypt in 1799. Its text is written in three scripts: hieroglyphic, demotic, and Greek. The deciphering of the hieroglyphs by Jean-François Champollion in 1822 led to the interpretation of many other early records of Egyptian civilization.

Rosetta stones (plural noun)

- **a key to some previously undecipherable mystery or unattainable knowledge.**
 - "zero point energy could be the Rosetta stone of physics"



Get your very own Industry Decoder Ring today!

Knowledge Builds Confidence

Ability to understand basic terminology and navigate efficiently through a set of drawings:

1. reduces “drawings phobia”
2. lessens feelings of intimidation and lack of confidence
3. can significantly improve design review/coordination
4. allows you to perform your job better because you can **actively participate in conversations and ask informed/insightful questions**



Objectives

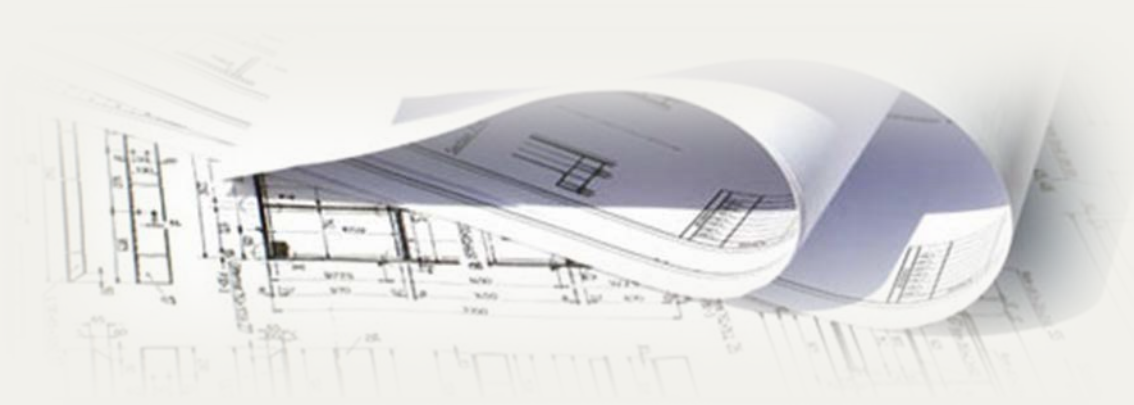
- Define approach/methodology
- Show tools and techniques
- Focus on **overall concepts** vs. implementing instructions to build something – **just the highlights**
- Present Case Studies
 - Typical Manufacturing Plant
 - Typical Rendering Plant



Note: Every format is different!

Outline

- Introduction to Reading Plans/Drawings (formal, to build something)
 - Concepts also apply to sketches/diagrams (less formal, to communicate)
- Focus on Source Control/Pollution Prevention
 - Best Management Practices (BMPs)
 - Industry-Related Examples
 - Case Studies



Introduction to Reading Plans/Drawings

Reading Plans - Overview

- Why Is It Important To Read Plans? (What's In It For Me?)
- Terminology
- Major Drawing Elements
- Getting Started
- **Practice, Practice, Practice!**



Why Is It Important To Read Plans?

What's In It For Me?

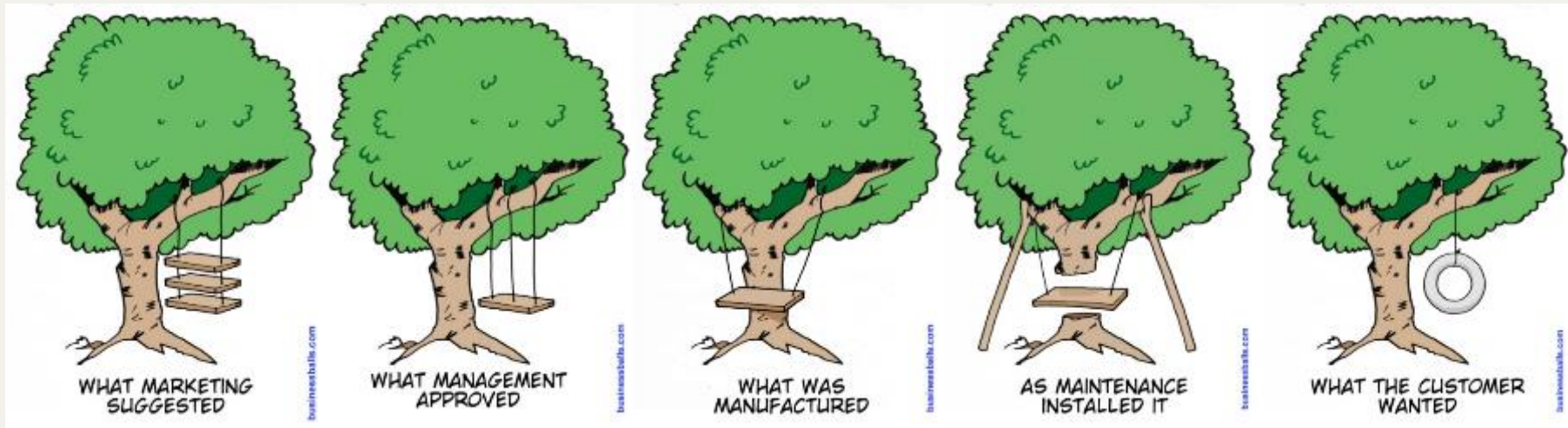
- **Review New/ Proposed Work**
 - Design Development
 - Regulatory Impacts/ Requirements
 - New/Modified Construction Impacts
 - Coordination
 - Is it clear/unambiguous?

- **Reference**
 - Research for new projects
 - Recordkeeping
 - Troubleshooting problems
- **Teaching**
 - Instruct Employees



Why Read Plans/Drawings?

- To **understand**/implement/construct **the ideas, thoughts, and designs of others.**
- *“A picture is worth a thousand words.”*



Acknowledgement: www.businessballs.com

Terminology - What is a Plan? Why is “Plan” synonymous with “Drawing”?

- Basic Definition of “Plan”
 - a scheme or method of acting, doing, proceeding, making, etc., developed in advance
 - a design or scheme of arrangement
 - a specific project or definite purpose
- **Engineering Drawings (a.k.a., blueprints) are drawings used to illustrate ideas/plans**



Terminology - Plan Set/Drawing Set

- The terms “plans,” “blueprints,” “drawings,” and “sheets” may all be used interchangeably in casual conversation.
- Here, we use “plans/blueprints/drawings” to refer to an entire *set of construction drawings*.
- An 11” x 17” reduced (half-size) set of drawings may look like a ledger.
- “Full-size” drawings, often rolled for storage, are typically ANSI D (22” x 34”).

Name	in × in
ANSI A	8½ × 11
ANSI B	17 × 11 11 × 17
ANSI C	17 × 22
ANSI D	22 × 34
ANSI E	34 × 44

ANSI = American National Standards Institute, a private non-profit organization that oversees the development of voluntary consensus standards for products, services, processes, systems, and personnel in the United States.



Terminology - Plans/Blueprints/Drawings

- A set of plans/blueprints/drawings is a *roadmap/guidebook* that:
 - describes how to complete a project; or
 - is a record of how a project was constructed



What Do Plans/Blueprints/Drawings Look Like?

Typical Cover/Title Sheet - Sample

**NEW COMMERCIAL CAR WASH FACILITY FOR
JUPITER INLET CAR WASH
1441 NORTH ALTERNATE A1A, JUPITER, FLORIDA**

LOCATION MAP

SHEET INDEX

T1.0	TITLE SHEET AND GENERAL NOTES	80.0	BUILDING SECTION 1
T1.1	TRUCK SURVEY	80.1	BUILDING SECTION 2
L1.0	LANDSCAPE PLAN	80.2	TOWER SECTION
L1.1	IRRIGATION PLAN	80.3	TYPICAL WALL SECTIONS 1
A1.0	SITE PLAN	80.4	TYPICAL WALL SECTIONS 2
A1.1	SITE DETAILS	80.5	TYPICAL WALL SECTIONS 3
A1.2	GRASSY ENCLOSURE	80.6	STRUCTURAL DETAILS AND NOTES
A1.3	MONUMENT AND DIRECTIONAL SIGN	80.7	WELDING SCHEDULE AND CONNECTIONS
A1.4	FLOOR PLAN	80.8	MECHANICAL ROOF PLAN
A1.5	SCHEDULES AND NOTES	80.9	ST. LIGHTING PLAN
A1.6	MECHANICAL ROOMS PLANS	80.10	SITE PRELIMINARY PLAN
A1.7	AVULSED CURB PLAN	80.11	MECHANICAL ROOF PLAN
A1.8	ROOF PLAN	80.12	EQUIPMENT LIFT & DETAILS
A1.9	EXTERIOR ELEVATIONS	80.13	ELECTRICAL LAMPING PLAN
A1.10	EXTERIOR ELEVATIONS	80.14	ELECTRICAL PANELS, RACKS AND BRACKETS
S1.0	GENERAL STRUCTURAL NOTES	80.15	MECHANICAL, DETAILS, NOTES AND SPECS
S1.1	FOUNDATION PLAN	80.16	MECHANICAL PLAN
S1.2	CONCRETE & STEEL TRENCH PLAN	80.17	MECHANICAL PLAN
S1.3	CONCRETE & STEEL TRENCH PLAN	80.18	PLUMBING PLAN
S1.4	LOWER STRUCTURAL BEAM PLAN	80.19	CAR WASH PLUMBING NOTES
S1.5	UPPER STRUCTURAL BEAM PLAN	80.20	PLUMBING RISERS AND SPICES
S1.6	ROOF TRUSS PLAN	80.21	PLUMBING DETAILS AND SPECS

DESIGN TEAM

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GENERAL NOTES:

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS AND APPROVALS FROM THE APPROPRIATE AGENCIES.
2. THE CONTRACTOR SHALL MAINTAIN ACCESS TO ALL ADJACENT PROPERTIES AND UTILITIES AT ALL TIMES.
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING ALL EXISTING UTILITIES AND STRUCTURES.
4. THE CONTRACTOR SHALL MAINTAIN ADEQUATE DRAINAGE AND EROSION CONTROL MEASURES.
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS AND APPROVALS FROM THE APPROPRIATE AGENCIES.

OWNER / APPLICANT

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JRD
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E-MAIL: JRD@JRDARCHITECT.COM

New Commercial Car Wash Facility for
JUPITER INLET CAR WASH
1441 North Alternate A1A
Jupiter
Florida

TITLE SHEET

T1.0

Pricing may be based on a fixed "cost per sheet"

How are Drawings Organized?

Drawing Sheets may be organized by:

1. Discipline/Professional Work Area

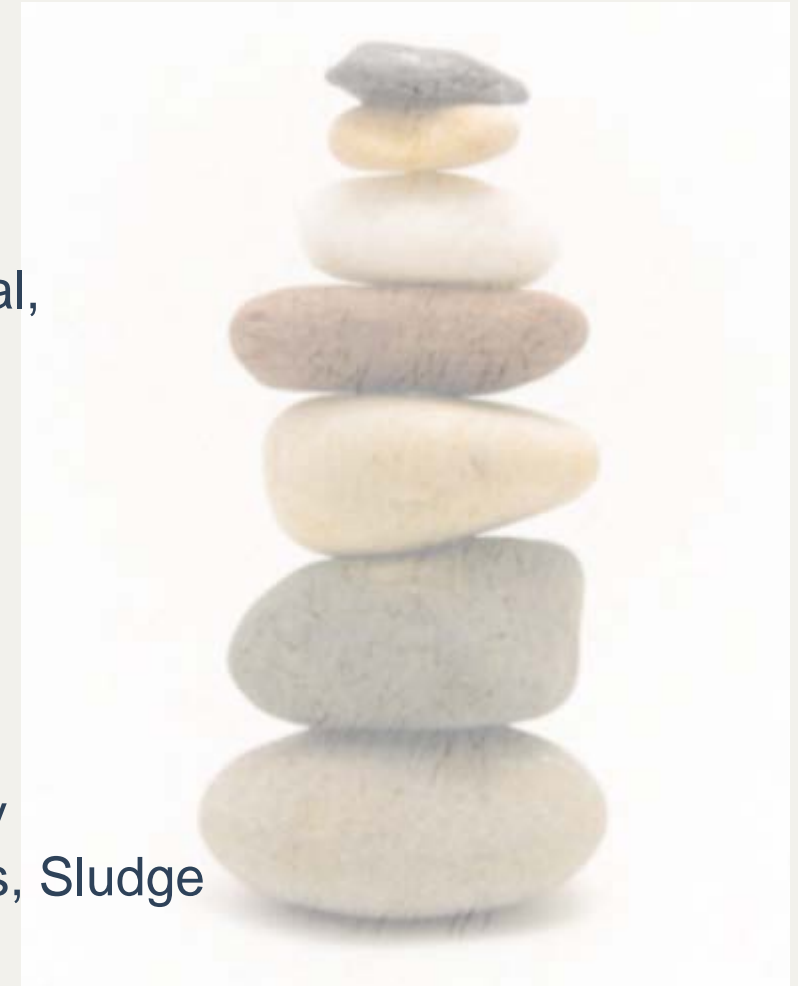
For example,

- General, Civil, Plumbing/Mechanical, Structural, Architectural, Electrical, Instrumentation, etc.
- Other disciplines may include: Landscape Architecture, Traffic, Cathodic Protection

2. Structure, Location, or Treatment Process

For example,

- Campus building numbers
- Treatment Process Area: Headworks, Primary Clarifiers, Aeration Tanks, Secondary Clarifiers, Sludge Dewatering, etc.



Terminology – Plan/Drawing Elements

- Engineering Drawing
 - Drawn by one having engineering knowledge for the purposes of the drawing
- Here, we use “plan/drawing” to refer to an individual sheet of paper with engineering information on it
- May contain one or more of the following elements:
 - Illustration/graphical representation
 - Text
 - Plan views
 - Section views
 - Details
 - Legends/Symbols, Notes, and Abbreviations
 - Schedules/Equipment Lists
 - Materials List



Plan/Drawing Elements – Plan View



Pump Station – Viewed from above

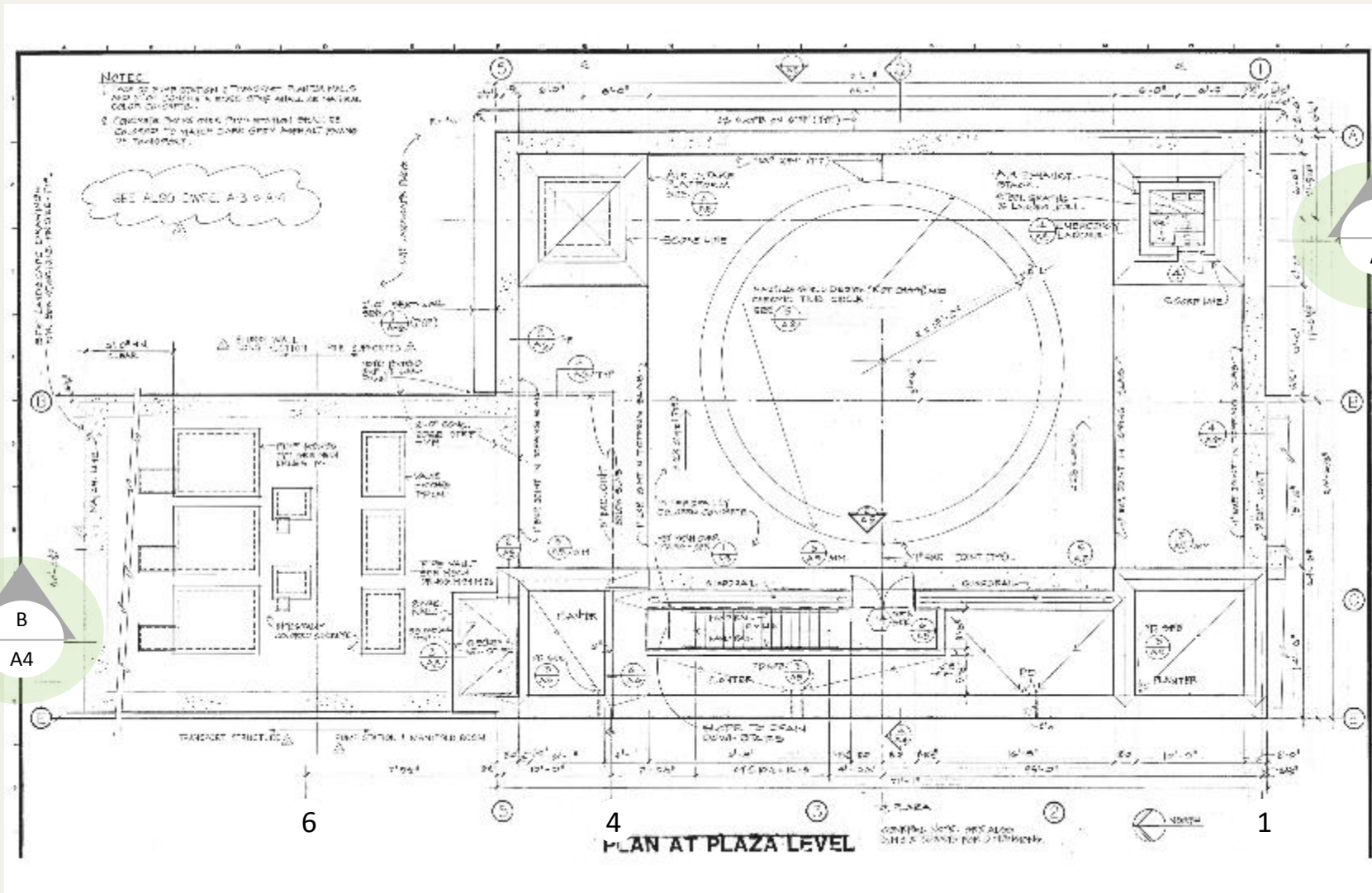


Analogy =
street map/
aerial view

- May contain one or more of the following:
 - Illustration/graphical representation
 - Text
 - **Plan views – views from above, looking down; “a bird’s eye view”**
 - Section views
 - Details
 - Legends/Symbols, Notes, and Abbreviations
 - Schedules/Equipment Lists
 - Materials List



Plan/Drawing Elements – Plan View



You've probably read
simple plans before but
may not have realized it.



Name a simple plan that you've likely encountered before.

CHAT QUESTION

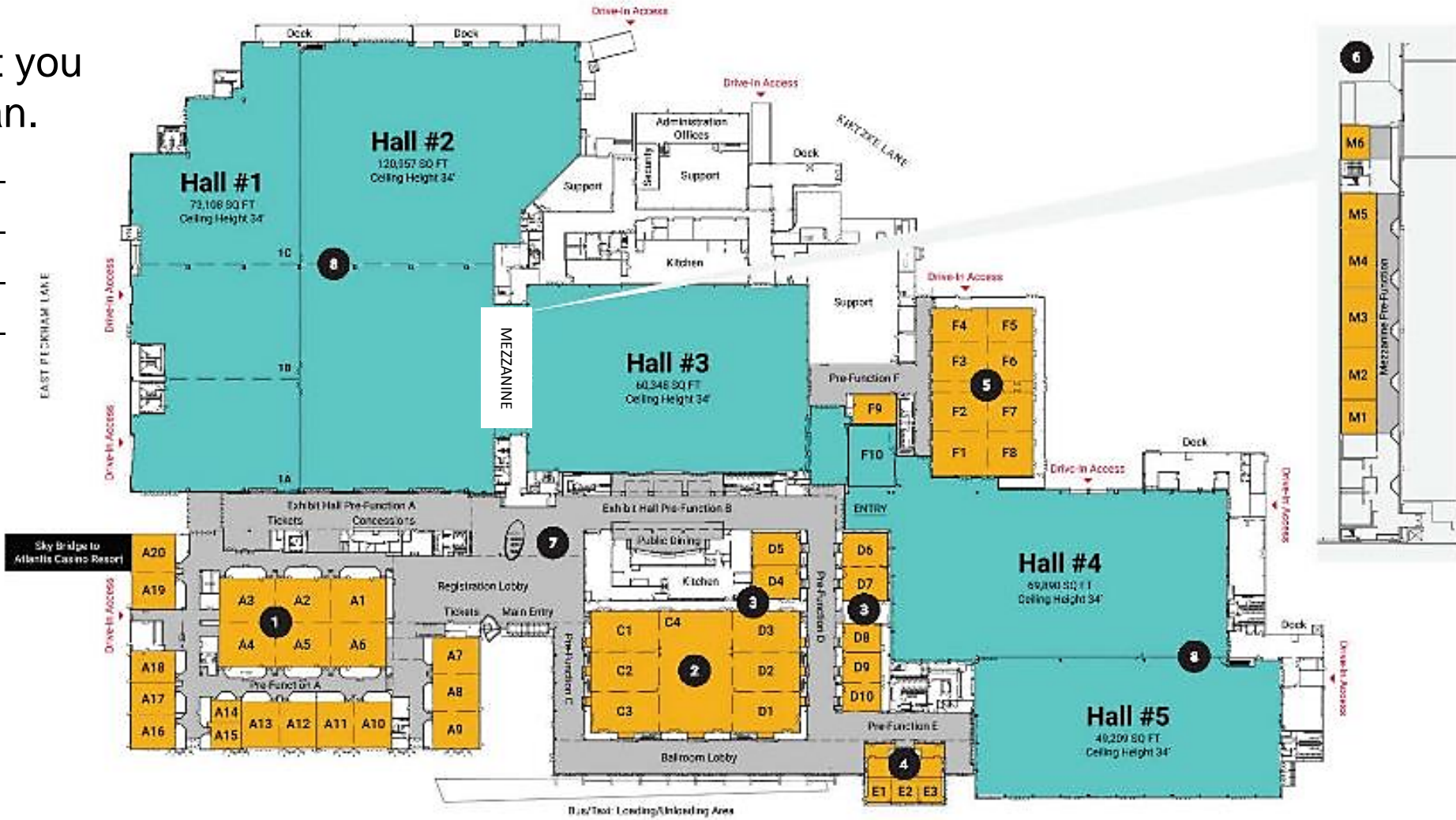
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Reno/Sparks Convention Center Floor Plan

- Group Exercise 1

Use "Chat" to share what you notice about this floor plan.

- _____
- _____
- _____
- _____

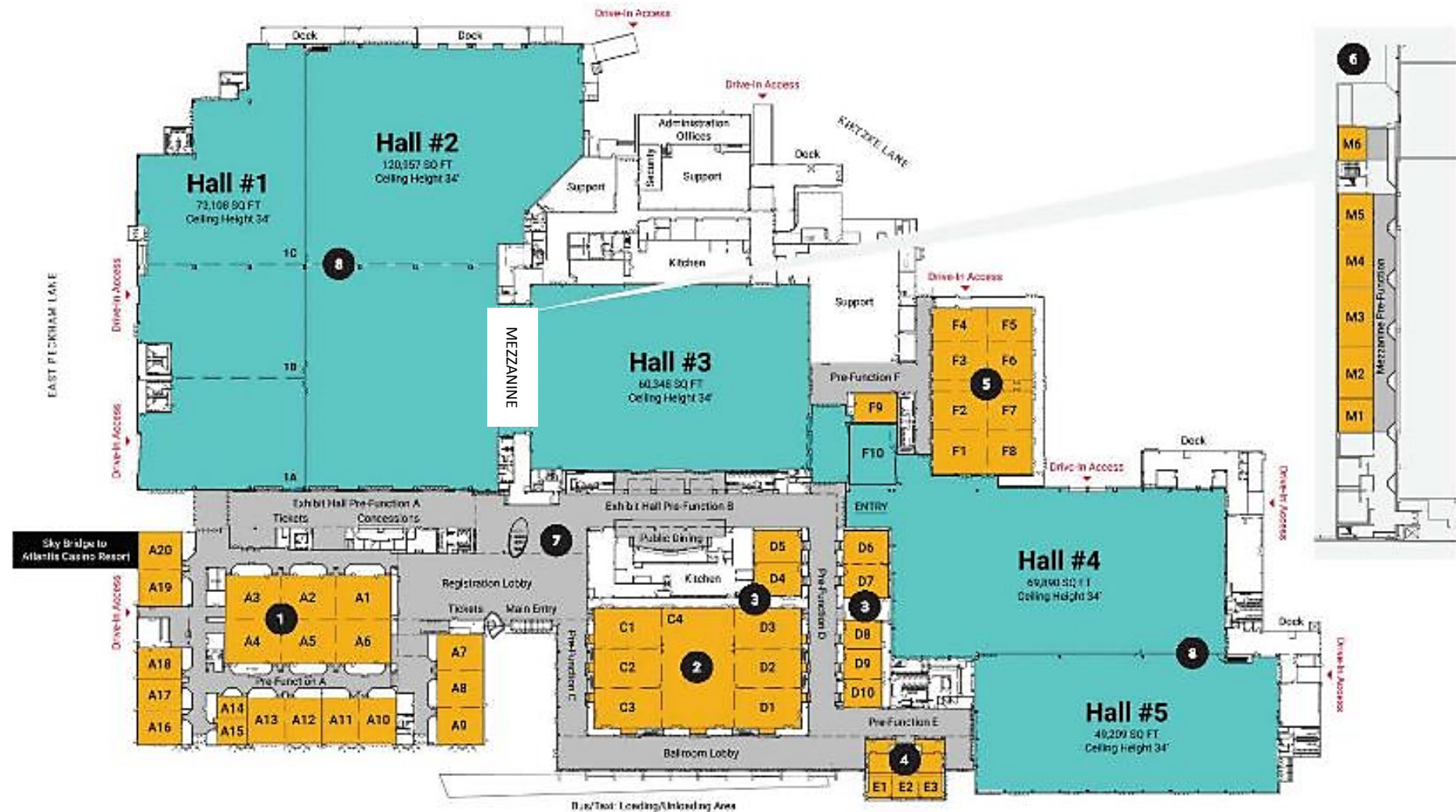


Reno/Sparks Convention Center Floor Plan

- Group Exercise 1

What do I notice about this floor plan?

- Different colors – teal, orange, grey
- Numbered black circles
- “Exploded View” for Mezzanine
- Space descriptions/names for “Halls”
- Callout text (e.g., Drive-In Access)

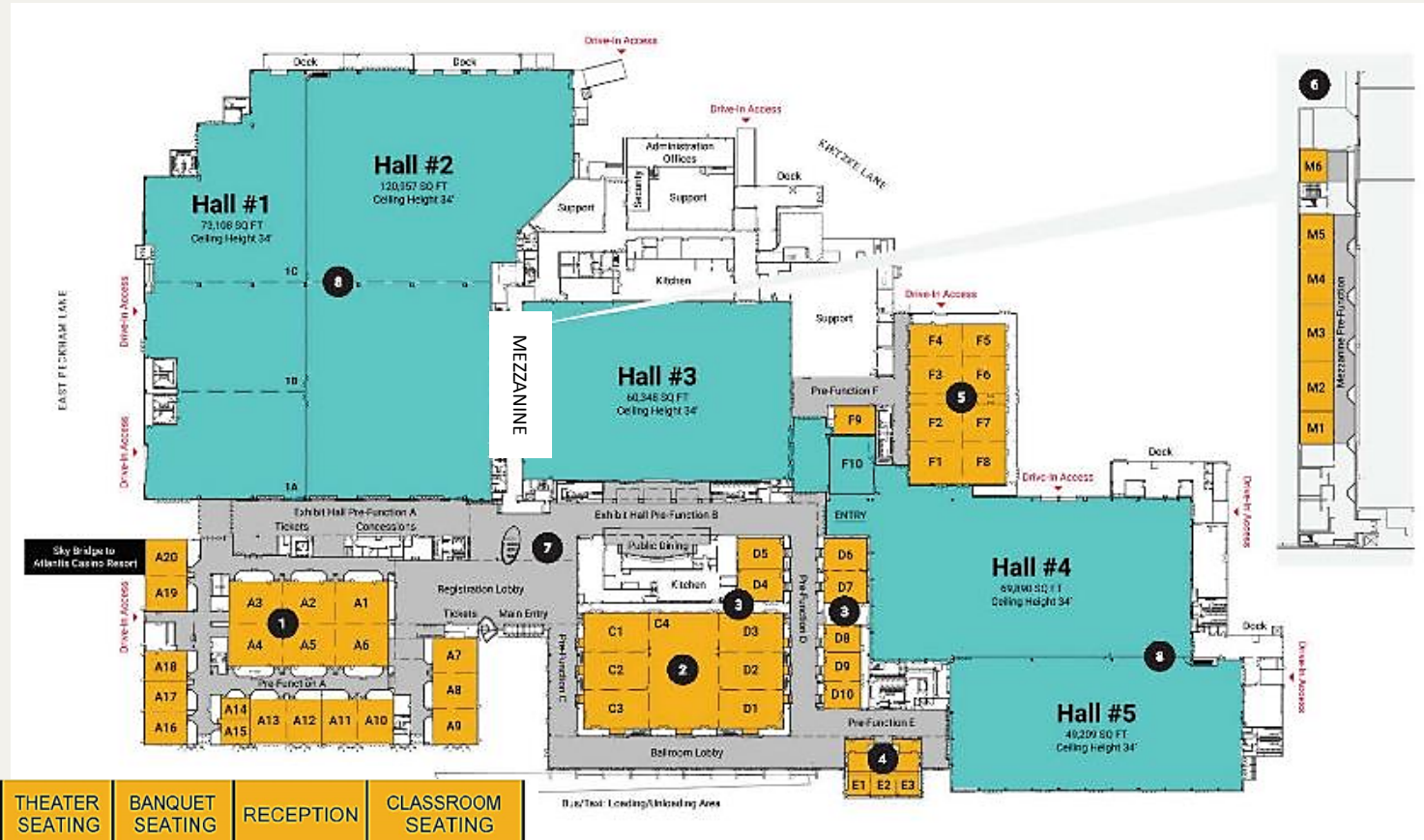


Reno/Sparks Convention Center Floor Plan

- Group Exercise 1

Thought Exercise...Consider:

- How many meeting spaces are available in the Mezzanine?
- How many Halls are there?
- Where are “Drive-in Access” locations? How are they identified?

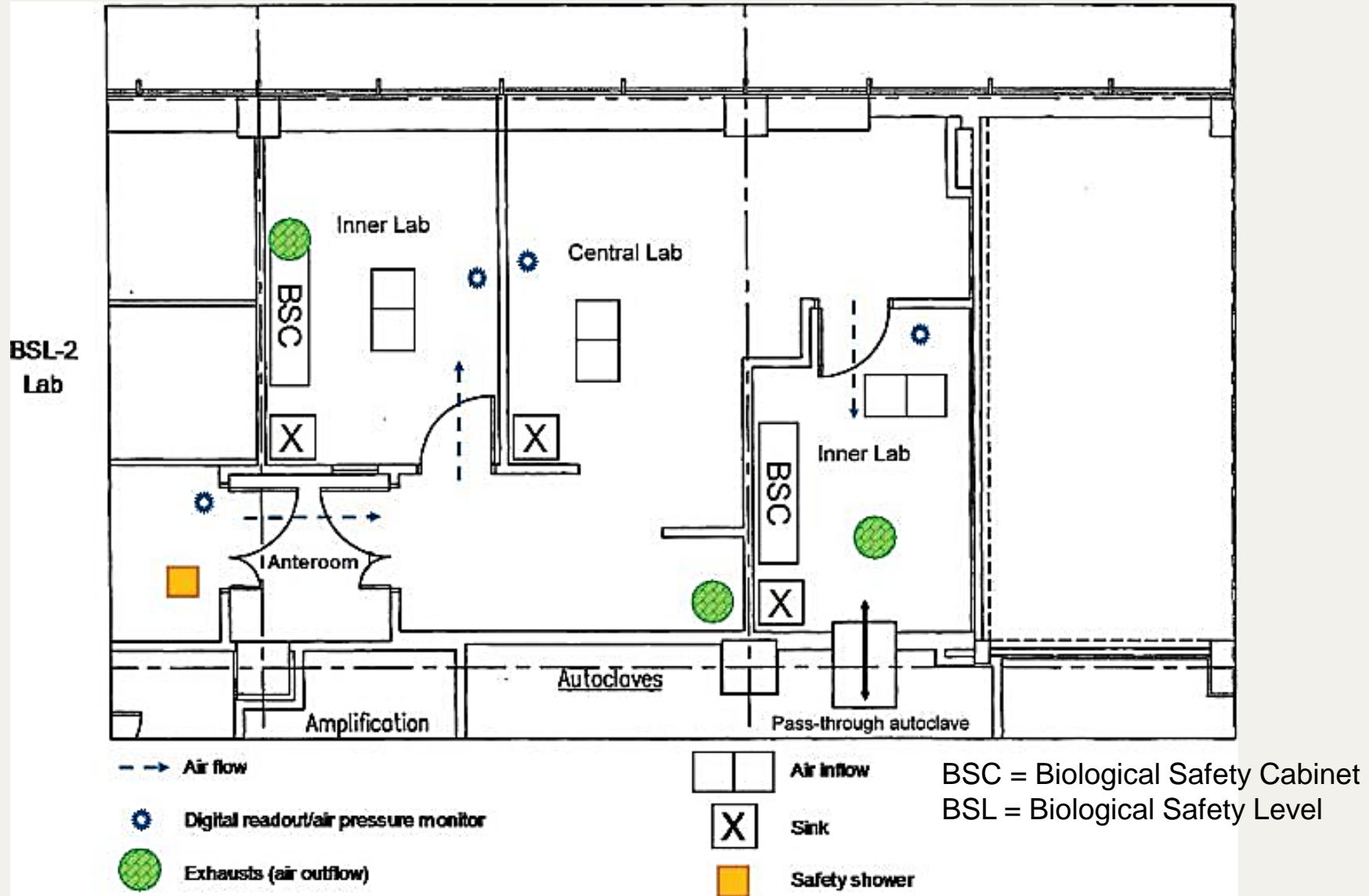


6

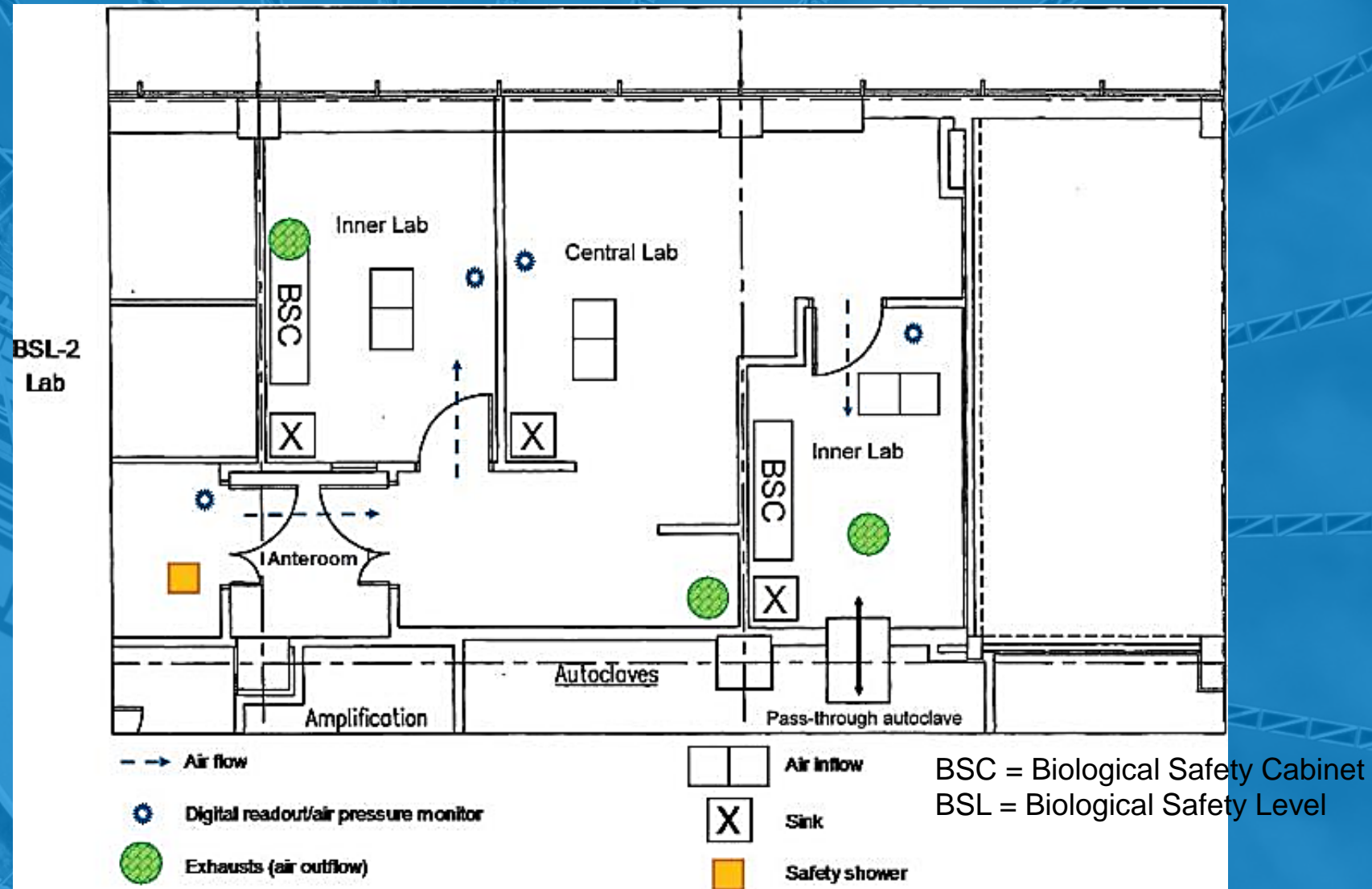
MEZZ	SQUARE FEET	DIMENSIONS	CEILING HEIGHT	THEATER SEATING	BANQUET SEATING	RECEPTION	CLASSROOM SEATING
M1*	569	17' x 20'	9'	24	16	48	16
M2	603	31' x 20'	9'	48	24	88	32
M3	603	29.5' x 20'	9'	48	24	84	32
M4	603	29.5' x 20'	9'	48	24	84	32
M5	440	20' x 20'	9'	24	16	56	16
M6	564	28' x 19'	9'	48	24	75	32
MEETING ROOMS / TOTAL SQ FT: 109,836							

* Room M1 also includes a permanent wet bar area of 220 sq. ft.

Laboratory Floor Plan – Group Exercise 2



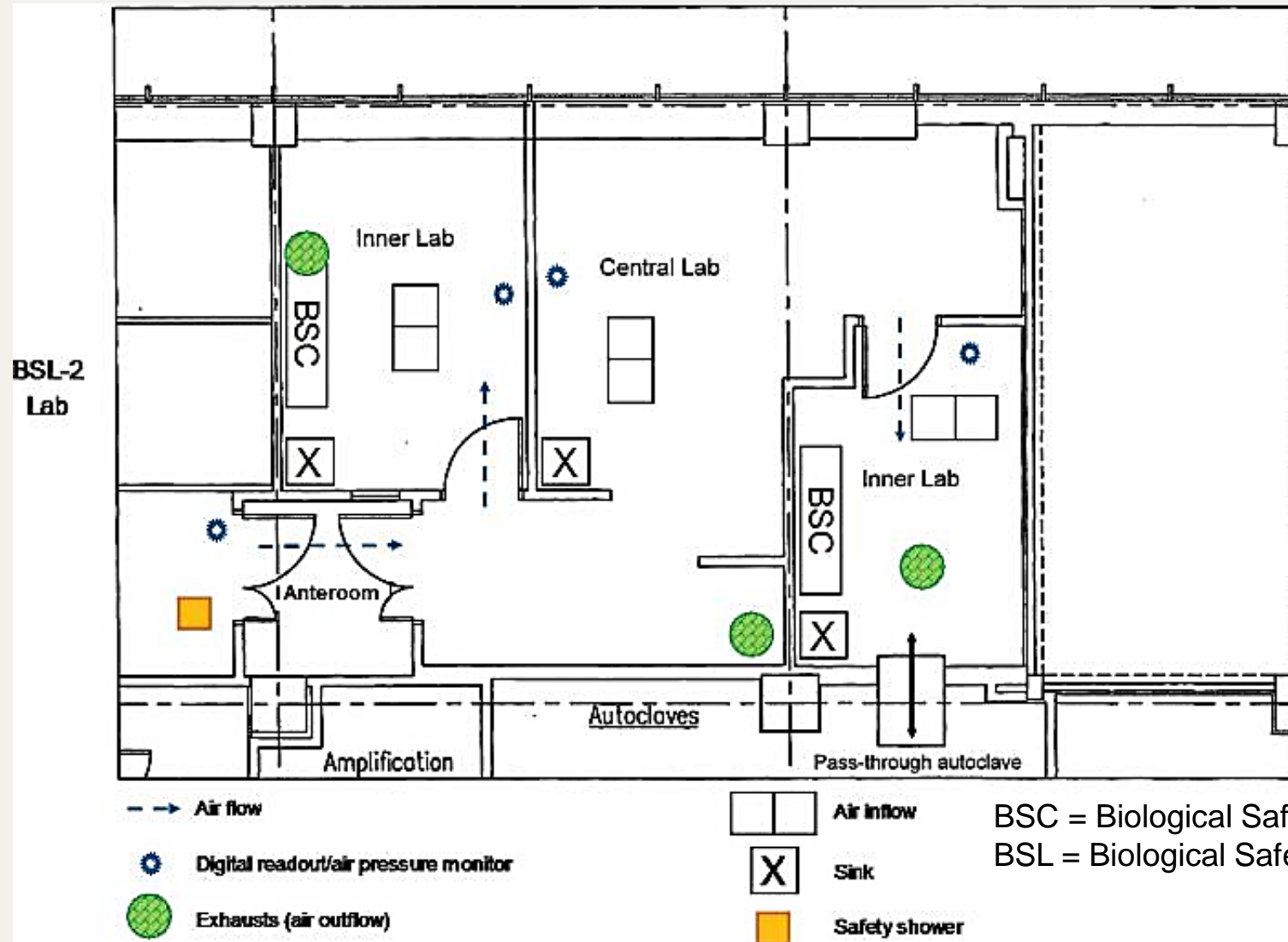
How is a Biological Safety Cabinet represented on the floor plan?



CHAT QUESTION

Reference: <https://cmr.asm.org/content/cmr/31/3/e00062-17/F6.large.jpg>

Laboratory Floor Plan – Group Exercise 2



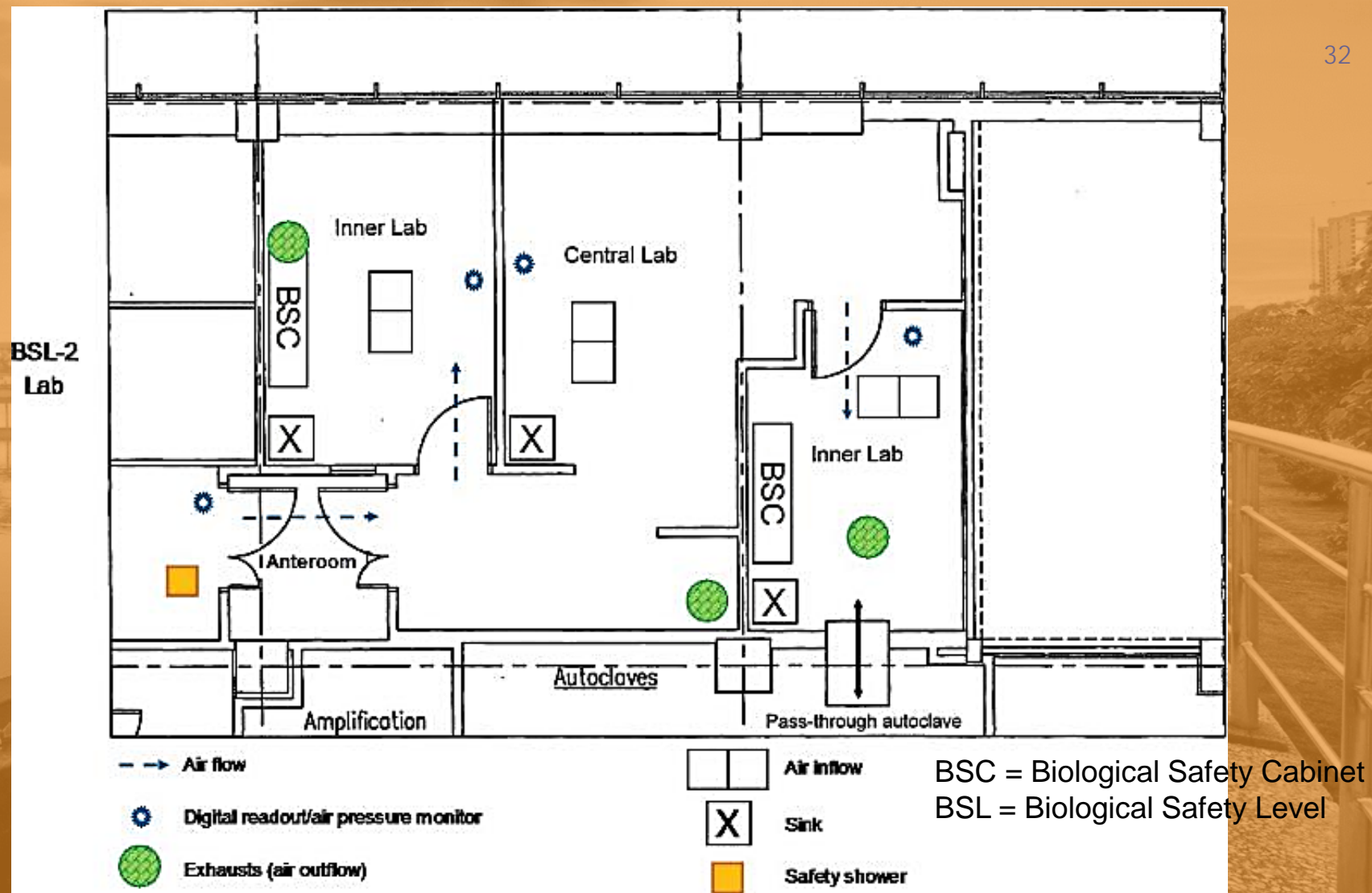
Let's use polls to see how folks answer the following questions:

1. List the number of air pressure monitors installed. _____
2. Where is the safety shower located?

3. How many Biological Safety Cabinets are provided? _____

How many air pressure monitors are installed?

- a) 2
- b) 4
- c) 1
- d) 3

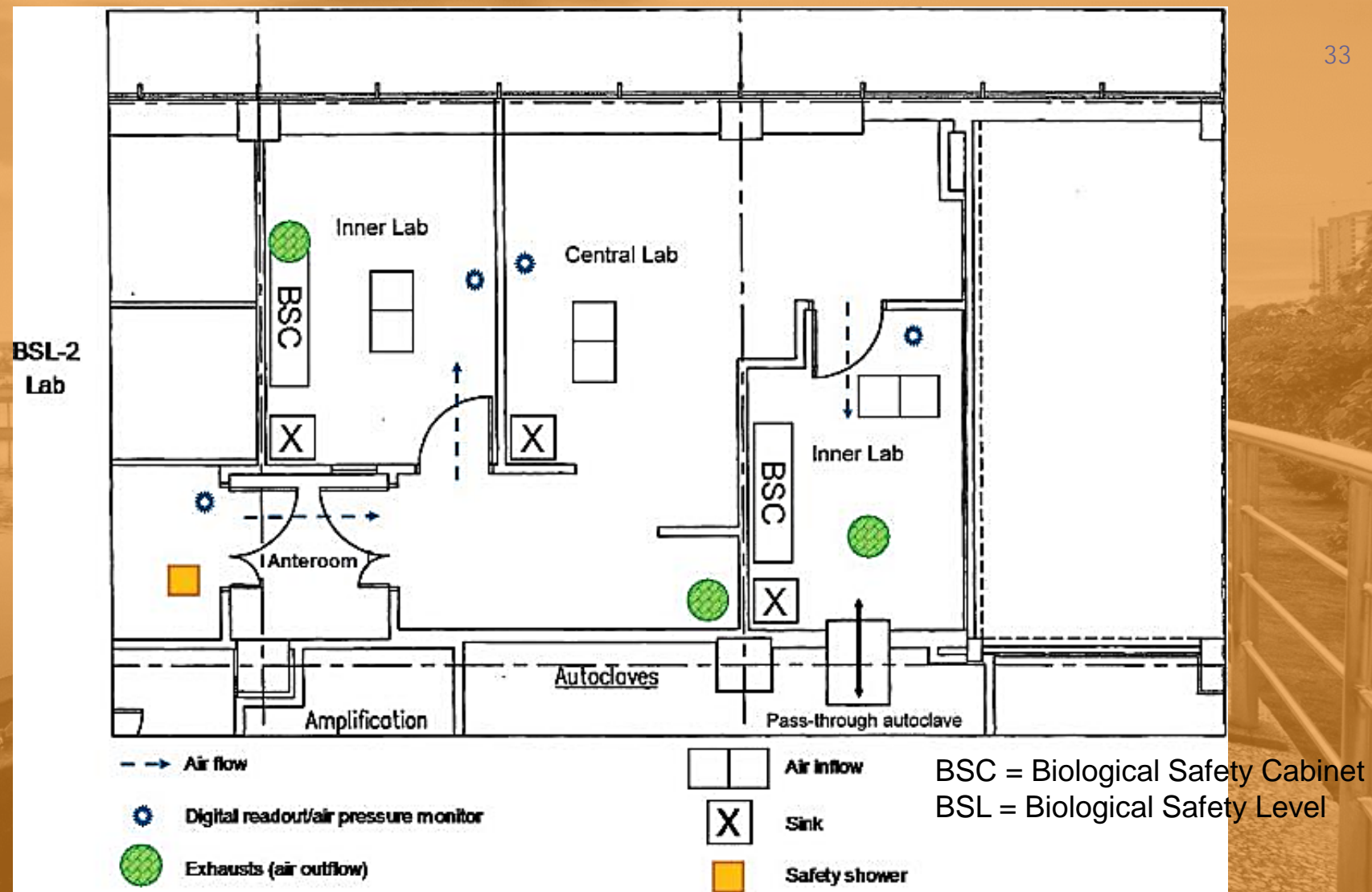


POLL QUESTION

Reference: <https://cmr.asm.org/content/cmr/31/3/e00062-17/F6.large.jpg>

Where is the safety shower located?

- a) Central Lab
- b) Right-most Inner Lab
- c) Left of Anteroom
- d) No safety shower provided

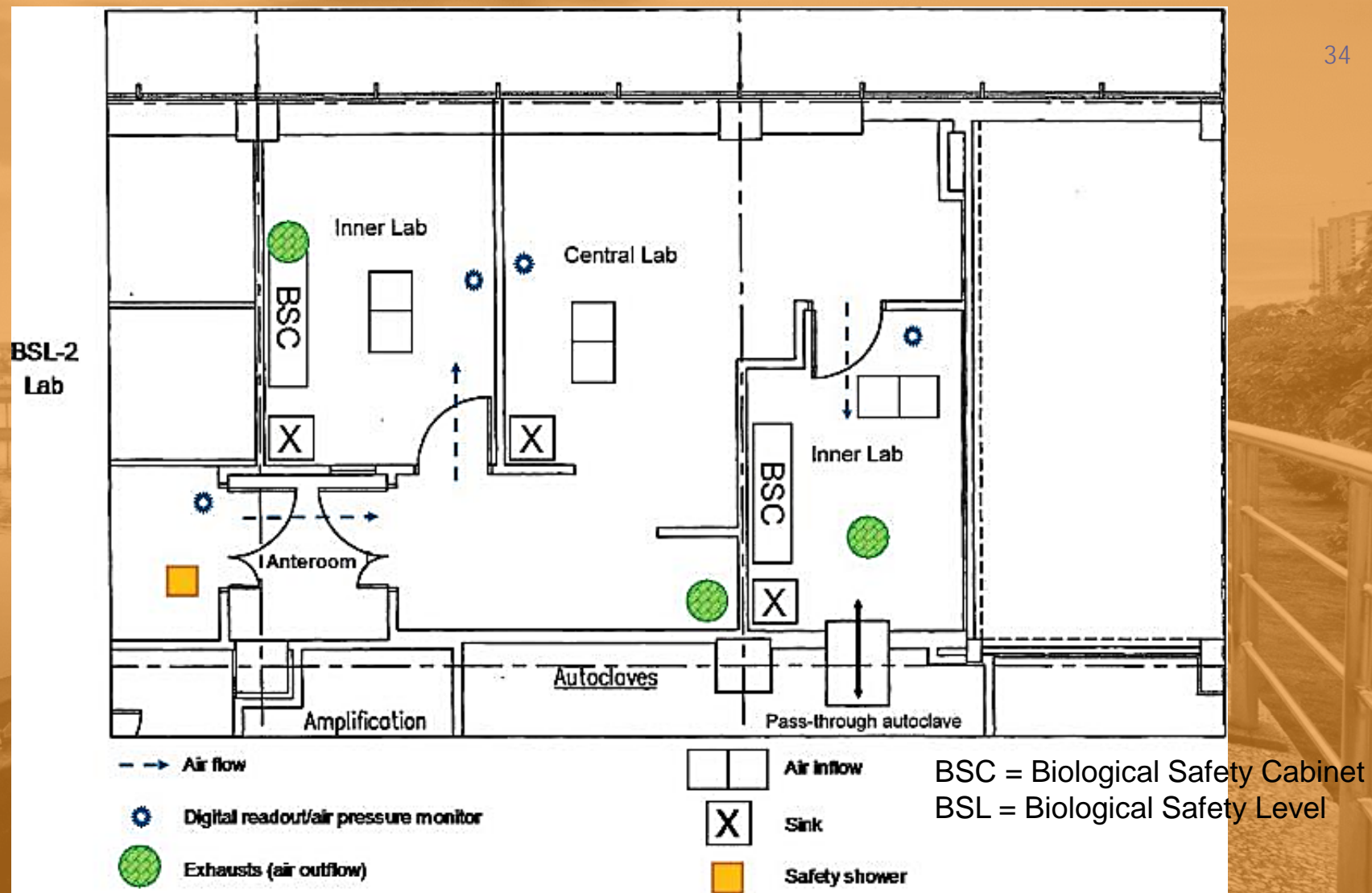


POLL QUESTION

Reference: <https://cmr.asm.org/content/cmr/31/3/e00062-17/F6.large.jpg>

How many Biological Safety Cabinets are provided?

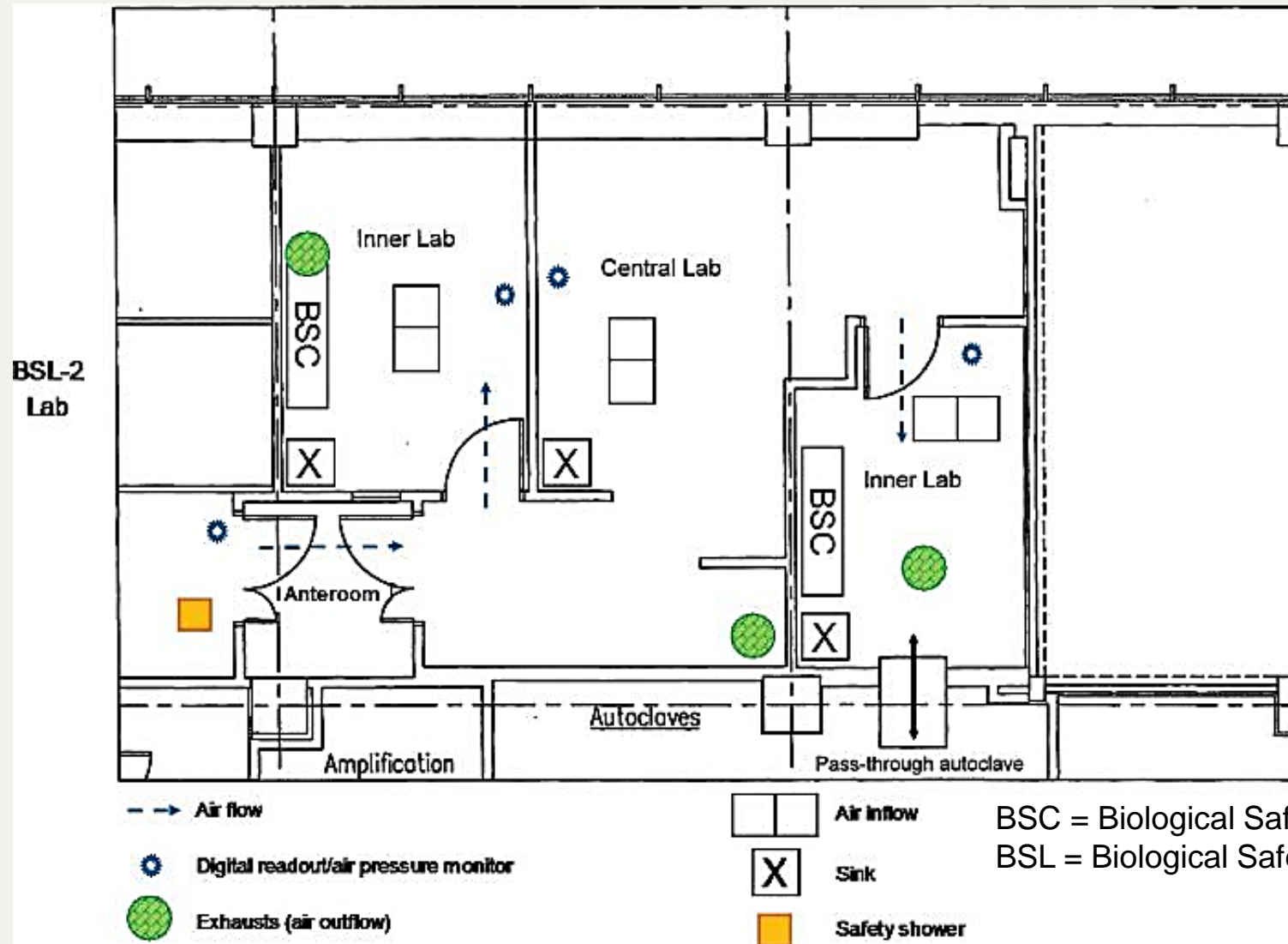
- a) 3
- b) 0
- c) 1
- d) 2



POLL QUESTION

Reference: <https://cmr.asm.org/content/cm/31/3/e00062-17/F6.large.jpg>

Laboratory Floor Plan – Answers



- List the number of air pressure monitors installed. 4
- Where is the safety shower located? left of Anteroom
- How many Biological Safety Cabinets are provided? 2

Terminology – Plan/Drawing Elements

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 - **Section views**
 - Details
 - Legends/Symbols, Notes, and Abbreviations
 - Schedules/Equipment Lists
 - Materials List



Plan/Drawing Elements – Section View



Pump Station – Viewed from the side

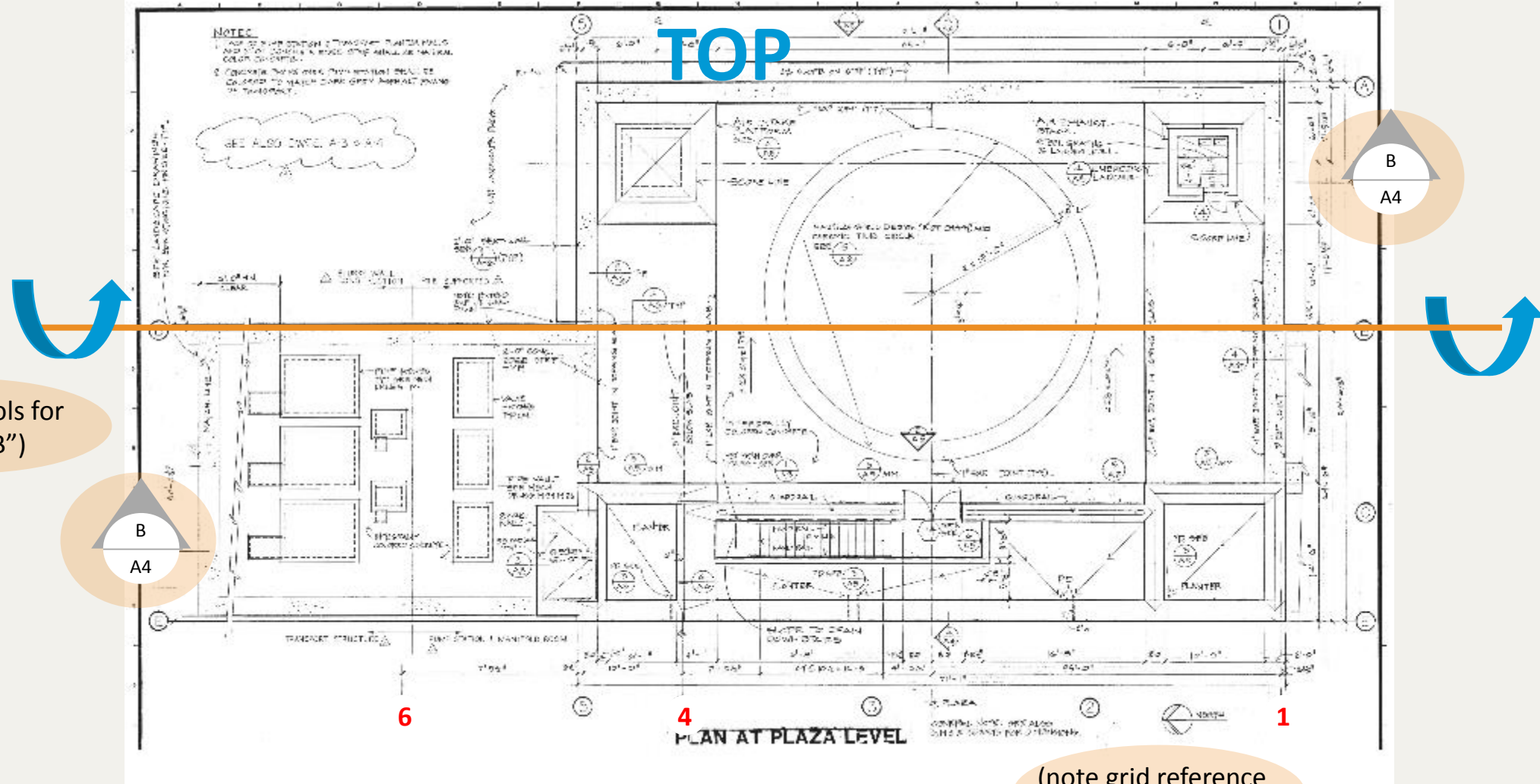


Analogy =
street view

- May contain one or more of the following:
 - Illustration/graphical representation
 - Text
 - Plan views
 - **Section views – views from the side (i.e., profile)**
 - Details
 - Legends/Symbols, Notes, and Abbreviations
 - Schedules/Equipment Lists
 - Materials List



Note Plan View with Symbols for Section B-B; Orient yourself so that arrowheads point toward top edge of paper, then imagine rotating paper about the center axis, with top edge of paper moving in the direction of arrowheads until paper is parallel to the floor.

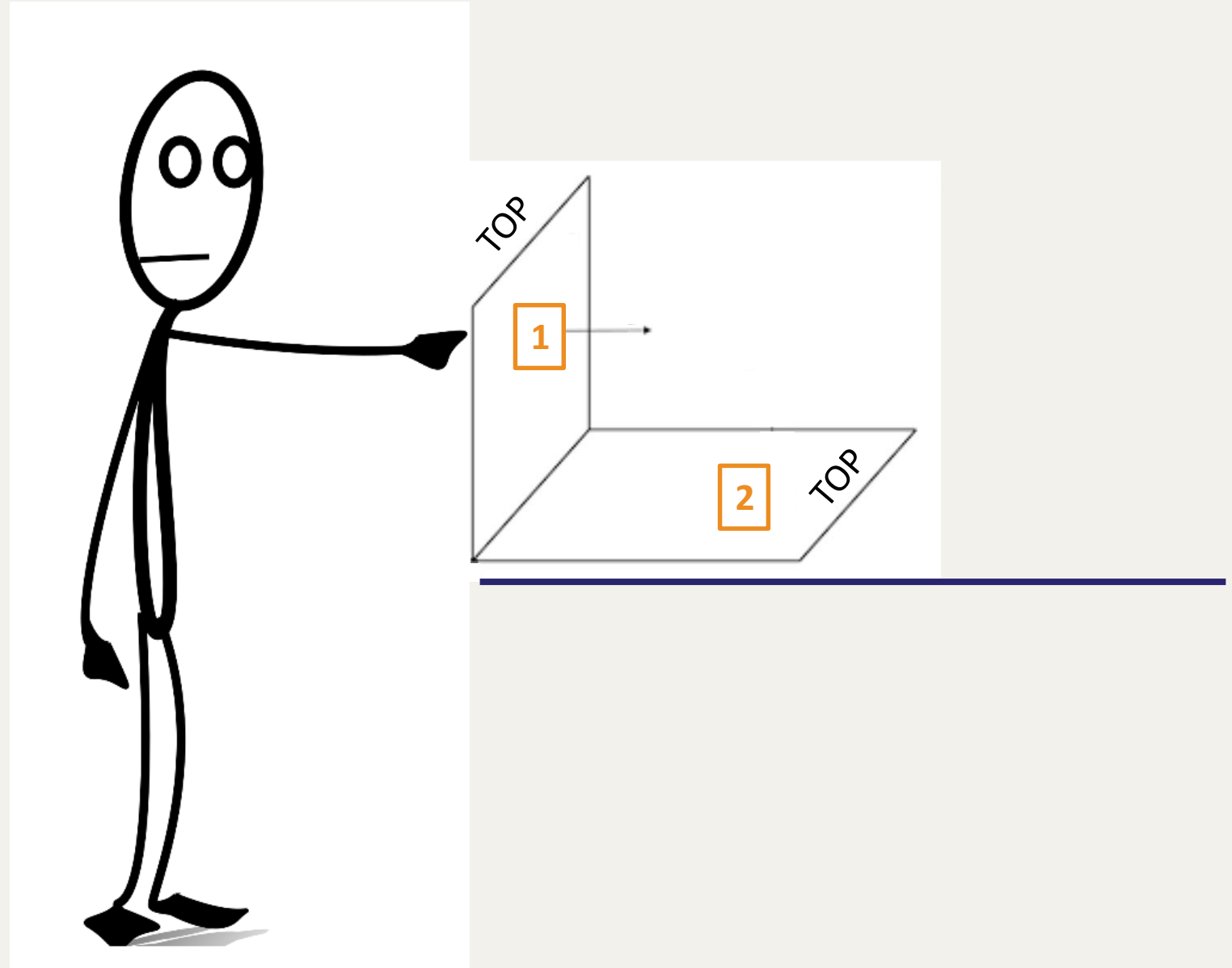


(note symbols for
"Section B-B")

(note grid reference
numbers in red type)

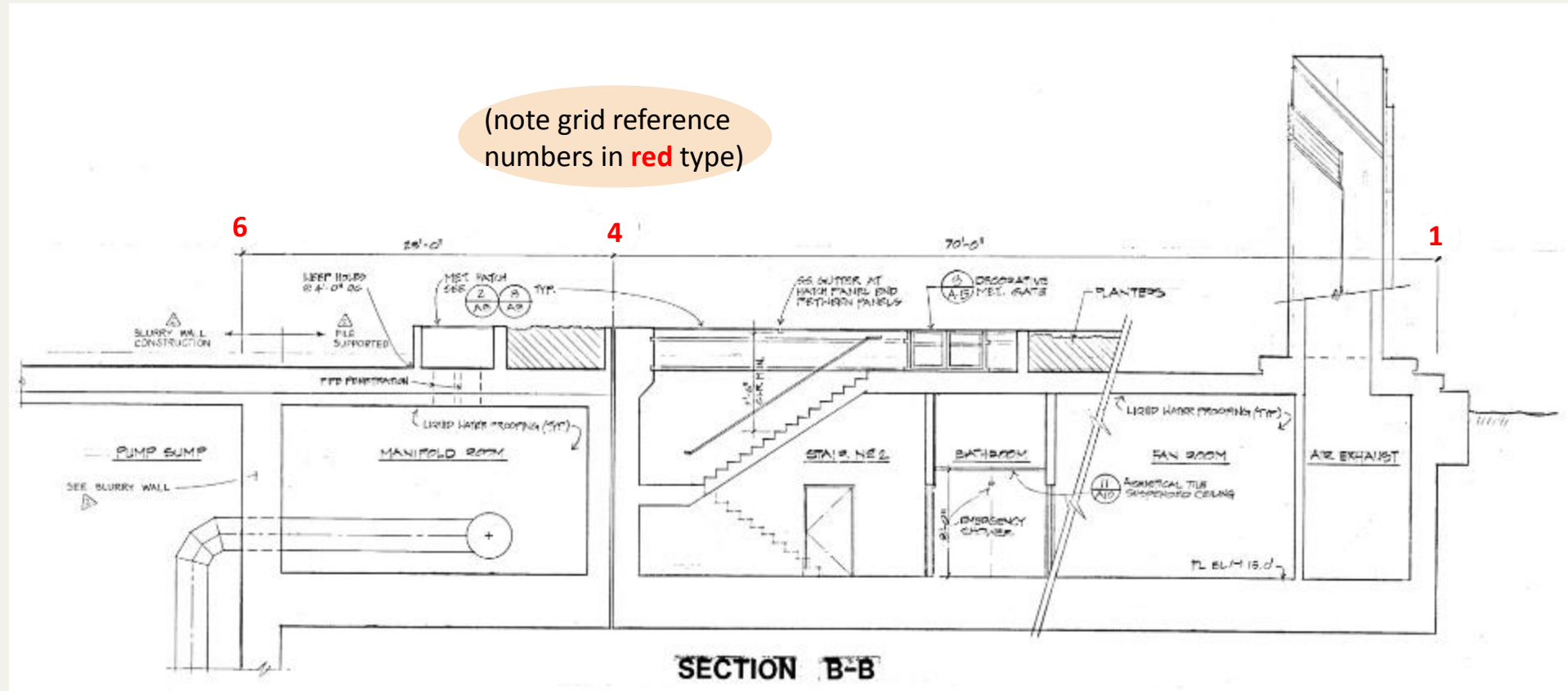
"Plan View" Drawing

See the illustration: orient yourself so that arrowheads point toward top edge of paper, then imagine rotating paper about the center axis, with top edge of paper moving in the direction of arrowheads until paper is parallel to the floor.



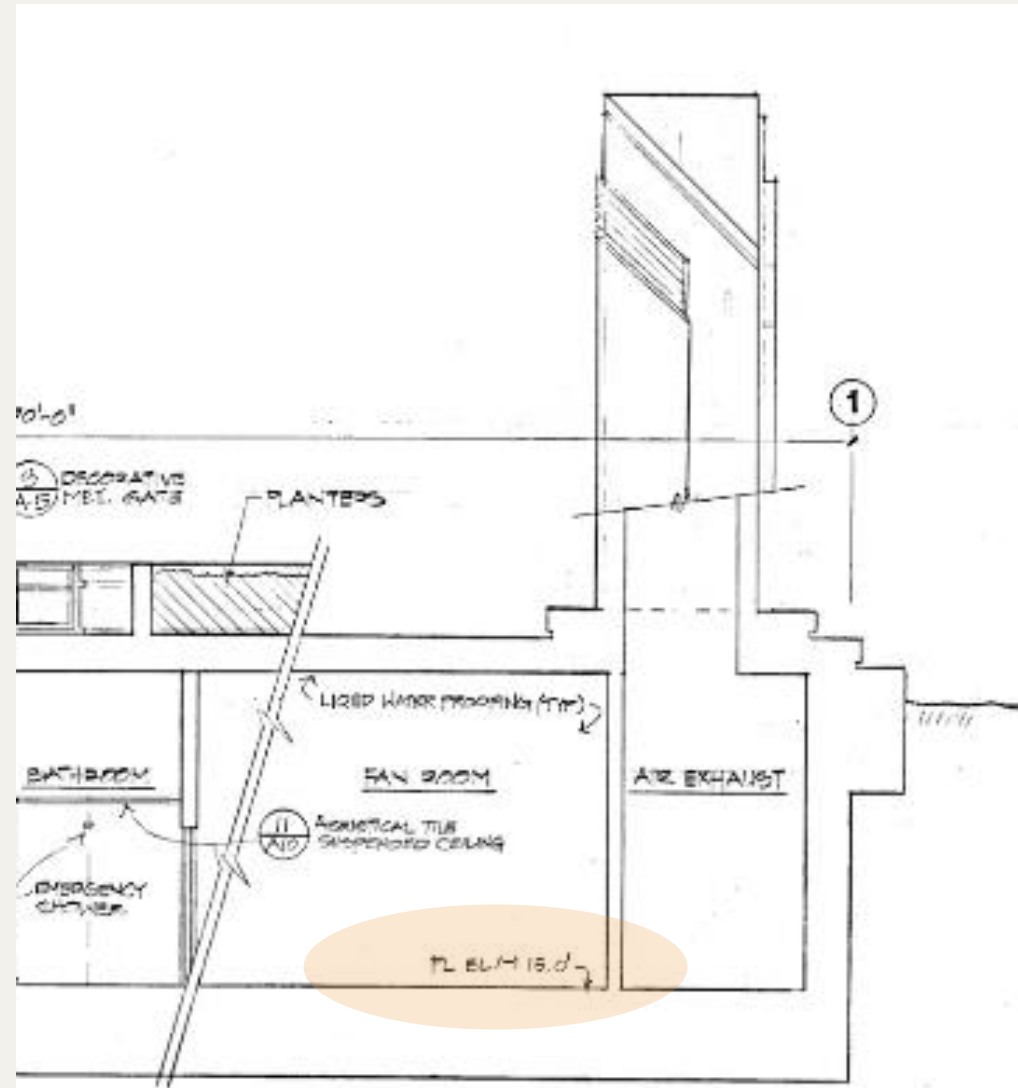
Plan/Drawing Elements – Section View

View expected after rotating paper:



Note callout: FL EL (-)15.0'

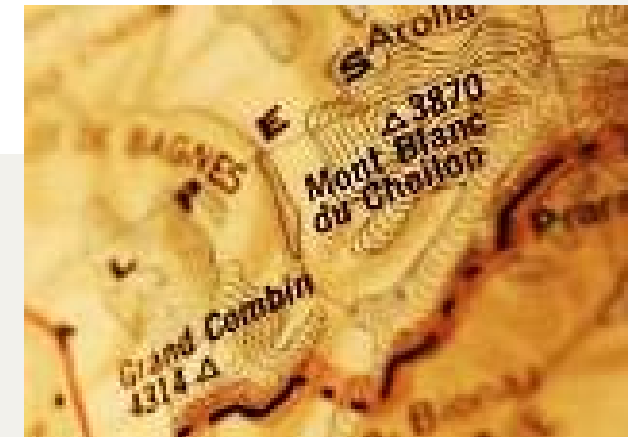
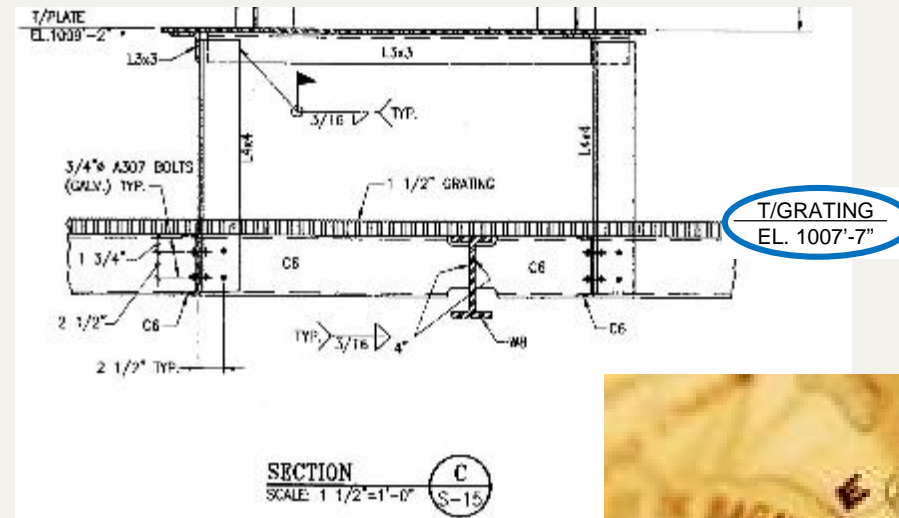
Elevation measurements are relative to a specified datum



Elevation Measurements and Datum

- A **geodetic datum** (plural *datums*, not *data*) is a reference from which measurements are made. Typically, such reference points are established by a Land Surveyor.
- Vertical datums are used to measure elevations or depths. Example: elevation at a mountain summit.
- In engineering and drafting, a **datum is a reference point**, surface, or axis on an object against which measurements are made.
- *In the wastewater industry, datums are often related to a mean (i.e., average) seawater level.*

- **EXAMPLE:** the project datum is “City datum + 1000 ft.”; therefore, the top of the grating is shown to be 7’-7” above City datum.



Equipment Cut Sheet – Group Exercise

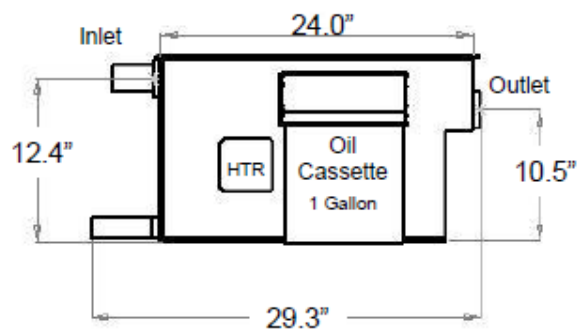
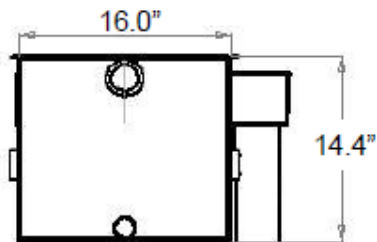
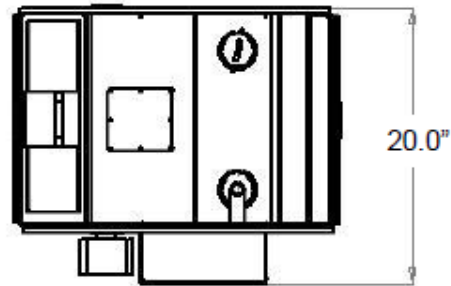
goslyn™ MODEL GOS40 10 GPM (US) Grease Recovery Device



The innovative (patented) goslyn™ is an immiscible liquid separator which operates under hydro-static pressure. The goslyn™ does not require any moving parts. It continuously and permanently removes the Fat, Oil, and Grease (FOG) from waste water. Drains and pipes remain grease free forever.

Grease Trap Pumping is eliminated.

No Consumables. No Chemicals



GOS40 Features:

GOS40 Features:

- HEAVY DUTY 2.5 MM 304 Stainless Steel EXTERIOR CONSTRUCTION
- NEOPRENE SEALS FOR BASE
- FIXED RATE FLOW RESTRICTOR INCLUDED (10US GPM - 37.85 Litres)
- IMMERSION HEATER (UL LISTED) TO KEEP EFFLUENT WARM DURING IDLE PERIODS
- SELF-CLOSING DRAIN VALVE INCLUDED
- STRAINER BASKET TO PREVENT SOLID DEBRIS FROM ENTERING DRAIN PIPES
- EASY ACCESS HINGED LID COMPARTMENTS
- TWO OIL COLLECTION CASSETTES INCLUDED (1 spare)
- NSF CERTIFIED TO ASME A112.14.3 and ASME A112.14.4

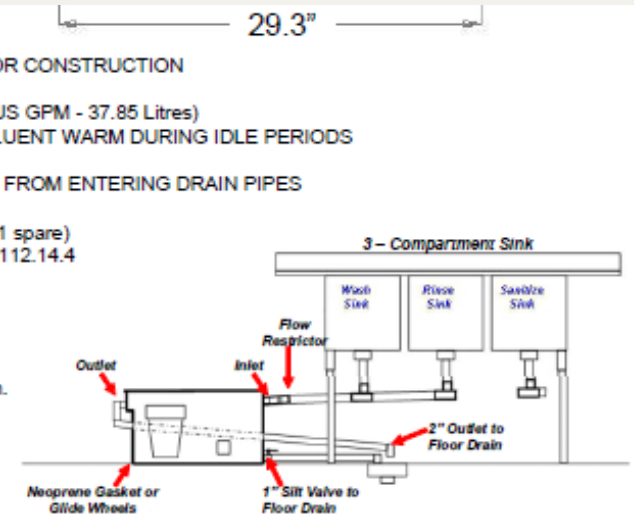
Installation Requirements

Electrical:

110 Volt, 1000 watts, 9 Amps - within 5 feet of Goslyn.

Physical:

- Headroom needed above strainer basket: 12"
- 2" drain pipe to outlet
- Access to front Oil Cassette
- Access to hinged lid for Oil Valve




CSA B481.1 Certified



<http://www.greasetrap.ca/pdfs/GOS40-CUT-SHEET.pdf>

Equipment Cut Sheet – Plan & Section

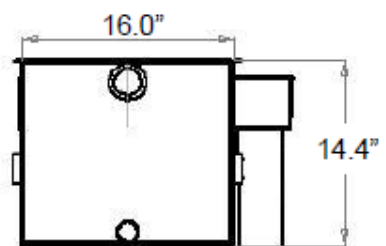
goslyn™ MODEL GOS40
10 GPM (US)
Grease Recovery Device



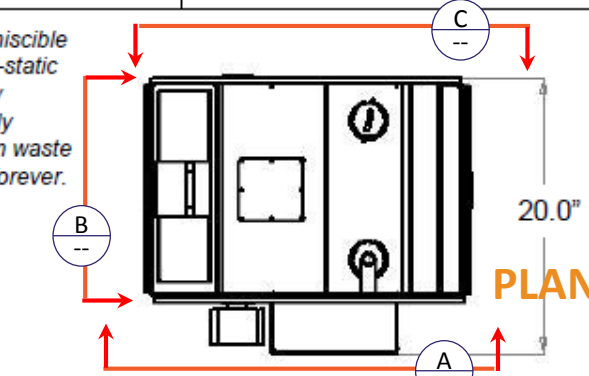
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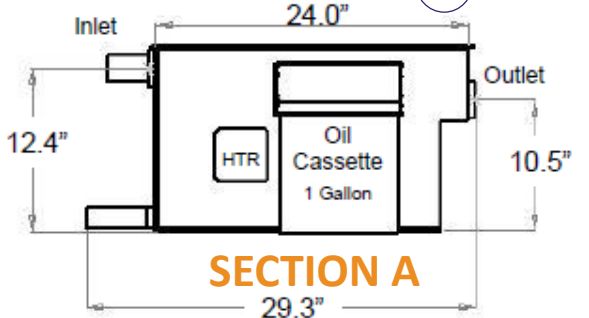
No Consumables. No Chemicals



SECTION B



PLAN



SECTION A

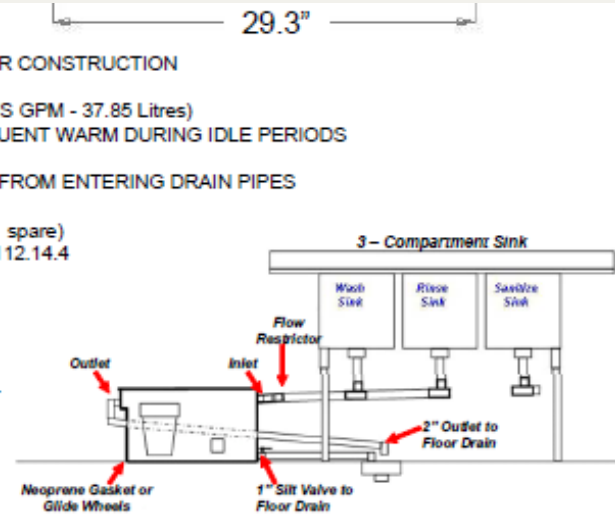
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- NSF CERTIFIED TO ASME A112.14.3 and ASME A112.14.4


Installation Requirements

Electrical:
110 Volt, 1000 watts, 9 Amps - within 5 feet of Goslyn.


Physical:
Headroom needed above strainer basket: 12"
2" drain pipe to outlet
Access to front Oil Cassette
Access to hinged lid for Oil Valve



SECTION C



CSA B481.1 Certified



<http://www.greasetrap.ca/pdfs/GOS40-CUT-SHEET.pdf>

Plan/Drawing Elements - Details



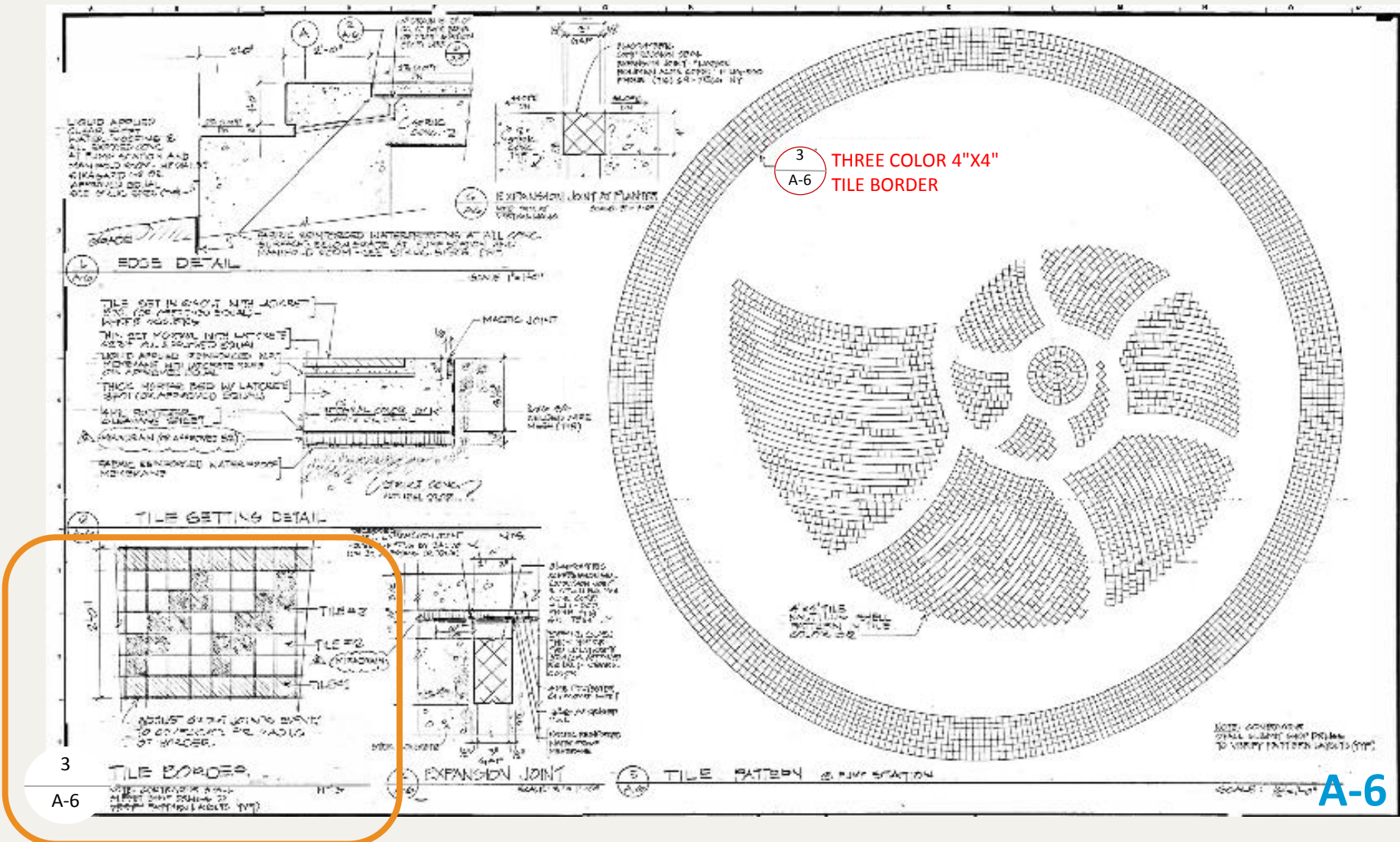
Pump Station – Detail/closeup of a particular feature



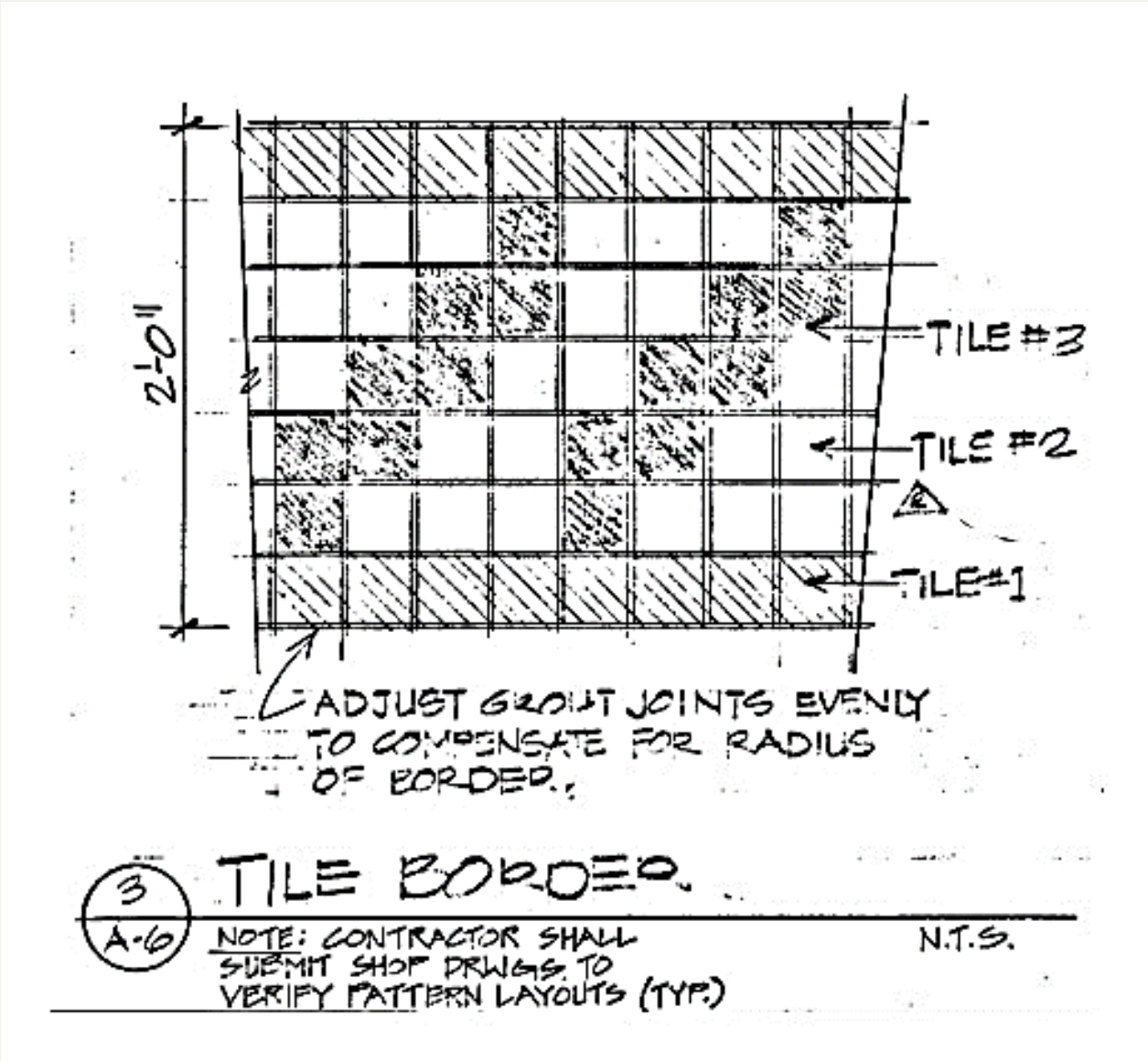
Analogy =
street view/
zoom in

- May contain one or more of the following:
 - Illustration/graphical representation
 - Text
 - Plan views
 - Section views
 - **Details – closeup view showing greater detail**
 - Legends/Symbols, Notes, and Abbreviations
 - Schedules/Equipment Lists
 - Materials List

Plan/Drawing Elements - Details (continued)

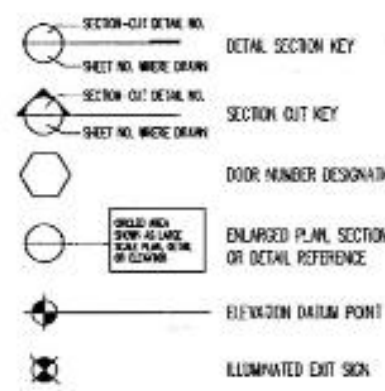


Plan/Drawing Elements - Details (continued)



Plan/Drawing Elements – Legend/Symbols, Notes, and Abbreviations

- May contain one or more of the following:
 - Illustration/graphical representation
 - Text
 - Plan views
 - Section views
 - Details
 - **Legends/Symbols, Notes, and Abbreviations**
 - Schedules/Equipment Lists
 - Materials List

GENERAL NOTES	SYMBOLS
<ol style="list-style-type: none"> 1. DO NOT SCALE DRAWINGS. USE DIMENSIONS SHOWN. 2. ALL DIMENSIONS ARE GIVEN TO THE FACE OF STUD OR MASONRY U.O.M. 3. VERIFY THAT EXISTING CONDITIONS ARE AS INDICATED ON THE DRAWINGS AND SPECIFICATIONS. NOTIFY CITY ARCHITECT IMMEDIATELY OF VARIATIONS OR DISCREPANCIES. DO NOT PROCEED WITH AFFECTED WORK UNTIL THE VARIATIONS OR DISCREPANCIES ARE RESOLVED BY THE CITY ARCHITECT. 4. INSTALL ALL WORK PLUMB, LEVEL, AND STRAIGHT. 5. INSTALL MANUFACTURED MATERIALS AND EQUIPMENT ACCORDING TO MANUFACTURER'S RECOMMENDATIONS AND INSTRUCTIONS (U.O.M.). 6. PROVIDE SEISMIC BRACING AT ALL PARTITIONS, SOFFITS, LIGHTING FIXTURES, AND CEILING CONSTRUCTION AS REQUIRED BY CODE. 7. PROVIDE ALL ITEMS NOT SPECIFIED BUT REQUIRED FOR A COMPLETE AND FINISHED JOB. 8. WHEN PROJECT IS COMPLETE, CLEAN AND POLISH ALL NEW GLASS, HARDWARE, RESILIENT FLOORING, CERAMIC TILE AND OTHER SUCH ITEMS WITH FACTORY FINISH. REMOVE ALL DUST WITH TREATED DUST CLOTHS OR VACUUM CLEANERS. 9. WORK REQUIRED UNDER THIS CONTRACT INCLUDES LABOR, MATERIALS, EQUIPMENT, ETC. NECESSARY TO COMPLETE THIS PROJECT. 10. ALL DIMENSIONS NOTED "CLEAR" OR "CLR." MUST BE STRICTLY MAINTAINED. 11. ALL PARTITION LOCATIONS, DIMENSIONS, TYPES, ETC. AND ALL DOOR LOCATIONS SHALL BE AS SHOWN ON FLOOR PLANS. IN CASE OF CONFLICT, DISCREPANCIES SHALL BE RESOLVED BY THE CITY ARCHITECT. 	 <p> SECTION-CUT DETAIL NO. SHEET NO. WHERE DRAWN DETAIL SECTION KEY </p> <p> SECTION CUT DETAIL NO. SHEET NO. WHERE DRAWN SECTION CUT KEY </p> <p> DOOR NUMBER DESIGNATION </p> <p> ENLARGED PLAN, SECTION OR DETAIL REFERENCE </p> <p> ELEVATION DATUM POINT </p> <p> ILLUMINATED EXIT SIGN </p>

Plan/Drawing Elements – Legend/Symbols, Notes, and Abbreviations (continued)

- The **NOTES and LEGEND** sections define special symbols and conventions used. They typically provide vital information for drawing completeness and understanding. For construction purposes, these sections **should be reviewed *before*** reading a drawing.

NOTES:

- FOR GENERAL SEQUENCING AND WORK CONSTRAINTS, SEE SPECIFICATION 01010.
- THE INTENT OF THESE DRAWINGS IS TO SHOW THE SCOPE OF MECHANICAL DEMOLITION ONLY. REFER TO OTHER DISCIPLINES FOR THEIR SPECIFIC SCOPE.
- CONTRACTOR SHALL PROTECT ALL EXISTING EQUIPMENT AND EQUIPMENT INTENDED TO BE IN OPERATION DURING CONSTRUCTION FROM DUST AND CONSTRUCTION DEBRIS.
- SEE REFERENCE DRAWINGS.
- DEMO ALL 1/2" SEAL LINES AND PIPE SUPPORTS AT PILLAR. REMOVE GROUT FROM SUPPORT POSTS AND CUT BOLTS FLUSH W/ TOP OF SLAB.

Legend:

PIPING SYMBOLS		
SYMBOL		DESCRIPTION
SINGLE LINE	DOUBLE LINE	
		FLANGED
		ELBOW
		TEE
		REDUCER
		SLEEVE TYPE (FLEXIBLE) COUPLING
SINGLE LINE	DOUBLE LINE	VALVES AND GATES
		PLUG
		CHECK
		HOSE VALVE W/ RACK
		NOT USED

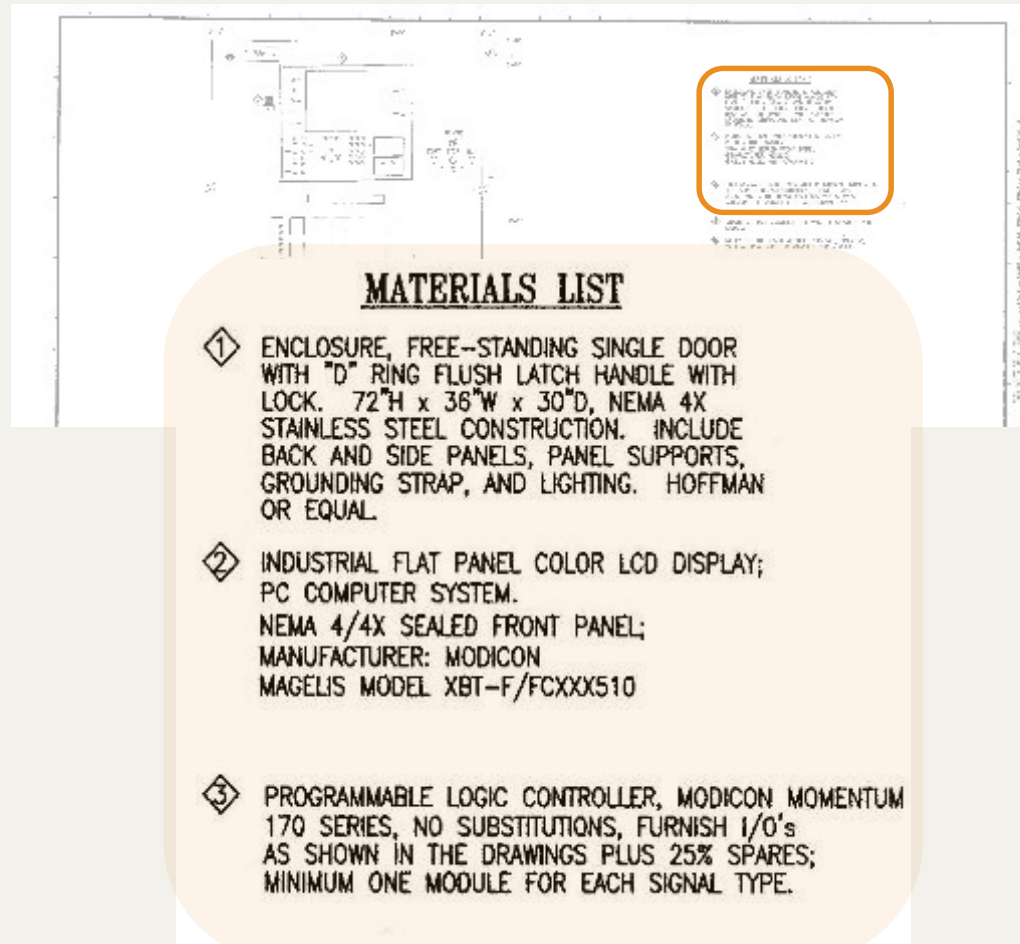
Plan/Drawing Elements – Schedules/Equipment Lists

- May contain one or more of the following:
 - Illustration/graphical representation
 - Text
 - Plan views
 - Section views
 - Details
 - Legends/Symbols, Notes, and Abbreviations
 - **Schedules/Equipment Lists**
 - Materials List

Definition of “Schedule”: an appendix to a formal document or statute, especially as a list, table, or inventory.

GRAVITY BELT THICKENER (GBT) SCHEDULE											
OPERATING LOCATION	PHYSICAL LOCATION	SERVICE	SPECIFICATION REFERENCE	QTY	BELT WIDTH	UNIT CAPACITY	BELT TRACKING AND TENSIONING	DRIVE TYPE	HP	VOLTS/PH/HZ	M
SE42M55-1,2	BLDG 785	GBT SYSTEM	11350	2	4.0 METERS	800 - 1200 GPM	PNEUMATIC	ADJUSTABLE SPEED	7.5	460/3/60	

Plan/Drawing Elements – Materials List



- May contain one or more of the following:
 - Illustration/graphical representation
 - Text
 - Plan views
 - Section views
 - Details
 - Legends/Symbols, Notes, and Abbreviations
 - Schedules/Equipment Lists
 - **Materials List**



Stand up...Stretch

Questions so far?

Don't forget to reference "Slide Number"

CHAT QUESTION

CWEA

Work Situations for Which You May Need to Read Plans

- **Source Control**

- Verify whether proposed pollution prevention measures are planned

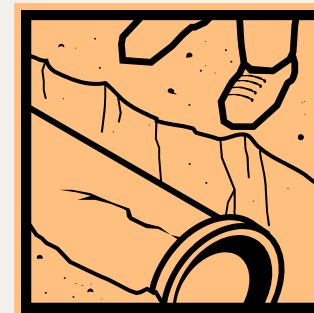


- **Collections**

- Locate manholes and sewer laterals

- **WWTP & PS**

- Verify hydraulic gradeline/water level



Plans/Drawings Help to Convey Ideas

- To Bidders
 - Obtain competitive (i.e., cost-effective) bid prices
- To Contractors
 - Minimize “extras” and achieve “no claims”
- To Clients
 - Meet clients’ needs and expectations
- To Building Department/
Permitting Agency
 - Meet/comply with permitting requirements



Which Drawings Might Be Important To An Environmental Compliance Inspector (ECI)?


- **Stormwater/Pollution Prevention**
 - Site Plans
 - Grading Plans
 - Landscaping Plans
 - Erosion Control Plans
- **Collections**
 - Map Books
 - Block Books
 - Site Plans
 - Grading Plans
 - Hydraulic Profile
- **Pretreatment**
 - Floor Plans
 - Plumbing Plans
 - Plumbing Schedules
 - Plumbing Isometrics
- **Plants & Pump Stations**
 - Site Plans
 - Hydraulic Profiles
 - Equipment Schedules
 - Process Instrument Diagrams (PIDs)
 - Single-Line Diagrams

How to Get Started (1 of 2)



- **Get Oriented**
 - Are you looking at the correct drawing? Check:
 1. Drawing Index
 2. Sheet Title
 3. Drawing Revision Number
 4. Scale
 5. North Direction
 - Get a feel for the size of facility
 - Field-verify information whenever possible
- **Before You Go...Consider “Is it safe?”**
 - Location/surroundings?
 - Remote?
 - Isolated?
 - Poor lighting?
 - Security/Access?

How to Get Started (2 of 2)

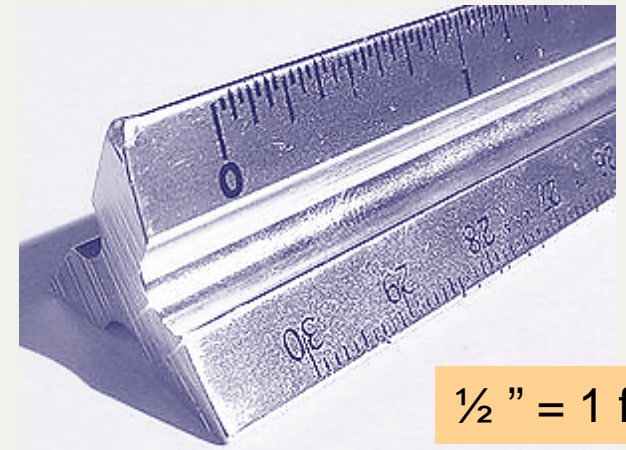
- Gain Understanding
 - What is this drawing trying to tell me?
 - “Connect the dots” 
 - Don't forget to review the drawing NOTES and LEGEND!
- Use Plan Reading Tools
 - Symbols/Abbreviations
 - **Scales**
 - Contours*
 - Consult others



*Contours are important when considering runoff, erosion, and site drainage.

Scaling

- Drawings can be schematic (not to scale/illustrative only) or “drawn to scale”
- A scale drawing is one that shows a real object with **accurate sizes reduced or enlarged** by a certain amount (called the scale).
- The scale can be shown as the length in the drawing, then a colon (:), then the matching length on the real thing if the units of measure are the same. For example, 1:10 implies that the real thing is 10 times bigger than the size shown.
- Alternatively, the scale can be shown as the length in the drawing, followed by an equal sign (=), then the matching length on the real thing. The unit of measure can be different on either side of the equal sign.



Two Different Scales are Common in the U.S.

- Understanding Scales and Proper Use

- Architectural Scale

Fractions of an inch

$1/16$, $3/32$, $1/8$, $3/16$, $1/4$, $3/8$, $1/2$, $3/4$, 1, $1\ 1/2$, 3



- Engineering Scale

Decimal fractions of an inch

10, 20, 30, 40, 50, and 60-scale



Scaling (continued)

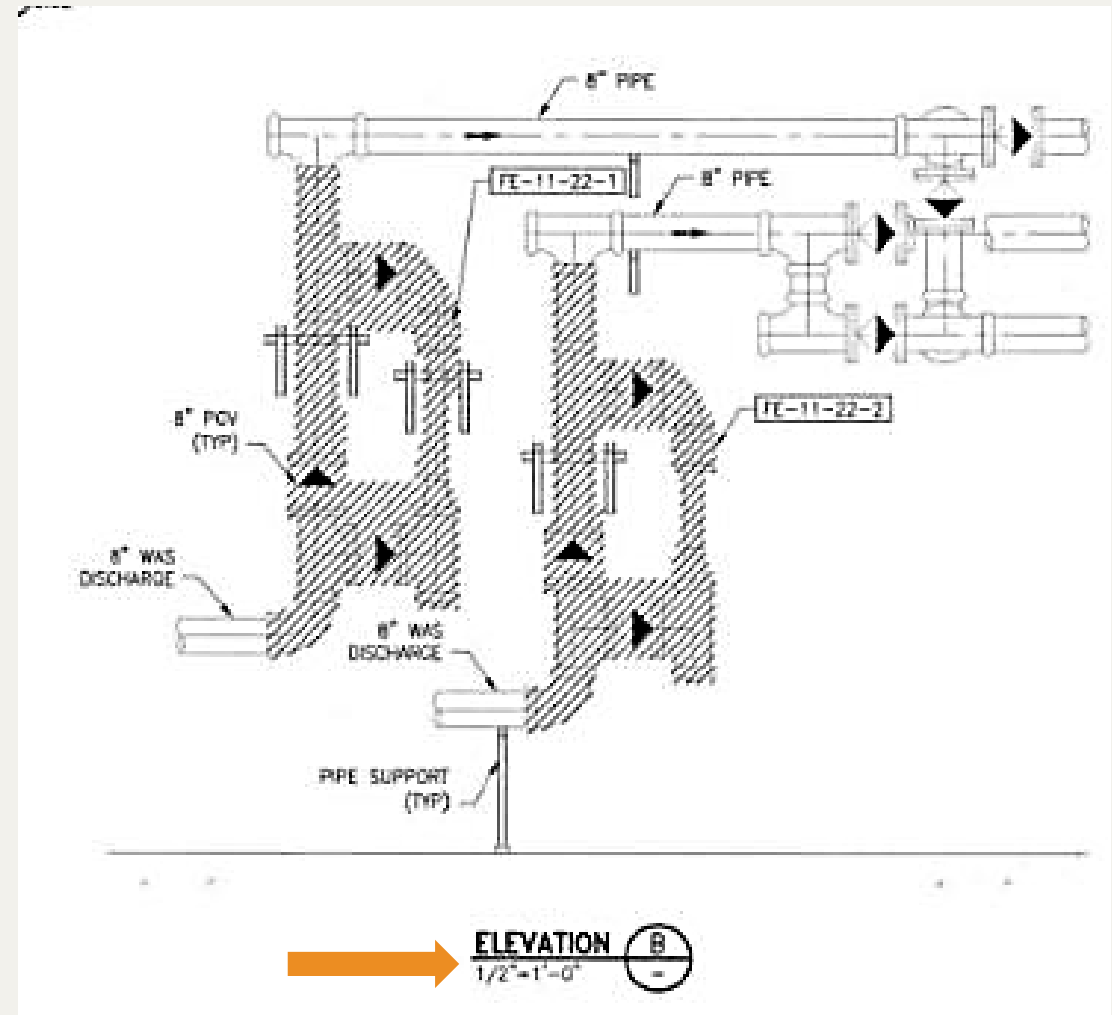
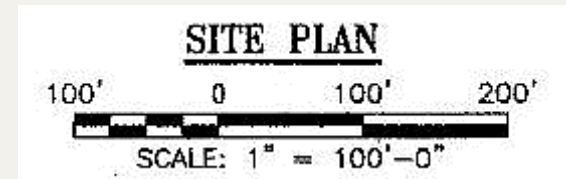
How To Figure Out Scale

1. Look on the drawing

Scale is typically noted or shown using a graphic scale

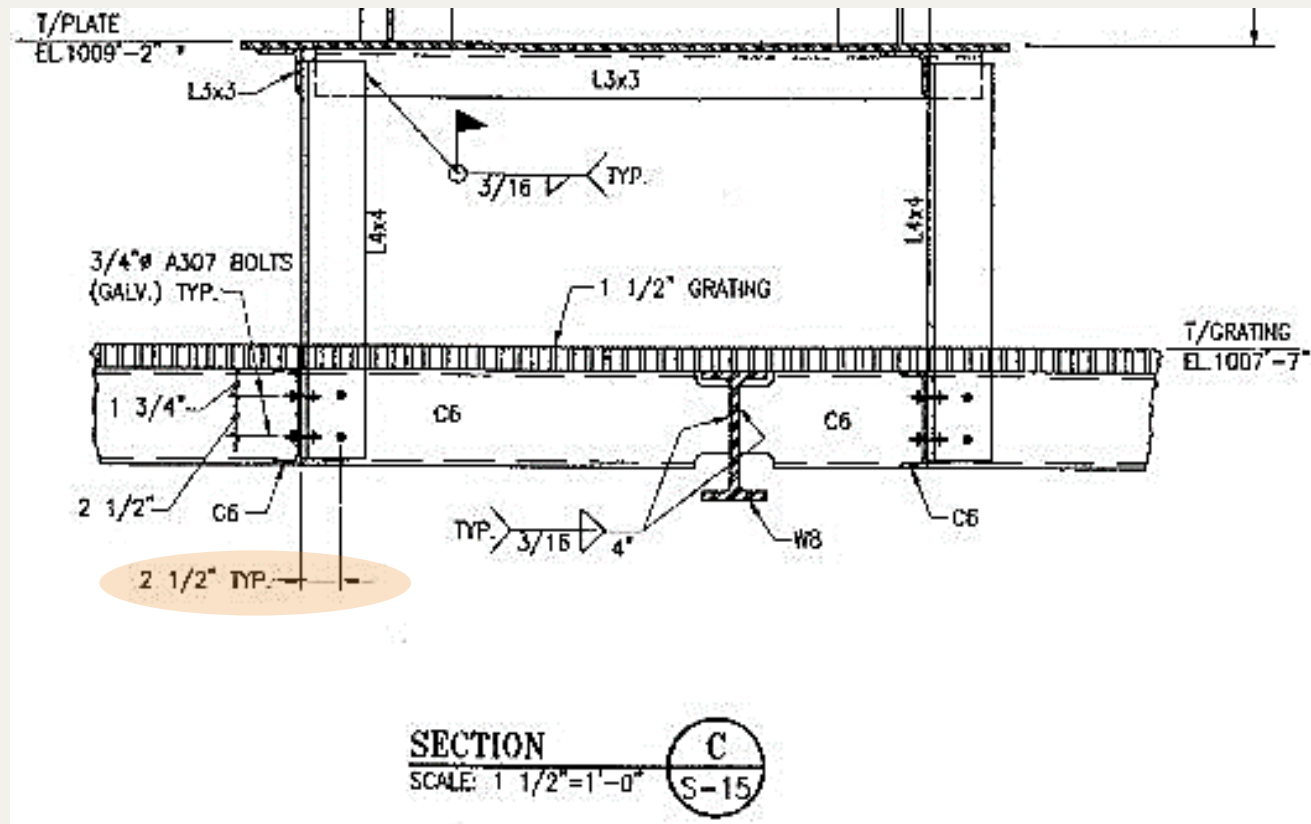
2. Measure

BEWARE! Scale can be distorted by scanning or faxing



Scaling (continued)

Measure using a known dimension. NOTE: When drawings are prepared with dimensions written on the plans, the *written dimensions always take precedence over scaled measurements.*



Scaling (continued)

- Free (limited) smartphone app:
Scala Architectural and Engineering Scale
- **Scaling Exercise (on your own):**
<http://www.usfa.fema.gov/downloads/pdf/nfa/engineer-architect-scales.pdf>

Using Engineer and Architect Scales

NOTE: When PRINTING this document, be sure the pull down menu next to "Print Scaling" in the Print Dialog window is set to "None". This will ensure the sample drawings will measure accurately.

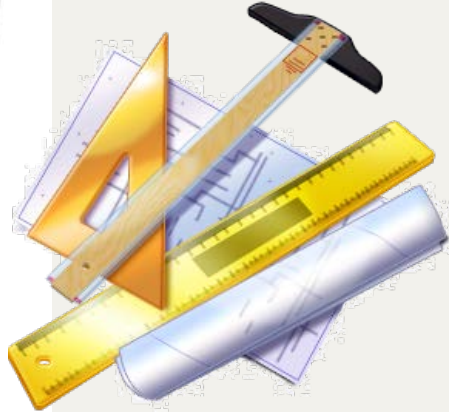
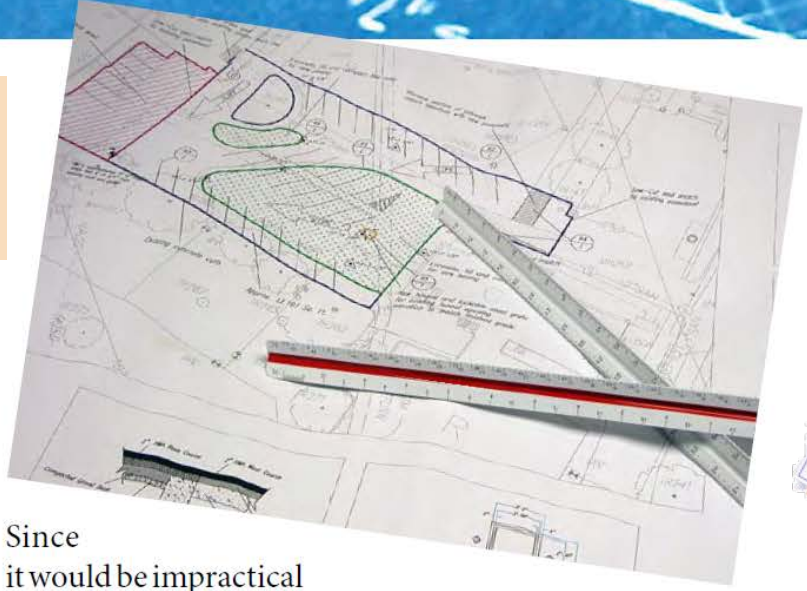
Introduction

Using and interpreting information from engineer (civil) and architect scales is an important fire protection engineering skill. Construction and fire protection equipment drawings must be interpreted with a high degree of accuracy.

Student Performance Objective

Given an architect or engineer scale and a set of scaled

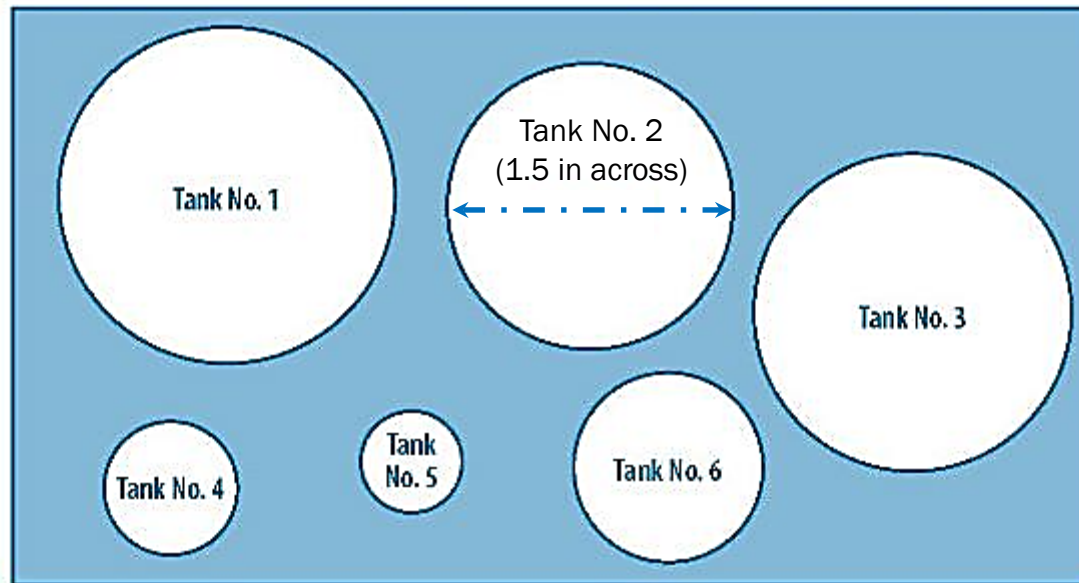
Since it would be impractical to create full-size drawings for these objects, they are reduced to a manageable size (scale) so they can be studied. A set of plans may include a variety of different scales, depending upon what

Scaling Exercise – Print page from Handout at Actual Size

Use a ruler or ruler app

This drawing represents the plan view of a bulk tank facility. The scale is 1:60. What are the tank diameters in feet?



Tank No. 1 = _____ feet

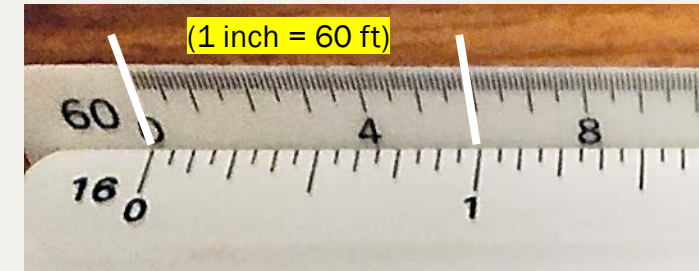
Tank No. 4 = _____ feet

Tank No. 2 = _____ feet

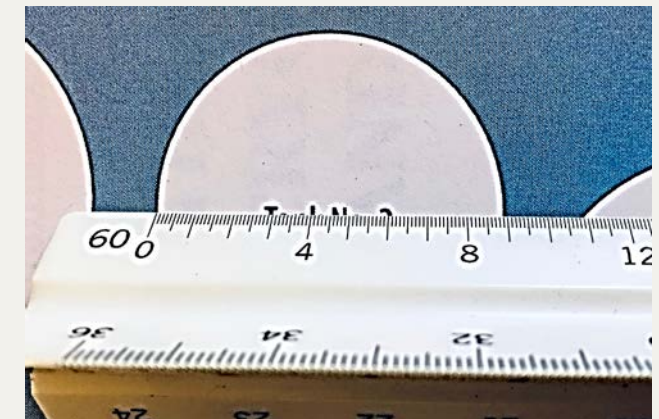
Tank No. 5 = _____ feet

Tank No. 3 = _____ feet

Tank No. 6 = _____ feet



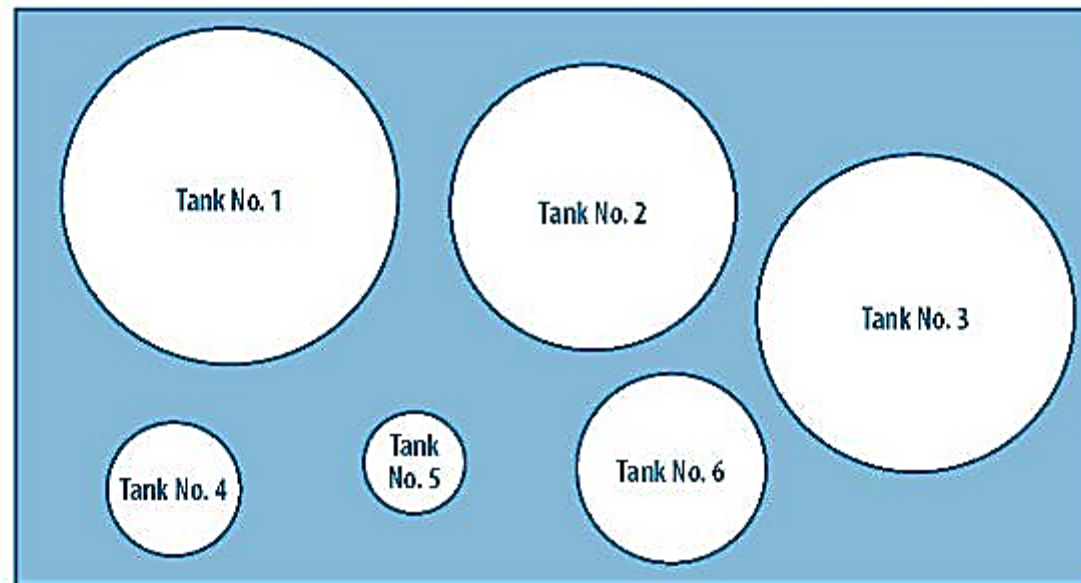
You can use an Engineering Scale to approximate the diameter of Tank No. 2 as 90 ft.



<Pause>
2 minutes to
complete the
exercise

Scaling Exercise – Answers

This drawing represents the plan view of a bulk tank facility. The scale is 1:60. What are the tank diameters in feet?



Tank No. 1 = 105 feet

Tank No. 4 = 44 feet

Tank No. 2 = 90 feet

Tank No. 5 = 32 feet

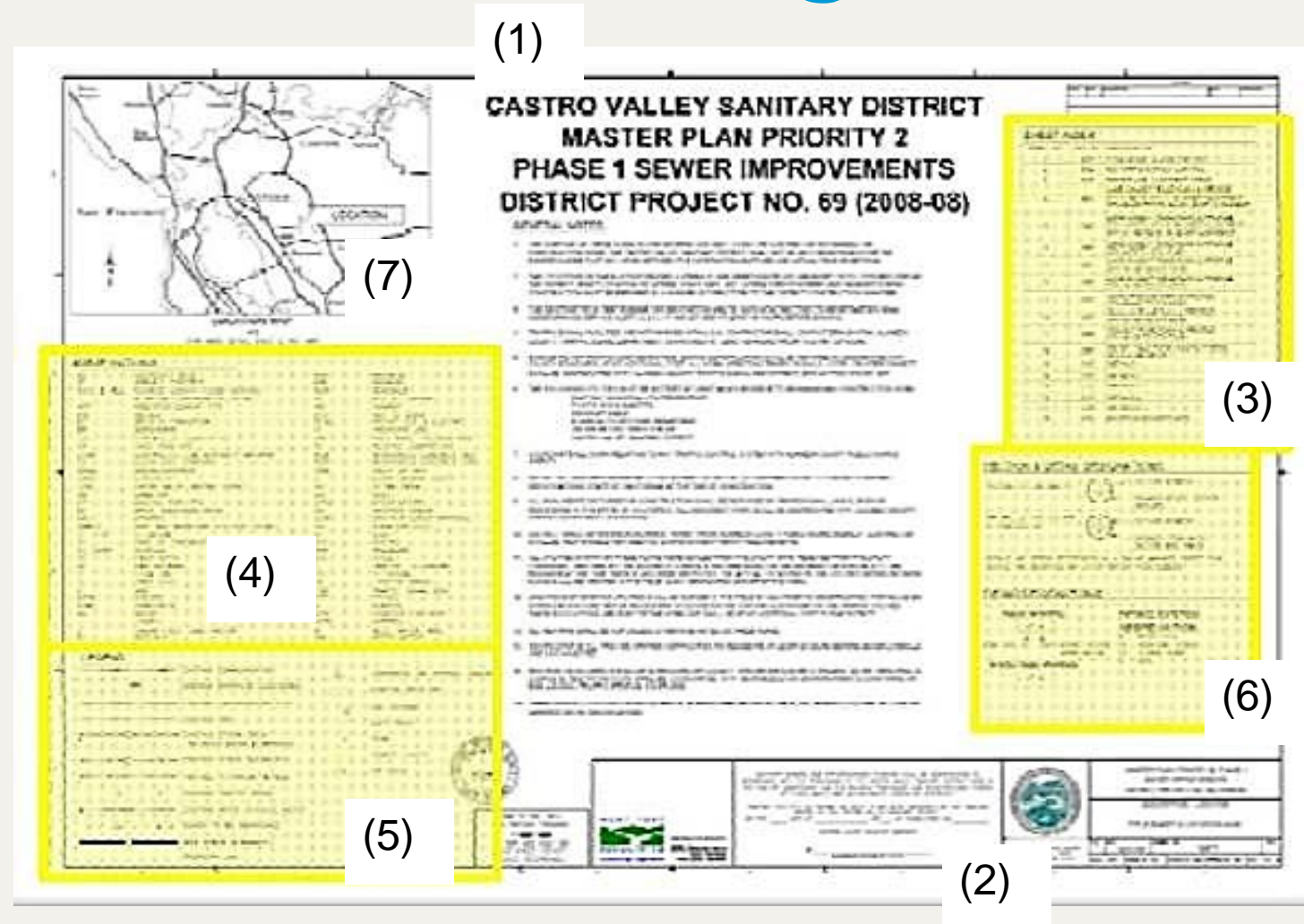
Tank No. 3 = 99 feet

Tank No. 6 = 62 feet

Actual Examples and Details of Plan/Drawing Elements

Key Elements of Plans/Drawings - Example

- 1) Project Title
- 2) Designer
- 3) Sheet Index
- 4) Abbreviations
- 5) Legend
- 6) Section & Detail References
- 7) Key Map



Note: For large projects, one or more Key Elements may be presented on separate drawings.

Sheet Index/Abbreviations - Example

SHEET INDEX		
SHEET NO.	DWG NO.	DESCRIPTION
1	G01	TITLE SHEET & LOCATION MAP
2	G02	KEY MAP & SURVEY CONTROL
3	G03	SEWER LINE ALIGNMENT TABLE
4	C01	LAKE CHABOT ROAD PLAN & PROFILE STA 0+00 TO STA 4+00 (WEST ALIGNMENT) STA 50+00 TO STA 54+00 (EAST ALIGNMENT)
6	C02	LAKE CHABOT ROAD PLAN & PROFILE STA 4+00 TO STA 8+50 (WEST ALIGNMENT) STA 54+00 TO 59+45 (EAST ALIGNMENT)
6	C03	LAKE CHABOT ROAD PLAN & PROFILE STA 8+50 TO STA 13+00
7	C04	LAKE CHABOT ROAD PLAN & PROFILE STA 13+00 TO STA 16+60
8	C05	LAKE CHABOT ROAD PLAN & PROFILE STA 16+60 TO STA 20+10
9	C06	QUAIL AVENUE PLAN & PROFILE STA 58+45 TO STA 63+00
10	C07	QUAIL AVENUE PLAN & PROFILE STA 63+00 TO STA 69+00
11	C08	WALNUT ROAD PLAN & PROFILE STA 69+00 TO STA 72+69
12	C09	SEVEN HILLS ROAD & QUAIL AVENUE PLAN & PROFILES
13	C10	DETAILS 1
14	C11	DETAILS 2
15	C12	DETAILS 3
16	C13	DETAILS 4
17	C14	DETAILS 5
18	C15	EXISTING SEWER FLOWS

ABBREVIATIONS

AB	AGGREGATE BASE	MAX	MAXIMUM
AC	ASPHALT CONCRETE	MIN	MINIMUM
ACFC & WCD	ALAMEDA COUNTY FLOOD CONTROL & WATER CONSERVATION DISTRICT	MON	MONUMENT
ACP	ASBESTOS CEMENT PIPE	NIC	NOT IN CONTRACT
AVE	AVENUE	NO.	NUMBER
B/C	BREAK IN CONNECTION	NTS	NOT TO SCALE
BM	BENCHMARK	PG&E	PACIFIC GAS & ELECTRIC
CDP	CONTROLLED DENSITY FILL	PL	PROPERTY LINE
CIP	CAST IRON PIPE	PVC	POLY VINYL CHLORIDE PIPE
CLSM	CONTROLLED LOW STRENGTH MATERIAL	RC	RELATIVE COMPACTION
CO	CLEAN OUT, COMPANY	RCB	REINFORCED CONCRETE BOX
COMM	COMMUNICATIONS	RCP	REINFORCED CONCRETE PIPE
CONC	CONCRETE	ROW	RIGHT-OF-WAY
CVSD	CASTRO VALLEY SANITARY DISTRICT	S	SLOPE, SEWER, SOUTH
DIA	DIAMETER	SD	STORM DRAIN
DIP	DUCTILE IRON PIPE	SHT	SHEET
DR	DRIVE, DIMENSION RATIO	SPEC	SPECIFICATION
DWG	DRAWING	SS	SANITARY SEWER
EBMUD	EAST BAY MUNICIPAL UTILITIES DISTRICT	SSMH	SANITARY SEWER MANHOLE
EL, ELEV	ELEVATION	SST	STAINLESS STEEL
EP	EDGE OF PAVEMENT	ST	STREET
EX, EXIST	EXISTING	STA	STATION
FO	FIBER OPTIC	STD	STANDARD
FH	FIRE HYDRANT	STL	STEEL
FL	FLOW LINE	T	TANGENT, TELEPHONE
FT	FOOT, FEET	TEL	TELEPHONE
G	GAS	TS	TRAFFIC SIGNAL
GRND	GROUND	TSB	TRAFFIC SIGNAL BOX
HORZ	HORIZONTAL	TYP	TYPICAL
INV	INVERT	V	VERTICAL
L	LENGTH	VCP	VITRIFIED CLAY PIPE
LF	LINEAR FOOT, LOAD FACTOR	VERT	VERTICAL
MH	MANHOLE	W	WEST, WATER, WIRE
		WM	WATER METER
		WV	WATER VALVE

Sheet Index = Table of Contents

Abbreviations = Glossary

Notes: (1) There are MANY variations to abbreviations; (2) Each discipline/professional work area may use its own set of abbreviations; (3) "Murphy's Law" applies: "If you're looking for it, you likely won't find it."

Legend – Examples of Lines, Symbols, and Hatching

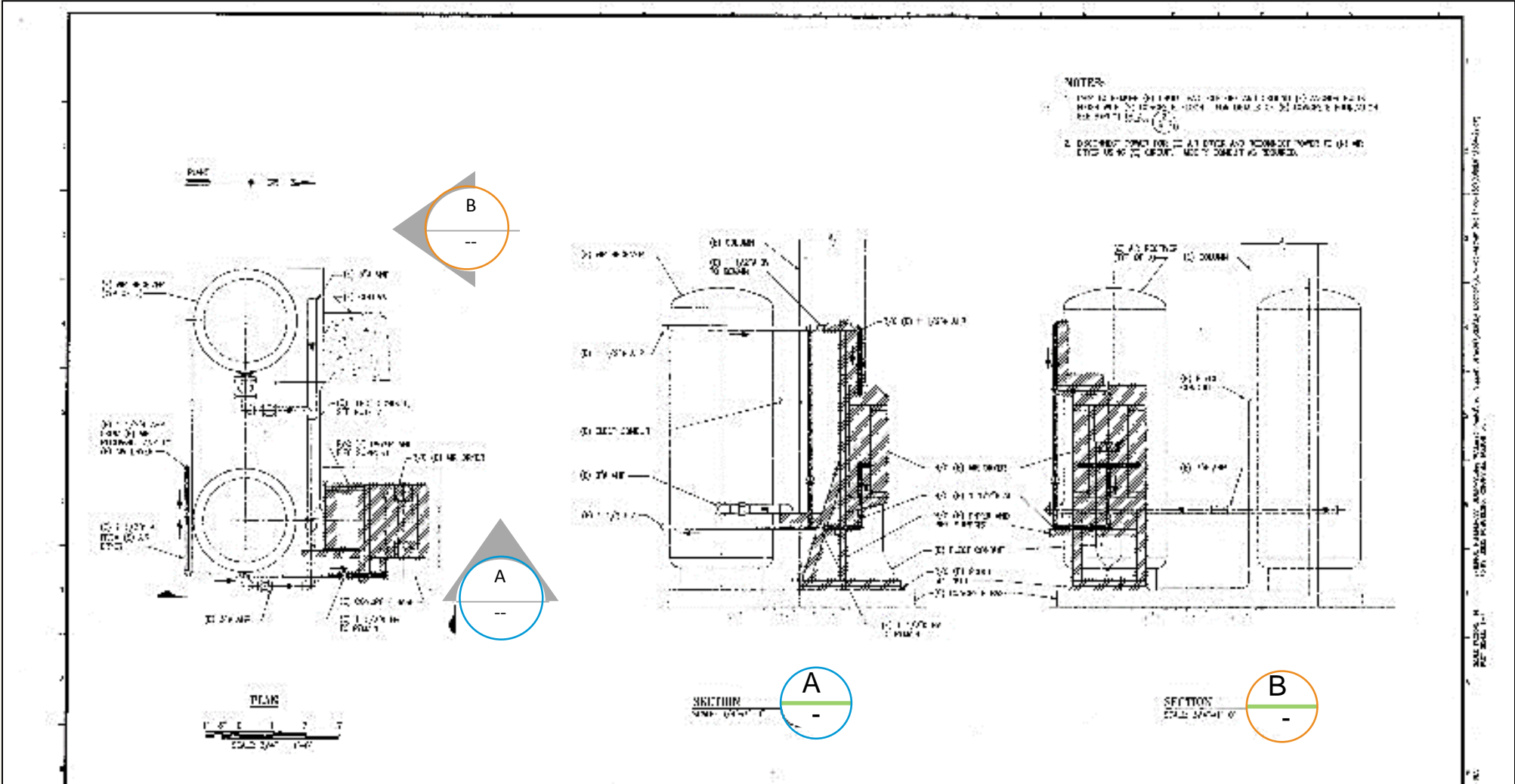
LEGEND	
	EXISTING COMMUNICATION
	EXISTING OVERHEAD ELEC/CABLE
	EXISTING UNDERGROUND ELEC
	EXISTING GAS
	EXISTING STORM DRAIN W/CATCH BASIN & MANHOLE
	EXISTING SEWER W/MANHOLE
	EXISTING TELEPHONE W/BOX
	EXISTING TRAFFIC SIGNAL
	EXISTING WATER W/VALVE, METER
	SEWER TO BE ABANDONED
	NEW SEWER W/MANHOLE
	PROPERTY LINE
	HORIZONTAL OR VERTICAL CONTROL
	EXISTING DRIVE WAY
	FIRE HYDRANT
	LIGHT POLE
	SIGN
	TRAFFIC LIGHTS
	AIR VALVE

For retrofits/remodels, understanding existing items versus new work is required.

LEGEND	
	FLOW AREA BOUNDARY
	STORM DRAIN LINE
	STORM WATER FILTER DEVICE
	DIRECTION OF FLOW
	TREATING AREA
	ROOF AREA TREATED BY BIO-SWALE
	ROOF AREA TREATED BY SWFD
	PERVIOUS SURFACE SELF-TREATING AREA
	BIO-SWALE
	SWALE TREATMENT AREA PROVIDED

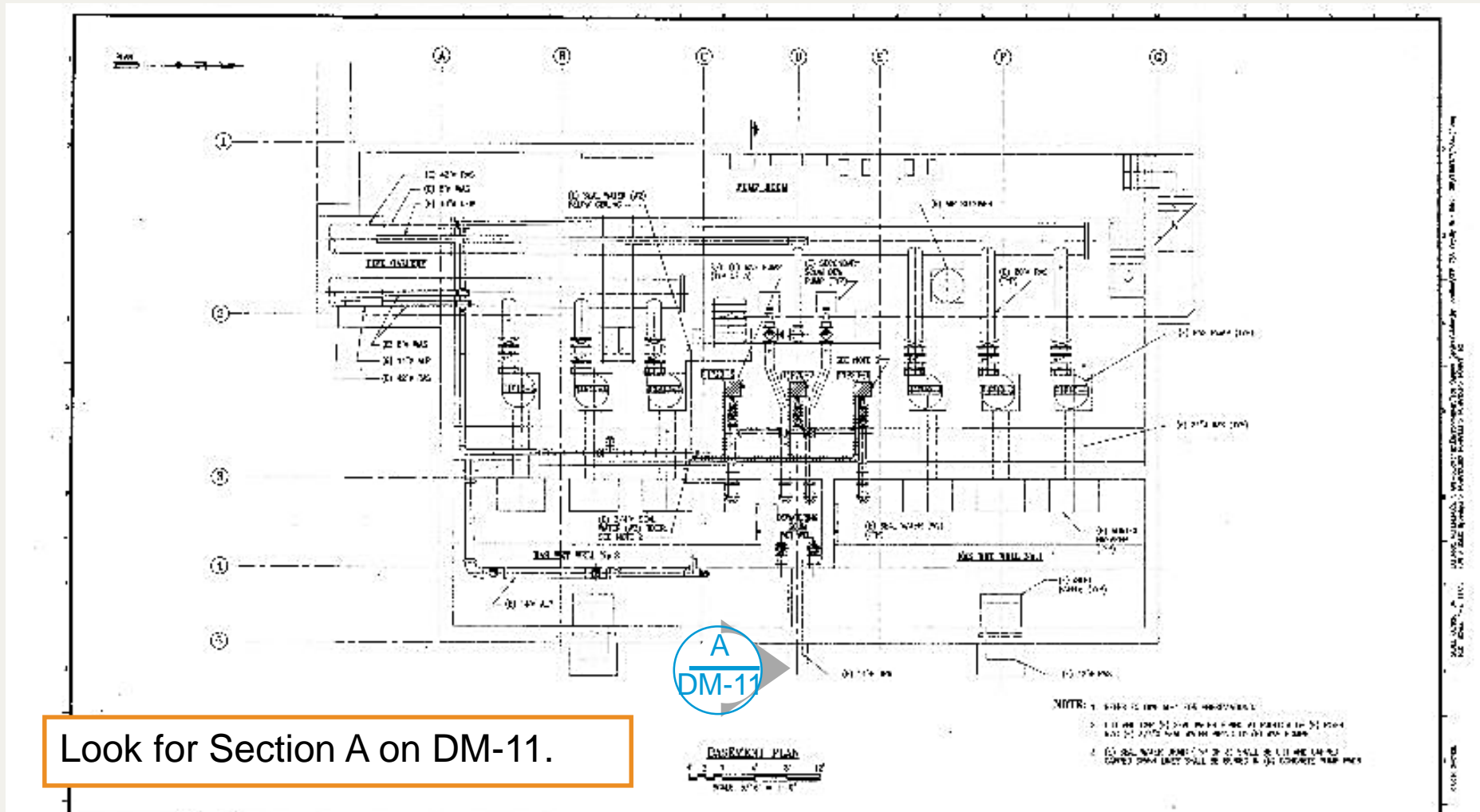
Legend/Hatching = Glossary or Shorthand Notation

Section & Detail References - Example



When no sheet reference appears beneath the letter, the indicated section appears on the same page as the plan view as shown here, where Sections A and B appear on the same page. Detail references are similar.

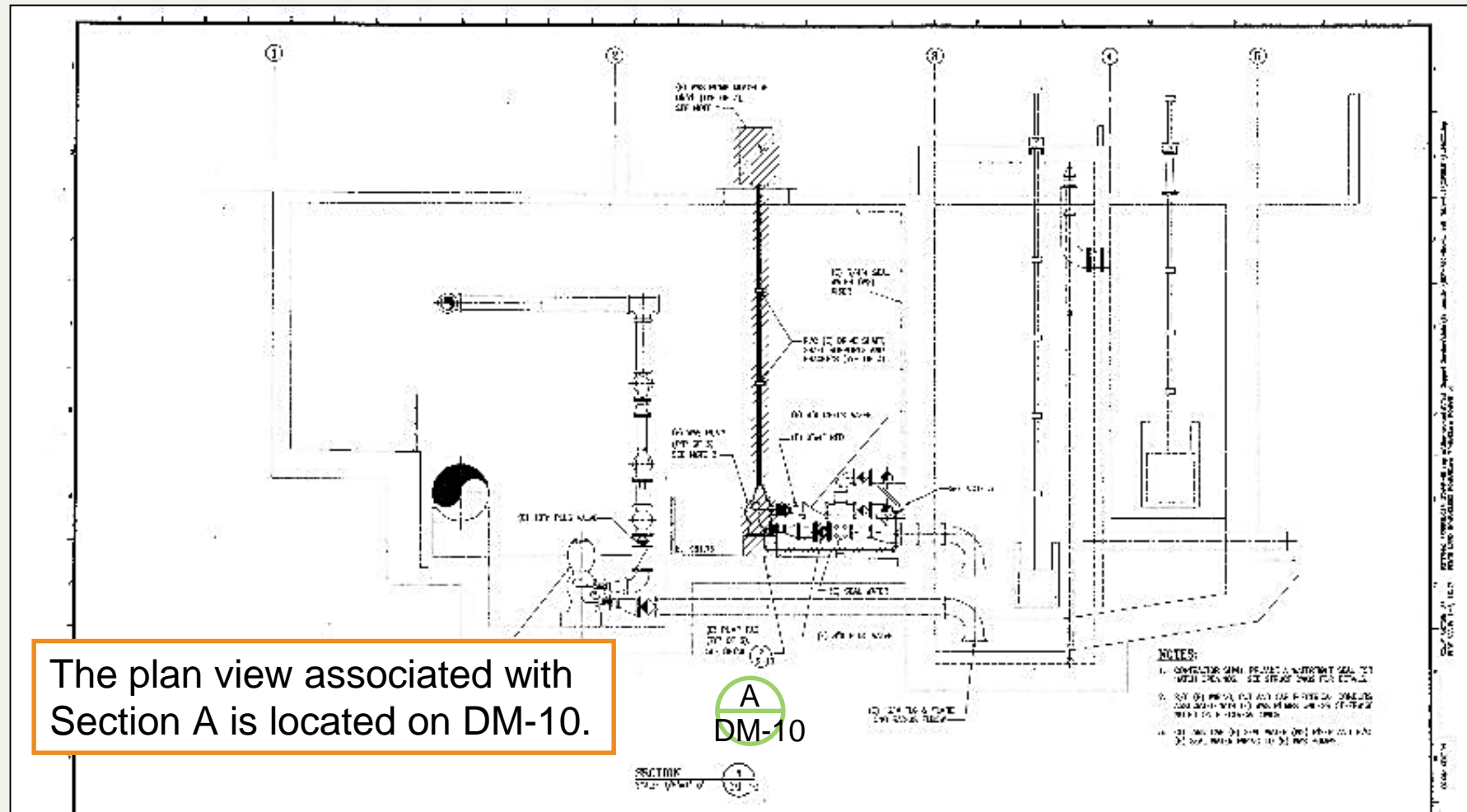
Section & Detail References - Example



Look for Section A on DM-11.

When a sheet reference appears beneath the letter, the indicated section appears on the referenced sheet. Detail references are similar.

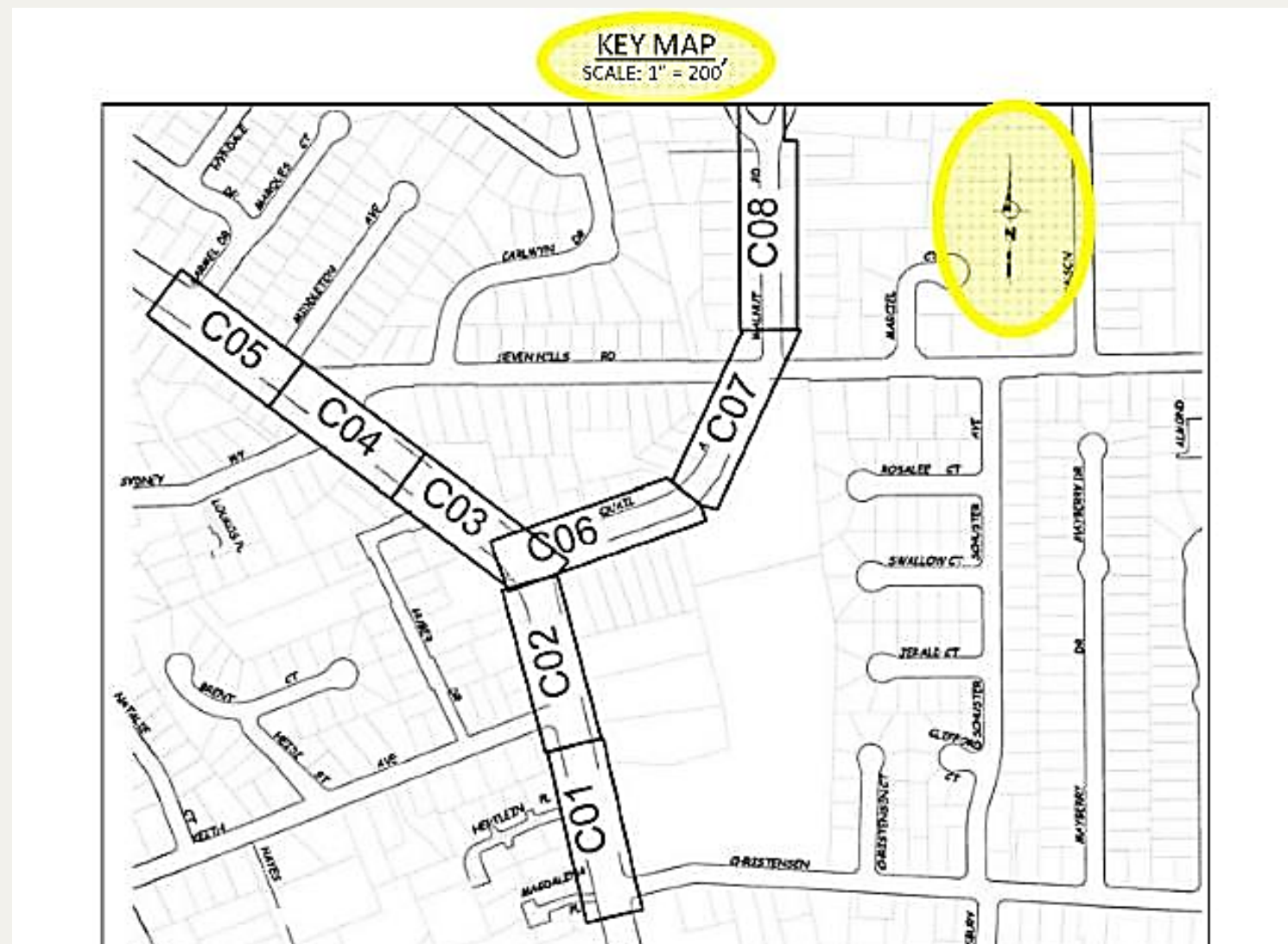
Section & Detail References - Example



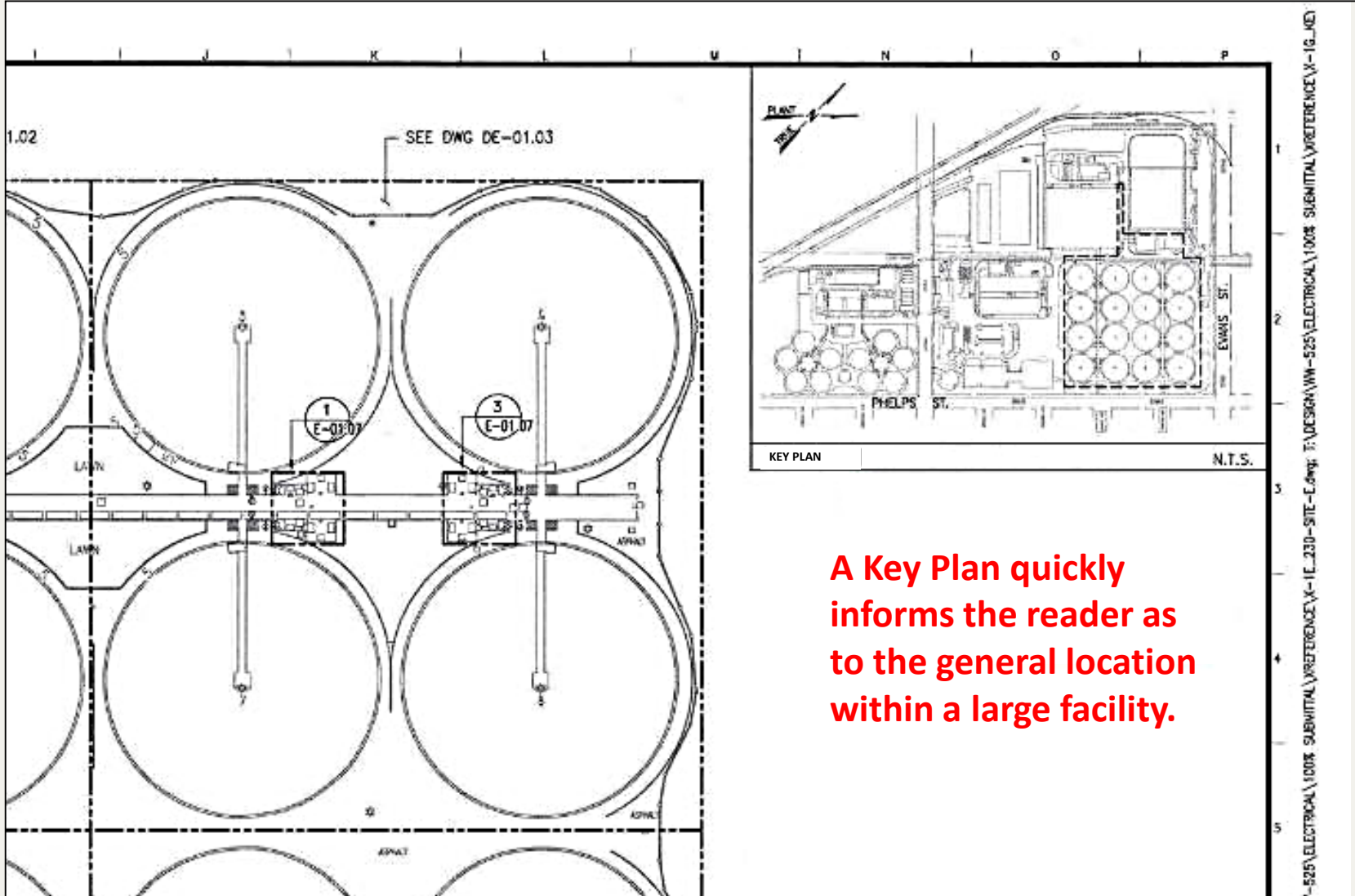
When a sheet reference appears beneath the letter, the associated plan view appears on the referenced sheet. Detail references are similar.

Key Map/Key Plan – Example (Sewer)

- Helps orient the reader
- Provides an overview for a large project

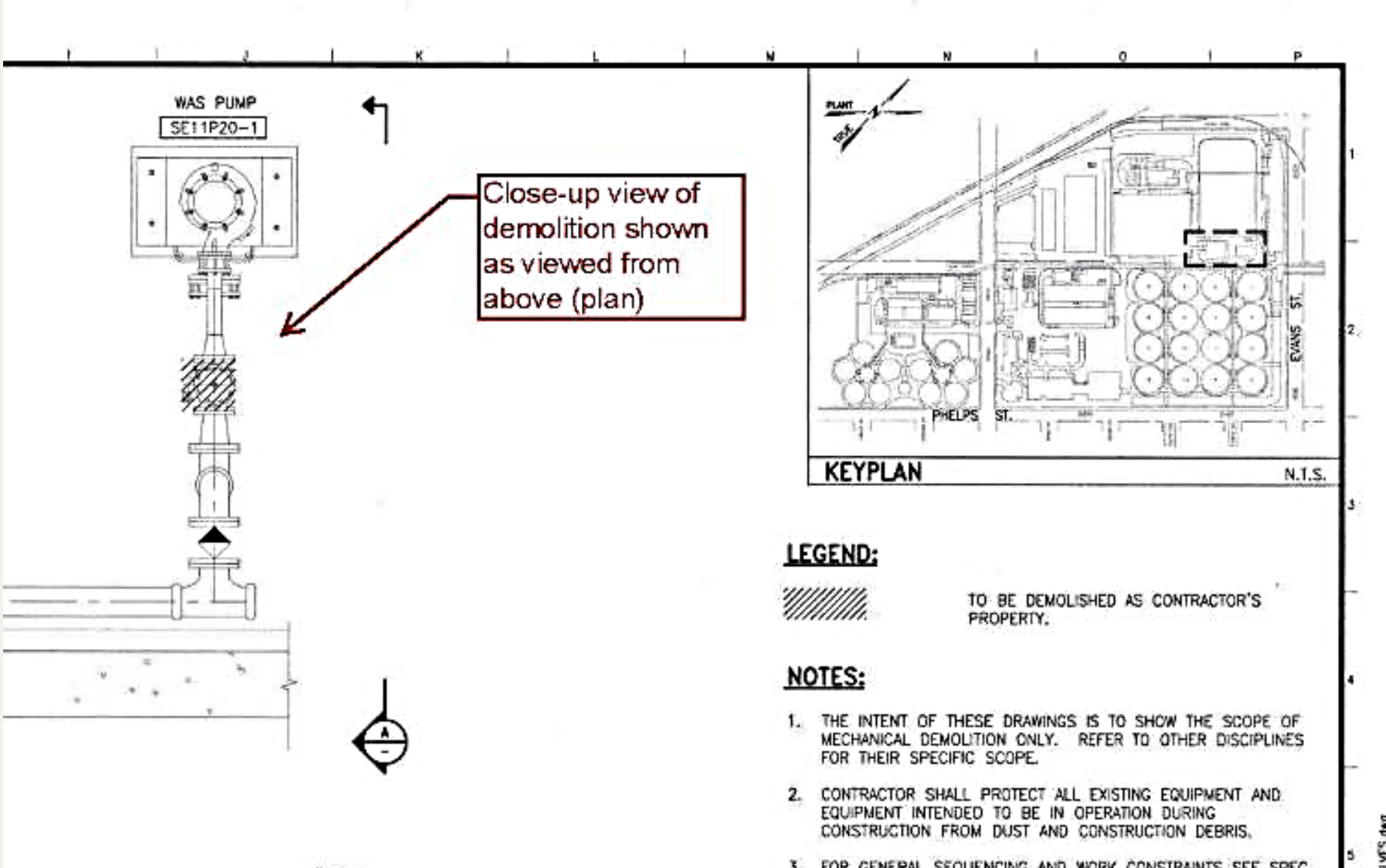


Key Map/Key Plan – Example (Treatment Facility)

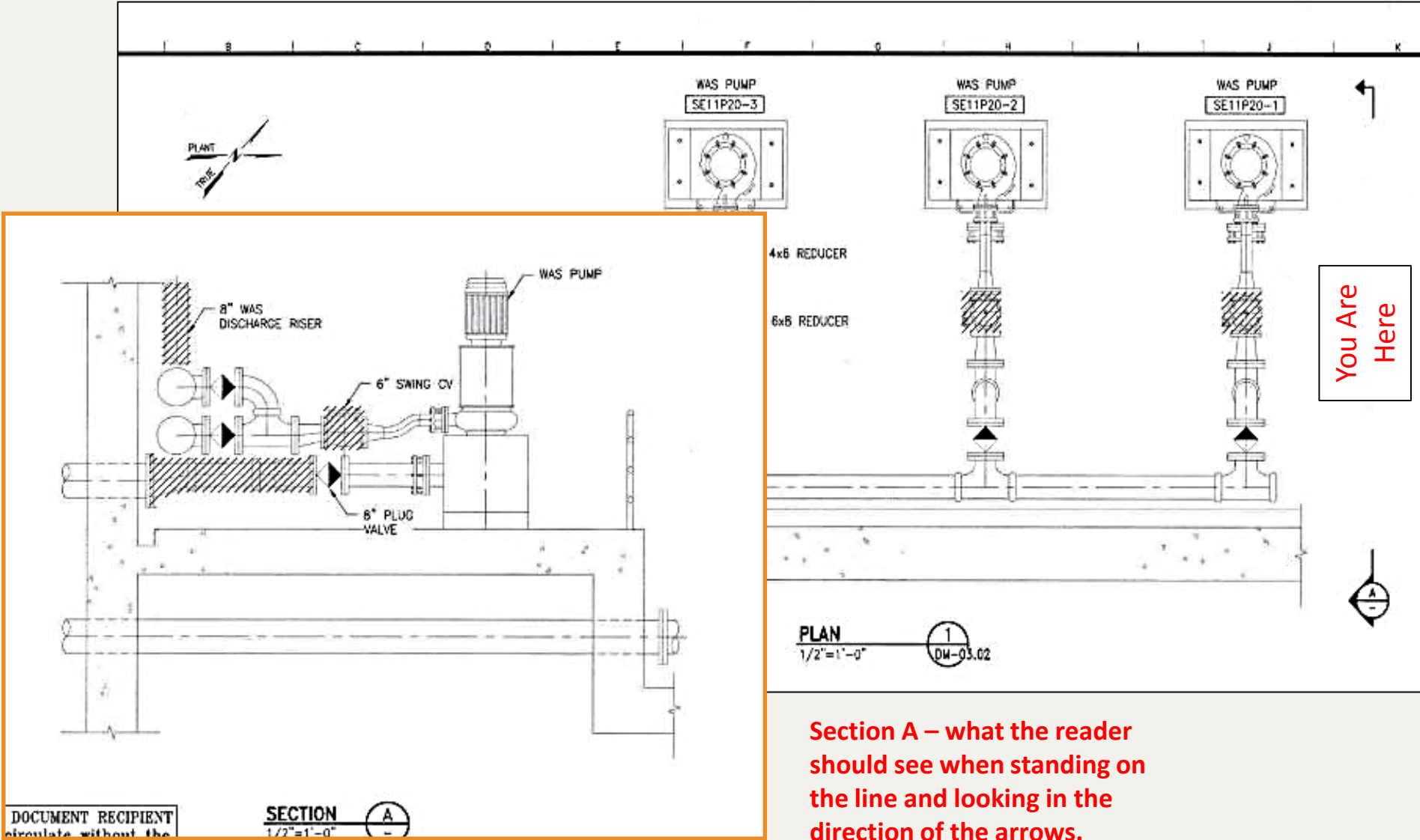


A Key Plan quickly informs the reader as to the general location within a large facility.

Key Map/Key Plan – Example (Treatment Facility)

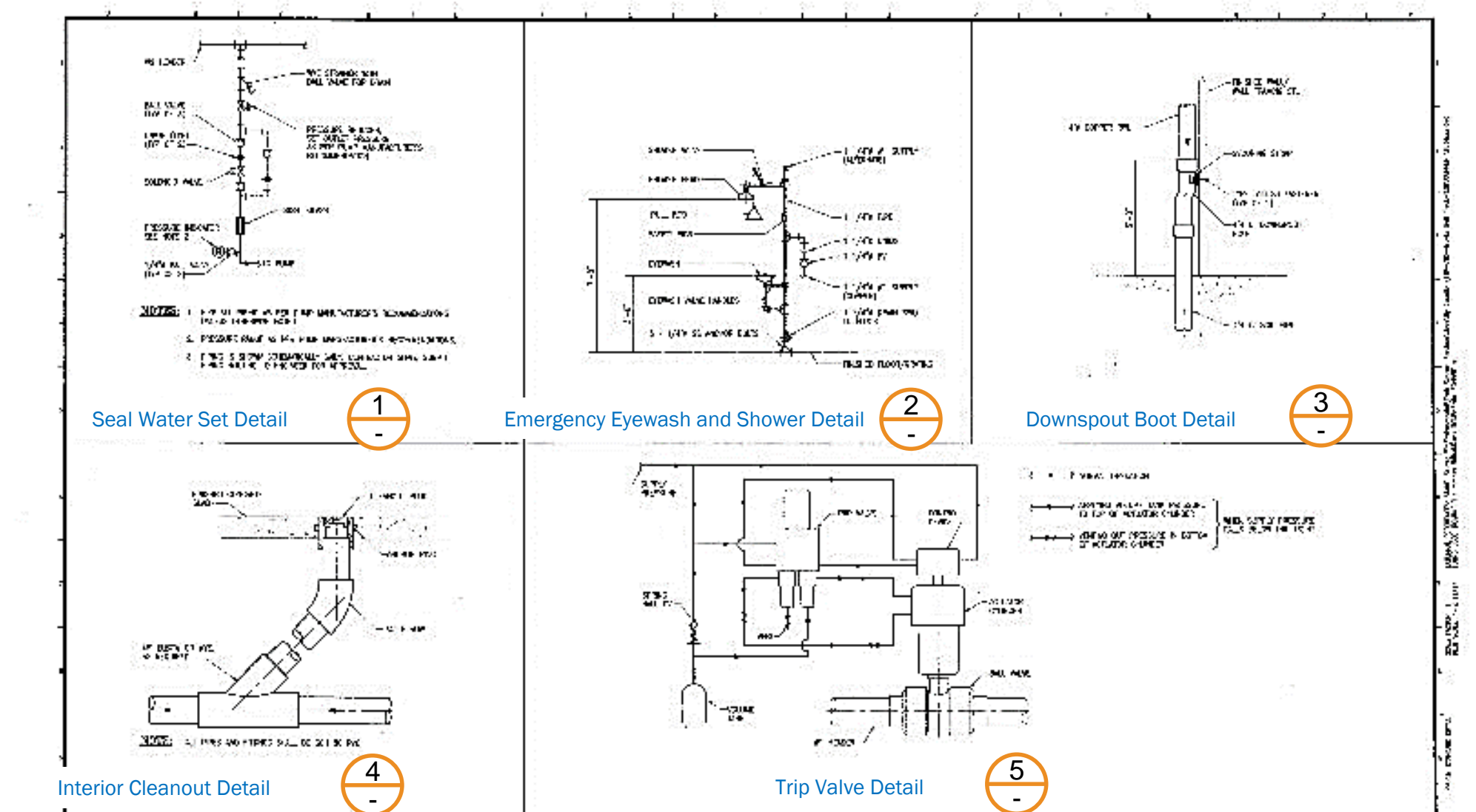


Section View – Example



Section A – what the reader should see when standing on the line and looking in the direction of the arrows.

Standard Mechanical Details – Example



Piping and Valve Schedule - Example

SYMBOL	SERVICE	SIZE (SEE NOTE 3)	MATERIAL	INSTALLATION	OPERATING PRESS. (PSIG)	LINE COATING	VALVE TYPE	VALVE SIZE	VALVE SPEC. NO.	VALVE INSTALLATION	VALVE OPERATING PRESS. (PSIG)	VALVE LINE COATING	VALVE TESTING
AHP	AIR, HIGH PRESSURE	1/2 IN & LARGER	COPPER	INSIDE EXPOSED	110	BARE/NO. 13	W	1/2 IN	15237	INSIDE EXPOSED	110	BARE/NO. 13	110
AHP	AIR, HIGH PRESSURE	3/8 IN & SMALLER	316 SS TUBING	OUTSIDE EXPOSED	110	BARE/NO. 17	W	3/8 IN	15236	OUTSIDE EXPOSED	110	BARE/NO. 17	110
AI	AIR, INSTRUMENT	1/2 IN & LARGER	COPPER	INSIDE EXPOSED	110	BARE/NO. 13	W	1/2 IN	15237	INSIDE EXPOSED	110	BARE/NO. 13	110
AI	AIR, INSTRUMENT	3/8 IN & SMALLER	316 SS TUBING	OUTSIDE EXPOSED	110	BARE/NO. 17	W	3/8 IN	15236	OUTSIDE EXPOSED	110	BARE/NO. 17	110
D	DRAIN	4 IN & LARGER	CAST IRON	INSIDE EXPOSED	GRAVITY	BARE/BARE	W	4 IN	15238	INSIDE EXPOSED	GRAVITY	BARE/BARE	GRAVITY
D	DRAIN	3 IN & LARGER	PVC SCH 80	INSIDE EXPOSED	GRAVITY	BARE/BARE	W	3 IN	15234	INSIDE EXPOSED	GRAVITY	BARE/BARE	GRAVITY

LEGEND	SERVICE	SIZE (SEE NOTE 3)	PIPING MATERIAL	SPEC NO.	INSTALLATION	LINING/COATING (SEE NOTE 4)	OPERATING PRESS. (PSIG)
AHP	AIR, HIGH PRESSURE	1/2 IN & LARGER	COPPER	15237	INSIDE EXPOSED	BARE/NO. 13	110
AHP	AIR, HIGH PRESSURE	3/8 IN & SMALLER	316 SS TUBING	15236	OUTSIDE EXPOSED	BARE/NO. 17	110
AI	AIR, INSTRUMENT	1/2 IN & LARGER	COPPER	15237	INSIDE EXPOSED	BARE/NO. 13	110
AI	AIR, INSTRUMENT	3/8 IN & SMALLER	316 SS TUBING	15236	OUTSIDE EXPOSED	BARE/NO. 17	110
D	DRAIN	4 IN & LARGER	CAST IRON	15238	INSIDE EXPOSED	BARE/BARE	GRAVITY
D	DRAIN	3 IN & LARGER	PVC SCH 80	15234	INSIDE EXPOSED	BARE/BARE	GRAVITY

SYMBOL	SERVICE	SIZE (SEE NOTE 3)	MATERIAL	INSTALLATION	OPERATING PRESS. (PSIG)	LINE COATING	VALVE TYPE	VALVE SIZE	VALVE SPEC. NO.	VALVE INSTALLATION	VALVE OPERATING PRESS. (PSIG)	VALVE LINE COATING	VALVE TESTING
AHP	AIR, HIGH PRESSURE	1/2 IN & LARGER	COPPER	INSIDE EXPOSED	110	BARE/NO. 13	W	1/2 IN	15237	INSIDE EXPOSED	110	BARE/NO. 13	110
AHP	AIR, HIGH PRESSURE	3/8 IN & SMALLER	316 SS TUBING	OUTSIDE EXPOSED	110	BARE/NO. 17	W	3/8 IN	15236	OUTSIDE EXPOSED	110	BARE/NO. 17	110
AI	AIR, INSTRUMENT	1/2 IN & LARGER	COPPER	INSIDE EXPOSED	110	BARE/NO. 13	W	1/2 IN	15237	INSIDE EXPOSED	110	BARE/NO. 13	110
AI	AIR, INSTRUMENT	3/8 IN & SMALLER	316 SS TUBING	OUTSIDE EXPOSED	110	BARE/NO. 17	W	3/8 IN	15236	OUTSIDE EXPOSED	110	BARE/NO. 17	110
D	DRAIN	4 IN & LARGER	CAST IRON	INSIDE EXPOSED	GRAVITY	BARE/BARE	W	4 IN	15238	INSIDE EXPOSED	GRAVITY	BARE/BARE	GRAVITY
D	DRAIN	3 IN & LARGER	PVC SCH 80	INSIDE EXPOSED	GRAVITY	BARE/BARE	W	3 IN	15234	INSIDE EXPOSED	GRAVITY	BARE/BARE	GRAVITY

NOTES:

- SEE SPECIFICATION SHEET FOR PIPE DIMENSIONS AND WEIGHTS.
- VALVE AND PIPE SCHEDULE SHALL BE AS SHOWN UNLESS OTHERWISE SPECIFIED. GRAVITY DRAIN SHALL BE SCHEDULE 40 UNLESS OTHERWISE SPECIFIED.
- THE CODE FOR EACH SERVICE SHALL BE SHOWN ON THE DRAWING.
- OPERATING PRESSURE IS THE DESIGNATED OPERATING PRESSURE.
- WALL THICKNESS IS TO BE AS SHOWN IN THE FOLLOWING TABLE UNLESS OTHERWISE SPECIFIED:

PIPE SIZE (IN)	WALL THICKNESS (IN)
1/2 - 1 1/2	0.048
2 - 4	0.063
6 - 10	0.083
12 - 18	0.104
24 - 30	0.125
36 - 48	0.156
60 - 72	0.188
90 - 108	0.234
120 - 144	0.281
180 - 216	0.375
240 - 300	0.469

- THE WEIGHTS AND DIMENSIONS OF VALVES SHALL BE AS SHOWN IN THE SPECIFICATION SHEET.
- FLANGES SHALL BE AS SHOWN UNLESS OTHERWISE SPECIFIED.
- VALVE AND PIPE SCHEDULE SHALL BE AS SHOWN UNLESS OTHERWISE SPECIFIED.
- THE WEIGHTS AND DIMENSIONS OF VALVES SHALL BE AS SHOWN IN THE SPECIFICATION SHEET.
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Mechanical Equipment Schedule - Partial Example

GRAVITY BELT THICKENER (GBT) SCHEDULE											
OPERATING LOCATION	PHYSICAL LOCATION	SERVICE	SPECIFICATION REFERENCE	QTY	BELT WIDTH	UNIT CAPACITY	BELT TRACKING AND TENSIONING	DRIVE TYPE	HP	VOLTS/PH/Hz	MANUFACTURE AND MODEL NO.
SE42M55-1,2	BLDG 785	GBT SYSTEM	11350	2	4.0 METERS	600 - 1200 GPM	PNEUMATIC	ADJUSTABLE SPEED	7.5	480/3/60	ANDRITZ

CHEMICAL CLEANING SOLUTION TANK MIXER SCHEDULE											
OPERATING LOCATION	PHYSICAL LOCATION	SERVICE	SPECIFICATION REFERENCE	QTY	MIXER OUTPUT SPEED (RPM)	MOTOR (RPM)	DRIVE TYPE	HP	VOLTS/PH/Hz	ADJUSTABLE IMPELLER TYPE	MANUFACTURE AND MODEL NO.
SE42M70	BLDG 780 BASEMENT	GBT BELT CLEANING AND WASHDOWN	11363	1	50	1750	CONSTANT SPEED	0.3	480/3/60	TWO-BLADE FOLDING AXIAL FLOW	LIGHTNING

GRAVITY BELT THICKENER (GBT) SCHEDULE											
OPERATING LOCATION	PHYSICAL LOCATION	SERVICE	SPECIFICATION REFERENCE	QTY	BELT WIDTH	UNIT CAPACITY	BELT TRACKING AND TENSIONING	DRIVE TYPE	HP	VOLTS/PH/Hz	MANUFACTURE AND MODEL NO.
SE42M55-1,2	BLDG 785	GBT SYSTEM	11350	2	4.0 METERS	600 - 1200 GPM	PNEUMATIC	ADJUSTABLE SPEED	7.5	480/3/60	ANDRITZ

CHEMICAL CLEANING SOLUTION TANK MIXER SCHEDULE											
OPERATING LOCATION	PHYSICAL LOCATION	SERVICE	SPECIFICATION REFERENCE	QTY	MIXER OUTPUT SPEED (RPM)	MOTOR (RPM)	DRIVE TYPE	HP	VOLTS/PH/Hz	ADJUSTABLE IMPELLER TYPE	MANUFACTURE AND MODEL NO.
SE42M70	BLDG 780 BASEMENT	GBT BELT CLEANING AND WASHDOWN	11363	1	50	1750	CONSTANT SPEED	0.3	480/3/60	TWO-BLADE FOLDING AXIAL FLOW	LIGHTNING

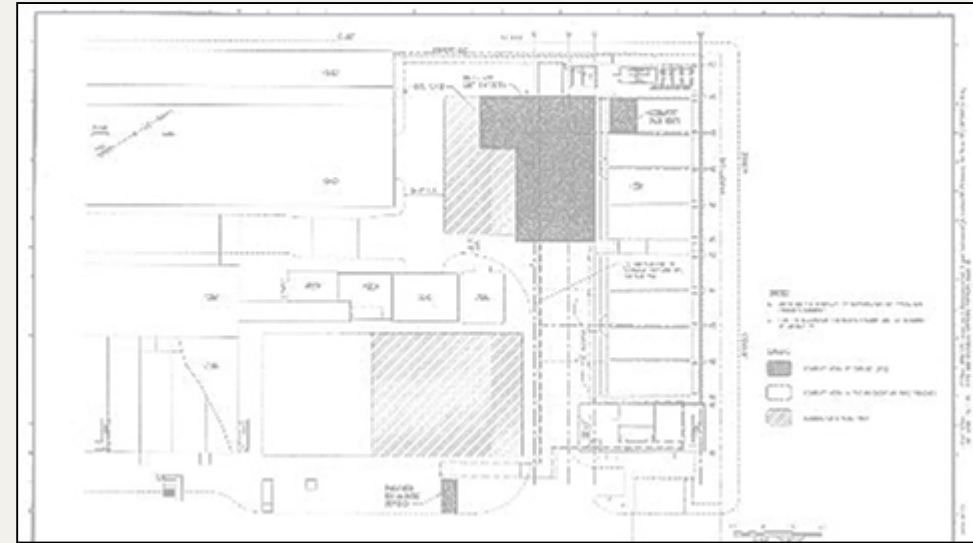
Major Types Of Drawings (typical)

- General Information
- Civil/Site, Landscape Architecture
- Architectural
- Plumbing/Mechanical
 - Fire Protection
- Structural
- Electrical
- Instrumentation



Major Types Of Drawings (continued)

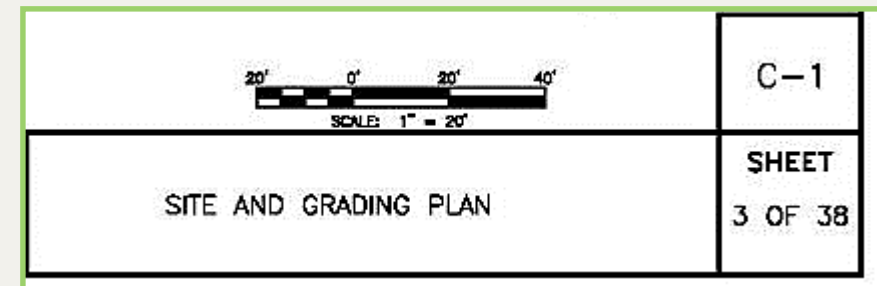
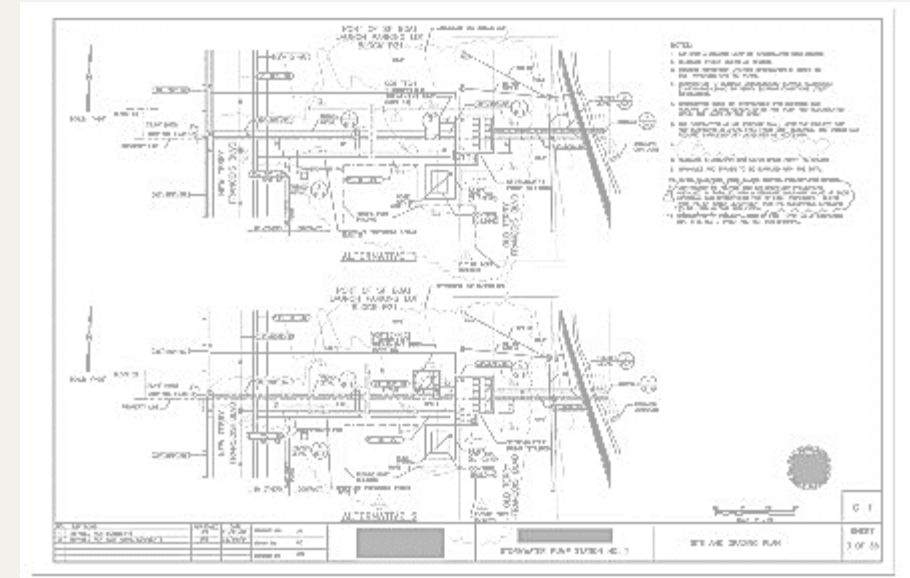
- **General Information**
 - G-drawings could include a location map, describe the general work area, summarize the work tasks, etc.
- Civil/Site, Landscape Architecture
- Architectural
- Plumbing/Mechanical
 - Fire Protection
- Structural
- Electrical
- Instrumentation



INTERIM GRAVITY BELT THICKENER FACILITY GENERAL WORK AREA PLAN	DRAWING ID G-05
	FILE NO. CW204
	REV. NO. 0

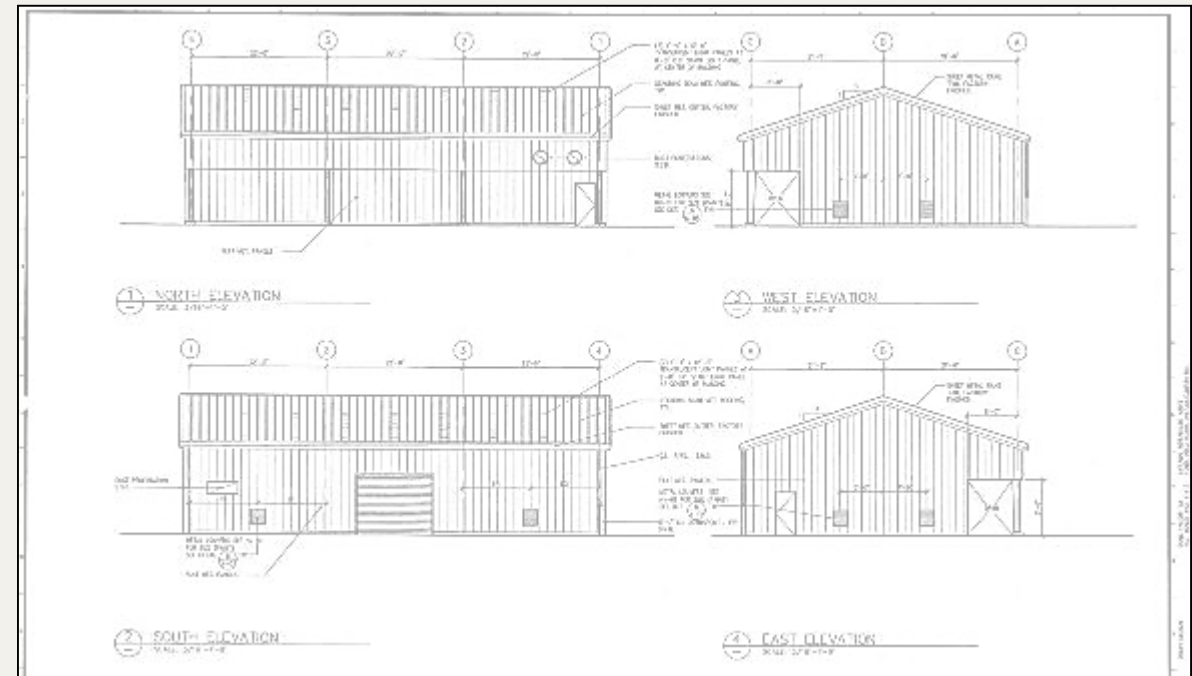
Major Types Of Drawings (continued)

- General Information
- **Civil/Site, Landscape Architecture**
 - C- or LA-drawings could include site grading, pervious pavement, sidewalks, curbs, landscaping, etc.
- Architectural
- Plumbing/ Mechanical
 - Fire Protection
- Structural
- Electrical
- Instrumentation



Major Types Of Drawings (continued)

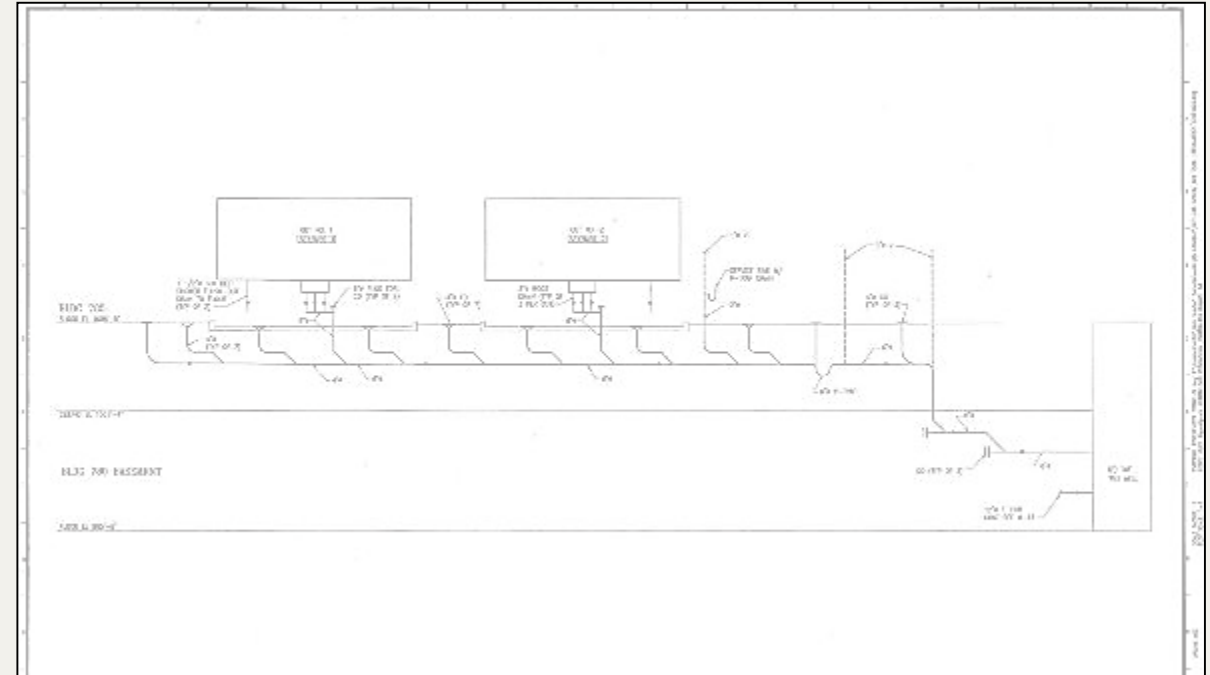
- General Information
- Civil/Site
- **Architectural**
 - A-drawings include exterior elevations, door/ window schedules, etc.
- Plumbing/Mechanical
 - Fire Protection
- Structural
- Electrical
- Instrumentation



INTERIM GRAVITY BELT THICKENER FACILITY BUILDING 785 ELEVATIONS	DRAWING ID: A-03
	FILE NO. CW0219
	REV. NO. 0

Major Types Of Drawings (continued)

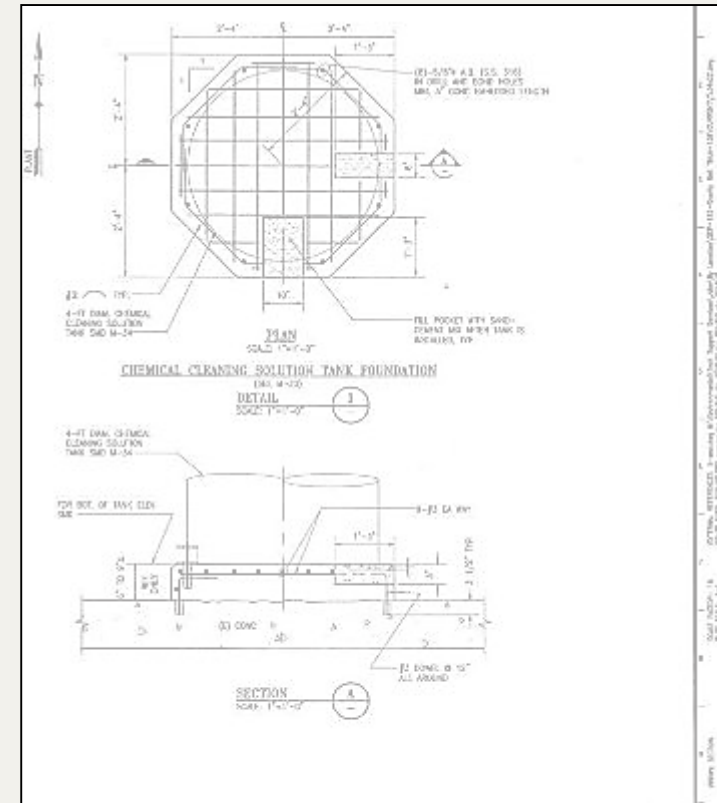
- General Information
- Civil/Site
- Architectural
- **Plumbing/Mechanical**
 - P- and M-drawings include drainage/sewer piping and traps, water supply lines, etc.
 - Fire Protection
- Structural
- Electrical
- Instrumentation



INTERIM GRAVITY BELT THICKENER FACILITY		DRAWING ID M-14
BLDG 785 DRAINAGE SCHEMATIC		FILE NO. CW0256
		REV. NO. 0

Major Types Of Drawings (continued)

- General Information
- Civil/Site
- Architectural
- Plumbing/Mechanical
 - Fire Protection
- **Structural**
 - S-drawings include structural foundation, support, and reinforcement information
- Electrical
- Instrumentation

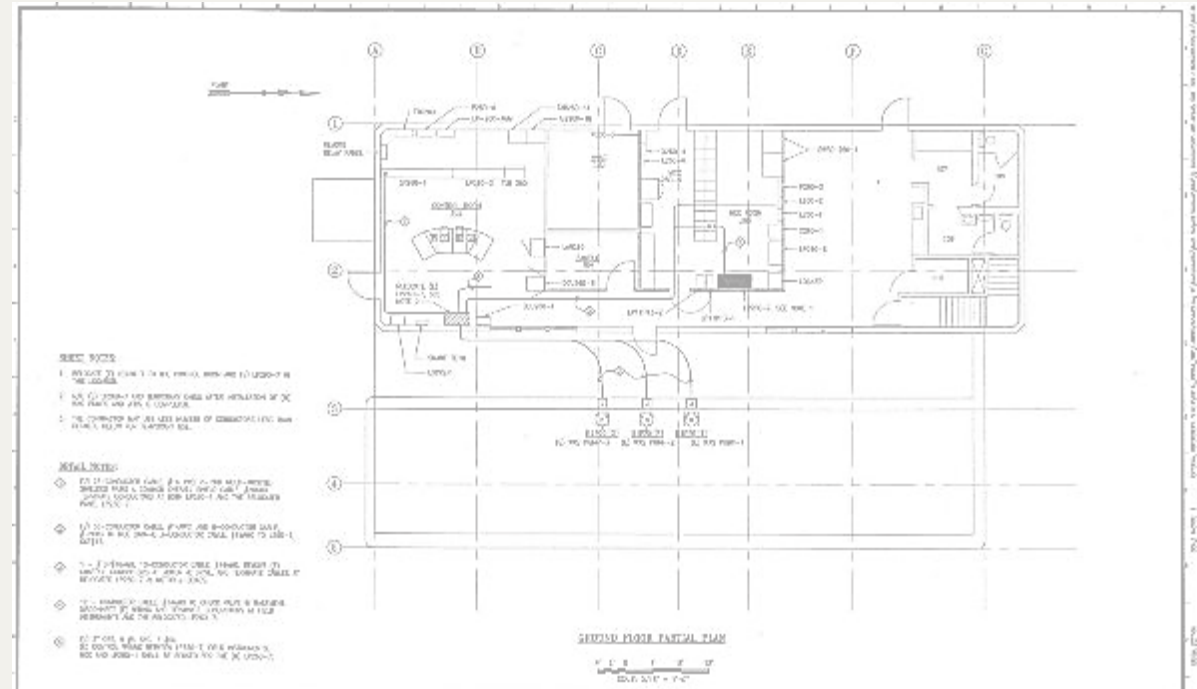


INTERIM GRAVITY BELT THICKENER FACILITY
 TANK FOUNDATION AND EQUIPMENT SUPPORT
 MISCELLANEOUS SUPPORT DETAILS

DRAWING ID	S-16
FILE NO.	CW0238
REV. NO.	0

Major Types Of Drawings (continued)

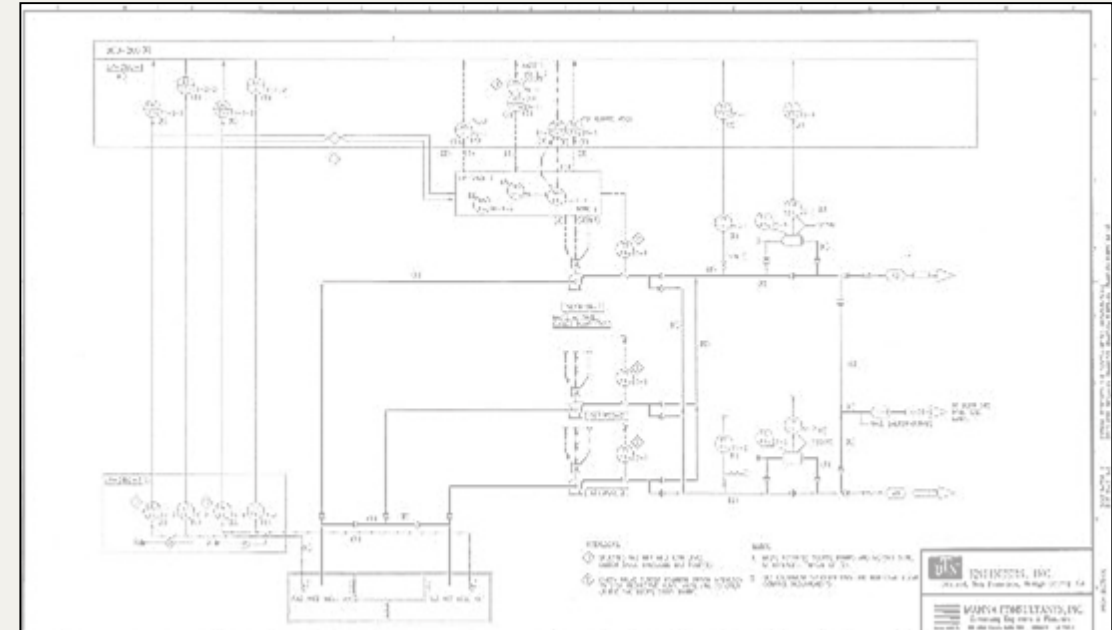
- General Information
- Civil/Site
- Architectural
- Plumbing/Mechanical
 - Fire Protection
- Structural
- **Electrical**
 - E-drawings include power supply/lighting information
- Instrumentation



INTERIM GRAVITY BELT THICKENER FACILITY BUILDING 280 GROUND FLOOR PARTIAL ELECTRICAL PLAN	DRAWING NO. E-15
	FILE NO. CW0311
	REV. NO. 0

Major Types Of Drawings (continued)

- General Information
- Civil/Site
- Architectural
- Plumbing/Mechanical
 - Fire Protection
- Structural
- Electrical
- **Instrumentation**
 - I-drawings include piping and instrumentation diagrams (P&IDs), control wiring diagrams, communication system block diagrams, etc.



INTERIM GRAVITY BELT THICKENER FACILITY		DRAWING ID 1-03
P & ID - PROCESS 11 WASTE ACTIVATED SLUDGE PUMPING SYSTEM		FILE NO. CW0333
		REV. NO. 0

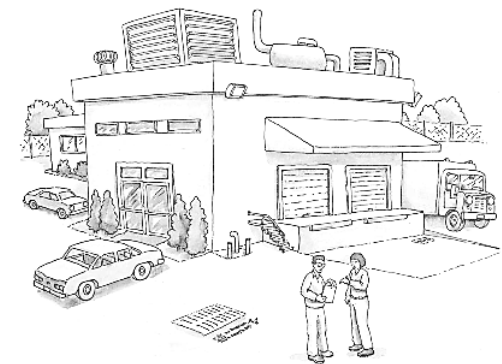
Examples Focused on Source Control/Pollution Prevention

Source Control/Pollution Prevention - *What is it?*

- Also known as “**Pretreatment, Pollution Prevention and Stormwater (P3S)**”
- Industrial Activities Requiring **Best Management Practices (BMPs)**
 - Non-stormwater discharges to drains
 - Vehicle and Equipment Fueling
 - Vehicle and Equipment Washing and Steamcleaning
 - Vehicle and Equipment Maintenance and Repair
 - Outdoor Loading/Unloading of Materials
 - Outdoor Containers/Storage of Liquids
(continued next column)
- (BMPs, continued)
 - Outdoor Process Equipment Operations and Maintenance
 - Outdoor Storage of Raw Materials, Products, and Byproducts
 - Waste Handling and Disposal
 - Contaminated or Erodible Surface Areas
 - Building and Grounds Maintenance
 - Building Repair, Remodeling, and Construction
 - Over-Water Activities
 - Employee Training

Acknowledgements: Based on material provided by Cassie Prudhel

**Best Management Practices
For Industrial Storm Water
Pollution Control**



Pretreatment & Stormwater Program Requirements Often Associated with Drawings (1 of 2)

- Storm Drains and Sanitary Sewers
- Use of Pervious Pavement
- Catch Basin Markings (No Dumping! Flows to Bay)
- Food Service – Grease Removal Device (GRD)
- Source Control
 - Minimize Stormwater Pollutants in Urban Runoff
 - Landscaping and Irrigation
- Sediment and Erosion Control (during construction)
- Site Design and Stormwater Treatment
 - Low-Impact Design/Development (LID)

Acknowledgements: Based on material provided by Cassie Prudhel

SAN MATEO COUNTYWIDE
Water Pollution
Prevention Program

Stormwater Requirements Checklist

Municipal Regional Stormwater Permit (MRP)
Order No. R2-2009-0074 ; Order No. R2-2011-0083
NPDES No. CAS612008

INSERT CITY SPECIFIC INFO HERE
ADDRESS
PHONE
FAX
WEB (for those who allow download etc)

Complete this form for all projects regardless of size. The purpose of this form is to identify requirements for stormwater controls.

A. Project Information

A.1 Project Name: _____

A.2 Project Address: _____

A.3 Project APN: _____

A.4 Is the project a C.3 Regulated Project? (Refer to the C.3 and C.6 Data Collection Form for projects that create and/or replace 5,000 square feet or more of impervious surface. Smaller projects check No.) Yes No
> For non-Regulated Projects, Sections B, C, and D apply. For Regulated Projects, all sections of this checklist apply.

B. Select Appropriate Site Design Measures (Required for C.3 Regulated Projects; all other projects are encouraged to implement site design measures, which may be required at municipality discretion. Starting December 1, 2012, projects that create and/or replace 2,500 – 10,000 sq. ft. of impervious surface, and stand-alone single family homes that create/replace 2,500 sq. ft. or more of impervious surface, must include one of Site Design Measures a through f.¹ Consult with municipal staff about requirements for your project.)

B.1 Is the site design measure included in the project plans?

Yes	No	Plan Sheet No.
<input type="checkbox"/>	<input type="checkbox"/>	a. Direct roof runoff into cisterns or rain barrels and use rainwater for irrigation or other non-potable uses.
<input type="checkbox"/>	<input type="checkbox"/>	b. Direct roof runoff onto vegetated areas.
<input type="checkbox"/>	<input type="checkbox"/>	c. Direct runoff from sidewalks, walkways, and/or patios onto vegetated areas.
<input type="checkbox"/>	<input type="checkbox"/>	d. Direct runoff from driveways and/or uncovered parking lots onto vegetated areas.
<input type="checkbox"/>	<input type="checkbox"/>	e. Construct sidewalks, walkways, and/or patios with permeable surfaces.
<input type="checkbox"/>	<input type="checkbox"/>	f. Construct bike lanes, driveways, and/or uncovered parking lots with permeable surfaces.
<input type="checkbox"/>	<input type="checkbox"/>	g. Minimize land disturbance and impervious surface (especially parking lots).
<input type="checkbox"/>	<input type="checkbox"/>	h. Maximize permeability by clustering development and preserving open space.
<input type="checkbox"/>	<input type="checkbox"/>	i. Use micro-detention, including distributed landscape-based detention.
<input type="checkbox"/>	<input type="checkbox"/>	j. Protect sensitive areas, including wetland and riparian areas, and minimize changes to the natural topography.
<input type="checkbox"/>	<input type="checkbox"/>	k. Self-treating area (see Section 4.2 of the C.3 Technical Guidance)
<input type="checkbox"/>	<input type="checkbox"/>	l. Self-retaining area (see Section 4.3 of the C.3 Technical Guidance)
<input type="checkbox"/>	<input type="checkbox"/>	m. Plant or preserve interceptor trees (Section 4.1, C.3 Technical Guidance)

¹ See MRP Provision C.3.a.i(6) for non-C.3 Regulated Projects, C.3.c.i(2)(a) for Regulated Projects, C.3.i for projects that create/replace 2,500 to 10,000 sq. ft. of impervious surface and stand-alone single family homes that create/replace 2,500 sq. ft. or more of impervious surface.

1

FINAL Approved June 12, 2012

Pretreatment & Stormwater Program

Requirements Often Associated with Drawings (2 of 2)

- Project Applicant Stormwater Checklist and Data Worksheet
- Condensate and/or Blowdown from Rooftop Equipment
- Underground Parking – Groundwater Infiltration
- Separate Water Meters
- Fleet Concrete Wash Area and Drainage
- Sample Point(s)
- Lint Traps
- pH Adjustment - Holding Tank
- **NEW!** Water Reuse Units (e.g., onsite water recycling)
- **NEW!** COD Removal with Microbes (e.g., breweries)

“Water reuse is onsite water recycling for non-potable use (toilet flushing) such as at SFPUC Headquarters or East Bay Municipal Utility District headquarters.”

“COD removal with microbes is onsite small scale package plant secondary treatment. These systems are used in breweries most commonly.”

- Brenda Donald, SFPUC



Acknowledgements: Based on material provided by Cassie Prudhel and Brenda Donald

Preparing for an Inspection (1 of 2)

1. If inspecting for Fats, Oils, and Grease (FOG), familiarize yourself with Grease Removal Devices (GRDs)
2. Become familiar with cut sheets/data sheets for often-installed equipment and cleaning how-to videos on YouTube. Refer these to the permittee, and they should be able to perform maintenance.
 - <http://www.greasetrap.ca/pdfs/GOS40-CUT-SHEET.pdf>
 - <https://www.youtube.com/watch?v=qUWghZAX-pM>
3. In general, the following equipment are not allowed to be connected to a GRD:
 - Garbage grinder
 - Dishwasher
4. Look for pretreatment devices on a fixture schedule. <https://commaq.com/cq/wp-content/uploads/2015/04/CDi-Bldg-G-Plumbing-Fixture-Cut-Sheets.pdf>
5. NOTE: oftentimes, water consumption is not equal to water discharged due to evaporation or incorporation of water into “product”. Flow factor reductions are common when billing breweries, food manufacturers, cooling towers, and even foundries with cast cooling tanks that are not connected to the sewer.



Preparing for an Inspection (2 of 2)

6. Familiarize yourself with your jurisdiction's Plumbing Codes.
7. Establish mutually beneficial relationships with jurisdictional Plumbing Inspectors/department. They can inform you of new projects, and you can report scofflaws.
8. Most jurisdictions have plumbing and building permit applications online. Check online if you suspect a questionable installation.
9. Pretreatment Inspectors should not have to worry about the installation of backward or upside-down equipment if the equipment was properly permitted, installed by a licensed contractor, and inspected by competent **plumbing** inspectors. If you think there is an issue and a permit is not on file, document the issue with your jurisdiction's Plumbing Inspectors. There is no grandfathering-in of code violations without a grandfather clause.
10. If you find any non-permitted fixtures, this is likely a violation of either the plumbing code, the sewer use ordinance, or both. Issue an NOV (Notice of Violation) and/or send a report to the Plumbing Inspector.

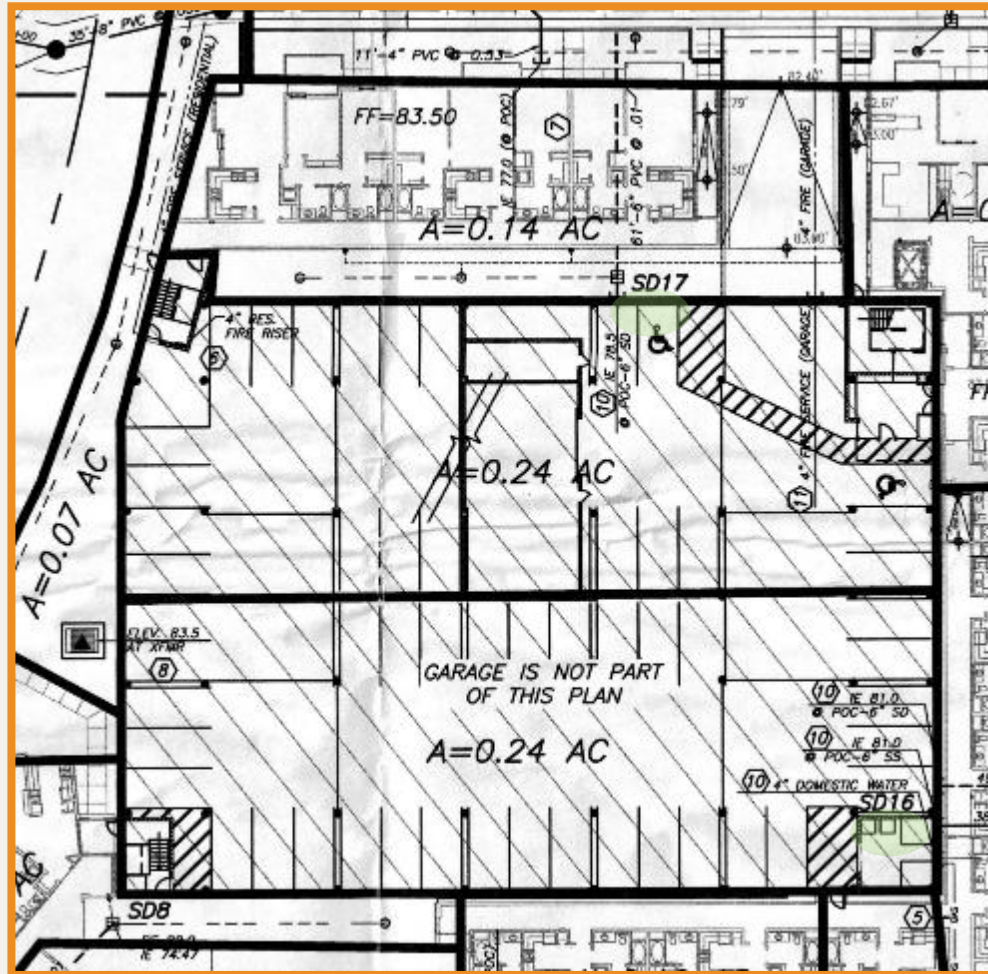


A Few Industry-Related Examples

Source Control/Pollution Prevention

Example - Drainage Area Calculations Included

Supporting data for a Stormwater Management Plan (SWMP)



Storm Sewer Summary Report

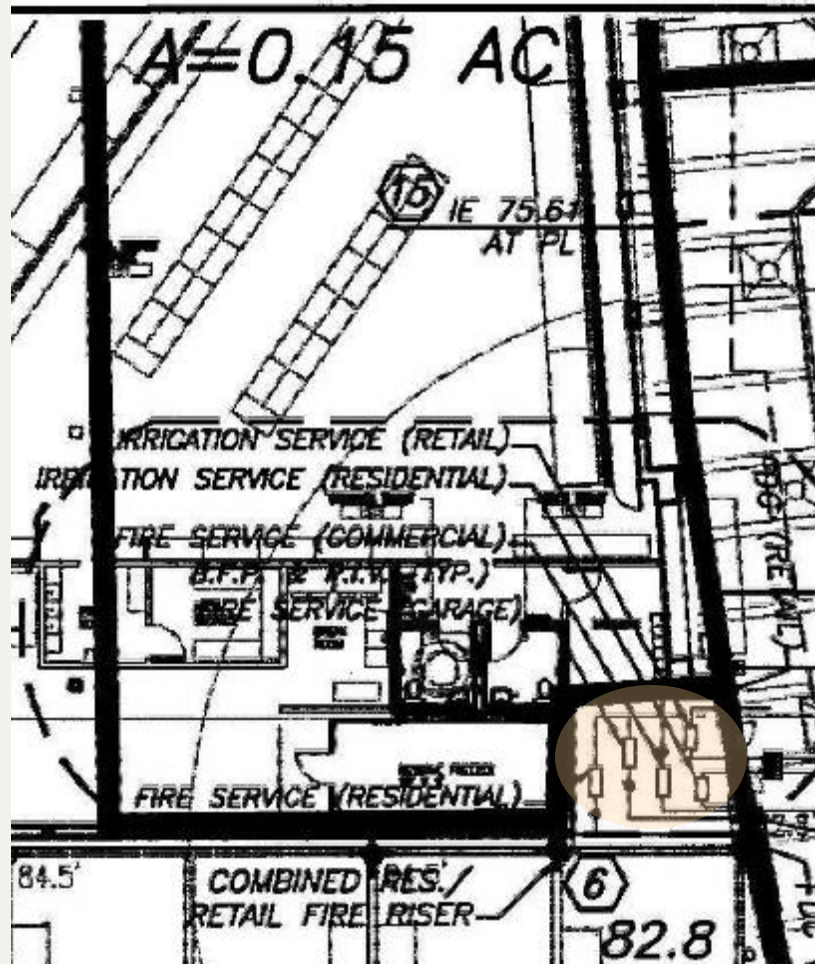
Pipe	Pipe Dim (in)	Pipe Capacity (cfs)	Tot Flow (cfs)	Catch Area (ac)
16	6.00	2.65	0.58	0.24
17	6.00	1.60	0.91	0.38

Acknowledgements: Based on material provided by Cassie Prudhel



Source Control/Pollution Prevention

Example – Separate Water Meters



1. Irrigation Service (Retail)
2. Irrigation Service (Residential)
3. Fire Service (Commercial); B.F.P. (backflow preventer) & P.I.V. (typ.)
4. Fire Service (Garage)
5. Fire Service (Residential)

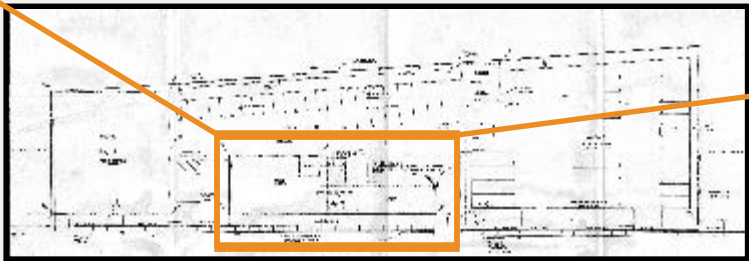
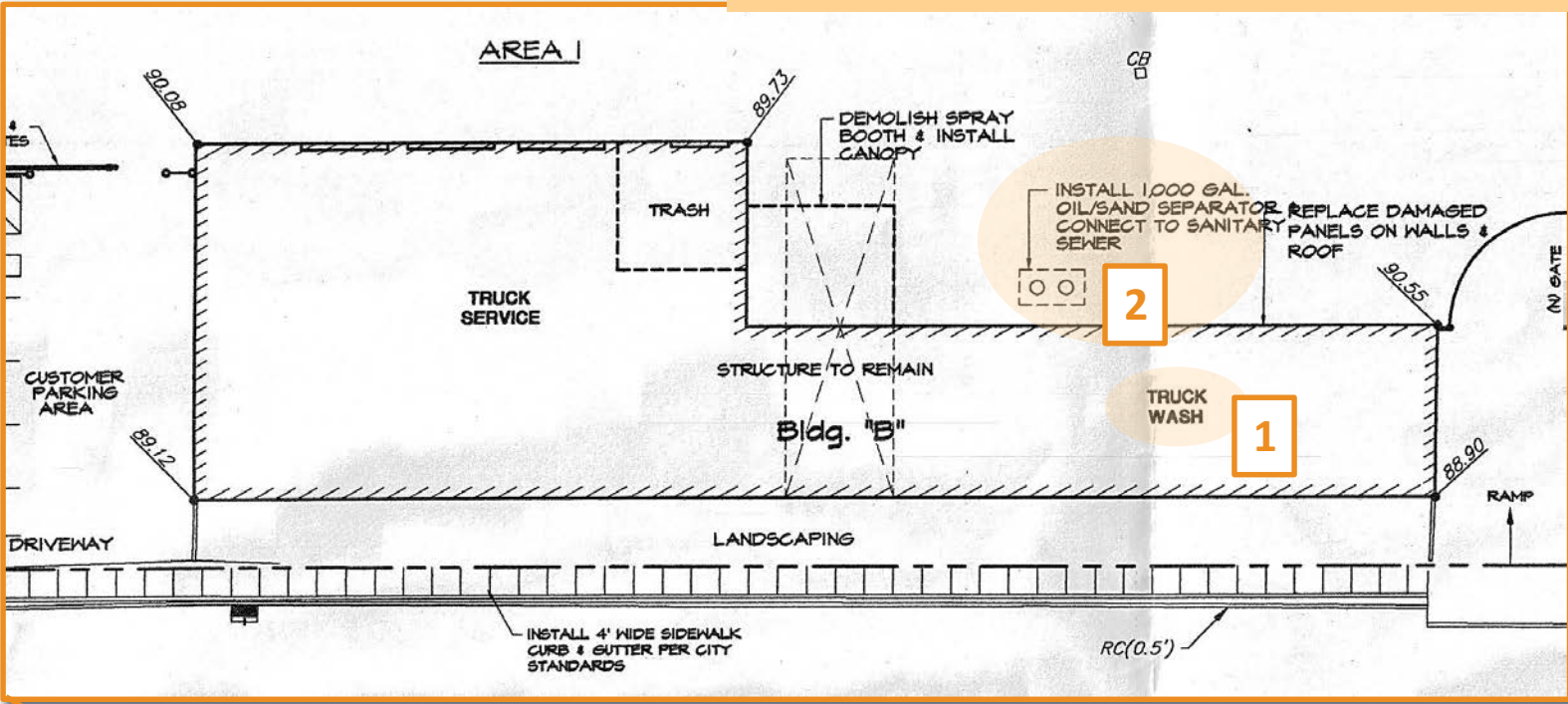
Verify/Locate Each Meter; Follow Piping to Appropriate Discharge Location

P.I.V. = Post Indicator Valve (firefighting)

Source Control/Pollution Prevention

Example - Truck Rental Facility

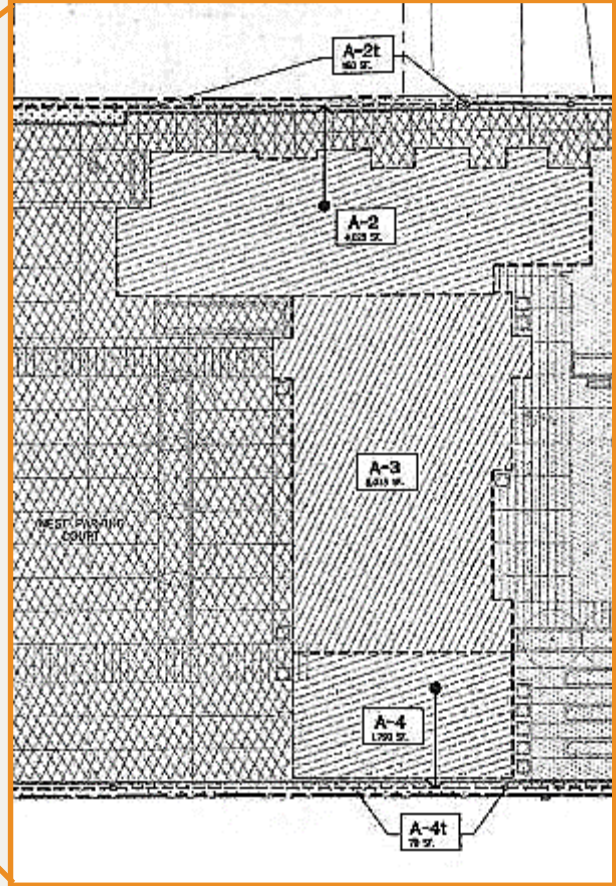
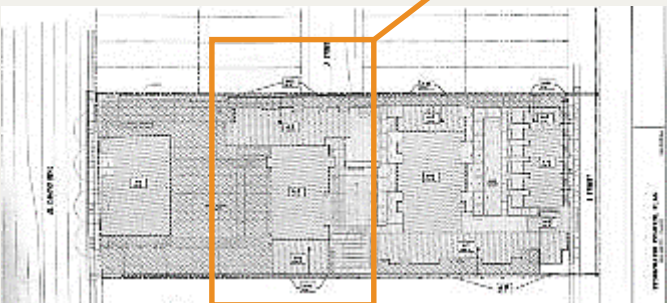
Potential Areas of concern:
1. Truck Wash
2. Oil/Water Separator Connected to Sanitary Sewer



Total Area = 73,015 SF
Total Landscape = 18,050 SF (24.7%)

Source Control/Pollution Prevention

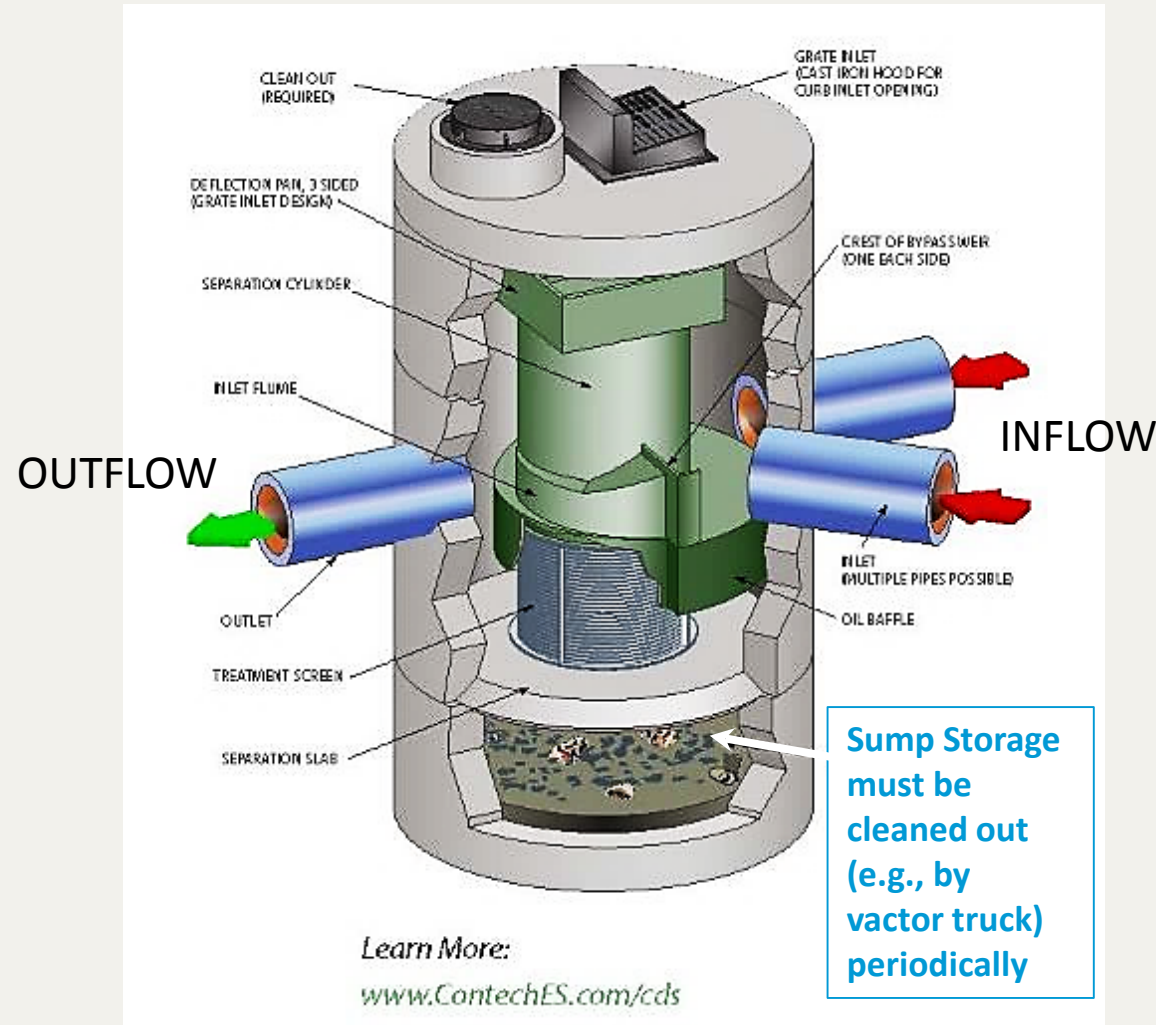
Example - Stormwater Control Plan



CDS®

Source Control/Pollution Prevention

Cutaway View - Stormwater Filter Device (SWFD)



Also known as a “CDS unit”

Continuous
Deflective
Separation
 technology, uses
 the natural motion
 of the water to
 separate and trap
 pollutants.

Source Control/Pollution Prevention

Example - Low-Impact Design/Development (LID)

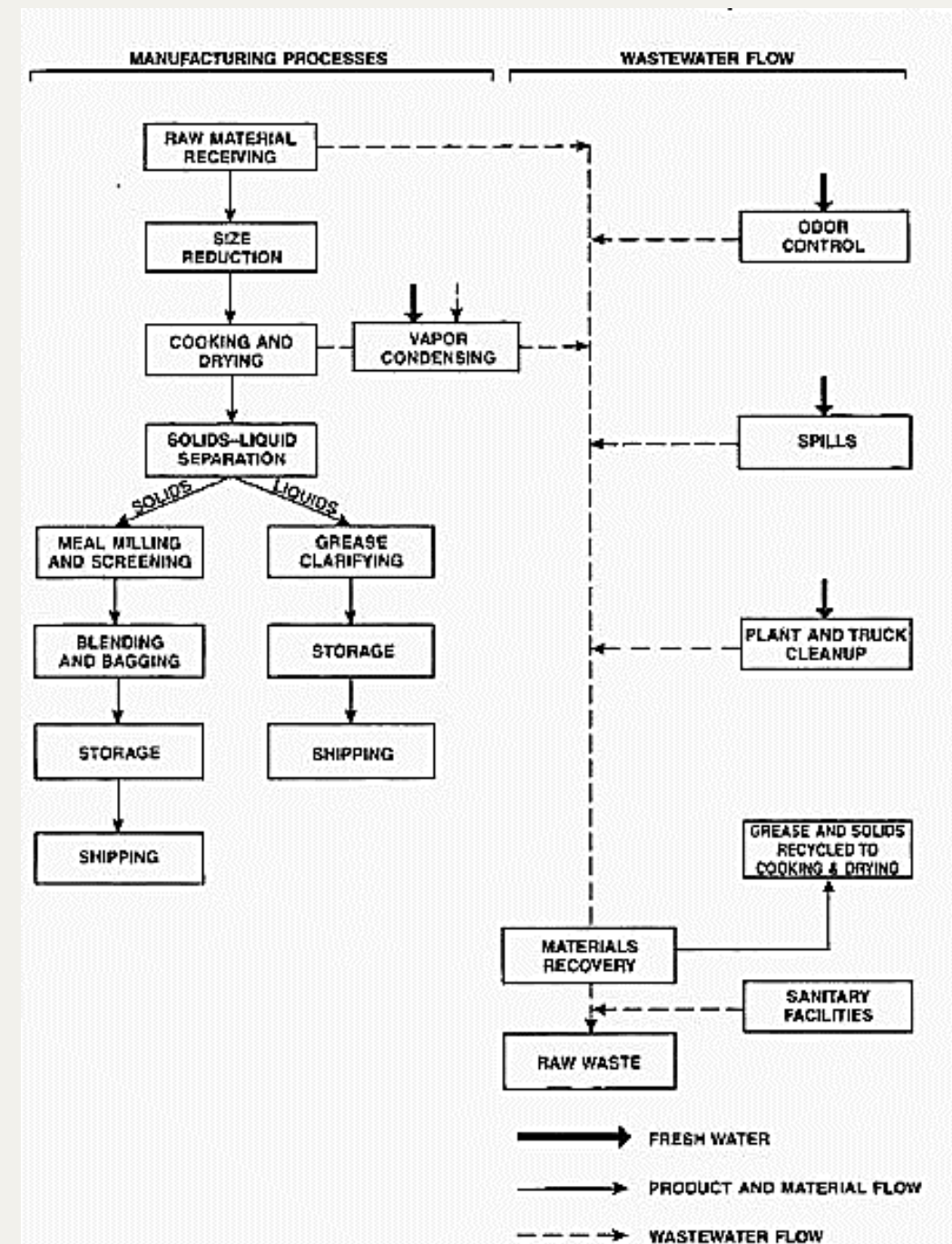
- Two types of stormwater management methods
 - *vegetated swales*
 - *infiltration basins*
- **Capture and purify** drainage from paved areas
- **Vegetated swales** capture stormwater runoff and convey it to infiltration basins at the low end of each swale
- Breaks in curbs allow surface runoff to enter swales at controlled points.
- **Infiltration basins** reduce and delay stormwater flows by capturing and holding runoff. They allow stormwater to percolate into the soil, recharging groundwater and postponing or completely bypassing drainage into on-site catch basins.



Two Case Studies

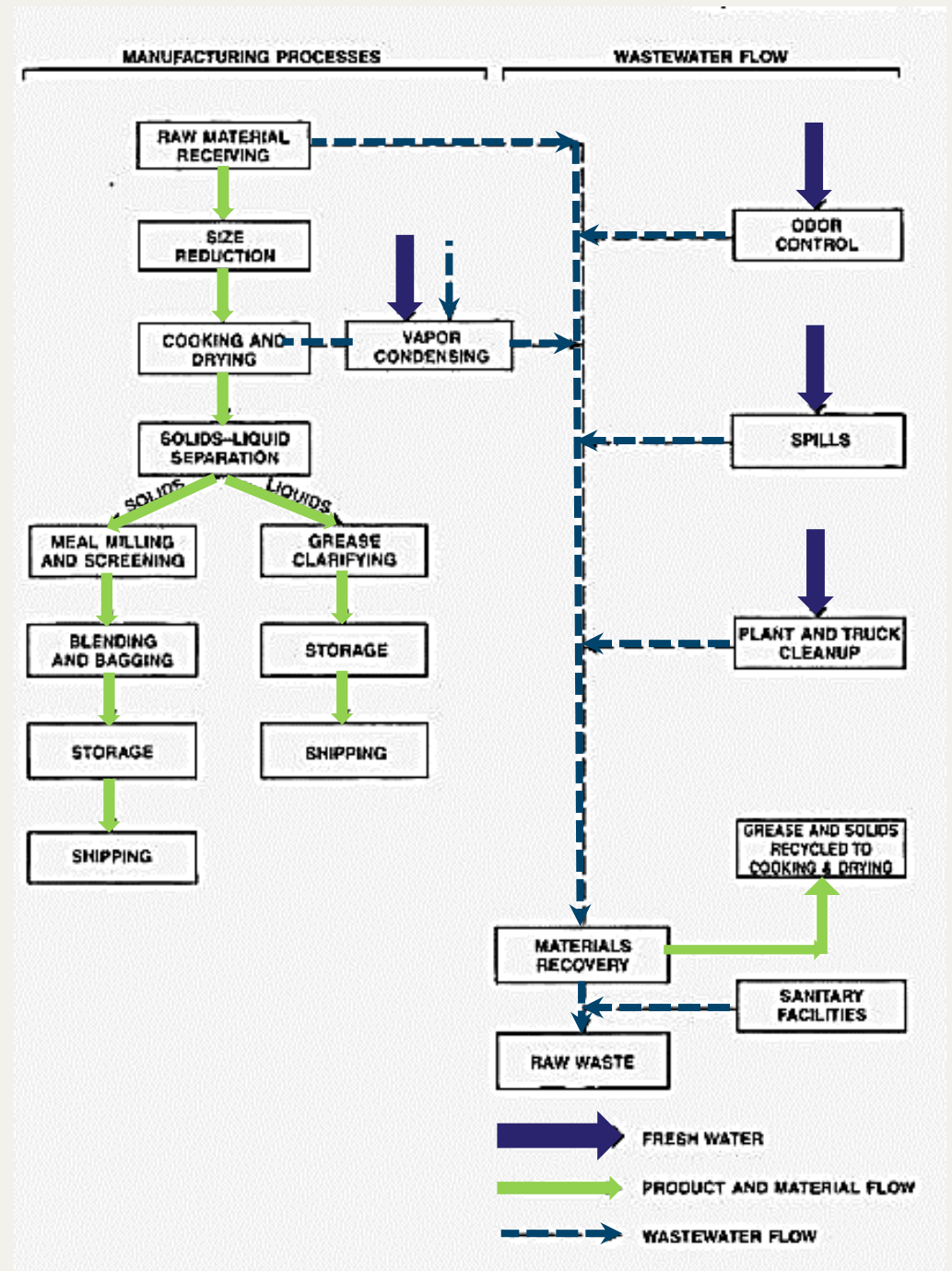
Case Study 1 – Typical Manufacturing Plant

1. Image from Pretreatment Facility Inspection, Third Edition, A Field Study Training Program 1996 CSUS.
2. Follow the flow of water and the flow of product/material.
3. **If the amount of final product added to the amount of hauled waste weighs much less than the wastewater pollutant loadings suggest, what might be happening?**
4. One possible approach follows.



Case Study 1 – Typical Manufacturing Plant

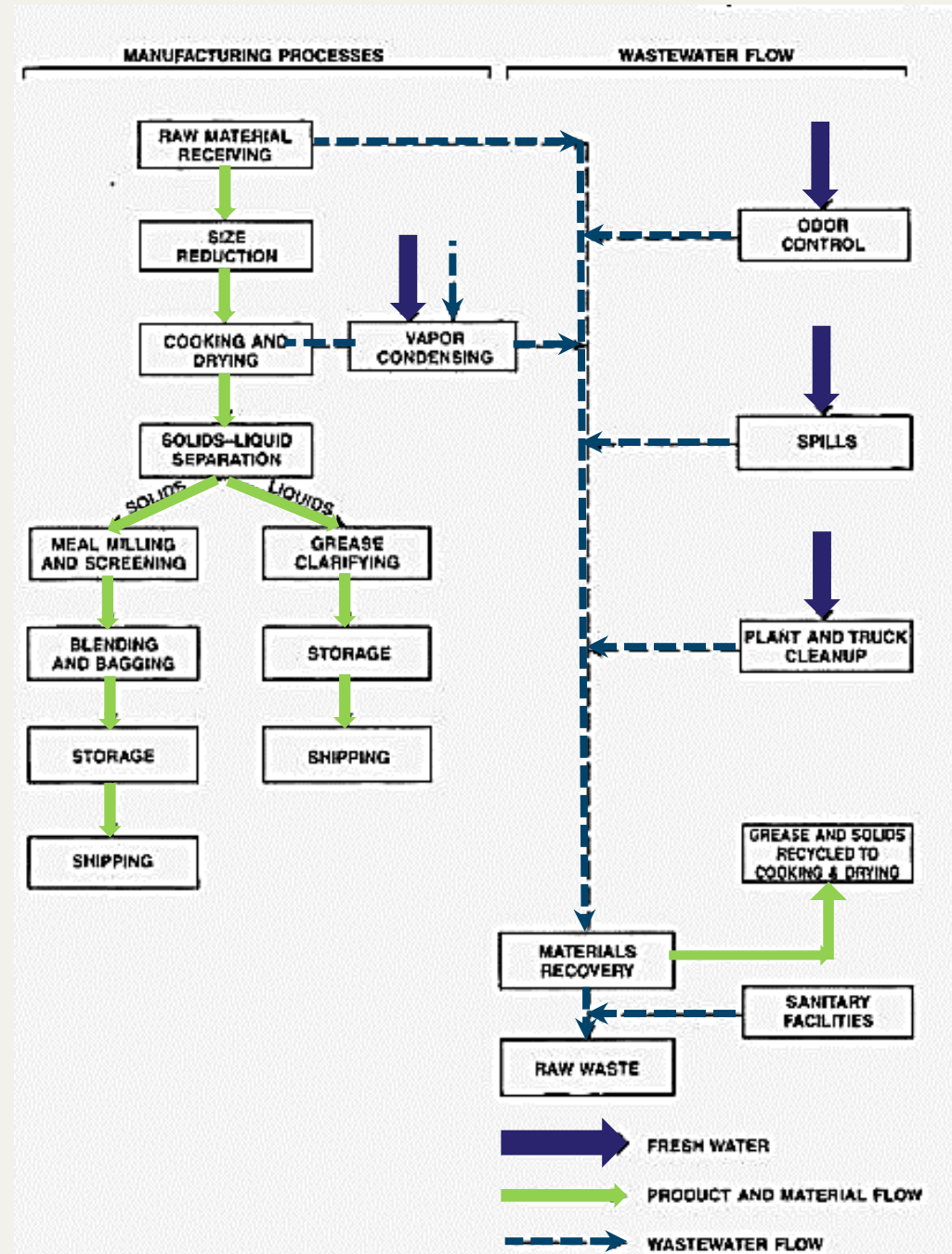
Follow (1) the flow of **water** and (2) the flow of **product/material**



Case Study 1 – Typical Manufacturing Plant

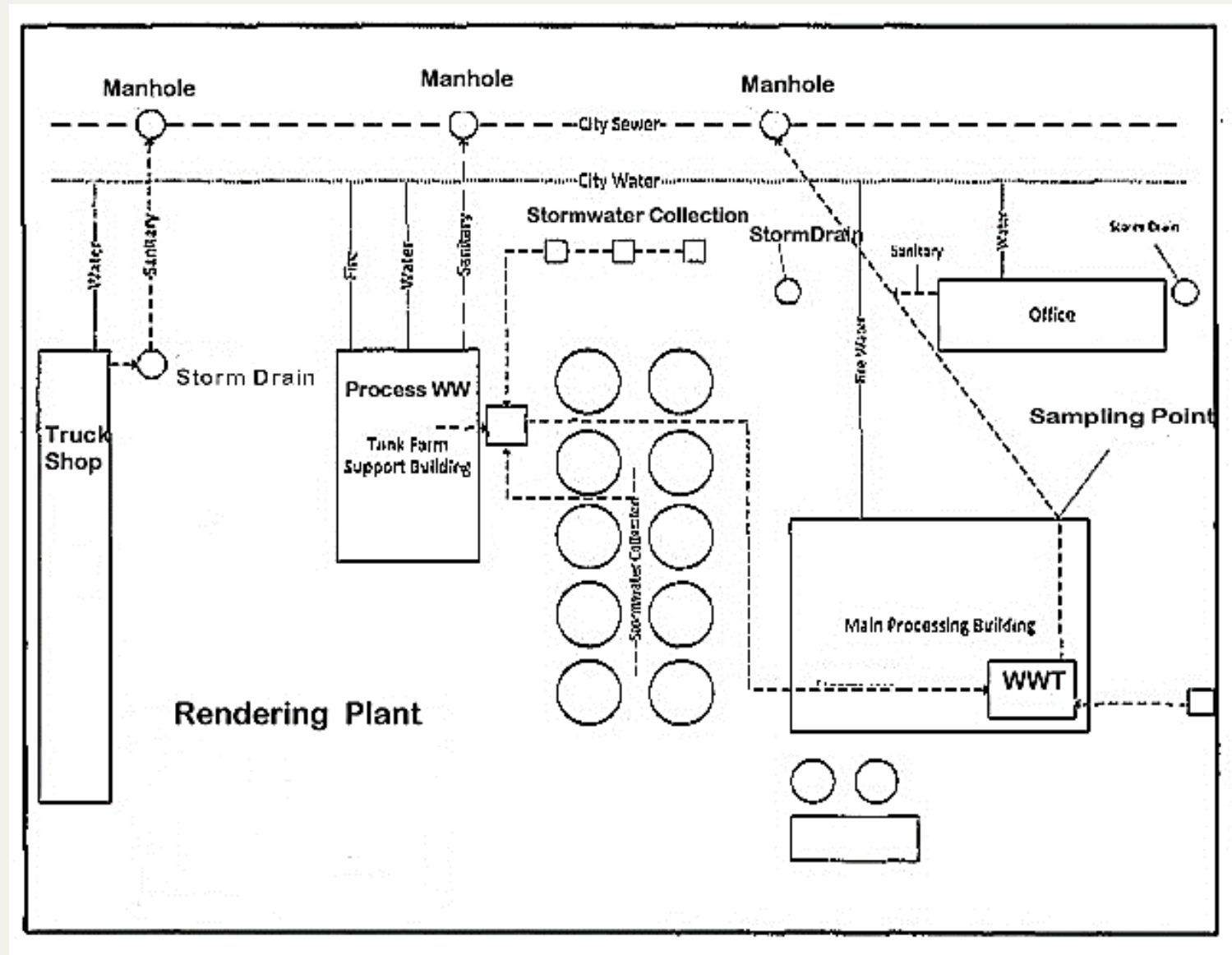
Answer/Things to Consider:

- The plant may not be operating at peak efficiency and product is going into the sewer. Or, the plant may be dumping waste that should be hauled.
 - The inspector needs to inform the designated contact staff at the plant and inspect further.
- For this process, annual numbers of water use and pounds of product are reported twice a year as part of the plant's permit conditions.
- Again, follow the flow as an equation of water + raw materials = waste + product; make sure the numbers make sense.
- For air coolers and boilers, evaporation credits can be deducted from sewer flowrates if the water is metered.



Case Study 2 – Typical Rendering Plant

Rendering is a process that converts waste animal tissue into stable, usable materials. Rendering can refer to any processing of animal products into more useful materials, or, more narrowly, to the rendering of whole animal fatty tissue into purified fats like lard or tallow.



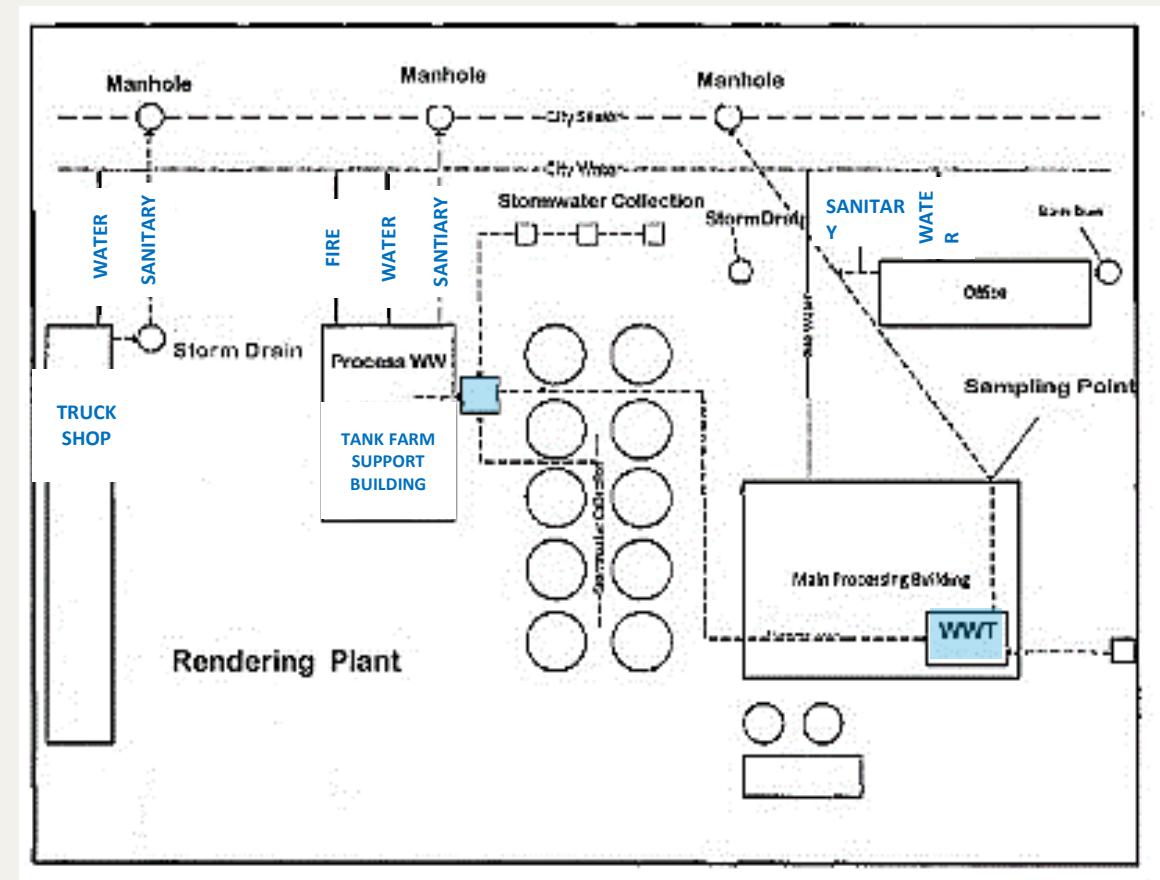
Case Study 2 – Typical Rendering Plant (continued)

Plans/schematics must be provided with any Industrial User Permit Application. For more details, see Pretreatment Facility Inspection Third Edition, Chapter 10, Industrial Inspection Procedures, Rendering Facilities Section 10.35 (a.k.a., Ken Kerri book).

First, **review the plans** in your office. Follow the flow of water to the sewer, making sure to connect all the dots. Make a list questions or comments in the Inspection Report for later use.

From left to right:

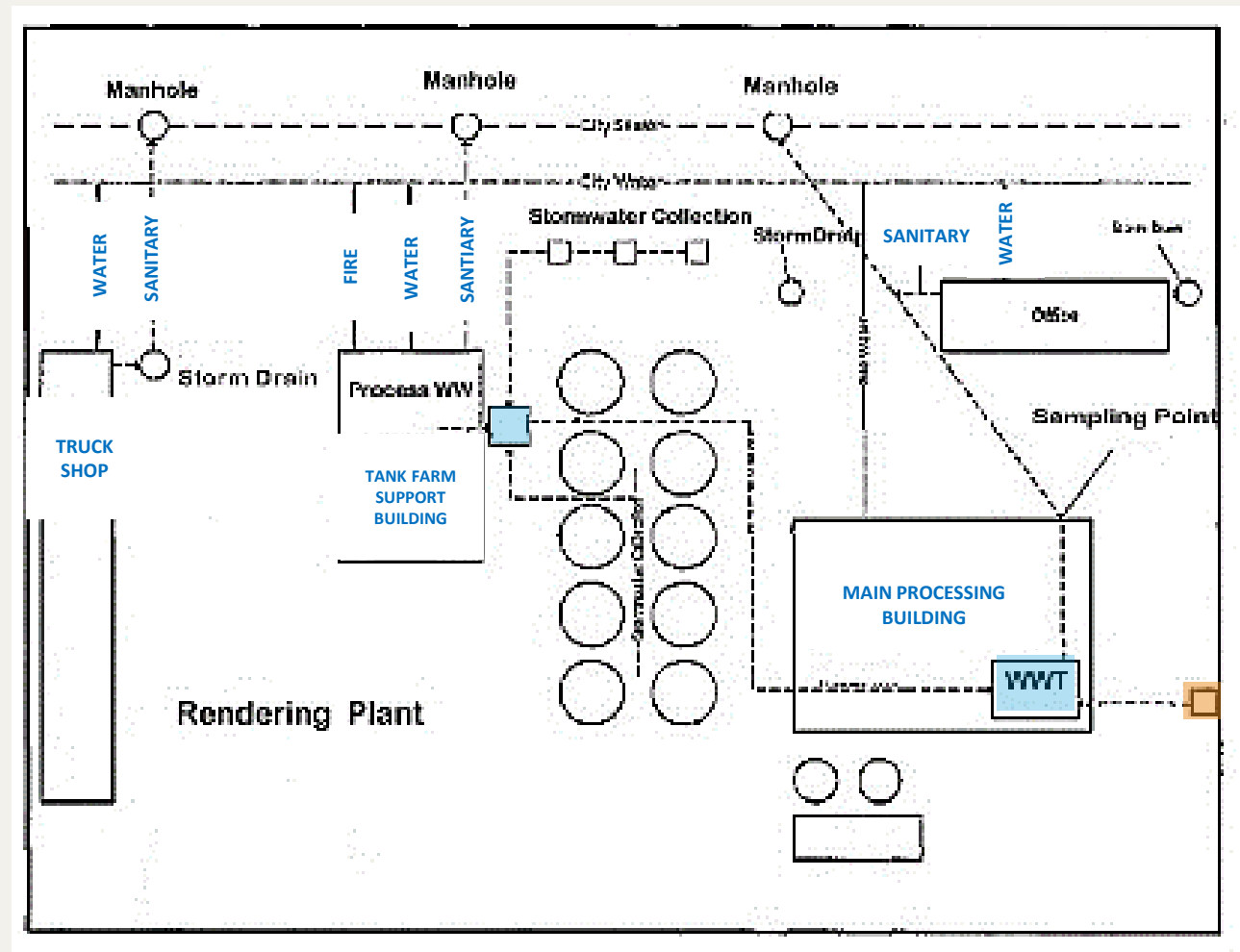
- 1. Truck Shop drains to Storm Drain which then connects to City Sewer.** For a combined sewer system, the storm drain connected to the “sanitary” line leading to the sewer is correct. In a sanitary only sewer system, such a stormwater connection would not be allowed.
- 2. Does the Truck Shop have an oil/water separator?** If not, the wastewater flow from this building is domestic and does not require monitoring unless illegal dumping is suspected.
- 3. Check the Tank Farm Support Building** to see if the domestic wastewater (sanitary) is separate from the process wastewater (process WW).



Case Study 2 – Typical Rendering Plant (continued)

Planning (continued)

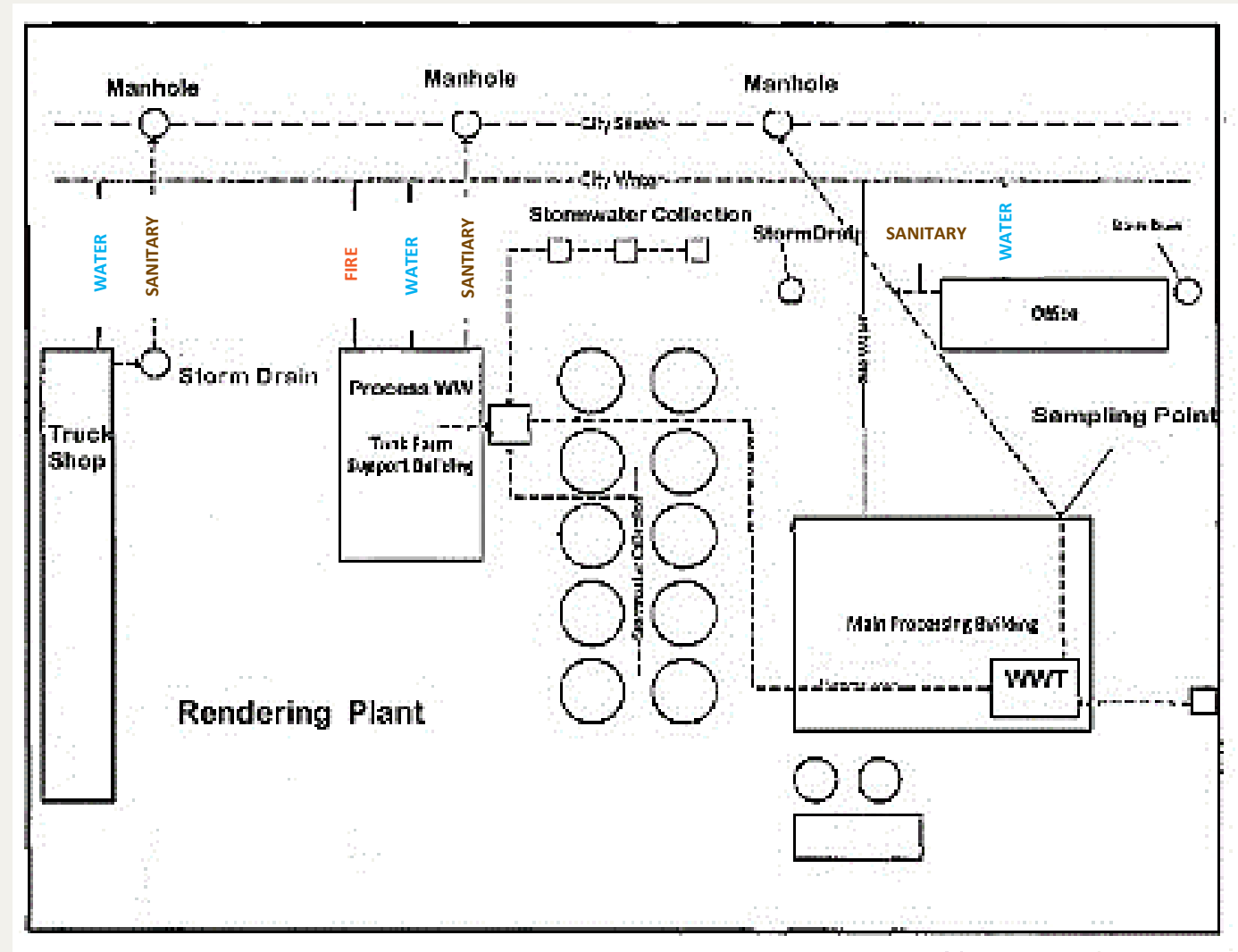
4. Process WW and collected Stormwater are **combined** before being directed to Wastewater Treatment (WWT) in the Main Processing Building.
5. The **WWT sampling point** is located on the discharge line from WWT to City Sewer.
6. **Twice yearly sampling** in dry weather is required to provide a representative sample for accurate monitoring and fair billing. In San Francisco, dry weather typically occurs in May and October.
7. **Stormwater collected from this site requires pretreatment** due to the nature of the business, which includes offloading product and raw materials outside (in the yard area).
8. **Consider taking/recording a baseline wet weather sample**, which may be helpful to contrast with samples taken during or after a wet weather spill or overflow.



Case Study2 – Typical Rendering Plant (continued)

Site Visit

1. Meet the facility/plant staff for an **onsite review**.
2. **Ask questions and document answers** or explanations for the record, i.e., for other inspectors that may be assigned to this site in the future as well as for any Pretreatment Program audit.
3. If there is more than one water account, find out which water meter(s) are connected to the process versus which meter(s) are for domestic use. The example drawing suggests **three potable water accounts, one fire suppression water account, and three wastewater/sewer accounts**. If data isn't clear, record all meter information for later review/comparison with flow information obtained from the Water Department.



**Downloadable Handouts/
Additional Resources
are available via the Webinar Website**

Stormwater Requirements Checklist

Municipal Regional Stormwater Permit (MRP)
Order No. R2-2009-0074 ; Order No. R2-2011-0083
NPDES No. CAS612008

INSERT CITY SPECIFIC INFO HERE

ADDRESS

PHONE

FAX

WEB (for those who allow download etc)

Complete this form for all projects regardless of size. The purpose of this form is to identify requirements for stormwater controls.

A. Project Information

A.1 Project Name: _____

A.2 Project Address: _____

A.3 Project APN: _____

A.4 Is the project a C.3 Regulated Project? (Refer to the C.3 and C.6 Data Collection Form for projects that create and/or replace 5,000 square feet or more of impervious surface. Smaller projects check No.) Yes No

➤ For non-Regulated Projects, Sections B, C, and D apply. For Regulated Projects, all sections of this checklist apply.

B. Select Appropriate Site Design Measures (Required for C.3 Regulated Projects; all other projects are encouraged to implement site design measures, which may be required at municipality discretion. Starting December 1, 2012, projects that create and/or replace 2,500 – 10,000 sq.ft. of impervious surface, and stand-alone single family homes that create/replace 2,500 sq.ft. or more of impervious surface, must include one of Site Design Measures a through f.¹ Consult with municipal staff about requirements for your project.)

B.1 Is the site design measure included in the project plans?

Yes	No	Plan Sheet No.
<input type="checkbox"/>	<input type="checkbox"/>	a. Direct roof runoff into cisterns or rain barrels and use rainwater for irrigation or other non-potable uses.
<input type="checkbox"/>	<input type="checkbox"/>	b. Direct roof runoff onto vegetated areas.
<input type="checkbox"/>	<input type="checkbox"/>	c. Direct runoff from sidewalks, walkways, and/or patios onto vegetated areas.
<input type="checkbox"/>	<input type="checkbox"/>	d. Direct runoff from driveways and/or uncovered parking lots onto vegetated areas.
<input type="checkbox"/>	<input type="checkbox"/>	e. Construct sidewalks, walkways, and/or patios with permeable surfaces.
<input type="checkbox"/>	<input type="checkbox"/>	f. Construct bike lanes, driveways, and/or uncovered parking lots with permeable surfaces.
<input type="checkbox"/>	<input type="checkbox"/>	g. Minimize land disturbance and impervious surface (especially parking lots).
<input type="checkbox"/>	<input type="checkbox"/>	h. Maximize permeability by clustering development and preserving open space.
<input type="checkbox"/>	<input type="checkbox"/>	i. Use micro-detention, including distributed landscape-based detention.
<input type="checkbox"/>	<input type="checkbox"/>	j. Protect sensitive areas, including wetland and riparian areas, and minimize changes to the natural topography.
<input type="checkbox"/>	<input type="checkbox"/>	k. Self-treating area (see Section 4.2 of the C.3 Technical Guidance)
<input type="checkbox"/>	<input type="checkbox"/>	l. Self-retaining area (see Section 4.3 of the C.3 Technical Guidance)
<input type="checkbox"/>	<input type="checkbox"/>	m. Plant or preserve interceptor trees (Section 4.1, C.3 Technical Guidance)

¹ See MRP Provision C.3.a.i(6) for non-C.3 Regulated Projects, C.3.c.i(2)(a) for Regulated Projects, C.3.i for projects that create/replace 2,500 to 10,000 sq.ft. of impervious surface and stand-alone single family homes that create/replace 2,500 sq.ft. or more of impervious surface.

Stormwater Requirements Checklist

Data Collection Form

C.3 and C.6 Data Collection Form

Municipal Regional Stormwater Permit (MRP)
Order No. R2-2009-0074; Order No. R2-2011-0083
NPDES No. CAS612008

INSERT CITY SPECIFIC INFO HERE
ADDRESS
PHONE
FAX
WEB (for those who allow download, etc.)

Complete this form for all projects that propose to create and/or replace 5,000 sq. ft. or more of impervious surface. (For "C.3 Regulated Projects," data will be reported in the municipality's stormwater Annual Report).

A. Project Data

A.1 Project Name: _____

A.2 Project Address (include cross streets): _____

A.3 Project APN: _____ A.4 Project Watershed: _____

A.5 Applicant Name: _____

A.6 Applicant Address: _____

A.7 Applicant Phone: _____ Applicant Email Address: _____

A.8 Development type: (check all that apply)
 Residential Commercial Industrial Mixed-Use Streets, Roads, etc.
 'Redevelopment' as defined by MRP: creating, adding and/or replacing exterior existing impervious surface on a site where past development has occurred.¹
 'Special land use categories' as defined by MRP: (1) auto service facilities², (2) retail gasoline outlets, (3) restaurants², and (4) uncovered parking area (stand-alone or part of a larger project).

A.9 Project Description³
(Also note any past or future phases of the project): _____

A.10 Total Area of Site: _____ acres
 Total Area of land disturbed during construction (include clearing, grading, excavating and stockpile area): _____ acres

B. Is the project a "C.3 Regulated Project" per MRP Provision 3.b?

B.1 Enter the amount of impervious surface⁴ created and/or replaced by the project (if the total amount is 5,000 sq.ft. or more):

Table of Impervious and Pervious Surfaces

Type of Impervious Surface	a	b	c	d
	Pre-Project Impervious Surface (sq.ft.)	Existing Impervious Surface to be Replaced ⁵ (sq.ft.)	New Impervious Surface to be Created ⁶ (sq.ft.)	Post-project landscaping (sq.ft.), if applicable
Roof area(s) – excluding any portion of the roof that is vegetated ("green roof")				N/A
Impervious ⁴ sidewalks, patios, paths, driveways				
Impervious ⁴ uncovered parking ⁵				
Streets (public)				
Streets (private)				
Totals:				
Area of Existing Impervious Surface NOT replaced	N/A			
Total New Impervious Surface (sum of totals for columns b and c):				

¹ Roadway projects that replace existing impervious surfaces are subject to C.3 requirements only if one or more lanes of travel are added.
² See Standard Industrial Classification (SIC) codes [here](#).
³ Project description examples: 5-story office building, industrial warehouse, residential with five 4-story buildings for 200 condominiums, etc.
⁴ Per the MRP, pavement that meets the following definition of pervious pavement is NOT an impervious surface. Pervious pavement is defined as pavement that stores and infiltrates rainfall at a rate equal to immediately surrounding unpaved, landscaped areas, or that stores and infiltrates the rainfall runoff volume described in Provision C.3.d.
⁵ Uncovered parking includes the top level of a parking structure.
⁶ "Replace" means to install new impervious surface where existing impervious surface is removed. "Create" means to install new impervious surface where there is currently no impervious surface.

Plan Check Memo Template

Anytown, USA Water Pollution Control Plant

Date:
To: City Planning
From: Plant Supervisor
Subject:

The following items must be included in the plans or are requirements of the Stormwater and/or Pretreatment programs and must be completed prior to the issuance of a permit:

1. A plan showing the location of all storm drains and sanitary sewers must be submitted.
2. Encourage the use of pervious pavement where possible.
3. The onsite catch basins are to be stenciled with the approved Countywide Stormwater Logo (No Dumping! Flows to Bay).
4. Any food service establishments must install a grease removal device. The grease removal device must be connected to all wash sinks, mop sinks, and floor sinks and must be upstream of the domestic waste stream. Sizing of the grease removal device must be in accordance with the uniform plumbing code. The minimum size shall be no less than 750 gallons. This must be shown on the plans prior to the issuance of a permit.
5. A signed maintenance agreement for the grease removal device must be submitted prior to the issuance of a permit.
6. Source Control Requirements
The project must implement source control measures onsite that at a minimum shall include the following:
 - (a) Minimization of stormwater pollutants of concern in urban runoff through measures that may include plumbing of the following discharges to the sanitary sewer, subject to the local sanitary sewer agency's authority and standards:
 - Discharges from indoor floor mat/equipment/hood filter wash racks or covered outdoor wash racks for restaurants;
 - Dumpster drips from covered trash, food waste and compactor enclosures;
 - Discharges from covered outdoor wash areas for vehicles, equipment, and accessories;

Thank You

Acknowledgements:

Thank you Cassie Prudhel and Brenda Donald
for providing technical examples and support.

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QUESTIONS & ANSWERS

CWEA