

3D Modeling of an Aquatic Life Support System

National Zoological Park
Seal & Sea Lion Rehabilitation

Presented by



Overview

- ▶ **Description of Facility**
- ▶ **High Definition Laser Survey**
- ▶ **Development of As-Builts**
- ▶ **3-D Modeling and Design**
- ▶ **The Future: Modeling of LSS Operations**

Seal & Sea Lion Exhibit

PBS!

- ▶ **Constructed 1978**
- ▶ **Sea Lion pool (300,000 gal)**
- ▶ **Seal pool (125,000 gal)**
- ▶ **Holding pools**
- ▶ **LSS building**





LSS Building

PBS



- ▶ Three levels
- ▶ Two levels of structure below grade
- ▶ Sea Lion LSS
- ▶ Seal LSS
- ▶ Backwash supply
- ▶ MEP systems
- ▶ Food prep, water quality lab and storage/workshop

Facility Staff

- ▶ Zoo – Operations, Husbandry, Maintenance
- ▶ Smithsonian – Engineering, Development
- ▶ Siemens – Controls, Instrumentation



Existing LSS Conditions



- ▶ **Mix of original and replaced equipment**
- ▶ **Reconfigured and reused piping**
- ▶ **Dense layout and tight access**
- ▶ **Relocated rooms**
- ▶ **No up to date documentation**

Documenting Existing Conditions

- ▶ **Original design drawings**
- ▶ **Photo documentation**
- ▶ **Field verification**
- ▶ **High definition laser survey**

Original Design Drawings

MATERIALS			
STAINLESS STEEL	BRASS	BRASS	BRASS
CONCRETE - FINISHED	BRASS	BRASS	BRASS
CONCRETE - UNFINISHED	BRASS	BRASS	BRASS
SPRING FINISHED	BRASS	BRASS	BRASS
SPRING UNFINISHED	BRASS	BRASS	BRASS
STEEL - FINISHED	BRASS	BRASS	BRASS
STEEL - UNFINISHED	BRASS	BRASS	BRASS
WOOD	BRASS	BRASS	BRASS
INSULATION	BRASS	BRASS	BRASS

ABBREVIATIONS			
A	ARCH	ELECTRICAL	MECHANICAL
B	BRIDGE	MECHANICAL	MECHANICAL
C	CIVIL	MECHANICAL	MECHANICAL
D	DRAINAGE	MECHANICAL	MECHANICAL
E	ELECTRICAL	MECHANICAL	MECHANICAL
F	FLOORING	MECHANICAL	MECHANICAL
G	GEOTECHNICAL	MECHANICAL	MECHANICAL
H	HEATING	MECHANICAL	MECHANICAL
I	INSULATION	MECHANICAL	MECHANICAL
J	JOB	MECHANICAL	MECHANICAL
K	KITCHEN	MECHANICAL	MECHANICAL
L	LANDSCAPE	MECHANICAL	MECHANICAL
M	MATERIALS	MECHANICAL	MECHANICAL
N	NATURAL	MECHANICAL	MECHANICAL
O	OTHER	MECHANICAL	MECHANICAL
P	PLUMBING	MECHANICAL	MECHANICAL
Q	QUALITY	MECHANICAL	MECHANICAL
R	ROOFING	MECHANICAL	MECHANICAL
S	STRUCTURAL	MECHANICAL	MECHANICAL
T	TERRAZZO	MECHANICAL	MECHANICAL
U	UTILITIES	MECHANICAL	MECHANICAL
V	VENTILATION	MECHANICAL	MECHANICAL
W	WOODWORK	MECHANICAL	MECHANICAL
X	GENERAL	MECHANICAL	MECHANICAL
Y	YARD	MECHANICAL	MECHANICAL
Z	ZONING	MECHANICAL	MECHANICAL

SYMBOLS			
(1)	INDEX NUMBER	(2)	GENERAL CONTRACTOR
(3)	DRAWING NUMBER	(4)	ASSOCIATED BUILDERS, INC.
(5)	GENERAL CONTRACTOR	(6)	ASSOCIATED BUILDERS, INC.
(7)	GENERAL CONTRACTOR	(8)	ASSOCIATED BUILDERS, INC.

NOTES		
1.	THE DETAILS REFERENCED ON	FULL SIZE SHEETS SEE DRAWING
2.	DETAILS NOT SHOWN ON THIS	DRAWING SHALL BE AS SHOWN ON
3.	THE DETAILS REFERENCED ON	THIS DRAWING SHALL BE AS SHOWN

KEY PLAN	
1	2
3	4
5	6

BEAVER VALLEY NATIONAL ZOOLOGICAL PARK SMITHSONIAN INSTITUTION WASHINGTON D.C.

DRAWING INDEX					
NO.	TITLE	ISSUE DATE	NO.	TITLE	ISSUE DATE
ARCHITECTURAL					
A-1	COVER & OVERALL PLAN	4 MAR 77	S-1	UPPER VALLEY ELEVATION	4 MAR 77
A-2	PLAN UPPER VALLEY	4 MAR 77	S-2	BEAVER & OTHER FILTER BLEND SECTIONS	4 MAR 77
A-3	BEAVER & OTHER DOUBT	4 MAR 77	S-3	SITE PLAN - BEAVER & OTHER	4 MAR 77
A-4	BEAVER & OTHER DOUBT FILTER BLEND	4 MAR 77	S-4	SITE PLAN - WOLP	4 MAR 77
A-5	WOLP DOUBT	4 MAR 77	S-5	SITE PLAN - BEAVER	4 MAR 77
A-6	BEAVER & OTHER DOUBT FILTER BLEND	4 MAR 77	S-6	SITE PLAN - SEA LOOPS	4 MAR 77
A-7	BEAVER & OTHER DOUBT FILTER BLEND	4 MAR 77	S-7	BEAVER & OTHER FILTER BLEND SECTIONS	4 MAR 77
A-8	BEAVER & OTHER DOUBT FILTER BLEND	4 MAR 77	S-8	BEAVER & OTHER FILTER BLEND SECTIONS	4 MAR 77
A-9	BEAVER & OTHER DOUBT FILTER BLEND	4 MAR 77	S-9	BEAVER & OTHER FILTER BLEND SECTIONS	4 MAR 77
A-10	BEAVER & OTHER DOUBT FILTER BLEND	4 MAR 77	S-10	BEAVER & OTHER FILTER BLEND SECTIONS	4 MAR 77
A-11	BEAVER & OTHER DOUBT FILTER BLEND	4 MAR 77	S-11	BEAVER & OTHER FILTER BLEND SECTIONS	4 MAR 77
A-12	BEAVER & OTHER DOUBT FILTER BLEND	4 MAR 77	S-12	BEAVER & OTHER FILTER BLEND SECTIONS	4 MAR 77
MECHANICAL					
M-1	ELECTRICAL DISTRIBUTION SITE PLAN	4 MAR 77	M-2	ELECTRICAL DISTRIBUTION SITE PLAN	4 MAR 77
M-2	ELECTRICAL DISTRIBUTION SITE PLAN	4 MAR 77	M-3	ELECTRICAL DISTRIBUTION SITE PLAN	4 MAR 77
M-3	ELECTRICAL DISTRIBUTION SITE PLAN	4 MAR 77	M-4	ELECTRICAL DISTRIBUTION SITE PLAN	4 MAR 77
M-4	ELECTRICAL DISTRIBUTION SITE PLAN	4 MAR 77	M-5	ELECTRICAL DISTRIBUTION SITE PLAN	4 MAR 77
M-5	ELECTRICAL DISTRIBUTION SITE PLAN	4 MAR 77	M-6	ELECTRICAL DISTRIBUTION SITE PLAN	4 MAR 77
M-6	ELECTRICAL DISTRIBUTION SITE PLAN	4 MAR 77	M-7	ELECTRICAL DISTRIBUTION SITE PLAN	4 MAR 77
M-7	ELECTRICAL DISTRIBUTION SITE PLAN	4 MAR 77	M-8	ELECTRICAL DISTRIBUTION SITE PLAN	4 MAR 77
M-8	ELECTRICAL DISTRIBUTION SITE PLAN	4 MAR 77	M-9	ELECTRICAL DISTRIBUTION SITE PLAN	4 MAR 77
M-9	ELECTRICAL DISTRIBUTION SITE PLAN	4 MAR 77	M-10	ELECTRICAL DISTRIBUTION SITE PLAN	4 MAR 77
M-10	ELECTRICAL DISTRIBUTION SITE PLAN	4 MAR 77	M-11	ELECTRICAL DISTRIBUTION SITE PLAN	4 MAR 77
STRUCTURAL					
S-1	UPPER VALLEY ELEVATION	4 MAR 77	S-2	BEAVER & OTHER FILTER BLEND SECTIONS	4 MAR 77
S-2	BEAVER & OTHER FILTER BLEND SECTIONS	4 MAR 77	S-3	SITE PLAN - BEAVER & OTHER	4 MAR 77
S-3	SITE PLAN - BEAVER & OTHER	4 MAR 77	S-4	SITE PLAN - WOLP	4 MAR 77
S-4	SITE PLAN - WOLP	4 MAR 77	S-5	SITE PLAN - BEAVER	4 MAR 77
S-5	SITE PLAN - BEAVER	4 MAR 77	S-6	SITE PLAN - SEA LOOPS	4 MAR 77
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S-11	BEAVER & OTHER FILTER BLEND SECTIONS	4 MAR 77	S-12	BEAVER & OTHER FILTER BLEND SECTIONS	4 MAR 77
S-12	BEAVER & OTHER FILTER BLEND SECTIONS	4 MAR 77	S-13	BEAVER & OTHER FILTER BLEND SECTIONS	4 MAR 77

REVISIONS			
NO.	DATE	SCALE	BY
1	4 MAR 77	1/8" = 1'	
2	4 MAR 77	1/8" = 1'	
3	4 MAR 77	1/8" = 1'	
4	4 MAR 77	1/8" = 1'	
5	4 MAR 77	1/8" = 1'	

COVER & OVERALL PLAN		
DRAWN BY	COVER & OVERALL PLAN	DATE
DATE	COVER & OVERALL PLAN	DATE
PROJECT NO.	COVER & OVERALL PLAN	DATE
SCALE	COVER & OVERALL PLAN	DATE

Photo Documentation



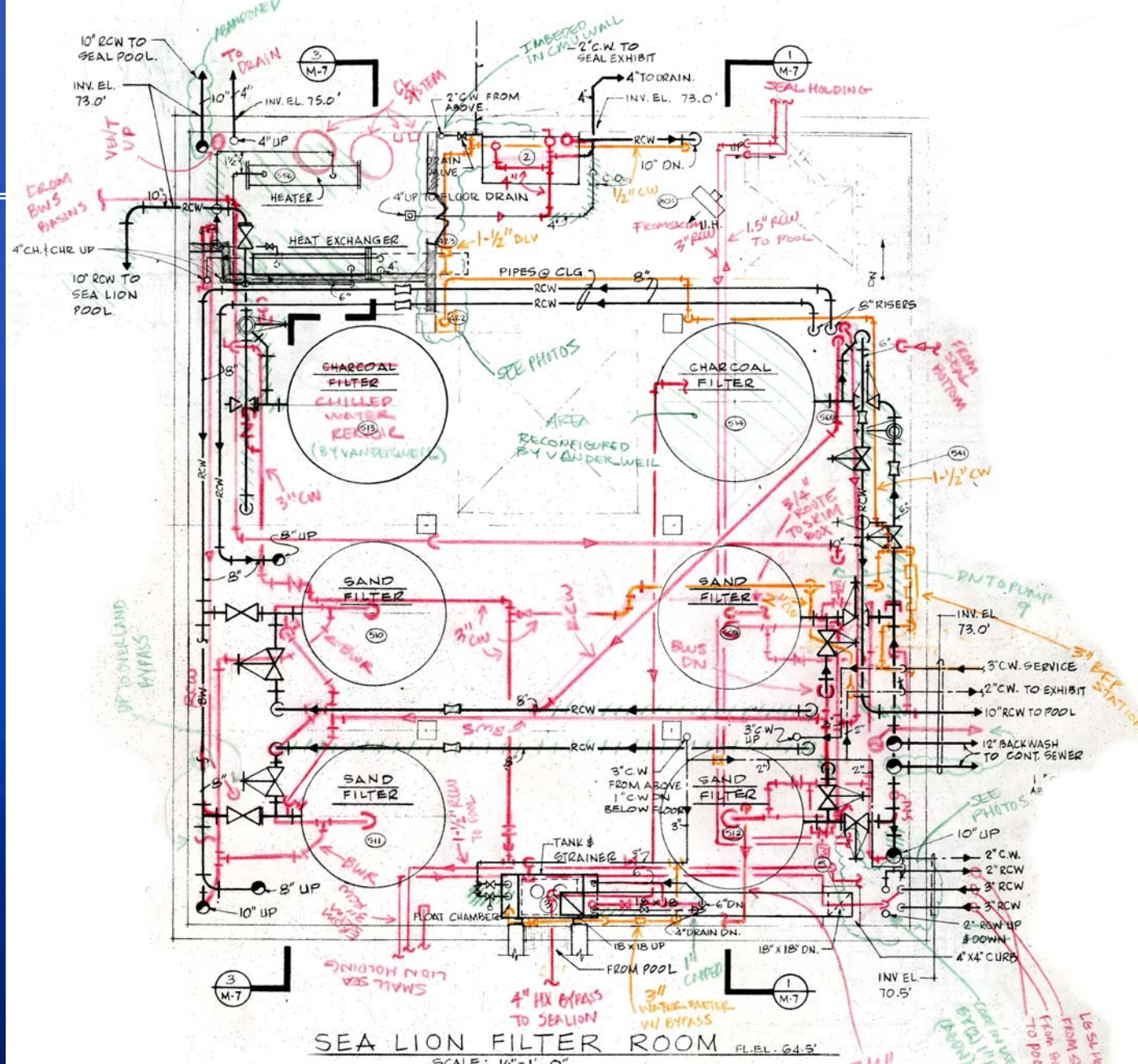
Photos...



More Photos...

PBS!





SEA LION FILTER ROOM FL. EL. 64.5'
SCALE: 1/4" = 1'-0"

3/4" ROUTE TO SKIM BOX (TYP 509, 512)

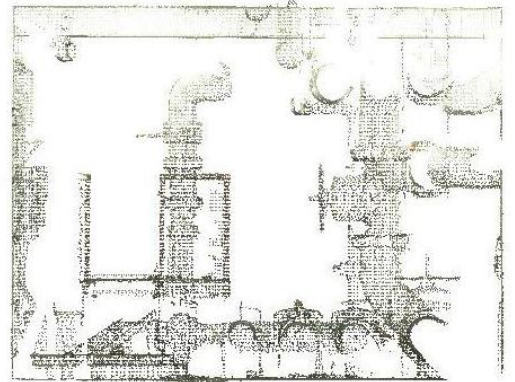
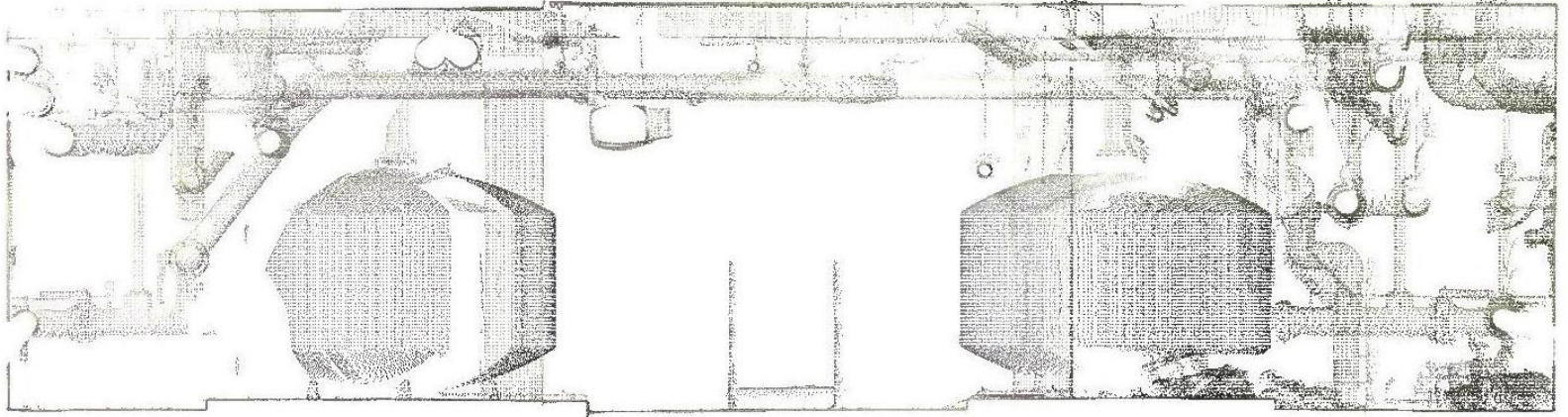
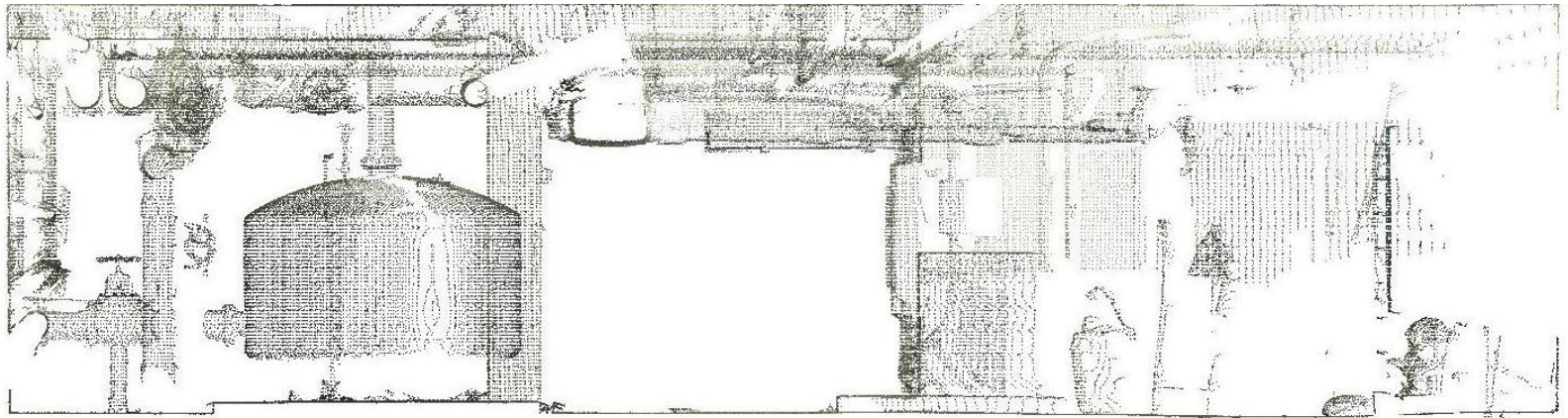
TO BE USED BY 11/11/10 (BARR)

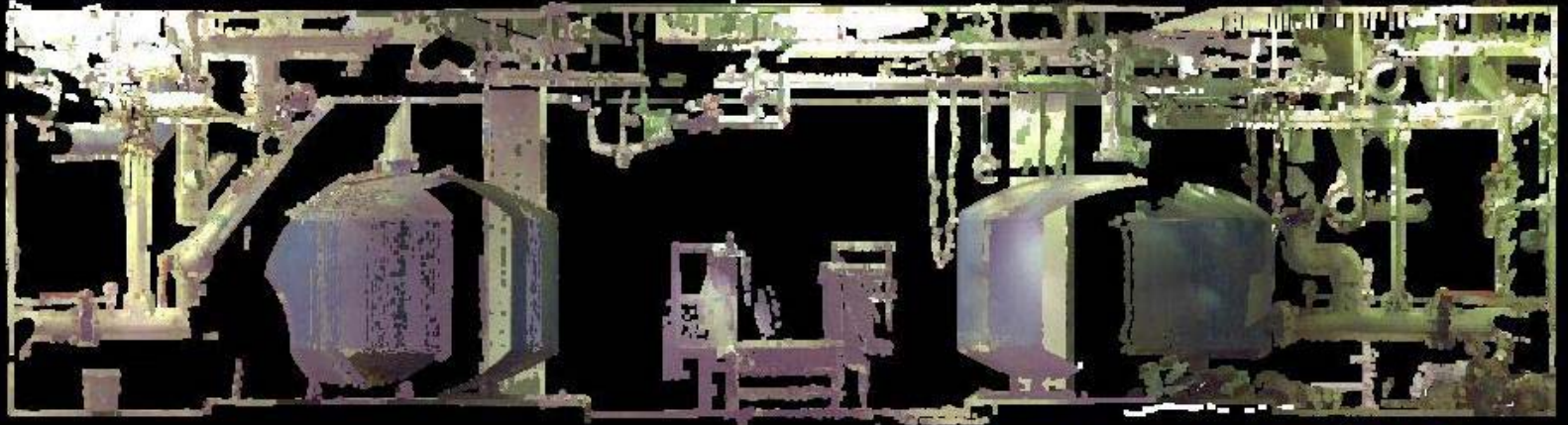
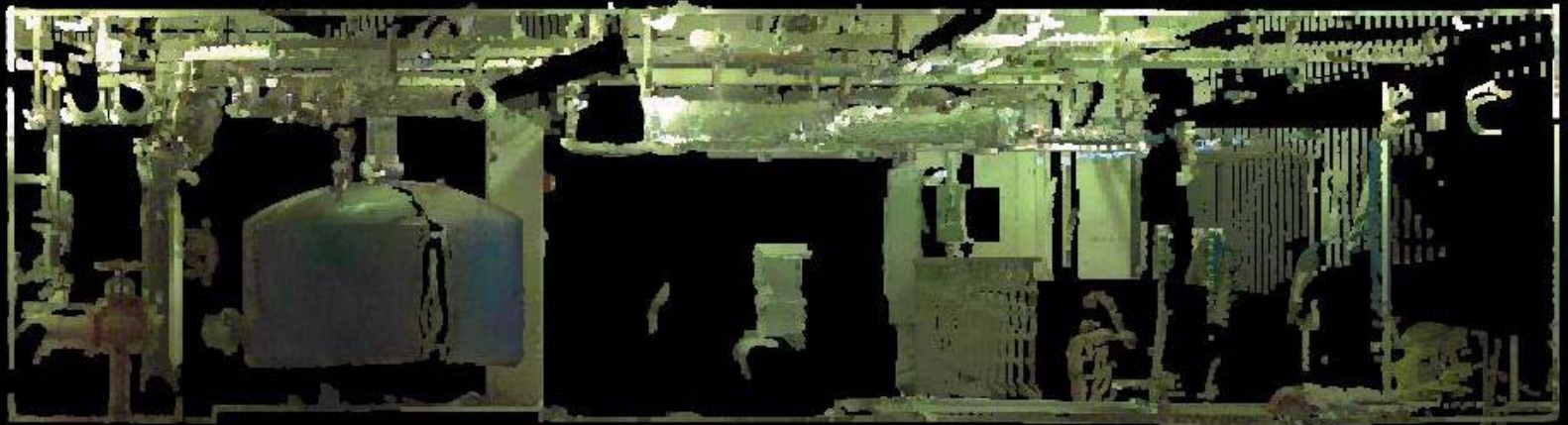
LE SL HOLDINGS: FROM SKIM FROM BOTTOM TO POOL

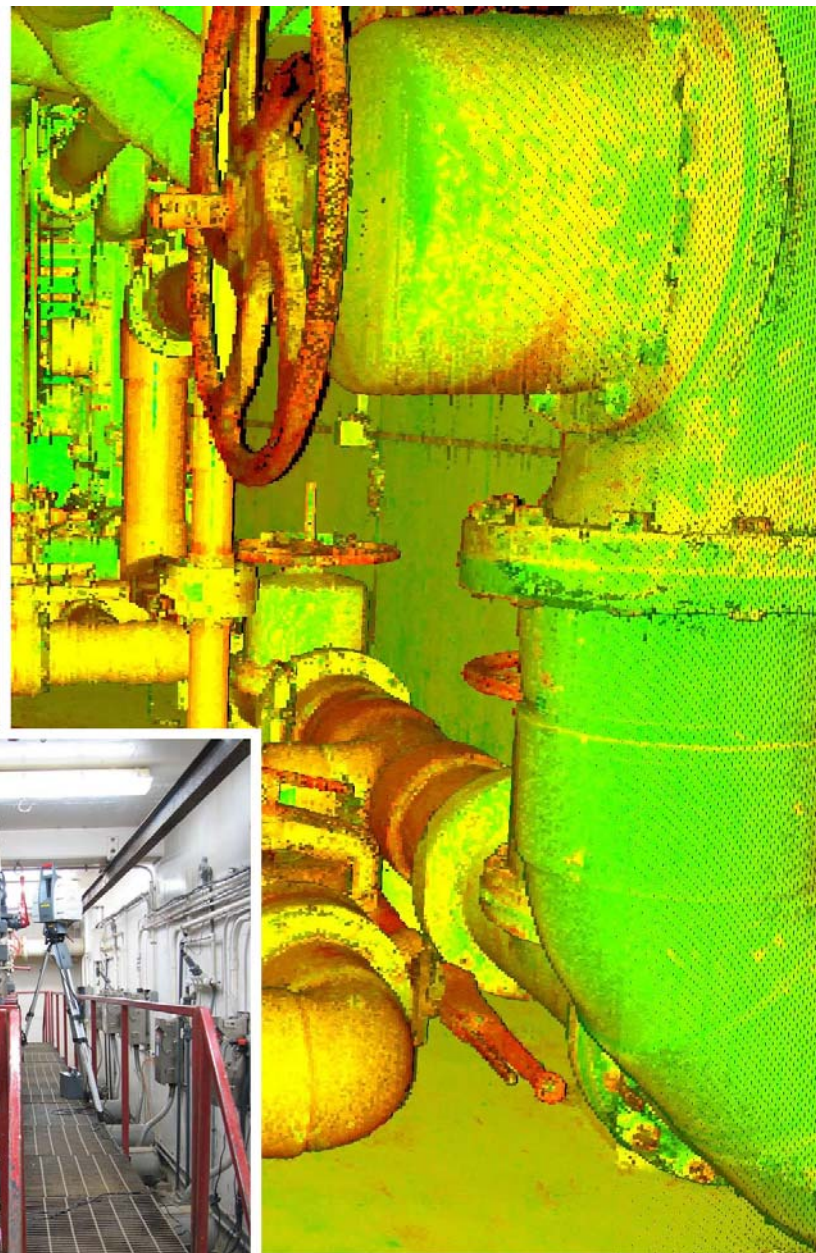
High Definition Laser Survey

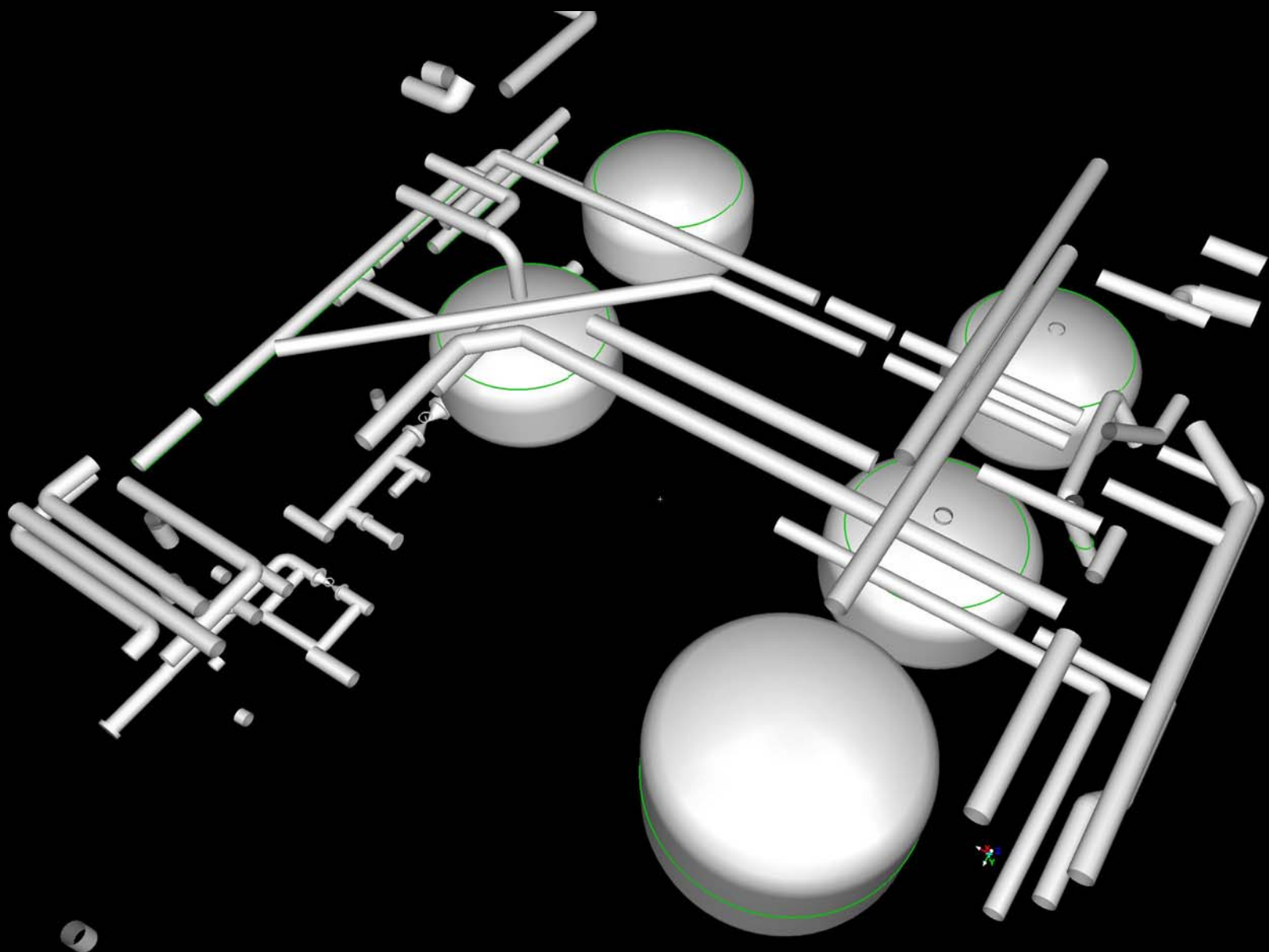
PBS!











1.5" FWS TO
SMALL SEA LION
HOLDING POOL

3" FWR FROM
SMALL SEA LION
HOLDING POOL
SKIMMER

SEA LION POOL
SKIMMER COLLECTION
BOX

4" HEAT EXCH
BYPASS SEA LION
EXHIBIT

6" O/F DRAIN
DOWN TO SEA LION
SWR PUMP HEADER

GREY SEAL HOLDING
POOL TOP SKIMMER
H-12

SMALL SEA LION
HOLDING
H-11B

3" FWR FROM
SEA LION HOLDING
POOL 11A BOTTOM

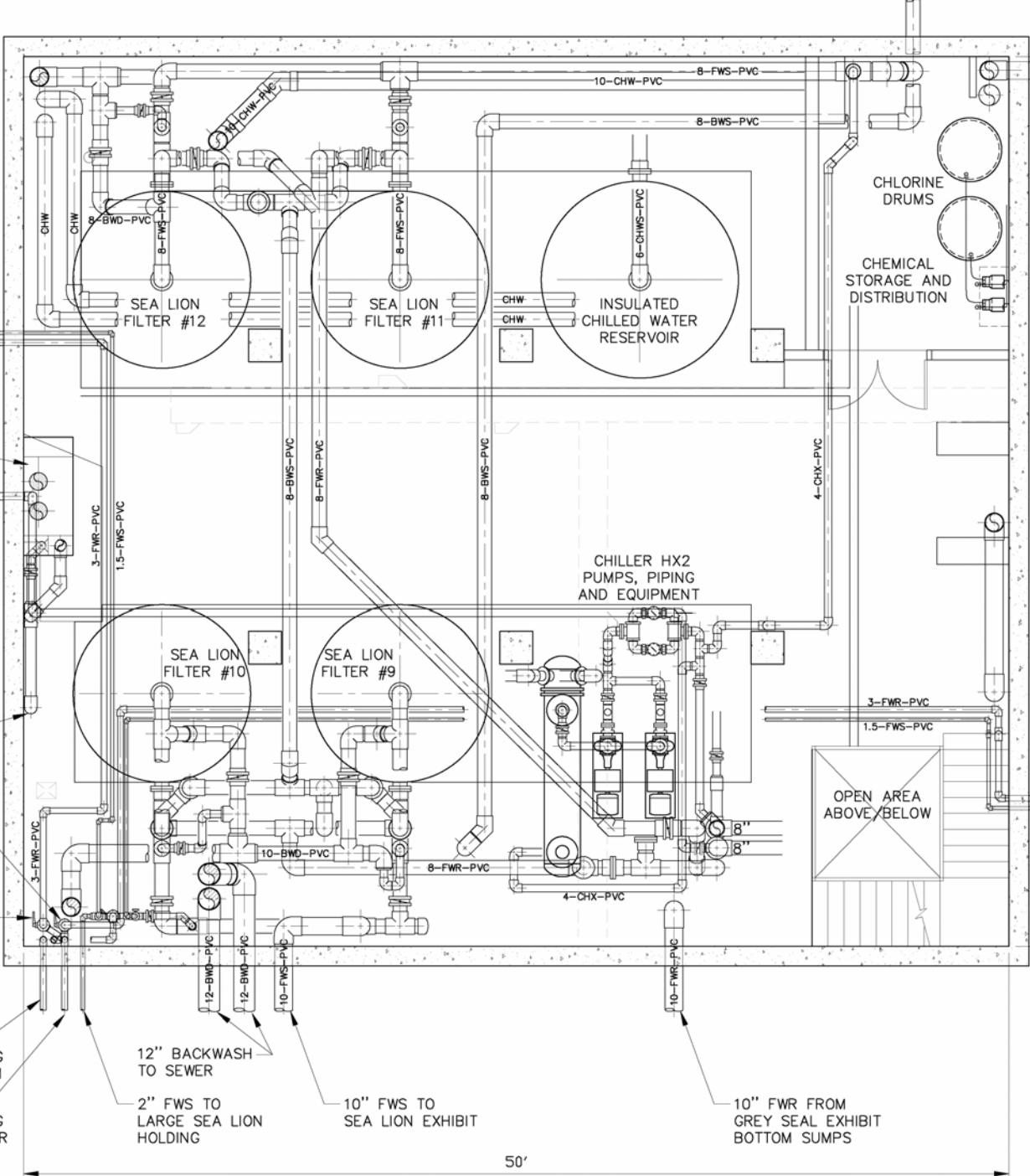
3" FWR FROM
SEA LION HOLDING
POOL 11A SKIMMER

12" BACKWASH
TO SEWER

2" FWS TO
LARGE SEA LION
HOLDING

10" FWS TO
SEA LION EXHIBIT

10" FWR FROM
GREY SEAL EXHIBIT
BOTTOM SUMPS



50'

10" PIPE
(ABANDONED)
12" AIR VENT
STORAGE BASINS

CHLORINE
DRUMS
CHEMICAL
STORAGE AND
DISTRIBUTION

LEVEL B1 OF LSS
BUILDING FF EL= 64.5'

GREY SEAL EXHIBIT POOL
WATER SURFACE EL= 78.0'

SEA LION EXHIBIT POOL
WATER SURFACE EL= 69.0'

OPEN AREA
ABOVE/BELOW

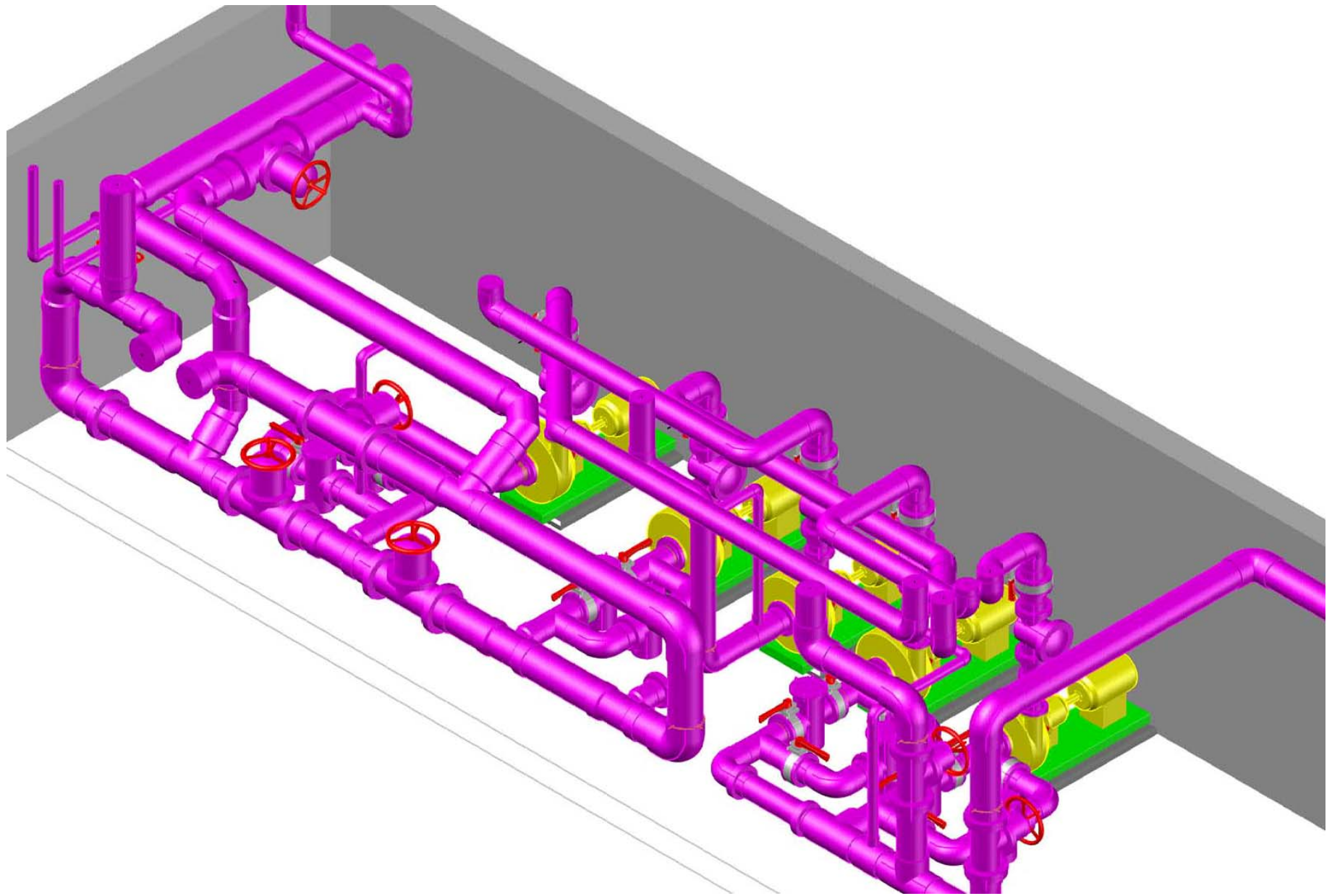
3" FROM SEAL
HOLDING POOL
SKIMMER

1.5" TO SEAL
HOLDING POOL

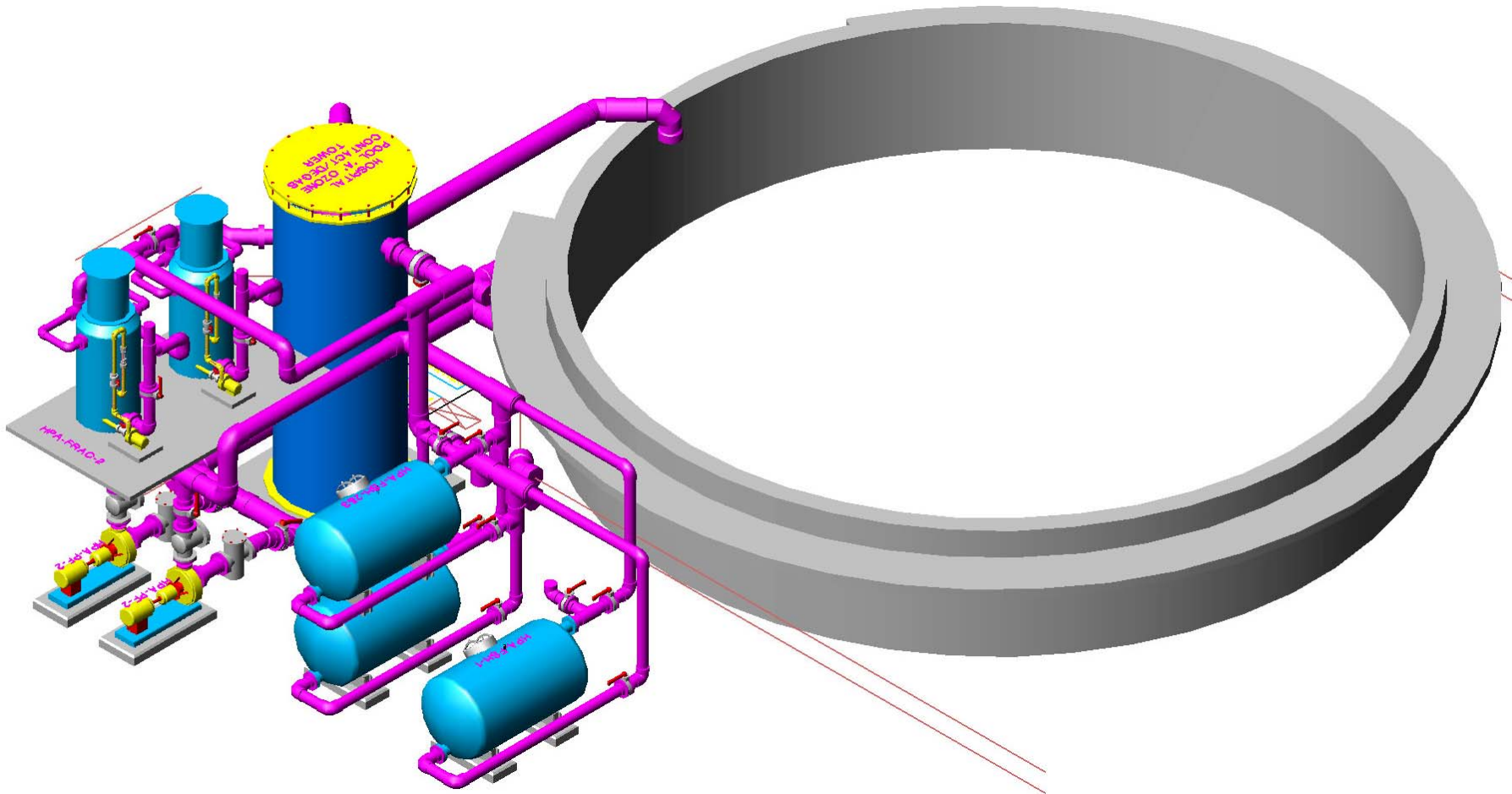
Advantages of As-Built Documentation Using HDS

PBS!

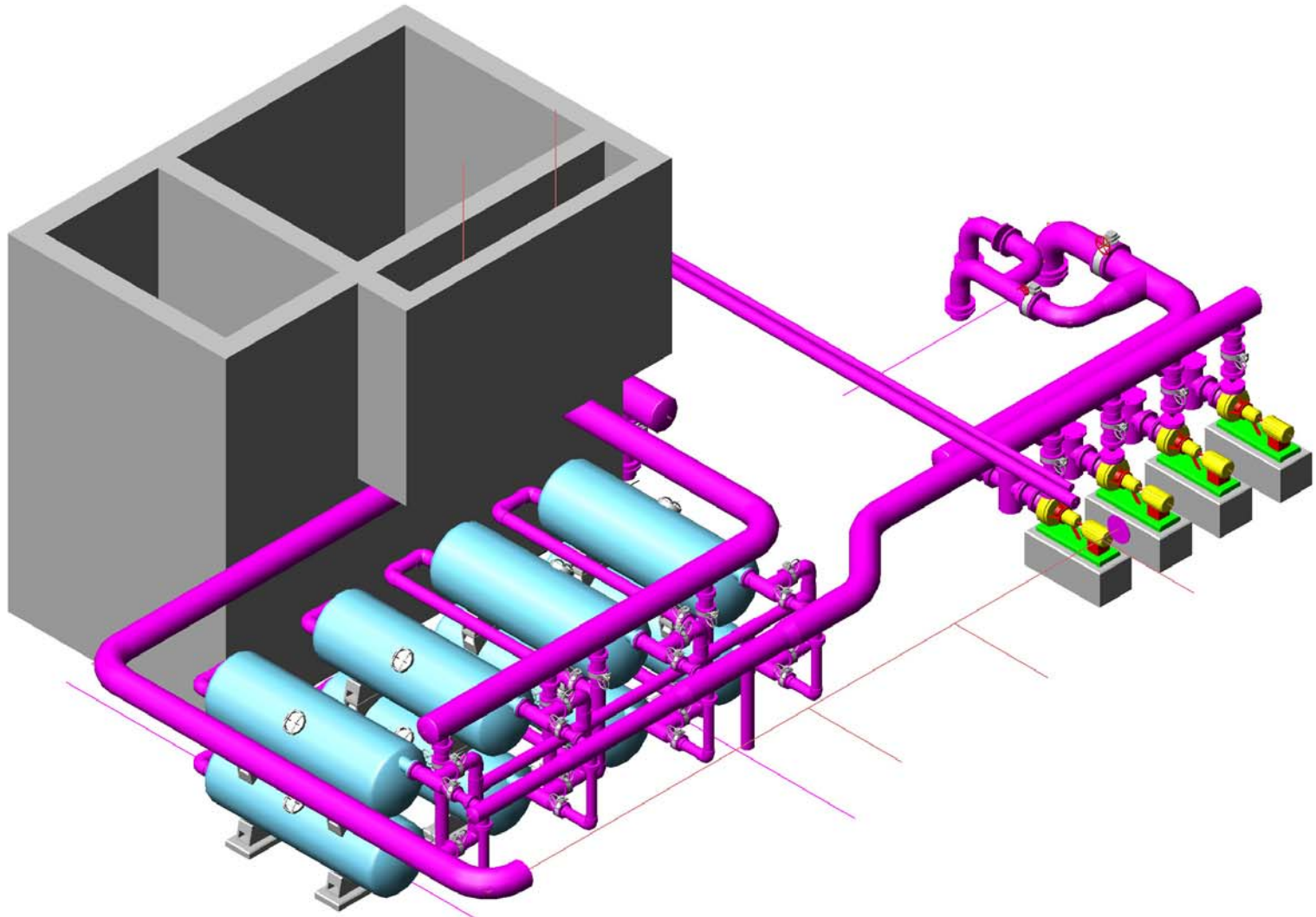
- ▶ Precise and accurate locations of equipment and piping
- ▶ Hard documentation of LSS configuration
- ▶ User friendly end product – digital and hard copy
- ▶ Platform for 3-D modeling

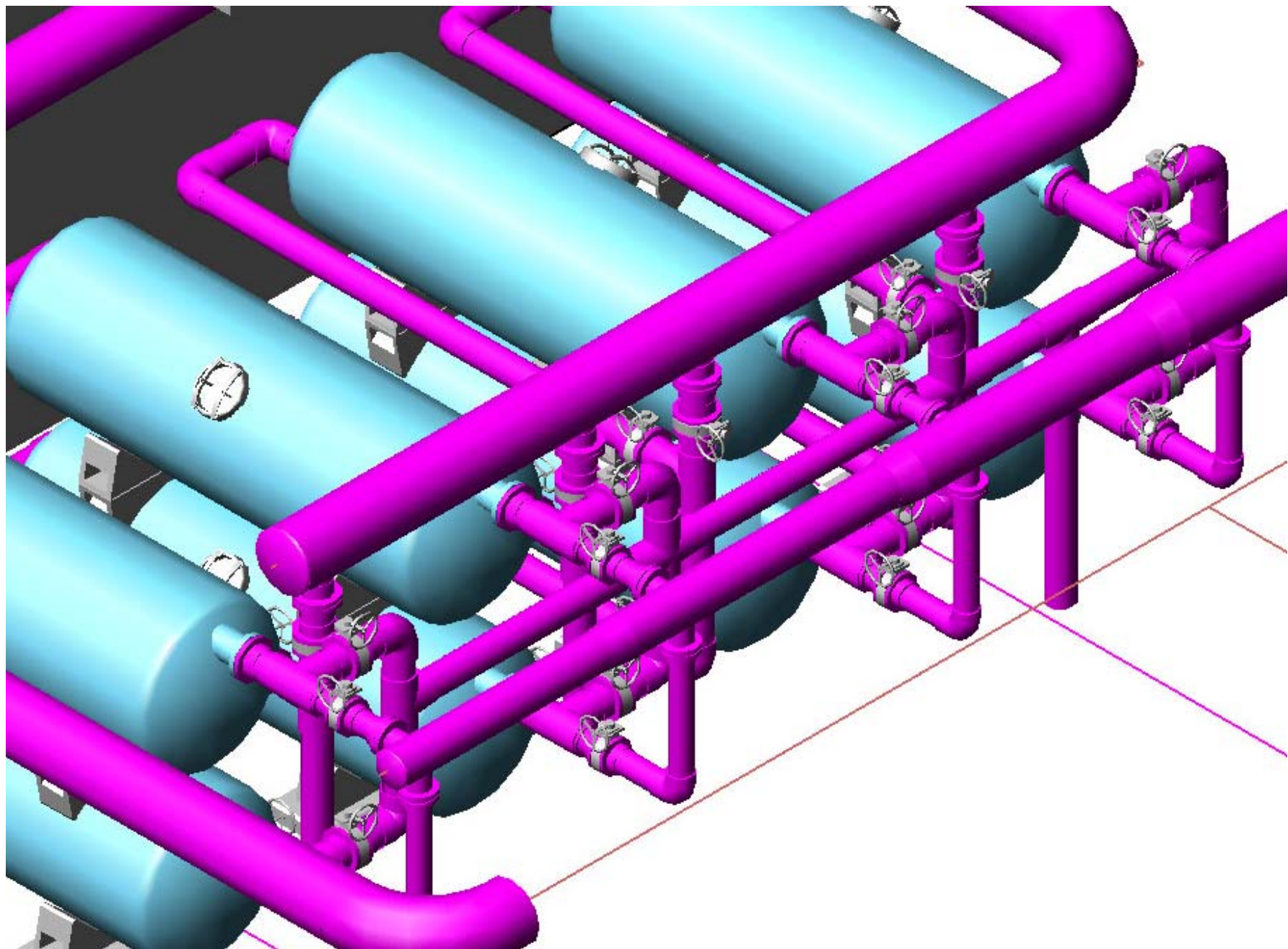


Aquarium of the Pacific



Ripley's Aquarium of Canada





Advantages of 3-D Modeling & Design

- ▶ Clear visual presentation of LSS for review
- ▶ Reduced piping conflicts and fewer interferences
- ▶ Virtual tours of LSS facility
- ▶ Unlimited number of plans, sections and elevations

The Future: Modeling of LSS Operations

- ▶ Operate virtual equipment and valves
- ▶ Predict water quality parameters
- ▶ Troubleshoot problems
- ▶ Experiment without risk
- ▶ Optimize LSS performance and efficiency

Keys to Success



- ▶ Realize the potential of technology
- ▶ Know when to use it

Questions?

PBS!

