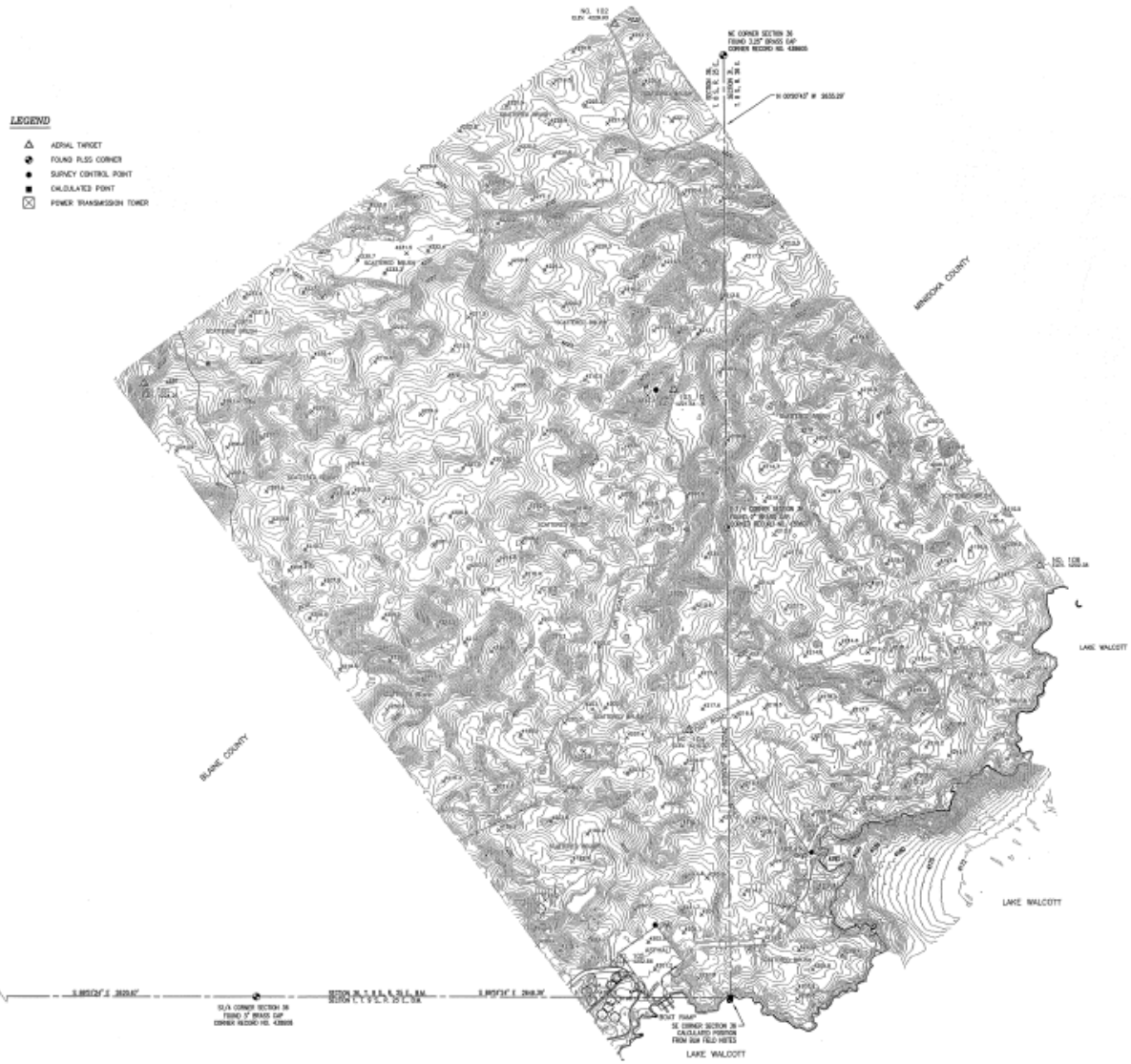
IDAHO
Water Resource Board

Milepost 31, Spring 2013.

ESPA Update
Idaho Water Resource Board Meeting

Mathew Weaver
November 20, 2013

MAGIC VALLEY GROUNDWATER DISTRICT – LAKE WALCOTT RECHARGE SITE TOPOGRAPHIC SURVEY
LOCATED IN PORTIONS OF SECTION 36, T 8 S., R 25 E., SECTION 31, T 8 S., R 26 E., SECTION 1, T 9 S., R 25 E., AND SECTION 6, T 9 S., R 26 E., BOISE MERIDIAN
BLAINE AND MINIDOKA COUNTIES, IDAHO
JULY, 2013



CERTIFICATE OF SURVEYOR

I, TRAVIS P. FOSTER, DO HEREBY CERTIFY THAT I AM A PROFESSIONAL LAND SURVEYOR, LICENSED IN THE STATE OF IDAHO, AND THAT THIS MAP HAS BEEN PREPARED FROM AN ACTUAL SURVEY MADE ON THE GROUND UNDER MY DIRECT SUPERVISION, AND THAT THIS MAP IS AN ACCURATE REPRESENTATION OF SAID SURVEY.

TRAVIS P. FOSTER — DATE: 7/19/13

NOTES:

1) BASIS OF BEARING IS PER THE IDAHO STATE PLANE COORDINATE SYSTEM, CENTRAL ZONE (NAD83), ESTABLISHED THROUGH GPS OBSERVATIONS.

2) GROUND COORDINATES ARE USED IN THIS SURVEY. TO CONVERT TO GRID COORDINATES MULTIPLY GROUND COORDINATES BY THE COMBINED SCALE FACTOR = 0.9997702?.

3) ELEVATIONS ARE BASED UPON THE NAVD 88 DATUM.

4) 1' CONTOUR INTERVALS ARE SHOWN FOR THE BATHYMETRIC PORTION OF THIS SURVEY.

5) 2' CONTOUR INTERVALS ARE SHOWN FOR THE AERIAL PORTION OF THIS SURVEY.

6) CONDITIONS SHOWN HEREON ARE BASED ON SURFACE ELEVATION DATA COLLECTED ON JUNE 12th, 2013. WATER SURFACE ELEVATION = 4197.75'.

7) THE RANGE LINE SHOWN BETWEEN R25E AND R26E IS ALSO THE COUNTY LINE WITH BLAINE COUNTY LYING TO THE WEST AND MINIDOKA COUNTY LYING TO THE EAST.

WHPacific
2110 S. Overland Street
Boise, ID 83705
208-343-0450 Fax 208-343-0203
www.whpacific.com

PROFESSIONAL LAND SURVEYOR 10729 STATE OF IDAHO TRAVIS P. FOSTER

REVISIONS			
NO.	BY	DATE	REMARKS

SHEET INFO	
SURVEYED	HB
DRAWN	HB
CHECKED	TF
APPROVED	TF
LAST SURV	11/18/2013
PLOT DATE	11/18/2013
SURVEYW	

MAGIC VALLEY GROUNDWATER DISTRICT
LAKE WALCOTT RECHARGE SITE TOPOGRAPHIC SURVEY
LAKE WALCOTT, IDAHO
WHPACIFIC

SCALE: 1" = 300'

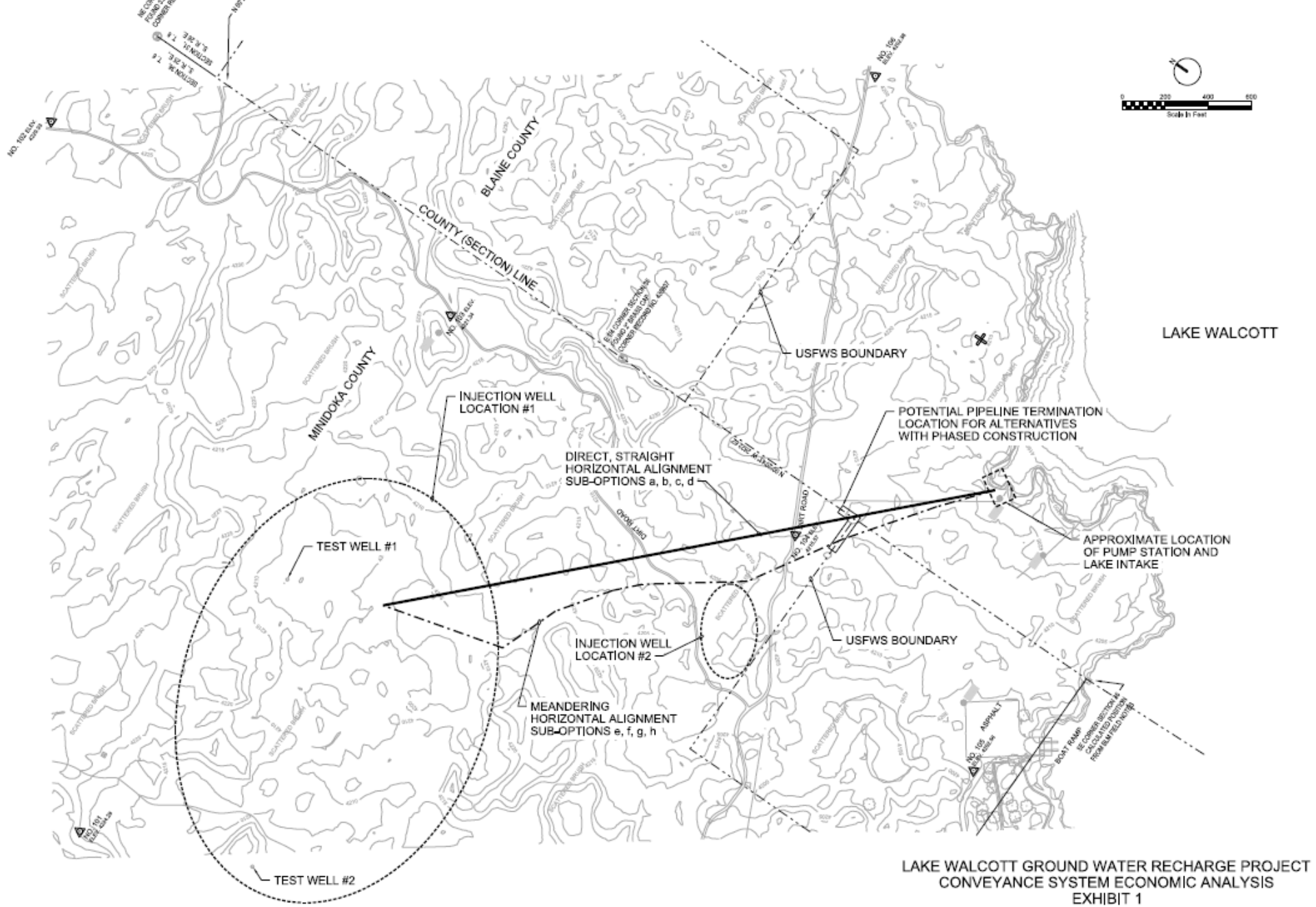
PROJECT NUMBER: 36751
DRAWING FILE NAME: 36751_SURV_BM01

SHEET NUMBER
1 of 2

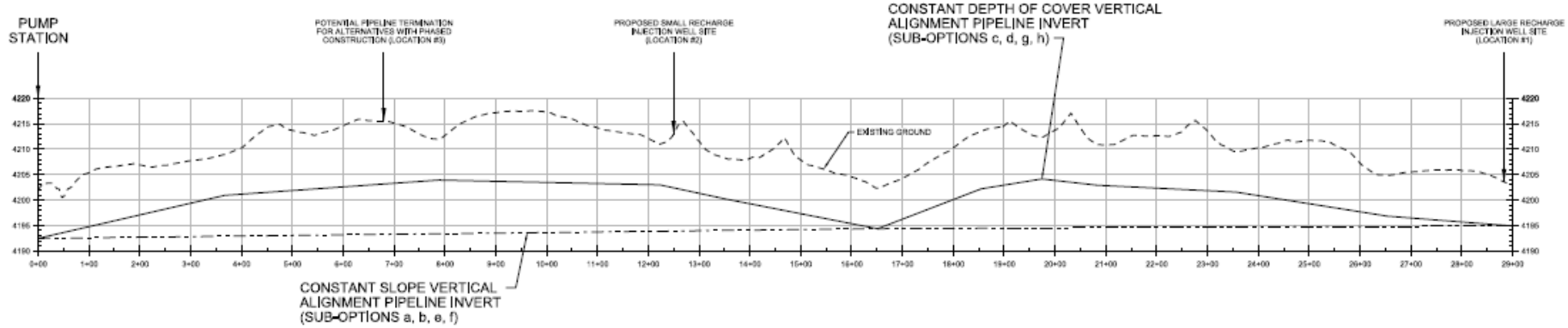
[DATE: 7/19/2013 3:32 PM] [AUTHOR: hbarsh] [PLOTTER: \\psi-fs1\Plot3001] [STYLE: WHP-Standard.ctb]
[PATH: P:\Magic Valley Ground Water District\36751\Survey\Drawings\36751_Surv_BM01.dwg] [LAYOUT: SHEET1]

CH2M Hill Scope of Work

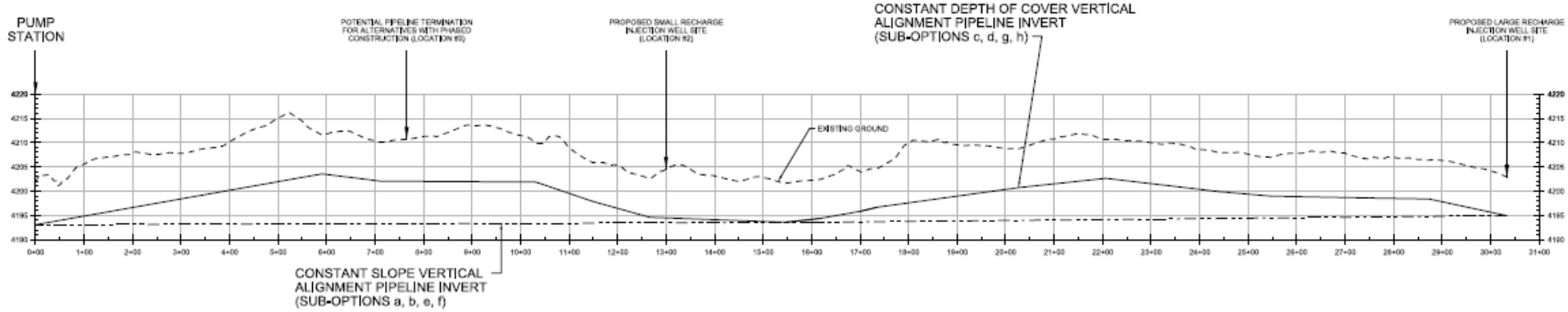
- Task 1 Project Management – In Progress
- Task 2 Project Scoping/Planning - Completed
- Task 3 Conveyance System Alternatives Economic Analysis – Completed
- Task 4 Concept Layout and Stakeholder Coordination – In Progress
- Task 5 environmental Compliance (Environmental Assessment) – Not Yet Started
- Task 6 Preliminary Design (30%) – Not Yet Started
- Task 7 Construction Cost Estimates – Not Yet Started



LAKE WALCOTT GROUND WATER RECHARGE PROJECT
CONVEYANCE SYSTEM ECONOMIC ANALYSIS
EXHIBIT 1



DIRECT HORIZONTAL PIPELINE ALIGNMENT - SUB-OPTIONS a, b, c, d

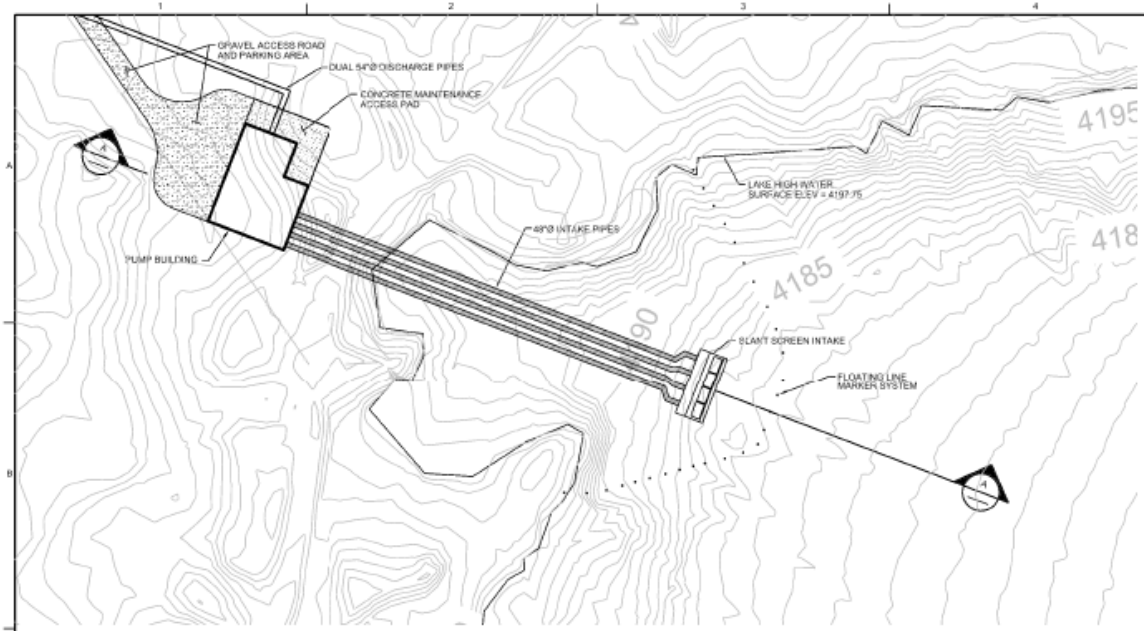


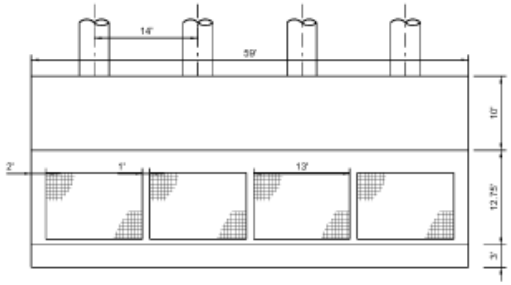
MEANDERING HORIZONTAL PIPELINE ALIGNMENT - SUB-OPTIONS e, f, g, h

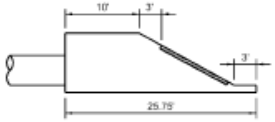
LAKE WALCOTT GROUND WATER RECHARGE PROJECT
CONVEYANCE SYSTEM ECONOMIC ANALYSIS
EXHIBIT 2

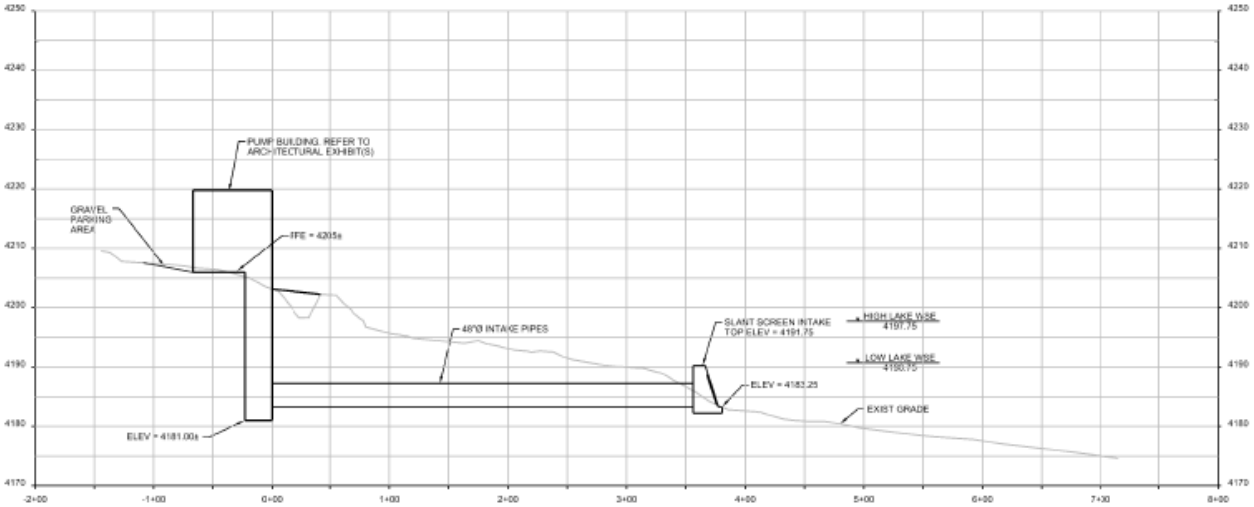
Task 3 - Conclusions

- Initial pump station design and construction will be for 100 cfs, but design will accommodate a possible future ultimate build out of 200 cfs
- Pipeline design and construction across the Wildlife Refuge will support capacity of 200 cfs (63”Ø x2), but design and construction refuge to basin will support 100 cfs capacity (63”Ø x1)
- Pump selection and arrangement will support multiple pumps in lieu of a single pump (4 pumps, 50 cfs ea.)
- Straight horizontal alignment
- Vertical alignment with constant depth of cover









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VERT: 1"=10'

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0 50 100 150
1"=50'

NO.	DATE	BY	CHK	APVD
0502k	11/12/13			

REVISION

Lake Walcott Groundwater Recharge Project
Conceptual Intake Facility Alternatives
A&B Irrigation District
Lake Walcott, Idaho

CH2MHILL®

CONCEPT
ALTERNATIVE NO. 1
SLANT SCREEN INTAKE

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"

DATE
PROJ 477631
DWG
SHEET of

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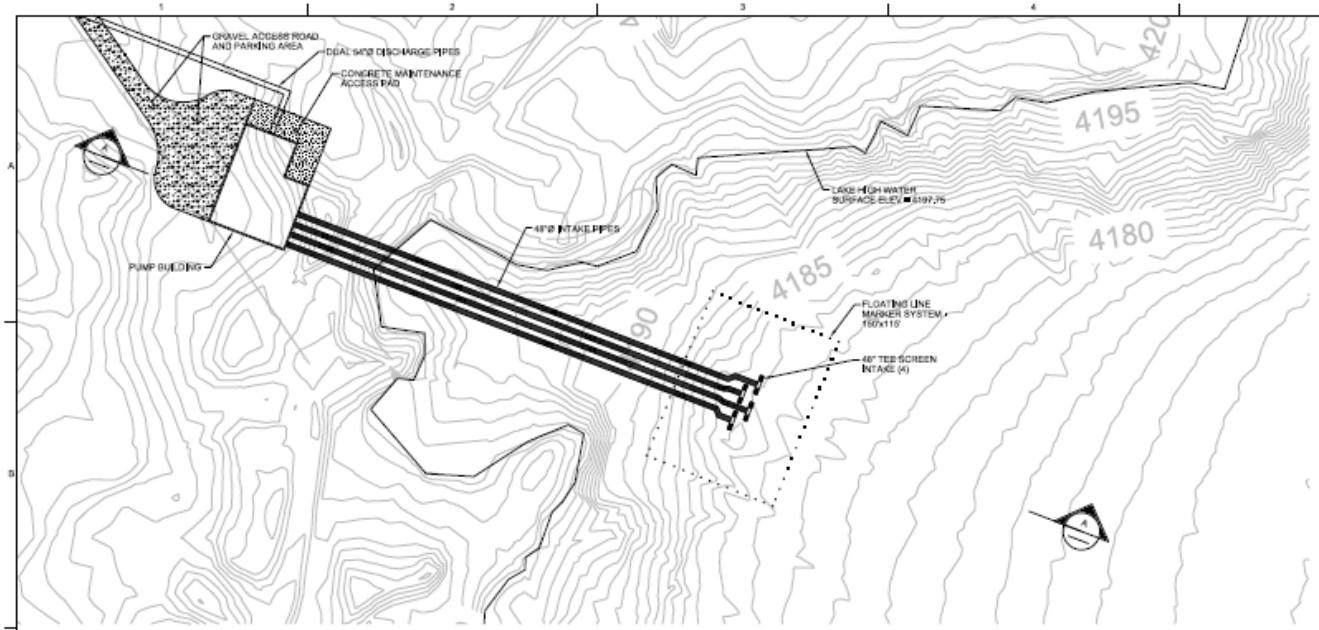

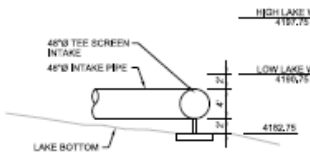

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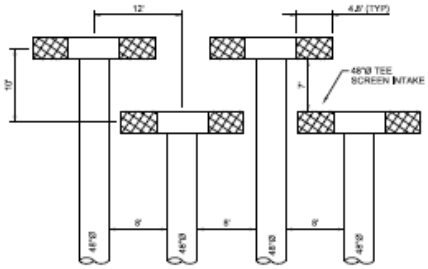
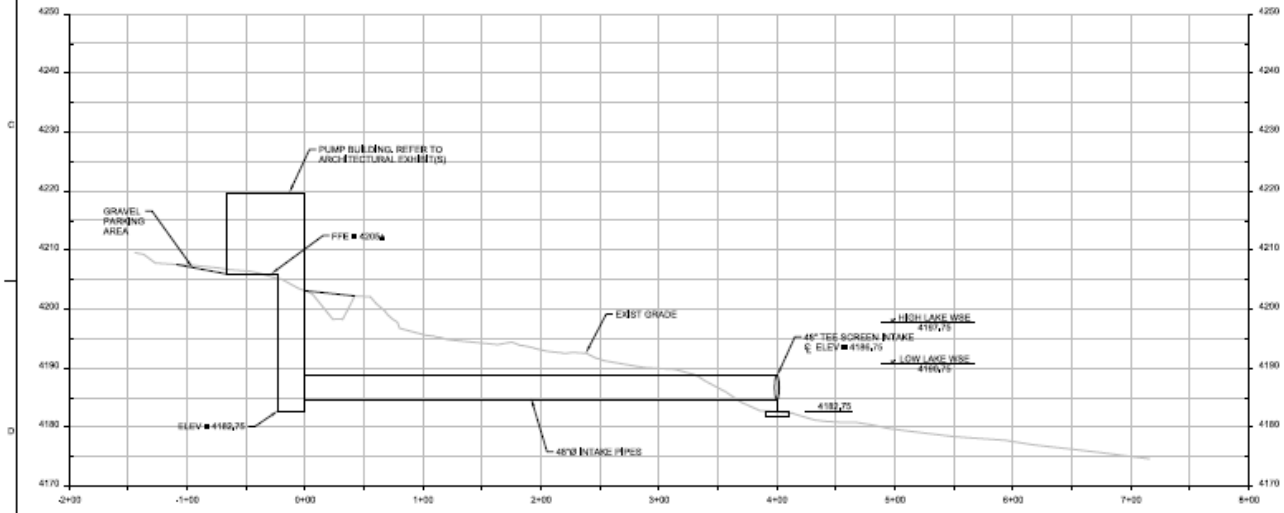


PLAN



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VERT: 1"=10'

1"=50'

NO.	DATE	DR	REVISION	CHK	APVD	BY	APVD

DESIGN

Lake Walcott Groundwater Recharge Project
Conceptual Intake Facility Alternatives
A&E Inquiry Document
Lake Walcott, Idaho

CH2MHILL®

CONCEPT
ALTERNATIVE NO. 2
TEE SCREEN INTAKE

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING
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DATE	2013/11/01
PROJ	477631
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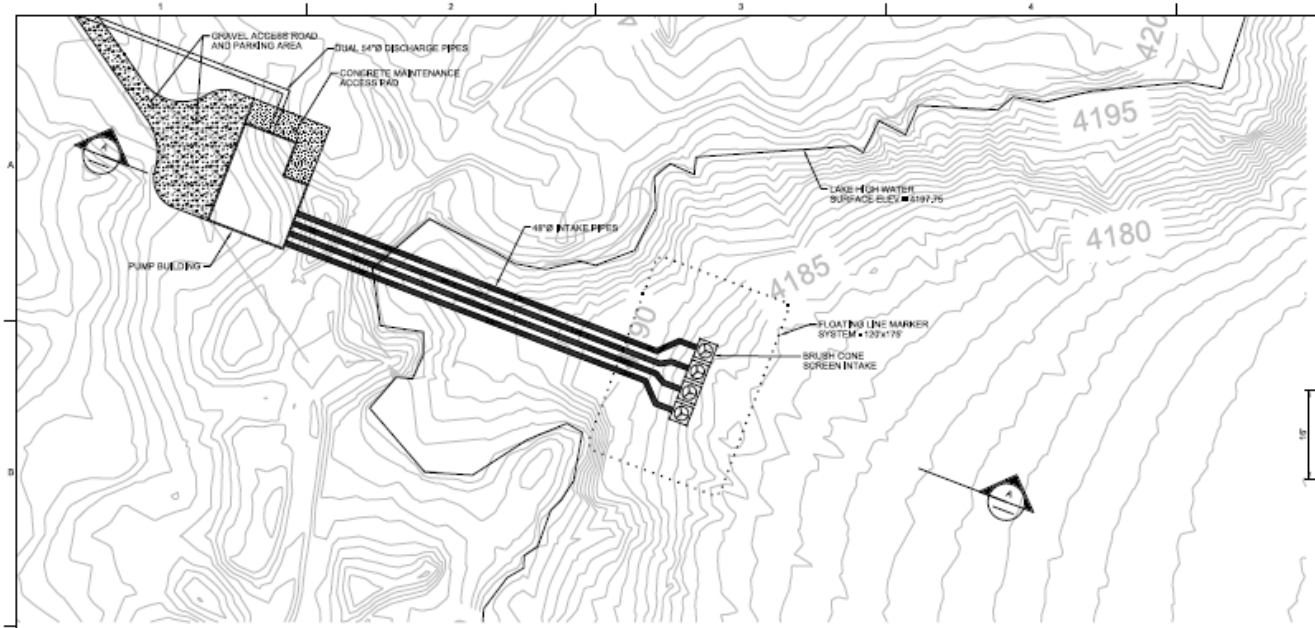

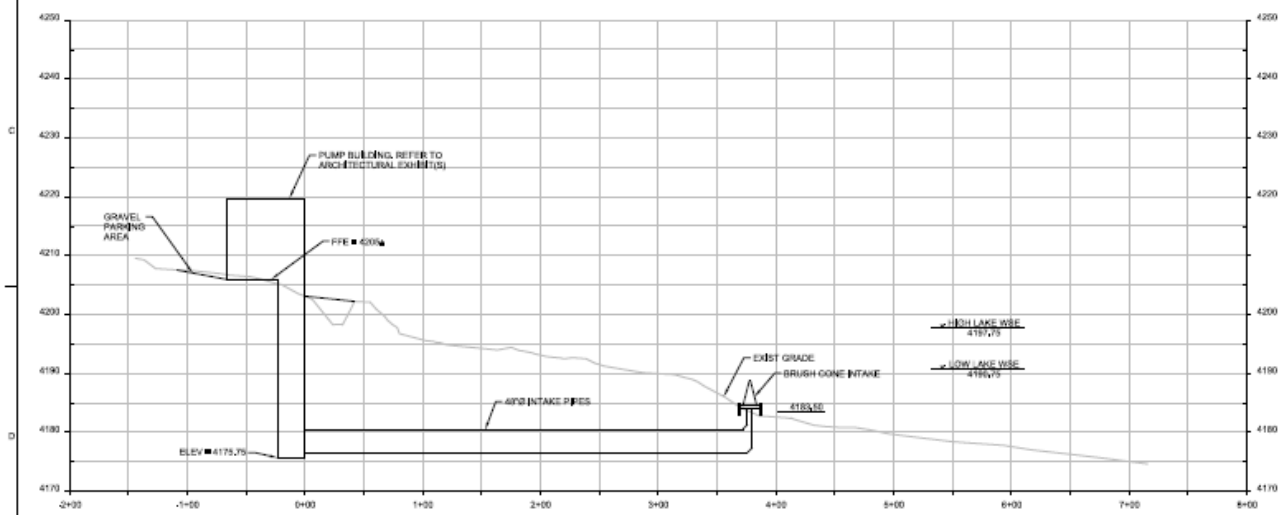

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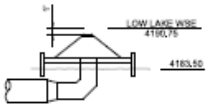

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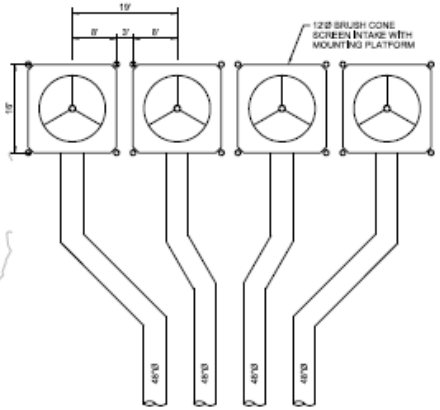

PLAN

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0 50 100 150
1"=50'

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CONCEPT
ALTERNATIVE NO. 3
BRUSH CONE SCREEN INTAKE

Lake Wallcut Groundwater Recharge Project
Conceptual Intake Facility Alternatives
Add Irrigation District
Lake Wallcut, Idaho

NO.	DATE	DR	REVISION	CHK	APVD	BY	APVD
DSGN							

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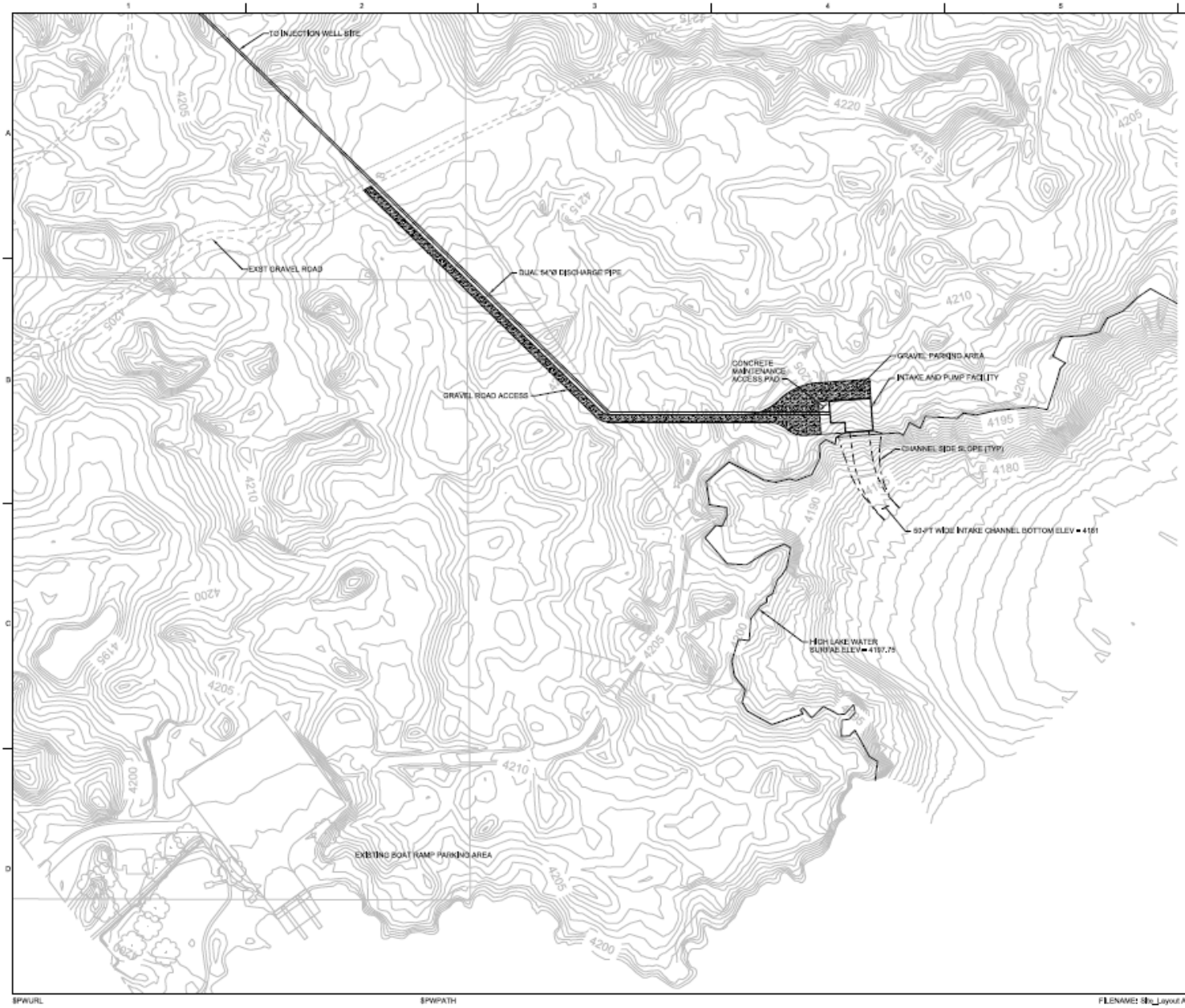

CH2MHILL®

CONCEPT

ALTERNATIVE NO. 4
EXCAVATED INTAKE CHANNEL

Lake Walcott Groundwater Recharge Project
Conceptual Intake Facility Alternatives
A&B Irrigation District
Lake Walcott, Idaho

NO.	DATE	REVISION	BY	APVD
DSGN	DR	CHK		

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
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DATE	2013/11/01
PROJ	477631
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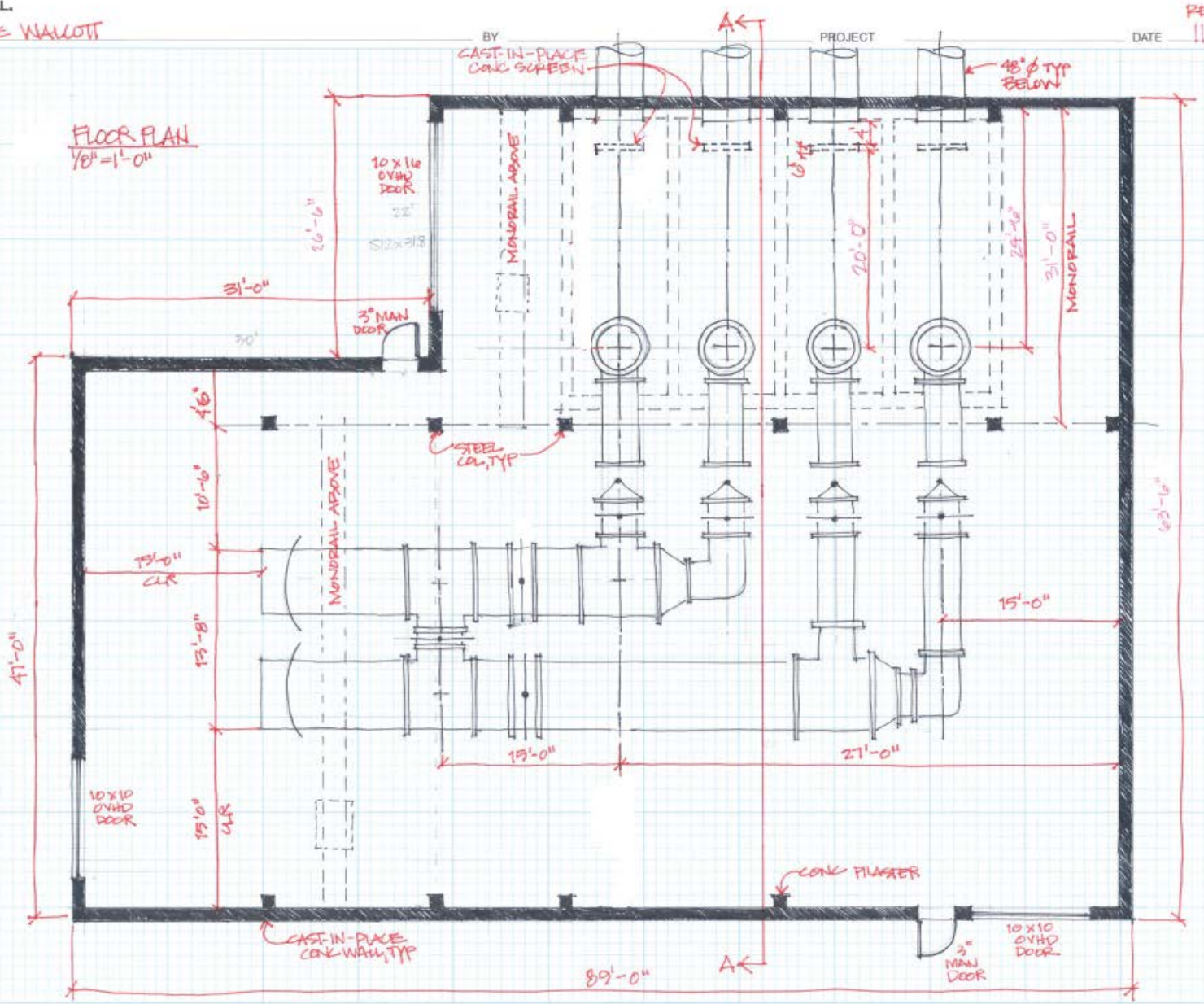
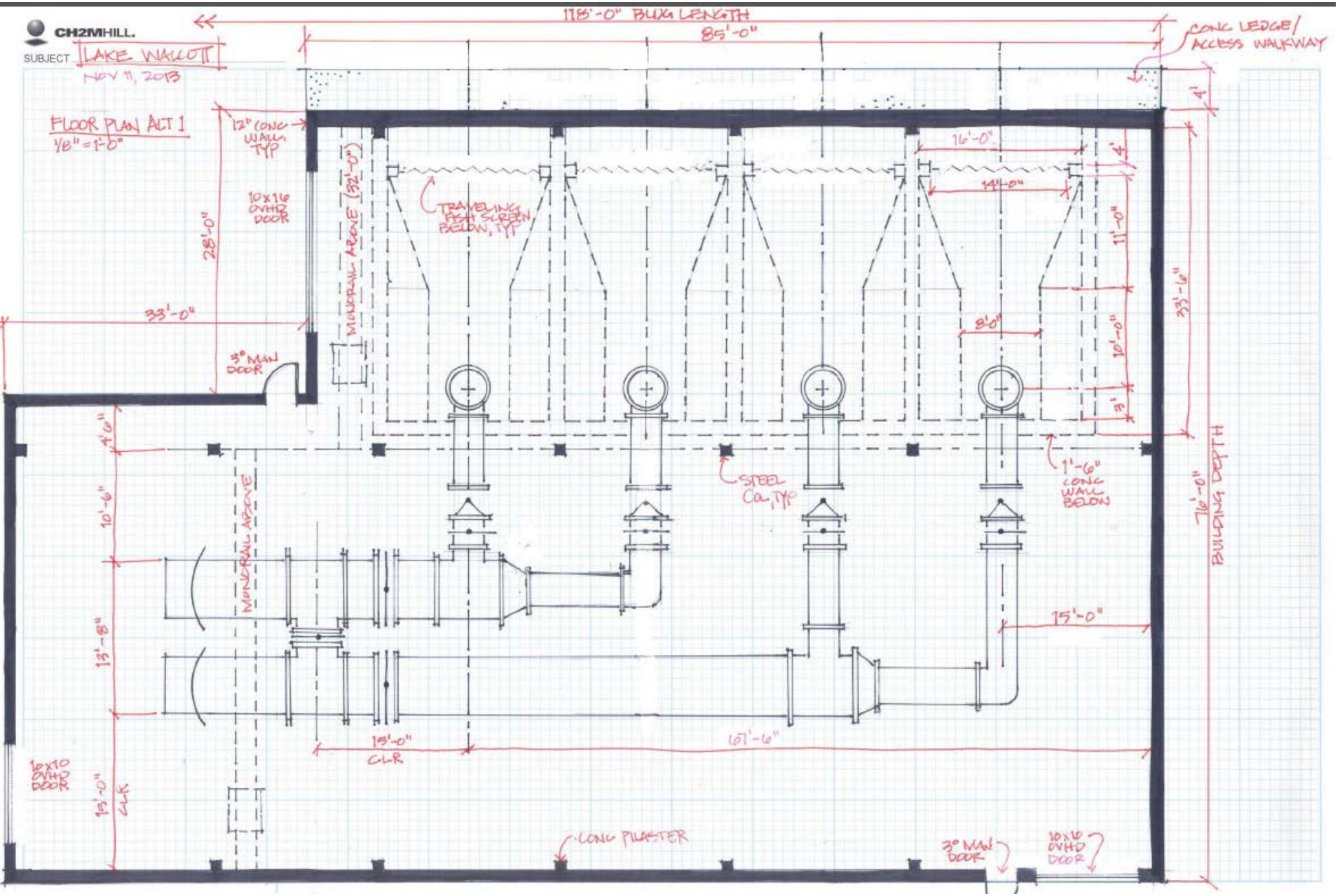
CH2MHILL.

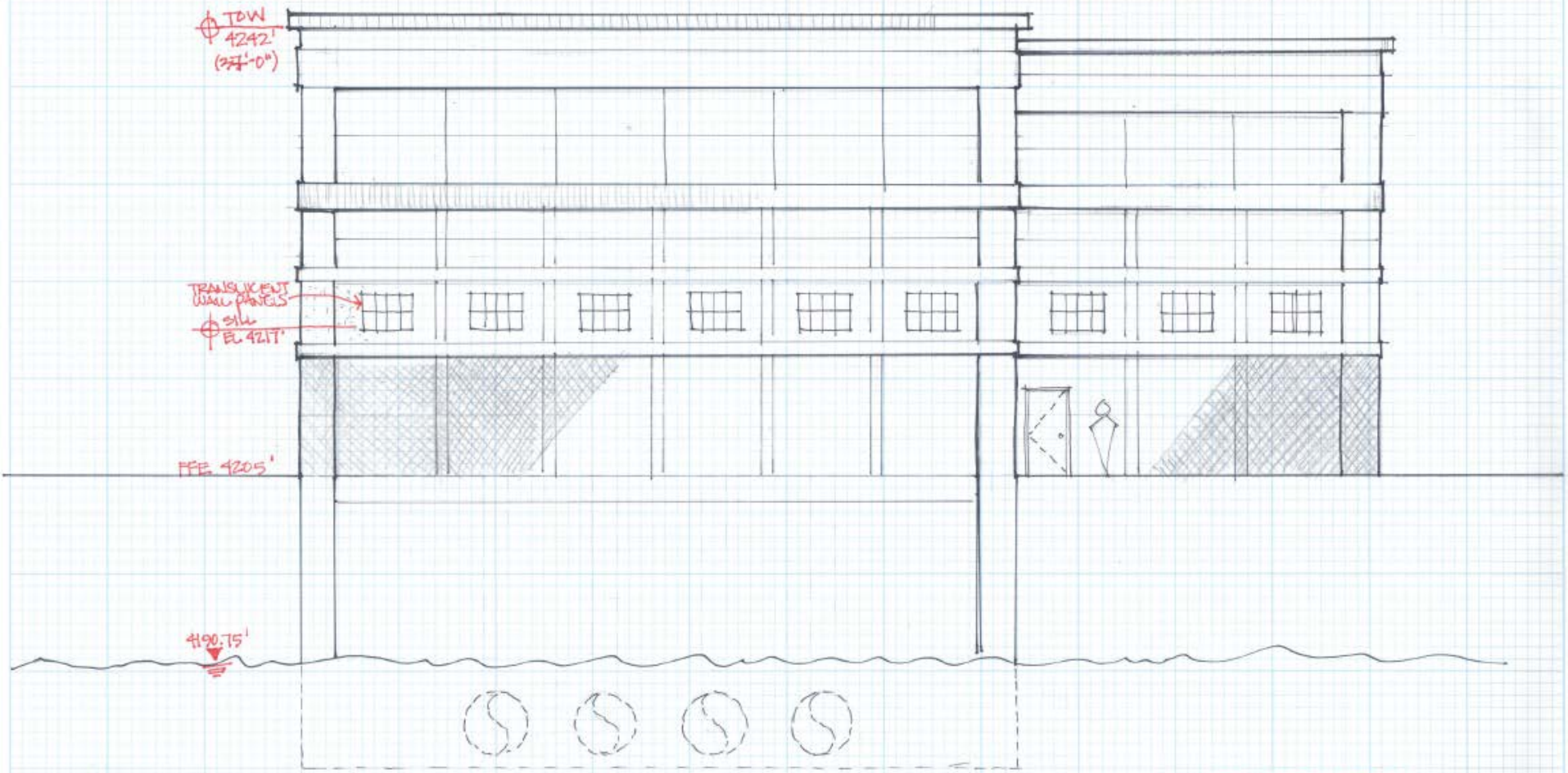
SUBJECT LAKE WALCOTT BY PROJECT DATE REVISED 11-11-13 SHT OF




CH2MHILL.
SUBJECT LAKE WALLOTT
NOV 11, 2013
FLOOR PLAN ALT 1
1/8" = 1'-0"
118'-0" BLDG LENGTH
85'-0"
CONC LEDGE/ ACCESS WALKWAY
12" CONC WALL, TYP
10x16 OVHD DOOR
28'-0"
33'-0"
3' MAN DOOR
MONORAIL ABOVE (32'-0")
TRAVELING FISH SCREEN BELOW, TYP
16'-0"
14'-0"
11'-0"
10'-0"
3'
8'-0"
33'-6"
4'
1'-6" CONC WALL BELOW
STEEL COL, TYP
BUILDING DEPTH 116'-0"
15'-0"
4'-6"
10'-6"
13'-8"
19'-0" CLR
MONORAIL ABOVE
16x10 OVHD DOOR
19'-0" CLR
61'-6"
CONC PILASTER
3' MAN DOOR
10x10 OVHD DOOR

CH2MHILL.

SUBJECT LAKE WALCOTT BY PROJECT DATE 10-30-13 SHT OF



EAST ELEVATION
1/8" = 1'-0"

Task 4 - Questions

- Preferred intake configuration
- Appropriateness of air bursting
- O&M associated w/ pipelines in reservoir
- Building location
- Appropriateness of proposed building
- Is building even needed

AWEP Update

2013 AWEP Summary Table

Project Type	No. of Projects	Obligation	Contract Acres
Groundwater to Surface Water Conversions	5	$4,112,652	1,580
Demand Reduction	8	$262,844	496
Water Savings	4	$203,555	277
End-gun Removal	3	$38,952	202
Totals	20	$4,618,003	2,555

AWEP: A&B Conversion Project

MAGICVALLEY.COM powered by Times-News

A&B Irrigation District Approves $7 Million Bond

2 HOURS AGO • BY LAURIE WELCH
LWELCH@MAGICVALLEY.COM

RUPERT • The A&B Irrigation District passed a $7 million bond issue Tuesday with 80 percent approval.

Water users in the district cast 210 yes votes and 50 no votes. The bond required a two-thirds majority to pass.

The district will use $3.8 million to put a new pumping plant in Unit A, which consists of 170 landowners on 17,300 acres. Unit B consists of 480 landowners with 65,300 acres. The district has 185 active wells on Unit B, but some are going dry.

A&B also will share costs on a Lake Walcott Recharge Project that will inject available Snake River water into the aquifer.

Any Questions?

Hilton Spill Recharge Basin, June 2011.

IDAHO WATER RESOURCE BOARD

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Governor

Roger W. Chase
Chairman
Pocatello
District 4

Bob Graham
Secretary
Bonners Ferry
District 1

Charles "Chuck" Cuddy
Orofino
At Large

Vince Alberdi
Kimberly
At Large

Jeff Raybould
St. Anthony
At Large

Peter Van Der Meulen
Hailey
At Large

Albert Barker
Boise
District 2

John "Bert" Stevenson
Rupert
District 3

TO: IDAHO WATER RESOURCE BOARD

FROM: Neal Farmer & Mat Weaver

DATE: November 19, 2013

SUBJECT: Fall 2013 Aquifer Recharge Activities Update

This memo provides an update of Eastern Snake Plain Aquifer recharge activity since the last Board meeting.

Walcott Recharge Site – Preliminary Design & Env. Assessment

Since the last Board meeting there have been significant advancements of the preliminary design of the Lake Walcott recharge project. W&H Pacific has completed and delivered their final site topographic survey. This survey is being utilized by CH2M Hill in their preliminary design work. At this time W&H Pacific has completed all of their contracted items, save one: preparing a final instrument describing an easement for the pipeline and roadway access across federal land.

Since the last meeting CH2M Hill has completed Task 3 of their contract, which was preparing an economic analysis of various conveyance pipeline configurations. The economic analysis is titled "Lake Walcott Ground Water Recharge Project Conveyance System Alternatives Economic Analysis (Task 3) and is included as an attachment to this memo. Following a review of the economic analysis and several project coordination meetings (9/9/13, 9/26/13), the following project assumptions were agreed upon.

- Pump station shall be designed for ultimate build out capacity of 200 cfs with initial phase pumping rate targeting 100 cfs.
- Pipeline across the wildlife refuge shall be designed for ultimate build out capacity of 200 cfs with portion of pipe(s) terminating at state/federal property line with 100 cfs capacity saved for future extension to basin.
- Concept pump station and intake facility will focus on providing pump arrangement of: (1) two 50 cfs pumps and one 100 cfs pump; (2) four 50 cfs pumps. CH2M Hill will review pump performance and operation considerations for these two pump scenarios to drive future decision.
- A straight horizontal alignment and vertical alignment that follows topography will be the basis of the conveyance pipeline design.

The first draft of Task 4 has also been submitted by CH2M Hill since the last Board meeting. CH2M Hill's deliverable for Task 4 was a report titled "Lake

Walcott Ground Water Recharge Project: Intake and Pump Station Facility Conceptual Alternatives (Task 4)—it is included as an attachment to this memo. We have had one project coordination meeting regarding Task 4 (11/7/13). At the coordination meeting we discussed the four proposed intake design options presented in the report.

1. Slant screen intake with air burst cleaning system
2. Tee screen intake with air burst cleaning system
3. Brush cone screen intake
4. Excavated intake channel with traveling screen

We also discussed the proposed conceptual pump building plans. At the conclusion of the meeting no decisions were made on how to proceed forward. Instead we decided that the conceptual ideas proposed in the Task 4 report should be presented to the respective Boards of all the parties for consideration, discussion, and feedback. The following questions are some of the considerations identified during the meeting.

1. Which of the four intake concepts is preferred?
2. Is air bursting a feasible means of cleaning the screened intakes in and adjacent to a wildlife refuge? Air bursting results in a large noisy discharge of compressed air at depth.
3. Is the operation and maintenance of large screened pipe inlets that project hundreds of feet into the reservoir desirable?
4. Should we relocate the building to sit immediately adjacent to the reservoir?
5. Is the building as proposed appropriate given its location within the wildlife refuge?
6. What are the effects on fishing and other recreational activities in the refuge if the pump building were immediately adjacent to the reservoir?
7. Is a building even needed? Could we get by with a large sound barrier screening wall and exposed pumping facilities in lieu of a building?

Once we have come to agreement of these questions and given appropriate direction to CH2M Hill, they will finalize our preliminary plans and initiate the environmental assessment process with the U.S. Fish and Wildlife Services.

<u>Walcott Recharge Site – Hydrogeologic Investigations</u>

Exploratory drilling is continuing at the 'Walcott' recharge site by A&B's well drilling staff in coordination with Department's staff. In August two test wells were drilled to a depth of 120 feet and 140 feet to perform hydraulic testing on the unsaturated zone above the water table. Figure 1 and 2 show the test well locations and drilling setup. Figure 3 details a subsurface cross-section of the geology at the site. A report was completed September 18th (see attached document) summarizing recharge testing and aquifer parameterization from the first two test wells. Recharge testing associated with the wells revealed a recharge capacity of approximately 250 gpm per well. These findings suggest that approximately 180 wells would be needed to achieve the targeted recharge rate of 100 cfs (44,880 gpm). In response to those findings we decided to drill the wells to deeper depths, where we would inject directly into the regional aquifer.

Deepening of the first test well is currently underway and is at a depth of 330 feet, or about 200 feet below the water table. The target completion depth for this well is approximately 350 feet. A 30-foot layer of heaving sand was encountered at 190 to 220 feet, which caused problems and a delay in drilling. A check valve on the air hammer drill bit failed and allowed sand to flow back up into the drill bit resulting in a "sand lock". Delay in drilling was due in large part to the need to transport the bit to Nampa, to be disassembled, cleaned, and repaired. The heaving sand layer also caused casing placement problems resulting in additional delays. Drilling resumed on October 28th until a second loose sand layer was encountered from 321 to 330 feet (Figure 4). Drilling is currently on hold

pending the evaluation of the sand layer which appears to have settled out at 317 feet and how/if to proceed further. After well construction is completed, the Department plans to perform aquifer pumping tests to determine aquifer characteristics necessary to estimate recharge rates and the ability of the well to receive injected recharge water. Depending on the recharge capacities encountered, this information will be used to evaluate whether the test well drilling should continue, not continue, or whether additional investigation is required. If a new test well drilling location is deemed necessary the north side of the state section of land in Figure 1 may have less sediments in the subsurface.

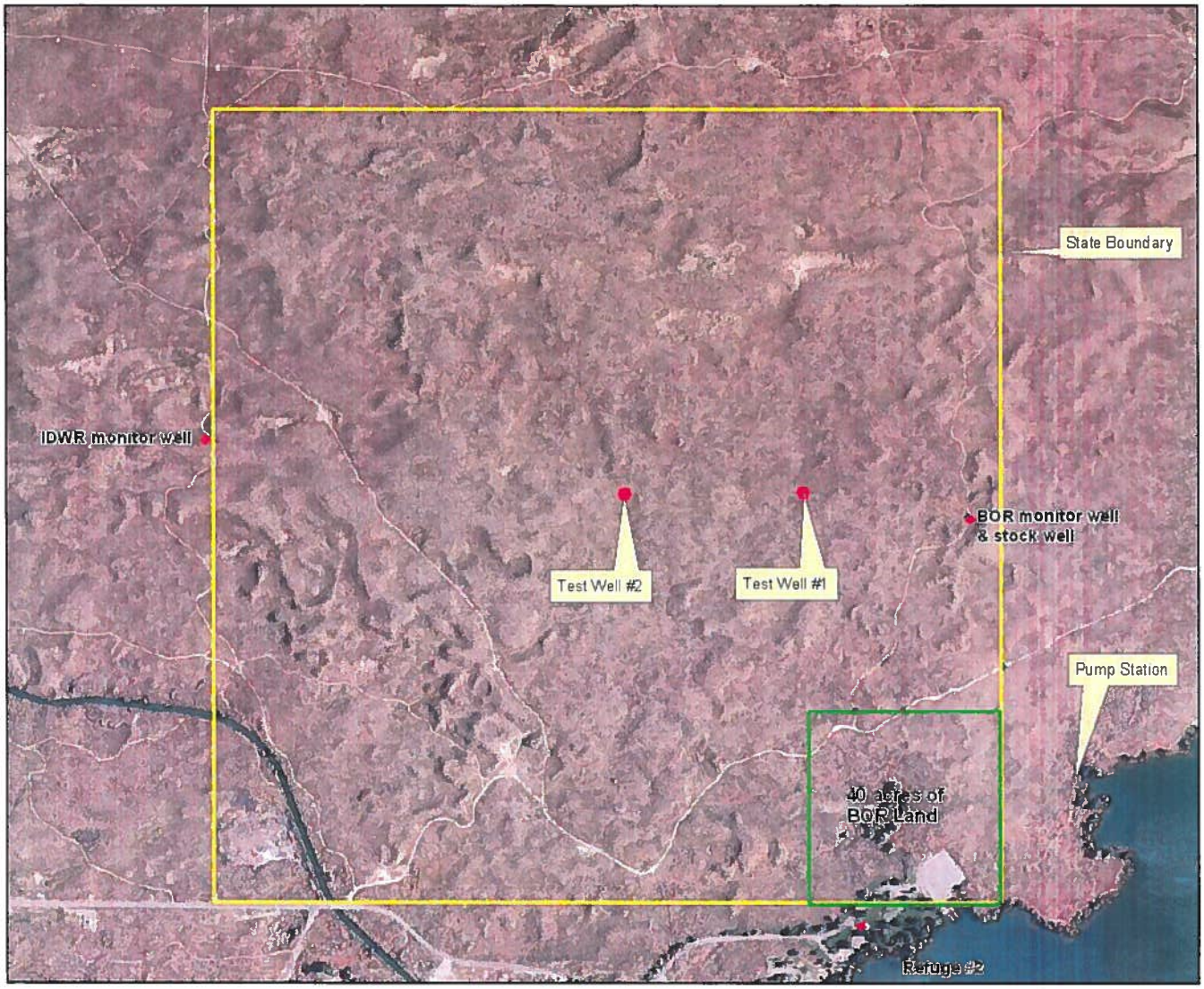

Figure 1. Site map of the Lake Walcott location and test wells.

Figure 2. South to North cross section of the subsurface hydrogeology at Lake Walcott site.

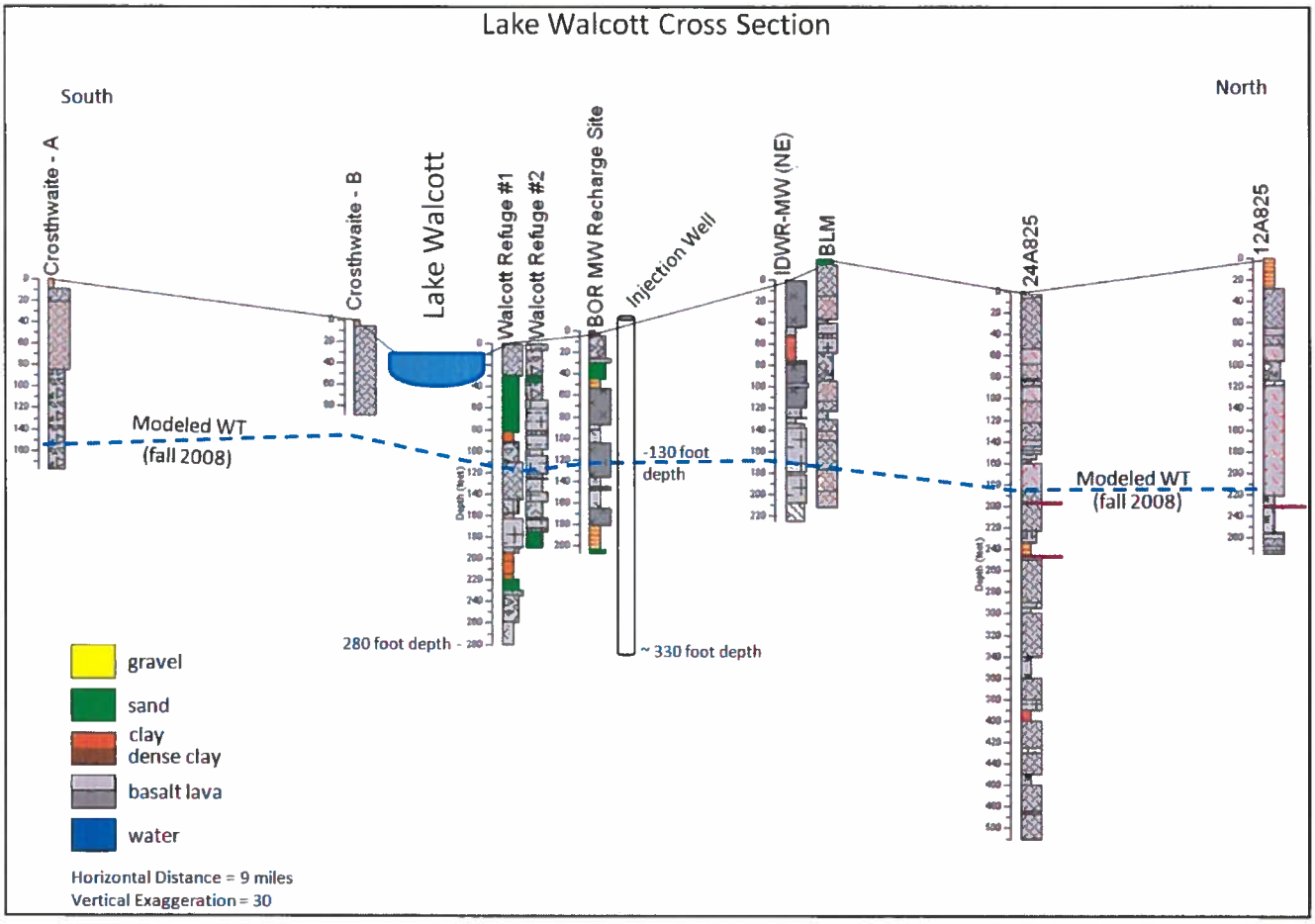

Figure 3. Drilling at Walcott.

Figure 4. Blowing sand from 330 foot depth.

Southwest Irrigation District

Southwest Irrigation District has started pumping recharge water from the Milner pool as of November 4, 2013. They were unable to pump recharge water sooner because the pool level of the Milner Reservoir was too low and/or the Board's recharge right was not in priority. Dam inspection, maintenance, and/or repairs require the pool level to be dropped for a period of time in most years. Southwest pumped recharge water a year ago in cold weather and experienced some damage to their pipeline which was redesigned and repaired last winter. As a result they made repairs and modifications to their system that will hopefully allow for cold weather diversions and recharge. They hope to pump as late in the year as possible until weather conditions prohibit further pumping.

Mile Post 31 and AFRD2 (Milner-Gooding canal).

American Falls Reservoir District 2 (AFRD2) will not be able to participate in fall recharge due to unforeseen canal operation and maintenance requirements associated with canal lining failures that occurred during the irrigation season. The manager informed IDWR that work needs to be done in the canal upstream of Mile Post 31 (MP31) and they will not be able to recharge this fall.

However, after the main gates for AFRD2 were closed on October 1, while the canal system was draining, the turnout gates to MP31 were opened allowing for three day of diversion into the basin. Diversion of the 'drain' water into the basin allowed IDWR, with the help of Idaho Power Company, to perform additional site testing. On October 2, during the three day testing period, Idaho Power Company provided two staff, one vehicle, and flow measurement equipment to measure the flow through the turn out structure at MP31 (Figure 5, 6 and 7). At the time of the measurements, a diversion rate of approximately 94 cfs was reported. Canal 'drain' water flowed into the site for approximately 3 days.

Figure 5. Idaho Power measuring flow into Mile Post 31 using an acoustic Doppler instrument.

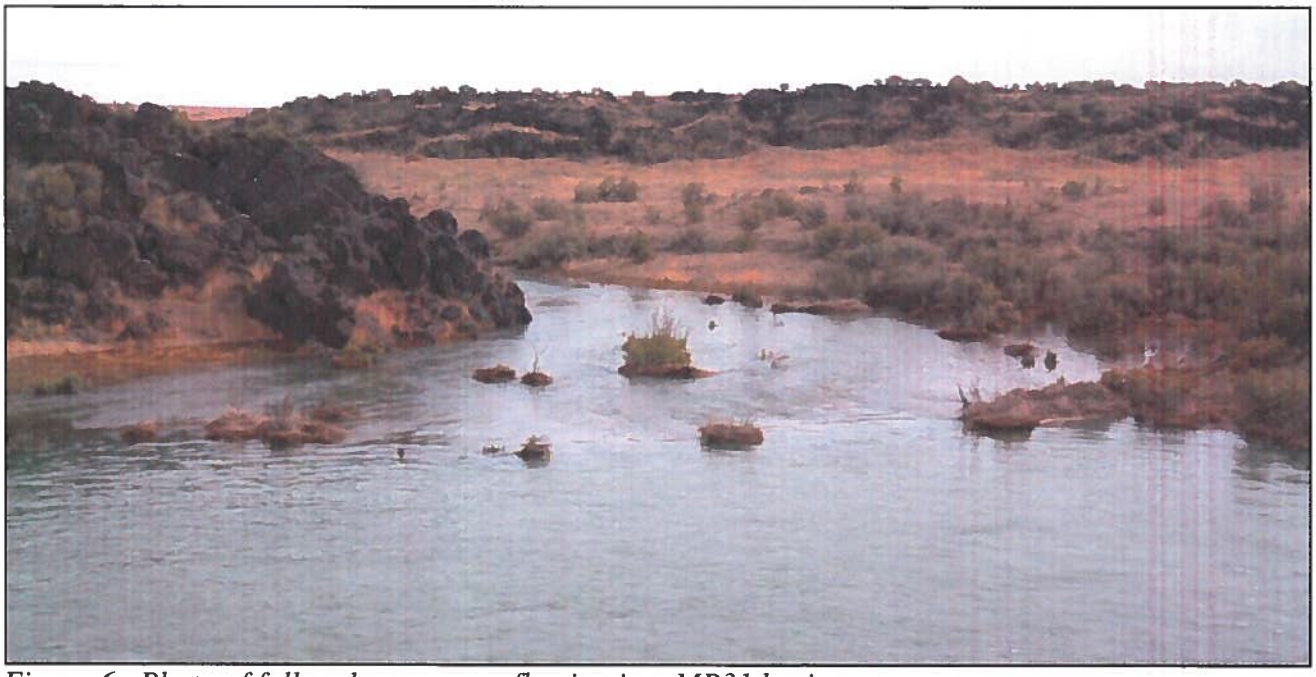

Figure 6. Photo of fall recharge water flowing into MP31 basin.

Figure 7. Photo of fall recharge water flowing out through the MP31 turnout structure completed last winter.

Attachments:

1- Lake Walcott Ground Water Recharge Project Conveyance System Alternatives Economic Analysis (Task 3)
2- Lake Walcott Ground Water Recharge Project: Intake and Pump Station Facility Conceptual Alternatives (Task 4)
3- Lake Walcott Recharge Slug Injection Test

Lake Walcott Ground Water Recharge Project Conveyance System Alternatives Economic Analysis (Task 3)

PREPARED FOR:	Dan Temple/A&B Irrigation District (A&B) Dean Stevenson/Magic Valley Ground Water District (MVGWD) Mat Weaver/Idaho Department of Water Resources (IDWR) Brian Patton/IDWR
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PREPARED BY:	Jenny Kindig/CH2M HILL
DATE:	September 10, 2013
PROJECT NUMBER:	477631

Introduction

This technical memorandum documents CH2M HILL's economic analysis for conveyance system alternatives as part of the Lake Walcott Ground Water Recharge Project. The work was performed as part of CH2M HILL's task order with A&B Irrigation District (Client) to develop a preliminary design and Environmental Assessment for the project. To provide a basis for decisions regarding conveyance system design criteria by the Client, CH2M HILL evaluated several pipeline concept alternatives with variations in horizontal alignment, vertical alignment, design flow rate, and number of pipelines. Included herein are a description of the conceptual level analysis and a summary of the alternatives that were evaluated. Also included is a summary of relative costs for the various alternatives.

Cost Estimate

As part of the economic analysis, CH2M HILL prepared a cursory estimate of costs for the major construction elements relevant to comparison of alternatives. This order-of-magnitude cost estimate includes cost factors for the following:

- Pipeline material, delivery, and installation including HDPE fusing
- Pumps and pump house
- Excavation costs assuming blasting, as it was determined that rock cutting will be cost prohibitive and rock appears to be present at or near the ground surface throughout the project site.

Unit rate costs are based on client-supplied information, previous project history, and verbal quotes from a local HDPE pipeline supplier. This cost estimate does not include any cost associated with the intake/fish screen, nor is it intended to provide a basis for evaluation of overall project cost or budget. The estimate's sole intent is to provide a reasonable basis to compare broad alternatives.

The cost estimate for each of the alternatives has been converted to a ratio of least cost value for ease of comparative purposes between the alternatives. The least cost alternative has been assigned a value of 1.0. An alternative estimated to cost 30 percent more than the least cost alternative is assigned a ratio value of 1.3.

Two least cost ratio variations are reported: 1) ratio of least cost irrespective of design flow rate and 2) ratio of least cost normalized by taking design flow rate into account.

Description of Alternatives

Variables for the pipeline concepts that formulate the alternatives consisted of the following:

- Horizontal Alignments (See Exhibit 1)
    - Straight-line alignment minimizes the length of the conveyance route

    - Meandering alignment follows the topography to reduce the volume of excavation required
- Vertical Alignments (See Exhibit 2)
    - Constant grade (straight) alignment eliminates the need for pipeline appurtenances such as air relief valves and blowoff valves
    - Constant depth of cover alignment minimizes the volume of excavation required by following the natural topography and providing air relief valves at high points in the pipeline and blowoff valves at low points in the pipeline
- Design Flow Rates
    - Flow rate of 100 cfs as defined in the Idaho Water Resource Board's Proposed Lake Walcott Ground Water Recharge Project Executive Briefing
    - Flow rate of 200 cfs which was subsequently identified by Client as a potential option to maximize groundwater recharge
    - For each of these two flow rates, alternatives have also been identified to allow for construction of all pipelines across federal refuge and terminating a portion of the pipes for future expansion thus creating an initial design flow rate (Initial Q) and an ultimate flow rate at full build-out (Ultimate Q).
- Number of Pipelines - For the purpose of this analysis, it is assumed that the flow is split equally between the pipelines.
    - 2 pipelines (2 pumps)
    - 3 pipelines (3 pumps)
    - 4 pipelines (4 pumps)
- Pipeline Termination Location
    - Proposed large recharge injection well site as defined in the Idaho Water Resource Board's Proposed Lake Walcott Ground Water Recharge Project Executive Briefing.
    - Proposed small recharge injection well site which was subsequently identified by Client as a potential option to reduce the length of the conveyance route.
    - Cap pipeline just beyond the State/USFWS boundary for future use. These alternatives would minimize the need for future NEPA work associated with future expansion of the project at a later date as funds are available. For this reason, the initial design flow rate is less than the ultimate design flow rate and has fewer pumps initially. The cost estimate for the pump house assumes full build-out as it is on federal land but does not include the additional pump and pipeline beyond the State/USFWS boundary.

Alternative Comparison

A spreadsheet was used to compare the alternatives, generated from the variables described above, in least cost ratio terms. Attachment 1 presents the summary of results for all 40 concept alternatives.

Based on analysis of the data presented in Attachment 1, the following conclusions were made relative to the key concept variables:

- Horizontal Alignments: The horizontal alignment following the topography to reduce excavation costs is approximately 140 feet longer than a direct, straight horizontal alignment. In general, for constant grade vertical alignments, it is slightly more cost effective to meander and follow the topography. For variable vertical alignments with constant depth of cover, it is slightly more cost effective to have a direct, straight alignment.

- Vertical Alignments: The alternatives where the pipeline vertical alignment follows the topography to maintain a constant depth of cover were the least cost alternatives, as the cost of additional excavation to maintain a constant vertical profile exceeded the cost of pipeline appurtenances such as air relief valves and blowoff valves. For example, the alternative with a design flow rate of 100 cfs, which maintained a constant vertical grade and discharged groundwater to both the proposed recharge sites, was 28 percent more expensive than the least cost alternative (Option 1a compared to Option 1c).
- Design Flow Rate: Increasing the design flow rate from 100 cfs to 200 cfs results in a 35 percent increase for total project cost (Option 1c compared to Option 3c). Considering project benefits, it should noted that in terms of cost per design flow rate Option 3c is the least cost alternative.
- Number of Pipelines: In general, the alternatives with fewer pipes are more cost effective than those which split the design flow to provide operational flexibility. For example, at 100 cfs design flow rate, it is approximately 17 percent more expensive than the least cost alternative to go from 2 to 3 pipelines (Option 1c compared to Option 2c).

Attachments 2 and 3 have been sorted according to least total cost ratio (Attachment 2) and to least cost per initial flow rate (Attachment 3).

Conclusion

CH2M HILL generally recommends that the project proceed with a straight horizontal alignment and a pipeline profile (grade) that follows the natural topography with constant cover and an appropriate number of air valves. Further, if total cost takes precedence over cost per cfs of recharge benefit, the design flow rate should be 100 cfs and the project should include no more than two pipelines and two pumps.

As a follow-up to these recommendations, the project team participated in a teleconference on September 9 to discuss the initial findings and recommendations of the Conveyance System Alternatives Economic Analysis. During the teleconference an additional option was identified (Option 3i) which maintains a straight horizontal alignment, has a pipeline profile that follows the natural topography, has two pipes and pumps, and phases the project with the initial project delivering 100 cfs to the proposed large recharge location while terminating a second pipe with a 100 cfs capacity just beyond the State/USFWS boundary. It was determined during this meeting, and supported by the analysis which showed a relatively low ratio to least cost, that this option is a viable alternative to move forward to the predesign phase. For the purposes of the NEPA analysis, CH2M HILL will evaluate Option 3i for the ultimate design flow rate (200 cfs).

Attachments

Summaries of Alternatives

Attachment 1 - Summary of Alternatives

Option[1]	Ultimate Q (cfs)	Initial Q (cfs)	# of Pipes	# of Pumps Initial Project	Pipe Horiz Alignment	Pipe Vert Alignment	Pipe Cover	Pipeline Termination Location[2]	Ratio to Least Cost	Ratio to Least Cost Per Initial Q
1a	100	100	2	2	Straight	Constant Grade	Varies	1 pipe to #1, 1 pipe to #2	1.28	1.90
1b	100	100	2	2	Straight	Constant Grade	Varies	2 pipes to #1	1.57	2.33
1c	100	100	2	2	Straight	Varies	Constant with AV's	1 pipe to #1, 1 pipe to #2	1.00	1.49
1d	100	100	2	2	Straight	Varies	Constant with AV's	2 pipes to #1	1.20	1.78
1e	100	100	2	2	Meander	Constant Grade	Varies	1 pipe to #1, 1 pipe to #2	1.20	1.79
1f	100	100	2	2	Meander	Constant Grade	Varies	2 pipes to #1	1.49	2.21
1g	100	100	2	2	Meander	Varies	Constant with AV's	1 pipe to #1, 1 pipe to #2	1.02	1.52
1h	100	100	2	2	Meander	Varies	Constant with AV's	2 pipes to #1	1.24	1.84
2a	100	100	3	3	Straight	Constant Grade	Varies	2 pipe to #1, 1 pipe to #2	1.45	2.16
2b	100	100	3	3	Straight	Constant Grade	Varies	3 pipes to #1	1.77	2.63
2c	100	100	3	3	Straight	Varies	Constant with AV's	2 pipe to #1, 1 pipe to #2	1.17	1.74
2d	100	100	3	3	Straight	Varies	Constant with AV's	3 pipes to #1	1.37	2.03
2e	100	100	3	3	Meander	Constant Grade	Varies	2 pipe to #1, 1 pipe to #2	1.37	2.04
2f	100	100	3	3	Meander	Constant Grade	Varies	3 pipes to #1	1.68	2.50
2g	100	100	3	3	Meander	Varies	Constant with AV's	2 pipe to #1, 1 pipe to #2	1.19	1.77
2h	100	100	3	3	Meander	Varies	Constant with AV's	3 pipes to #1	1.41	2.10
3a	200	200	2	2	Straight	Constant Grade	Varies	1 pipe to #1, 1 pipe to #2	1.66	1.23
3b	200	200	2	2	Straight	Constant Grade	Varies	2 pipes to #1	2.02	1.50
3c	200	200	2	2	Straight	Varies	Constant with AV's	1 pipe to #1, 1 pipe to #2	1.35	1.00
3d	200	200	2	2	Straight	Varies	Constant with AV's	2 pipes to #1	1.61	1.20
3e	200	200	2	2	Meander	Constant Grade	Varies	1 pipe to #1, 1 pipe to #2	1.58	1.17
3f	200	200	2	2	Meander	Constant Grade	Varies	2 pipes to #1	1.94	1.44
3g	200	200	2	2	Meander	Varies	Constant with AV's	1 pipe to #1, 1 pipe to #2	1.37	1.02
3h	200	200	2	2	Meander	Varies	Constant with AV's	2 pipes to #1	1.67	1.24
3i	200	100	2	1	Straight	Varies	Constant with AV's	1 pipe to #1, 1 pipe to #3	1.06	1.58
4a	200	133	3	2	Straight	Constant Grade	Varies	1 pipe to #1, 1 pipe to #2, 1 pipe to #3	1.94	2.16
4b	200	200	3	3	Straight	Constant Grade	Varies	2 pipes to #1, 1 pipe to #2	2.64	1.96
4c	200	133	3	2	Straight	Varies	Constant with AV's	1 pipe to #1, 1 pipe to #2, 1 pipe to #3	1.54	1.72
4d	200	200	3	3	Straight	Varies	Constant with AV's	2 pipes to #1, 1 pipe to #2	2.07	1.54
4e	200	133	3	2	Meander	Constant Grade	Varies	1 pipe to #1, 1 pipe to #2, 1 pipe to #3	1.83	2.04
4f	200	200	3	3	Meander	Constant Grade	Varies	2 pipes to #1, 1 pipe to #2	2.51	1.87
4g	200	200	3	3	Meander	Varies	Constant with AV's	1 pipe to #1, 1 pipe to #2, 1 pipe to #3	1.66	1.23
4h	200	200	3	3	Meander	Varies	Constant with AV's	2 pipes to #1, 1 pipe to #2	2.13	1.59
5a	200	150	4	3	Straight	Constant Grade	Varies	2 pipe to #1, 1 pipe to #2, 1 pipe to #3	2.14	2.12
5b	200	200	4	4	Straight	Constant Grade	Varies	2 pipes to #1, 2 pipe to #2	2.70	2.01
5c	200	150	4	3	Straight	Varies	Constant with AV's	2 pipe to #1, 1 pipe to #2, 1 pipe to #3	1.73	1.71
5d	200	200	4	4	Straight	Varies	Constant with AV's	2 pipes to #1, 2 pipe to #2	2.07	1.54
5e	200	150	4	3	Meander	Constant Grade	Varies	2 pipe to #1, 1 pipe to #2, 1 pipe to #3	2.02	2.01
5f	200	200	4	4	Meander	Constant Grade	Varies	2 pipes to #1, 2 pipe to #2	2.55	1.90
5g	200	200	4	4	Meander	Varies	Constant with AV's	2 pipe to #1, 1 pipe to #2, 1 pipe to #3	1.82	1.36
5h	200	200	4	4	Meander	Varies	Constant with AV's	2 pipes to #1, 2 pipe to #2	2.13	1.58

[1]Options

1 - 100 cfs split in 2 pipes
2 - 100 cfs split in 3 pipes
3 - 200 cfs split in 2 pipes
4 - 200 cfs split in 3 pipes
5 - 200 cfs split in 4 pipes

[1]Sub-options

a - direct horizontal pipeline alignment, constant grade, variable cover depth, discharge to Location #1 and #2
b - direct horizontal pipeline alignment, constant grade, variable cover depth, discharge to Location #1
c - direct horizontal pipeline alignment, constant depth of cover with air relief valves at high points, discharge to Location #1 and #2
d - direct horizontal pipeline alignment, constant depth of cover with air relief valves at high points, discharge to Location #1
e - horizontal alignment meanders with topography to avoid high points, constant grade, discharge to Location #1 and #2
f - horizontal alignment meanders with topography to avoid high points, constant grade, discharge to Location #1
g - horizontal alignment meanders with topography to reduce high/low points, constant depth of cover, discharge to Location #1 and #2
h - horizontal alignment meanders with topography to reduce high/low points, constant depth of cover, discharge to Location #1
i - direct horizontal pipeline alignment, constant depth of cover with air relief valves at high points, discharge to Location #1 and #3

[2]Pipeline Termination Location

Location #1 - Proposed large recharge injection well site as defined in the Idaho Water Resource Boards's Proposed Lake Walcott Ground Water Recharge Project Executive Briefing.
Location #2 - Proposed small recharge injection well site which was subsequently identified by Client as a potential option (minor depression near the "fork" in the dirt road).
Location #3 - Cap pipeline just beyond the State/USFWS boundary for future use (minimize the need for future NEPA work associated with future expansion of the project at a later date as funds are available).

Attachment 2 - Summary of Alternatives Sorted by Least Cost Ratio

Option[1]	Ultimate Q (cfs)	Initial Q (cfs)	# of Pipes	# of Pumps Initial Project	Pipe Horiz Alignment	Pipe Vert Alignment	Pipe Cover	Pipeline Termination Location[2]	Ratio to Least Cost	Ratio to Least Cost Per Initial Q
1c	100	100	2	2	Straight	Varies	Constant with AV's	1 pipe to #1, 1 pipe to #2	1.00	1.49
1g	100	100	2	2	Meander	Varies	Constant with AV's	1 pipe to #1, 1 pipe to #2	1.02	1.52
3i	200	100	2	1	Straight	Varies	Constant with AV's	1 pipe to #1, 1 pipe to #3	1.06	1.58
2c	100	100	3	3	Straight	Varies	Constant with AV's	2 pipe to #1, 1 pipe to #2	1.17	1.74
2g	100	100	3	3	Meander	Varies	Constant with AV's	2 pipe to #1, 1 pipe to #2	1.19	1.77
1d	100	100	2	2	Straight	Varies	Constant with AV's	2 pipes to #1	1.20	1.78
1e	100	100	2	2	Meander	Constant Grade	Varies	1 pipe to #1, 1 pipe to #2	1.20	1.79
1h	100	100	2	2	Meander	Varies	Constant with AV's	2 pipes to #1	1.24	1.84
1a	100	100	2	2	Straight	Constant Grade	Varies	1 pipe to #1, 1 pipe to #2	1.28	1.90
3c	200	200	2	2	Straight	Varies	Constant with AV's	1 pipe to #1, 1 pipe to #2	1.35	1.00
2d	100	100	3	3	Straight	Varies	Constant with AV's	3 pipes to #1	1.37	2.03
2e	100	100	3	3	Meander	Constant Grade	Varies	2 pipe to #1, 1 pipe to #2	1.37	2.04
3g	200	200	2	2	Meander	Varies	Constant with AV's	1 pipe to #1, 1 pipe to #2	1.37	1.02
2h	100	100	3	3	Meander	Varies	Constant with AV's	3 pipes to #1	1.41	2.10
2a	100	100	3	3	Straight	Constant Grade	Varies	2 pipe to #1, 1 pipe to #2	1.45	2.16
1f	100	100	2	2	Meander	Constant Grade	Varies	2 pipes to #1	1.49	2.21
4c	200	133	3	2	Straight	Varies	Constant with AV's	1 pipe to #1, 1 pipe to #2, 1 pipe to #3	1.54	1.72
1b	100	100	2	2	Straight	Constant Grade	Varies	2 pipes to #1	1.57	2.33
3e	200	200	2	2	Meander	Constant Grade	Varies	1 pipe to #1, 1 pipe to #2	1.58	1.17
3d	200	200	2	2	Straight	Varies	Constant with AV's	2 pipes to #1	1.61	1.20
3a	200	200	2	2	Straight	Constant Grade	Varies	1 pipe to #1, 1 pipe to #2	1.66	1.23
4g	200	200	3	3	Meander	Varies	Constant with AV's	1 pipe to #1, 1 pipe to #2, 1 pipe to #3	1.66	1.23
3h	200	200	2	2	Meander	Varies	Constant with AV's	2 pipes to #1	1.67	1.24
2f	100	100	3	3	Meander	Constant Grade	Varies	3 pipes to #1	1.68	2.50
5c	200	150	4	3	Straight	Varies	Constant with AV's	2 pipe to #1, 1 pipe to #2, 1 pipe to #3	1.73	1.71
2b	100	100	3	3	Straight	Constant Grade	Varies	3 pipes to #1	1.77	2.63
5g	200	200	4	4	Meander	Varies	Constant with AV's	2 pipe to #1, 1 pipe to #2, 1 pipe to #3	1.82	1.36
4e	200	133	3	2	Meander	Constant Grade	Varies	1 pipe to #1, 1 pipe to #2, 1 pipe to #3	1.83	2.04
4a	200	133	3	2	Straight	Constant Grade	Varies	1 pipe to #1, 1 pipe to #2, 1 pipe to #3	1.94	2.16
3f	200	200	2	2	Meander	Constant Grade	Varies	2 pipes to #1	1.94	1.44
3b	200	200	2	2	Straight	Constant Grade	Varies	2 pipes to #1	2.02	1.50
5e	200	150	4	3	Meander	Constant Grade	Varies	2 pipe to #1, 1 pipe to #2, 1 pipe to #3	2.02	2.01
4d	200	200	3	3	Straight	Varies	Constant with AV's	2 pipes to #1, 1 pipe to #2	2.07	1.54
5d	200	200	4	4	Straight	Varies	Constant with AV's	2 pipes to #1, 2 pipe to #2	2.07	1.54
5h	200	200	4	4	Meander	Varies	Constant with AV's	2 pipes to #1, 2 pipe to #2	2.13	1.58
4h	200	200	3	3	Meander	Varies	Constant with AV's	2 pipes to #1, 1 pipe to #2	2.13	1.59
5a	200	150	4	3	Straight	Constant Grade	Varies	2 pipe to #1, 1 pipe to #2, 1 pipe to #3	2.14	2.12
4f	200	200	3	3	Meander	Constant Grade	Varies	2 pipes to #1, 1 pipe to #2	2.51	1.87
5f	200	200	4	4	Meander	Constant Grade	Varies	2 pipes to #1, 2 pipe to #2	2.55	1.90
4b	200	200	3	3	Straight	Constant Grade	Varies	2 pipes to #1, 1 pipe to #2	2.64	1.96
5b	200	200	4	4	Straight	Constant Grade	Varies	2 pipes to #1, 2 pipe to #2	2.70	2.01

[1]Options

1 - 100 cfs split in 2 pipes
2 - 100 cfs split in 3 pipes
3 - 200 cfs split in 2 pipes
4 - 200 cfs split in 3 pipes
5 - 200 cfs split in 4 pipes

[1]Sub-options

a - direct horizontal pipeline alignment, constant grade, variable cover depth, discharge to Location #1 and #2
b - direct horizontal pipeline alignment, constant grade, variable cover depth, discharge to Location #1
c - direct horizontal pipeline alignment, constant depth of cover with air relief valves at high points, discharge to Location #1 and #2
d - direct horizontal pipeline alignment, constant depth of cover with air relief valves at high points, discharge to Location #1
e - horizontal alignment meanders with topography to avoid high points, constant grade, discharge to Location #1 and #2
f - horizontal alignment meanders with topography to avoid high points, constant grade, discharge to Location #1
g - horizontal alignment meanders with topography to reduce high/low points, constant depth of cover, discharge to Location #1 and #2
h - horizontal alignment meanders with topography to reduce high/low points, constant depth of cover, discharge to Location #1
i - direct horizontal pipeline alignment, constant depth of cover with air relief valves at high points, discharge to Location #1 and #3

[2]Pipeline Termination Location

Location #1 - Proposed large recharge injection well site as defined in the Idaho Water Resource Boards's Proposed Lake Walcott Ground Water Recharge Project Executive Briefing
Location #2 - Proposed small recharge injection well site which was subsequently identified by Client as a potential option (minor depression near the "fork" in the dirt road)
Location #3 - Cap pipeline just beyond the State/USFWS boundary for future use (minimize the need for future NEPA work associated with future expansion of the project at a later date as funds are available).

Attachment 3 - Summary of Alternatives Sorted by Least Cost Ratio per Initial Flow Rate

Option[1]	Ultimate Q (cfs)	Initial Q (cfs)	# of Pipes	# of Pumps Initial Project	Pipe Horiz Alignment	Pipe Vert Alignment	Pipe Cover	Pipeline Termination Location[2]	Ratio to Least Cost	Ratio to Least Cost Per Initial Q
3c	200	200	2	2	Straight	Varies	Constant with AV's	1 pipe to #1, 1 pipe to #2	1.35	1.00
3g	200	200	2	2	Meander	Varies	Constant with AV's	1 pipe to #1, 1 pipe to #2	1.37	1.02
3e	200	200	2	2	Meander	Constant Grade	Varies	1 pipe to #1, 1 pipe to #2	1.58	1.17
3d	200	200	2	2	Straight	Varies	Constant with AV's	2 pipes to #1	1.61	1.20
3a	200	200	2	2	Straight	Constant Grade	Varies	1 pipe to #1, 1 pipe to #2	1.66	1.23
4g	200	200	3	3	Meander	Varies	Constant with AV's	1 pipe to #1, 1 pipe to #2, 1 pipe to #3	1.66	1.23
3h	200	200	2	2	Meander	Varies	Constant with AV's	2 pipes to #1	1.67	1.24
5g	200	200	4	4	Meander	Varies	Constant with AV's	2 pipe to #1, 1 pipe to #2, 1 pipe to #3	1.82	1.36
3f	200	200	2	2	Meander	Constant Grade	Varies	2 pipes to #1	1.94	1.44
1c	100	100	2	2	Straight	Varies	Constant with AV's	1 pipe to #1, 1 pipe to #2	1.00	1.49
3b	200	200	2	2	Straight	Constant Grade	Varies	2 pipes to #1	2.02	1.50
1g	100	100	2	2	Meander	Varies	Constant with AV's	1 pipe to #1, 1 pipe to #2	1.02	1.52
4d	200	200	3	3	Straight	Varies	Constant with AV's	2 pipes to #1, 1 pipe to #2	2.07	1.54
5d	200	200	4	4	Straight	Varies	Constant with AV's	2 pipes to #1, 2 pipe to #2	2.07	1.54
3i	200	100	2	1	Straight	Varies	Constant with AV's	1 pipe to #1, 1 pipe to #3	1.06	1.58
5h	200	200	4	4	Meander	Varies	Constant with AV's	2 pipes to #1, 2 pipe to #2	2.13	1.58
4h	200	200	3	3	Meander	Varies	Constant with AV's	2 pipes to #1, 1 pipe to #2	2.13	1.59
5c	200	150	4	3	Straight	Varies	Constant with AV's	2 pipe to #1, 1 pipe to #2, 1 pipe to #3	1.73	1.71
4c	200	133	3	2	Straight	Varies	Constant with AV's	1 pipe to #1, 1 pipe to #2, 1 pipe to #3	1.54	1.72
2c	100	100	3	3	Straight	Varies	Constant with AV's	2 pipe to #1, 1 pipe to #2	1.17	1.74
2g	100	100	3	3	Meander	Varies	Constant with AV's	2 pipe to #1, 1 pipe to #2	1.19	1.77
1d	100	100	2	2	Straight	Varies	Constant with AV's	2 pipes to #1	1.20	1.78
1e	100	100	2	2	Meander	Constant Grade	Varies	1 pipe to #1, 1 pipe to #2	1.20	1.79
1h	100	100	2	2	Meander	Varies	Constant with AV's	2 pipes to #1	1.24	1.84
4f	200	200	3	3	Meander	Constant Grade	Varies	2 pipes to #1, 1 pipe to #2	2.51	1.87
5f	200	200	4	4	Meander	Constant Grade	Varies	2 pipes to #1, 2 pipe to #2	2.55	1.90
1a	100	100	2	2	Straight	Constant Grade	Varies	1 pipe to #1, 1 pipe to #2	1.28	1.90
4b	200	200	3	3	Straight	Constant Grade	Varies	2 pipes to #1, 1 pipe to #2	2.64	1.96
5e	200	150	4	3	Meander	Constant Grade	Varies	2 pipe to #1, 1 pipe to #2, 1 pipe to #3	2.02	2.01
5b	200	200	4	4	Straight	Constant Grade	Varies	2 pipes to #1, 2 pipe to #2	2.70	2.01
2d	100	100	3	3	Straight	Varies	Constant with AV's	3 pipes to #1	1.37	2.03
4e	200	133	3	2	Meander	Constant Grade	Varies	1 pipe to #1, 1 pipe to #2, 1 pipe to #3	1.83	2.04
2e	100	100	3	3	Meander	Constant Grade	Varies	2 pipe to #1, 1 pipe to #2	1.37	2.04
2h	100	100	3	3	Meander	Varies	Constant with AV's	3 pipes to #1	1.41	2.10
5a	200	150	4	3	Straight	Constant Grade	Varies	2 pipe to #1, 1 pipe to #2, 1 pipe to #3	2.14	2.12
2a	100	100	3	3	Straight	Constant Grade	Varies	2 pipe to #1, 1 pipe to #2	1.45	2.16
4a	200	133	3	2	Straight	Constant Grade	Varies	1 pipe to #1, 1 pipe to #2, 1 pipe to #3	1.94	2.16
1f	100	100	2	2	Meander	Constant Grade	Varies	2 pipes to #1	1.49	2.21
1b	100	100	2	2	Straight	Constant Grade	Varies	2 pipes to #1	1.57	2.33
2f	100	100	3	3	Meander	Constant Grade	Varies	3 pipes to #1	1.68	2.50
2b	100	100	3	3	Straight	Constant Grade	Varies	3 pipes to #1	1.77	2.63

[1]Options

1 - 100 cfs split in 2 pipes
2 - 100 cfs split in 3 pipes
3 - 200 cfs split in 2 pipes
4 - 200 cfs split in 3 pipes
5 - 200 cfs split in 4 pipes

[1]Sub-options

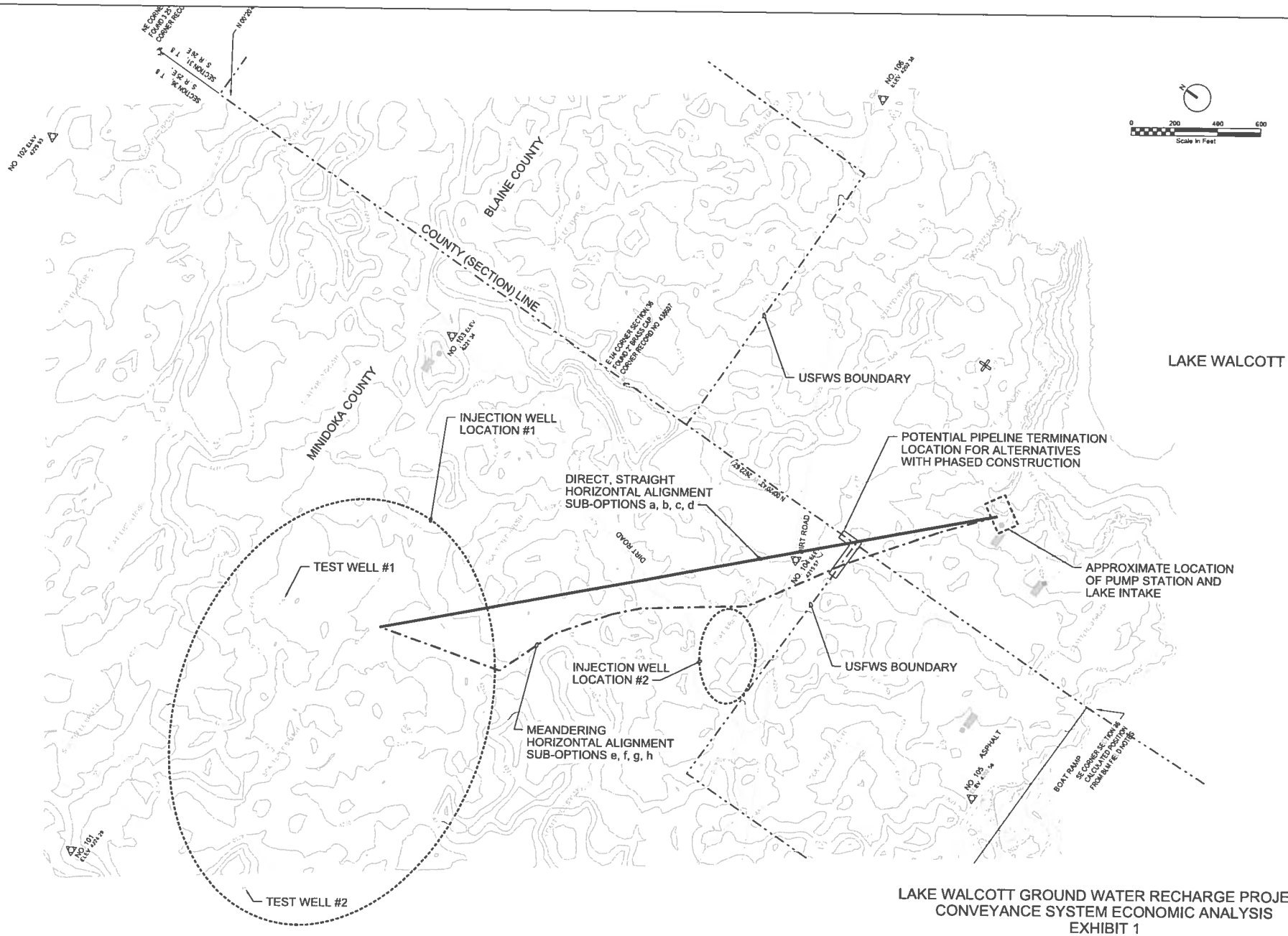
a - direct horizontal pipeline alignment, constant grade, variable cover depth, discharge to Location #1 and #2
b - direct horizontal pipeline alignment, constant grade, variable cover depth, discharge to Location #1
c - direct horizontal pipeline alignment, constant depth of cover with air relief valves at high points, discharge to Location #1 and #2
d - direct horizontal pipeline alignment, constant depth of cover with air relief valves at high points, discharge to Location #1
e - horizontal alignment meanders with topography to avoid high points, constant grade, discharge to Location #1 and #2
f - horizontal alignment meanders with topography to avoid high points, constant grade, discharge to Location #1
g - horizontal alignment meanders with topography to reduce high/low points, constant depth of cover, discharge to Location #1 and #2
h - horizontal alignment meanders with topography to reduce high/low points, constant depth of cover, discharge to Location #1
i - direct horizontal pipeline alignment, constant depth of cover with air relief valves at high points, discharge to Location #1 and #3

[2]Pipeline Termination Location

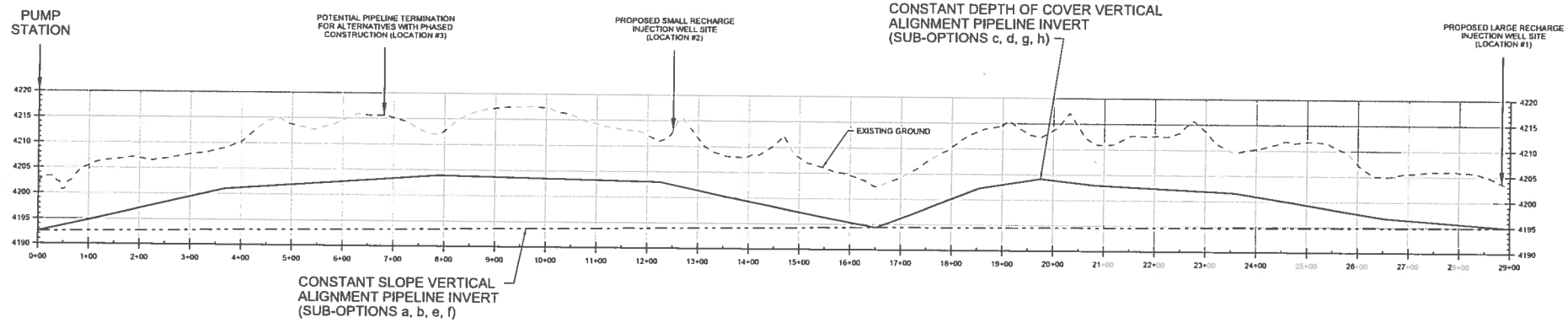
Location #1 - Proposed large recharge injection well site as defined in the Idaho Water Resource Board's's Proposed Lake Walcott Ground Water Recharge Project Executive Briefing.
Location #2 - Proposed small recharge injection well site which was subsequently identified by Client as a potential option (minor depression near the "fork" in the dirt road).
Location #3 - Cap pipeline just beyond the State/USFWS boundary for future use (minimize the need for future NEPA work associated with future expansion of the project at a later date as funds are available).

Exhibits

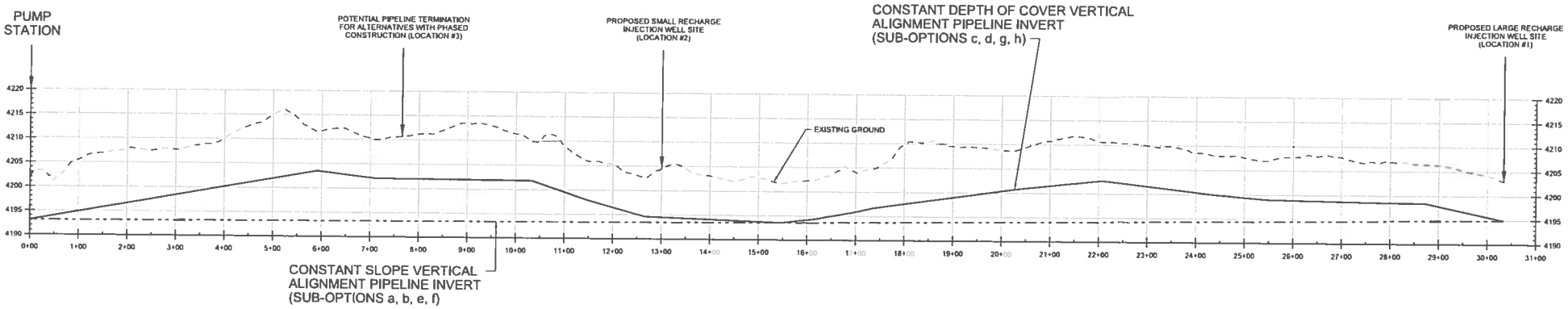
Pipeline Horizontal and Vertical Alignments



LAKE WALCOTT GROUND WATER RECHARGE PROJECT
CONVEYANCE SYSTEM ECONOMIC ANALYSIS
EXHIBIT 1



DIRECT HORIZONTAL PIPELINE ALIGNMENT - SUB-OPTIONS a, b, c, d



MEANDERING HORIZONTAL PIPELINE ALIGNMENT - SUB-OPTIONS e, f, g, h

LAKE WALCOTT GROUND WATER RECHARGE PROJECT
CONVEYANCE SYSTEM ECONOMIC ANALYSIS
EXHIBIT 2

Lake Walcott Ground Water Recharge Project: Intake and Pump Station Facility Conceptual Alternatives (Task 4)

PREPARED FOR:	Dan Temple/A&B Irrigation District (A&B) Dean Stevenson/Magic Valley Ground Water District (MVGWD) Mat Weaver/Idaho Department of Water Resources (IDWR) Brian Patton/IDWR
COPY TO:	Project File
PREPARED BY:	Perrin Robinson/CH2M HILL
DATE:	November 11, 2013
PROJECT NUMBER:	477631

Introduction

This technical memorandum documents CH2M HILL's proposed conceptual alternatives for the intake and pump station facility associated with the Lake Walcott Ground Water Recharge Project. The work was performed as part of CH2M HILL's task order with A&B Irrigation District (Client) to develop a preliminary design and Environmental Assessment for the project. The intent of this technical memorandum is to provide a basis for discussions with the client, regulatory agencies, and other stakeholders regarding the design approach and criteria in order to obtain endorsement on the alternative to advance to the preliminary design stage. CH2M HILL developed four facility alternatives specifically for the lake intake, pump station, and building. Included herein are descriptions of the design criteria, descriptions of the facility alternatives, and comparison of the facility alternatives.

Design Criteria

Flowrate, Pump Conditions, and Intake Suction Pipe

The pump flowrate to the injection well site(s) at ultimate build-out has been identified to be 200 cubic feet per second (cfs) with a first phase pump rate of 100 cfs. The decision to provide a degree of pump redundancy in the facility was made as an outcome of the previous effort associated with the Conveyance System Alternatives Economic Analysis (Task 3). Therefore, the proposed design approach is to provide a total of four pumps at ultimate build-out with a rate of 50 cfs each. For the first phase, two of the 50 cfs pumps would be installed to meet the 100 cfs rate requirement.

Four intake suction pipes, each 48-inches in diameter, are proposed to convey the water from the intake screen(s) to the pump station wetwell for Alternative Nos. 1, 2, and 3. One intake suction pipe will provide dedicated conveyance to each individual pump. At a flowrate of 50 cfs, the pipe velocity will be approximately 4 fps.

Alternative 4 relies on a channel, rather than a pipeline, to carry water to the fish screens.

Water Surface Elevations and Submergence Depth

The water surface elevation of the lake during typical high water (full) conditions is 4197.75 (NAVD 88 datum) based on survey data collected by WH Pacific on June 13, 2013. A Bureau of Reclamation staff knowledgeable of the Minidoka Dam operations stated that the low level water drawdown reduces the water surface elevation by 7-feet thereby establishing a water surface elevation of 4190.75 (NAVD 88 datum).

The intake concepts have been developed to provide a minimum submergence depth appropriate for each of the various approaches to reduce the distance that the intakes need to extend into the lake from shore. Furthermore, the proposed alternative intake depths are based on the low level water surface elevation and allow for up to 1-ft ice thickness during winter pumping conditions.

Intake Approach Velocity

A proposed intake approach velocity of 0.5 feet per second (fps) has been used as the basis for sizing the intake screens for the various alternatives developed. This design approach velocity was selected based on the understanding that protected anadromous fish species are not present in Lake Walcott and that the species of primary concern are warm water fish such as bass. An intake approach velocity of 0.5 fps is generally considered adequate to prevent trapping of fingerling and juvenile fish, but this assumption will need to be verified with the appropriate state/federal agencies.

The slot size for the screens in each of the alternatives is proposed to be 0.25-inch which will provide a through-slot velocity on the order of 0.5 fps as well.

Description of Alternatives

Alternative No. 1 – Slant Screen Intake with Air Burst Cleaning System

A concrete intake structure is proposed to be placed on the bottom of the lake. The structure will be constructed to provide an angled face with a 1.5 horizontal to 1 vertical slope at the water intake location. The structure will consist of four bays, each with protective screening. The proposed slant screen is based on an effective water depth of 6-feet.

Blast excavation of the lake bed will be necessary along the suction pipe alignment to allow for the placement of the pipe and the screen structure.

An air burst cleaning system will be incorporated into the intake structure with the compressor and reserve tank located in the pump station building. The air burst system is provided to periodically discharge a volume of air to each of the screen areas to remove trapped debris. The air burst will result in agitation to the water surface and pose a potential flip risk to small water craft. Therefore, the intake structure would need to be cordoned off to prevent boaters from getting close.

Routine maintenance for the intake structure will be achieved by sending a boat and diver to the intake location. For more intensive maintenance or equipment replacement, dewatering provisions would need to be employed at low water level.

Alternative No. 2 – Tee Screen Intake with Air Burst Cleaning System

Alternative No. 2 consists of installing four tee screens on the lake floor, each capable of passing 50 cfs of water while meeting the approach and through-slot velocity objectives. The tee screens will be installed in a staggered fashion to reduce the footprint width.

Blast excavation of the lake bed will be necessary along the suction pipe alignment to allow for the placement of the pipe.

An air burst cleaning system will be incorporated into the intake structure with the compressor and reserve tank located in the pump station building. The air burst system is provided to periodically discharge a volume of air to each of the screen areas to remove trapped debris. A brush cleaning system can be incorporated instead of air burst and would be similar technology as that presented for Alternative No. 3.

Similar to Alternative No. 1, the area around the intake structure and exposed suction piping will need to be cordoned off to prevent boaters from getting close.

Routine maintenance for the intake structure will be achieved by sending a boat, barge, and/or diver to the intake location. Individual tee screens can be removed and elevated onto a barge for replacement if needed.

Alternative No. 3 – Brush Cone Screen Intake

Four cone screens with brush cleaning systems are proposed with each sized appropriately to draw 50 cfs per screen. Cone screens require minimal submergence and are proposed to have a top elevation equivalent to the low lake level with ice allowance.

Blast excavation of the lake bed will be necessary along the suction pipe alignment to allow for the placement of the pipe.

The brush cleaning system consists of a hydraulically driven motor that periodically rotates three brush arms across the surface of the screen to remove debris. There cleaning action will not cause a noticeable disturbance to the water surface.

The cone screens will be oriented in a staggered fashion. The cones will be mounted to platforms that are secured to the lake bottom through tubular pile anchoring system. The suction pipe will extend vertically from the bottom of the screen platform and then turn 90-degrees to run horizontally to the pump building.

The area around the intake structure will need to be cordoned off to keep boaters a safe distance away, primarily to avoid damage to the screens from boat anchors or potential injury to swimmers or divers.

When maintenance is required, access will be achieved through the use of a boat and diver or barge. The brush motor can be removed or the entire cone screen can be unbolted from the platform and lifted to the deck of a barge.

Alternative No. 4 – Excavated Intake Channel with Traveling Screen

In this proposed alternative, the pump building site location was changed to place the building in a location along the shore that provides a shorter distance to achieve the proper intake depth within the lake. The intake consists of blast excavating and intake channel in the lake bed to bring water to the pump building. Four traveling screens are located within the pump building in front of each of the four pump approach chambers. The width required for the traveling screen to meet the approach and through-slot velocity criteria is larger than the width required for the pump approach chambers. Therefore, a transition zone of concrete wall filler to achieve proper pump intake hydraulic conditions will be required thus increasing the building footprint for this alternative as compared to the previous three alternatives. Large-debris trash racks are located at the face of the building where the building intake openings are present.

The traveling screens allow water to pass through while lifting debris to the ground-level floor of the pump building and depositing the debris onto a conveyor system. The debris is conveyed to a bin that will require periodic disposal. A fish selector system and return pipe may be required to reintroduce fish that enter the pump building and are lifted on the traveling screen.

The exterior building wall on the side of the water intake will extend 2-feet below the low lake level water surface elevation to provide a “water seal” and prevent ice and some floating debris from entering the pump building (as well as providing a seal against cold air in the winter). Due to open water being present within the interior of the building, coating provisions will be required on exposed metal surfaces in the interior of the building to prevent corrosion.

Building Architectural

The pump building illustrated in the conceptual architectural exhibits is a cast-in-place concrete structure with steel roof trusses, metal roof deck and metal standing seam roofing. The building incorporates two separate monorail systems mounted on 24” deep steel beams for the purpose of providing an internal means of pump and valve removal for periodic maintenance. The overall building dimensions are 89’-0” long x 69’-0” deep. There are three overhead doors for truck access into the building, and two personnel doors that meet life safety code requirements (exits must be at least one half the total diagonal distance across the building). To accommodate the monorail system and minimize the height of the building, the roof slope is the minimum 1:12 pitch. Snow load considerations will be taken by the structural designer.

The intent of the exterior elevation treatments is to lower the scale of the building using concrete formwork, textures and staining. This is achieved by providing a heavy base textured and colored to match the native lava rock (see example image). Lighter colored horizontal banding and translucent wall panels bring the eye down to human scale. Translucent wall panels (4’x3’) are located 11’-0” above finish floor to provide daylight at the work level. Translucent wall panels are cost-effective, thermally efficient, and provide evenly distributed daylight with

little heat gain. A dark accent band with vertical texture grounds the building, echoing the surrounding landscape. It also creates a false roof while the remaining wall and light colored roof above seem to float or disappear.

Alternative Comparison

A summary comparison of the intake facility alternatives is provided in Table 1.

TABLE 1
Intake Facility Alternative Comparison Summary

Alternative No.	Intake Option	General Description	Screen Cleaning Type	Fate of Debris from Screen Cleaning	Building Characteristics	Noise Considerations	Boating Considerations	Maintenance Requirements	Visual Considerations
1	Slant Screen	Inclined flat plate screen in concrete structure at prescribed depth in lake, connected to four pipelines back to pump wet well installed via blasting or rock cutting	Air burst	Stays in lake, may or may not escape screen suction once blown off	Somewhat larger footprint to house air receiver & compressor	Occasional blast of air out in lake to clean off screen (perhaps several times a day)	Need to close off area to protect boaters from air burst or anchor damage to screens	Minimal, outside occasional inspection of screens by divers	Somewhat larger building, but nothing on the exterior of building (presuming no access bridge needed to screen)
2	Tee Screen	Four stainless steel tee screens placed at prescribed depth in lake, connected to four pipelines back to pump wet well installed via blasting or rock cutting	Air burst	Stays in lake, may or may not escape screen suction once blown off	Somewhat larger footprint to house air receiver & compressor	Occasional blast of air out in lake to clean off screen (perhaps several times a day)	Need to close off area to protect boaters from air burst or anchor damage to screens	Minimal, outside occasional inspection of screens by divers	Somewhat larger building, but nothing on the exterior of building
3	Cone Screen	Four stainless steel conical screens placed at prescribed depth in lake, connected to four pipelines back to pump wet well installed via blasting or rock cutting	Rotating brush arms across screen	Stays in lake, may or may not escape screen suction once wiped off	Somewhat smaller (little or no screen system components indoors)	Minimal	Need to close off area to protect anchor damage to screens	Minimal, outside occasional inspection of screens by divers	Somewhat smaller building, nothing visible on exterior of building
4	Traveling Screen	HDPE traveling screens housed inside pump building, with channel carved out of lake bottom (via blasting or rock cutting) to prescribed depth	Wiper/spray bar	Collected in building, occasional haul-off by Owner	Larger footprint to house traveling screen, debris trough, and vehicle access	Minimal	None	Occasional need to collect debris inside building and rake off debris caught on trashrack outside building	Larger building, visible platform and trashrack on exterior, visible blasted channel in lower water

Conclusions

The slant screen and tee screen intakes share several common elements in terms of screen cleaning system, distance from shore and intake pipe centerline elevation relative to the intake (e.g. the pipe exits the intake structure horizontally). The air burst cleaning system causes a disruption (visual and noise) at the water surface that may be undesirable in this application setting.

The cone screen intake with brush cleaning system can be located in a shallower water condition thus allowing the intake to be located closer to shore. Also, the brush cleaning system does not impact the water surface from a visual or agitation perspective. A tee screen can be provided with a brush cleaning system and thus eliminating the impacts resultant from an air burst cleaning system. A brush cleaning system does not require ancillary equipment to be placed in the pump building thus reducing the footprint needed for the pump building. Given the proprietary nature of the brush cleaning system, the cost for the brush cleaning system will likely be more than the cost of an air burst cleaning system, excluding the potential building cost difference.

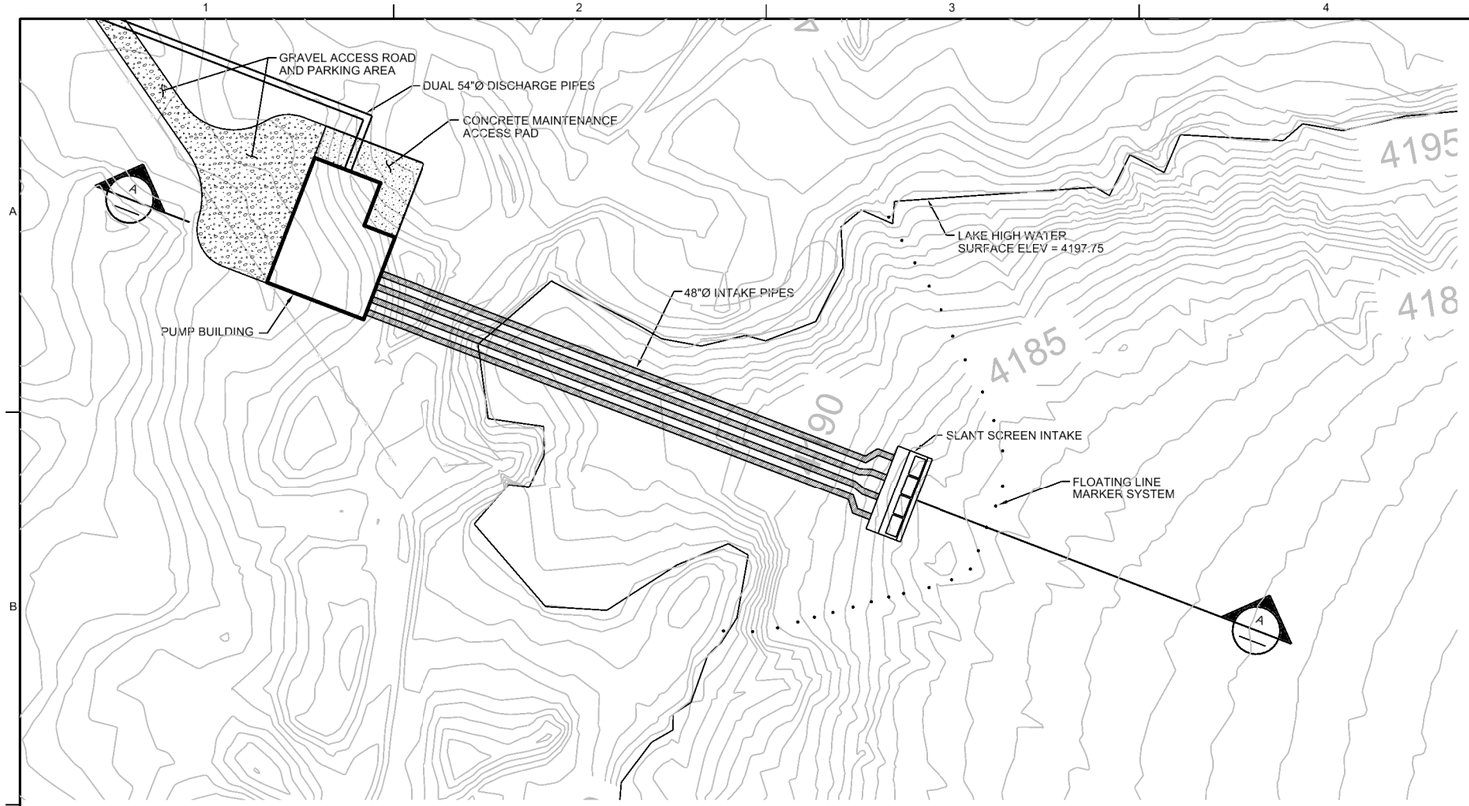
The excavated channel intake, with traveling screens located within the building, reduce the boater recreationist impacts by avoiding the need to cordon off a portion of the lake. However, at low water level, the face of the building along the shore will be more visible in terms of overall building height and the excavated channel will be evident.

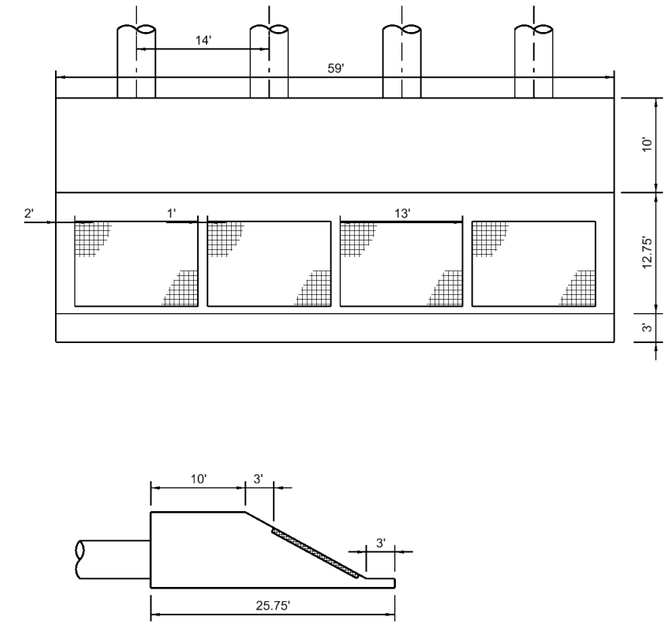
Variations exist within the alternatives presented. For example, the concrete slant, tee, or cone screens could be placed in an excavated channel that would locate the intake structure closer to the building and reduce the intake suction pipeline construction cost.

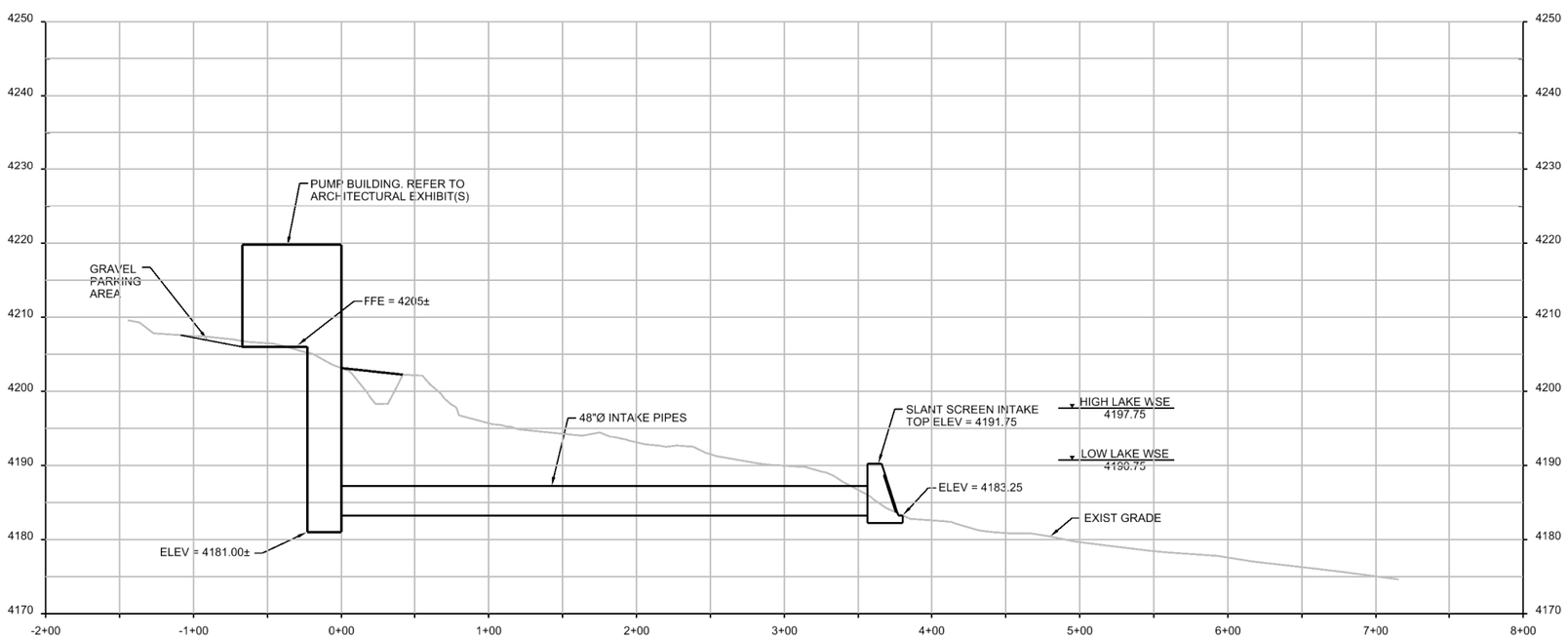
The alternatives presented in the technical memorandum along with the variations will be discussed with the agencies for input with the goal of identifying a preferred alternative to advance to preliminary design.

Attachment A

Intake Facility Alternative Exhibits







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VERT: 1"=10'

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NO.	DATE	REVISION	BY	APVD
DSGN	DR	CHK	APVD	
	11/1/2013			

Lake Walcott Groundwater Recharge Project
Conceptual Intake Facility Alternatives
A&B Irrigation District
Lake Walcott, Idaho

CH2MHILL®

CONCEPT
ALTERNATIVE NO. 1
SLANT SCREEN INTAKE

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

DATE	
PROJ	477631
DWG	
SHEET	of

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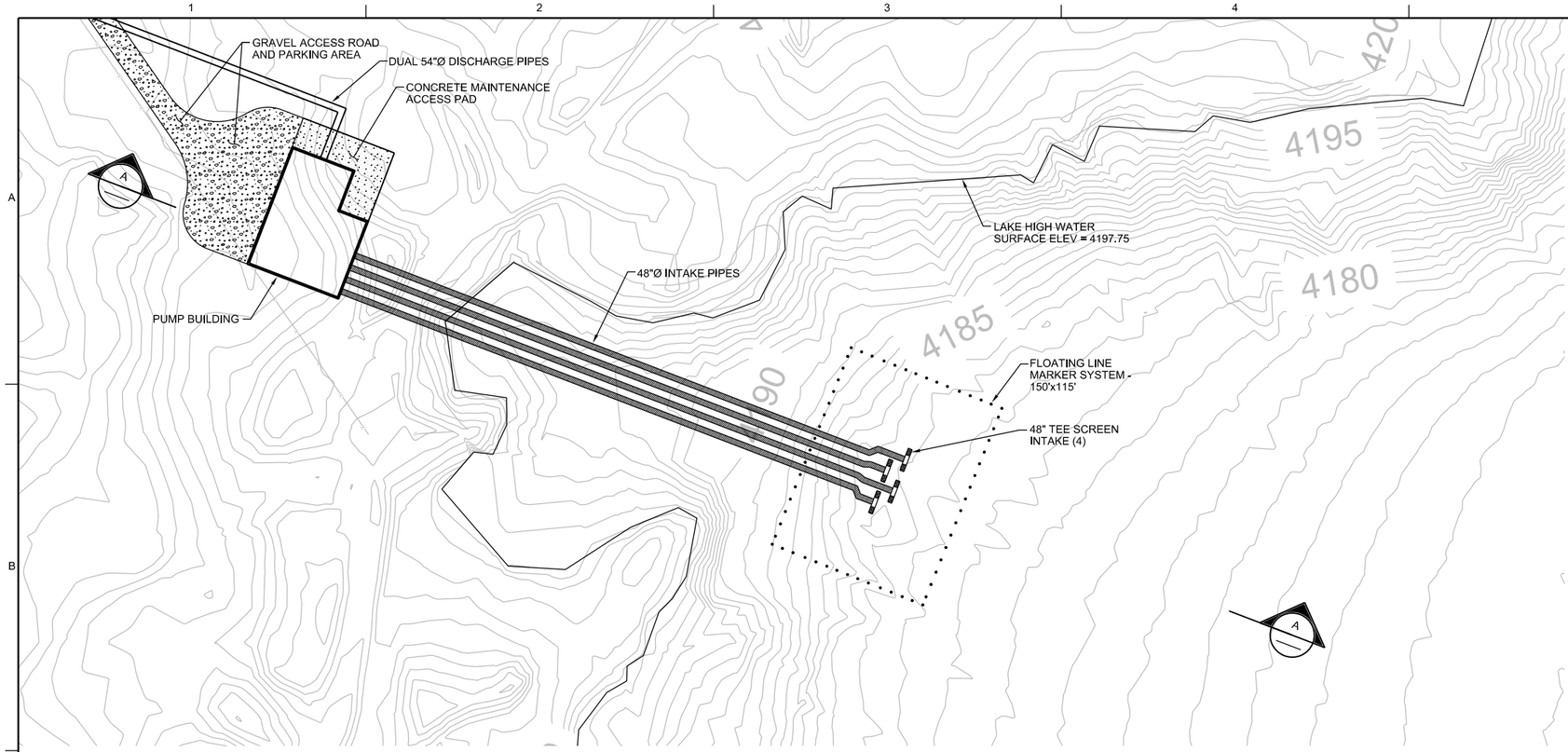

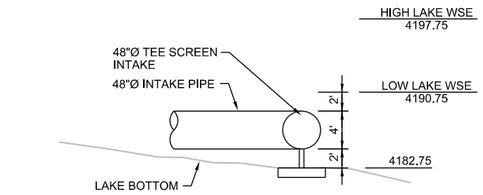

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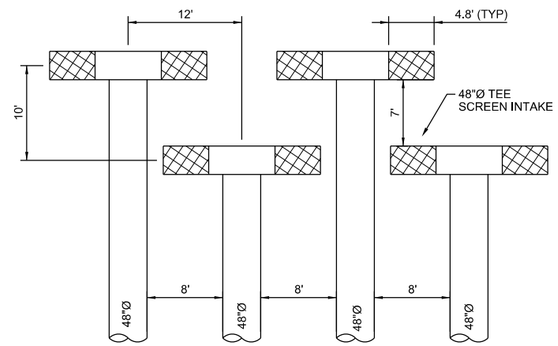

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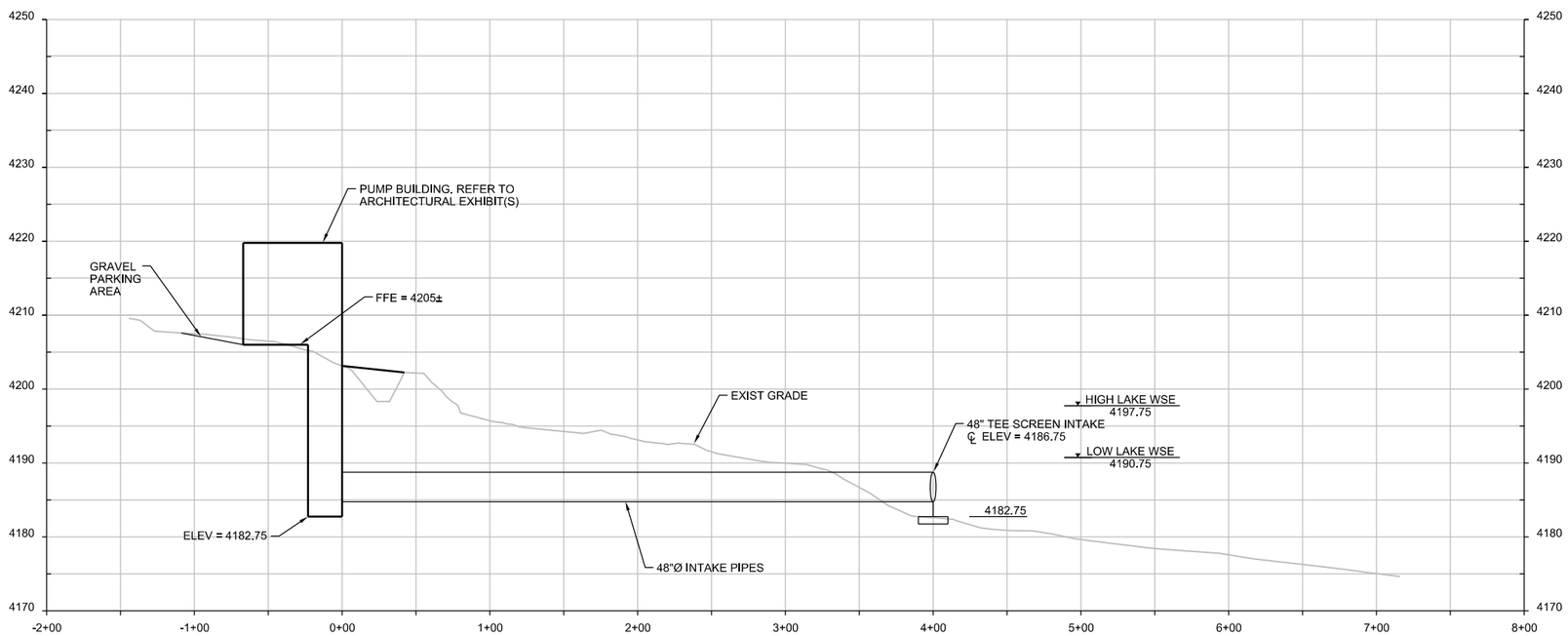

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NO.	DATE	DR	CHK	APVD	BY	APVD
DSGN		REVISION				

Lake Walcott Groundwater Recharge Project
Conceptual Intake Facility Alternatives
A&B Irrigation District
Lake Walcott, Idaho

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CONCEPT
ALTERNATIVE NO. 2
TEE SCREEN INTAKE

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

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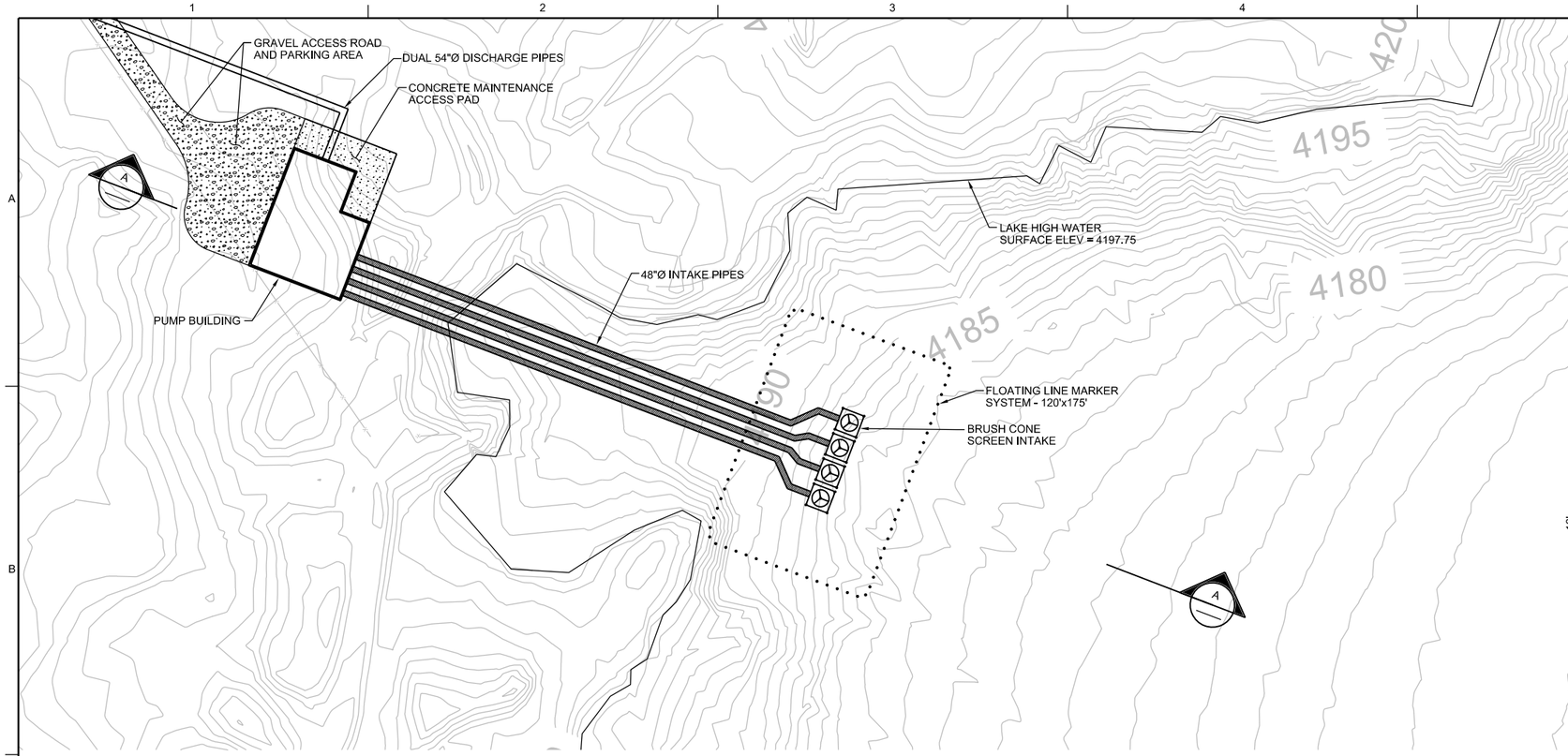

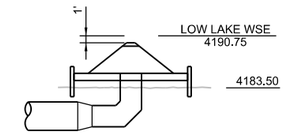

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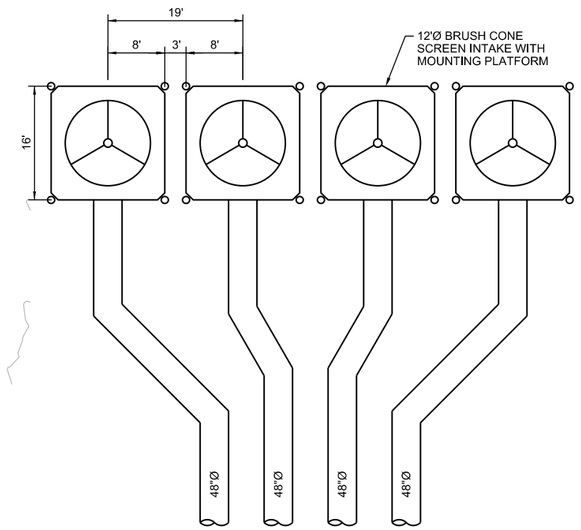

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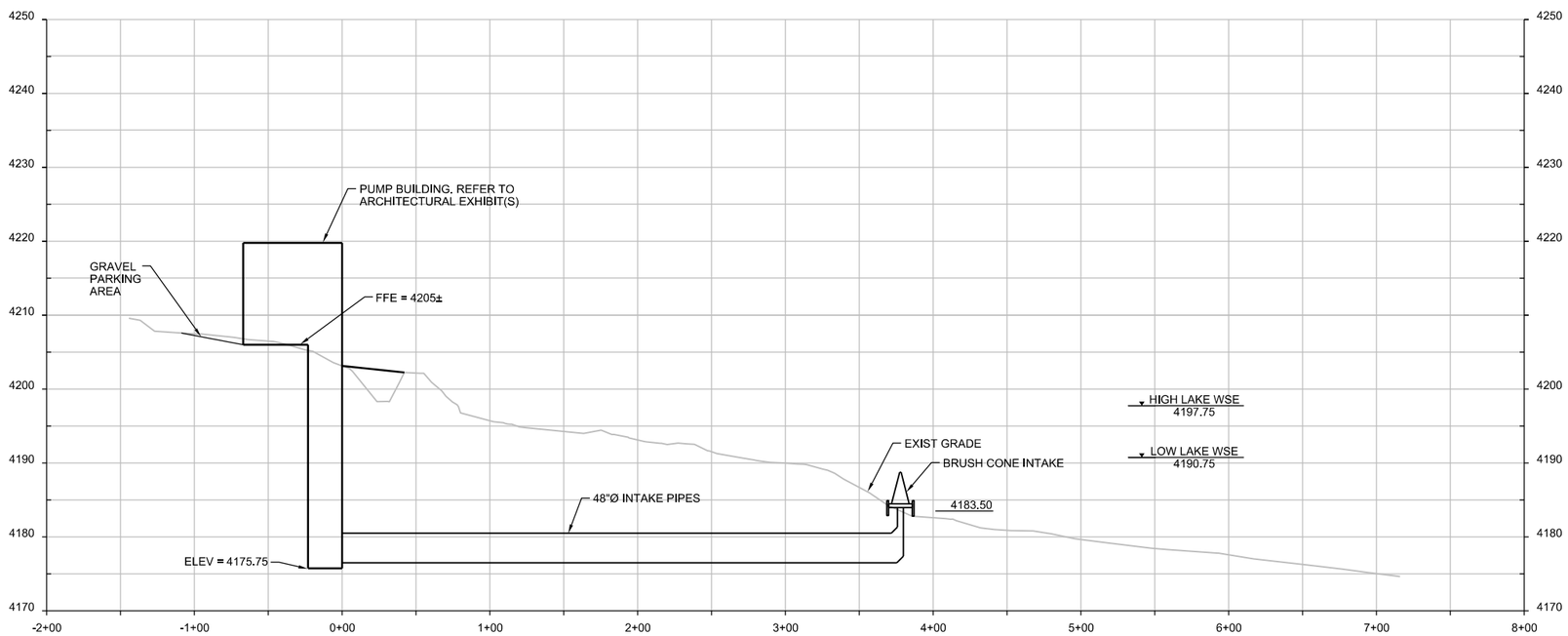

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1"=50'

NO.	DATE	REVISION	CHK	APVD	BY	APVD
DSGN		DR				

Lake Walcott Groundwater Recharge Project
Conceptual Intake Facility Alternatives
A&B Irrigation District
Lake Walcott, Idaho

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CONCEPT
ALTERNATIVE NO. 3
BRUSH CONE SCREEN INTAKE

VERIFY SCALE
BAR IS ONE INCH ON ORIGINAL DRAWING.
0 1"

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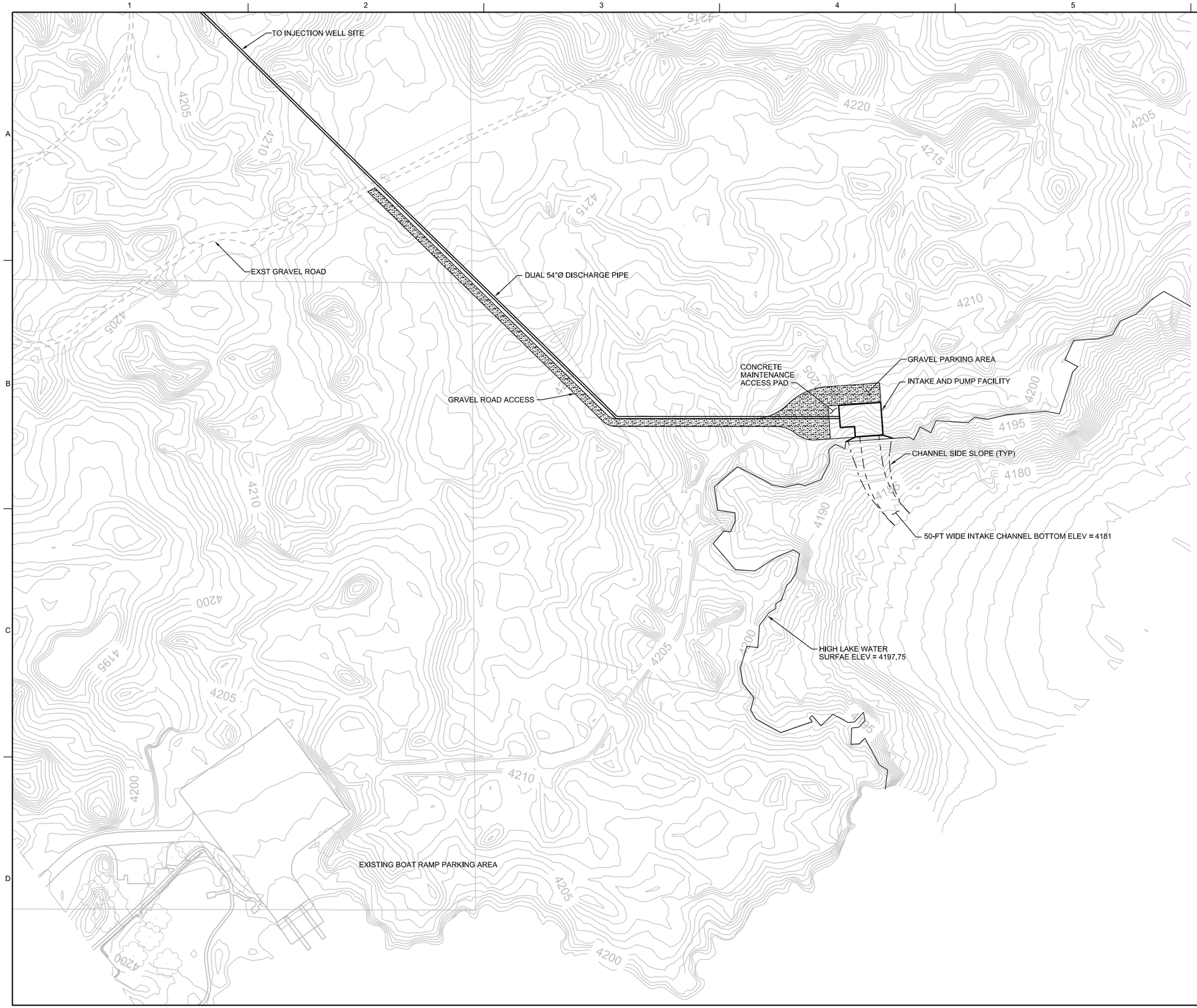

NO.	DATE	REVISION	BY	APVD
DSGN	DR	CHK	APVD	

Lake Walcott Groundwater Recharge Project
Conceptual Intake Facility Alternatives
A&B Irrigation District
Lake Walcott, Idaho

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CONCEPT
ALTERNATIVE NO. 4
EXCAVATED INTAKE CHANNEL

VERIFY SCALE
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0 1"

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Attachment B

Pump Building Exhibits

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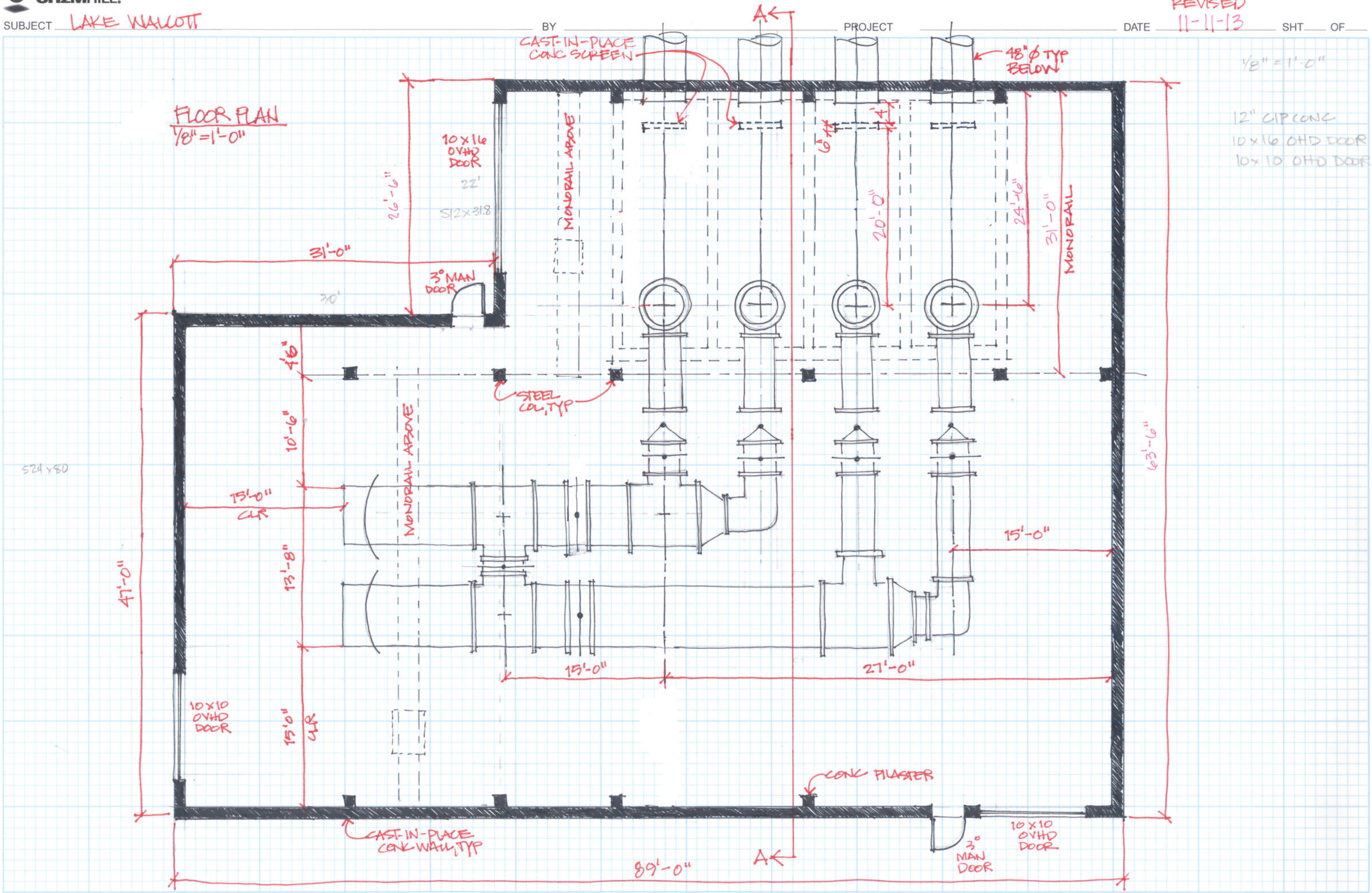
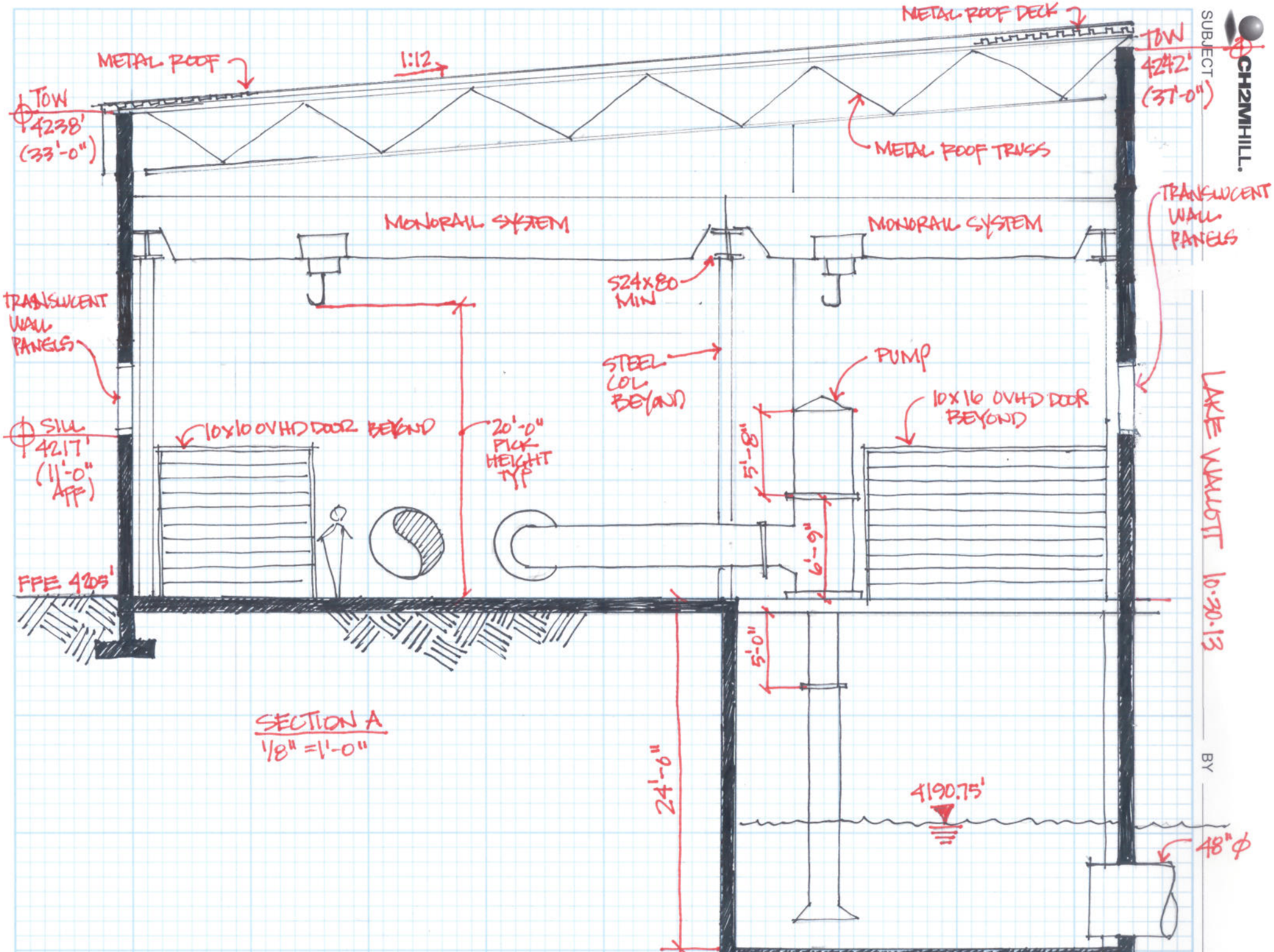
SUBJECT LAKE WALCOTT BY PROJECT DATE REVISED 11-11-13 SHT OF

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METAL ROOF
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MONORAIL SYSTEM
TRANSLUCENT WALL PANELS
TRANSLUCENT WALL PANELS
S24x80 MIN
STEEL COL BEYOND
PUMP
10x16 OVHD DOOR BEYOND
10x10 OVHD DOOR BEYOND
20'-0" PICK HEIGHT TYP
SILL 4217' (11'-0" AFF)
FFE 4205'
5'-8"
6'-9"
5'-0"
24'-6"
4190.75'
48"Φ
SECTION A
1/8" = 1'-0"
SUBJECT
BY
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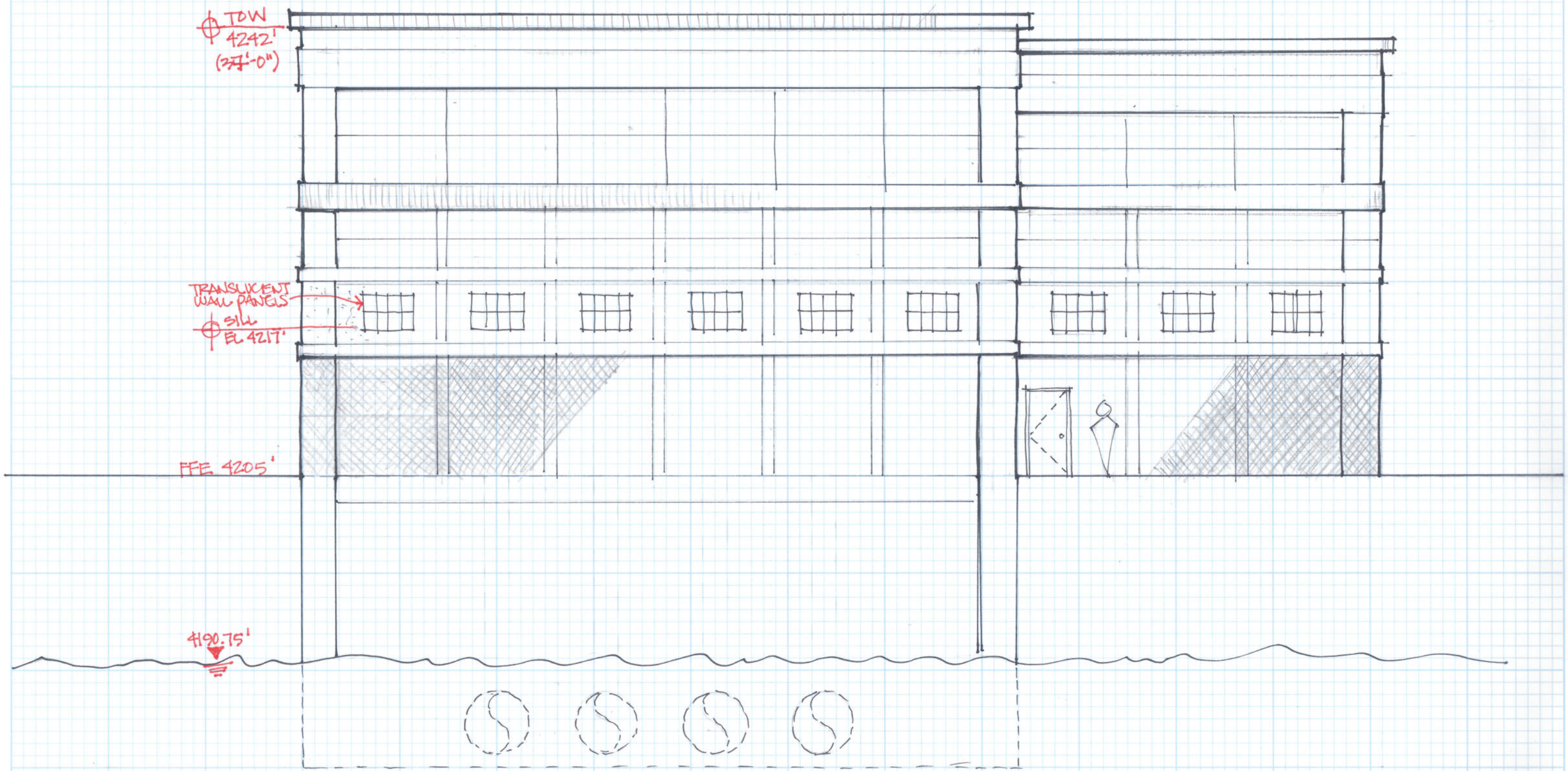
LAKE WALLOTT 10.30.13

CH2MHILL.

SUBJECT LAKE WALCOTT BY PROJECT DATE 10·30·13 SHT OF

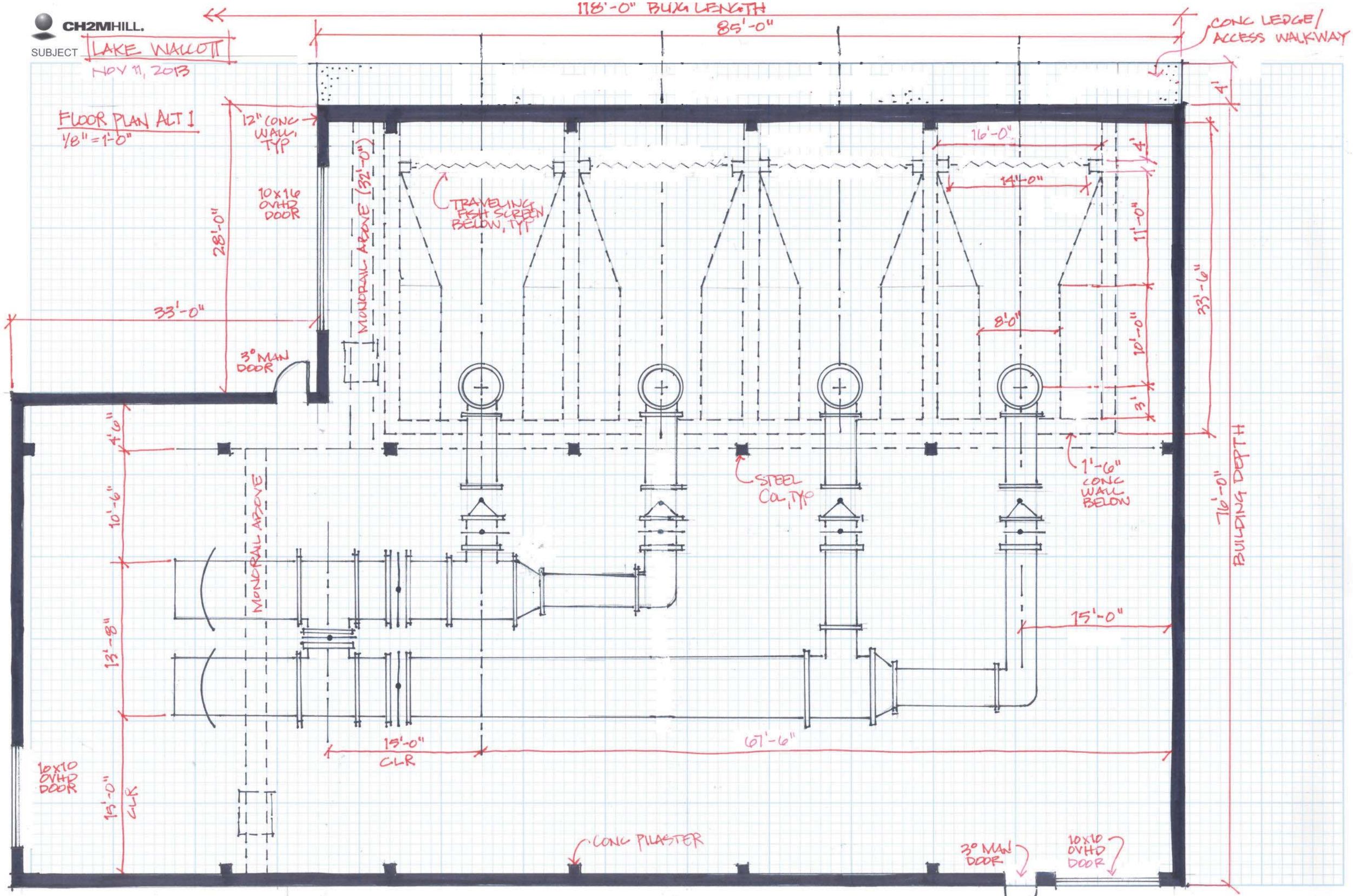


EAST ELEVATION
1/8" = 1'-0"

CH2MHILL.

SUBJECT LAKE WALLOTT

NOV 11, 2013



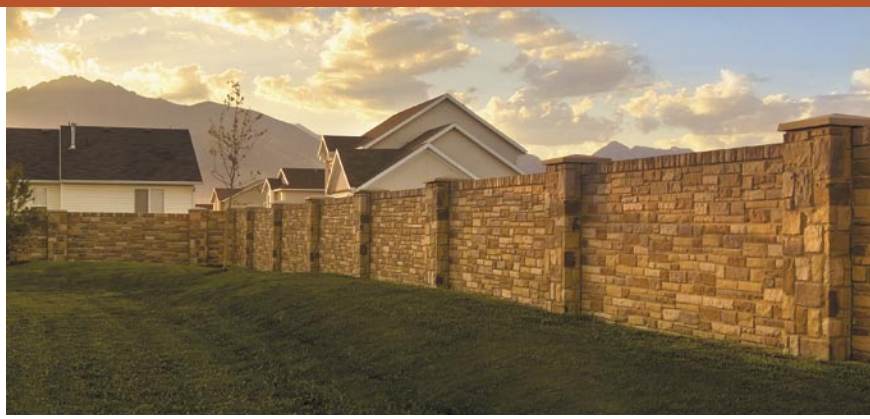
Attachment C

Pump Building Color Samples

Color Chart

Colors

White	Limestone	Sunset	Harvest Gold	Nutmeg
Khaki Bronze	Beige	Washed Suede	Smokey Beige	Terra Cotta
Sepia	Chestnut	Western Cedar	Cocoa Brown	Dark Walnut
Plum	Taupe	Brick Red	Island Spruce	Blue Slate
Heather Grey	Stonewall	Deep Grey	Charcoal	Wrought Iron



Verti-Crete Colors

VC*-Stain is a water-based acrylic coating designed for superior penetration into concrete. It ensures moisture proofing, color stability, and ultraviolet resistance. When properly applied it will not discolor, peel, crack, or blister. Multiple coatings are compatible for color combinations on concrete and masonry and correction of natural color imperfections. VC-stains will impart a uniform color on all forms of concrete: precast, poured, glass-fiber-reinforces, brick, stucco, and stone surfaces. Its water-based composition makes it a user-friendly product, which is solvent-free, odor-free, and safe on interior surfaces. VC-stains comply with all VOC regulations.

APPLICATION: *As a pre-requisite for all coatings, a clean surface is a must.*

1- Surfaces must be free of dust, oil, and external soils, which can affect adhesion and color. DO NOT use with form oils containing SILICON. For best results, any previous coating must be removed. Sealers/curing compounds containing silicons or resins must be removed or they will affect the quality of finish. Extremely smooth surfaces should be sandblasted. Some previous coatings can be compatible, however, a test-spot is definitely recommended.

2- VC-stains are water-dilutable, in all proportions. For best dilution (Base Coat vs. Highlighter) see your rep. All methods of application can be used: spray, roll, brush or rag touch up. Size, quantity and quality of your parts will determine your choice of equipment. For your custom plan talk to your rep. All paint equipment can be cleaned with warm-soapy water.

COVERAGE: The following variables will affect your square foot per gallon coverage: Your choice of application equipment, your design plan, number of base-coats, high-lighters, etc. Consult your rep.

VARIATIONS IN COLOR tone/shade/hue are to be expected between "actual concrete colors" and the color chart. These differences are mostly due to:

A. Chemical reaction between various concrete mixes and stains.

B. Reaction to sun's ultraviolet energy, and local environmental conditions such as: humidity, salt, temperature, air quality, etc.

C. Printing inks on paper versus the actual product on your concrete surface.

WARRANTY & CAUTION: With environmental considerations, the sealing/moisture protection and quality of this product is guaranteed for 10 years. However, the same enviro-conditions (see paragraph "B" above) will affect the longevity of color within 2-4 years.

Mail
P.O. Box 2347 / Sandy, Utah 84091

Plant
16500 South Pony Express Road / Bluffdale, Utah 84065

Phone 801 571-2028
Fax 801 571-3486
E-mail sales@verti-crete.com
Web www.verti-crete.com

VERTI-CRETE®
MOLDS FORMS

* VC=Verti-Crete

Since 1955

Kalwall® CRF™

HIGH-PERFORMANCE ARCHITECTURAL COATINGS

Now With Fluoropolymer Resins!

THE BEST OF BOTH WORLDS!

Kalwall Corrosion Resistant Finish (CRF) is THE high-performance finish for large and unusual, pre-engineered/prefabricated fenestration shapes. The spray-applied, air-dried, two-part system, including the latest chemically curable fluoropolymer resins, permits large welded and mechanically assembled Kalwall components to be finished as a unit. Touch-ups with the same coating are easily performed!

- **Premium Performance**
  Meets or Exceeds AAMA Voluntary Specifications for High-Performance Organic Coatings on Architectural Extrusions and Panels
- **Proven in Use**
  On thousands of buildings in every climate for years
- **Factory- and Field-Repairable**
  Fluoropolymer-fortified Thermoset Acrylic/Urethane Systems are extremely “user friendly”
- **10-Year Limited Warranty**
  Available with Clear Top Coat

Sample colors appear on the reverse side…

Since 1955

Kalwall® CRF™

HIGH-PERFORMANCE ARCHITECTURAL COATINGS

Now With Fluoropolymer!

Standard Colors

Aluminum #79

White #00

Bone White #21B

Black #95

Gray #80

Bronze #85

Minuette #03

Blue #15

Coro Blue #48

Hartford Green #75

Brick #88

Banner Red #90

Mountain Green #70

Kalwall standard CRF colors are represented here and custom colors can be supplied. A Clear Top Coat is optional for additional protection against severe weathering and chemical exposure.

These color samples should be considered approximations of actual colors because of the limitations of color reproduction. Actual samples on aluminum substrate are available for final color consideration. Best viewed under natural daylight.

Kalwall CORPORATION
PO Box 237, Manchester, NH 03105 Phone 800-258-9777 or 603-627-3861 Fax 603-627-7905 www.kalwall.com
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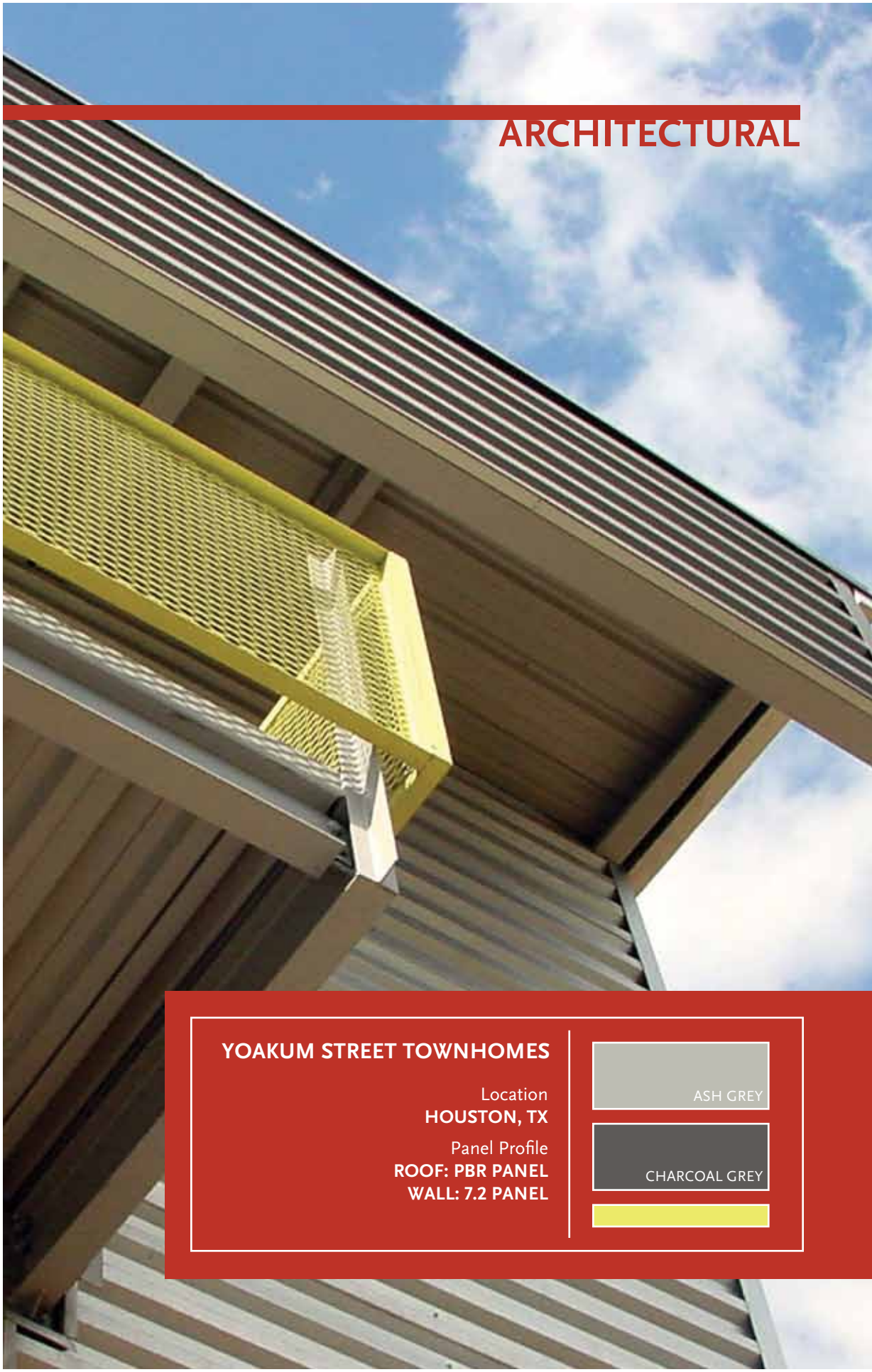
Lava Rock Exterior Wall Finish Sample

ARCHITECTURAL

COLOR CHART



YOAKUM STREET TOWNHOMES

Location
HOUSTON, TX

Panel Profile
ROOF: PBR PANEL
WALL: 7.2 PANEL

ASH GREY

CHARCOAL GREY

MBCI®
Metal Roof and Wall Systems

COLOR CHART

ARCHITECTURAL

- ***Final color selection should be made from actual color chips.***
- For the most current information available, visit our website at **www.mbci.com**.
- See product selection chart for gauge and color availability.
- All products available in smooth or embossed finish.
- Trim available in all colors.
- A 40-year limited paint warranty is available upon written request for all colors except for Brite Red, Copper Metallic, Silver Metallic and Polar White. Please review our sample warranty for complete performance attributes and terms and conditions.

SIGNATURE® 300
STANDARD COLORS

KYNAR 500®, HYLAR 5000®, Low Gloss

HARBOR BLUE ★ SR .28 SRI 30	COLONIAL RED ★ SR .34 SRI 37	MEDIUM BRONZE ★ SR .33 SRI 36	PACIFIC BLUE ★ SR .29 SRI 31	NATURAL PATINA ★ SR .41 SRI 47
SNOW WHITE ★ SR .65 SRI 79	SLATE GRAY ★ SR .37 SRI 41	ALMOND ★ SR .63 SRI 76	MIDNIGHT BRONZE ★ SR .29 SRI 31	CLASSIC GREEN ★ SR .28 SRI 30
EVERGLADE ★ SR .33 SRI 36	BROWNSTONE ★ SR .47 SRI 54	TUNDRA ★ SR .46 SRI 53	SPRUCE ★ SR .36 SRI 40	HUNTER GREEN ★ SR .35 SRI 39
BRITE RED SR .49 SRI 55	BONE WHITE** ★ SR .70 SRI 85			

SIGNATURE® 200
STANDARD COLORS

Siliconized Polyester
Polar White is a Straight Polyester.

BURNISHED SLATE ★ SR .28 SRI 29	POLAR WHITE ★ SR .58 SRI 69	CHARCOAL GRAY ★ SR .28 SRI 30	LIGHT STONE ★ SR .50 SRI 58	RUSTIC RED ★ SR .36 SRI 40
KOKO BROWN ★ SR .28 SRI 30	FERN GREEN ★ SR .28 SRI 29	COAL BLACK ★ SR .30 SRI 31	HAWAIIAN BLUE ★ SR .32 SRI 35	SOLAR WHITE** ★ SR .74 SRI 91

SIGNATURE® 300
METALLIC

KYNAR 500®, HYLAR 5000®, Low Gloss

COPPER METALLIC ★ SR .45 SRI 51	SILVER METALLIC ★ SR .52 SRI 60

Metallic coatings are directional. Panels and trim must be installed oriented in the same direction to prevent perceived shade variances.

** Minimum quantities and/or extended lead times may be required. Please inquire.

Signature® is a registered trademark of NCI Group, Inc. KYNAR 500® is a registered trademark of Arkema, Inc. HYLAR 5000® is a registered trademark of Solvay Solexis.

ENERGY STAR PARTNER

★ ENERGY STAR® Qualified

COLORATION IMAGINATION

HUNTER GREEN ★

SILVER CREST ELEMENTARY SCHOOL

Location
HERRIMAN, UT

Panel Profile
ROOF: CRAFTSMAN™ HB

COAL BLACK ★ ORANGE* ASH GRAY

HARLEY-DAVIDSON SHOP & STORE

Location
GILLETTE, WY

Panel Profile
ROOF: BATTENLOK® HS, PBR PANEL
WALL: PBR PANEL

* Custom Color

BRITE RED CHARCOAL GRAY ★

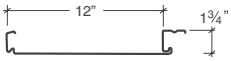
URBAN LOFTS

Location
HOUSTON, TX

Panel Profile
WALL: PBR PANEL, PBC PANEL

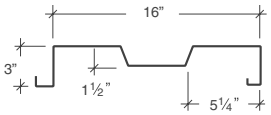
DESIGNER® SERIES

16.0 Fluted

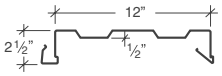


12.0 Flat

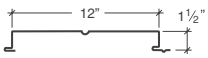
SHADOWRIB™



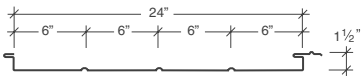
NUWALL®



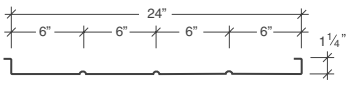
WALL / LINER PANELS



FW 120-1 (with Bead)

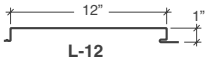


ILM-240-3 (with Beads)

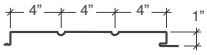


ILM-240-2 (with Beads)

ARTISAN® SERIES



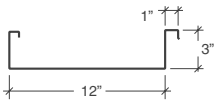
L-12



L-12 (with Beads)

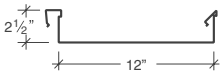
8" and 10" also available

CLASSIC® SERIES

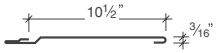


16" also available

QWIKLOK™

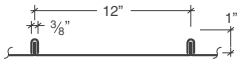


FLEXLOC®



8½" and 9½" also available

CRAFTSMAN™ SERIES



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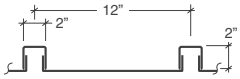
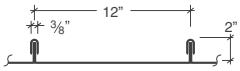


LB-12



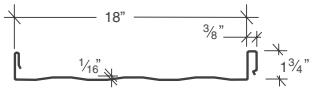
HB-12

16½"also available

STANDING SEAM

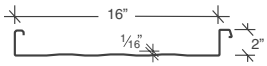
Vertical Leg

LOKSEAM®



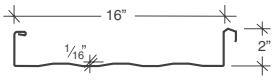
Snap-Together System
12" and 16" also available

BATTENLOK® HS



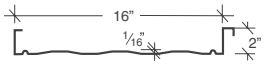
Field Seamed System
12" also available

SUPERLOK®



Field Seamed System
12" also available

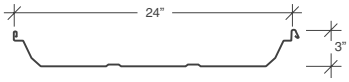
CURVED BATTENLOK®



Field Seamed System

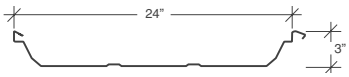
Trapezoidal Leg

ULTRA-DEK®



Snap-Together System
12" and 18" also available

DOUBLE-LOK®



Field Seamed System
12" and 18" also available

SR/SRI CHART

SIGNATURE® 300 - KYNAR 500®/HYLAR 5000®		
	SR #	SRI #
HARBOR BLUE	.28	30
COLONIAL RED	.34	37
MEDIUM BRONZE	.33	36
PACIFIC BLUE	.29	31
HUNTER GREEN	.35	39
SNOW WHITE	.65	79
SLATE GRAY	.37	41
ALMOND	.63	76
MIDNIGHT BRONZE	.29	31
CLASSIC GREEN	.28	30
EVERGLADE	.33	36
BROWNSTONE	.47	54
TUNDRA	.46	53
SPRUCE	.36	40
NATURAL PATINA	.41	47
BRITE RED	.49	55
BONE WHITE	.70	85

SIGNATURE® 300 METALLIC - KYNAR 500®/HYLAR 5000®		
	SR #	SRI #
COPPER METALLIC	.45	51
SILVER METALLIC	.52	60

SIGNATURE® 200 - SILICONIZED POLYESTER		
	SR #	SRI #
BURNISHED SLATE	.28	29
POLAR WHITE	.58	69
CHARCOAL GRAY	.28	30
LIGHT STONE	.50	58
HAWAIIAN BLUE	.32	35
RUSTIC RED	.36	40
KOKO BROWN	.28	30
FERN GREEN	.28	29
COAL BLACK	.30	31
SOLAR WHITE	.74	91

SOLAR REFLECTIVITY (SR)?

Solar reflectivity or reflectance (SR) is the ability of a material to reflect solar energy from its surface back into the atmosphere. The SR value is a number from 0 to 1.0. A value of 0 indicates that the material absorbs all solar energy and a value of 1.0 indicates it is all reflected. Energy Star requires SR testing of both new and aged roof products. New products must have an SR value of 0.25 or higher for steep slope (above 2:12) roofing and an SR value of 0.65 or higher for low slope (2:12 or less) roofing. Aged testing takes 3 years to complete, so not all products that meet the initial requirements are qualified. For more information, please go to **www.energystar.gov**.

SOLAR REFLECTANCE INDEX (SRI)?

The SRI is used to determine compliance with LEED requirements and is calculated according to ASTM E 1980 using values for reflectance and emissivity. Emissivity is a material's ability to release absorbed energy. To meet LEED requirements, a roofing material must have an SRI of 29 or higher for steep slope (above 2:12) roofing and an SRI value of 78 or higher for low slope (2:12 or less) roofing. For more information, please go to **www.usgbc.org**.

CUSTOM COLORS AND ACCESSORIES

If you're looking for a color that isn't on our chart, let us know and we'll work with you to find the exact color offering you need. MBCI also has a large selection of standard trim and flashing for each of its metal roof and wall panels. All trim and flashing are available in the same gauge and finish as our panel systems. Additionally, MBCI can make most any custom trim you require. Gutter systems are also available and can be ordered to match or in any other color you choose.

For complete performance specifications, product limitations and disclaimers, please consult MBCI's Paint and Galvalume Plus® warranties. Upon receipt of payment in full, these warranties are available upon request for all painted or Galvalume Plus®, prime products. Sample copies can be found at **www.mbci.com** or contact your local MBCI Sales Representative.

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Atlanta, GA | 877.512.6224
Atwater, CA | 800.829.9324
Dallas, TX | 800.653.6224
Indianapolis, IN | 800.735.6224
Jackson, MS | 800.622.4136
Lubbock, TX | 800.758.6224
Mattoon, IL | 888.885.0468
Memphis, TN | 800.206.6224
Oklahoma City, OK | 800.597.6224
Omaha, NE | 800.458.6224
Phoenix, AZ | 888.533.6224
Richmond, VA | 800.729.6224
Rome, NY | 800.559.6224
Salt Lake City, UT | 800.874.2404
San Antonio, TX | 800.598.6224

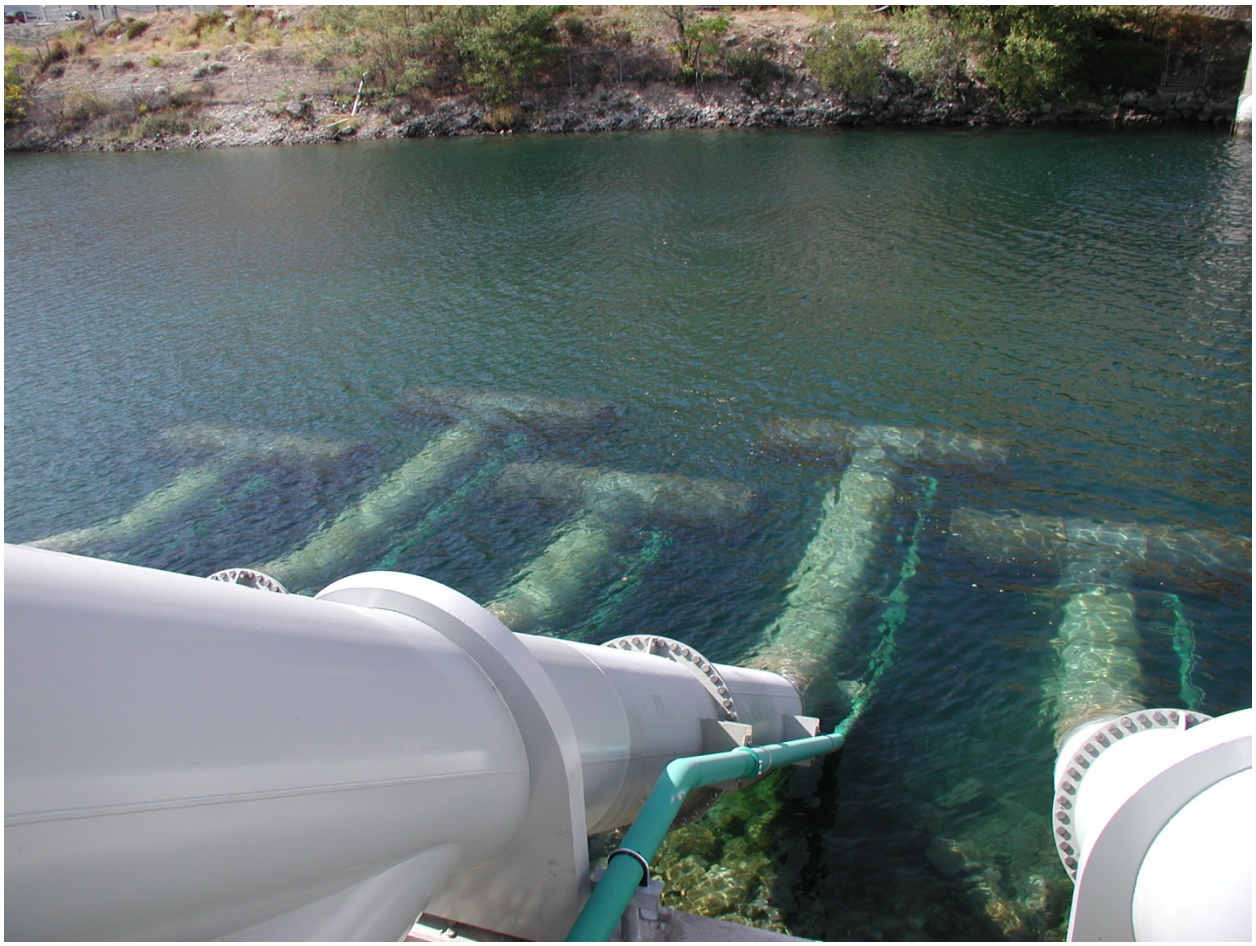
MBCI®
Metal Roof and Wall Systems

07-12/20M

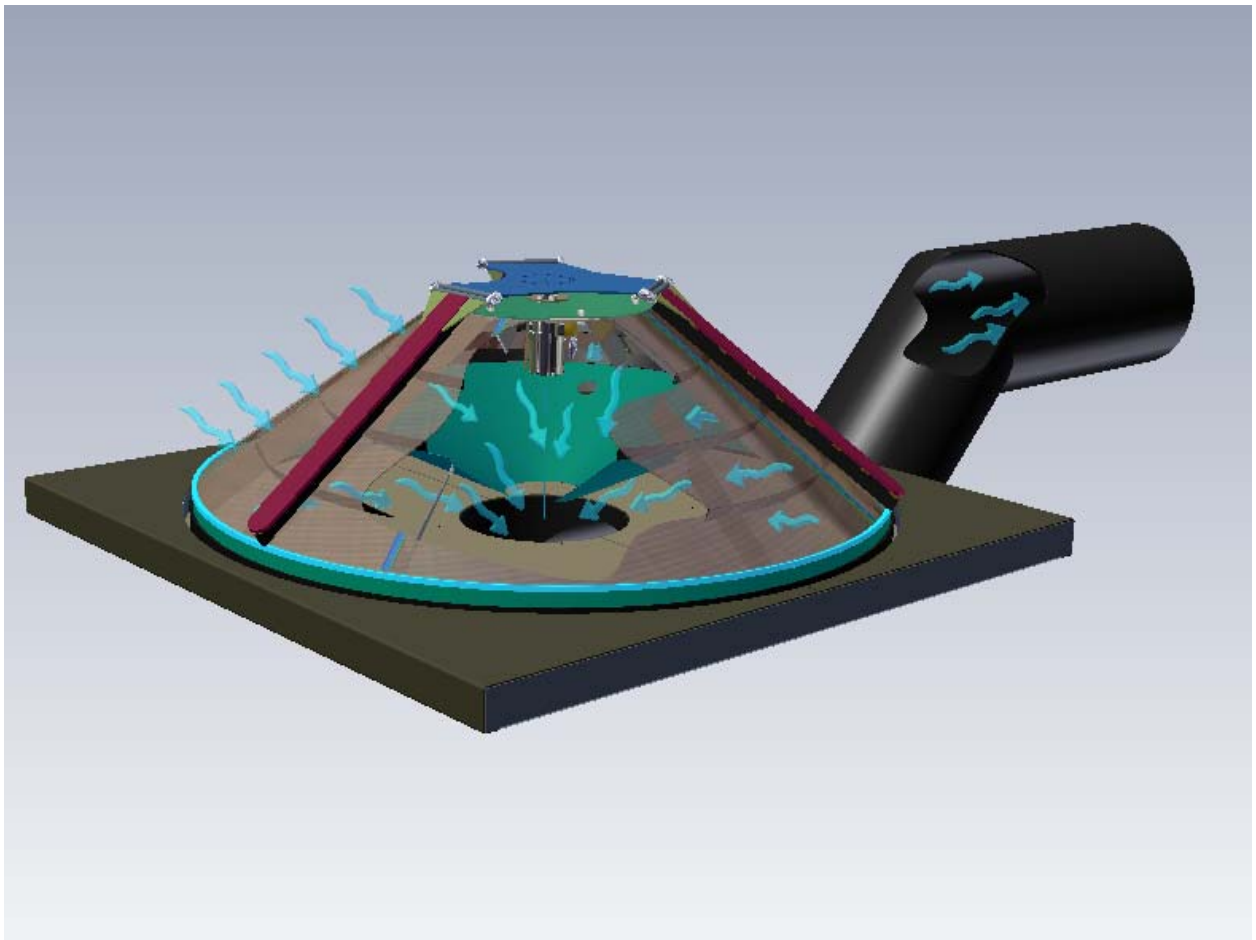
Attachment D

Representative Facility Graphics

Small Slant Screen Intake Example

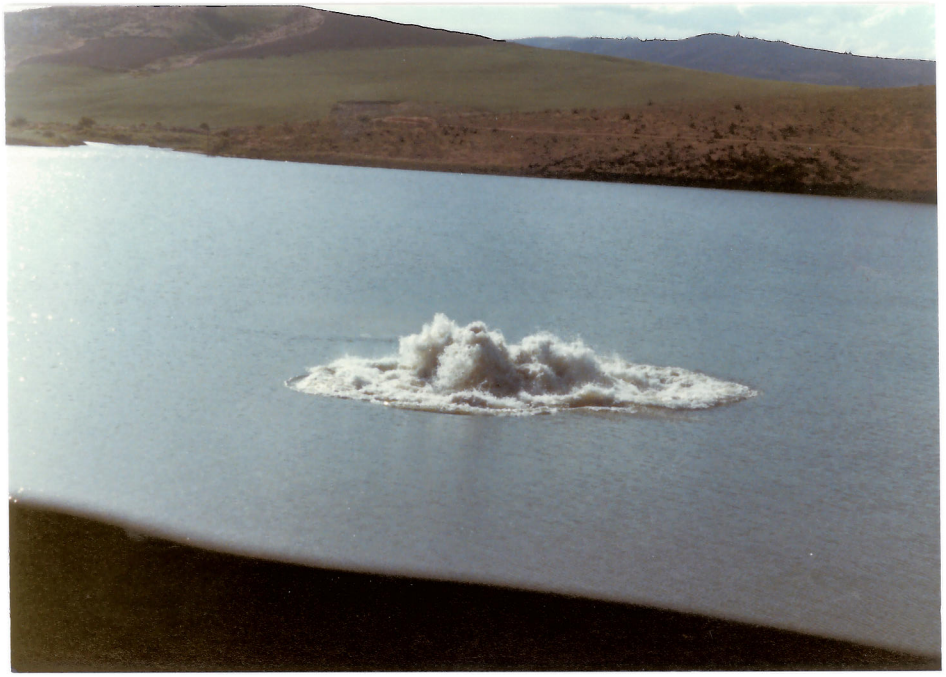


Staggered Tee Screen Installation



Rendering of Cone Shaped Intake Screen with Brush Cleaning System prepared by Intake Screens, Inc.

Small Traveling Screen Example – photo from Hydrolox website



Air Burst Screen Cleaning System Water Surface Disturbance Example

MEMO

State of Idaho
Department of Water Resources
322 E Front Street, P.O. Box 83720, Boise, Idaho 83720-0098
Phone: (208) 287-4800 Fax: (208) 287-6700

Date:	September 11, 2013
To:	Brian Patton
From:	Allan Wylie AW and Neal Farmer C.N.F.
cc:	Sean Vincent and Rick Raymondi
Subject:	Walcott Recharge Test

Introduction

The water levels in the Eastern Snake Plain Aquifer have been declining for a number of reasons (IDWR, 2005a and 2005b). Many entities implement aquifer recharge in an attempt to mitigate these declines, prompting the Idaho Water Resource Board to prioritize recharge locations so that recharge water will be put to maximum benefit when recharge water is scarce. The location of the Lake Walcott Recharge site with respect to discharge areas (springs and connected river reaches) proved to be an excellent site for improving aquifer storage and was given a relatively high priority when compared to other sites in the report by Johnson (2012). The A&B Irrigation District, Magic Valley Groundwater District, and the Idaho Water Resource Board entered into an agreement to develop the Lake Walcott Recharge site (IWRB, 2013). The plan calls for an injection capacity of 100 cubic feet per second (cfs).

Method

Two test wells were drilled on State of Idaho land near Lake Walcott (Figure 1) and terminated above the water table to test the ability of the unsaturated zone to accept recharge water. Two water trucks, one holding 2,000 gallons provided by Dean Stevenson a member of the Magic Valley Groundwater District (2,000 gal truck) and one holding 1,500 gallons provided by A&B Irrigation District (1,500 gal truck), supplied potable water for the injection tests. A tremmie pipe was inserted into the test well and then an In-Situ Level Troll 300 transducer (60 m range) was installed in the tremmie pipe and suspended six inches above the bottom of the well. The transducer was programmed to collect readings once every 60 seconds. Injection from the water trucks passed through an eight foot long section of nominal four-inch diameter PVC before being directed down the well. The injection rate was measured using a Thyme Flyte polysonic portable flow meter. Once the transducer and flow meter were programmed and started, injection commenced until the water truck was empty or the well filled up.

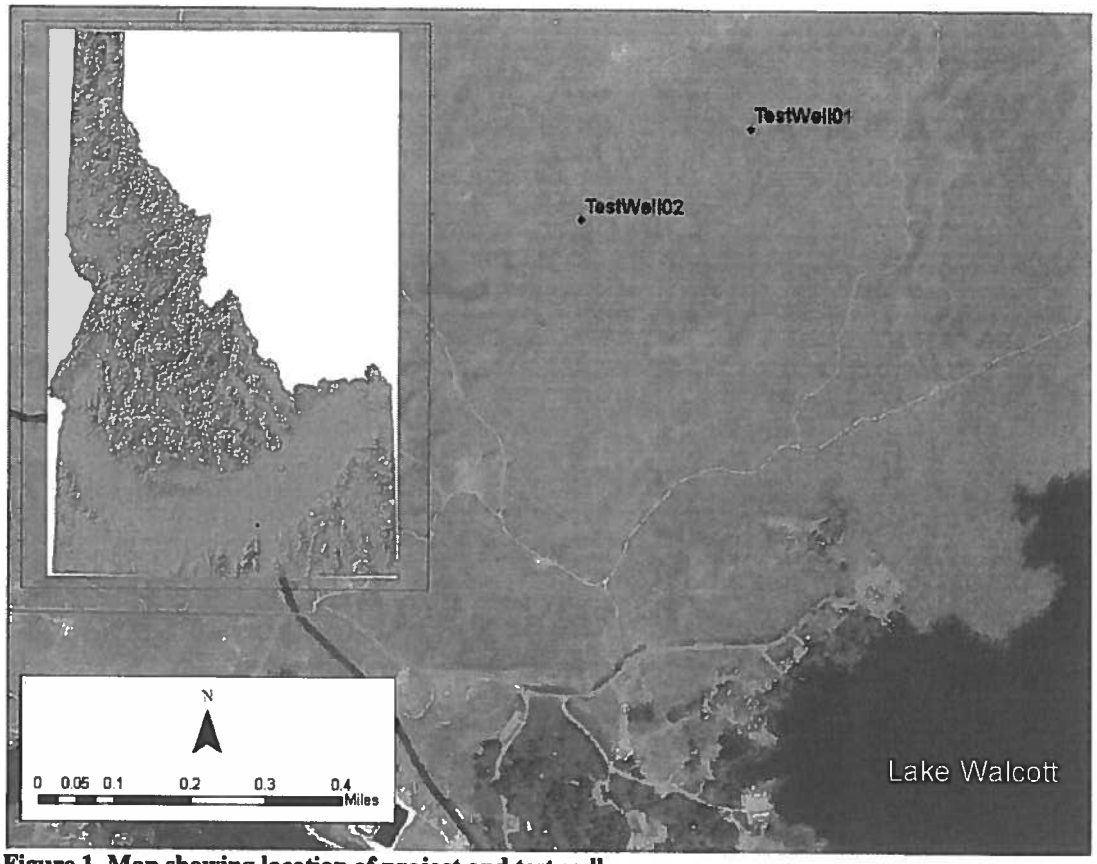


Figure 1. Map showing location of project and test wells.

Two test wells were completed on August 12, 2013 north of Lake Walcott on State land at Township 8 South, Range 25 East, NW of the SW of Section 36 to determine if the vadose zone in this area is suitable for injection of recharge water from Lake Walcott. The first well was positioned west of the US BOR/stock well approximately 1,100 foot, then the second well further west another 1,100 foot. A&B Irrigation District provided the drilling equipment and supplies to place 20 feet of 12-inch diameter casing in a 12-inch diameter hole. The drill rig was a dual reverse air rotary that advanced casing with a drive shoe at the same time as the drill bit but casing was stopped at 20 feet and then open hole drilling proceeded to the bottom of the borehole. The first test well ended at 120 feet below land surface with the goal of stopping just before the water table which was measured in the BOR well at 132 feet below top of casing. The second well terminated at a depth of 140 feet but sand was encountered from approximately 23 feet down to 35 feet and it collapsed as the drill steel was removed and filled the hole back up to a depth of 120 feet. Onsite observation of the drill cuttings during the drilling process showed nearly all basalt in the first borehole and then all basalt in the second borehole except for the fine homogenous sand unit from 23 to 35 feet. An IDWR resource protection staff was on site during the well drilling operation and oversaw placement of a well cap and temporary seal. Several days later after the holes had cleared of drilling 'fog' they were logged with a downhole camera to confirm geology, fractures, flow contacts, casing and depth of hole.

Results

Both wells were tested on August 28, 2013. Video logging of Test Well 01 showed a flow contact at 92-102 feet below land surface (bls), or 28-18 feet above the bottom of the well. Video logging of Test Well 02 showed flow contacts at 88-92 feet bls and a flow contact at 115-119 feet bls. Test Well 01 was the first well tested, testing of Test Well 02 followed. The following analyses assume that the injected water is accepted by the flow contact zones and the remainder of the stratigraphy penetrated accepted virtually no water and that during injection the flow contact zones became fully saturated.

Test Well 01

Testing of Test Well 01 consisted of injecting about 2,000 gal of water at an average rate of 121 gal/min (gpm) for about 17 min. The 2,000 gal truck was then empty so injection was stopped while the 1,500 gal water truck was connected to the four-inch PVC pipe and then injection resumed at 326 gpm for 4 min and injection was stopped because the water level in the well was near land surface. After injection stopped and the water level in Test Well 01 dropped to 92 ft bls (the depth of the flow contact zone encountered near the bottom of the well) the transducer was pulled from the well and the tremmie removed and installed in Test Well 02. The transducer was then reinserted into Test Well 01 to the same depth as before to monitor recovery in the dense basalt below the flow contact. Figure 2 contains a plot of water level measured relative to the transducer depth.

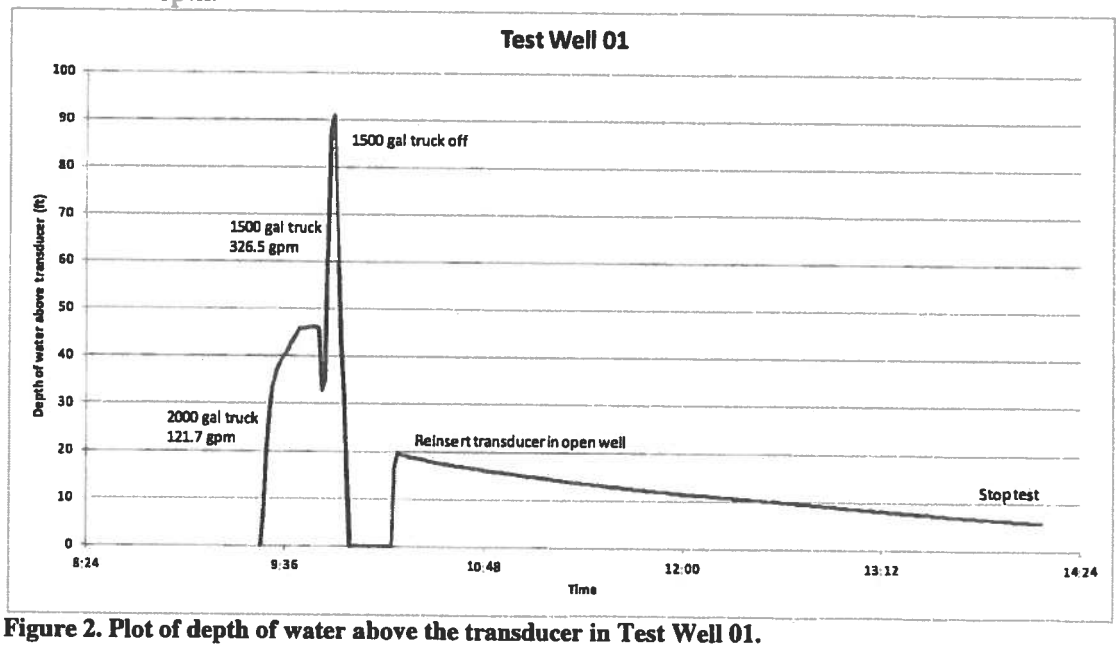


Figure 2. Plot of depth of water above the transducer in Test Well 01.

The data shown in Figure 2 presents two opportunities to calculate the hydraulic properties of the flow contact 92-102 ft bls, the recession after emptying the 2,000 gal truck and the recession after injection from the 1,500 gal truck was stopped. Figure 3 contains a plot of log of H(t) vs. time from the first recession resulting from the switch between the 2,000 gal truck and the 1,500 gal truck. The transition took less time than anticipated and only two points were collected before injection was resumed, however an analysis can be conducted using the Bouwer and Rice (1976) technique. The results of

this analysis indicate a hydraulic conductivity of 17 ft/day for the flow contact at 92-102 ft bls.

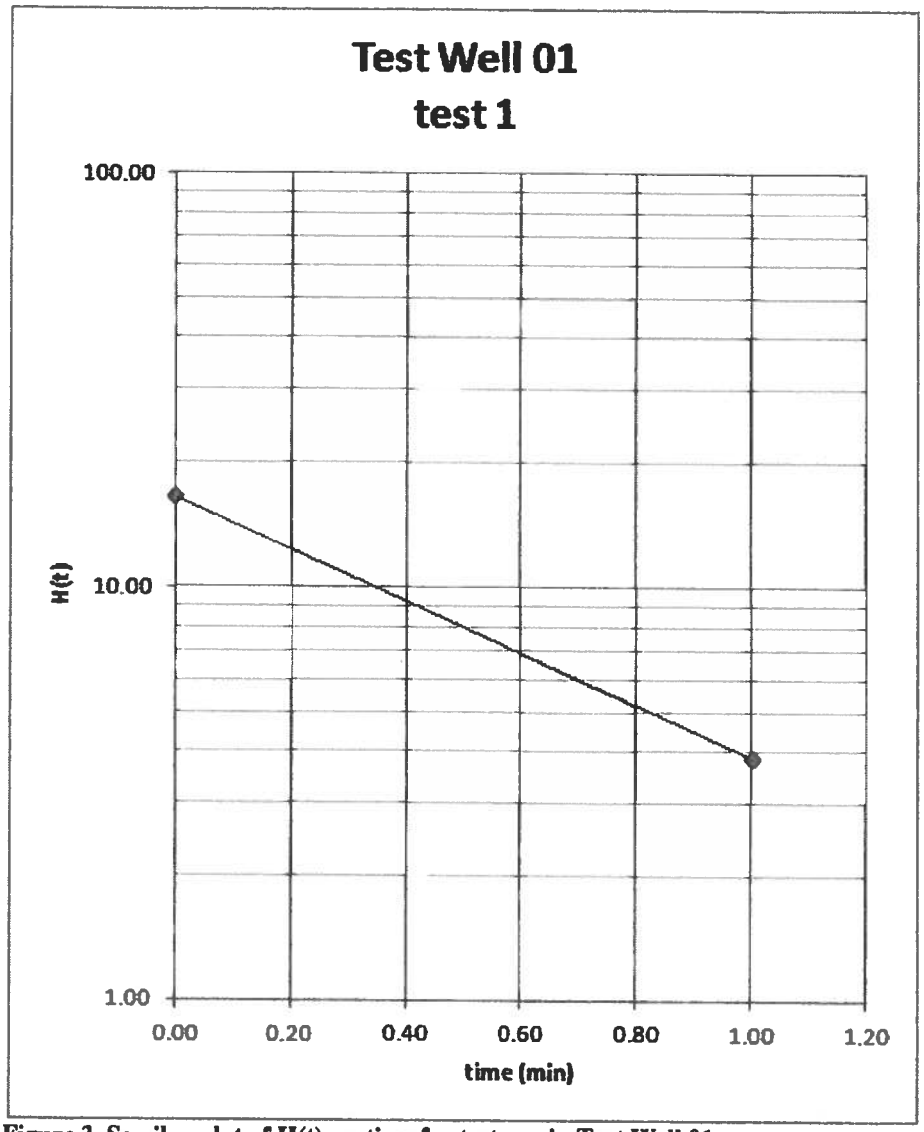


Figure 3. Semilog plot of H(t) vs. time for test one in Test Well 01.

Figure 4 contains a plot of log of H(t) vs. time starting at the end of injection into Test Well 01. This plot contains four observations with the pressure transducer. Four observations provide more confidence in the Bouwer and Rice (1976) analysis because the rate of decline is better constrained. The computed hydraulic conductivity from this portion of the test is 7 ft/day.

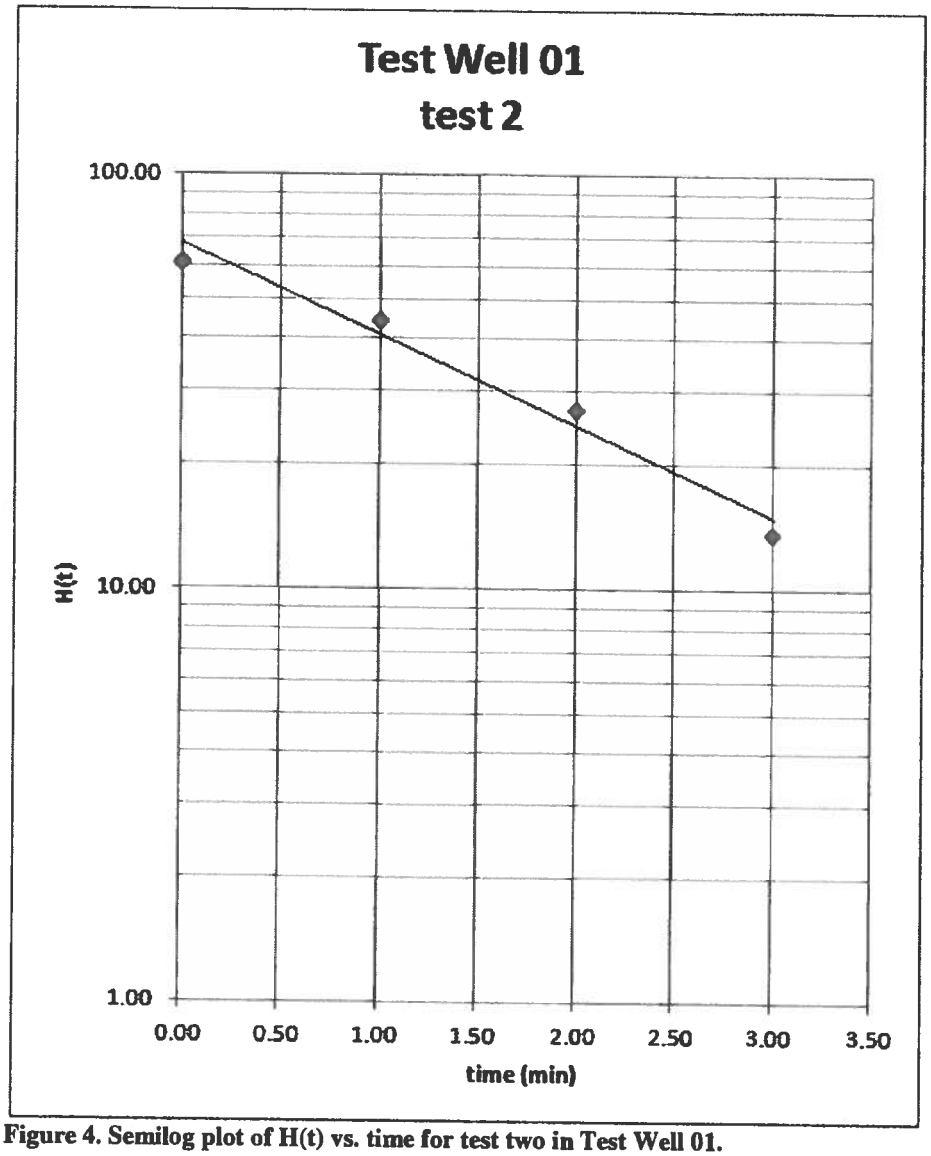


Figure 4. Semilog plot of H(t) vs. time for test two in Test Well 01.

The recession at the end of the injection in Test Well 01 can be analyzed using the Theis (1935) recovery method. This analysis technique assumes a constant discharge, but in practice tends to be relatively insensitive to changes in pumping rate. Figure 5 contains a plot of residual drawdown (s') vs log of time since pumping started divided by time since pumping stopped (log(t/t')). The computed hydraulic conductivity using this technique is 7 ft/day. Appendix A contains the calculations from all analyses conducted for Test Well 01.

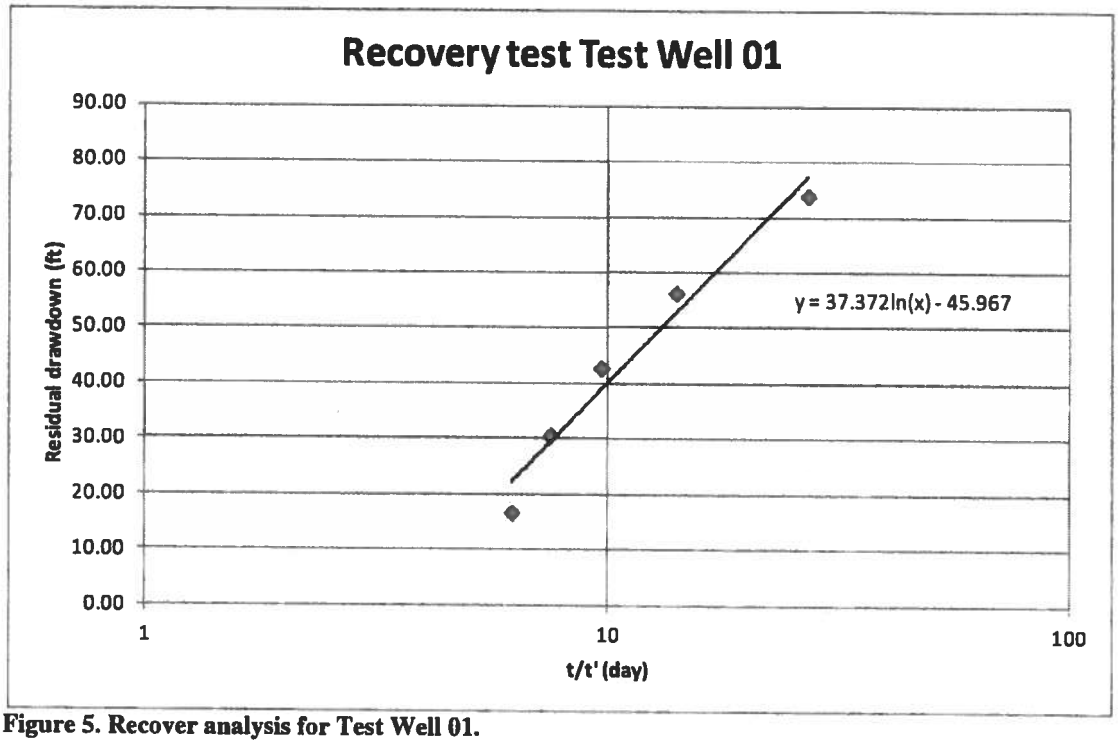


Figure 5. Recover analysis for Test Well 01.

Test Well 02

After drilling was completed, the sedimentary interbed at 23 feet bls caved into Test Well 02. The tremmie was inserted to 120 feet bls and was resting on the material that caved into the well. A transducer was inserted into the tremmie and suspended six inches above the bottom of the tremmie and programmed to collect data every 60 seconds. The Thyme Flyte polysonic portable flow meter was installed on the four- inch PVC and programmed. Both water trucks were refilled from a nearby well, and injection commenced with the 2,000 gal truck. During injection, the tremmie settled in the well about 0.7 feet into the sediment and the transducer became stuck. After the test was over, the tremmie was pulled and the transducer freed. The tremmie was then suspended 5 feet above the sediment in the bottom of the well and the transducer suspended 5 feet above the bottom of the tremmie and then the contents of the 1,500 gal truck was injected into the well. A decision was made to refill both water trucks and inject the contents of both water trucks at the same time. The 1,500 gal water truck was discharged through the 4 inch PVC pipe and measured with the Thyme Flyte polysonic portable flow meter, and the 2,000 gal truck was injected directly into the well. The 1,500 gal truck was measured because the injection rate of the 2,000 gal water truck was more constant, and thus more accurately estimated. Figure 6 contains a graph of the water level changes recorded in Test Well 02 with the transducer.

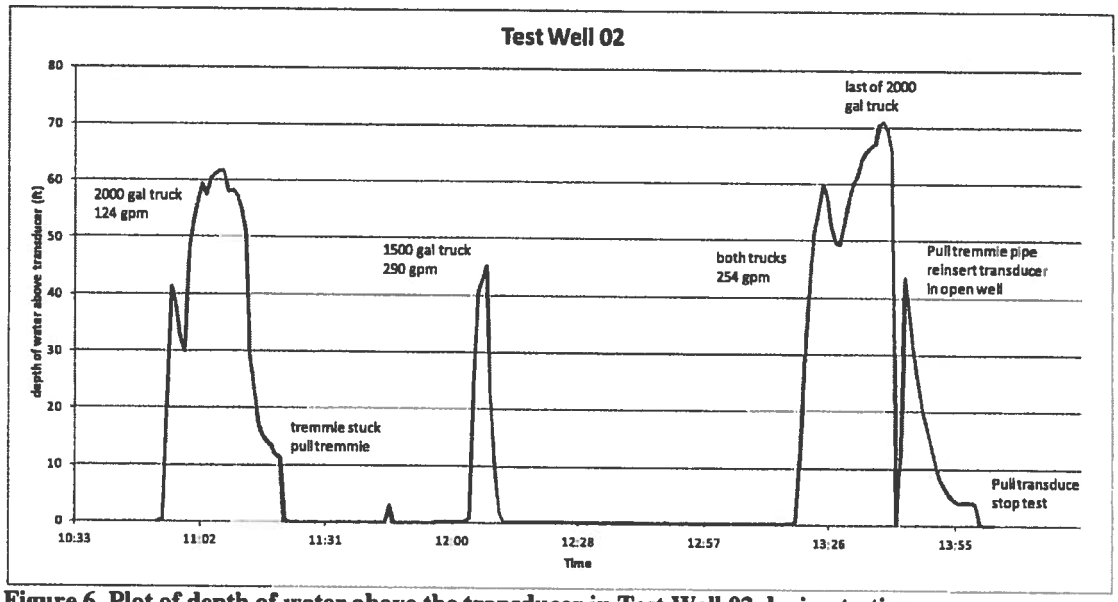


Figure 6. Plot of depth of water above the transducer in Test Well 02 during testing.

Two basalt flow contact zones were encountered while drilling Test Well 02, one from 88-92 feet bls and one at 115-119 feet bls. Personnel on site during drilling of the well did not observe any indication of flow contact zones below 120 feet bls.

The sequence of events outlined above presents three opportunities to estimate the physical properties of the flow contacts that may accept water.

1) The recession resulting from the injection from the 2,000 gal truck when the tremmie settled and the transducer became stuck,
2) the recession from the injection of the 1,500 gal truck and
3) the recession from the combined injection of both trucks.

Figure 7 contains a plot of log of H(t) vs. time for the Bouwer and Rice (1976) analysis from the recession after injecting the contents of the 2,000 gal truck. The first observation to note in both Figure 6 and Figure 7 is that the flow contact at 88-92 feet bls (32-28 feet above the transducer) does not appear to accept significant volumes of water because there is no change in slope after the water level drops below 32 feet above the transducer, thus all of the water must be discharging through the flow contact observed at 115-119 ft bls. Assuming all the water is discharging through the four-ft flow contact near the bottom of the well, the computed hydraulic conductivity from this test is 11 ft/day.

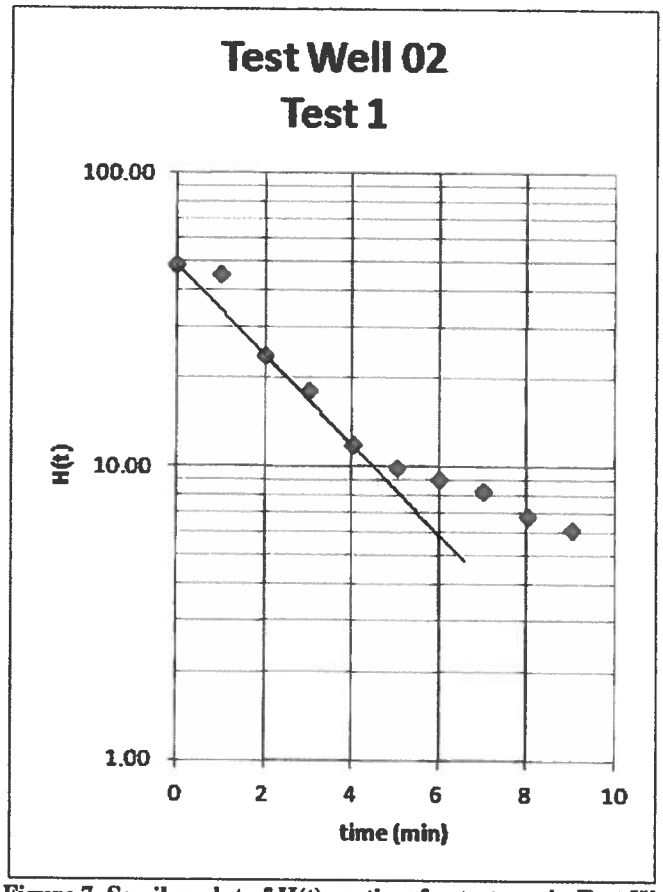


Figure 7. Semilog plot of H(t) vs. time for test one in Test Well 02.

Figure 8 contains the plot of s' vs log(t/t') for the Thies (1935) recovery analysis for Test 1 conducted in Test Well 02. This technique provides a hydraulic conductivity of 32 ft/day.

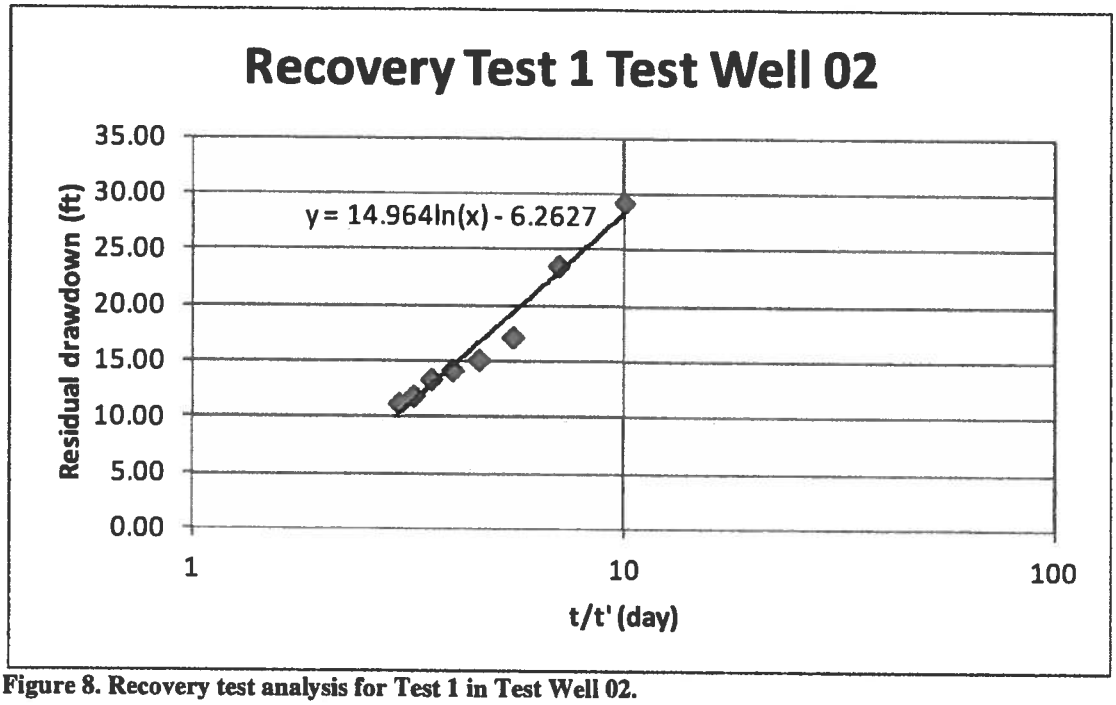


Figure 8. Recovery test analysis for Test 1 in Test Well 02.

Figure 9 contains a plot of H(t) vs. time of the recession resulting from the injection of the contents of the 1,500 gal water truck for the Bouwer and Rice (1976) analysis. This recession plot also does not show any evidence that water discharged into the flow contact observed 32-28 feet above the bottom of the well, 22-18 feet above the transducer (the transducer was raised 10 feet for this test). The computed hydraulic conductivity from this test is 23 ft/day.

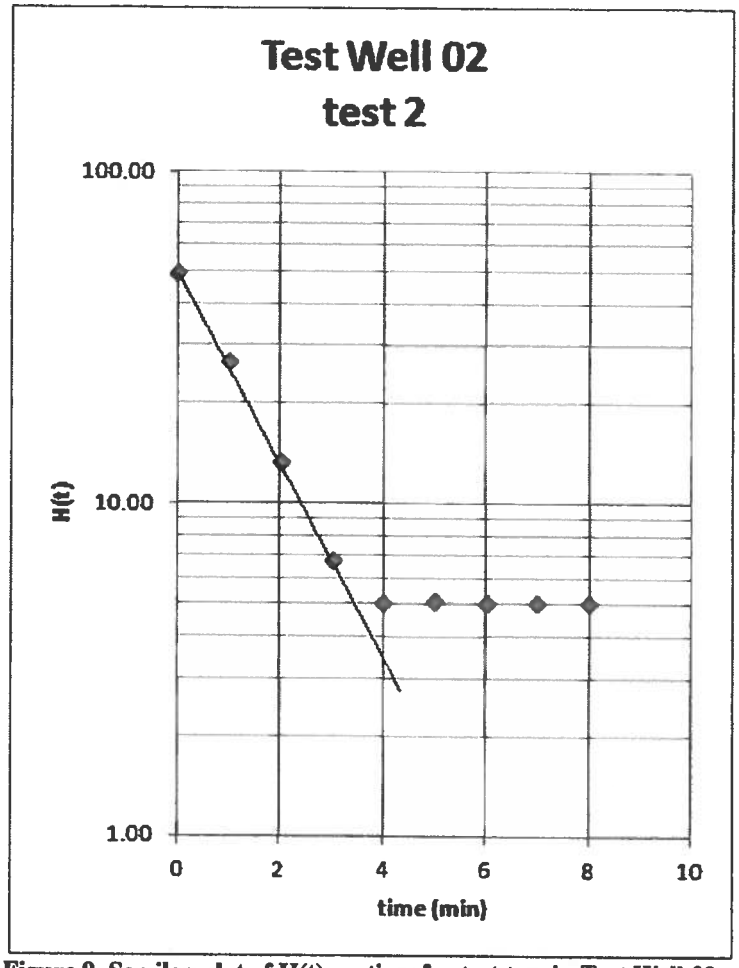


Figure 9. Semilog plot of H(t) vs. time for test two in Test Well 02.

Figure 10 contains the plot of s' vs log(t/t') for the Thies (1935) recovery analysis for Test 2 conducted in Test Well 02. This technique provides a hydraulic conductivity of 42 ft/day.

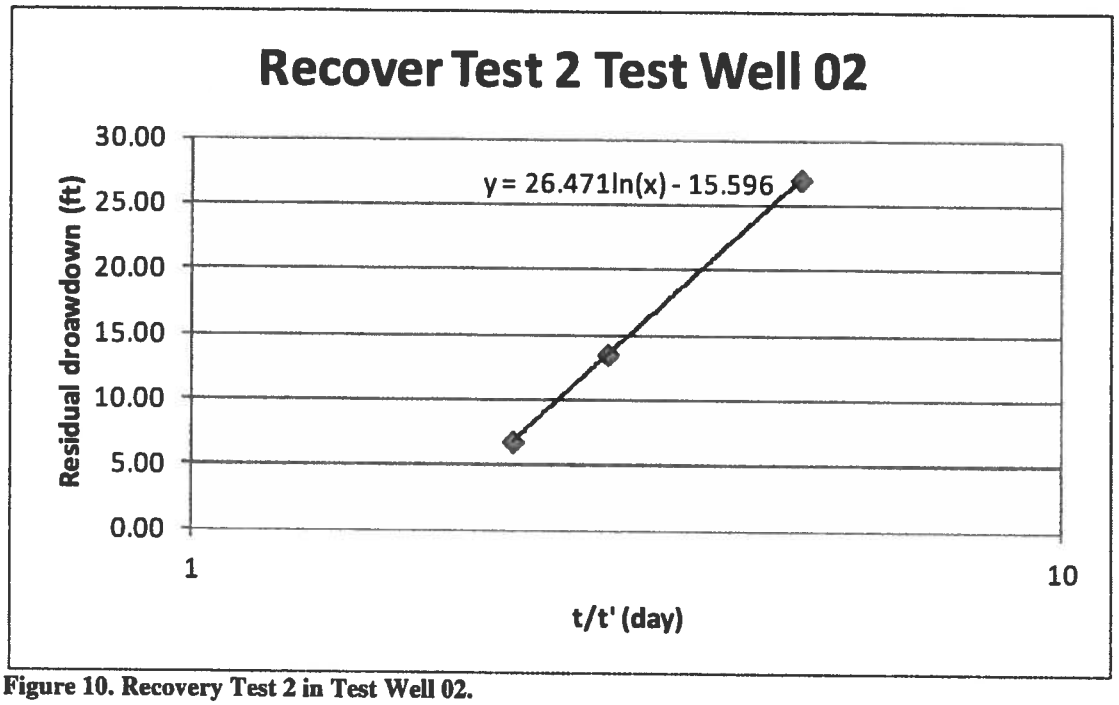


Figure 10. Recovery Test 2 in Test Well 02.

Figure 11 contains a plot of H(t) vs. time of the recession resulting from the injection of the contents of both the 2,000 gal and 1,500 gal water trucks. This recession plot also does not show any evidence of the flow contact observed 32-28 feet above the bottom of the well (22-18 feet above the transducer). The computed hydraulic conductivity from this test is 5 ft/day. Appendix B contains the calculations from the tests conducted in Test Well 02.

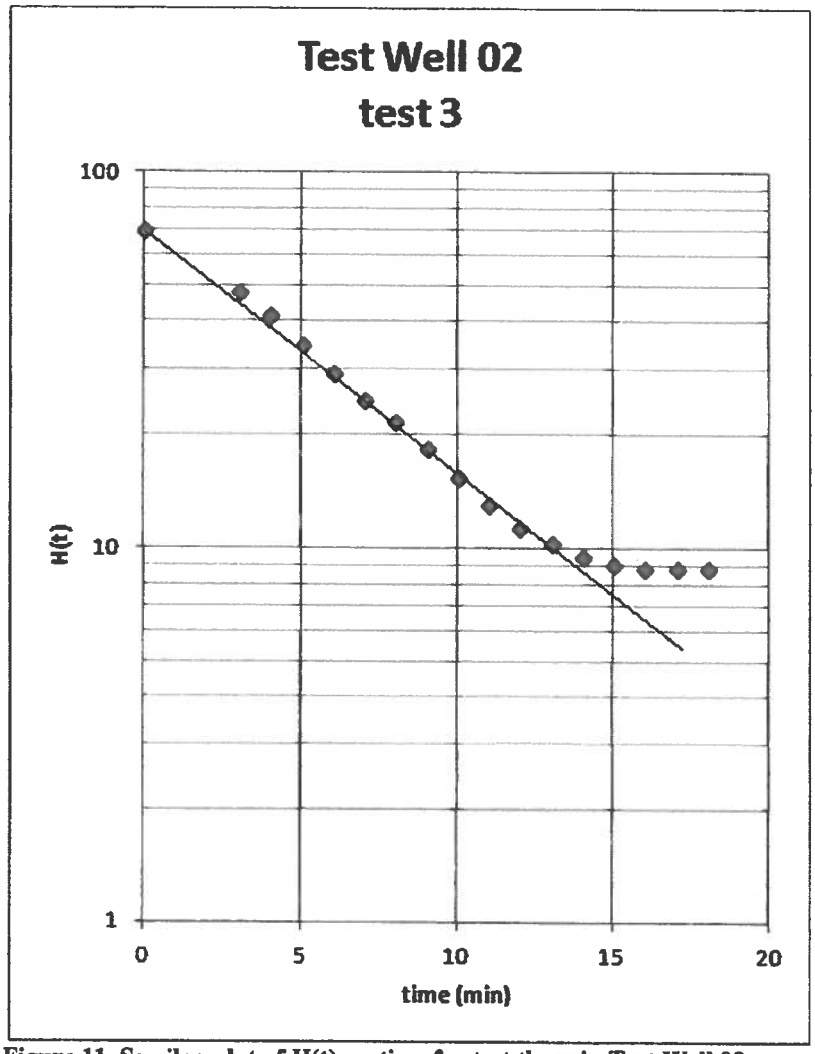


Figure 11. Semilog plot of H(t) vs. time for test three in Test Well 02.

Figure 12 contains the plot of s' vs log(t/t') for the Thies (1935) recovery analysis for Test 3 conducted in Test Well 02. This technique provides a hydraulic conductivity of 27 ft/day.

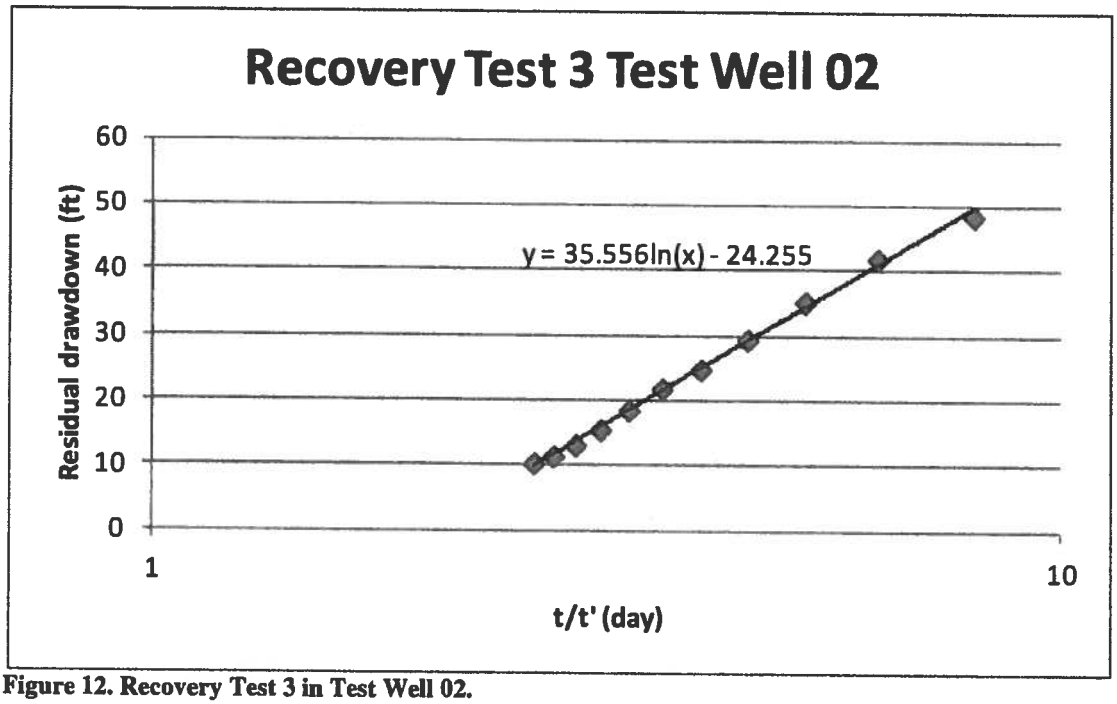


Figure 12. Recovery Test 3 in Test Well 02.

Conclusions

The average hydraulic conductivity for the tests in Test Well 01 was 10 ft/day and the average hydraulic conductivity for the tests in Test Well 02 was 23 ft/day (Table 1). The analyses techniques are not ideally suited these conditions, however they yield similar hydraulic conductivity values. In any case, the key observation is that when the injection rate exceeded about 250 gpm, the water level never stabilized in either well. All of these analyses together with this last observation suggest that it would take somewhere around 200 wells to inject 100 cfs, assuming these tests are representative for the area. The number of wells can be reduced by drilling the wells deeper to intersect more flow contact zones.

Table 1. Estimated hydraulic conductivity (ft/day). B&R = Bouwer and Rice (1976) and Thies = Thies (1935).

Test Well	B&R 1	B&R 2	B&R 3	Thies 1	Thies 2	Thies 3	Average
01	17	7			7		10
02	11	23	5	32	42	27	23

References

Bouwer H, and R.C. Rice. 1976. A slug test for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells. Water Resources Research. V. 12, pp 423-428.

IDWR, 2005a. Order in Response to Blue Lakes Trout Farm.

IDWR, 2005b. Order in Response to Delivery Calls by Clear Springs Foods Inc.

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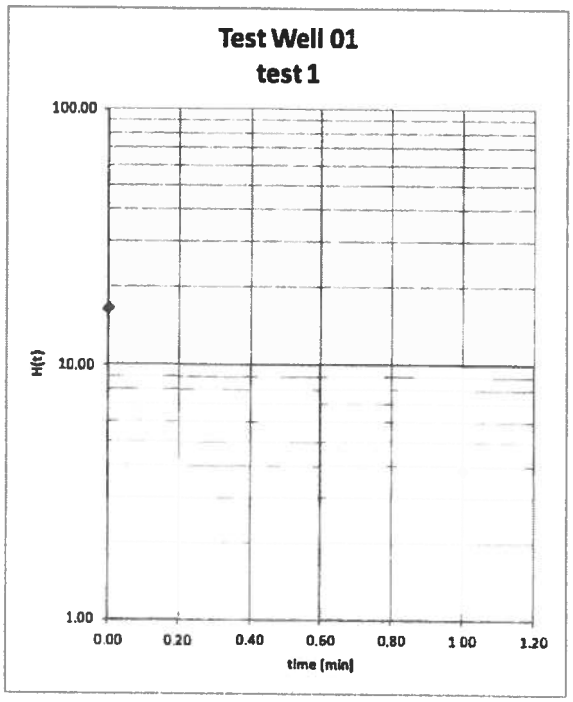
Johnson, G.S., 2012. Prioritization of Aquifer Recharge Sites Based on Hydrologic Benefits.

Thies C.V., 1935. The relation between the lowering of the piezometric surface and the rate and duration of discharge of a well using groundwater storage. Transactions American Geophysical Union, V. 16, pp 519-524.

Appendix A

Calculations from Tests Conducted in Test Well 01

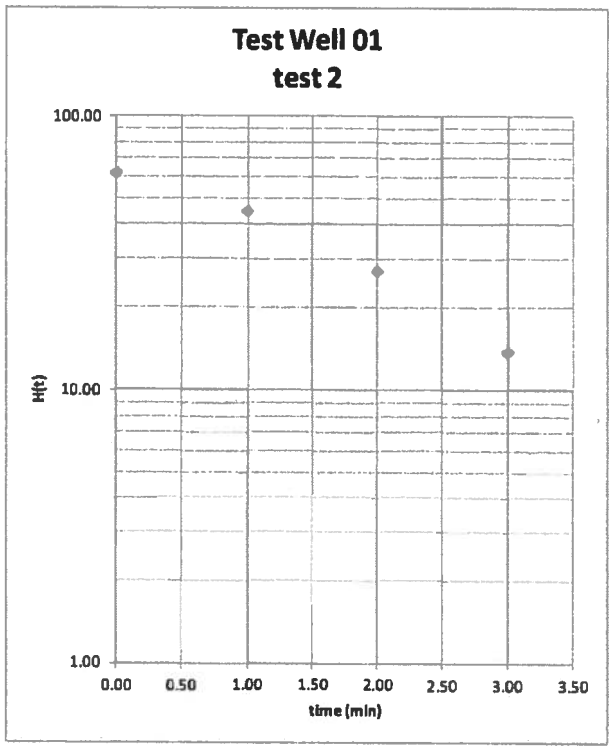


Analysis assumptions

interflow zone 92-102 ft below land surface is aquifer

static water level	10	ft
length of screened interval (L)	10	ft
diameter of casing (Rc)	0.5	ft
diameter of screen (Rw)	0.5	ft
kh/kv ratio	1	

L/Rw	20
A	2.17
B	0.33
C	1.40
ln(Re/Rw)	0.64
t	0.000694
Ho	16.6
Ht	3.88
1/t(ln(Ho/Ht)	2093.14
K	16.62

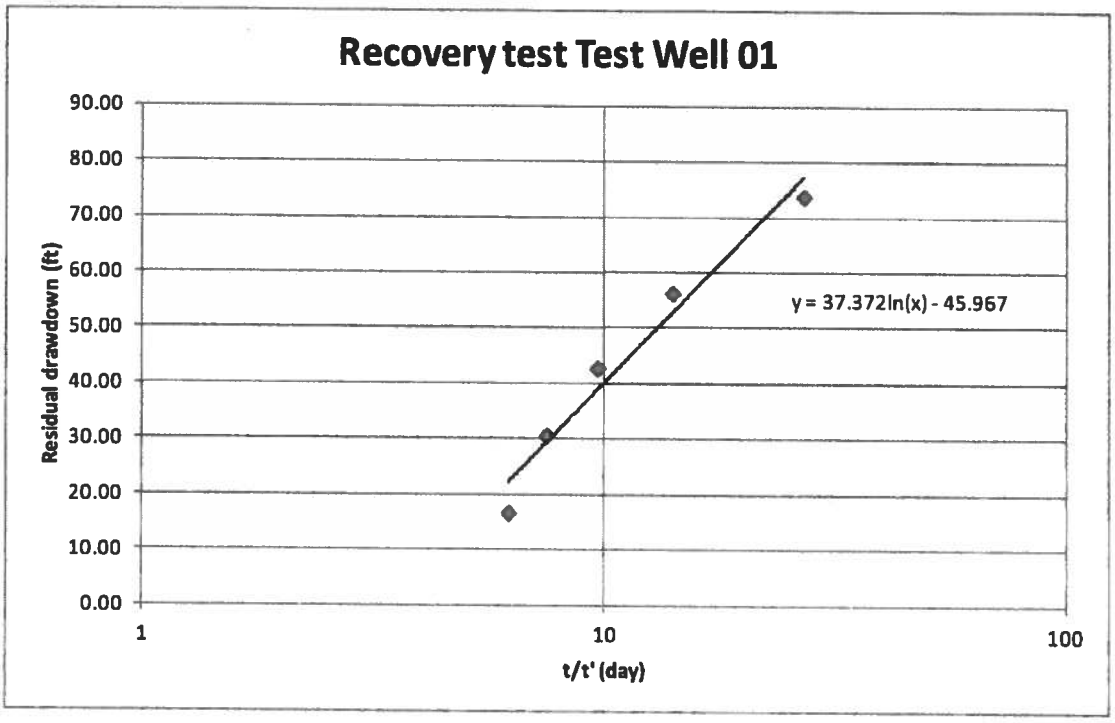


Analysis assumptions

interflow zone 92-102 ft below land surface is aquifer

static water level	10	ft
length of screened interval (L)	10	ft
diameter of casing (Rc)	0.5	ft
diameter of screen (Rw)	0.5	ft
kh/kv ratio	1	

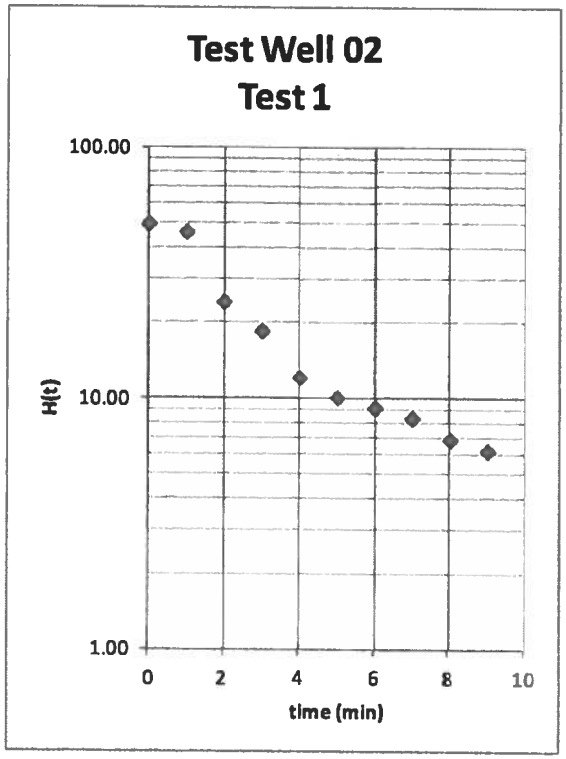
L/Rw	20
A	2.17
B	0.33
C	1.40
ln(Re/Rw)	0.64
t	0.002083
Ho	78
Ht	13.79
1/t(ln(Ho/Ht)	831.73
K	6.61



t/t' =100	126
t/t' = 10	40
delta s'	86
Q ft**3/d	33360
T ft**2/d	71
K ft/d	7

Appendix B

Calculations from Tests Conducted in Test Well 02

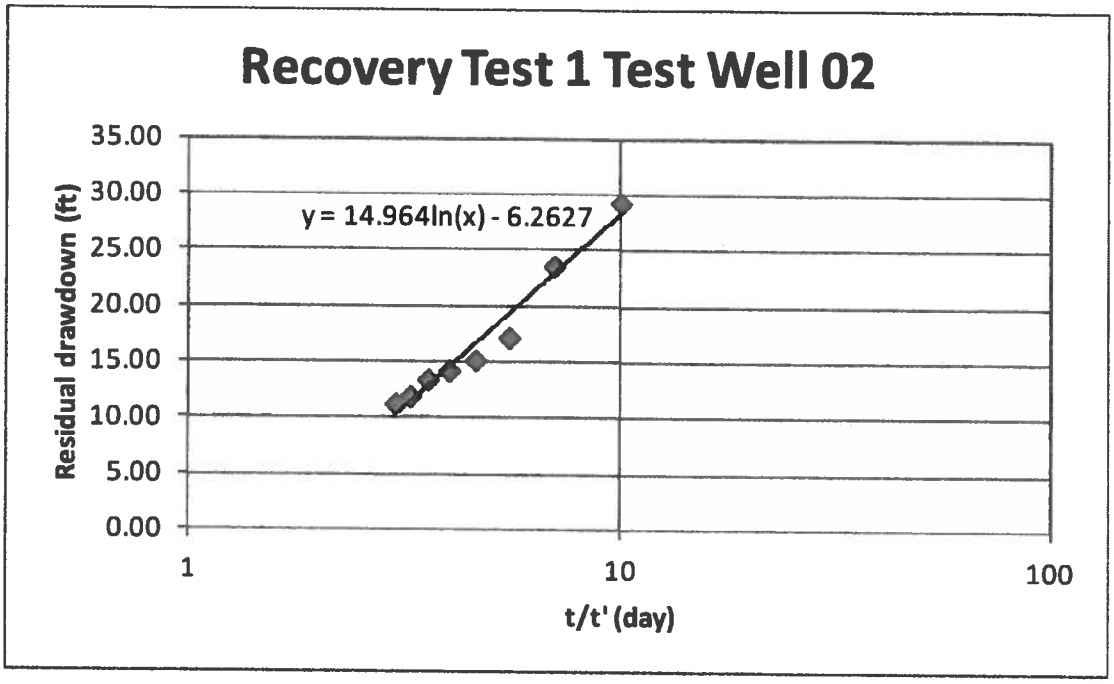


Analysis assumptions

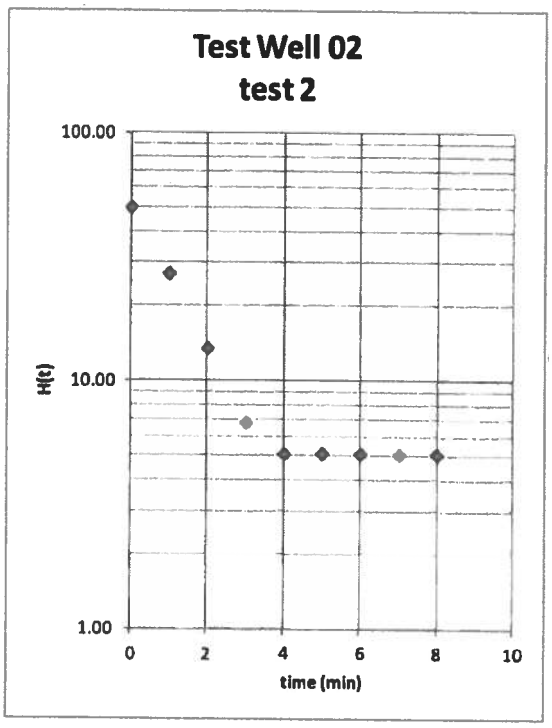
interflow zone 114-118 ft below land surface is aquifer

static water level	10	ft
length of screened interval (L)	4	ft
diameter of casing (Rc)	0.5	ft
diameter of screen (Rw)	0.5	ft
kh/kv ratio	1	

L/Rw	8
A	1.84
B	0.27
C	0.93
ln(Re/Rw)	0.77
Ho	49.64
t	0.002083
Ht	18.55
1/t(ln(Ho/Ht)	472.35
K	11.41



t/t' =100	63
t/t' = 10	28
delta s'	34
Q ft**3/d	23870
T ft**2/d	127
K ft/d	32

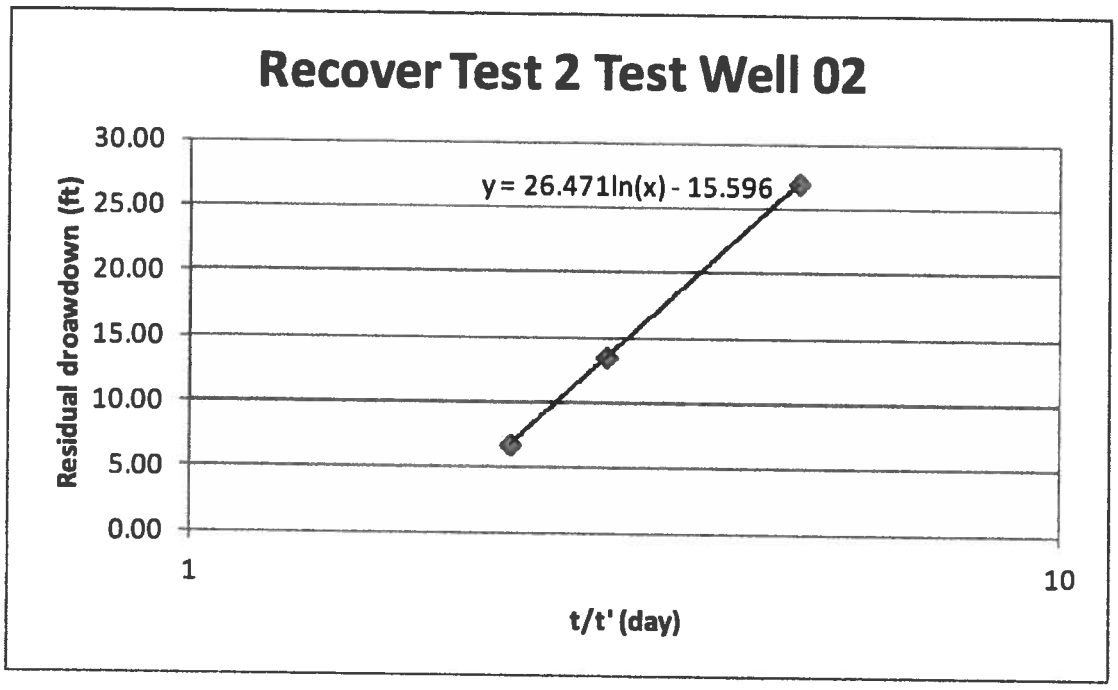


Analysis assumptions

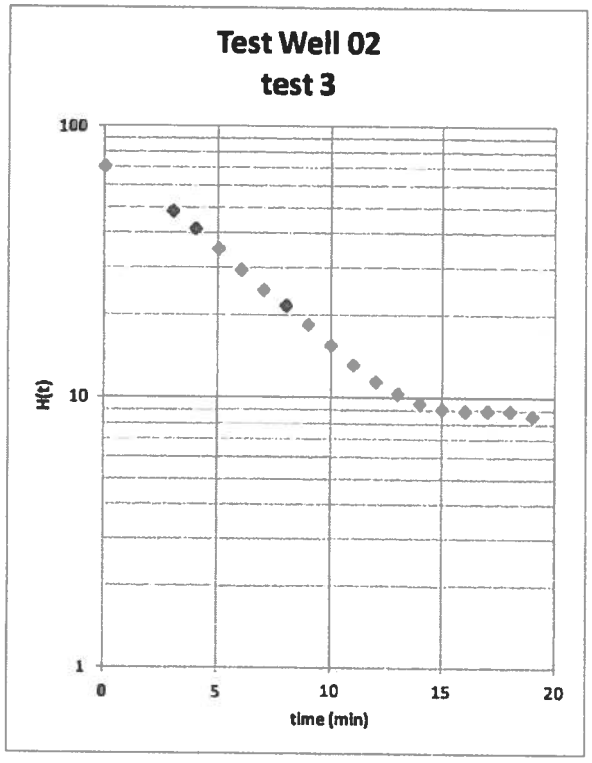
interflow zone 114-118 ft below land surface is aquifer

static water level	10	ft
length of screened interval (L)	4	ft
diameter of casing (Rc)	0.5	ft
diameter of screen (Rw)	0.5	ft
kh/kv ratio	1	

L/Rw	8
A	1.84
B	0.27
C	0.93
ln(Re/Rw)	0.77
Ho	50.07
t	0.002083
Ht	6.81
1/t(ln(Ho/Ht)	957.93
K	23.14



t/t' =100	106
t/t' = 10	45
delta s'	61
Q ft**3/d	55825
T ft**2/d	168
K ft/d	42

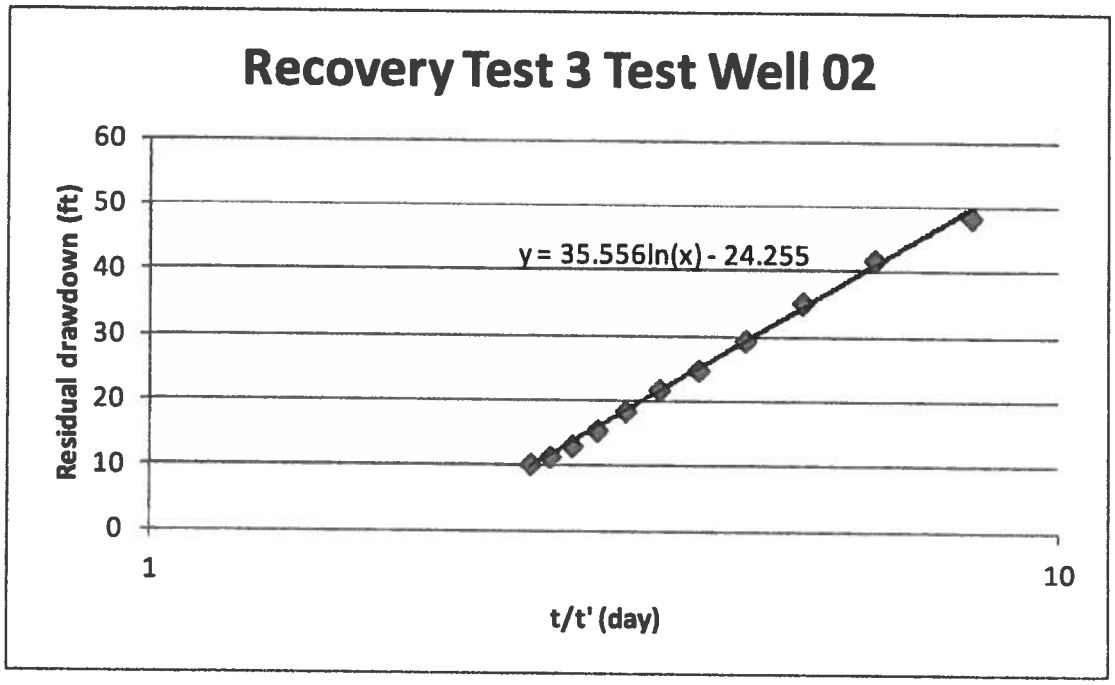


Analysis assumptions

interflow zone 114-118 ft below land surface is aquifer

static water level	10	ft
length of screened interval (L)	4	ft
diameter of casing (Rc)	0.5	ft
diameter of screen (Rw)	0.5	ft
kh/kv ratio	1	

L/Rw	8
A	1.84
B	0.27
C	0.93
ln(Re/Rw)	0.77
Ho	75.00
t	0.003472
Ht	35.22
1/t(ln(Ho/Ht)	217.70
K	5.26



t/t' =100	139
t/t' = 10	58
delta s'	82
Q ft**3/d	48895
T ft**2/d	109
K ft/d	27