Community & Economic
Development Department
www.adcogov.org

ADAMS COUNTY
COLORADO

4430 South Adams County Parkway
1st Floor, Suite W2000B
Brighton, CO 80601-8218
PHONE 720.523.6800
FAX 720.523.6967

Development Review Team Comments

Date: 1/4/19
Project Number: RCU2018-00060
Project Name: Watkins South Compressor Station

For submission of revisions to applications, a cover letter addressing each staff review comments must be provided. The cover letter must include the following information: restate each comment that require a response and provide a response below the comment; respond to each comment with a description of the revisions and the page of the response on the site plan. And identify any additional changes made to the original document other than those required by staff.

A re-submittal is required. Please submit 1 hard copy and 1 electronic copy to the Community and Economic Development Department front desk with the re-submittal form.

An additional 20% review fee will be required after the third review and upon submittal of the fourth review.

Commenting Division: Development Services, Planning
Name of Reviewer: Emily Collins
Email: ecollins@adcogov.org

PLN1. REQUEST: A Conditional Use Permit for an oil and gas compressor station.
- a. Equipment will be located on a 10 acre portion of the site and will include 4 compressors, slug catcher, metering, dehydration tower (49' tall), process vent flare (65' tall), up to 60' communications tower, MCC buildings, fuel tanks, and pump skid.
- b. The facility is unmanned with proposed operation for five years.

PLN2. SITE ZONING/ HISTORY:
- a. PIN 0181700000107 (approximately SE corner of E. Colfax Ave and Manilla Rd)
- b. Designated Agriculture-3 (A-3) and is approximately 160 acres. The proposed compressor station would occupy 10 acres.
- c. The site is located in the Airport Influence and Noise Overlays (AIZ and ANO). A determination of no hazard to air navigation is required from the FAA concerning the proposed height of the process vent flare structure. **The applicant provided documentation from the FAA with the application demonstrating no hazard to air navigation.**

BOARD OF COUNTY COMMISSIONERS
Eva J. Henry — DISTRICT 1
Charles "Chaz" Tedesco — DISTRICT 2
Erik Hansen — DISTRICT 3
Steve O'Dorisio — DISTRICT 4
Mary Hodge — DISTRICT 5

d. The entire parcel is located in Restriction Area One for the Colorado Air and Space Port. Per Section 3-34-05-01, no structures designed for full or part-time occupation for residential, commercial, institutional, or industrial uses shall be permitted.

PLN3. FUTURE LAND USE:

a. Designation is Mixed Use Employment which is intended to allow a mixture of employment uses, including offices, retail, and clean, indoor manufacturing, distribution, warehousing, and airport and technology uses.

PLN4. COMMENTS:

a. Please submit a draft development agreement for staff review (similar to the Powhaton Compressor Station requirements).
b. Please provide a supplemental site plan showing the location of the 10 acres on the overall site. Please include the setbacks from the lease area boundary to all adjacent property lines.
c. Please provide height and setbacks for all structures to the nearest property line on the site plan. This can be provided in a table format on the site plan.
d. Please identify the 10' easement shown on the site plat (i.e. easement grantee/ purpose of easement).
e. Please provide the approximate distance from the towers to the nearest residential dwelling.
f. Please update the legal description to just the 10 acre lease area.
g. A landscape and screening plan was submitted with the application for staff review:
    - One area of landscape (17' wide) is proposed along the southern lease boundary. Visual mitigation should be provided from the north and east (closest to Colfax Ave and the residential uses). Please note all vegetation on site can be included in the overall 10% requirement.
    - Please provide the proposed fence elevations on the landscape plan.
    - See show location of proposed water-tank on site plan. Provide height of water tank structure.
h. Please provide a response to all referral comments, especially any proposed mitigation measures for the towers to reduce wildlife disruption and how the fence design complies with CPW recommendations and if the site requires firefighting water supply.
i. An ambient sound study was submitted with the application materials. This included a map of the monitoring locations. Average noise levels ranged between 45 and 47 dBA closest to the compressor station site which is in compliance with the maximum levels for the A-3 zone district (75-80 dBA).

PLN5. ANTICIPATED CONDITIONS OF APPROVAL:

a. Expiration date
b. Development Agreement to address pre-construction requirements, construction and operational standards, etc. The agreement must incorporate all referral agency comments/ requirements (Tri-County, Xcel, CDOT, CPW, Fire, Colorado Air and Space Port)
c. Right-of-way dedication (70 ft along Manilla Rd.).

d. Signed and recorded aviation easement prior to issuance of building permits
e. Building and access permits
f. Landscape and screening plan installation date
g. Tracking pad (via CDOT comments)

Commenting Division: Development Services, Engineering:
Name of Review: Greg Labrie
Email: glabrie@adcogov.org

ENG1: No comments.

Commenting Division: Development Services, Right-of-Way:
Name of Review: Eden Steele
Email: esteele@adcogov.org

ROW1: Manilla Road is classified as a Major Arterial road per the 2012 Adams County Master Transportation Plan. As such it should have a half right-of-way width of 70 feet. Since the existing half right-of-way width is 0 feet, 70 feet of additional right-of-way will need to be dedicated as a condition of approval.

ROW2: The property needs an address assignment. Please submit an access/CLV permit along with an address request form http://www.adcogov.org/documents/row-address-request-form. Address will be assigned during the access permit review and is based on the approved access location.

Commenting Division: Development Services, Building Safety:
Name of Review: Justin Blair
Email: jblair@adcogov.org

BSD1- Building permits would be required. Engineered plans will be required to obtain permits.
BSD2- Applicant should refer to commercial and industrial submittal requirements.
BSD3- Current adopted codes are the 2012 International Building Codes, 2006 International Energy Code, and the 2014 National Electrical Code.
BSD4- Applicant should contact Fire Department for their requirements.

COLORADO
Parks and Wildlife
Department of Natural Resources

Northeast Regional Office
6060 Broadway
Denver, CO 80216
P 303.291.7227 | F 303.291.7114

December 14, 2018

Emily Collins
Adams County
Community and Economic Development Department
4430 South Adams County Parkway, Suite W2000A
Brighton, CO 80601-8216

RE: Conditional Use Permit to allow Watkins South Compressor Station in the Agricultural-3 (A-3) Zone District (RCU2018-00060)

Dear Ms. Collins:

Thank you for the opportunity to comment on the proposed Watkins South Compressor Station. The mission of Colorado Parks and Wildlife (CPW) is to perpetuate the wildlife resources of the state, to provide a quality state parks system, and to provide enjoyable and sustainable outdoor recreation opportunities that educate and inspire current and future generations to serve as active stewards of Colorado's natural resources. Our goal in responding to land use proposals such as this is to provide complete, consistent, and timely information to all entities who request comment on matters within our statutory authority.

The proposed Watkins South Compressor Station, on a 10-acre portion of parcel number 0181700000107, is located on the east side of Manilla Road and the south side of East Colfax Avenue, Adams County, Colorado. The proposed compressor station is surrounded by agricultural lands and major highways.

District Wildlife Manager Serena Rocksund recently analyzed this site. The main impacts to wildlife from this development include fragmentation and loss of habitat. Fragmentation of wildlife habitat has been shown to impede the movement of big game species across the landscape. Open space areas are more beneficial to wildlife if they connect to other natural areas. The areas of wildlife habitat that most closely border human development show heavier impact than do areas on the interior of the open space. However, when open space areas are smaller in size, the overall impact of the fragmentation is greater (Odell and Knight, 2001). By keeping open space areas contiguous and of larger size the overall benefit to wildlife increases dramatically.

CPW would expect a variety of wildlife species to utilize this site on a regular basis, most notably, small to mid-sized mammals, songbirds, and raptors. The potential also exists for large mammals such as deer to frequent this site. Raptors and other migratory birds are protected from take, harassment, and nest disruption at both the state and federal levels. If an active nest is discovered within the development area, CPW recommends that buffer zones

Bob D. Broscheid, Director, Colorado Parks and Wildlife • Parks and Wildlife Commission: Robert W. Bray • Matthew Burkett • Charles Garcia • Marie Haskett
Carrie Besnette Hauser • John Howard, Chair • Marvin McDaniel • Colleen Peppler • Jennifer Rieke Taylor • James Vigil, Secretary • Michelle Zimmerman, Vice-Chair

around nest sites be implemented during any period of activity that may interfere with nesting season. This will prevent the intentional or unintentional destruction of an active nest.

For further information on this topic, a copy of the document "Recommended Buffer Zones and Seasonal Restrictions for Colorado Raptors," is available from your local District Wildlife Manager or located at https://cpw.state.co.us/Documents/WildlifeSpecies/LivingWithWildlife/RaptorBufferGuidelines2008.pdf.
Following the recommendations outlined in this document will decrease the likelihood of unintentional take through disturbance.

If a prairie dog colony is discovered within the project area, the potential may also exist for the presence of burrowing owls. Burrowing owls live on flat, treeless land with short vegetation, and nest underground in burrows dug by prairie dogs, badgers, and foxes. These raptors are classified as a state threatened species and are protected by both state and federal laws, including the Migratory Bird Treaty Act. These laws prohibit the killing of burrowing owls or disturbance of their nests. Therefore, if any earth-moving will begin between March 15th and October 31st, a burrowing owl survey should be performed. Guidelines for performing a burrowing owl survey can also be obtained from your local District Wildlife Manager or found at https://cpw.state.co.us/Documents/WildlifeSpecies/LivingWithWildlife/RecommendedSurveyOwls.pdf.

If prairie dog colonies are present, CPW recommends they either be captured alive and moved to another location or humanely euthanized before any earth-moving occurs. The possibility of live-trapping and donating to a raptor rehabilitation facility or the black-footed ferret recovery program may also exist. If interested, please contact the local District Wildlife Manager. Be aware that a permit and approval from county commissioners may be required for live relocation.

CPW understand there is a proposed communication antenna up to 60-foot. The amount of habitat disrupted by the communication antenna should not be significant to wildlife in Adams County. However, communication towers themselves may have negative impacts on flying birds. It is estimated that 4-5 million flying birds are killed each year in the United States when they collide with communication towers. We appreciate any efforts that are made to mitigate any possible impacts to passing birds. The U.S. Fish and Wildlife Service developed guidelines on communication towers in order to address some of the impacts. Some of these guidelines may not apply in this case. However, a summary of a few of those guidelines are listed below:

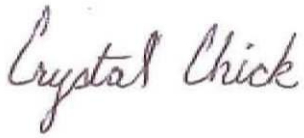
1. Guy wires should have daytime visual markers on the wires to avoid collisions.
2. Any on-ground security lighting should be down-shielded to keep light within the boundaries of the site.
3. Towers no longer in use should be removed within 12 month of cessation of use.

CPW recommends all site lights be motion-activated and downward-directed to minimize light pollution for active nocturnal or resting diurnal wildlife species.

CPW recommends the installation of an exclusionary fence, at least seven-feet in height plus 2 strands of top wire, to prevent deer form accessing the station. CPW recommends a smooth top to the fence (e.g., no top barbed wire or exposed metal rods) to prevent wildlife from impaling themselves or entanglement if they attempt to cross into the station. The bottom of the fence shall be four inches or less from the ground. CPW has developed a document, https://cpw.state.co.us/Documents/LandWater/PrivateLandPrograms/FencingWithWildlifeInMind.pdf, to assist with choosing the correct type of fencing to allow or restrict wildlife movement.

Thank you again for opportunity to comment on the Watkins South Compressor Station, in Adams County. Please do not hesitate to contact us again about ways to continue managing the station in order to maximize wildlife value while minimizing potential conflicts. If you have any further questions, please contact District Wildlife Manager Serena Rocksund at (303) 291-7132 or serena.rocksund@state.co.us.

Sincerely,



Crystal Chick
Area 5 Wildlife Manager

Cc: M. Leslie, T. Kroening, S. Rocksund

December 19, 2018

Emily Collins
Community & Economic Development
4430 South Adams County Parkway
Brighton, Colorado 80601-8218

RE: Watkins South Compressor Station, RCU2018-00060
TCHD Case No. 5307

Dear Ms. Collins,

Thank you for the opportunity to review and comment on the Conditional Use Permit to allow a compressor station in the A-3 zone district, located southeast of Colfax Avenue and Manilla Road. Tri-County Health Department (TCHD) staff has reviewed the application for compliance with applicable environmental and public health regulations and principles of healthy community design. After reviewing the application, TCHD has the following comments.

Air Quality Permitting
Air pollutant emissions including flares are regulated by the Colorado Department of Public Health and Environment. Vapor recovery equipment should be used to control the release of vapors into the environment. The use of green completion technology is strongly encouraged at every site. If the site is to use multiple flares and combustors, the oil and gas industry permits should include a regulatory analysis determining the applicability of state and federal air quality permitting requirements and air pollution control regulations for the proposed emissions source(s). More information as well as all forms can be found online at https://www.colorado.gov/pacific/cdphe/all-permits.

Above Ground Storage Tanks
Fuel is often stored onsite at oil and gas sites. All storage tanks must have a secondary containment area, a routine monitoring system to check for leaks, and best management practices implemented in order to prevent the release of contaminants into the soil and water supplies.

Traffic Safety
Oil and gas production and monitoring wells involve significant truck traffic to and from a site during the construction and drilling process. TCHD commends the applicant for including traffic control in their best management practices and TCHD encourages the County to designate a primary traffic route for all construction traffic and deliveries. If the trucks servicing the site will be traveling on a local school bus route, we encourage the County to work with the applicant to minimize traffic during hours when school buses are in operation.

Noise

Regular exposure to elevated sound levels can have a negative impact on both physical and mental health by increasing the risk of stress, hearing impairment, hypertension, ischemic heart disease, and sleep disturbance. Colorado's noise abatement statute (CRS 25-12-103) sets maximum permissible noise levels for various land uses at different time periods. Noises that exceed these levels are considered to be a public nuisance. Noise levels from commercial uses are considered a public nuisance if they exceed 60 db(A) beyond 25 feet of the property boundary during the day (7 a.m. – 7 p.m.). At night (7 p.m. - 7 a.m.), the nuisance level is 55 db(A). Although an Ambient Sound Level Survey was included in the submittal, a noise analysis should be conducted to evaluate the potential impact of noise from the proposed use to surrounding areas. TCHD recommends that the applicant consider how noise mitigation measures could aid in the mitigation of nuisance noises. These measures could include setbacks, sound walls, vegetative barriers, construction design, operational practices, or similar measures.

Please feel free to contact me at 720-200-1575 or kboyer@tchd.org if you have any questions on TCHD's comments.

Sincerely,



Kathy Boyer, REHS
Land Use and Built Environment Specialist III

cc: Sheila Lynch, Dylan Garrison, TCHD

Bennett-Watkins Fire Rescue

District Office: 303-644-3572 Fax: 303-644-3401
355 4th Street, Bennett, CO 80102
Email: Info@BennettFireRescue.org
"Striving to Preserve Life and Property"

December 3rd, 2018

Emily Collins
Adams County Planning & Development
4430 South Adams County Parkway
1st Floor - Suite W2000A
Brighton, CO 80601-8216

Re: RCU2018-00060 Watkins South Compressor Station

Manager Collins,
In regards to the RCU2018-00060 Watkins South Compressor Station case, Bennett –Watkins Fire Rescue (BWFR) is providing this letter of comments for Adams County as follows:

- The proposed development shall be submitted to BWFR for required fire plan review and permitting processes.
- Approved KNOX fire department key hardware shall be provided on facility vehicle and gate access points.
- All roadways and driveways serving the development shall conform to and meet the requirements in the adopted International Fire Code 2012 edition as adopted by Adams County, including Appendix D.
- It is possible that one or more of the buildings on site will trigger a requirement for an approved NFPA compliant firefighting water supply to be maintained on site. The applicant should enter into dialogue with BWFR to determine these requirements.

If you have any other questions or concerns, please feel free to contact me. Thanks!

Thank You



Captain Caleb J. Connor
Life Safety Division
Bennett-Watkins Fire Rescue
303-644-3572 - Headquarters / 720-893-7672 - Direct
www.BennettFireRescue.org

Emily Collins

From: Bob Lewan
Sent: Thursday, November 29, 2018 9:03 AM
To: Emily Collins
Subject: RE: RCU2018-00060 Watkins South Compressor Station Request for Comments

Emily
Even though the FAA has determined that this structure offers no hazard to air navigation, they do acknowledge that it does penetrate the 40:1 departure slope for runway 17. Being this close to the arrival and departure ends of the runway, the airport would like to see a red obstruction light mounted to the top of the antenna structure. These lights can be solar powered LED so running electricity to the tower would be unnecessary. They typically cost less than $400.00.
Thanks

Bob Lewan | Deputy Air and Space Port Director, **Colorado *Air and Space Port***
Adams County, Colorado | 5200 Front Range Parkway | Watkins, CO 80137
303-261-9103 | Fax: 303-261-9195
blewan@adcogov.org | www.adcogov.org | www.coloradoairandspaceport.com

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From: Emily Collins
Sent: Wednesday, November 28, 2018 11:26 AM
To: Bob Lewan; Land Use; Caleb J. Connor; brandyn.wiedrich@centurylink.com; eliza.hunholz@state.co.us; serena.rocksund@state.co.us; thomas_lowe@cable.comcast.com; pbinney@ci.aurora.co.us; pingrum@aurora.org; Simmonds, Craig; George, Donna L; linda.bruce@faa.gov; Director@bennettrec.org; mmeier@up.com; robinp@bsd29j.com; tom.reed@flydenver.com
Subject: RCU2018-00060 Watkins South Compressor Station Request for Comments

Good Afternoon:

Please see the attached Request for Comments on the above case. Comments are due by **Wednesday, December 19th.**

Thank you for your review!

Emily Collins, AICP
Planner III, *Community and Economic Development*
ADAMS COUNTY, COLORADO
4430 South Adams County Parkway, W2000A
Brighton, CO 80601
o: 720-523-6820 | *ecollins@adcogov.org*
www.adcogov.org

Emily Collins

From: Loeffler - CDOT, Steven [steven.loeffler@state.co.us]
Sent: Tuesday, December 18, 2018 1:58 PM
To: Emily Collins
Subject: RCU2018-00060, Watkins South Compressor Station

Emily,

I have reviewed the referral named above requesting a CUP for an oil and gas compressor station in the A-3 zone district, located at approximately Manilla Rd. and E. Colfax Ave. and have the following comments:

- If any work associated with this compressor station will need to be done in the State Highway or Interstate Right-of-Way, a permit from our office will be required. Application can be made through our website at the following link: https://www.codot.gov/business/permits/utilitiesspecialuse/online-permit-application
- A tracking pad should be used prior to accessing Manilla Road. This will minimize the likelihood of any impact to the State Highway or Interstate.

Thank you for the opportunity to review this referral.

Steve Loeffler
Permits Unit

COLORADO
Department of Transportation
Region 1

P 303.757.9891 | F 303.757.9886
2829 W. Howard Pl. 2nd Floor, Denver, CO 80204
steven.loeffler@state.co.us | www.codot.gov | www.cotrip.org

Right of Way & Permits

1123 West 3rd Avenue
Denver, Colorado 80223
Telephone: **303.571.3306**
Facsimile: 303. 571. 3284
donna.l.george@xcelenergy.com

December 18, 2018

Adams County Community and Economic Development Department
4430 South Adams County Parkway, 3rd Floor, Suite W3000
Brighton, CO 80601

Attn: Emily Collins

Re: Watkins South Compressor Station, Case # RCU2018-00060

Public Service Company of Colorado's (PSCo) Right of Way & Permits Referral Desk has reviewed the conditional use permit documentation for **Watkins South Compressor Station**. The property owner/developer/contractor must complete the **application process** for any new electric service, or modification to the existing electric facilities in the area via FastApp-Fax-Email-USPS (go to: https://www.xcelenergy.com/start,_stop,_transfer/new_construction_service_activation_for_builders). It is then the responsibility of the developer to contact the Designer assigned to the project for approval of design details. Additional easements will need to be acquired by separate document for new facilities.

As a safety precaution, PSCo would like to remind the developer to call the **Utility Notification Center at 1-800-922-1987** to have all utilities located prior to any construction.

If there are any questions about this referral response, please contact me at (303) 571-3306 or donna.l.george@xcelenergy.com.

Donna George
Right of Way and Permits
Public Service Company of Colorado

Project Name: Watkins South Compressor Station
Project Number: RCU2018-00060

Development Review Team Comments
Dated: 1/4/19

Commenting Division: Development Services, Planning:

PLN4. COMMENTS

a. Please submit a draft development agreement for staff review (similar to the Powhaton Compressor Station requirements).

Response: Per an email between Scott Elery and Emily Collins on 01/22/19, it was determined that this is not required.

b. Please provide a supplemental site plan showing the location of the 10 acres on the overall site. Please include the setbacks from the lease area boundary to all adjacent property lines.

Response: An Overall Site Plan (WCSS-CE-102) has been added including the setbacks from all adjacent property lines (section or quarter section lines) to the lease boundary.

c. Please provide height and setbacks for all structures to the nearest property line on the site plan. This can be provided in a table format on the site plan.

Response: A Civil Site Setback Plan (WCSS-CE-104) has been added to provide the height and setbacks for all structures.

d. Please identify the 10' easement shown on the site plan (i.e. easement grantee / purpose of easement).

Response: All easements have been identified on the Site Plan. Some linework, including the 10' easement, was labeled in error and this has been corrected.

e. Please provide the approximate distance from the towers to the nearest residential dwelling.

Response: This distance has been provided on the Overall Site Plan.

f. Please update the legal description to just the 10-acre lease area.

Response: All site plans have been updated to include legal description to just the 10-acre lease area, as described on Exhibit "A" Compressor Station map.

g. A landscape and screening plan was submitted with the application for staff review:
   - One area of landscape (17' wide) is proposed along the southern lease boundary. Visual mitigation should be provided from the north and east (closest to Colfax Ave. and the residential uses). Please note all vegetation on site can be included in the overall 10% requirement.

     - *Response: This compressor station will be on site for only up to 5 years therefore we are requesting no landscaping as it will not continue to be maintained and die after the site is decommissioned.*

       For this location we are proposing an ornamental iron fence, 7 feet tall, with two smooth top wires across the top to comply with CPW's recommendations for wildlife protection.

       In the event this station is in place longer than five years, RMM agrees to submit formal landscaping and visual mitigation plans for the County's approval.

       Alternatively, in the event that the PC and BOCC require some form of landscaping at this time, we are including a landscaping with visual mitigation plan with this submittal. We plan to help with visual mitigation for the residential structures on the north east and north west corners with landscaping along the northern fence line, continuing south approximately one-third of the length the fence line on both the east and west fence lines. Plantings may include a mix of Austrian Black Pine, Amur Maple Flame, Burning Bush, Feather Reed Grass, and Harvest Brown Mulch.

   - Please provide the proposed fence elevations on the landscape plan.

     - *Response: Proposed fence elevations are included in the updated site plan drawing number WCSS-CE-501.*

   - See show location of proposed water-tank on site plan. Provide height of water tank structure.

     - *Response: Proposed water-tank location and structure details are included in the updated site plan drawing WCSS-CE-103.*

h. Please provide a response to all referral comments, especially any proposed mitigation measures for the towers to reduce wildlife disruption and how the fence design complies with CPW recommendations and if the site requires firefighting water supply.

   <u>Referral Summary</u>

   Colorado Parks and Wildlife
   Date: December 14, 2018

   If an active nest is discovered within the development area, CPW recommends that buffer zones around nest sites be implemented during any period of activity that may interfere with nesting season.

   Response: All required CPW protocols will be followed in the form of the monitoring and recording to CPW in the event of nesting activities. Buffer zones around any active nest sites will be implemented during any period of activity.

If any earth-moving will begin between March 15th and October 31st, a burrowing owl survey should be performed.

Response: All required CPW protocols will be followed in the form of the monitoring and recording to CPW in the event of burrowing owl activities. Buffer zones around any active nest sites will be implemented during any period of activity.

If prairie dog colonies are present, CPW recommends they either be captured alive and moved to another location or humanely euthanized before any earth-moving occurs.

Response: Should prairie dogs be present, they will be either moved to another location or humanely euthanized prior to any earth-moving activity.

The U.S. Fish and Wildlife Service developed guidelines on communication towers in order to address some of the impacts.

1. Guy wires should have daytime visual markers on the wires to avoid collisions.

   Response: Guy wires are not required as the communication tower is self-supported. See tower drawings included with this submittal.

2. Any on-ground security lighting should be down-shielded to keep light within the boundaries of the site.

   Response: This is an unmanned facility therefore minimal lighting is utilized following recommendations of the International Dark-Sky Association. To help minimize light pollution, all luminaries shall be Dark-Sky compliant, downcast and shielded at a 45° angle, provided with a cutoff shield, visor or shroud. All lights will be on-demand with the exception of a light illuminating the entrance doors to the PDC building and those will be downcast and shielded.

3. Towers no longer in use should be removed within 12 months of cessation of use.

   Response: All towers no longer in use shall be removed within 12 months of cessation of use.

CPW recommends that all site lights be motion-activated and downward-directed to minimize light pollution.

Response: This is an unmanned facility therefore minimal lighting is utilized following recommendations of the International Dark-Sky Association. To help minimize light pollution, all luminaries shall be Dark-Sky compliant, downcast and shielded at a 45° angle, provided with a cutoff shield, visor or shroud. All lights will be on-demand with the exception of a light illuminating the entrance doors to the PDC building and those will be downcast and shielded.

CPW recommends the installation of an exclusionary fence, at least seven-feet in height plus 2 strands of top wire, to prevent deer from access the station. CPW recommends a smooth top to the fence to prevent wildlife from impaling themselves or entanglement if they attempt to cross into the station. The bottom of the fence shall be four inches or less from the ground.

Response: For this location we are proposing an ornamental iron fence, 7 feet tall, with two smooth top wires across the top to comply with CPW's recommendations for wildlife protection.

Tri-County Health Department
Date: December 19, 2018

Air Quality Permitting
Vapor recovery equipment should be used to control the release of vapors into the environment. The use of green completion technology is strongly encouraged at every site. If the site is to use multiple flares and combustors, the oil and gas industry permits should include a regulatory analysis determining the applicability of state and federal air quality permitting requirements and air pollution control regulations for the proposed emissions sources(s).

Response: Rocky Mountain Midstream is in the process of obtaining all necessary air permits from CDPHE and will be obtained prior to the start of construction.

Above Ground Storage Tanks
Fuel is often stored onsite and oil and gas sites. All storage tanks must have a secondary containment area, a routine monitoring system to check for leaks, and best management practices implemented in order to prevent the release of contaminants in the soil and water supplies.

Response: Fuel will not be stored on site. In the event fuel might be needed, nothing greater than a five (5) gallon gas can will be used. The facility will operate using a small portion of the inlet natural gas as fuel for the inlet compressors and for the combustor.

Noise
Although an Ambient Sound Level Survey was included in the submittal, a noise analysis should be conducted to evaluate the potential impact of noise from the proposed use to surrounding areas.

Response: Rocky Mountain Midstream has consulted with sound engineers, to ensure all of their compressor facilities are designed to meet the noise decibel levels for site-specific areas and not to exceed local noise requirements.

Noise impacts from the facility will be reduced by enclosing compressors within buildings provided with acoustical insulation. Compressors will utilize horizontal coolers helping to direct the noise vertically instead of horizontally along the ground. The compressors utilize hospital-grade mufflers with quiet tipped fan blades to further reduce noise levels.

An ambient sound level survey was conducted as a base line for the compressor site and is included with this submittal.

A Noise Mitigation Plan is included to outline the process Rocky Mountain Midstream will follow in the event the site is out of compliance with surrounding noise compliance levels.

After the site has been built and fully operational additional testing will be performed to verify compliance.

Bennett-Watkins Fire Rescue
Date: December 3, 2018

The proposed development shall be submitted to BWFR for required fire plan review and permitting processes.

Response: Fire District Plan Review, dated December 13th, 2018, is included with this submittal. All referral comments from the Fire District have been addressed as noted in their comments below. Updated drawings addressing their requirements have been submitted to the Bennett-Watkins Fire District for their review. A draft of a site-specific Emergency Response Plan is also included with this submittal.

1. All aspects of this project shall be subject to approval by any and all other Authorities Having Jurisdiction as required.

   Response: Noted.

2. KNOX fire department gate access to the facility shall be provided/maintained at all times. Gate width shall not be less than 20ft minimum.

   Response: A Fencing Plan (WCSS-CE-501) has been added. This information has been referenced on that sheet.

3. Facility address and sign must be posted on a permanent sign and maintained at all times identifying the address, facility name, and facility contact information.

   Response: A note has been added to the Civil Site Plan (WCSS-CE-103).

4. Facility interior shall be maintained vegetation free gravel for the life of the facility.

   Response: A note has been added to the Erosion Control Plan (WCSS-CE-401).

5. Access road to facility shall be a width not less than 20 feet and comprised of Class 6 road base or better at a 6" depth. Right-of-way dedication (70 ft along Manilla Rd.).

   Response: A detail has been provided on the Grading and Drainage Plan (WCSS-CE-601) and the Site Access Road Plan and Profile (WCSS-CE-602).

6. Please show corrections and detail on plans for road composition and dimensions.

   Response: A detail has been provided on the Grading and Drainage Plan (WCSS-CE-601) and the Access Road Plan and Profile (WCSS-CE-602).

7. Please show gate detail showing compliance with minimum widths and IFC requirements.

   Response: The gate detail has been provided with the Landscape Plan. A note referencing those plans has been added to the Fencing Plan.

8. Please show corrections on plans for facility sign, KNOX gate access, and placarding.

   Response: Comments 1-7 have been addressed on plans as noted above.

9. A final inspection and system acceptance test (if applicable) shall be required before a facility shall be accepted and approved.

   Response: Noted.

Colorado Air and Space Port
Date: November 29, 2018

Being this close to the arrival and departure ends of the runway, the airport would like to see a red obstruction light mounted to the top of the antenna structure.

Response: As recommended, a red obstruction light will be mounted to the top of the antenna structure.

Colorado Department of Transportation (CDOT)
Date: December 18, 2018

If any work associated with this compressor station will need to be done in the State Highway or Interstate Right-of-Way, a permit from our office will be required.

Response: No construction for this facility will take place within the State Highway or Interstate Right-of-Way.

A tracking pad should be use prior to accessing Manilla Road.

Response: A tracking pad shall be used during construction of this facility. Tracking control is noted on site plan WCSS-CE-403, included with this submittal.

Xcel Energy Public Service Company
Date: December 18, 2018

The property owner / developer / contractor must complete the application process for any new electric service, or modification to the existing electric facilities in the area.

Answer: Rocky Mountain Midstream is currently working with Xcel for electrical needs of this facility.

i. An ambient sound study was submitted with the application materials. This included a map of the monitoring locations. Average noise levels ranged between 45 and 47 dBA closest to the compressor station site which is in compliance with the maximum levels for the A-3 zone district (75-80 dBA).

Response: Rocky Mountain Midstream has consulted with sound engineers, to ensure all of their compressor facilities are designed to meet the noise decibel levels for site-specific areas and not to exceed local noise requirements.

Noise impacts from the facility will be reduced by enclosing compressors within buildings provided with acoustical insulation. Compressors will utilize horizontal coolers helping to direct the noise vertically instead of horizontally along the ground. The compressors utilize hospital-grade mufflers with quiet tipped fan blades to further reduce noise levels.

An ambient sound level survey was conducted as a base line for the compressor site and is included with this submittal.

A Noise Mitigation Plan is included to outline the process Rocky Mountain Midstream will follow in the event the site is out of compliance with surrounding noise compliance levels.

After the site has been built and fully operational additional testing will be performed to verify compliance. In the event of non-compliance, Rocky Mountain Midstream will mitigate sound levels by adding further sound dampening materials to site-specific areas to ensure compliance with local noise requirements.

PLN5. ANTICIPATED CONDITIONS OF APPROVAL:

a. Expiration date.

Response: This is a temporary facility. The expiration date will be up to five years following BOCC approval.

b. Development Agreement to address pre-construction requirements, construction and operational standards, etc. The agreement must incorporate all referral agency comments / requirements (Tri-County, Xcel, CDOT, CPW, Fire, Colorado Air and Space Port).

Response: Per an email between Scott Elery and Emily Collins on 01/22/19, it was determined that this is not required.

c. Right-of-way dedication (70 ft. along Manilla Rd.).

Response: Rocky Mountain Midstream is in the process of securing a Right-of-Way dedication from the property owner.

d. Signed and recorded aviation easement prior to issuance of building permits.

Response: Rocky Mountain Midstream is in the process of securing a signed Aircraft Activity Covenant from the property owner.

e. Building and access permits.

Response:
Building - Engineering is still in the process of finalizing the drawings for this location.
Access - A permanent access permit will be applied for upon BOCC approval.

f. Landscape and screening plan installation date.

Response:
Landscaping – If landscaping is required, it shall be installed upon completion of construction. After BOCC approval, it will take approximately 4-6 months for construction to be completed.

Screening – An ornamental iron fence will be installed approximately 1-2 months prior to completion of construction.

g. Tracking pad (via CDOT comments).

Response. A tracking pad shall be used during construction of this facility as indicated on Site plan drawing number WCSS-CE-602. Vehicle tracking control installation and maintenance notes are included on site plan drawing number WCSS-CE-403.

Commenting Division: Development Services, Engineering:

ENG1: No comments.

Commenting Division: Development Services, Right-of-Way:

ROW1: Manilla Road is classified as a Major Arterial road per the 2012 Adams County Master Transportation Plan. As such it should have a half right-of-way width of 70 feet. Since the existing half right-of-way width is 0 feet, 70 feet of additional right-of-way will need to be dedicated as a condition of approval.

Response: Rocky Mountain Midstream is in the process of securing a Right-of-Way dedication from the property owner.

ROW2: The property needs an address assignment. Please submit an access / CLV permit along with an address request form http://www.adcogov.org/documents/row-address-request-form. Address will be assigned during the access permit review and is based on the approved access location.

Response: Following BOCC approval, an access / CLV permit application and address request form will be submitted to Adams County.

Commenting Division: Development Services, Building Safety:

BSD1 – Building permits would be required. Engineered plans will be required to obtain permits.

Response: Following BOCC approval, building permits will be applied for with Adams County.

BSD2 – Applicant should refer to commercial and industrial submittal requirements.

Response: Rocky Mountain Midstream will refer to commercial and industrial submittal requirements.

BSD3 – Current adopted codes are the 2012 International Building Codes, 2006 International Energy Code, and 2014 National Electrical Code.

Response: Rocky Mountain Midstream will adhere to all current codes.

BSD4 – Applicant should contact Fire Department for their requirements.

Response: Bennett-Watkins Fire District Plan Review, dated December 13th, 2018, is included with this submittal. All referral comments from the Fire District have been addressed as noted in their comments below. Updated drawings addressing their requirements have been submitted to the Bennett-Watkins Fire District for their review. A draft of a site-specific Emergency Response Plan is also included with this submittal.

Bennett-Watkins Fire District Plan Review

1. All aspects of this project shall be subject to approval by any and all other Authorities Having Jurisdiction as required.

   Response: Noted.

2. KNOX fire department gate access to the facility shall be provided/maintained at all times. Gate width shall not be less than 20ft minimum.

   Response: A Fencing Plan (WCSS-CE-501) has been added. This information has been referenced on that sheet.

3. Facility address and sign must be posted on a permanent sign and maintained at all times identifying the address, facility name, and facility contact information.

   Response: A note has been added to the Civil Site Plan (WCSS-CE-103).

4. Facility interior shall be maintained vegetation free gravel for the life of the facility.

   Response: A note has been added to the Erosion Control Plan (WCSS-CE-401).

5. Access road to facility shall be a width not less than 20 feet and comprised of Class 6 road base or better at a 6” depth. Right-of-way dedication (70 ft along Manilla Rd.).

   Response: A detail has been provided on the Grading and Drainage Plan (WCSS-CE-601) and the Site Access Road Plan and Profile (WCSS-CE-602).

6. Please show corrections and detail on plans for road composition and dimensions.

   Response: A detail has been provided on the Grading and Drainage Plan (WCSS-CE-601) and the Access Road Plan and Profile (WCSS-CE-602).

7. Please show gate detail showing compliance with minimum widths and IFC requirements.

   Response: The gate detail has been provided with the Landscape Plans (by others). A note referencing those plans has been added to the Fencing Plan.

8. Please show corrections on plans for facility sign, KNOX gate access, and placarding.

   Response: Comments 1-7 have been addressed on plans as noted above.

9. A final inspection and system acceptance test (if applicable) shall be required before a facility shall be accepted and approved.

   Response: Noted.

Additional information:

Flaring: Flaring is the controlled burning of natural gas. During the final stages of construction, up to a 30-foot flare will run periodically during testing over the course of 30 days. After testing is completed, flaring will occur approximately once every three months. Flaring is used to manage waste gas that cannot be efficiently captured and returned to the system for processing. A flare is an important safety device. In an emergency situation where equipment or piping becomes over-pressured, special valves on the equipment automatically release gas through flaring.

Option to Purchase: Rocky Mountain Midstream is planning on exercising an Option to Purchase an 80-acre portion located on the N2NW of Parcel 0181700000107. It is not anticipated that the purchase shall be completed prior to the BOCC of this application.

Safety Suite: The Safety Suite will provide a location for an operator to access station information and controls during site visits. The location of the Safety Suite is noted on updated site plan WCSS-CE-103

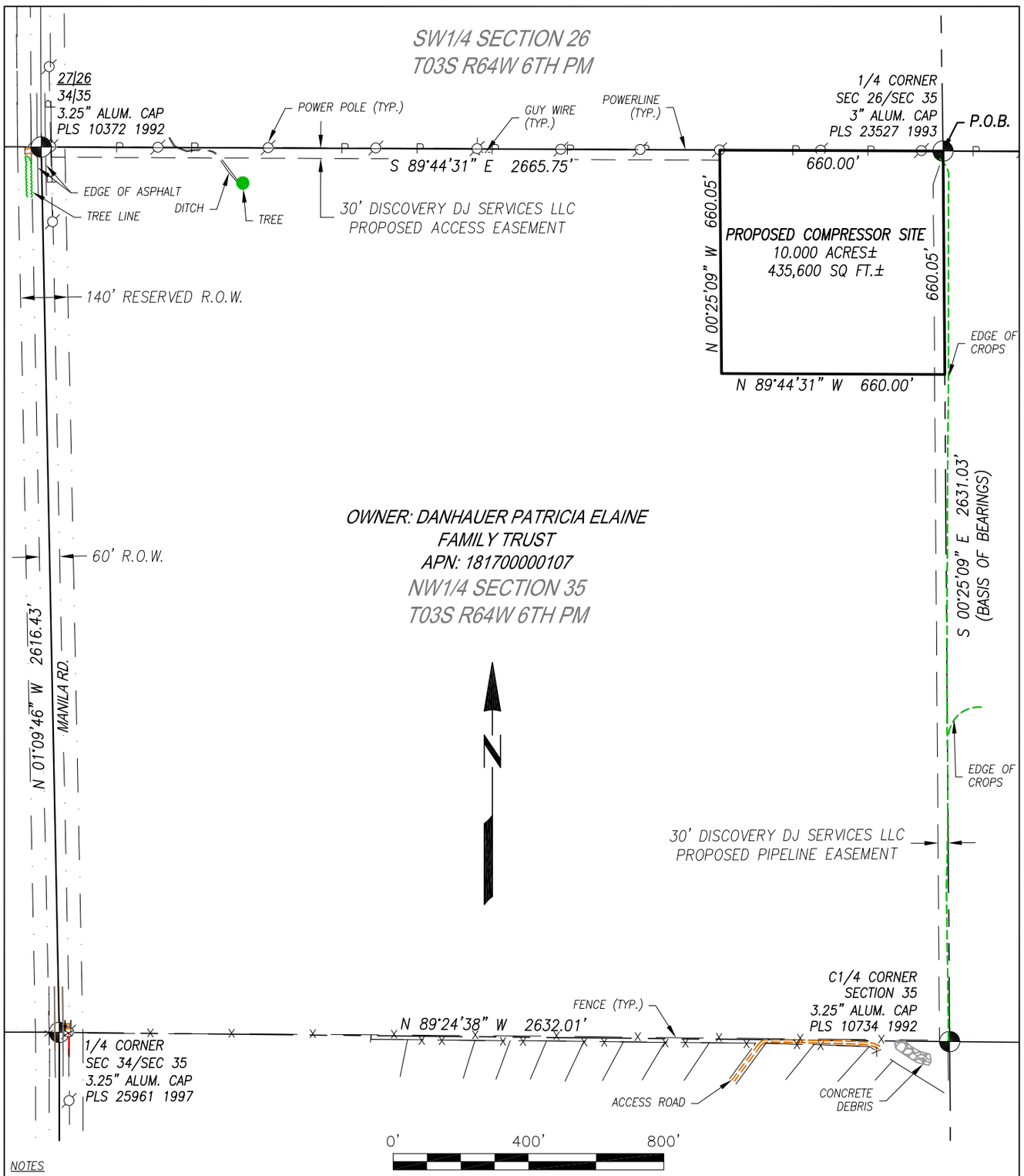
Because this station is unmanned, potable water is not required and is not proposed for this facility. Temporary personnel will have access to bottled water.

Sewage disposal is not required and is not proposed for this facility. Portable toilets will be placed on site and cleaned regularly.

Electrical requirements for the Safety Suite will be included as part of the site electrical requirements and the necessary permit application will be submitted.

Supplemental documents included with this submittal:

- Exhibit A Compressor Station Map
- Landscaping Plan
- Tower Design Drawing
- Ambient Noise Study
- Noise Mitigation Plan
- Fire District Plan Review
- Emergency Response Plan
- Updated Storm Drainage Study
- Updated Civil Drawings



NOTES

1.) LOCATIONS OF UTILITIES AND FOREIGN PIPELINES WERE DETERMINED FROM VISIBLE SURFACE EVIDENCE. THESE LOCATIONS IF SHOWN MAY NOT BE ACCURATE OR COMPLETE. OTHER UTILITIES MAY EXIST AND ARE TO BE FIELD LOCATED BY OTHERS PRIOR TO EXCAVATION.

2.) THIS EXHIBIT WAS PREPARED WITHOUT THE BENEFIT OF A TITLE COMMITMENT, THEREFORE ACKLAM, INC. HAS NOT RESEARCHED OR SHOWN ANY OTHER EASEMENTS, RIGHTS OF WAY, VARIANCES AND OR AGREEMENTS OF RECORD EXCEPT AS SHOWN HEREON.

3.) THIS EXHIBIT IS NOT A LAND SURVEY PLAT OR IMPROVEMENT SURVEY PLAT. EXCEPT FOR THE EASEMENT/RIGHT OF WAY DEPICTED HERON IT IS NOT TO BE RELIED UPON FOR THE DIVISION OF LAND, ESTABLISHMENT OF ANY LAND BOUNDARY, FENCE, BUILDING, OR OTHER FUTURE IMPROVEMENT LINES.

4.) BEARINGS SHOWN HEREON ARE BASED ON GPS OBSERVATIONS VIA "VRS NOW" POSITIONING SYSTEM AND/OR THE ONLINE POSITIONING USER SERVICE OFFERED BY THE N.G.S. AND PROJECTED TO "COLORADO COORDINATE SYSTEM OF 1983 NORTH ZONE" (C.R.S. 38-52-105 & 106). DISTANCES SHOWN HEREON ARE IN US SURVEY FEET GROUND. THE COMBINED FACTOR USED TO OBTAIN THE GRID DISTANCES IS 0.999725885.

5.) NOTICE: ACCORDING TO COLORADO LAW YOU MUST COMMENCE ANY LEGAL ACTION BASED UPON ANY DEFECT IN THIS SURVEY WITHIN THREE YEARS AFTER YOU FIRST DISCOVER SUCH DEFECT. IN NO EVENT MAY ANY ACTION BASED UPON ANY DEFECT IN THIS SURVEY BE COMMENCED MORE THAN TEN YEARS FROM THE DATE OF THE CERTIFICATION SHOWN HEREON.

6.) THIS EXHIBIT WAS PREPARED BY DOUGLAS W. CHINN, PLS 37070, FOR AND ON BEHALF OF ACKLAM, INC. 133 S. 27TH AVENUE, BRIGHTON, CO 80601.

7.) SEE THE ATTACHED DESCRIPTIONBY WHICH THIS REFERENCE IS MADE HEREOF.

PRELIMINARY
PRELIMINARY

Acklam, Inc.
133 S. 27th Avenue
Brighton, CO 80601

ROCKY MOUNTAIN MIDSTREAM, LLC
EXHIBIT "A" COMPRESSOR STATION
NW1/4 SECTION 35
T3S R64W 6TH PM, ADAMS COUNTY, COLORADO

SCALE: 1"=400'	
DATE: 10/19/18	KTH
JOB No.: 180023	
JOB NAME: WATKINS C.S	
SHEET 1 OF 2	
REV: A	DWC 01/21/19
AFE No.:	

FILE: Z:\ACKLAM JOBS\2018\DISCOVERY\180023 WATKINS COMP SITE\DRAWINGS\CO_AD_005WATKINS_DANHAUER_WATKINS_CS_REV_A.DWG PLOTTED: Jan 21, 2019 5:41am

DESCRIPTION – COMPRESSOR STATION

A PORTION OF THAT PARCEL DESCRIBED IN QUIT CLAIM DEED TO PATRICIA ELAINE DANHAUER FAMILY TRUST, FILED FOR RECORD IN THE OFFICE OF THE ADAMS COUNTY CLERK AND RECORDER AT RECEPTION NO. 2009000084336, SAID PARCEL LOCATED IN THE NORTHWEST ONE-QUARTER OF SECTION 35, TOWNSHIP 3 SOUTH, RANGE 64 WEST OF THE 6TH PRINCIPAL MERIDIAN, COUNTY OF ADAMS, STATE OF COLORADO DESCRIBED AS FOLLOWS:

BEGINNING AT THE NORTH ONE-QUARTER CORNER OF SAID SECTION 35, BEING A 3 INCH ALUMINUM CAP MARKED PLS 23527 1993, THENCE SOUTH 00°25'09" EAST, ALONG THE EAST LINE OF THE NORTHWEST ONE-QUARTER OF SAID SECTION 35, A DISTANCE OF 660.05 FEET;

THENCE NORTH 89°44'31" WEST, DEPARTING SAID LINE, A DISTANCE OF 660.00 FEET;

THENCE NORTH 00°25'09" WEST A DISTANCE OF 660.05 FEET, MORE OR LESS, TO THE NORTH LINE OF THE NORTHWEST ONE-QUARTER OF SAID SECTION 35;

THENCE SOUTH 89°44'31" EAST, ALONG SAID LINE, A DISTANCE OF 660.00 FEET TO THE **POINT OF BEGINNING**;

CONTAINING 10.000 ACRES(435600 SQUARE FEET) OF LAND, MORE OR LESS.

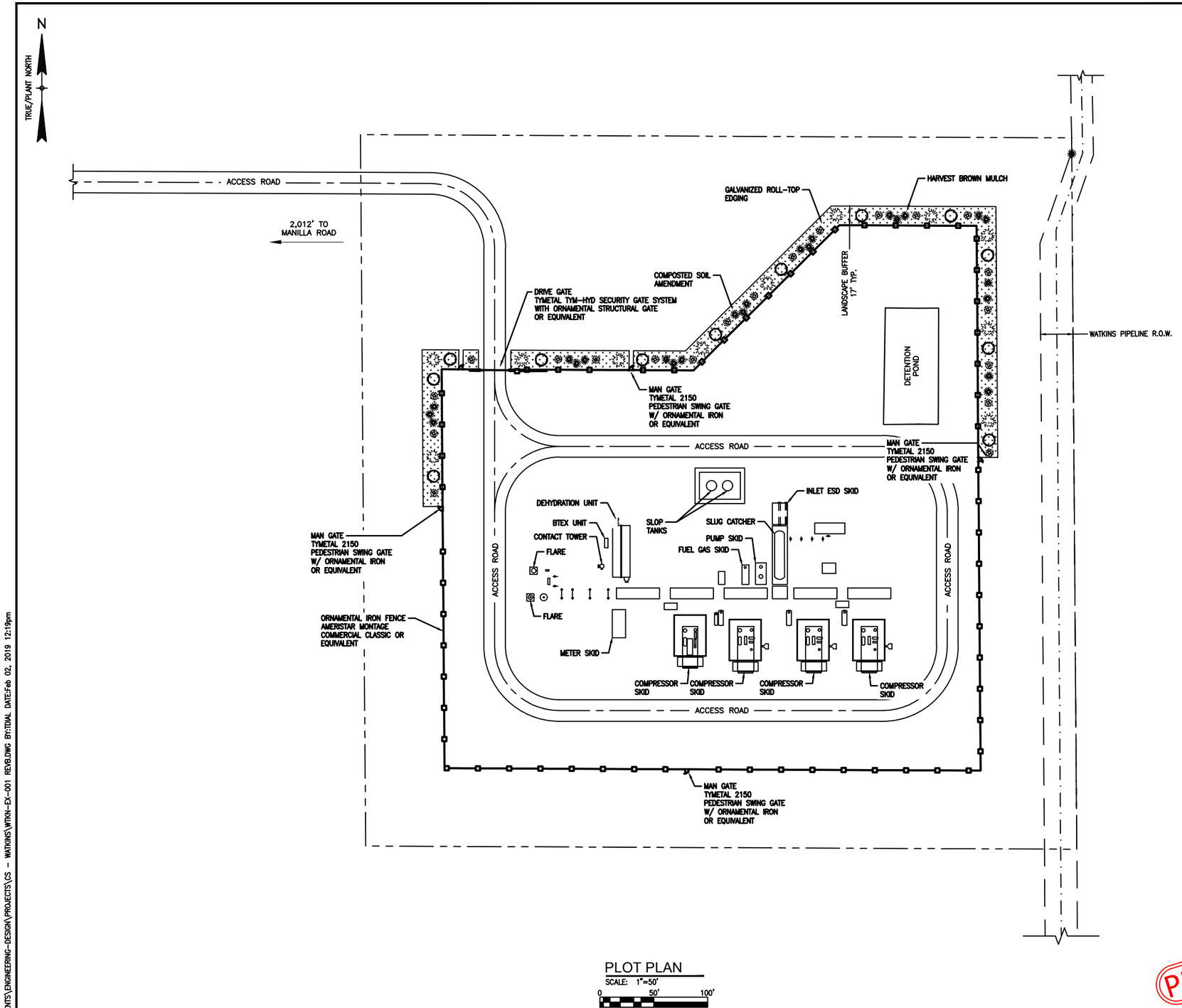
NOTES:

1. SEE THE ATTACHED EXHIBIT BY WHICH THIS REFERENCE IS MADE PART HEREOF.
2. THIS DESCRIPTION WAS PREPARED WITHOUT THE BENEFIT OF A TITLE COMMITMENT, THEREFORE ACKLAM, INC. HAS NOT RESEARCHED OR SHOWN ANY OTHER EASEMENTS, RIGHTS OF WAY, VARIANCES AND OR AGREEMENTS OF RECORD EXCEPT AS SHOWN HEREON.
3. BEARINGS SHOWN HEREON ARE BASED ON GPS OBSERVATIONS AND/OR THE ONLINE POSITIONING USER SERVICE OFFERED BY THE N.G.S. AND PROJECTED TO "COLORADO COORDINATE SYSTEM OF 1983 NORTH ZONE" (C.R.S. 38-52-105 & 106).
4. DISTANCES SHOWN HEREON ARE IN US SURVEY FEET GROUND. THE COMBINED FACTOR USED TO OBTAIN THE GRID DISTANCES IS 0.999725885.
5. THE BASIS OF BEARINGS FOR THIS SURVEY IS THE EAST LINE OF THE NORTHWEST ONE-QUARTER OF SECTION 35, TOWNSHIP 3 SOUTH, RANGE 64 WEST OF THE 6TH P.M., SAID LINE BEING MONUMENTED ON THE NORTH BY THE NORTH ONE-QUARTER CORNER OF SAID SECTION 35, BEING A 3 INCH ALUMINUM CAP MARKED PLS 23527 1993 AND ON THE SOUTH BY THE CENTER ONE-QUARTER CORNER OF SAID SECTION 35, BEING A 3.25 INCH ALUMINUM CAP MARKED PLS 10734 1992 AND BEARS SOUTH 00°25'09" EAST.

REVISIONS

NO.	DATE	BY	DESCRIPTION

PROJ. NO. 180023
PREPARED BY: DOUGLAS W. CHINN
DATE PREPARED: 01/21/19
FOR AND ON BEHALF OF ACKLAM, INC..
133 S. 27th AVENUE, BRIGHTON, CO 80601
303.659.6267
Danhauer_Watkins_CS.docx
PRINTED: 1/21/2019 5:39:00 AM Doug Chinn



PLOT PLAN
SCALE: 1"=50'
0 50' 100'

PRELIMINARY

PLANT LEGEND

SYMBOL	QTY.	BOTANICAL NAME	COMMON NAME	SIZE	LIFE EXPECTANCY (YRS)
	2	ACER GINNALA 'FLAME'	AMUR MAPLE 'FLAME'	2" B&B	50+
	8	PINUS NIGRA 'ARNOLD SENTINEL	AUSTRIAN PINE, ARNOLD SENTINEL	#20	50+
	16	EUONYMUS ALATAS 'COMPACTUS'	BURNING BUSH 'DWARF'	5 GAL.	20+
	24	CALAMAGROSTIS ACUTIFLORA 'KARL FOERSTER'	FEATHER REED GRASS	1 GAL	10+
			HARVEST BROWN MULCH		

FACILITY AREA

SITE AREA	SQ. FT.	% OF TOTAL	% OF LANDSCAPE
TOTAL AREA	435,361	100	N/A
LANDSCAPE AREA	10,506	2	N/A
LIVING MATERIAL AREA*	4,780	N/A	45
NON-LIVING MATERIAL AREA	5,746	N/A	55

* LIVING MATERIAL AREA ASSUMED AT PLANT MATURITY

PLANTING NOTES

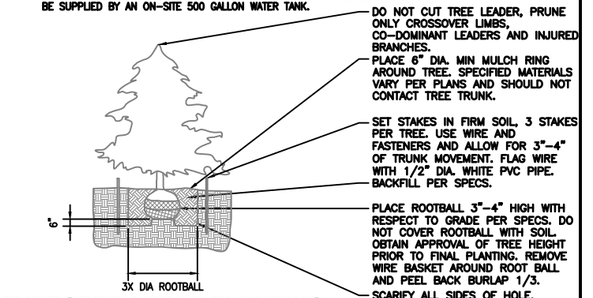
1. PLANT QUANTITIES ARE PROVIDED FOR CONTRACTOR'S CONVENIENCE ONLY AND SHALL BE VERIFIED BY CONTRACTOR BY REVIEWING PLANTING PLAN SYMBOLS.
2. CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING ALL PLANT MATERIAL INCLUDING SEEDED AREAS IN A HEALTHY STATE DURING CONSTRUCTION ANY DAMAGE TO PLANT MATERIAL DUE TO NEGLECT BY THE CONTRACTOR SHALL BE REPAIRED OR REPLACED AT THE CONTRACTORS EXPENSE.
3. ALL TREES TO BE MULCHED WITH HARVEST BROWN MULCH, DEPTH PER DETAIL.

MAINTENANCE NOTES

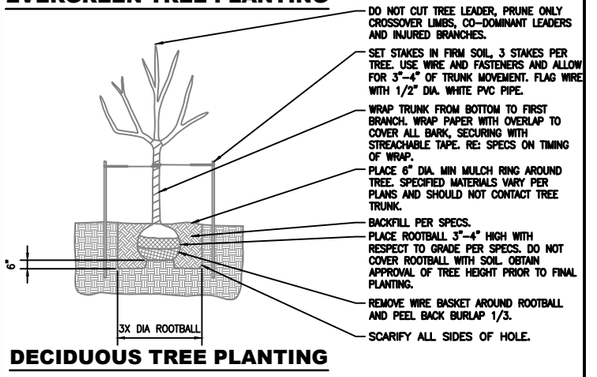
1. LIVING GROUND COVERS: LIVING GROUND COVERS MUST BE FIFTY PERCENT (50%) ESTABLISHED AFTER THE FIRST GROWING SEASON, AND NINETY PERCENT (90%) ESTABLISHED THEREAFTER.
2. NON-LIVING GROUND COVERS: NON-LIVING GROUND COVERS, SUCH AS ROCK OR MULCH MUST BE ONE HUNDRED PERCENT (100%) IN TACT AFTER ONE (1) YEAR AND EIGHTY PERCENT (80%) INTACT THEREAFTER.
3. TREES AND SHRUBS: TREES AND SHRUBS MUST HAVE A ONE HUNDRED PERCENT (100%) SURVIVAL RATE AFTER ONE (1) YEAR AND A NINETY PERCENT (90%) SURVIVAL RATE THEREAFTER.

IRRIGATION NOTES

1. ALL IRRIGATION WILL BE PROVIDED BY A DRIP IRRIGATION SYSTEM. SYSTEM IS TO BE SUPPLIED BY AN ON-SITE 500 GALLON WATER TANK.



EVERGREEN TREE PLANTING



DECIDUOUS TREE PLANTING

NOTES:

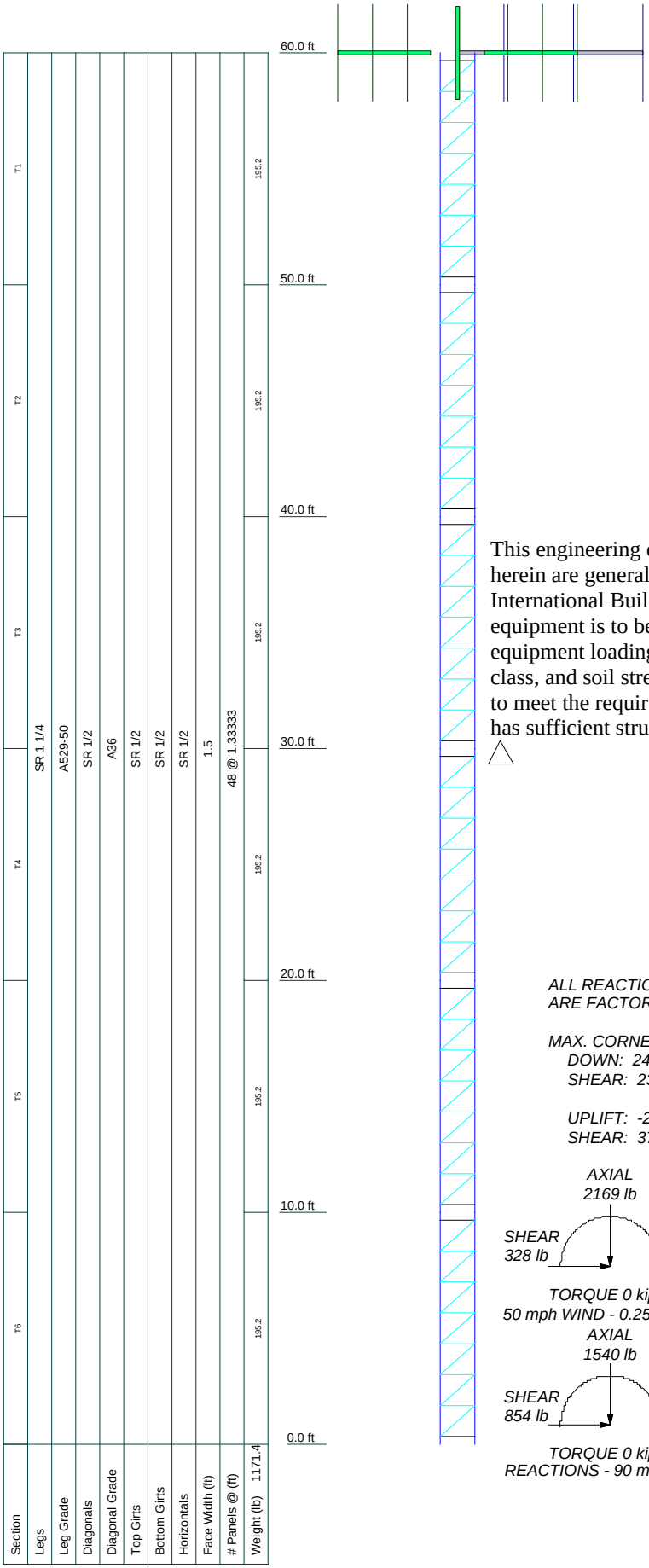
REFERENCE DRAWINGS		REVISIONS								APPROVALS		
											SIGNATURE	DATE
										DRAWN		
										CHECKED		
										APPROVED		
MONTAGE COMMERCIAL CLASSIC	MONTAGE COMMERCIAL CLASSIC 3/4-RAIL											
TYM-PED-2150	TYMETAL 2150 PEDESTRIAN SWING GATE	B	ISSUED FOR PERMIT	DRA	12/17/18	CJS	12/17/18	–	–			
TYM-HYD-S-ORN	TYM-HYD SECURITY DRIVE GATE	A	ISSUED FOR PERMIT	DRA	12/17/18	CJS	12/17/18	–	–			
DWG NO.	TITLE	REV	DESCRIPTION	BY	DATE	CHK BY	CHK DATE	APR BY	APR DATE			

ROCKY MOUNTAIN MIDSTREAM

WATKINS COMPRESSOR STATION
AFE: GTH010
INTERCONNECT SITE
SITE LANDSCAPING PLAN, NOTES & DETAILS

SCALE:	DRAWING NO.	REV.
AS NOTED	WTKN-EX-001	B

FILE PATH: C:\USERS\PUBLIC\DOCUMENTS\ENGINEERING-DESIGN\PROJECTS\CS - WATKINS\WTKN-EX-001 REV.B.DWG BY:TIDAL DATE:Feb 02, 2019 12:19pm



DESIGNED APPURTENANCE LOADING

TYPE	ELEVATION	TYPE	ELEVATION
Lightning Rod	60	Generic Yagi Antenna	60
Generic Yagi Antenna	60	Generic Yagi Antenna	60

MATERIAL STRENGTH

GRADE	Fy	Fu	GRADE	Fy	Fu
A529-50	50 ksi	65 ksi	A36	36 ksi	58 ksi

TOWER DESIGN NOTES

1. Tower is located in Adams County, Colorado.
2. Tower designed for Exposure C to the TIA-222-G Standard.
3. Tower designed for a 90 mph basic wind in accordance with the TIA-222-G Standard.
4. Tower is also designed for a 50 mph basic wind with 0.25 in ice. Ice is considered to increase in thickness with height.
5. Deflections are based upon a 60 mph wind.
6. Tower Structure Class II.
7. Topographic Category 1 with Crest Height of 0.00 ft
8. Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications.
9. Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards.
10. TOWER RATING: 52.6%

This engineering document is intended to be used as a sales tool. The engineering judgments herein are general in nature and are not intended to be site specific. Per section 107 of the International Building Code site specific drawings are required. Therefore, if or when this equipment is to be installed, a site specific analysis including site specific conditions (antenna equipment loading, elevations, wind speed, topographic factors, exposure coefficients, structure class, and soil strengths, ect) should be considered. DaVinci can provide site specific documents to meet the requirements of the building code and to ensure that the mounts, tower & foundation has sufficient structural capacity to support the proposed loading.

△

ALL REACTIONS ARE FACTORED

MAX. CORNER REACTIONS AT BASE:
DOWN: 24001 lb
SHEAR: 233 lb

UPLIFT: -23001 lb
SHEAR: 372 lb

AXIAL
2169 lb

SHEAR *328 lb* — *MOMENT* *12 kip-ft*

TORQUE 0 kip-ft
50 mph WIND - 0.2500 in ICE

AXIAL
1540 lb

SHEAR *854 lb* — *MOMENT* *31 kip-ft*

TORQUE 0 kip-ft
REACTIONS - 90 mph WIND

COLORADO LICENSED
SIMON W. LELAND
41108
PROFESSIONAL ENGINEER

7/27/2018

DaVinci Engineering, Inc.
191 S. House Rock Dr.
Cedar City, UT 84720
Phone: (805) 922-5221
FAX: (805) 880-0402

Job: **9918267-075**			
Project: **60-ft LDSST**			
Client: Gas Measurement Services	Drawn by: Simon W. Leland	App'd:	
Code: TIA-222-G	Date: 07/27/18	Scale: NTS	
Path: R:\Engineering Documents\TNX TOWER Files\Daley Tower 267\2018\18267-075.eri		Dwg No. E-1	

GENERAL NOTES:

1. THIS ENGINEERING DOCUMENT IS INTENDED TO BE USED AS A SALES TOOL. THE ENGINEERING JUDGMENTS HEREIN ARE GENERAL IN NATURE AND ARE NOT INTENDED TO BE SITE SPECIFIC. PER SECTION 107 OF THE INTERNATIONAL BUILDING CODE SITE SPECIFIC DRAWINGS ARE REQUIRED. THEREFORE, IF OR WHEN THIS EQUIPMENT IS TO BE INSTALLED, A SITE SPECIFIC ANALYSIS INCLUDING SITE SPECIFIC CONDITIONS (ANTENNA EQUIPMENT LOADING, ELEVATIONS, WIND SPEED, TOPOGRAPHIC FACTORS, EXPOSURE COEFFICIENTS, STRUCTURE CLASS, AND SOIL STRENGTHS, ECT) SHOULD BE CONSIDERED. DAVINCI CAN PROVIDE SITE SPECIFIC DOCUMENTS TO MEET THE REQUIREMENTS OF THE BUILDING CODE AND TO ENSURE THAT THE TOWER & FOUNDATION HAVE SUFFICIENT STRUCTURAL CAPACITY TO SUPPORT THE PROPOSED LOADING.

2. ALL STEEL SHALL MEET THE REQUIREMENTS OF THE "STANDARD SPECIFICATIONS FOR STRUCTURAL STEEL" ASTM A36, UNLESS OTHERWISE NOTED ON THE STRUCTURAL PLANS OR BELOW.

3. ALL SOLID ROUND BAR SHALL MEET THE REQUIREMENTS OF ASTM A529-50 OR A36 AS SPECIFIED ON THE DRAWING.

4. ALL WELDED CONNECTIONS SHALL CONFORM TO THE LATEST VERSION OF THE AMERICAN WELDING SOCIETY AWS D1.1 CODE. ALL WELD ELECTRODES OR WIRE SHALL AT A MINIMUM CONFORM TO AWS E81T1-Ni1CJ H8 ELECTRODES (80 KSI YIELD).

5. ALL EXPOSED STEEL SHAPES AND PLATES SHALL BE HOT-DIPPED GALVANIZED ACCORDING TO ASTM A123. ALL EXPOSED STEEL NUTS AND BOLTS AND ASSOCIATED HARDWARE SHALL BE HOT-DIPPED ACCORDING TO ASTM A153.

6. THE MAIN TOWER STRUCTURE SHALL BE FABRICATED BY DALEY TOWER. FABRICATION DRAWINGS SHALL BE SUBMITTED TO DAVINCI ENGINEERING FOR REVIEW AND APPROVAL.

7. ANY SUPPORT SERVICE PERFORMED BY THE ENGINEER OF RECORD DURING CONSTRUCTION SHALL BE DISTINGUISHED FROM CONTINUOUS AND DETAILED INSPECTION SERVICES, WHICH ARE FURNISHED BY OTHERS. THESE SUPPORT SERVICES PERFORMED BY THE ENGINEER OF RECORD ARE ONLY FOR THE PURPOSE OF ASSISTING IN THE QUALITY CONTROL AND IN ACHIEVING CONFORMANCE WITH THE CONTRACT DOCUMENTS. THIS SUPPORT DOES NOT GUARANTEE THE CONTRACTOR'S PERFORMANCE AND SHALL NOT BE CONSTRUED AS SUPERVISION OF CONSTRUCTION.

ERECTION NOTES:

8. THE CONTRACTOR SHALL INSTALL THE ANTENNA AND MOUNT AS REQUIRED BY THE OWNER.

9. ALL GALVANIZED SURFACES THAT ARE DAMAGED BY ABRASIONS, CUTS, DRILLING OR FIELD WELDING DURING SHIPPING OR ERECTION SHALL BE TOUCHED UP WITH TWO COATS OF A COLD GALVANIZING COMPOUND MEETING THE REQUIREMENTS OF ASTM A780.

BOLT INSTALLATION DETAILS:

10. INSTALLATION OF BOLTS: BOLTS FOR TOWER AND ANTENNA SHALL BE INSTALLED WITH THE NUTS FACING TO THE OUTSIDE AND/ OR TO THE TOP OF THE TOWER, UNLESS PROHIBITED BY LACK OF CLEARANCE.

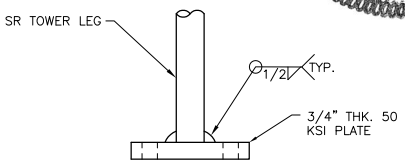
11. TIGHTENING OF FLANGE BOLTS: BASED ON SPECIFICATIONS FOR STRUCTURAL JOINTS USING ASTM A325 OR A490 BOLTS. FLANGES BOLTS SHALL BE INSTALLED IN PROPERLY ALIGNED HOLES AND TIGHTENED BY THE TURN OF THE NUT METHOD. THE TURN OF THE NUT METHOD IS DEFINED AS: BOLTS SHALL BE INSTALLED IN ALL HOLES OF THE CONNECTION, BROUGHT TO A SNUG TIGHT CONDITION (AS DEFINED BELOW). FOLLOWING THIS INITIAL OPERATION, ALL BOLTS IN THE CONNECTION SHALL BE TIGHTENED FURTHER BY THE FOLLOWING AMOUNT OF ROTATION.

FOR BOLT LENGTH UP TO AND INCLUDING 4 DIAMETERS:	1/3 TURN
FOR BOLT LENGTH OVER 4 DIAMETERS BUT LESS THAN 8 DIAMETERS:	1/2 TURN
FOR BOLT LENGTH OVER 8 DIAMETERS BUT LESS THAN 12 DIAMETERS:	2/3 TURN

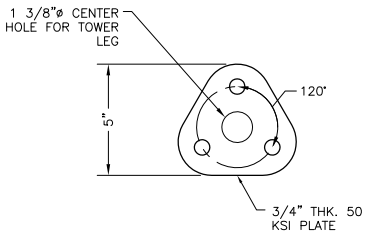
12. THE SNUG TIGHT CONDITION IS DEFINED AS THE TIGHTNESS THAT EXIST WHEN ALL PLIES IN A JOINT ARE IN FIRM CONTACT, THIS MAY BE ATTAINED BY A FEW IMPACTS OF AN IMPACT WRENCH OR THE FULL EFFORT OF A MAN USING AN ORDINARY SPUD WRENCH.

COLORADO LICENSED
SIMON W. LELAND
41108
PROFESSIONAL ENGINEER

7/27/2018



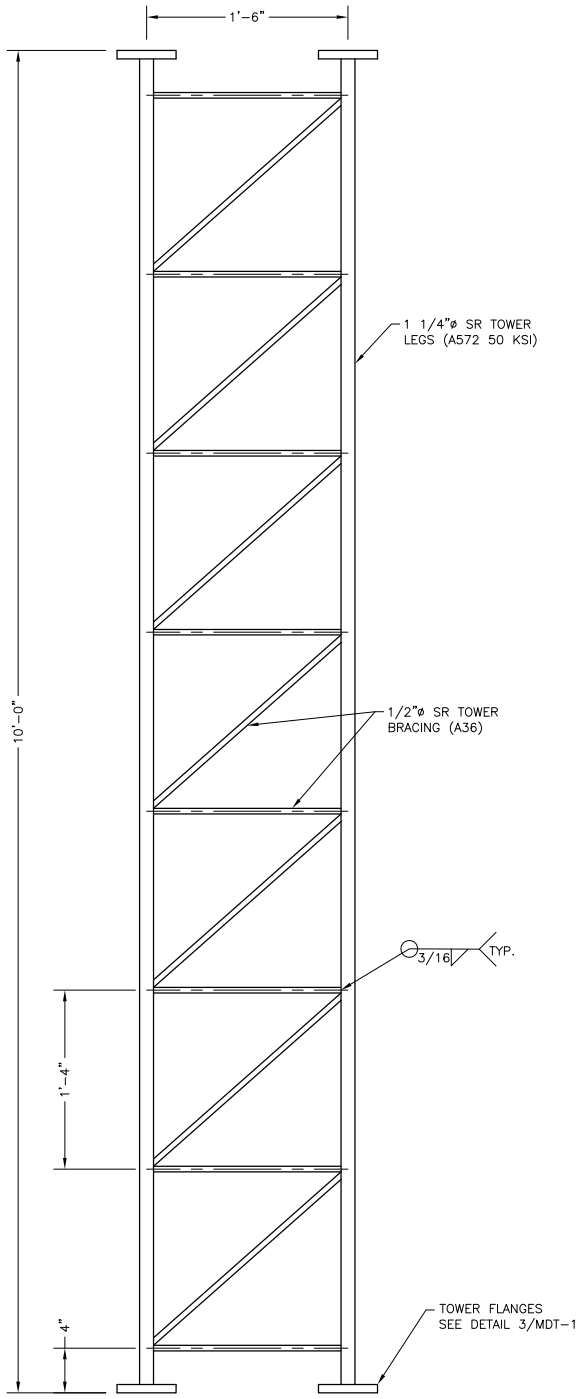
FLANGE WELD A / DT-1



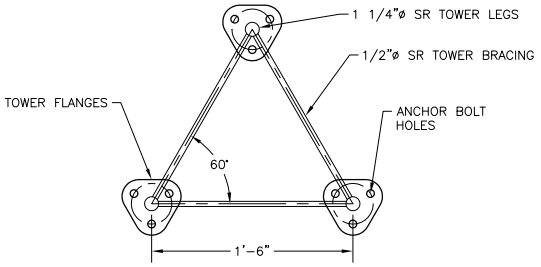
FLANGE LAYOUT 3 / DT-1

Additional Notes:

LIGHT DUTY SELF SUPPORT TOWER



TOWER ELEVATION 1 / DT-1
TYP. OF (3) FACES



TOWER SECTION 2 / DT-1

DaVinci Engineering, Inc.
191 S. HOUSE ROCK DR.
CEDAR CITY, UT 84720
(805) 922-5221

DALEY TOWER SERVICE, INC.
1223 West Gloria Switch Rd
Carencro, LA 70520
(337) 886-0995

Revision:	Description:	Date:

APPROVED FOR FABRICATION

By: _____ Date: _____

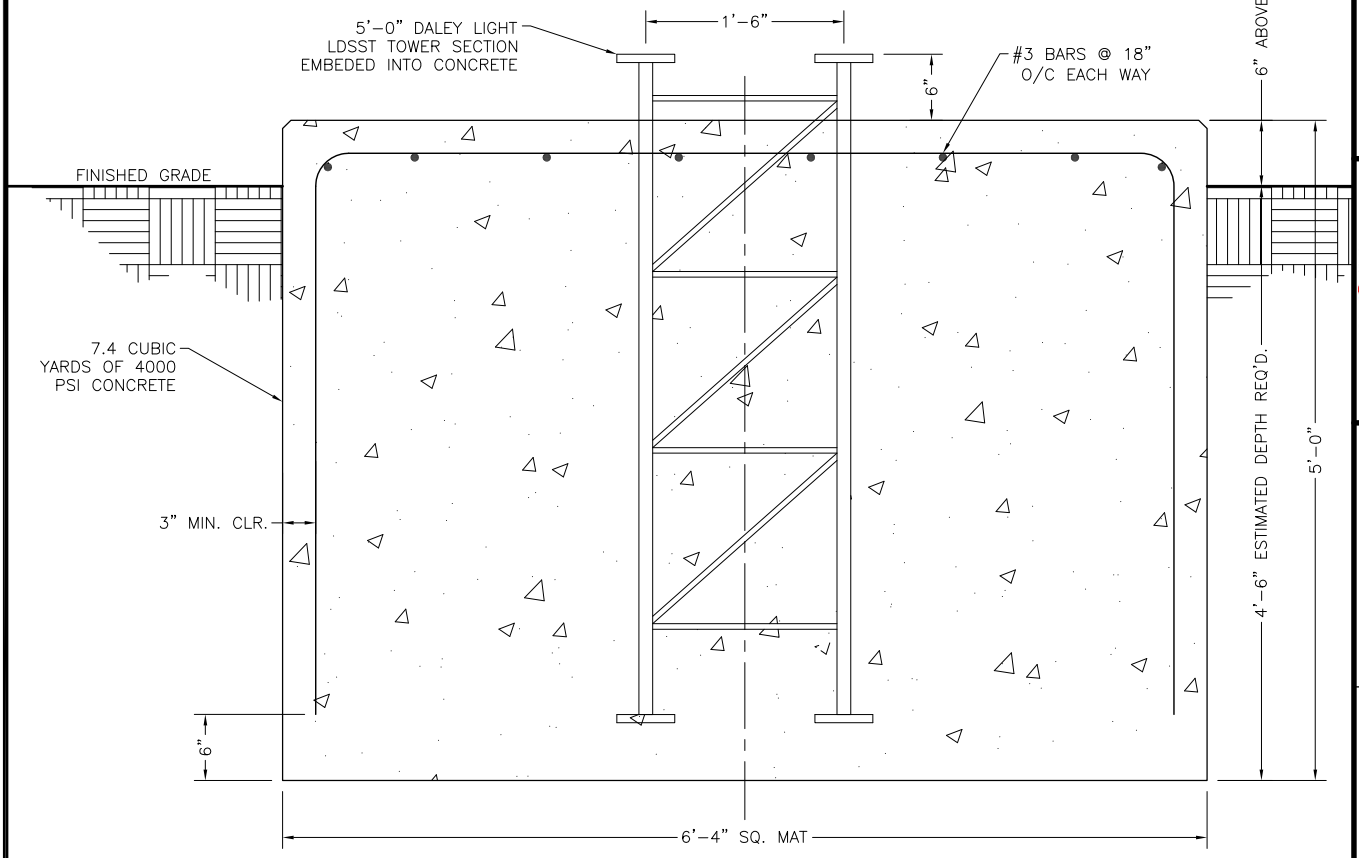
Site Name: ADAMS COUNTY
Site Location: ADAMS CO. COLORADO
Designed By: SWL
Drawn By: SWL
Date: 7/26/2018
Scale: NTS/_AS_NOTED

Project Description: LIGHT DUTY TOWER (LDSST)
Project Number: 991826?-075
DALEY TOWER 56170
Owner: DALEY TOWER

Sheet No.
DT-1

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DALEY TOWER
LDSST STANDARD MAT FOUNDATION



MAT FOUNDATION A DT-2

CENTERLINE OF TOWER SHALL BE LOCATED AT THE CENTERLINE OF THE FOUNDATION

FOUNDATION NOTES:

1. THIS ENGINEERING DOCUMENT IS INTENDED TO BE USED AS A SALES TOOL. THE ENGINEERING JUDGMENTS HEREIN ARE GENERAL IN NATURE AND ARE NOT INTENDED TO BE SITE SPECIFIC. PER SECTION 107 OF THE INTERNATIONAL BUILDING CODE SITE SPECIFIC DRAWINGS ARE REQUIRED. THEREFORE, IF OR WHEN THIS EQUIPMENT IS TO BE INSTALLED, A SITE SPECIFIC ANALYSIS INCLUDING SITE SPECIFIC CONDITIONS (ANTENNA EQUIPMENT LOADING, ELEVATIONS, WIND SPEED, TOPOGRAPHIC FACTORS, EXPOSURE COEFFICIENTS, STRUCTURE CLASS, AND SOIL STRENGTHS, ECT) SHOULD BE CONSIDERED. DAVINCI CAN PROVIDE SITE SPECIFIC DOCUMENTS TO MEET THE REQUIREMENTS OF THE BUILDING CODE AND TO ENSURE THAT THE TOWER & FOUNDATION HAVE SUFFICIENT STRUCTURAL CAPACITY TO SUPPORT THE PROPOSED LOADING.

2. FOUNDATION DESIGN IS BASED ON THE FOLLOWING ASSUMED SOIL VALUES:
   UNIT WEIGHT OF SOIL: 100 PCF
   ALLOWABLE BEARING CAPACITY: 2000 PSF
   ALLOWABLE LATERAL LOAD: 220 PSF/FT DEPTH
   GROUND WATER BELOW THE DEPTH OF THE FOUNDATION

3. ALL FOUNDATION CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 4000 PSI WITHIN 28 DAYS OF PLACEMENT. PROPORTIONING OF THE CONCRETE MIX SHALL BE DESIGNED BY AN APPROVED LABORATORY. COPIES OF EACH MIX SHALL BE SUBMITTED TO THE ENGINEER FOR REVIEW AND COMMENTS PRIOR TO PLACING ANY CONCRETE. CONCRETE SHALL HAVE A MAXIMUM WATER/CEMENT RATIO OF 0.46 AND SHALL BE AIR ENTRAINED 4.5% (±1.5%). ALL CONCRETE CONSTRUCTION SHALL BE IN ACCORDANCE WITH ACI 318, "THE BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE", LATEST EDITION. CEMENT SHALL BE TYPE V, LOW ALKALI, CONFORMING TO ASTM C-150. ALL AGGREGATE USED IN THE CONCRETE SHALL CONFORM TO ASTM C-33. USE ONLY AGGREGATES KNOWN NOT TO CAUSE EXCESSIVE SHRINKAGE. MAXIMUM AGGREGATE SIZE TO BE 1 1/2".

4. ALL REINFORCING STEEL SHALL CONFORM TO ASTM A615. PRIMARY REINFORCING BARS SHALL BE GRADE 40 OR BETTER. THE PLACEMENT OF ALL REINFORCEMENT SHALL CONFORM TO ACI 315, "MANUAL OF STANDARD PRACTICE FOR DETAILING REINFORCED CONCRETE STRUCTURES", LATEST EDITION, UNLESS OTHERWISE DETAILED ON THIS SHEET.

5. THE FOUNDATION HAS BEEN DESIGNED TO RESIST THE FOLLOWING FACTORED LOADS:
   MOMENT: 55 FT*KIPS
   SHEAR: 1.5 KIPS
   AXIAL MIN: 1.5 KIPS
   AXIAL MAX: 2.5 KIPS

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PROFESSIONAL ENGINEER

7/27/2018

Additional Notes:

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(805) 922-5221

DALEY TOWER SERVICE, INC.
1223 West Gloria Switch Rd
Carencro, LA 70520
(337) 886-0995

Revision: | Description: | Date:

APPROVED FOR FABRICATION

By: _____ Date: _____

Site Name: ADAMS COUNTY
Site Location: ADAMS CO. COLORADO
Designed By: SWL | Drawn By: SWL
Date: 7/26/2018
Scale: NTS/_AS_NOTED

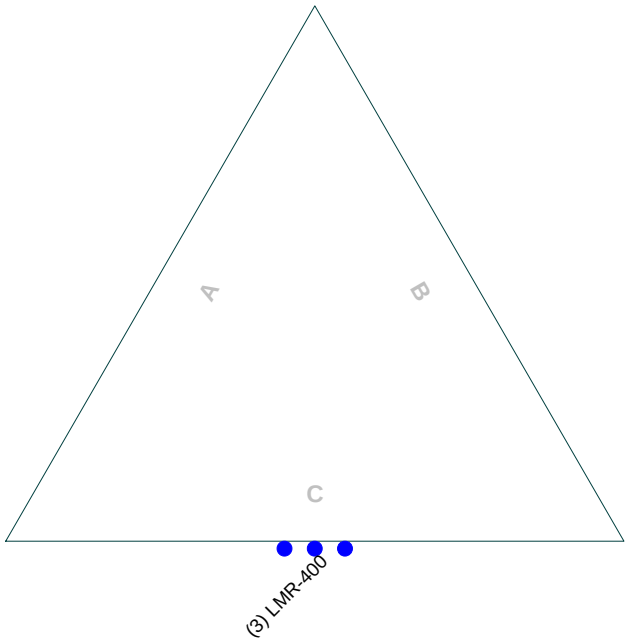
Project Description: LIGHT DUTY TOWER (LDSST)
Project Number: 9918267-075
DALEY TOWER 56170
Owner: DALEY TOWER

Sheet No.
DT-2

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Feed Line Plan

Round Flat App In Face App Out Face



DaVinci Engineering, Inc.
191 S. House Rock Dr.
Cedar City, UT 84720
Phone: (805) 922-5221
FAX: (805) 880-0402

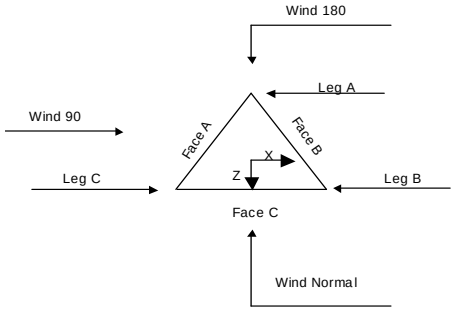
Job: ***9918267-075***		
Project: ***60-ft LDSST***		
Client: Gas Measurement Services	Drawn by: Simon W. Leland	App'd:
Code: TIA-222-G	Date: 07/27/18	Scale: NTS
Path: R:\Engineering Documents\TNX TOWER Files\Daley Tower 267\2018\18267-075.eri		Dwg No. E-7

Tower Input Data

This engineering document is intended to be used as a sales tool. The engineering judgments herein are general in nature and are not intended to be site specific. Per section 107 of the International Building Code site specific drawings are required. Therefore, if or when this equipment is to be installed, a site specific analysis including site specific conditions (antenna equipment loading, elevations, wind speed, topographic factors, exposure coefficients, structure class, and soil strengths, ect) should be considered. DaVinci can provide site specific documents to meet the requirements of the building code and to ensure that the mounts, tower & foundation has sufficient structural capacity to support the proposed loading.

The main tower is a 3x free standing tower with an overall height of 60.00 ft above the ground line.
The base of the tower is set at an elevation of 0.00 ft above the ground line.
The face width of the tower is 1.50 ft at the top and 1.50 ft at the base.
This tower is designed using the TIA-222-G standard.
The following design criteria apply:

Tower is located in Adams County, Colorado.
Basic wind speed of 90 mph.
Structure Class II.
Exposure Category C.
Topographic Category 1.
Crest Height 0.00 ft.
Nominal ice thickness of 0.2500 in.
Ice thickness is considered to increase with height.
Ice density of 56 pcf.
A wind speed of 50 mph is used in combination with ice.
Temperature drop of 50 °F.
Deflections calculated using a wind speed of 60 mph.
Connections use galvanized A325 bolts, nuts and locking devices. Installation per TIA/EIA-222 and AISC Specifications..
Tower members are "hot dipped" galvanized in accordance with ASTM A123 and ASTM A153 Standards..
A non-linear (P-delta) analysis was used.
Pressures are calculated at each section.
Stress ratio used in tower member design is 1.
Local bending stresses due to climbing loads, feed line supports, and appurtenance mounts are not considered.



Triangular Tower

Tower Section Geometry

Tower Section	Tower Elevation ft	Assembly Database	Description	Section Width ft	Number of Sections	Section Length ft
T1	60.00-50.00			1.50	1	10.00
T2	50.00-40.00			1.50	1	10.00
T3	40.00-30.00			1.50	1	10.00
T4	30.00-20.00			1.50	1	10.00
T5	20.00-10.00			1.50	1	10.00
T6	10.00-0.00			1.50	1	10.00

Tower Section Geometry *(cont'd)*

Tower Section	Tower Elevation ft	Diagonal Spacing ft	Bracing Type	Has K Brace End Panels	Has Horizontals	Top Girt Offset in	Bottom Girt Offset in
T1	60.00-50.00	1.33	Z Brace	No	Yes	4.0000	4.0000
T2	50.00-40.00	1.33	Z Brace	No	Yes	4.0000	4.0000
T3	40.00-30.00	1.33	Z Brace	No	Yes	4.0000	4.0000
T4	30.00-20.00	1.33	Z Brace	No	Yes	4.0000	4.0000
T5	20.00-10.00	1.33	Z Brace	No	Yes	4.0000	4.0000
T6	10.00-0.00	1.33	Z Brace	No	Yes	4.0000	4.0000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Type	Leg Size	Leg Grade	Diagonal Type	Diagonal Size	Diagonal Grade
T1 60.00-50.00	Solid Round	1 1/4		Solid Round	1/2	
T2 50.00-40.00	Solid Round	1 1/4	A529-50	Solid Round	1/2	A36
T3 40.00-30.00	Solid Round	1 1/4	(50 ksi)	Solid Round	1/2	(36 ksi)
T4 30.00-20.00	Solid Round	1 1/4		Solid Round	1/2	
T5 20.00-10.00	Solid Round	1 1/4		Solid Round	1/2	
T6 10.00-0.00	Solid Round	1 1/4		Solid Round	1/2	

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Top Girt Type	Top Girt Size	Top Girt Grade	Bottom Girt Type	Bottom Girt Size	Bottom Girt Grade
T1 60.00-50.00	Solid Round	1/2		Solid Round	1/2	
T2 50.00-40.00	Solid Round	1/2		Solid Round	1/2	
T3 40.00-30.00	Solid Round	1/2	A36	Solid Round	1/2	A36
T4 30.00-20.00	Solid Round	1/2	(36 ksi)	Solid Round	1/2	(36 ksi)
T5 20.00-10.00	Solid Round	1/2		Solid Round	1/2	
T6 10.00-0.00	Solid Round	1/2		Solid Round	1/2	

Tower Section Geometry *(cont'd)*

Tower Elevation ft	No. of Mid Girts	Mid Girt Type	Mid Girt Size	Mid Girt Grade	Horizontal Type	Horizontal Size	Horizontal Grade
T1 60.00-50.00	None	Solid Round			Solid Round	1/2	
T2 50.00-40.00	None	Solid Round			Solid Round	1/2	
T3 40.00-30.00	None	Solid Round			Solid Round	1/2	A36
T4 30.00-20.00	None	Solid Round			Solid Round	1/2	(36 ksi)
T5 20.00-10.00	None	Solid Round			Solid Round	1/2	
T6 10.00-0.00	None	Solid Round			Solid Round	1/2	

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Gusset Area (per face) ft^2	Gusset Thickness in	Gusset Grade	Adjust. Factor A_f	Adjust. Factor A_r	Weight Mult.	Double Angle Stitch Bolt Spacing Diagonals in	Double Angle Stitch Bolt Spacing Horizontals in	Double Angle Stitch Bolt Spacing Redundants in
T1 60.00-50.00	0.00	0.0000		1	1	1.1	36.0000	36.0000	36.0000
T2 50.00-40.00	0.00	0.0000		1	1	1.1	36.0000	36.0000	36.0000
T3 40.00-30.00	0.00	0.0000		1	1	1.1	36.0000	36.0000	36.0000
T4 30.00-20.00	0.00	0.0000		1	1	1.1	36.0000	36.0000	36.0000
T5 20.00-10.00	0.00	0.0000		1	1	1.1	36.0000	36.0000	36.0000
T6 10.00-0.00	0.00	0.0000		1	1	1.1	36.0000	36.0000	36.0000

Tower Section Geometry *(cont'd)*

Tower Elevation ft	Leg Connection Type	Leg		Diagonal		Top Girt		Bottom Girt		Mid Girt		Long Horizontal		Short Horizontal	
		Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.	Bolt Size in	No.
T1 60.00-50.00	Flange	0.6250 A325N	3	0.5000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.5000 A325N	0	0.6250 A325N	0
T2 50.00-40.00	Flange	0.6250 A325N	3	0.5000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.5000 A325N	0	0.6250 A325N	0
T3 40.00-30.00	Flange	0.6250 A325N	3	0.5000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.5000 A325N	0	0.6250 A325N	0
T4 30.00-20.00	Flange	0.6250 A325N	3	0.5000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.5000 A325N	0	0.6250 A325N	0
T5 20.00-10.00	Flange	0.6250 A325N	3	0.5000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.5000 A325N	0	0.6250 A325N	0
T6 10.00-0.00	Flange	0.6250 A325N	3	0.5000 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.6250 A325N	0	0.5000 A325N	0	0.6250 A325N	0

Feed Line/Linear Appurtenances - Entered As Round Or Flat

Description	Face or Leg	Allow Shield	Component Type	Placement ft	Total Number	Number Per Row	Clear Spacing in	Width or Diameter in	Perimeter in	Weight plf
LMR-400	C	No	Ar (CaAa)	60.00 - 3.00	3	3	0.4405	0.4405		0.07

Feed Line/Linear Appurtenances Section Areas

Tower Section	Tower Elevation ft	Face	A_R ft^2	A_F ft^2	C_AA_A In Face ft^2	C_AA_A Out Face ft^2	Weight lb
T1	60.00-50.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	1.321	0.000	2.04
T2	50.00-40.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	1.321	0.000	2.04
T3	40.00-30.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	1.321	0.000	2.04
T4	30.00-20.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	1.321	0.000	2.04
T5	20.00-10.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	1.321	0.000	2.04
T6	10.00-0.00	A	0.000	0.000	0.000	0.000	0.00
		B	0.000	0.000	0.000	0.000	0.00
		C	0.000	0.000	0.925	0.000	1.43

Feed Line Center of Pressure

Section	Elevation ft	CP_X in	CP_Z in	CP_X Ice in	CP_Z Ice in
T1	60.00-50.00	0.0000	0.7896	0.0000	1.2119
T2	50.00-40.00	0.0000	0.7896	0.0000	1.2208
T3	40.00-30.00	0.0000	0.7896	0.0000	1.2316
T4	30.00-20.00	0.0000	0.7896	0.0000	1.2399
T5	20.00-10.00	0.0000	0.7896	0.0000	1.2452
T6	10.00-0.00	0.0000	0.5780	0.0000	0.9450

Shielding Factor Ka

Tower Section	Feed Line Record No.	Description	Feed Line Segment Elev.	K_a No Ice	K_a Ice
T1	1	LMR-400	50.00 - 60.00	0.6000	0.5878
T2	1	LMR-400	40.00 - 50.00	0.6000	0.5920
T3	1	LMR-400	30.00 - 40.00	0.6000	0.5971
T4	1	LMR-400	20.00 - 30.00	0.6000	0.6000
T5	1	LMR-400	10.00 - 20.00	0.6000	0.6000
T6	1	LMR-400	3.00 - 10.00	0.6000	0.6000

Discrete Appurtenance Pressures - No Ice $G_H = 0.850$

Description	Aiming Azimuth °	Weight lb	$Offset_x$ ft	$Offset_z$ ft	z ft	K_z	q_z psf	C_AA_C Front ft^2	C_AA_C Side ft^2
Lightning Rod	0.0000	25.00	0.00	0.00	60.00	1.137	20	0.25	0.25
Generic Yagi Antenna	0.0000	25.00	0.00	-1.37	60.00	1.137	20	1.10	1.10
Generic Yagi Antenna	120.0000	25.00	1.18	0.68	60.00	1.137	20	1.10	1.10
Generic Yagi Antenna	240.0000	25.00	-1.18	0.68	60.00	1.137	20	1.10	1.10
	Sum Weight:	100.00							

Discrete Tower Loads

Description	Face or Leg	Offset Type	Offsets: Horz ft	Azimuth Adjustment °	Placement ft		C_AA_A Front ft^2	C_AA_A Side ft^2	Weight lb
Lightning Rod	C	None		0.0000	60.00	No Ice	0.25	0.25	25.00
						1/2" Ice	0.50	0.50	50.00
Generic Yagi Antenna	A	From Leg	0.50	0.0000	60.00	No Ice	1.10	1.10	25.00
						1/2" Ice	1.30	1.30	45.00
Generic Yagi Antenna	B	From Leg	0.50	0.0000	60.00	No Ice	1.10	1.10	25.00
						1/2" Ice	1.30	1.30	45.00
Generic Yagi Antenna	C	From Leg	0.50	0.0000	60.00	No Ice	1.10	1.10	25.00
						1/2" Ice	1.30	1.30	45.00

Tower Forces - No Ice - Wind Normal To Face

Section Elevation ft	Add Weight lb	Self Weight lb	Face	e	C_F	q_z psf	D_F	D_R	A_E ft^2	F lb	w plf	Ctrl. Face
T1	2.04	195.24	A	0.193	2.62	20	1	1	1.773	90.94	9.09	C
60.00-50.00			B	0.193	2.62		1	1	1.773			
			C	0.193	2.62		1	1	1.773			
T2	2.04	195.24	A	0.193	2.62	19	1	1	1.773	87.17	8.72	C
50.00-40.00			B	0.193	2.62		1	1	1.773			
			C	0.193	2.62		1	1	1.773			
T3	2.04	195.24	A	0.193	2.62	18	1	1	1.773	82.68	8.27	C
40.00-30.00			B	0.193	2.62		1	1	1.773			
			C	0.193	2.62		1	1	1.773			
T4	2.04	195.24	A	0.193	2.62	17	1	1	1.773	77.03	7.70	C
30.00-20.00			B	0.193	2.62		1	1	1.773			
			C	0.193	2.62		1	1	1.773			
T5	2.04	195.24	A	0.193	2.62	15	1	1	1.773	69.26	6.93	C
20.00-10.00			B	0.193	2.62		1	1	1.773			
			C	0.193	2.62		1	1	1.773			
T6 10.00-0.00	1.43	195.24	A	0.193	2.62	15	1	1	1.773	66.24	6.62	C
			B	0.193	2.62		1	1	1.773			
			C	0.193	2.62		1	1	1.773			
Sum Weight:	11.63	1171.42						OTM	15.11 kip-ft	473.32		

Load Combinations

Comb. No.	Description
1	Dead Only
2	1.2 Dead+1.6 Wind 0 deg - No Ice
3	0.9 Dead+1.6 Wind 0 deg - No Ice
4	1.2 Dead+1.6 Wind 30 deg - No Ice
5	0.9 Dead+1.6 Wind 30 deg - No Ice
6	1.2 Dead+1.6 Wind 60 deg - No Ice
7	0.9 Dead+1.6 Wind 60 deg - No Ice
8	1.2 Dead+1.6 Wind 90 deg - No Ice
9	0.9 Dead+1.6 Wind 90 deg - No Ice
10	1.2 Dead+1.6 Wind 120 deg - No Ice
11	0.9 Dead+1.6 Wind 120 deg - No Ice
12	1.2 Dead+1.6 Wind 150 deg - No Ice
13	0.9 Dead+1.6 Wind 150 deg - No Ice
14	1.2 Dead+1.6 Wind 180 deg - No Ice

Comb. No.	Description
15	0.9 Dead+1.6 Wind 180 deg - No Ice
16	1.2 Dead+1.6 Wind 210 deg - No Ice
17	0.9 Dead+1.6 Wind 210 deg - No Ice
18	1.2 Dead+1.6 Wind 240 deg - No Ice
19	0.9 Dead+1.6 Wind 240 deg - No Ice
20	1.2 Dead+1.6 Wind 270 deg - No Ice
21	0.9 Dead+1.6 Wind 270 deg - No Ice
22	1.2 Dead+1.6 Wind 300 deg - No Ice
23	0.9 Dead+1.6 Wind 300 deg - No Ice
24	1.2 Dead+1.6 Wind 330 deg - No Ice
25	0.9 Dead+1.6 Wind 330 deg - No Ice
26	1.2 Dead+1.0 Ice+1.0 Temp
27	1.2 Dead+1.0 Wind 0 deg+1.0 Ice+1.0 Temp
28	1.2 Dead+1.0 Wind 30 deg+1.0 Ice+1.0 Temp
29	1.2 Dead+1.0 Wind 60 deg+1.0 Ice+1.0 Temp
30	1.2 Dead+1.0 Wind 90 deg+1.0 Ice+1.0 Temp
31	1.2 Dead+1.0 Wind 120 deg+1.0 Ice+1.0 Temp
32	1.2 Dead+1.0 Wind 150 deg+1.0 Ice+1.0 Temp
33	1.2 Dead+1.0 Wind 180 deg+1.0 Ice+1.0 Temp
34	1.2 Dead+1.0 Wind 210 deg+1.0 Ice+1.0 Temp
35	1.2 Dead+1.0 Wind 240 deg+1.0 Ice+1.0 Temp
36	1.2 Dead+1.0 Wind 270 deg+1.0 Ice+1.0 Temp
37	1.2 Dead+1.0 Wind 300 deg+1.0 Ice+1.0 Temp
38	1.2 Dead+1.0 Wind 330 deg+1.0 Ice+1.0 Temp
39	Dead+Wind 0 deg - Service
40	Dead+Wind 30 deg - Service
41	Dead+Wind 60 deg - Service
42	Dead+Wind 90 deg - Service
43	Dead+Wind 120 deg - Service
44	Dead+Wind 150 deg - Service
45	Dead+Wind 180 deg - Service
46	Dead+Wind 210 deg - Service
47	Dead+Wind 240 deg - Service
48	Dead+Wind 270 deg - Service
49	Dead+Wind 300 deg - Service
50	Dead+Wind 330 deg - Service

Maximum Tower Deflections - Service Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	60 - 50	2.541	45	0.2718	0.0847
T2	50 - 40	1.970	45	0.2688	0.0814
T3	40 - 30	1.411	45	0.2561	0.0736
T4	30 - 20	0.892	45	0.2279	0.0615
T5	20 - 10	0.449	46	0.1790	0.0451
T6	10 - 0	0.133	46	0.1045	0.0245

Maximum Tower Deflections - Design Wind

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T1	60 - 50	9.175	16	0.9815	0.2039
T2	50 - 40	7.114	16	0.9708	0.1972
T3	40 - 30	5.096	16	0.9248	0.1796

Section No.	Elevation ft	Horz. Deflection in	Gov. Load Comb.	Tilt °	Twist °
T4	30 - 20	3.220	16	0.8231	0.1514
T5	20 - 10	1.622	16	0.6464	0.1121
T6	10 - 0	0.479	16	0.3773	0.0614

Bolt Design Data

Section No.	Elevation ft	Component Type	Bolt Grade	Bolt Size in	Number Of Bolts	Maximum Load per Bolt lb	Allowable Load per Bolt lb	Ratio Load / Allowable	Allowable Ratio	Criteria
T1	60	Leg	A325N	0.6250	3	413.25	20708.70	0.020 ✔	1	Bolt Tension
T2	50	Leg	A325N	0.6250	3	1208.14	20708.70	0.058 ✔	1	Bolt Tension
T3	40	Leg	A325N	0.6250	3	2356.94	20708.70	0.114 ✔	1	Bolt Tension
T4	30	Leg	A325N	0.6250	3	3835.68	20708.70	0.185 ✔	1	Bolt Tension
T5	20	Leg	A325N	0.6250	3	5611.39	20708.70	0.271 ✔	1	Bolt Tension
T6	10	Leg	A325N	0.6250	3	7667.83	20708.70	0.370 ✔	1	Bolt Tension

Leg Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	60 - 50	1 1/4	10.00	1.33	51.2 K=1.00	1.2272	-1451.39	45591.10	0.032 [1] ✔
T2	50 - 40	1 1/4	10.00	1.33	51.2 K=1.00	1.2272	-3987.92	45591.10	0.087 [1] ✔
T3	40 - 30	1 1/4	10.00	1.33	51.2 K=1.00	1.2272	-7592.78	45591.10	0.167 [1] ✔
T4	30 - 20	1 1/4	10.00	1.33	51.2 K=1.00	1.2272	-12191.20	45591.10	0.267 [1] ✔
T5	20 - 10	1 1/4	10.00	1.33	51.2 K=1.00	1.2272	-17679.30	45591.10	0.388 [1] ✔
T6	10 - 0	1 1/4	10.00	1.33	51.2 K=1.00	1.2272	-23999.70	45591.10	0.526 [1] ✔

[1] $P_u / \phi P_n$ controls

Diagonal Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	60 - 50	1/2	2.01	1.87	125.5 K=0.70	0.1963	-290.39	2776.34	0.105 [1] ✔
T2	50 - 40	1/2	2.01	1.87	125.5 K=0.70	0.1963	-469.89	2776.34	0.169 [1] ✔
T3	40 - 30	1/2	2.01	1.87	125.5 K=0.70	0.1963	-638.81	2776.34	0.230 [1]

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T4	30 - 20	1/2	2.01	1.87	125.5 K=0.70	0.1963	-793.25	2776.34	0.286 [1]
T5	20 - 10	1/2	2.01	1.87	125.5 K=0.70	0.1963	-927.07	2776.34	0.334 [1]
T6	10 - 0	1/2	2.01	1.87	125.5 K=0.70	0.1963	-1094.34	2776.34	0.394 [1]

[1] P_u / ϕP_n controls

Horizontal Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	60 - 50	1/2	1.50	1.40	93.8 K=0.70	0.1963	-174.42	4003.27	0.044 [1]
T2	50 - 40	1/2	1.50	1.40	93.8 K=0.70	0.1963	-288.77	4003.27	0.072 [1]
T3	40 - 30	1/2	1.50	1.40	93.8 K=0.70	0.1963	-397.72	4003.27	0.099 [1]
T4	30 - 20	1/2	1.50	1.40	93.8 K=0.70	0.1963	-500.10	4003.27	0.125 [1]
T5	20 - 10	1/2	1.50	1.40	93.8 K=0.70	0.1963	-593.58	4003.27	0.148 [1]
T6	10 - 0	1/2	1.50	1.40	93.8 K=0.70	0.1963	-703.87	4003.27	0.176 [1]

[1] P_u / ϕP_n controls

Top Girt Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	60 - 50	1/2	1.50	1.40	93.8 K=0.70	0.1963	-54.99	4003.27	0.014 [1]
T2	50 - 40	1/2	1.50	1.40	93.8 K=0.70	0.1963	-130.97	4003.27	0.033 [1]
T3	40 - 30	1/2	1.50	1.40	93.8 K=0.70	0.1963	-206.55	4003.27	0.052 [1]
T4	30 - 20	1/2	1.50	1.40	93.8 K=0.70	0.1963	-280.13	4003.27	0.070 [1]
T5	20 - 10	1/2	1.50	1.40	93.8 K=0.70	0.1963	-351.15	4003.27	0.088 [1]
T6	10 - 0	1/2	1.50	1.40	93.8 K=0.70	0.1963	-418.33	4003.27	0.104 [1]

[1] P_u / ϕP_n controls

Bottom Girt Design Data (Compression)

Section No.	Elevation ft	Size	L ft	L_u ft	Kl/r	A in^2	P_u lb	ϕP_n lb	Ratio $\frac{P_u}{\phi P_n}$
T1	60 - 50	1/2	1.50	1.40	93.8 K=0.70	0.1963	-120.14	4003.27	0.030 [1] ✔
T2	50 - 40	1/2	1.50	1.40	93.8 K=0.70	0.1963	-193.21	4003.27	0.048 [1] ✔
T3	40 - 30	1/2	1.50	1.40	93.8 K=0.70	0.1963	-261.20	4003.27	0.065 [1] ✔
T4	30 - 20	1/2	1.50	1.40	93.8 K=0.70	0.1963	-322.90	4003.27	0.081 [1] ✔
T5	20 - 10	1/2	1.50	1.40	93.8 K=0.70	0.1963	-376.52	4003.27	0.094 [1] ✔
T6	10 - 0	1/2	1.50	1.40	93.8 K=0.70	0.1963	-409.75	4003.27	0.102 [1] ✔

[1] P_u / ϕP_n controls

Section Capacity Table

Section No.	Elevation ft	Component Type	Size	Critical Element	P lb	ϕP_{allow} lb	% Capacity	Pass Fail
T1	60 - 50	Leg	1 1/4	1	-1451.39	45591.10	3.2	Pass
		Diagonal	1/2	10	-290.39	2776.34	10.5	Pass
		Horizontal	1/2	13	-174.42	4003.27	4.4	Pass
		Top Girt	1/2	4	-54.99	4003.27	1.4	Pass
		Bottom Girt	1/2	7	-120.14	4003.27	3.0	Pass
T2	50 - 40	Leg	1 1/4	50	-3987.92	45591.10	8.7	Pass
		Diagonal	1/2	58	-469.89	2776.34	16.9	Pass
		Horizontal	1/2	61	-288.77	4003.27	7.2	Pass
		Top Girt	1/2	52	-130.97	4003.27	3.3	Pass
		Bottom Girt	1/2	55	-193.21	4003.27	4.8	Pass
T3	40 - 30	Leg	1 1/4	98	-7592.78	45591.10	16.7	Pass
		Diagonal	1/2	106	-638.81	2776.34	23.0	Pass
		Horizontal	1/2	109	-397.72	4003.27	9.9	Pass
		Top Girt	1/2	100	-206.55	4003.27	5.2	Pass
		Bottom Girt	1/2	103	-261.20	4003.27	6.5	Pass
T4	30 - 20	Leg	1 1/4	146	-12191.20	45591.10	26.7	Pass
		Diagonal	1/2	154	-793.25	2776.34	28.6	Pass
		Horizontal	1/2	157	-500.10	4003.27	12.5	Pass
		Top Girt	1/2	148	-280.13	4003.27	7.0	Pass
		Bottom Girt	1/2	151	-322.90	4003.27	8.1	Pass
T5	20 - 10	Leg	1 1/4	194	-17679.30	45591.10	38.8	Pass
		Diagonal	1/2	202	-927.07	2776.34	33.4	Pass
		Horizontal	1/2	205	-593.58	4003.27	14.8	Pass
		Top Girt	1/2	196	-351.15	4003.27	8.8	Pass
		Bottom Girt	1/2	199	-376.52	4003.27	9.4	Pass
T6	**10 - 0**	**Leg**	**1 1/4**	**242**	**-23999.70**	**45591.10**	**52.6**	**Pass**
		Diagonal	1/2	250	-1094.34	2776.34	39.4	Pass
		Horizontal	1/2	253	-703.87	4003.27	17.6	Pass
		Top Girt	1/2	244	-418.33	4003.27	10.4	Pass
		Bottom Girt	1/2	247	-409.75	4003.27	10.2	Pass

Behrens and Associates, Inc.
Environmental Noise Control

October 24, 2018

Rocky Mountain Midstream
7859 Walnut Hill Lane, Suite 335
Dallas, TX 75320

Attention: Scott Elery

Subject: Ambient Sound Level Report

Re: Proposed Watkins Compressor Station

Dear Mr. Elery:

Per your request, an ambient sound level survey was performed near the proposed Watkins Compressor Station in Watkins, Colorado from Friday October 12, to Monday October 15, 2018 to measure and document the ambient sound levels near the site. The following report documents our findings.

Ambient Sound Level Survey

An ambient sound level survey, including A-weighted dB(A) sound level data, was performed for the proposed Watkins Compressor Station to measure and document ambient sound levels for hourly, 15 minute and daily L_{eq} averages during typical operations. Per Colorado Revised Statue (CRS) Title 25, Sec. 25-12-103 *Measurements with sound level meters shall be made when the wind velocity at the time and place of such measurement is not more than five miles per hour.* The sound level averages in Table 1 omit the data collected where the wind speed exceeded 5 miles per hour.

Sound Measurement and Modeling Instrumentation

The instrumentation used for the monitoring locations were Type 1 Svantek model 971 integrating and logging sound level meters with windscreens, which were calibrated prior to deployment. The metering systems were deployed in accordance with ANSI standards, and in a locked box for security. The measured noise levels are presented graphically in Attachments 2 through 8 and in tabulated form in Attachments 9 through 12.

The noise levels were used to determine the typical daytime (7am to 7pm) and nighttime (7pm to 7am) averages at the monitored locations. The equivalent sound level, or L_{eq}, is a sound energy average, calculated over a stated time period. The overall daytime and nighttime averages were calculated using the hourly average L_{eq} noise levels measured at each location over the entire deployment period. The calculated average daytime and nighttime noise levels are summarized in Table 1.

Table 1

Rocky Mountain Midstream - Watkins Compressor Station							
Location 1		**Location 2**		**Location 3**		**Location 4**	
Average Daytime Ambient Noise Levels	**Average Nighttime Ambient Noise Levels**	**Average Daytime Ambient Noise Levels**	**Average Nighttime Ambient Noise Levels**	**Average Daytime Ambient Noise Levels**	**Average Nighttime Ambient Noise Levels**	**Average Daytime Ambient Noise Levels**	**Average Nighttime Ambient Noise Levels**
dBA	**dBA**	**dBA**	**dBA**	**dBA**	**dBA**	**dBA**	**dBA**
51.8	49.8	47.5	45.1	47.3	46.4	51.6	50.2

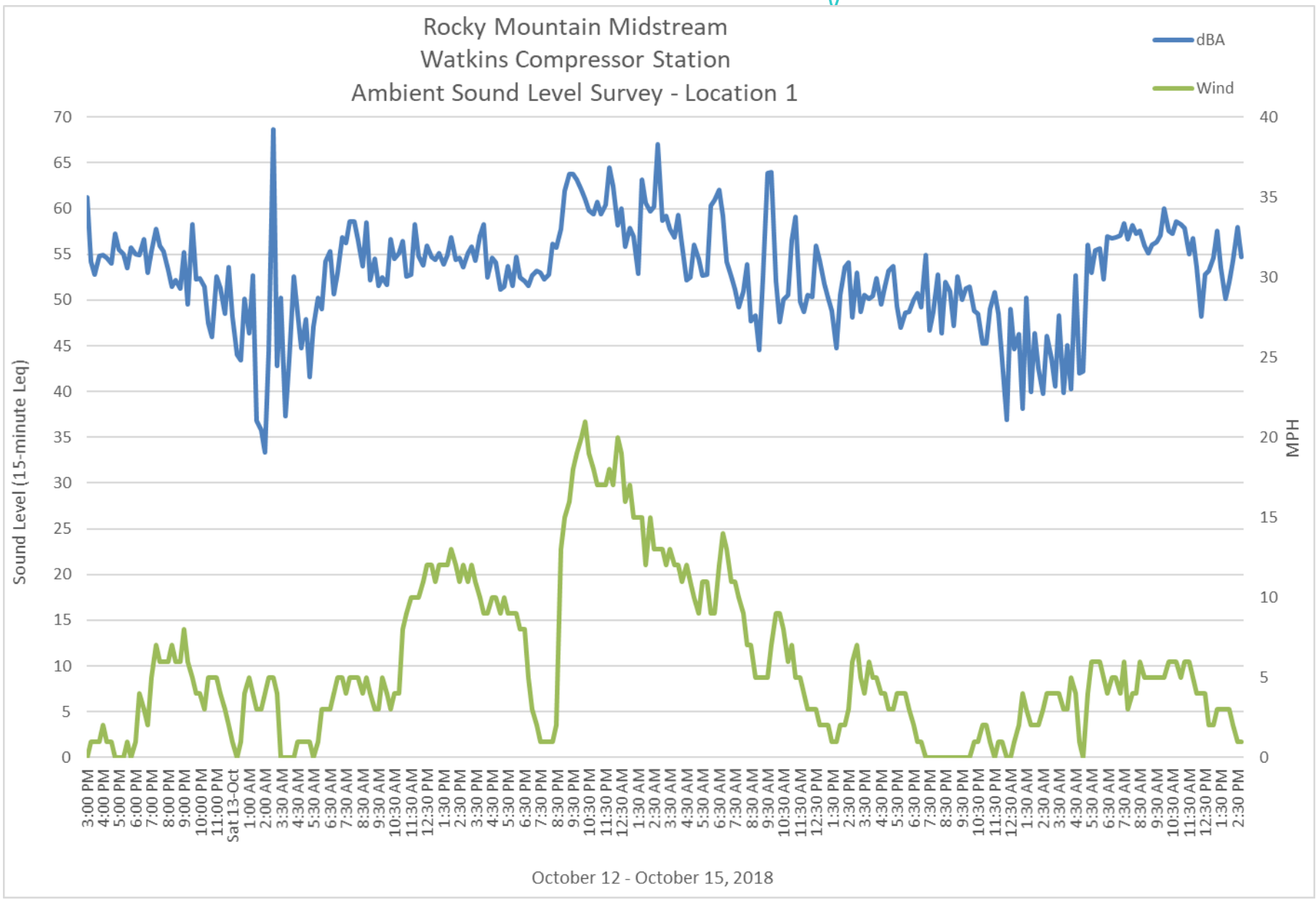
Very truly yours,



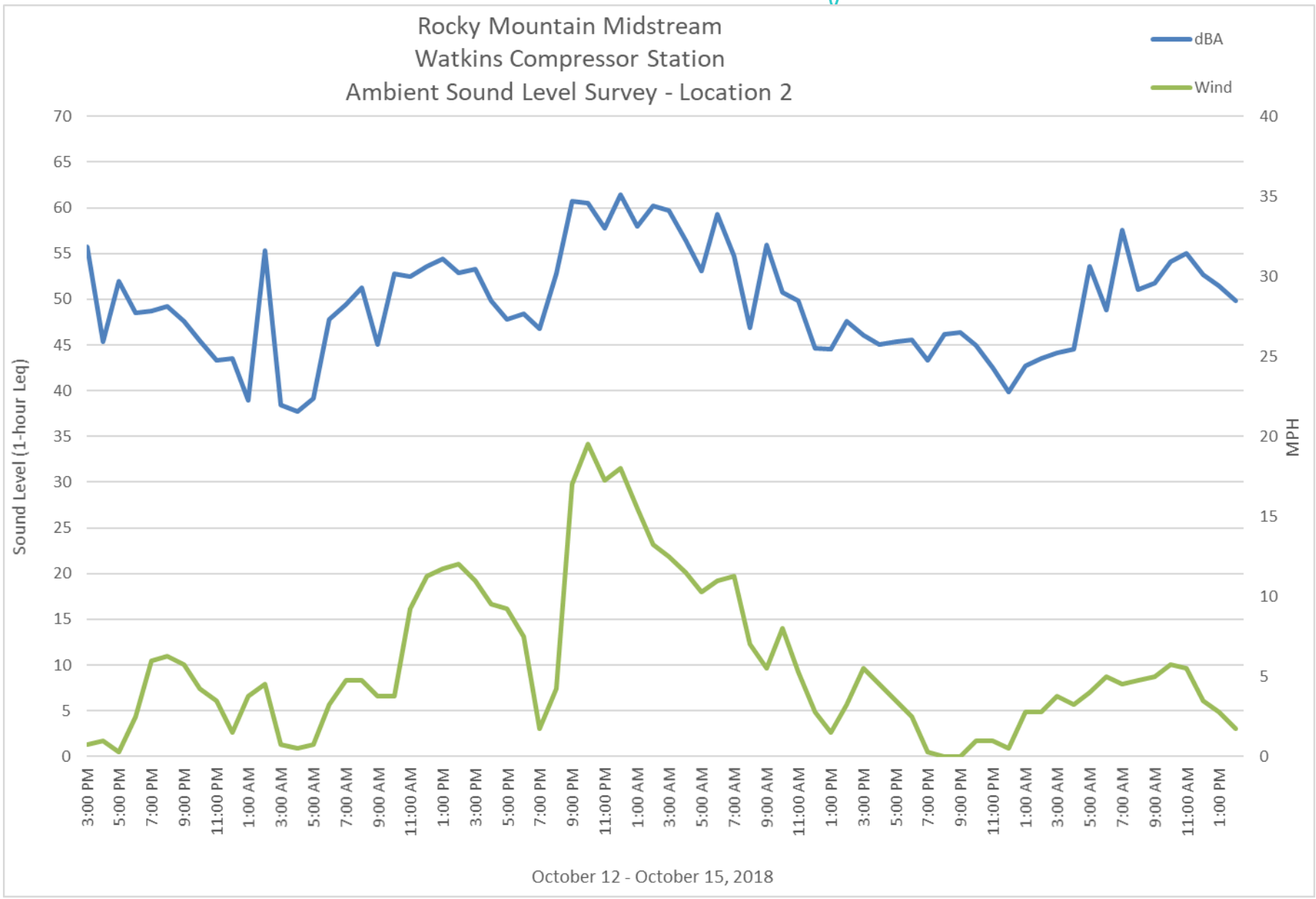
Colin M. Drolshagen
Lead Acoustical Technician



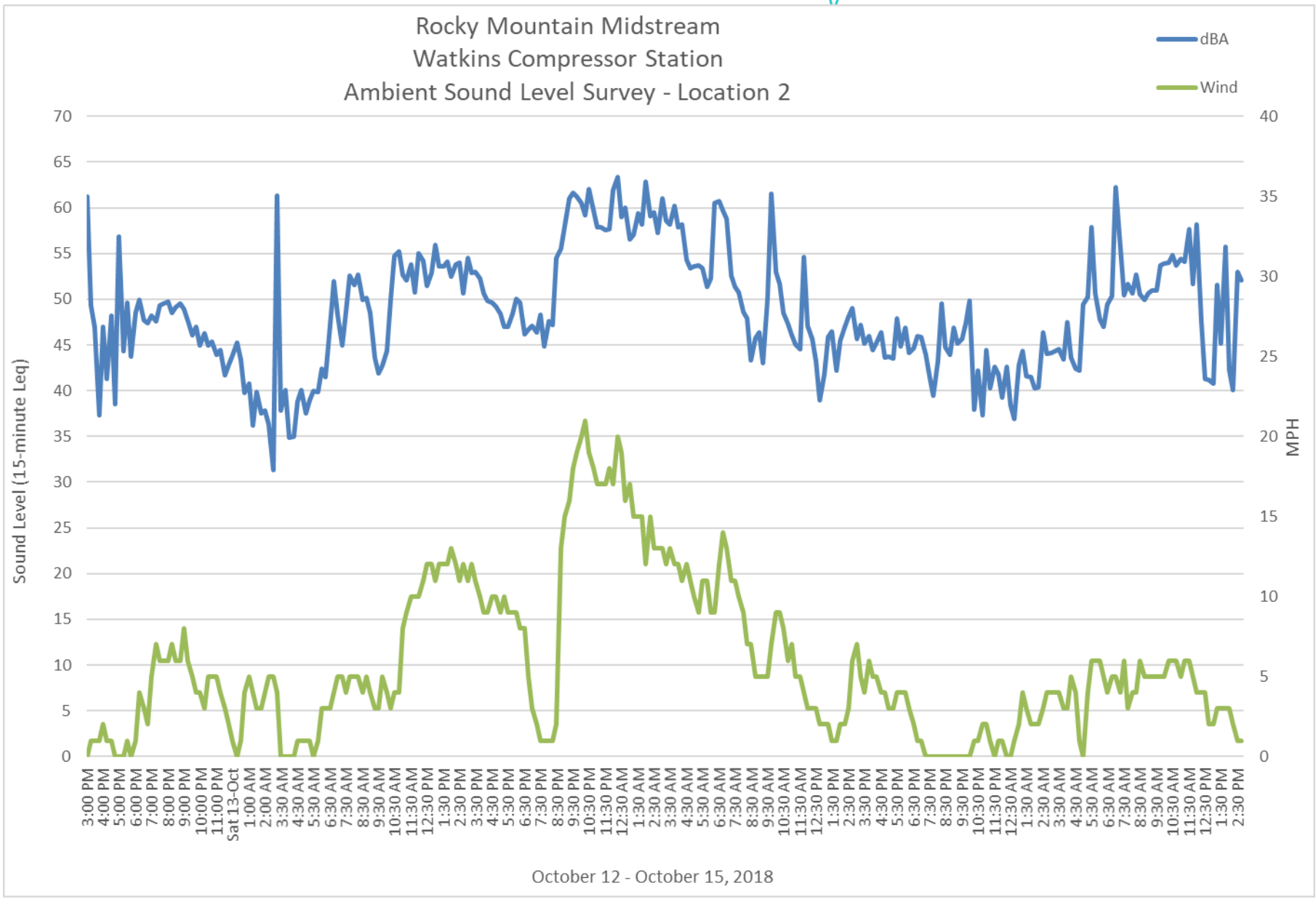
Attachment 1
Ambient Noise Monitoring Locations



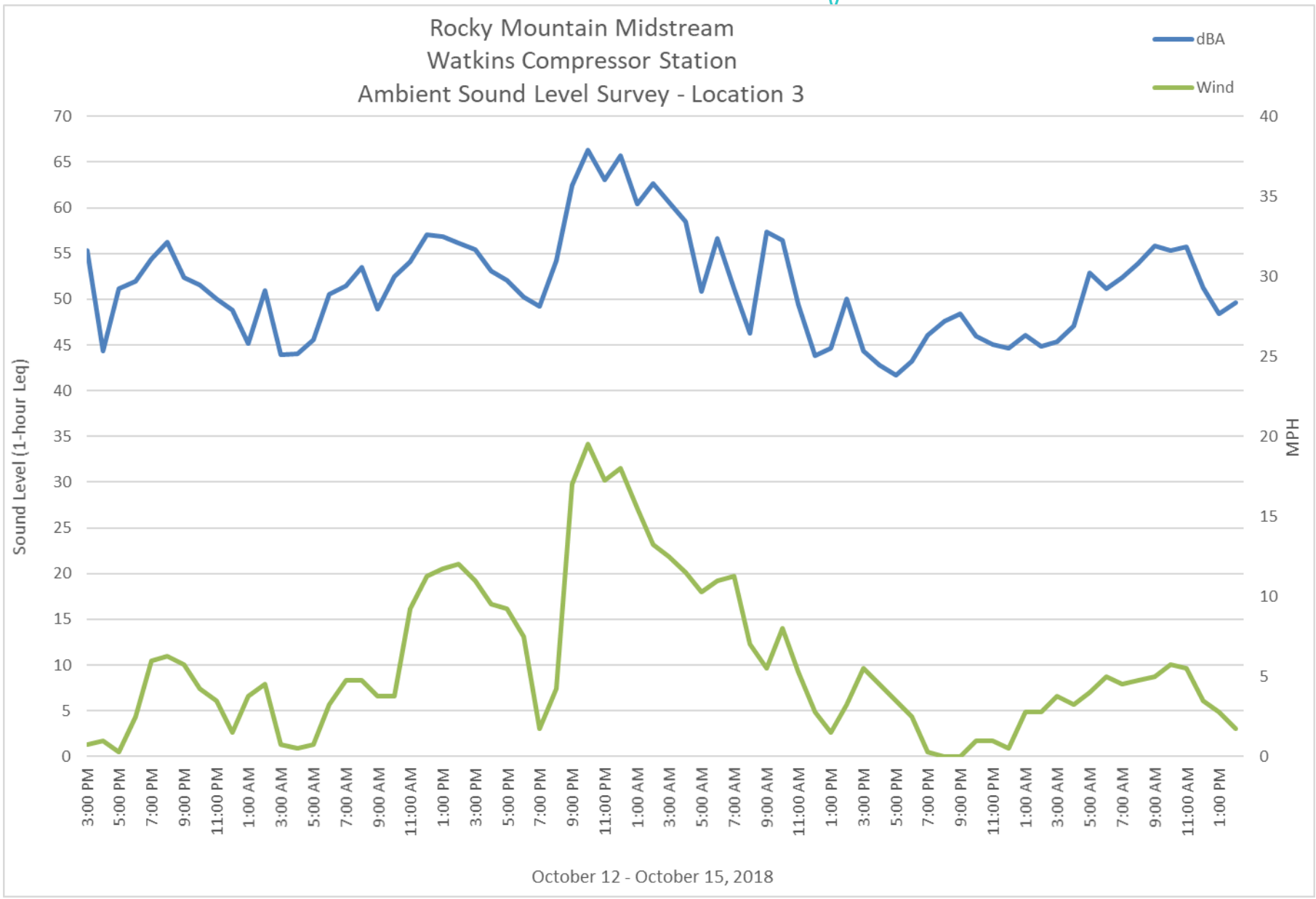
Attachment 2



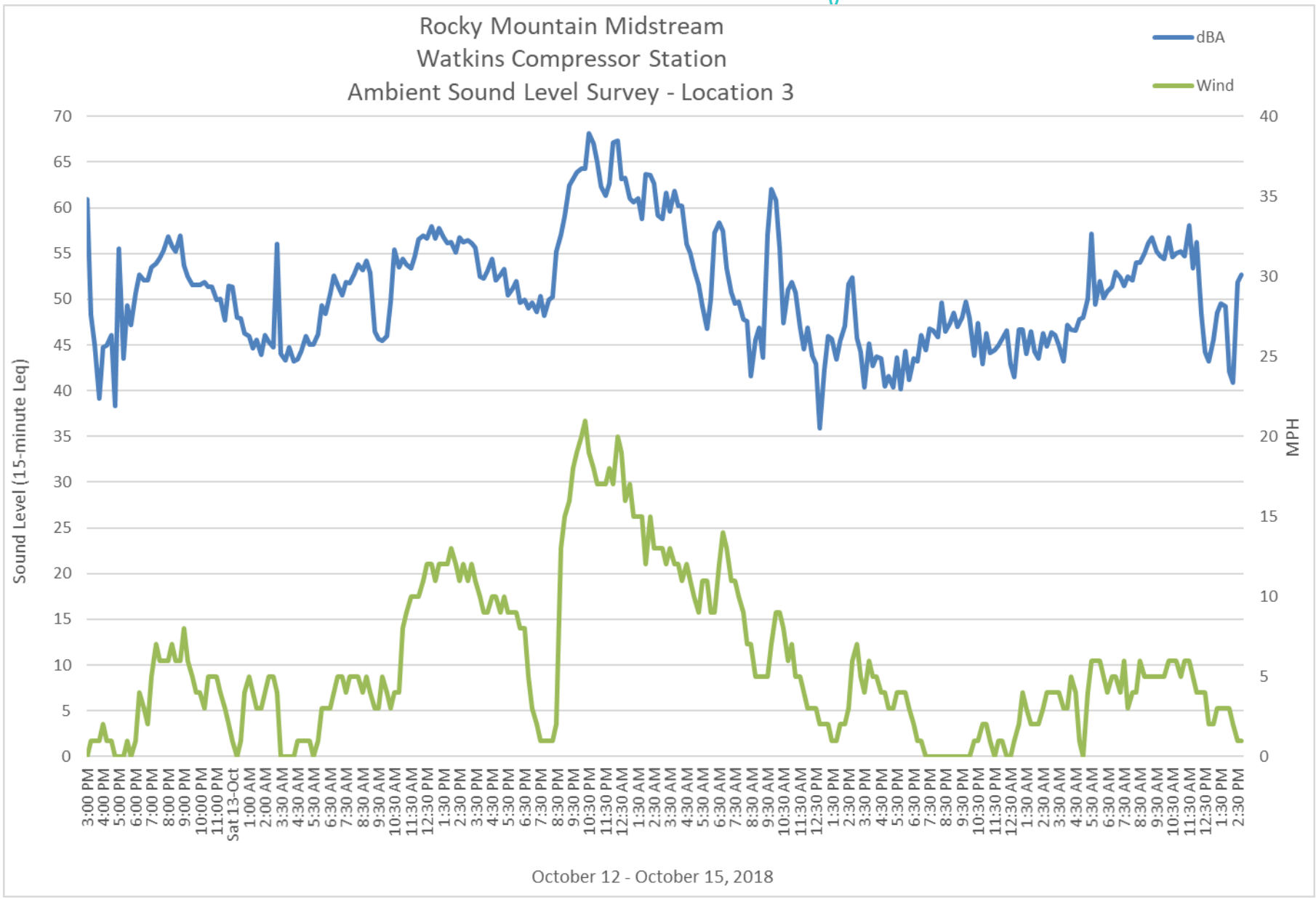
Attachment 3



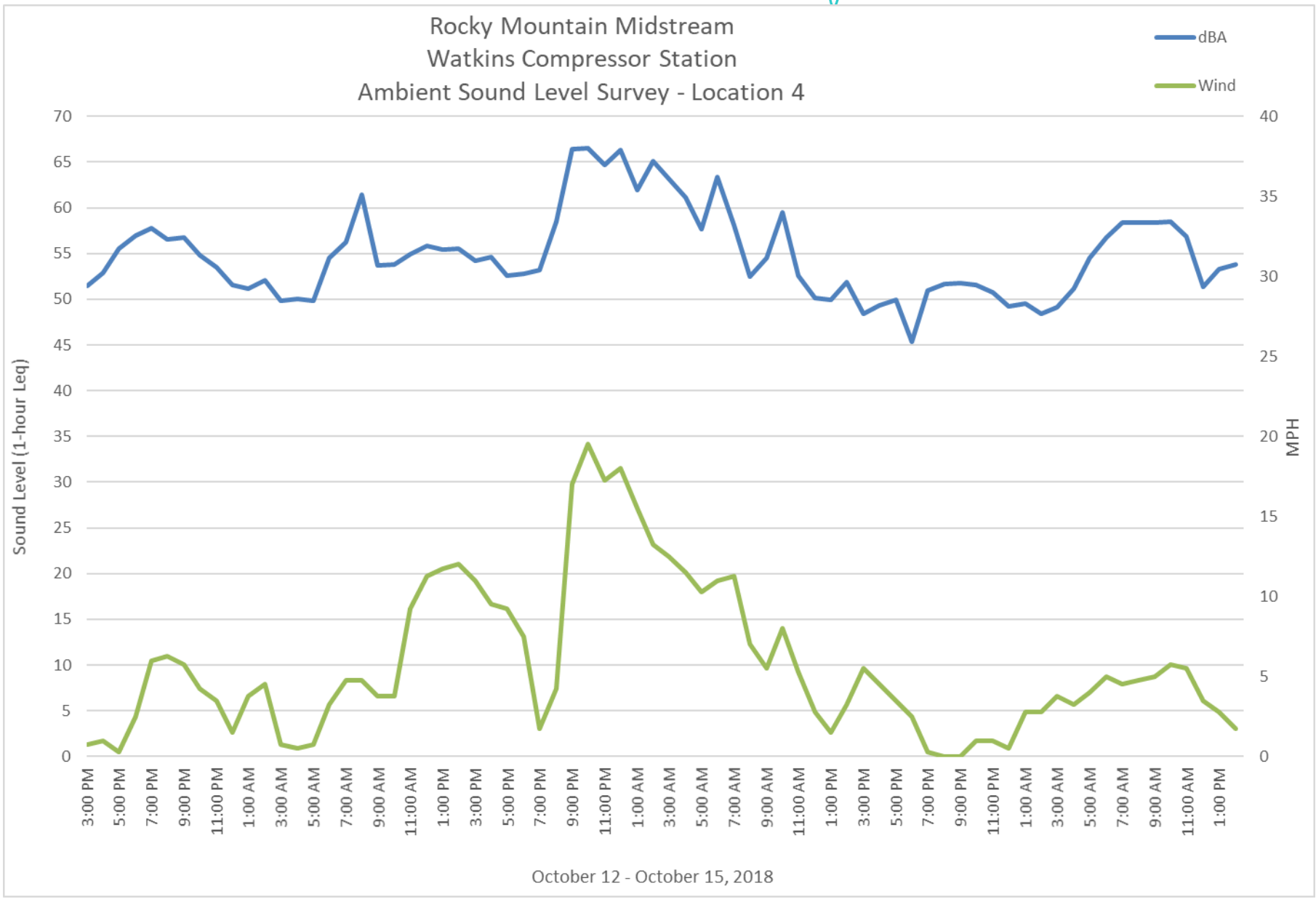
Attachment 4



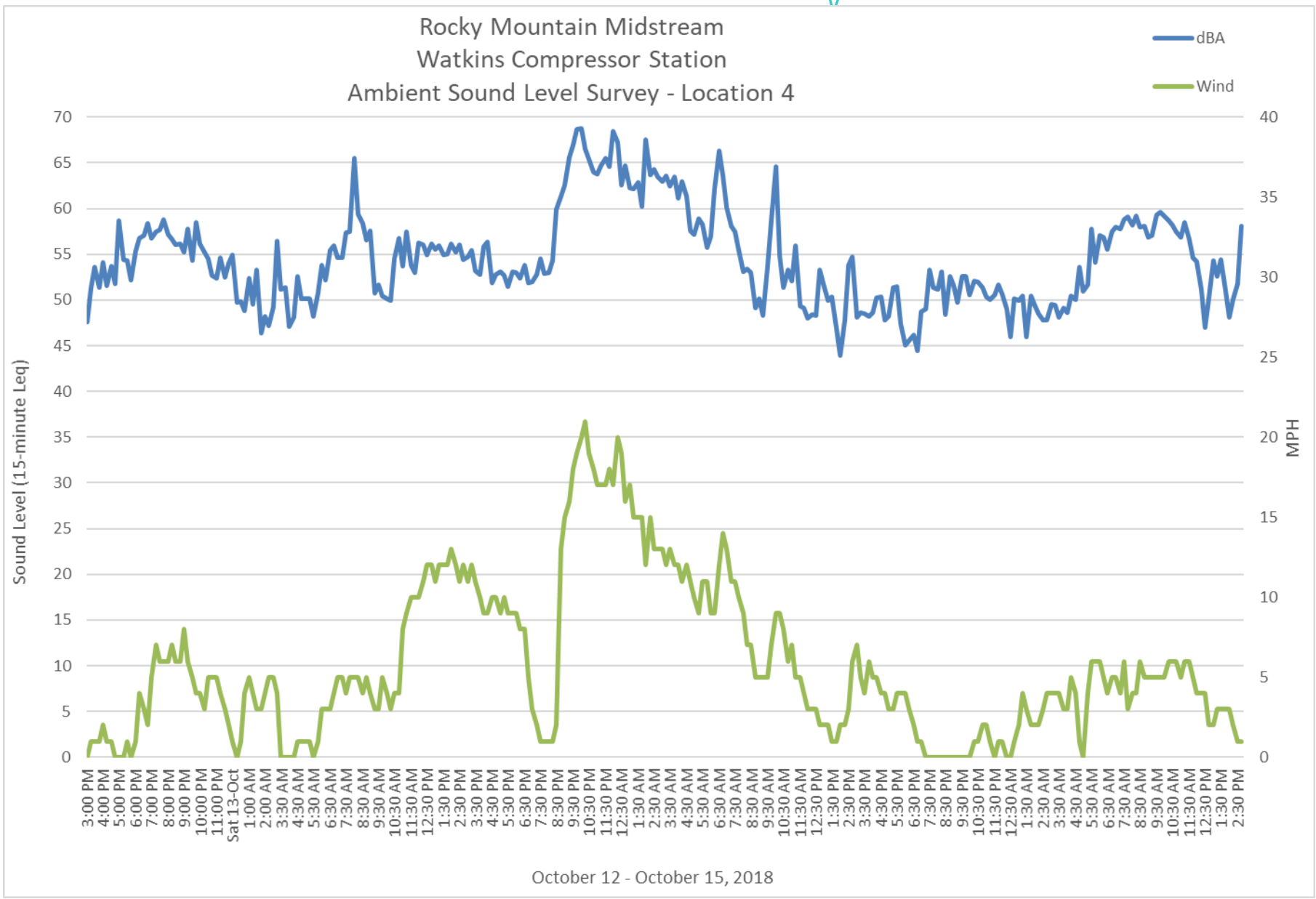
Attachment 5



Attachment 6



Attachment 7



Attachment 8

Rocky Mountain Midstream - Watkins Compressor Station			
Location 1 - Hourly Averages			
Time	dBA	Time	dBA
3:00 PM	57.2	3:00 AM	58.2
4:00 PM	55.4	4:00 AM	56.0
5:00 PM	55.0	5:00 AM	54.2
6:00 PM	55.1	6:00 AM	60.8
7:00 PM	56.2	7:00 AM	52.1
8:00 PM	52.1	8:00 AM	50.9
9:00 PM	55.0	9:00 AM	61.1
10:00 PM	50.1	10:00 AM	50.4
11:00 PM	51.9	11:00 AM	55.6
Sat 13-Oct	47.3	12:00 PM	53.4
1:00 AM	47.8	1:00 PM	49.6
2:00 AM	62.6	2:00 PM	52.2
3:00 AM	46.3	3:00 PM	50.9
4:00 AM	48.9	4:00 PM	51.1
5:00 AM	47.7	5:00 PM	51.6
6:00 AM	53.0	6:00 PM	49.6
7:00 AM	56.6	7:00 PM	51.1
8:00 AM	57.2	8:00 PM	51.1
9:00 AM	52.8	9:00 PM	50.7
10:00 AM	54.8	10:00 PM	49.0
11:00 AM	55.7	11:00 PM	48.8
12:00 PM	54.9	Mon 15-Oct	45.3
1:00 PM	54.6	1:00 AM	46.1
2:00 PM	55.0	2:00 AM	44.4
3:00 PM	55.7	3:00 AM	44.5
4:00 PM	55.4	4:00 AM	47.8
5:00 PM	52.1	5:00 AM	53.8
6:00 PM	52.9	6:00 AM	55.8
7:00 PM	52.8	7:00 AM	57.3
8:00 PM	55.9	8:00 AM	57.3
9:00 PM	63.2	9:00 AM	56.2
10:00 PM	60.7	10:00 AM	58.5
11:00 PM	61.7	11:00 AM	57.1
Sun 14-Oct	59.8	12:00 PM	52.4
1:00 AM	59.3	1:00 PM	54.7
2:00 AM	63.1	2:00 PM	55.3

Rocky Mountain Midstream - Watkins Compressor Station			
Location 2 - Hourly Averages			
Time	**dBA**	**Time**	**dBA**
3:00 PM	55.7	3:00 AM	59.7
4:00 PM	45.3	4:00 AM	56.4
5:00 PM	52.0	5:00 AM	53.1
6:00 PM	48.5	6:00 AM	59.3
7:00 PM	48.7	7:00 AM	54.7
8:00 PM	49.2	8:00 AM	46.8
9:00 PM	47.5	9:00 AM	56.0
10:00 PM	45.4	10:00 AM	50.7
11:00 PM	43.3	11:00 AM	49.9
Sat 13-Oct	43.5	12:00 PM	44.6
1:00 AM	39.0	1:00 PM	44.6
2:00 AM	55.3	2:00 PM	47.6
3:00 AM	38.5	3:00 PM	46.1
4:00 AM	37.7	4:00 PM	45.0
5:00 AM	39.2	5:00 PM	45.4
6:00 AM	47.8	6:00 PM	45.5
7:00 AM	49.5	7:00 PM	43.3
8:00 AM	51.2	8:00 PM	46.2
9:00 AM	45.1	9:00 PM	46.4
10:00 AM	52.8	10:00 PM	44.9
11:00 AM	52.5	11:00 PM	42.5
12:00 PM	53.6	Mon 15-Oct	39.9
1:00 PM	54.4	1:00 AM	42.7
2:00 PM	52.9	2:00 AM	43.5
3:00 PM	53.3	3:00 AM	44.1
4:00 PM	49.8	4:00 AM	44.5
5:00 PM	47.7	5:00 AM	53.6
6:00 PM	48.5	6:00 AM	48.8
7:00 PM	46.8	7:00 AM	57.6
8:00 PM	52.7	8:00 AM	51.1
9:00 PM	60.7	9:00 AM	51.7
10:00 PM	60.5	10:00 AM	54.1
11:00 PM	57.7	11:00 AM	55.0
Sun 14-Oct	61.4	12:00 PM	52.7
1:00 AM	57.9	1:00 PM	51.5
2:00 AM	60.2	2:00 PM	49.8

Rocky Mountain Midstream - Watkins Compressor Station			
Location 3 - Hourly Averages			
Time	dBA	Time	dBA
3:00 PM	55.3	3:00 AM	60.7
4:00 PM	44.3	4:00 AM	58.4
5:00 PM	51.1	5:00 AM	50.9
6:00 PM	51.9	6:00 AM	56.7
7:00 PM	54.4	7:00 AM	51.1
8:00 PM	56.3	8:00 AM	46.2
9:00 PM	52.4	9:00 AM	57.4
10:00 PM	51.6	10:00 AM	56.4
11:00 PM	50.0	11:00 AM	49.4
Sat 13-Oct	48.8	12:00 PM	43.8
1:00 AM	45.1	1:00 PM	44.6
2:00 AM	51.0	2:00 PM	50.1
3:00 AM	44.0	3:00 PM	44.3
4:00 AM	44.0	4:00 PM	42.8
5:00 AM	45.6	5:00 PM	41.7
6:00 AM	50.5	6:00 PM	43.2
7:00 AM	51.4	7:00 PM	46.0
8:00 AM	53.5	8:00 PM	47.6
9:00 AM	48.9	9:00 PM	48.5
10:00 AM	52.4	10:00 PM	46.0
11:00 AM	54.1	11:00 PM	45.0
12:00 PM	57.1	Mon 15-Oct	44.6
1:00 PM	56.8	1:00 AM	46.1
2:00 PM	56.1	2:00 AM	44.8
3:00 PM	55.4	3:00 AM	45.3
4:00 PM	53.1	4:00 AM	47.1
5:00 PM	52.0	5:00 AM	52.9
6:00 PM	50.3	6:00 AM	51.1
7:00 PM	49.3	7:00 AM	52.4
8:00 PM	54.2	8:00 AM	53.9
9:00 PM	62.5	9:00 AM	55.8
10:00 PM	66.3	10:00 AM	55.3
11:00 PM	63.1	11:00 AM	55.7
Sun 14-Oct	65.7	12:00 PM	51.3
1:00 AM	60.4	1:00 PM	48.4
2:00 AM	62.6	2:00 PM	49.6

Rocky Mountain Midstream - Watkins Compressor Station			
Location 4 - Hourly Averages			
Time	**dBA**	**Time**	**dBA**
3:00 PM	51.4	3:00 AM	63.1
4:00 PM	52.9	4:00 AM	61.2
5:00 PM	55.6	5:00 AM	57.7
6:00 PM	57.0	6:00 AM	63.4
7:00 PM	57.7	7:00 AM	58.1
8:00 PM	56.5	8:00 AM	52.5
9:00 PM	56.8	9:00 AM	54.6
10:00 PM	54.8	10:00 AM	59.5
11:00 PM	53.5	11:00 AM	52.6
Sat 13-Oct	51.6	12:00 PM	50.1
1:00 AM	51.1	1:00 PM	49.9
2:00 AM	52.0	2:00 PM	51.9
3:00 AM	49.8	3:00 PM	48.4
4:00 AM	50.0	4:00 PM	49.4
5:00 AM	49.9	5:00 PM	50.0
6:00 AM	54.6	6:00 PM	45.3
7:00 AM	56.2	7:00 PM	51.0
8:00 AM	61.4	8:00 PM	51.7
9:00 AM	53.7	9:00 PM	51.8
10:00 AM	53.8	10:00 PM	51.5
11:00 AM	54.9	11:00 PM	50.7
12:00 PM	55.9	Mon 15-Oct	49.3
1:00 PM	55.4	1:00 AM	49.6
2:00 PM	55.5	2:00 AM	48.4
3:00 PM	54.2	3:00 AM	49.1
4:00 PM	54.6	4:00 AM	51.1
5:00 PM	52.6	5:00 AM	54.5
6:00 PM	52.8	6:00 AM	56.8
7:00 PM	53.1	7:00 AM	58.4
8:00 PM	58.5	8:00 AM	58.4
9:00 PM	66.5	9:00 AM	58.4
10:00 PM	66.5	10:00 AM	58.4
11:00 PM	64.7	11:00 AM	56.8
Sun 14-Oct	66.3	12:00 PM	51.4
1:00 AM	62.0	1:00 PM	53.3
2:00 AM	65.1	2:00 PM	53.8

Rocky Mountain Midstream, LLC
Unoccupied Compression/Treating Station

Noise Mitigation Plan

Preamble

Rocky Mountain Midstream, LLC is committed to minimizing sound impacts from current and future operations. In the development standards for unoccupied discovery compressor stations, the Weld County Board of Commissioners imposed a residential sound limit on the facility, to be measured at the property boundaries. This sound limit is based on current zoning for the development area. Changes to applicable zoning and sound limits associated with land use designations require approval by Weld County.

Typical Development Standard language states:

“The facility shall adhere to the maximum permissible noise levels allowed in the applicable Zone District as delineated in Section 25-12-103, C.R.S., and comply with the Noise Mitigation Plan, as approved.”

The operating Company has developed this sound mitigation plan that will achieve such sound standards through a combination of equipment and engineering measures.

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Purpose

Satisfy the Condition of Approval addendum to Weld County Use by Special Review (USR) requiring County review and approval of an unoccupied compressor station Noise Mitigation and Compliance Plan.

Scope

Upon review and approval, this document identifies the minimum acceptable conditions for complying with the referenced Development Standards developed as part of the Weld County USR process.

Definitions

Company shall mean Rocky Mountain Midstream, LLC, the local operating company of Williams, its affiliates or successors.

Noise Level Limits shall mean the maximum noise level limits referenced in applicable USR Development Standard, and applicable to the facility based on the zoning.

Pre-existing Non-compliance Location shall mean any on-site location identified and tested by the Company, prior to the commencement of site construction or facility operation, and documented to be in non-conformance or out of compliance with the existing Noise Level Limits.

Stakeholders shall mean any adult tenants, property owner, or member of a registered Homeowner's and/or Neighborhood Association immediately adjacent to an above-ground Company facility boundary, fence, or property line.

Responsibility

The Company's Operations Manager and Facility Supervisor will have the overall responsibility for ensuring that this plan is implemented.

Guidelines

1.0 Company Duty to Comply

Per C.R.S Section 25-12-103, and referenced by applicable USR Development Standard language, based on facility zoning;

- The Company will comply with applicable Noise Level Limits for site construction until such time as normal facility operation commences.
- Between the hours of 9:00 p.m. and 7:00 a.m., the Noise Level Limits shall not be exceeded by more than ten (10) decibels for no more than fifteen (15) minutes in any one-hour period.
- Following new facility commissioning, but not later than twelve (12) months after startup, the Company will commence initial sound level testing to monitor compliance with permissible Noise Level Limits.
- Following initial sound level testing, the Company will commission sound level testing to be performed annually, but not to exceed 15 months, to monitor compliance with permissible Noise Level Limits.

- To ensure consistency, Noise Level testing will, at a minimum, include previously tested on-site locations for which data was collected. Annual Noise Level Limit testing will take place for 72 consecutive hours during normal site operations, and be performed by an appropriately qualified 3rd party consultant experienced in environmental noise control.
- The annual sound level survey commissioned by the Company will be prepared by a qualified acoustical consulting firm having at least five years of experiences in noise control engineering and environmental noise analysis.
- The annual sound level survey commissioned by the Company shall employ Type-1 sound level meters to be calibrated prior to and immediately after use in accordance with American National Standards Institute (ANSI) S1.40.
- All sound level meters will be programmed to record A-weighted, Leq sound levels. The sound level meters are to be deployed at a measurement height of 4 ft. above ground and employ the use of windscreens in accordance with ANSI S12.9. The sound level meters are to be deployed at locations in accordance with Section 14-9-50, A.2 of the Weld County Noise Limits.
- Except for excursions associated with documented Pre-existing Non-compliance Locations, the Company will identify and undertake corrective or mitigating action(s) in the event that a determination is made that the applicable facility is in violation of the reference noise levels.
- In the event of a documented noise complaint from a Stakeholder, the Company will coordinate with appropriate County personnel to conduct appropriate sound level surveys and/or investigative measures.

Document Management Log

AUTHORS	
This document was prepared by:	
Name	Matthew C. Norton
Title	HSE Compliance Supervisor
Asset	
Phone	
Email	

VERSION HISTORY / CHANGE LOG

REVISION RECORD			APPROVAL SIGNATURES	
Version Date	**Version No.**	**Description of Change / Remarks**	**Name of Revising Party**	**Approver Signature**
	draft	Initial Draft and Review	N/A	N/A
07/04/2018	1.0	Incorporate final edits for application submittal	M Norton	Matthew C. Norton
11/15/2018	1.1	Ownership, position titles, header formatting updates.	J Kinnin	Matthew C. Norton

Rocky Mountain Midstream, LLC
540 E Bridge Street
Brighton, Colorado 80601

March 22, 2019

Bennett-Watkins Fire Rescue
825 Shari's Court
Bennett, CO 80102

Attention: Caleb J. Connor, Fire Marshal

RE: Watkins South Compressor Station

Dear Mr. Connor,

Please find below Rocky Mountain Midstream, LLC response to the Fire District Plan Review in connection to the Watkins South Compressor Station, dated December 13, 2018, a copy of which is included with this submittal.

1. All aspects of this project shall be subject to approval by any and all other Authorities Having Jurisdiction as required.

   Response: Noted.

2. KNOX fire department gate access to the facility shall be provided/maintained at all times. Gate width shall not be less than 20ft minimum.

   Response: A Fencing Plan (WCSS-CE-501) has been added. This information has been referenced on that sheet.

3. Facility address and sign must be posted on a permanent sign and maintained at all times identifying the address, facility name, and facility contact information.

   Response: A note has been added to the Civil Site Plan (WCSS-CE-103).

4. Facility interior shall be maintained vegetation free gravel for the life of the facility.

   Response: A note has been added to the Erosion Control Plan (WCSS-CE-401).

5. Access road to facility shall be a width not less than 20 feet and comprised of Class 6 road base or better at a 6" depth. Right-of-way dedication (70 ft along Manilla Rd.).

   Response: A detail has been provided on the Grading and Drainage Plan (WCSS-CE-601) and the Site Access Road Plan and Profile (WCSS-CE-602).

Rocky Mountain Midstream, LLC
540 E Bridge Street
Brighton, Colorado 80601

6. Please show corrections and detail on plans for road composition and dimensions.

   Response: A detail has been provided on the Grading and Drainage Plan (WCSS-CE-601) and the Access Road Plan and Profile (WCSS-CE-602).

7. Please show gate detail showing compliance with minimum widths and IFC requirements.

   Response: The gate detail has been provided with the Landscape Plans (by others). A note referencing those plans has been added to the Fencing Plan.

8. Please show corrections on plans for facility sign, KNOX gate access, and placarding.

   Response: Comments 1-7 have been addressed on plans as noted above.

9. A final inspection and system acceptance test (if applicable) shall be required before a facility shall be accepted and approved.

   Response: Noted.

Upon review of our responses above, along with the updated plans included with this submittal, please let me know if you have any questions. If everything meets your requirements, we would appreciate receiving an updated Fire District Plan Review stating "approved".

Sincerely,

Scott Jay Elery
Permitting Manager
701-578-4074

Rocky Mountain Midstream Emergency Response Plan		
10.00.70.02	Revision 01	Effective Date 12/14/2017

Emergency Response Plan[1]

Watkins Compressor Station

Scope and Description

The Watkins Compressor Station is composed of three caterpillar 3608 compressors in two phases along with an inlet slug catcher, pig launcher, two metering buildings, one Alco dehy and one conventional dehy. There is one 16" outlet from the site. This site has Produced Water, Waste Water, Lube Oil, Glycol, TEG and Antifreeze tanks of various sizes. Some equipment may be turned off and placed in a ready for service state or idled depending on system operations.

Compression is used for compressing natural gas prior to gas processing/treatment and the separators remove entrained liquids from the gas stream. This site is subject to all hazards associated with natural gas and liquids as it is a two phase stream of liquids and gas..

Geographic Location: Township 5 South, Range 64 West, Section 11

Area Office Phone Number:

Compressor Station Address:

Revision Number: 01

Revision Date: 1/24/19

Last Review Date: 1/24/19

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3.0 RESPONSE ACTIONS 4
4.0 POST EMERGENCY ACTIVITIES 7

[1] Refer to 03.00.71.03 – Plans Required of Facilities-Pipelines and address all items in the "Required in Plan" portion in your ERP.

1.0 GENERAL

1.1 Overview

An Emergency Response is a response effort by Company employees or designated responders (fire departments, paramedics, police, etc.) to an Emergency Event.

An Emergency Event is an unexpected event, which, if not responded to immediately, has the potential to cause large-scale injury to humans and/or damage to the environment or property. An Emergency Event may include, but is not limited to:

- Uncontrolled Fire,
- Gas detected inside or near a building,
- Extreme weather conditions (flooding, blizzard, hurricane, tornado),
- Explosions (accidental or intentional, as in a bombing),
- Pipeline or equipment (vessels, etc.) rupture or serious leak,
- Releases of hazardous chemicals (accidental or intentional),

The nature of an Emergency Event will dictate the level of response and emergency actions necessary. Protection of human life and safety pre-empts the protection of the environment or property.

Incidents ***not*** considered an Emergency Event include:

- Incidental releases of hazardous substances where no potential safety or health hazards exists, and where the substance can be absorbed, neutralized, or otherwise controlled by trained personnel in the immediate release area.
- Small, quickly contained (incipient stage) fires
- Other minor incidental events where there are no potential safety or health hazards.

Post-Emergency Response includes activities performed after the immediate threat of an emergency is stabilized or eliminated. Activities such as repairs, decontamination, and cleanup of the site are considered post-Emergency Response. These are not considered a part of the Emergency Response, so long as there is no further emergency condition or immediate threat of an emergency condition.

2.0 RECOGNITION, REPORTING AND NOTIFICATION

2.1 Recognition, Reporting and Notification[2]

2.1.1 Upon recognition of an Emergency Event, authorized persons must activate local alarms and/or warning devices.

2.1.1.1 Press ESD; Sound the emergency siren if applicable.

2.1.1.2 If off-site assistance is required, immediately call 911.

2.1.1.3 When requesting emergency service via 911 (or otherwise), emergency responders are to be advised of the “physical address” of where we expect them to respond. Give basic directions.

[2] The activities of 2.1.1 through 2.1.3 may occur simultaneously, depending on the exigency of the situation.

2.1.2 Summon Emergency Response Agencies (ERAs) in order listed in Table 2.1.2.

TABLE 2.1.2 - EMERGENCY RESPONSE AGENCIES - TELEPHONE NUMBERS	
Agency or Individual	**Telephone Number**
911 Emergency (fire, ambulance, sheriff)	911
Agency	**Non-Emergency Number**
State Highway Patrol	303-857-6638
United Power – Utility Company	303-637-1300

2.1.3 Notify Pipeline Control **(800-635-7400)**.

2.1.4 Follow 11.05.00.01 – Incident Notification and Reporting.

2.1.5 Notify the Required Contacts (Area Manager, Supervisor, etc,) in order listed in Table 2.1.4. Notify Additional Contacts listed in Table 2.1.4 as needed to ensure an adequate response.

TABLE 2.1.4 - REQUIRED CONTACTS (INTERNAL)				
NAME	**TITLE**	**WORK #**	**MOBILE #**	**HOME #**
Matt Hastings	Director of Ops and Engineering		405-664-7823	
Cory Kline	Ops Manager		970-987-2527	
Michael Minnehan	Ops Supervisor		402-613-7711	
Josh Bruce	Ops Supervisor		970-776-6851	
Craig Strother	Ops Supervisor		970-210-2411	
Matt Norton	EHS Supervisor		817-455-5799	
Tyler Whorton	Safety Rep.		620-242-4312	
ADDITIONAL CONTACTS (INTERNAL)				
NAME	**TITLE**	**WORK #**	**MOBILE #**	**HOME #**
Jacob Herzog	Engineer		505-427-9643	
Lito White	Engineer		303-717-9808	
Blaine Prichett	Manager Projects		720-412-0182	
Erin Vandagriff	FOA		817-781-4512	

2.1.6 Notify residents identified as public receptors in accordance with Risk

Management Plans (RMP) when necessary. Maps of RMP facility public receptor locations are in Attachment A. A list of public receptors is in Table 2.1.5.

TABLE 2.1.5 – PUBLIC RECEPTOR CONTACTS (RMP FACILITIES ONLY)				
NAME	**LOCATION**	**WORK #**	**MOBILE #**	**HOME #**
N/A	N/A	N/A	N/A	N/A

2.1.7 In accordance with 11.05.00.01 – Incident Notification and Reporting procedure, report **onshore** releases and spills to **(855- 945- 5762).**

2.1.8 In accordance with 11.05.00.01 – Incident Notification and Reporting procedure, report **offshore** releases and spills to O'Brien's Oil Pollution Services (OOPS) at **(985-781-0804),** Williams Environmental Specialistand the DOT Compliance Specialist.

3.0 RESPONSE ACTIONS

3.1 Evacuation

3.1.1 If personnel are onsite when an Emergency Event occurs, they should evacuate to a pre-determined point upwind, uphill and upgrade.

3.1.1.1 Take the following actions as necessary to ensure a safe response to potential emergency events:

- Evacuate the premises.
- Locate upwind, uphill, and upgrade of the incident. Trained facility personnel may also designate a credible alternate path or route to evacuate personnel. Refer to the "evacuation plot plans" located in each facility.
- Account for all personnel.

3.1.2 When the evacuation is complete, account for all personnel before proceeding.

3.1.2.1 Personnel assembled at the mustering station are accounted for by means of the F2-004 Visitor Sign In Log or applicable forms. Personnel are cross referenced with the sign in logs the missing are listed and compared with attendance at the other mustering stations.

3.1.2.2 Incident Commander/911 Dispatch will manage evacuation of citizens.

NOTE: Some employees may delay evacuation until critical functions have been performed such as closing valves, etc. However, these functions do not take precedence over an employee's safety. If an employee feels he or she is in danger, they should evacuate immediately.

3.2 Operator Qualification – Covered Tasks

3.2.1 Any activity that has been determined to be a covered task must be performed by a qualified individual during emergency situations. Span of Control may be used during these emergencies.

3.3 Shut-Downs or Pressure Reductions

3.3.1 Perform emergency shutdown, pressure reduction and/or venting of the affected asset (pipelines and pipeline systems, plants, pump and compressor stations, etc.) necessary to minimize hazards to life or property.

3.3.1.1 If this ERP covers a DOT jurisdictional pipeline controlled by Pipeline Control, Pipeline Controllers will follow all appropriate Pipeline Control Site / Segment Specific Procedures necessary to minimize hazards to life or property.

If this ERP does not cover a DOT jurisdictional pipeline operated by Pipeline control; list the steps to accomplish 3.3.1 or refer to and link to your site-specific procedures.

3.4 Response (From a Remote Site)

3.4.1 First Responders (Company personnel who arrive at the Emergency Event site first) should observe and evaluate the general conditions before taking further action.

3.4.2 Offensive mitigation actions may not be attempted until ICS is established.

3.5 Isolate and Deny Access or Entry

3.5.1 In conjunction with Emergency Response Agencies, isolate the scene of the Emergency Event. The following actions may be taken:

3.5.1.1 Establish perimeter controls to keep persons out of any potentially hazardous areas

3.5.1.2 Reroute traffic around the area

3.5.1.3 Identify and remove ignition sources (e.g. - pilot lights, engines, motors, etc.)

3.5.1.4 Identify and contact railroads, roadways, shipping lanes, flight paths, utilities, etc. which may need closed or shut down due to the event.

3.6 Establish Incident Command (ICS)

3.6.1 Establish the Incident Command System (ICS) and appoint a Safety Officer.

3.6.1.1 ICS positions beyond these two required positions should match the complexity of the situation.

3.6.1.2 The entire Incident Command structure is shown in Attachment C.

3.6.2 Establish the **Hot (Red)**, **Warm (Yellow)** and **Cold (Green)** zones. The North American Emergency Response Guidebook (NAERG) should be used initially to establish the boundary between red and green zones. Then, use air monitoring equipment and incident command judgment to refine the size and shape of the red zone. A warm (yellow) zone should also be established in the area of no gas detection between the red and green zones as a buffer between the red and green zones. Decontamination should be set up in the Warm zone.

3.6.3 Establish reliable communication methods between individuals who will play an active role in the response.

3.6.3.1 An alternate means of communications may need to be available.

3.6.3.2 Communication systems of the police, fire departments or highway patrol should be used **only** if communications cannot be established and maintained with Company equipment.

3.7 Identify Hazardous Materials

3.7.1 The identity of most, if not all, hazardous materials spilled or released during an Emergency Event involving Company assets is typically easy to ascertain due to the hazardous materials' properties (e.g. – natural gas, crude oil, condensate, etc.). Utilize SDS(s) or the NAERG to identify risks associated with spilled or released hazardous materials. SDS(s) are online at MSDS Online, are available by calling MSDS Online at **888-362-7416** and/or may be attached to this Plan in Attachment B.

3.8 Personal Protective Equipment (PPE)

3.8.1 Select PPE appropriate to the situation, taking into account such variables as the properties of any spilled hazardous materials and hazards introduced by the response and by reviewing the appropriate SDS(s) for the levels of protection. SDS(s) are online at MSDS Online, are available by calling MSDS Online at **888-362-7416** and/or may be attached to this Plan in Attachment B.

3.9 Site Control

3.9.1 Identify and initiate appropriate confinement and/or control methods based upon the nature of the incident. This may require the use of Company and third party resources. The location and nature of available Company owned and third party provided equipment, tools, materials, manpower and other resources are listed in Table 3.8.1.

TABLE 3.8.1 – AVAILABLE RESOURCES

(add rows if necessary, delete unused rows)

RESOURCE (Company owned and third party provided Equipment/Tools/Materials/Manpower/Other)	LOCATION (Location of Company owned equipment) (Location, Contact name, phone numbers of third party provided Resources)

3.10 Protective Actions

3.10.1 Identify and employ appropriate evacuation measures and/or shelter-in-place options for persons affected or displaced by the event.

3.11 Repairs and Mitigating Actions

3.11.1 If offensive mitigating actions are conducted, they must be in a brief written plan that is developed and communicated to the entire repair or offensive group through a field briefing.

3.11.2 Consider the preservation and protection of evidence, samples, failed components, etc. in any repair plans.

3.11.3 The Incident Commander will ensure significant pieces of evidence (samples, failed components, etc.) are appropriately identified, labeled, photographed, collected, catalogued and preserved.

4.0 POST EMERGENCY ACTIVITIES

4.1 Restoration of Service

4.1.1 Follow the appropriate Site-Specific Operating and Maintenance Procedures and Pipeline Control Procedures when restoring service and returning to normal operations.

4.2 Decontamination

4.2.1 The Incident Commander will establish and provide decontamination. When required, decontamination should be established in the **Warm (Yellow)** zone.

4.3 Termination

4.3.1 The termination phase is important for the safe, effective and legally sound conclusion of Emergency Event operations. The termination phase begins after the immediate threat of the Emergency Event has been stabilized or eliminated (usually at the time repairs begin).

4.3.2 Termination may include equipment status evaluation, personnel debriefings and/or personnel assignments for post-incident critique, etc.

4.3.3 A debriefing with any third party responder must be held before their release.

4.4 Disposal

4.4.1 The Incident Commander will ensure appropriate disposal of all recovered materials and contaminated soils. Enlist the support of the area Environmental Specialist.

4.5 Medical

4.5.1 Report all injuries and exposures in accordance with 02.00.70.02 – Accident Reporting.

4.5.2 Only those individuals that have been properly trained and have demonstrated capability can provide First Aid and CPR.

4.5.3 Any treatment beyond First Aid or CPR will be performed by trained medical professionals.

4.6 Documentation

4.6.1 The Incident Commander will ensure all necessary documentation is gathered, organized and submitted to the Safety Representative.

4.7 Critique

4.7.1 The Incident Commander, in conjunction with the Safety Representative, will schedule a critique of the Emergency Response and inform affected personnel. Document the critique on M02-032 – Emergency Response or Drill.

DRAFT

ATTACHMENT A

MAPS AND DRAWINGS

DRAFT

ATTACHMENT B

MSDS

(Attach appropriate MSDSs here)

OR

ACCESS SDS INFORMATION TELEPHONICALLY FROM MSDS ONLINE COMPANY (888-362-7416)

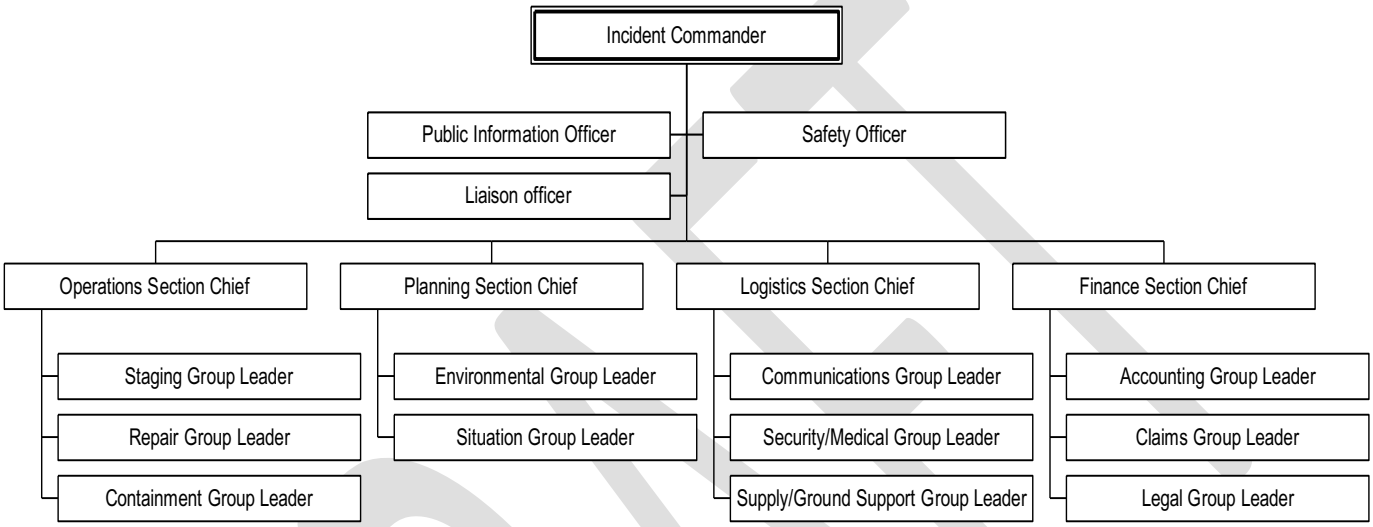
OR

WEBSITE AT MSDS Online

DRAFT

ATTACHMENT C

INCIDENT COMMAND STRUCTURE



INCIDENT COMMANDER (IC) (REQUIRED)

The Incident Commander (IC) manages all activities related to an Emergency Response. As such, the Incident Commander needs to be familiar with the contents of the Emergency Response Plan (ERP), the Spill Prevention Control and Countermeasure Plan (SPCC) and/or Oil Spill Response Plans (OSRP). The Incident Commander (IC) must also be familiar with the operation of the Incident Command System (ICS) and the Unified Command Structure (UCS).

SAFETY OFFICER (REQUIRED)

The Safety Officer is responsible for assessing and monitoring hazardous and unsafe situations at the Emergency Event site(s). The Safety Officer must enforce measures that assure the safety of the public and response personnel.

PUBLIC INFORMATION OFFICER (PIO)

The Public Information Officer (PIO) provides critical contact between the media/public and the emergency responders. The PIO is responsible for developing and releasing information about the incident to the news media, incident personnel, appropriate agencies and the public. When the response is multi-jurisdictional (involves the federal and state agencies), the PIO must coordinate gathering and releasing information with these agencies.

LIAISON OFFICER

If a Unified Command Structure is not established, a Liaison Officer is appointed as the point of contact for personnel assigned to the incident from assisting or cooperating agencies.

OPERATIONS SECTION CHIEF

The Operations Section Chief is responsible for the management of all operations applicable to the field response and site restoration activities. Operations directs field activities based on the Assessment/Action Plan

STAGING GROUP LEADER

The Staging Group Leader is responsible for managing all activities within the staging area(s). The Staging Group Leader will collect, organize, and allocate resources to the various response locations as directed by the Operations Section Chief.

REPAIR GROUP LEADER

The Repair Group Leader is responsible for supervising repairs.

CONTAINMENT GROUP LEADER

The Containment Group Leader is responsible for supervising the containment and recovery of spilled product and contaminated environmental media on land and on water.

PLANNING SECTION CHIEF

The Planning Section Chief is responsible for collecting, evaluating, and disseminating information related to the current and future activities of the response effort. The Planning Section Chief must understand the current situation; reasonably predict the future course of events; reasonably predict future resource needs; and assist in development of cleanup strategies.

The Planning Section Chief must coordinate activities with the Incident Commander (IC) and other Section Chiefs to ensure that current and future needs are appropriately handled.

ENVIRONMENTAL GROUP LEADER

The Environmental Group Leader is responsible for ensuring that all areas impacted by a release are identified and cleaned up in accordance with Company and regulatory standards. The Environmental Group Leader supports Planning and Operations to minimize and document the environmental impact of the release. The Environmental Group Leader must plan for future site considerations such as long-term remediation and alternative response strategies in unusually sensitive areas. In a Unified Command Structure (UCS), representatives from the federal and state responding agencies will be included in this group.

SITUATION GROUP LEADER

The Situation Group Leader is responsible for the collection, evaluation, display, and dissemination of all information related to the Emergency Response effort. The Situation Group Leader must establish and maintain communications with all portions of the Incident Command and the response site in order to collect the information. The Situation Group Leader also attempts to predict spill movement/migration and identifies areas that may be impacted by the Emergency Event.

LOGISTICS SECTION CHIEF

The Logistics Section Chief is responsible for procuring facilities, services and material in support of the Emergency Response effort.

COMMUNICATIONS GROUP LEADER

The Communications Group Leader is responsible for ensuring that the Incident Command and emergency responders have reliable and effective means of communication. This may involve activation of multiple types of communications equipment and coordination among multiple responding agencies and contractors.

SECURITY/MEDICAL GROUP LEADER

The Security/Medical Group Leader is responsible for developing a plan to deal with medical emergencies, obtaining medical aid and transportation for Emergency Response personnel, and preparation of reports and records.

SUPPLY/GROUND SUPPORT GROUP LEADER

The Supply/Ground Support Group Leader is responsible for procurement and the disposition of personnel, equipment and supplies; receiving and storing all supplies for the incident; maintaining an inventory of supplies; and servicing non-expendable supplies and equipment. The Supply/Ground Support Group Leader supports the following: transportation of personnel; supplies, food, equipment; and fueling, service, maintenance and repair of vehicles and equipment.

FINANCE SECTION CHIEF

The Finance Section Chief is responsible for accounting, legal, right-of-way and risk management functions that support the Emergency Response effort. In this role, the primary responsibility is supporting the Command Staff and Logistics Section matters pertaining to expenses during and following the Emergency Response. The Finance Section Chief will ensure that the cost tracking and reporting process for reimbursable and non-reimbursable insurance-related cost accounting is followed.

ACCOUNTING GROUP LEADER

The Accounting Group Leader is responsible for identifying and dispensing funding during an Emergency Response. All charges directly attributed to the incident should be accounted for in the proper charge areas.

CLAIMS GROUP LEADER

The Claims Group Leader is responsible for managing all risk management and right-of-way issues during and following an Emergency Response. It is important that all claims are investigated and handled expediently.

LEGAL GROUP LEADER

The Legal Group Leader is responsible for advising the Incident Command Staff and Section Chiefs on all matters of Legal relevance.

Revision History

Rev Date	Rev #	Request #	Section #	Description
12/14/2017	00	N/A	N/A	SIP port to WIMS.
1/3/19	01	N/A	N/A	New document for Rocky Mountain Midstream Assest.

System Integrity Plan Change Log

Date	Change Location	Brief Description of Change
06-14-11 (Rev. 6)	Title Page	Added footnote 1 as a reminder to refer to 6.04-ADM-003 and address necessary portions of such.
	2.1	Added footnote 2 to clarify sequence of events.
	3.2.11	Added "If this ERP covers a DOT jurisdictional pipeline operated by Pipeline Control, you must list actions to be taken by Pipeline Controllers during an emergency." Revised original to read "If this ERP does not cover a DOT jurisdictional pipeline operated by Pipeline control; list the steps to accomplish 3.2.1 or refer to and link to your site-specific procedures." These revisions were made to clarify/require Pipeline Controllers' actions be entered here for those DOT Jurisdictional assets which they control. (Ref. 49 CFR 192.631(f)(2), 195.446(f)(2), 192.631(b)(3) and 195.446(b)(3)).
	3.6.1 3.7.1 Attachment B	Changed the references, links and phone number from 3E Online MSDS to the new provider, MSDS Online.
	Headers and Footers	Updated revision number.
09/18/11	Document	Updated links.
6/22/12 (Rev. 7)	3.5.2	SIP Feedback # 7312363 Revised to add more detailed information regarding the steps to refine the Hot (red) zone, and the criteria for Warm (yellow) zones.
		Implementation 3rd Quarter 2012

Date	Change Location	Brief Description of Change
(Rev 8) cr 490	3.2	Added in section 3.2 to ensure all covered tasks are to be performed by qualified individuals even during emergencies.
11/17/16 (Rev 9) CR 1002	Throughout	Updated to be consistent with the Incident Management Program documents Implemented 11/17/2016
2/22/2017 (Rev 10) CR 1253	2.13	Added new step: Notify Pipeline Control (800-635-7400).
3/24/2017 (Rev 11) cr 1333	4.5.2	Updated step to clarify only individuals that have been properly trained and have demonstrated capability can provide First Aid and CPR.

DRAFT

Submittal Coversheet Guide

Document Titles and Numbers *(Numbers to be assigned by WIMS Team)*
10.00.70.02 – Midstream Emergency Response Plan Template
SIP Documents to be Replaced/Archived *(Indicate if any SIP feedback requests are being addressed)*
12.01-ADM-002 - Emergency Response Plan Template

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LEVEL 3
STORM DRAINAGE STUDY

CE-102

DJ BASIN FIELD COMPRESSION
WATKINS COMPRESSOR STATION

NW 1/4 of Section 35, Township 3 South, Range 64 West,
6th Principal Meridian
Adams County, Colorado

PREPARED FOR:

ROCKY MOUNTAIN MIDSTREAM LLC

PREPARED BY:

SAMUEL ENGINEERING, INC.
8450 EAST CRESCENT PARKWAY, SUITE 200
GREENWOOD VILLAGE, CO 80111
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January 21, 2019

Revision B

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RECORD OF REVISIONS

Originator/Lead Engineer:	Michael Cloud	Date:	01/21/18
Project Engineer Approval:		Date:	
Project Manager Approval:	Brandon Primeaux	Date:	01/21/18
Client Approval:		Date:	

Rev. No.	By	Revisions	Approval	Date
A	M. Morgan	Issued for Permit	BP	11/15/18
B	M. Cloud	Issued Final – No County Comments	BP	01/21/09

Current Working Revision Rev. B Date 01/21/2018

ENGINEER CERTIFICATION OF DRAINAGE REPORT

I, Michael Cloud, hereby certify that this report (plan) for the Preliminary Drainage design of the Watkins South Compressor Station was prepared by me or under my direct supervision in accordance with the provisions of Adams County Storm Drainage Design and Technical Criteria for drainage facilities designed by others.



JANUARY 21, 2019
Date

Registered Professional Engineer
State of Colorado No. 49458
(Affix Seal)

DEVELOPER CERTIFICATION OF DRAINAGE FACILITIES

Rocky Mountain Midstream LLC, hereby certifies that the drainage facilities for the Watkins Compressor Station shall be constructed according to the design presented in this report. I understand Adams County does not and will not assume liability for the drainage facilities designed and/or certified by my engineer. I understand that Adams County reviews drainage plans pursuant to Colorado Revised Statues Title 30, Article 28; but cannot, on behalf of the Watkins Compressor Station, guarantee that final drainage review will absolve Rocky Mountain Midstream, LLC and/or their successors and/or assigns the future liability for improper design. I further understand that approval of the Final Plat and/or Final Development Plan does not imply approval of my engineer's drainage design.

Date

Rocky Mountain Midstream, LLC (please print)

Authorized Signature

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1.0 DESCRIPTION OF PROJECT

The subject property is a 10-acre parcel leased by Rocky Mountain Midstream, LLC for the installation of a 40 MMSCFD gas compression station. The compression station and detention pond will disturb approximately 3.8 acres of the 10-acre lease site. The site access road is approximately 2,300 feet long aligned through a 30 foot wide easement, the access road will disturb approximately 1.9 acres. The site will have several small enclosures for the compressors, a pipe rack and miscellaneous pieces of equipment. The site will be surfaced with gravel and the access road will be also be gravel. The site will have a security fence surrounding the facility and a twenty foot landscaping buffer outside of the security fence.

The project site is located southeast of the intersection of Manilla Road and East Colfax Avenue. More specifically the NW 1/4 of Section 35, Township 3 South, Range 64 West, of the 6th Principal Meridian, Adams County, Colorado. The proposed site will be accessed from Manilla Road.

The project site is zoned A-3. The adjacent zoning is A-3 on the north, south and west, the east boundary of the project site is zoned PUD A-1. All nearby land cover including the site is row crop.

There are no open channels, lakes, streams or irrigation ditches in the proposed development. The access road will have four culvert crossings including the tie-in to Manilla Road. The subject property is not located in a floodplain or located within an MS4 Permit area.

A Level 3 Storm Drainage Report using Chapter 9 of the Adams County Storm Drainage Design and Stormwater Quality Regulations and portions of the Urban Drainage and Flood Control District were used for the basis of design.

See Appendix A for the Vicinity Map.

2.0 METHODOLOGY

2.1 EXISTING CONDITIONS

The project site is located on an undeveloped agricultural tract of land. There are no storm drainage facilities near the site. The site slopes from the south to the north. The elevations of the compressor station range from 5575 to 5566, grades generally range from 1.0% to 2.0%.

The existing topography along the access road alignment slopes away from the site to the west and ties into Manilla Road at approximately elevation 5552. Manilla Road is an asphalt surfaced road with a slightly defined roadside ditch.

See Appendix G for the Developed and Existing Conditions Drainage Maps.

2.1.1 Site Soils

The characteristics of the soils on the site contribute to the amount of storm runoff. Regional soil information was obtained from the National Resource Conservation Service (NRCS) Web Soil Survey. The majority of the site soils are Ascalon Sandy Loam with slopes of 3% to 5% classified as Hydraulic Soil Group (HSG) B. The access road alignment passes through several different types of soil classifications; Ascalon Sandy Loam (0% to 3% slopes), Ascalon-Vona Sandy Loam (1% to 5% slopes) Vona Loamy Sand (3% to 9% slopes) and Ascalon-Platner Association. These soils are classified as HSG B, with the exception of Vona Loamy Sand, which is HSG A. For a conservative analysis of the existing runoff calculations, HSG B will be used for the purposes of this Storm Drainage Study. The existing regional soil information obtained from NRCS is used for all runoff calculations.

See Appendix B for the regional NRCS Web Soil Survey of this site.

2.1.2 Off-Site Basins

The lease boundary is located inside of existing Basin D. The proposed site development splits the existing runoff pattern of Basin D into separate flows. Two proposed swales route this existing flow around the compressor pad on the east side and west side. At the north edge of the lease boundary these two swales combine the runoff to continue northerly to maintain historic flow patterns.

The site access road alignment passes through existing Basins B, C and D. Culverts will provided at existing low points along this alignment to maintain historic runoff patterns.

2.1.3 Project Site Basin

Drawing WCSS-CE-611 delineates Basin 1, which is the proposed pad, site access road and detention pond. Basins D1 and D2 are the balance of the area within the predeveloped conditions Basin D.

2.1.4 Hydrology

Peak flowrates for Basins A, B, C, D and Basin 1 are calculated following the Urban Drainage and Flood Control District (UDFCD) design manual and worksheets. Inputs for Rational Method calculations are determined from the drawing WCSS-CE-610, *Predeveloped Conditions Drainage Basin Map* and WCSS-CE-611, *Developed Conditions Drainage Basin Map*. The Rational Method calculations are developed using Urban Drainage and Flood Control District Worksheet “UD-Rational v2.00.xls”.

An impervious value of 2% is used in the existing conditions (pre-development) calculations.

See Appendix C for the site hydrology calculations.

2.2 DEVELOPED CONDITIONS

2.2.1 Site Soils

As indicated in Section 2.1.1, the predominate soil type is HSG B. The soil type boundary is shown on drainage drawing WCSS-CE-610 located in Appendix G.

2.2.2 Site Basin

The proposed facility disturbs approximately 5.7 acres of land, including the site access road. Due to the natural topography of the existing land and the facility layout, one developed primary basin was delineated, Basin 1. This basin includes the compressor station equipment area, approximately one half of the access road around the equipment and the detention pond. The 2,600 foot site access road is not considered in developing Basin 1 hydrology. The peak runoff rate for Basin 1 is used to size the two culverts draining to the detention pond. It is assumed that each culvert will convey one half of the peak flow rate of the basin.

To maintain historic runoff rates and patterns, Basin 1 is used to size the detention pond and outlet structure due to the change in impervious area for the compressor station pad.

The proposed facility surfacing will be gravel. The weighted impervious area for Basin 1 is 52.9%.

2.2.3 Hydrology

Peak flow rates for Basin 1 are calculated using the UDFCD design manual and worksheets. Inputs for Rational Method calculations are determined from the drawing WCS-CE-611, *Predeveloped Conditions Drainage Basin Map*. The Rational Method calculations are developed using Urban Drainage and Flood Control District Worksheet “UD-Rational 2.00.xls”.

Weighted impervious values are used for the developed conditions hydrology.

2.3 HYDRAULICS

Due to the type of plant being constructed the site grading will have minimum slopes with the majority of onsite runoff being conveyed by sheet flow to drop inlets with culverts to pass flow beneath the plant road to the detention pond.

Shallow swales on the perimeter of the site will be used to convey the off-site runoff around the site.

See Appendix F for the project hydraulic calculations.

2.3.1 Culverts

The site access road will utilize corrugated metal pipes (CMP) for conveying flow under the road. These culverts will utilize flared end sections on the inlets and outlets with rip-rap lining on both

ends. The culverts will be designed with the maximum headwater (H/D < 1.5) for the 100-year peak flow rate.

The two culverts inside the compressor pad will be reinforced concrete pipes with flared end sections and rip-rap lining on the outlets.

2.3.2 Perimeter swales

The perimeter swales convey the runoff from Basin D1 and Basin D2 around the project site. Typical drainage ditches are grass lined trapezoidal channels with 2' bottom width and 4H:1V side-slopes. The swale draining to the detention pond has a 2' bottom width and 3H:1V side-slopes. Ditches typically have and average depth of approximately 1-foot.

The outside perimeter swales conveying flow for Basins D1 and D2 have the capacity to pass the 5-year event without overtopping the swale. In the unlikely event of over-topping of a swale, there is no danger to the facility or surrounding areas. These swales are only used to divert runoff around the site which is elevated several feet above existing grade. The swales daylight to existing grade near the edge of the lease boundary and rejoin existing patterns.

2.4 DETENTION POND

The detention pond is designed to store the 100-year storm volume plus one-half the Water Quality Capture Volume. Basin 1 is the basis for the pond sizing which includes the disturbed area for the pad, access road around the equipment and detention pond surface.

Basins D1 and D2 are routed around the site and not detained, these values were not used in any detention calculations. The footprint of the disturbed area was evaluated for peak runoff rate in the pre-development conditions. Also, the discharge rate from Chapter 9 of Adams County criteria was evaluated and the pond outlet structure was designed so the discharge rate is not to exceed the lesser of these two values.

AutoCAD modeling of the pond was used verify that the construction drawings accurately reflect the required volume of the pond. The pond volume was modeled in 0.01 ft increments and a stage-storage spreadsheet was developed as inputs for the discharge structure design.

See Appendix E for the pond stage-storage and outlet design details.

3.0 SUMMARY OF DESIGN VALUES

3.1 DISTURBED AREA

The pre-development runoff rate for Basin D is 3.20 cfs for the 5-year storm and 33.25 cfs for the 100-year storm. The developed area uses three design points to analyze the runoff rates. Design Point 1 corresponds to the project site for sizing the culverts to the detention pond. The pad is sloped to the north and two small swales collect the runoff and divert the flow to each culvert on the east and west edge of the equipment area. It is assumed these swales each collect one half the flow for the basin.

Design Point 2 is used to size the culvert that drains Basin D1 under the site access road. This basin is primarily undisturbed land.

Design Point 3 is accumulated flow from Basin D2 and Design Points 1 & 2. This design point shows that the post development runoff does not exceed the predevelopment runoff. As shown in the calculation "Design Point 3 Peak Runoff", the rational method was used to determine the runoff for Basins D1 and D2, then the maximum allowable release rate from the pond was added the flow from D1 and D2. The developed runoff rate at Design Point 3 is 2.76 cfs for the 5-year storm and 28.26 cfs for the 100-year storm, which is less than the pre-developed conditions, therefore there should be no downstream impacts from this project.

3.2 CULVERTS

Drawing WCSS-CE-610 delineates the pre-development basins. In each of these basins a culvert will convey the flow under the site access road, four corresponding design points were calculated for the culvert sizing. It is assumed the access road has a negligible impact of the impervious area of these large basins, therefore the culverts were sized using a predeveloped impervious area of 2% for Basins B, C and D. Basins A is the tributary area of the Manilla Road ditch, the impervious area for this basin is 50%.

Design Point A has a runoff rate of 0.55 cfs for the 5-year storm and 1.72 cfs for the 100-year storm. An 18" CMP will be used for conveying this flow, the 100-year storm will pass through this culvert without overtopping the site access entrance.

Design Point B has a runoff rate of 1.77 cfs for the 5-year storm and 18.36 cfs for the 100-year storm. A 24" CMP will be used for conveying this flow, the 100-year storm will pass through this culvert without overtopping the site access road.

Design Point C has a runoff rate of 6.05 cfs for the 5-year storm and 62.86 cfs for the 100-year storm. Two 30" CMP's will be used for conveying this flow, the 100-year storm will pass through these culverts without overtopping the site access road.

Design Point D is used to establish the predeveloped peak runoff rate for the project site basin. Design Point 2 (drawing WCSS-CE-611) is used to size the culvert under the site access road. The runoff at Design Point D1 is 2.01 cfs for the 5-year storm and 21.05 cfs for the 100-year storm. Two 24" CMP's will be used for conveying this flow, the 100-year storm will pass through these culverts without overtopping the site access road.

Design Point 1 has runoff rate of 3.30 cfs for the 5-year storm and 9.88 cfs for the 100-year storm. The compressor pad is sloped uniformly to the north and two small swales at the north end of the pad collects the runoff and directs the flow to a 12" RCP at the east edge of the pad and 12" RCP at the west end of the pad. It is assumed the swale these two swale evenly split the runoff of Basin 1. The 12" RCP have capacity have a combined capacity of 7.64 cfs. These culverts pass the 5-year storm. In the event of the 100-year storm, the culverts will build head and pass the storm or in the event of a clogged pipe, the excess storm water will pond and flow across the facility road and be collected by the ditch on the north side of the road and flow into the detention pond.

3.3 DETENTION POND

3.3.1 VOLUME

The calculated water quality capture volume is 2,162 ft^3., the provided volume is 2,183 ft^3. This corresponds to a stage elevation of 5569.50, or 0.64' of depth.

The 5-year storage volume including WQCV is 6,819 ft^3., the provided 5-year storage volume is 6,875 ft^3 at stage elevation of 5570.24.

The 100-year storage volume including WQCV is 12,388 ft^3, the provided 100-year storage volume is 12,458 ft^3 at stage elevation 5571.00.

In the event the overflow spillway is utilized, the storage volume at the crest of the spillway is the same as the 100-year storage volume including WQCV. The spillway has a 10 foot wide crest and has a capacity (0.5' head) of 11.90 cfs, which exceeds the 100-year peak flow rate from Basin 1 of 9.88 cfs. The pond has one foot of freeboard, elevation 5572.00, the storage volume at this elevation is 21,067 ft^3 .

See Appendix D for pond sizing calculations.

3.3.2 OUTLET STRUCTURE

The outlet structure has three primary components that regulate storm water discharge. The first component is the water quality capture volume. This volume of water is to be released over a period of 40 hours. Two - 7/8" orifices are used to discharge this volume of water in 35.48 hours.

The next component is the 5-year storm release rate. The maximum allowable release rate per Adams County Chapter 9 design criteria is 0.47 cfs. The 5-year orifice plate design (10"W x 1.5"H) for the outlet structure is 0.41 cfs.

The final component is the 100-year storm release rate. The maximum allowable release rate per Adams County Chapter 9 design criteria is 2.78. cfs. A restrictor plate will be added to the outlet pipe. The outlet pipe is a 12" RCP, the restrictor plate will be added 6-1/4" above the flowline of the outlet. The restrictor plate has a maximum release rate of 2.70 cfs, which is less than maximum allowable release rate.

The outlet structure releases storm water equal to or less than Adams County requirements for discharge rate and below the pre-developed conditions rate, therefore the proposed facility should have no downstream impacts in the watershed basin. To ensure water rights are not infringed upon, the pond drains in 41.51 hours from the 100-year storage volume.

4.0 CONCLUSION

This drainage study has been prepared in accordance with the Adams County Storm Drainage Criteria and Urban Drainage Criteria Manuals and accepted Professional Engineering Practices.

For the detention pond to continually function as designed, it must be maintained to ensure that adequate storage volume is available and that the drainage structures are not damaged.

The site drainage infrastructure has been designed to convey developed flows through an extended detention basin pond designed with controlled discharge rates for the minor and major storms. The flows then travel through established drainage ways in a manner consistent with the predevelopment drainage patterns. With a properly constructed and maintained pond along with the proposed erosion control measures this development will not adversely impact the existing drainage or existing downstream developments.

5.0 POND MAINTENANCE REQUIREMENTS

The structural and functional integrity of the detention basin shall be maintained at all times by removing and preventing drainage interference, obstructions, blockages, or other adverse effects into, through, or out of the system.

5.1 ROUTINE MAINTENANCE

5.1.1 Inspections

Routine inspections shall be performed a minimum of 2 times annually and after major rainfall events.

5.1.2 Sediment and Debris Management

Periodic silt removal shall occur when standing water conditions occur or the pond's storage volume is reduced by more than 10%. Silt shall be removed and the pond/basin returned to original lines and grades shown on the approved engineering plans (See Appendix H). In addition, corrective measures are required any time a basin does not drain completely within 72 hours of cessation of inflow.

Accumulated litter, sediment, and debris shall be removed every 6 months or as necessary to maintain proper operation of the basin. Disposal shall be in accordance with federal, state and local regulations.

5.1.3 Vegetation Management

Detention facilities shall be mowed monthly between the months of April and October or anytime vegetation exceeds 12-inches in height.

5.2 NON-ROUTINE MAINTENANCE

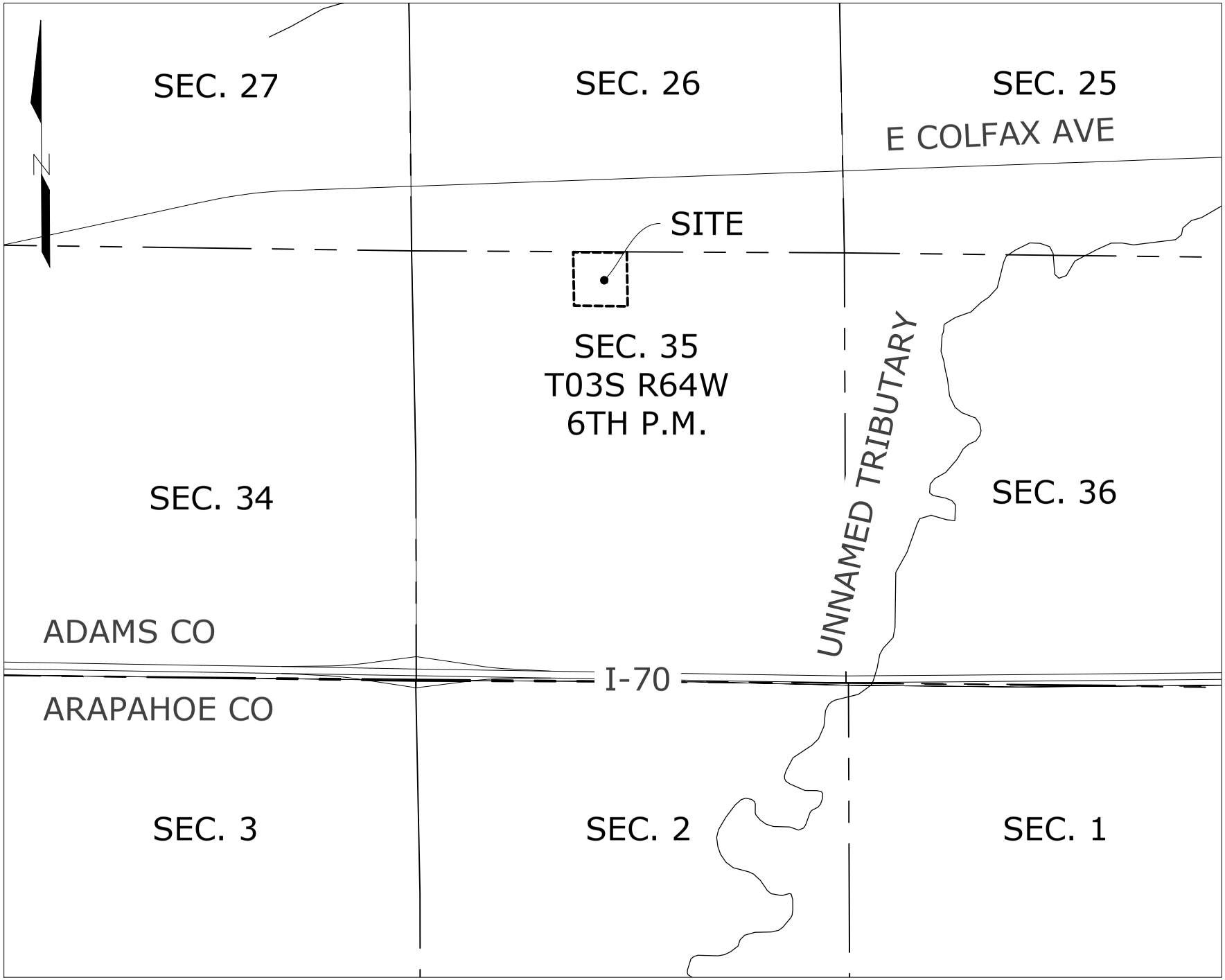
5.2.1 General

The detention basin shall be kept free of excess trash and debris, poisonous and noxious weeds, contaminants and pollution, rodent holes, standing water harboring insects, and unwanted vegetation growth (i.e. trees). These potential defects shall be repaired or mitigated to the original state within 30 days from the date of observation.

5.2.2 Facility Repairs

If upon routine inspection any signs of damage to the outlet structure, forebay, trickle channel, outlet pipe, emergency spillway, or pond embankment are observed, the feature shall be repaired to the original state within 30 days from the date of observation.

Appendix A:
Vicinity Map



VICINITY MAP

SCALE: 1" = 3000'

Appendix B:
NRCS Web Soil Survey

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

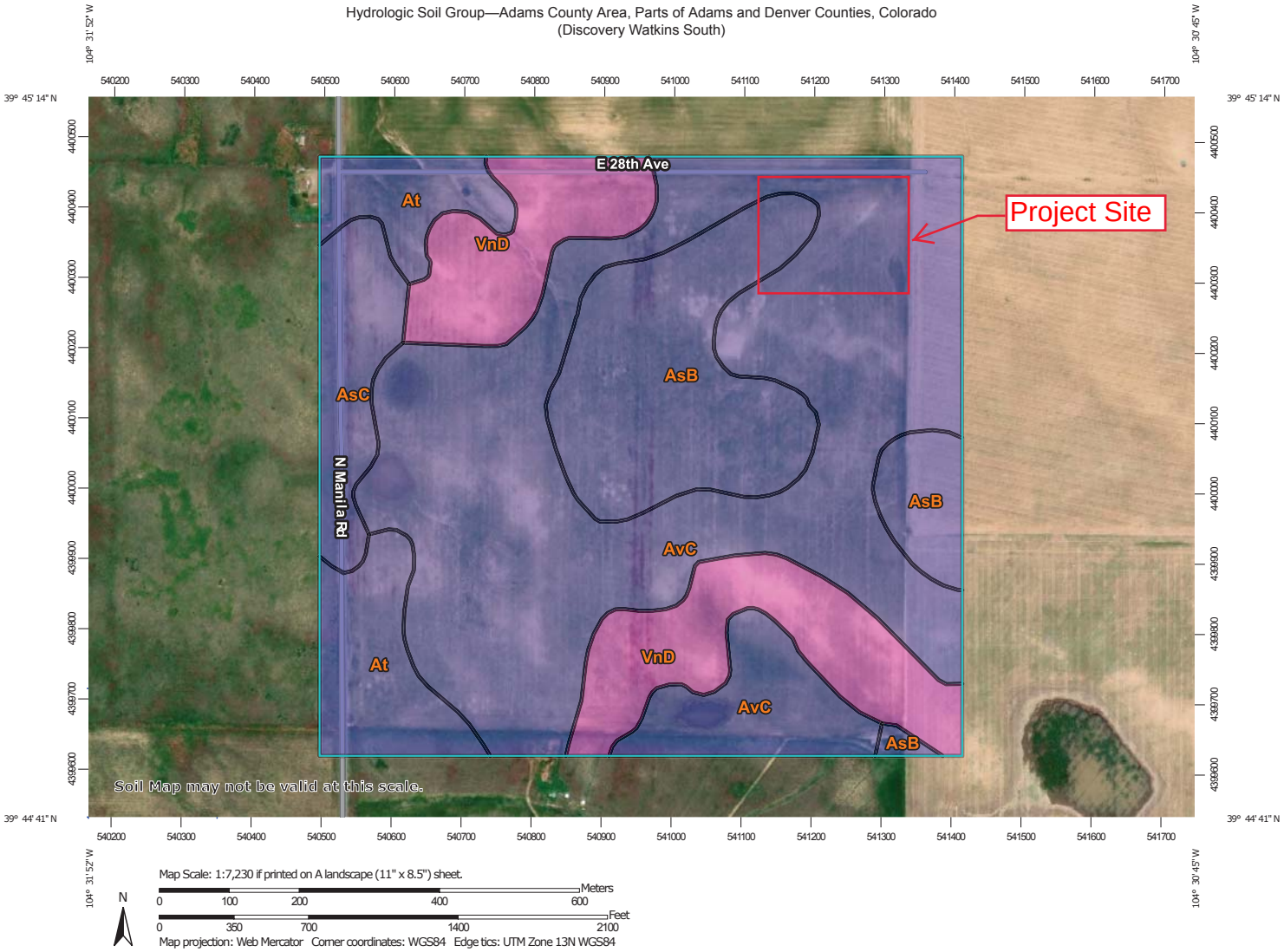
A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Adams County Area, Parts of Adams and Denver Counties, Colorado; and Arapahoe County, Colorado



November 2, 2018

Hydrologic Soil Group—Adams County Area, Parts of Adams and Denver Counties, Colorado
(Discovery Watkins South)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Adams County Area, Parts of Adams and Denver Counties, Colorado
Survey Area Data: Version 15, Sep 13, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 17, 2015—Oct 2, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
AsB	Ascalon sandy loam, 0 to 3 percent slopes	B	34.3	17.6%
AsC	Ascalon sandy loam, 3 to 5 percent slopes	B	10.5	5.4%
At	Ascalon-Platner association	B	18.5	9.5%
AvC	Ascalon-Vona sandy loams, 1 to 5 percent slopes	B	99.3	51.1%
VnD	Vona loamy sand, 3 to 9 percent slopes	A	31.8	16.4%
Totals for Area of Interest			**194.3**	**100.0%**

Appendix C:
Hydrologic Calculations

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Client: Rocky Mountain Midstream
Project Name: Watkins Compressor Station
Project No.: 18256-01
Subject: Basin 1 Impervious Area
Prepared By: M. Morgan
Date: 11/08/2018 Sheet 1 of 1

DEVELOPED CONDITIONS IMPERVIOUS AREA

Use	% Impervious	Area (AC)
Pond	100	0.39
Equipment	80	0.31
Access/Pad (packed gravel)	40	2.08
Yard Area (native vegetation)	2	0
	52.9 %	**2.78**

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Phone: 303.714.4840 Fax: 303.714.4800

Client: Rocky Mountain Midstream
Project Name: Watkins Compressor Station
Project No.: 18256-01
Subject: Basin D1 Impervious Area
Prepared By: M. Morgan
Date: 11/08/2018 Sheet 1 of 1

DEVELOPED CONDITIONS IMPERVIOUS AREA

Use	% Impervious	Area (AC)
Pond	100	0.00
Equipment	80	0.00
Access/Pad (packed gravel)	40	0.34
Yard Area (native vegetation)	2	12.08
	3.0 %	**12.42**

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Client: Rocky Mountain Midstream
Project Name: Watkins Compressor Station
Project No.: 18256-01
Subject: Basin D2 Impervious Area
Prepared By: M. Morgan
Date: 11/08/2018 Sheet 1 of 1

DEVELOPED CONDITIONS IMPERVIOUS AREA

Use	% Impervious	Area (AC)
Pond	100	0.00
Equipment	80	0.00
Access/Pad (packed gravel)	40	0.09
Yard Area (native vegetation)	2	5.59
	2.6 %	**5.68**

Calculation of Peak Runoff using Rational Method

Designer: Matt Morgan
Company: Samuel Engineering
Date: 11/12/2018
Project: Watkins CSS
Location: Adams County, Colorado

Version 2.00 released May 2017

Cells of this color are for required user-input
Cells of this color are for optional override values
Cells of this color are for calculated results based on overrides

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_i^{0.33}}$$

$$t_t = \frac{L_t}{60K\sqrt{S_t}} = \frac{L_t}{60V_t}$$

$$\text{Computed } t_c = t_i + t_t$$

$$\text{Regional } t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$

$t_{minimum}$= 5 (urban)
$t_{minimum}$= 10 (non-urban)

$$\text{Selected } t_c = \max\{t_{minimum}, \min(\text{Computed } t_c, \text{Regional } t_c)\}$$

Select UDFCD location for NOAA Atlas 14 Rainfall Depths from the pulldown list OR enter your own depths obtained from the NOAA website (click this link)

	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
1-hour rainfall depth, P1 (in) =	1.00	1.42	1.68		2.35	2.71	
	a	b	c				
Rainfall Intensity Equation Coefficients =	28.50	10.00	0.786				

$$I(in/hr) = \frac{a * P_1}{(b + t_c)^c}$$

$$Q(cfs) = CIA$$

Subcatchment Name	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C							Overland (Initial) Flow Time					Channelized (Travel) Flow Time							Time of Concentration			Rainfall Intensity, I (in/hr)							Peak Flow, Q (cfs)						
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	Overland Flow Length L_i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S_i (ft/ft)	Overland Flow Time t_i (min)	Channelized Flow Length L_t (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Velocity V_t (ft/sec)	Channelized Flow Time t_t (min)	Computed t_c (min)	Regional t_c (min)	Selected t_c (min)	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
D1	12.42	B	3.0	0.01	0.02	0.08	0.27	0.34	0.44	0.55	361.00	5577.55	5574.45	0.009	39.00	468.00	5572.46	5569.17	0.007	15	1.26	6.20	45.20	35.37	35.37	1.42	2.02	2.39		3.34	3.85		0.24	0.47	2.41		14.30	21.05	
					0.08										36.79								43.00										2.01					
D2	5.68	B	2.6	0.01	0.02	0.08	0.27	0.34	0.44	0.55	236.00	5578.88	5573.97	0.021	23.61	577.00	5572.58	5566.32	0.011	15	1.56	6.16	29.76	35.42	29.76	1.58	2.24	2.65		3.70	4.27		0.10	0.21	1.17		7.21	10.63	
					0.08										22.22								28.37										1.02					
Basin 1	2.78	B	52.9	0.40	0.43	0.48	0.58	0.62	0.67	0.73	183.00	5574.73	5573.07	0.009	16.93	148.00	5573.07	5572.87	0.001	20	0.74	3.36	20.29	21.10	20.29	1.95	2.77	3.28		4.59	5.29		2.15	3.30	4.41		7.95	9.88	

Calculation of Peak Runoff using Rational Method

Designer: Matt Morgan
Company: Samuel Engineering
Date: 11/12/2018
Project: Watkins South CS
Location: Adams County, Colorado

Version 2.00 released May 2017

Cells of this color are for required user-input
Cells of this color are for optional override values
Cells of this color are for calculated results based on overrides

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_i^{0.33}}$$

$$t_t = \frac{L_t}{60K\sqrt{S_t}} = \frac{L_t}{60V_t}$$

$$\text{Computed } t_c = t_i + t_t$$

$$\text{Regional } t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$

$t_{minimum}$= 5 (urban)
$t_{minimum}$= 10 (non-urban)

$$\text{Selected } t_c = \max\{t_{minimum}, \min(\text{Computed } t_c, \text{Regional } t_c)\}$$

Select UDFCD location for NOAA Atlas 14 Rainfall Depths from the pulldown list OR enter your own depths obtained from the NOAA website (click this link)

	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
1-hour rainfall depth, P1 (in) =	1.00	1.42	1.68		2.35	2.71	
	a	b	c				
Rainfall Intensity Equation Coefficients =	28.50	10.00	0.786				

$$I(in/hr) = \frac{a * P_1}{(b + t_c)^c}$$

$$Q(cfs) = CIA$$

Subcatchment Name	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C							Overland (Initial) Flow Time					Channelized (Travel) Flow Time							Time of Concentration			Rainfall Intensity, I (in/hr)							Peak Flow, Q (cfs)						
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	Overland Flow Length L_i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S_i (ft/ft)	Overland Flow Time t_i (min)	Channelized Flow Length L_t (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Velocity V_t (ft/sec)	Channelized Flow Time t_t (min)	Computed t_c (min)	Regional t_c (min)	Selected t_c (min)	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
Basin A	0.51	B	50.0	0.37	0.40	0.46	0.56	0.61	0.66	0.72	86.00	5574.29	5574.01	0.003	16.89	741.00	5574.01	5551.02	0.031	15	2.64	4.67	21.56	21.87	21.56	1.89	2.68	3.18		4.44	5.12		0.36	0.55	0.75		1.38	1.72	
Basin B	9.34	B	2.0	0.01	0.01	0.07	0.26	0.34	0.44	0.54	100.00	5578.29	5576.08	0.022	15.12	713.00	5576.08	5547.84	0.040	5	1.00	11.94	27.06	32.09	27.06	1.67	2.37	2.80		3.92	4.51		0.13	0.27	1.91		12.40	18.36	
					0.08										14.18								26.12																
Basin C	48.11	B	2.0	0.01	0.01	0.07	0.26	0.34	0.44	0.54	431.00	5579.71	5578.09	0.004	56.32	1751.00	5578.09	5553.70	0.014	5	0.59	49.45	105.77	52.31	52.31	1.11	1.57	1.86		2.60	3.00		0.46	0.92	6.55		42.47	62.86	
					0.08										52.80								102.26																
Basin D	20.89	B	2.0	0.01	0.01	0.07	0.26	0.34	0.44	0.54	250.00	5577.55	5575.94	0.006	35.91	804.00	5575.94	5565.72	0.013	5	0.56	23.77	59.68	38.47	38.47	1.35	1.92	2.27		3.17	3.66		0.24	0.49	3.46		22.46	33.25	
					0.08										33.67								57.44																

Samuel Engineering
We Provide Solutions

8450 East Crescent Parkway, Suite 200
Greenwood Village, CO 80111-2855
Phone: 303.714.4840 Fax: 303.714.4800

Client: Rocky Mountain Midsream
Project Name: Watkins Compressor Station
Project No.: 18256-01
Subject: Design Point 3 Impervious Area
Prepared By: M. Morgan
Date: 11/08/2018 Sheet 1 of 1

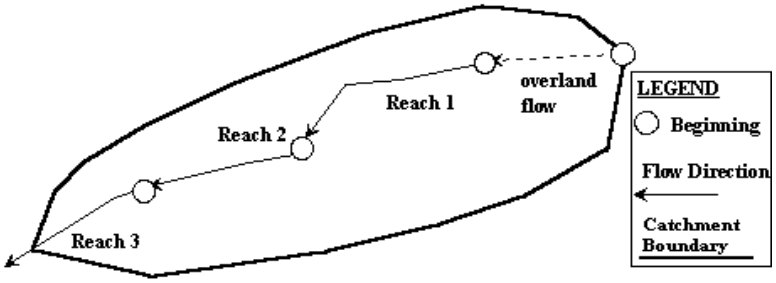
DEVELOPED CONDITIONS IMPERVIOUS AREA

Use	% Impervious	Area (AC)
Pond	100	0.00
Equipment	80	0.00
Access/Pad (packed gravel)	40	0.43
Yard Area (native vegetation)	2	17.67
	2.9 %	**18.10**

Reach-Weighted Time of Concentration Calculations

Version 2.00 released May 2017

Designer: Matt Morgan
Company: Samuel Engineering
Date: 11/8/2018
Project: Watkins CSS
Location: Adams County, Colorado



Subcatchment Name	Percent Imperviousness (%)
Design Point 3	2.9

OVERLAND FLOW

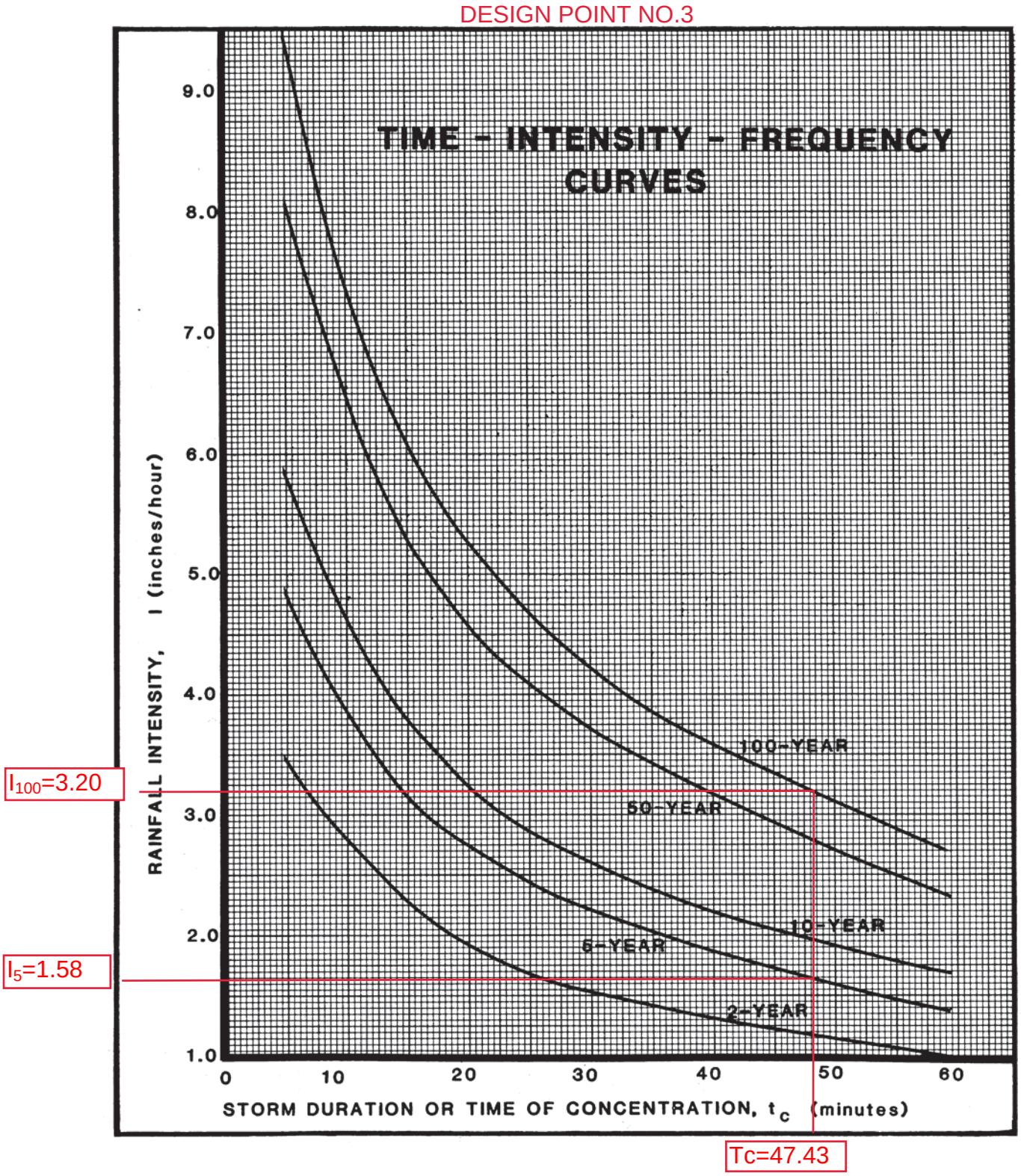
Reach ID	Overland Flow Length L_i (ft)	Overland Flow Slope S_i (ft/ft)	5-yr Runoff Coefficient, C_5	Overland Flow Time t_i (min)
DP 3	361.00	0.009	0.08	36.23
Weighted Totals	**361.00**	**0.009**	**Total t_i (min)**	**36.23**

CHANNELIZED FLOW

Reach ID	Channelized Flow Length L_t (ft)	Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Time t_t (min)
DP 3	468.00	0.007	15	6.22
DP 3	527.00	0.006	15	7.56
Weighted Totals	**995.00**	**0.006**	**Total t_t (min)**	**13.77**

Computed t_c (min)	**50.00**
Regional t_c (min)	**47.43**
Selected t_c (min)	**47.43**

Figure 9.1—Time-Intensity-Frequency Curves



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Phone: 303.714.4840 Fax: 303.714.4800

Client: Rocky Mountain Midstream
Project Name: Watkins Compressor Station
Project No.: 18256-01
Subject: Design Point 3 Peak Runoff
Prepared By: M. Morgan
Date: 11/08/2018 Sheet 1 of 1

DESIGN POINT 3 PEAK RUNOFF

Use	% Impervious	Area (AC)
Pond	100	0.00
Equipment	80	0.00
Access/Pad (packed gravel)	40	0.43
Yard Area (native vegetation)	2	17.67
	2.9 %	**18.10**

RATIONAL METHOD (Q=CIA)

T_c= 47.43 minutes (See DP 3 Tc Calculation)

I_5= 1.58 in/hr

I_{100}= 3.20 in/hr (See DP 3 Intensity)

C_5= 0.08

C_{100}= 0.44 (See Developed Hydrology for Basins D1 & D2)

A= 18.10 ac (Area of D1 & D2)

Q_5= 2.29 cfs

Q_{100}= 25.48 cfs

PEAK RUNOFF AT DESIGN POINT 3 (INCLUDING POND DISCHARGE)

Q total = Q_x + Max Allowable Pond Release Rate

Q_5(DP 3)= 2.76 cfs

Q_{100}(DP 3)= 28.26 cfs

Appendix D:
Pond Sizing Calculations

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Phone: 303.714.4840 Fax: 303.714.4800

Client: Rocky Mountain Midstream
Project Name: Watkins Compressor Station
Project No.: 18256-01
Subject: Developed Conditions Pond Sizing
Prepared By: M. Morgan
Date: 11/08/2018 Sheet 1 of 1

DEVELOPED CONDITIONS IMPERVIOUS AREA

Use	% Impervious	Area (AC)
Pond	100	0.39
Equipment	80	0.31
Access/Pad (packed gravel)	40	2.08
Yard Area (native vegetation)	2	0
	52.9 %	**2.78**

DETENTION POND VOLUME

$V = K_x * Area\ (af)$

5-year volume

$K_5=((0.77 * I)-2.26)/1000$

0.0385

$V_5=$ **0.11** af

4,657 ft^3

100-year volume

$K_{100}=(1.78*I-0.002*I^2-3.56)/910$

0.0934

$V_{100}=$ **0.26** af

11,307 ft^3

$WQCV=a(0.91*I^3 - 1.19*I^2 + 0.78*I)$

a= 1.0 (40 hour drain time)

I = % impervious/100

0.2143 watershed-inches

V=(WQCV/12)*Area

0.05 af

2,162 ft^3

TOTAL DETENTION VOLUME INCLUDING WQCV

$V_{total\ (5)}$=V5 + WQCV

6,819 ft^3

$V_{total(100)}=V_{100}$ + 1/2(WQCV)

12,388 ft^3

MAXIMUM ALLOWABLE POND RELEASE RATE

Q_5=(0.17 * AC)

0.47 cfs

Q_{100}=(1.00 * AC)

2.78 cfs

Appendix E:
Stage-Storage and Outlet Design Details

Stage-Storage Report

Stage-Storage
Project: Watkins CSS
Basin Description: Detention Pond

Contour Elevation	Contour Area (sq. ft)	Depth (ft)	Incremental Volume Avg. End (cu. ft)	Cumulative Volume Avg. End (cu. ft)
5,568.86	0.23	N/A	N/A	0.00
5,568.87	11.71	0.01	0.06	0.06
5,568.88	40.55	0.01	0.26	0.32
5,568.89	86.76	0.01	0.64	0.96
5,568.90	150.33	0.01	1.19	2.14
5,568.91	231.27	0.01	1.91	4.05
5,568.92	326.75	0.01	2.79	6.84
5,568.93	431.15	0.01	3.79	10.63
5,568.94	544.31	0.01	4.88	15.51
5,568.95	666.22	0.01	6.05	21.56
5,568.96	792.24	0.01	7.29	28.85
5,568.97	918.55	0.01	8.55	37.41
5,568.98	1,045.14	0.01	9.82	47.23
5,568.99	1,172.00	0.01	11.09	58.31
5,569.00	1,299.15	0.01	12.36	70.67
5,569.01	1,426.58	0.01	13.63	84.30
5,569.02	1,554.29	0.01	14.90	99.20
5,569.03	1,682.28	0.01	16.18	115.38
5,569.04	1,810.55	0.01	17.46	132.85
5,569.05	1,939.09	0.01	18.75	151.59
5,569.06	2,067.92	0.01	20.04	171.63
5,569.07	2,197.03	0.01	21.32	192.95
5,569.08	2,326.42	0.01	22.62	215.57
5,569.09	2,456.09	0.01	23.91	239.48
5,569.10	2,586.04	0.01	25.21	264.70
5,569.11	2,716.27	0.01	26.51	291.21
5,569.12	2,846.78	0.01	27.82	319.02
5,569.13	2,977.57	0.01	29.12	348.14
5,569.14	3,108.64	0.01	30.43	378.57
5,569.15	3,239.99	0.01	31.74	410.32
5,569.16	3,371.63	0.01	33.06	443.38
5,569.17	3,503.54	0.01	34.38	477.75
5,569.18	3,635.73	0.01	35.70	513.45
5,569.19	3,768.20	0.01	37.02	550.47
5,569.20	3,900.95	0.01	38.35	588.81
5,569.21	4,033.99	0.01	39.67	628.49
5,569.22	4,167.30	0.01	41.01	669.49
5,569.23	4,300.89	0.01	42.34	711.84
5,569.24	4,434.7	0.01	43.68	755.51

5,569.25	4,568.92	0.01	45.02	800.53
5,569.26	4,703.35	0.01	46.36	846.89
5,569.27	4,838.07	0.01	47.71	894.60
5,569.28	4,973.06	0.01	49.06	943.66
5,569.29	5,108.20	0.01	50.41	994.06
5,569.30	5,233.44	0.01	51.71	1045.77
5,569.31	5,342.54	0.01	52.88	1098.65
5,569.32	5,435.50	0.01	53.89	1152.54
5,569.33	5,512.32	0.01	54.74	1207.28
5,569.34	5,573.00	0.01	55.43	1262.71
5,569.35	5,619.87	0.01	55.96	1318.67
5,569.36	5,658.49	0.01	56.39	1375.06
5,569.37	5,689.11	0.01	56.74	1431.80
5,569.38	5,711.72	0.01	57.00	1488.81
5,569.39	5,726.55	0.01	57.19	1546.00
5,569.40	5,739.01	0.01	57.33	1603.32
5,569.41	5,751.48	0.01	57.45	1660.78
5,569.42	5,763.97	0.01	57.58	1718.35
5,569.43	5,776.46	0.01	57.70	1776.06
5,569.44	5,788.97	0.01	57.83	1833.88
5,569.45	5,801.49	0.01	57.95	1891.84
5,569.46	5,814.01	0.01	58.08	1949.91
5,569.47	5,826.55	0.01	58.20	2008.12
5,569.48	5,839.11	0.01	58.33	2066.44
5,569.49	5,851.67	0.01	58.45	2124.90
5,569.50	5,864.24	0.01	58.58	2183.48 WQCV
5,569.51	5,876.83	0.01	58.71	2242.18
5,569.52	5,889.42	0.01	58.83	2301.01
5,569.53	5,902.03	0.01	58.96	2359.97
5,569.54	5,914.65	0.01	59.08	2419.05
5,569.55	5,927.28	0.01	59.21	2478.26
5,569.56	5,939.92	0.01	59.34	2537.60
5,569.57	5,952.57	0.01	59.46	2597.06
5,569.58	5,965.23	0.01	59.59	2656.65
5,569.59	5,977.91	0.01	59.72	2716.37
5,569.60	5,990.59	0.01	59.84	2776.21
5,569.61	6,003.29	0.01	59.97	2836.18
5,569.62	6,016.00	0.01	60.10	2896.28
5,569.63	6,028.72	0.01	60.22	2956.50
5,569.64	6,041.45	0.01	60.35	3016.85
5,569.65	6,054.19	0.01	60.48	3077.33
5,569.66	6,066.94	0.01	60.61	3137.93
5,569.67	6,079.71	0.01	60.73	3198.67
5,569.68	6,092.48	0.01	60.86	3259.53
5,569.69	6,105.27	0.01	60.99	3320.52
5,569.70	6,118.07	0.01	61.12	3381.63
5,569.71	6,130.88	0.01	61.24	3442.88
5,569.72	6,143.70	0.01	61.37	3504.25

5,569.73	6,156.53	0.01	61.50	3565.75
5,569.74	6,169.37	0.01	61.63	3627.38
5,569.75	6,182.22	0.01	61.76	3689.14
5,569.76	6,195.09	0.01	61.89	3751.03
5,569.77	6,207.96	0.01	62.02	3813.04
5,569.78	6,220.85	0.01	62.14	3875.19
5,569.79	6,233.75	0.01	62.27	3937.46
5,569.80	6,246.66	0.01	62.40	3999.86
5,569.81	6,259.58	0.01	62.53	4062.39
5,569.82	6,272.51	0.01	62.66	4125.05
5,569.83	6,285.46	0.01	62.79	4187.84
5,569.84	6,298.41	0.01	62.92	4250.76
5,569.85	6,311.38	0.01	63.05	4313.81
5,569.86	6,324.36	0.01	63.18	4376.99
5,569.87	6,337.34	0.01	63.31	4440.30
5,569.88	6,350.34	0.01	63.44	4503.74
5,569.89	6,363.35	0.01	63.57	4567.30
5,569.90	6,376.38	0.01	63.70	4631.00
5,569.91	6,389.41	0.01	63.83	4694.83 5-YR Volume
5,569.92	6,402.45	0.01	63.96	4758.79
5,569.93	6,415.51	0.01	64.09	4822.88
5,569.94	6,428.58	0.01	64.22	4887.10
5,569.95	6,441.66	0.01	64.35	4951.45
5,569.96	6,454.74	0.01	64.48	5015.94
5,569.97	6,467.85	0.01	64.61	5080.55
5,569.98	6,480.96	0.01	64.74	5145.29
5,569.99	6,494.08	0.01	64.88	5210.17
5,570.00	6,507.21	0.01	65.01	5275.17
5,570.01	6,520.36	0.01	65.14	5340.31
5,570.02	6,533.52	0.01	65.27	5405.58
5,570.03	6,546.68	0.01	65.40	5470.98
5,570.04	6,559.86	0.01	65.53	5536.51
5,570.05	6,573.05	0.01	65.66	5602.18
5,570.06	6,586.26	0.01	65.80	5667.98
5,570.07	6,599.47	0.01	65.93	5733.90
5,570.08	6,612.69	0.01	66.06	5799.97
5,570.09	6,625.93	0.01	66.19	5866.16
5,570.10	6,639.17	0.01	66.33	5932.48
5,570.11	6,652.43	0.01	66.46	5998.94
5,570.12	6,665.70	0.01	66.59	6065.53
5,570.13	6,678.98	0.01	66.72	6132.26
5,570.14	6,692.27	0.01	66.86	6199.11
5,570.15	6,705.57	0.01	66.99	6266.10
5,570.16	6,718.89	0.01	67.12	6333.22
5,570.17	6,732.21	0.01	67.26	6400.48
5,570.18	6,745.55	0.01	67.39	6467.87
5,570.19	6,758.90	0.01	67.52	6535.39
5,570.20	6,772.25	0.01	67.66	6603.05

5,570.21	6,785.62	0.01	67.79	6670.84	
5,570.22	6,799.00	0.01	67.92	6738.76	
5,570.23	6,812.40	0.01	68.06	6806.82	
5,570.24	6,825.80	0.01	68.19	6875.01	5-YR Vol + WOCV
5,570.25	6,839.21	0.01	68.33	6943.33	
5,570.26	6,852.64	0.01	68.46	7011.79	
5,570.27	6,866.08	0.01	68.59	7080.38	
5,570.28	6,879.53	0.01	68.73	7149.11	
5,570.29	6,892.98	0.01	68.86	7217.97	
5,570.30	6,906.46	0.01	69.00	7286.97	
5,570.31	6,919.94	0.01	69.13	7356.10	
5,570.32	6,933.43	0.01	69.27	7425.37	
5,570.33	6,946.93	0.01	69.40	7494.77	
5,570.34	6,960.45	0.01	69.54	7564.31	
5,570.35	6,973.98	0.01	69.67	7633.98	
5,570.36	6,987.51	0.01	69.81	7703.79	
5,570.37	7,001.06	0.01	69.94	7773.73	
5,570.38	7,014.62	0.01	70.08	7843.81	
5,570.39	7,028.20	0.01	70.21	7914.02	
5,570.40	7,041.78	0.01	70.35	7984.37	
5,570.41	7,055.37	0.01	70.49	8054.86	
5,570.42	7,068.98	0.01	70.62	8125.48	
5,570.43	7,082.59	0.01	70.76	8196.24	
5,570.44	7,096.22	0.01	70.89	8267.13	
5,570.45	7,109.86	0.01	71.03	8338.16	
5,570.46	7,123.51	0.01	71.17	8409.33	
5,570.47	7,137.17	0.01	71.30	8480.63	
5,570.48	7,150.84	0.01	71.44	8552.07	
5,570.49	7,164.53	0.01	71.58	8623.65	
5,570.50	7,178.22	0.01	71.71	8695.37	
5,570.51	7,191.93	0.01	71.85	8767.22	
5,570.52	7,205.65	0.01	71.99	8839.20	
5,570.53	7,219.37	0.01	72.13	8911.33	
5,570.54	7,233.11	0.01	72.26	8983.59	
5,570.55	7,246.85	0.01	72.40	9055.99	
5,570.56	7,260.63	0.01	72.54	9128.53	
5,570.57	7,274.40	0.01	72.68	9201.20	
5,570.58	7,288.19	0.01	72.81	9274.02	
5,570.59	7,301.98	0.01	72.95	9346.97	
5,570.60	7,315.79	0.01	73.09	9420.06	
5,570.61	7,329.61	0.01	73.23	9493.28	
5,570.62	7,343.44	0.01	73.37	9566.65	
5,570.63	7,357.28	0.01	73.50	9640.15	
5,570.64	7,371.13	0.01	73.64	9713.79	
5,570.65	7,384.99	0.01	73.78	9787.58	
5,570.66	7,398.87	0.01	73.92	9861.49	
5,570.67	7,412.75	0.01	74.06	9935.55	
5,570.68	7,426.65	0.01	74.20	10009.75	

5,570.69	7,440.56	0.01	74.34	10084.09
5,570.70	7,454.48	0.01	74.48	10158.56
5,570.71	7,468.41	0.01	74.61	10233.18
5,570.72	7,482.35	0.01	74.75	10307.93
5,570.73	7,496.30	0.01	74.89	10382.82
5,570.74	7,510.27	0.01	75.03	10457.85
5,570.75	7,524.24	0.01	75.17	10533.03
5,570.76	7,538.23	0.01	75.31	10608.34
5,570.77	7,552.22	0.01	75.45	10683.79
5,570.78	7,566.23	0.01	75.59	10759.38
5,570.79	7,580.25	0.01	75.73	10835.12
5,570.80	7,594.28	0.01	75.87	10910.99
5,570.81	7,608.33	0.01	76.01	10987.00
5,570.82	7,622.38	0.01	76.15	11063.16
5,570.83	7,636.45	0.01	76.29	11139.45
5,570.84	7,650.52	0.01	76.43	11215.89
5,570.85	7,664.61	0.01	76.58	11292.46
5,570.86	7,678.71	0.01	76.72	11369.18
5,570.87	7,692.82	0.01	76.86	11446.03
5,570.88	7,706.94	0.01	77.00	11523.03
5,570.89	7,721.07	0.01	77.14	11600.17
5,570.90	7,735.21	0.01	77.28	11677.46
5,570.91	7,749.37	0.01	77.42	11754.88
5,570.92	7,763.54	0.01	77.56	11832.44
5,570.93	7,777.71	0.01	77.71	11910.15
5,570.94	7,791.90	0.01	77.85	11988.00
5,570.95	7,806.10	0.01	77.99	12065.99
5,570.96	7,820.31	0.01	78.13	12144.12
5,570.97	7,834.53	0.01	78.27	12222.39
5,570.98	7,848.77	0.01	78.42	12300.81
5,570.99	7,863.01	0.01	78.56	12379.37
5,571.00	7,877.27	0.01	78.70	12458.07
5,571.01	7,891.53	0.01	78.84	12536.91
5,571.02	7,905.81	0.01	78.99	12615.90
5,571.03	7,920.10	0.01	79.13	12695.03
5,571.04	7,934.40	0.01	79.27	12774.30
5,571.05	7,948.71	0.01	79.42	12853.72
5,571.06	7,963.04	0.01	79.56	12933.28
5,571.07	7,977.37	0.01	79.70	13012.98
5,571.08	7,991.72	0.01	79.85	13092.82
5,571.09	8,006.07	0.01	79.99	13172.81
5,571.10	8,020.44	0.01	80.13	13252.95
5,571.11	8,034.82	0.01	80.28	13333.22
5,571.12	8,049.21	0.01	80.42	13413.64
5,571.13	8,063.61	0.01	80.56	13494.21
5,571.14	8,078.02	0.01	80.71	13574.91
5,571.15	8,092.45	0.01	80.85	13655.77
5,571.16	8,106.88	0.01	81.00	13736.76

100-YR Volume

100-YR Vol + 1/2 WQCV

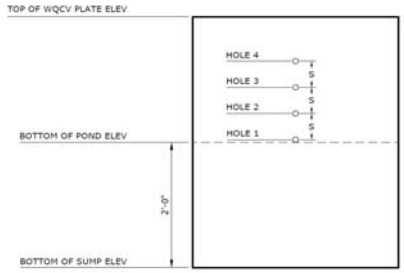
5,571.17	8,121.33	0.01	81.14	13817.90
5,571.18	8,135.79	0.01	81.29	13899.19
5,571.19	8,150.25	0.01	81.43	13980.62
5,571.20	8,164.73	0.01	81.57	14062.20
5,571.21	8,179.22	0.01	81.72	14143.92
5,571.22	8,193.73	0.01	81.86	14225.78
5,571.23	8,208.24	0.01	82.01	14307.79
5,571.24	8,222.77	0.01	82.16	14389.94
5,571.25	8,237.30	0.01	82.30	14472.25
5,571.26	8,251.85	0.01	82.45	14554.69
5,571.27	8,266.41	0.01	82.59	14637.28
5,571.28	8,280.98	0.01	82.74	14720.02
5,571.29	8,295.56	0.01	82.88	14802.90
5,571.30	8,310.15	0.01	83.03	14885.93
5,571.31	8,324.75	0.01	83.17	14969.10
5,571.32	8,339.37	0.01	83.32	15052.43
5,571.33	8,353.99	0.01	83.47	15135.89
5,571.34	8,368.63	0.01	83.61	15219.51
5,571.35	8,383.28	0.01	83.76	15303.26
5,571.36	8,397.94	0.01	83.91	15387.17
5,571.37	8,412.61	0.01	84.05	15471.22
5,571.38	8,427.29	0.01	84.20	15555.42
5,571.39	8,441.98	0.01	84.35	15639.77
5,571.40	8,456.69	0.01	84.49	15724.26
5,571.41	8,471.40	0.01	84.64	15808.90
5,571.42	8,486.13	0.01	84.79	15893.69
5,571.43	8,500.87	0.01	84.93	15978.63
5,571.44	8,515.62	0.01	85.08	16063.71
5,571.45	8,530.38	0.01	85.23	16148.94
5,571.46	8,545.15	0.01	85.38	16234.32
5,571.47	8,559.93	0.01	85.53	16319.84
5,571.48	8,574.72	0.01	85.67	16405.51
5,571.49	8,589.53	0.01	85.82	16491.34
5,571.50	8,604.34	0.01	85.97	16577.31
5,571.51	8,619.16	0.01	86.12	16663.42
5,571.52	8,634.00	0.01	86.27	16749.69
5,571.53	8,648.84	0.01	86.41	16836.10
5,571.54	8,663.69	0.01	86.56	16922.67
5,571.55	8,678.55	0.01	86.71	17009.38
5,571.56	8,693.42	0.01	86.86	17096.24
5,571.57	8,708.31	0.01	87.01	17183.25
5,571.58	8,723.20	0.01	87.16	17270.40
5,571.59	8,738.10	0.01	87.31	17357.71
5,571.60	8,753.01	0.01	87.46	17445.16
5,571.61	8,767.93	0.01	87.60	17532.77
5,571.62	8,782.86	0.01	87.75	17620.52
5,571.63	8,797.80	0.01	87.90	17708.43
5,571.64	8,812.75	0.01	88.05	17796.48

5,571.65	8,827.71	0.01	88.20	17884.68	
5,571.66	8,842.68	0.01	88.35	17973.03	
5,571.67	8,857.65	0.01	88.50	18061.54	
5,571.68	8,872.64	0.01	88.65	18150.19	
5,571.69	8,887.64	0.01	88.80	18238.99	
5,571.70	8,902.65	0.01	88.95	18327.94	
5,571.71	8,917.67	0.01	89.10	18417.04	
5,571.72	8,932.69	0.01	89.25	18506.29	
5,571.73	8,947.73	0.01	89.40	18595.69	
5,571.74	8,962.78	0.01	89.55	18685.25	
5,571.75	8,977.83	0.01	89.70	18774.95	
5,571.76	8,992.90	0.01	89.85	18864.80	
5,571.77	9,007.97	0.01	90.00	18954.81	
5,571.78	9,023.06	0.01	90.16	19044.96	
5,571.79	9,038.15	0.01	90.31	19135.27	
5,571.80	9,053.26	0.01	90.46	19225.73	
5,571.81	9,068.37	0.01	90.61	19316.33	
5,571.82	9,083.50	0.01	90.76	19407.09	
5,571.83	9,098.63	0.01	90.91	19498.00	
5,571.84	9,113.78	0.01	91.06	19589.07	
5,571.85	9,128.93	0.01	91.21	19680.28	
5,571.86	9,144.09	0.01	91.37	19771.65	
5,571.87	9,159.27	0.01	91.52	19863.16	
5,571.88	9,174.45	0.01	91.67	19954.83	
5,571.89	9,189.64	0.01	91.82	20046.65	
5,571.90	9,204.84	0.01	91.97	20138.62	
5,571.91	9,220.06	0.01	92.12	20230.75	
5,571.92	9,235.28	0.01	92.28	20323.02	
5,571.93	9,250.51	0.01	92.43	20415.45	
5,571.94	9,265.75	0.01	92.58	20508.04	
5,571.95	9,281.00	0.01	92.73	20600.77	
5,571.96	9,296.26	0.01	92.89	20693.66	
5,571.97	9,311.53	0.01	93.04	20786.69	
5,571.98	9,326.81	0.01	93.19	20879.89	
5,571.99	9,342.10	0.01	93.34	20973.23	
5,572.00	9,357.40	0.01	93.50	21066.73	1 FT. Freeboard
5,572.01	9,372.71	0.01	93.65	21160.38	
5,572.02	9,388.03	0.01	93.80	21254.18	
5,572.03	9,403.36	0.01	93.96	21348.14	
5,572.04	9,418.69	0.01	94.11	21442.25	
5,572.05	9,434.04	0.01	94.26	21536.51	
5,572.06	9,449.40	0.01	94.42	21630.93	
5,572.07	9,464.77	0.01	94.57	21725.50	
5,572.08	9,480.14	0.01	94.72	21820.23	
5,572.09	9,495.53	0.01	94.88	21915.10	
5,572.10	9,510.93	0.01	95.03	22010.14	

Watkins Compressor Station - Detention Pond WQCV Orifce Plate Design Worksheet

Calculation By: M. Morgan
Date: 11/09/2018

WQCV Orifice Plate Diagram:



Equations:

$$Q = C_0 A_0 (2gH_0)^{0.5}$$

where:
Q = orifice flow discharge
C_d = dimensionless coefficient of discharge
A_0 = cross-sectional area of orifice (ft^2)
g = acceleration due to gravity (32.2 ft/s^2)
H_0 = effective head on orifice, from centroid to water surface elevation (ft)

$$A_0 = \pi \left(\frac{d}{2}\right)^2$$

where:
A_0 = cross-sectional area of orifice (in^2)

$$\Delta t = \frac{\Delta V}{3600 Q}$$

where:
Δt = drain time for incremental depth (hours)
ΔV = storage volume drained from stage increment (ft^3)
Q = orifice dischrage rate for stage increment (ft^3/s)

DESIGN INPUTS:

WQCV Orifice Size Design Input:

Number of Holes Used (1-5):	N =	2	
Hole Spacing:	S =	2.25	inches
Drain Time:	t =	40	hours
Orifice Coefficient:	C_0 =	0.6	
Gravitational Constant:	g =	32.2	ft/s^2

Pond Geometry Design Input:

Bottom of Pond Elevation:	EL_{BP} =	5568.86	ft
Water Quality Capture Volume:	WQCV =	2162	ft^3
WQCV Max Water Surface Elevation:	EL_{TP} =	5569.50	ft

VARIABLE INPUTS:

Change Orifice Hole Diameter:

Hole Diameter:	d =	0.8750	in
		7/8	"
Hole Area:	A_0 =	0.60132	in^2

= variable user input
= calculation variable

* Change hole diameter in increments of 1/32" and adjust hole spacing to achieve target drain down time

CALCULATED RESULTS:

Computed Orifice Centroid Elevations:

Centroid Elevation Hole 1:	EL_1 =	5568.90	ft
Centroid Elevation Hole 2:	EL_2 =	5569.08	ft
Centroid Elevation Hole 3:	EL_3 =	n/a	ft
Centroid Elevation Hole 4:	EL_4 =	n/a	ft
Centroid Elevation Hole 5:	EL_5 =	n/a	ft

SOLVE FOR DRAIN TIME:

Calculated Drain Time:	t_{WQCV} =	**35.48 hours**
Check: $t_{WQCV} - t_{required} = 0$		-4.52

INTERMEDIATE CALCULATIONS:

Notes:
1. Flow rate is calculated at each 0.10-ft stage decrease. It is assumed that the discharge rate calculated at the maximum stage value for each increment and the corresponding effective head is representative of the entire 0.10-ft depth.

2. Storage volumes are determined using the pond design contour areas and the average end-area method.

WSEL	H_0					Q					Q
	Hole 1	Hole 2	Hole 3	Hole 4	Hole 5	Hole 1	Hole 2	Hole 3	Hole 4	Hole 5	Total
5569.50	0.60	0.42	n/a	n/a	n/a	0.01562	0.01297	n/a	n/a	n/a	0.02859
5569.49	0.59	0.41	n/a	n/a	n/a	0.01549	0.01281	n/a	n/a	n/a	0.02830
5569.48	0.58	0.40	n/a	n/a	n/a	0.01536	0.01265	n/a	n/a	n/a	0.02801
5569.47	0.57	0.39	n/a	n/a	n/a	0.01523	0.01249	n/a	n/a	n/a	0.02772
5569.46	0.56	0.38	n/a	n/a	n/a	0.01509	0.01233	n/a	n/a	n/a	0.02742
5569.45	0.55	0.37	n/a	n/a	n/a	0.01496	0.01216	n/a	n/a	n/a	0.02712
5569.44	0.54	0.36	n/a	n/a	n/a	0.01482	0.01200	n/a	n/a	n/a	0.02682
5569.43	0.53	0.35	n/a	n/a	n/a	0.01469	0.01183	n/a	n/a	n/a	0.02651
5569.42	0.52	0.34	n/a	n/a	n/a	0.01455	0.01166	n/a	n/a	n/a	0.02620
5569.41	0.51	0.33	n/a	n/a	n/a	0.01441	0.01148	n/a	n/a	n/a	0.02589
5569.40	0.50	0.32	n/a	n/a	n/a	0.01427	0.01130	n/a	n/a	n/a	0.02557
5569.39	0.49	0.31	n/a	n/a	n/a	0.01413	0.01112	n/a	n/a	n/a	0.02525
5569.38	0.48	0.30	n/a	n/a	n/a	0.01398	0.01094	n/a	n/a	n/a	0.02492
5569.37	0.47	0.29	n/a	n/a	n/a	0.01384	0.01075	n/a	n/a	n/a	0.02459
5569.36	0.46	0.28	n/a	n/a	n/a	0.01369	0.01056	n/a	n/a	n/a	0.02425
5569.35	0.45	0.27	n/a	n/a	n/a	0.01354	0.01037	n/a	n/a	n/a	0.02391
5569.34	0.44	0.26	n/a	n/a	n/a	0.01339	0.01017	n/a	n/a	n/a	0.02356
5569.33	0.43	0.25	n/a	n/a	n/a	0.01324	0.00997	n/a	n/a	n/a	0.02321
5569.32	0.42	0.24	n/a	n/a	n/a	0.01309	0.00977	n/a	n/a	n/a	0.02285
5569.31	0.41	0.23	n/a	n/a	n/a	0.01293	0.00956	n/a	n/a	n/a	0.02249
5569.30	0.40	0.22	n/a	n/a	n/a	0.01277	0.00935	n/a	n/a	n/a	0.02212
5569.29	0.39	0.21	n/a	n/a	n/a	0.01261	0.00913	n/a	n/a	n/a	0.02174
5569.28	0.38	0.20	n/a	n/a	n/a	0.01245	0.00890	n/a	n/a	n/a	0.02135
5569.27	0.37	0.19	n/a	n/a	n/a	0.01229	0.00867	n/a	n/a	n/a	0.02096
5569.26	0.36	0.18	n/a	n/a	n/a	0.01212	0.00844	n/a	n/a	n/a	0.02056
5569.25	0.35	0.17	n/a	n/a	n/a	0.01196	0.00819	n/a	n/a	n/a	0.02015
5569.24	0.34	0.16	n/a	n/a	n/a	0.01178	0.00794	n/a	n/a	n/a	0.01973
5569.23	0.33	0.15	n/a	n/a	n/a	0.01161	0.00768	n/a	n/a	n/a	0.01930
5569.22	0.32	0.14	n/a	n/a	n/a	0.01144	0.00742	n/a	n/a	n/a	0.01885
5569.21	0.31	0.13	n/a	n/a	n/a	0.01126	0.00714	n/a	n/a	n/a	0.01840
5569.20	0.30	0.12	n/a	n/a	n/a	0.01108	0.00685	n/a	n/a	n/a	0.01793
5569.19	0.29	0.11	n/a	n/a	n/a	0.01089	0.00655	n/a	n/a	n/a	0.01744
5569.18	0.28	0.10	n/a	n/a	n/a	0.01071	0.00623	n/a	n/a	n/a	0.01694
5569.17	0.27	0.09	n/a	n/a	n/a	0.01052	0.00590	n/a	n/a	n/a	0.01641

Volume at WSEL	Incremental Volume	Time seconds	Time hours	Cumulative Time
2242.18				
2183.48	58.71	2053.40	0.57	0.57
2124.90	58.58	2069.76	0.57	1.15
2008.12	116.78	4168.89	1.16	2.30
1949.91	58.20	2099.68	0.58	2.89
1891.83	58.08	2117.79	0.59	3.47
1833.88	57.95	2136.56	0.59	4.07
1776.06	57.83	2156.04	0.60	4.67
1718.35	57.70	2176.26	0.60	5.27
1660.78	57.58	2197.28	0.61	5.88
1603.32	57.45	2219.13	0.62	6.50
1546.00	57.33	2241.89	0.62	7.12
1488.80	57.19	2265.14	0.63	7.75
1431.80	57.00	2287.35	0.64	8.39
1375.06	56.74	2307.38	0.64	9.03
1318.67	56.39	2325.12	0.65	9.67
1262.71	55.96	2340.46	0.65	10.32
1207.28	55.43	2352.10	0.65	10.98
1152.54	54.74	2358.19	0.66	11.63
1098.65	53.89	2358.03	0.66	12.29
1045.77	52.88	2351.33	0.65	12.94
994.06	51.71	2337.81	0.65	13.59
943.66	50.41	2318.58	0.64	14.23
894.60	49.06	2297.19	0.64	14.87
846.89	47.71	2275.97	0.63	15.50
800.53	46.36	2255.01	0.63	16.13
755.51	45.02	2234.34	0.62	16.75
711.84	43.68	2214.07	0.62	17.37
669.49	42.34	2194.29	0.61	17.97
628.49	41.01	2175.08	0.60	18.58
588.81	39.67	2156.59	0.60	19.18
550.47	38.35	2139.01	0.59	19.77
513.45	37.02	2122.55	0.59	20.36
477.75	35.70	2107.52	0.59	20.95

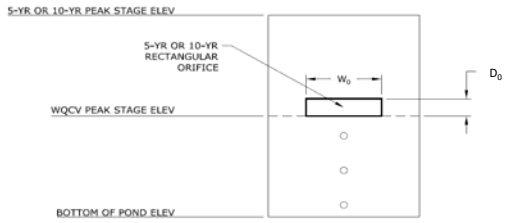
5569.16	0.26	0.08	n/a	n/a	n/a	0.01032	0.00554	n/a	n/a	n/a	0.01587
5569.15	0.25	0.07	n/a	n/a	n/a	0.01012	0.00517	n/a	n/a	n/a	0.01529
5569.14	0.24	0.06	n/a	n/a	n/a	0.00992	0.00476	n/a	n/a	n/a	0.01468
5569.13	0.23	0.05	n/a	n/a	n/a	0.00972	0.00431	n/a	n/a	n/a	0.01403
5569.12	0.22	0.04	n/a	n/a	n/a	0.00951	0.00382	n/a	n/a	n/a	0.01332
5569.11	0.21	0.03	n/a	n/a	n/a	0.00929	0.00324	n/a	n/a	n/a	0.01254
5569.10	0.20	0.02	n/a	n/a	n/a	0.00907	0.00255	n/a	n/a	n/a	0.01162
5569.09	0.19	0.01	n/a	n/a	n/a	0.00885	0.00156	n/a	n/a	n/a	0.01041
5569.08	0.18	n/a	n/a	n/a	n/a	0.00861	n/a	n/a	n/a	n/a	0.00861
5569.07	0.17	n/a	n/a	n/a	n/a	0.00838	n/a	n/a	n/a	n/a	0.00838
5569.06	0.16	n/a	n/a	n/a	n/a	0.00813	n/a	n/a	n/a	n/a	0.00813
5569.05	0.15	n/a	n/a	n/a	n/a	0.00788	n/a	n/a	n/a	n/a	0.00788
5569.04	0.14	n/a	n/a	n/a	n/a	0.00762	n/a	n/a	n/a	n/a	0.00762
5569.03	0.13	n/a	n/a	n/a	n/a	0.00735	n/a	n/a	n/a	n/a	0.00735
5569.02	0.12	n/a	n/a	n/a	n/a	0.00707	n/a	n/a	n/a	n/a	0.00707
5569.01	0.11	n/a	n/a	n/a	n/a	0.00678	n/a	n/a	n/a	n/a	0.00678
5569.00	0.10	n/a	n/a	n/a	n/a	0.00647	n/a	n/a	n/a	n/a	0.00647
5568.99	0.09	n/a	n/a	n/a	n/a	0.00615	n/a	n/a	n/a	n/a	0.00615
5568.98	0.08	n/a	n/a	n/a	n/a	0.00581	n/a	n/a	n/a	n/a	0.00581
5568.97	0.07	n/a	n/a	n/a	n/a	0.00545	n/a	n/a	n/a	n/a	0.00545
5568.96	0.06	n/a	n/a	n/a	n/a	0.00507	n/a	n/a	n/a	n/a	0.00507
5568.95	0.05	n/a	n/a	n/a	n/a	0.00465	n/a	n/a	n/a	n/a	0.00465
5568.94	0.04	n/a	n/a	n/a	n/a	0.00420	n/a	n/a	n/a	n/a	0.00420
5568.93	0.03	n/a	n/a	n/a	n/a	0.00368	n/a	n/a	n/a	n/a	0.00368
5568.92	0.02	n/a	n/a	n/a	n/a	0.00309	n/a	n/a	n/a	n/a	0.00309
5568.91	0.01	n/a	n/a	n/a	n/a	0.00234	n/a	n/a	n/a	n/a	0.00234
5568.90	0.00	n/a	n/a	n/a	n/a	0.00120	n/a	n/a	n/a	n/a	0.00120
5568.89	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5568.88	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5568.87	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
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n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
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n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
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n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
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n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
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n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

443.38	34.38	2094.33	0.58	21.53
410.32	33.06	2083.52	0.58	22.11
378.57	31.74	2075.89	0.58	22.68
348.14	30.43	2072.62	0.58	23.26
319.02	29.12	2075.52	0.58	23.84
291.21	27.82	2087.67	0.58	24.42
264.70	26.51	2114.83	0.59	25.00
239.48	25.21	2170.00	0.60	25.61
215.57	23.91	2297.43	0.64	26.24
192.95	22.62	2625.64	0.73	26.97
171.63	21.32	2545.92	0.71	27.68
151.59	20.04	2463.99	0.68	28.37
132.85	18.75	2379.63	0.66	29.03
115.38	17.46	2292.56	0.64	29.66
99.20	16.18	2202.46	0.61	30.28
84.30	14.90	2108.96	0.59	30.86
70.67	13.63	2011.58	0.56	31.42
58.31	12.36	1909.74	0.53	31.95
47.23	11.09	1802.70	0.50	32.45
37.41	9.82	1689.48	0.47	32.92
28.85	8.55	1568.78	0.44	33.36
21.56	7.29	1438.79	0.40	33.76
15.51	6.05	1300.95	0.36	34.12
10.63	4.88	1162.49	0.32	34.44
6.84	3.79	1029.09	0.29	34.73
4.05	2.79	904.41	0.25	34.98
2.14	1.91	815.46	0.23	35.20
0.96	1.19	990.70	0.28	35.48
0.32	0.64	n/a	n/a	35.48
0.06	0.26	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
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n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48

Watkins Compressor Station - Detention Pond Minor Storm Orifice Design Worksheet

Calculation By:
Date:

Rectangular Orifice Plate Diagram:



Equations:

$$Q = C_0 A_0 (2gH_0)^{0.5}$$

where:
Q = orifice flow discharge
C_d = dimensionless coefficient of discharge
A_0 = cross-sectional area of orifice (ft^2)
g = acceleration due to gravity (32.2 ft/s^2)

$$A_0 = W_0 D_0$$

where:
A_0 = cross-sectional area of orifice (in^2)
D_0 = height of orifice opening (in)
W_0 = width of orifice opening (in)

$$\Delta t = \frac{\Delta V}{3600Q}$$

where:
Δt = drain time for incremental depth (hours)
ΔV = storage volume drained from stage increment (ft^3)
Q = orifice dischrage rate for stage increment (ft^3/s)

DESIGN INPUTS:

WQCV Orifice Size Design Input:

Rectangular Orifice Width:	W_0 =	10	inches
Maximum Allowable Discharge Rate:	$Q_{allowable}$ =	0.47	ft^3/s
Orifice Coefficient:	C_0 =	0.6	
Gravitational Constant:	g =	32.2	ft/s^2

Pond Geometry Design Input:

WQCV Peak Stage (Bottom of Rect. Orifice):	EL_{BP} =	5569.50	ft
Minor Storm Max Water Surface Elevation:	EL_{TP} =	5570.24	ft
Water Quality Capture Volume:	WQCV =	2162.00	ft^3
Minor Storm Storage Volume:	V_5 or V_{10} =	6875.00	ft^3
Volume Drained through Rectangular Orifice:	V_{design} =	4713.00	ft^3

VARIABLE INPUTS:

Change Orifice Hole Diameter:

Rectangular Orifice Height:	D_0 =	1.5000	in
Hole Area:	A_0 =	15	in^2
Top of orifice (less than Max WSEL):	EL_{TO} =	5569.63	ft

= variable user input

= calculation variable

CALCULATED RESULTS:

Computed Orifice Centroid Elevation:

Centroid Elevation:	$EL_{centroid}$ =	5569.56	ft

CALCULATE POND DRAIN TIME FROM MINOR STORM MAX WSEL:

Drain Time to Top of WQCV Orifice:	$t_{minor\ storm}$ =	**5.39**	**hours**

CALCULATE Q AT MINOR STORM MAX WSEL:

Effective Head on Orifice:	H_0 =	0.68	ft
Orifice Flow Discharge:	**Q_{calc} =**	**0.41**	**ft^3/s**
Check: $Q_{calc} - Q_{allowable} = 0$		-0.06	

INTERMEDIATE CALCULATIONS:

Notes:

1. Flow rate is calculated at each 0.10-ft stage decrease. It is assumed that the discharge rate calculated at the maximum stage value for each increment and the corresponding effective head is representative of the entire 0.10-ft depth.

2. Storage volumes are determined using the pond design contour areas and the average end-area method.

WSEL	H_0	Q
5570.24	0.68	0.41284
5570.23	0.67	0.40978
5570.22	0.66	0.40670
5570.21	0.65	0.40359
5570.20	0.64	0.40046
5570.19	0.63	0.39731
5570.18	0.62	0.39413
5570.17	0.61	0.39093
5570.16	0.60	0.38770
5570.15	0.59	0.38444
5570.14	0.58	0.38115
5570.13	0.57	0.37784
5570.12	0.56	0.37449
5570.11	0.55	0.37112
5570.10	0.54	0.36772
5570.09	0.53	0.36428
5570.08	0.52	0.36081
5570.07	0.51	0.35731
5570.06	0.50	0.35377
5570.05	0.49	0.35020
5570.04	0.48	0.34658
5570.03	0.47	0.34294
5570.02	0.46	0.33925
5570.01	0.45	0.33552
5570.00	0.44	0.33175

Volume at WSEL	Incremental Volume	Time seconds	Time hours	Cumulative Time
6943.33				
6875.01	68.33	165.50	0.05	0.05
6738.76	136.25	332.49	0.09	0.14
6670.83	67.92	167.01	0.05	0.18
6603.05	67.79	167.96	0.05	0.23
6535.39	67.66	168.94	0.05	0.28
6467.87	67.52	169.95	0.05	0.33
6400.48	67.39	170.98	0.05	0.37
6333.22	67.26	172.04	0.05	0.42
6266.10	67.12	173.13	0.05	0.47
6199.11	66.99	174.25	0.05	0.52
6132.26	66.86	175.41	0.05	0.57
6065.53	66.72	176.59	0.05	0.62
5998.94	66.59	177.81	0.05	0.66
5932.48	66.46	179.07	0.05	0.71
5866.16	66.33	180.37	0.05	0.76
5799.96	66.19	181.71	0.05	0.81
5733.90	66.06	183.09	0.05	0.87
5667.98	65.93	184.52	0.05	0.92
5602.18	65.80	185.99	0.05	0.97
5536.51	65.66	187.51	0.05	1.02
5470.98	65.53	189.08	0.05	1.07
5405.58	65.40	190.71	0.05	1.13
5340.31	65.27	192.39	0.05	1.18
5275.17	65.14	194.14	0.05	1.23

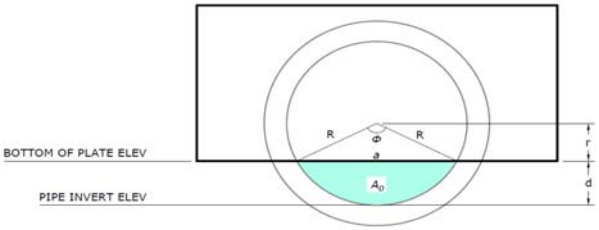
5569.99	0.43	0.32794
5569.98	0.42	0.32408
5569.97	0.41	0.32017
5569.96	0.40	0.31622
5569.95	0.39	0.31222
5569.94	0.38	0.30816
5569.93	0.37	0.30405
5569.92	0.36	0.29989
5569.91	0.35	0.29567
5569.90	0.34	0.29138
5569.89	0.33	0.28703
5569.88	0.32	0.28261
5569.87	0.31	0.27813
5569.86	0.30	0.27357
5569.85	0.29	0.26893
5569.84	0.28	0.26421
5569.83	0.27	0.25941
5569.82	0.26	0.25451
5569.81	0.25	0.24952

5210.17	65.01	195.95	0.05	1.29
5145.29	64.88	197.83	0.05	1.34
5080.55	64.74	199.78	0.06	1.40
5015.93	64.61	201.81	0.06	1.45
4951.45	64.48	203.91	0.06	1.51
4887.10	64.35	206.11	0.06	1.57
4822.88	64.22	208.40	0.06	1.63
4758.79	64.09	210.78	0.06	1.68
4694.83	63.96	213.28	0.06	1.74
4631.00	63.83	215.88	0.06	1.80
4567.30	63.70	218.61	0.06	1.86
4503.74	63.57	221.47	0.06	1.93
4440.30	63.44	224.47	0.06	1.99
4376.99	63.31	227.62	0.06	2.05
4313.81	63.18	230.94	0.06	2.12
4250.76	63.05	234.44	0.07	2.18
4187.84	62.92	238.14	0.07	2.25
4125.05	62.79	242.05	0.07	2.31
4062.39	62.66	246.20	0.07	2.38

Watkins Compressor Station - Detention Pond 100-year Flow Restrictor Plate Design Worksheet

Calculation By: M. Morgan
Date: 10/1/2018

WQCV Orifice Plate Diagram:



Equations:

$$Q = C_0 A_0 (2gH_0)^{0.5}$$

where:
Q = orifice flow discharge
C_d = dimensionless coefficient of discharge
A_0 = cross-sectional area of orifice (ft^2)
g = acceleration due to gravity (32.2 ft/s^2)

$$A_0 = R^2 \cos^{-1}\left(\frac{R-d}{R}\right) - (R-d)\sqrt{2Rd - d^2}$$

where:
A_0 = cross-sectional area of orifice (in^2)
R = pipe radius (in)
d = restrictor plate opening height (in)

$$\emptyset = 2\cos^{-1}\left(\frac{R-d}{R}\right)$$

where:
Φ = central angle made by plate (Φ < π radians)
R = pipe radius (in)
d = restrictor plate opening height (in)

$$C_y = R - \left(\frac{4R}{3}\left(\frac{\left(\sin\frac{\emptyset}{2}\right)^3}{\emptyset - \sin\emptyset}\right)\right)$$

where:
C_y = height of orifice centroid above pipe invert (in)
Φ = central angle made by plate (Φ < π radians)
R = pipe radius (in)

$$\Delta t = \frac{\Delta V}{3600Q}$$

where:
Δt = drain time for incremental depth (hours)
ΔV = storage volume drained from stage increment (ft^3)
Q = orifice dischrage rate for stage increment (ft^3/s)

DESIGN INPUTS:

Restrictor Plate Orifice Size Design Input:

Outlet Pipe Diameter:	D =	12	inches
Maximum Allowable Discharge Rate:	$Q_{allowable}$ =	2.78	ft^3/s
Orifice Coefficient:	C_0 =	0.6	
Gravitational Constant:	g =	32.2	ft/s^2

Pond Geometry Design Input:

Bottom of Pond Elevation:	EL_{BP} =	5568.86	ft
Outlet Pipe Invert Elevation:	EL_{inv} =	5568.86	ft
100-year Storage Volume:	V_{100} =	12458.00	ft^3
Minor Storm Max Water Surface Elevation:	EL_{TP} =	5570.24	ft
100-year Max Water Surface Elevation:	EL_{100} =	5571.00	ft

** Restrictor plate controls flow between 100-year Max Water Surface Elevation until the pond drains to the Minor Storm Max Water Surface Elevation.*

VARIABLE INPUTS:

Change Orifice Hole Diameter:

Restrictor Plate Opening Height:	d =	6.2500	in
Outlet Pipe Radius:	R =	6	in
Orifice Area:	A_0 =	59.5477995	in^2
Central Angle:	Φ =	3.22495012	rad

= variable user input
= calculation variable

** Change restrictor plate opening height to achieve maximum allowable flow at 100-year Max Water Surface Elevation.*

CALCULATED RESULTS:

Computed Orifice Centroid Elevation:

Centroid Height Above Pipe Invert:	C_y =	3.5881	in
Orifice Centroid Elevation:	EL_1 =	5569.16	ft
Bottom of Plate Elevation:	EL_{plate} =	5569.38	ft

CALCULATE Q AT 100-YR MAX WSEL:

Effective Head on Orifice:	H_0 =	1.84	ft
Orifice Flow Discharge:	**Q_{calc} =**	**2.70**	**ft^3/s**

Check:
$Q_{calc} - Q_{allowable} = 0$ -0.08

CALCULATE FOR POND DRAIN TIME FROM 100-YR MAX WSEL:

Drain Time to Top of Minor Storm Orifice:	**t_{100} =**	**0.65 hours**
Drain Time for WQCV:	**t_{WQCV} =**	**35.48 hours**
** From WQCV Orifice plate design worksheet*		
Drain Time for Minor Storm Volume:	**$t_{minor\ storm}$ =**	**5.39 hours**
** From Minor Storm Orifice plate design worksheet*		
Total Drain Time from Max WSEL:	**t_{total} =**	**41.51 hours**
** CHECK: Total drain down time must be less than 72-hours*		

Pond drains in less than 72 hours

INTERMEDIATE CALCULATIONS:

Notes:

1. Flow rate is calculated at each 0.10-ft stage decrease. It is assumed that the discharge rate calculated at the maximum stage value for each increment and the corresponding effective head is representative of the entire 0.10-ft depth.

2. Storage volumes are determined using the pond design contour areas and the average end-area method.

WSEL	H_0	Q
5571.00	1.84	2.70162
5570.99	1.83	2.69427
5570.98	1.82	2.68690
5570.97	1.81	2.67951
5570.96	1.80	2.67211
5570.95	1.79	2.66468
5570.94	1.78	2.65723
5570.93	1.77	2.64976
5570.92	1.76	2.64227
5570.91	1.75	2.63475
5570.90	1.74	2.62722
5570.89	1.73	2.61966
5570.88	1.72	2.61208
5570.87	1.71	2.60448
5570.86	1.70	2.59686
5570.85	1.69	2.58922
5570.84	1.68	2.58155
5570.83	1.67	2.57386
5570.82	1.66	2.56615
5570.81	1.65	2.55841
5570.80	1.64	2.55065
5570.79	1.63	2.54287
5570.78	1.62	2.53506
5570.77	1.61	2.52723
5570.76	1.60	2.51937
5570.75	1.59	2.51149
5570.74	1.58	2.50359
5570.73	1.57	2.49566
5570.72	1.56	2.48770
5570.71	1.55	2.47972
5570.70	1.54	2.47171
5570.69	1.53	2.46368
5570.68	1.52	2.45562
5570.67	1.51	2.44753
5570.66	1.50	2.43942
5570.65	1.49	2.43128
5570.64	1.48	2.42312
5570.63	1.47	2.41492
5570.62	1.46	2.40670
5570.61	1.45	2.39845
5570.60	1.44	2.39017
5570.59	1.43	2.38186
5570.58	1.42	2.37352
5570.57	1.41	2.36516
5570.56	1.40	2.35676
5570.55	1.39	2.34834
5570.54	1.38	2.33988
5570.53	1.37	2.33139
5570.52	1.36	2.32287
5570.51	1.35	2.31432

Volume at WSEL	Incremental Volume	Time seconds	Time hours	Cumulative Time
12536.91				
12458.07	78.84	29.18	0.01	0.01
12379.37	78.70	29.21	0.01	0.02
12222.39	156.98	58.42	0.02	0.03
12144.12	78.27	29.21	0.01	0.04
12065.99	78.13	29.24	0.01	0.05
11988.00	77.99	29.27	0.01	0.06
11910.15	77.85	29.30	0.01	0.06
11832.44	77.71	29.33	0.01	0.07
11754.88	77.56	29.36	0.01	0.08
11677.45	77.42	29.39	0.01	0.09
11600.17	77.28	29.42	0.01	0.10
11523.03	77.14	29.45	0.01	0.11
11446.03	77.00	29.48	0.01	0.11
11369.18	76.86	29.51	0.01	0.12
11292.46	76.72	29.54	0.01	0.13
11215.88	76.58	29.57	0.01	0.14
11139.45	76.43	29.61	0.01	0.15
11063.16	76.29	29.64	0.01	0.16
10987.00	76.15	29.68	0.01	0.16
10910.99	76.01	29.71	0.01	0.17
10835.12	75.87	29.75	0.01	0.18
10759.38	75.73	29.78	0.01	0.19
10683.79	75.59	29.82	0.01	0.20
10608.34	75.45	29.86	0.01	0.20
10533.03	75.31	29.89	0.01	0.21
10457.85	75.17	29.93	0.01	0.22
10382.82	75.03	29.97	0.01	0.23
10307.93	74.89	30.01	0.01	0.24
10233.17	74.75	30.05	0.01	0.25
10158.56	74.61	30.09	0.01	0.25
10084.08	74.48	30.13	0.01	0.26
10009.75	74.34	30.17	0.01	0.27
9935.55	74.20	30.22	0.01	0.28
9861.49	74.06	30.26	0.01	0.29
9787.57	73.92	30.30	0.01	0.30
9713.79	73.78	30.35	0.01	0.31
9640.15	73.64	30.39	0.01	0.31
9566.65	73.50	30.44	0.01	0.32
9493.28	73.37	30.48	0.01	0.33
9420.06	73.23	30.53	0.01	0.34
9346.97	73.09	30.58	0.01	0.35
9274.02	72.95	30.63	0.01	0.36
9201.20	72.81	30.68	0.01	0.36
9128.53	72.68	30.73	0.01	0.37
9055.99	72.54	30.78	0.01	0.38
8983.59	72.40	30.83	0.01	0.39
8911.33	72.26	30.88	0.01	0.40
8839.20	72.13	30.94	0.01	0.41
8767.22	71.99	30.99	0.01	0.42

Overflow Spillway

Project Description

Solve For	Discharge

Input Data

Headwater Elevation	5571.50	ft
Crest Elevation	5571.00	ft
Tailwater Elevation	5569.00	ft
Weir Coefficient	3.37	US
Crest Length	10.00	ft

Results

Discharge	11.90	ft³/s	> 9.88 cfs (100-YR peak runoff rate)
Headwater Height Above Crest	0.50	ft	
Tailwater Height Above Crest	-2.00	ft	
Equal Side Slopes	0.25	ft/ft (H:V)	
Flow Area	5.06	ft²	
Velocity	2.35	ft/s	
Wetted Perimeter	11.03	ft	
Top Width	10.25	ft	

Pond Outlet - 12" RCP

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00500	ft/ft
Normal Depth	11.3	in
Diameter	12	in

Results

Discharge	2.71	ft³/s	> 2.70 cfs release rate
Flow Area	0.76	ft²	
Wetted Perimeter	2.64	ft	
Hydraulic Radius	3.5	in	
Top Width	0.48	ft	
Critical Depth	0.71	ft	
Percent Full	93.8	%	
Critical Slope	0.00808	ft/ft	
Velocity	3.54	ft/s	
Velocity Head	0.20	ft	
Specific Energy	1.13	ft	
Froude Number	0.50		
Maximum Discharge	2.71	ft³/s	
Discharge Full	2.52	ft³/s	
Slope Full	0.00579	ft/ft	
Flow Type	SubCritical		

GVF Input Data

Downstream Depth	0.0	in
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.0	in
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	93.75	%
Downstream Velocity	Infinity	ft/s

Appendix F:
Hydraulic Calculations

Design Point A

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.024		
Channel Slope	0.0214	ft/ft	
Diameter	18	in	
Discharge	1.72	ft³/s	Basin A 100-YR peak runoff

Results

Normal Depth	5.55	in	< 18" ok
Flow Area	0.46	ft²	
Wetted Perimeter	1.77	ft	
Hydraulic Radius	3.15	in	
Top Width	1.39	ft	
Critical Depth	0.49	ft	
Percent Full	30.8	%	
Critical Slope	0.01675	ft/ft	
Velocity	3.71	ft/s	
Velocity Head	0.21	ft	
Specific Energy	0.68	ft	
Froude Number	1.13		
Maximum Discharge	8.95	ft³/s	
Discharge Full	8.32	ft³/s	
Slope Full	0.00091	ft/ft	
Flow Type	SuperCritical		

GVF Input Data

Downstream Depth	0.00	in
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	in
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	30.85	%
Downstream Velocity	Infinity	ft/s

Design Point B

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.024		
Channel Slope	0.0247	ft/ft	
Diameter	24	in	
Discharge	18.37	ft³/s	Basin B 100-YR peak runoff

Results

Normal Depth	19.32	in	< 24" ok
Flow Area	2.66	ft²	
Wetted Perimeter	4.45	ft	
Hydraulic Radius	7.17	in	
Top Width	1.51	ft	
Critical Depth	1.55	ft	
Percent Full	82.0	%	
Critical Slope	0.02664	ft/ft	
Velocity	6.91	ft/s	
Velocity Head	0.74	ft	
Specific Energy	2.35	ft	
Froude Number	0.92		
Maximum Discharge	19.76	ft³/s	
Discharge Full	18.37	ft³/s	
Slope Full	0.02470	ft/ft	
Flow Type	SubCritical		

GVF Input Data

Downstream Depth	0.00	in
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	in
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	81.96	%
Downstream Velocity	Infinity	ft/s

Design Point C

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.024		
Channel Slope	0.0262	ft/ft	
Diameter	30	in	
Discharge	31.43	ft³/s	1/2 Basin C 100-YR peak runoff

Results

Normal Depth	21.72	in	< 30" (2-30" CMP's @ proposed crossing)
Flow Area	3.81	ft²	
Wetted Perimeter	5.09	ft	
Hydraulic Radius	8.98	in	
Top Width	2.24	ft	
Critical Depth	1.91	ft	
Percent Full	72.4	%	
Critical Slope	0.02307	ft/ft	
Velocity	8.26	ft/s	
Velocity Head	1.06	ft	
Specific Energy	2.87	ft	
Froude Number	1.12		
Maximum Discharge	38.68	ft³/s	
Discharge Full	35.96	ft³/s	
Slope Full	0.02001	ft/ft	
Flow Type	SuperCritical		

GVF Input Data

Downstream Depth	0.00	in
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	in
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	72.40	%
Downstream Velocity	Infinity	ft/s

Design Point 1

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.013		
Channel Slope	0.01000	ft/ft	
Normal Depth	11.00	in	
Diameter	12	in	Basin 1 (2 - 12" RCP's)

Results

Discharge	3.82	ft³/s	2-12" RCP's (7.64 cfs > 5-YR storm)
Flow Area	0.75	ft²	
Wetted Perimeter	2.56	ft	
Hydraulic Radius	3.54	in	
Top Width	0.55	ft	
Critical Depth	0.83	ft	
Percent Full	91.7	%	
Critical Slope	0.01122	ft/ft	
Velocity	5.07	ft/s	
Velocity Head	0.40	ft	
Specific Energy	1.32	ft	
Froude Number	0.76		
Maximum Discharge	3.83	ft³/s	
Discharge Full	3.56	ft³/s	
Slope Full	0.01150	ft/ft	
Flow Type	SubCritical		

GVF Input Data

Downstream Depth	0.00	in
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	in
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	91.67	%
Downstream Velocity	Infinity	ft/s

Design Point 2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.024		
Channel Slope	0.00800	ft/ft	
Diameter	24	in	
Discharge	10.53	ft³/s	1/2 Basin D1 100-YR peak runoff

Results

Normal Depth	18.88	in	< 24" (2-24" CMP's @ proposed crossing)
Flow Area	2.65	ft²	
Wetted Perimeter	4.36	ft	
Hydraulic Radius	7.29	in	
Top Width	1.64	ft	
Critical Depth	1.16	ft	
Percent Full	78.6	%	
Critical Slope	0.01805	ft/ft	
Velocity	3.97	ft/s	
Velocity Head	0.25	ft	
Specific Energy	1.82	ft	
Froude Number	0.55		
Maximum Discharge	11.79	ft³/s	
Discharge Full	10.96	ft³/s	
Slope Full	0.00739	ft/ft	
Flow Type	SubCritical		

GVF Input Data

Downstream Depth	0.00	in
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	in
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	78.65	%
Downstream Velocity	Infinity	ft/s

Perimeter Swale

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.045	
Channel Slope	0.00500	ft/ft
Normal Depth	1.0	ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	2.00	ft

Results

Discharge	9.81	ft³/s	> 5-YR peak runoff for Basin D1 or D2
Flow Area	6.00	ft²	
Wetted Perimeter	10.25	ft	
Hydraulic Radius	0.6	ft	
Top Width	10.00	ft	
Critical Depth	0.62	ft	
Critical Slope	0.04134	ft/ft	
Velocity	1.63	ft/s	
Velocity Head	0.04	ft	
Specific Energy	1.04	ft	
Froude Number	0.37		
Flow Type	Subcritical		

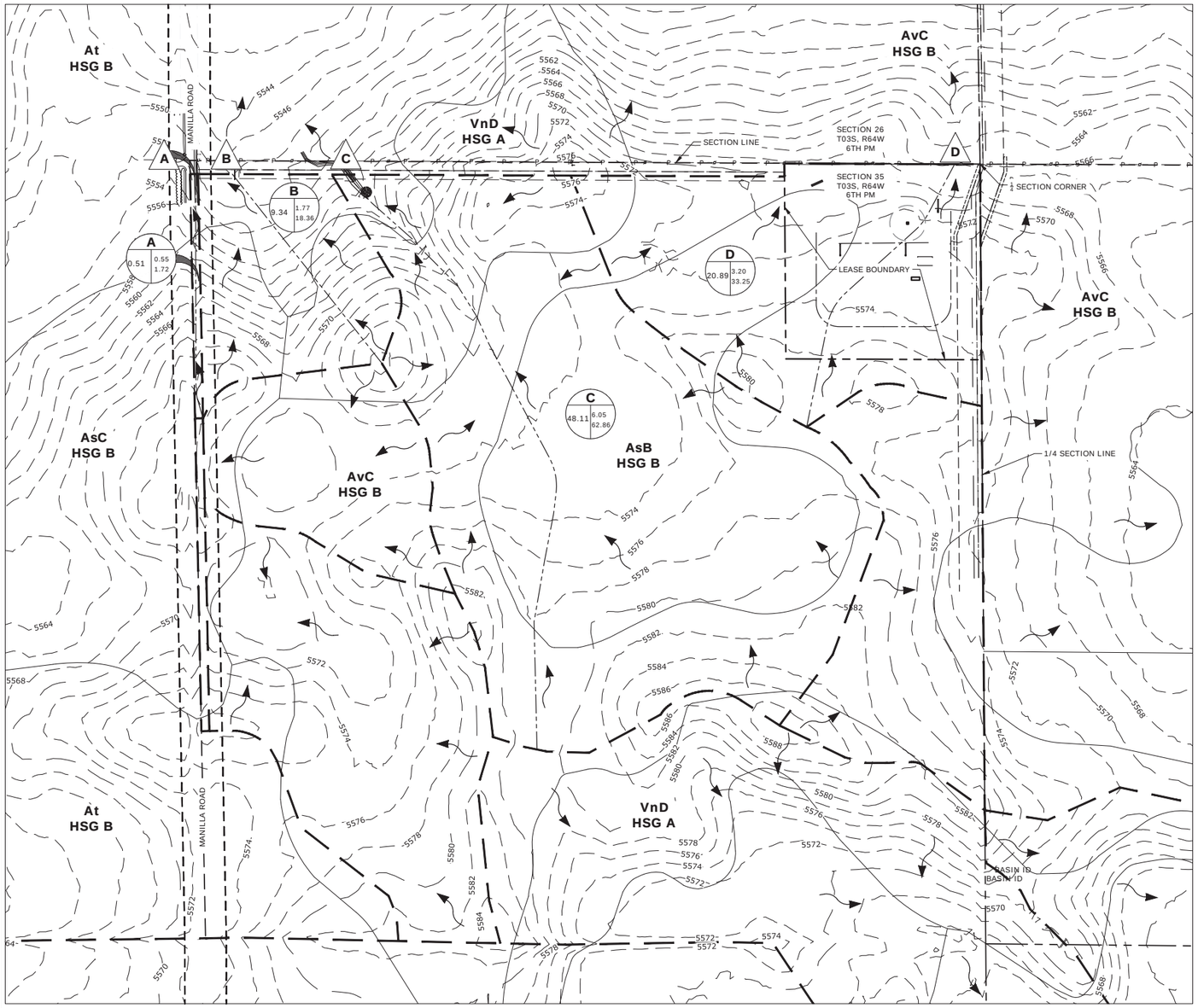
GVF Input Data

Downstream Depth	0.0	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.0	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.0	ft
Critical Depth	0.62	ft
Channel Slope	0.00500	ft/ft

Appendix G:
Predeveloped and Developed Conditions Drainage Maps



NOTES

1. THE WATKINS COMPRESSOR STATION SOUTH PROPOSED SITE IS A 10-ACRE LEASE LOCATED IN THE NORTHWEST QUARTER OF SECTION 35, TOWNSHIP 3 SOUTH, RANGE 64 WEST, 6TH PRINCIPAL MERIDIAN, ADAMS COUNTY, STATE OF COLORADO.
2. THE SITE SURVEY FOR THIS PROJECT WAS PREPARED BY ACKLAM, INC. AND WAS RECEIVED ON 10/12/2018.

   HORIZONTAL DATUM: BASED ON COLORADO STATE PLANE COORDINATES, NORTH ZONE, NORTH AMERICAN HORIZONTAL DATUM, 1983 (US SURVEY FEET).

   VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM 1988.
3. FOR GRADING AND DRAINAGE PLANS SEE WCSS-CE-601 AND WCSS-CE-602. FOR EROSION CONTROL AND SURFACING SEE PLAN WCSS-CE-401. FOR DRAINAGE MAPS SEE DRAWINGS WCSS-CE-610 AND WCSS-CE-611.
4. OFFSITE PIPE CONNECTIONS TO THE COMPRESSOR STATION DESIGNED AND INSTALLED BY OTHERS.
5. THE PROJECT SITE HAS NO EXISTING UTILITIES OR STORM DRAINAGE FEATURES.

LEGEND

- EXISTING MAJOR CONTOUR (5405)
- EXISTING MINOR CONTOUR (5403)
- PROPOSED MAJOR CONTOUR (5405)
- PROPOSED MINOR CONTOUR (5403)
- EASEMENT LINE
- LEASE BOUNDARY
- SECTION LINE
- 1/4 SECTION LINE
- PIPELINE EASEMENT
- RIGHT-OF-WAY (ROW)
- SECURITY FENCE
- EXISTING CONDITIONS BASIN BOUNDARY
- TIME OF CONCENTRATION PATH
- EXISTING OVERHEAD POWER (P — P — P)
- DRAINAGE FLOW ARROW
- AvC HSG A — NRCS HYDROLOGIC SOIL GROUP
- A — DESIGN POINT
- BASIN ID, BASIN AREA (AC), Q_5, Q_{100} — BASIN HYDROLOGY

DRAINAGE BASIN SUMMARY

BASIN	DESIGN POINT	DESCRIPTION	CONTRIBUTING AREA (ACRES)	HYDROLOGIC SOIL GROUP (HSG)	IMPERVIOUS AREA (%)	BASIN FLOW LENGTH (FT)	BASIN FLOW SLOPE (%)	5-YR RUNOFF COEFFICIENT C_5	100-YR RUNOFF COEFFICIENT C_{100}	5-YR PEAK FLOW RATE (CFS) Q_5	100-YR PEAK FLOW RATE (CFS) Q_{100}
A	A	EX. CONDITIONS BASIN	0.51	B	50.0	827	2.78	0.40	0.66	0.55	1.72
B	B	EX. CONDITIONS BASIN	9.34	B	2.0	813	3.75	0.08	0.44	1.77	18.36
C	C	EX. CONDITIONS BASIN	48.11	B	2.0	2182	1.19	0.08	0.44	6.05	62.86
D	D	EX. CONDITIONS BASIN ENCOMPASSING SITE	20.89	B	2.0	1054	1.12	0.08	0.44	3.20	33.25

NRCS WEB SOIL SURVEY DATA

MAP UNIT SYMBOL	MAP SOIL NAME	HYDROLOGIC SOIL GROUP RATING
AsB	ASCALON SANDY LOAM, (0%-3% SLOPES)	B
AsC	ASCALON SANDY LOAM, (3%-5% SLOPES)	B
At	ASCALON-PLATNER ASSOCIATION	B
AvC	ASCALON-VONA SANDY LOAM, (1%-5% SLOPES)	B
VnD	VONA LOAMY SAND, (3% TO 9% SLOPES)	A

NORTH

0' 100' 200' 400' 600'

SCALE: 1" = 200'

Know what's below. Call before you dig.

COLORADO LICENSED MICHAEL T. CLOUD 49458 01-21-19 PROFESSIONAL ENGINEER FOR PERMIT

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REFERENCE DRAWINGS

DWG NO.	DESCRIPTION

REVISIONS

NO.	DESCRIPTION	DATE	BY

REVISIONS

NO.	DESCRIPTION	DATE	BY
B	ISSUED FOR PERMIT - RESPONSE TO COMMENT	01/21/19	LER
A	ISSUED FOR PERMIT	11/15/18	DMM

SCALE:	1" = 200'	DATE
DESIGNED:	M. MORGAN	11/15/2018
DRAWN:	M. MORGAN	10/18/2018
CHECKED:	M. CLOUD	11/15/2018
APPROVED:		
APPROVED:		

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC

LOCATION: ADAMS COUNTY, CO

Samuel Engineering
We Provide Solutions
8450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
Phone: 303.714.4840
Fax: 303.714.4800

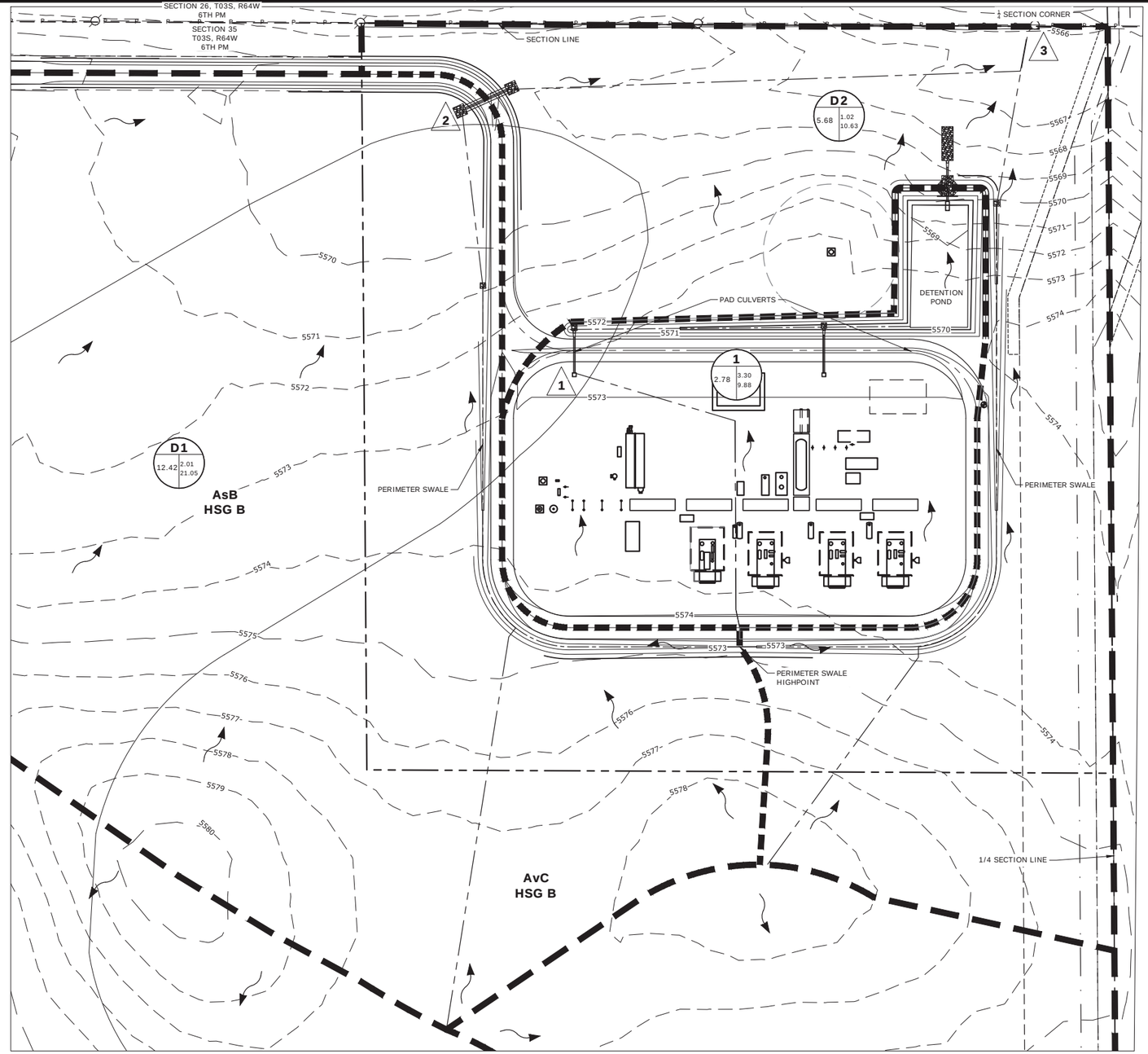
TITLE
WATKINS COMPRESSOR STATION
WILLIAMS DJ BASIN FIELD COMPRESSION
CIVIL
GENERAL
PREDEVELOPED CONDITIONS DRAINAGE MAP

PROJECT NUMBER
18256

DRAWING NUMBER
WCSS-CE-610

REV. B

CAD File: S:\Projects\18256_Watkins_Compressor\CAD\Civil\Watkins South\Drawings\WCSS-CE-610.dwg
Plot Date: Monday, January 21, 2019 12:55:20 PM Plotted By: Lauren Root
CTB Used: SE_Std_BkW_full_sect.ctb



NOTES

1. THE WATKINS COMPRESSOR STATION SOUTH PROPOSED SITE IS A 10-ACRE LEASE LOCATED IN THE NORTHWEST QUARTER OF SECTION 35, TOWNSHIP 3 SOUTH, RANGE 64 WEST, 6TH PRINCIPAL MERIDIAN, ADAMS COUNTY, STATE OF COLORADO.
2. THE SITE SURVEY FOR THIS PROJECT WAS PREPARED BY ACKLAM, INC. AND WAS RECEIVED ON 10/12/2018.

   HORIZONTAL DATUM: BASED ON COLORADO STATE PLANE COORDINATES, NORTH ZONE, NORTH AMERICAN HORIZONTAL DATUM, 1983 (US SURVEY FEET).

   VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM 1988.
3. FOR GRADING AND DRAINAGE PLANS SEE WCSS-CE-601 AND WCSS-CE-602. FOR EROSION CONTROL AND SURFACING SEE PLAN WCSS-CE-401. FOR PREDEVELOPED CONDITIONS DRAINAGE MAP SEE WCSS-CE-610.
4. OFFSITE PIPE CONNECTIONS TO THE COMPRESSOR STATION DESIGNED AND INSTALLED BY OTHERS.
5. THE PROJECT SITE HAS NO EXISTING UTILITIES OR STORM DRAINAGE FEATURES.

LEGEND

- 5405 — EXISTING MAJOR CONTOUR
- 5403 — EXISTING MINOR CONTOUR
- 5405 — PROPOSED MAJOR CONTOUR
- 5403 — PROPOSED MINOR CONTOUR
- EASEMENT LINE
- LEASE BOUNDARY
- SECTION LINE
- 1/4 SECTION LINE
- PIPELINE EASEMENT
- RIGHT-OF-WAY (ROW)
- SECURITY FENCE
- EXISTING CONDITIONS BASIN BOUNDARY
- DEVELOPED CONDITIONS BASIN BOUNDARY
- TIME OF CONCENTRATION FLOWPATH
- P P P — EXISTING OVERHEAD POWER
- DRAINAGE FLOW ARROW
- AvC HSG A — NRCS HYDROLOGIC SOIL GROUP
- A — DESIGN POINT
- BASIN ID B; BASIN AREA (AC) 15.99; XX.XX; XX.XX; Q_5 Q_{100} — BASIN HYDROLOGY

DRAINAGE BASIN SUMMARY

BASIN	DESIGN POINT	DESCRIPTION	CONTRIBUTING AREA (ACRES)	HYDROLOGIC SOIL GROUP (HSG)	IMPERVIOUS AREA (%)	BASIN FLOW LENGTH (FT)	BASIN FLOW SLOPE (%)	5-YR RUNOFF COEFFICIENT C_5	100-YR RUNOFF COEFFICIENT C_{100}	5-YR PEAK FLOW RATE (CFS) Q_5	100-YR PEAK FLOW RATE (CFS) Q_{100}
D1	2	PRIMARILY UNDISTURBED AREA	12.42	B	3.0	829	1.01	0.08	0.44	2.01	21.05
D2	SEE DP 3	PRIMARILY UNDISTURBED AREA	5.68	B	2.6	813	1.54	0.08	0.44	1.02	10.63
BASIN 1	1	PROCESS AREA AND ROADS	2.78	B	52.9	331	0.56	0.43	0.67	3.30	9.88
D1 & D2, 1	3	COMBINED PEAK RUNOFF AT DESIGN POINT 3	20.88	B	2.9	1345	0.83	0.08	0.44	2.76	28.26

NRCS WEB SOIL SURVEY DATA

MAP UNIT SYMBOL	MAP SOIL NAME	HYDRLOGIC SOIL GROUP RATING
AsB	ASCALON SANDY LOAM, (0%-3% SLOPES)	B
AvC	ASCALON-VONA SANDY LOAM, (1%-5% SLOPES)	B

N

NORTH

0' 100' 200' 400' 600'

SCALE: 1" = 200'

811 Know what's below. Call before you dig.

COLORADO LICENSED MICHAEL T. CLOUD 49458 10-21-19 PROFESSIONAL ENGINEER FOR PERMIT

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Plot Date: Monday, January 21, 2019 1:06:50 PM Plotted By: Lauren Root
CTB Used: SE_Std_BeW_Full_Size.ctb

REFERENCE DRAWINGS

DWG NO.	DESCRIPTION

REVISIONS

NO.	DESCRIPTION	DATE	BY

REVISIONS

NO.	DESCRIPTION	DATE	BY
B	ISSUED FOR PERMIT - RESPONSE TO COMMENT	01/21/19	LER
A	ISSUED FOR PERMIT	11/15/18	DMM

SCALE:	1" = 200'	DATE
DESIGNED:	M. MORGAN	11/15/2018
DRAWN:	M. MORGAN	10/18/2018
CHECKED:	M. CLOUD	11/15/2018
APPROVED:		
APPROVED:		

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC

LOCATION: ADAMS COUNTY, CO

Williams

Samuel Engineering
We Provide Solutions
8450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
Phone: 303.714.4840
Fax: 303.714.4800

TITLE

WATKINS COMPRESSOR STATION
WILLIAMS DJ BASIN FIELD COMPRESSION
CIVIL-SOUTH
GENERAL
DEVELOPED CONDITIONS DRAINAGE MAP

PROJECT NUMBER

18256

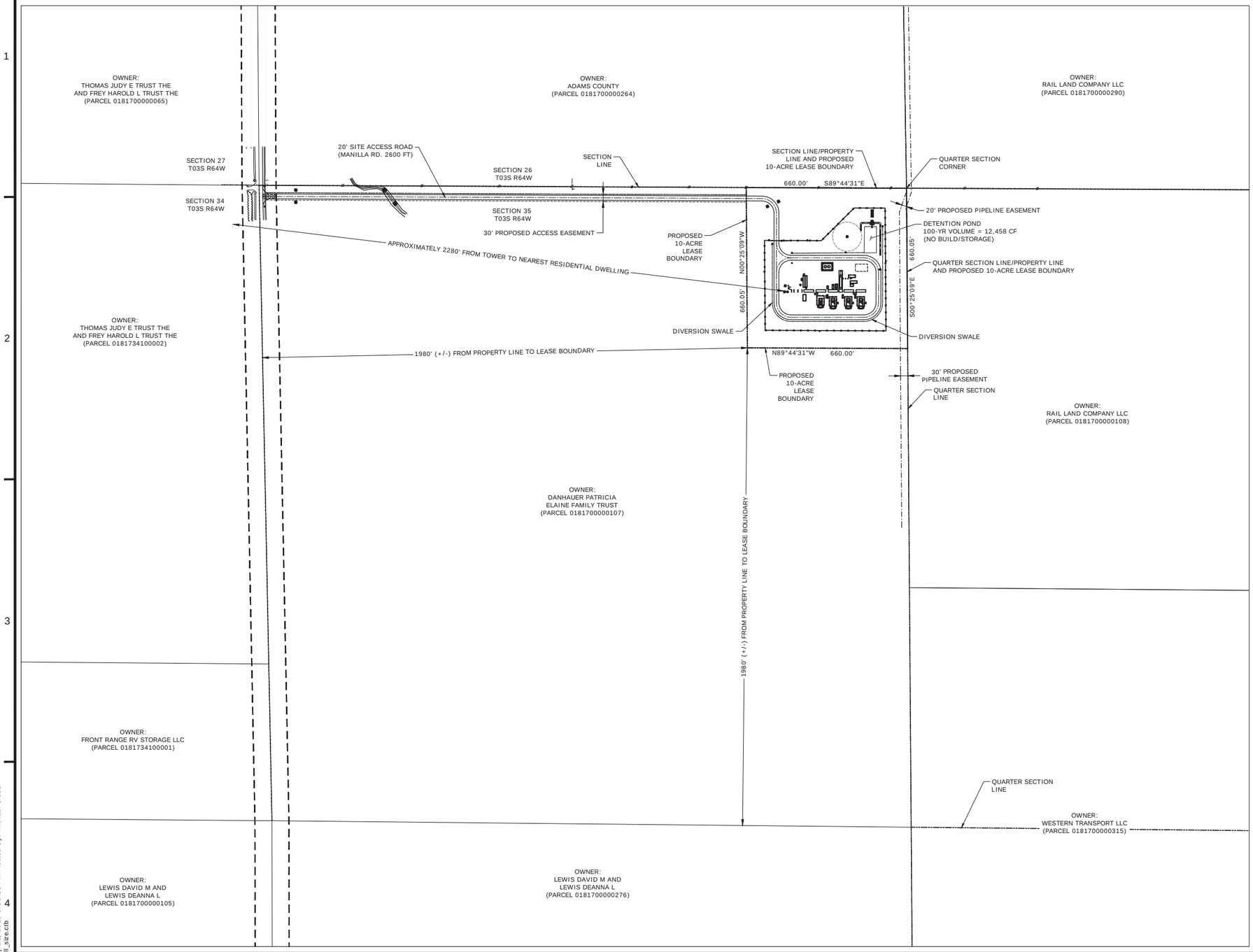
DRAWING NUMBER

WCSS-CE-611 REV. B

Appendix H:
Construction Drawings

OVERALL SITE PLAN
WATKINS COMPRESSOR STATION
WILLIAMS DJ BASIN FIELD COMPRESSION

ADAMS COUNTY, COLORADO
PARCEL NO. 181700000107
NW ¼ SECTION 35 T03S R64W
6th PRINCIPAL MERIDIAN



NOTES

1. THE WATKINS COMPRESSOR STATION SOUTH PROPOSED SITE IS A 10-ACRE LEASE LOCATED IN THE NORTHWEST QUARTER OF SECTION 35, TOWNSHIP 3 SOUTH, RANGE 64 WEST, 6TH PRINCIPAL MERIDIAN, ADAMS COUNTY, STATE OF COLORADO.
2. THE SITE SURVEY FOR THIS PROJECT WAS PREPARED BY ACKLAM, INC. AND WAS RECEIVED ON 10/12/2018.

   HORIZONTAL DATUM: BASED ON COLORADO STATE PLANE COORDINATES, NORTH ZONE, NORTH AMERICAN HORIZONTAL DATUM, 1983 (US SURVEY FEET).

   VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM 1988.
3. SEE CIVIL SITE PLAN FOR MORE INFORMATION (WCSS-CE-103).

LEASE AREA LEGAL DESCRIPTION

A PORTION OF THAT PARCEL DESCRIBED IN QUIT CLAIM DEED TO PATRICIA ELAINE DANHAUER FAMILY TRUST, FILED FOR RECORD IN THE OFFICE OF THE ADAMS COUNTY CLERK AND RECORDER AT RECEPTION NO. 2009000084336, SAID PARCEL LOCATED IN THE NORTHWEST ONEQUARTER OF SECTION 35, TOWNSHIP 3 SOUTH, RANGE 64 WEST OF THE 6TH PRINCIPAL MERIDIAN, COUNTY OF ADAMS, STATE OF COLORADO DESCRIBED AS FOLLOWS:

BEGINNING AT THE NORTH ONE-QUARTER CORNER OF SAID SECTION 35, BEING A 3 INCH ALUMINUM CAP MARKED PLS 23527 1993, THENCE SOUTH 00°25'09" EAST, ALONG THE EAST LINE OF THE NORTHWEST ONE-QUARTER OF SAID SECTION 35, A DISTANCE OF 660.05 FEET;

THENCE NORTH 89°44'31" WEST, DEPARTING SAID LINE, A DISTANCE OF 660.00 FEET;

THENCE NORTH 00°25'09" WEST A DISTANCE OF 660.05 FEET, MORE OR LESS, TO THE NORTH LINE OF THE NORTHWEST ONE-QUARTER OF SAID SECTION 35;

THENCE SOUTH 89°44'31" EAST, ALONG SAID LINE, A DISTANCE OF 660.00 FEET TO THE POINT OF BEGINNING;

CONTAINING 10.000 ACRES (435600 SQUARE FEET) OF LAND, MORE OR LESS.

LEGEND

- EASEMENT LINE
- LEASE BOUNDARY
- SECTION LINE
- 1/4 SECTION LINE
- PIPELINE EASEMENT
- RIGHT-OF-WAY (ROW)
- SECURITY FENCE
- EXISTING OVERHEAD POWER

NORTH

0' 100' 200' 400' 600'

SCALE: 1" = 200'

Know what's below. Call before you dig.

COLORADO LICENSED
MICHAEL T. CLOUD
49458
01-21-19
PROFESSIONAL ENGINEER
FOR PERMIT

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Plot Date: Monday, January 21, 2019 6:52:15 PM Plotted By: Michael Cloud
CTB Used: SE_Std_B&W_Full_Size.ctb

REFERENCE DRAWINGS

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REVISIONS

NO.	DESCRIPTION	DATE	BY

REVISIONS

NO.	DESCRIPTION	DATE	BY
A	ISSUED FOR PERMIT - RESPONSE TO COMMENT	01/21/19	LER

SCALE:	1" = 200'	DATE
DESIGNED:	M. CLOUD	01/21/2019
DRAWN:	L. ROOT	01/21/2019
CHECKED:	M. CLOUD	01/21/2019
APPROVED:		
APPROVED:		

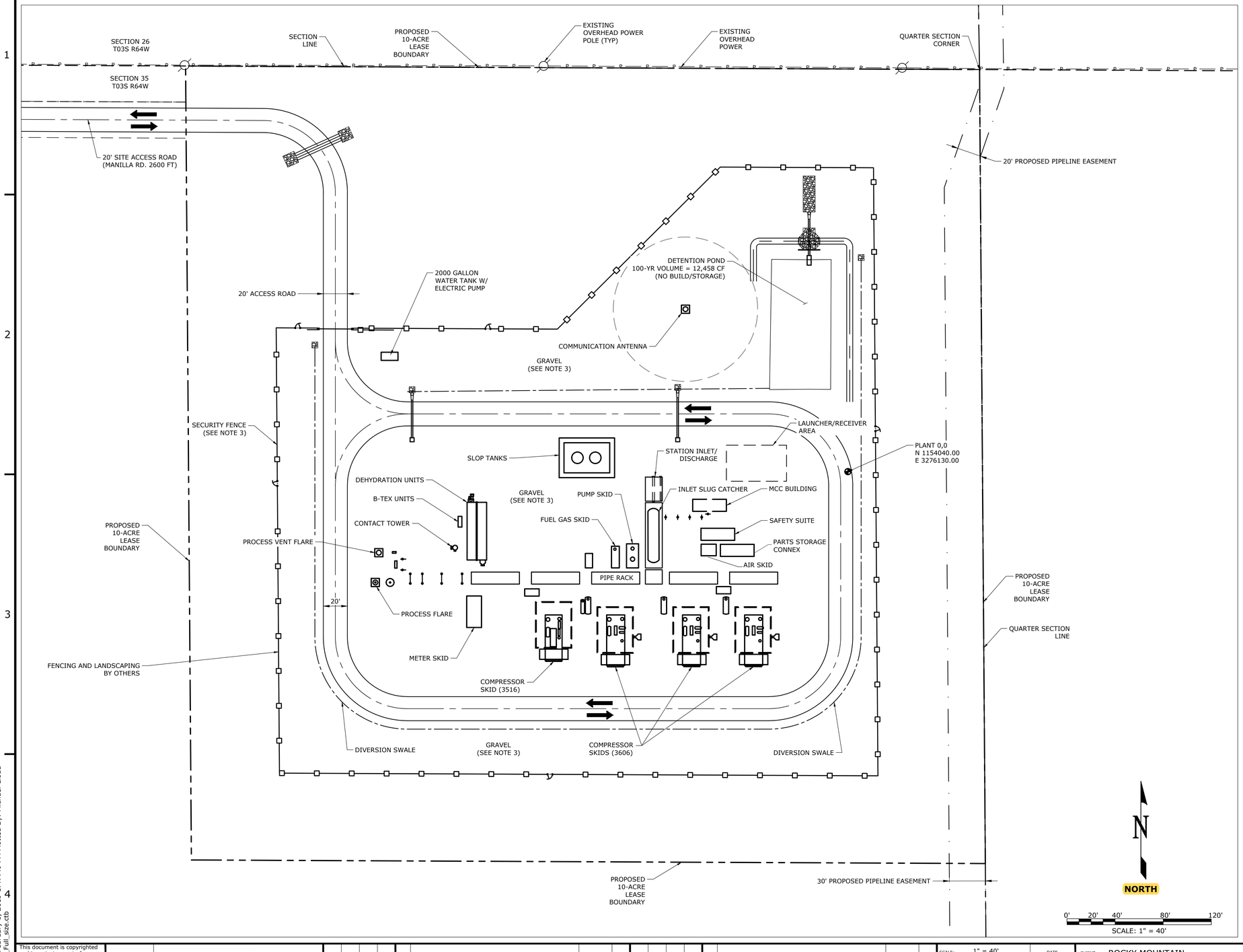
CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC
LOCATION: ADAMS COUNTY, CO

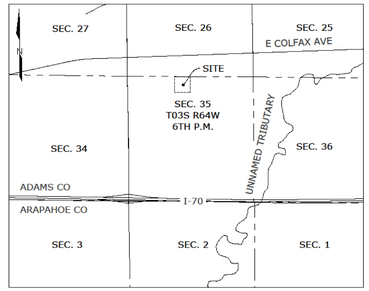
Samuel Engineering
We Provide Solutions
8450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
Phone: 303.714.4840
Fax: 303.714.4800

TITLE	PROJECT NUMBER
WATKINS COMPRESSOR STATION WILLIAMS DJ BASIN FIELD COMPRESSION CIVIL GENERAL OVERALL SITE PLAN	18256
	DRAWING NUMBER
	WCSS-CE-102 REV. A

CIVIL SITE PLAN
WATKINS COMPRESSOR STATION
WILLIAMS DJ BASIN FIELD COMPRESSION

ADAMS COUNTY, COLORADO
PARCEL NO. 1817000000107
NW ¼ SECTION 35 T03S R64W
6th PRINCIPAL MERIDIAN





VICINITY MAP
SCALE: 1" = 3000'

NOTES

1. THE WATKINS COMPRESSOR STATION SOUTH PROPOSED SITE IS A 10-ACRE LEASE LOCATED IN THE NORTHWEST QUARTER OF SECTION 35, TOWNSHIP 3 SOUTH, RANGE 64 WEST, 6TH PRINCIPAL MERIDIAN, ADAMS COUNTY, STATE OF COLORADO.
2. THE SITE SURVEY FOR THIS PROJECT WAS PREPARED BY ACKLAM, INC. AND WAS RECEIVED ON 10/12/2018.

   HORIZONTAL DATUM: BASED ON COLORADO STATE PLANE COORDINATES, NORTH ZONE, NORTH AMERICAN HORIZONTAL DATUM, 1983 (US SURVEY FEET).

   VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM 1988.
3. FOR GRADING AND DRAINAGE PLANS SEE WCSS-CE-601 AND WCSS-CE-602. FOR EROSION CONTROL AND SURFACING SEE PLAN WCSS-CE-401. FOR FENCING PLAN SEE WCSS-CE-501. FOR DRAINAGE MAPS SEE DRAWINGS WCSS-CE-610 AND WCSS-CE-611.
4. OFFSITE PIPE CONNECTIONS TO THE COMPRESSOR STATION DESIGNED AND INSTALLED BY OTHERS.
5. LANDSCAPING BUFFER LOCATION SHOWN ON SEPARATE PLAN TO BE PROVIDED BY OTHERS.
6. THE PROJECT SITE HAS NO EXISTING UTILITIES OR STORM DRAINAGE FEATURES.
7. PERMANENT SIGN IDENTIFYING FACILITY ADDRESS, NAME, AND CONTACT INFORMATION MUST BE POSTED AND MAINTAINED AT ALL TIMES.
8. NFPA 704 PLACARD MUST BE POSTED AT ALL TIMES.

LEASE AREA LEGAL DESCRIPTION

A PORTION OF THAT PARCEL DESCRIBED IN QUIT CLAIM DEED TO PATRICIA ELAINE DANHAUER FAMILY TRUST, FILED FOR RECORD IN THE OFFICE OF THE ADAMS COUNTY CLERK AND RECORDER AT RECEPTION NO. 2009000084336, SAID PARCEL LOCATED IN THE NORTHWEST ONEQUARTER OF SECTION 35, TOWNSHIP 3 SOUTH, RANGE 64 WEST OF THE 6TH PRINCIPAL MERIDIAN, COUNTY OF ADAMS, STATE OF COLORADO DESCRIBED AS FOLLOWS:

BEGINNING AT THE NORTH ONE-QUARTER CORNER OF SAID SECTION 35, BEING A 3 INCH ALUMINUM CAP MARKED PLS 23527 1993, THENCE SOUTH 00°25'09" EAST, ALONG THE EAST LINE OF THE NORTHWEST ONE-QUARTER OF SAID SECTION 35, A DISTANCE OF 660.05 FEET;

THENCE NORTH 89°44'31" WEST, DEPARTING SAID LINE, A DISTANCE OF 660.00 FEET;

THENCE NORTH 00°25'09" WEST A DISTANCE OF 660.05 FEET, MORE OR LESS, TO THE NORTH LINE OF THE NORTHWEST ONE-QUARTER OF SAID SECTION 35;

THENCE SOUTH 89°44'31" EAST, ALONG SAID LINE, A DISTANCE OF 660.00 FEET TO THE POINT OF BEGINNING;

CONTAINING 10.000 ACRES (435600 SQUARE FEET) OF LAND, MORE OR LESS.

LEGEND

- EASEMENT LINE
- LEASE BOUNDARY
- SECTION LINE
- 1/4 SECTION LINE
- PIPELINE EASEMENT
- RIGHT-OF-WAY (ROW)
- SECURITY FENCE
- EXISTING OVERHEAD POWER
- LANDSCAPING BUFFER
- TRAFFIC FLOW

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COLORADO LICENSED PROFESSIONAL ENGINEER MICHAEL T. CLOUD 49458 02-06-19
FOR PERMIT

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CTB Used: SE_Std_B&W_Full_size.ctb

REFERENCE DRAWINGS

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REVISIONS

NO.	DESCRIPTION	DATE	BY
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B	ISSUED FOR PERMIT - RESPONSE TO COMMENT	01/21/19	LER
A	ISSUED FOR PERMIT	11/15/18	DMM

	CLIENT	PROJECT ENGINEER	LEAD ENGINEER	CHECK
		MTC	LER	
		MTC	MTC	
		DMM	MTC	

SCALE:	1" = 40'
DESIGNED:	M. MORGAN
DRAWN:	M. MORGAN
CHECKED:	M. CLOUD
APPROVED:	
APPROVED:	

DATE
11/15/2018
10/18/2018
11/15/2018

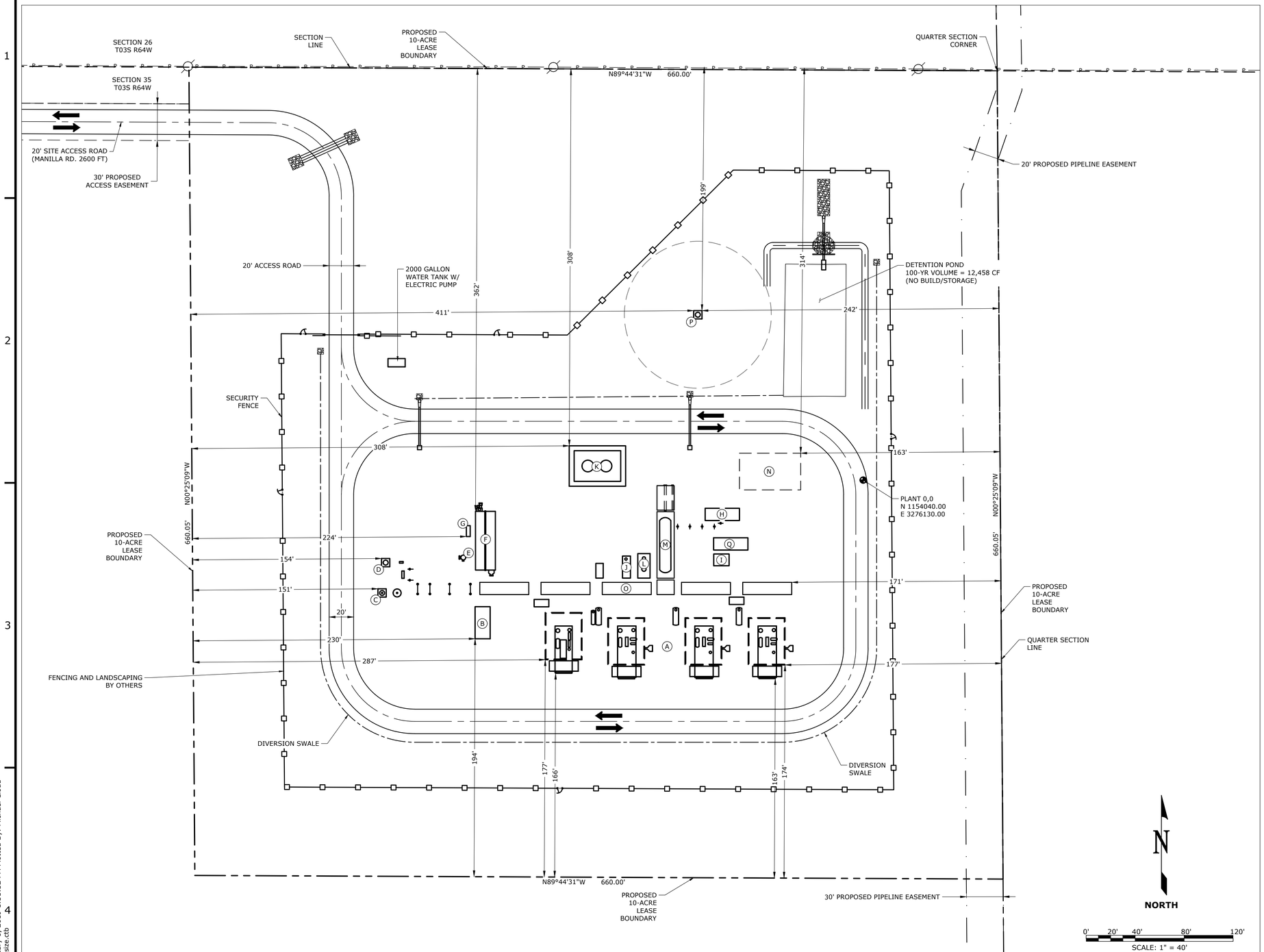
CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC
LOCATION: ADAMS COUNTY, CO

Samuel Engineering
We Provide Solutions
8450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
Phone: 303.714.4840
Fax: 303.714.4800

TITLE	PROJECT NUMBER
WATKINS COMPRESSOR STATION WILLIAMS DJ BASIN FIELD COMPRESSION CIVIL GENERAL CIVIL SITE PLAN	18256
	DRAWING NUMBER
	WCSS-CE-103 REV. C

CIVIL SITE SETBACK PLAN
WATKINS COMPRESSOR STATION
WILLIAMS DJ BASIN FIELD COMPRESSION

ADAMS COUNTY, COLORADO
PARCEL NO. 1817000000107
NW ¼ SECTION 35 T03S R64W
6th PRINCIPAL MERIDIAN



NOTES

1. THE WATKINS COMPRESSOR STATION SOUTH PROPOSED SITE IS A 10-ACRE LEASE LOCATED IN THE NORTHWEST QUARTER OF SECTION 35, TOWNSHIP 3 SOUTH, RANGE 64 WEST, 6TH PRINCIPAL MERIDIAN, ADAMS COUNTY, STATE OF COLORADO.
2. THE SITE SURVEY FOR THIS PROJECT WAS PREPARED BY ACKLAM, INC. AND WAS RECEIVED ON 10/12/2018.

   HORIZONTAL DATUM: BASED ON COLORADO STATE PLANE COORDINATES, NORTH ZONE, NORTH AMERICAN HORIZONTAL DATUM, 1983 (US SURVEY FEET).

   VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM 1988.
3. SEE CIVIL SITE PLAN FOR MORE INFORMATION (WCSS-CE-103).

LEASE AREA LEGAL DESCRIPTION

A PORTION OF THAT PARCEL DESCRIBED IN QUIT CLAIM DEED TO PATRICIA ELAINE DANHAUER FAMILY TRUST, FILED FOR RECORD IN THE OFFICE OF THE ADAMS COUNTY CLERK AND RECORDER AT RECEPTION NO. 2009000084336, SAID PARCEL LOCATED IN THE NORTHWEST ONEQUARTER OF SECTION 35, TOWNSHIP 3 SOUTH, RANGE 64 WEST OF THE 6TH PRINCIPAL MERIDIAN, COUNTY OF ADAMS, STATE OF COLORADO DESCRIBED AS FOLLOWS:

BEGINNING AT THE NORTH ONE-QUARTER CORNER OF SAID SECTION 35, BEING A 3 INCH ALUMINUM CAP MARKED PLS 23527 1993, THENCE SOUTH 00°25'09" EAST, ALONG THE EAST LINE OF THE NORTHWEST ONE-QUARTER OF SAID SECTION 35, A DISTANCE OF 660.05 FEET;

THENCE NORTH 89°44'31" WEST, DEPARTING SAID LINE, A DISTANCE OF 660.00 FEET;

THENCE NORTH 00°25'09" WEST A DISTANCE OF 660.05 FEET, MORE OR LESS, TO THE NORTH LINE OF THE NORTHWEST ONE-QUARTER OF SAID SECTION 35;

THENCE SOUTH 89°44'31" EAST, ALONG SAID LINE, A DISTANCE OF 660.00 FEET TO THE POINT OF BEGINNING;

CONTAINING 10.000 ACRES (435600 SQUARE FEET) OF LAND, MORE OR LESS.

EQUIPMENT LIST

	STRUCTURE	HEIGHT
A	COMPRESSOR BUILDING (4 UNITS)	22.5 FT
B	METER SKID	11 FT
C	PROCESS FLARE	65 FT
D	PROCESS VENT FLARE	26 FT
E	CONTACT TOWER	54 FT
F	DEHYDRATION UNIT	15 FT
G	BTEX UNIT	10 FT
H	MCC BUILDING	10 FT
I	AIR SKID	10 FT
J	FUEL GAS SKID	10 FT
K	SLOP TANKS	7.5 FT
L	PUMP SKID	10 FT
M	INLET SLUG CATCHER	15 FT
N	LAUNCHER/RECEIVER AREA	5 FT
O	PIPE RACK	7 FT
P	COMMUNICATION ANTENNA	60 FT
Q	PARTS STORAGE CONNEX	10 FT

LEGEND

- EASEMENT LINE
- LEASE BOUNDARY
- SECTION LINE
- 1/4 SECTION LINE
- PIPELINE EASEMENT
- RIGHT-OF-WAY (ROW)
- SECURITY FENCE
- EXISTING OVERHEAD POWER
- LANDSCAPING BUFFER
- TRAFFIC FLOW

NORTH

0' 20' 40' 80' 120'
SCALE: 1" = 40'

Know what's below. Call before you dig.

COLORADO LICENSED MICHAEL T. CLOUD 49458 PROFESSIONAL ENGINEER 02-06-19 FOR PERMIT

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REFERENCE DRAWINGS

DWG NO.	DESCRIPTION

REVISIONS

NO.	DESCRIPTION	DATE	BY

REVISIONS

NO.	DESCRIPTION	DATE	BY
B	ISSUED FOR PERMIT - ADD WATER TANK	02/06/19	MTC
A	ISSUED FOR PERMIT - RESPONSE TO COMMENT	01/21/19	LER

SCALE:	1" = 40'	DATE
DESIGNED:	M. CLOUD	01/21/2019
DRAWN:	L. ROOT	01/21/2019
CHECKED:	M. CLOUD	01/21/2019
APPROVED:		
APPROVED:		

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC
LOCATION: ADAMS COUNTY, CO

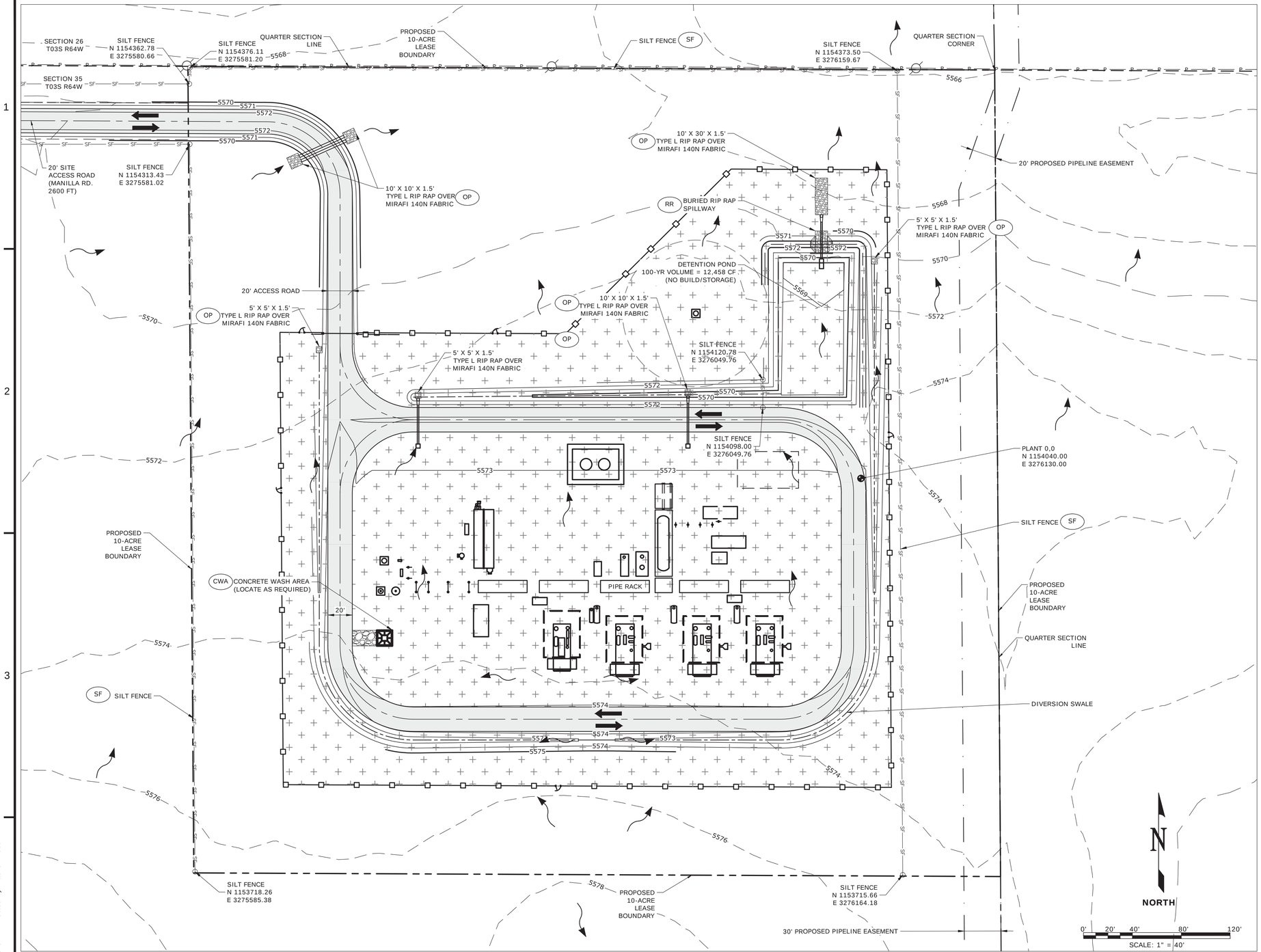
Samuel Engineering
We Provide Solutions
8450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
Phone: 303.714.4840
Fax: 303.714.4800

TITLE
WATKINS COMPRESSOR STATION
WILLIAMS DJ BASIN FIELD COMPRESSION
CIVIL
GENERAL
CIVIL SITE SETBACK PLAN

PROJECT NUMBER
18256

DRAWING NUMBER
WCSS-CE-104 REV. B

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Plot Date: Wednesday, February 6, 2019 1:51:32 PM Plotted By: Michael Cloud
CTB Used: SE_Std_B&W_Full_size.ctb



GENERAL NOTES

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING AND PROTECTING ALL UNDERGROUND UTILITIES PRIOR TO CONSTRUCTION. THE CONTRACTOR IS TO ENSURE THAT 811 AND OWNER'S SITE PERSONNEL ARE CONTACTED PRIOR TO COMMENCING CONSTRUCTION ACTIVITIES. CAUTION SHOULD BE TAKEN DURING ALL EXCAVATION OF SOIL AND FOUNDATIONS WITHIN THE LIMITS OF DISTURBANCE. CONTACT ENGINEER IF THERE ARE CONFLICTS.
2. THE MAJORITY OF THE SITE GRAVEL WILL BE INSTALLED AFTER EQUIPMENT IS SET AND FINAL GRADING IS COMPLETE. THE CONTRACTOR IS TO COORDINATE WITH THE OWNER FOR ALL GRAVEL INSTALLATION TIMING.
3. THE CONTRACTOR IS TO SUBMIT A GRADATION SAMPLE TO OWNER PRIOR TO PLACING GRAVEL MATERIAL. OWNER WILL DETERMINE SIZE OF GRAVEL TO BE USED.
4. PERIMETER SILT FENCE IS TO BE INSTALLED PRIOR TO ANY CONSTRUCTION ACTIVITIES. ALL OTHER EROSION CONTROL MEASURES CAN BE INSTALLED AFTER ROUGH GRADING AND DRAINAGE IS COMPLETE.
5. ALL AREAS WITHIN THE SECURITY FENCE SHALL BE MAINTAINED VEGETATION FREE GRAVEL FOR THE LIFE OF THE FACILITY.
6. ALL AREAS OUTSIDE THE SECURITY FENCE NOT SURFACED WITH GRAVEL, ROAD BASE, ETC. THAT ARE DISTURBED DURING CONSTRUCTION SHALL BE SEEDED WITH A NATIVE SEED MIXTURE OR OTHERWISE PROTECTED FROM EROSION AS APPROVED BY WELD COUNTY AND THE OWNER.
7. A CDPHE SWMP SHALL BE PREPARED AND MAINTAINED FOR THIS PROJECT SITE.
8. SEE DRAWING WCSS-CE-602 FOR ADDITIONAL EROSION CONTROL FEATURES ON THE SITE ACCESS ROAD.

EROSION CONTROL NOTES

1. REFERENCE DRAWING WCSS-CE-103 FOR CIVIL SITE PLAN AND NOTES AND WCSS-CE-601 FOR DRAINAGE AND GRADING PLANS AND NOTES.
2. EROSION CONTROL BMP'S ON THIS DRAWING MAY BE SHOWN LARGER THAN ACTUAL SIZE FOR CLARITY.
3. PERMANENT SEEDING AND MULCHING WILL BE REQUIRED OUTSIDE SECURITY FENCING ON ALL DISTURBED AREAS NOT RECEIVING GRAVEL OR ROAD BASE DURING CONSTRUCTION.
4. THE RECEIVING WATERS FOR THE SITE IS AN UNNAMED TRIBUTARY OF THE LOST SAND CREEK.
5. SITE AREA AND AREA OF DISTURBANCE FOR THIS SITE AND THE ACCESS ROAD IS APPROXIMATELY 5.0 ACRES.

GRUBBING NOTES

1. ALL VEGETATION AND ORGANIC MATERIAL IS TO BE REMOVED AS DEFINED BY THE LIMITS OF DISTURBANCE SHOWN ON THIS DRAWING. LIMITS OF DISTURBANCE ARE ESTIMATES AND THE CONTRACTOR IS TO CONFIRM WITH THE ONSITE CONSTRUCTION MANAGER FOR FINAL CLEARING LIMITS. NO CLEARING ACTIVITIES SHALL TAKE PLACE OUTSIDE OF THE LIMITS OF DISTURBANCE.
2. THE CONTRACTOR IS TO REMOVE ALL ORGANIC MATERIAL PRIOR TO SITE GRADING. ALL TOPSOIL SHALL BE STOCKPILED ONSITE AND USED FOR FINAL STABILIZATION FOLLOWING CONSTRUCTION.
3. IN AREAS WHERE GRUBBING IS NOT PERFORMED THE CONTRACTOR IS TO MOW OR CUT EXISTING VEGETATION.

EROSION CONTROL LEGEND

	CWA	CONCRETE WASHOUT (TEMPORARY)
SF SF	SF	SILT FENCE (TEMPORARY)
	OP	OUTLET PROTECTION (PERMANENT)
	RR	RIP-RAP RUNDOWN (PERMANENT)
	VTC	VEHICLE TRACKING CONTROL (TEMPORARY)
		8" ROADBASE SURFACING (PERMANENT STABILIZATION)
		4" GRAVEL SURFACING (PERMANENT STABILIZATION)

GENERAL LEGEND

5405	EXISTING MAJOR CONTOUR
5403	EXISTING MINOR CONTOUR
5405	PROPOSED MAJOR CONTOUR
5403	PROPOSED MINOR CONTOUR
	EASEMENT LINE
	LEASE BOUNDARY
	SECTION LINE
	1/4 SECTION LINE
	PIPELINE EASEMENT
	RIGHT-OF-WAY (ROW)
	SECURITY FENCE
P P P	EXISTING OVERHEAD POWER
	DRAINAGE FLOW ARROW

ABBREVIATIONS

BMP	BEST MANAGEMENT PRACTICE
CDPHE	COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
CWA	CONCRETE WASHOUT AREA
E	EASTING
N	NORTHING
OP	OUTLET PROTECTION
R.O.W.	RIGHT-OF-WAY
RR	RIP RAP
SF	SILT FENCE
SWMP	STORM WATER MANAGEMENT PLAN

Know what's below. Call before you dig.

COLORADO LICENSED MICHAEL T. CLOUD 49458 01-21-19 PROFESSIONAL ENGINEER FOR PERMIT

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REFERENCE DRAWINGS

DWG NO.	DESCRIPTION

REVISIONS

NO.	DESCRIPTION	DATE	BY
MTC	ISSUED FOR PERMIT - RESPONSE TO COMMENT	01/21/19	LER
DMM	ISSUED FOR PERMIT	11/15/18	DMM

SCALE:	1" = 40'	DATE
DESIGNED:	M. MORGAN	11/15/2018
DRAWN:	M. MORGAN	10/18/2018
CHECKED:	M. CLOUD	11/15/2018
APPROVED:		
APPROVED:		

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC
LOCATION: ADAMS COUNTY, CO

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TITLE	PROJECT NUMBER
WATKINS COMPRESSOR STATION WILLIAMS DJ BASIN FIELD COMPRESSION CIVIL GENERAL EROSION CONTROL PLAN	18256
	DRAWING NUMBER
	WCSS-CE-401 REV. B

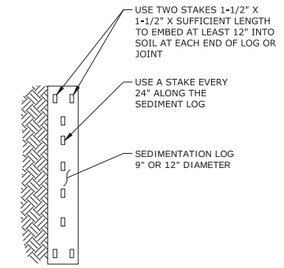
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CONSTRUCTION BEST MANAGEMENT PRACTICES

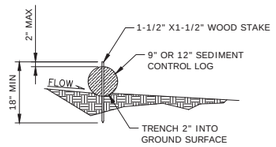
1. EROSION AND SEDIMENT CONTROL DEVICES SHALL BE INSTALLED AND INSPECTED PRIOR TO ANY LAND DISTURBANCE ON SITE.
2. THE PERMITTEE AND/OR CONTRACTOR SHALL REMOVE ALL SEDIMENT, MUD, CONSTRUCTION DEBRIS, OR OTHER POTENTIAL POLLUTANTS THAT MAY HAVE BEEN DISCHARGED TO OR, ACCUMULATE IN, THE FLOW LINES, STORM DRAINAGE APPURTENANCES, AND PUBLIC RIGHTS OF WAYS OF THE LOCAL GOVERNING AUTHORITY AS A RESULT OF CONSTRUCTION ACTIVITIES ASSOCIATED WITH THIS SITE DEVELOPMENT OR CONSTRUCTION PROJECT. SAID REMOVAL SHALL BE CONDUCTED IN A TIMELY MANNER.
3. THE CONTRACTOR SHALL PREVENT SEDIMENT, DEBRIS AND ALL OTHER POLLUTANTS FROM ENTERING THE STORM SEWER SYSTEM DURING ALL DEMOLITION, EXCAVATION, TRENCHING, BORING, GRADING, OR OTHER CONSTRUCTION OPERATIONS THAT ARE PART OF THIS PROJECT. THE CONTRACTOR SHALL BE HELD RESPONSIBLE FOR REMEDIATION OF ANY ADVERSE IMPACTS TO THE MUNICIPAL STORM SEWER SYSTEM, RECEIVING WATERS, WATERWAYS, WETLANDS, AND OR OTHER PUBLIC OR PRIVATE PROPERTIES, RESULTING FROM WORK DONE AS PART OF THIS PROJECT.
4. SOIL STABILIZATION MEASURES SHALL BE IMPLEMENTED WITHIN FOURTEEN (14) DAYS FOLLOWING COMPLETION OF GRADING ACTIVITIES. STABILIZATION OF DISTURBED AREAS ADJACENT TO RECEIVING WATERS OR WITH SLOPES 3 TO 1 OR GREATER SHALL BE COMPLETED WITHIN SEVEN (7) DAYS FOLLOWING COMPLETION OF GRADING ACTIVITIES. NOTE: FEDERAL AND STATE REGULATIONS MAY SOON REQUIRE STABILIZATION WITHIN SEVEN (7) DAYS OF COMPLETION OF GRADING ACTIVITIES. IN SUCH CASES, THE SHORTER SHALL APPLY.
5. THE CONTRACTOR, GRADING CONTRACTOR AND/OR THEIR AUTHORIZED AGENTS SHALL INSURE THAT ALL LOADS OF CUT AND FILL MATERIAL IMPORTED TO OR EXPORTED FROM THIS SITE SHALL BE PROPERLY COVERED TO PREVENT LOSS OF THE MATERIAL DURING TRANSPORT ON PUBLIC RIGHTS OF WAY.
6. THE USE OF REBAR, TO ANCHOR BEST MANAGEMENT PRACTICES IS PROHIBITED. STEEL FENCE POSTS MAY BE USED ON A CASE BY CASE BASIS AND REQUIRES APPROVAL FROM THE LOCAL GOVERNING AUTHORITY SWMP REVIEWER OR THE STORMWATER ENFORCEMENT INVESTIGATOR PRIOR TO INSTALLATION.
7. SOILS THAT WILL BE STOCKPILED FOR MORE THAN THIRTY (30) DAYS SHALL BE PROTECTED FROM WIND AND WATER EROSION WITHIN FOURTEEN (14) DAYS OF STOCKPILE CONSTRUCTION. STABILIZATION OF STOCKPILES LOCATED WITHIN 100 FEET OF RECEIVING WATERS, OR WITH SLOPES 3 TO 1 OR GREATER SHALL BE COMPLETED WITHIN SEVEN (7) DAYS FOLLOWING STOCKPILE CONSTRUCTION. STABILIZATION AND PROTECTION OF THE STOCKPILE MAY BE ACCOMPLISHED BY ANY OF THE FOLLOWING: MULCHING, TEMPORARY/PERMANENT REVEGETATION OPERATIONS, OR EROSION CONTROL MATTING/GEOTEXTILES. IF STOCKPILES ARE LOCATED WITHIN 100 FEET OF RECEIVING WATERS, A DRAINAGE WAY OR THE SITE PERIMETER, ADDITIONAL SEDIMENT CONTROLS SHALL BE REQUIRED.
8. APPROVED EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICES SHALL BE MAINTAINED AND KEPT IN GOOD REPAIR FOR THE DURATION OF THIS PROJECT. AT A MINIMUM, THE PERMITTEE OR CONTRACTOR SHALL PRODUCE AND RETAIN WEEKLY WRITTEN INSPECTION RECORDS FOR ALL BMPS AND AFTER SIGNIFICANT PRECIPITATION EVENTS. ALL NECESSARY MAINTENANCE AND REPAIR SHALL BE COMPLETED IMMEDIATELY. ADDITIONALLY, STREET SWEEPING IS TO BE COMPLETED BY THE CLOSE OF BUSINESS DAY OR (AND) ON AN AS NEEDED BASIS THROUGHOUT THE DAY.
9. WATER USED IN THE CLEANING OF CEMENT TRUCK DELIVERY CHUTES SHALL BE DISCHARGED INTO A PREDEFINED, CONCRETE WASHOUT AREA ON THE JOB SITE. BERMED CONTAINMENT OR COMMERCIALLY AVAILABLE CONCRETE WASHOUT DEVICES THAT FULLY CONTAIN ALL WASH WATER ARE ACCEPTABLE. WASH WATER DISCHARGED INTO THE CONTAINMENT AREA OR DEVICE SHALL BE ALLOWED TO INFILTRATE OR EVAPORATE AND OR BE DISPOSED OF IN ACCORDANCE WITH APPLICABLE REGULATIONS. DRIED CEMENT WASTE IS TO BE REMOVED FROM THE CONTAINMENT AREA AND PROPERLY DISPOSED OF.
10. SHOULD THE USE OF A PREDEFINED BERMED CONTAINMENT AREA OR APPROVED WASHOUT DEVICE BE TECHNICALLY INFEASIBLE DUE TO THE PROJECT SIZE, OR LACK OF AN AREA WITH A SUITABLE GROUND SURFACE FOR ESTABLISHING A CONTAINMENT, PROPER DISPOSAL OF CONCRETE WASHOUT AND WASH WATER AT THE JOB SITE SHALL CONFORM TO THE APPROVED TECHNIQUES AND PRACTICES IDENTIFIED IN THE COLORADO DEPARTMENT OF PUBLIC HEALTH & ENVIRONMENTS' TRAINING VIDEO ENTITLED "BUILDING FOR A CLEANER ENVIRONMENT, READY MIX WASHOUT TRAINING" AND ITS ACCOMPANYING MANUAL ENTITLED, "READY MIX WASHOUT GUIDEBOOK, VEHICLE AND EQUIPMENT WASHOUT AT CONSTRUCTION SITES."
11. THE DIRECT OR INDIRECT DISCHARGE OF WATER CONTAINING WASTE CEMENT TO THE STORM SEWER SYSTEM IS PROHIBITED.
12. THE CONTRACTOR SHALL PROTECT ALL STORM SEWER FACILITIES ADJACENT TO ANY LOCATION WHERE PAVEMENT CUTTING OPERATIONS INVOLVING WHEEL CUTTING, SAW CUTTING, OR ABRASIVE WATER JET CUTTING ARE TO TAKE PLACE.
13. THE CONTRACTOR SHALL REMOVE AND PROPERLY DISPOSE OF ALL WASTE PRODUCTS GENERATED BY SAID CUTTING OPERATIONS ON A DAILY BASIS OR AS NEEDED THROUGHOUT THE DAY.
14. THE DISCHARGE OF ANY WATER CONTAMINATED BY WASTE PRODUCTS FROM CUTTING OPERATIONS TO THE STORM SEWER SYSTEM IS PROHIBITED.
15. PAVED AND IMPERVIOUS SURFACES WHICH ARE ADJACENT TO CONSTRUCTION SITES MUST BE SWEPT ON A DAILY BASIS OR AS NEEDED DURING THE DAY WHEN SEDIMENT AND OTHER MATERIAL ARE TRACKED OR DISCHARGED ONTO THEM. EITHER SWEEPING BY HAND OR USE OF STREET SWEEPERS IS ACCEPTABLE. STREET SWEEPERS USING WATER WHILE SWEEPING IS PREFERRED IN ORDER TO MINIMIZE DUST. FLUSHING OF PAVED SURFACES WITH WATER IS PROHIBITED.

COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT NOTES

1. ALL UNPAVED ROADS AND OTHER DISTURBED SURFACE AREAS ON SITE MUST BE WATERED AS NECESSARY TO PREVENT OFF-PROPERTY TRANSPORT OF VISIBLE FUGITIVE PARTICULATE EMISSIONS.
2. VEHICLE SPEED ON ALL UNPAVED ROADS AND DISTURBED AREAS SHALL NOT EXCEED A MAXIMUM OF 30 MPH. SPEED LIMIT SIGNS SHALL BE POSTED.
3. NO EARTHWORK ACTIVITIES SHALL BE PERFORMED WHEN THE WIND SPEED EXCEEDS 30 MPH.
4. ALL DISTURBED SURFACE AREAS SHALL BE REVEGETATED WITHIN ONE YEAR AND ACCORDING TO THE INFORMATION SUBMITTED BY THE APPLICANT WITH THE PERMIT APPLICATION.
5. GRAVEL ENTRYWAYS SHALL BE UTILIZED TO PREVENT MUD AND DIRT CARRYOUT ONTO PAVED SURFACES. ANY MUD AND DIRT CARRYOUT ONTO PAVED SURFACES SHALL BE CLEANED UP DAILY.



TYPICAL STAKE INSTALLATION



STANDARD INSTALLATION

SCL

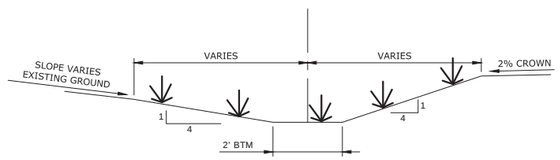
SEDIMENT CONTROL LOG INSTALLATION NOTES

1. SEE SEDIMENTATION (EROSION) CONTROL PLAN FOR LOCATION AND LENGTH OF SEDIMENT CONTROL LOG.
2. SEDIMENT CONTROL LOGS INDICATED ON INITIAL EROSION CONTROL PLAN SHALL BE INSTALLED PRIOR TO ANY LAND-DISTURBING ACTIVITIES.
3. SEDIMENT CONTROL LOGS SHALL CONSIST OF STRAW, COMPOST, EXCELSIOR OR COCONUT FIBER.
4. NOT FOR USE IN CONCENTRATED FLOW AREAS.
5. THE SEDIMENT CONTROL LOG SHALL BE TRENCHED INTO THE GROUND A MINIMUM OF 2".
6. PROVIDE A 12" OVERLAP AT EACH JOINT (END OF LOG).

SEDIMENT CONTROL LOG MAINTENANCE NOTES

1. THE SWMP MANAGER SHALL INSPECT SEDIMENT CONTROL LOGS DAILY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OR CLEAN OUT UPSTREAM SEDIMENT AS NECESSARY.
2. SEDIMENT ACCUMULATED UPSTREAM OF SEDIMENT CONTROL LOGS SHALL BE REMOVED WHEN THE UPSTREAM SEDIMENT DEPTH IS WITHIN ½ THE HEIGHT OF THE CREST OF THE LOG.
3. SEDIMENT CONTROL LOGS MAY OR MAY NOT NEED TO BE REMOVED, DEPENDING ON THE LOCATION AND APPLICATION USE. IF REMOVED, ANY DISTURBED AREAS SHALL BE COVERED WITH TOP SOIL, DRILL SEEDED AND CRIMP MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE GOVERNING AUTHORITY.

SEDIMENT CONTROL LOG
NOT TO SCALE



TYPICAL DRAINAGE SWALE
NOT TO SCALE

* EROSION CONTROL DETAILS ARE FROM URBAN DRAINAGE AND FLOOD CONTROL DISTRICT, DRAINAGE CRITERIA MANUAL, VOLUME 3 - CONSTRUCTION BEST MANAGEMENT PRACTICES. INSTALLATION AND MAINTENANCE OF SITE BMP'S ARE TO ADHERE TO ADAMS COUNTY OR STATE OF COLORADO LATEST STANDARDS AND REQUIREMENTS.

GENERAL NOTES

1. REFERENCE DRAWINGS WCSS-CE-103 FOR CIVIL SITE PLAN AND NOTES, WCSS-CE-601 FOR DRAINAGE AND GRADING GENERAL NOTES AND WCSS-CE-401 FOR EROSION CONTROL PLANS.

Table 506-2

Pay Item	Stone Size d50[1] (Inches)	Percent of Material Smaller Than Typical Stone[2]	Typical Stone Dimensions[3] (Inches)	Typical Stone Weight[4] (Pounds)
VL Riprap	6	70-100 50-70 35-50 2-10	12 9 6 2	85 35 10 0.4
L Riprap	9	70-100 50-70 35-50 2-10	15 12 9 3	160 85 35 1.3
M Riprap	12	70-100 50-70 35-50 2-10	21 18 12 4	440 275 85 3
H Riprap	18	100 50-70 35-50 2-10	30 24 18 6	1280 650 275 10
VH Riprap	24	100 50-70 35-50 2-10	42 33 24 9	3500 1700 650 35

[1]d50 = nominal stone size
[2]based on typical rock mass
[3]equivalent spherical diameter
[4]based on a specific gravity = 2.5

RIP-RAP GRADATIONS

Know what's below. Call before you dig.

COLORADO REGISTERED DAVID MATTHEW MORGAN 39814 PROFESSIONAL ENGINEER
11/15/2018

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REFERENCE DRAWINGS

DWG NO.	DESCRIPTION

REVISIONS

NO.	DESCRIPTION	DATE	BY

REVISIONS

NO.	DESCRIPTION	DATE	BY
A	ISSUED FOR PERMIT	11/15/18	DMM

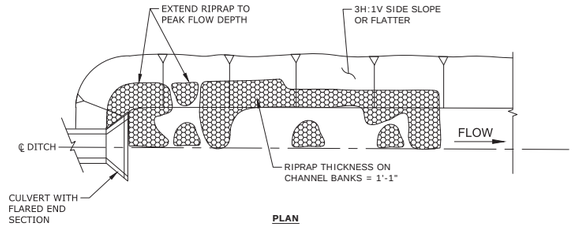
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DRAWN:	M. MORGAN	10/18/2018
CHECKED:	M. CLOUD	11/15/2018
APPROVED:		
APPROVED:		

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC
LOCATION: ADAMS COUNTY, CO

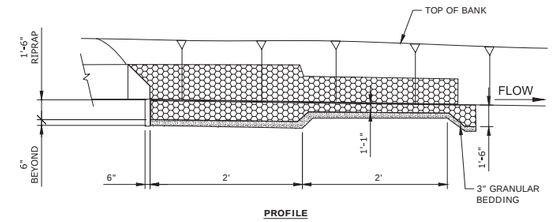
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8450 E. Crescent Parkway, Suite 200
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TITLE	PROJECT NUMBER
WATKINS COMPRESSOR STATION WILLIAMS DJ BASIN FIELD COMPRESSION CIVIL GENERAL EROSION CONTROL NOTES & DETAILS	18256
	DRAWING NUMBER
	WCSS-CE-402 REV. A

Plot Date: Thursday, November 15, 2018 2:27:12 PM Plotted By: Matt Morgan
CTB Used: SE_Std_B&W_Full_size.ctb



PLAN

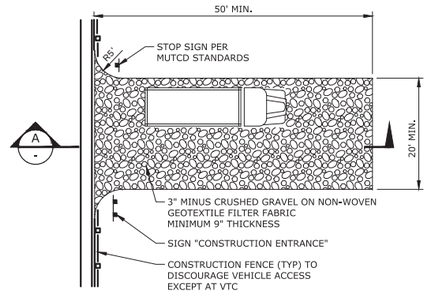


PROFILE

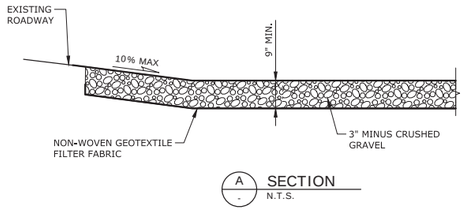
NOTES

1. FLARED END SECTION REQUIRED AT ALL CULVERT OUTLETS.
2. PROVIDE JOINT FASTENERS FOR FLARED END SECTIONS FOR SLOPES GREATER THAN 5%.
3. INSTALL MIRAFI 140N FILTER FABRIC (OR EQUAL) BELOW ALL RIPRAP.
4. DISTURBED SURFACES SHALL BE LEFT IN A ROUGHENED CONDITION AT ALL TIMES DURING CONSTRUCTION.
5. EROSION CONTROL MEASURES AT TEMPORARY FACILITIES SHALL BE REMOVED WHEN THEY HAVE SERVED THEIR USEFUL PURPOSE. EROSION CONTROL MEASURES AT PERMANENT FACILITIES SHALL REMAIN IN PLACE.
6. RIP RAP SIZE SHALL BE TYPE L MINIMUM OR AS INDICATED ON PLANS.

OP **CULVERT AND OUTLET EROSION PROTECTION**
NOT TO SCALE



PLAN



A - SECTION
N.T.S.

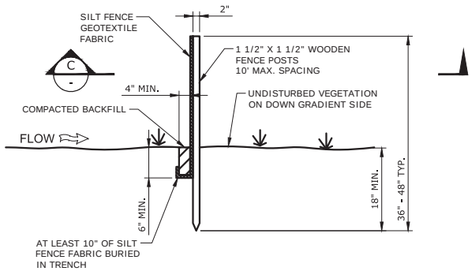
VEHICLE TRACKING CONTROL INSTALLATION NOTES

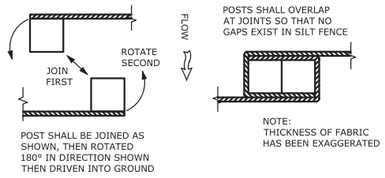
1. VEHICLE TRACKING CONTROL PADS SHALL BE INSTALLED AT EVERY ACCESS POINT TO SITE.
2. VEHICLE TRACKING CONTROL PADS SHALL CONSIST OF HARD, DENSE, DURABLE STONE, ANGULAR IN SHAPE AND RESISTANT TO WEATHERING. ROUNDED STONE OR BOULDERS WILL NOT BE ACCEPTABLE. THE STONES SHALL BE 3" MINUS.
3. A STOP SIGN INSTALLED IN ACCORDANCE WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD), AS AMENDED, SHALL BE INSTALLED FOR EXITING TRAFFIC AT THE VTC.

VEHICLE TRACKING CONTROL MAINTENANCE NOTES

1. THE EROSION CONTROL SUPERVISOR SHALL INSPECT VEHICLE TRACKING CONTROL DAILY. GRAVEL SURFACE SHALL BE CLEAN AND LOOSE ENOUGH TO RUT SLIGHTLY UNDER WHEEL LOADS AND CAUSE LOOSE GRAVEL TO DISLODGE MUD FROM TIRES. WHEN GRAVEL BECOMES COMPACTED OR FILLED WITH SEDIMENT SO THAT THE EFFECTIVENESS OF THE PAD IS DIMINISHED, GRADING CONTRACTOR SHALL RIP, TURN OVER, OR OTHERWISE LOOSEN GRAVEL, PLACE ADDITIONAL NEW GRAVEL, OR REPLACE WITH NEW GRAVEL AS NECESSARY TO RESTORE EFFECTIVENESS.
2. VEHICLE TRACKING CONTROL SHALL BE REMOVED AT THE END OF CONSTRUCTION, THE GRAVEL MATERIAL REMOVED OR, IF APPROVED, USED ON SITE, AND TOPSOIL ADDED TO THE AREA, DRILL SEEDED AND CRIMP MULCHED OR OTHERWISE STABILIZED.

VTC **VEHICLE TRACKING CONTROL**
NOT TO SCALE





C - SECTION
N.T.S.

SILT FENCE INSTALLATION NOTES

1. SEE PLAN VIEW FOR LOCATION AND LENGTH OF FENCE.
2. ANCHOR TRENCH SHALL BE EXCAVATED WITH TRENCHER, OR WITH SILT FENCE INSTALLATION MACHINE; NO ROAD GRADERS, BACKHOES, ETC. SHALL BE USED. TRENCH SHALL BE COMPACTED BY HAND, WITH "JUMPING JACK", OR BY WHEEL ROLLING. COMPACTION SHALL BE SUCH THAT SILT FENCE RESISTS BEING PULLED OUT OF ANCHOR TRENCH BY HAND.
3. SILT FENCE GEOTEXTILE SHALL MEET THE FOLLOWING REQUIREMENTS:
   - 6-TO 12-GALLONS PER MINUTE PER SQUARE FOOT FLOW CAPACITY.
   - 90 LB. TENSILE STRENGTH PER ASTM D4622.
   - UV DESIGN AT 500 HRS MIN. 70% STRENGTH RETAINED PER ASTM D 4355.
4. SILT FENCE INDICATED ON THE EROSION CONTROL PLAN SHALL BE INSTALLED PRIOR TO ANY LAND-DISTURBING ACTIVITIES.

SILT FENCE MAINTENANCE NOTES

1. INSPECT SILT FENCE DAILY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OR CLEAN OUT UPSTREAM SEDIMENT AS NECESSARY.
2. SEDIMENT ACCUMULATED UPSTREAM OF SILT FENCE SHALL BE REMOVED WHEN THE UPSTREAM SEDIMENT REACHES A DEPTH OF ½H.
3. SILT FENCE SHALL BE REMOVED WHEN THE UPSTREAM DISTURBED AREA IS STABILIZED AND GRASS COVER HAS BEEN ESTABLISHED. IF ANY DISTURBED AREA EXISTS AFTER REMOVAL, IT SHALL BE SEEDED AND MULCHED OR OTHERWISE STABILIZED.

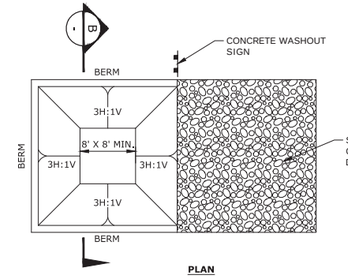
—SF— SF **SILT FENCE**
NOT TO SCALE

CONCRETE WASHOUT AREA INSTALLATION NOTES

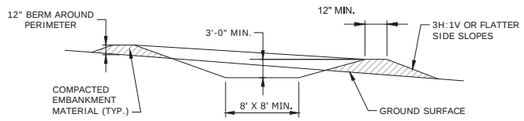
1. SEE PLAN VIEW FOR LOCATIONS OF CONCRETE WASHOUT AREA.
2. THE CONCRETE WASHOUT AREA SHALL BE INSTALLED PRIOR TO ANY CONCRETE PLACEMENT ON SITE.
3. VEHICLE TRACKING CONTROL IS REQUIRED AT THE ACCESS POINT SLOPED AT 2% TOWARDS THE CWA.
4. SIGNS SHALL BE PLACED AT THE CONSTRUCTION ENTRANCE, AT THE WASHOUT AREA,AND ELSEWHERE AS NECESSARY TO CLEARLY INDICATE THE LOCATION OF THE CONCRETE WASHOUT AREA TO OPERATORS OF THE CONCRETE TRUCKS AND PUMP RIGS.
5. EXCAVATED MATERIAL SHALL BE UTILIZED IN PERIMETER BERM CONSTRUCTION.

CONCRETE WASHOUT AREA MAINTENANCE NOTES

1. THE CONCRETE WASHOUT AREA SHALL BE REPAIRED AND ENLARGED OR CLEANED OUT AS NECESSARY TO MAINTAIN CAPACITY FOR WASTED CONCRETE. CONCRETE MATERIALS SHALL BE REMOVED ONCE THE MATERIALS HAVE REACHED A DEPTH OF 2'.
2. AT THE END OF THE CONSTRUCTION PROJECT, ALL CONCRETE SHALL BE REMOVED FROM THE SITE AND DISPOSED OF AT AN APPROVED WASTE SITE.
3. WHEN THE CONCRETE WASHOUT AREA IS REMOVED, COVER THE DISTURBED AREA WITH TOP SOIL, DRILL SEED AND CRIMP MULCH OR OTHERWISE STABILIZE IN A MANNER APPROVED BY GOVERNING AUTHORITY.
4. INSPECT WEEKLY AND DURING AND AFTER ANY STORM EVENT.



PLAN



B - SECTION
N.T.S.

CWA **CONCRETE WASHOUT**
NOT TO SCALE

811 Know what's below. Call before you dig.

COLORADO REGISTERED CHRISTOPHER MORGAN 39814 PROFESSIONAL ENGINEER
11/15/2018

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REFERENCE DRAWINGS

DWG NO.	DESCRIPTION

REVISIONS

NO.	DESCRIPTION	DATE	BY
A	ISSUED FOR PERMIT	11/15/18	DMM

SCALE:	AS NOTED
DESIGNED:	M. MORGAN
DRAWN:	M. MORGAN
CHECKED:	M. CLOUD
APPROVED:	
APPROVED:	

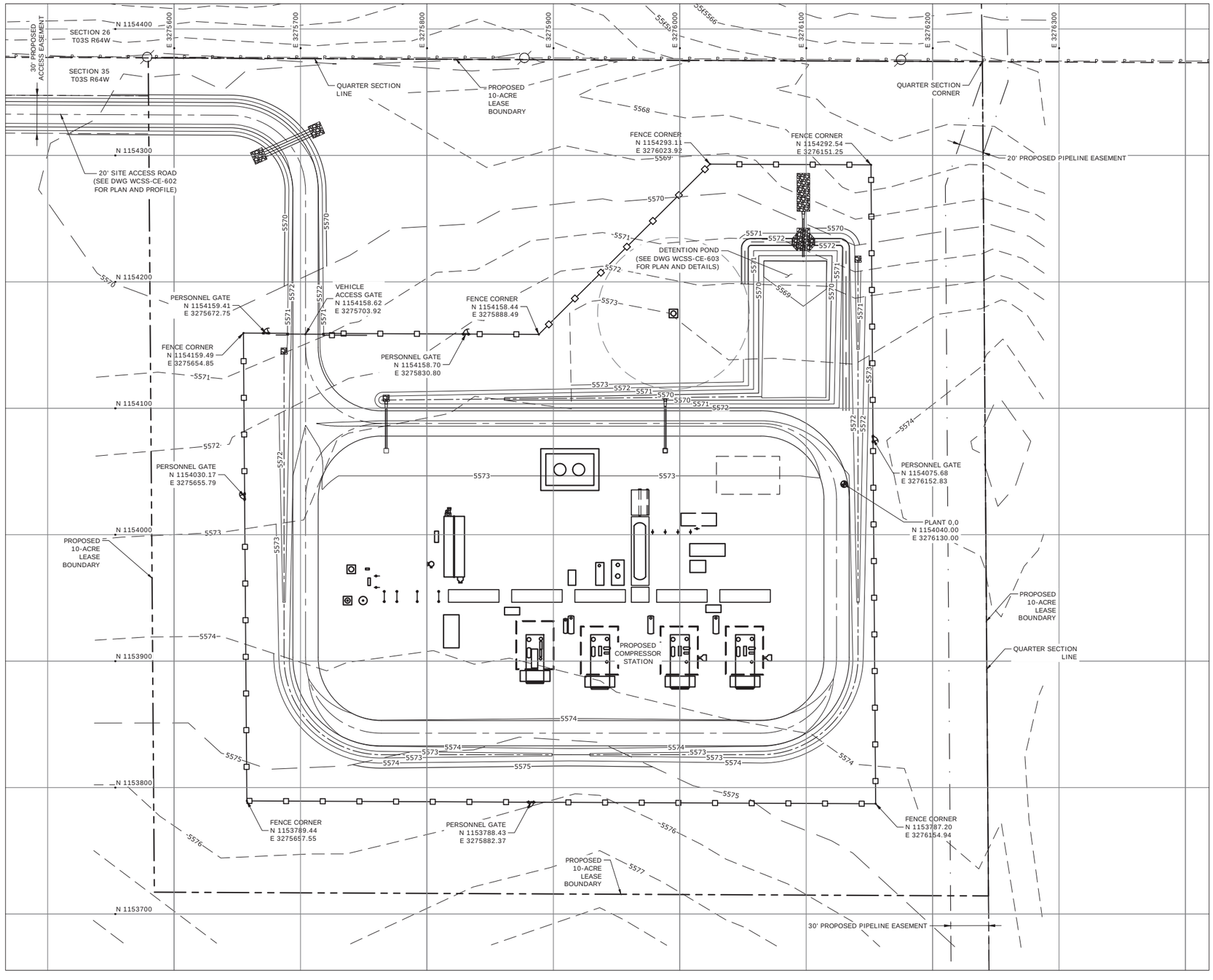
DATE	11/15/2018
DATE	10/18/2018
DATE	11/15/2018

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC
LOCATION: ADAMS COUNTY, CO

Samuel Engineering
We Provide Solutions
8450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
Phone: 303.714.4840
Fax: 303.714.4800

TITLE	PROJECT NUMBER
WATKINS COMPRESSOR STATION WILLIAMS DJ BASIN FIELD COMPRESSION CIVIL GENERAL EROSION CONTROL NOTES & DETAILS	18256
	DRAWING NUMBER
	WCSS-CE-403 REV. A

Plot Date: Thursday, November 15, 2018 2:28:32 PM Plotted By: Matt Morgan
CTB Used: SE_Std_B&W_Full_size.ctb



NOTES

1. SEE LANDSCAPE PLANS (BY OTHERS) FOR DETAILS AND ADDITIONAL INFORMATION.
2. SITE GRADING SHOULD BE COMPLETE BEFORE THE FENCE IS INSTALLED. THE FENCE CONTRACTOR SHALL COORDINATE WITH THE OWNER (OR OWNER'S REPRESENTATIVE) TO CONFIRM FINAL GRADES ALONG THE FENCE ALIGNMENT.
3. THE FENCE INSTALLATION CONTRACTOR MAY ADJUST POST AND/OR GATE LOCATIONS TO BETTER FIT THE POST LAYOUT OR TERRAIN WITH PERMISSION FROM OWNER'S OPERATIONS PERSONNEL.
4. COORDINATES FOR GATES ARE SHOWN AT THE CENTER OF THE GATE.
5. ALL PERSONNEL GATES SHALL SWING OUT (AWAY FROM PLANT).
6. ANY SUBSTITUTIONS SHALL BE APPROVED BY THE ENGINEER AND OWNER PRIOR TO INSTALLATION.
7. THE CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING AND PROTECTING ALL UNDERGROUND UTILITIES WHETHER LOCATED ON SURVEY OR ENCOUNTERED IN THE FIELD DURING CONSTRUCTION. CAUTION SHOULD BE TAKEN DURING ALL EXCAVATION DURING EXCAVATION OF ALL SOIL AND FOUNDATIONS WITHIN THE LIMITS OF DISTURBANCE. CONTACT ENGINEER IF CONFLICTS ARE ENCOUNTERED.
8. IF ANY EXISTING FENCE IS REMOVED, THE EXISTING FENCE POSTS SHALL BE CUT OFF FLUSH WITH EXISTING GRADE AND THE NEW POSTS SHALL BE INSTALLED ADJACENT TO THE OLD POSTS ALONG PROPERTY LINES. CORNER POST COORDINATES SHALL BE ADJUSTED AS REQUIRED TO THE INSIDE OF THE EXISTING POST SO AS NOT TO OVERHANG PROPERTY LINES.
9. ANY EXISTING FENCING AND POSTS REMOVED DURING CONSTRUCTION SHALL BE DISPOSED OF OFFSITE AT AN OWNER APPROVED DISPOSAL SITE BY THE FENCE INSTALLATION CONTRACTOR.
10. FENCE INSTALLATION CONTRACTOR SHALL ENSURE THAT ALL NEW FENCING IS INSTALLED WITHIN THE LEASE BOUNDARY.
11. KNOX FIRE DEPARTMENT GATE ACCESS TO THE FACILITY SHALL BE PROVIDED AND MAINTAINED AT ALL TIMES.

LEGEND

- 7' ORNAMENTAL IRON SECURITY FENCE *
- ORNAMENTAL IRON SECURITY GATE (20' MIN.) WITH KNOX ACCESS *
- PERSONNEL GATE WITH PANIC HARDWARE *

*BY FENCING CONTRACTOR

NORTH

0' 20' 40' 80' 120'
SCALE: 1" = 40'

Know what's below. Call before you dig.

COLORADO LICENSED MICHAEL T. CLOUD 49458 01-21-19 PROFESSIONAL ENGINEER
FOR PERMIT

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REFERENCE DRAWINGS

DWG NO.	DESCRIPTION

REVISIONS

NO.	DESCRIPTION	DATE	BY

REVISIONS

NO.	DESCRIPTION	DATE	BY
A	ISSUED FOR PERMIT - RESPONSE TO COMMENT	01/21/19	LER

SCALE:	1" = 40'	DATE
DESIGNED:	M. CLOUD	01/21/2019
DRAWN:	L. ROOT	01/21/2019
CHECKED:	M. CLOUD	01/21/2019
APPROVED:		
APPROVED:		

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC
LOCATION: ADAMS COUNTY, CO

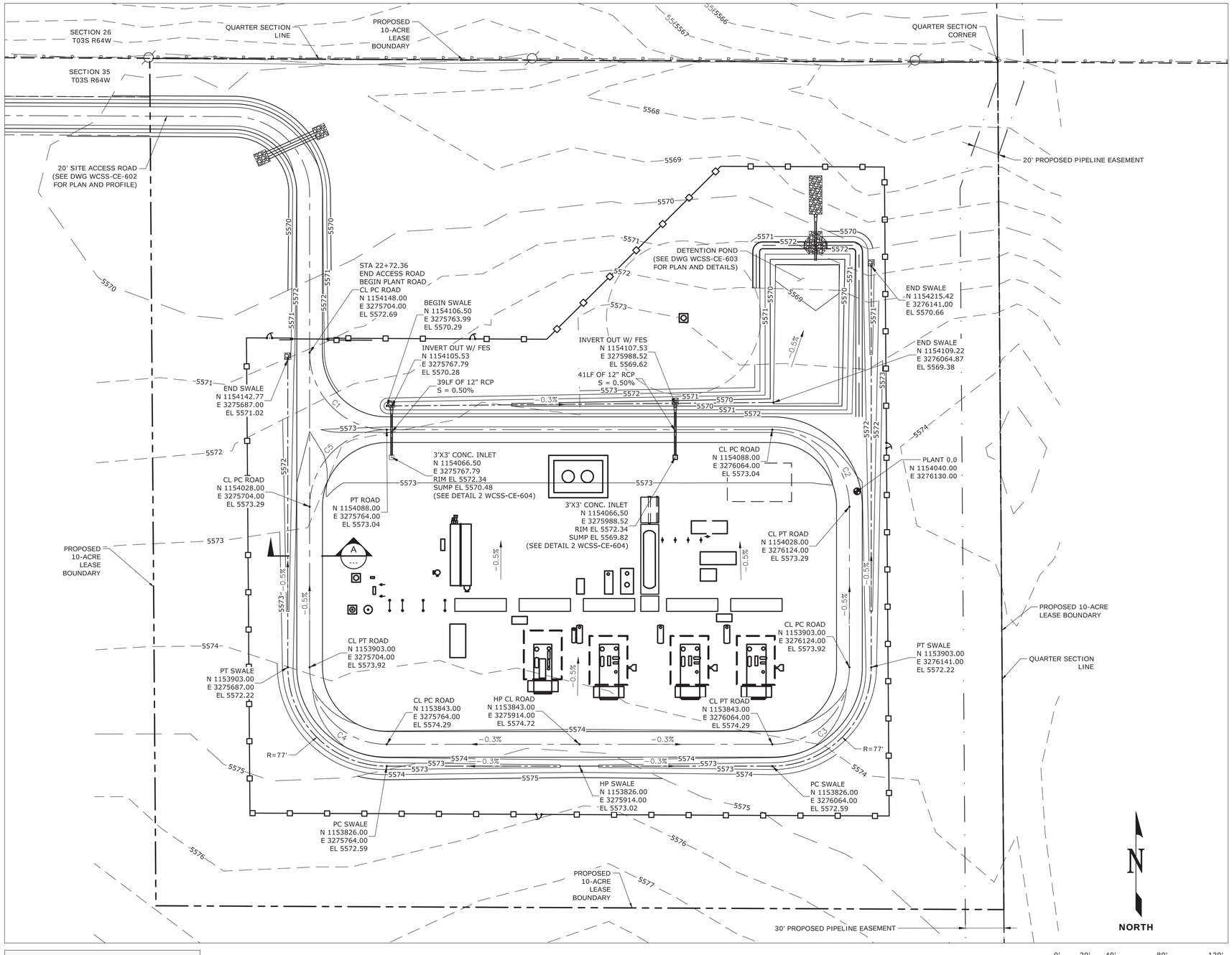
Samuel Engineering
We Provide Solutions
8450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
Phone: 303.714.4840
Fax: 303.714.4800

TITLE
WATKINS COMPRESSOR STATION
WILLIAMS DJ BASIN FIELD COMPRESSION
CIVIL
GENERAL
FENCING PLAN

PROJECT NUMBER
18256

DRAWING NUMBER
WCSS-CE-501 REV. A

CAD File: S:\Projects\18256_Watkins_Compressor\CAD\Civil\Watkins South\Drawings\WCSS-CE-501.dwg
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CTB Used: SE_Std_B&W_Full_Size.ctb



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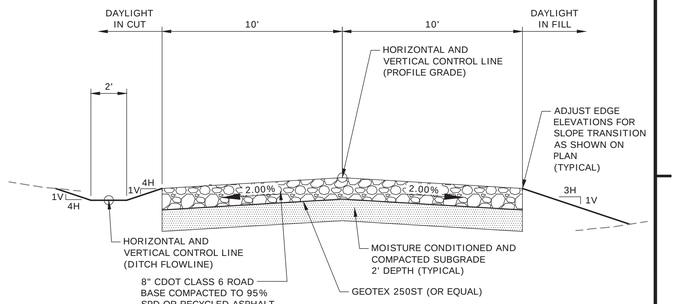
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C4	60.00	90.00°	94.25
C5	60.00	90.00°	94.25

NOTES

1. THE WATKINS COMPRESSOR STATION PROPOSED SITE IS A 10-ACRE LEASE LOCATED IN THE NORTHWEST QUARTER OF SECTION 35, TOWNSHIP 3 SOUTH, RANGE 64 WEST, 6TH PRINCIPAL MERIDIAN, ADAMS COUNTY, STATE OF COLORADO.
2. THE SITE SURVEY FOR THIS PROJECT WAS PREPARED BY ACKLAM, INC. AND WAS RECEIVED ON 10/12/2018.

   HORIZONTAL DATUM: BASED ON COLORADO STATE PLANE COORDINATES, NORTH ZONE, NORTH AMERICAN HORIZONTAL DATUM, 1983 (US SURVEY FEET).

   VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM 1988.
3. THE SITE CONSISTS OF EXISTING CROP LAND. PRIOR TO BEGINNING EARTHWORK OPERATIONS, CLEAR SITE OF ALL ORGANIC AND/OR UNSUITABLE MATERIALS. SCARIFY, MOISTURE TREAT AND COMPACT THE SUBGRADE PRIOR TO PLACING FILL OR SURFACE MATERIALS.
4. ALL CUT AND FILL SLOPES ARE 3H:1V UNLESS NOTED OTHERWISE ON THE DRAWINGS.
5. GRADING ELEVATIONS SHOWN ARE TO TOP OF FINISHED SURFACING. FOR ROUGH GRADE ELEVATIONS SUBTRACT 8" FROM ROAD AREAS AND 4" FROM ALL OTHER ELEVATIONS SHOWN.
6. ALL SOILS SHALL BE COMPACTED TO A MINIMUM OF 95% OF THE STANDARD PROCTOR DENSITY (SPD) AT ± 2% OF THE OPTIMUM MOISTURE CONTENT ASTM D-698. REFER TO THE PROJECT GEOTECHNICAL INVESTIGATION FOR ADDITIONAL INFORMATION AND SITE SPECIFIC REQUIREMENTS.
7. THE CONTRACTOR WILL BE RESPONSIBLE FOR LOCATING AND PROTECTING ALL UNDERGROUND UTILITIES. THE CONTRACTOR IS TO ENSURE THAT 811 AND DISCOVERY SITE PERSONNEL ARE CONTACTED PRIOR TO COMMENCING CONSTRUCTION ACTIVITIES. CAUTION SHOULD BE TAKEN DURING ALL EXCAVATION OF SOIL AND FOUNDATIONS WITHIN THE LIMITS OF DISTURBANCE. CONTACT ENGINEER IF THERE ARE CONFLICTS.
8. THE MAJORITY OF THE SITE GRAVEL WILL BE INSTALLED AFTER EQUIPMENT IS SET AND FINAL GRADING IS COMPLETE. THE CONTRACTOR IS TO COORDINATE WITH DISCOVERY FOR ALL GRAVEL INSTALLATION TIMING.
9. THE CONTRACTOR IS TO SUBMIT A GRADATION SAMPLE TO DISCOVERY PRIOR TO PLACING GRAVEL MATERIAL. DISCOVERY PERSONNEL WILL DETERMINE SIZE OF GRAVEL TO BE USED. PLACE CRUSHED GRANITE FOR THE SITE BENCH AREAS AS DIRECTED BY THE OWNER'S REPRESENTATIVE.
10. INTERIOR ACCESS ROADS SHALL HAVE A MINIMUM OF 8" CDOT CLASS 6 ROAD BASE PLACED OVER GEOTEX 250ST WOVEN POLYPROPYLENE GEOTEXTILE FABRIC AS MANUFACTURED BY PROPEX, INC. OR EQUIVALENT. RECYCLED ASPHALT OF SIMILAR GRADATION OF THE SPECIFIED ROAD BASE CAN BE SUBSTITUTED FOR ROAD BASE WITH COUNTY APPROVAL.
11. ALL AREAS WITHIN THE SECURITY FENCE SHALL BE MAINTAINED VEGETATION FREE 4" GRAVEL FOR THE LIFE OF THE FACILITY.
12. ALL EQUIPMENT PAD AREAS SHALL HAVE A MINIMUM OF 4" CRUSHED GRAVEL PLACED ON COMPACTED SUBGRADE FOR FINAL SURFACING.
13. PERIMETER SILT FENCE IS TO BE INSTALLED PRIOR TO ANY CONSTRUCTION ACTIVITIES. ALL OTHER EROSION CONTROL MEASURES CAN BE INSTALLED AFTER ROUGH GRADING IS COMPLETE.
14. SEE DRAWING WCSS-CE-103 FOR SITE PLAN AND NOTES, WCSS-CE-401 FOR EROSION CONTROL, SURFACING, CLEARING & GRUBBING PLAN AND NOTES, WCSS-CE-602 FOR SITE ACCESS ROAD PLAN AND PROFILE AND WCSS-CE-603 FOR DETENTION BASIN DETAILS.



A ... TYPICAL SECTION - 20' CROWN PLANT ROAD
NTS

LEGEND

- EXISTING MAJOR CONTOUR (5405)
- EXISTING MINOR CONTOUR (5403)
- PROPOSED MAJOR CONTOUR (5405)
- PROPOSED MINOR CONTOUR (5403)
- EASEMENT LINE
- LEASE BOUNDARY
- SECTION LINE
- 1/4 SECTION LINE
- PIPELINE EASEMENT
- RIGHT-OF-WAY (ROW)
- EXISTING OVERHEAD POWER (P P P)

ABBREVIATIONS

PC	POINT OF CURVATURE
PCC	POINT OF COMPOUND CURVATURE
PRC	POINT OF REVERSE CURVATURE
PI	POINT OF INTERSECTION
PT	POINT OF TANGENCY
ROW	RIGHT-OF-WAY
BTM	BOTTOM
CL	CENTERLINE
FL	FLOWLINE
E	EASTING
EL	ELEVATION
HP	HIGH POINT
LP	LOW POINT
MP	MID POINT
N	NORTHING
GB	GRADE BREAK
EOP	EDGE OF PAVEMENT/GRAVEL

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REFERENCE DRAWINGS

DWG NO.	DESCRIPTION

REVISIONS

NO.	DESCRIPTION	DATE	BY

REVISIONS

CLIENT	PROJECT ENGINEER	LEAD ENGINEER	CHECK	NO.	DESCRIPTION	DATE	BY
		MTC	MTC	B	ISSUED FOR PERMIT - RESPONSE TO COMMENT	01/21/19	LER
		DMM	MTC	A	ISSUED FOR PERMIT	11/15/18	DMM

SCALE:	1" = 40'	DATE
DESIGNED:	M. MORGAN	11/15/2018
DRAWN:	M. MORGAN	10/18/2018
CHECKED:	M. CLOUD	11/15/2018
APPROVED:		
APPROVED:		

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC
LOCATION: ADAMS COUNTY, CO

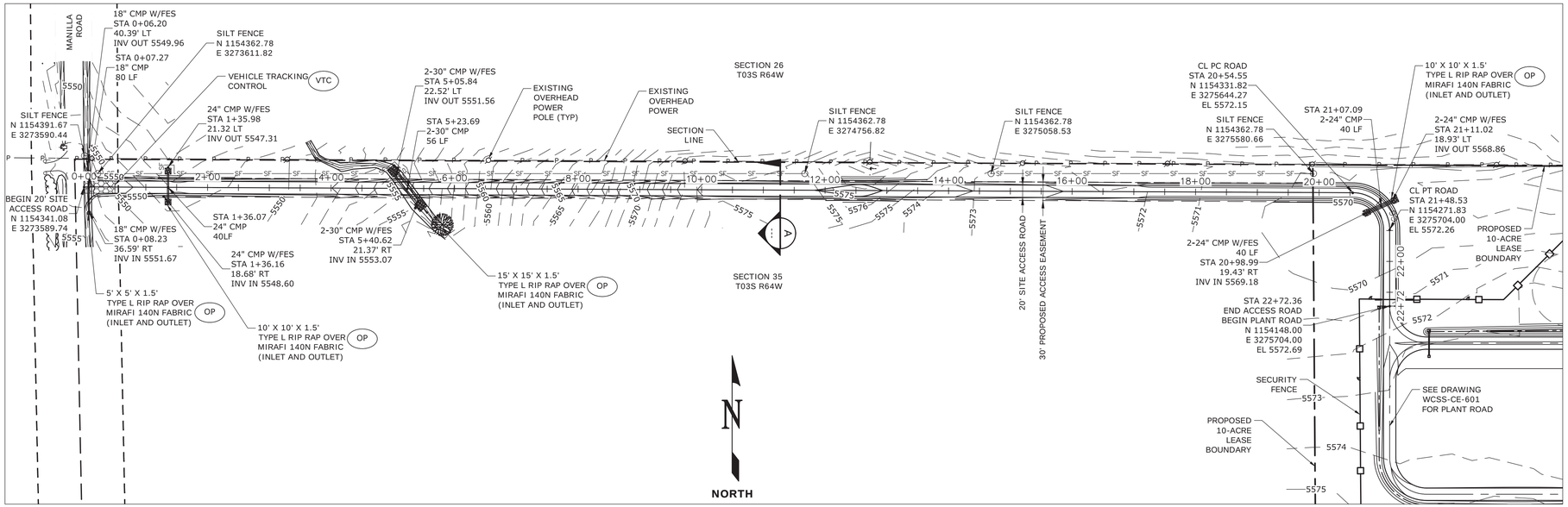
Samuel Engineering
We Provide Solutions
9450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
Phone: 303.714.4840
Fax: 303.714.4800

TITLE
WATKINS COMPRESSOR STATION
WILLIAMS DJ BASIN FIELD COMPRESSION
CIVIL
GENERAL
GRADING AND DRAINAGE PLAN

PROJECT NUMBER
18256

DRAWING NUMBER
WCSS-CE-601 REV. B

CAD File: S:\Projects\18256_Watkins_Compressor\CAD\Civil\Watkins South\Drawings\WCSS-CE-601.dwg
Plot Date: Monday, January 21, 2019 1:24:41 PM Plotted By: Lauren Root
CTB Used: SE_5to1_B&W_Full_Size.ctb



SITE ACCESS ROAD PLAN
STA. 0+00 TO 22+72

0' 50' 100' 200' 300'

SCALE: 1" = 100'

CURVE TABLE

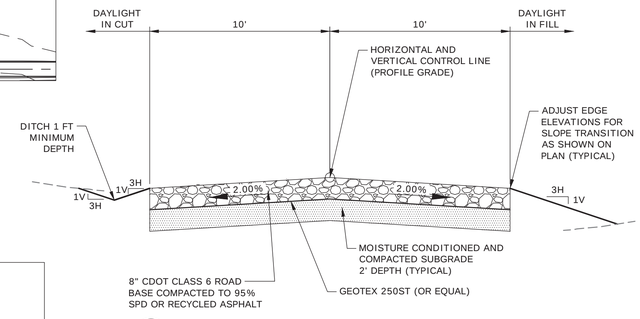
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NOTES

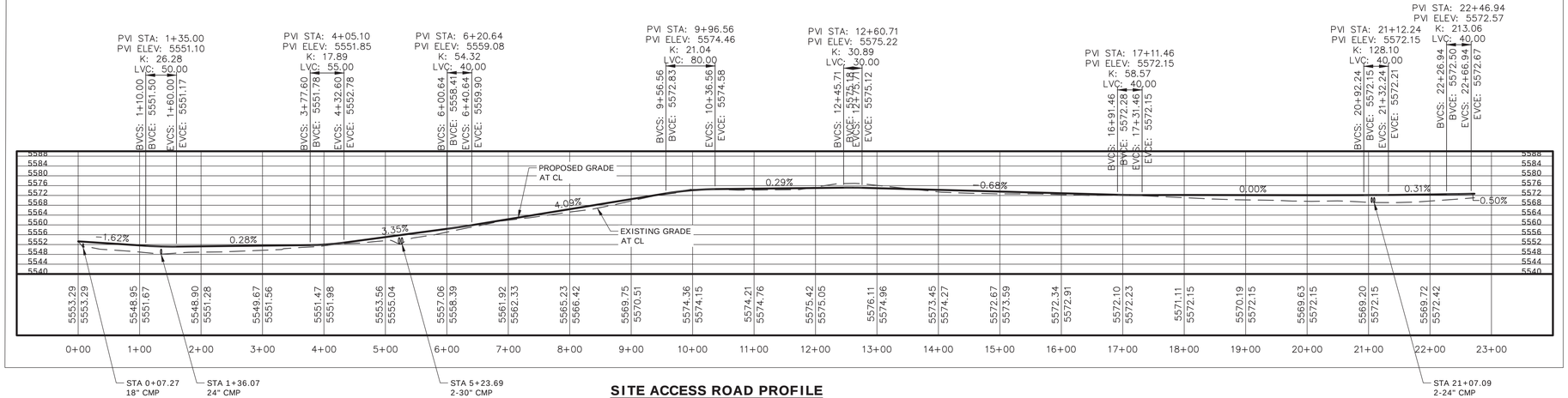
1. THE WATKINS COMPRESSOR STATION PROPOSED SITE IS A 10-ACRE LEASE LOCATED IN THE NORTHWEST QUARTER OF SECTION 35, TOWNSHIP 3 SOUTH, RANGE 64 WEST, 6TH PRINCIPAL MERIDIAN, ADAMS COUNTY, STATE OF COLORADO.
2. THE SITE SURVEY FOR THIS PROJECT WAS PREPARED BY ACKLAM, INC. AND WAS RECEIVED ON 10/12/2018.

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   VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM 1988.
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9. PERIMETER SILT FENCE IS TO BE INSTALLED PRIOR TO ANY CONSTRUCTION ACTIVITIES. ALL OTHER EROSION CONTROL MEASURES CAN BE INSTALLED AFTER ROUGH GRADING IS COMPLETE.
10. SEE DRAWINGS WCSS-CE-102, 103, AND 104 FOR SITE PLAN AND NOTES, WCSS-CE-401 FOR EROSION CONTROL, SURFACING, CLEARING & GRUBBING PLAN AND NOTES, AND WCSS-CE-603 FOR DETENTION BASIN DETAILS.
11. SEE DRAWING WCSS-CE-601 FOR SITE SPECIFIC CONSTRUCTION NOTES AND DETAILS.



A — TYPICAL SECTION - 20' CROWN SITE ACCESS ROAD
NTS



SITE ACCESS ROAD PROFILE
STA. 0+00 TO 22+72

SCALE:
HORIZONTAL 1"=100'
VERTICAL 1"=25'

LEGEND

- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- EASEMENT LINE
- LEASE BOUNDARY
- SECTION LINE
- 1/4 SECTION LINE
- PIPELINE EASEMENT
- RIGHT-OF-WAY (ROW)
- EXISTING OVERHEAD POWER

ABBREVIATIONS

PC	POINT OF CURVATURE
PCC	POINT OF COMPOUND CURVATURE
PRC	POINT OF REVERSE CURVATURE
PI	POINT OF INTERSECTION
PT	POINT OF TANGENCY
ROW	RIGHT-OF-WAY
BTM	BOTTOM
CL	CENTERLINE
FL	FLOWLINE
E	EASTING
EL	ELEVATION
HP	HIGH POINT
LP	LOW POINT
MP	MID POINT
N	NORTHING
GB	GRADE BREAK
EOP	EDGE OF PAVEMENT/GRAVEL

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REFERENCE DRAWINGS

DWG NO.	DESCRIPTION

REVISIONS

NO.	DESCRIPTION	DATE	BY
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A	ISSUED FOR PERMIT	11/15/18	DMM

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PROJECT ENGINEER: MTC
LEAD ENGINEER:
CHECK:

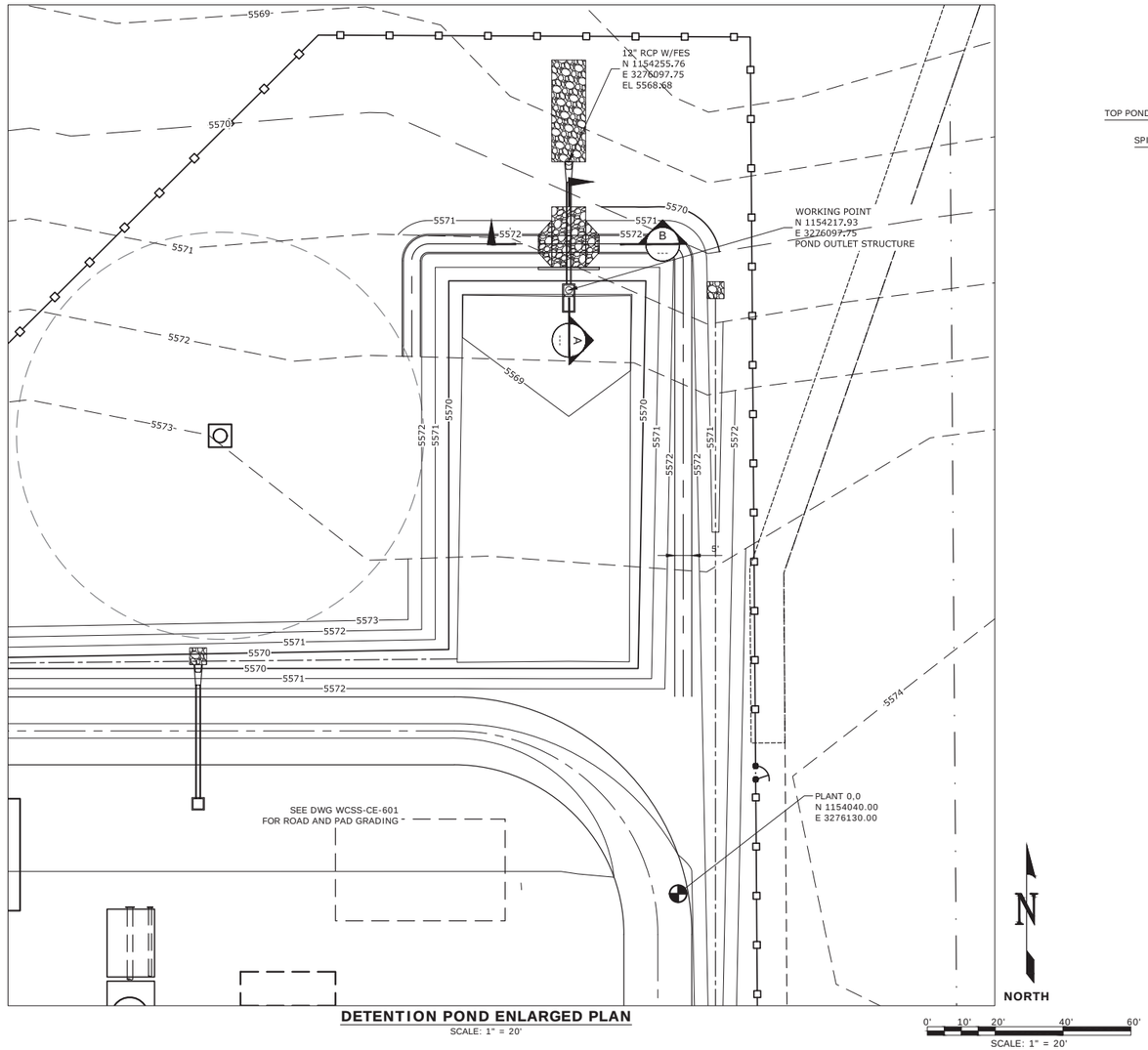
SCALE: 1" = 100'
DESIGNED: M. MORGAN 11/15/2018
DRAWN: M. MORGAN 10/18/2018
CHECKED: M. CLOUD 11/15/2018
APPROVED:
APPROVED:
DATE

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC
LOCATION: ADAMS COUNTY, CO

Samuel Engineering
We Provide Solutions
8450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
Phone: 303.714.4840
Fax: 303.714.4800

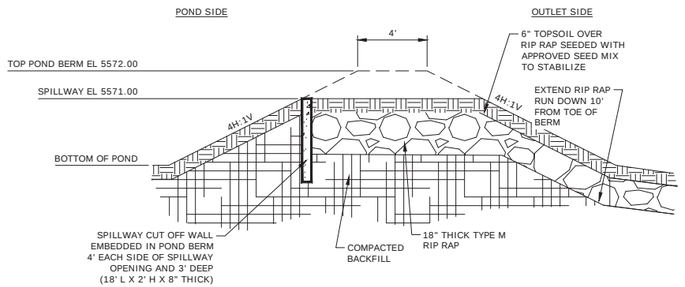
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WATKINS COMPRESSOR STATION WILLIAMS DJ BASIN FIELD COMPRESSION CIVIL GENERAL SITE ACCESS ROAD PLAN AND PROFILE	18256
	DRAWING NUMBER
	WCSS-CE-602 REV. B

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CTB Used: SE_Std_24x36_Full_Size.ctb

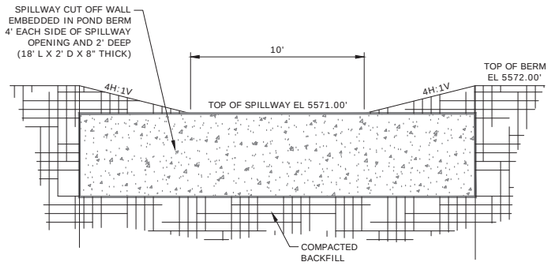


DETENTION POND ENLARGED PLAN

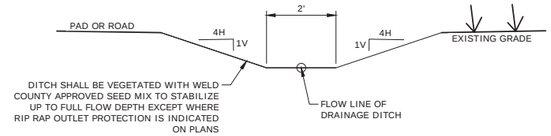
SCALE: 1" = 20'



A … SECTION - EMERGENCY OVERFLOW SPILLWAY
N.T.S.



B … SECTION - EMERGENCY OVERFLOW SPILLWAY
N.T.S.



TYPICAL DRAINAGE DITCH SECTION

SCALE: 1/2" = 1'

LEGEND

- 5405 — EXISTING MAJOR CONTOUR
- 5403 — EXISTING MINOR CONTOUR
- 5405 — PROPOSED MAJOR CONTOUR
- 5403 — PROPOSED MINOR CONTOUR
- EASEMENT LINE
- LEASE BOUNDARY
- SECTION LINE
- 1/4 SECTION LINE
- PIPELINE EASEMENT
- RIGHT-OF-WAY (ROW)
- P — P — P — EXISTING OVERHEAD POWER
- SECURITY FENCE
- DRAINAGE FLOW ARROW

WATKINS COMPRESSOR STATION STAGE-STORAGE

INTERVAL (FT)	ELEVATION (FT)	AREA (SF)	VOLUME (CF)	DESCRIPTION
0.00	5568.86	0.00	0.00	BOTTOM POND
0.50	5569.36	5658.49	1375.06	
0.64	5569.50	5864.24	2183.48	WQCV
1.00	5569.86	6324.36	4376.99	
1.38	5570.24	6825.80	6875.01	5-YR DESIGN VOLUME + WQCV
1.50	5570.36	6987.51	7703.79	
2.00	5570.86	7678.71	11369.18	100-YR DESIGN VOLUME
2.14	5571.00	7877.27	12458.07	100-YR + 1/2WQCV, SPILLWAY ELEV.
3.14	5572.00	9357.40	21066.73	FREEBOARD

1 … DETAIL - DETENTION POND STAGE-STORAGE

NOTES

1. FOR GRADING PLAN NOTES AND ABBREVIATIONS SEE DRAWING WCSS-CE-601.
2. SEE DETAIL 3, WCS-CE-604 FOR OUTLET STRUCTURE DETAILS.

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COLORADO LICENSED — MICHAEL T. CLOUD — 49458 — 01-21-19 — PROFESSIONAL ENGINEER — FOR PERMIT

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DWG NO.	DESCRIPTION

REVISIONS

NO.	DESCRIPTION	DATE	BY
B	ISSUED FOR PERMIT - RESPONSE TO COMMENT	01/21/19	LER
A	ISSUED FOR PERMIT	11/15/18	DMM

SCALE:	AS SHOWN
DESIGNED:	M. MORGAN
DRAWN:	M. MORGAN
CHECKED:	M. CLOUD
APPROVED:	
APPROVED:	
DATE	11/15/2018
DATE	10/18/2018
DATE	11/15/2018

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC

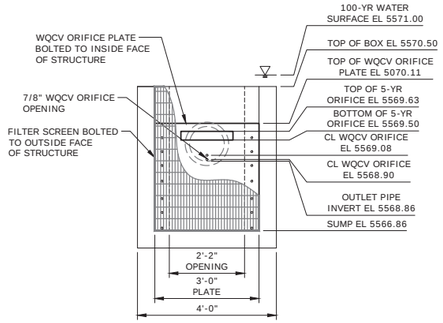
LOCATION: ADAMS COUNTY, CO

Williams

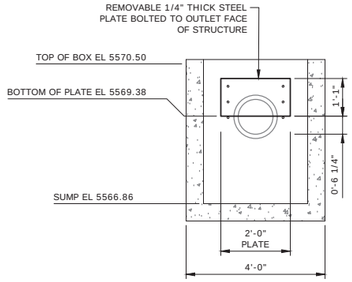
Samuel Engineering
We Provide Solutions
8450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
Phone: 303.714.4840
Fax: 303.714.4800

TITLE	PROJECT NUMBER
WATKINS COMPRESSOR STATION WILLIAMS DJ BASIN FIELD COMPRESSION CIVIL GENERAL GRADING AND DRAINAGE DETAILS	18256
	DRAWING NUMBER
	WCSS-CE-603 REV. B

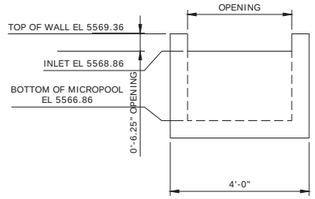
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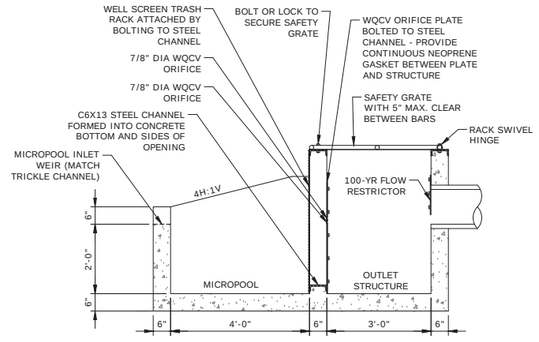
E — FILTER SCREEN & WQCV ORIFICE PLATE
1/2" = 1'



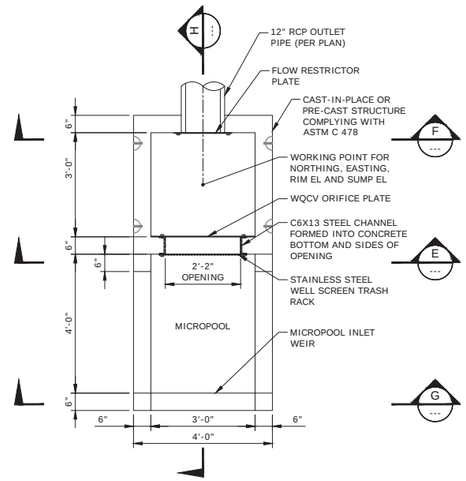
F — 100-YR FLOW RESTRICTOR PLATE
1/2" = 1'



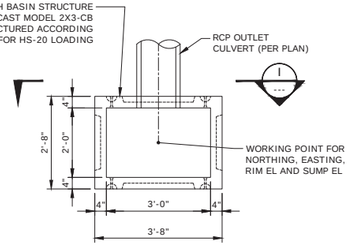
G — MICROPOOL INLET WEIR
1/2" = 1'



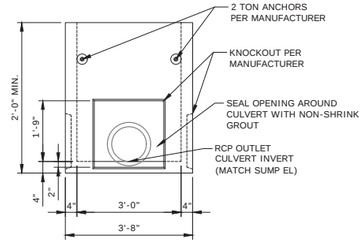
H — POND OUTLET STRUCTURE SECTION
1/2" = 1'



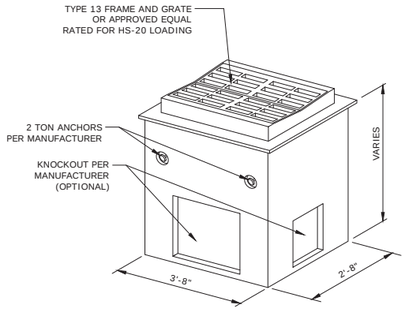
1 — DETAIL - DETENTION POND OUTLET STRUCTURE PLAN
1/2" = 1'



PLAN VIEW
FRAME & GRATE NOT SHOWN



I — RCP CONNECTION TO DROP INLET
1/2" = 1'



ISOMETRIC VIEW

2 — DETAIL - DROP INLET STRUCTURE
1/2" = 1'

0' 1' 2' 4' 6'
SCALE: 1/2" = 1'-0"

Know what's below. Call before you dig.

COLORADO REGISTERED DAVID MATTHEW MORGAN 39514 PROFESSIONAL ENGINEER
11/15/2018

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REFERENCE DRAWINGS

DWG NO.	DESCRIPTION

REVISIONS

NO.	DESCRIPTION	DATE	BY

REVISIONS

NO.	DESCRIPTION	DATE	BY
A	ISSUED FOR PERMIT	11/15/18	DMM

SCALE:	AS SHOWN	DATE
DESIGNED:	M. MORGAN	11/15/2018
DRAWN:	M. MORGAN	10/18/2018
CHECKED:	M. CLOUD	11/15/2018
APPROVED:		
APPROVED:		

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC
LOCATION: ADAMS COUNTY, CO

Samuel Engineering
We Provide Solutions
8450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
Phone: 303.714.4840
Fax: 303.714.4800

TITLE
WATKINS COMPRESSOR STATION
WILLIAMS DJ BASIN FIELD COMPRESSION
CIVIL
GENERAL
DRAINAGE STRUCTURE DETAILS

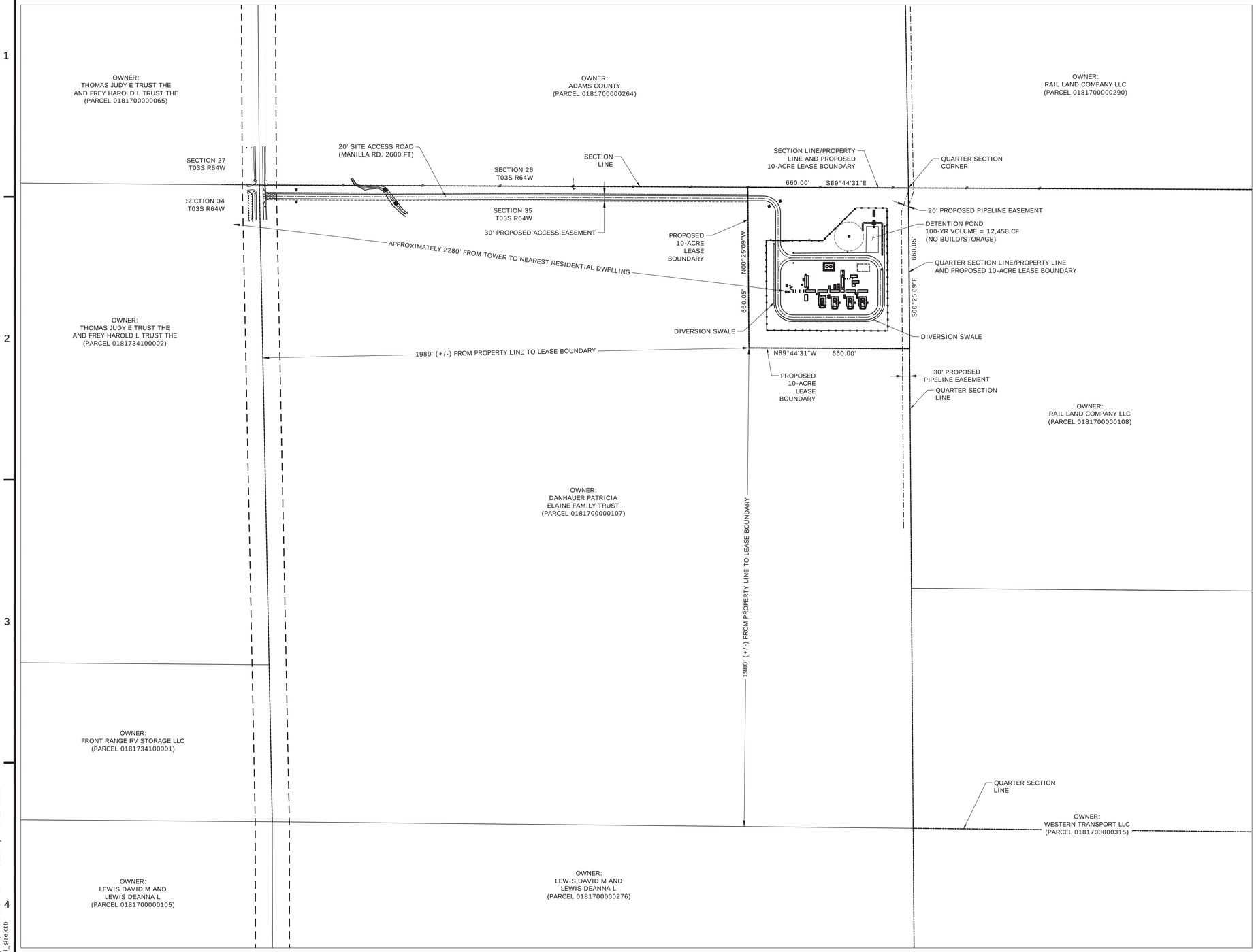
PROJECT NUMBER
18256

DRAWING NUMBER
WCSS-CE-604 REV. A

Plot Date: Thursday, November 15, 2018 3:25:43 PM Plotted By: Matt Morgan
CTB Used: SE_Std_B&W_Full_size.ctb

OVERALL SITE PLAN
WATKINS COMPRESSOR STATION
WILLIAMS DJ BASIN FIELD COMPRESSION

ADAMS COUNTY, COLORADO
PARCEL NO. 181700000107
NW ¼ SECTION 35 T03S R64W
6th PRINCIPAL MERIDIAN



NOTES

1. THE WATKINS COMPRESSOR STATION SOUTH PROPOSED SITE IS A 10-ACRE LEASE LOCATED IN THE NORTHWEST QUARTER OF SECTION 35, TOWNSHIP 3 SOUTH, RANGE 64 WEST, 6TH PRINCIPAL MERIDIAN, ADAMS COUNTY, STATE OF COLORADO.
2. THE SITE SURVEY FOR THIS PROJECT WAS PREPARED BY ACKLAM, INC. AND WAS RECEIVED ON 10/12/2018.

   HORIZONTAL DATUM: BASED ON COLORADO STATE PLANE COORDINATES, NORTH ZONE, NORTH AMERICAN HORIZONTAL DATUM, 1983 (US SURVEY FEET).

   VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM 1988.
3. SEE CIVIL SITE PLAN FOR MORE INFORMATION (WCSS-CE-103).

LEASE AREA LEGAL DESCRIPTION

A PORTION OF THAT PARCEL DESCRIBED IN QUIT CLAIM DEED TO PATRICIA ELAINE DANHAUER FAMILY TRUST, FILED FOR RECORD IN THE OFFICE OF THE ADAMS COUNTY CLERK AND RECORDER AT RECEPTION NO. 2009000084336, SAID PARCEL LOCATED IN THE NORTHWEST ONEQUARTER OF SECTION 35, TOWNSHIP 3 SOUTH, RANGE 64 WEST OF THE 6TH PRINCIPAL MERIDIAN, COUNTY OF ADAMS, STATE OF COLORADO DESCRIBED AS FOLLOWS:

BEGINNING AT THE NORTH ONE-QUARTER CORNER OF SAID SECTION 35, BEING A 3 INCH ALUMINUM CAP MARKED PLS 23527 1993, THENCE SOUTH 00°25'09" EAST, ALONG THE EAST LINE OF THE NORTHWEST ONE-QUARTER OF SAID SECTION 35, A DISTANCE OF 660.05 FEET;

THENCE NORTH 89°44'31" WEST, DEPARTING SAID LINE, A DISTANCE OF 660.00 FEET;

THENCE NORTH 00°25'09" WEST A DISTANCE OF 660.05 FEET, MORE OR LESS, TO THE NORTH LINE OF THE NORTHWEST ONE-QUARTER OF SAID SECTION 35;

THENCE SOUTH 89°44'31" EAST, ALONG SAID LINE, A DISTANCE OF 660.00 FEET TO THE POINT OF BEGINNING;

CONTAINING 10.000 ACRES (435600 SQUARE FEET) OF LAND, MORE OR LESS.

LEGEND

- EASEMENT LINE
- LEASE BOUNDARY
- SECTION LINE
- 1/4 SECTION LINE
- PIPELINE EASEMENT
- RIGHT-OF-WAY (ROW)
- SECURITY FENCE
- EXISTING OVERHEAD POWER

NORTH

0' 100' 200' 400' 600'
SCALE: 1" = 200'

Know what's below. Call before you dig.

COLORADO LICENSED
MICHAEL T. CLOUD
49458
01-21-19
PROFESSIONAL ENGINEER
FOR PERMIT

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REFERENCE DRAWINGS

DWG NO.	DESCRIPTION

REVISIONS

NO.	DESCRIPTION	DATE	BY

REVISIONS

NO.	DESCRIPTION	DATE	BY
A	ISSUED FOR PERMIT - RESPONSE TO COMMENT	01/21/19	LER

CLIENT / PROJECT ENGINEER: MTC — LEAD ENGINEER / CHECK: MTC

SCALE:	1" = 200'	DATE
DESIGNED:	M. CLOUD	01/21/2019
DRAWN:	L. ROOT	01/21/2019
CHECKED:	M. CLOUD	01/21/2019
APPROVED:		
APPROVED:		

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC
LOCATION: ADAMS COUNTY, CO

Williams

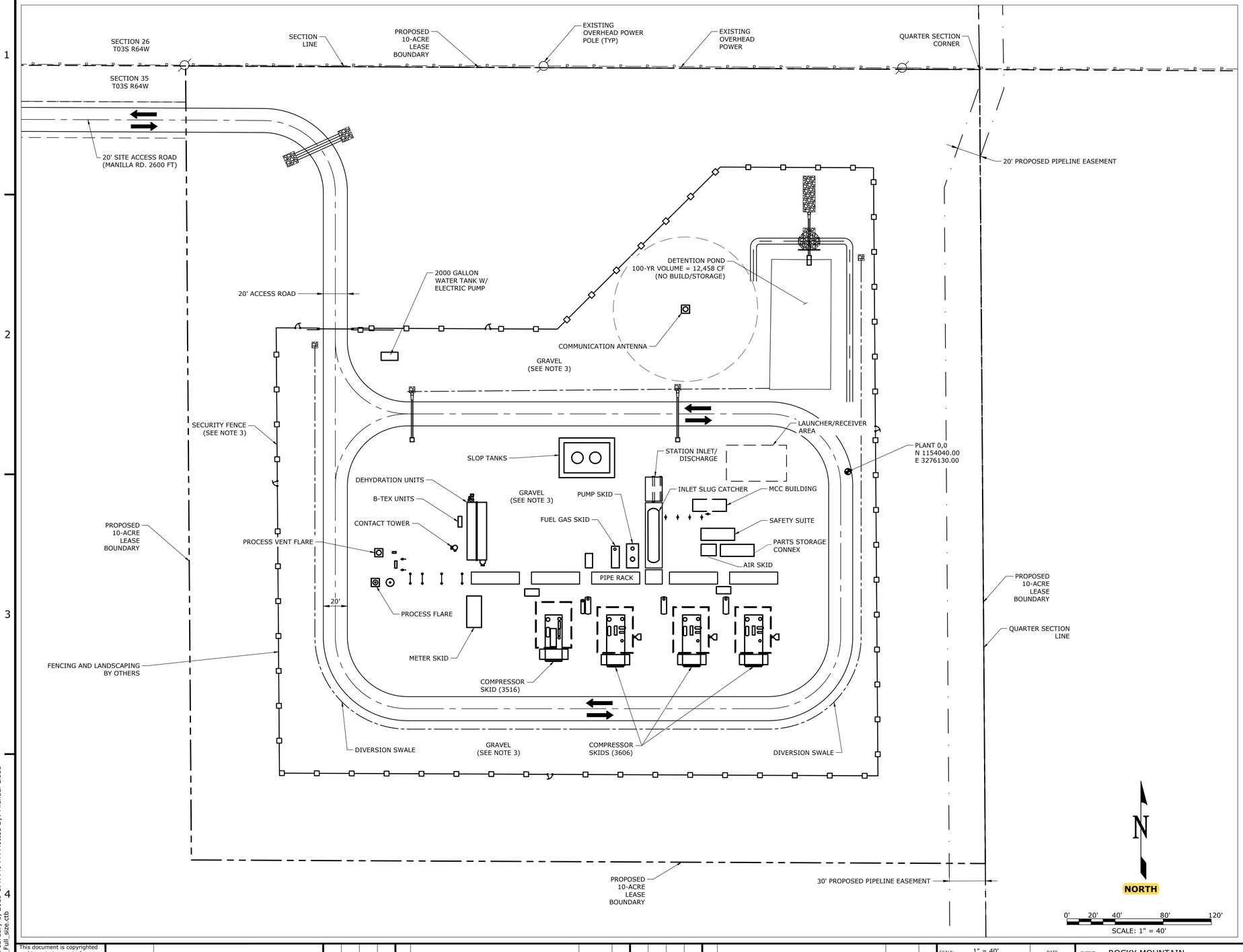
Samuel Engineering
We Provide Solutions
8450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
Phone: 303.714.4840
Fax: 303.714.4800

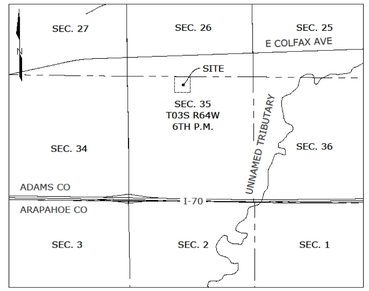
TITLE	PROJECT NUMBER
WATKINS COMPRESSOR STATION WILLIAMS DJ BASIN FIELD COMPRESSION CIVIL GENERAL OVERALL SITE PLAN	18256
	DRAWING NUMBER
	WCSS-CE-102 REV. A

CAD File: S:\Projects\18256_Watkins_Compressor\CAD\Civil\Watkins South\Drawings\WCSS-CE-102.dwg
Plot Date: Monday, January 21, 2019 6:52:15 PM Plotted By: Michael Cloud
CTB Used: SE_Std_B&W_Full_size.ctb

CIVIL SITE PLAN
WATKINS COMPRESSOR STATION
WILLIAMS DJ BASIN FIELD COMPRESSION

ADAMS COUNTY, COLORADO
PARCEL NO. 1817000000107
NW ¼ SECTION 35 T03S R64W
6th PRINCIPAL MERIDIAN





VICINITY MAP
SCALE: 1" = 3000'

NOTES

1. THE WATKINS COMPRESSOR STATION SOUTH PROPOSED SITE IS A 10-ACRE LEASE LOCATED IN THE NORTHWEST QUARTER OF SECTION 35, TOWNSHIP 3 SOUTH, RANGE 64 WEST, 6TH PRINCIPAL MERIDIAN, ADAMS COUNTY, STATE OF COLORADO.
2. THE SITE SURVEY FOR THIS PROJECT WAS PREPARED BY ACKLAM, INC. AND WAS RECEIVED ON 10/12/2018.

   HORIZONTAL DATUM: BASED ON COLORADO STATE PLANE COORDINATES, NORTH ZONE, NORTH AMERICAN HORIZONTAL DATUM, 1983 (US SURVEY FEET).

   VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM 1988.
3. FOR GRADING AND DRAINAGE PLANS SEE WCSS-CE-601 AND WCSS-CE-602. FOR EROSION CONTROL AND SURFACING SEE PLAN WCSS-CE-401. FOR FENCING PLAN SEE WCSS-CE-501. FOR DRAINAGE MAPS SEE DRAWINGS WCSS-CE-610 AND WCSS-CE-611.
4. OFFSITE PIPE CONNECTIONS TO THE COMPRESSOR STATION DESIGNED AND INSTALLED BY OTHERS.
5. LANDSCAPING BUFFER LOCATION SHOWN ON SEPARATE PLAN TO BE PROVIDED BY OTHERS.
6. THE PROJECT SITE HAS NO EXISTING UTILITIES OR STORM DRAINAGE FEATURES.
7. PERMANENT SIGN IDENTIFYING FACILITY ADDRESS, NAME, AND CONTACT INFORMATION MUST BE POSTED AND MAINTAINED AT ALL TIMES.
8. NFPA 704 PLACARD MUST BE POSTED AT ALL TIMES.

LEASE AREA LEGAL DESCRIPTION

A PORTION OF THAT PARCEL DESCRIBED IN QUIT CLAIM DEED TO PATRICIA ELAINE DANHAUER FAMILY TRUST, FILED FOR RECORD IN THE OFFICE OF THE ADAMS COUNTY CLERK AND RECORDER AT RECEPTION NO. 2009000084336, SAID PARCEL LOCATED IN THE NORTHWEST ONEQUARTER OF SECTION 35, TOWNSHIP 3 SOUTH, RANGE 64 WEST OF THE 6TH PRINCIPAL MERIDIAN, COUNTY OF ADAMS, STATE OF COLORADO DESCRIBED AS FOLLOWS:

BEGINNING AT THE NORTH ONE-QUARTER CORNER OF SAID SECTION 35, BEING A 3 INCH ALUMINUM CAP MARKED PLS 23527 1993, THENCE SOUTH 00°25'09" EAST, ALONG THE EAST LINE OF THE NORTHWEST ONE-QUARTER OF SAID SECTION 35, A DISTANCE OF 660.05 FEET;

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CONTAINING 10.000 ACRES (435600 SQUARE FEET) OF LAND, MORE OR LESS.

LEGEND

- EASEMENT LINE
- LEASE BOUNDARY
- SECTION LINE
- 1/4 SECTION LINE
- PIPELINE EASEMENT
- RIGHT-OF-WAY (ROW)
- SECURITY FENCE
- EXISTING OVERHEAD POWER
- LANDSCAPING BUFFER
- TRAFFIC FLOW

Know what's below. Call before you dig.

COLORADO LICENSED PROFESSIONAL ENGINEER MICHAEL T. CLOUD 49458 02-06-19
FOR PERMIT

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Plot Date: Wednesday, February 6, 2019 1:47:49 PM Plotted By: Michael Cloud
CTB Used: SE_Std_B&W_Full_size.ctb

REFERENCE DRAWINGS

DWG NO.	DESCRIPTION

REVISIONS

NO.	DESCRIPTION	DATE	BY
C	ISSUED FOR PERMIT - ADD WATER TANK	02/06/19	MTC
B	ISSUED FOR PERMIT - RESPONSE TO COMMENT	01/21/19	LER
A	ISSUED FOR PERMIT	11/15/18	DMM

	CLIENT	PROJECT ENGINEER	LEAD ENGINEER	CHECK
		MTC	LER	
		MTC	MTC	
		DMM	MTC	

SCALE:	1" = 40'
DESIGNED:	M. MORGAN
DRAWN:	M. MORGAN
CHECKED:	M. CLOUD
APPROVED:	
APPROVED:	

DATE
11/15/2018
10/18/2018
11/15/2018

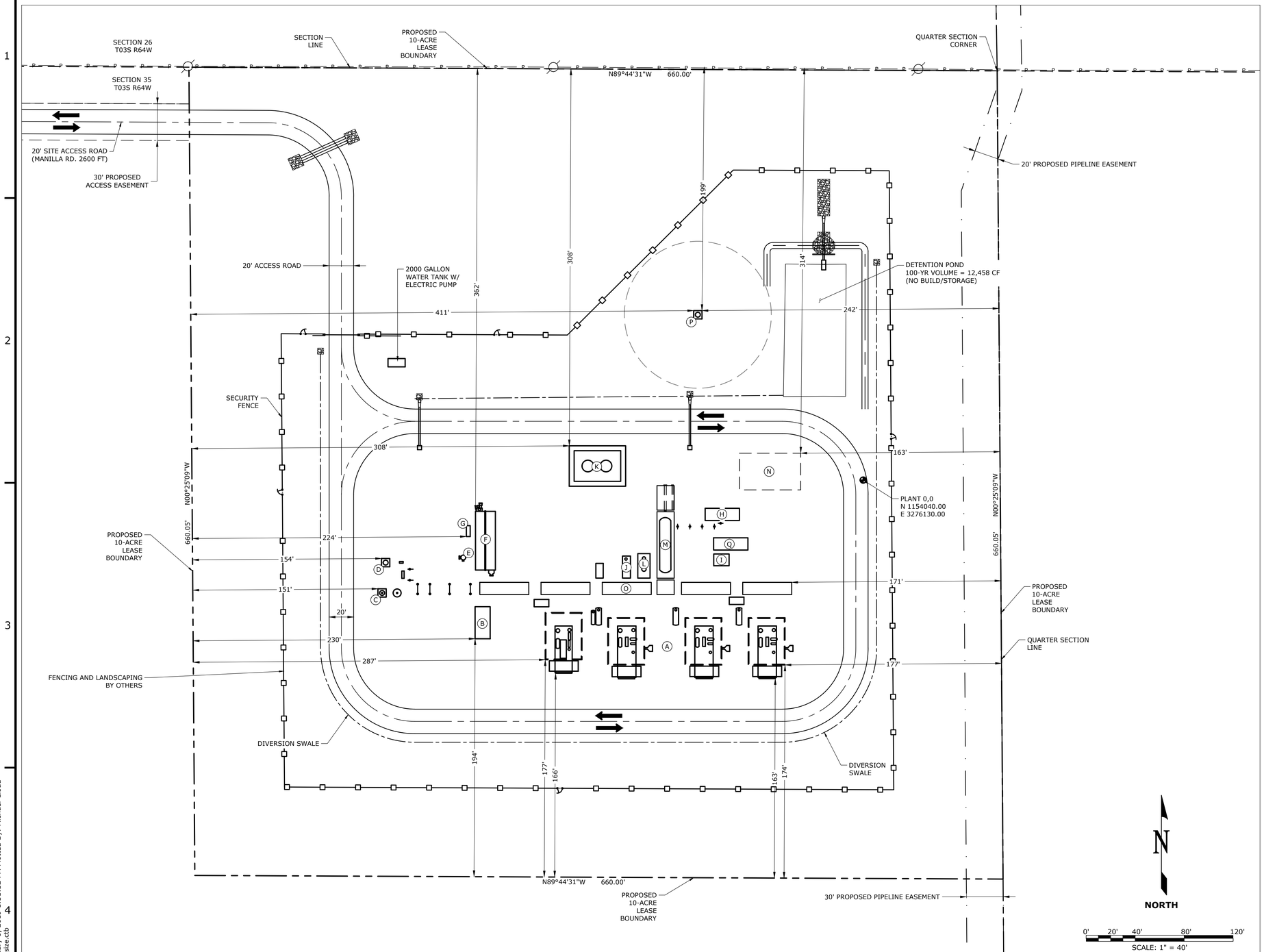
CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC
LOCATION: ADAMS COUNTY, CO

Samuel Engineering
We Provide Solutions
8450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
Phone: 303.714.4840
Fax: 303.714.4800

TITLE	PROJECT NUMBER
WATKINS COMPRESSOR STATION WILLIAMS DJ BASIN FIELD COMPRESSION CIVIL GENERAL CIVIL SITE PLAN	18256
	DRAWING NUMBER
	WCSS-CE-103 REV. C

CIVIL SITE SETBACK PLAN
WATKINS COMPRESSOR STATION
WILLIAMS DJ BASIN FIELD COMPRESSION

ADAMS COUNTY, COLORADO
PARCEL NO. 1817000000107
NW ¼ SECTION 35 T03S R64W
6th PRINCIPAL MERIDIAN



NOTES

1. THE WATKINS COMPRESSOR STATION SOUTH PROPOSED SITE IS A 10-ACRE LEASE LOCATED IN THE NORTHWEST QUARTER OF SECTION 35, TOWNSHIP 3 SOUTH, RANGE 64 WEST, 6TH PRINCIPAL MERIDIAN, ADAMS COUNTY, STATE OF COLORADO.
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   VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM 1988.
3. SEE CIVIL SITE PLAN FOR MORE INFORMATION (WCSS-CE-103).

LEASE AREA LEGAL DESCRIPTION

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CONTAINING 10.000 ACRES (435600 SQUARE FEET) OF LAND, MORE OR LESS.

EQUIPMENT LIST

	STRUCTURE	HEIGHT
A	COMPRESSOR BUILDING (4 UNITS)	22.5 FT
B	METER SKID	11 FT
C	PROCESS FLARE	65 FT
D	PROCESS VENT FLARE	26 FT
E	CONTACT TOWER	54 FT
F	DEHYDRATION UNIT	15 FT
G	BTEX UNIT	10 FT
H	MCC BUILDING	10 FT
I	AIR SKID	10 FT
J	FUEL GAS SKID	10 FT
K	SLOP TANKS	7.5 FT
L	PUMP SKID	10 FT
M	INLET SLUG CATCHER	15 FT
N	LAUNCHER/RECEIVER AREA	5 FT
O	PIPE RACK	7 FT
P	COMMUNICATION ANTENNA	60 FT
Q	PARTS STORAGE CONNEX	10 FT

LEGEND

- EASEMENT LINE
- LEASE BOUNDARY
- SECTION LINE
- 1/4 SECTION LINE
- PIPELINE EASEMENT
- RIGHT-OF-WAY (ROW)
- SECURITY FENCE
- EXISTING OVERHEAD POWER
- LANDSCAPING BUFFER
- TRAFFIC FLOW

NORTH

0' 20' 40' 80' 120'
SCALE: 1" = 40'

Know what's below. Call before you dig.

COLORADO LICENSED MICHAEL T. CLOUD 49458 PROFESSIONAL ENGINEER 02-06-19 FOR PERMIT

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REFERENCE DRAWINGS

DWG NO.	DESCRIPTION

REVISIONS

NO.	DESCRIPTION	DATE	BY

REVISIONS

NO.	DESCRIPTION	DATE	BY
B	ISSUED FOR PERMIT - ADD WATER TANK	02/06/19	MTC
A	ISSUED FOR PERMIT - RESPONSE TO COMMENT	01/21/19	LER

SCALE:	1" = 40'	DATE
DESIGNED:	M. CLOUD	01/21/2019
DRAWN:	L. ROOT	01/21/2019
CHECKED:	M. CLOUD	01/21/2019
APPROVED:		
APPROVED:		

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC
LOCATION: ADAMS COUNTY, CO

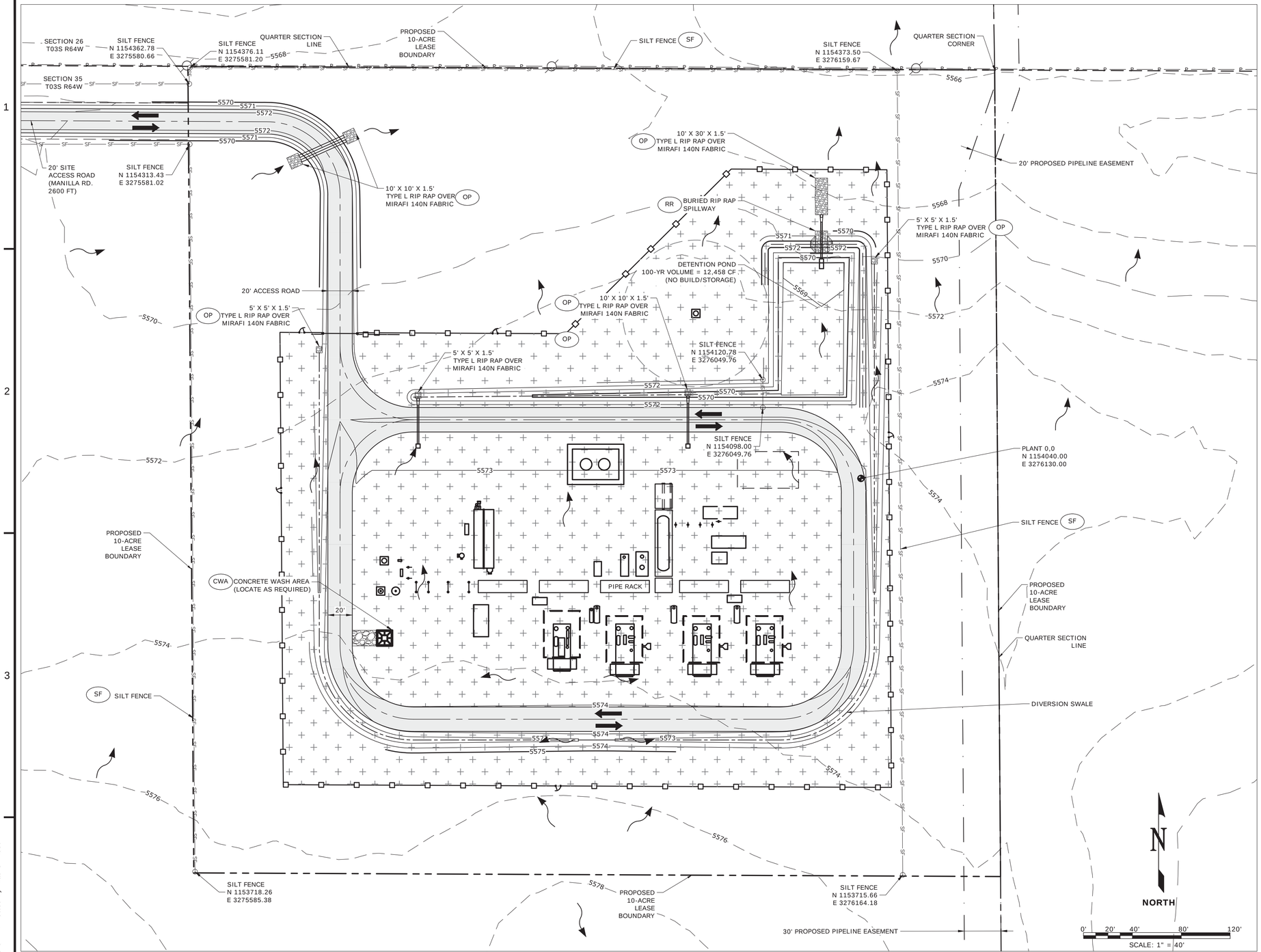
Samuel Engineering
We Provide Solutions
8450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
Phone: 303.714.4840
Fax: 303.714.4800

TITLE
WATKINS COMPRESSOR STATION
WILLIAMS DJ BASIN FIELD COMPRESSION
CIVIL
GENERAL
CIVIL SITE SETBACK PLAN

PROJECT NUMBER
18256

DRAWING NUMBER
WCSS-CE-104 REV. B

CAD File: S:\Projects\18256_Watkins_Compressor\CAD\Civil\Watkins South\Drawings\WCSS-CE-104.dwg
Plot Date: Wednesday, February 6, 2019 1:51:32 PM Plotted By: Michael Cloud
CTB Used: SE_Std_B&W_Full_size.ctb



GENERAL NOTES

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING AND PROTECTING ALL UNDERGROUND UTILITIES PRIOR TO CONSTRUCTION. THE CONTRACTOR IS TO ENSURE THAT 811 AND OWNER'S SITE PERSONNEL ARE CONTACTED PRIOR TO COMMENCING CONSTRUCTION ACTIVITIES. CAUTION SHOULD BE TAKEN DURING ALL EXCAVATION OF SOIL AND FOUNDATIONS WITHIN THE LIMITS OF DISTURBANCE. CONTACT ENGINEER IF THERE ARE CONFLICTS.
2. THE MAJORITY OF THE SITE GRAVEL WILL BE INSTALLED AFTER EQUIPMENT IS SET AND FINAL GRADING IS COMPLETE. THE CONTRACTOR IS TO COORDINATE WITH THE OWNER FOR ALL GRAVEL INSTALLATION TIMING.
3. THE CONTRACTOR IS TO SUBMIT A GRADATION SAMPLE TO OWNER PRIOR TO PLACING GRAVEL MATERIAL. OWNER WILL DETERMINE SIZE OF GRAVEL TO BE USED.
4. PERIMETER SILT FENCE IS TO BE INSTALLED PRIOR TO ANY CONSTRUCTION ACTIVITIES. ALL OTHER EROSION CONTROL MEASURES CAN BE INSTALLED AFTER ROUGH GRADING AND DRAINAGE IS COMPLETE.
5. ALL AREAS WITHIN THE SECURITY FENCE SHALL BE MAINTAINED VEGETATION FREE GRAVEL FOR THE LIFE OF THE FACILITY.
6. ALL AREAS OUTSIDE THE SECURITY FENCE NOT SURFACED WITH GRAVEL, ROAD BASE, ETC. THAT ARE DISTURBED DURING CONSTRUCTION SHALL BE SEEDED WITH A NATIVE SEED MIXTURE OR OTHERWISE PROTECTED FROM EROSION AS APPROVED BY WELD COUNTY AND THE OWNER.
7. A CDPHE SWMP SHALL BE PREPARED AND MAINTAINED FOR THIS PROJECT SITE.
8. SEE DRAWING WCSS-CE-602 FOR ADDITIONAL EROSION CONTROL FEATURES ON THE SITE ACCESS ROAD.

EROSION CONTROL NOTES

1. REFERENCE DRAWING WCSS-CE-103 FOR CIVIL SITE PLAN AND NOTES AND WCSS-CE-601 FOR DRAINAGE AND GRADING PLANS AND NOTES.
2. EROSION CONTROL BMP'S ON THIS DRAWING MAY BE SHOWN LARGER THAN ACTUAL SIZE FOR CLARITY.
3. PERMANENT SEEDING AND MULCHING WILL BE REQUIRED OUTSIDE SECURITY FENCING ON ALL DISTURBED AREAS NOT RECEIVING GRAVEL OR ROAD BASE DURING CONSTRUCTION.
4. THE RECEIVING WATERS FOR THE SITE IS AN UNNAMED TRIBUTARY OF THE LOST SAND CREEK.
5. SITE AREA AND AREA OF DISTURBANCE FOR THIS SITE AND THE ACCESS ROAD IS APPROXIMATELY 5.0 ACRES.

GRUBBING NOTES

1. ALL VEGETATION AND ORGANIC MATERIAL IS TO BE REMOVED AS DEFINED BY THE LIMITS OF DISTURBANCE SHOWN ON THIS DRAWING. LIMITS OF DISTURBANCE ARE ESTIMATES AND THE CONTRACTOR IS TO CONFIRM WITH THE ONSITE CONSTRUCTION MANAGER FOR FINAL CLEARING LIMITS. NO CLEARING ACTIVITIES SHALL TAKE PLACE OUTSIDE OF THE LIMITS OF DISTURBANCE.
2. THE CONTRACTOR IS TO REMOVE ALL ORGANIC MATERIAL PRIOR TO SITE GRADING. ALL TOPSOIL SHALL BE STOCKPILED ONSITE AND USED FOR FINAL STABILIZATION FOLLOWING CONSTRUCTION.
3. IN AREAS WHERE GRUBBING IS NOT PERFORMED THE CONTRACTOR IS TO MOW OR CUT EXISTING VEGETATION.

EROSION CONTROL LEGEND

	CWA	CONCRETE WASHOUT (TEMPORARY)
SF SF	SF	SILT FENCE (TEMPORARY)
	OP	OUTLET PROTECTION (PERMANENT)
	RR	RIP-RAP RUNDOWN (PERMANENT)
	VTC	VEHICLE TRACKING CONTROL (TEMPORARY)
		8" ROADBASE SURFACING (PERMANENT STABILIZATION)
		4" GRAVEL SURFACING (PERMANENT STABILIZATION)

GENERAL LEGEND

5405	EXISTING MAJOR CONTOUR
5403	EXISTING MINOR CONTOUR
5405	PROPOSED MAJOR CONTOUR
5403	PROPOSED MINOR CONTOUR
	EASEMENT LINE
	LEASE BOUNDARY
	SECTION LINE
	1/4 SECTION LINE
	PIPELINE EASEMENT
	RIGHT-OF-WAY (ROW)
	SECURITY FENCE
P P P	EXISTING OVERHEAD POWER
	DRAINAGE FLOW ARROW

ABBREVIATIONS

BMP	BEST MANAGEMENT PRACTICE
CDPHE	COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
CWA	CONCRETE WASHOUT AREA
E	EASTING
N	NORTHING
OP	OUTLET PROTECTION
R.O.W.	RIGHT-OF-WAY
RR	RIP RAP
SF	SILT FENCE
SWMP	STORM WATER MANAGEMENT PLAN

Know what's below. Call before you dig.

COLORADO LICENSED MICHAEL T. CLOUD 49458 01-21-19 PROFESSIONAL ENGINEER FOR PERMIT

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REFERENCE DRAWINGS

DWG NO.	DESCRIPTION

REVISIONS

NO.	DESCRIPTION	DATE	BY
MTC	ISSUED FOR PERMIT - RESPONSE TO COMMENT	01/21/19	LER
DMM	ISSUED FOR PERMIT	11/15/18	DMM

SCALE:	1" = 40'	DATE
DESIGNED:	M. MORGAN	11/15/2018
DRAWN:	M. MORGAN	10/18/2018
CHECKED:	M. CLOUD	11/15/2018
APPROVED:		
APPROVED:		

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC
LOCATION: ADAMS COUNTY, CO

Samuel Engineering
We Provide Solutions
8450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
Phone: 303.714.4840
Fax: 303.714.4800

TITLE	PROJECT NUMBER
WATKINS COMPRESSOR STATION WILLIAMS DJ BASIN FIELD COMPRESSION CIVIL GENERAL EROSION CONTROL PLAN	18256
	DRAWING NUMBER
	WCSS-CE-401 REV. B

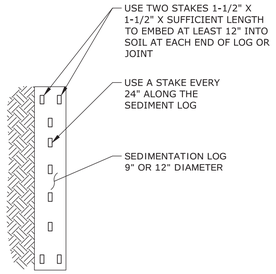
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CONSTRUCTION BEST MANAGEMENT PRACTICES

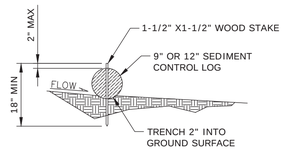
1. EROSION AND SEDIMENT CONTROL DEVICES SHALL BE INSTALLED AND INSPECTED PRIOR TO ANY LAND DISTURBANCE ON SITE.
2. THE PERMITTEE AND/OR CONTRACTOR SHALL REMOVE ALL SEDIMENT, MUD, CONSTRUCTION DEBRIS, OR OTHER POTENTIAL POLLUTANTS THAT MAY HAVE BEEN DISCHARGED TO OR, ACCUMULATE IN, THE FLOW LINES, STORM DRAINAGE APPURTENANCES, AND PUBLIC RIGHTS OF WAYS OF THE LOCAL GOVERNING AUTHORITY AS A RESULT OF CONSTRUCTION ACTIVITIES ASSOCIATED WITH THIS SITE DEVELOPMENT OR CONSTRUCTION PROJECT. SAID REMOVAL SHALL BE CONDUCTED IN A TIMELY MANNER.
3. THE CONTRACTOR SHALL PREVENT SEDIMENT, DEBRIS AND ALL OTHER POLLUTANTS FROM ENTERING THE STORM SEWER SYSTEM DURING ALL DEMOLITION, EXCAVATION, TRENCHING, BORING, GRADING, OR OTHER CONSTRUCTION OPERATIONS THAT ARE PART OF THIS PROJECT. THE CONTRACTOR SHALL BE HELD RESPONSIBLE FOR REMEDIATION OF ANY ADVERSE IMPACTS TO THE MUNICIPAL STORM SEWER SYSTEM, RECEIVING WATERS, WATERWAYS, WETLANDS, AND OR OTHER PUBLIC OR PRIVATE PROPERTIES, RESULTING FROM WORK DONE AS PART OF THIS PROJECT.
4. SOIL STABILIZATION MEASURES SHALL BE IMPLEMENTED WITHIN FOURTEEN (14) DAYS FOLLOWING COMPLETION OF GRADING ACTIVITIES. STABILIZATION OF DISTURBED AREAS ADJACENT TO RECEIVING WATERS OR WITH SLOPES 3 TO 1 OR GREATER SHALL BE COMPLETED WITHIN SEVEN (7) DAYS FOLLOWING COMPLETION OF GRADING ACTIVITIES. NOTE: FEDERAL AND STATE REGULATIONS MAY SOON REQUIRE STABILIZATION WITHIN SEVEN (7) DAYS OF COMPLETION OF GRADING ACTIVITIES. IN SUCH CASES, THE SHORTER SHALL APPLY.
5. THE CONTRACTOR, GRADING CONTRACTOR AND/OR THEIR AUTHORIZED AGENTS SHALL INSURE THAT ALL LOADS OF CUT AND FILL MATERIAL IMPORTED TO OR EXPORTED FROM THIS SITE SHALL BE PROPERLY COVERED TO PREVENT LOSS OF THE MATERIAL DURING TRANSPORT ON PUBLIC RIGHTS OF WAY.
6. THE USE OF REBAR, TO ANCHOR BEST MANAGEMENT PRACTICES IS PROHIBITED. STEEL FENCE POSTS MAY BE USED ON A CASE BY CASE BASIS AND REQUIRES APPROVAL FROM THE LOCAL GOVERNING AUTHORITY SWMP REVIEWER OR THE STORMWATER ENFORCEMENT INVESTIGATOR PRIOR TO INSTALLATION.
7. SOILS THAT WILL BE STOCKPILED FOR MORE THAN THIRTY (30) DAYS SHALL BE PROTECTED FROM WIND AND WATER EROSION WITHIN FOURTEEN (14) DAYS OF STOCKPILE CONSTRUCTION. STABILIZATION OF STOCKPILES LOCATED WITHIN 100 FEET OF RECEIVING WATERS, OR WITH SLOPES 3 TO 1 OR GREATER SHALL BE COMPLETED WITHIN SEVEN (7) DAYS FOLLOWING STOCKPILE CONSTRUCTION. STABILIZATION AND PROTECTION OF THE STOCKPILE MAY BE ACCOMPLISHED BY ANY OF THE FOLLOWING: MULCHING, TEMPORARY/PERMANENT REVEGETATION OPERATIONS, OR EROSION CONTROL MATTING/GEOTEXTILES. IF STOCKPILES ARE LOCATED WITHIN 100 FEET OF RECEIVING WATERS, A DRAINAGE WAY OR THE SITE PERIMETER, ADDITIONAL SEDIMENT CONTROLS SHALL BE REQUIRED.
8. APPROVED EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICES SHALL BE MAINTAINED AND KEPT IN GOOD REPAIR FOR THE DURATION OF THIS PROJECT. AT A MINIMUM, THE PERMITTEE OR CONTRACTOR SHALL PRODUCE AND RETAIN WEEKLY WRITTEN INSPECTION RECORDS FOR ALL BMPS AND AFTER SIGNIFICANT PRECIPITATION EVENTS. ALL NECESSARY MAINTENANCE AND REPAIR SHALL BE COMPLETED IMMEDIATELY. ADDITIONALLY, STREET SWEEPING IS TO BE COMPLETED BY THE CLOSE OF BUSINESS DAY OR (AND) ON AN AS NEEDED BASIS THROUGHOUT THE DAY.
9. WATER USED IN THE CLEANING OF CEMENT TRUCK DELIVERY CHUTES SHALL BE DISCHARGED INTO A PREDEFINED, CONCRETE WASHOUT AREA ON THE JOB SITE. BERMED CONTAINMENT OR COMMERCIALLY AVAILABLE CONCRETE WASHOUT DEVICES THAT FULLY CONTAIN ALL WASH WATER ARE ACCEPTABLE. WASH WATER DISCHARGED INTO THE CONTAINMENT AREA OR DEVICE SHALL BE ALLOWED TO INFILTRATE OR EVAPORATE AND OR BE DISPOSED OF IN ACCORDANCE WITH APPLICABLE REGULATIONS. DRIED CEMENT WASTE IS TO BE REMOVED FROM THE CONTAINMENT AREA AND PROPERLY DISPOSED OF.
10. SHOULD THE USE OF A PREDEFINED BERMED CONTAINMENT AREA OR APPROVED WASHOUT DEVICE BE TECHNICALLY INFEASIBLE DUE TO THE PROJECT SIZE, OR LACK OF AN AREA WITH A SUITABLE GROUND SURFACE FOR ESTABLISHING A CONTAINMENT, PROPER DISPOSAL OF CONCRETE WASHOUT AND WASH WATER AT THE JOB SITE SHALL CONFORM TO THE APPROVED TECHNIQUES AND PRACTICES IDENTIFIED IN THE COLORADO DEPARTMENT OF PUBLIC HEALTH & ENVIRONMENTS' TRAINING VIDEO ENTITLED "BUILDING FOR A CLEANER ENVIRONMENT, READY MIX WASHOUT TRAINING" AND ITS ACCOMPANYING MANUAL ENTITLED, "READY MIX WASHOUT GUIDEBOOK, VEHICLE AND EQUIPMENT WASHOUT AT CONSTRUCTION SITES."
11. THE DIRECT OR INDIRECT DISCHARGE OF WATER CONTAINING WASTE CEMENT TO THE STORM SEWER SYSTEM IS PROHIBITED.
12. THE CONTRACTOR SHALL PROTECT ALL STORM SEWER FACILITIES ADJACENT TO ANY LOCATION WHERE PAVEMENT CUTTING OPERATIONS INVOLVING WHEEL CUTTING, SAW CUTTING, OR ABRASIVE WATER JET CUTTING ARE TO TAKE PLACE.
13. THE CONTRACTOR SHALL REMOVE AND PROPERLY DISPOSE OF ALL WASTE PRODUCTS GENERATED BY SAID CUTTING OPERATIONS ON A DAILY BASIS OR AS NEEDED THROUGHOUT THE DAY.
14. THE DISCHARGE OF ANY WATER CONTAMINATED BY WASTE PRODUCTS FROM CUTTING OPERATIONS TO THE STORM SEWER SYSTEM IS PROHIBITED.
15. PAVED AND IMPERVIOUS SURFACES WHICH ARE ADJACENT TO CONSTRUCTION SITES MUST BE SWEPT ON A DAILY BASIS OR AS NEEDED DURING THE DAY WHEN SEDIMENT AND OTHER MATERIAL ARE TRACKED OR DISCHARGED ONTO THEM. EITHER SWEEPING BY HAND OR USE OF STREET SWEEPERS IS ACCEPTABLE. STREET SWEEPERS USING WATER WHILE SWEEPING IS PREFERRED IN ORDER TO MINIMIZE DUST. FLUSHING OF PAVED SURFACES WITH WATER IS PROHIBITED.

COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT NOTES

1. ALL UNPAVED ROADS AND OTHER DISTURBED SURFACE AREAS ON SITE MUST BE WATERED AS NECESSARY TO PREVENT OFF-PROPERTY TRANSPORT OF VISIBLE FUGITIVE PARTICULATE EMISSIONS.
2. VEHICLE SPEED ON ALL UNPAVED ROADS AND DISTURBED AREAS SHALL NOT EXCEED A MAXIMUM OF 30 MPH. SPEED LIMIT SIGNS SHALL BE POSTED.
3. NO EARTHWORK ACTIVITIES SHALL BE PERFORMED WHEN THE WIND SPEED EXCEEDS 30 MPH.
4. ALL DISTURBED SURFACE AREAS SHALL BE REVEGETATED WITHIN ONE YEAR AND ACCORDING TO THE INFORMATION SUBMITTED BY THE APPLICANT WITH THE PERMIT APPLICATION.
5. GRAVEL ENTRYWAYS SHALL BE UTILIZED TO PREVENT MUD AND DIRT CARRYOUT ONTO PAVED SURFACES. ANY MUD AND DIRT CARRYOUT ONTO PAVED SURFACES SHALL BE CLEANED UP DAILY.



TYPICAL STAKE INSTALLATION



STANDARD INSTALLATION

SCL

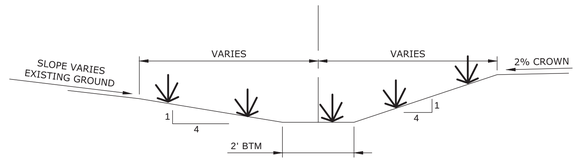
SEDIMENT CONTROL LOG INSTALLATION NOTES

1. SEE SEDIMENTATION (EROSION) CONTROL PLAN FOR LOCATION AND LENGTH OF SEDIMENT CONTROL LOG.
2. SEDIMENT CONTROL LOGS INDICATED ON INITIAL EROSION CONTROL PLAN SHALL BE INSTALLED PRIOR TO ANY LAND-DISTURBING ACTIVITIES.
3. SEDIMENT CONTROL LOGS SHALL CONSIST OF STRAW, COMPOST, EXCELSIOR OR COCONUT FIBER.
4. NOT FOR USE IN CONCENTRATED FLOW AREAS.
5. THE SEDIMENT CONTROL LOG SHALL BE TRENCHED INTO THE GROUND A MINIMUM OF 2".
6. PROVIDE A 12" OVERLAP AT EACH JOINT (END OF LOG).

SEDIMENT CONTROL LOG MAINTENANCE NOTES

1. THE SWMP MANAGER SHALL INSPECT SEDIMENT CONTROL LOGS DAILY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OR CLEAN OUT UPSTREAM SEDIMENT AS NECESSARY.
2. SEDIMENT ACCUMULATED UPSTREAM OF SEDIMENT CONTROL LOGS SHALL BE REMOVED WHEN THE UPSTREAM SEDIMENT DEPTH IS WITHIN ½ THE HEIGHT OF THE CREST OF THE LOG.
3. SEDIMENT CONTROL LOGS MAY OR MAY NOT NEED TO BE REMOVED, DEPENDING ON THE LOCATION AND APPLICATION USE. IF REMOVED, ANY DISTURBED AREAS SHALL BE COVERED WITH TOP SOIL, DRILL SEEDED AND CRIMP MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE GOVERNING AUTHORITY.

SEDIMENT CONTROL LOG
NOT TO SCALE



TYPICAL DRAINAGE SWALE
NOT TO SCALE

* EROSION CONTROL DETAILS ARE FROM URBAN DRAINAGE AND FLOOD CONTROL DISTRICT, DRAINAGE CRITERIA MANUAL, VOLUME 3 - CONSTRUCTION BEST MANAGEMENT PRACTICES. INSTALLATION AND MAINTENANCE OF SITE BMP'S ARE TO ADHERE TO ADAMS COUNTY OR STATE OF COLORADO LATEST STANDARDS AND REQUIREMENTS.

GENERAL NOTES

1. REFERENCE DRAWINGS WCSS-CE-103 FOR CIVIL SITE PLAN AND NOTES, WCSS-CE-601 FOR DRAINAGE AND GRADING GENERAL NOTES AND WCSS-CE-401 FOR EROSION CONTROL PLANS.

Table 506-2

Pay Item		Percent of Material Smaller Than Typical Stone[2]	Typical Stone Dimensions[3] (Inches)	Typical Stone Weight[4] (Pounds)
	Stone Size d50[1] (Inches)			
VL Riprap	6	70-100 50-70 35-50 2-10	12 9 6 2	85 35 10 0.4
L Riprap	9	70-100 50-70 35-50 2-10	15 12 9 3	160 85 35 1.3
M Riprap	12	70-100 50-70 35-50 2-10	21 18 12 4	440 275 85 3
H Riprap	18	100 50-70 35-50 2-10	30 24 18 6	1280 650 275 10
VH Riprap	24	100 50-70 35-50 2-10	42 33 24 9	3500 1700 650 35

[1]d50 = nominal stone size
[2]based on typical rock mass
[3]equivalent spherical diameter
[4]based on a specific gravity = 2.5

RIP-RAP GRADATIONS

Know what's below. Call before you dig.

COLORADO REGISTERED DAVID MATTHEW MORGAN 39814 PROFESSIONAL ENGINEER 11/15/2018

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REFERENCE DRAWINGS

DWG NO.	DESCRIPTION

REVISIONS

NO.	DESCRIPTION	DATE	BY

REVISIONS

NO.	DESCRIPTION	DATE	BY
A	ISSUED FOR PERMIT	11/15/18	DMM

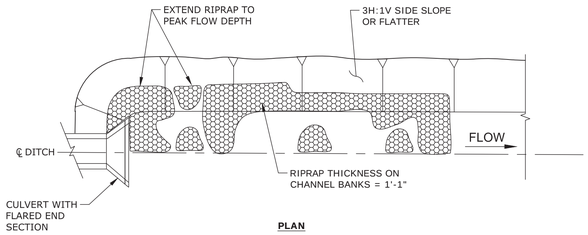
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DESIGNED:	M. MORGAN	11/15/2018
DRAWN:	M. MORGAN	10/18/2018
CHECKED:	M. CLOUD	11/15/2018
APPROVED:		
APPROVED:		

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC
LOCATION: ADAMS COUNTY, CO

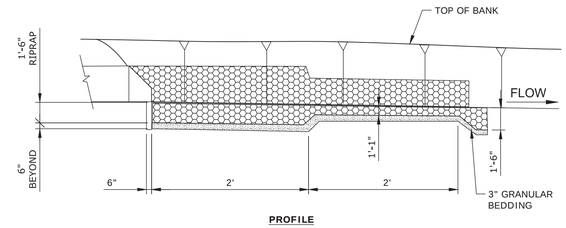
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We Provide Solutions
8450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
Phone: 303.714.4840
Fax: 303.714.4800

TITLE	PROJECT NUMBER
WATKINS COMPRESSOR STATION WILLIAMS DJ BASIN FIELD COMPRESSION CIVIL GENERAL EROSION CONTROL NOTES & DETAILS	18256
	DRAWING NUMBER
	WCSS-CE-402 REV. A

Plot Date: Thursday, November 15, 2018 2:27:12 PM Plotted By: Matt Morgan
CTB Used: SE_Std_B&W_Full_size.ctb



PLAN

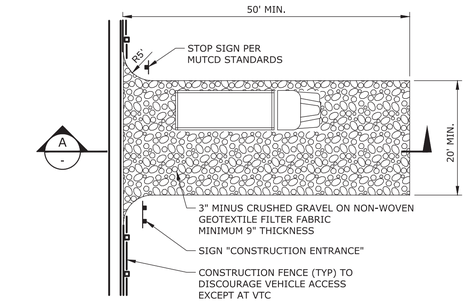


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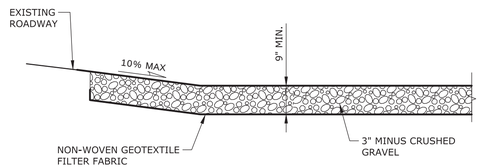
NOTES

1. FLARED END SECTION REQUIRED AT ALL CULVERT OUTLETS.
2. PROVIDE JOINT FASTENERS FOR FLARED END SECTIONS FOR SLOPES GREATER THAN 5%.
3. INSTALL MIRAFI 140N FILTER FABRIC (OR EQUAL) BELOW ALL RIPRAP.
4. DISTURBED SURFACES SHALL BE LEFT IN A ROUGHENED CONDITION AT ALL TIMES DURING CONSTRUCTION.
5. EROSION CONTROL MEASURES AT TEMPORARY FACILITIES SHALL BE REMOVED WHEN THEY HAVE SERVED THEIR USEFUL PURPOSE. EROSION CONTROL MEASURES AT PERMANENT FACILITIES SHALL REMAIN IN PLACE.
6. RIP RAP SIZE SHALL BE TYPE L MINIMUM OR AS INDICATED ON PLANS.

OP **CULVERT AND OUTLET EROSION PROTECTION**
NOT TO SCALE



PLAN



A SECTION
N.T.S.

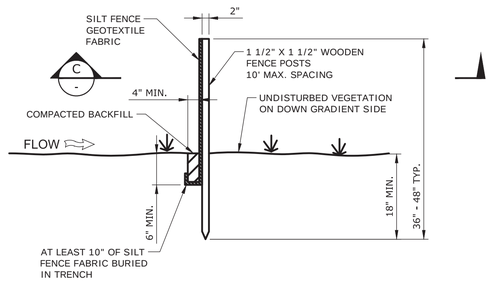
VEHICLE TRACKING CONTROL INSTALLATION NOTES

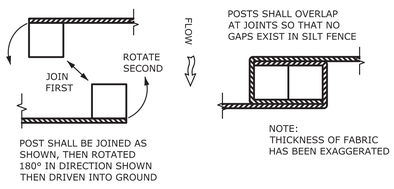
1. VEHICLE TRACKING CONTROL PADS SHALL BE INSTALLED AT EVERY ACCESS POINT TO SITE.
2. VEHICLE TRACKING CONTROL PADS SHALL CONSIST OF HARD, DENSE, DURABLE STONE, ANGULAR IN SHAPE AND RESISTANT TO WEATHERING. ROUNDED STONE OR BOULDERS WILL NOT BE ACCEPTABLE. THE STONES SHALL BE 3" MINUS.
3. A STOP SIGN INSTALLED IN ACCORDANCE WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD), AS AMENDED, SHALL BE INSTALLED FOR EXITING TRAFFIC AT THE VTC.

VEHICLE TRACKING CONTROL MAINTENANCE NOTES

1. THE EROSION CONTROL SUPERVISOR SHALL INSPECT VEHICLE TRACKING CONTROL DAILY. GRAVEL SURFACE SHALL BE CLEAN AND LOOSE ENOUGH TO RUT SLIGHTLY UNDER WHEEL LOADS AND CAUSE LOOSE GRAVEL TO DISLODGE MUD FROM TIRES. WHEN GRAVEL BECOMES COMPACTED OR FILLED WITH SEDIMENT SO THAT THE EFFECTIVENESS OF THE PAD IS DIMINISHED, GRADING CONTRACTOR SHALL RIP, TURN OVER, OR OTHERWISE LOOSEN GRAVEL, PLACE ADDITIONAL NEW GRAVEL, OR REPLACE WITH NEW GRAVEL AS NECESSARY TO RESTORE EFFECTIVENESS.
2. VEHICLE TRACKING CONTROL SHALL BE REMOVED AT THE END OF CONSTRUCTION, THE GRAVEL MATERIAL REMOVED OR, IF APPROVED, USED ON SITE, AND TOPSOIL ADDED TO THE AREA, DRILL SEEDED AND CRIMP MULCHED OR OTHERWISE STABILIZED.

VTC **VEHICLE TRACKING CONTROL**
NOT TO SCALE





C SECTION
N.T.S.

SILT FENCE INSTALLATION NOTES

1. SEE PLAN VIEW FOR LOCATION AND LENGTH OF FENCE.
2. ANCHOR TRENCH SHALL BE EXCAVATED WITH TRENCHER, OR WITH SILT FENCE INSTALLATION MACHINE; NO ROAD GRADERS, BACKHOES, ETC. SHALL BE USED. TRENCH SHALL BE COMPACTED BY HAND, WITH "JUMPING JACK", OR BY WHEEL ROLLING. COMPACTION SHALL BE SUCH THAT SILT FENCE RESISTS BEING PULLED OUT OF ANCHOR TRENCH BY HAND.
3. SILT FENCE GEOTEXTILE SHALL MEET THE FOLLOWING REQUIREMENTS:
   - 6-TO 12-GALLONS PER MINUTE PER SQUARE FOOT FLOW CAPACITY.
   - 90 LB. TENSILE STRENGTH PER ASTM D4622.
   - UV DESIGN AT 500 HRS MIN. 70% STRENGTH RETAINED PER ASTM D 4355.
4. SILT FENCE INDICATED ON THE EROSION CONTROL PLAN SHALL BE INSTALLED PRIOR TO ANY LAND-DISTURBING ACTIVITIES.

SILT FENCE MAINTENANCE NOTES

1. INSPECT SILT FENCE DAILY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OR CLEAN OUT UPSTREAM SEDIMENT AS NECESSARY.
2. SEDIMENT ACCUMULATED UPSTREAM OF SILT FENCE SHALL BE REMOVED WHEN THE UPSTREAM SEDIMENT REACHES A DEPTH OF ⅓H.
3. SILT FENCE SHALL BE REMOVED WHEN THE UPSTREAM DISTURBED AREA IS STABILIZED AND GRASS COVER HAS BEEN ESTABLISHED. IF ANY DISTURBED AREA EXISTS AFTER REMOVAL, IT SHALL BE SEEDED AND MULCHED OR OTHERWISE STABILIZED.

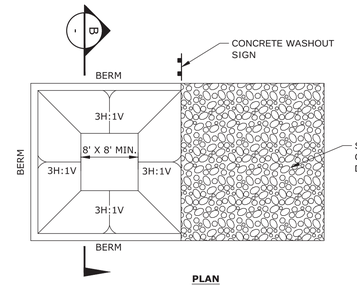
—SF— SF **SILT FENCE**
NOT TO SCALE

CONCRETE WASHOUT AREA INSTALLATION NOTES

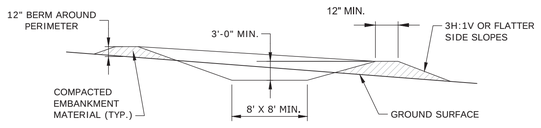
1. SEE PLAN VIEW FOR LOCATIONS OF CONCRETE WASHOUT AREA.
2. THE CONCRETE WASHOUT AREA SHALL BE INSTALLED PRIOR TO ANY CONCRETE PLACEMENT ON SITE.
3. VEHICLE TRACKING CONTROL IS REQUIRED AT THE ACCESS POINT SLOPED AT 2% TOWARDS THE CWA.
4. SIGNS SHALL BE PLACED AT THE CONSTRUCTION ENTRANCE, AT THE WASHOUT AREA,AND ELSEWHERE AS NECESSARY TO CLEARLY INDICATE THE LOCATION OF THE CONCRETE WASHOUT AREA TO OPERATORS OF THE CONCRETE TRUCKS AND PUMP RIGS.
5. EXCAVATED MATERIAL SHALL BE UTILIZED IN PERIMETER BERM CONSTRUCTION.

CONCRETE WASHOUT AREA MAINTENANCE NOTES

1. THE CONCRETE WASHOUT AREA SHALL BE REPAIRED AND ENLARGED OR CLEANED OUT AS NECESSARY TO MAINTAIN CAPACITY FOR WASTED CONCRETE. CONCRETE MATERIALS SHALL BE REMOVED ONCE THE MATERIALS HAVE REACHED A DEPTH OF 2'.
2. AT THE END OF THE CONSTRUCTION PROJECT, ALL CONCRETE SHALL BE REMOVED FROM THE SITE AND DISPOSED OF AT AN APPROVED WASTE SITE.
3. WHEN THE CONCRETE WASHOUT AREA IS REMOVED, COVER THE DISTURBED AREA WITH TOP SOIL, DRILL SEED AND CRIMP MULCH OR OTHERWISE STABILIZE IN A MANNER APPROVED BY GOVERNING AUTHORITY.
4. INSPECT WEEKLY AND DURING AND AFTER ANY STORM EVENT.



PLAN



B SECTION
N.T.S.

CWA **CONCRETE WASHOUT**
NOT TO SCALE

Know what's below. Call before you dig.

COLORADO REGISTERED DWIGHT MATTHEW MORGAN 39814 PROFESSIONAL ENGINEER 11/15/2018

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REFERENCE DRAWINGS

DWG NO.	DESCRIPTION

REVISIONS

NO.	DESCRIPTION	DATE	BY
A	ISSUED FOR PERMIT	11/15/18	DMM

CLIENT | PROJECT ENGINEER | LEAD ENGINEER | CHECK: DMM | MTC

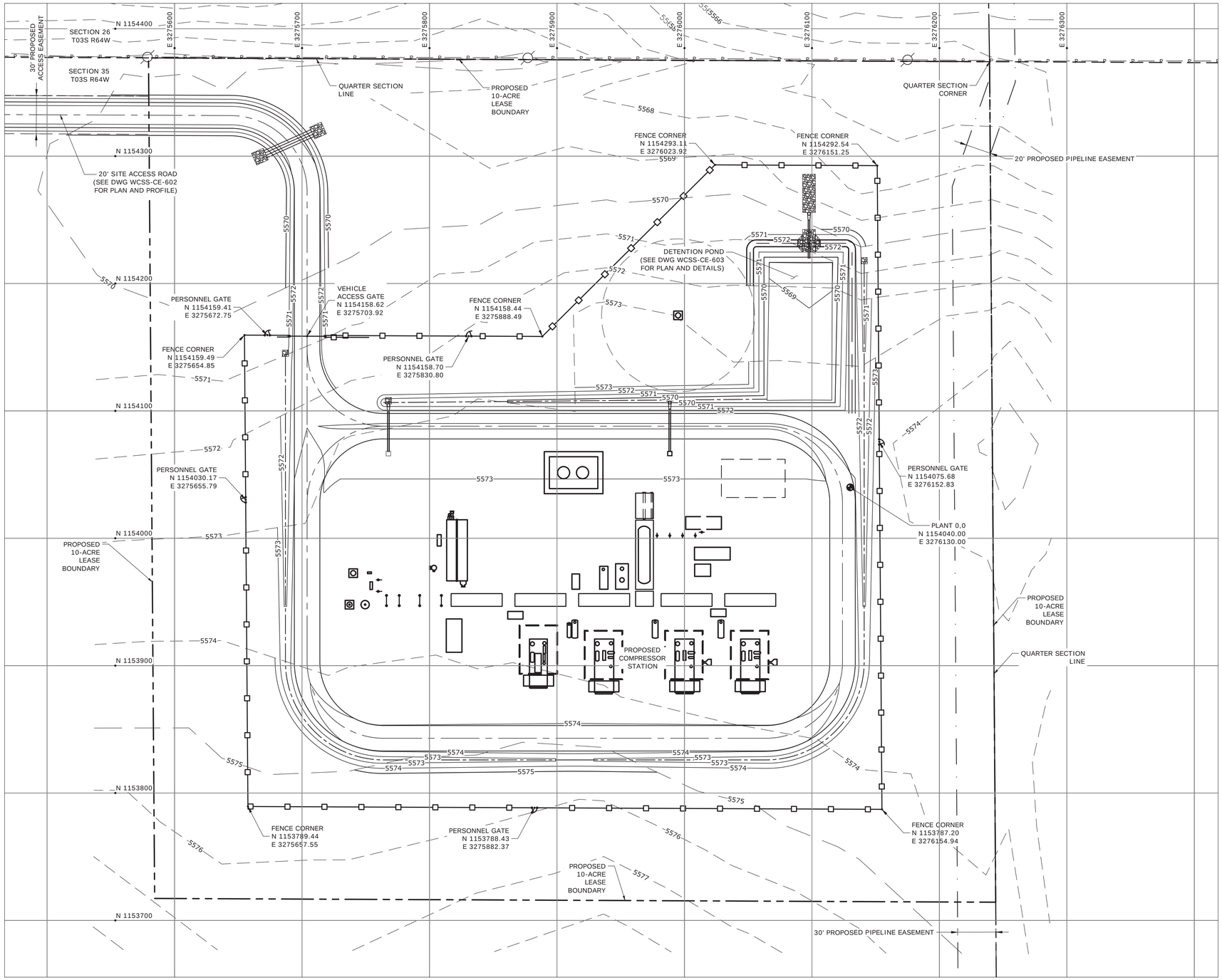
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APPROVED:		
APPROVED:		

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC
LOCATION: ADAMS COUNTY, CO

Samuel Engineering
We Provide Solutions
8450 E. Crescent Parkway, Suite 200
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Phone: 303.714.4840
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WATKINS COMPRESSOR STATION WILLIAMS DJ BASIN FIELD COMPRESSION CIVIL GENERAL EROSION CONTROL NOTES & DETAILS	18256
	DRAWING NUMBER
	WCSS-CE-403 REV. A

Plot Date: Thursday, November 15, 2018 2:28:32 PM Plotted By: Matt Morgan
CTB Used: SE_Std_B&W_Full_size.ctb



NOTES

1. SEE LANDSCAPE PLANS (BY OTHERS) FOR DETAILS AND ADDITIONAL INFORMATION.
2. SITE GRADING SHOULD BE COMPLETE BEFORE THE FENCE IS INSTALLED. THE FENCE CONTRACTOR SHALL COORDINATE WITH THE OWNER (OR OWNER'S REPRESENTATIVE) TO CONFIRM FINAL GRADES ALONG THE FENCE ALIGNMENT.
3. THE FENCE INSTALLATION CONTRACTOR MAY ADJUST POST AND/OR GATE LOCATIONS TO BETTER FIT THE POST LAYOUT OR TERRAIN WITH PERMISSION FROM OWNER'S OPERATIONS PERSONNEL.
4. COORDINATES FOR GATES ARE SHOWN AT THE CENTER OF THE GATE.
5. ALL PERSONNEL GATES SHALL SWING OUT (AWAY FROM PLANT).
6. ANY SUBSTITUTIONS SHALL BE APPROVED BY THE ENGINEER AND OWNER PRIOR TO INSTALLATION.
7. THE CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING AND PROTECTING ALL UNDERGROUND UTILITIES WHETHER LOCATED ON SURVEY OR ENCOUNTERED IN THE FIELD DURING CONSTRUCTION. CAUTION SHOULD BE TAKEN DURING ALL EXCAVATION DURING EXCAVATION OF ALL SOIL AND FOUNDATIONS WITHIN THE LIMITS OF DISTURBANCE. CONTACT ENGINEER IF CONFLICTS ARE ENCOUNTERED.
8. IF ANY EXISTING FENCE IS REMOVED, THE EXISTING FENCE POSTS SHALL BE CUT OFF FLUSH WITH EXISTING GRADE AND THE NEW POSTS SHALL BE INSTALLED ADJACENT TO THE OLD POSTS ALONG PROPERTY LINES. CORNER POST COORDINATES SHALL BE ADJUSTED AS REQUIRED TO THE INSIDE OF THE EXISTING POST SO AS NOT TO OVERHANG PROPERTY LINES.
9. ANY EXISTING FENCING AND POSTS REMOVED DURING CONSTRUCTION SHALL BE DISPOSED OF OFFSITE AT AN OWNER APPROVED DISPOSAL SITE BY THE FENCE INSTALLATION CONTRACTOR.
10. FENCE INSTALLATION CONTRACTOR SHALL ENSURE THAT ALL NEW FENCING IS INSTALLED WITHIN THE LEASE BOUNDARY.
11. KNOX FIRE DEPARTMENT GATE ACCESS TO THE FACILITY SHALL BE PROVIDED AND MAINTAINED AT ALL TIMES.

LEGEND

- 7' ORNAMENTAL IRON SECURITY FENCE *
- ORNAMENTAL IRON SECURITY GATE (20' MIN.) WITH KNOX ACCESS *
- PERSONNEL GATE WITH PANIC HARDWARE *

*BY FENCING CONTRACTOR

NORTH

0' 20' 40' 80' 120'

SCALE: 1" = 40'

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REFERENCE DRAWINGS

DWG NO.	DESCRIPTION

REVISIONS

NO.	DESCRIPTION	DATE	BY

REVISIONS

NO.	DESCRIPTION	DATE	BY
A	ISSUED FOR PERMIT - RESPONSE TO COMMENT	01/21/19	LER

CLIENT MTC | PROJECT ENGINEER MTC | LEAD ENGINEER | CHECK

SCALE:	1" = 40'	DATE
DESIGNED:	M. CLOUD	01/21/2019
DRAWN:	L. ROOT	01/21/2019
CHECKED:	M. CLOUD	01/21/2019
APPROVED:		
APPROVED:		

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC

LOCATION: ADAMS COUNTY, CO

Williams

Samuel Engineering
We Provide Solutions
8450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
Phone: 303.714.4840
Fax: 303.714.4800

TITLE

WATKINS COMPRESSOR STATION
WILLIAMS DJ BASIN FIELD COMPRESSION
CIVIL
GENERAL
FENCING PLAN

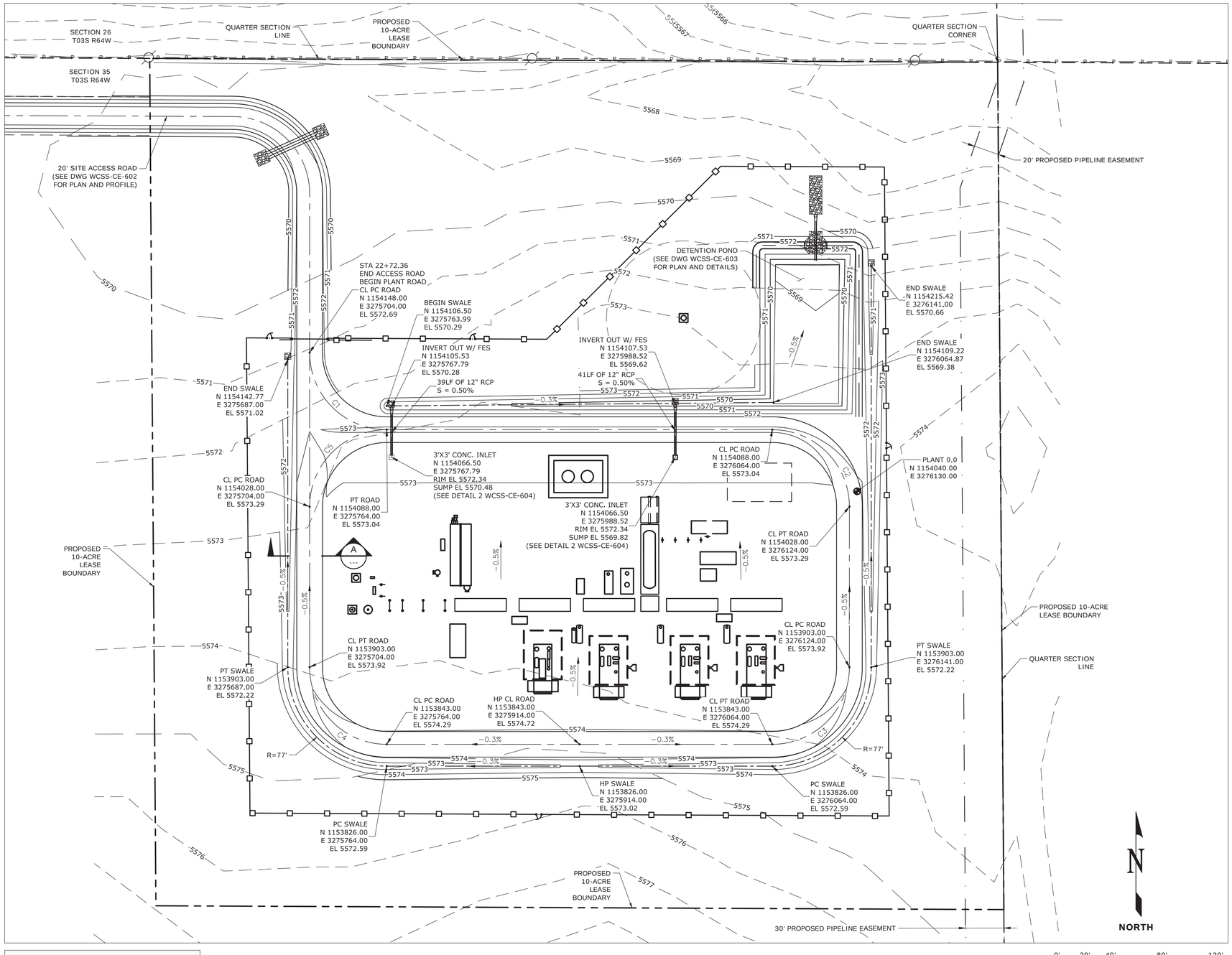
PROJECT NUMBER

18256

DRAWING NUMBER

WCSS-CE-501 REV. A

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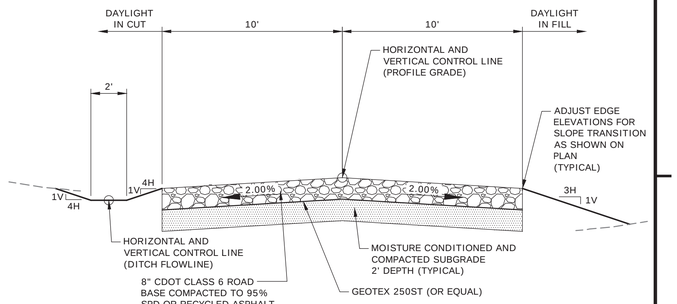
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C4	60.00	90.00°	94.25
C5	60.00	90.00°	94.25

NOTES

1. THE WATKINS COMPRESSOR STATION PROPOSED SITE IS A 10-ACRE LEASE LOCATED IN THE NORTHWEST QUARTER OF SECTION 35, TOWNSHIP 3 SOUTH, RANGE 64 WEST, 6TH PRINCIPAL MERIDIAN, ADAMS COUNTY, STATE OF COLORADO.
2. THE SITE SURVEY FOR THIS PROJECT WAS PREPARED BY ACKLAM, INC. AND WAS RECEIVED ON 10/12/2018.

   HORIZONTAL DATUM: BASED ON COLORADO STATE PLANE COORDINATES, NORTH ZONE, NORTH AMERICAN HORIZONTAL DATUM, 1983 (US SURVEY FEET).

   VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM 1988.
3. THE SITE CONSISTS OF EXISTING CROP LAND. PRIOR TO BEGINNING EARTHWORK OPERATIONS, CLEAR SITE OF ALL ORGANIC AND/OR UNSUITABLE MATERIALS. SCARIFY, MOISTURE TREAT AND COMPACT THE SUBGRADE PRIOR TO PLACING FILL OR SURFACE MATERIALS.
4. ALL CUT AND FILL SLOPES ARE 3H:1V UNLESS NOTED OTHERWISE ON THE DRAWINGS.
5. GRADING ELEVATIONS SHOWN ARE TO TOP OF FINISHED SURFACING. FOR ROUGH GRADE ELEVATIONS SUBTRACT 8" FROM ROAD AREAS AND 4" FROM ALL OTHER ELEVATIONS SHOWN.
6. ALL SOILS SHALL BE COMPACTED TO A MINIMUM OF 95% OF THE STANDARD PROCTOR DENSITY (SPD) AT ± 2% OF THE OPTIMUM MOISTURE CONTENT ASTM D-698. REFER TO THE PROJECT GEOTECHNICAL INVESTIGATION FOR ADDITIONAL INFORMATION AND SITE SPECIFIC REQUIREMENTS.
7. THE CONTRACTOR WILL BE RESPONSIBLE FOR LOCATING AND PROTECTING ALL UNDERGROUND UTILITIES. THE CONTRACTOR IS TO ENSURE THAT 811 AND DISCOVERY SITE PERSONNEL ARE CONTACTED PRIOR TO COMMENCING CONSTRUCTION ACTIVITIES. CAUTION SHOULD BE TAKEN DURING ALL EXCAVATION OF SOIL AND FOUNDATIONS WITHIN THE LIMITS OF DISTURBANCE. CONTACT ENGINEER IF THERE ARE CONFLICTS.
8. THE MAJORITY OF THE SITE GRAVEL WILL BE INSTALLED AFTER EQUIPMENT IS SET AND FINAL GRADING IS COMPLETE. THE CONTRACTOR IS TO COORDINATE WITH DISCOVERY FOR ALL GRAVEL INSTALLATION TIMING.
9. THE CONTRACTOR IS TO SUBMIT A GRADATION SAMPLE TO DISCOVERY PRIOR TO PLACING GRAVEL MATERIAL. DISCOVERY PERSONNEL WILL DETERMINE SIZE OF GRAVEL TO BE USED. PLACE CRUSHED GRANITE FOR THE SITE BENCH AREAS AS DIRECTED BY THE OWNER'S REPRESENTATIVE.
10. INTERIOR ACCESS ROADS SHALL HAVE A MINIMUM OF 8" CDOT CLASS 6 ROAD BASE PLACED OVER GEOTEX 250ST WOVEN POLYPROPYLENE GEOTEXTILE FABRIC AS MANUFACTURED BY PROPEX, INC. OR EQUIVALENT. RECYCLED ASPHALT OF SIMILAR GRADATION OF THE SPECIFIED ROAD BASE CAN BE SUBSTITUTED FOR ROAD BASE WITH COUNTY APPROVAL.
11. ALL AREAS WITHIN THE SECURITY FENCE SHALL BE MAINTAINED VEGETATION FREE 4" GRAVEL FOR THE LIFE OF THE FACILITY.
12. ALL EQUIPMENT PAD AREAS SHALL HAVE A MINIMUM OF 4" CRUSHED GRAVEL PLACED ON COMPACTED SUBGRADE FOR FINAL SURFACING.
13. PERIMETER SILT FENCE IS TO BE INSTALLED PRIOR TO ANY CONSTRUCTION ACTIVITIES. ALL OTHER EROSION CONTROL MEASURES CAN BE INSTALLED AFTER ROUGH GRADING IS COMPLETE.
14. SEE DRAWING WCSS-CE-103 FOR SITE PLAN AND NOTES, WCSS-CE-401 FOR EROSION CONTROL, SURFACING, CLEARING & GRUBBING PLAN AND NOTES, WCSS-CE-602 FOR SITE ACCESS ROAD PLAN AND PROFILE AND WCSS-CE-603 FOR DETENTION BASIN DETAILS.



A ... TYPICAL SECTION - 20' CROWN PLANT ROAD
NTS

LEGEND

- EXISTING MAJOR CONTOUR (5405)
- EXISTING MINOR CONTOUR (5403)
- PROPOSED MAJOR CONTOUR (5405)
- PROPOSED MINOR CONTOUR (5403)
- EASEMENT LINE
- LEASE BOUNDARY
- SECTION LINE
- 1/4 SECTION LINE
- PIPELINE EASEMENT
- RIGHT-OF-WAY (ROW)
- EXISTING OVERHEAD POWER (P P P)

ABBREVIATIONS

PC	POINT OF CURVATURE
PCC	POINT OF COMPOUND CURVATURE
PRC	POINT OF REVERSE CURVATURE
PI	POINT OF INTERSECTION
PT	POINT OF TANGENCY
ROW	RIGHT-OF-WAY
BTM	BOTTOM
CL	CENTERLINE
FL	FLOWLINE
E	EASTING
EL	ELEVATION
HP	HIGH POINT
LP	LOW POINT
MP	MID POINT
N	NORTHING
GB	GRADE BREAK
EOP	EDGE OF PAVEMENT/GRAVEL

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REFERENCE DRAWINGS

DWG NO.	DESCRIPTION

REVISIONS

NO.	DESCRIPTION	DATE	BY

REVISIONS

CLIENT	PROJECT ENGINEER	LEAD ENGINEER	CHECK	NO.	DESCRIPTION	DATE	BY
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		DMM	MTC	A	ISSUED FOR PERMIT	11/15/18	DMM

SCALE:	1" = 40'	DATE
DESIGNED:	M. MORGAN	11/15/2018
DRAWN:	M. MORGAN	10/18/2018
CHECKED:	M. CLOUD	11/15/2018
APPROVED:		
APPROVED:		

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC
LOCATION: ADAMS COUNTY, CO

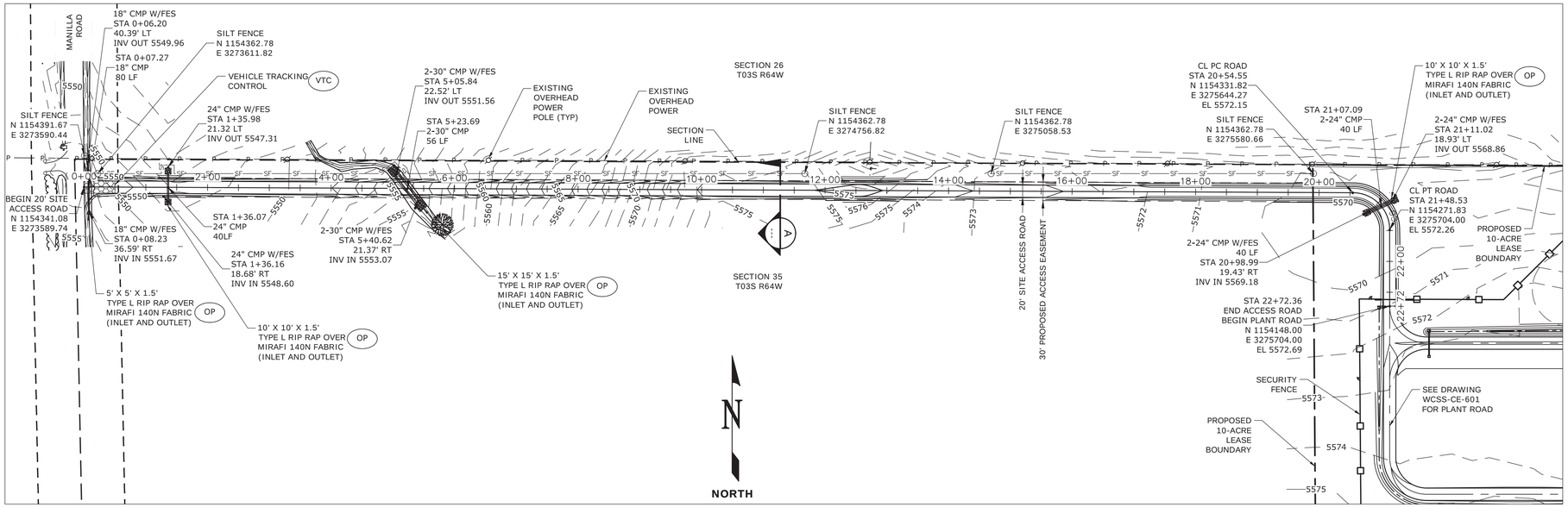
Samuel Engineering
We Provide Solutions
9450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
Phone: 303.714.4840
Fax: 303.714.4800

TITLE
WATKINS COMPRESSOR STATION
WILLIAMS DJ BASIN FIELD COMPRESSION
CIVIL
GENERAL
GRADING AND DRAINAGE PLAN

PROJECT NUMBER
18256

DRAWING NUMBER
WCSS-CE-601 REV. B

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CTB Used: SE_5to1_B&W_Full_Size.ctb



SITE ACCESS ROAD PLAN
STA. 0+00 TO 22+72

0' 50' 100' 200' 300'

SCALE: 1" = 100'

CURVE TABLE

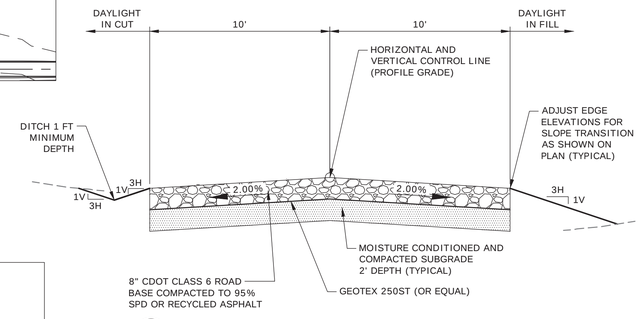
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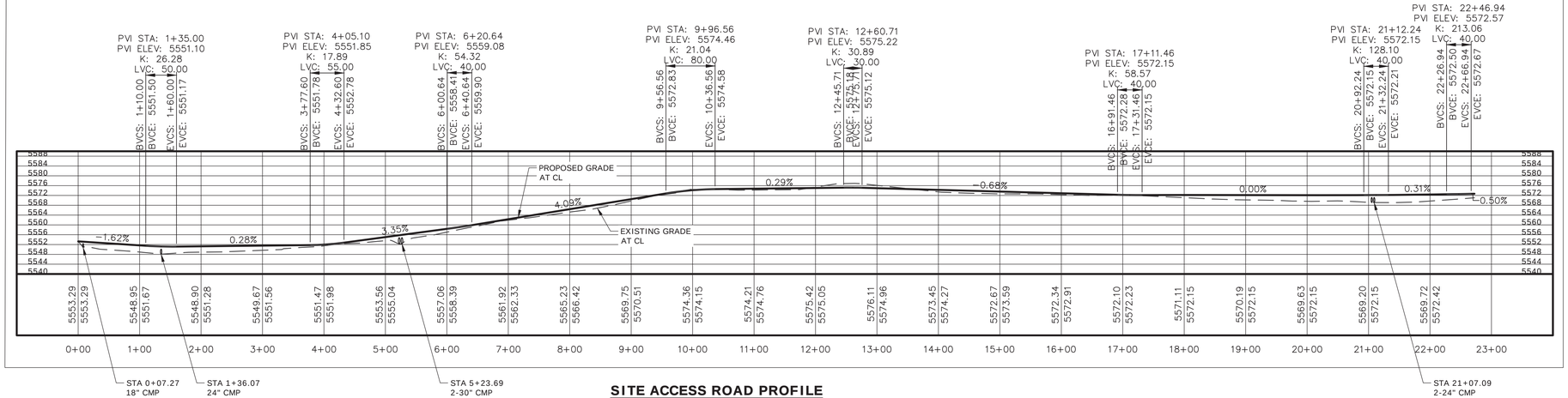
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10. SEE DRAWINGS WCSS-CE-102, 103, AND 104 FOR SITE PLAN AND NOTES, WCSS-CE-401 FOR EROSION CONTROL, SURFACING, CLEARING & GRUBBING PLAN AND NOTES, AND WCSS-CE-603 FOR DETENTION BASIN DETAILS.
11. SEE DRAWING WCSS-CE-601 FOR SITE SPECIFIC CONSTRUCTION NOTES AND DETAILS.



A — TYPICAL SECTION - 20' CROWN SITE ACCESS ROAD
NTS



SITE ACCESS ROAD PROFILE
STA. 0+00 TO 22+72

SCALE:
HORIZONTAL 1"=100'
VERTICAL 1"=25'

LEGEND

- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- PROPOSED MAJOR CONTOUR
- PROPOSED MINOR CONTOUR
- EASEMENT LINE
- LEASE BOUNDARY
- SECTION LINE
- 1/4 SECTION LINE
- PIPELINE EASEMENT
- RIGHT-OF-WAY (ROW)
- EXISTING OVERHEAD POWER

ABBREVIATIONS

PC	POINT OF CURVATURE
PCC	POINT OF COMPOUND CURVATURE
PRC	POINT OF REVERSE CURVATURE
PI	POINT OF INTERSECTION
PT	POINT OF TANGENCY
ROW	RIGHT-OF-WAY
BTM	BOTTOM
CL	CENTERLINE
FL	FLOWLINE
E	EASTING
EL	ELEVATION
HP	HIGH POINT
LP	LOW POINT
MP	MID POINT
N	NORTHING
GB	GRADE BREAK
EOP	EDGE OF PAVEMENT/GRAVEL

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REVISIONS

NO.	DESCRIPTION	DATE	BY
B	ISSUED FOR PERMIT - RESPONSE TO COMMENT	01/21/19	LER
A	ISSUED FOR PERMIT	11/15/18	DMM

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PROJECT ENGINEER: MTC
LEAD ENGINEER:
CHECK:

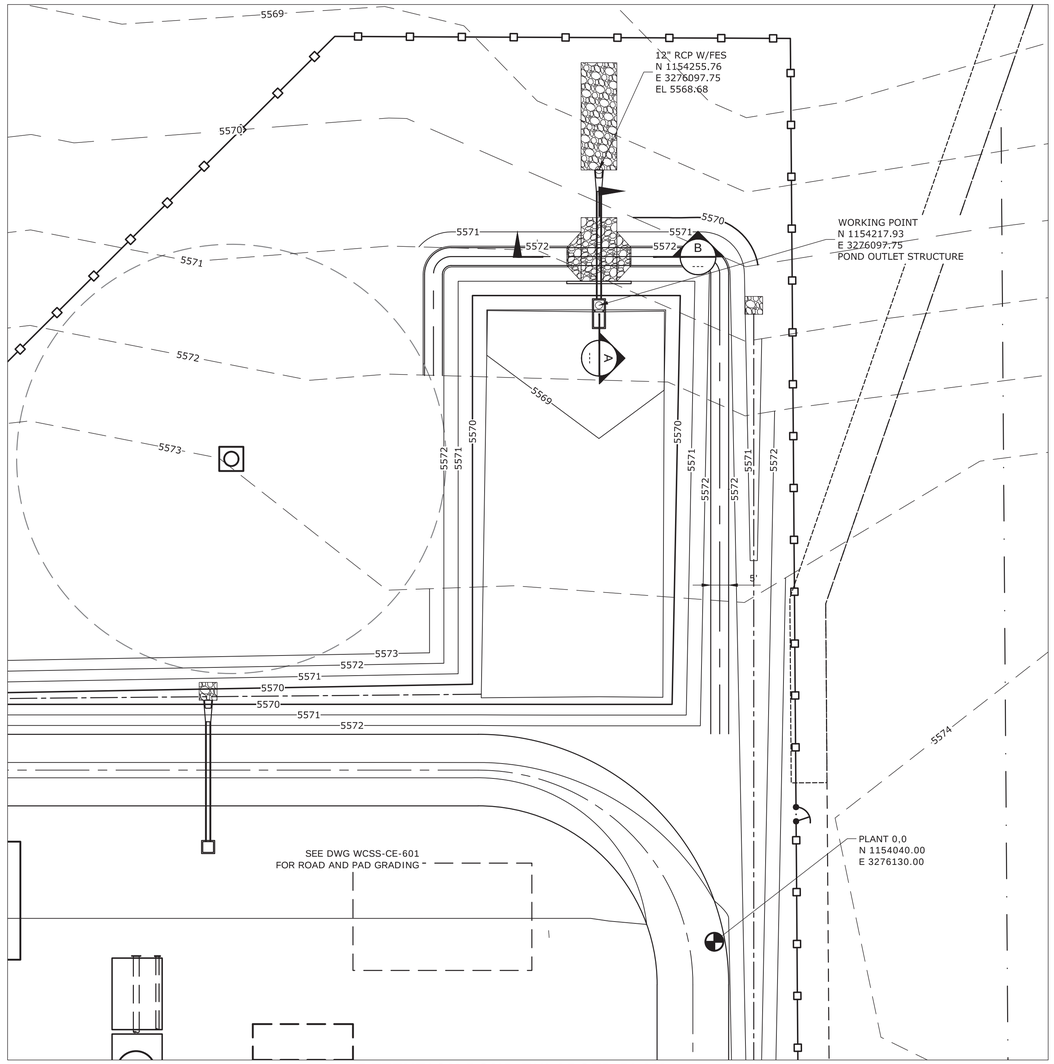
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DESIGNED: M. MORGAN 11/15/2018
DRAWN: M. MORGAN 10/18/2018
CHECKED: M. CLOUD 11/15/2018
APPROVED:
APPROVED:
DATE

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC
LOCATION: ADAMS COUNTY, CO

Samuel Engineering
We Provide Solutions
8450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
Phone: 303.714.4840
Fax: 303.714.4800

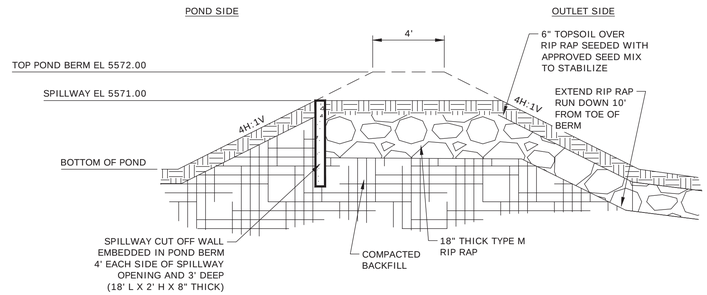
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WATKINS COMPRESSOR STATION WILLIAMS DJ BASIN FIELD COMPRESSION CIVIL GENERAL SITE ACCESS ROAD PLAN AND PROFILE	18256
	DRAWING NUMBER
	WCSS-CE-602 REV. B

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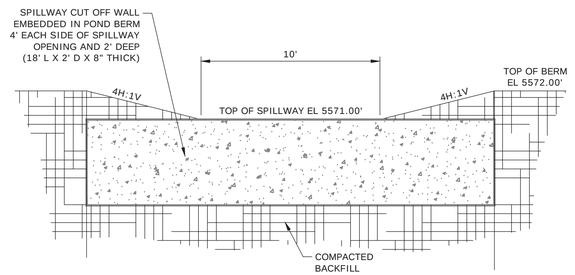


DETENTION POND ENLARGED PLAN
SCALE: 1" = 20'

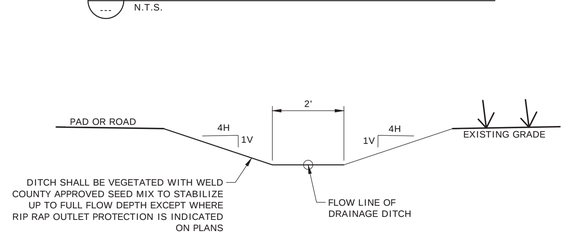
SCALE: 1" = 20'



A — SECTION - EMERGENCY OVERFLOW SPILLWAY
N.T.S.



B — SECTION - EMERGENCY OVERFLOW SPILLWAY
N.T.S.



TYPICAL DRAINAGE DITCH SECTION
SCALE: 1/2" = 1'

LEGEND

- 5405 — EXISTING MAJOR CONTOUR
- 5403 — EXISTING MINOR CONTOUR
- 5405 — PROPOSED MAJOR CONTOUR
- 5403 — PROPOSED MINOR CONTOUR
- EASEMENT LINE
- LEASE BOUNDARY
- SECTION LINE
- 1/4 SECTION LINE
- PIPELINE EASEMENT
- RIGHT-OF-WAY (ROW)
- P — P — P — EXISTING OVERHEAD POWER
- SECURITY FENCE
- DRAINAGE FLOW ARROW

WATKINS COMPRESSOR STATION STAGE-STORAGE				
INTERVAL (FT)	ELEVATION (FT)	AREA (SF)	VOLUME (CF)	DESCRIPTION
0.00	5568.86	0.00	0.00	BOTTOM POND
0.50	5569.36	5658.49	1375.06	
0.64	5569.50	5864.24	2183.48	WQCV
1.00	5569.86	6324.36	4376.99	
1.38	5570.24	6825.80	6875.01	5-YR DESIGN VOLUME + WQCV
1.50	5570.36	6987.51	7703.79	
2.00	5570.86	7678.71	11369.18	100-YR DESIGN VOLUME
2.14	5571.00	7877.27	12458.07	100-YR + 1/2WQCV, SPILLWAY ELEV.
3.14	5572.00	9357.40	21066.73	FREEBOARD

1 — DETAIL - DETENTION POND STAGE-STORAGE

NOTES

1. FOR GRADING PLAN NOTES AND ABBREVIATIONS SEE DRAWING WCSS-CE-601.
2. SEE DETAIL 3, WCS-CE-604 FOR OUTLET STRUCTURE DETAILS.

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DWG NO.	DESCRIPTION

REVISIONS

NO.	DESCRIPTION	DATE	BY

REVISIONS

NO.	DESCRIPTION	DATE	BY	CLIENT	PROJECT ENGINEER	LEAD ENGINEER	CHECK
B	ISSUED FOR PERMIT - RESPONSE TO COMMENT	01/21/19	LER	MTC	MTC		
A	ISSUED FOR PERMIT	11/15/18	DMM	DMM	MTC		

SCALE:	AS SHOWN	DATE
DESIGNED:	M. MORGAN	11/15/2018
DRAWN:	M. MORGAN	10/18/2018
CHECKED:	M. CLOUD	11/15/2018
APPROVED:		
APPROVED:		

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC
LOCATION: ADAMS COUNTY, CO

Williams

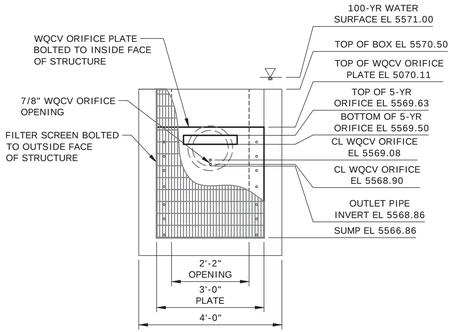
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We Provide Solutions
8450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
Phone: 303.714.4840
Fax: 303.714.4800

TITLE
WATKINS COMPRESSOR STATION
WILLIAMS DJ BASIN FIELD COMPRESSION
CIVIL
GENERAL
GRADING AND DRAINAGE DETAILS

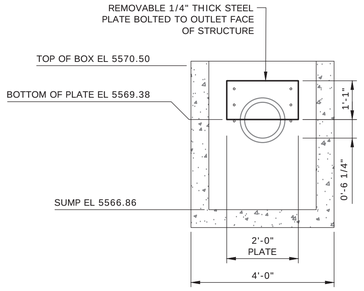
PROJECT NUMBER
18256

DRAWING NUMBER
WCSS-CE-603 REV. B

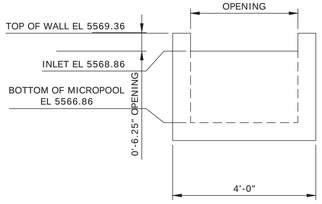
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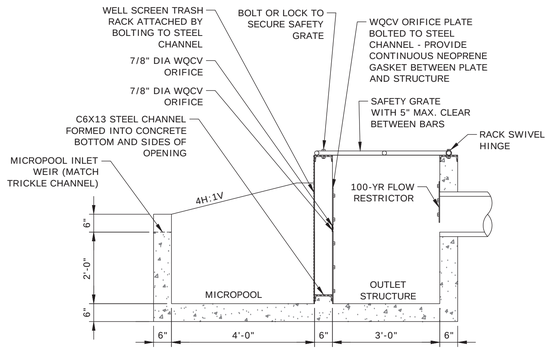
E — FILTER SCREEN & WQCV ORIFICE PLATE
1/2" = 1'



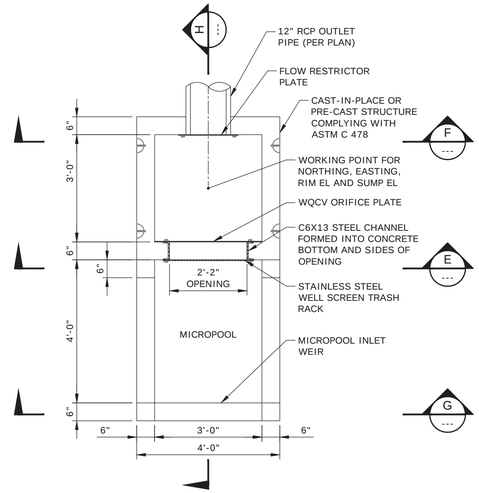
F — 100-YR FLOW RESTRICTOR PLATE
1/2" = 1'



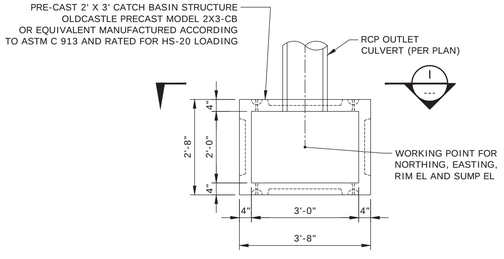
G — MICROPOOL INLET WEIR
1/2" = 1'



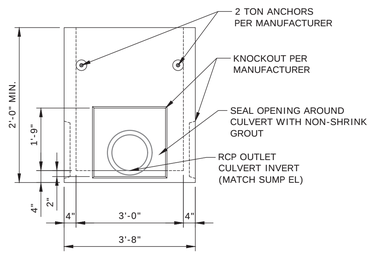
H — POND OUTLET STRUCTURE SECTION
1/2" = 1'



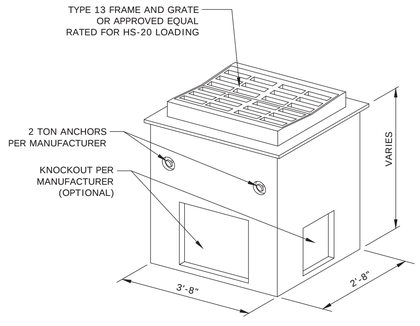
1 — DETAIL - DETENTION POND OUTLET STRUCTURE PLAN
1/2" = 1'



PLAN VIEW
FRAME & GRATE NOT SHOWN



I — RCP CONNECTION TO DROP INLET
1/2" = 1'



ISOMETRIC VIEW

2 — DETAIL - DROP INLET STRUCTURE
1/2" = 1'

0' 1' 2' 4' 6'
SCALE: 1/2" = 1'-0"

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COLORADO REGISTERED DAVID MATTHEW MORGAN 39814 PROFESSIONAL ENGINEER 11/15/2018

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REFERENCE DRAWINGS

DWG NO.	DESCRIPTION

REVISIONS

NO.	DESCRIPTION	DATE	BY

REVISIONS

NO.	DESCRIPTION	DATE	BY
A	ISSUED FOR PERMIT	11/15/18	DMM

SCALE:	AS SHOWN	DATE
DESIGNED:	M. MORGAN	11/15/2018
DRAWN:	M. MORGAN	10/18/2018
CHECKED:	M. CLOUD	11/15/2018
APPROVED:		
APPROVED:		

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC
LOCATION: ADAMS COUNTY, CO

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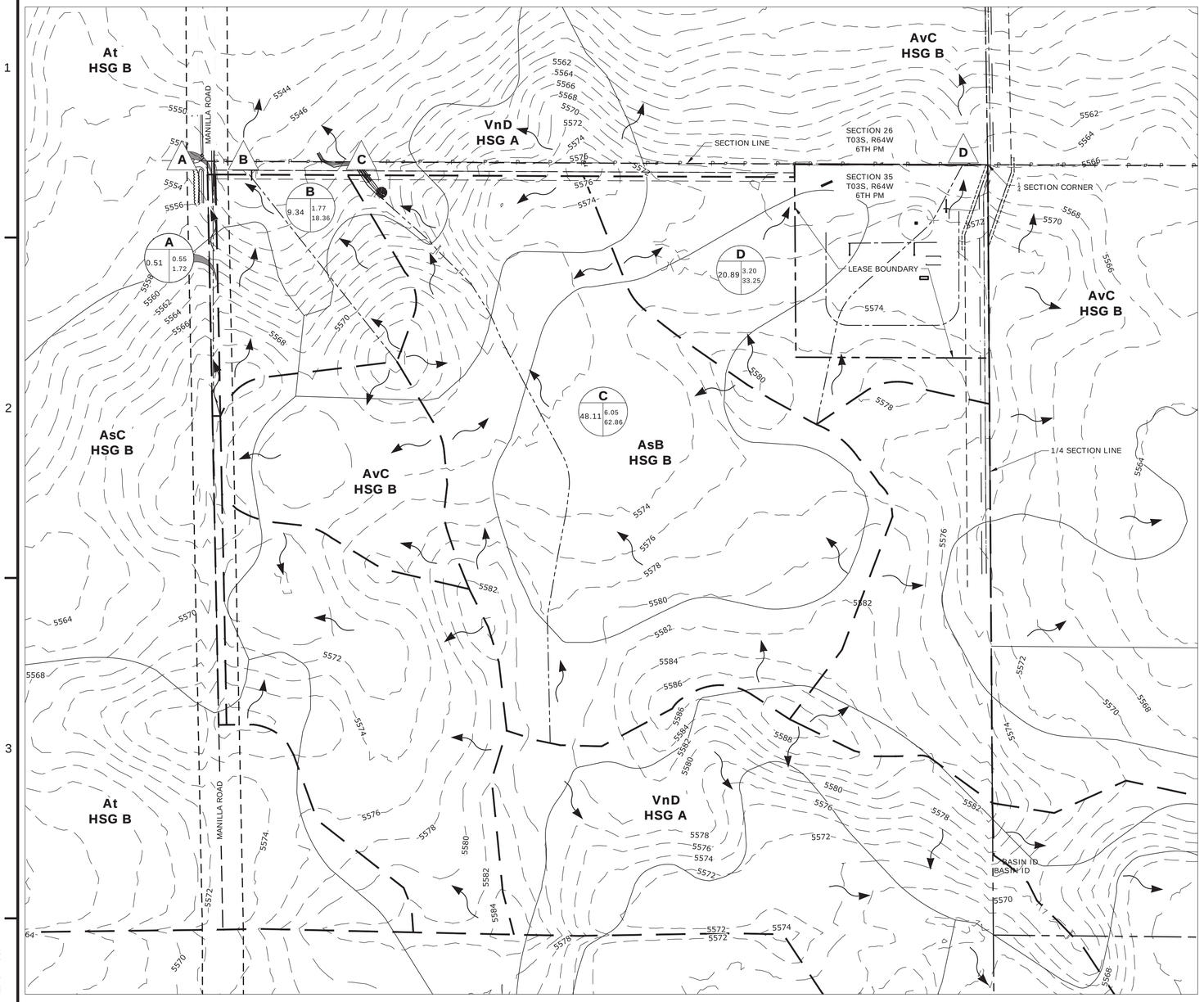
TITLE
WATKINS COMPRESSOR STATION
WILLIAMS DJ BASIN FIELD COMPRESSION
CIVIL
GENERAL
DRAINAGE STRUCTURE DETAILS

PROJECT NUMBER
18256

DRAWING NUMBER
WCSS-CE-604

REV.
A

Plot Date: Thursday, November 15, 2018 3:25:43 PM Plotted By: Matt Morgan
CTB Used: SE_Std_B&W_Full_size.ctb



NOTES

1. THE WATKINS COMPRESSOR STATION SOUTH PROPOSED SITE IS A 10-ACRE LEASE LOCATED IN THE NORTHWEST QUARTER OF SECTION 35, TOWNSHIP 3 SOUTH, RANGE 64 WEST, 6TH PRINCIPAL MERIDIAN, ADAMS COUNTY, STATE OF COLORADO.
2. THE SITE SURVEY FOR THIS PROJECT WAS PREPARED BY ACKLAM, INC. AND WAS RECEIVED ON 10/12/2018.

   HORIZONTAL DATUM: BASED ON COLORADO STATE PLANE COORDINATES, NORTH ZONE, NORTH AMERICAN HORIZONTAL DATUM, 1983 (US SURVEY FEET).

   VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM 1988.
3. FOR GRADING AND DRAINAGE PLANS SEE WCSS-CE-601 AND WCSS-CE-602. FOR EROSION CONTROL AND SURFACING SEE PLAN WCSS-CE-401. FOR DRAINAGE MAPS SEE DRAWINGS WCSS-CE-610 AND WCSS-CE-611.
4. OFFSITE PIPE CONNECTIONS TO THE COMPRESSOR STATION DESIGNED AND INSTALLED BY OTHERS.
5. THE PROJECT SITE HAS NO EXISTING UTILITIES OR STORM DRAINAGE FEATURES.

LEGEND

- EXISTING MAJOR CONTOUR (5405)
- EXISTING MINOR CONTOUR (5403)
- PROPOSED MAJOR CONTOUR (5405)
- PROPOSED MINOR CONTOUR (5403)
- EASEMENT LINE
- LEASE BOUNDARY
- SECTION LINE
- 1/4 SECTION LINE
- PIPELINE EASEMENT
- RIGHT-OF-WAY (ROW)
- SECURITY FENCE
- EXISTING CONDITIONS BASIN BOUNDARY
- TIME OF CONCENTRATION PATH
- EXISTING OVERHEAD POWER (P — P — P)
- DRAINAGE FLOW ARROW
- AvC HSG A — NRCS HYDROLOGIC SOIL GROUP
- A — DESIGN POINT
- BASIN ID, BASIN AREA (AC), Q_5, Q_{100} — BASIN HYDROLOGY

DRAINAGE BASIN SUMMARY

BASIN	DESIGN POINT	DESCRIPTION	CONTRIBUTING AREA (ACRES)	HYDROLOGIC SOIL GROUP (HSG)	IMPERVIOUS AREA (%)	BASIN FLOW LENGTH (FT)	BASIN FLOW SLOPE (%)	5-YR RUNOFF COEFFICIENT C_5	100-YR RUNOFF COEFFICIENT C_{100}	5-YR PEAK FLOW RATE (CFS) Q_5	100-YR PEAK FLOW RATE (CFS) Q_{100}
A	A	EX. CONDITIONS BASIN	0.51	B	50.0	827	2.78	0.40	0.66	0.55	1.72
B	B	EX. CONDITIONS BASIN	9.34	B	2.0	813	3.75	0.08	0.44	1.77	18.36
C	C	EX. CONDITIONS BASIN	48.11	B	2.0	2182	1.19	0.08	0.44	6.05	62.86
D	D	EX. CONDITIONS BASIN ENCOMPASSING SITE	20.89	B	2.0	1054	1.12	0.08	0.44	3.20	33.25

NRCS WEB SOIL SURVEY DATA

MAP UNIT SYMBOL	MAP SOIL NAME	HYDROLOGIC SOIL GROUP RATING
AsB	ASCALON SANDY LOAM, (0%-3% SLOPES)	B
AsC	ASCALON SANDY LOAM, (3%-5% SLOPES)	B
At	ASCALON-PLATNER ASSOCIATION	B
AvC	ASCALON-VONA SANDY LOAM, (1%-5% SLOPES)	B
VnD	VONA LOAMY SAND, (3% TO 9% SLOPES)	A

NORTH

0' 100' 200' 400' 600'

SCALE: 1" = 200'

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COLORADO LICENSED — MICHAEL T. CLOUD — 49458 — 01-21-19 — PROFESSIONAL ENGINEER

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CTB Used: SE_Std_B&W_Full_size.ctb

REFERENCE DRAWINGS

DWG NO.	DESCRIPTION

REVISIONS

NO.	DESCRIPTION	DATE	BY
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A	ISSUED FOR PERMIT	11/15/18	DMM

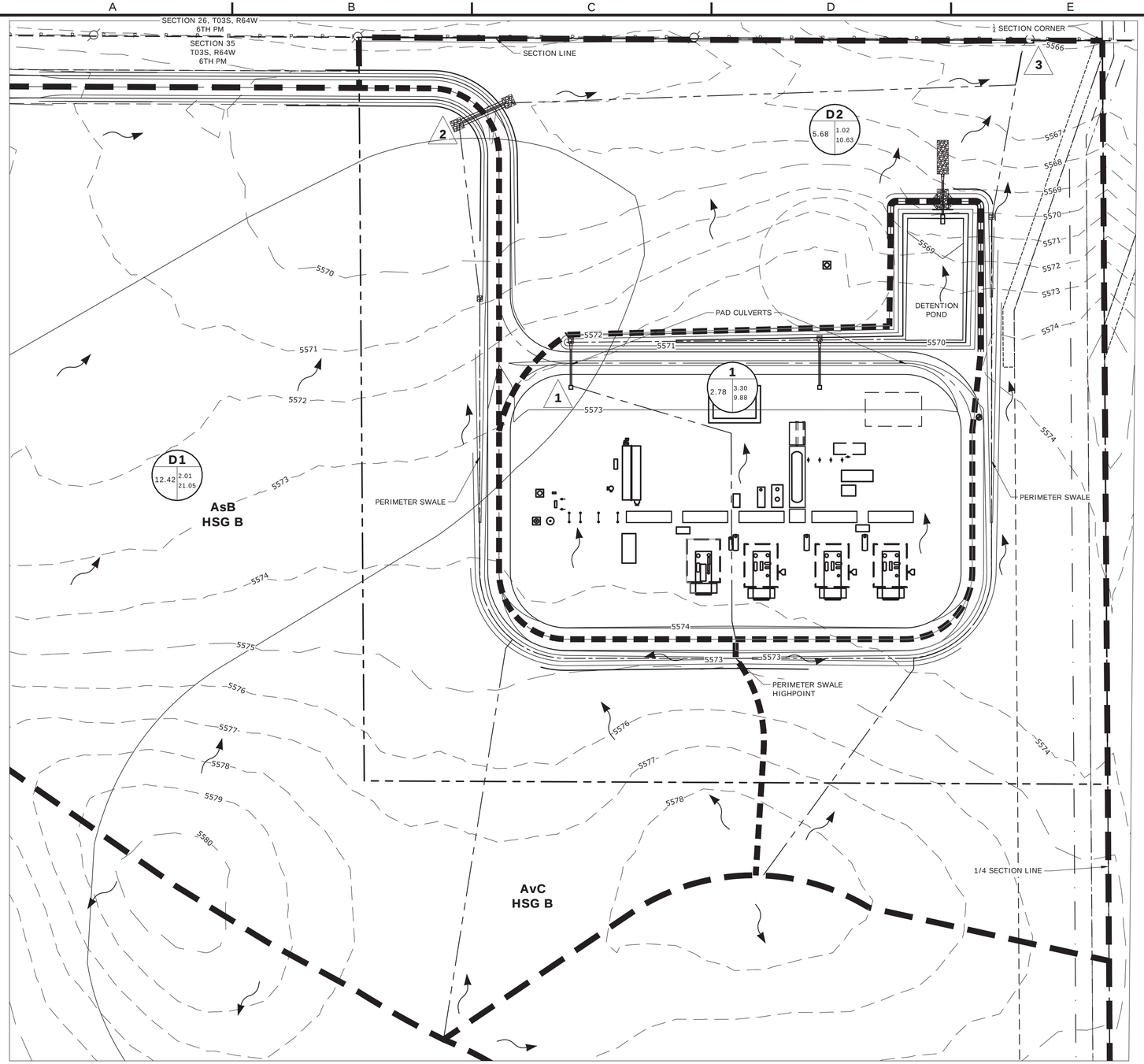
SCALE:	1" = 200'
DESIGNED:	M. MORGAN 11/15/2018
DRAWN:	M. MORGAN 10/18/2018
CHECKED:	M. CLOUD 11/15/2018
APPROVED:	
APPROVED:	

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC

LOCATION: ADAMS COUNTY, CO

Samuel Engineering
We Provide Solutions
8450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
Phone: 303.714.4840
Fax: 303.714.4800

TITLE	PROJECT NUMBER
WATKINS COMPRESSOR STATION WILLIAMS DJ BASIN FIELD COMPRESSION CIVIL GENERAL PREDEVELOPED CONDITIONS DRAINAGE MAP	18256
	DRAWING NUMBER
	WCSS-CE-610 REV. B



NOTES

1. THE WATKINS COMPRESSOR STATION SOUTH PROPOSED SITE IS A 10-ACRE LEASE LOCATED IN THE NORTHWEST QUARTER OF SECTION 35, TOWNSHIP 3 SOUTH, RANGE 64 WEST, 6TH PRINCIPAL MERIDIAN, ADAMS COUNTY, STATE OF COLORADO.
2. THE SITE SURVEY FOR THIS PROJECT WAS PREPARED BY ACKLAM, INC. AND WAS RECEIVED ON 10/12/2018.

   HORIZONTAL DATUM: BASED ON COLORADO STATE PLANE COORDINATES, NORTH ZONE, NORTH AMERICAN HORIZONTAL DATUM, 1983 (US SURVEY FEET).

   VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM 1988.
3. FOR GRADING AND DRAINAGE PLANS SEE WCSS-CE-601 AND WCSS-CE-602. FOR EROSION CONTROL AND SURFACING SEE PLAN WCSS-CE-401. FOR PREDEVELOPED CONDITIONS DRAINAGE MAP SEE WCSS-CE-610.
4. OFFSITE PIPE CONNECTIONS TO THE COMPRESSOR STATION DESIGNED AND INSTALLED BY OTHERS.
5. THE PROJECT SITE HAS NO EXISTING UTILITIES OR STORM DRAINAGE FEATURES.

LEGEND

- 5405 — EXISTING MAJOR CONTOUR
- 5403 — EXISTING MINOR CONTOUR
- 5405 — PROPOSED MAJOR CONTOUR
- 5403 — PROPOSED MINOR CONTOUR
- EASEMENT LINE
- LEASE BOUNDARY
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- SECURITY FENCE
- EXISTING CONDITIONS BASIN BOUNDARY
- DEVELOPED CONDITIONS BASIN BOUNDARY
- TIME OF CONCENTRATION FLOWPATH
- P P P — EXISTING OVERHEAD POWER
- DRAINAGE FLOW ARROW
- AvC HSG A — NRCS HYDROLOGIC SOIL GROUP
- A — DESIGN POINT
- BASIN ID, BASIN AREA (AC): B, 15.99, XX.XX, XX.XX — BASIN HYDROLOGY (Q_5, Q_{100})

DRAINAGE BASIN SUMMARY

BASIN	DESIGN POINT	DESCRIPTION	CONTRIBUTING AREA (ACRES)	HYDROLOGIC SOIL GROUP (HSG)	IMPERVIOUS AREA (%)	BASIN FLOW LENGTH (FT)	BASIN FLOW SLOPE (%)	5-YR RUNOFF COEFFICIENT C_5	100-YR RUNOFF COEFFICIENT C_{100}	5-YR PEAK FLOW RATE (CFS) Q_5	100-YR PEAK FLOW RATE (CFS) Q_{100}
D1	2	PRIMARILY UNDISTURBED AREA	12.42	B	3.0	829	1.01	0.08	0.44	2.01	21.05
D2	SEE DP 3	PRIMARILY UNDISTURBED AREA	5.68	B	2.6	813	1.54	0.08	0.44	1.02	10.63
BASIN 1	1	PROCESS AREA AND ROADS	2.78	B	52.9	331	0.56	0.43	0.67	3.30	9.88
D1 & D2, 1	3	COMBINED PEAK RUNOFF AT DESIGN POINT 3	20.88	B	2.9	1345	0.83	0.08	0.44	2.76	28.26

NRCS WEB SOIL SURVEY DATA

MAP UNIT SYMBOL	MAP SOIL NAME	HYDRLOGIC SOIL GROUP RATING
AsB	ASCALON SANDY LOAM, (0%-3% SLOPES)	B
AvC	ASCALON-VONA SANDY LOAM, (1%-5% SLOPES)	B

NORTH

0' 100' 200' 400' 600'

SCALE: 1" = 200'

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REFERENCE DRAWINGS

DWG NO.	DESCRIPTION

REVISIONS

NO.	DESCRIPTION	DATE	BY
MTC	MTC B ISSUED FOR PERMIT - RESPONSE TO COMMENT	01/21/19	LER
DMM	MTC A ISSUED FOR PERMIT	11/15/18	DMM

SCALE:	1" = 200'
DESIGNED:	M. MORGAN
DRAWN:	M. MORGAN
CHECKED:	M. CLOUD
APPROVED:	
APPROVED:	
DATE	11/15/2018
DATE	10/18/2018
DATE	11/15/2018

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC

LOCATION: ADAMS COUNTY, CO

Williams

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TITLE
WATKINS COMPRESSOR STATION
WILLIAMS DJ BASIN FIELD COMPRESSION
CIVIL-SOUTH
GENERAL
DEVELOPED CONDITIONS DRAINAGE MAP

PROJECT NUMBER
18256

DRAWING NUMBER
WCSS-CE-611 REV. B

CAD File: S:\Projects\18256_Watkins_Compressor\CAD\Civil\Watkins South\Drawings\WCSS-CE-611.dwg
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CTB Used: SE_Std_B&W_Full_size.ctb

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Fax: 303-714-4800

LEVEL 3
STORM DRAINAGE STUDY

CE-102

DJ BASIN FIELD COMPRESSION
WATKINS COMPRESSOR STATION

NW 1/4 of Section 35, Township 3 South, Range 64 West,
6th Principal Meridian
Adams County, Colorado

PREPARED FOR:

ROCKY MOUNTAIN MIDSTREAM LLC

PREPARED BY:

SAMUEL ENGINEERING, INC.
8450 EAST CRESCENT PARKWAY, SUITE 200
GREENWOOD VILLAGE, CO 80111
(303) 714-4840

January 21, 2019

Revision B

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RECORD OF REVISIONS

Originator/Lead Engineer:	Michael Cloud	Date:	01/21/18
Project Engineer Approval:		Date:	
Project Manager Approval:	Brandon Primeaux	Date:	01/21/18
Client Approval:		Date:	

Rev. No.	By	Revisions	Approval	Date
A	M. Morgan	Issued for Permit	BP	11/15/18
B	M. Cloud	Issued Final – No County Comments	BP	01/21/09

Current Working Revision Rev. B Date 01/21/2018

ENGINEER CERTIFICATION OF DRAINAGE REPORT

I, Michael Cloud, hereby certify that this report (plan) for the Preliminary Drainage design of the Watkins South Compressor Station was prepared by me or under my direct supervision in accordance with the provisions of Adams County Storm Drainage Design and Technical Criteria for drainage facilities designed by others.



JANUARY 21, 2019
Date

Registered Professional Engineer
State of Colorado No. 49458
(Affix Seal)

DEVELOPER CERTIFICATION OF DRAINAGE FACILITIES

Rocky Mountain Midstream LLC, hereby certifies that the drainage facilities for the Watkins Compressor Station shall be constructed according to the design presented in this report. I understand Adams County does not and will not assume liability for the drainage facilities designed and/or certified by my engineer. I understand that Adams County reviews drainage plans pursuant to Colorado Revised Statues Title 30, Article 28; but cannot, on behalf of the Watkins Compressor Station, guarantee that final drainage review will absolve Rocky Mountain Midstream, LLC and/or their successors and/or assigns the future liability for improper design. I further understand that approval of the Final Plat and/or Final Development Plan does not imply approval of my engineer's drainage design.

Date

Rocky Mountain Midstream, LLC (please print)

Authorized Signature

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1.0 DESCRIPTION OF PROJECT

The subject property is a 10-acre parcel leased by Rocky Mountain Midstream, LLC for the installation of a 40 MMSCFD gas compression station. The compression station and detention pond will disturb approximately 3.8 acres of the 10-acre lease site. The site access road is approximately 2,300 feet long aligned through a 30 foot wide easement, the access road will disturb approximately 1.9 acres. The site will have several small enclosures for the compressors, a pipe rack and miscellaneous pieces of equipment. The site will be surfaced with gravel and the access road will be also be gravel. The site will have a security fence surrounding the facility and a twenty foot landscaping buffer outside of the security fence.

The project site is located southeast of the intersection of Manilla Road and East Colfax Avenue. More specifically the NW 1/4 of Section 35, Township 3 South, Range 64 West, of the 6th Principal Meridian, Adams County, Colorado. The proposed site will be accessed from Manilla Road.

The project site is zoned A-3. The adjacent zoning is A-3 on the north, south and west, the east boundary of the project site is zoned PUD A-1. All nearby land cover including the site is row crop.

There are no open channels, lakes, streams or irrigation ditches in the proposed development. The access road will have four culvert crossings including the tie-in to Manilla Road. The subject property is not located in a floodplain or located within an MS4 Permit area.

A Level 3 Storm Drainage Report using Chapter 9 of the Adams County Storm Drainage Design and Stormwater Quality Regulations and portions of the Urban Drainage and Flood Control District were used for the basis of design.

See Appendix A for the Vicinity Map.

2.0 METHODOLOGY

2.1 EXISTING CONDITIONS

The project site is located on an undeveloped agricultural tract of land. There are no storm drainage facilities near the site. The site slopes from the south to the north. The elevations of the compressor station range from 5575 to 5566, grades generally range from 1.0% to 2.0%.

The existing topography along the access road alignment slopes away from the site to the west and ties into Manilla Road at approximately elevation 5552. Manilla Road is an asphalt surfaced road with a slightly defined roadside ditch.

See Appendix G for the Developed and Existing Conditions Drainage Maps.

2.1.1 Site Soils

The characteristics of the soils on the site contribute to the amount of storm runoff. Regional soil information was obtained from the National Resource Conservation Service (NRCS) Web Soil Survey. The majority of the site soils are Ascalon Sandy Loam with slopes of 3% to 5% classified as Hydraulic Soil Group (HSG) B. The access road alignment passes through several different types of soil classifications; Ascalon Sandy Loam (0% to 3% slopes), Ascalon-Vona Sandy Loam (1% to 5% slopes) Vona Loamy Sand (3% to 9% slopes) and Ascalon-Platner Association. These soils are classified as HSG B, with the exception of Vona Loamy Sand, which is HSG A. For a conservative analysis of the existing runoff calculations, HSG B will be used for the purposes of this Storm Drainage Study. The existing regional soil information obtained from NRCS is used for all runoff calculations.

See Appendix B for the regional NRCS Web Soil Survey of this site.

2.1.2 Off-Site Basins

The lease boundary is located inside of existing Basin D. The proposed site development splits the existing runoff pattern of Basin D into separate flows. Two proposed swales route this existing flow around the compressor pad on the east side and west side. At the north edge of the lease boundary these two swales combine the runoff to continue northerly to maintain historic flow patterns.

The site access road alignment passes through existing Basins B, C and D. Culverts will provided at existing low points along this alignment to maintain historic runoff patterns.

2.1.3 Project Site Basin

Drawing WCSS-CE-611 delineates Basin 1, which is the proposed pad, site access road and detention pond. Basins D1 and D2 are the balance of the area within the predeveloped conditions Basin D.

2.1.4 Hydrology

Peak flowrates for Basins A, B, C, D and Basin 1 are calculated following the Urban Drainage and Flood Control District (UDFCD) design manual and worksheets. Inputs for Rational Method calculations are determined from the drawing WCSS-CE-610, *Predeveloped Conditions Drainage Basin Map* and WCSS-CE-611, *Developed Conditions Drainage Basin Map*. The Rational Method calculations are developed using Urban Drainage and Flood Control District Worksheet “UD-Rational v2.00.xls”.

An impervious value of 2% is used in the existing conditions (pre-development) calculations.

See Appendix C for the site hydrology calculations.

2.2 DEVELOPED CONDITIONS

2.2.1 Site Soils

As indicated in Section 2.1.1, the predominate soil type is HSG B. The soil type boundary is shown on drainage drawing WCSS-CE-610 located in Appendix G.

2.2.2 Site Basin

The proposed facility disturbs approximately 5.7 acres of land, including the site access road. Due to the natural topography of the existing land and the facility layout, one developed primary basin was delineated, Basin 1. This basin includes the compressor station equipment area, approximately one half of the access road around the equipment and the detention pond. The 2,600 foot site access road is not considered in developing Basin 1 hydrology. The peak runoff rate for Basin 1 is used to size the two culverts draining to the detention pond. It is assumed that each culvert will convey one half of the peak flow rate of the basin.

To maintain historic runoff rates and patterns, Basin 1 is used to size the detention pond and outlet structure due to the change in impervious area for the compressor station pad.

The proposed facility surfacing will be gravel. The weighted impervious area for Basin 1 is 52.9%.

2.2.3 Hydrology

Peak flow rates for Basin 1 are calculated using the UDFCD design manual and worksheets. Inputs for Rational Method calculations are determined from the drawing WCS-CE-611, *Predeveloped Conditions Drainage Basin Map*. The Rational Method calculations are developed using Urban Drainage and Flood Control District Worksheet “UD-Rational 2.00.xls”.

Weighted impervious values are used for the developed conditions hydrology.

2.3 HYDRAULICS

Due to the type of plant being constructed the site grading will have minimum slopes with the majority of onsite runoff being conveyed by sheet flow to drop inlets with culverts to pass flow beneath the plant road to the detention pond.

Shallow swales on the perimeter of the site will be used to convey the off-site runoff around the site.

See Appendix F for the project hydraulic calculations.

2.3.1 Culverts

The site access road will utilize corrugated metal pipes (CMP) for conveying flow under the road. These culverts will utilize flared end sections on the inlets and outlets with rip-rap lining on both

ends. The culverts will be designed with the maximum headwater (H/D < 1.5) for the 100-year peak flow rate.

The two culverts inside the compressor pad will be reinforced concrete pipes with flared end sections and rip-rap lining on the outlets.

2.3.2 Perimeter swales

The perimeter swales convey the runoff from Basin D1 and Basin D2 around the project site. Typical drainage ditches are grass lined trapezoidal channels with 2' bottom width and 4H:1V side-slopes. The swale draining to the detention pond has a 2' bottom width and 3H:1V side-slopes. Ditches typically have and average depth of approximately 1-foot.

The outside perimeter swales conveying flow for Basins D1 and D2 have the capacity to pass the 5-year event without overtopping the swale. In the unlikely event of over-topping of a swale, there is no danger to the facility or surrounding areas. These swales are only used to divert runoff around the site which is elevated several feet above existing grade. The swales daylight to existing grade near the edge of the lease boundary and rejoin existing patterns.

2.4 DETENTION POND

The detention pond is designed to store the 100-year storm volume plus one-half the Water Quality Capture Volume. Basin 1 is the basis for the pond sizing which includes the disturbed area for the pad, access road around the equipment and detention pond surface.

Basins D1 and D2 are routed around the site and not detained, these values were not used in any detention calculations. The footprint of the disturbed area was evaluated for peak runoff rate in the pre-development conditions. Also, the discharge rate from Chapter 9 of Adams County criteria was evaluated and the pond outlet structure was designed so the discharge rate is not to exceed the lesser of these two values.

AutoCAD modeling of the pond was used verify that the construction drawings accurately reflect the required volume of the pond. The pond volume was modeled in 0.01 ft increments and a stage-storage spreadsheet was developed as inputs for the discharge structure design.

See Appendix E for the pond stage-storage and outlet design details.

3.0 SUMMARY OF DESIGN VALUES

3.1 DISTURBED AREA

The pre-development runoff rate for Basin D is 3.20 cfs for the 5-year storm and 33.25 cfs for the 100-year storm. The developed area uses three design points to analyze the runoff rates. Design Point 1 corresponds to the project site for sizing the culverts to the detention pond. The pad is sloped to the north and two small swales collect the runoff and divert the flow to each culvert on the east and west edge of the equipment area. It is assumed these swales each collect one half the flow for the basin.

Design Point 2 is used to size the culvert that drains Basin D1 under the site access road. This basin is primarily undisturbed land.

Design Point 3 is accumulated flow from Basin D2 and Design Points 1 & 2. This design point shows that the post development runoff does not exceed the predevelopment runoff. As shown in the calculation "Design Point 3 Peak Runoff", the rational method was used to determine the runoff for Basins D1 and D2, then the maximum allowable release rate from the pond was added the flow from D1 and D2. The developed runoff rate at Design Point 3 is 2.76 cfs for the 5-year storm and 28.26 cfs for the 100-year storm, which is less than the pre-developed conditions, therefore there should be no downstream impacts from this project.

3.2 CULVERTS

Drawing WCSS-CE-610 delineates the pre-development basins. In each of these basins a culvert will convey the flow under the site access road, four corresponding design points were calculated for the culvert sizing. It is assumed the access road has a negligible impact of the impervious area of these large basins, therefore the culverts were sized using a predeveloped impervious area of 2% for Basins B, C and D. Basins A is the tributary area of the Manilla Road ditch, the impervious area for this basin is 50%.

Design Point A has a runoff rate of 0.55 cfs for the 5-year storm and 1.72 cfs for the 100-year storm. An 18" CMP will be used for conveying this flow, the 100-year storm will pass through this culvert without overtopping the site access entrance.

Design Point B has a runoff rate of 1.77 cfs for the 5-year storm and 18.36 cfs for the 100-year storm. A 24" CMP will be used for conveying this flow, the 100-year storm will pass through this culvert without overtopping the site access road.

Design Point C has a runoff rate of 6.05 cfs for the 5-year storm and 62.86 cfs for the 100-year storm. Two 30" CMP's will be used for conveying this flow, the 100-year storm will pass through these culverts without overtopping the site access road.

Design Point D is used to establish the predeveloped peak runoff rate for the project site basin. Design Point 2 (drawing WCSS-CE-611) is used to size the culvert under the site access road. The runoff at Design Point D1 is 2.01 cfs for the 5-year storm and 21.05 cfs for the 100-year storm. Two 24" CMP's will be used for conveying this flow, the 100-year storm will pass through these culverts without overtopping the site access road.

Design Point 1 has runoff rate of 3.30 cfs for the 5-year storm and 9.88 cfs for the 100-year storm. The compressor pad is sloped uniformly to the north and two small swales at the north end of the pad collects the runoff and directs the flow to a 12" RCP at the east edge of the pad and 12" RCP at the west end of the pad. It is assumed the swale these two swale evenly split the runoff of Basin 1. The 12" RCP have capacity have a combined capacity of 7.64 cfs. These culverts pass the 5-year storm. In the event of the 100-year storm, the culverts will build head and pass the storm or in the event of a clogged pipe, the excess storm water will pond and flow across the facility road and be collected by the ditch on the north side of the road and flow into the detention pond.

3.3 DETENTION POND

3.3.1 VOLUME

The calculated water quality capture volume is 2,162 ft^3., the provided volume is 2,183 ft^3. This corresponds to a stage elevation of 5569.50, or 0.64' of depth.

The 5-year storage volume including WQCV is 6,819 ft^3., the provided 5-year storage volume is 6,875 ft^3 at stage elevation of 5570.24.

The 100-year storage volume including WQCV is 12,388 ft^3, the provided 100-year storage volume is 12,458 ft^3 at stage elevation 5571.00.

In the event the overflow spillway is utilized, the storage volume at the crest of the spillway is the same as the 100-year storage volume including WQCV. The spillway has a 10 foot wide crest and has a capacity (0.5' head) of 11.90 cfs, which exceeds the 100-year peak flow rate from Basin 1 of 9.88 cfs. The pond has one foot of freeboard, elevation 5572.00, the storage volume at this elevation is 21,067 ft^3 .

See Appendix D for pond sizing calculations.

3.3.2 OUTLET STRUCTURE

The outlet structure has three primary components that regulate storm water discharge. The first component is the water quality capture volume. This volume of water is to be released over a period of 40 hours. Two - 7/8" orifices are used to discharge this volume of water in 35.48 hours.

The next component is the 5-year storm release rate. The maximum allowable release rate per Adams County Chapter 9 design criteria is 0.47 cfs. The 5-year orifice plate design (10"W x 1.5"H) for the outlet structure is 0.41 cfs.

The final component is the 100-year storm release rate. The maximum allowable release rate per Adams County Chapter 9 design criteria is 2.78. cfs. A restrictor plate will be added to the outlet pipe. The outlet pipe is a 12" RCP, the restrictor plate will be added 6-1/4" above the flowline of the outlet. The restrictor plate has a maximum release rate of 2.70 cfs, which is less than maximum allowable release rate.

The outlet structure releases storm water equal to or less than Adams County requirements for discharge rate and below the pre-developed conditions rate, therefore the proposed facility should have no downstream impacts in the watershed basin. To ensure water rights are not infringed upon, the pond drains in 41.51 hours from the 100-year storage volume.

4.0 CONCLUSION

This drainage study has been prepared in accordance with the Adams County Storm Drainage Criteria and Urban Drainage Criteria Manuals and accepted Professional Engineering Practices.

For the detention pond to continually function as designed, it must be maintained to ensure that adequate storage volume is available and that the drainage structures are not damaged.

The site drainage infrastructure has been designed to convey developed flows through an extended detention basin pond designed with controlled discharge rates for the minor and major storms. The flows then travel through established drainage ways in a manner consistent with the predevelopment drainage patterns. With a properly constructed and maintained pond along with the proposed erosion control measures this development will not adversely impact the existing drainage or existing downstream developments.

5.0 POND MAINTENANCE REQUIREMENTS

The structural and functional integrity of the detention basin shall be maintained at all times by removing and preventing drainage interference, obstructions, blockages, or other adverse effects into, through, or out of the system.

5.1 ROUTINE MAINTENANCE

5.1.1 Inspections

Routine inspections shall be performed a minimum of 2 times annually and after major rainfall events.

5.1.2 Sediment and Debris Management

Periodic silt removal shall occur when standing water conditions occur or the pond's storage volume is reduced by more than 10%. Silt shall be removed and the pond/basin returned to original lines and grades shown on the approved engineering plans (See Appendix H). In addition, corrective measures are required any time a basin does not drain completely within 72 hours of cessation of inflow.

Accumulated litter, sediment, and debris shall be removed every 6 months or as necessary to maintain proper operation of the basin. Disposal shall be in accordance with federal, state and local regulations.

5.1.3 Vegetation Management

Detention facilities shall be mowed monthly between the months of April and October or anytime vegetation exceeds 12-inches in height.

5.2 NON-ROUTINE MAINTENANCE

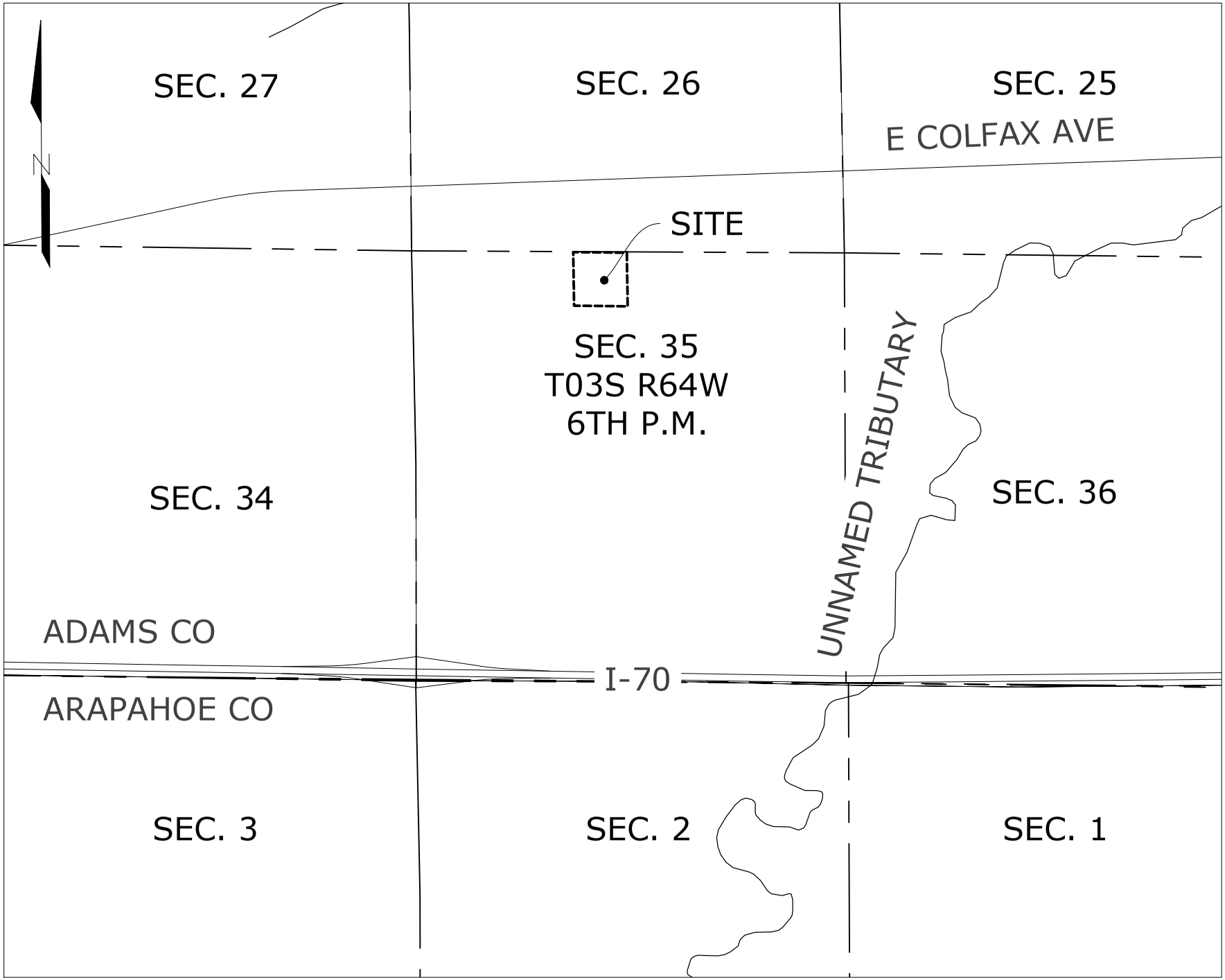
5.2.1 General

The detention basin shall be kept free of excess trash and debris, poisonous and noxious weeds, contaminants and pollution, rodent holes, standing water harboring insects, and unwanted vegetation growth (i.e. trees). These potential defects shall be repaired or mitigated to the original state within 30 days from the date of observation.

5.2.2 Facility Repairs

If upon routine inspection any signs of damage to the outlet structure, forebay, trickle channel, outlet pipe, emergency spillway, or pond embankment are observed, the feature shall be repaired to the original state within 30 days from the date of observation.

Appendix A:
Vicinity Map



VICINITY MAP

SCALE: 1" = 3000'

Appendix B:
NRCS Web Soil Survey

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

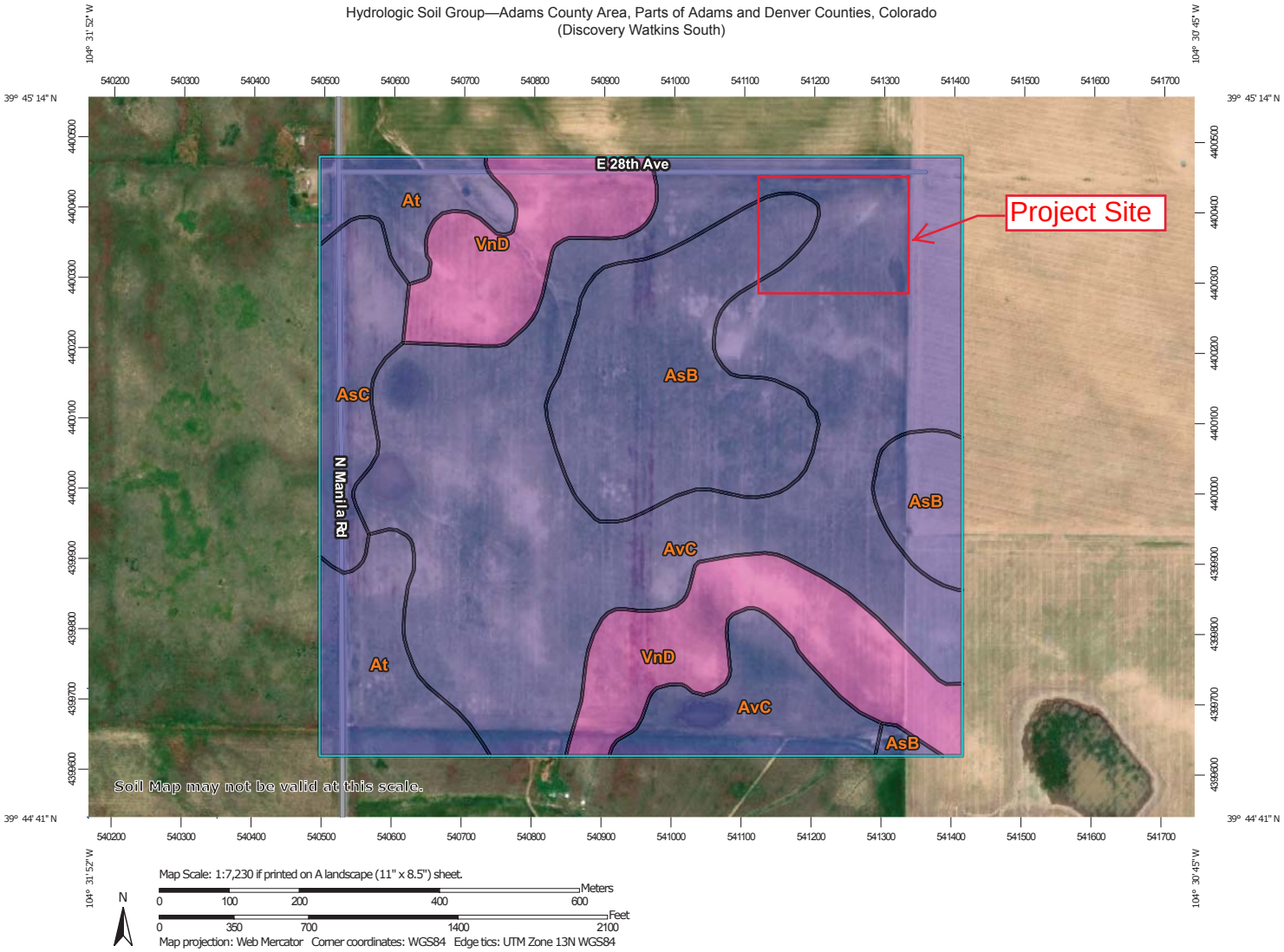
A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Adams County Area, Parts of Adams and Denver Counties, Colorado; and Arapahoe County, Colorado



November 2, 2018

Hydrologic Soil Group—Adams County Area, Parts of Adams and Denver Counties, Colorado
(Discovery Watkins South)



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils

Soil Rating Polygons
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points
- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Adams County Area, Parts of Adams and Denver Counties, Colorado
Survey Area Data: Version 15, Sep 13, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 17, 2015—Oct 2, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
AsB	Ascalon sandy loam, 0 to 3 percent slopes	B	34.3	17.6%
AsC	Ascalon sandy loam, 3 to 5 percent slopes	B	10.5	5.4%
At	Ascalon-Platner association	B	18.5	9.5%
AvC	Ascalon-Vona sandy loams, 1 to 5 percent slopes	B	99.3	51.1%
VnD	Vona loamy sand, 3 to 9 percent slopes	A	31.8	16.4%
Totals for Area of Interest			**194.3**	**100.0%**

Appendix C:
Hydrologic Calculations

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8450 East Crescent Parkway, Suite 200
Greenwood Village, CO 80111-2855
Phone: 303.714.4840 Fax: 303.714.4800

Client: Rocky Mountain Midstream
Project Name: Watkins Compressor Station
Project No.: 18256-01
Subject: Basin 1 Impervious Area
Prepared By: M. Morgan
Date: 11/08/2018 Sheet 1 of 1

DEVELOPED CONDITIONS IMPERVIOUS AREA

Use	% Impervious	Area (AC)
Pond	100	0.39
Equipment	80	0.31
Access/Pad (packed gravel)	40	2.08
Yard Area (native vegetation)	2	0
	52.9 %	**2.78**

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Phone: 303.714.4840 Fax: 303.714.4800

Client: Rocky Mountain Midstream
Project Name: Watkins Compressor Station
Project No.: 18256-01
Subject: Basin D1 Impervious Area
Prepared By: M. Morgan
Date: 11/08/2018 Sheet 1 of 1

DEVELOPED CONDITIONS IMPERVIOUS AREA

Use	% Impervious	Area (AC)
Pond	100	0.00
Equipment	80	0.00
Access/Pad (packed gravel)	40	0.34
Yard Area (native vegetation)	2	12.08
	3.0 %	**12.42**

Samuel Engineering
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Greenwood Village, CO 80111-2855
Phone: 303.714.4840 Fax: 303.714.4800

Client: Rocky Mountain Midstream
Project Name: Watkins Compressor Station
Project No.: 18256-01
Subject: Basin D2 Impervious Area
Prepared By: M. Morgan
Date: 11/08/2018 Sheet 1 of 1

DEVELOPED CONDITIONS IMPERVIOUS AREA

Use	% Impervious	Area (AC)
Pond	100	0.00
Equipment	80	0.00
Access/Pad (packed gravel)	40	0.09
Yard Area (native vegetation)	2	5.59
	2.6 %	**5.68**

Calculation of Peak Runoff using Rational Method

Designer: Matt Morgan
Company: Samuel Engineering
Date: 11/12/2018
Project: Watkins CSS
Location: Adams County, Colorado

Version 2.00 released May 2017

Cells of this color are for required user-input
Cells of this color are for optional override values
Cells of this color are for calculated results based on overrides

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_i^{0.33}}$$

$$t_t = \frac{L_t}{60K\sqrt{S_t}} = \frac{L_t}{60V_t}$$

$$\text{Computed } t_c = t_i + t_t$$

$$\text{Regional } t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$

$t_{minimum}$= 5 (urban)
$t_{minimum}$= 10 (non-urban)

$$\text{Selected } t_c = \max\{t_{minimum}, \min(\text{Computed } t_c, \text{Regional } t_c)\}$$

Select UDFCD location for NOAA Atlas 14 Rainfall Depths from the pulldown list OR enter your own depths obtained from the NOAA website (click this link)

	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
1-hour rainfall depth, P1 (in) =	1.00	1.42	1.68		2.35	2.71	
	a	b	c				
Rainfall Intensity Equation Coefficients =	28.50	10.00	0.786				

$$I(in/hr) = \frac{a * P_1}{(b + t_c)^c}$$

$$Q(cfs) = CIA$$

Subcatchment Name	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C							Overland (Initial) Flow Time					Channelized (Travel) Flow Time							Time of Concentration			Rainfall Intensity, I (in/hr)							Peak Flow, Q (cfs)						
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	Overland Flow Length L_i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S_i (ft/ft)	Overland Flow Time t_i (min)	Channelized Flow Length L_t (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Velocity V_t (ft/sec)	Channelized Flow Time t_t (min)	Computed t_c (min)	Regional t_c (min)	Selected t_c (min)	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
D1	12.42	B	3.0	0.01	0.02	0.08	0.27	0.34	0.44	0.55	361.00	5577.55	5574.45	0.009	39.00	468.00	5572.46	5569.17	0.007	15	1.26	6.20	45.20	35.37	35.37	1.42	2.02	2.39		3.34	3.85		0.24	0.47	2.41		14.30	21.05	
					0.08										36.79								43.00										2.01					
D2	5.68	B	2.6	0.01	0.02	0.08	0.27	0.34	0.44	0.55	236.00	5578.88	5573.97	0.021	23.61	577.00	5572.58	5566.32	0.011	15	1.56	6.16	29.76	35.42	29.76	1.58	2.24	2.65		3.70	4.27		0.10	0.21	1.17		7.21	10.63	
					0.08										22.22								28.37										1.02					
Basin 1	2.78	B	52.9	0.40	0.43	0.48	0.58	0.62	0.67	0.73	183.00	5574.73	5573.07	0.009	16.93	148.00	5573.07	5572.87	0.001	20	0.74	3.36	20.29	21.10	20.29	1.95	2.77	3.28		4.59	5.29		2.15	3.30	4.41		7.95	9.88	

Calculation of Peak Runoff using Rational Method

Designer: Matt Morgan
Company: Samuel Engineering
Date: 11/12/2018
Project: Watkins South CS
Location: Adams County, Colorado

Version 2.00 released May 2017

Cells of this color are for required user-input
Cells of this color are for optional override values
Cells of this color are for calculated results based on overrides

$$t_i = \frac{0.395(1.1 - C_5)\sqrt{L_i}}{S_i^{0.33}}$$

$$t_t = \frac{L_t}{60K\sqrt{S_t}} = \frac{L_t}{60V_t}$$

$$\text{Computed } t_c = t_i + t_t$$

$$\text{Regional } t_c = (26 - 17i) + \frac{L_t}{60(14i + 9)\sqrt{S_t}}$$

$t_{minimum}$= 5 (urban)
$t_{minimum}$= 10 (non-urban)

$$\text{Selected } t_c = \max\{t_{minimum}, \min(\text{Computed } t_c, \text{Regional } t_c)\}$$

Select UDFCD location for NOAA Atlas 14 Rainfall Depths from the pulldown list OR enter your own depths obtained from the NOAA website (click this link)

	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
1-hour rainfall depth, P1 (in) =	1.00	1.42	1.68		2.35	2.71	
	a	b	c				
Rainfall Intensity Equation Coefficients =	28.50	10.00	0.786				

$$I(in/hr) = \frac{a * P_1}{(b + t_c)^c}$$

$$Q(cfs) = CIA$$

Subcatchment Name	Area (ac)	NRCS Hydrologic Soil Group	Percent Imperviousness	Runoff Coefficient, C							Overland (Initial) Flow Time					Channelized (Travel) Flow Time							Time of Concentration			Rainfall Intensity, I (in/hr)							Peak Flow, Q (cfs)						
				2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	Overland Flow Length L_i (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Overland Flow Slope S_i (ft/ft)	Overland Flow Time t_i (min)	Channelized Flow Length L_t (ft)	U/S Elevation (ft) (Optional)	D/S Elevation (ft) (Optional)	Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Velocity V_t (ft/sec)	Channelized Flow Time t_t (min)	Computed t_c (min)	Regional t_c (min)	Selected t_c (min)	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	500-yr
Basin A	0.51	B	50.0	0.37	0.40	0.46	0.56	0.61	0.66	0.72	86.00	5574.29	5574.01	0.003	16.89	741.00	5574.01	5551.02	0.031	15	2.64	4.67	21.56	21.87	21.56	1.89	2.68	3.18		4.44	5.12		0.36	0.55	0.75		1.38	1.72	
Basin B	9.34	B	2.0	0.01	0.01	0.07	0.26	0.34	0.44	0.54	100.00	5578.29	5576.08	0.022	15.12	713.00	5576.08	5547.84	0.040	5	1.00	11.94	27.06	32.09	27.06	1.67	2.37	2.80		3.92	4.51		0.13	0.27	1.91		12.40	18.36	
					0.08										14.18								26.12																
Basin C	48.11	B	2.0	0.01	0.01	0.07	0.26	0.34	0.44	0.54	431.00	5579.71	5578.09	0.004	56.32	1751.00	5578.09	5553.70	0.014	5	0.59	49.45	105.77	52.31	52.31	1.11	1.57	1.86		2.60	3.00		0.46	0.92	6.55		42.47	62.86	
					0.08										52.80								102.26																
Basin D	20.89	B	2.0	0.01	0.01	0.07	0.26	0.34	0.44	0.54	250.00	5577.55	5575.94	0.006	35.91	804.00	5575.94	5565.72	0.013	5	0.56	23.77	59.68	38.47	38.47	1.35	1.92	2.27		3.17	3.66		0.24	0.49	3.46		22.46	33.25	
					0.08										33.67								57.44																

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Phone: 303.714.4840 Fax: 303.714.4800

Client: Rocky Mountain Midsream
Project Name: Watkins Compressor Station
Project No.: 18256-01
Subject: Design Point 3 Impervious Area
Prepared By: M. Morgan
Date: 11/08/2018 Sheet 1 of 1

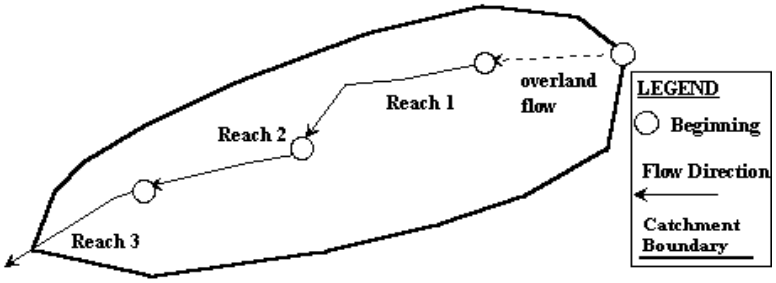
DEVELOPED CONDITIONS IMPERVIOUS AREA

Use	% Impervious	Area (AC)
Pond	100	0.00
Equipment	80	0.00
Access/Pad (packed gravel)	40	0.43
Yard Area (native vegetation)	2	17.67
	2.9 %	**18.10**

Reach-Weighted Time of Concentration Calculations

Version 2.00 released May 2017

Designer: Matt Morgan
Company: Samuel Engineering
Date: 11/8/2018
Project: Watkins CSS
Location: Adams County, Colorado



Subcatchment Name	Percent Imperviousness (%)
Design Point 3	2.9

OVERLAND FLOW

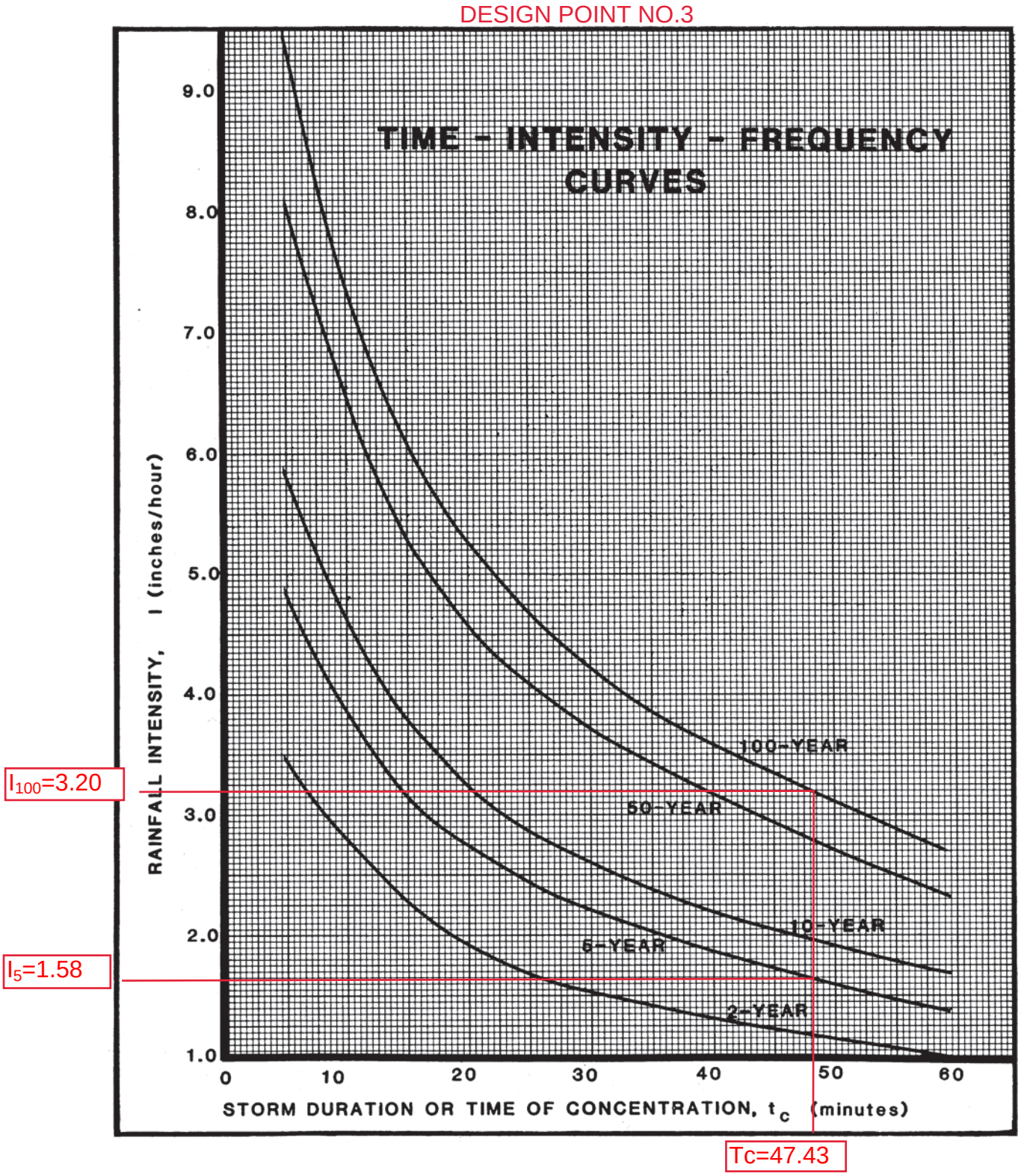
Reach ID	Overland Flow Length L_i (ft)	Overland Flow Slope S_i (ft/ft)	5-yr Runoff Coefficient, C_5	Overland Flow Time t_i (min)
DP 3	361.00	0.009	0.08	36.23
Weighted Totals	**361.00**	**0.009**	**Total t_i (min)**	**36.23**

CHANNELIZED FLOW

Reach ID	Channelized Flow Length L_t (ft)	Channelized Flow Slope S_t (ft/ft)	NRCS Conveyance Factor K	Channelized Flow Time t_t (min)
DP 3	468.00	0.007	15	6.22
DP 3	527.00	0.006	15	7.56
Weighted Totals	**995.00**	**0.006**	**Total t_t (min)**	**13.77**

Computed t_c (min)	**50.00**
Regional t_c (min)	**47.43**
Selected t_c (min)	**47.43**

Figure 9.1—Time-Intensity-Frequency Curves



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Phone: 303.714.4840 Fax: 303.714.4800

Client: Rocky Mountain Midstream
Project Name: Watkins Compressor Station
Project No.: 18256-01
Subject: Design Point 3 Peak Runoff
Prepared By: M. Morgan
Date: 11/08/2018 Sheet 1 of 1

DESIGN POINT 3 PEAK RUNOFF

Use	% Impervious	Area (AC)
Pond	100	0.00
Equipment	80	0.00
Access/Pad (packed gravel)	40	0.43
Yard Area (native vegetation)	2	17.67
	2.9 %	**18.10**

RATIONAL METHOD (Q=CIA)

T_c= 47.43 minutes (See DP 3 Tc Calculation)

I_5= 1.58 in/hr

I_{100}= 3.20 in/hr (See DP 3 Intensity)

C_5= 0.08

C_{100}= 0.44 (See Developed Hydrology for Basins D1 & D2)

A= 18.10 ac (Area of D1 & D2)

Q_5= 2.29 cfs

Q_{100}= 25.48 cfs

PEAK RUNOFF AT DESIGN POINT 3 (INCLUDING POND DISCHARGE)

Q total = Q_x + Max Allowable Pond Release Rate

Q_5(DP 3)= 2.76 cfs

Q_{100}(DP 3)= 28.26 cfs

Appendix D:
Pond Sizing Calculations

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Phone: 303.714.4840 Fax: 303.714.4800

Client: Rocky Mountain Midstream
Project Name: Watkins Compressor Station
Project No.: 18256-01
Subject: Developed Conditions Pond Sizing
Prepared By: M. Morgan
Date: 11/08/2018 Sheet 1 of 1

DEVELOPED CONDITIONS IMPERVIOUS AREA

Use	% Impervious	Area (AC)
Pond	100	0.39
Equipment	80	0.31
Access/Pad (packed gravel)	40	2.08
Yard Area (native vegetation)	2	0
	52.9 %	**2.78**

DETENTION POND VOLUME

$V = K_x * Area\ (af)$

5-year volume

$K_5=((0.77 * I)-2.26)/1000$

0.0385

$V_5=$ **0.11** af

4,657 ft^3

100-year volume

$K_{100}=(1.78*I-0.002*I^2-3.56)/910$

0.0934

$V_{100}=$ **0.26** af

11,307 ft^3

$WQCV=a(0.91*I^3 - 1.19*I^2 + 0.78*I)$

a= 1.0 (40 hour drain time)

I = % impervious/100

0.2143 watershed-inches

V=(WQCV/12)*Area

0.05 af

2,162 ft^3

TOTAL DETENTION VOLUME INCLUDING WQCV

$V_{total\ (5)}$=V5 + WQCV

6,819 ft^3

$V_{total(100)}=V_{100}$ + 1/2(WQCV)

12,388 ft^3

MAXIMUM ALLOWABLE POND RELEASE RATE

Q_5=(0.17 * AC)

0.47 cfs

Q_{100}=(1.00 * AC)

2.78 cfs

Appendix E:
Stage-Storage and Outlet Design Details

Stage-Storage Report

Stage-Storage
Project: Watkins CSS
Basin Description: Detention Pond

Contour Elevation	Contour Area (sq. ft)	Depth (ft)	Incremental Volume Avg. End (cu. ft)	Cumulative Volume Avg. End (cu. ft)
5,568.86	0.23	N/A	N/A	0.00
5,568.87	11.71	0.01	0.06	0.06
5,568.88	40.55	0.01	0.26	0.32
5,568.89	86.76	0.01	0.64	0.96
5,568.90	150.33	0.01	1.19	2.14
5,568.91	231.27	0.01	1.91	4.05
5,568.92	326.75	0.01	2.79	6.84
5,568.93	431.15	0.01	3.79	10.63
5,568.94	544.31	0.01	4.88	15.51
5,568.95	666.22	0.01	6.05	21.56
5,568.96	792.24	0.01	7.29	28.85
5,568.97	918.55	0.01	8.55	37.41
5,568.98	1,045.14	0.01	9.82	47.23
5,568.99	1,172.00	0.01	11.09	58.31
5,569.00	1,299.15	0.01	12.36	70.67
5,569.01	1,426.58	0.01	13.63	84.30
5,569.02	1,554.29	0.01	14.90	99.20
5,569.03	1,682.28	0.01	16.18	115.38
5,569.04	1,810.55	0.01	17.46	132.85
5,569.05	1,939.09	0.01	18.75	151.59
5,569.06	2,067.92	0.01	20.04	171.63
5,569.07	2,197.03	0.01	21.32	192.95
5,569.08	2,326.42	0.01	22.62	215.57
5,569.09	2,456.09	0.01	23.91	239.48
5,569.10	2,586.04	0.01	25.21	264.70
5,569.11	2,716.27	0.01	26.51	291.21
5,569.12	2,846.78	0.01	27.82	319.02
5,569.13	2,977.57	0.01	29.12	348.14
5,569.14	3,108.64	0.01	30.43	378.57
5,569.15	3,239.99	0.01	31.74	410.32
5,569.16	3,371.63	0.01	33.06	443.38
5,569.17	3,503.54	0.01	34.38	477.75
5,569.18	3,635.73	0.01	35.70	513.45
5,569.19	3,768.20	0.01	37.02	550.47
5,569.20	3,900.95	0.01	38.35	588.81
5,569.21	4,033.99	0.01	39.67	628.49
5,569.22	4,167.30	0.01	41.01	669.49
5,569.23	4,300.89	0.01	42.34	711.84
5,569.24	4,434.7	0.01	43.68	755.51

5,569.25	4,568.92	0.01	45.02	800.53
5,569.26	4,703.35	0.01	46.36	846.89
5,569.27	4,838.07	0.01	47.71	894.60
5,569.28	4,973.06	0.01	49.06	943.66
5,569.29	5,108.20	0.01	50.41	994.06
5,569.30	5,233.44	0.01	51.71	1045.77
5,569.31	5,342.54	0.01	52.88	1098.65
5,569.32	5,435.50	0.01	53.89	1152.54
5,569.33	5,512.32	0.01	54.74	1207.28
5,569.34	5,573.00	0.01	55.43	1262.71
5,569.35	5,619.87	0.01	55.96	1318.67
5,569.36	5,658.49	0.01	56.39	1375.06
5,569.37	5,689.11	0.01	56.74	1431.80
5,569.38	5,711.72	0.01	57.00	1488.81
5,569.39	5,726.55	0.01	57.19	1546.00
5,569.40	5,739.01	0.01	57.33	1603.32
5,569.41	5,751.48	0.01	57.45	1660.78
5,569.42	5,763.97	0.01	57.58	1718.35
5,569.43	5,776.46	0.01	57.70	1776.06
5,569.44	5,788.97	0.01	57.83	1833.88
5,569.45	5,801.49	0.01	57.95	1891.84
5,569.46	5,814.01	0.01	58.08	1949.91
5,569.47	5,826.55	0.01	58.20	2008.12
5,569.48	5,839.11	0.01	58.33	2066.44
5,569.49	5,851.67	0.01	58.45	2124.90
5,569.50	5,864.24	0.01	58.58	2183.48 WQCV
5,569.51	5,876.83	0.01	58.71	2242.18
5,569.52	5,889.42	0.01	58.83	2301.01
5,569.53	5,902.03	0.01	58.96	2359.97
5,569.54	5,914.65	0.01	59.08	2419.05
5,569.55	5,927.28	0.01	59.21	2478.26
5,569.56	5,939.92	0.01	59.34	2537.60
5,569.57	5,952.57	0.01	59.46	2597.06
5,569.58	5,965.23	0.01	59.59	2656.65
5,569.59	5,977.91	0.01	59.72	2716.37
5,569.60	5,990.59	0.01	59.84	2776.21
5,569.61	6,003.29	0.01	59.97	2836.18
5,569.62	6,016.00	0.01	60.10	2896.28
5,569.63	6,028.72	0.01	60.22	2956.50
5,569.64	6,041.45	0.01	60.35	3016.85
5,569.65	6,054.19	0.01	60.48	3077.33
5,569.66	6,066.94	0.01	60.61	3137.93
5,569.67	6,079.71	0.01	60.73	3198.67
5,569.68	6,092.48	0.01	60.86	3259.53
5,569.69	6,105.27	0.01	60.99	3320.52
5,569.70	6,118.07	0.01	61.12	3381.63
5,569.71	6,130.88	0.01	61.24	3442.88
5,569.72	6,143.70	0.01	61.37	3504.25

5,569.73	6,156.53	0.01	61.50	3565.75
5,569.74	6,169.37	0.01	61.63	3627.38
5,569.75	6,182.22	0.01	61.76	3689.14
5,569.76	6,195.09	0.01	61.89	3751.03
5,569.77	6,207.96	0.01	62.02	3813.04
5,569.78	6,220.85	0.01	62.14	3875.19
5,569.79	6,233.75	0.01	62.27	3937.46
5,569.80	6,246.66	0.01	62.40	3999.86
5,569.81	6,259.58	0.01	62.53	4062.39
5,569.82	6,272.51	0.01	62.66	4125.05
5,569.83	6,285.46	0.01	62.79	4187.84
5,569.84	6,298.41	0.01	62.92	4250.76
5,569.85	6,311.38	0.01	63.05	4313.81
5,569.86	6,324.36	0.01	63.18	4376.99
5,569.87	6,337.34	0.01	63.31	4440.30
5,569.88	6,350.34	0.01	63.44	4503.74
5,569.89	6,363.35	0.01	63.57	4567.30
5,569.90	6,376.38	0.01	63.70	4631.00
5,569.91	6,389.41	0.01	63.83	4694.83 5-YR Volume
5,569.92	6,402.45	0.01	63.96	4758.79
5,569.93	6,415.51	0.01	64.09	4822.88
5,569.94	6,428.58	0.01	64.22	4887.10
5,569.95	6,441.66	0.01	64.35	4951.45
5,569.96	6,454.74	0.01	64.48	5015.94
5,569.97	6,467.85	0.01	64.61	5080.55
5,569.98	6,480.96	0.01	64.74	5145.29
5,569.99	6,494.08	0.01	64.88	5210.17
5,570.00	6,507.21	0.01	65.01	5275.17
5,570.01	6,520.36	0.01	65.14	5340.31
5,570.02	6,533.52	0.01	65.27	5405.58
5,570.03	6,546.68	0.01	65.40	5470.98
5,570.04	6,559.86	0.01	65.53	5536.51
5,570.05	6,573.05	0.01	65.66	5602.18
5,570.06	6,586.26	0.01	65.80	5667.98
5,570.07	6,599.47	0.01	65.93	5733.90
5,570.08	6,612.69	0.01	66.06	5799.97
5,570.09	6,625.93	0.01	66.19	5866.16
5,570.10	6,639.17	0.01	66.33	5932.48
5,570.11	6,652.43	0.01	66.46	5998.94
5,570.12	6,665.70	0.01	66.59	6065.53
5,570.13	6,678.98	0.01	66.72	6132.26
5,570.14	6,692.27	0.01	66.86	6199.11
5,570.15	6,705.57	0.01	66.99	6266.10
5,570.16	6,718.89	0.01	67.12	6333.22
5,570.17	6,732.21	0.01	67.26	6400.48
5,570.18	6,745.55	0.01	67.39	6467.87
5,570.19	6,758.90	0.01	67.52	6535.39
5,570.20	6,772.25	0.01	67.66	6603.05

5,570.21	6,785.62	0.01	67.79	6670.84	
5,570.22	6,799.00	0.01	67.92	6738.76	
5,570.23	6,812.40	0.01	68.06	6806.82	
5,570.24	6,825.80	0.01	68.19	6875.01	5-YR Vol + WOCV
5,570.25	6,839.21	0.01	68.33	6943.33	
5,570.26	6,852.64	0.01	68.46	7011.79	
5,570.27	6,866.08	0.01	68.59	7080.38	
5,570.28	6,879.53	0.01	68.73	7149.11	
5,570.29	6,892.98	0.01	68.86	7217.97	
5,570.30	6,906.46	0.01	69.00	7286.97	
5,570.31	6,919.94	0.01	69.13	7356.10	
5,570.32	6,933.43	0.01	69.27	7425.37	
5,570.33	6,946.93	0.01	69.40	7494.77	
5,570.34	6,960.45	0.01	69.54	7564.31	
5,570.35	6,973.98	0.01	69.67	7633.98	
5,570.36	6,987.51	0.01	69.81	7703.79	
5,570.37	7,001.06	0.01	69.94	7773.73	
5,570.38	7,014.62	0.01	70.08	7843.81	
5,570.39	7,028.20	0.01	70.21	7914.02	
5,570.40	7,041.78	0.01	70.35	7984.37	
5,570.41	7,055.37	0.01	70.49	8054.86	
5,570.42	7,068.98	0.01	70.62	8125.48	
5,570.43	7,082.59	0.01	70.76	8196.24	
5,570.44	7,096.22	0.01	70.89	8267.13	
5,570.45	7,109.86	0.01	71.03	8338.16	
5,570.46	7,123.51	0.01	71.17	8409.33	
5,570.47	7,137.17	0.01	71.30	8480.63	
5,570.48	7,150.84	0.01	71.44	8552.07	
5,570.49	7,164.53	0.01	71.58	8623.65	
5,570.50	7,178.22	0.01	71.71	8695.37	
5,570.51	7,191.93	0.01	71.85	8767.22	
5,570.52	7,205.65	0.01	71.99	8839.20	
5,570.53	7,219.37	0.01	72.13	8911.33	
5,570.54	7,233.11	0.01	72.26	8983.59	
5,570.55	7,246.85	0.01	72.40	9055.99	
5,570.56	7,260.63	0.01	72.54	9128.53	
5,570.57	7,274.40	0.01	72.68	9201.20	
5,570.58	7,288.19	0.01	72.81	9274.02	
5,570.59	7,301.98	0.01	72.95	9346.97	
5,570.60	7,315.79	0.01	73.09	9420.06	
5,570.61	7,329.61	0.01	73.23	9493.28	
5,570.62	7,343.44	0.01	73.37	9566.65	
5,570.63	7,357.28	0.01	73.50	9640.15	
5,570.64	7,371.13	0.01	73.64	9713.79	
5,570.65	7,384.99	0.01	73.78	9787.58	
5,570.66	7,398.87	0.01	73.92	9861.49	
5,570.67	7,412.75	0.01	74.06	9935.55	
5,570.68	7,426.65	0.01	74.20	10009.75	

5,570.69	7,440.56	0.01	74.34	10084.09
5,570.70	7,454.48	0.01	74.48	10158.56
5,570.71	7,468.41	0.01	74.61	10233.18
5,570.72	7,482.35	0.01	74.75	10307.93
5,570.73	7,496.30	0.01	74.89	10382.82
5,570.74	7,510.27	0.01	75.03	10457.85
5,570.75	7,524.24	0.01	75.17	10533.03
5,570.76	7,538.23	0.01	75.31	10608.34
5,570.77	7,552.22	0.01	75.45	10683.79
5,570.78	7,566.23	0.01	75.59	10759.38
5,570.79	7,580.25	0.01	75.73	10835.12
5,570.80	7,594.28	0.01	75.87	10910.99
5,570.81	7,608.33	0.01	76.01	10987.00
5,570.82	7,622.38	0.01	76.15	11063.16
5,570.83	7,636.45	0.01	76.29	11139.45
5,570.84	7,650.52	0.01	76.43	11215.89
5,570.85	7,664.61	0.01	76.58	11292.46
5,570.86	7,678.71	0.01	76.72	11369.18
5,570.87	7,692.82	0.01	76.86	11446.03
5,570.88	7,706.94	0.01	77.00	11523.03
5,570.89	7,721.07	0.01	77.14	11600.17
5,570.90	7,735.21	0.01	77.28	11677.46
5,570.91	7,749.37	0.01	77.42	11754.88
5,570.92	7,763.54	0.01	77.56	11832.44
5,570.93	7,777.71	0.01	77.71	11910.15
5,570.94	7,791.90	0.01	77.85	11988.00
5,570.95	7,806.10	0.01	77.99	12065.99
5,570.96	7,820.31	0.01	78.13	12144.12
5,570.97	7,834.53	0.01	78.27	12222.39
5,570.98	7,848.77	0.01	78.42	12300.81
5,570.99	7,863.01	0.01	78.56	12379.37
5,571.00	7,877.27	0.01	78.70	12458.07
5,571.01	7,891.53	0.01	78.84	12536.91
5,571.02	7,905.81	0.01	78.99	12615.90
5,571.03	7,920.10	0.01	79.13	12695.03
5,571.04	7,934.40	0.01	79.27	12774.30
5,571.05	7,948.71	0.01	79.42	12853.72
5,571.06	7,963.04	0.01	79.56	12933.28
5,571.07	7,977.37	0.01	79.70	13012.98
5,571.08	7,991.72	0.01	79.85	13092.82
5,571.09	8,006.07	0.01	79.99	13172.81
5,571.10	8,020.44	0.01	80.13	13252.95
5,571.11	8,034.82	0.01	80.28	13333.22
5,571.12	8,049.21	0.01	80.42	13413.64
5,571.13	8,063.61	0.01	80.56	13494.21
5,571.14	8,078.02	0.01	80.71	13574.91
5,571.15	8,092.45	0.01	80.85	13655.77
5,571.16	8,106.88	0.01	81.00	13736.76

100-YR Volume

100-YR Vol + 1/2 WQCV

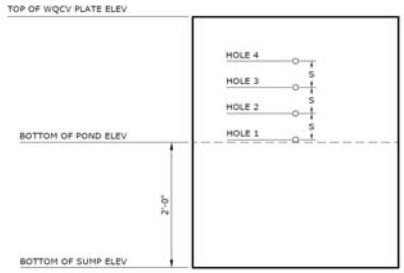
5,571.17	8,121.33	0.01	81.14	13817.90
5,571.18	8,135.79	0.01	81.29	13899.19
5,571.19	8,150.25	0.01	81.43	13980.62
5,571.20	8,164.73	0.01	81.57	14062.20
5,571.21	8,179.22	0.01	81.72	14143.92
5,571.22	8,193.73	0.01	81.86	14225.78
5,571.23	8,208.24	0.01	82.01	14307.79
5,571.24	8,222.77	0.01	82.16	14389.94
5,571.25	8,237.30	0.01	82.30	14472.25
5,571.26	8,251.85	0.01	82.45	14554.69
5,571.27	8,266.41	0.01	82.59	14637.28
5,571.28	8,280.98	0.01	82.74	14720.02
5,571.29	8,295.56	0.01	82.88	14802.90
5,571.30	8,310.15	0.01	83.03	14885.93
5,571.31	8,324.75	0.01	83.17	14969.10
5,571.32	8,339.37	0.01	83.32	15052.43
5,571.33	8,353.99	0.01	83.47	15135.89
5,571.34	8,368.63	0.01	83.61	15219.51
5,571.35	8,383.28	0.01	83.76	15303.26
5,571.36	8,397.94	0.01	83.91	15387.17
5,571.37	8,412.61	0.01	84.05	15471.22
5,571.38	8,427.29	0.01	84.20	15555.42
5,571.39	8,441.98	0.01	84.35	15639.77
5,571.40	8,456.69	0.01	84.49	15724.26
5,571.41	8,471.40	0.01	84.64	15808.90
5,571.42	8,486.13	0.01	84.79	15893.69
5,571.43	8,500.87	0.01	84.93	15978.63
5,571.44	8,515.62	0.01	85.08	16063.71
5,571.45	8,530.38	0.01	85.23	16148.94
5,571.46	8,545.15	0.01	85.38	16234.32
5,571.47	8,559.93	0.01	85.53	16319.84
5,571.48	8,574.72	0.01	85.67	16405.51
5,571.49	8,589.53	0.01	85.82	16491.34
5,571.50	8,604.34	0.01	85.97	16577.31
5,571.51	8,619.16	0.01	86.12	16663.42
5,571.52	8,634.00	0.01	86.27	16749.69
5,571.53	8,648.84	0.01	86.41	16836.10
5,571.54	8,663.69	0.01	86.56	16922.67
5,571.55	8,678.55	0.01	86.71	17009.38
5,571.56	8,693.42	0.01	86.86	17096.24
5,571.57	8,708.31	0.01	87.01	17183.25
5,571.58	8,723.20	0.01	87.16	17270.40
5,571.59	8,738.10	0.01	87.31	17357.71
5,571.60	8,753.01	0.01	87.46	17445.16
5,571.61	8,767.93	0.01	87.60	17532.77
5,571.62	8,782.86	0.01	87.75	17620.52
5,571.63	8,797.80	0.01	87.90	17708.43
5,571.64	8,812.75	0.01	88.05	17796.48

5,571.65	8,827.71	0.01	88.20	17884.68	
5,571.66	8,842.68	0.01	88.35	17973.03	
5,571.67	8,857.65	0.01	88.50	18061.54	
5,571.68	8,872.64	0.01	88.65	18150.19	
5,571.69	8,887.64	0.01	88.80	18238.99	
5,571.70	8,902.65	0.01	88.95	18327.94	
5,571.71	8,917.67	0.01	89.10	18417.04	
5,571.72	8,932.69	0.01	89.25	18506.29	
5,571.73	8,947.73	0.01	89.40	18595.69	
5,571.74	8,962.78	0.01	89.55	18685.25	
5,571.75	8,977.83	0.01	89.70	18774.95	
5,571.76	8,992.90	0.01	89.85	18864.80	
5,571.77	9,007.97	0.01	90.00	18954.81	
5,571.78	9,023.06	0.01	90.16	19044.96	
5,571.79	9,038.15	0.01	90.31	19135.27	
5,571.80	9,053.26	0.01	90.46	19225.73	
5,571.81	9,068.37	0.01	90.61	19316.33	
5,571.82	9,083.50	0.01	90.76	19407.09	
5,571.83	9,098.63	0.01	90.91	19498.00	
5,571.84	9,113.78	0.01	91.06	19589.07	
5,571.85	9,128.93	0.01	91.21	19680.28	
5,571.86	9,144.09	0.01	91.37	19771.65	
5,571.87	9,159.27	0.01	91.52	19863.16	
5,571.88	9,174.45	0.01	91.67	19954.83	
5,571.89	9,189.64	0.01	91.82	20046.65	
5,571.90	9,204.84	0.01	91.97	20138.62	
5,571.91	9,220.06	0.01	92.12	20230.75	
5,571.92	9,235.28	0.01	92.28	20323.02	
5,571.93	9,250.51	0.01	92.43	20415.45	
5,571.94	9,265.75	0.01	92.58	20508.04	
5,571.95	9,281.00	0.01	92.73	20600.77	
5,571.96	9,296.26	0.01	92.89	20693.66	
5,571.97	9,311.53	0.01	93.04	20786.69	
5,571.98	9,326.81	0.01	93.19	20879.89	
5,571.99	9,342.10	0.01	93.34	20973.23	
5,572.00	9,357.40	0.01	93.50	21066.73	1 FT. Freeboard
5,572.01	9,372.71	0.01	93.65	21160.38	
5,572.02	9,388.03	0.01	93.80	21254.18	
5,572.03	9,403.36	0.01	93.96	21348.14	
5,572.04	9,418.69	0.01	94.11	21442.25	
5,572.05	9,434.04	0.01	94.26	21536.51	
5,572.06	9,449.40	0.01	94.42	21630.93	
5,572.07	9,464.77	0.01	94.57	21725.50	
5,572.08	9,480.14	0.01	94.72	21820.23	
5,572.09	9,495.53	0.01	94.88	21915.10	
5,572.10	9,510.93	0.01	95.03	22010.14	

Watkins Compressor Station - Detention Pond WQCV Orifce Plate Design Worksheet

Calculation By: M. Morgan
Date: 11/09/2018

WQCV Orifice Plate Diagram:



Equations:

$$Q = C_0 A_0 (2gH_0)^{0.5}$$

where:
Q = orifice flow discharge
C_d = dimensionless coefficient of discharge
A_0 = cross-sectional area of orifice (ft^2)
g = acceleration due to gravity (32.2 ft/s^2)
H_0 = effective head on orifice, from centroid to water surface elevation (ft)

$$A_0 = \pi \left(\frac{d}{2}\right)^2$$

where:
A_0 = cross-sectional area of orifice (in^2)

$$\Delta t = \frac{\Delta V}{3600 Q}$$

where:
Δt = drain time for incremental depth (hours)
ΔV = storage volume drained from stage increment (ft^3)
Q = orifice dischrage rate for stage increment (ft^3/s)

DESIGN INPUTS:

WQCV Orifice Size Design Input:

Number of Holes Used (1-5):	N =	2	
Hole Spacing:	S =	2.25	inches
Drain Time:	t =	40	hours
Orifice Coefficient:	C_0 =	0.6	
Gravitational Constant:	g =	32.2	ft/s^2

Pond Geometry Design Input:

Bottom of Pond Elevation:	EL_{BP} =	5568.86	ft
Water Quality Capture Volume:	WQCV =	2162	ft^3
WQCV Max Water Surface Elevation:	EL_{TP} =	5569.50	ft

VARIABLE INPUTS:

Change Orifice Hole Diameter:

Hole Diameter:	d =	0.8750	in
		7/8	"
Hole Area:	A_0 =	0.60132	in^2

= variable user input
= calculation variable

* Change hole diameter in increments of 1/32" and adjust hole spacing to achieve target drain down time

CALCULATED RESULTS:

Computed Orifice Centroid Elevations:

Centroid Elevation Hole 1:	EL_1 =	5568.90	ft
Centroid Elevation Hole 2:	EL_2 =	5569.08	ft
Centroid Elevation Hole 3:	EL_3 =	n/a	ft
Centroid Elevation Hole 4:	EL_4 =	n/a	ft
Centroid Elevation Hole 5:	EL_5 =	n/a	ft

SOLVE FOR DRAIN TIME:

Calculated Drain Time:	t_{WQCV} =	**35.48 hours**
Check: $t_{WQCV} - t_{required} = 0$		-4.52

INTERMEDIATE CALCULATIONS:

Notes:
1. Flow rate is calculated at each 0.10-ft stage decrease. It is assumed that the discharge rate calculated at the maximum stage value for each increment and the corresponding effective head is representative of the entire 0.10-ft depth.

2. Storage volumes are determined using the pond design contour areas and the average end-area method.

WSEL	H_0					Q					Q
	Hole 1	Hole 2	Hole 3	Hole 4	Hole 5	Hole 1	Hole 2	Hole 3	Hole 4	Hole 5	Total
5569.50	0.60	0.42	n/a	n/a	n/a	0.01562	0.01297	n/a	n/a	n/a	0.02859
5569.49	0.59	0.41	n/a	n/a	n/a	0.01549	0.01281	n/a	n/a	n/a	0.02830
5569.48	0.58	0.40	n/a	n/a	n/a	0.01536	0.01265	n/a	n/a	n/a	0.02801
5569.47	0.57	0.39	n/a	n/a	n/a	0.01523	0.01249	n/a	n/a	n/a	0.02772
5569.46	0.56	0.38	n/a	n/a	n/a	0.01509	0.01233	n/a	n/a	n/a	0.02742
5569.45	0.55	0.37	n/a	n/a	n/a	0.01496	0.01216	n/a	n/a	n/a	0.02712
5569.44	0.54	0.36	n/a	n/a	n/a	0.01482	0.01200	n/a	n/a	n/a	0.02682
5569.43	0.53	0.35	n/a	n/a	n/a	0.01469	0.01183	n/a	n/a	n/a	0.02651
5569.42	0.52	0.34	n/a	n/a	n/a	0.01455	0.01166	n/a	n/a	n/a	0.02620
5569.41	0.51	0.33	n/a	n/a	n/a	0.01441	0.01148	n/a	n/a	n/a	0.02589
5569.40	0.50	0.32	n/a	n/a	n/a	0.01427	0.01130	n/a	n/a	n/a	0.02557
5569.39	0.49	0.31	n/a	n/a	n/a	0.01413	0.01112	n/a	n/a	n/a	0.02525
5569.38	0.48	0.30	n/a	n/a	n/a	0.01398	0.01094	n/a	n/a	n/a	0.02492
5569.37	0.47	0.29	n/a	n/a	n/a	0.01384	0.01075	n/a	n/a	n/a	0.02459
5569.36	0.46	0.28	n/a	n/a	n/a	0.01369	0.01056	n/a	n/a	n/a	0.02425
5569.35	0.45	0.27	n/a	n/a	n/a	0.01354	0.01037	n/a	n/a	n/a	0.02391
5569.34	0.44	0.26	n/a	n/a	n/a	0.01339	0.01017	n/a	n/a	n/a	0.02356
5569.33	0.43	0.25	n/a	n/a	n/a	0.01324	0.00997	n/a	n/a	n/a	0.02321
5569.32	0.42	0.24	n/a	n/a	n/a	0.01309	0.00977	n/a	n/a	n/a	0.02285
5569.31	0.41	0.23	n/a	n/a	n/a	0.01293	0.00956	n/a	n/a	n/a	0.02249
5569.30	0.40	0.22	n/a	n/a	n/a	0.01277	0.00935	n/a	n/a	n/a	0.02212
5569.29	0.39	0.21	n/a	n/a	n/a	0.01261	0.00913	n/a	n/a	n/a	0.02174
5569.28	0.38	0.20	n/a	n/a	n/a	0.01245	0.00890	n/a	n/a	n/a	0.02135
5569.27	0.37	0.19	n/a	n/a	n/a	0.01229	0.00867	n/a	n/a	n/a	0.02096
5569.26	0.36	0.18	n/a	n/a	n/a	0.01212	0.00844	n/a	n/a	n/a	0.02056
5569.25	0.35	0.17	n/a	n/a	n/a	0.01196	0.00819	n/a	n/a	n/a	0.02015
5569.24	0.34	0.16	n/a	n/a	n/a	0.01178	0.00794	n/a	n/a	n/a	0.01973
5569.23	0.33	0.15	n/a	n/a	n/a	0.01161	0.00768	n/a	n/a	n/a	0.01930
5569.22	0.32	0.14	n/a	n/a	n/a	0.01144	0.00742	n/a	n/a	n/a	0.01885
5569.21	0.31	0.13	n/a	n/a	n/a	0.01126	0.00714	n/a	n/a	n/a	0.01840
5569.20	0.30	0.12	n/a	n/a	n/a	0.01108	0.00685	n/a	n/a	n/a	0.01793
5569.19	0.29	0.11	n/a	n/a	n/a	0.01089	0.00655	n/a	n/a	n/a	0.01744
5569.18	0.28	0.10	n/a	n/a	n/a	0.01071	0.00623	n/a	n/a	n/a	0.01694
5569.17	0.27	0.09	n/a	n/a	n/a	0.01052	0.00590	n/a	n/a	n/a	0.01641

Volume at WSEL	Incremental Volume	Time seconds	Time hours	Cumulative Time
2242.18				
2183.48	58.71	2053.40	0.57	0.57
2124.90	58.58	2069.76	0.57	1.15
2008.12	116.78	4168.89	1.16	2.30
1949.91	58.20	2099.68	0.58	2.89
1891.83	58.08	2117.79	0.59	3.47
1833.88	57.95	2136.56	0.59	4.07
1776.06	57.83	2156.04	0.60	4.67
1718.35	57.70	2176.26	0.60	5.27
1660.78	57.58	2197.28	0.61	5.88
1603.32	57.45	2219.13	0.62	6.50
1546.00	57.33	2241.89	0.62	7.12
1488.80	57.19	2265.14	0.63	7.75
1431.80	57.00	2287.35	0.64	8.39
1375.06	56.74	2307.38	0.64	9.03
1318.67	56.39	2325.12	0.65	9.67
1262.71	55.96	2340.46	0.65	10.32
1207.28	55.43	2352.10	0.65	10.98
1152.54	54.74	2358.19	0.66	11.63
1098.65	53.89	2358.03	0.66	12.29
1045.77	52.88	2351.33	0.65	12.94
994.06	51.71	2337.81	0.65	13.59
943.66	50.41	2318.58	0.64	14.23
894.60	49.06	2297.19	0.64	14.87
846.89	47.71	2275.97	0.63	15.50
800.53	46.36	2255.01	0.63	16.13
755.51	45.02	2234.34	0.62	16.75
711.84	43.68	2214.07	0.62	17.37
669.49	42.34	2194.29	0.61	17.97
628.49	41.01	2175.08	0.60	18.58
588.81	39.67	2156.59	0.60	19.18
550.47	38.35	2139.01	0.59	19.77
513.45	37.02	2122.55	0.59	20.36
477.75	35.70	2107.52	0.59	20.95

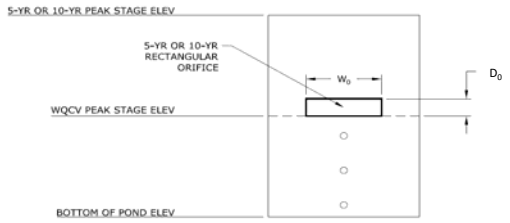
5569.16	0.26	0.08	n/a	n/a	n/a	0.01032	0.00554	n/a	n/a	n/a	0.01587
5569.15	0.25	0.07	n/a	n/a	n/a	0.01012	0.00517	n/a	n/a	n/a	0.01529
5569.14	0.24	0.06	n/a	n/a	n/a	0.00992	0.00476	n/a	n/a	n/a	0.01468
5569.13	0.23	0.05	n/a	n/a	n/a	0.00972	0.00431	n/a	n/a	n/a	0.01403
5569.12	0.22	0.04	n/a	n/a	n/a	0.00951	0.00382	n/a	n/a	n/a	0.01332
5569.11	0.21	0.03	n/a	n/a	n/a	0.00929	0.00324	n/a	n/a	n/a	0.01254
5569.10	0.20	0.02	n/a	n/a	n/a	0.00907	0.00255	n/a	n/a	n/a	0.01162
5569.09	0.19	0.01	n/a	n/a	n/a	0.00885	0.00156	n/a	n/a	n/a	0.01041
5569.08	0.18	n/a	n/a	n/a	n/a	0.00861	n/a	n/a	n/a	n/a	0.00861
5569.07	0.17	n/a	n/a	n/a	n/a	0.00838	n/a	n/a	n/a	n/a	0.00838
5569.06	0.16	n/a	n/a	n/a	n/a	0.00813	n/a	n/a	n/a	n/a	0.00813
5569.05	0.15	n/a	n/a	n/a	n/a	0.00788	n/a	n/a	n/a	n/a	0.00788
5569.04	0.14	n/a	n/a	n/a	n/a	0.00762	n/a	n/a	n/a	n/a	0.00762
5569.03	0.13	n/a	n/a	n/a	n/a	0.00735	n/a	n/a	n/a	n/a	0.00735
5569.02	0.12	n/a	n/a	n/a	n/a	0.00707	n/a	n/a	n/a	n/a	0.00707
5569.01	0.11	n/a	n/a	n/a	n/a	0.00678	n/a	n/a	n/a	n/a	0.00678
5569.00	0.10	n/a	n/a	n/a	n/a	0.00647	n/a	n/a	n/a	n/a	0.00647
5568.99	0.09	n/a	n/a	n/a	n/a	0.00615	n/a	n/a	n/a	n/a	0.00615
5568.98	0.08	n/a	n/a	n/a	n/a	0.00581	n/a	n/a	n/a	n/a	0.00581
5568.97	0.07	n/a	n/a	n/a	n/a	0.00545	n/a	n/a	n/a	n/a	0.00545
5568.96	0.06	n/a	n/a	n/a	n/a	0.00507	n/a	n/a	n/a	n/a	0.00507
5568.95	0.05	n/a	n/a	n/a	n/a	0.00465	n/a	n/a	n/a	n/a	0.00465
5568.94	0.04	n/a	n/a	n/a	n/a	0.00420	n/a	n/a	n/a	n/a	0.00420
5568.93	0.03	n/a	n/a	n/a	n/a	0.00368	n/a	n/a	n/a	n/a	0.00368
5568.92	0.02	n/a	n/a	n/a	n/a	0.00309	n/a	n/a	n/a	n/a	0.00309
5568.91	0.01	n/a	n/a	n/a	n/a	0.00234	n/a	n/a	n/a	n/a	0.00234
5568.90	0.00	n/a	n/a	n/a	n/a	0.00120	n/a	n/a	n/a	n/a	0.00120
5568.89	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5568.88	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
5568.87	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a

443.38	34.38	2094.33	0.58	21.53
410.32	33.06	2083.52	0.58	22.11
378.57	31.74	2075.89	0.58	22.68
348.14	30.43	2072.62	0.58	23.26
319.02	29.12	2075.52	0.58	23.84
291.21	27.82	2087.67	0.58	24.42
264.70	26.51	2114.83	0.59	25.00
239.48	25.21	2170.00	0.60	25.61
215.57	23.91	2297.43	0.64	26.24
192.95	22.62	2625.64	0.73	26.97
171.63	21.32	2545.92	0.71	27.68
151.59	20.04	2463.99	0.68	28.37
132.85	18.75	2379.63	0.66	29.03
115.38	17.46	2292.56	0.64	29.66
99.20	16.18	2202.46	0.61	30.28
84.30	14.90	2108.96	0.59	30.86
70.67	13.63	2011.58	0.56	31.42
58.31	12.36	1909.74	0.53	31.95
47.23	11.09	1802.70	0.50	32.45
37.41	9.82	1689.48	0.47	32.92
28.85	8.55	1568.78	0.44	33.36
21.56	7.29	1438.79	0.40	33.76
15.51	6.05	1300.95	0.36	34.12
10.63	4.88	1162.49	0.32	34.44
6.84	3.79	1029.09	0.29	34.73
4.05	2.79	904.41	0.25	34.98
2.14	1.91	815.46	0.23	35.20
0.96	1.19	990.70	0.28	35.48
0.32	0.64	n/a	n/a	35.48
0.06	0.26	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48
n/a	n/a	n/a	n/a	35.48

Watkins Compressor Station - Detention Pond Minor Storm Orifice Design Worksheet

Calculation By:
Date:

Rectangular Orifice Plate Diagram:



Equations:

$$Q = C_0 A_0 (2gH_0)^{0.5}$$

where:
Q = orifice flow discharge
C_d = dimensionless coefficient of discharge
A_0 = cross-sectional area of orifice (ft^2)
g = acceleration due to gravity (32.2 ft/s^2)

$$A_0 = W_0 D_0$$

where:
A_0 = cross-sectional area of orifice (in^2)
D_0 = height of orifice opening (in)
W_0 = width of orifice opening (in)

$$\Delta t = \frac{\Delta V}{3600Q}$$

where:
Δt = drain time for incremental depth (hours)
ΔV = storage volume drained from stage increment (ft^3)
Q = orifice dischrage rate for stage increment (ft^3/s)

DESIGN INPUTS:

WQCV Orifice Size Design Input:

Rectangular Orifice Width:	W_0 =	10	inches
Maximum Allowable Discharge Rate:	$Q_{allowable}$ =	0.47	ft^3/s
Orifice Coefficient:	C_0 =	0.6	
Gravitational Constant:	g =	32.2	ft/s^2

Pond Geometry Design Input:

WQCV Peak Stage (Bottom of Rect. Orifice):	EL_{BP} =	5569.50	ft
Minor Storm Max Water Surface Elevation:	EL_{TP} =	5570.24	ft
Water Quality Capture Volume:	WQCV =	2162.00	ft^3
Minor Storm Storage Volume:	V_5 or V_{10} =	6875.00	ft^3
Volume Drained through Rectangular Orifice:	V_{design} =	4713.00	ft^3

VARIABLE INPUTS:

Change Orifice Hole Diameter:

Rectangular Orifice Height:	D_0 =	1.5000	in
Hole Area:	A_0 =	15	in^2
Top of orifice (less than Max WSEL):	EL_{TO} =	5569.63	ft

= variable user input

= calculation variable

CALCULATED RESULTS:

Computed Orifice Centroid Elevation:

Centroid Elevation:	$EL_{centroid}$ =	5569.56	ft

CALCULATE POND DRAIN TIME FROM MINOR STORM MAX WSEL:

Drain Time to Top of WQCV Orifice:	$t_{minor\ storm}$ =	**5.39**	**hours**

CALCULATE Q AT MINOR STORM MAX WSEL:

Effective Head on Orifice:	H_0 =	0.68	ft
Orifice Flow Discharge:	**Q_{calc} =**	**0.41**	**ft^3/s**
Check: $Q_{calc} - Q_{allowable} = 0$		-0.06	

INTERMEDIATE CALCULATIONS:

Notes:

1. Flow rate is calculated at each 0.10-ft stage decrease. It is assumed that the discharge rate calculated at the maximum stage value for each increment and the corresponding effective head is representative of the entire 0.10-ft depth.

2. Storage volumes are determined using the pond design contour areas and the average end-area method.

WSEL	H_0	Q
5570.24	0.68	0.41284
5570.23	0.67	0.40978
5570.22	0.66	0.40670
5570.21	0.65	0.40359
5570.20	0.64	0.40046
5570.19	0.63	0.39731
5570.18	0.62	0.39413
5570.17	0.61	0.39093
5570.16	0.60	0.38770
5570.15	0.59	0.38444
5570.14	0.58	0.38115
5570.13	0.57	0.37784
5570.12	0.56	0.37449
5570.11	0.55	0.37112
5570.10	0.54	0.36772
5570.09	0.53	0.36428
5570.08	0.52	0.36081
5570.07	0.51	0.35731
5570.06	0.50	0.35377
5570.05	0.49	0.35020
5570.04	0.48	0.34658
5570.03	0.47	0.34294
5570.02	0.46	0.33925
5570.01	0.45	0.33552
5570.00	0.44	0.33175

Volume at WSEL	Incremental Volume	Time seconds	Time hours	Cumulative Time
6943.33				
6875.01	68.33	165.50	0.05	0.05
6738.76	136.25	332.49	0.09	0.14
6670.83	67.92	167.01	0.05	0.18
6603.05	67.79	167.96	0.05	0.23
6535.39	67.66	168.94	0.05	0.28
6467.87	67.52	169.95	0.05	0.33
6400.48	67.39	170.98	0.05	0.37
6333.22	67.26	172.04	0.05	0.42
6266.10	67.12	173.13	0.05	0.47
6199.11	66.99	174.25	0.05	0.52
6132.26	66.86	175.41	0.05	0.57
6065.53	66.72	176.59	0.05	0.62
5998.94	66.59	177.81	0.05	0.66
5932.48	66.46	179.07	0.05	0.71
5866.16	66.33	180.37	0.05	0.76
5799.96	66.19	181.71	0.05	0.81
5733.90	66.06	183.09	0.05	0.87
5667.98	65.93	184.52	0.05	0.92
5602.18	65.80	185.99	0.05	0.97
5536.51	65.66	187.51	0.05	1.02
5470.98	65.53	189.08	0.05	1.07
5405.58	65.40	190.71	0.05	1.13
5340.31	65.27	192.39	0.05	1.18
5275.17	65.14	194.14	0.05	1.23

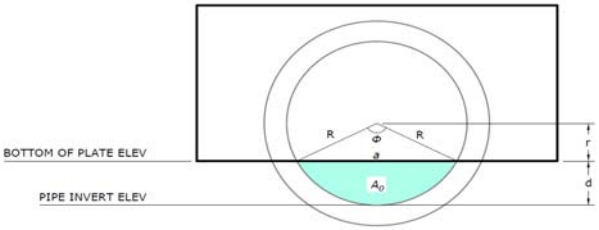
5569.99	0.43	0.32794
5569.98	0.42	0.32408
5569.97	0.41	0.32017
5569.96	0.40	0.31622
5569.95	0.39	0.31222
5569.94	0.38	0.30816
5569.93	0.37	0.30405
5569.92	0.36	0.29989
5569.91	0.35	0.29567
5569.90	0.34	0.29138
5569.89	0.33	0.28703
5569.88	0.32	0.28261
5569.87	0.31	0.27813
5569.86	0.30	0.27357
5569.85	0.29	0.26893
5569.84	0.28	0.26421
5569.83	0.27	0.25941
5569.82	0.26	0.25451
5569.81	0.25	0.24952

5210.17	65.01	195.95	0.05	1.29
5145.29	64.88	197.83	0.05	1.34
5080.55	64.74	199.78	0.06	1.40
5015.93	64.61	201.81	0.06	1.45
4951.45	64.48	203.91	0.06	1.51
4887.10	64.35	206.11	0.06	1.57
4822.88	64.22	208.40	0.06	1.63
4758.79	64.09	210.78	0.06	1.68
4694.83	63.96	213.28	0.06	1.74
4631.00	63.83	215.88	0.06	1.80
4567.30	63.70	218.61	0.06	1.86
4503.74	63.57	221.47	0.06	1.93
4440.30	63.44	224.47	0.06	1.99
4376.99	63.31	227.62	0.06	2.05
4313.81	63.18	230.94	0.06	2.12
4250.76	63.05	234.44	0.07	2.18
4187.84	62.92	238.14	0.07	2.25
4125.05	62.79	242.05	0.07	2.31
4062.39	62.66	246.20	0.07	2.38

Watkins Compressor Station - Detention Pond 100-year Flow Restrictor Plate Design Worksheet

Calculation By: M. Morgan
Date: 10/1/2018

WQCV Orifice Plate Diagram:



Equations:

$$Q = C_0 A_0 (2gH_0)^{0.5}$$

where:
Q = orifice flow discharge
C_d = dimensionless coefficient of discharge
A_0 = cross-sectional area of orifice (ft^2)
g = acceleration due to gravity (32.2 ft/s^2)

$$A_0 = R^2 \cos^{-1}\left(\frac{R-d}{R}\right) - (R-d)\sqrt{2Rd - d^2}$$

where:
A_0 = cross-sectional area of orifice (in^2)
R = pipe radius (in)
d = restrictor plate opening height (in)

$$\emptyset = 2\cos^{-1}\left(\frac{R-d}{R}\right)$$

where:
Φ = central angle made by plate (Φ < π radians)
R = pipe radius (in)
d = restrictor plate opening height (in)

$$C_y = R - \left(\frac{4R}{3}\left(\frac{\left(\sin\frac{\emptyset}{2}\right)^3}{\emptyset - \sin\emptyset}\right)\right)$$

where:
C_y = height of orifice centroid above pipe invert (in)
Φ = central angle made by plate (Φ < π radians)
R = pipe radius (in)

$$\Delta t = \frac{\Delta V}{3600Q}$$

where:
Δt = drain time for incremental depth (hours)
ΔV = storage volume drained from stage increment (ft^3)
Q = orifice dischrage rate for stage increment (ft^3/s)

DESIGN INPUTS:

Restrictor Plate Orifice Size Design Input:

Outlet Pipe Diameter:	D =	12	inches
Maximum Allowable Discharge Rate:	$Q_{allowable}$ =	2.78	ft^3/s
Orifice Coefficient:	C_0 =	0.6	
Gravitational Constant:	g =	32.2	ft/s^2

Pond Geometry Design Input:

Bottom of Pond Elevation:	EL_{BP} =	5568.86	ft
Outlet Pipe Invert Elevation:	EL_{inv} =	5568.86	ft
100-year Storage Volume:	V_{100} =	12458.00	ft^3
Minor Storm Max Water Surface Elevation:	EL_{TP} =	5570.24	ft
100-year Max Water Surface Elevation:	EL_{100} =	5571.00	ft

** Restrictor plate controls flow between 100-year Max Water Surface Elevation until the pond drains to the Minor Storm Max Water Surface Elevation.*

VARIABLE INPUTS:

Change Orifice Hole Diameter:

Restrictor Plate Opening Height:	d =	6.2500	in
Outlet Pipe Radius:	R =	6	in
Orifice Area:	A_0 =	59.5477995	in^2
Central Angle:	Φ =	3.22495012	rad

= variable user input
= calculation variable

** Change restrictor plate opening height to achieve maximum allowable flow at 100-year Max Water Surface Elevation.*

CALCULATED RESULTS:

Computed Orifice Centroid Elevation:

Centroid Height Above Pipe Invert:	C_y =	3.5881	in
Orifice Centroid Elevation:	EL_1 =	5569.16	ft
Bottom of Plate Elevation:	EL_{plate} =	5569.38	ft

CALCULATE Q AT 100-YR MAX WSEL:

Effective Head on Orifice:	H_0 =	1.84	ft
Orifice Flow Discharge:	**Q_{calc} =**	**2.70**	**ft^3/s**

Check:
$Q_{calc} - Q_{allowable} = 0$ -0.08

CALCULATE FOR POND DRAIN TIME FROM 100-YR MAX WSEL:

Drain Time to Top of Minor Storm Orifice:	**t_{100} =**	**0.65 hours**
Drain Time for WQCV:	**t_{WQCV} =**	**35.48 hours**
** From WQCV Orifice plate design worksheet*		
Drain Time for Minor Storm Volume:	**$t_{minor\ storm}$ =**	**5.39 hours**
** From Minor Storm Orifice plate design worksheet*		
Total Drain Time from Max WSEL:	**t_{total} =**	**41.51 hours**
** CHECK: Total drain down time must be less than 72-hours*		

Pond drains in less than 72 hours

INTERMEDIATE CALCULATIONS:

Notes:

1. Flow rate is calculated at each 0.10-ft stage decrease. It is assumed that the discharge rate calculated at the maximum stage value for each increment and the corresponding effective head is representative of the entire 0.10-ft depth.

2. Storage volumes are determined using the pond design contour areas and the average end-area method.

WSEL	H_0	Q
5571.00	1.84	2.70162
5570.99	1.83	2.69427
5570.98	1.82	2.68690
5570.97	1.81	2.67951
5570.96	1.80	2.67211
5570.95	1.79	2.66468
5570.94	1.78	2.65723
5570.93	1.77	2.64976
5570.92	1.76	2.64227
5570.91	1.75	2.63475
5570.90	1.74	2.62722
5570.89	1.73	2.61966
5570.88	1.72	2.61208
5570.87	1.71	2.60448
5570.86	1.70	2.59686
5570.85	1.69	2.58922
5570.84	1.68	2.58155
5570.83	1.67	2.57386
5570.82	1.66	2.56615
5570.81	1.65	2.55841
5570.80	1.64	2.55065
5570.79	1.63	2.54287
5570.78	1.62	2.53506
5570.77	1.61	2.52723
5570.76	1.60	2.51937
5570.75	1.59	2.51149
5570.74	1.58	2.50359
5570.73	1.57	2.49566
5570.72	1.56	2.48770
5570.71	1.55	2.47972
5570.70	1.54	2.47171
5570.69	1.53	2.46368
5570.68	1.52	2.45562
5570.67	1.51	2.44753
5570.66	1.50	2.43942
5570.65	1.49	2.43128
5570.64	1.48	2.42312
5570.63	1.47	2.41492
5570.62	1.46	2.40670
5570.61	1.45	2.39845
5570.60	1.44	2.39017
5570.59	1.43	2.38186
5570.58	1.42	2.37352
5570.57	1.41	2.36516
5570.56	1.40	2.35676
5570.55	1.39	2.34834
5570.54	1.38	2.33988
5570.53	1.37	2.33139
5570.52	1.36	2.32287
5570.51	1.35	2.31432

Volume at WSEL	Incremental Volume	Time seconds	Time hours	Cumulative Time
12536.91				
12458.07	78.84	29.18	0.01	0.01
12379.37	78.70	29.21	0.01	0.02
12222.39	156.98	58.42	0.02	0.03
12144.12	78.27	29.21	0.01	0.04
12065.99	78.13	29.24	0.01	0.05
11988.00	77.99	29.27	0.01	0.06
11910.15	77.85	29.30	0.01	0.06
11832.44	77.71	29.33	0.01	0.07
11754.88	77.56	29.36	0.01	0.08
11677.45	77.42	29.39	0.01	0.09
11600.17	77.28	29.42	0.01	0.10
11523.03	77.14	29.45	0.01	0.11
11446.03	77.00	29.48	0.01	0.11
11369.18	76.86	29.51	0.01	0.12
11292.46	76.72	29.54	0.01	0.13
11215.88	76.58	29.57	0.01	0.14
11139.45	76.43	29.61	0.01	0.15
11063.16	76.29	29.64	0.01	0.16
10987.00	76.15	29.68	0.01	0.16
10910.99	76.01	29.71	0.01	0.17
10835.12	75.87	29.75	0.01	0.18
10759.38	75.73	29.78	0.01	0.19
10683.79	75.59	29.82	0.01	0.20
10608.34	75.45	29.86	0.01	0.20
10533.03	75.31	29.89	0.01	0.21
10457.85	75.17	29.93	0.01	0.22
10382.82	75.03	29.97	0.01	0.23
10307.93	74.89	30.01	0.01	0.24
10233.17	74.75	30.05	0.01	0.25
10158.56	74.61	30.09	0.01	0.25
10084.08	74.48	30.13	0.01	0.26
10009.75	74.34	30.17	0.01	0.27
9935.55	74.20	30.22	0.01	0.28
9861.49	74.06	30.26	0.01	0.29
9787.57	73.92	30.30	0.01	0.30
9713.79	73.78	30.35	0.01	0.31
9640.15	73.64	30.39	0.01	0.31
9566.65	73.50	30.44	0.01	0.32
9493.28	73.37	30.48	0.01	0.33
9420.06	73.23	30.53	0.01	0.34
9346.97	73.09	30.58	0.01	0.35
9274.02	72.95	30.63	0.01	0.36
9201.20	72.81	30.68	0.01	0.36
9128.53	72.68	30.73	0.01	0.37
9055.99	72.54	30.78	0.01	0.38
8983.59	72.40	30.83	0.01	0.39
8911.33	72.26	30.88	0.01	0.40
8839.20	72.13	30.94	0.01	0.41
8767.22	71.99	30.99	0.01	0.42

Overflow Spillway

Project Description

Solve For	Discharge

Input Data

Headwater Elevation	5571.50	ft
Crest Elevation	5571.00	ft
Tailwater Elevation	5569.00	ft
Weir Coefficient	3.37	US
Crest Length	10.00	ft

Results

Discharge	11.90	ft³/s	> 9.88 cfs (100-YR peak runoff rate)
Headwater Height Above Crest	0.50	ft	
Tailwater Height Above Crest	-2.00	ft	
Equal Side Slopes	0.25	ft/ft (H:V)	
Flow Area	5.06	ft²	
Velocity	2.35	ft/s	
Wetted Perimeter	11.03	ft	
Top Width	10.25	ft	

Pond Outlet - 12" RCP

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00500	ft/ft
Normal Depth	11.3	in
Diameter	12	in

Results

Discharge	2.71	ft³/s	> 2.70 cfs release rate
Flow Area	0.76	ft²	
Wetted Perimeter	2.64	ft	
Hydraulic Radius	3.5	in	
Top Width	0.48	ft	
Critical Depth	0.71	ft	
Percent Full	93.8	%	
Critical Slope	0.00808	ft/ft	
Velocity	3.54	ft/s	
Velocity Head	0.20	ft	
Specific Energy	1.13	ft	
Froude Number	0.50		
Maximum Discharge	2.71	ft³/s	
Discharge Full	2.52	ft³/s	
Slope Full	0.00579	ft/ft	
Flow Type	SubCritical		

GVF Input Data

Downstream Depth	0.0	in
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.0	in
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	93.75	%
Downstream Velocity	Infinity	ft/s

Appendix F:
Hydraulic Calculations

Design Point A

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.024		
Channel Slope	0.0214	ft/ft	
Diameter	18	in	
Discharge	1.72	ft³/s	Basin A 100-YR peak runoff

Results

Normal Depth	5.55	in	< 18" ok
Flow Area	0.46	ft²	
Wetted Perimeter	1.77	ft	
Hydraulic Radius	3.15	in	
Top Width	1.39	ft	
Critical Depth	0.49	ft	
Percent Full	30.8	%	
Critical Slope	0.01675	ft/ft	
Velocity	3.71	ft/s	
Velocity Head	0.21	ft	
Specific Energy	0.68	ft	
Froude Number	1.13		
Maximum Discharge	8.95	ft³/s	
Discharge Full	8.32	ft³/s	
Slope Full	0.00091	ft/ft	
Flow Type	SuperCritical		

GVF Input Data

Downstream Depth	0.00	in
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	in
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	30.85	%
Downstream Velocity	Infinity	ft/s

Design Point B

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.024		
Channel Slope	0.0247	ft/ft	
Diameter	24	in	
Discharge	18.37	ft³/s	Basin B 100-YR peak runoff

Results

Normal Depth	19.32	in	< 24" ok
Flow Area	2.66	ft²	
Wetted Perimeter	4.45	ft	
Hydraulic Radius	7.17	in	
Top Width	1.51	ft	
Critical Depth	1.55	ft	
Percent Full	82.0	%	
Critical Slope	0.02664	ft/ft	
Velocity	6.91	ft/s	
Velocity Head	0.74	ft	
Specific Energy	2.35	ft	
Froude Number	0.92		
Maximum Discharge	19.76	ft³/s	
Discharge Full	18.37	ft³/s	
Slope Full	0.02470	ft/ft	
Flow Type	SubCritical		

GVF Input Data

Downstream Depth	0.00	in
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	in
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	81.96	%
Downstream Velocity	Infinity	ft/s

Design Point C

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.024		
Channel Slope	0.0262	ft/ft	
Diameter	30	in	
Discharge	31.43	ft³/s	1/2 Basin C 100-YR peak runoff

Results

Normal Depth	21.72	in	< 30" (2-30" CMP's @ proposed crossing)
Flow Area	3.81	ft²	
Wetted Perimeter	5.09	ft	
Hydraulic Radius	8.98	in	
Top Width	2.24	ft	
Critical Depth	1.91	ft	
Percent Full	72.4	%	
Critical Slope	0.02307	ft/ft	
Velocity	8.26	ft/s	
Velocity Head	1.06	ft	
Specific Energy	2.87	ft	
Froude Number	1.12		
Maximum Discharge	38.68	ft³/s	
Discharge Full	35.96	ft³/s	
Slope Full	0.02001	ft/ft	
Flow Type	SuperCritical		

GVF Input Data

Downstream Depth	0.00	in
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	in
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	72.40	%
Downstream Velocity	Infinity	ft/s

Design Point 1

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.013		
Channel Slope	0.01000	ft/ft	
Normal Depth	11.00	in	
Diameter	12	in	Basin 1 (2 - 12" RCP's)

Results

Discharge	3.82	ft³/s	2-12" RCP's (7.64 cfs > 5-YR storm)
Flow Area	0.75	ft²	
Wetted Perimeter	2.56	ft	
Hydraulic Radius	3.54	in	
Top Width	0.55	ft	
Critical Depth	0.83	ft	
Percent Full	91.7	%	
Critical Slope	0.01122	ft/ft	
Velocity	5.07	ft/s	
Velocity Head	0.40	ft	
Specific Energy	1.32	ft	
Froude Number	0.76		
Maximum Discharge	3.83	ft³/s	
Discharge Full	3.56	ft³/s	
Slope Full	0.01150	ft/ft	
Flow Type	SubCritical		

GVF Input Data

Downstream Depth	0.00	in
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	in
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	91.67	%
Downstream Velocity	Infinity	ft/s

Design Point 2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.024		
Channel Slope	0.00800	ft/ft	
Diameter	24	in	
Discharge	10.53	ft³/s	1/2 Basin D1 100-YR peak runoff

Results

Normal Depth	18.88	in	< 24" (2-24" CMP's @ proposed crossing)
Flow Area	2.65	ft²	
Wetted Perimeter	4.36	ft	
Hydraulic Radius	7.29	in	
Top Width	1.64	ft	
Critical Depth	1.16	ft	
Percent Full	78.6	%	
Critical Slope	0.01805	ft/ft	
Velocity	3.97	ft/s	
Velocity Head	0.25	ft	
Specific Energy	1.82	ft	
Froude Number	0.55		
Maximum Discharge	11.79	ft³/s	
Discharge Full	10.96	ft³/s	
Slope Full	0.00739	ft/ft	
Flow Type	SubCritical		

GVF Input Data

Downstream Depth	0.00	in
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	in
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	78.65	%
Downstream Velocity	Infinity	ft/s

Perimeter Swale

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Roughness Coefficient	0.045	
Channel Slope	0.00500	ft/ft
Normal Depth	1.0	ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Bottom Width	2.00	ft

Results

Discharge	9.81	ft³/s	> 5-YR peak runoff for Basin D1 or D2
Flow Area	6.00	ft²	
Wetted Perimeter	10.25	ft	
Hydraulic Radius	0.6	ft	
Top Width	10.00	ft	
Critical Depth	0.62	ft	
Critical Slope	0.04134	ft/ft	
Velocity	1.63	ft/s	
Velocity Head	0.04	ft	
Specific Energy	1.04	ft	
Froude Number	0.37		
Flow Type	Subcritical		

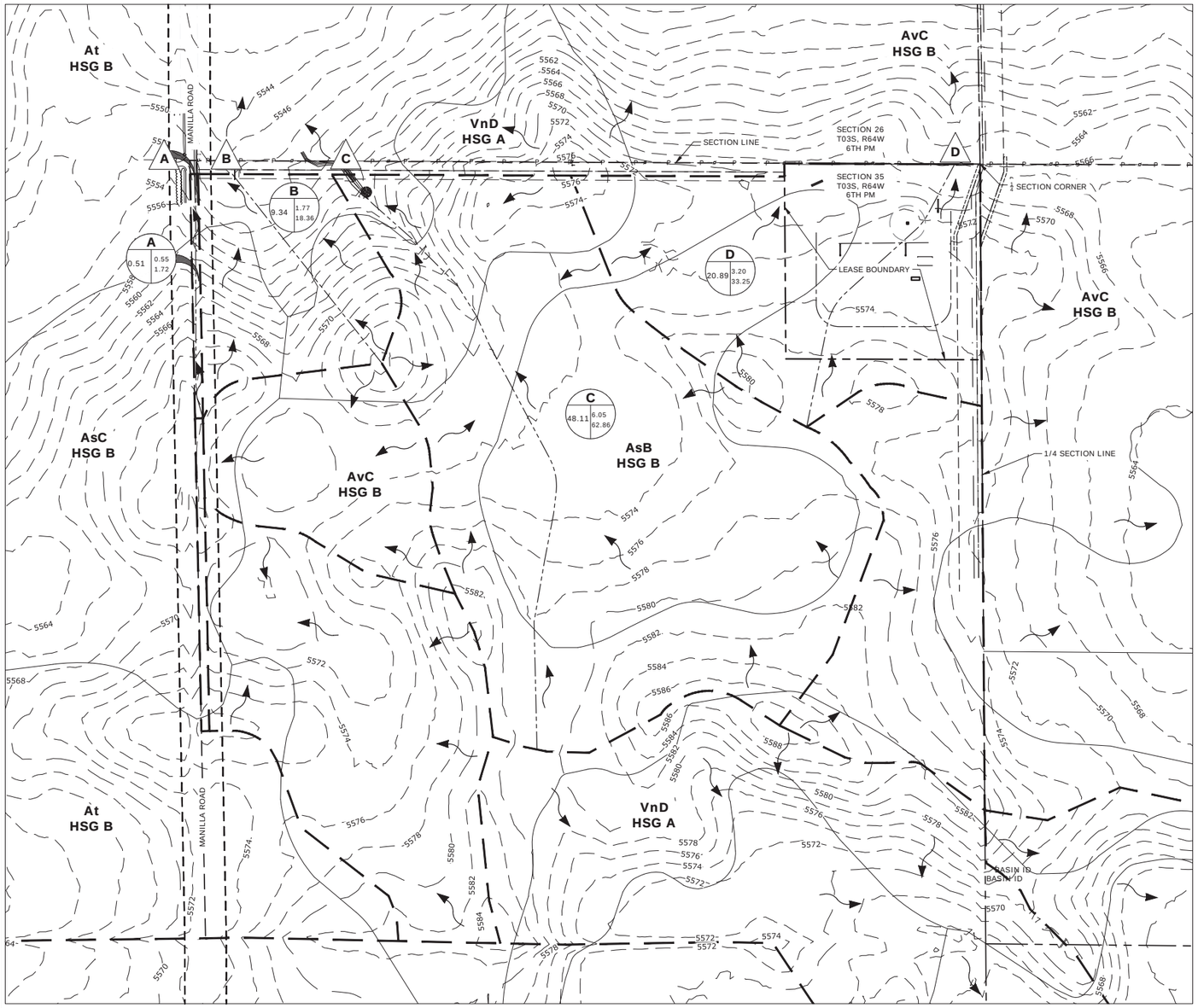
GVF Input Data

Downstream Depth	0.0	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.0	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.0	ft
Critical Depth	0.62	ft
Channel Slope	0.00500	ft/ft

Appendix G:
Predeveloped and Developed Conditions Drainage Maps



NOTES

1. THE WATKINS COMPRESSOR STATION SOUTH PROPOSED SITE IS A 10-ACRE LEASE LOCATED IN THE NORTHWEST QUARTER OF SECTION 35, TOWNSHIP 3 SOUTH, RANGE 64 WEST, 6TH PRINCIPAL MERIDIAN, ADAMS COUNTY, STATE OF COLORADO.
2. THE SITE SURVEY FOR THIS PROJECT WAS PREPARED BY ACKLAM, INC. AND WAS RECEIVED ON 10/12/2018.

   HORIZONTAL DATUM: BASED ON COLORADO STATE PLANE COORDINATES, NORTH ZONE, NORTH AMERICAN HORIZONTAL DATUM, 1983 (US SURVEY FEET).

   VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM 1988.
3. FOR GRADING AND DRAINAGE PLANS SEE WCSS-CE-601 AND WCSS-CE-602. FOR EROSION CONTROL AND SURFACING SEE PLAN WCSS-CE-401. FOR DRAINAGE MAPS SEE DRAWINGS WCSS-CE-610 AND WCSS-CE-611.
4. OFFSITE PIPE CONNECTIONS TO THE COMPRESSOR STATION DESIGNED AND INSTALLED BY OTHERS.
5. THE PROJECT SITE HAS NO EXISTING UTILITIES OR STORM DRAINAGE FEATURES.

LEGEND

- EXISTING MAJOR CONTOUR (5405)
- EXISTING MINOR CONTOUR (5403)
- PROPOSED MAJOR CONTOUR (5405)
- PROPOSED MINOR CONTOUR (5403)
- EASEMENT LINE
- LEASE BOUNDARY
- SECTION LINE
- 1/4 SECTION LINE
- PIPELINE EASEMENT
- RIGHT-OF-WAY (ROW)
- SECURITY FENCE
- EXISTING CONDITIONS BASIN BOUNDARY
- TIME OF CONCENTRATION PATH
- EXISTING OVERHEAD POWER (P — P — P)
- DRAINAGE FLOW ARROW
- AvC HSG A — NRCS HYDROLOGIC SOIL GROUP
- A — DESIGN POINT
- BASIN ID, BASIN AREA (AC), Q_5, Q_{100} — BASIN HYDROLOGY

DRAINAGE BASIN SUMMARY

BASIN	DESIGN POINT	DESCRIPTION	CONTRIBUTING AREA (ACRES)	HYDROLOGIC SOIL GROUP (HSG)	IMPERVIOUS AREA (%)	BASIN FLOW LENGTH (FT)	BASIN FLOW SLOPE (%)	5-YR RUNOFF COEFFICIENT C_5	100-YR RUNOFF COEFFICIENT C_{100}	5-YR PEAK FLOW RATE (CFS) Q_5	100-YR PEAK FLOW RATE (CFS) Q_{100}
A	A	EX. CONDITIONS BASIN	0.51	B	50.0	827	2.78	0.40	0.66	0.55	1.72
B	B	EX. CONDITIONS BASIN	9.34	B	2.0	813	3.75	0.08	0.44	1.77	18.36
C	C	EX. CONDITIONS BASIN	48.11	B	2.0	2182	1.19	0.08	0.44	6.05	62.86
D	D	EX. CONDITIONS BASIN ENCOMPASSING SITE	20.89	B	2.0	1054	1.12	0.08	0.44	3.20	33.25

NRCS WEB SOIL SURVEY DATA

MAP UNIT SYMBOL	MAP SOIL NAME	HYDROLOGIC SOIL GROUP RATING
AsB	ASCALON SANDY LOAM, (0%-3% SLOPES)	B
AsC	ASCALON SANDY LOAM, (3%-5% SLOPES)	B
At	ASCALON-PLATNER ASSOCIATION	B
AvC	ASCALON-VONA SANDY LOAM, (1%-5% SLOPES)	B
VnD	VONA LOAMY SAND, (3% TO 9% SLOPES)	A

NORTH

0' 100' 200' 400' 600'

SCALE: 1" = 200'

Know what's below. Call before you dig.

COLORADO LICENSED MICHAEL T. CLOUD 49458 01-21-19 PROFESSIONAL ENGINEER FOR PERMIT

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REFERENCE DRAWINGS

DWG NO.	DESCRIPTION

REVISIONS

NO.	DESCRIPTION	DATE	BY

REVISIONS

NO.	DESCRIPTION	DATE	BY
B	ISSUED FOR PERMIT - RESPONSE TO COMMENT	01/21/19	LER
A	ISSUED FOR PERMIT	11/15/18	DMM

SCALE:	1" = 200'	DATE
DESIGNED:	M. MORGAN	11/15/2018
DRAWN:	M. MORGAN	10/18/2018
CHECKED:	M. CLOUD	11/15/2018
APPROVED:		
APPROVED:		

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC

LOCATION: ADAMS COUNTY, CO

Samuel Engineering
We Provide Solutions
8450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
Phone: 303.714.4840
Fax: 303.714.4800

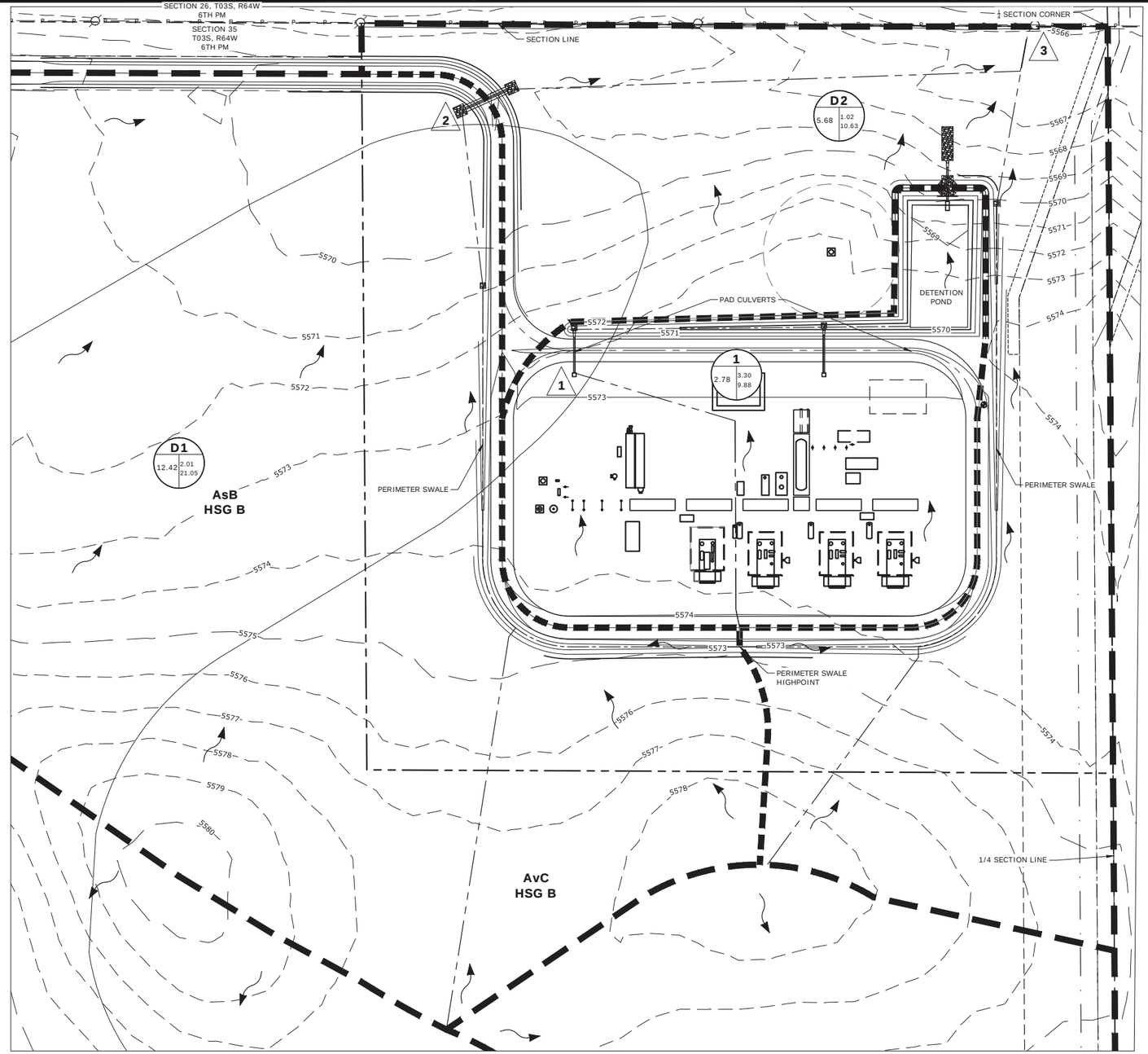
TITLE
WATKINS COMPRESSOR STATION
WILLIAMS DJ BASIN FIELD COMPRESSION
CIVIL
GENERAL
PREDEVELOPED CONDITIONS DRAINAGE MAP

PROJECT NUMBER
18256

DRAWING NUMBER
WCSS-CE-610

REV. B

CAD File: S:\Projects\18256_Watkins_Compressor\CAD\Civil\Watkins South\Drawings\WCSS-CE-610.dwg
Plot Date: Monday, January 21, 2019 12:55:20 PM Plotted By: Lauren Root
CTB Used: SE_Std_BkW_full_sect.ctb



NOTES

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4. OFFSITE PIPE CONNECTIONS TO THE COMPRESSOR STATION DESIGNED AND INSTALLED BY OTHERS.
5. THE PROJECT SITE HAS NO EXISTING UTILITIES OR STORM DRAINAGE FEATURES.

LEGEND

- 5405 — EXISTING MAJOR CONTOUR
- 5403 — EXISTING MINOR CONTOUR
- 5405 — PROPOSED MAJOR CONTOUR
- 5403 — PROPOSED MINOR CONTOUR
- EASEMENT LINE
- LEASE BOUNDARY
- SECTION LINE
- 1/4 SECTION LINE
- PIPELINE EASEMENT
- RIGHT-OF-WAY (ROW)
- SECURITY FENCE
- EXISTING CONDITIONS BASIN BOUNDARY
- DEVELOPED CONDITIONS BASIN BOUNDARY
- TIME OF CONCENTRATION FLOWPATH
- P P P — EXISTING OVERHEAD POWER
- DRAINAGE FLOW ARROW
- AvC HSG A — NRCS HYDROLOGIC SOIL GROUP
- A — DESIGN POINT
- BASIN ID B; BASIN AREA (AC) 15.99; XX.XX; XX.XX; Q_5 Q_{100} — BASIN HYDROLOGY

DRAINAGE BASIN SUMMARY

BASIN	DESIGN POINT	DESCRIPTION	CONTRIBUTING AREA (ACRES)	HYDROLOGIC SOIL GROUP (HSG)	IMPERVIOUS AREA (%)	BASIN FLOW LENGTH (FT)	BASIN FLOW SLOPE (%)	5-YR RUNOFF COEFFICIENT C_5	100-YR RUNOFF COEFFICIENT C_{100}	5-YR PEAK FLOW RATE (CFS) Q_5	100-YR PEAK FLOW RATE (CFS) Q_{100}
D1	2	PRIMARILY UNDISTURBED AREA	12.42	B	3.0	829	1.01	0.08	0.44	2.01	21.05
D2	SEE DP 3	PRIMARILY UNDISTURBED AREA	5.68	B	2.6	813	1.54	0.08	0.44	1.02	10.63
BASIN 1	1	PROCESS AREA AND ROADS	2.78	B	52.9	331	0.56	0.43	0.67	3.30	9.88
D1 & D2, 1	3	COMBINED PEAK RUNOFF AT DESIGN POINT 3	20.88	B	2.9	1345	0.83	0.08	0.44	2.76	28.26

NRCS WEB SOIL SURVEY DATA

MAP UNIT SYMBOL	MAP SOIL NAME	HYDRLOGIC SOIL GROUP RATING
AsB	ASCALON SANDY LOAM, (0%-3% SLOPES)	B
AvC	ASCALON-VONA SANDY LOAM, (1%-5% SLOPES)	B

N

NORTH

0' 100' 200' 400' 600'

SCALE: 1" = 200'

811 Know what's below. Call before you dig.

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Plot Date: Monday, January 21, 2019 1:06:50 PM Plotted By: Lauren Root
CTB Used: SE_Std_BeW_Full_Size.ctb

REFERENCE DRAWINGS

DWG NO.	DESCRIPTION

REVISIONS

NO.	DESCRIPTION	DATE	BY

REVISIONS

NO.	DESCRIPTION	DATE	BY
B	ISSUED FOR PERMIT - RESPONSE TO COMMENT	01/21/19	LER
A	ISSUED FOR PERMIT	11/15/18	DMM

SCALE:	1" = 200'	DATE
DESIGNED:	M. MORGAN	11/15/2018
DRAWN:	M. MORGAN	10/18/2018
CHECKED:	M. CLOUD	11/15/2018
APPROVED:		
APPROVED:		

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC

LOCATION: ADAMS COUNTY, CO

Williams

Samuel Engineering
We Provide Solutions
8450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
Phone: 303.714.4840
Fax: 303.714.4800

TITLE

WATKINS COMPRESSOR STATION
WILLIAMS DJ BASIN FIELD COMPRESSION
CIVIL-SOUTH
GENERAL
DEVELOPED CONDITIONS DRAINAGE MAP

PROJECT NUMBER

18256

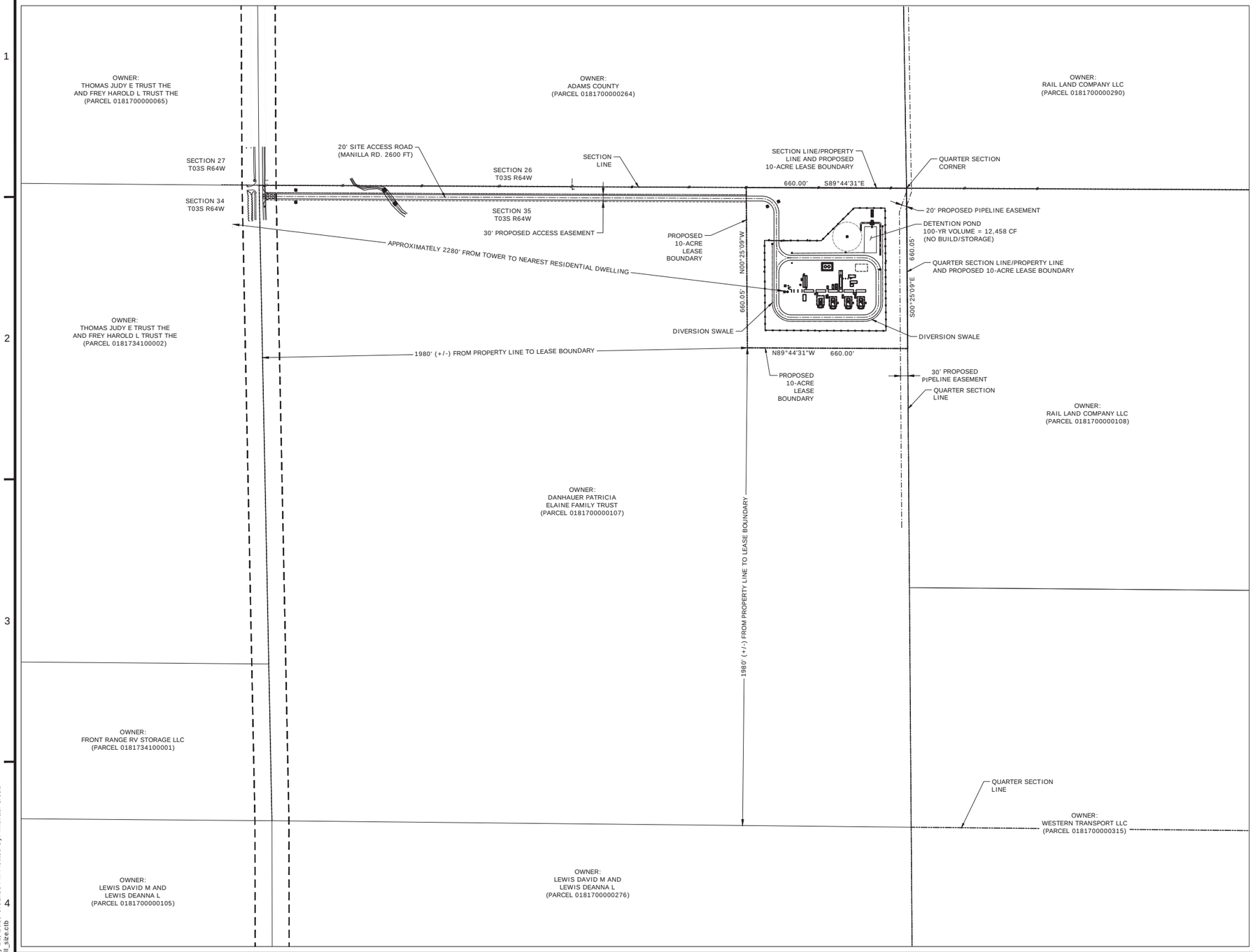
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WCSS-CE-611 REV. B

Appendix H:
Construction Drawings

OVERALL SITE PLAN
WATKINS COMPRESSOR STATION
WILLIAMS DJ BASIN FIELD COMPRESSION

ADAMS COUNTY, COLORADO
PARCEL NO. 181700000107
NW ¼ SECTION 35 T03S R64W
6th PRINCIPAL MERIDIAN



NOTES

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   VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM 1988.
3. SEE CIVIL SITE PLAN FOR MORE INFORMATION (WCSS-CE-103).

LEASE AREA LEGAL DESCRIPTION

A PORTION OF THAT PARCEL DESCRIBED IN QUIT CLAIM DEED TO PATRICIA ELAINE DANHAUER FAMILY TRUST, FILED FOR RECORD IN THE OFFICE OF THE ADAMS COUNTY CLERK AND RECORDER AT RECEPTION NO. 2009000084336, SAID PARCEL LOCATED IN THE NORTHWEST ONEQUARTER OF SECTION 35, TOWNSHIP 3 SOUTH, RANGE 64 WEST OF THE 6TH PRINCIPAL MERIDIAN, COUNTY OF ADAMS, STATE OF COLORADO DESCRIBED AS FOLLOWS:

BEGINNING AT THE NORTH ONE-QUARTER CORNER OF SAID SECTION 35, BEING A 3 INCH ALUMINUM CAP MARKED PLS 23527 1993, THENCE SOUTH 00°25'09" EAST, ALONG THE EAST LINE OF THE NORTHWEST ONE-QUARTER OF SAID SECTION 35, A DISTANCE OF 660.05 FEET;

THENCE NORTH 89°44'31" WEST, DEPARTING SAID LINE, A DISTANCE OF 660.00 FEET;

THENCE NORTH 00°25'09" WEST A DISTANCE OF 660.05 FEET, MORE OR LESS, TO THE NORTH LINE OF THE NORTHWEST ONE-QUARTER OF SAID SECTION 35;

THENCE SOUTH 89°44'31" EAST, ALONG SAID LINE, A DISTANCE OF 660.00 FEET TO THE POINT OF BEGINNING;

CONTAINING 10.000 ACRES (435600 SQUARE FEET) OF LAND, MORE OR LESS.

LEGEND

- EASEMENT LINE
- LEASE BOUNDARY
- SECTION LINE
- 1/4 SECTION LINE
- PIPELINE EASEMENT
- RIGHT-OF-WAY (ROW)
- SECURITY FENCE
- EXISTING OVERHEAD POWER

NORTH

0' 100' 200' 400' 600'

SCALE: 1" = 200'

Know what's below. Call before you dig.

COLORADO LICENSED
MICHAEL T. CLOUD
49458
01-21-19
PROFESSIONAL ENGINEER
FOR PERMIT

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Plot Date: Monday, January 21, 2019 6:52:15 PM Plotted By: Michael Cloud
CTB Used: SE_Std_B&W_Full_Size.ctb

REFERENCE DRAWINGS

DWG NO.	DESCRIPTION

REVISIONS

NO.	DESCRIPTION	DATE	BY

REVISIONS

NO.	DESCRIPTION	DATE	BY
A	ISSUED FOR PERMIT - RESPONSE TO COMMENT	01/21/19	LER

SCALE:	1" = 200'	DATE
DESIGNED:	M. CLOUD	01/21/2019
DRAWN:	L. ROOT	01/21/2019
CHECKED:	M. CLOUD	01/21/2019
APPROVED:		
APPROVED:		

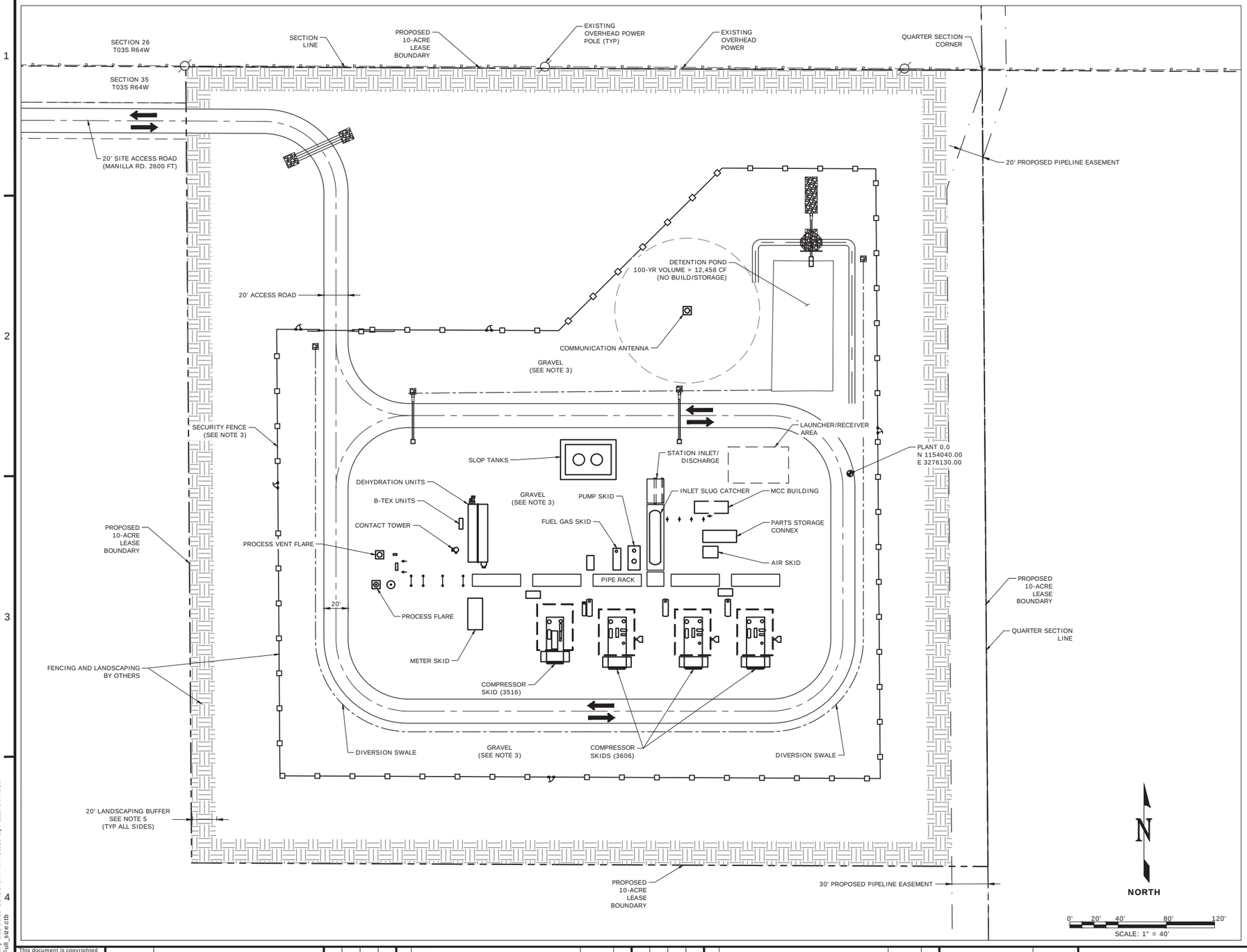
CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC
LOCATION: ADAMS COUNTY, CO

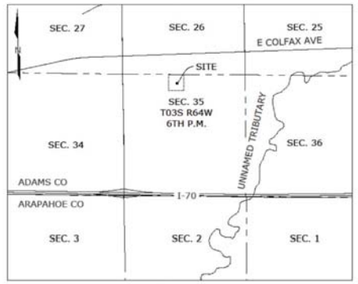
Samuel Engineering
We Provide Solutions
8450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
Phone: 303.714.4840
Fax: 303.714.4800

TITLE	PROJECT NUMBER
WATKINS COMPRESSOR STATION WILLIAMS DJ BASIN FIELD COMPRESSION CIVIL GENERAL OVERALL SITE PLAN	18256
	DRAWING NUMBER
	WCSS-CE-102 REV. A

CIVIL SITE PLAN
WATKINS COMPRESSOR STATION
WILLIAMS DJ BASIN FIELD COMPRESSION

ADAMS COUNTY, COLORADO
PARCEL NO. 1817000000107
NW ¼ SECTION 35 T03S R64W
6th PRINCIPAL MERIDIAN





VICINITY MAP
SCALE: 1" = 3000'

NOTES

1. THE WATKINS COMPRESSOR STATION SOUTH PROPOSED SITE IS A 10-ACRE LEASE LOCATED IN THE NORTHWEST QUARTER OF SECTION 35, TOWNSHIP 3 SOUTH, RANGE 64 WEST, 6TH PRINCIPAL MERIDIAN, ADAMS COUNTY, STATE OF COLORADO.
2. THE SITE SURVEY FOR THIS PROJECT WAS PREPARED BY ACKLAM, INC. AND WAS RECEIVED ON 10/12/2018.

   HORIZONTAL DATUM: BASED ON COLORADO STATE PLANE COORDINATES, NORTH ZONE, NORTH AMERICAN HORIZONTAL DATUM, 1983 (US SURVEY FEET).

   VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM 1988.
3. FOR GRADING AND DRAINAGE PLANS SEE WCSS-CE-601 AND WCSS-CE-602. FOR EROSION CONTROL AND SURFACING SEE PLAN WCSS-CE-401. FOR FENCING PLAN SEE WCSS-CE-501. FOR DRAINAGE MAPS SEE DRAWINGS WCSS-CE-610 AND WCSS-CE-611.
4. OFFSITE PIPE CONNECTIONS TO THE COMPRESSOR STATION DESIGNED AND INSTALLED BY OTHERS.
5. 20 FT LANDSCAPING BUFFER PROVIDED FROM THE LEASE BOUNDARY AND/OR THE 30 FT PIPE LINE EASEMENT (EAST SIDE OF PROPERTY) BY OTHERS.
6. THE PROJECT SITE HAS NO EXISTING UTILITIES OR STORM DRAINAGE FEATURES.
7. PERMANENT SIGN IDENTIFYING FACILITY ADDRESS, NAME, AND CONTACT INFORMATION MUST BE POSTED AND MAINTAINED AT ALL TIMES.
8. NFPA 704 PLACARD MUST BE POSTED AT ALL TIMES.

LEASE AREA LEGAL DESCRIPTION

A PORTION OF THAT PARCEL DESCRIBED IN QUIT CLAIM DEED TO PATRICIA ELAINE DANHAUER FAMILY TRUST, FILED FOR RECORD IN THE OFFICE OF THE ADAMS COUNTY CLERK AND RECORDER AT RECEPTION NO. 2009000084336, SAID PARCEL LOCATED IN THE NORTHWEST ONEQUARTER OF SECTION 35, TOWNSHIP 3 SOUTH, RANGE 64 WEST OF THE 6TH PRINCIPAL MERIDIAN, COUNTY OF ADAMS, STATE OF COLORADO DESCRIBED AS FOLLOWS:

BEGINNING AT THE NORTH ONE-QUARTER CORNER OF SAID SECTION 35, BEING A 3 INCH ALUMINUM CAP MARKED PLS 23527 1993, THENCE SOUTH 00°25'09" EAST, ALONG THE EAST LINE OF THE NORTHWEST ONE-QUARTER OF SAID SECTION 35, A DISTANCE OF 660.05 FEET;

THENCE NORTH 89°44'31" WEST, DEPARTING SAID LINE, A DISTANCE OF 660.00 FEET;

THENCE NORTH 00°25'09" WEST A DISTANCE OF 660.05 FEET, MORE OR LESS, TO THE NORTH LINE OF THE NORTHWEST ONE-QUARTER OF SAID SECTION 35;

THENCE SOUTH 89°44'31" EAST, ALONG SAID LINE, A DISTANCE OF 660.00 FEET TO THE POINT OF BEGINNING;

CONTAINING 10.000 ACRES (435600 SQUARE FEET) OF LAND, MORE OR LESS.

LEGEND

- EASEMENT LINE
- LEASE BOUNDARY
- SECTION LINE
- 1/4 SECTION LINE
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- RIGHT-OF-WAY (ROW)
- SECURITY FENCE
- EXISTING OVERHEAD POWER
- LANDSCAPING BUFFER
- TRAFFIC FLOW

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REFERENCE DRAWINGS

DWG NO.	DESCRIPTION

REVISIONS

NO.	DESCRIPTION	DATE	BY
B	ISSUED FOR PERMIT - RESPONSE TO COMMENT	01/21/19	LER
A	ISSUED FOR PERMIT	11/15/18	DMM

SCALE:	1" = 40'
DESIGNED:	M. MORGAN
DRAWN:	M. MORGAN
CHECKED:	M. CLOUD
APPROVED:	
APPROVED:	
DATE	11/15/2018
DATE	10/18/2018
DATE	11/15/2018

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC
LOCATION: ADAMS COUNTY, CO

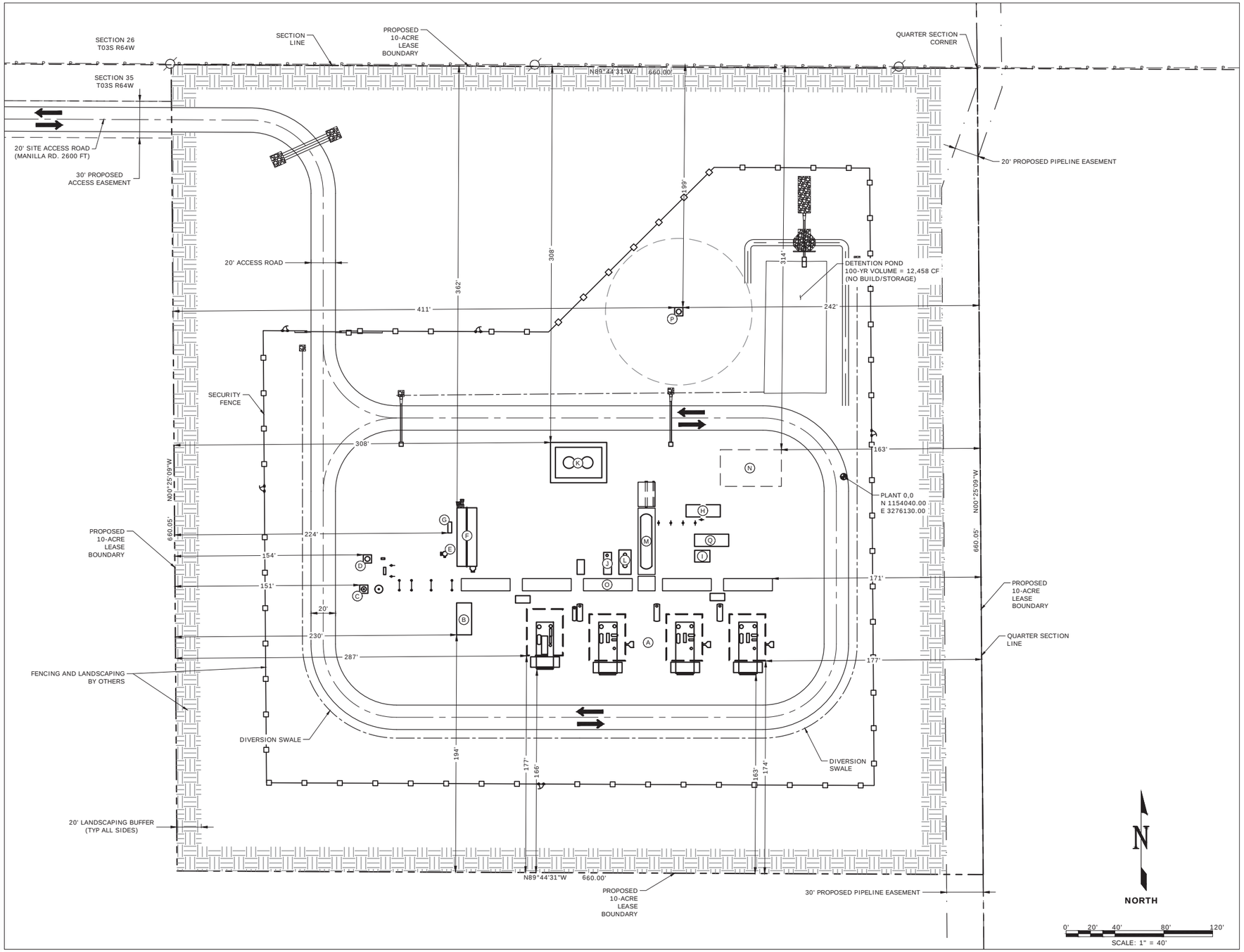
Samuel Engineering
We Provide Solutions
8450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
Phone: 303.714.4840
Fax: 303.714.4800

TITLE	PROJECT NUMBER
WATKINS COMPRESSOR STATION WILLIAMS DJ BASIN FIELD COMPRESSION CIVIL GENERAL CIVIL SITE PLAN	18256
	DRAWING NUMBER
	WCSS-CE-103 REV: B

CAD File: S:\Projects\18256_Watkins_Compressor\CAD\Civil\Watkins South\Drawings\WCSS-CE-103.dwg
Plot Date: Monday, January 21, 2019 12:36:57 PM Plotted By: Lauren Root
CTB Used: SE_5id_0.6M_Full_Std+.ctb

CIVIL SITE SETBACK PLAN
WATKINS COMPRESSOR STATION
WILLIAMS DJ BASIN FIELD COMPRESSION

ADAMS COUNTY, COLORADO
PARCEL NO. 1817000000107
NW ¼ SECTION 35 T03S R64W
6th PRINCIPAL MERIDIAN



NOTES

1. THE WATKINS COMPRESSOR STATION SOUTH PROPOSED SITE IS A 10-ACRE LEASE LOCATED IN THE NORTHWEST QUARTER OF SECTION 35, TOWNSHIP 3 SOUTH, RANGE 64 WEST, 6TH PRINCIPAL MERIDIAN, ADAMS COUNTY, STATE OF COLORADO.
2. THE SITE SURVEY FOR THIS PROJECT WAS PREPARED BY ACKLAM, INC. AND WAS RECEIVED ON 10/12/2018.

   HORIZONTAL DATUM: BASED ON COLORADO STATE PLANE COORDINATES, NORTH ZONE, NORTH AMERICAN HORIZONTAL DATUM, 1983 (US SURVEY FEET).

   VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM 1988.
3. SEE CIVIL SITE PLAN FOR MORE INFORMATION (WCSS-CE-103).

LEASE AREA LEGAL DESCRIPTION

A PORTION OF THAT PARCEL DESCRIBED IN QUIT CLAIM DEED TO PATRICIA ELAINE DANHAUER FAMILY TRUST, FILED FOR RECORD IN THE OFFICE OF THE ADAMS COUNTY CLERK AND RECORDER AT RECEPTION NO. 2009000084336, SAID PARCEL LOCATED IN THE NORTHWEST ONEQUARTER OF SECTION 35, TOWNSHIP 3 SOUTH, RANGE 64 WEST OF THE 6TH PRINCIPAL MERIDIAN, COUNTY OF ADAMS, STATE OF COLORADO DESCRIBED AS FOLLOWS:

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CONTAINING 10.000 ACRES (435600 SQUARE FEET) OF LAND, MORE OR LESS.

EQUIPMENT LIST

		STRUCTURE	HEIGHT
A	A	COMPRESSOR BUILDING (4 UNITS)	22.5 FT
B	B	METER SKID	11 FT
C	C	PROCESS FLARE	65 FT
D	D	PROCESS VENT FLARE	26 FT
E	E	CONTACT TOWER	54 FT
F	F	DEHYDRATION UNIT	15 FT
G	G	BTEX UNIT	10 FT
H	H	MCC BUILDING	10 FT
I	I	AIR SKID	10 FT
J	J	FUEL GAS SKID	10 FT
K	K	SLOP TANKS	7.5 FT
L	L	PUMP SKID	10 FT
M	M	INLET SLUG CATCHER	15 FT
N	N	LAUNCHER/RECEIVER AREA	5 FT
O	O	PIPE RACK	7 FT
P	P	COMMUNICATION ANTENNA	60 FT
Q	Q	PARTS STORAGE CONNEX	10 FT

LEGEND

- EASEMENT LINE
- LEASE BOUNDARY
- SECTION LINE
- 1/4 SECTION LINE
- PIPELINE EASEMENT
- RIGHT-OF-WAY (ROW)
- SECURITY FENCE
- EXISTING OVERHEAD POWER
- LANDSCAPING BUFFER
- TRAFFIC FLOW

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CTB Used: SE_5to1_BW.ctb Style Used: SE_5to1_Full_Site.stb

DWG NO.	DESCRIPTION
	REFERENCE DRAWINGS

NO.	DESCRIPTION	DATE	BY
	REVISIONS		

NO.	DESCRIPTION	DATE	BY
A	ISSUED FOR PERMIT - RESPONSE TO COMMENT	01/21/19	LER
	REVISIONS		

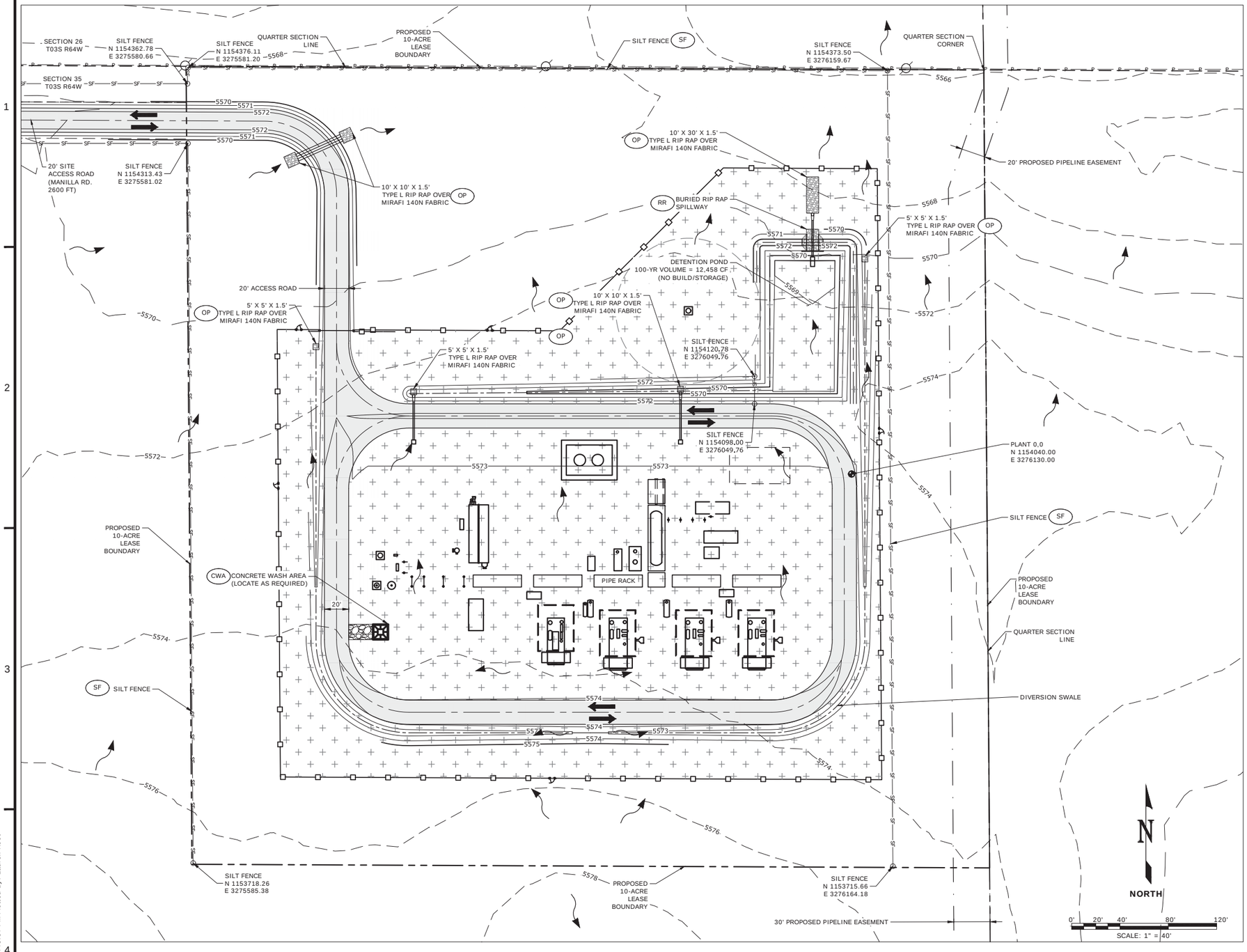
CLIENT | PROJECT ENGINEER | LEAD ENGINEER | CHECK: MTC | MTC

		DATE
SCALE:	1" = 40'	
DESIGNED:	M. CLOUD	01/21/2019
DRAWN:	L. ROOT	01/21/2019
CHECKED:	M. CLOUD	01/21/2019
APPROVED:		
APPROVED:		

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC
LOCATION: ADAMS COUNTY, CO

Samuel Engineering — We Provide Solutions
8450 E. Crescent Parkway, Suite 200 Greenwood Village, CO 80111
Phone: 303.714.4840 Fax: 303.714.4800

TITLE	PROJECT NUMBER
WATKINS COMPRESSOR STATION WILLIAMS DJ BASIN FIELD COMPRESSION CIVIL GENERAL CIVIL SITE SETBACK PLAN	18256
	DRAWING NUMBER
	WCSS-CE-104 REV: A



GENERAL NOTES

1. THE CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING AND PROTECTING ALL UNDERGROUND UTILITIES PRIOR TO CONSTRUCTION. THE CONTRACTOR IS TO ENSURE THAT 811 AND OWNER'S SITE PERSONNEL ARE CONTACTED PRIOR TO COMMENCING CONSTRUCTION ACTIVITIES. CAUTION SHOULD BE TAKEN DURING ALL EXCAVATION OF SOIL AND FOUNDATIONS WITHIN THE LIMITS OF DISTURBANCE. CONTACT ENGINEER IF THERE ARE CONFLICTS.
2. THE MAJORITY OF THE SITE GRAVEL WILL BE INSTALLED AFTER EQUIPMENT IS SET AND FINAL GRADING IS COMPLETE. THE CONTRACTOR IS TO COORDINATE WITH THE OWNER FOR ALL GRAVEL INSTALLATION TIMING.
3. THE CONTRACTOR IS TO SUBMIT A GRADATION SAMPLE TO OWNER PRIOR TO PLACING GRAVEL MATERIAL. OWNER WILL DETERMINE SIZE OF GRAVEL TO BE USED.
4. PERIMETER SILT FENCE IS TO BE INSTALLED PRIOR TO ANY CONSTRUCTION ACTIVITIES. ALL OTHER EROSION CONTROL MEASURES CAN BE INSTALLED AFTER ROUGH GRADING AND DRAINAGE IS COMPLETE.
5. ALL AREAS WITHIN THE SECURITY FENCE SHALL BE MAINTAINED VEGETATION FREE GRAVEL FOR THE LIFE OF THE FACILITY.
6. ALL AREAS OUTSIDE THE SECURITY FENCE NOT SURFACED WITH GRAVEL, ROAD BASE, ETC. THAT ARE DISTURBED DURING CONSTRUCTION SHALL BE SEEDED WITH A NATIVE SEED MIXTURE OR OTHERWISE PROTECTED FROM EROSION AS APPROVED BY WELD COUNTY AND THE OWNER.
7. A CDPHE SWMP SHALL BE PREPARED AND MAINTAINED FOR THIS PROJECT SITE.
8. SEE DRAWING WCSS-CE-602 FOR ADDITIONAL EROSION CONTROL FEATURES ON THE SITE ACCESS ROAD.

EROSION CONTROL NOTES

1. REFERENCE DRAWING WCSS-CE-103 FOR CIVIL SITE PLAN AND NOTES AND WCSS-CE-601 FOR DRAINAGE AND GRADING PLANS AND NOTES.
2. EROSION CONTROL BMP'S ON THIS DRAWING MAY BE SHOWN LARGER THAN ACTUAL SIZE FOR CLARITY.
3. PERMANENT SEEDING AND MULCHING WILL BE REQUIRED OUTSIDE SECURITY FENCING ON ALL DISTURBED AREAS NOT RECEIVING GRAVEL OR ROAD BASE DURING CONSTRUCTION.
4. THE RECEIVING WATERS FOR THE SITE IS AN UNNAMED TRIBUTARY OF THE LOST SAND CREEK.
5. SITE AREA AND AREA OF DISTURBANCE FOR THIS SITE AND THE ACCESS ROAD IS APPROXIMATELY 5.0 ACRES.

GRUBBING NOTES

1. ALL VEGETATION AND ORGANIC MATERIAL IS TO BE REMOVED AS DEFINED BY THE LIMITS OF DISTURBANCE SHOWN ON THIS DRAWING. LIMITS OF DISTURBANCE ARE ESTIMATES AND THE CONTRACTOR IS TO CONFIRM WITH THE ONSITE CONSTRUCTION MANAGER FOR FINAL CLEARING LIMITS. NO CLEARING ACTIVITIES SHALL TAKE PLACE OUTSIDE OF THE LIMITS OF DISTURBANCE.
2. THE CONTRACTOR IS TO REMOVE ALL ORGANIC MATERIAL PRIOR TO SITE GRADING. ALL TOPSOIL SHALL BE STOCKPILED ONSITE AND USED FOR FINAL STABILIZATION FOLLOWING CONSTRUCTION.
3. IN AREAS WHERE GRUBBING IS NOT PERFORMED THE CONTRACTOR IS TO MOW OR CUT EXISTING VEGETATION.

EROSION CONTROL LEGEND

	CWA	CONCRETE WASHOUT (TEMPORARY)
SF SF	SF	SILT FENCE (TEMPORARY)
	OP	OUTLET PROTECTION (PERMANENT)
	RR	RIP-RAP RUNDOWN (PERMANENT)
	VTC	VEHICLE TRACKING CONTROL (TEMPORARY)
		8" ROADBASE SURFACING (PERMANENT STABILIZATION)
		4" GRAVEL SURFACING (PERMANENT STABILIZATION)

GENERAL LEGEND

5405	EXISTING MAJOR CONTOUR
5403	EXISTING MINOR CONTOUR
5405	PROPOSED MAJOR CONTOUR
5403	PROPOSED MINOR CONTOUR
	EASEMENT LINE
	LEASE BOUNDARY
	SECTION LINE
	1/4 SECTION LINE
	PIPELINE EASEMENT
	RIGHT-OF-WAY (ROW)
	SECURITY FENCE
P P P	EXISTING OVERHEAD POWER
	DRAINAGE FLOW ARROW

ABBREVIATIONS

BMP	BEST MANAGEMENT PRACTICE
CDPHE	COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT
CWA	CONCRETE WASHOUT AREA
E	EASTING
N	NORTHING
OP	OUTLET PROTECTION
R.O.W.	RIGHT-OF-WAY
RR	RIP RAP
SF	SILT FENCE
SWMP	STORM WATER MANAGEMENT PLAN

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REFERENCE DRAWINGS

DWG NO.	DESCRIPTION

REVISIONS

NO.	DESCRIPTION	DATE	BY
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A	ISSUED FOR PERMIT	11/15/18	DMM

SCALE:	1" = 40'
DESIGNED:	M. MORGAN
DRAWN:	M. MORGAN
CHECKED:	M. CLOUD
APPROVED:	
APPROVED:	
DATE	11/15/2018
DATE	10/18/2018
DATE	11/15/2018

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC

LOCATION: ADAMS COUNTY, CO

Samuel Engineering
We Provide Solutions
8450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
Phone: 303.714.4840
Fax: 303.714.4800

TITLE	PROJECT NUMBER
WATKINS COMPRESSOR STATION WILLIAMS DJ BASIN FIELD COMPRESSION CIVIL GENERAL EROSION CONTROL PLAN	18256 DRAWING NUMBER WCSS-CE-401 REV. B

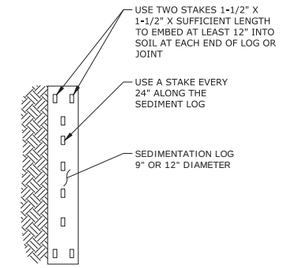
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Plot Date: Monday, January 21, 2019 12:43:57 PM Plotted By: Lauren Root
CTB Used: SE_3rd_BW_Full_Site.ctb

CONSTRUCTION BEST MANAGEMENT PRACTICES

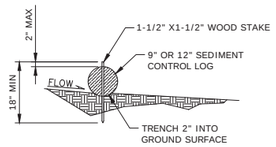
1. EROSION AND SEDIMENT CONTROL DEVICES SHALL BE INSTALLED AND INSPECTED PRIOR TO ANY LAND DISTURBANCE ON SITE.
2. THE PERMITTEE AND/OR CONTRACTOR SHALL REMOVE ALL SEDIMENT, MUD, CONSTRUCTION DEBRIS, OR OTHER POTENTIAL POLLUTANTS THAT MAY HAVE BEEN DISCHARGED TO OR, ACCUMULATE IN, THE FLOW LINES, STORM DRAINAGE APPURTENANCES, AND PUBLIC RIGHTS OF WAYS OF THE LOCAL GOVERNING AUTHORITY AS A RESULT OF CONSTRUCTION ACTIVITIES ASSOCIATED WITH THIS SITE DEVELOPMENT OR CONSTRUCTION PROJECT. SAID REMOVAL SHALL BE CONDUCTED IN A TIMELY MANNER.
3. THE CONTRACTOR SHALL PREVENT SEDIMENT, DEBRIS AND ALL OTHER POLLUTANTS FROM ENTERING THE STORM SEWER SYSTEM DURING ALL DEMOLITION, EXCAVATION, TRENCHING, BORING, GRADING, OR OTHER CONSTRUCTION OPERATIONS THAT ARE PART OF THIS PROJECT. THE CONTRACTOR SHALL BE HELD RESPONSIBLE FOR REMEDIATION OF ANY ADVERSE IMPACTS TO THE MUNICIPAL STORM SEWER SYSTEM, RECEIVING WATERS, WATERWAYS, WETLANDS, AND OR OTHER PUBLIC OR PRIVATE PROPERTIES, RESULTING FROM WORK DONE AS PART OF THIS PROJECT.
4. SOIL STABILIZATION MEASURES SHALL BE IMPLEMENTED WITHIN FOURTEEN (14) DAYS FOLLOWING COMPLETION OF GRADING ACTIVITIES. STABILIZATION OF DISTURBED AREAS ADJACENT TO RECEIVING WATERS OR WITH SLOPES 3 TO 1 OR GREATER SHALL BE COMPLETED WITHIN SEVEN (7) DAYS FOLLOWING COMPLETION OF GRADING ACTIVITIES. NOTE: FEDERAL AND STATE REGULATIONS MAY SOON REQUIRE STABILIZATION WITHIN SEVEN (7) DAYS OF COMPLETION OF GRADING ACTIVITIES. IN SUCH CASES, THE SHORTER SHALL APPLY.
5. THE CONTRACTOR, GRADING CONTRACTOR AND/OR THEIR AUTHORIZED AGENTS SHALL INSURE THAT ALL LOADS OF CUT AND FILL MATERIAL IMPORTED TO OR EXPORTED FROM THIS SITE SHALL BE PROPERLY COVERED TO PREVENT LOSS OF THE MATERIAL DURING TRANSPORT ON PUBLIC RIGHTS OF WAY.
6. THE USE OF REBAR, TO ANCHOR BEST MANAGEMENT PRACTICES IS PROHIBITED. STEEL FENCE POSTS MAY BE USED ON A CASE BY CASE BASIS AND REQUIRES APPROVAL FROM THE LOCAL GOVERNING AUTHORITY SWMP REVIEWER OR THE STORMWATER ENFORCEMENT INVESTIGATOR PRIOR TO INSTALLATION.
7. SOILS THAT WILL BE STOCKPILED FOR MORE THAN THIRTY (30) DAYS SHALL BE PROTECTED FROM WIND AND WATER EROSION WITHIN FOURTEEN (14) DAYS OF STOCKPILE CONSTRUCTION. STABILIZATION OF STOCKPILES LOCATED WITHIN 100 FEET OF RECEIVING WATERS, OR WITH SLOPES 3 TO 1 OR GREATER SHALL BE COMPLETED WITHIN SEVEN (7) DAYS FOLLOWING STOCKPILE CONSTRUCTION. STABILIZATION AND PROTECTION OF THE STOCKPILE MAY BE ACCOMPLISHED BY ANY OF THE FOLLOWING: MULCHING, TEMPORARY/PERMANENT REVEGETATION OPERATIONS, OR EROSION CONTROL MATTING/GEOTEXTILES. IF STOCKPILES ARE LOCATED WITHIN 100 FEET OF RECEIVING WATERS, A DRAINAGE WAY OR THE SITE PERIMETER, ADDITIONAL SEDIMENT CONTROLS SHALL BE REQUIRED.
8. APPROVED EROSION AND SEDIMENT CONTROL BEST MANAGEMENT PRACTICES SHALL BE MAINTAINED AND KEPT IN GOOD REPAIR FOR THE DURATION OF THIS PROJECT. AT A MINIMUM, THE PERMITTEE OR CONTRACTOR SHALL PRODUCE AND RETAIN WEEKLY WRITTEN INSPECTION RECORDS FOR ALL BMPS AND AFTER SIGNIFICANT PRECIPITATION EVENTS. ALL NECESSARY MAINTENANCE AND REPAIR SHALL BE COMPLETED IMMEDIATELY. ADDITIONALLY, STREET SWEEPING IS TO BE COMPLETED BY THE CLOSE OF BUSINESS DAY OR (AND) ON AN AS NEEDED BASIS THROUGHOUT THE DAY.
9. WATER USED IN THE CLEANING OF CEMENT TRUCK DELIVERY CHUTES SHALL BE DISCHARGED INTO A PREDEFINED, CONCRETE WASHOUT AREA ON THE JOB SITE. BERMED CONTAINMENT OR COMMERCIALLY AVAILABLE CONCRETE WASHOUT DEVICES THAT FULLY CONTAIN ALL WASH WATER ARE ACCEPTABLE. WASH WATER DISCHARGED INTO THE CONTAINMENT AREA OR DEVICE SHALL BE ALLOWED TO INFILTRATE OR EVAPORATE AND OR BE DISPOSED OF IN ACCORDANCE WITH APPLICABLE REGULATIONS. DRIED CEMENT WASTE IS TO BE REMOVED FROM THE CONTAINMENT AREA AND PROPERLY DISPOSED OF.
10. SHOULD THE USE OF A PREDEFINED BERMED CONTAINMENT AREA OR APPROVED WASHOUT DEVICE BE TECHNICALLY INFEASIBLE DUE TO THE PROJECT SIZE, OR LACK OF AN AREA WITH A SUITABLE GROUND SURFACE FOR ESTABLISHING A CONTAINMENT, PROPER DISPOSAL OF CONCRETE WASHOUT AND WASH WATER AT THE JOB SITE SHALL CONFORM TO THE APPROVED TECHNIQUES AND PRACTICES IDENTIFIED IN THE COLORADO DEPARTMENT OF PUBLIC HEALTH & ENVIRONMENTS' TRAINING VIDEO ENTITLED "BUILDING FOR A CLEANER ENVIRONMENT, READY MIX WASHOUT TRAINING" AND ITS ACCOMPANYING MANUAL ENTITLED, "READY MIX WASHOUT GUIDEBOOK, VEHICLE AND EQUIPMENT WASHOUT AT CONSTRUCTION SITES."
11. THE DIRECT OR INDIRECT DISCHARGE OF WATER CONTAINING WASTE CEMENT TO THE STORM SEWER SYSTEM IS PROHIBITED.
12. THE CONTRACTOR SHALL PROTECT ALL STORM SEWER FACILITIES ADJACENT TO ANY LOCATION WHERE PAVEMENT CUTTING OPERATIONS INVOLVING WHEEL CUTTING, SAW CUTTING, OR ABRASIVE WATER JET CUTTING ARE TO TAKE PLACE.
13. THE CONTRACTOR SHALL REMOVE AND PROPERLY DISPOSE OF ALL WASTE PRODUCTS GENERATED BY SAID CUTTING OPERATIONS ON A DAILY BASIS OR AS NEEDED THROUGHOUT THE DAY.
14. THE DISCHARGE OF ANY WATER CONTAMINATED BY WASTE PRODUCTS FROM CUTTING OPERATIONS TO THE STORM SEWER SYSTEM IS PROHIBITED.
15. PAVED AND IMPERVIOUS SURFACES WHICH ARE ADJACENT TO CONSTRUCTION SITES MUST BE SWEPT ON A DAILY BASIS OR AS NEEDED DURING THE DAY WHEN SEDIMENT AND OTHER MATERIAL ARE TRACKED OR DISCHARGED ONTO THEM. EITHER SWEEPING BY HAND OR USE OF STREET SWEEPERS IS ACCEPTABLE. STREET SWEEPERS USING WATER WHILE SWEEPING IS PREFERRED IN ORDER TO MINIMIZE DUST. FLUSHING OF PAVED SURFACES WITH WATER IS PROHIBITED.

COLORADO DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT NOTES

1. ALL UNPAVED ROADS AND OTHER DISTURBED SURFACE AREAS ON SITE MUST BE WATERED AS NECESSARY TO PREVENT OFF-PROPERTY TRANSPORT OF VISIBLE FUGITIVE PARTICULATE EMISSIONS.
2. VEHICLE SPEED ON ALL UNPAVED ROADS AND DISTURBED AREAS SHALL NOT EXCEED A MAXIMUM OF 30 MPH. SPEED LIMIT SIGNS SHALL BE POSTED.
3. NO EARTHWORK ACTIVITIES SHALL BE PERFORMED WHEN THE WIND SPEED EXCEEDS 30 MPH.
4. ALL DISTURBED SURFACE AREAS SHALL BE REVEGETATED WITHIN ONE YEAR AND ACCORDING TO THE INFORMATION SUBMITTED BY THE APPLICANT WITH THE PERMIT APPLICATION.
5. GRAVEL ENTRYWAYS SHALL BE UTILIZED TO PREVENT MUD AND DIRT CARRYOUT ONTO PAVED SURFACES. ANY MUD AND DIRT CARRYOUT ONTO PAVED SURFACES SHALL BE CLEANED UP DAILY.



TYPICAL STAKE INSTALLATION



STANDARD INSTALLATION

SCL

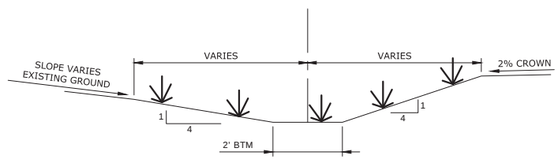
SEDIMENT CONTROL LOG INSTALLATION NOTES

1. SEE SEDIMENTATION (EROSION) CONTROL PLAN FOR LOCATION AND LENGTH OF SEDIMENT CONTROL LOG.
2. SEDIMENT CONTROL LOGS INDICATED ON INITIAL EROSION CONTROL PLAN SHALL BE INSTALLED PRIOR TO ANY LAND-DISTURBING ACTIVITIES.
3. SEDIMENT CONTROL LOGS SHALL CONSIST OF STRAW, COMPOST, EXCELSIOR OR COCONUT FIBER.
4. NOT FOR USE IN CONCENTRATED FLOW AREAS.
5. THE SEDIMENT CONTROL LOG SHALL BE TRENCHED INTO THE GROUND A MINIMUM OF 2".
6. PROVIDE A 12" OVERLAP AT EACH JOINT (END OF LOG).

SEDIMENT CONTROL LOG MAINTENANCE NOTES

1. THE SWMP MANAGER SHALL INSPECT SEDIMENT CONTROL LOGS DAILY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OR CLEAN OUT UPSTREAM SEDIMENT AS NECESSARY.
2. SEDIMENT ACCUMULATED UPSTREAM OF SEDIMENT CONTROL LOGS SHALL BE REMOVED WHEN THE UPSTREAM SEDIMENT DEPTH IS WITHIN ½ THE HEIGHT OF THE CREST OF THE LOG.
3. SEDIMENT CONTROL LOGS MAY OR MAY NOT NEED TO BE REMOVED, DEPENDING ON THE LOCATION AND APPLICATION USE. IF REMOVED, ANY DISTURBED AREAS SHALL BE COVERED WITH TOP SOIL, DRILL SEEDED AND CRIMP MULCHED OR OTHERWISE STABILIZED IN A MANNER APPROVED BY THE GOVERNING AUTHORITY.

SEDIMENT CONTROL LOG
NOT TO SCALE



TYPICAL DRAINAGE SWALE
NOT TO SCALE

* EROSION CONTROL DETAILS ARE FROM URBAN DRAINAGE AND FLOOD CONTROL DISTRICT, DRAINAGE CRITERIA MANUAL, VOLUME 3 - CONSTRUCTION BEST MANAGEMENT PRACTICES. INSTALLATION AND MAINTENANCE OF SITE BMP'S ARE TO ADHERE TO ADAMS COUNTY OR STATE OF COLORADO LATEST STANDARDS AND REQUIREMENTS.

GENERAL NOTES

1. REFERENCE DRAWINGS WCSS-CE-103 FOR CIVIL SITE PLAN AND NOTES, WCSS-CE-601 FOR DRAINAGE AND GRADING GENERAL NOTES AND WCSS-CE-401 FOR EROSION CONTROL PLANS.

Table 506-2

Pay Item	Stone Size d50[1] (Inches)	Percent of Material Smaller Than Typical Stone[2]	Typical Stone Dimensions[3] (Inches)	Typical Stone Weight[4] (Pounds)
VL Riprap	6	70-100 50-70 35-50 2-10	12 9 6 2	85 35 10 0.4
L Riprap	9	70-100 50-70 35-50 2-10	15 12 9 3	160 85 35 1.3
M Riprap	12	70-100 50-70 35-50 2-10	21 18 12 4	440 275 85 3
H Riprap	18	100 50-70 35-50 2-10	30 24 18 6	1280 650 275 10
VH Riprap	24	100 50-70 35-50 2-10	42 33 24 9	3500 1700 650 35

[1]d50 = nominal stone size
[2]based on typical rock mass
[3]equivalent spherical diameter
[4]based on a specific gravity = 2.5

RIP-RAP GRADATIONS

Know what's below. Call before you dig.

COLORADO REGISTERED DAVID MATTHEW MORGAN 39814 PROFESSIONAL ENGINEER
11/15/2018

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REFERENCE DRAWINGS

DWG NO.	DESCRIPTION

REVISIONS

NO.	DESCRIPTION	DATE	BY

REVISIONS

NO.	DESCRIPTION	DATE	BY
A	ISSUED FOR PERMIT	11/15/18	DMM

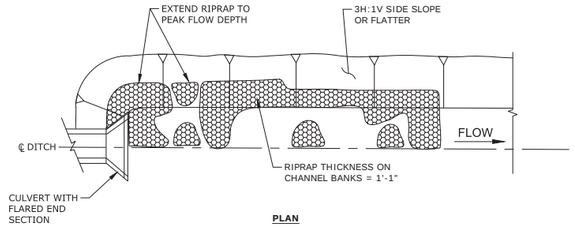
SCALE:	AS NOTED	DATE
DESIGNED:	M. MORGAN	11/15/2018
DRAWN:	M. MORGAN	10/18/2018
CHECKED:	M. CLOUD	11/15/2018
APPROVED:		
APPROVED:		

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC
LOCATION: ADAMS COUNTY, CO

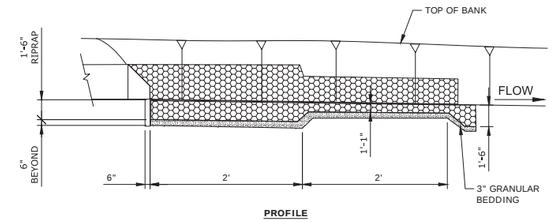
Samuel Engineering
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8450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
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Fax: 303.714.4800

TITLE	PROJECT NUMBER
WATKINS COMPRESSOR STATION WILLIAMS DJ BASIN FIELD COMPRESSION CIVIL GENERAL EROSION CONTROL NOTES & DETAILS	18256
	DRAWING NUMBER
	WCSS-CE-402 REV. A

Plot Date: Thursday, November 15, 2018 2:27:12 PM Plotted By: Matt Morgan
CTB Used: SE_Std_B&W_Full_size.ctb



PLAN

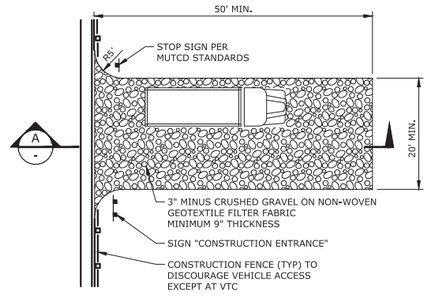


PROFILE

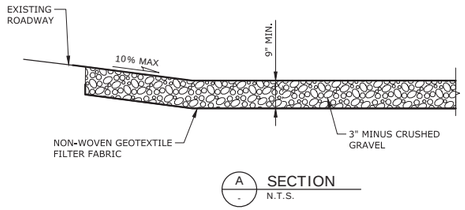
NOTES

1. FLARED END SECTION REQUIRED AT ALL CULVERT OUTLETS.
2. PROVIDE JOINT FASTENERS FOR FLARED END SECTIONS FOR SLOPES GREATER THAN 5%.
3. INSTALL MIRAFI 140N FILTER FABRIC (OR EQUAL) BELOW ALL RIPRAP.
4. DISTURBED SURFACES SHALL BE LEFT IN A ROUGHENED CONDITION AT ALL TIMES DURING CONSTRUCTION.
5. EROSION CONTROL MEASURES AT TEMPORARY FACILITIES SHALL BE REMOVED WHEN THEY HAVE SERVED THEIR USEFUL PURPOSE. EROSION CONTROL MEASURES AT PERMANENT FACILITIES SHALL REMAIN IN PLACE.
6. RIP RAP SIZE SHALL BE TYPE L MINIMUM OR AS INDICATED ON PLANS.

OP **CULVERT AND OUTLET EROSION PROTECTION**
NOT TO SCALE



PLAN



A - SECTION
N.T.S.

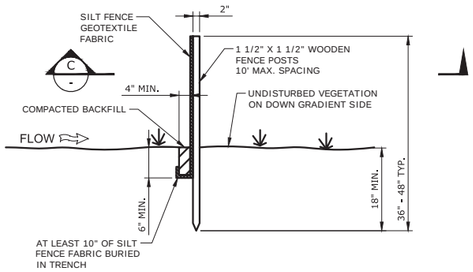
VEHICLE TRACKING CONTROL INSTALLATION NOTES

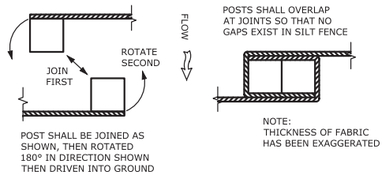
1. VEHICLE TRACKING CONTROL PADS SHALL BE INSTALLED AT EVERY ACCESS POINT TO SITE.
2. VEHICLE TRACKING CONTROL PADS SHALL CONSIST OF HARD, DENSE, DURABLE STONE, ANGULAR IN SHAPE AND RESISTANT TO WEATHERING. ROUNDED STONE OR BOULDERS WILL NOT BE ACCEPTABLE. THE STONES SHALL BE 3" MINUS.
3. A STOP SIGN INSTALLED IN ACCORDANCE WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES (MUTCD), AS AMENDED, SHALL BE INSTALLED FOR EXITING TRAFFIC AT THE VTC.

VEHICLE TRACKING CONTROL MAINTENANCE NOTES

1. THE EROSION CONTROL SUPERVISOR SHALL INSPECT VEHICLE TRACKING CONTROL DAILY. GRAVEL SURFACE SHALL BE CLEAN AND LOOSE ENOUGH TO RUT SLIGHTLY UNDER WHEEL LOADS AND CAUSE LOOSE GRAVEL TO DISLODGE MUD FROM TIRES. WHEN GRAVEL BECOMES COMPACTED OR FILLED WITH SEDIMENT SO THAT THE EFFECTIVENESS OF THE PAD IS DIMINISHED, GRADING CONTRACTOR SHALL RIP, TURN OVER, OR OTHERWISE LOOSEN GRAVEL, PLACE ADDITIONAL NEW GRAVEL, OR REPLACE WITH NEW GRAVEL AS NECESSARY TO RESTORE EFFECTIVENESS.
2. VEHICLE TRACKING CONTROL SHALL BE REMOVED AT THE END OF CONSTRUCTION, THE GRAVEL MATERIAL REMOVED OR, IF APPROVED, USED ON SITE, AND TOPSOIL ADDED TO THE AREA, DRILL SEEDED AND CRIMP MULCHED OR OTHERWISE STABILIZED.

VTC **VEHICLE TRACKING CONTROL**
NOT TO SCALE





C - SECTION
N.T.S.

SILT FENCE INSTALLATION NOTES

1. SEE PLAN VIEW FOR LOCATION AND LENGTH OF FENCE.
2. ANCHOR TRENCH SHALL BE EXCAVATED WITH TRENCHER, OR WITH SILT FENCE INSTALLATION MACHINE; NO ROAD GRADERS, BACKHOES, ETC. SHALL BE USED. TRENCH SHALL BE COMPACTED BY HAND, WITH "JUMPING JACK", OR BY WHEEL ROLLING. COMPACTION SHALL BE SUCH THAT SILT FENCE RESISTS BEING PULLED OUT OF ANCHOR TRENCH BY HAND.
3. SILT FENCE GEOTEXTILE SHALL MEET THE FOLLOWING REQUIREMENTS:
   - 6-TO 12-GALLONS PER MINUTE PER SQUARE FOOT FLOW CAPACITY.
   - 90 LB. TENSILE STRENGTH PER ASTM D4622.
   - UV DESIGN AT 500 HRS MIN. 70% STRENGTH RETAINED PER ASTM D 4355.
4. SILT FENCE INDICATED ON THE EROSION CONTROL PLAN SHALL BE INSTALLED PRIOR TO ANY LAND-DISTURBING ACTIVITIES.

SILT FENCE MAINTENANCE NOTES

1. INSPECT SILT FENCE DAILY, DURING AND AFTER ANY STORM EVENT AND MAKE REPAIRS OR CLEAN OUT UPSTREAM SEDIMENT AS NECESSARY.
2. SEDIMENT ACCUMULATED UPSTREAM OF SILT FENCE SHALL BE REMOVED WHEN THE UPSTREAM SEDIMENT REACHES A DEPTH OF ½H.
3. SILT FENCE SHALL BE REMOVED WHEN THE UPSTREAM DISTURBED AREA IS STABILIZED AND GRASS COVER HAS BEEN ESTABLISHED. IF ANY DISTURBED AREA EXISTS AFTER REMOVAL, IT SHALL BE SEEDED AND MULCHED OR OTHERWISE STABILIZED.

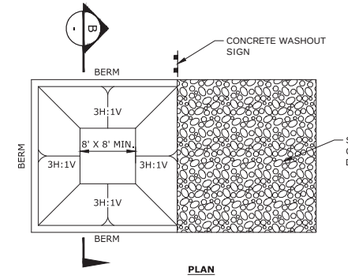
—SF— SF **SILT FENCE**
NOT TO SCALE

CONCRETE WASHOUT AREA INSTALLATION NOTES

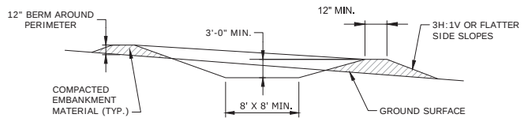
1. SEE PLAN VIEW FOR LOCATIONS OF CONCRETE WASHOUT AREA.
2. THE CONCRETE WASHOUT AREA SHALL BE INSTALLED PRIOR TO ANY CONCRETE PLACEMENT ON SITE.
3. VEHICLE TRACKING CONTROL IS REQUIRED AT THE ACCESS POINT SLOPED AT 2% TOWARDS THE CWA.
4. SIGNS SHALL BE PLACED AT THE CONSTRUCTION ENTRANCE, AT THE WASHOUT AREA,AND ELSEWHERE AS NECESSARY TO CLEARLY INDICATE THE LOCATION OF THE CONCRETE WASHOUT AREA TO OPERATORS OF THE CONCRETE TRUCKS AND PUMP RIGS.
5. EXCAVATED MATERIAL SHALL BE UTILIZED IN PERIMETER BERM CONSTRUCTION.

CONCRETE WASHOUT AREA MAINTENANCE NOTES

1. THE CONCRETE WASHOUT AREA SHALL BE REPAIRED AND ENLARGED OR CLEANED OUT AS NECESSARY TO MAINTAIN CAPACITY FOR WASTED CONCRETE. CONCRETE MATERIALS SHALL BE REMOVED ONCE THE MATERIALS HAVE REACHED A DEPTH OF 2'.
2. AT THE END OF THE CONSTRUCTION PROJECT, ALL CONCRETE SHALL BE REMOVED FROM THE SITE AND DISPOSED OF AT AN APPROVED WASTE SITE.
3. WHEN THE CONCRETE WASHOUT AREA IS REMOVED, COVER THE DISTURBED AREA WITH TOP SOIL, DRILL SEED AND CRIMP MULCH OR OTHERWISE STABILIZE IN A MANNER APPROVED BY GOVERNING AUTHORITY.
4. INSPECT WEEKLY AND DURING AND AFTER ANY STORM EVENT.



PLAN



B - SECTION
N.T.S.

CWA **CONCRETE WASHOUT**
NOT TO SCALE

811 Know what's below. Call before you dig.

COLORADO REGISTERED CHRISTOPHER MORGAN 39814 PROFESSIONAL ENGINEER
11/15/2018

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REFERENCE DRAWINGS

DWG NO.	DESCRIPTION

REVISIONS

NO.	DESCRIPTION	DATE	BY
A	ISSUED FOR PERMIT	11/15/18	DMM

SCALE:	AS NOTED
DESIGNED:	M. MORGAN
DRAWN:	M. MORGAN
CHECKED:	M. CLOUD
APPROVED:	
APPROVED:	

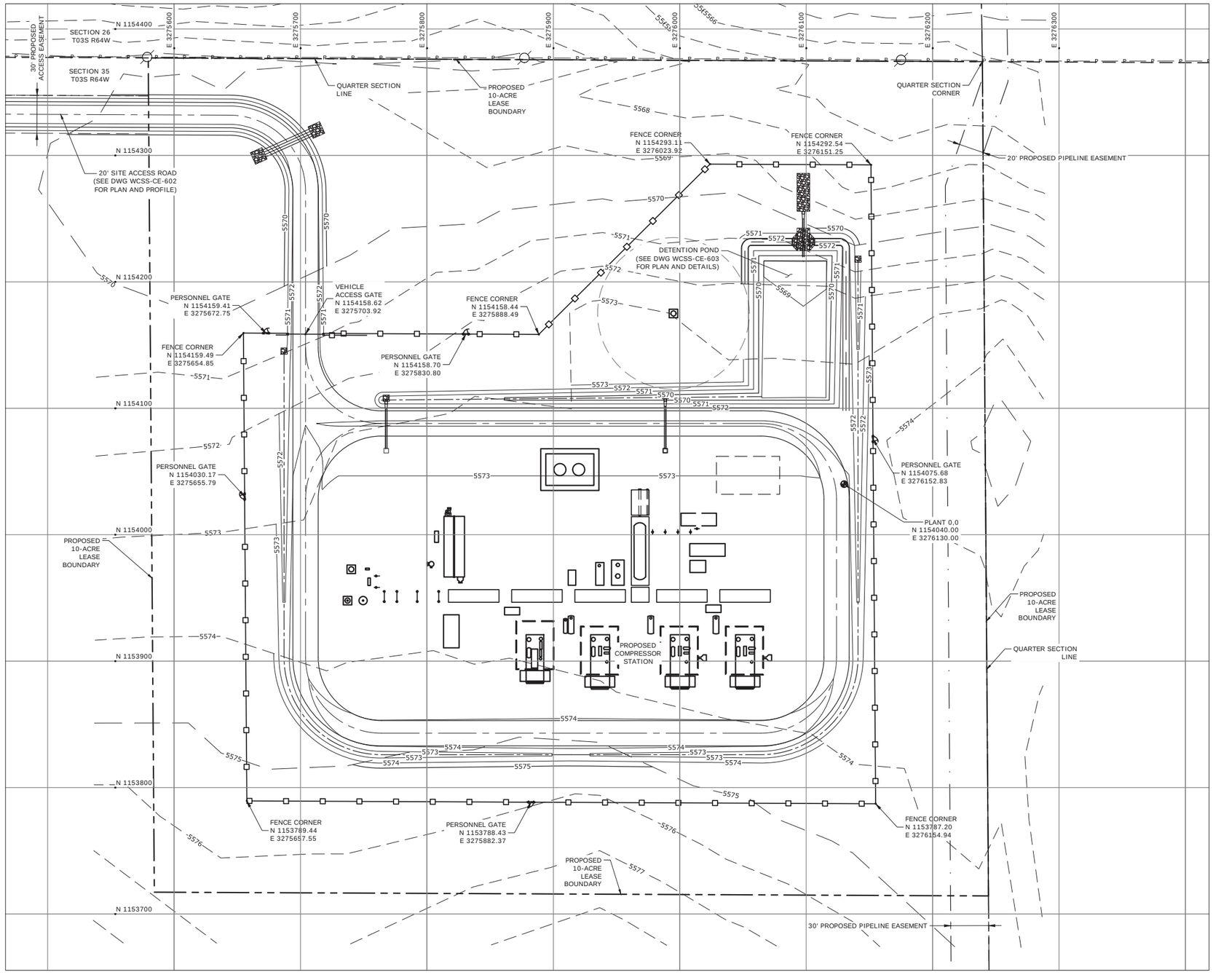
DATE	11/15/2018
DATE	10/18/2018
DATE	11/15/2018

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC
LOCATION: ADAMS COUNTY, CO

Samuel Engineering
We Provide Solutions
8450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
Phone: 303.714.4840
Fax: 303.714.4800

TITLE	PROJECT NUMBER
WATKINS COMPRESSOR STATION WILLIAMS DJ BASIN FIELD COMPRESSION CIVIL GENERAL EROSION CONTROL NOTES & DETAILS	18256
	DRAWING NUMBER
	WCSS-CE-403 REV. A

Plot Date: Thursday, November 15, 2018 2:28:32 PM Plotted By: Matt Morgan
CTB Used: SE_Std_B&W_Full_size.ctb



NOTES

1. SEE LANDSCAPE PLANS (BY OTHERS) FOR DETAILS AND ADDITIONAL INFORMATION.
2. SITE GRADING SHOULD BE COMPLETE BEFORE THE FENCE IS INSTALLED. THE FENCE CONTRACTOR SHALL COORDINATE WITH THE OWNER (OR OWNER'S REPRESENTATIVE) TO CONFIRM FINAL GRADES ALONG THE FENCE ALIGNMENT.
3. THE FENCE INSTALLATION CONTRACTOR MAY ADJUST POST AND/OR GATE LOCATIONS TO BETTER FIT THE POST LAYOUT OR TERRAIN WITH PERMISSION FROM OWNER'S OPERATIONS PERSONNEL.
4. COORDINATES FOR GATES ARE SHOWN AT THE CENTER OF THE GATE.
5. ALL PERSONNEL GATES SHALL SWING OUT (AWAY FROM PLANT).
6. ANY SUBSTITUTIONS SHALL BE APPROVED BY THE ENGINEER AND OWNER PRIOR TO INSTALLATION.
7. THE CONTRACTOR SHALL BE RESPONSIBLE FOR LOCATING AND PROTECTING ALL UNDERGROUND UTILITIES WHETHER LOCATED ON SURVEY OR ENCOUNTERED IN THE FIELD DURING CONSTRUCTION. CAUTION SHOULD BE TAKEN DURING ALL EXCAVATION DURING EXCAVATION OF ALL SOIL AND FOUNDATIONS WITHIN THE LIMITS OF DISTURBANCE. CONTACT ENGINEER IF CONFLICTS ARE ENCOUNTERED.
8. IF ANY EXISTING FENCE IS REMOVED, THE EXISTING FENCE POSTS SHALL BE CUT OFF FLUSH WITH EXISTING GRADE AND THE NEW POSTS SHALL BE INSTALLED ADJACENT TO THE OLD POSTS ALONG PROPERTY LINES. CORNER POST COORDINATES SHALL BE ADJUSTED AS REQUIRED TO THE INSIDE OF THE EXISTING POST SO AS NOT TO OVERHANG PROPERTY LINES.
9. ANY EXISTING FENCING AND POSTS REMOVED DURING CONSTRUCTION SHALL BE DISPOSED OF OFFSITE AT AN OWNER APPROVED DISPOSAL SITE BY THE FENCE INSTALLATION CONTRACTOR.
10. FENCE INSTALLATION CONTRACTOR SHALL ENSURE THAT ALL NEW FENCING IS INSTALLED WITHIN THE LEASE BOUNDARY.
11. KNOX FIRE DEPARTMENT GATE ACCESS TO THE FACILITY SHALL BE PROVIDED AND MAINTAINED AT ALL TIMES.

LEGEND

- 7' ORNAMENTAL IRON SECURITY FENCE *
- ORNAMENTAL IRON SECURITY GATE (20' MIN.) WITH KNOX ACCESS *
- PERSONNEL GATE WITH PANIC HARDWARE *

*BY FENCING CONTRACTOR

NORTH

0' 20' 40' 80' 120'
SCALE: 1" = 40'

Know what's below. Call before you dig.

COLORADO LICENSED MICHAEL T. CLOUD 49458 01-21-19 PROFESSIONAL ENGINEER
FOR PERMIT

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REFERENCE DRAWINGS

DWG NO.	DESCRIPTION

REVISIONS

NO.	DESCRIPTION	DATE	BY

REVISIONS

NO.	DESCRIPTION	DATE	BY
A	ISSUED FOR PERMIT - RESPONSE TO COMMENT	01/21/19	LER

SCALE:	1" = 40'	DATE
DESIGNED:	M. CLOUD	01/21/2019
DRAWN:	L. ROOT	01/21/2019
CHECKED:	M. CLOUD	01/21/2019
APPROVED:		
APPROVED:		

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC
LOCATION: ADAMS COUNTY, CO

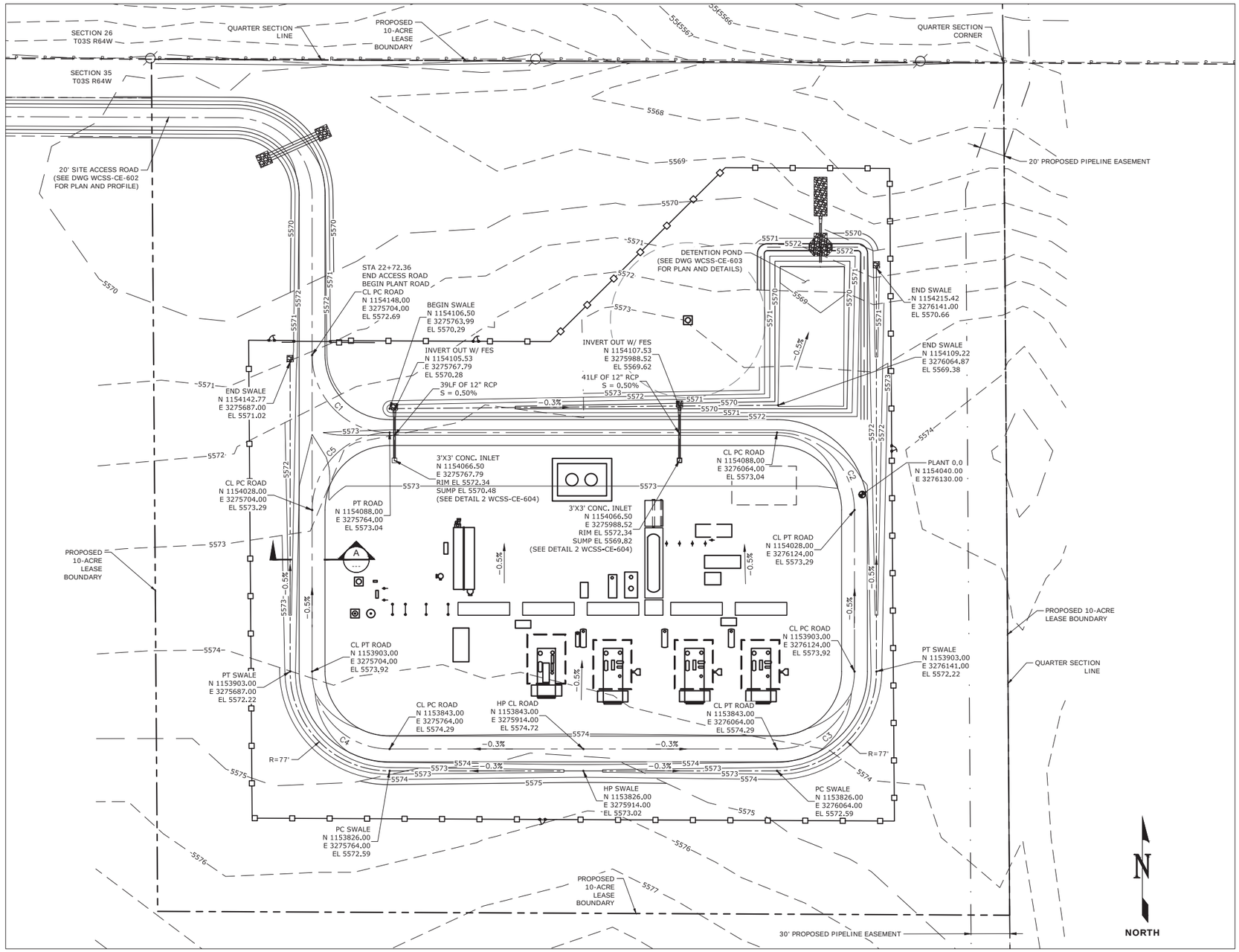
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We Provide Solutions
8450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
Phone: 303.714.4840
Fax: 303.714.4800

TITLE
WATKINS COMPRESSOR STATION
WILLIAMS DJ BASIN FIELD COMPRESSION
CIVIL
GENERAL
FENCING PLAN

PROJECT NUMBER
18256

DRAWING NUMBER
WCSS-CE-501 REV. A

CAD File: S:\Projects\18256_Watkins_Compressor\CAD\Civil\Watkins South\Drawings\WCSS-CE-501.dwg
Plot Date: Monday, January 21, 2019 12:43:00 PM Plotted By: Lauren Root
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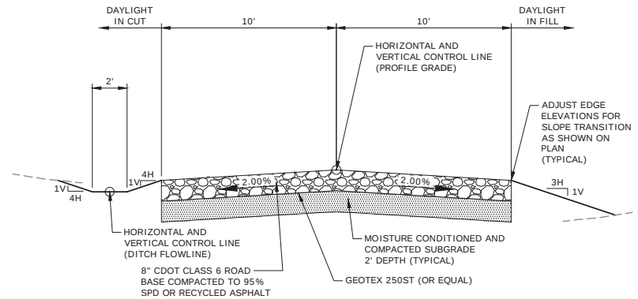


NOTES

1. THE WATKINS COMPRESSOR STATION PROPOSED SITE IS A 10-ACRE LEASE LOCATED IN THE NORTHWEST QUARTER OF SECTION 35, TOWNSHIP 3 SOUTH, RANGE 64 WEST, 6TH PRINCIPAL MERIDIAN, ADAMS COUNTY, STATE OF COLORADO.
2. THE SITE SURVEY FOR THIS PROJECT WAS PREPARED BY ACKLAM, INC. AND WAS RECEIVED ON 10/12/2018.

   HORIZONTAL DATUM: BASED ON COLORADO STATE PLANE COORDINATES, NORTH ZONE, NORTH AMERICAN HORIZONTAL DATUM, 1983 (US SURVEY FEET).

   VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM 1988.
3. THE SITE CONSISTS OF EXISTING CROP LAND. PRIOR TO BEGINNING EARTHWORK OPERATIONS, CLEAR SITE OF ALL ORGANIC AND/OR UNSUITABLE MATERIALS. SCARIFY, MOISTURE TREAT AND COMPACT THE SUBGRADE PRIOR TO PLACING FILL OR SURFACE MATERIALS.
4. ALL CUT AND FILL SLOPES ARE 3H:1V UNLESS NOTED OTHERWISE ON THE DRAWINGS.
5. GRADING ELEVATIONS SHOWN ARE TO TOP OF FINISHED SURFACING. FOR ROUGH GRADE ELEVATIONS SUBTRACT 8" FROM ROAD AREAS AND 4" FROM ALL OTHER ELEVATIONS SHOWN.
6. ALL SOILS SHALL BE COMPACTED TO A MINIMUM OF 95% OF THE STANDARD PROCTOR DENSITY (SPD) AT ± 2% OF THE OPTIMUM MOISTURE CONTENT ASTM D-698. REFER TO THE PROJECT GEOTECHNICAL INVESTIGATION FOR ADDITIONAL INFORMATION AND SITE SPECIFIC REQUIREMENTS.
7. THE CONTRACTOR WILL BE RESPONSIBLE FOR LOCATING AND PROTECTING ALL UNDERGROUND UTILITIES. THE CONTRACTOR IS TO ENSURE THAT 811 AND DISCOVERY SITE PERSONNEL ARE CONTACTED PRIOR TO COMMENCING CONSTRUCTION ACTIVITIES. CAUTION SHOULD BE TAKEN DURING ALL EXCAVATION OF SOIL AND FOUNDATIONS WITHIN THE LIMITS OF DISTURBANCE. CONTACT ENGINEER IF THERE ARE CONFLICTS.
8. THE MAJORITY OF THE SITE GRAVEL WILL BE INSTALLED AFTER EQUIPMENT IS SET AND FINAL GRADING IS COMPLETE. THE CONTRACTOR IS TO COORDINATE WITH DISCOVERY FOR ALL GRAVEL INSTALLATION TIMING.
9. THE CONTRACTOR IS TO SUBMIT A GRADATION SAMPLE TO DISCOVERY PRIOR TO PLACING GRAVEL MATERIAL. DISCOVERY PERSONNEL WILL DETERMINE SIZE OF GRAVEL TO BE USED. PLACE CRUSHED GRANITE FOR THE SITE BENCH AREAS AS DIRECTED BY THE OWNER'S REPRESENTATIVE.
10. INTERIOR ACCESS ROADS SHALL HAVE A MINIMUM OF 8" CDOT CLASS 6 ROAD BASE PLACED OVER GEOTEX 250ST WOVEN POLYPROPYLENE GEOTEXTILE FABRIC AS MANUFACTURED BY PROPEX, INC. OR EQUIVALENT. RECYCLED ASPHALT OF SIMILAR GRADATION OF THE SPECIFIED ROAD BASE CAN BE SUBSTITUTED FOR ROAD BASE WITH COUNTY APPROVAL.
11. ALL AREAS WITHIN THE SECURITY FENCE SHALL BE MAINTAINED VEGETATION FREE 4" GRAVEL FOR THE LIFE OF THE FACILITY.
12. ALL EQUIPMENT PAD AREAS SHALL HAVE A MINIMUM OF 4" CRUSHED GRAVEL PLACED ON COMPACTED SUBGRADE FOR FINAL SURFACING.
13. PERIMETER SILT FENCE IS TO BE INSTALLED PRIOR TO ANY CONSTRUCTION ACTIVITIES. ALL OTHER EROSION CONTROL MEASURES CAN BE INSTALLED AFTER ROUGH GRADING IS COMPLETE.
14. SEE DRAWING WCSS-CE-103 FOR SITE PLAN AND NOTES, WCSS-CE-401 FOR EROSION CONTROL, SURFACING, CLEARING & GRUBBING PLAN AND NOTES, WCSS-CE-602 FOR SITE ACCESS ROAD PLAN AND PROFILE AND WCSS-CE-603 FOR DETENTION BASIN DETAILS.



A — TYPICAL SECTION - 20' CROWN PLANT ROAD
NTS

CURVE TABLE

CURVE #	RADIUS	DELTA	LENGTH
C1	60.00	90.00°	94.25
C2	60.00	90.00°	94.25
C3	60.00	90.00°	94.25
C4	60.00	90.00°	94.25
C5	60.00	90.00°	94.25

LEGEND

- EXISTING MAJOR CONTOUR (5405)
- EXISTING MINOR CONTOUR (5403)
- PROPOSED MAJOR CONTOUR (5405)
- PROPOSED MINOR CONTOUR (5403)
- EASEMENT LINE
- LEASE BOUNDARY
- SECTION LINE
- 1/4 SECTION LINE
- PIPELINE EASEMENT
- RIGHT-OF-WAY (ROW)
- EXISTING OVERHEAD POWER (P — P — P)

ABBREVIATIONS

PC	POINT OF CURVATURE
PCC	POINT OF COMPOUND CURVATURE
PRC	POINT OF REVERSE CURVATURE
PI	POINT OF INTERSECTION
PT	POINT OF TANGENCY
ROW	RIGHT-OF-WAY
BTM	BOTTOM
CL	CENTERLINE
FL	FLOWLINE
E	EASTING
EL	ELEVATION
HP	HIGH POINT
LP	LOW POINT
MP	MID POINT
N	NORTHING
GB	GRADE BREAK
EOP	EDGE OF PAVEMENT/GRAVEL

Know what's below. Call before you dig.

COLORADO LICENSED MICHAEL T. CLOUD 49458 01-21-19 PROFESSIONAL ENGINEER FOR PERMIT

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REFERENCE DRAWINGS

DWG NO.	DESCRIPTION

REVISIONS

NO.	DESCRIPTION	DATE	BY
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A	ISSUED FOR PERMIT	11/15/18	DMM

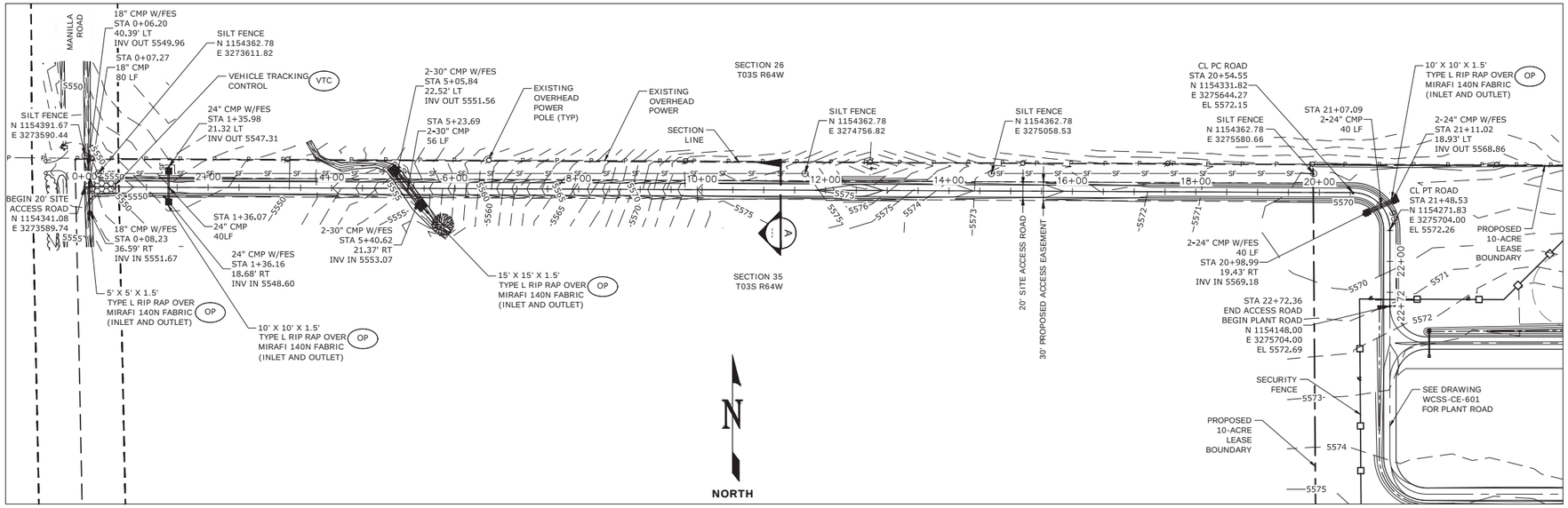
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DESIGNED:	M. MORGAN 11/15/2018
DRAWN:	M. MORGAN 10/18/2018
CHECKED:	M. CLOUD 11/15/2018
APPROVED:	
APPROVED:	

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC
LOCATION: ADAMS COUNTY, CO

Samuel Engineering
We Provide Solutions
8450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
Phone: 303.714.4840
Fax: 303.714.4800

TITLE	PROJECT NUMBER
WATKINS COMPRESSOR STATION WILLIAMS DJ BASIN FIELD COMPRESSION CIVIL GENERAL GRADING AND DRAINAGE PLAN	18256
	DRAWING NUMBER: WCSS-CE-601 REV. B

CAD File: S:\Projects\18256_Watkins_Compressor\CAD\Civil\Watkins South\Drawings\WCSS-CE-601.dwg
Plot Date: Monday, January 21, 2019 1:24:41 PM Plotted By: Lauren Root
CTB Used: SE_Std_B&W_Full_Size.ctb



SITE ACCESS ROAD PLAN
STA. 0+00 TO 22+72

0' 50' 100' 200' 300'

SCALE: 1" = 100'

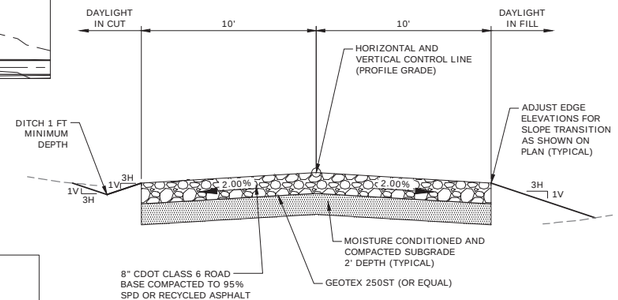
CURVE TABLE			
CURVE #	RADIUS	DELTA	LENGTH
C6	60.00	89.74°	93.98

NOTES

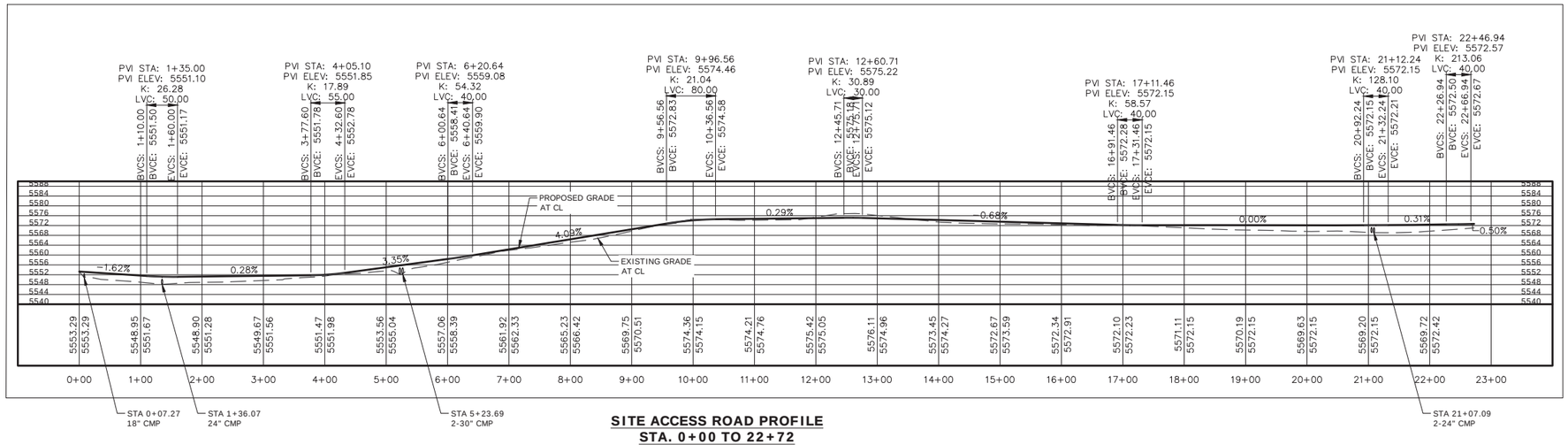
1. THE WATKINS COMPRESSOR STATION PROPOSED SITE IS A 10-ACRE LEASE LOCATED IN THE NORTHWEST QUARTER OF SECTION 35, TOWNSHIP 3 SOUTH, RANGE 64 WEST, 6TH PRINCIPAL MERIDIAN, ADAMS COUNTY, STATE OF COLORADO.
2. THE SITE SURVEY FOR THIS PROJECT WAS PREPARED BY ACKLAM, INC. AND WAS RECEIVED ON 10/12/2018.

   HORIZONTAL DATUM: BASED ON COLORADO STATE PLANE COORDINATES, NORTH ZONE, NORTH AMERICAN HORIZONTAL DATUM, 1983 (US SURVEY FEET).

   VERTICAL DATUM: NORTH AMERICAN VERTICAL DATUM 1988.
3. THE SITE CONSISTS OF EXISTING CROP LAND. PRIOR TO BEGINNING EARTHWORK OPERATIONS, CLEAR SITE OF ALL ORGANIC AND/OR UNSUITABLE MATERIALS. SCARIFY, MOISTURE TREAT AND COMPACT THE SUBGRADE PRIOR TO PLACING FILL OR SURFACE MATERIALS.
4. ALL CUT AND FILL SLOPES ARE 3H:1V UNLESS NOTED OTHERWISE ON THE DRAWINGS.
5. GRADING ELEVATIONS SHOWN ARE TO TOP OF FINISHED SURFACING. FOR ROUGH GRADE ELEVATIONS SUBTRACT 8" FROM ROAD AREAS AND 4" FROM ALL OTHER ELEVATIONS SHOWN.
6. ALL SOILS SHALL BE COMPACTED TO A MINIMUM OF 95% OF THE STANDARD PROCTOR DENSITY (SPD) AT ± 2% OF THE OPTIMUM MOISTURE CONTENT ASTM D-698. REFER TO THE PROJECT GEOTECHNICAL INVESTIGATION FOR ADDITIONAL INFORMATION AND SITE SPECIFIC REQUIREMENTS.
7. THE CONTRACTOR WILL BE RESPONSIBLE FOR LOCATING AND PROTECTING ALL UNDERGROUND UTILITIES. THE CONTRACTOR IS TO ENSURE THAT 811 AND DISCOVERY SITE PERSONNEL ARE CONTACTED PRIOR TO COMMENCING CONSTRUCTION ACTIVITIES. CAUTION SHOULD BE TAKEN DURING ALL EXCAVATION OF SOIL AND FOUNDATIONS WITHIN THE LIMITS OF DISTURBANCE. CONTACT ENGINEER IF THERE ARE CONFLICTS.
8. SITE ACCESS ROAD SHALL HAVE A MINIMUM OF 8" CDOT CLASS 6 ROAD BASE PLACED OVER GEOTEX 250ST WOVEN POLYPROPYLENE GEOTEXTILE FABRIC AS MANUFACTURED BY PROPEX, INC. OR EQUIVALENT. RECYCLED ASPHALT OF SIMILAR GRADATION OF THE SPECIFIED ROAD BASE CAN BE SUBSTITUTED FOR ROAD BASE WITH COUNTY APPROVAL.
9. PERIMETER SILT FENCE IS TO BE INSTALLED PRIOR TO ANY CONSTRUCTION ACTIVITIES. ALL OTHER EROSION CONTROL MEASURES CAN BE INSTALLED AFTER ROUGH GRADING IS COMPLETE.
10. SEE DRAWINGS WCSS-CE-102, 103, AND 104 FOR SITE PLAN AND NOTES, WCSS-CE-401 FOR EROSION CONTROL, SURFACING, CLEARING & GRUBBING PLAN AND NOTES, AND WCSS-CE-603 FOR DETENTION BASIN DETAILS.
11. SEE DRAWING WCSS-CE-601 FOR SITE SPECIFIC CONSTRUCTION NOTES AND DETAILS.



A — TYPICAL SECTION - 20' CROWN SITE ACCESS ROAD
NTS



SITE ACCESS ROAD PROFILE
STA. 0+00 TO 22+72

SCALE:
HORIZONTAL 1"=100'
VERTICAL 1"=25'

LEGEND

- EXISTING MAJOR CONTOUR (5405)
- EXISTING MINOR CONTOUR (5403)
- PROPOSED MAJOR CONTOUR (5405)
- PROPOSED MINOR CONTOUR (5403)
- EASEMENT LINE
- LEASE BOUNDARY
- SECTION LINE
- 1/4 SECTION LINE
- PIPELINE EASEMENT
- RIGHT-OF-WAY (ROW)
- EXISTING OVERHEAD POWER (P P P)

ABBREVIATIONS

PC	POINT OF CURVATURE
PCC	POINT OF COMPOUND CURVATURE
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PI	POINT OF INTERSECTION
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MP	MID POINT
N	NORTHING
GB	GRADE BREAK
EOP	EDGE OF PAVEMENT/GRAVEL

Know what's below. Call before you dig.

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REFERENCE DRAWINGS

DWG NO.	DESCRIPTION

REVISIONS

NO.	DESCRIPTION	DATE	BY

REVISIONS

NO.	DESCRIPTION	DATE	BY	CLIENT	PROJECT ENGINEER	LEAD ENGINEER	CHECK
B	ISSUED FOR PERMIT - RESPONSE TO COMMENT	01/21/19	LER	MTC	MTC		
A	ISSUED FOR PERMIT	11/15/18	DMM	DMM	MTC		

SCALE:	1" = 100'	DATE
DESIGNED:	M. MORGAN	11/15/2018
DRAWN:	M. MORGAN	10/18/2018
CHECKED:	M. CLOUD	11/15/2018
APPROVED:		
APPROVED:		

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC

LOCATION: ADAMS COUNTY, CO

Williams

Samuel Engineering
We Provide Solutions
8450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
Phone: 303.714.4840
Fax: 303.714.4800

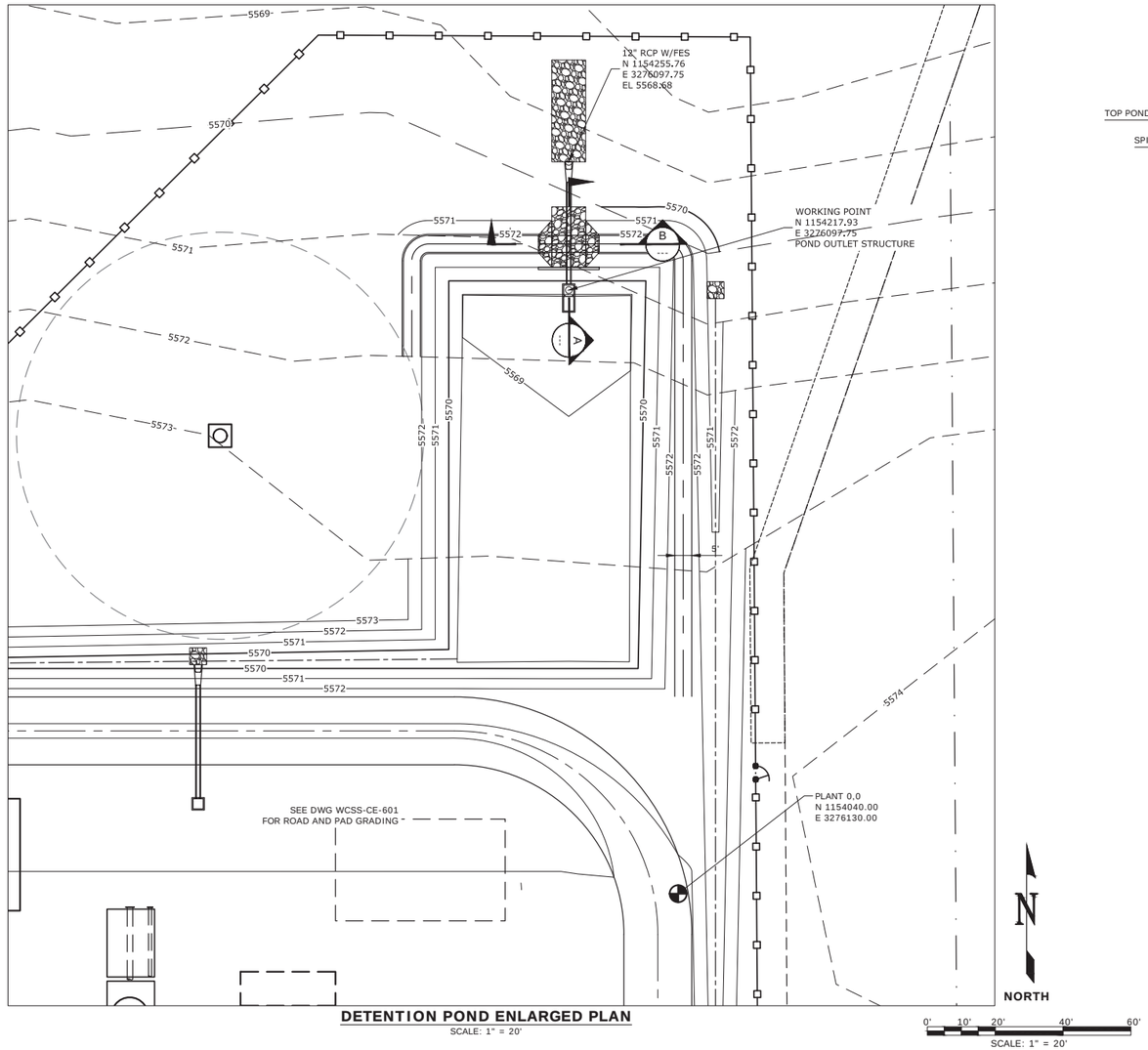
TITLE
WATKINS COMPRESSOR STATION
WILLIAMS DJ BASIN FIELD COMPRESSION
CIVIL
GENERAL
SITE ACCESS ROAD PLAN AND PROFILE

PROJECT NUMBER
18256

DRAWING NUMBER
WCSS-CE-602

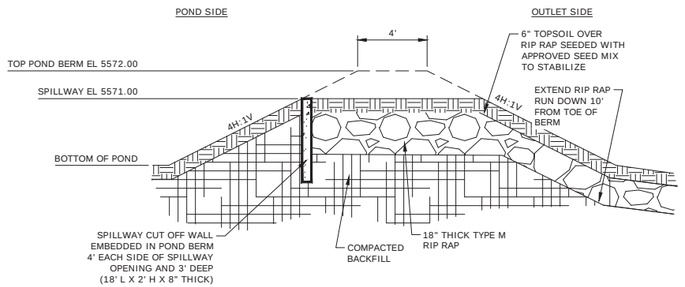
REV. B

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CTB Used: SE_Std_B&W_Full_Size.ctb

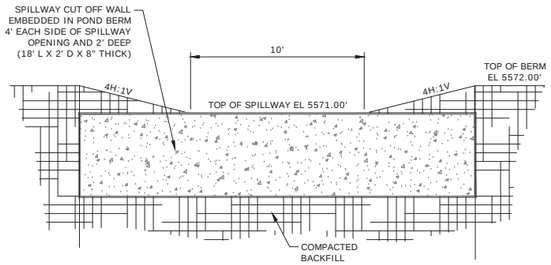


DETENTION POND ENLARGED PLAN

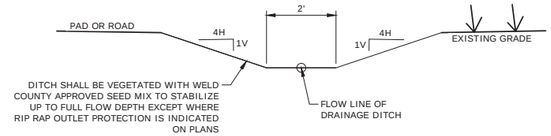
SCALE: 1" = 20'



A … SECTION - EMERGENCY OVERFLOW SPILLWAY
N.T.S.



B … SECTION - EMERGENCY OVERFLOW SPILLWAY
N.T.S.



TYPICAL DRAINAGE DITCH SECTION

SCALE: 1/2" = 1'

LEGEND

- 5405 — EXISTING MAJOR CONTOUR
- 5403 — EXISTING MINOR CONTOUR
- 5405 — PROPOSED MAJOR CONTOUR
- 5403 — PROPOSED MINOR CONTOUR
- EASEMENT LINE
- LEASE BOUNDARY
- SECTION LINE
- 1/4 SECTION LINE
- PIPELINE EASEMENT
- RIGHT-OF-WAY (ROW)
- P — P — P — EXISTING OVERHEAD POWER
- SECURITY FENCE
- DRAINAGE FLOW ARROW

WATKINS COMPRESSOR STATION STAGE-STORAGE

INTERVAL (FT)	ELEVATION (FT)	AREA (SF)	VOLUME (CF)	DESCRIPTION
0.00	5568.86	0.00	0.00	BOTTOM POND
0.50	5569.36	5658.49	1375.06	
0.64	5569.50	5864.24	2183.48	WQCV
1.00	5569.86	6324.36	4376.99	
1.38	5570.24	6825.80	6875.01	5-YR DESIGN VOLUME + WQCV
1.50	5570.36	6987.51	7703.79	
2.00	5570.86	7678.71	11369.18	100-YR DESIGN VOLUME
2.14	5571.00	7877.27	12458.07	100-YR + 1/2WQCV, SPILLWAY ELEV.
3.14	5572.00	9357.40	21066.73	FREEBOARD

1 … DETAIL - DETENTION POND STAGE-STORAGE

NOTES

1. FOR GRADING PLAN NOTES AND ABBREVIATIONS SEE DRAWING WCSS-CE-601.
2. SEE DETAIL 3, WCS-CE-604 FOR OUTLET STRUCTURE DETAILS.

Know what's below. Call before you dig.

COLORADO LICENSED — MICHAEL T. CLOUD — 49458 — 01-21-19 — PROFESSIONAL ENGINEER — FOR PERMIT

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B	ISSUED FOR PERMIT - RESPONSE TO COMMENT	01/21/19	LER
A	ISSUED FOR PERMIT	11/15/18	DMM

SCALE:	AS SHOWN
DESIGNED:	M. MORGAN
DRAWN:	M. MORGAN
CHECKED:	M. CLOUD
APPROVED:	
APPROVED:	
DATE	11/15/2018
DATE	10/18/2018
DATE	11/15/2018

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC

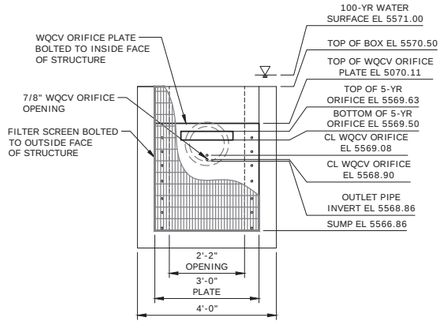
LOCATION: ADAMS COUNTY, CO

Williams

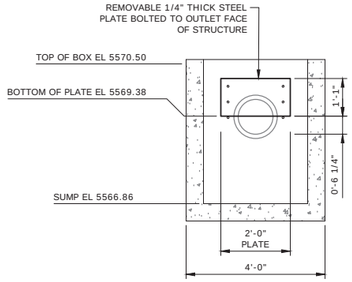
Samuel Engineering
We Provide Solutions
8450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
Phone: 303.714.4840
Fax: 303.714.4800

TITLE	PROJECT NUMBER
WATKINS COMPRESSOR STATION WILLIAMS DJ BASIN FIELD COMPRESSION CIVIL GENERAL GRADING AND DRAINAGE DETAILS	18256
	DRAWING NUMBER
	WCSS-CE-603 REV. B

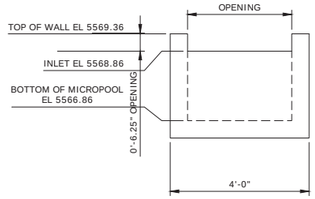
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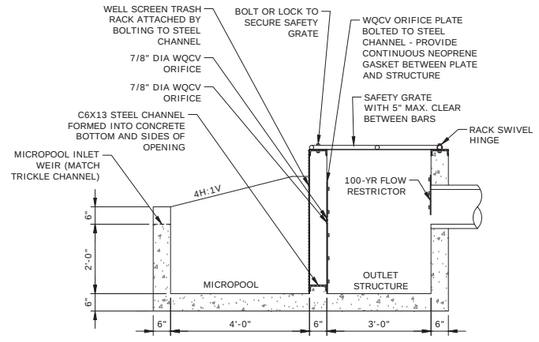
E — FILTER SCREEN & WQCV ORIFICE PLATE
1/2" = 1'



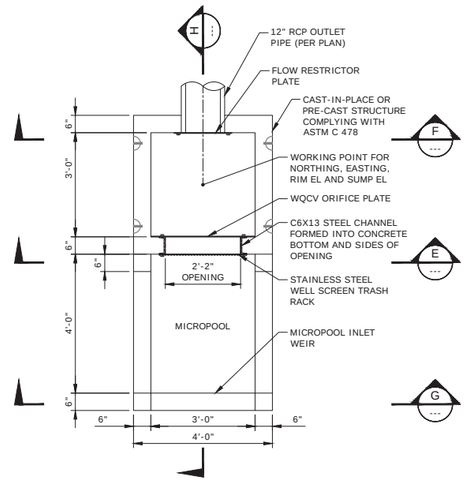
F — 100-YR FLOW RESTRICTOR PLATE
1/2" = 1'



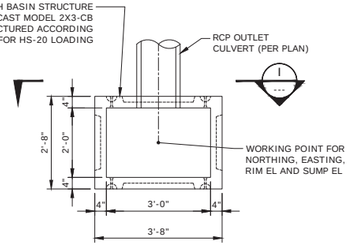
G — MICROPOOL INLET WEIR
1/2" = 1'



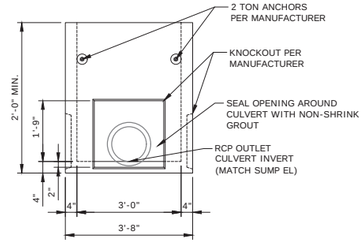
H — POND OUTLET STRUCTURE SECTION
1/2" = 1'



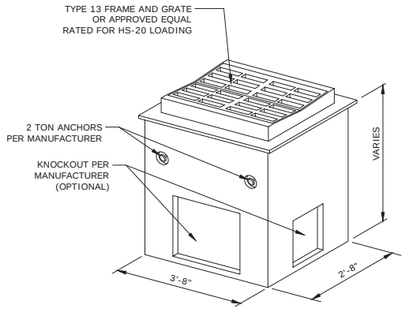
1 — DETAIL - DETENTION POND OUTLET STRUCTURE PLAN
1/2" = 1'



PLAN VIEW
FRAME & GRATE NOT SHOWN



I — RCP CONNECTION TO DROP INLET
1/2" = 1'



ISOMETRIC VIEW

2 — DETAIL - DROP INLET STRUCTURE
1/2" = 1'

0' 1' 2' 4' 6'
SCALE: 1/2" = 1'-0"

Know what's below. Call before you dig.

COLORADO REGISTERED DAVID MATTHEW MORGAN 39514 PROFESSIONAL ENGINEER
11/15/2018

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REVISIONS

NO.	DESCRIPTION	DATE	BY

REVISIONS

NO.	DESCRIPTION	DATE	BY
A	ISSUED FOR PERMIT	11/15/18	DMM

SCALE:	AS SHOWN	DATE
DESIGNED:	M. MORGAN	11/15/2018
DRAWN:	M. MORGAN	10/18/2018
CHECKED:	M. CLOUD	11/15/2018
APPROVED:		
APPROVED:		

CLIENT: ROCKY MOUNTAIN MIDSTREAM LLC
LOCATION: ADAMS COUNTY, CO

Samuel Engineering
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8450 E. Crescent Parkway, Suite 200
Greenwood Village, CO 80111
Phone: 303.714.4840
Fax: 303.714.4800

TITLE
WATKINS COMPRESSOR STATION
WILLIAMS DJ BASIN FIELD COMPRESSION
CIVIL
GENERAL
DRAINAGE STRUCTURE DETAILS

PROJECT NUMBER
18256

DRAWING NUMBER
WCSS-CE-604 REV. A

Plot Date: Thursday, November 15, 2018 3:25:43 PM Plotted By: Matt Morgan
CTB Used: SE_Std_B&W_Full_size.ctb