



WWTP Expansion Report

(Work Order No. 101)

Prepared for:
Inscription Canyon Ranch Sanitary District
P.O. Box 215
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Prepared by:
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Job # 11097
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A. INTRODUCTION

Granite Basin Engineering, Inc. was recently commissioned by the Inscription Canyon Ranch Sanitary District (hereafter referred to as the District) to provide District Engineering services. This work order, requested by the District, includes upgrade recommendations for the existing Wastewater Treatment Plant (up to \$400,000) to increase capacity and reduce operating costs. A summary of the tasks cited in this work order are outlined below.

- *Task 1 – Consider recommendations made by Dwight Zemp, ACT III Investments*
- *Task 2 – Prepare Project budget for recommended program, and an implementation timeline (in weeks)*
- *Task 3 – Consider future plant expansion(s)*
- *Task 4 – Consider whether the improvements will require ADEQ approval, and the impact of modification of the present APP*

The District operates a wastewater treatment plant (WWTP) that provides service to the master planned communities of Inscription Canyon Ranch (ICR), Whispering Canyon (WC), The Preserve at the Ranch (PR) and Talking Rock Ranch (TRR). The District has approved 1,446 residential units from within its service area. Approximately 1,034 of these units have been sold and there are 450 active connections. The District operates and maintains the WWTP through a service contract with A Quality Water Company.

The WWTP operates under Aquifer Protection Permit (APP) No. P-103119 issued in July of 1997. The original permit issued in 1997 was for a sequencing batch reactor (SBR) with a design capacity of 120,000-gpd, although the APP permit was limited to 46,000-gpd. The original SBR system was designed to meet Class B re-use standards.

In 2002, the APP was amended changing the treatment process to modified extended aeration with a design capacity of 455,000-gpd and a Class B+ re-use standard. This treatment process was designed in four phases of increasing capacity ranging from 62,500-gpd to 455,500-gpd for full build out conditions. There was no specific requirement in this APP for timing of construction of subsequent phases to increase capacity. The existing WWTP currently operates within Phase 1 of the design with a treatment capacity of 62,500-gpd.

Another amendment to the APP was completed in 2007 changing the treatment process to a membrane bioreactor system meeting a Class A+ re-use standard. The ultimate treatment capacity of the membrane bioreactor system is 455,000-gpd. The District has reconsidered implementation of this latest treatment technology based on current design flows and limited growth rates within the service area.

The existing WWTP, operating as a modified extended aeration process, has an average daily flow of 35,000-gpd, or approximately 56% of the 62,500-gpd design capacity. A phased expansion to the existing WWTP is being considered by the District to increase treatment capacity.

A letter was issued to the Arizona Department of Environmental Quality (ADEQ) on July 10, 2012 requesting a meeting for the purpose of confirming the appropriate procedure and steps required to modify the existing APP. The current permit issued at the request of the prior ICRSD Board of Directors was in anticipation of replacing the existing wastewater treatment facility with a new facility. However, due to the subsequent change in District leadership, the continuing satisfactory performance of the current system, slowdown in the economy and rate of new home development, the District does not plan to replace the existing system. Rather than construction of a new facility, the District's intent is to upgrade the existing facility.

In response to the letter, ADEQ has indicated that the previous APP does not allow for expansion of the existing plant. In order to change the APP back to the Santec treatment process, a complete design submittal must be made showing the existing plant along with specific design elements for future expansion. A significant amendment to the current APP must be completed noting the size and configuration of the existing plant and proposed upgrade modifications. When future expansion is required yet again, another significant amendment will be required based on the proposed expansion capacity and technology to be used.

The WWTP site is located at 14000 Grey Bears Trail on parcels 306-55-029G and 306-55-100B. The site is surrounded by Grey Bears Trail to the east, the Western Area Power Administration (WAPA) easement to the west (owned by Yavapai County) and privately owned residential properties to the north and south. An aerial map of the treatment plant site is shown in the adjacent figure. From the image it is possible to see remnants of the concrete basins used in the original sequencing batch reactor. The currently operating Santec plant is located to the east of the concrete basins – the Santec plant is an underground facility backfilled with pea gravel. The operation and control building is seen near the mid-portion of the south property boundary, next to the Inscription Canyon Ranch Water Users Association (ICRWUA) facilities building. The backup generator and power company switching cabinet is seen between the two buildings. The polishing pond for the original sequencing batch reactor is seen north of the Santec plant – this depression currently serves as emergency overflow. The effluent pump station is seen at the north end of the treatment plant site – the effluent is pumped north to the effluent storage lagoons at Talking Rock. A detailed plan of the existing WWTP site is included in Appendix A.



B. TASK ITEMS

The relevant tasks and findings associated with this Work Order are included below. Our findings are based on information provided by the District and various public resources including ADEQ. The intent is to provide objective recommendations for WWTP upgrades based on available information.

Task 1 – Consider recommendations made by Dwight Zemp, ACT III Investments

The referenced report was prepared by Mr. Dwight Zemp on September 22, 2011. The purpose of the report was to evaluate existing WWTP capacity, document historical and projected flow rates, and provide recommendations for future expansion. The report provided recommended capacity upgrades based on a 90,000-gpd (0.090-MGD) average flow rate.

The report summarized historical flow data provided by the District since 2003 and recommended that this data be used to predict ultimate WWTP capacity to which we affirm. The report also suggests that upgrades should not be considered by the District until the need for additional capacity is necessary based on recorded flow data. This is due to the fact that new technologies and process designs are continually being improved and made available to the wastewater marketplace.

The report suggests a number of facility additions and expansion recommendations which are summarized below.

- Site Improvements
 - New entrance road from Grey Bears Trail on north end of WWTP site

We agree that this would improve site access, traffic and general usability of the site. However, we should point out that this would degrade site security and would require a significant drainage structure along Grey Bears Trail. We do not believe this new entrance would benefit parking control without encroaching on future plant expansion areas or the existing regional detention basin located along the west portion of the WWTP site.

- Remove the old concrete chlorination contact basin

We agree that this would provide additional usable space for parking and that it would improve the visual appearance of the site. This will require a closure plan as discussed below under Task 4.

- New Operations/Equipment Building
 - Construct a new building using the northwest cell of the old SBR facility

We do not believe the cost to construct a new building over the existing concrete basin(s) would outweigh the benefit. We recommend that a closure plan be developed for the SBR and that the concrete basin(s) be demolished.

- Construct new sludge handling system (bagging system vs. centrifuge unit)

We agree that a new sludge handling system would improve plant operations and reduce sludge disposal costs. The report estimated that a new sludge bagging unit (6 bag capacity) would cost approximately \$70,000 and that a new centrifuge unit or sludge press would cost about \$170,000. The report states that a new centrifuge unit could reduce operator costs by up to 10 hours per week. Based on the reduced operating costs we believe installation of a new sludge handling system could be recovered in approximately 5 years. We recommend that a sludge bagging unit be installed based on the reduced operating costs and long term savings that would be realized by the District.

- Additional Flow Equalization

- Convert existing sludge holding tank into second flow equalization basin

If the District installs a new sludge handling system as noted above, the additional volume of the sludge holding tank would double the flow equalization volume. We concur with this recommendation and believe that this concept would be a practical and effective use of this current asset.

- Add Anoxic Reactor

- Install an anoxic reactor ahead of the aeration reactors

According to Santec Corporation, anoxic reactors are found at the head of the process only in denitrification processes with large daily average flow rates (>0.1-MGD). The purpose of an anoxic reactor is to remove a large portion of the BOD5 and nitrogen prior to the aeration process. We understand, based on current WWTP operation, that the anoxic reactor is not necessary for the proposed plant expansion to 90,000-gpd (0.090-MGD). The cost for this item would be approximately \$40,000.

- Denitrification Reactor

- Replace mixers with new units

It is our understanding that the mixers have been replaced and that they are adequate to properly roll the tanks.

- New Plant Controls, Controllers, Alarm Systems & Blowers

- New control for FEQ pumps to be moved to new Operations/Equipment building

We agree that new controls for the Flow Equalization (FEQ) pumps should be installed in the new Operations/Equipment building (assuming a new O/E building is constructed, a new sludge handling system is installed and the sludge holding tank is converted to additional FEQ volume).

- New blowers to be upgraded to Robuschi model RBS 66-H

We concur that new blowers should be installed. We understand that the existing units have been in operation for nearly 10 years and that the new units include air bearings that significantly reduce maintenance cost and provide extended life cycle.

- Relocate existing RAS and MLSS controls to new Operations/Equipment building

We agree that the existing RAS and MLSS controls should be moved to the new Operations/Equipment building (assuming a new O/E building is constructed).

- Existing chemical (methanol) storage cabinet and metering pumps to be relocated outside the new Operations/Equipment building

We concur that the existing chemical (methanol) storage cabinet and metering pumps should be moved to the new Operations/Equipment building (assuming a new O/E building is constructed).

- Existing chemical (chlorine) storage cabinet and metering pumps to be relocated outside the new Operations/Equipment building

We agree that the existing chemical (chlorine) storage cabinet and metering pumps should be moved to the new Operations/Equipment building (assuming a new O/E building is constructed).

- Flow Meter

- Add additional remote-read flow meters for all influent lines

We agree that individual flow meters should be installed on all the influent lines from Inscription Canyon Ranch and Preserve at the Ranch, Whispering Canyon and Talking Rock. The installation of individual flow meters will allow the District to monitor flows from each development and evaluate recorded flow data in real time.

- Aeration

- Not necessary with installation of anoxic reactor noted above, but may be prudent based on previous discussions and concerns expressed by the plant operator and the previous Board.

We understand that there have been numerous discussions and concerns expressed by the plant operator and the previous board. Although, since recent operational changes have been made, we understand that the existing WWTP is in general good working condition. We understand that additional aeration would be required for the proposed plant expansion to 90,000-gpd (0.090-MGD).

Task 2 – Prepare project budget for recommended program and an implementation timeline

A preliminary budget for proposed WWTP improvements is included below:

Engineering Services & ADEQ Review

No.	Description	Quantity	Unit	Unit Cost	Total
1	Plans, Specifications & APP Amendment	1	L.S.	\$ 20,000	\$ 20,000
2	Develop Closure Plan for SBR	1	L.S.	\$ 5,000	\$ 5,000
3	ADEQ Review Fees	1	L.S.	\$ 15,000	\$ 15,000
Subtotal					\$ 40,000

Site Improvements

No.	Description	Quantity	Unit	Unit Cost	Total
4	SBR Demolition & Closure	1	L.S.	\$ 10,000	\$ 10,000
5	New Driveway Culvert Structure w/Concrete Headwalls	1	L.S.	\$ 10,000	\$ 10,000
6	Site Grading (Old SBR Site & Polishing Pond)	12,000	C.Y.	\$ 4	\$ 48,000
7	Site Paving & Parking Improvements (3"AC/6"ABC)	875	S.Y.	\$ 30	\$ 26,250
8	New 6' CMU Screen Wall	174	L.F.	\$ 50	\$ 8,700
9	New 38'x38' O/E Building (Metal)	1440	S.F.	\$ 50	\$ 72,000
10	Remodel Old O/E Building for Administrative Use	1	L.S.	\$ 10,000	\$ 10,000
Subtotal					\$ 184,950

Process & Control Improvements

No.	Description	Quantity	Unit	Unit Cost	Total
11	Convert SHT to second FEQ including base connection	1	L.S.	\$ 1,000	\$ 1,000
12	New Sludge Holding Tank	1	L.S.	\$ 60,000	\$ 60,000
13	New Sludge Bagging System	1	L.S.	\$ 100,000	\$ 100,000
14	Retrofit Aeration Reactors for higher flows 65K - 90K	1	L.S.	\$ 25,000	\$ 25,000
15	New controls for FEQ pumps installed in new building	1	L.S.	\$ 7,500	\$ 7,500
16	New blowers Robuschi model RBS 66-H	1	L.S.	\$ 15,000	\$ 15,000
17	New controls for RAS & MLSS installed in new building	1	L.S.	\$ 1,500	\$ 1,500
18	Add additional remote-read flow meters for all influent lines	1	L.S.	\$ 20,000	\$ 20,000
19	Freight to the job site	1	L.S.	\$ 7,500	\$ 7,500
20	Construction Labor & Startup	1	L.S.	\$ 40,000	\$ 40,000
Subtotal					\$ 277,500

Total **\$ 502,450**
10% Contingency **\$ 50,245**
Project Total **\$ 552,695**

A preliminary implementation timeline for proposed improvements is outlined below.

Description	Duration	Start	End
Plans, Specifications & APP Amendment	1 Year	August 20, 2012	August 20, 2013
Construct Site Improvements	3 Months	September 2, 2013	November 29, 2013
Construct Process Improvements	3 Months	December 2, 2013	February 28, 2014
Construct Control Improvements	1 Month	March 3, 2014	March 28, 2014
As-Built Plans & Approval to Operate	1 Month	March 31, 2014	May 2, 2014

Task 3 – Consider future plant expansion(s)

We believe an expansion to 90,000-gpd (0.090-MGD), a 44% increase in current capacity, would be a reasonable goal for the District based on historical flow data. Historical data suggests that the unit flow rate per residence is less than 80-gpd. The data also suggests that at the current rate of increase in average daily flow, an expansion to 90,000-gpd (0.090-MGD) would be adequate for years to come (refer to updated capacity analysis spreadsheet from Bob Busch).

Recommended WWTP upgrades consider a number of site improvements including decommissioning the old SBR facility, construction of a new O/E building and remodeling of the existing O/E building, a number of process improvements, and system control improvements.

A detailed site plan of proposed expansion upgrades is included in Appendix B. A summary of the suggested plant expansion is included below.

1. Site Improvements

- 1.1. File a closure plan for the old SBR with an explanation and/or reason for leaving part of the old SBR (concrete basins) in place

We believe the closure plan should be done in order to properly decommission this obsolete facility. Remnants of the old SBR are a major hindrance to site development and future plant expansion(s).

- 1.2. Install new culvert structure at driveway entrance

The existing culvert structure consists of two (2) 30” corrugated metal pipes located immediately downstream from two (2) 36” culverts. We recommend the culverts be replaced to match the upstream structure, with concrete headwalls to improve flow transition through the structure.

- 1.3. Site grading (old SBR concrete tanks and polishing pond)

Site grading is recommended to flatten the area where the concrete basins are located and filling in the old polishing pond. This will create a significant amount of usable space on the site for additional parking, future building(s) and future plant expansion(s).

- 1.4. Paving and parking improvements

Paving and parking improvements are recommended to improve site access, parking availability and dust abatement.

- 1.5. Screen wall along south property line

A screen wall along the south property line will provide a buffer for the adjacent residential property. This wall will provide both visual and noise buffering.

1.6. New Operations/Equipment Building (located at the old SBR concrete tank site)

It is recommended that a new O/E building be constructed at the site of the old SBR concrete tank site. This would create a larger buffer from adjacent residential properties and may be necessary to contain a new sludge handling system. This building would also contain the control systems for the existing WWTP. Please note that it is possible for the new sludge handling system to be located within or adjacent to the existing O/E building with construction of a shed roof to cover the equipment.

1.7. Remodel existing O/E building for administrative use

It is recommended that the existing O/E building be remodeled and used for administrative purposes including records and database storage, and a venue for the Board to hold regular meetings.

2. Process Improvements

2.1. Construct new sludge handling system (interim bagging system)

A new sludge handling system would improve plant operations and reduce sludge disposal costs. Based on the reduced operating costs we believe installation of a new sludge handling system could be recovered in approximately 5 years. We recommend that a sludge bagging unit be installed in the new O/E building based on the reduced operating costs and long term savings that would be realized by the District. It is possible that this could be constructed either within or adjacent to the existing O/E building with construction of a shed roof to cover the equipment.

2.2. Additional Flow Equalization

This requires conversion of the existing sludge holding tank to an additional FEQ basin. The additional volume of the sludge holding tank would double the flow equalization volume. This is a practical and effective use of this current asset. A new sludge holding tank will be installed for a total cost of approximately \$65,000.

2.3. Aeration

Additional aeration is necessary for a plant expansion to 90,000-gpd (0.090-MGD).

2.4. Tertiary Treatment

Tertiary treatment will be required for A+ quality effluent as desired by the District or as mandated by ADEQ. The existing plant yields B+ effluent, although the recently amended APP requires A+ effluent. We believe the plant expansion should be permitted for B+ since it is consistent with the currently operating plant. If the Board desires to treat effluent to an A+ standard they can do so by installing tertiary treatment; although we believe this would be an unnecessary, self-imposed burden as it is not required for golf irrigation. The cost to install this additional process is approximately \$150,000.

3. System Control Improvements

3.1. New Plant Controls, Controllers, Alarm Systems & Blowers

It is recommended that new controls for the Flow Equalization (FEQ) pumps, the existing RAS and MLSS feeds, the existing chemical (methanol) storage cabinet and metering pumps, and the existing chemical (chlorine) storage cabinet and metering pumps be moved to the new O/E building. Consideration of possible freezing must be given to locating storage of chemicals outside the building, especially outside of the cabinet. New blowers should also be installed in the new O/E building (the new units will significantly reduce maintenance cost and provide extended life cycle).

3.2. Flow Meters

It is recommended that individual flow meters be installed on all the influent lines from Inscription Canyon Ranch and Preserve at the Ranch, Whispering Canyon and Talking Rock. The installation of individual flow meters will allow the District to monitor flows from each development and evaluate recorded flow data in real time.

Generally, a WWTP is planned for upgrade when the annual average daily flow reaches 80% design capacity. In addition, there are many other factors to consider when determining the point of action including historical flow records, growth rates and schedule to design, permit and construct a new plant. Historical flow records and growth rates are monitored on a quarterly basis as part of the reporting requirements for the APP. This flow monitoring should establish the appropriate time to begin construction of future plant expansions. Scheduling for future additional plant expansions must consider design and permitting times.

Task 4 – Consider whether the improvements will require ADEQ approval, and the impact of modification of the present APP

The previous Aquifer Protection Permit (APP) does not allow for expansion or upgrading of the existing plant. To change the APP back to the Santec treatment process, a complete design submittal must be made showing the existing plant along with specific design elements for future expansion phases. The significant amendment must note the ultimate capacity based on projected flow data and any portion of the existing WWTP that will be used for ultimate capacity must also be described.

At the present time there is no provision to allow for flexible phasing (meaning the size of future phases will be determined based on need at a future time). A significant amendment to the current APP must be completed noting the size and configuration of the existing plant and proposed upgrade modifications. When future expansion is required yet again, another significant amendment will be required based on the proposed expansion capacity and technology to be used.

ADEQ has also expressed concern over preserving the existing site approvals and setbacks. The existing variances platted over the properties within the 500-ft setback distance from the plant (sanitary easement) must be included with the significant amendment. Based on our research, only the portion of the WWTP within Section 28 was platted with a 500-ft noise and odor waiver (Tract 'A') as noted on the final plat recorded in Book 34, Page 79 of the YCRO. This issue will need to be researched further during the significant amendment process.

Effluent quality will need to be addressed in the significant amendment as well. ADEQ will need to make a new determination as to whether B+ effluent will be acceptable based on the current APP status. The significant amendment will need to clearly explain the current use, effluent storage volumes, water balance, etc. We believe the plant expansion should be permitted for B+ effluent since it is consistent with the currently operating WWTP. If the Board desires to treat effluent to an A+ standard, they can do so by installing tertiary treatment outside of the APP. Although we believe this would be an unnecessary, self-imposed burden as it is not required for golf irrigation.

The significant amendment must include a closure plan with an explanation and/or reason for leaving part of the old SBR (concrete basins) in place. It is possible the concrete basins could be incorporated as part of the future facility. Any equipment that has been previously removed must be identified and addressed in the significant amendment. The closure plan is required for decommissioning a permitted facility. The closure plan may be noted as a partial plant closure, as required, and must be included in the compliance schedule established in the significant amendment. The closure plan must include specified dates for all items, including the date that full closure will be accomplished. If the concrete basins are incorporated as part of the new facility, a subsequent closure plan will need to be filed. The closure plan may include removing or filling in the existing concrete basin(s) and constructing a new O/E building over the top. By leaving the lower portion of the basin(s) in place, beneath the new O/E building, it may be possible to avoid post closure monitoring and associated expenses.

C. CONCLUSIONS

We believe an expansion to 90,000-gpd (0.090-MGD), a 44% increase in current capacity, would be a reasonable goal for the District based on historical flow data. The data suggests that the unit flow rate per residence is less than 80-gpd. The data also suggests that at the current rate of increase in average daily flow, an expansion to 90,000-gpd (0.090-MGD) would be adequate for years to come (refer to updated capacity analysis spreadsheet from Bob Busch).

Generally, a WWTP is planned for upgrade when the annual average daily flow reaches 80% design capacity. In addition, there are many other factors to consider when determining the point of action including historical flow records, growth rates and schedule to design, permit and construct a new plant. Historical flow records and growth rates are monitored on a quarterly basis as part of the reporting requirements for the APP. This flow monitoring should establish the appropriate time to begin construction of future plant expansions. Scheduling for future additional plant expansions must consider design and permitting times.

In order to change the APP back to the Santec treatment process, a complete design submittal must be made showing the existing plant along with specific design elements for future expansion phases. The significant amendment must note the ultimate capacity based on projected flow data and any portion of the existing WWTP that will be used for ultimate capacity must also be described.

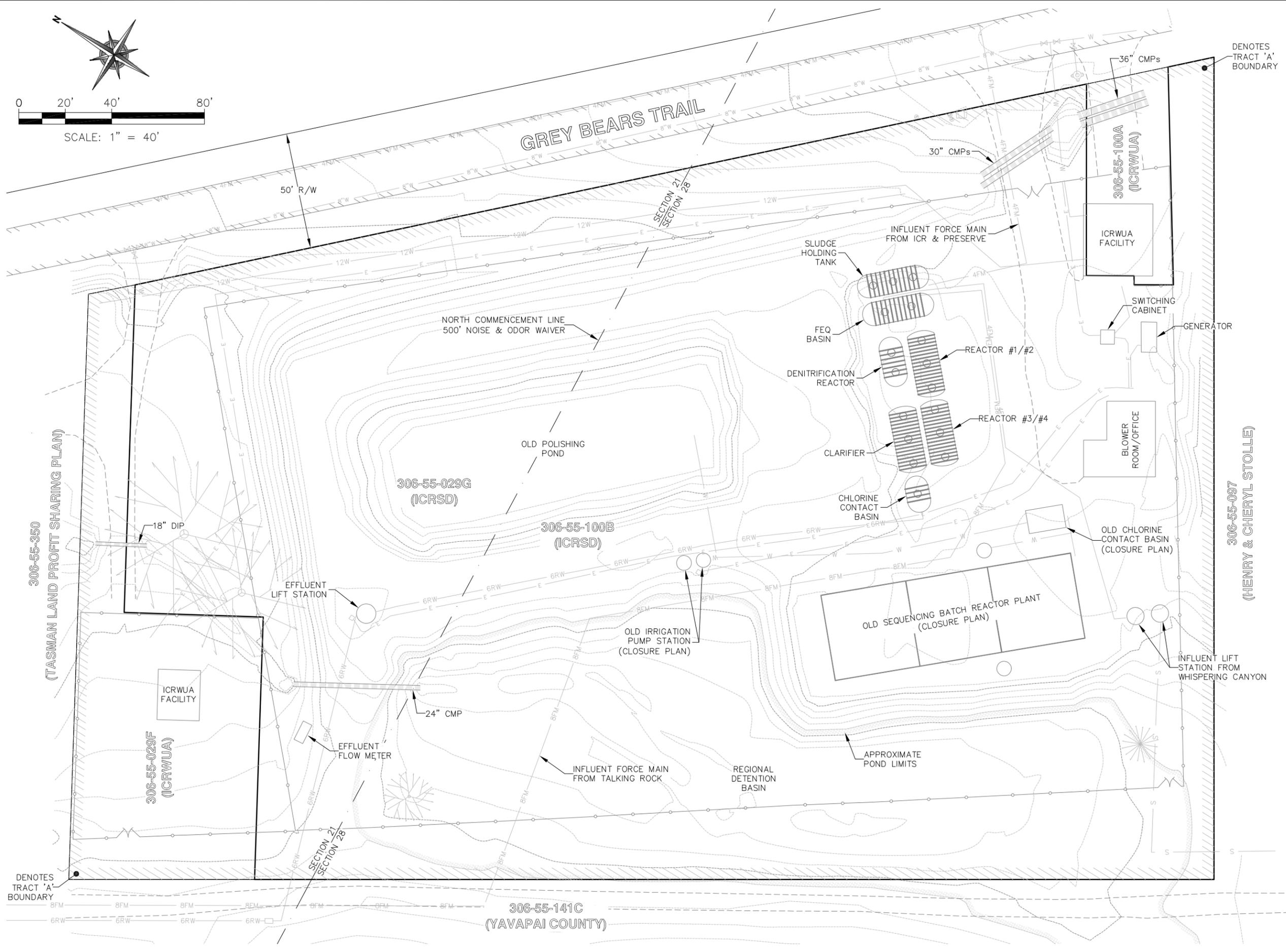
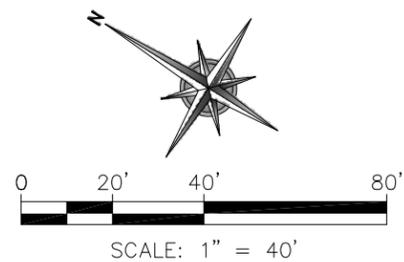
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The existing variances platted over the properties within the 500-ft setback distance from the plant (sanitary easement) must be included with the significant amendment. Based on our research, only the portion of the WWTP within Section 28 was platted with a 500-ft noise and odor waiver (Tract 'A') as noted on the final plat recorded in Book 34, Page 79 of the YCRO. This issue will need to be researched further during the significant amendment process.

ADEQ will need to make a new determination as to whether B+ effluent will be acceptable based on the current APP status. The significant amendment will need to clearly explain the current use, effluent storage volumes, water balance, etc. We believe the plant expansion should be permitted for B+ effluent since it is consistent with the currently operating WWTP. If the Board desires to treat effluent to an A+ standard, they can do so by installing tertiary treatment outside of the APP. Although we believe this would be an unnecessary, self-imposed burden as it is not required for golf irrigation.

The significant amendment must include a closure plan for the old SBR. The closure plan is required for decommissioning a permitted facility. The closure plan may include removing or filling in the existing concrete basin(s) and constructing a new O/E building over the top. By leaving the lower portion of the basin(s) in place, beneath the new O/E building, it may be possible to avoid post closure monitoring and associated expenses.

***APPENDIX A
EXISTING WWTP SITE PLAN***



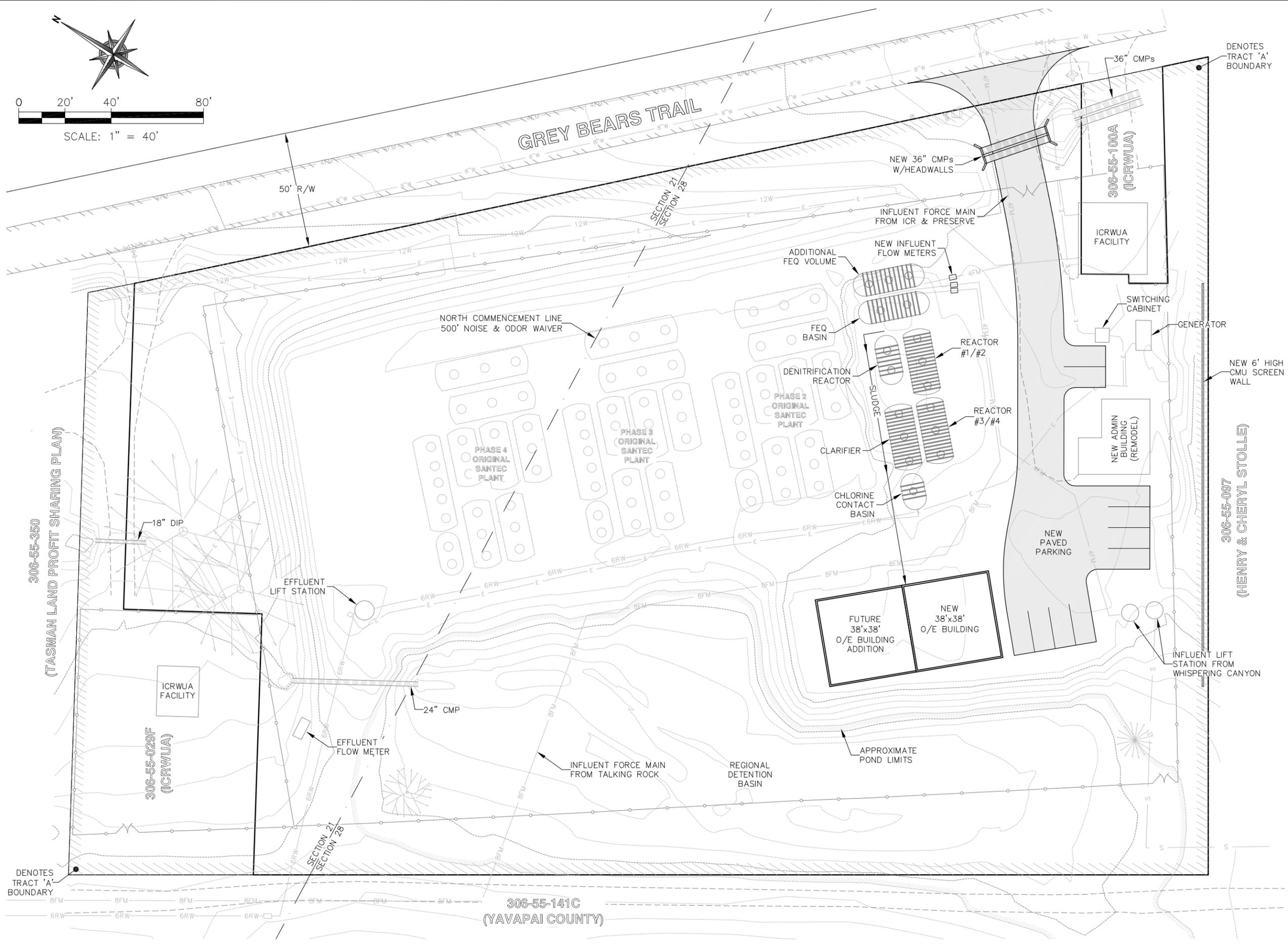
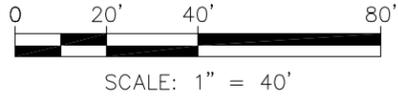
**EXISTING WWTP
SITE PLAN
APN: 306-55-029G & 100B**

DESIGN: DB	GBE JOB #11097
CHECKED: DB	DATE: MAY 2012
PREPARED FOR: INSCRIPTION CANYON RANCH SANITARY DISTRICT	

GRANITE BASIN
ENGINEERING, INC.
1981 Commerce Center Circle, Suite B
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**SCHEMATIC
FOR EXHIBIT
PURPOSES ONLY**

***APPENDIX B
PROPOSED WWTP SITE PLAN***



**PROPOSED WWTP
SITE PLAN
APN: 306-55-029G & 100B**

DESIGN: DB	PREPARED FOR: INSCRIPTION CANYON RANCH SANITARY DISTRICT
CHECKED: DB	GBE JOB #11097 DATE: MAY 2012

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**SCHEMATIC
FOR EXHIBIT
PURPOSES ONLY**