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JUN 21 2010
UTAH DIVISION OF SOLID & HAZARDOUS WASTE

Utah Class IV and VI Landfill Permit Application Form

Part I General Information APPLICANT PLEASE COMPLETE ALL SECTIONS

I Landfill Type	☐ Class IVa ☒ Class VI	☐ Class IVb	II Application Type	☐ New Application ☒ Renewal Application	☐ Facility Expansion ☐ Modification

For Renewal Applications Facility Expansion Applications and Modifications Enter Current Permit Number 0012

III Facility Name and Location

Legal Name of Facility CEDAR VALLEY LANDFILL LC				
Site Address (street or directions to site) 18150 WEST ALLEN RANCH ROAD				County UTAH
City FAIRFIELD		Zip Code 84043		Telephone (801) 437-9502
Township 7 S	Range 2 W	Section(s) 5 & 8	Quarter/Quarter Section	Quarter Section
Mam Gale Latitude 40 degrees 14 minutes 28 seconds N			Longitude 112 degrees 05 minutes 49 seconds W	

IV Facility Owner(s) Information

Legal Name of Facility Owner CEDAR VALLEY LANDFILL LC / GZ ROCK LLC			
Address (mailing) P.O BOX 1503			
City OREM	State UT	Zip Code 84059	Telephone (801) 437-9502

V Facility Operator(s) Information

Legal Name of Facility Operator CEOAR VLLEY LANDFILL LC			
Address (mailing) P O BOX 1503			
City OREM	State UT	Zip Code 84069	Telephone (801)437-9502

VI Property Owner(s) Information

Legal Name of Property Owner GZ ROCK LLC			
Address (mailing) 1819 EAST MORTON AVENUE			
City PHOENIX	State AZ	Zip Code 85020	Telephone (602) 943-2360

VII Contact Information

Owner Contact DAVID JOHNSTON		Title MANAGER	
Address (mailing) P O BOX 1503			
City OREM	State UT	Zip Code 84059	Telephone (801) 437-9502
Email Address david@summitdevelop.com		Alternative Telephone (cell or other)	(801) 420-1924
Operator Contact DAVID JOHNSTON		Title MANAGER	
Address (mailing) P O BOX 1503			
City OREM	State UT	Zip Code 84069	Telephone (801) 437-9502
Email Address david@summitdevelop com		Alternative Telephone (cell or other)	(801) 420-1924
Property Owner Contact BARRY ZEMEL		Title MANAGER	
Address (mailing) 1819 EAST MORTON AVENUE			
City PHOENIX	State AZ	Zip Code 85020	Telephone (602) 943-2360
Email Address zemel36@yahoo com		Alternative Telephone (cell or other)	

Utah Class IV and VI Landfill Permit Application Form

Part I General Information (Continued)

VIII Waste Types (check all that apply)			IX Facility Area	
☐ Landfill will accept all wastes allowed in Class IV or VI landfills Or landfill will accept only the following wastes			Facility Area	298 6 acres
Waste Type	Combined Disposal Unit	Monofill Unit	Disposal Area	270 acres
☒ Construction & Demolition	☐	☐	Design Capacity	
☐ Tires	☐	☐	Years	58
☒ Yard Waste	☐	☐	Cubic Yards	29.5 million
☐ Animals	☐	☐	Tons	14 8 million
☐ Contaminated Soil	☐	☐		
☐ Other ______	☐	☐		
Note Disposal of dead animals must be approved by the Executive Secretary ______				

X Fee and Application Documents

Indicate Documents Attached To This Application ☐ Application Fee Amount $

☐ Facility Map or Maps ☐ Facility Legal Description ☐ Plan of Operation ☐ Waste Description
☐ Ground Water Report ☐ Closure Design ☐ Cost Estimates ☐ Financial Assurance

Class VI Special Requirements
☐ Documents required by DCA 19 6 108(9) and (10)

I HEREBY CERTIFY THAT THIS INFORMATION AND ALL ATTACHED PAGES ARE CORRECT AND COMPLETE

Signature of Authorized Owner Representative: [signature]	Title: Manager	Date: 2/15/11
Name typed or printed: DAVID N. JOHNSTON	Address: PO Box 1503 Orem, Ut. 84059	
Signature of Authorized Land Owner Representative (if applicable): [signature]	Title: MGR MBR 62 Acres LLC	Date: 2/10/11
Name typed or printed: Barry Zenke	Address: 1819 E Morten Phx AZ 85020	
Signature of Authorized Operator Representative (if applicable): [signature]	Title: Manager	Date: 2/15/11
Name typed or printed: DAVID N. JOHNSTON	Address: PO Box 1503, Orem Ut. 84059	

Cedar Valley Construction and Demolition Landfill

Class VI Landfill

Application for Permit Renewal

June 2010

Current Permit No
0012

Cedar Valley Landfill
P O Box 1503
Orem, Utah 84059

Application Form

Cedar Valley Construction and Demolition Landfill

Table of Contents

Part II General Report

1.0 General *Facility Description*

Cedar Valley Construction and Demolition Landfill is located in the Town of Fairfield in Utah Coimty, Utah The facility is located 1 5 miles southerly of the main center of Tovm The facility is a Class VI landfill that receives yard waste, inert waste, and construction and demolition waste It contains 298 6 acres of land all of which is flat and generally sloping to the south and east Currently 69 5 acres of land is fenced with a 6' chain link fence topped with 3 strands of barbed wire Located on site are a scale and scale house, a 120,000 gallon water reservoir, a water shed, and a small office house The landfill site is first excavated below ground to create a pit for dumping The waste is covered and mixed with soil as it fills in The site is bermed on the sides and extends above grade at a slope of 2 4 1

1.1 Legal Description

The overall legal description is as follows

Commencing at a point m the center line of a county road, said point being located N00°45'22"W along the Section Line 1343 60 feet, and East 1257 45 feet from the West Quarter Comer of Section 5, Township 7 South, Range 2 West, Salt Lake Base and Meridian, thence S89°42'06"E, 74 22 feet, thence S00°16'40"E, 1347 56 feet, thence S89°48'26"E along the quarter section line 1320 48 feet to the center of Section 5, thence S00°12'08"W, along the quarter section line 2646 06 feet to the quarter comer common to Section 5 and Section 8, thence S00°20'54"W along the quarter section line 2707 93 feet to the center of said section 8, Township 7 South, Range 2 West, thence N89°32'40"E, along the quarter section line1327 91 feet, thence S00°20'12"W, 1325 56 feet, thence N89°34'40"E, 1328 17 feet, thence S00°19'31"W, along the section line 1326 33 feet to the Southeast Comer of said Section 8, thence S89°36'40"W, along the section line 2656 85 feet to the South Quarter Comer of said Section 8, thence S89°36'21"W, along the Section line 837 61 feet to the center line of a coimty road, thence along the center lme of said coimty road as follows N00°12'43"E, 302 92 feet, thence N00°39'59"E, 1196 28 feet, thence N00°37'44"E, 2427 90 feet, thence N00°35'40"E, 1861 44 feet, thence N00°52'12"E, 405 93 feet, thence along the arc of a 400 00 foot radius curve to the left 316 45 feet (chord bears N21°47'38"W, 308 26 feet), thence N44°27'28"W, 473 22 feet, thence N45°02'02"W, 137 61 feet, thence N44°56'18"W, 131 01 feet, thence N42°46'21"W, 92 34 feet, thence along the arc of a 360 00 foot radius curve to the right, 313 28 feet (chord bears N17°50'34"W, 303 49 feet), th ence N07°05'14"E, 428 46 feet, thence N05°05'24"E, 201 10 feet, thence N04°53'03"E, 678 65 feet, thence N06°19'16"E, 569 05 feet, thence along the arc of a 2550 00 foot radius curve to the left, 130 05 feet (chord bears N04°51'36"E, 130 04 feet) to the point of beginning

Less and excepting the following

Beginning at a point in the center line of a county road said point being located N00°45'22"W, along the Section Line 1343 60 feet, and East 1257 45 feet from the West Quarter Corner of Section 5, Township 7 South, Range 2 West, Salt Lake Base and Meridian and running thence S89°42'06"E, 74 22 feet, thence S00°16'40"E, 447 43 feet to a fence line, thence S 89°59'07"W 122 66 feet along said fence line and the extension thereof to the center of said county road, thence N06°19'16"E, 320 22 feet along the center line of said county road, thence northerly 130 06 feet along the arc of a curve to the left, having a radius of 2550 00 feet (chord bears N04°51'36"E, 130 037 feet) to the point of beginning

1.2 Proof of Ownership

The property is currently owned by GZ Rock, LLC A copy of the recorded Trustee's Deed is attached in Appendix A The facility owner and operator is Cedar Vally Landfill, LC

1.3 Waste Type

Waste accepted for disposal at this site is construction and demolition waste, inert waste, and yard waste comprised mainly of wood, cardboard, wallboard, and any and all waste that meet the requirements of the UAC R315-301-2(17)(37)(87) Waste not accepted includes, but not limited to municipal, industrial, medical, and hazardous wastes, liquids, used oils, contaminated soils, dead animals, and tires

Construction and Demolition Waste is defined in R305-301-2(17) means solid waste from building materials, packaging, and rubble resulting from construction, remodeling, repair, abatement, rehabilitation, renovation, and demolition operations on pavements, houses, commercial buildings, and other structures, including waste from a conditionally exempt small quantity generator of hazardous waste, as defined by R315-2-5, that may be generated by these operations

(a) Such waste may include

(i) Concrete, bricks, and other masonry materials

(ii) Soil and rock

(iii) Waste asphalt

(iv) Rebar contamed m concrete

(v) Untreated wood and tree stumps

Inert Waste is defined in R315-301-2(37) and means, noncombustible nonhazardous solid wastes that retam their physical and chemical stmcture under expected conditions of disposal, including resistance to biological or chemical attack

Yard Waste is defined in R315-301-2(87) means vegetative matter resulting from landscapmg, yard maintenance, and land clearing operations including grass clippings, pruning, and other discarded material generated from yards, gardens, parks, and similar types of facilities Yard waste does not include garbage paper, plastic, processed wood, sludge, septage, or manure

The daily volume anticipated for the landfill is approximately 260 cubic yards per day This is based on last years amount of 50,000 tons of waste received at the landfill

1.4 Schedule of Construction

The permit application is for renewal The landfill is constmcted and in operation

2.0 Plan of Operation

2.1 Waste Handling Procedures

The landfill operates by excavatmg and removmg the existmg soil from the site to a depth of approximately 20 feet deep Beyond the 20 feet deep, the amount of soil removed becomes burdensome to the overall productivity of the landfill The soil is stock piled to be mixed with the waste and also to cover the site after the desired height is obtained When waste is brought to the site it is first weighed at the scales and then taken to a location on the site to be dumped A cat and or compactor pushes the waste to consolidate and compact it, and mix it with soil The compactor is used to remove voids withm the dumped waste Dirt is mixed with the waste, as well as dumped over the surface of the waste to bind the waste and to keep it from blowmg from the site, and to better control the possibility of combustion Tmcks that have dumped waste will again pass over the scales to determine the amount of waste that was deposited on the site

See sample form for weight recording m Appendix B

The workmg surface of the site is covered by a minimum of 6" of native soil This covering allows for a better driving surface, as well as to provide the cover required to avoid combustion of the waste This cover is applied daily to the working surface

2.2 Inspections and Monitoring

Inspections are performed to satisfy R315-302-2(5)(a) A brief visual inspection of equipment and the facility is completed daily All problems found which threaten human health or environmental quality will be noted and fixed immediately All other findings of these brief visual inspections will be fixed in a timely manner A thorough inspection of the whole facility will be done quarterly Its findings will be logged and any and all corrective action will be noted See Appendix C for sample form (please note that not all of the items apply)

2 3 Fire and Explosion

Facility personnel will be prepared for immediate fire suppression in the event of a fire mvolvmg the waste Fire extinguishers are mounted on equipment On-site cover fill will be used to cover the known fire, or smoldering areas Water will be applied to the affected areas only as a last resort, thus to mimmize water to waste contact In the event that the on-site personnel can not manage the fire because of its size, or a dangerous condition is evident, the Eagle Mountam Fire Department will be notified The Fire Department is located m Eagle Mountain City approximately

10 miles away Response time is estimated at 15 mmutes The responding Fire Department will then take responsibility for fire suppression and extmguishing

2.4 Fugitive Dust

Dust can be a problem from May through October as these are the drier and warmer times of the year The soil on the site consists mainly of clay and silty sands A water tmck is employed to keep the site damp especially m the traveled areas Cmshed concrete and road base are used at the site entrance to keep a roadway that is more dust free Also, the main road to the site is being improved by widemng the roadway and placmg road base and eventually asphalt

As the height of the landfill mcreases, the new exposed sides are planted with a native seed mix This planting is accomplished in the fall, October or November of each year By planting in the fall, the seed will remain dormant through the winter and then have the spring moisture to germinate The vegetation around the landfill holds the soil from blowmg and creating dust from the perimeter slopes

2.5 Litter Control

Blowmg litter has been a problem and continues to be a challenge on the site The active portion of the site is fenced with a six-foot chain link fence to attempt to keep blowing litter from leaving the site However, the fence alone does not keep litter from blowmg In addition to the fence portable "wmd screens" have been fabricated to collect litter that is blovm from the landfill The "wind screens" are located on top of the berm allowing for maximum efficiency As the operations continue to be refined, more dirt is mixed with the waste The additional cover and mixture of dirt also keeps litter from blowing from the site Occasionally, a wind storm has come across the site that has picked up litter and blown it from the site When this occurs, the litter is gathered manually and brought back to the site and buried

(Portable Wind Screens located on the site)

2.6 Prohibited Waste Exclusion Plan

Wastes which are prohibited from disposal at the Cedar Valley Landfill include, but are not limited to, municipal, industrial, and medical wastes, hazardous wastes, liquids, used oils, contaminated soils, dead animals, and tires. Pursuant to UAC 315-303-4(7), an owner or operator of a solid waste disposal facility shall not knowingly dispose, treat, store, or otherwise handle hazardous waste or waste containing PCBs. An owner or operator of a solid waste disposal facility shall include and implement, as part of the plan of operation, a plan that will inspect loads or take other steps as approved by the Executive Secretary that will prevent the disposal of prohibited hazardous waste or prohibited waste containing PCB's (R315-303-4-(7)(b)). This plan includes random inspections, separate inspection area, training of on-site personnel to identify prohibited waste, and a written record of the inspections signed by the inspector.

Containers holding liquid, larger than household containers, are not acceptable at the landfill Containers exceeding this requirement are loaded back on to the truck they arrived in and hauled off

2.6.1 Random Inspections

Trucks using the facility will be subject to random inspections performed by an on-site attendant who will be trained and qualified to identify hazardous waste and waste containing PCB's Drivers will be notified by the scale house attendant to proceed to the special inspections area The contents will be spread with a front loader or dozer, and inspected for regulated hazardous waste or waste containing PCB's Acceptance of the load will depend on the findings of the following procedures

- The load will be dumped and spread in a designated area
- The vehicle and driver will be required to wait until the contents have been properly inspected and verified
- The contents will be spread out, with special attention not to break or rupture any unknown or unmarked containers, by a front loader or dozer
- Any containers such as 55 gallon drums, that are unmarked or are not easily identifiable will be treated a hazardous waste and will be opened only by trained and qualified personnel
- If the waste has been inspected and is deemed safe, it will be allowed to be disposed of at the face of the landfill

If the inspection of the waste determines that it contains hazardous waste or waste-containing PCB's, the inspection area will be immediately closed to the public and on-site personnel The operator will immediately contact AET Environmental they will then be responsible for the proper management, transport, and care of the waste If known, the hauler of the waste will be notified that they have transported hazardous waste or waste containing PCB's into the facility A copy of the Random Inspection Form is included in Appendix D

In addition to the random inspections, the on-site attendant that will operate near the face of the landfill will have the responsibility to monitor the waste of in-coming loads and to remove any questionable material from the site as to facility guidelines

2.6.2 *Training of Facility Personnel*

All facility personnel will be trained to identify suspected hazardous waste or waste containing PCB's using standard labels used to mark said waste Training will include identification, handling, safety precautions, and documentation requirements All records of training will be maintained in the facilities operating record

2 6.3 *Written Record of Inspections*

Inspections will be recorded on the Random Load Inspection Form (See appendix D) Inspection records will include, but are not limited to inspector's name, date, and time of inspection, hauler information, truck and driver information, observations of the inspector, results of inspection, description of any questionable materials, and the reason for rejection of the waste

2,6.4 *Notification of the Solid Waste Management Authority*

Within 24 hours of the receipt of suspected hazardous or PCB containing waste the operator will notify the Utah Division of Environmental Quality A record of the notification will be submitted to the Utah Division of Environmental Quality that identifies the date and time of discovery, type of material (if possible), probable hauler, an estimate of the material quantity, and actions proposed for the removal of the material from the facility A record of the notification will then be entered into the operating record of the facility

2.7 *Controlling Disease Vectors*

Cedar Valley Landfill will be accepting only construction and demolition waste and yard waste In accepting only these wastes it is hoped that any available food source for rodents or wild animals will be an absolute minimum The presence of wild animals will limit the choice of animal control All effort will be made to keep the debris face compacted and graded to keep the area unacceptable for habitation for rodents and other wild animals Smoke devices and sonar techniques will be employed first if a problem is discovered <u>Poisons will be the absolute last option attempted</u>

Some animals present in the surrounding area (mule deer and antelope) may not be stopped from encroaching on the facility by the fencing If these animals are found in an active area of the site, they will be escorted off of the facility with as little stress as possible At no time will any animals be purposely injured or killed to remove them Any migrating birds that locate on the storage pond will be left alone

2.8 Alternative Waste Handling

The Cedar Valley Landfill is open Monday through Friday from 7 30 am to 5 00 pm There will be enough capacity at the site to hold 15 working days worth of material without having to move any borrow If a major equipment failure occurs, the facility will replace the damaged equipment with a rental or lease machine within 1 working day If the Cedar Valley Landfill can not accept incoming waste because of an unforeseen or unknown problem, major customers will be contacted and told of their options These options include North Point Transfer Station, Trans Jordan Landfill, and the Payson Landfill All of these options are inside a fifty-mile radius of the site

2.9 General Training and Safety Plan for Site Operations

The employees and management of the Cedar Valley Landfill will receive instruction and training in landfill and equipment operations The training of all personnel will be an ongoing process Basic first aid, site safety, and CPR certification will also be included Seminars to keep all personnel up to date on any new procedures for landfill operations will be held at least once a year The training of personnel will be noted and entered into the operating record of the facility (See form in Appendix E)

Basic first aid will be administered to non-life threatening injuries 9-1-1 will be called if any injury appears to be life threatening or beyond basic first aid techniques

2.10 Recyclıng Programs

Cedar Valley Landfill recogmzes the ımportance of recyclıng and makes ıt part of theır plan of operatıon Currently loads of concrete and asphalt are gmded to a specıfic area on the sıte Concrete and asphalt ıs cmshed to create a road base materıal Also, metals that are found wıthın loads are currently set asıde and recycled As a market exısts for other materıals, recyclıng wıll contınue to be ıncorporated ın day to day sıte operatıons

2.11 Sıte Specıfic Informatıon

Because of the remoteness of the Cedar Valley Landfill, the possıbılıty of ıllegal after hours dumpıng on or near the sıte wıll be monıtored Securıty cameras have been set up that momtor the sıte and record 24 hours a day

3.0 Engıneerıng Reports

3.1 General Constructıon Plan

Plans are ıncluded ın Appendıx F showıng the general constmctıon standards of the sıte The plans show the sıte beıng constmcted so as to use excavated materıal to berm and cover the waste As waste ıs dumped on sıte ıt wıll be moved and shaped to allow for 2 4 1 sıde slopes and a mımmum of a 2-foot cap The plans also propose a phasıng plan

3.2 Run On and Run Off Control Systems.

Storm water wıll not be allowed to run off the actıve area of the landfill A berm has been constmcted around the actıve portıon of the landfill ın the magnıtude of 8 to 10 feet hıgh Storm Draınage Calculatıons are mcluded ın Appendıx G showıng that a 25 year 1 hour storm wıll generate approxımately 50,000 cubıc feet of water Thıs wıll stay wıthm the 10-feet hıgh berms As the water flows to the low pomt on the sıte ıt wıll pond ın an area approxımately 225 feet by 225 feet, 1-foot deep As the sıte ıs not smoothly graded, much of thıs water wıll not reach the low poınt, rather, the storm water wıll be sread out over the 69 5 acre sıte

The same berm keeping storm water on site prohibits storm water from flowing onto the site The flow from the surrounding area after a 1 hour storm may be 1-inch deep This flow will be diverted by the berm around the landfill Eventually, all storm water will slowly percolate into the soil, or evaporate from the site

3.3 Facility Life

The facility has a life expectancy of approximately 60 years The life expectancy is based on the assumptions that the conversion of tons to yards is 2 yards per ton of waste In 2004, approximately 135,000 tons of waste was accepted at the landfill The "build-out" volume of the landfill is approximately 30 million cubic yards There are many assumptions and variables that may alter the calculations for this site The conversion from tons of material to yards is dependant on the material, the compaction that is achieved of the waste to fill voids, and the amount of on-site dirt that is mixed with the soil The landfill has been in operation since 2002 and currently encompasses approximately 21 acres The total acreage of the landfill is over 298 acres, and the operation plan may vary as the amount of waste increases to the site

3.4 Location Standards

Floodplain – The Cedar Valley Landfill is not located within a floodplain, or near any body of water

Wetlands – The Cedar Valley Landfill is not located near any Wetlands A copy of the wetland documentation from previous permit included in Appendix H

Ground Water Clearance – The site is excavated down approximately 20 feet from the surface Initial ground water depths and subsequent test holes have determined the ground water to vary from 33 feet to over 43 feet from the surface (pending location on the site) The 20-foot depth allows for keeping a 10-foot clearance above the groundwater A copy of a Groundwater Study is included in Appendix I

3.5 Borrow Sources

The final cover for the site will use native material from the site

3.6 Run-off Collection

No run-off collection, treatment, or disposal is anticipated from the site

4.0 Closure Plan

Closure of Cedar Valley Landfill is not anticipated for many years As the northern portion of the facility fills with waste, and the face of the landfill moves to the south, it may be possible to begin closure of portions of the landfill With the normal operating plan that includes sloping the sides at a 2 4 1 slope, and yearly vegetation of the slopes, part of the closure procedures will be worked in As the engineering detail shows in Appendix F, Sheet 3, the closure includes a 2-foot minimum cap, vegetation, and 2 4 1 side slopes The native soil is a clay and silty-clay soil This native soil will be used in the construction of the 2-foot cap

The seeding of the slopes will occur in the fall of each year The seed is put on by hydro-seeding which allows the seed to lay dormant through the winter months and have the benefit of the spring moisture to germinate The seed type is a native plant that will grow in the on-site soil It is not anticipated that top-soil will need to be imported to the site

The facility is planned to be in operation for many years It is anticipated that the overall tonnage exceeds 15 million tons of waste to be stored and the landfill site At least 90 days before the final date of operation of the landfill. Cedar Valley Landfill will notify the Department of Environmental Quality and begin the implementation of the closure plan The construction schedule to complete the closure plan is anticipated to be 180 days

Currently Cedar Valley Landfill, LC, is anticipated to be the main contact through the life and closure of the facility As the design life is many years, any change in ownership will be reported as required

5.0 Post Closure Care Plan

The post closure care plan shall require monthly inspections of the site to check the landfill for settlement and erosion Should settlement occurs that is excessive, or erosion that removes the cap of the landfill, new soil will be hauled and filled into the areas of settlement or erosion and reseeded to prevent further erosion As necessary, matting, or hydro-seeding may be used The intent of the post closure plan is to monitor the integrity of the final cap

Cedar Valley Landfill, LC, will be responsible for Post Closure Care Contact information is as follows

Cedar Valley Landfill
Attn David Johnston
P O Box 1503
Orem, Utah 84059
(801) 437-9502

6.0 Financial Assurance

Cedar Valley Landfill maintains a letter of credit posted with the Division of Environmental Quality This Letter of Credit will be adjusted by pending the amount of landfill that is under operation As area is closed and opened, the bond amount may need to be adjusted

A copy of the letter of credit and bond amount for 21 acres of area is included in Appendix J

Cedar Valley Landfill
21 05 Acre
Phase Closure Bond

Item	Quantity	Unit	Unit Cost	Total Cost
2-foot Cap				
Soil (located on site)	67921 3	cu yd	$0 00	$0 00
Load / Haul	67921 3	cu yd	$0 95	$64,525 24
Spread and grade	67921 3	cu yd	$0 30	$20,376 39
Landscape				
Native Seed Mix	421 0	PLS lbs	$4 63	$1,949 23
Fourwing saltbush		10		
Wyoming big sagebrush		0 75		
Alkali sacation		1		
Blue grama		2 5		
Bluebunch wheatgrass		14 25		
Streambank wheatgrass		13		
Smooth brome		15 5		
Intermediate wheatgrass		10		
Sandbarg bluegrass		2		
Sheep fescue		3		
Slender wheatgrass		11		
Western wheatgrass		17		
		100%		
Planting with Grain Drill		hrs		
Post Closure Care				
Inspection *	60 0	ea	$150 00	$9,000 00
Fence Repair **	300 0	lf	$9 00	$2,700 00
Soil Repair ***	3000 0	sf	$1 25	$3,750 00
Total Bond Amount				**$102,300 86**

* Inspection assumes twice per year for 30 years
** Fence repair assumes 20 feet per year
*** Cap repair assumes 100 sq ft per year

APPENDIX A

WHEN RECORDED RETURN TO

Kyle V Leishman
Jones, Waldo, Holbrook & McDonough
170 South Main Street, Suite 1500
Salt Lake City, UT 84101

ENT 39909 2010 PG 1 of 5
RODNEY D. CAMPBELL
UTAH COUNTY RECORDER
2010 May 14 1 00 pm FEE 22 00 BY SS
RECORDED FOR JONES WALDO HOLBROOK &2

MAIL TAX NOTICE TO

GZ Rock, LLC
P O Box 47638
Phoenix, AZ 85068
Attn Barry Zemel

TRUSTEE'S DEED

BY THIS TRUSTEE'S DEED, made this 13th day of May, 2010, Kyle V Leishman, a member of the Utah State Bar, whose address is 170 South Main Street, Suite 1500, Salt Lake City, Utah 84101, as Trustee (hereinafter Grantor), under that certain Deed of Trust and Assignment of Rents dated December 2, 2005, recorded December 7, 2005, as Entry No 141656 2005, in the records of the County Recorder of Utah County, State of Utah, executed by CEDAR VALLEY LANDFILL, LC , a limited liability company, as to 49% interest, THE WASTE GROUP, LC, a limited liability company, as to a 36 6% interest, DON FLOYD PHILLIPS and SHEILA PHILLIPS, husband and wife as joint tenants, as to a 7% interest, and M TIMOTHY ROSS and MARIE ROSS, husband and wife as joint tenants, as to a 7 4% interest, collectively as Trustor, in favor of STEWART TITLE & TRUST OF PHOENIX, INC , a Delaware corporation, as Trustee, and KENWOOD MORTGAGE & INVESTMENT, INC , an Arizona corporation, as Beneficiary (the "Deed of Trust"), grants and conveys to GZ ROCK, LLC, an Arizona limited liability company (hereinafter "Grantee") all of the title of the Trustee

929507_1 DOC

under the Deed of Trust and all of the nght, tıtle ınterest and claım of CEDAR VALLEY LANDFILL, LC , THE WASTE GROUP, LC, DON FLOYD PHILLIPS, SHEILA PHILLIPS, M TIMOTHY ROSS, and MARIE ROSS, and of all persons claımıng by, through or under them, ıncludıng all such nght, tıtle, ınterest and claım acquıred by CEDAR VALLEY LANDFILL, LC , THE WASTE GROUP, LC, DON FLOYD PHILLIPS, SHEILA PHILLIPS, M TIMOTHY ROSS, and MARIE ROSS, or theır successors ın ınterest subsequent to the executıon of the Deed of Trust ın and to the real property and all other property sıtuated at or on the property descnbed ın Exhıbıt "A" attached hereto, ın Utah County, State of Utah, together wıth all appurtenances thereto (the "Trust Property")

The Trust Property was also descnbed ın the Notıce of Default and Electıon to Sell under Deed of Trust (the "Notıce of Default") dated February 18, 2009 and recorded February 18, 2009, as Entry No 16689 2009, ın the Records of the Utah County Recorder, State of Utah

Grantor makes thıs transfer and conveyance pursuant to the powers conferred by the Deed of Trust Grantor, as Trustee, conveys the Trust Property for the benefit of PEACHTREE MORTGAGE, LTD , an Anzona corporatıon, and RANDOLPH O PERSSON, Trustee of the Randolph O Persson Separate Property Trust dated May 1, 2000, the current Beneficıanes under the Deed of Trust Thıs grant and conveyance ıs made after the fulfillment of the condıtıons specıfied ın saıd Deed of Trust and authonzıng the same as follows

1 Breach and default under the terms of the Deed of Trust as set forth ın partıcular ın the Notıce of Default referred to hereın, whıch default contınued to the tıme of sale under saıd Deed of Trust

2 Notıce of the declaratıon of saıd default was duly gıven to the Trustor and demand for sale pursuant to the terms of saıd Deed of Trust made, and thereafter, the Notıce of Default

929507_1 DOC

was filed as set forth above, and required copies were sent to the Trustor and to other persons having requested and entitled to the same m accordance with the provisions of the applicable statutes within ten (10) days of such filing for record

3 At least three (3) months elapsed after the filing of said Notice of Default, at which time the Grantor executed a Notice of Trustee's Sale stating that, by virtue of authonty granted pursuant to said Deed of Trust, Grantor would sell at public auction to the highest bidder, for cash in lawfiil money of the United States, the afore-descnbed Trust Property Said Notice of Trustee's Sale fixed the time and place of sale as March 24, 2010 at 10 30 a m , at the front entrance of the Fourth Judicial District Court, located at 125 North 100 West, Provo, Utah, at which time and place the Trustee's Sale was postponed by Trustee until Apnl 27, 2010

4 The Trustee gave wntten notice of the time and place of sale, particularly descnbmg the property to be sold, as follows (a) Grantor caused a copy of said Notice of Trustee's Sale to be published once a week for three (3) consecutive weeks in a newspaper having general circulation in Utah County, the county in which the said property is situated, the dates of publication being February 27, 2010, March 6, 2010 and the last date of such publication being March 13, 2010, (b) by publishing the Notice of Sale on the website created by the Utah Press Association in accordance with Utah Code Section 45-1-101, (c) by posting such notice at least twenty days pnor to the date of sale at the following locations (i) Utah County Recorder's Office located at 100 East Center Street, #1300, Provo, Utah, and (ii) the property located at 18150 West Allen Ranch Road, Fairfield, Utah, and (iii) by mailing, by certified mail, with postage prepaid, at least twenty days prior to the date of sale, a copy of the Notice of Trustee's Sale to the Trustor and other parties entitled to notice thereof

929507_1 DOC

ENT 39909 2010 PG 1 of 5

5 All applicable statutory provisions of the State of Utah and all of the provisions of said Deed of Trust have been complied with as to acts to be performed and notices to be given

6 The Grantor, at the time and place of sale fixed in accordance with the foregoing, then and there sold, at public auction, to Grantee, who was the highest bidder therefor, the Trust Property hereinbefore described, in full accordance with the laws of the State of Utah and with the terms of the said Deed of Trust

THIS SALE AND CONVEYANCE IS MADE WITHOUT ANY COVENANT OR WARRANTY, EXPRESS OR IMPLIED, AS TO TITLE, POSSESSION, OR OTHERWISE WITH RESPECT TO THE TRUST PROPERTY

DATED this 13th day of May, 2010

GRANTOR/TRUSTEE

Kyle V Leishman, Trustee

STATE OF UTAH)
) ss
COUNTY OF SALT LAKE)

This instrument was acknowledged and executed before me this 13th day of May, 2010, by Kyle V Leishman who acknowledged to me or proved to me on the basis of satisfactory evidence, to be the persons whose names are subscribed to the within instrument and acknowledged to me that he executed the same in his audionzed capacity, and that by his signature on the instrument the person or the entity upon behalf of which the person acted, executed the instrument

WITNESS my hand and official seal

My Commission Expires Notary Public

929507_1 DOC

BARBARA K PARRY
NOTARY PUBLIC STATE OF UTAH
170 S. MAIN STREET #1500
SALT LAKE CITY, UT 84101
My Comm Exp 11/04/2011

EXHIBIT "A"

That certain property situated in Utah County, State of Utah, and more particularly described as follows

Commencing at a point m the center line of a county road said point being located North 00°45'22" West along the Section line 1343 60 feet and East 1257 45 feet from the West quarter corner of Section 5, Township 7 South, Range 2 West, Salt Lake Base and Meridian, thence South 89°42'06" East 74 22 feet, thence South 00°16'40" East 1347 56 feet, thence South 89°48'26" East along the quarter section line 1320 48 feet to the center of said Section 5, thence South 00°12'08" West along the quarter section line 2646 06 feet to the quarter corner common to Section 5 and Section 8, thence South 00°20'54" West along the quarter section line 2707 93 feet to the center of said Section 8, Township 7 South, Range 2 West, dience North 89°32'40" East along the quarter section line 1327 91 feet, thence South 00°20'12" West 1325 56 feet, thence North 89°34'40" East 1328 17 feet, thence South 00°19'31" West along the Section line 1326 33 feet to the Southeast corner of said Section 8, thence South 89°36'40" West along die Section line 2656 85 feet to the South quarter corner of said Section 8, thence South 89°36'21" West along the Section line 837 61 feet to die center line of a county road, thence along the center line of said county road as follows North 00°12'43" East 302 92 feet, thence North 00°39'59" East 1196 28 feet, thence North 00°37'44" East 2427 90 feet, dience North 00°35'40" East 1861 44 feet, thence North 00°52'12" East 405 93 feet, along the arc of a 400 00 foot radius curve to the left 316 45 feet (chord bears North 21°47'38" West 308 26 feet), thence North 44°27'28" West 473 22 feet, thence North 45°02'02" West 137 61 feet, thence North 44°56'18" West 131 01 feet, thence North 42°46'21" West 92 34 feet, along the arc of a 360 00 foot radius curve to the nght 313 28 feet (chord bears North 17°50'34" West 303 49 feet), thence North 07°05'14" East 428 46 feet, thence North 05°05'24" East 201 10 feet, thence North 04°53'03" East 678 65 feet, thence North 06°19'16" East 569 05 feet, along die arc of a 2550 00 foot radius curve to the left 130 05 feet (chord bears North 04°51'36" East 130 04 feet) to the point of beginning

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APPENDIX B

Cedar Valley Landfill Daily Hauling Log

Cedar Valley Landfill, LC
P O Box 1503
Orem, UT 84059
(801) 437-9502

Date ____________________

Load No	Load Time	Weight	Cubic Yards	Ticket No	Customer Name

APPENDIX C

Landfill Inspection End of Day Check-Out Procedure

Day of Week   Mon   Tues   Wed   Thurs   Fri   Sat   Date ___________ Time _____

Weather Conditions ____

____

Item	Acceptable	Unacceptable
MSW Disposal Cell – Required Daily Cover (Note if ADC is used)	________	________
Dead Animal Pit – Required Daily Cover	________	________
Class IV Disposal Cell – Cover Soil Provided as Needed	________	________
Green Waste Storage Pile – Non-Green Waste Removed	________	________
Metals Recycling Area – No Solid Waste Present	________	________
Litter Control – Blown litter picked up - as needed	________	________
Litter Control Fence – Maintained and cleaned	________	________
Active Disposal Area – Adequate cover material	________	________
Explosive Gas Detectors – Functioning	________	________
Entrance Gate Locked/Perimeter Secured – Prevent Unauthorized Entry	________	________

Comments

Describe details of any Unacceptable conditions and describe needed corrective action. Provide any related comments or problem which could affect the site's integrity (Use additional sheets if needed)

____

____

____

____

____

____

____

____

____

____

____

Signature of Person Completing Form ______________________________________

APPENDIX D

Cedar Valley Landfill
Random Record Inspection Form

Date Received ____________
Time Received ____________

Driver s Name ____________________

Vehicle Identification ________________

____

Source of Waste Generator

____
____
____
____

Observations Made During Inspection

____
____
____
____

Non-Conforming Items
Included in Load (if any)

____
____
____
____

If Rejected, Reason for Rejection

____
____
____
____

Notes

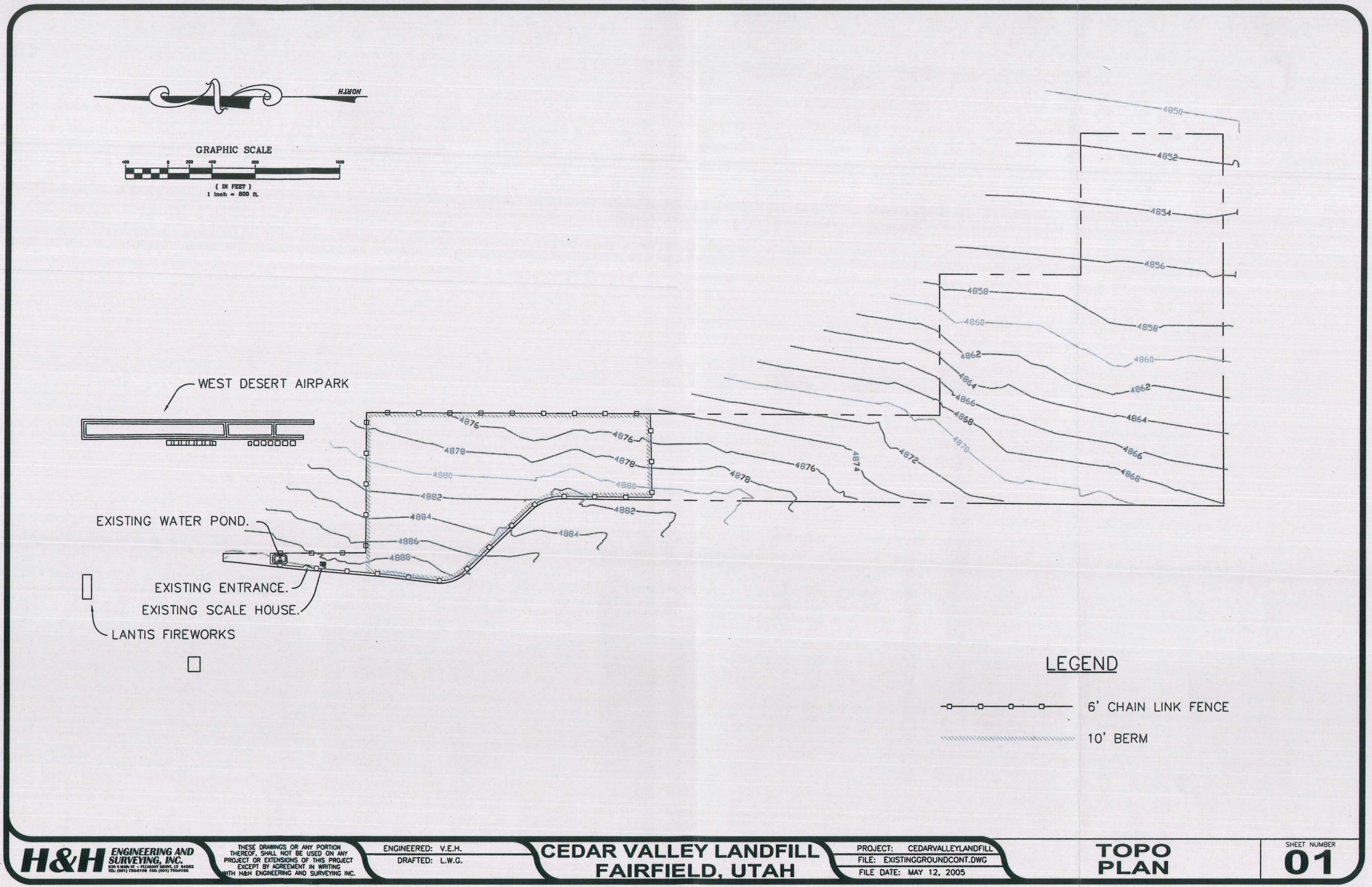
____
____
____
____
____

APPENDIX E

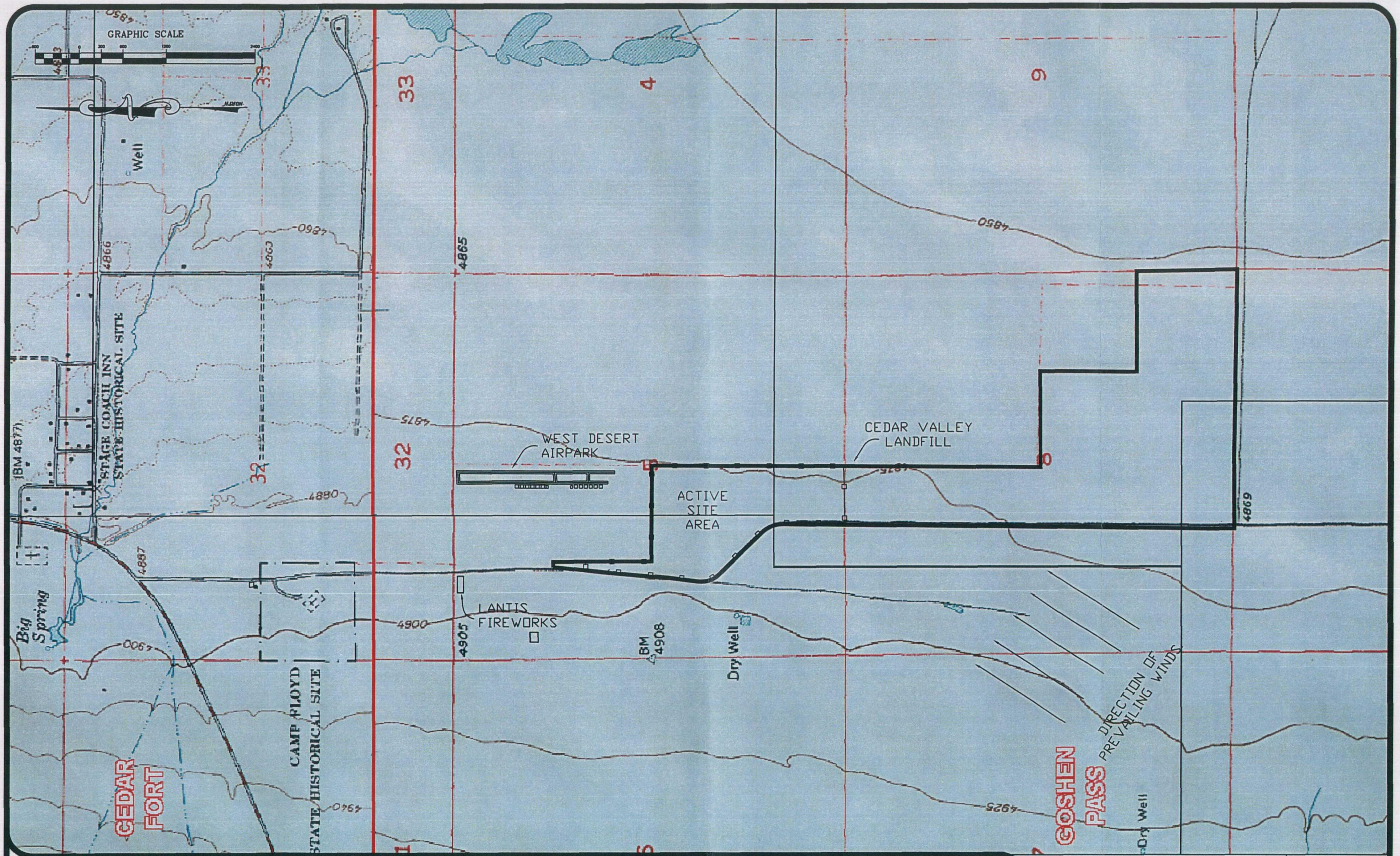
Annual Training and /or Procedures Completed

Person	Traınıng Course	Date Completed

APPENDIX F



NORTH
GRAPHIC SCALE
(IN FEET)
1 inch = 800 ft.
WEST DESERT AIRPARK
EXISTING WATER POND.
EXISTING ENTRANCE.
EXISTING SCALE HOUSE.
LANTIS FIREWORKS
4850
4852
4854
4856
4858
4860
4862
4864
4866
4868
4870
4872
4874
4876
4878
4880
4882
4884
4886
4888
LEGEND
6' CHAIN LINK FENCE
10' BERM
H&H ENGINEERING AND SURVEYING, INC.
THESE DRAWINGS OR ANY PORTION THEREOF, SHALL NOT BE USED ON ANY PROJECT OR EXTENSIONS OF THIS PROJECT EXCEPT BY AGREEMENT IN WRITING WITH H&H ENGINEERING AND SURVEYING INC.
ENGINEERED: V.E.H.
DRAFTED: L.W.G.
CEDAR VALLEY LANDFILL
FAIRFIELD, UTAH
PROJECT: CEDARVALLEYLANDFILL
FILE: EXISTINGGROUNDCONT.DWG
FILE DATE: MAY 12, 2005
TOPO PLAN
SHEET NUMBER
01



H&H ENGINEERING AND SURVEYING, INC.

THESE DRAWINGS OR ANY PORTION THEREOF, SHALL NOT BE USED ON ANY PROJECT OR EXTENSIONS OF THIS PROJECT EXCEPT BY AGREEMENT IN WRITING WITH H&H ENGINEERING AND SURVEYING INC.

ENGINEERED: V.E.H.
DRAFTED: L.W.G.

CEDAR VALLEY LANDFILL
FAIRFIELD, UTAH

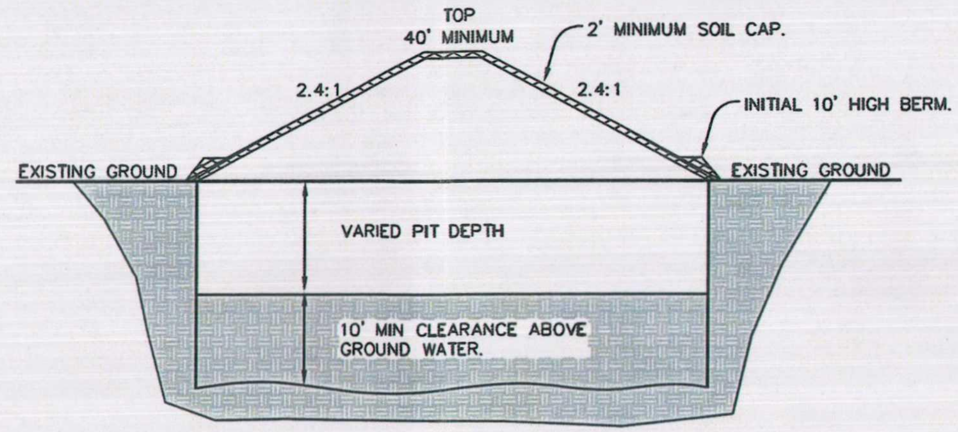
PROJECT: CEDARVALLEYLANDFILL
FILE: QUADS.DWG
FILE DATE: MAY 12, 2005

OVERALL PLAN

SHEET NUMBER
02

GRAPHIC SCALE

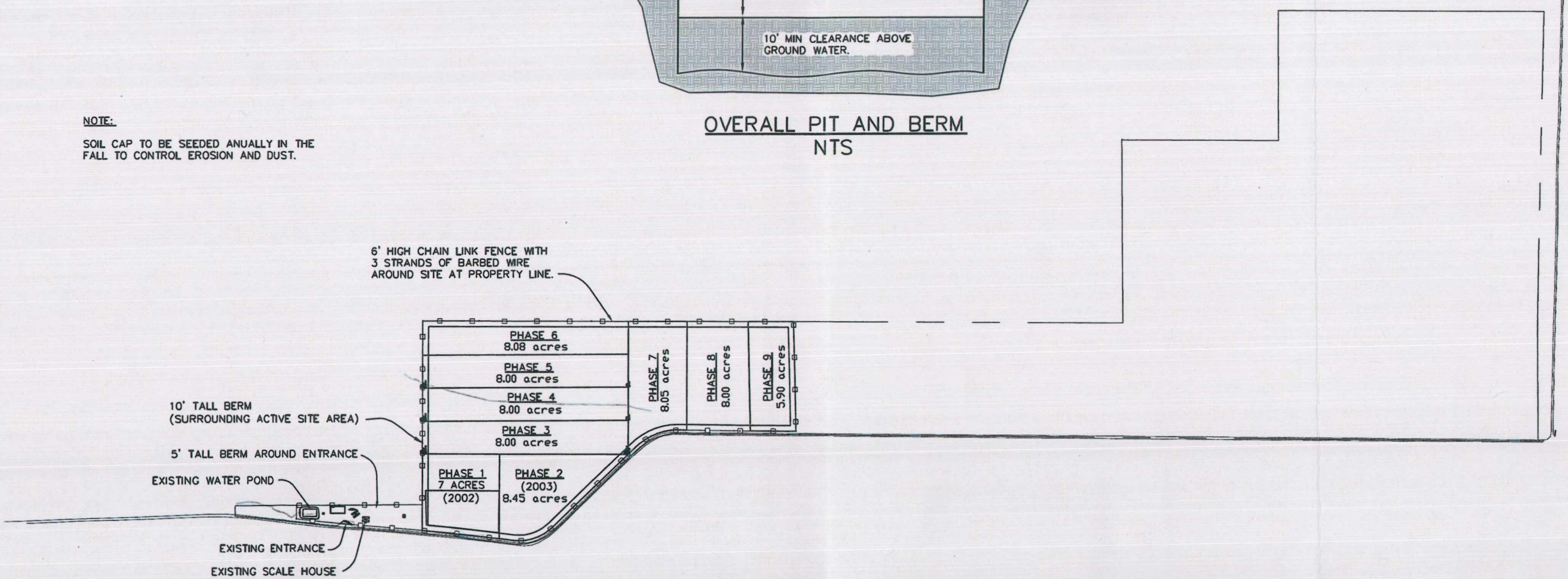
(IN FEET)
1 inch = 800 ft.



OVERALL PIT AND BERM
NTS

NOTE:

SOIL CAP TO BE SEEDED ANUALLY IN THE FALL TO CONTROL EROSION AND DUST.



LEGEND

6' CHAIN LINK FENCE

10' BERM

H&H ENGINEERING AND SURVEYING, INC.

THESE DRAWINGS OR ANY PORTION THEREOF, SHALL NOT BE USED ON ANY PROJECT OR EXTENSIONS OF THIS PROJECT EXCEPT BY AGREEMENT IN WRITING WITH H&H ENGINEERING AND SURVEYING INC.

ENGINEERED: V.E.H.
DRAFTED: V.E.H.

CEDAR VALLEY LANDFILL
FAIRFIELD, UTAH

PROJECT: CEDARVALLEYLANDFILL
FILE: SITEPLAN.DWG
FILE DATE: JUNE 15, 2010

PHASE PLAN

SHEET NUMBER
03

APPENDIX G

CEDAR VALLEY LANDFILL

Area	Total (AC)	Impervious (AC)	Pervious (AC)
Landfill	69 5	0	69 50
Runoff Coefficient		0 9	0 2
Weighted Area	13 90	0 00	13 90

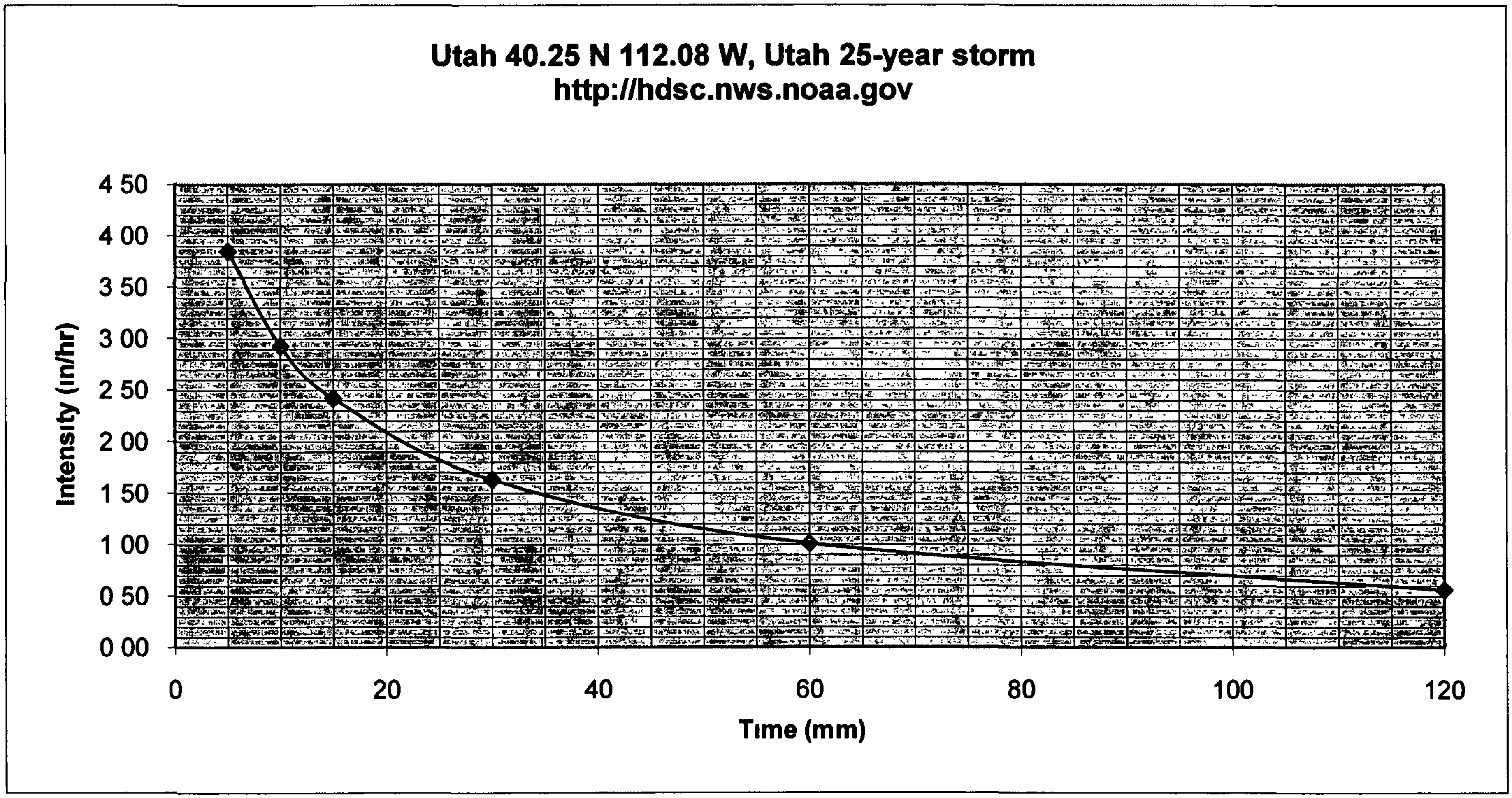
Storm Depth 1 01 in - (25-year 1-hour)

Storm Volume 50962 (CF)

No Allowable Discharge 0 cfs

Duration (min)	Intensity (in/hr)	Runoff (cfs)	Total Runoff (CF)	Allow Discharge (CF)	Storage Req'd (CF)
5	3 85	53 52	16054 50	0 00	16054 50
10	2 93	40 73	24436 20	0 00	24436 20
15	2 42	33 64	30274 20	0 00	30274 20
30	1 63	22 66	40782 60	0 00	40782 60
60	1 01	14 04	50540 40	0 00	50540 40

Total Pond Vol Required - 50540 CF



Utah 40.25 N 112.08 W, Utah 25-year storm
http://hdsc.nws.noaa.gov
Intensity (ın/hr)
4 50
4 00
3 50
3 00
2 50
2 00
1 50
1 00
0 50
0 00
0
20
40
60
80
100
120
Tıme (mm)

APPENDIX H

American Land Resources, Inc. 1176 North Compton Rd, Farmington, UT 84025
amlandresources@cs com (801) 451-7695, (208) 841-5766

April 13, 2000

Mr Mel Radmall
Cedar Valley Landfill
P O. Box 952
American Fork, Utah 84003

Re: Proposed Cedar Valley Landfill Wetland Delineation

Dear Mr Radmall,

I am writing this letter to document our field visit to document the existence of any special aquatic sites including jurisdiction wetlands within the boundaries of the above referenced project

There are no special aquatic sites including jurisdictional wetlands found within 2000 feet or within the property boundaries The entire site was a typical Great Basin high desert scrub-shrub vegetative community characterized by sagebrush (*Artemisia tridentata*), rabbitbrush (*Chrysothamnus nauseosus*), greasewood (*Sarcobatus vermiculatus*), and various grasses including tall wheatgrass (*Elymus elongatum*) and cheatgrass (*Bromus tectorum*).

If you have any questions, please call me at (208) 841-5766

Sincerely,

Brian Young
Sr. Wetland Scientist

c: File

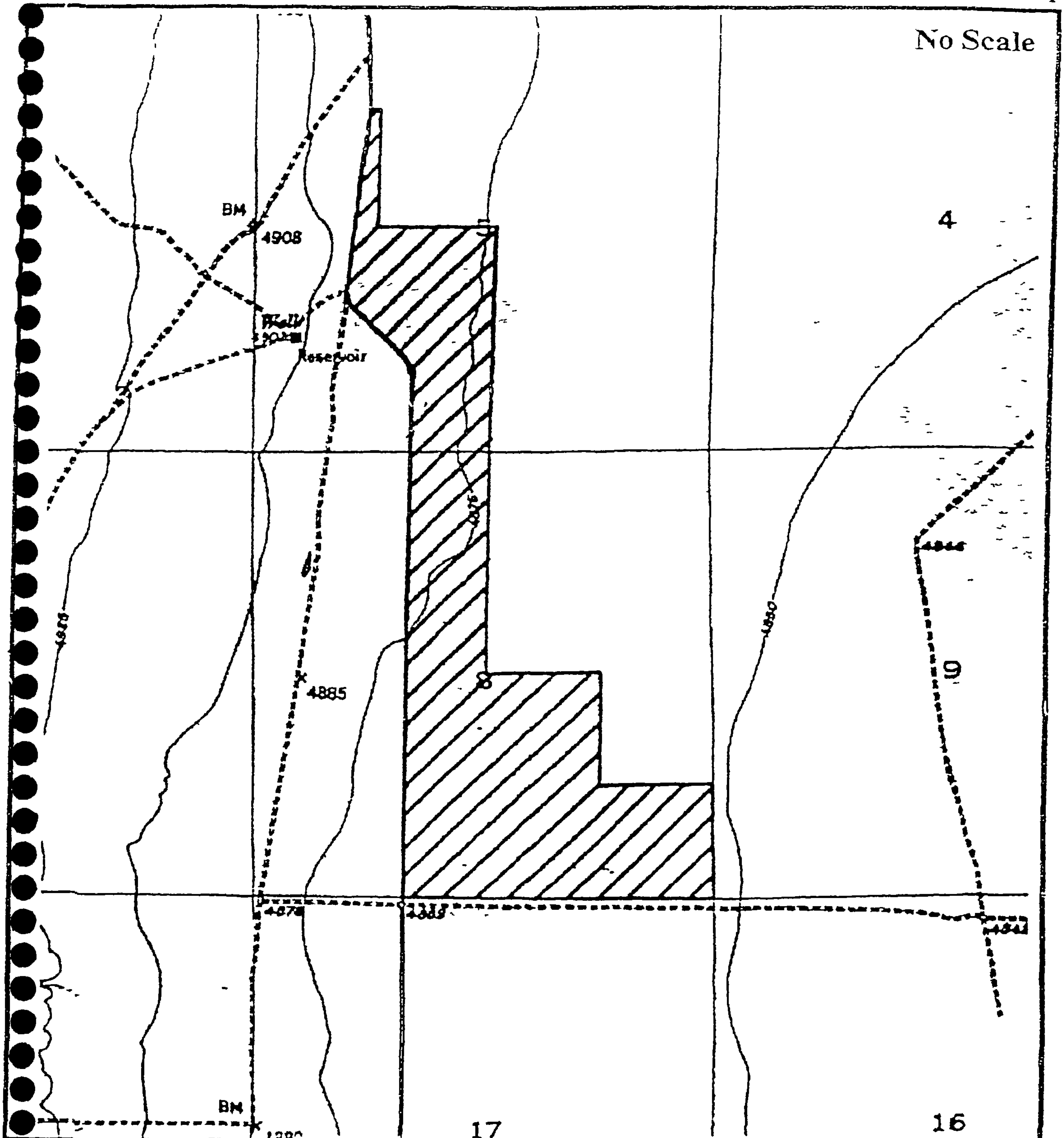


Figure 1.0: Cedar Valley Landfill

Cedar Valley Site Map

APPENDIX I

UTAH STATE ENGINEER
Technical Publication No. 16

GROUND-WATER CONDITIONS IN CEDAR VALLEY, UTAH COUNTY, UTAH

by R D. Feltis

Geologist, U S Geological Survey

Prepared by the U. S. Geological Survey

in cooperation with

The Utah State Engineer

1967

CONTENTS

ILLUSTRATIONS

TABLES

GROUND-WATER CONDITIONS IN CEDAR VALLEY, UTAH COUNTY, UTAH

by R. D Feltis

Geologist, U S Geological Survey

ABSTRACT

Cedar Valley is in north-central Utah about 20 miles west of Provo in Utah County The valley is mostly a topographically closed basin, developed in a structural trough caused principally by faulting, and is bordered by mountains largely composed of Paleozoic sedimentary rock The valley is filled with semiconsolidated to unconsolidated alluvial, colluvial, lacustrine, and eolian deposits of Tertiary and Quaternary age

Ground water occurs under both water-table and artesian conditions, but most of the wells are developed in the artesian aquifer The source of most recharge to the ground-water reservoir is in the Oquirrh Mountains in the northwest corner of the valley After seeping into the ground, water moves directly from the bedrock in the valley fill, thence east and southeast across the valley The estimated subsurface outflow along the east edge of the valley ranges from about 10,000 to 20,000 acre-feet per year

Water levels and spring discharges generally fluctuate in response to variations of precipitation, but they have declined markedly in response to pumping at nearby irrigation wells During 1965, about 1,900 acre-feet of water was pumped from eight irrigation wells in the valley

The coefficient of transmissibility of the artesian aquifer in the north-central part of the valley, as determined by pumping and recovery tests at wells, ranges from about 5,000 to 26,000 gallons per day per foot The specific capacities of irrigation wells in the center of the basin range from about 1 to 7 gallons per minute per foot of drawdown, but two wells at the west edge of the basin had specific capacities of 30 and 37 gallons per minute per foot of drawdown

Most of the ground water in the north half and southwest corner of the valley is of good chemical quality, containing less than 500 parts per million of dissolved solids In the southeast part of the valley, the water is of poor quality, containing more than 1,000 parts per million of dissolved solids

INTRODUCTION

Purpose and Scope

This study of the ground-water conditions in Cedar Valley, Utah, was made by the U S Geological Survey in cooperation with the Utah State Engineer during the period July 1965-July 1966 The purposes of the study were to estimate the recharge to and the yield of the ground-water reservoir and to determine the direction of ground-water movement through Cedar Valley

Water levels have been measured in observation wells in Cedar Valley from time to time since 1943 During the present investigation, water-level measurements were made in 38 observation wells, and 5 test wells were drilled to provide additional observation wells and also to provide information that would be helpful in understanding the subsurface geology of the valley Geophysical logs were run in several wells and test wells to aid in interpreting the subsurface geology and to show the occurrence of ground-water aquifers Tables 2-7 contain the basic data collected for the investigation and include records of selected wells and springs, chemical analyses of water, water-level measurements, drillers' logs of wells, and logs of test wells The locations of wells are shown in figure 4 and of springs in figure 7

Location of the area

Cedar Valley is in the northwest corner of Utah County, Utah, about 20 miles west of Provo, and lies between 39°58′ and 40°29′ north latitude and between 111°55′ and 112°13′ west longitude (figure 1) The drainage basin for the valley includes about 300 square miles, but the valley proper includes only about 140 square miles The valley has a maximum north-south length of about 25 miles and a maximum east-west width of about 8 miles The valley is a topographically closed basin except at the extreme north end where the surface drainage is into northern Utah Valley The valley is almost completely surrounded by mountains or low hills, and altitudes range from about 4,840 feet on the valley floor to 10,626 feet in the Oquirrh Mountains along the northwest edge of the valley Mountains on the east side and south end of the valley reach altitudes of 7,647 and 7,828 feet

Acknowledgments

Many thanks are owed to the residents and landowners of Cedar Valley who furnished or permitted the collection of hydrologic data and water samples from wells and springs and who gave permission to construct test holes for the collection of geologic and hydrologic data

Well-numbering system used in Utah

The system of numbering wells in Utah is based on the cadastral land-survey system of the Federal Government The well number, in addition to designating the well, locates its position to the nearest 10-acre tract in the land net By this system the State is divided into four quadrants by the Salt Lake base and meridian, and these quadrants are designated by the capital letters A, B, C, and D A is the northeast quadrant, B is the northwest, C is the southwest, and D is the southeast Numbers designating the township and range follow the quadrant letter, and all three are enclosed in parentheses The number after the parentheses designates the section, and the lowercase letters give the location of the well within the section The first letter indicates the quarter section, which is generally a tract of 160 acres, the second letter indicates the 40-acre tract, and the third letter indicates the 10-acre tract The number following the letters indicates the serial number of the well within the 10-acre tract Thus, well (C-6-2)13caa-1 in Utah County is in the NE¼NE¼SW¼ sec 13, T 6 S , R 2 W , and is the first well constructed or visited in that tract Figure 2 shows the method of numbering wells as described above In this report springs and sampling sites are also located by using this system, but the serial number within a 10-acre-tract is omitted

GEOLOGY

Consolidated rocks of Paleozoic age

The mountains surrounding Cedar Valley contain mostly rocks of Paleozoic age that include limestone, dolomite, quartzite, conglomerate, sandstone, and shale (figure 3) Each rock type is generally present in each mountain range, but limestone and dolomite predomi-

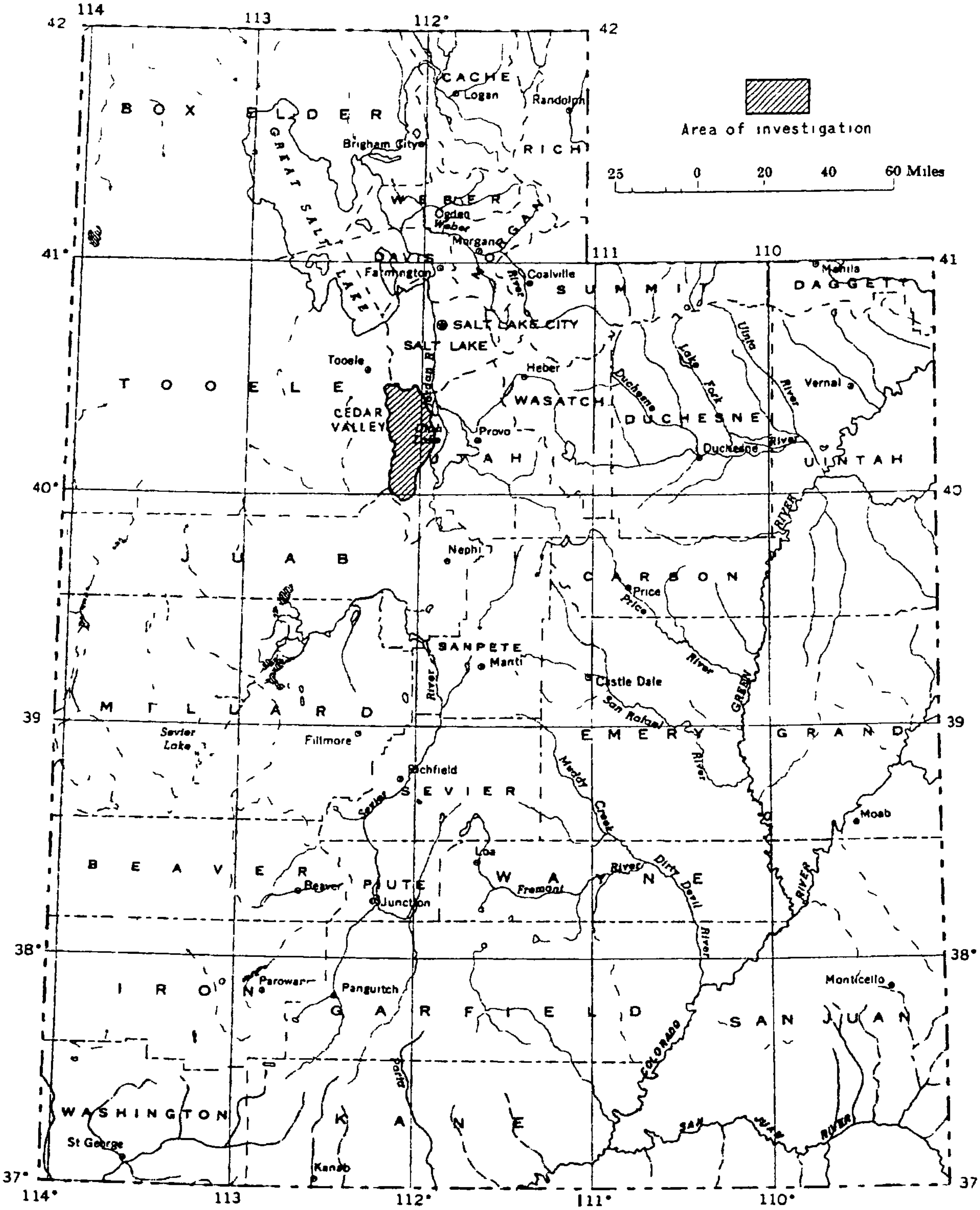


Figure 1 — Index map of Utah showing location of the Cedar Valley drainage basin

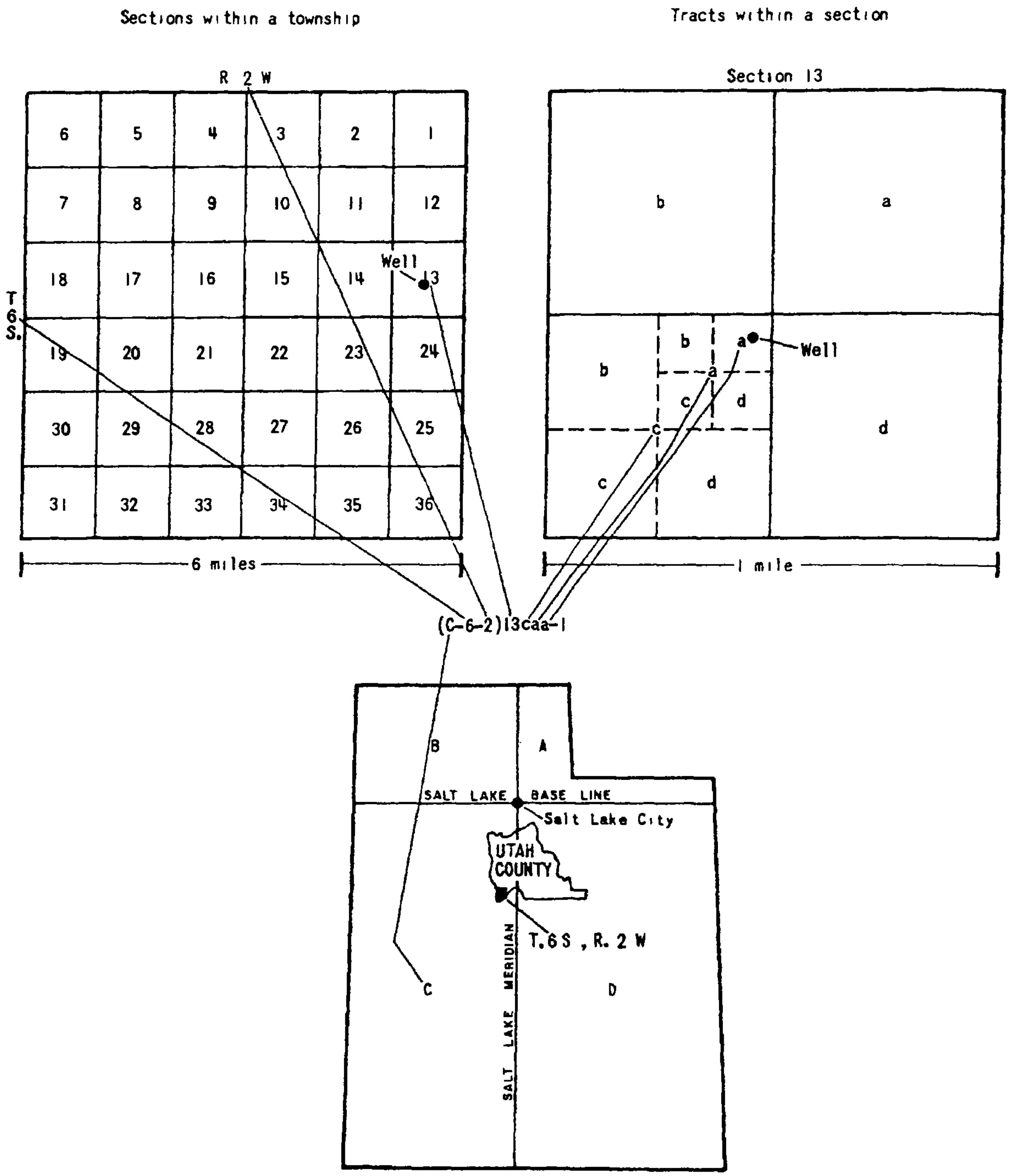


Figure 2 — Well-numbering system used in Utah

nate The age of the formations ranges fiom Devonıan to Peimian ın the Lake Moiuitams, from Cambrıan to Permıan ın the East Tıntıc Mountams, and from Mıssıssıppıan to Pernuan ın the Oquırrh and Traverse Mountaıns

Sedımentary and igneous rocks of Tertiary age

Sedımentary rocks —Scattered exposuies of lımestone and fiesh and argıllızed tuff ın the low hılls southwest of the Lake Mountaıns ıs part of an unnamed sequence belıeved to be of early Tertıary—probably late or mıddle oi eaily late Eocene—age (Morrıs and Loverıng, 1961, p 126) The lımestone ıs fıne to medıum graıned The argıllızed tuff, where ıt has been mıned, consısts of halloysıte and montmorıllonıte

The Salt Lake Formatıon of Plıocene age probably occurs along the mountam fronts and ın the subsurface of Cedar Valley, although ıt has not been mapped wıthm the draınage basm of Cedar Valley by those who have descrıbed the geology of the surroundmg mountaıns The formatıon has been descrıbed by Morrıs and Lovenng (1961, p 126-127) m Rush and Tmtıc Valleys to the west and southwest of Cedar Valley as "* * * marly lımestone, bentonıtıc tuff, sandy sılt, and gravel * * * " In the Jordan Narrows, noitheast of Cedar Valley, ıt ıs descrıbed by Hunt and others (1953, p 13), as " * * * alteınatıng dark-gray sılt and whıte or lıght-gray, fırm, ledge-formıng beds that probably aıe cemented, rewoıked tuffs The ındıvıdual beds range fıom 2 to 20 feet ın thıckness, ıncluded wıth them are a few, very thın, clay partıngs * * * These lıght-colored beds are overlaın ımconformably by a serıes of buff beds wıth a basal conglomerate * * * The basal conglomerate ıs about 15 feet thıck * * * Above thıs ıs 50 feet of moderately consolıdated buff sand and sılt, whıch apparently ıs reworked crystal tuff partly cemented by hme carbonate "

The upper part of the Salt Lake Formatıon ıs not easıly dıstmguıshed from yoımger alluvıal deposıts Some of the partly ındurated alluvıum around the edges of the valley and ın canyons of the mountaıns, that ıs mapped as unconsolıdated Quateruary deposıts m fıgure 3, may be Salt Lake Formatıon.

Igneous rocks —Most of the ıgneous rocks around Cedar Valley crop out m the Traverse Mountaıns, northeast of the vadley, and the East Tıntıc Mountaıns, m the southwest comer of the valley. Gılluly (1932, p 41) descrıbed the extrusıve ıgneous rocks ın the Traverse Moımtaıns as " * * * chıefly latıte and quartz latıte, wıth some mınor flows of basalt, rhyolıte obsıdıan, and nephehte basalt Among the extrusıve rocks, flows, although numerous, are quantıtatıvely subordınate to breccıas " The mtrusıve ıgneous rocks of the Traverse Moımtaıns are several small rhyohte plugs.

Morrıs and Loverıng (1961, p 124) descrıbed the ıgneous rocks of the East Tmtıc Moımtams as " * * * deeply eroded remnants of a large composıte volcano * * *." These ıgneous rocks ınclude ıntrusıve bodıes and thıck lava flows as well as the bedded tuffs, breccıas, agglomerates, and volcanıc gravels that can be consıdered to be, m part at least, sedımentary deposıts " The extrusıve rocks are latıte tuffs, flows, agglomerates, volcanıc gravels, quartz latıte, and basalt flows The mtrusıve rocks consıst of quartz monzonıte, monzonıte, monzomte porphyry, lamprophyre, andesıte, and dıabase

Unconsolıdated rocks of Quaternary age

The Quaternary deposıts of the basm fıll of Cedar Valley consıst mostly of alluvıal fans, lacustrme clay, sılt, sand, and gravel, and eolıan sand and sılt

The alluvıal fans, composed largely of sılt, sand, and gravel, extend from wıthm the canyons of the moımtaıns toward the center of the basın, where they Interfmger wıth lake and eolian deposits The fans range in age from early Pleistocene to Recent and in some areas may be lithologically similar to and indistinguishable from the upper part of the Salt Lake Formation of late Pliocene age The individual fans coalesce along the mountain front to form a continuous undulating surface around the edge of the valley The fans are generally very coarse grained and permeable near the mountains but become finer grained and less permeable toward the center of the valley A large alluvial fan in the north end of Cedar Valley extends from the mouth of West Canyon southward to the latitude of Cedar Fort It has overlapped the bedrock in the northeast corner of the valley, diverting the West Canyon drainage into Utah Valley

Lakes have probably occupied Cedar Valley during the several periods of glaciation of the Pleistocene Epoch The resultant lacustrine deposits are mostly impermeable, well-sorted, tabular beds of lake-bottom silt and clay, with some permeable lenticular beds of shoreline sand and gravel deposits Few large deposits of sand and gravel are present, because no large perennial streams carried coarse debris into the lakes and because the sheltered nature of the valley prevented strong lake currents which could have deposited material on the lakeshore Lake Bonneville was the last of the Pleistocene lakes that occupied the valley, and its shoreline can be seen etched in the alluvium around the basin

Active sand dunes as much as 15 feet thick are present about 2 miles south of Fairfield Goode (in Morris and Lovering, 1961, p 137) reports that the dunes probably were formed during or immediately after the recession of Lake Bonneville and are now being reattacked by the wind Blowouts in low stabilized dunes and in underlying lake beds are common across the floor of the valley and result in scattered, shifting masses of silt and sand

Other Quaternary deposits in the valley include colluvium, talus, and landslide debris which occur along the edges of the valley and in the canyons of the mountains. Glacial moraines are at the heads of West Canyon and the Left Fork of West Canyon in the Oquirrh Mountains.

Structure

Cedar Valley is a basin similar in structure to the many basins of the Basin and Range physiographic province in Utah and Nevada It is principally a graben produced by a system of faults that has uplifted and tilted the surrounding mountain blocks relative to the valley floor A gravity map of Cedar Valley (Cook and Berg, 1961, pl 13) shows the north-central part of the basin (T 6 S, R 2 W) to be deepest The fault system that produced the basins of western Utah is still active, therefore, Cedar Valley may still be in the process of development.

The rocks in the mountains surrounding the basin generally have been folded into broad, north to northwest trending folds (figure 3) These broad folds and their subsidiary faults and folds were probably made during Cretaceous and early Tertiary time, prior to development of the Cedar Valley graben The structural elements of the bedrock are of great importance to the hydrology of the valley because of their partial control of movement of ground water into and from Cedar Valley

WATER RESOURCES

Volume of precipitation

The range in the normal annual precipitation in Cedar Valley and surrounding mountains is generally from 12 to 40 inches. The isohyetal lines of figure 4 show that the greatest precipitation is on the Oquirrh Mountains, from which most of the surface and ground water in Cedar Valley is derived.

Not all precipitation in the Cedar Valley drainage basin is available to recharge the ground-water reservoir. It is assumed that only areas above the 12-inch isohyetal line on the west side of the basin receive precipitation that is effective in recharging the reservoir. Precipitation directly on the valley floor is used by vegetation or evaporated back to the atmosphere, and water from precipitation on the Lake Mountains moves eastward away from Cedar Valley (see p. 12).

The normal annual precipitation that falls above the 12-inch isohyetal line in the Cedar Valley drainage basin is about 150,000 acre-feet (table 1). Of this amount about 80,000 acre-feet falls above the 16-inch isohyetal line in the Oquirrh Mountains.

Surface water

The only perennial stream in Cedar Valley is in West Canyon in the Oquirrh Mountains, and all the water is diverted in sec. 7, T. 5 S., R. 2 W. for irrigation near Cedar Fort. The discharge from West Canyon from July 1965 through June 1966, as determined at a gaging station in sec. 7, T. 5 S., R. 2 W., was 2,100 acre-feet of water. Although the stream channel crosses the north end of Cedar Valley and drains into northern Utah Valley, surface water leaves the valley only in flash floods or as runoff from local snowmelt.

Ground water

Recharge.—The principal recharge area of the ground-water reservoir in Cedar Valley is in the Oquirrh Mountains along the northwest edge of the valley, where snowmelt percolates directly into fractures and solution channels of the rock. The alignment of springs (C-4-3) 20dba, (C-4-3)26cbd, (C-4-3)26dda, and (C-4-3)27bab, and springs (C-5-3)36cba, (C-6-2)6cad, and (C-6-3)1aad, along the strike of the bedrock, shows that some strata transmit water more readily than others. (See figures 3 and 7.) Some precipitation also enters the alluvial and glacial deposits in the mountain valleys. Most of the water in the basin fill throughout Cedar Valley entered the ground in the Oquirrh Mountains (figure 4).

Table 1. — Annual precipitation over the recharge area and estimated water available for recharge to the ground-water reservoir in Cedar Valley

Interval of annual precipitation (inches)	Area (acres)	Average annual precipitation (feet)	Quantity of water from precipitation (acre-feet, rounded)	Estimated percentage of precipitation as recharge	Estimated water available for recharge to ground-water reservoir (acre-feet, rounded)
12-16	60,500	1.17	70,800	5	3,500
16-20	16,400	1.50	24,600	15	3,700
20-25	7,600	1.88	14,300	20	2,900
25-30	6,000	2.29	13,700	27	3,700
30-40	6,500	2.92	19,000	35	6,600
More than 40	2,700	3.33	9,000	40	3,600
	Totals (rounded)		151,000		24,000

Other areas of recharge are the East Tintic Mountains, Topliff Hill, Thorpe Hills, and alluvial fans along the west side and north end of the valley above the 12-inch isohyetal line. At the north end of the valley, discharge from West Canyon is a source of recharge beginning near the mouth of the canyon, extending south along the West Canyon ditch, and ending in the irrigated land east of Cedar Fort.

The estimated water available for recharge to the ground-water reservoir from precipitation is about 24,000 acre-feet (table 1). The percentages used in the calculations are based on the method used by Eakin and Maxey (1951, p. 79-81) in which an increased percentage of water from precipitation becomes available for recharge as the total precipitation increases with an increase in altitude of a mountain mass (isohyetal intervals of figure 4). Of the 24,000 acre-feet of water available for recharge, about 20,500 acre-feet originates above the 16-inch isohyetal line in the Oquirrh Mountains.

The amount of recharge to the ground-water reservoir from West Canyon is probably less than 5 percent of the total recharge. The valley fill in the area crossed by the stream, the West Canyon ditch, and the irrigated fields consists of permeable alluvial-fan deposits, and it is estimated that 50 percent of the water is recharged to the ground-water reservoir. The recharge from streamflow in West Canyon for 1965-66 (See p. 11) amounts to about 1,000 acre-feet.

Occurrence.—Ground water in the unconsolidated deposits in Cedar Valley occurs under both water-table (unconfined) and artesian (confined) conditions. Water-table conditions predominate in the southern part of the valley, where stock wells have been hand dug to depths of more than 200 feet. In the central part of the basin, south and east of Fairfield, water in the shallow beds in unconfined, and these beds extend from the land surface to depths of about 100 feet. Water-table conditions occur around the edges of the basin fill as indicated by the water levels in wells (C-5-2)31dcd-1, (C-6-1)18dca-1, and (C-6-1)31dab-1.

Artesian aquifers are present in the valley fill opposite the drainages of Pole and Manning Canyons, and possibly in the alluvial fan of West Canyon. Permeable and impermeable beds in the lower parts of the alluvial fans in Pole and Manning Canyons form the aquifers and confining beds of the artesian system on the west side of the valley in secs. 17, 29, 32, and 33, T. 6 S., R. 2 W. Toward the center of the valley, as in secs. 13, 14, 15, and 26, T. 6 S., R. 2 W., fine-grained lake-bottom deposits overlap the alluvial deposits and act as the confining beds for the artesian system. The artesian aquifers between Cedar Fort and Fairfield, extending eastward across the basin, have had the greatest development as sources of ground water in Cedar Valley. In the town of Fairfield, wells flow from the artesian aquifer at depths ranging from 100 to 824 feet. Although the artesian system may extend across the central part of the basin, artesian pressures are not sufficient to cause wells in the center or topographically low parts of the basin to flow. The low artesian pressure may be due to the discharge of water from the basin fill into the bedrock along the east edge of the valley. Artesian conditions may occur at depths exceeding 200 feet in the southern part of the valley, but no substantiating data are available.

Movement of ground water.—The ground water in Cedar Valley moves generally from the west to the east side of the valley. Figure 4 shows contour lines connecting points of equal altitude on the water surface in March 1966. Because ground water moves from points of higher altitude to points of lower altitude, the contours indicate the direction of movement and the areas of ground-water recharge and discharge.

Altitudes of the water surface are highest near Fairfield and Cedar Fort, where water from the Oquirrh Mountains enters the basin fill. Nearly all the ground water in the central and southern parts of the valley has infiltrated along the Pole Canyon syncline (figure 3), and moved through fractures and solution channels in the rock, down the syncline, and into the valley fill.

The lowest altitudes of the water surface are along the east edge and southeast corner of the valley. Along the base of the Lake Mountains from about sec. 24, T. 5 S., R. 2 W., southward to sec. 8, T. 7 S., R. 1 W., the beds of the west limb of the Lake Mountains syncline (figure 3) dip toward the east and water leaves Cedar Valley along the bedding planes and through fractures and solution channels in the rocks. The water may discharge in springs and seeps on the east side of the Lake Mountains, in the bottom of Utah Lake, or to the alluvium northeast of the Lake Mountains on the west side of northern Utah Valley.

Ground water also leaves Cedar Valley through bedrock in the low pass between the Lake and Traverse Mountains. This movement is indicated by the difference of water levels in test wells (C-5-1)20ddc-1 and (C-5-2)24aab-1, which are completed in bedrock at the north end of the Lake Mountains.

The ground-water trough extending southwest of sec. 25, T. 5 S., R. 2 W. (figure 4), is probably caused by ground water draining from the basin in the northeast corner of the valley and by pumping irrigation wells in secs. 13, 14, and 15, T. 6 S., R. 2 W.

Ground water may also leave the southeast corner of Cedar Valley through the bedrock of the eastern East Tintic Mountains in Tps. 8 and 9 S., R. 2 W. This water may move into the alluvium on the west side of Goshen Valley.

Water in bedrock in the western East Tintic Mountains in Tps. 8 and 9 S., R. 3 W., probably moves to the west and east, controlled by the structure of the North Tintic anticline (figure 3). Water from the west limb of the anticline probably moves into Rush Valley, whereas water from the east limb moves into the valley fill in the southern end of Cedar Valley.

Water-level fluctuations.—Water levels in observation wells in Cedar Valley rise and fall in response to recharge to and discharge from the ground-water reservoir.

The hydrograph of well (C-6-2)29cac-1 (figure 5) shows three general water-level conditions: a relatively steady trend of high water levels from 1943 through 1952, a generally declining trend from 1953 to 1964, and rising water levels during 1965 and the spring of 1966. These trends generally follow the curve of the cumulative departure from the 1943-65 average annual precipitation at Fairfield (figure 5). Lines trending upward on the cumulative-departure curve indicate periods of above-average precipitation, when recharge to the ground-water reservoir is comparatively great, and lines trending downward indicate periods of below-average precipitation, when recharge is comparatively small.

Precipitation was above average for most of the period 1944 through 1952, but water levels in well (C-6-2)29cac-1 did not rise continuously because the discharge of nearby Fairfield Spring, (C-6-2)29ccc, had a damping effect.

From 1952 to 1962, however, the nearly continuous below-average precipitation resulted in a nearly continuous decline in water levels. This decline was accentuated in 1963-64 by the pumping of irrigation wells in secs. 17 and 32, T. 6 S., R. 2 W.

Water levels rose in 1965 and early in 1966 because of a combination of above-average precipitation from 1963 to 1965 and cessation of pumping at the irrigation wells in secs. 17 and 32, T. 6 S., R. 2 W.

The hydrographs of wells (C-6-2)14cba-1 and (C-6-2)16baa-1 (figure 5) show the decline of water levels from 1954 to 1966 in an area 3 miles northeast of Fairfield where irrigation wells have been pumped annually during the entire period of the hydrograph. Although water levels rose in 1965, they declined in the pumping season of 1966 to record lows at each observation well.

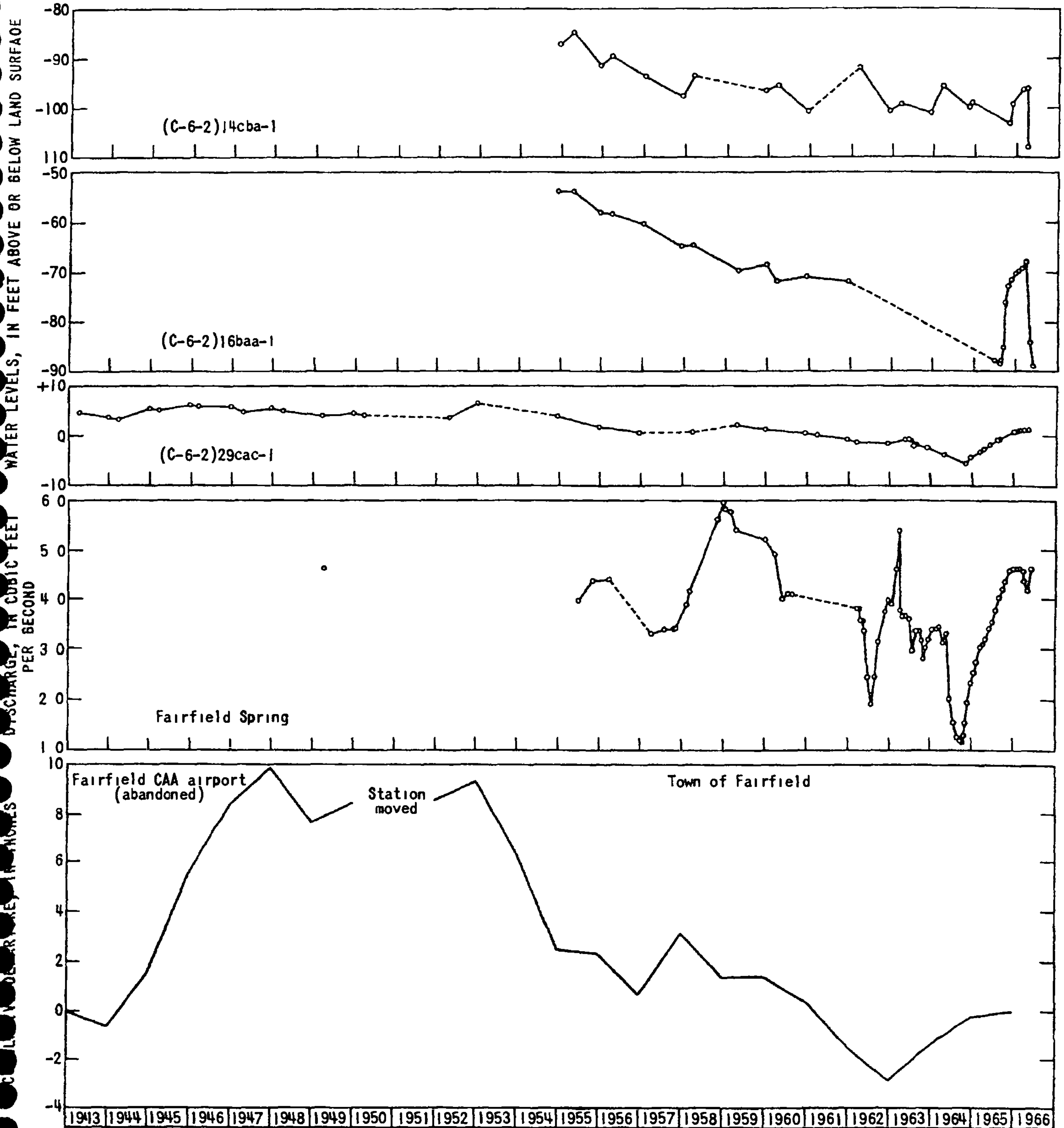


Figure 5. — Hydrographs of selected wells, discharge of Fairfield Spring, and cumulative departure from the 1943-65 average annual precipitation at Fairfield

The effects of pumping an irrigation well, (C-6-2)26cbb-1, on two wells of different depths are indicated by water-level measurements in table 5. The water level in well (C-6-2)27ccc-1 declined 11.1 feet from April 7 to June 9, 1966 while the irrigation well was being pumped. The wells are about 1 mile apart, and both are 505 feet deep. During the same period, however, water levels in well (C-6-2)27ccc-2, which is 100 feet deep, did not decline but rose 0.2 foot.

Figure 6 shows the change of water levels in north-central Cedar Valley from March-April 1964 to March-April 1966. The rise of water levels in the western part of the valley reflects above-average precipitation in the recharge area from 1963 to 1965 and a cessation of pumping at the irrigation wells in secs. 17 and 32, T. 6 S., R. 2 W., in 1965. The decline of water levels in the central part of the basin is the result of continued withdrawal of water for irrigation in that area. (See well (C-6-2)14aba-1 in table 5.)

Water-bearing characteristics of the aquifers.—Information on the water-bearing characteristics of the aquifers in Cedar Valley is based on data obtained from a pumping test of well (C-6-2)14cac-1 and recovery tests of wells (C-6-2)13caa-1 and (C-6-2)26cbb-1 and calculations of specific capacities of wells in various sections of T. 6 S., R. 2 W.

Data from the pumping test were used to determine the coefficients of transmissibility[1] and storage[2] of the aquifer. Well (C-6-2)14cac-1 was pumped at an average rate of 600 gpm (gallons per minute) from March 28 to April 1, 1966, at the beginning of the irrigation season and prior to the pumping of other irrigation wells. Water-level fluctuations were observed in wells (C-6-2)14aba-1, (C-6-2)14cba-1, and (C-6-2)14dba-1. The coefficients of transmissibility and storage were computed using the nonequilibrium formula (Theis, 1935). The respective determined values for T at wells (C-6-2)14aba-1, (C-6-2)14cba-1, and (C-6-2)14dba-1 were 26,000, 12,000, and 8,000 gpd per ft (gallons per day per foot) and for S were 0.002, 0.001, and 0.0005.

At the end of the 1965 pumping season, recovery tests were made at wells (C-6-2)26cbb-1 and (C-6-2)13caa-1 on September 15 and 17, respectively. The coefficients of transmissibility were computed using the Theis recovery formula (Theis, 1935). The coefficient of transmissibility was 9,000 gpd per ft at well (C-6-2)26cbb-1 and 5,000 gpd per ft at well (C-6-2)13caa-1.

The specific capacities of irrigation wells in Cedar Valley range from 0.7 to 37 gpm per foot of drawdown (table 2). This wide range is due mostly to the variation in the composition of the aquifers. Wells (C-6-2)17dcc-1 and (C-6-2)17dcc-2, which have respective specific capacities of 30 and 37 gpm per foot of drawdown, are developed in coarse-grained aquifers of the alluvial fan of Pole Canyon. Wells in the central part of the basin, with specific capacities of 0.7 to 6.8 gpm per foot of drawdown, are developed in fine-grained lacustrine, eolian, and alluvial deposits. Some of the lower specific capacities can be attributed to caving around the well, and several wells have been abandoned because of caving.

Data from the pumping test, recovery tests, and specific capacities of wells indicate an increase in the coefficient of transmissibility from the center of the basin toward the north end and west side of the basin.

Discharge.—Water is discharged from the ground-water reservoir in Cedar Valley by springs, by wells, by evapotranspiration, and by subsurface outflow from the basin.

[1]The coefficient of transmissibility, T, is the rate of flow of water, in gallons per day, at the prevailing water temperature, through a vertical strip of the aquifer 1-foot wide extending the full saturated height of the aquifer under a hydraulic gradient of 100 percent.

[2]The coefficient of storage, S, of an aquifer is the volume of water released or taken into storage per unit surface area of the aquifer per unit change in the component of head normal to that surface.

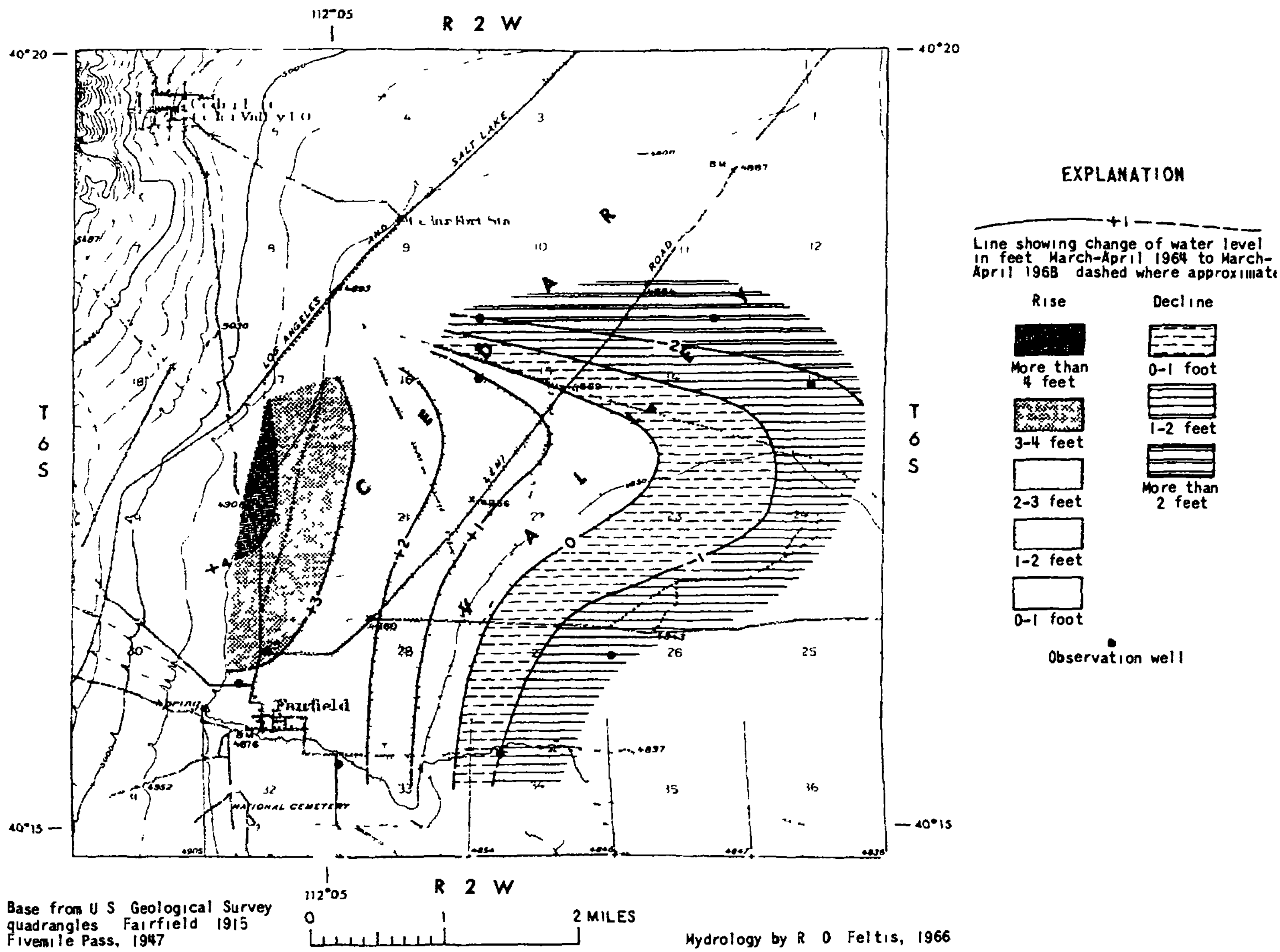


Figure 6 — Changes of water levels in the artesian aquifer, March-April 1964 to March-April 1966 in part of Cedar Valley

Fairfield Spring, (C-6-2)29ccc, at the west edge of Fairfield, is the largest spring in Cedar Valley It discharges water that is derived from precipitation on the Oquirrh Mountains The permeable coarse-grained aquifers at the head of the alluvial fans of Manning and Pole Canyons readily transmit the water, but increasingly finer grained deposits toward the toe of the fan and in the lake beds in the center of the basin retard the flow, forcing some of the water to the surface This discharges at the spring, which is at the break in slope of the alluvial fan with the valley floor

Fairfield Spring generally discharges between 3 and 5 cfs (cubic feet per second), and the maximum discharge on record is 5 96 cfs (figure 5) A comparison of the spring hydrograph with the curve showing the cumulative departure from average annual precipitation at Fairfield (figure 5) shows the time lag between precipitation on the Oquirrh Mountains and discharge from the spring For example, the above-average precipitation of 1957 resulted in a record high discharge of Fairfield Spring in late 1958 The sharp decrease in yield of the spring during the irrigation seasons of 1962-64 was due to pumping of irrigation wells in sec 17, T 6 S, R 2 W, which tap the same or interconnected aquifers

The water from Fairfield Spring is used mostly for irrigation near Fairfield in the summer and for irrigation of native pasture, from Fairfield southeast to the Sinks, during the winter The upper part of the valley fill between Fairfeld and the Sinks consists of fine grained lake beds with low permeability Much of the water applied for irrigation, therefore, is discharged by evapotranspiration Assuming an average discharge of 4 cfs from the spring, it is estimated that 70 percent of the water, or about 2 8 cfs (2,000 acre-feet per year), is consumed by evapotranspiration

The total annual discharge of three springs west of Cedar Fort, based upon measurements made in October 1965, was about 800 acre-feet About 50 percent of this water is returned to the ground-water reservoir, the remainder is consumed by evapotranspiration

Numerous springs discharge in the mountains, but their yields are generally less than 15 gpm They are used for stock watering

During 1965, about 10 acre-feet of water was withdrawn from small-diameter wells for domestic and stock use, and about 1,900 acre-feet of water was pumped at 8 large-diameter irrigation wells in secs 13 (1 well), 14 (3 wells), 15 (3 wells), and 26 (1 well), T 6 S, R 2 W The yield of the wells ranged from 130 to 1,115 gpm All the pumps are driven by electric motor, and the annual well discharge was computed from the amount of water discharged per 1,000 kilowatt hours of electricity used in 1965

During 1964, about 3,800 acre-feet of water was pumped at 11 irrigation wells These included the eight large-diameter irrigation wells mentioned above and three additional wells in secs 17 (2 wells) and 32 (1 well), T 6 S, R 2 W The two wells in sec 17 reportedly yielded 2,000 and 3,600 gpm upon their completion in 1961-62 The three wells in secs 17 and 32 produced 2,700 acre-feet of water in 1964 compared to 1,100 acre-feet from the 8 wells in secs 13, 14, 15, and 26 The wells in secs 17 and 32 tap more permeable, coarse-grained aquifers in alluvial fans along the west edge of the basin as compared to the fine-grained aquifers tapped by wells in secs 13, 14, 15, and 26 in the center of the basin

Evapotranspiration in secs 13, 14, 15, 26, and 32, T 6 S, R 2 W, probably consumes 90 percent of the water pumped for irrigation because the low permeability of the surface deposits prevents rapid downward percolation Thus in 1965, when the pumpage in these sections was about 1,900 acre-feet, approximately 1,700 acre-feet was consumed by evapotranspiration The rate of evapotranspiration is probably lower in sec 17, T 6 S, R 2 W., because the surface deposits consist of alluvial-fan sediments which permit a greater rate of infiltration

Two methods were used to estimate the subsurface outflow of water along the east edge of the basin. The first method was based on transmissibility data obtained from aquifer tests and the hydraulic gradient of March 1966, determined from the water-table contour map (figure 4). The second method was a water budget for the ground-water reservoir.

In the first method, the parts of the ground-water reservoir to which the calculations apply are shown by the line of reference in figure 4. The transmissibility and hydraulic gradient along each section of the line were assumed to be uniform. The subsurface outflow beneath each segment of the line of reference was calculated using the formula

$$Q = 0.00112\ T\ I\ W$$

where Q is the outflow, in acre-feet per year, 0.00112 is a factor that converts gallons per day to acre-feet per year, T is the coefficient of transmissibility, in gallons per day per foot, I is the hydraulic gradient, in feet per mile, and W is the length of the segment, in miles.

No aquifer test data are available for the southern part of Cedar Valley. The valley fill is relatively fine grained, however, and the coefficient of transmissibility along segment 1 is estimated to be about 7,000 gpd per ft. The hydraulic gradient is about 8 feet per mile.

Along segment 2, the hydraulic gradient is about 31 feet per mile. The coefficient of transmissibility based on data obtained during the recovery test at well (C-6-2)26cbb-1 is 9,000 gpd per ft.

Segment 3 is across an area where the depression of ground-water contours has been accentuated by pumping irrigation wells in secs. 13, 14, and 15, T. 6 S., R. 2 W. The transmissibility along this segment is based on the change in hydraulic gradient across the segment for an annual rate of discharge from wells of 1,500 acre-feet per year. The formula used to calculate the transmissibility of the segment is

$$T = \frac{Q}{0.00112\ (I-I')W}$$

where T is the transmissibility, in gallons per day per foot, Q is the discharge of wells, 1,500 acre-feet per year, 0.00112 is a factor converting gallons per day to acre-feet per year, I is the average hydraulic gradient as determined from figure 4, 50 feet per mile, I' is the estimated average hydraulic gradient before pumping began, 33 feet per mile, and W is the length of the segment, 4.3 miles or

$$T = \frac{1{,}500}{0.00112\ (50-33)4.3} = 18{,}320, \text{ rounded to } 20{,}000 \text{ gpd per ft}$$

Aquifer-test data are not available for the north end of Cedar Valley, however, the valley fill in this area consists of coarse-grained sediments of the West Canyon alluvial fan, which are assumed to be as permeable as the sediments of the Pole Canyon alluvial fan, which underlie the line of segment 3. The coefficient of transmissibility along segment 4, therefore, is assumed to be 20,000 gpd per ft. The hydraulic gradient is 73 feet per mile.

Underflow for the four segments is presented in the following table.

Segment (location shown in figure 4)	Coefficient of transmissibility (gallons per day per foot)	Hydraulic gradient (feet per mile)	Length of segment (miles)	Subsurface outflow past the segment (acre-feet per year)
1	7,000	8	6.1	400
2	9,000	31	8.4	2,600
3	20,000	33	4.3	3,200
4	20,000	73	2.2	3,600
		Total (rounded)		10,000

Thus the total subsurface outflow along the east edge of the basin is estimated to be 10,000 acre-feet per year.

The second method used to estimate subsurface outflow was a water budget of the ground-water reservoir in Cedar Valley. This budget is only an approximation of true conditions, however, because few data are available for rates of precipitation, evapotranspiration, and recharge in irrigated and nonirrigated areas.

It is assumed that all the water leaving the basin along the eastern margin (figure 4) is subsurface outflow from the basin and is a constant quantity. On this basis, the equation of the hydrologic budget is as follows: subsurface outflow (S) from the basin equals recharge from precipitation (Rp) minus evapotranspiration of surface water from West Canyon (Es), and of ground water from Fairfield Spring (Ef) and the three springs west of Cedar Fort (Ec), and of water pumped from wells (Ep), or

$$S = Rp - (Es + Ef + Ec + Ep)$$

Substituting values determined in previous sections of this report,

$$S = 24\,000 - (1{,}000 + 2{,}000 + 400 + 1{,}700)$$

$$S = 19{,}000 \text{ acre-feet per year (rounded)}$$

Thus the subsurface outflow along the east edge of the basin is estimated by the budget method to be 19,000 acre-feet per year. Although this is almost twice as much as the outflow calculated by the first method, the two figures are of the same order of magnitude and they are a good indication of the magnitude of the actual quantity of outflow.

Test-well drilling.—Five test wells were drilled at four sites in Cedar Valley to construct water-level observation wells and to obtain additional data about the aquifers in parts of the valley. Descriptive data, water-level measurements, and logs for the test wells are given in tables 2, 5, and 7. Electric and gamma-ray logs for four of the wells are in the files of the U.S. Geological Survey in Salt Lake City.

Test wells (C-5-1)20ddc-1 and (C-5-2)24aab-1 were drilled in the pass between the Lake Mountains and the Traverse Mountains to determine the thickness of the alluvium, the depth to water, and whether or not water moves from Cedar Valley to Utah Valley through the alluvium. The alluvium was found to be 70 feet thick in well (C-5-1)20ddc-1 and 60 feet thick in well (C-5-2)24aab-1 (table 7). Water levels in the two test wells in May 1966 were 94 and 127 feet below the land surface, respectively. This indicates that the water does not leave Cedar Valley through the alluvium, but it does move through the bedrock.

Test well (C-6-2)1acc-1 was drilled to provide water-level data for the northeast corner of the valley and to define more closely the water-level contour lines of that area (figure 4). The test well was drilled entirely in unconsolidated valley-fill deposits, mostly sandy and clayey silt with occasional beds of fine to medium-grained sand or silty sand, ranging in thickness from 2 to 8 feet. The water level in the well was 175 feet below the land surface in March 1966.

Two test wells, about 15 feet apart, were drilled in sec. 27, T. 6 S., R. 2 W. Test well (C-6-2)27ccc-1 was drilled to a depth of 505 feet for observation of water levels in the deep artesian aquifer. It was drilled entirely in unconsolidated valley-fill deposits, mostly clayey and sandy silt with occasional beds of fine-grained sand or silty sand, ranging in thickness from 2 to 10 feet. Test well (C-6-2)27ccc-2 was drilled to a depth of 100 feet to provide water-level measurements in the shallow unconfined aquifer. A plug was installed in the annulus of the deep test well at a depth of 150 feet in an attempt to isolate the deep and shallow aquifers. Water levels in the shallow test well and the annulus of the deep test well were at the same level and almost 3 feet higher than the level within the deep test well itself during April 1966.

Chemical quality of water

The concentration of dissolved solids in the water in Cedar Valley ranges from 225 to 2,020 ppm (parts per million). Figure 7 shows the areal distribution of dissolved-solids concentrations and also illustrates the chemical composition of the water with lined diagrams. Differences in chemical composition are shown by the differences in the slope and length of lines comprising the diagrams.

The water from most of the wells and springs in the northern and south-western parts of the valley contains less than 500 ppm of dissolved solids, and the principal chemical constituents are calcium and bicarbonate. The springs in the principal recharge area (Oquirrh Mountain slopes, west and northwest of Cedar Fort) yield a calcium bicarbonate type of water chemically similar to that of ground water in the north-central part of the valley. The wells in the southeastern part of the valley yield water containing the highest concentration of dissolved solids, and the principal chemical constituents are sodium and sulfate.

Most of the water in the valley is very hard (more than 180 ppm), but generally the chemical constituents do not exceed the recommended maximum concentrations of the U.S. Public Health Service (1962, p. 7) as given below.

Constituent	Recommended maximum concentration (parts per million)
Dissolved solids	500
Chloride (Cl)	250
Sulfate (SO_4)	250
Nitrate (NO_3)	45

Thirty water samples from wells and springs in Cedar Valley were evaluated for suitability for irrigation by using a method devised by the U.S. Salinity Laboratory Staff (1954, p. 80). The water was classified in regard to salinity hazard and sodium hazard by plotting the specific conductance versus the sodium-adsorption ratio (figure 8). The interpretation of these quality-class ratings plotted in figure 8 are summarized by the U.S. Salinity Laboratory Staff (1954, p. 79-81) as follows:

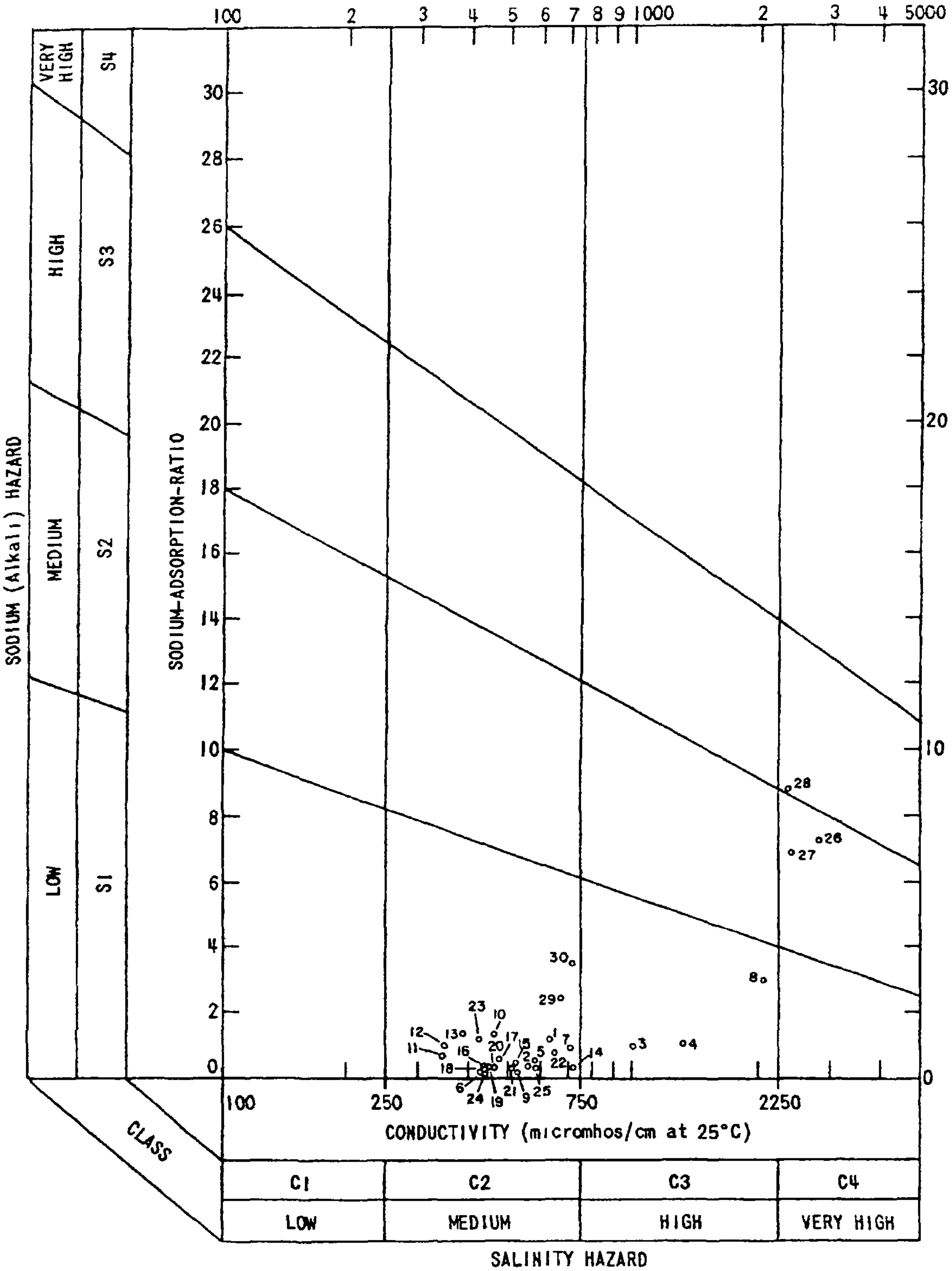
"Medium-salinity water (C2) can be used if a moderate amount of leaching occurs. Plants with moderate salt tolerance can be grown in most cases without special practices for salinity control.

"High-salinity water (C3) cannot be used on soils with restricted drainage. Even with adequate drainage, special management for salinity control may be required and plants with good salt tolerance should be selected.

"Very high salinity water (C4) is not suitable for irrigation under ordinary conditions, but may be used occasionally under very special circumstances. The soils must be permeable, drainage must be adequate, irrigation water must be applied in excess to provide considerable leaching, and very salt-tolerant crops should be selected.

"Low-sodium water (S1) can be used for irrigation on almost all soils with little danger of the development of harmful levels of exchangeable sodium. However, sodium-sensitive crops such as stone-fruit trees and avocados may accumulate injurious concentrations of sodium.

"Medium-sodium water (S2) will present an appreciable sodium hazard in fine-textured soils having high cation-exchange-capacity, especially under low-leaching conditions, unless gypsum is present in the soil. This water may be used on coarse-textured or organic soils with good permeability.



EXPLANATION

1 (0-4-2)26cbc
2 (C-4-3)20dba
3 (C-4-3)25dda
4 (C-5-1)17bdc
5 (C-5-2)26bbb-1
6 (C-5-3)36cba
7 (C-6-1)18dca-1
8 (C-6-1)31dab-1
9 (C-6-2)6cad
10 (C-6-2)13caa-1
11. (C-6-2)14cac-1
12 (C-6-2)14cba-1
13. (C-6-2)14dba-1
14 (C-6-2)15bbb-1
15 (C-6-2)15bcb-1
16 (C-6-2)15cbb-1
17 (C-6-2)26cbb-1
18 (C-6-2)29bdd-1
19 (C-6-2)29ccc-1
20 (C-6-2)29ccc
21 (C-6-2)32bbd-1
22 (C-6-2)32cbc-1
23 (C-6-2)33bcb-1
24 (C-6-3)1aad
25 (C-6-3)15bad
26 (C-7-2)25bdb-1
27 (C-7-2)35bcc-1
28 (C-8-2)15aad-1
29 (C-8-2)18bcb-1
30 (C-8-2)31adb-1

Figure 8 — Classification of water for irrigation in Cedar Valley (method of U.S. Salinity Lab. Staff, 1954, p 80) Numbers refer to analyses in table 4.

"Hıgh-sodıum wateı (S3) may pıoduce harmful levels of exchangeable sodıum m most soıls and wıll requııe specıal soıl management—good draınage, hıgh leachıng, ana organıc matter addıtıons Gypsıferous soıls may not develop harmful levels of exchangeable sodıum from such waters Chemıcal amendments may be requıred foı replacement of exchangeable sodıum, except that amendments may not be feasıble wıth wateıs of very hıgh salınty "

Wateı fıom most of the wells and spıings that weıe sampled ın Cedar Valley has a low-sodıum hazard and a medıum-salınıty hazaıd (fıguıe 8) The analyses of wateı from the three wells that weıe sampled ın the southern part of the valley, however, suggests that wateı ın a large area southeast of Fanfıeld probably has a veıy hıgh sahnıty hazard and medıum to hıgh-sodıum hazard

SUMMARY AND CONCLUSIONS

Most of the water ın the ground-water reservoır of Cedar Valley ıs denved from precıpıtatıon on the Oquırrh Mountaıns northwest of the valley After seepıng mto the ground, the water moves dırectly from the bedıock of the mountaıns ınto the aquıfers of the valley fıll, thence east and southeast across the valley

Most of the wells ın the valley tap artesıan aquıfers ın the noıth-central paıt of the basın and yıeld wateı of good qualıty foı domestıc use and ırrıgatıon Stock wells ın the southeast part of the basın yıeld water of pooı qualıty from aquıfers under wateı-table condıtıons In the southwest corneı of the valley, wheıe some ıecharge occurs at the base of the East Tıntıc Mountaıns, stock wells yıeld wateı of good qualıty

Durıng 1965, eıght ııngatıon wells ın sees 13, 14, 15, and 26, T. 6 S , R 2 W , dıscharged a total of 1,900 acre-feet of water The yıelds of the wells ranged from 130 to 1,115 gpm, and specıfıc capacıtıes ranged from 0 7 to 6 8 gpm per ft of drawdown Durıng 1964, the eıght wells dıscharged only 1,100 acıe-feet of wateı, but three wells m sees 17 and 32 dıscharged an addıtıonal 2,700 acre-feet of water Two of the wells ın sec 17, reportedly yıelded 2,000 and 3,600 gpm, wıth specıfıc capacıtıes of about 30 and 37 gpm peı ft of drawdown upon then completıon ın 1961-62 The dıffeıence ın well performance ın the two areas ıs an ındıcatıon of moıe permeable aquıfers on the west edge of the basın

Water levels ın the valley generally fluctuate m response to varıatıons of precıpıtatıon In sees 14 and 15, T 6 S , R 2 W , however, wheıe mne ırngatıon wells were dıılled durıng 1951-64, water levels have dechned as much as 21 feet durıng the penod 1954-66 Water levels ın wells near Fanfıeld and the dıscharge of Faırfıeld Sprıng declıned duıing the penod 1962-64 when large ırngatıon wells ın sec 17, T 6 S , R 2 W , were pumped ın the same or ınterconnected aquıfers

The estımated subsuıface outflow of wateı fıom Cedar Valley along the east edge of the basın ıanges from about 10 000 to 20,000 acıe-feet peı yeaı Some of thıs wateı could be ıecoveıed ın the valley by an ıncreased wıthdıawal of wateı from wells, prıncıpally along the west edge of the basm ın T 6 S , R 2 W , where most of the recharge enters the valley fıll from the bedrock ın the Oquırrh Mountaıns The aquıfers m thıs area are the most permeable known ın the basm, they aıe under artesıan condıtıons, and the quahty of the water ıs good The altıtude of the area would permıt gravıtatıonal flow of the water to nearly any area now beıng ırngated A long-term effect of pumpıng the wells, however, would be a decrease ın the artesıan pıessuıe of the aquıfers and a resultant decıease m or cessatıon of dıschaıge from flowmg wells and sprıngs m the Faırfıeld area

Anotheı aıea of potentıal gıound-wateı development ıs the alluvıal fan of West Canyon No well or water-level data are avaılable for the large area north of Utah Hıghway 73, but peımeable mateıuals should be pıesent ın the fan whıch was buılt by the only perennıal stıeam ın the valley

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Table 2 — Records of selected wells in Cedar Valley

Jell nur er See ext for desrr ptiun nt iunbe ing s ren L atiors a e lown in igure 4
Type ot veli Dr d L led Du dig
Al itude of land surface datum Surveved altit des (rom U S Coologica' Survey are given in feet ard ter ns altit des interpolated ir m top graphic naps are given n feet
Measuring poin Description Ahp access hole n pump Apc access pipe n caning Bph button f pump oase Edo end of dl charge pipo Hc4 note in cas ng Upb hol in pump oase fpt nole n plate ove c si g Tca top of tasin Tet op ol ap on asing fec top f elbow n easing c t p of flange on tsi g Tpc top of pipe to piing Trc top ot reducer un ceiny Tce top of tee on casing
Wa e level Measured distances to water levels are given in feet and tenths reported distances are given in feet
Me hod ot lift Cy cylinder pump F fowl ik well N n pump and uell does not flow 1 t rb ne pump Ts mersible turbine pump
Yield (gpm gall na per minute) B bal'cd ne ural ilou P pumped c esrimated m measu ed r reported
Spe ific capac ty gpm/ft gallons per minute per toot r draudnwn
Use of wa er n 1965 D domestic L irrigatl n S nune Nt none drilled as test well S st ck
Temperature r reported
Remarks and ot e da a ava lable C chemical ana ysis (able 4) SCA e a r al and gamma ray logs in files f U S Geol gical Survey Salt Lake City H hydro graph (fig 5) L driller s log (table 6) perf casing perforated TW tes well TWL test we l lug (table 7) W water evel measurements (table 5)

Well number	Owner or user	Year drilled	Type of well	Depth of well (feet)	Diameter of well (inches)	Depth of casing (feet)	Altitude of land surface datum (feet)	Measuring point: Description	Measuring point: Above(+) or below(-) land surface datum (feet)	Water level: Above(+) or below(-) surface (feet)	Water level: Date of measurement	Method of lift	Yield: Rate (gpm)	Yield: Date of measurement	Drawdown: Amount	Drawdown: Duration of test (days)	Specific capacity (gpm/ft)	Use of water in 1965	Temperature (F)	Remarks and other data available
(C 5 1)																				
9dbb 1		1963	Dr	105	10 6	105	9C0			Dry	S 4 65	b						N		
20ddc 1	U S Geologic a' Survey	1966	Dc	3C0	1	27C	4 795	Tea	+(1 5	93	5 3 66	N						Nt		T 3 Perl 60 0 90 100 210 220 ft EGR TWL W
(C 3 2)																				
24aab 1	do	1966	Dr	155	1	155	4 989 7	Tea	0	12/ 3	5 3 66	N						Nt		TW 2 Part 55 65 1-5 155 EGR TWL W
26bbb 1	State ot Ucah	1916	Or	448	S	44S	5 082 9			361	6-22 60	Cy	18Pr	6-22 60				S	53	C
11dcd 1	G S Cook	1963	Or	325	9	321	5 8 -	Tea	+1 4	296 S	2 28 66	N						N		Bailer test April 1963 yield 12 gpm so drawdown after 1 hr Perf 300-320 fc L W
34dab 1		1943	Dr	280	6 4	280	4 962 2	Tea	+ 9	249 0	3-26 66	N						N		No perforations reported Water level 250 tt in April 1943 reported by well driller W
(C 4-)																				
8dca 1	Cooperative Secu-ity Corp	1948	Dr	264	t	264	- 387	Tra	0	230 0	3 '4 66	Cy	2Pm	8 31 65				S	81	Per(235-264 ft C - W
31dab 1	du	1947	Dc	223	6	223	4 575	Tea	+1 1	195 3	3 14 66	Cy	6Pm	7 21 65				S	61	Perf 190 223 ft C W
(C 6 2)																				
1ace 1	U S Geolngical Survey	1966	Dr	300	1	300	4 891 5	Tea	0	174 6	3 30 66	N						Nt	-	TW 1 Perf 200 210 230 240 280 290 (t ECR TWL W
5cad 1		193_	Dr	105	4		4 972 8	Tea	3 3	82 9	2 28 66	N						N		Local resident reported well drilled in early 1930 s as drought relief we l to depth ot about 200 fc Wal was never used W
13caa 1	Cuuperative Secur ty Corp	1962	Dr	525	0	333	4 856 6	Ape	+1 5	119 8	3 18 66	T	400Pm	5 3 66	72	(1)	5 3	1	61	well was gravel packed 15 339 ft perl 0 339 t sealed 0-15 ft with bentonite in 20 inch surface casing C L W
14aba 1	do	1954	De	1 238	20 12	1 254	4 965 7	Tea	0	121 7	3-28-66	N	90Pr	2 54			-	N		Parf 150-300 306 I 254 ft L W
14aca 1	do	1954	Dr	1 014	20 12	1 014	4 862 6	Tea	0	109	2-28 56	N						N		Perf 130 274 280 I 014 ft W
14cac 1	do	1951	Dr	1 230	14 IC	1 250	4 855 1	Edp	+14 4	87 1	3 28-66	T	33CPm	5 3 66				I	59	Perf below 300 ft C W
14csa 1	do	1954	Dr	1 007	16	1 007	4 856 7	Hea	1 0	99 2	3 28 66	T	330Pm	5 3 66	-			D I	59	Parf 98 1 007 fc C W W
14dna 1	do	1964	Or	830	20 12 10	600	4 858 4	Bpb	+1 9	97 3	3 28-66	T	130Pm	5 3 6o	174	(1)	7	I	64	Casing 20-inch from 0-556 ft 12 inch from 0-350 ft and 10 Inch from 350 to 600 fc Perf 120 356 ft in 20 inch casing 170-600 ft in 12- and 10 inch casing Gravel packed between 20 inch and 12- and 10 inch casing 0 600 tc C W
15alb 1	do	1961	Dr	2 366	16 10 S	2 085	4 864 9	Tea	0	120 4	3 27-66	N	47CPm	7 1 63	-	-		N	-	Wall deepened fron 460 to 890 ft in 1959 and from 890 to 2 366 (c in 1961 Perf 222 440 985 995 1 045 1 375 1 440-1 485 1 844 2 070 c L W
15hbb 1	do	1957	Dr	835	16	835	4 871 7	Ape	0	8 9	2-28-66	T	515Pm	5 3 66	134	33	3 8	I	53	Pert below 185 ft C W
13hcb 1	do	1959	Dr	955	16 10	955	4 864 6	Ape	+2 5	S8 9	3 24 66	T	390Pm	5 3 66	140	(1)	2 8	I	53	Parf 278-955 ft C W
15cbb I	do	1957	Dr	455	16	415	4 860 5	Apo	+1 5	71 4	3-28-66	T	500Pm	5 3 66	138	(1)	3 6	I	53	Perf 190-340 395 403 fc C W
16haa 1	N E White	1951	Or	505	10	505	4 876 5	Hpb	+1 3	67 9	4 1-66	I	335Pm	7 10 63				I		Perf below 80 fc H W
17dcc 1	dn	1961	Dr	600	16	562	4 913 6	Ahp	+ 5	20 7	3 31-66	T	2 000Pr	12 30 61	67	2 6	30	I		Parf 150-175 237 246 350-376 422 432 445-492 525-535 fc The south wall of two wells L W
													2 890Pm	7 1 64						
17dcc 2	do	1962	Dr	595	16	595	4 920 9	Ahp	+ 5	27 9	3 31-66	I	3 600Pr	2 24 62	97	1	3	I	-	Perf 170-174 238 248 325 350 365 371 410-440 465 481 488 493 530-544 550 574 582 587 ft The north well of two wells W
													2 765Pm	7 1 64						
25cbc 1	Cooperative Secur ty Corp	-	Dr				4 838 8	Tea	+1 7	68 9	3 30-66	Cy	-	-				S		W
2bcbb 1	do	1962	Or	505	18	505	4 844 1	Ape	+3 3	59 2	4- 7-66	I	1 115Pn	5 3 66	164	26	6 8	1	53	Perf 210 505 ff C L W
27cca 1	S D Nicholas	1953	Dr	80	6	90	4 842 8	Tec	+ 6	34 6	4- 7 66	N						N	-	Petf below 35 fc W
27ccc 1	U S Geological Survey	1966	Dr	505	1	505	4 843 2	Tcw	0	27 9	4- 7 66	N						Ne		TW 4 Perl 265-275 455 465 485 495 fc EGR TWL W
27c c 2	do	1966	Dr	100	1	100	4 843 2	Tea	0	5 1	4- 7 66	N	-				-	Nt		TW 5 Perf 90-100 ft Located 15 tt from wall (C 6 2)27ccc 1 W
28bac 1	S D Nicholas	1953	Dr	80	6	80	4 858	Tec	+ 5	20 0	3-11 66	N					-	W		Pert below 20 ft W
29bdd	E R Carann		D	150	3	150	4 875 1	Trc	+1 2	+13 1	4 7 66	F	1 SFm	7 30 65			-	S	51	C W
29cac 1	L M Meinzer	-	Dr	350	4	350	4 888 4	Tea	0	+ 9	4 6 66	F	<1Fe	4 6 6b				S	50	C N W
29cac 2	do	1953	Dr	220	4	220	4 888 7	Tca	+ 5		4- 6 66	N					-	N		L W
29ccc 1	C R Carann	-	Dr	189	3	389	4 886 7	Tic	+1 8	+2 3	3 11 66	P	7Fm	9 9 65	-			1 S	52	C W
12bbd 1	M K White	1964	Dr	613	16	601	4 880	-				F	42 8Fm	9 10 65			-	I		Perf at 14 intervals between 205 and 595 ft C L
												T	750Pr	3 14-64	145	1 3	2			

Table 2 — Records of selected wells in Cedar Valley — Continued

ell number	Owner r u er	Year drilled	Type of well	Depth of well (feet)	Diameter of well (inche)	Depth of casing (feet)	Altitude of land surface datum (feet)	Measuring point: Description	Measuring point: Above(+) or below( ) land surface datum (feet)	ater level: Abo e(+) or below( ) surface (feet)	ater level: Date of measurement	Method f lift	Yield: Rate (gpm)	Yield: Date of measurement	Drawdown: Amount	Drawdown: Duration of test (days)	Specific capacity (gpm/ft)	Use of water in 1965	Temperature (F)	Remarks and other data available
(C 6 2)																				
32..c 1	Utah state Parks and Recreation Camp		Dr	64	4	64	4 890					T	6Pr					I		C
13bcb 1	Ru.um Carsoo	-	Dr	525	2	525	4 862 4	Tac	+2 0	+10 6	4- 7 66	F	<1Fm	4- 7 66				D I		C W
34oac 1	S O Micholas	1953	Dr	275	6	80	4 843 5	Tca	+1 7	30 9	3-11 66	N	25Pr	8- 53				N		Well depth sounded at 55 fc below the tap of casing in May 1963 ferf below 30 ft W
(C 7 2)																				
5cbe 1	W McKinney		Du	54	72x72		4 902			45		N					-	S		Water level reported by Snyder (1963 p 522)
23bcc 1	R J McKinney	1948	Dr	220	4	220	4 835	Bpe	D	114 6	3-11 66	Cy	10Pr	7 22 48				S	58r	L W
25bdb 1	do		Du	200		200	4 846		-			Cy	-					S	54	Original dug well backfilled around 6 inch clle casing with 4 inch steel pump column C
29dbc 1	L A Fitzgerald		Du	198			4 860	Tfc	+ 3	169 0	3 11-66	Ts						S		Original dug well backfilled around b inch tile casing with 4 inch steel pump column W
35bec 1	R J McKinrey	1948	Dr	225	5	225	4 8	Tca	0	180 4	3 11 66	Cy	0Br	7 14 48				S	60r	C W
(C 3 2)																				
15aad 1	J d Allen		Du	275			4 895	Tpc	+ 6	240 8	3 11 66	Cy						S		Original dug well backfilled around 6 inch tile casing with 4 inch steel pump column C W
18b b 1	do		Du	290	7x72		4 930					Cy						S		C
31adb 1	do		Du	365			5 016	Tca	+ 8	343 0	3 11 66	Cy						S		Original dug well backfilled around 6 inch steel casing with 4 inch pump column C W

1/ Well had been pumped for about 1 month since the beginning of the irrigation season

Table 3 — Records of selected springs in Cedar Valley

Location: See figure
Geologic source: Oquirrh Formation is of Pennsylvanian and Permian age
Use of water: D, domestic; I, irrigation; S, stock
Dependability: G, good; F, fair
Yield (gpm, gallons per minute): e, estimated; m, measured
Remarks and other data available: C, chemical analysis (table 4); H, hydrograph (fig 5); K, specific conductance (table 4)

Location	Owner or user	Name	Geologic source: Formation or type of rock	Geologic source: Nature of openings	Use of water	Temperature (°F)	Dependability	Improvements	Yield (gpm) and date of measurement	Deposits	Remarks and other data available
(C-4-2)26cbc		Tickville Spring	Alluvium in contact with igneous rock of Tertiary age	Large seep area in stream channel	S		G	None	10e 4-7-66	None	C
(C-4-3)20dba			Oquirrh Formation	Joints and solution channels in limestone	S	45		do	15m 1-3-65	do	C
26cbd		Cottonwood Spring	do	do	S	51?	G	Water trough	15e 11-3-65	Tufa	K
26dda			do	do	S	49	G	do	15e 11-3-65	do	C
27bab			do	do	S	46	G	None	17m 11-3-65	do	K
(C-5-1)17bdc			Alluvium	Seep area in stream channel	S		F	Water trough	<1e 8-?-65	None	C
(C-5-3)4cdc			Oquirrh Formation	Joints and solution channels in limestone	S	44		None	10e 11-2-65	do	K
4dcd			Alluvium	Seep area in canyon fill	S	42	G	Pipeline and trough	5m 11-2-65	do	Water piped about half a mile to water trough K
36cba	Cedar Fort Irrigation Co		Oquirrh Formation	Joints and solution channels in limestone	I S	46	G	None	300e 7-22-65	Tufa	C
(C-6-2)6cad	do		Alluvium overlying the Oquirrh Formation		D I S	50	G	Headhouse and pipeline	>124m 7-22-65	None	C
29ccc	Fairfield Irrigation Co	Fairfield Spring	Alluvial fan	Large seep and spring area at toe of alluvial fan	D I S	52	G	Headhouse, pipeline and diversion system	2,070m 3-1-66	do	C H
(C-6-3)1aad	Cedar Fort Irrigation Co		Oquirrh Formation	Joints and solution channels in limestone	D I S	47	G	Tunnel and pipeline	>88m 7-22-65	Tufa	C
15bad			do	do	S	52	F	None	7m 6-21-65	None	C
(C-9-2)29b and 32c	J H Allen		Alluvium	Seep area	D S		G	Pipeline and tanks			Water piped about 4 miles from two spring sites to ranch house and several stock tanks K

Table 4 — Chemical analyses of water from wells and springs in Cedar Valley

Disso ved solids Residue on evapo-atloo st 180 C unless indlcated otherwlse

Sampling site	Date of collection	Temperature (F)	Silica (SiO_2)	Calcium (Ca)	Magnesium (Mg)	Na + K: Sodium (Na)	Na + K: Potassium (K)	Bicarbonate (HCO_3)	Carbonate (CO_3)	Sulfate (SO_4)	Chloride (Cl)	Nitrate (NO_3)	Dissolved solids	Hardness as $CaCO_3$	Noncarbonate hardness as $CaCO_3$	Sodium adsorption ratio (SAR)	Specific conductance (micromhos/cm at 25 C)	pH
			Parts per million															
(C 4 2)26cbc	4 7 66		48	77	10	41		220	0	33	76	0 8	431	234	54	1 2	634	7 7
(C 4 3)20d6a	11 3 65	46	7 0	95	13	10		330	0	25	11	3	323	290	19	3	558	7 6
26cbd	11- 3 65	51		-	-									-			773	-
26ddA	11- 3 65	49	12	130	28	47		447	0	38	80	1	558	438	71	1 0	1 000	7 7
27bab	13- 3-63	48			-												670	-
(C 5 1)17bdc	8 2> 65	-	49	148	30	57		148	12	56	295	2 3	853	494	353	1 3	1 360	8 3
(C 5 2)26bbb 1	6 30-65	53	19	50	14	?1		262	0	37	34	1 1	337	257	42	6	572	7 6
(C 5-))4ede	11 3-65	45															477	
4dcc	11 2-6>	42			-			-		-		-			-		518	-
36cba	7 22-65	46	6 5	62	16	2 9		240	0	15	8 0	3 5	227	220	23	1	424	7 6
(C 6-1)18dca 1	7 1-63	91	21	73	25	35		240	0	70	66	1 4	421	288	91	9	706	7 7
31dah 1 1/	7 1-65	61	46	32	116	179		324	0	291	335	7	2/ 1 230	680	414	3 0	2 060	7 8
(C 6 2)6cad	7 22-65	50	8 0	88	12	5 5		288	0	27	11	2 1	290	269	33	3	520	7 7
13eaa 1	7 1-65	61	55	35	18	37		208	0	38	21	4	300	160	0	1 3	461	8 0
14cae 1	6 8-65	59	53	31	14	20		170	0	14	16	0	229	134	0	7	344	8 0
4cba 1	6 8-65	59	48	27	13	26		174	0	14	14	2	225	120	0	1 0	346	7 6
14dba 1	6 9 65	64	46	29	13	36		198	0	22	14	0	253	126	0	1 4	393	8 1
15bob 1	6 8 65	53	40	80	32	14		263	0	36	78	7	451	332	116	3	709	7 7
15bcb 1	6 8-65	53	38	>5	26	16		248	0	37	26	0	313	244	41	4	512	8 1
15cbb 1	6 8-6>	53	40	46	20	8 6		194	6	23	17	2 1	273	200	43	3	434	8 4
26cob 1	7 1-6>	53	53	36	30	20		246	0	27	19	2	298	212	10	6	470	3 2
29bdd 1	7 30 65	53	11	58	17	5 9		228	0	17	15	2 7	235	215	28	2	430	7 6
29cac 1	1 3-66	50			-				-		17	-	-	-	-		421	-
29ccc-1	9 9-65	52	11	57	18	9 2		232	0	18	17	3 4	262	234	24	3	444	7 7
29ccc	6 3 65		10	39	20	8 7		236	0	29	18	2 3	253	232	38	3	457	8 1
32bbd 1	6 30 65	-	14	36	27	12		248	0	40	21	1 0	290	250	47	3	502	8 1
32ebc 1	10 4-63	-	19	67	30	31		325	0	49	29	3	360	292	26	8	647	7 9
33bcb 1	1 3-66	-	15	32	16	33		393	0	34	16	3	237	146	0	1 2	424	8 0
(C 6 3)1aad	7 22-65	47	6 8	65	16	4 0		248	0	17	8 7	3 2	235	227	24	1	436	a 2
15bad	6-21-65	32	6 9	67	29	12		303	0	38	20	2	321	289	41	3	586	7 7
(C 7 2)25bdb 1 3/	3 31 66	54	32	28	135	426	54	338	0	941	140	4	2/ 2 020	625	200	7 4	2 870	8 1
35bcc-1	3 29 66		23	42	114	383		487	0	842	94	4	2/ 1 740	575	376	7 0	2 430	7 8
(C 8 2)15aad 1	3 66	-	52	30	92	439		764	0	638	84	5	2/ 1 710	455	0	8 9	2 410	8 1
18bcb-1	3 66	-	30	31	24	75		226	0	72	56	1 5	391	176	0	2 5	668	7 a
31adb	3 66		38	26	19	101		2?8	0	64	79	5	448	146	0	3 6	717	7 7
(C 9 2)29b and 32e		-														-	381	

1/ Analysis includes 2 2 ppm fluoride
2/ Calculated from determined constituents
3/ Analysis includes 0 00 ppm iron (at time of analysis) 4 0 ppm fluoride and 1 3 ppm boron

Table 5 — Water levels in observation wells in Cedar Valley

Water levels in feet below land surface datum are designated by a minus (-) sign immediately before the first entry in each column in the table; those above land surface datum are designated similarly by a plus (+) sign. The sign applied to any water level applies to all succeeding water levels until a change is indicated.

An asterisk (*) immediately after a measurement indicates that the measurement is from data supplied by the Office of the Utah State Engineer; a dagger (t) after a measurement indicates that the measurement is from data supplied by private consultant; all other measurements were made by the U S Geological Survey.

(C 5)20ddc 1 Records available 1966

Mar	18	1966	1/ -49 7	Mar	30	1966	2/ 88	May	3	1966	3/ 91 3
Mar	21		1/ 60 0	Apr	1		1/ 42 4	June	9		91 3
Mar	26		1/ 80 8	Apr	7		3/ 5 9				

(C 5 2)24aab 1 Records available 1966

Mar	26	1966	1/ 67 0	Apr	1	1966	1/ 101 2	June	9	1966	1/ 131 0
Mar	30		1/ 96 7	May	3		1/ 127 3				

(C 5 2)31dcd 1 Records available 1965 66

Aug	1	1965	-299 9	Oct	29	1965	298 6	Feb	1	1966	297 1
Aug	31		299 7	Nov	30		297 9	Feb	28		246 7
Oct	4		299 0	Jan	3	1966	297 4				

(C 5 2)14dab 1 Records available 1966

May	26	1966	49 0

(C 6 1)18dca 1 Records available 1964 66

Apr	28	1964	227 1	July	21	1965	229 9	Oct	4	1965	229 8
Nov	9		228 8	Aug	3		229 7	Oct	29		230 0
Mar	9	1965	229 6	Aug	12		4/ 210 2	Mar	14	1966	230 0
Apr	12		232 8	Sept	3		229 9				

(C 6 1)11dab 1 Records available 1964 66

Apr	28	1964	194 2	Aug	12	1965	94 9	Nov	30	1965	193 3
Dec	16		194 7	Sept	1		195 0	Jan	3	1966	195 3
Mar	26	1965	194 6	Oct	4		195 1	Mar	14		195 3
Aug	1		194 9	Oct	29		195 2				

(C 6 2)1acc 1 Records available 1966

Mar	21	1966	1/ 116 0	Mar	10	1966	174 4	May	3	1966	174 8
Mar	22		1/ 154 ?	Apr	1		1 4 5	June	9		174 6
Mar	6		174 5	Apr	7		174 5				

(C 6 2)5cad 1 Records available 1965-66

Aug	17	1965	85 6	Oct	29	1965	- 81 3	Feb	1	1966	82 8
Aug	31		94 5	Nov	30		53 4	Feb	28		82 6
Oct	4		81.7								

(C 6 2)13eaa-1 Records available 1963-66

Mar	29	1961	117 1*	Apr	12	1965	119 5	Nov	30	1965	122 8
Apr	5		117 4*	Sept	9		4/ 119 5	Jan	3	1966	121 4
June	6		*/ 156 6	Sept	7		4/ 169 3	Feb	1		120 6
July	10		4/ 133 1	Sept	18		4/ 141 9	Mar	14		120 0
Mar	25	1964	118 1	Sept	19		6/ 136 6	Mar	27		119 8
Oct	10		122 3	Sept	20		4/ 134 1	Mar	28		118 8
Dec	16		120 6	Oct	4		127 4	May	3		5/ 192 1
Mar	9	1963	120 1	Oct	29		124 6				
Mar	26		4/ 124 6								

(C-6 2)14aba-1 Records available 1954 55, 1963 66

Dec	9	1954	111 0	Mar	25	1964	118 9	July	11	1965	119 1
Apr	12	1953	109 1	Oct	1		129 6	Aug	11		114 9
Mar	23	1963	119 9*	Nov	10		123 7	Sept	17		133 2
Mar	29		122 4*	Dec	1a		122 3	Sept	50		129 9
Apr	5		127 0*	Dec	31		122 0	Oct	31		125 2
Apr	30		129 5*	Jan	31	1965	121 6	Nov	30		123 7
May	7		129 9*	Feb	25		121 4	Dec	31		122 3
May	11		130 7*	Mar	1		121 2	Feb	1	1966	122 3
May	23		132 4*	Mar	11		128 8	Mar	1		121 9
June	6		111 1	Apr	30		129 6	Mar	28		121 7
June	15		112 1*	May	11		131 8	May	3		133 0
July	1		128 4*	June	30		136 7	June	9		116 3
July	20		132 6*								

(C-6 2)14aea 1 Records available 1954 55, 1963 66

Dec	9	1954	- 98 4	Mar	25	1964	109 3	Oct	4	1965	120 1
Apr	12	1955	95 7	Mar	9	1965	109 7	Oct	29		114 7
Mar	21	1963	110 6*	July	1		145 4	Nov	30		112 3
Mar	29		120 1*	July	10		150 5	Jan	3	1966	111 t
Apr	5		133 1*	Aug	12		155 4	Feb	1		110 2
Apr	30		130 0*	Aug	11		131 5	Mar	1		109 7
June	6		139 2	Sept	17		135 7				

(C 6 2)14cac-1 Records available 1951-55, 1964 66

May	17	1951	76 8	Dec	22	1955	- 82 7	Oct	29	1965	92 7
June	6		76 7	Mar	25	1964	86 6	Nov	10		89 7
Apr	22	1952	77 6	Oct	2		100 8*	Jan	1	1966	88 6
Dec	31		78 2	Oct	22		92 3*	Feb	1		87 8
Apr	22	1953	77 8	Nov	10		91 1	Mar	1		87 3
May	14		77 8	Dec	16		89 2	Mar	28		8 1
Dec	9	1934	79 2	Apr	12	1965	6/ 08 1				

(C 6-2)14eha 1 Records available 1954 60, 1962 66

Dec	9	1954	8 1	Mar	13	1959	4/ 110 2	Apr	30	1963	4/ 150 3*
Apr	12	1955	84 9	Dec	24		96 4	Dec	5		101 3
Dec	22		91 6	Mar	25	1960	95 6	Mar	25	1964	96 7
Mar	28	1956	89 6	Dec	7		100 8	Nov	19		100 1
Jan	2	1957	93 8	Mar	5	1962	92 0	Dec	16		99 0
Dec	6		98 0	Dec	4		100 3	Apr	12	1965	4/ 116 0
Mar	14	1958	93 5	Mar	23	1963	99 3*	July	1		4/ 161 6

(C 6 2)14cha-1 Continued

Aug	25	1963	4/ 39 6	Sept	19	1965	4/ 130 7	Mar	1	1966	96 3
Aug	11		4/ 123 8	Oct	4		111 8	Mar	28		86 1
Sept	9		4/ 121 5	Oct	29		103 2	Mar	29		6/ 102 2
Sept	16		5/ 2 8 4	Nov	30		99 3	Mar	30		6/ 104 6
Sept	17		4/ 154 5	Jan	3	1966	98 1	Mar	11		4/ 106 6
Sept	18		4/ 143 3	Feb	1		4/ 100 7	Apr	1		6/ 107 9

(C-6-2)14dba-1 Records available 1964 66

Oct	10	1964	-101 9	Sept	18	1963	-148 8	Mar	1	1966	- 97 5
Dec	16		105 3	Sept	19		119 1	Mar	28		97 1
Mar	9	1963	102 4	Sept	20		111 3	Mar	29		6/ 102 7
Apr	12		120 2	Oct	4		112 6	Mar	30		6/ 103 9
July	1		169 7	Oct	29		104 4	Mar	31		6/ 108 3
Aug	25		147 1	Nov	30		100 6	Apr	1		6/ 110 0
Aug	11		128 6	Jan	1	1966	99 1	May	3		8/ 271 2
Sept	17		195 8	Feb	1		98 2				

(C 6-2)13abb 1 Records available 1964 66

Mar	25	1964	123 9	Aug	11	1965	116 3	Oct	29	1965	121 9
Nov	10		122 0	Sept	16		135 3	Nov	30		122 4
Dec	16		121 2	Sept	17		134 9	Jan	3	1966	121 6
Mar	9	1965	121 5	Sept	18		134 3	Feb	1		121 1
Apr	12		124 9	Sept	19		133 6	Feb	28		20
July	1		136 1	Sept	20		132 8	Mar	27		120 4
July	30		137 3	Sept	27		128 8	May	4		133 1
Aug	12		138 3	Oct	4		126 9				

(C 6 2)15bbb 1 Records available 1958 61, 1964 66

Mar	14	1958	101 9	Nov	6	1964	120 9*	Oct	4	1965	-127 4
Dec	24	1959	107 6	Nov	10		120 4	Oct	29		121 1
Mar	25	1960	6/ 123 7	Dec	16		119 1	Nov	30		121 4
Dec	7		131 2	Apr	12	1965	124 1	Jan	3	1966	120 2
Mar	22	1961	118 1	Aug	24		145 0	Feb	1		119 4
Mar	25	1964	116 6	Sept	9		5/ 240 2	Feb	28		119 0
Oct	2		126 0*	Sept	16		165 9	Mar	10		118 6
Oct	22		122 0*	Sept	20		141 9	May	1		5/ 252 1

(C 6 2)15bcb 1 Records available 1961 66

Mar	21	1961	96 5*	Dec	16	1964	90 1	Oct	29	1965	- 96 0
July	1		4/ 127 4	Mar	9	1965	96 8	Nov	30		93 2
Mar	25	1964	88 4	Apr	12		97 9	Jan	3	1966	92 2
Oct	2		107 4*	Sept	19		4/ 152 1	Feb	1		90 0
Oct	22		95 0*	Sept	20		4/ 145 1	Mar	1		89 2
Nov	6		91 0*	Oct	4		103 9	Mar	30		88 8
Nov.	10		97.1								

(C 6 2)15cbb 1 Records available 1963-66

Mar	23	1963	6/ 74 0*	Apr	29	1964	6/ 78 8*	Sept	18	1965	4/ -124 8
Mar	29		6/ 79 4*	Oct	22		78 7*	Sept	19		4/ 118 0
Apr	5		6/ 93 0*	Nov	6		76 6*	Sept	20		4/ 113 2
Apr	10		91 7*	Nov	10		75 6	Oct	4		86 9
May	7		6/ 98 5*	Dec	16		73 6	Oct	29		78 4
May	11		95 8*	Mar	9	1965	72 2	Nov	30		75 2
June	6		94 2	Apr	12		6/ 79 3	Jan	1	1966	71 4
June	15		6/ 102 2*	Sept	*		4/ 114 4	Feb	1		72 J
July	1		95 3*	Sept	15		5/ 213 3	Mar	1		71 7
July	20		6/ 117 2*	Sept	16		4/ 140 8	Mar	24		71 5
Mar	25	1964	72 8	Sept	17		4/ 133 3	Mar	28		71 4

(C 6 2)16baa 1 Records available 1954-61, 1965 66

Dec	9	1954	- 51 7	Dec	7	1960	70 6	Sept	19	1965	85 2
Apr	12	1955	51 8	Dec	20	1961	71 8	Oct	4		75 9
Dec	22		58 0	July	1	1965	6/ 87 7	Oct	29		72 7
Mar	28	1936	58 3	July	30		6/ 87 3	Nov	30		1 2
Jan	2	1937	60 4	Aug	12		6/ 88 3	Jan	3	1966	70 3
Dec	6		64 7	Aug	25		6/ 84 8	Feb	1		69 7
Mar	14	1938	64 6	Aug	31		6/ 87 7	Feb	28		69 2
Apr	11	1959	69 6	Sept	16		6/ 87 7	Apr	1		67 9
Dec	24		68 1	Sept	17		87 0	May	3		84 2
Mar	25	1960	71 8	Sept	15		86 1	June	9		88 9

(C 6 2)17dec 1 Records available 1961-66

Mar	2	1963	- 23 6*	Nov	1	1964	29 4t	July	3	1965	23 8t
Mar	23		21 1*	Nov	6		29 0*	July	10		23 6t
Mar	29		23 3*	Nov	7		28 9t	July	30		23 2
Apr	5		23 3*	Nov	13		28 8	Aug	12		22 8
Apr	30		23 2*	Dec	17		27 6	Aug	2		22 9
May	7		23 1*	Feb	17	1965	25 8*	Aug	31		22 1
May	11		23 1*	Mar	9		25 8	Oct	4		21 3
May	23		23 2*	Apr	2		25 2*	Oct	29		21 2
June	3		23 6	Apr	10		25 1*	Nov	30		20 8
July	3		23 1*	Apr	12		25 6	Jan	3	1966	20 7
July	20		23 2*	Apr	17		25 2t	Feb	2		20 8
Apr	8	1964	24 2	June	5		24 3t	Feb	28		20 7
Apr	29		24 0*	June	19		24 t	Mar	28		20 7
Oct	31		29 7t	July	1		23 8	Mar	31		20 7

(C 6 2)17dec-2 Records available 1963 66

Mar	2	1963	- 30 7*	Apr	5	1963	10 5*	May	11	1963	- 30 4*
Mar	23		30 5*	Apr	30		30 ?*	May	23		30 5*
Mar	29		30 6*	May	7		30 4*	June	3		31 0

Table 5 — Water levels in observation wells in Cedar Valley — Continued

(C 6)1 dcc 2 Continued

July	3	1963	30 *	a	16	1965	33 6†	July	10	1965	30 8
July	20		30 5*	Fan	13		13 1†	July	30		30
Mar	24	1964	32 0	Feb	1		33 0*	Aug	12		10 1
Apr	8		31 5	Mar	9		33 1	Aug	25		30 1
Apr	29		31 3*	Apr	2		1 *	Aug	1		29 6
Oct	31		36 9†	Apr	3		12 6†	Oct			28 7
Nov	1		36 †	Apr	10		3 3*	Oct	29		28 4
Nov	6		16 3*	Apr	12		12 9	Nov	30		28 0
Nov	7		36 2†	Apr	17		32	Jan	3	1966	7 9
Nov	15		36 1	June	5		31 6†	Fan	2		28 1
Nov	14		35 7†	June	19		11 3*	Fan	28		27 9
Nov	21		35 3†	July	1		31 1	Mar	28		28 0
Dec	17		14 9	July	1		11 0†	Mar	31		27 9
Dec.	26		34 0†								

(C 6 2)25cbc 1 Records available 1964 66

Dec	17	1964	67 8	Aug	12	1963	68 4	Jan	4	1966	66 9
Mar	9	1963	67 9	Aug	31		68 2	Fab	1		68 9
Apr	20		68 7	Oct	4		68 7	Mar	11		68 9
July	1		68 0	Oct	29		68 7	Mar	30		68 9
July	30		68 0	Nov	30		68 9				

(C 6 2)26cbo 1 Records available 1963 66

Mar	2	1963	- 53 1*	Apr	12	1965	56 1	Feo	1	1966	60 5
Apr	30		4/ 62 7*	June	5		4/ 62 7†	Mar	11		59 5
May	7		60 7*	Sept	13		2/ 225 7	Mar	28		59 2
Mar	24	1964	58 1	Sept	16		4/ 107 2	Mar	29		59 3
Apr	29		57 8*	Sept	18		4/ 97 1	Mar	30		59 2
Oct	2		68 3*	Sept	19		4/ 92 4	Mar	31		59 2
O	22		63 6*	Sept	20		4/ 88 4	Apr	1		59 1
Mc	6		62 0*	Oct	4		74 0	Apr	6		59 2
Nov	10		61 6	Oct	9		72 3	Apr			59 2
Dec	1		59 8	Nov	30		63 9	May	3		5/ 22 8
Ma	9,	1965	58 0	Jan	4	1966	61 5				

(C 6 2)2 cca 1 Records available 1963 66

May	7	1961	31 2*	Apr	29	1964	32 9*	July	30	1965	14 6
May	11		31 2*	Oct	2		34 2*	Aug	12		14 7
May	22		31 3*	Oct	10		34 3*	Aug	31		34 9
June	3		31 8	Oct	22		34 4*	Oct	4		35 2
June	3		31 6	Nov	6		34 3*	Oct	29		35 4
June	15		31 6*	Nov	10		34 3	Nov	30		33 4
July	3		31 8*	Dec	17		34 6	Jan	4		33 2
July	9		30 4	Mar	9	1965	14 1	Feb	2		33 0
July	20		32 1*	Apr	12		34 0	Mar	1		34 8
Aug	21		12 5	Apr	15		33 9	Apr	7		34 6
Mar	24	1964	33 2	July	1		33 9				

(C 6-2)27cce 1 Records available 1966

Mar	31	1966	27 7	Apr	6	1966	- 27 9	May	3	1966	14 1
Apr	1		27 9	Ap	7		27 9	June	9		39 0

(C 6 2)27ccc ? Records available 1966

Mar	31	1966	25 2	Apr	6	1966	25 1	May	1	1966	24 9
Apr	1		25 1	Apr	7		25 1	June	9		24 9

(C-6-2)28bae 1 Records available 1963 66

May	11	1963	- 19 7*	Apr	29	1964	- 20 3*	Aug	12	1965	19 4
May	23		19 7*	Nov	6		20 4*	Aug	31		19 5
June	1		19 5	Nov	10		20 4	Oct	4		19 0
June	15		19 4*	Dec	17		20 4	Oct	29		19 6
July	3		19 7*	Mar	9	1965	20 1	Nov	30		19 9
July	20		19 0*	Apr	12		20 0	Jan	3	1966	20 1
Aug	21		20 5	July	1		19 2	Feb	2		20 1
Ma	24,	1964	20 8	July	20		19 7	Ma	11		20 0

(C 6-)29bdd 1 Records available 1961 66

June	5	1963	+ 11 0	Apr	12	1965	† 8 9	Nov	30	1965	+ 12 9
July	9		1 0	July	1		10 3	Jan	1	1966	13 1
Aug	21		9 5	Aug	12		10 9	Fab	2		11 0
Mar	24	1964	9 8	Aug	31		11 5	Fab	28		13 2
Nov	10		6 1	Oct	4		12 4	Apr	7		13 1
Dec	14		7 6	Oct	29		12 8	May	1		11 1
Mar	9,	1965	8 6								

(C 6-2)29eac 1 Records available 1943 50, 1952, 1934 56, 1958 66

Mar	31	1943	+ 4 7	Mar	29	1948	* 3 0	Apr	13	1959	+ 3 1
Dec	28		3 9	Mar	15	1945	3 9	Dec	24		1 3
Mar	24	1944	3 4	Dec	15		4 3	Dec	7	1960	4
Dec	28		5 5	Mar	21	1950	4 0	Mar	22	1961	+ 1
Mar	13	1945	3 0	Apr	22	1932	3 6	Dec	20		9
Dec	18		6 2	Dec	31		6 4	Mar	5	1962	1 2
Mar	6	1946	3 9	Dec	9	1954	3 9	Dec	4		1 6
Dec	16		5 9	Dec	20	1955	1 7	May	21	1963	1 0*
Apr	8	1947	4 7	Dec	13	2956	6	June	5		9
Dec	16		5 5	Mar	14	1958	7	June	15		1 0*

(C 6 2 29cac 1 Continued

July	5	1963	1 0*	Nov	9	1964	5 8	Aug	3	1965	0 7
July	9		1 0	Dec	16		4 4	Jan	3	1966	+ 8
July	27		1 8*	Mar	9	1965	3 3	Feb	2		8
July	29		2 2*	Apr	12		3 0	Feb	28		9
Aug	21		3	June	9		2 0	Apr	6		1 0
Dec	5		6	Aug	12		1 0	May	3		1 1
Apr	29,	1964	4 1*								

(C 6 2)29cac 2 Records available 1954 1958 1960 66

Oct	9	1954	+ 2 3	Sept	17	1964	7 9*	Fab	17	1965	4 1*
Mar	14	1958	0	Sept	19		8 0†	Mar	9		4 1
Mar	5	1960	+ 1	Sept	26		9 1†	Apr	2		3 9*
Dec	7		1	Oct	2		8 1*	Apr	10		3 7*
Mar	27	1961	4	Oct	3		8 2†	Apr	12		1 7
Dec	20		1 5	Oct	10		8 1*	June	9		2 8
Mar	3	1962	1 9	Oct	17		8 3†	June	30		2 6
Dec	4		2 2	Oct	18		8 2†	July	21		2 3
Mar	8	1963	1 8	Oct	20		8 0†	July	30		2 2
May	23		1 7*	Oct	22		7 8*	Aug	12		2 0
June	5		1 6	Oct	21		8 3†	Aug	31		1 7
June	15		1 6*	Oct	29		7 4*	Oct	4		8
July	3		1 7*	Oct	11		8 4†	Oct	29		6
July	9		1 7	Nov	1		7 2†	Nov	30		5
July	20		1 7*	Nov	6		6 7*	Jan	3	1966	5
July	27		2 5*	Nov	7		6 7†	Jan	1		7/ 2
July	29		2 7	Nov	9		6 5	Jan	4		6
Aug	21		2 5	Nov	14		6 2†	Fab	1		6
Dec	5		1 1	Nov	21		6 0†	Mar	27		6
Mar	24	1964	5	Dec	5		5 6†	Apr	6		5
Apr	79		1*	Dec	16		5	Apr	6		7/ 4
Aug	13		7 2*	Dec	26		4 9†	May	1		4
Sept	5		7 9†	Jan	16	1965	4 6†	May	3		7/ 3
Sept	12		8 3†	Fan	11		4 31	June	9		3

(C-6 2)29ccc 1 Records available 1965 66

Sept	9	1965	+ 1 7	Nov	30	1965	+ 2 9	Fab	2	1966	+ 2 8
Oct	4		2 3	Jan	4	1966	2 9	Mar	11		2 8

(C 6 2)33beb 1 Records available 1950-51, 1954 56, 1958 66

Aug	7	1950	+ 14 9	Mar	22	1961	+ 9 7	July	1	1963	+ 6 7
Dec	5		14 4	Dec	20		9 1	July	30		8 1
Mar	30	1951	15 0	Mar	5	1962	10 4	Aug	12		8 2
Dec	9	1954	15 1	Dec	4		9 1	Aug	31		8 6
Apr	12	1953	13 1	Mar	8	1963	7 7	Oct	4		9 0
Dec	20		13 3	June	6		9 9	Oct	29		9 6
Mar	28	1956	13 6	July	9		10 0	Nov	10		9 8
Dec	13		12 6	Aug	21		8 7	Jan	1	1966	10 3
Mar	14	1958	11 8	Dec	5		6 9	Feb	2		10 4
Apr	13	1959	11 4	Mar	24	1964	7 9	Feb	28		10 2
Dec	24		12 3	Mo	9		3 0	Apr	7		10 6
Mar	25	1960	12 6	Dec	17		5 1	May	3		11 1
Dec	7		11 3	Mar	9,	1965	6 4				

(C 6 2)34bac 1 Records available 1963 66

May	7	1963	28 4*	Mar	24	1964	29 9	July	30	1965	31 5
May	11		28 4*	Apr	29		29 6*	Aug	12		31 8
May	22		28 5*	Oct	10		31 3*	Aug	31		11 9
June	5		28 7	Nov	6		31 5*	Oct	4		31 7
June	13		28 8*	Nov	10		31 5	Oct	29		31 8
July	3		29 2*	Dec	17		30 0	Nov	30		31 8
July	20		29 5*	Mar	9	1965	30 8	Jan	4	1966	31 6
July	27		29 3*	Apr	20		30 3	Fab	2		30 3
Aug	21		29 5	July	1		30 7	Mar	11		30 9

(C 7 2)23bcc 1 Records available 1964 66

Apr	28	1964	114 3	Aug	3	1965	114 6	Nov	30	1965	114 8
Mar	26	1965	114 5	Aug	31		114 7	Jan	4	1966	114 7
Apr	12		1 4 5	Oct	5		114 7	Mar	11		114 6
July	21		114 6	Oct	9		114 8				

(C 7 ?) 9dbe 1 Records available 1965 66

Nov	30,	1965	170 1	Mar	11,	1966	169 4				

(C-7-2)35bcc 1 Records available 1965 66

Oct	19	1965	180 4	Nov	30	1965	-180 4	Mar	11	1966	-180 4
Oct	29		180 5	Jan	4	1966	180 2				

(C 8-2)15aad 1 Records available 1965 66

Sept	10	1965	240 6	Nov	30	1965	-241 2	Fab	1	1966	241 4
Oct	5		240 6	Jan	4	1966	241 3	Mar	11		241 4
Oct.	29		240 7								

(C 9 2)3 adb 1 Records available 1965-66

Aug	3	1965	343 6	Oct	29	1965	-343 7	Feb	1	1966	-341 7
Aug	31		341 7	Nov	30		343 7	Mar	11		343 8
Oct	5		341 7	Jan	4	1966	343 7				

1/ Water le els decl ing after completi n t drilling and flu h ng ol servati n well
2/ Water to al prior t flual g wall f detergent • l t n
3/ Water level declin ng after fl shing observati n well
4/ Well rece tly pumpvd
5/ Well was buing pumped
6/ Nearby vell was bel ig p mped
_/ Nearly flowing we l s ill ln f r 30 minutes

Table 6 — Selected drillers' logs of wells in Cedar Valley

(Surveyed altitudes of land surface at the well by U.S. Geological Survey are given in feet and tenths; altitudes interpolated from topographic maps are given in feet.)

Thickness: Given in feet.
Depth: Given in feet below land surface.

	Thickness	Depth
(C-5-2)31dcd-1. Log by E. W. Hale. Alt. 5,181.4		
Boulders	15	15
Clay and sand	50	65
Boulders	2	67
Clay	9	76
Boulders	2	78
Clay	17	95
Hardpan	1	96
Clay and sand	22	118
Boulders	3	121
Clay	3	124
Boulders	2	126
Clay	10	136
Boulders	1	137
Clay and sand	27	164
Boulders	2	166
Clay	26	191
Boulders	1	193
Clay	26	219
Clay and sand	31	250
Boulders	[illegible]	252
Clay	24	276
Boulders	2	278
Clay	16	294
Boulders	2	296
Clay	4	300
Sand and gravel, water	25	32
(C-6-1)18dca-1. Log by L. E. Hale. Alt. 4,887.9		
Sand and clay	70	70
Clay with gravel	159	229
Gravel	5	234
Clay	4	238
Sand	5	243
Clay	7	250
Quicksand	2	252
Gravel	12	264
(C-6-2)13caa-1. Log by Robinson Drilling Co. Alt. 4,856.6 ft		
Silt	2	2
Clay and hardpan	2	4
Clay, blue	41	45
Clay, yellow	50	95
Clay and sand	10	105
Clay, yellow	40	145
Clay, gray	3	148
Clay and gravel, small amount of water	2	150
Clay, gray	10	160
Clay, yellow	30	190
Clay, blue	15	205
Clay, yellow	47	252
Sand	16	268
Clay and sand	82	350
Clay and sand, hard and soft streaks	45	395
Clay and sand	40	435
Clay and gravel, mixed	8	443
Clay and sand	82	525
(C-6-2)14cba-1. Log by Roscoe Moss Drilling Co. Alt. 4,865.7 ft		
Soil	4	4
Clay, gray	66	70
Clay, brown, sandy	47	217
Clay, brown	508	725
Sand, gravel, and clay	13	738
Clay, gray, hard, sandy	17	753
Clay, brown, soft	29	784
Clay, brown, hard, sandy	6	790
Clay, brown, soft, streaks of sand	20	810
Clay, blue, soft	15	825
Clay, brown, soft	15	840
Clay, brown, hard, sandy	20	860
Clay, brown, streaks of sand	27	887
Clay, light blue	15	902
Clay, gray, streaks of sand	101	1,003
Clay, brown, soft	102	1,103
Sand and gravel, streaks of clay	50	1,155
Sand and gravel, hard, clay streaks	71	1,226
Sand and gravel, hard	32	1,258

	Thickness	Depth
(C-6-2)15abb-1. Log by Robinson Drilling Co. Alt. 4,864.9 ft		
Clay, yellow	42	42
Clay, blue	11	51
Clay, yellow	29	82
Gravel, dry	4	86
Clay, yellow	31	117
Sand, fine, making water	[illegible]	121
Clay and gravel, sandy, yellow	6	127
Sand, fine	10	137
Sand and gravel	9	146
Clay, yellow	56	202
Clay, sandy, yellow	22	224
Clay, sand, and gravel	20	244
Clay, yellow, and fine gravel	28	272
Clay, sticky	10	282
Clay, sandy	6	288
Clay, sticky	3	291
Clay and fine gravel	3	294
Clay, sticky	3	297
Clay and fine gravel	3	300
Clay, sticky, light brown	8	308
Clay, sandy, light brown	28	336
Clay and gravel	11	347
Clay, sticky, light brown	4	351
Gravel	9	360
Clay, sticky, light brown	5	365
Clay, sandy, light brown	[illegible]	402
Sand and cobbles	4	406
Clay, sandy, light brown	5	411
Sand and cobbles, hard	2	413
Clay, sticky, light brown	21	442
Clay, white, sandy	4	446
Clay, sticky, light brown	54	500
Clay, yellow	34	514
Clay, blue	4	338
Clay, yellow	22	360
Gravel and clay	3	565
Clay, yellow	15	380
Gravel and clay	10	590
Clay, yellow	12	602
Gravel and clay	4	606
Clay, yellow	29	635
Sand, hard	8	643
Clay, yellow	19	662
Clay, blue	4	666
Clay, yellow	109	775
Clay, yellow, with some fine gravel	40	815
Clay, yellow	15	830
Clay and gravel	8	833
Clay, brown	35	871
Sand, hard, brown	12	885
Clay, sticky, yellow	32	917
Clay, sticky, blue	69	986
Gravel and sand, 1-inch gravel	10	996
Clay, yellow	49	1,045
Clay, yellow, sandy	30	1,075
Clay, blue	27	1,102
Clay, yellow	13	1,115
Clay, sticky, brown	32	1,442
Sand, brown, and stands up	23	1,465
Clay, brown and white	5	1,470
Clay, white and red	5	1,475
Clay, sandy, yellow	10	1,485
Clay, sticky, brown	230	1,715
Clay, brown, and gravel mixed, 1/4-inch gravel	10	1,725
Clay, brown	10	1,735
Clay, brown, and fine gravel mixed, 1/4-inch gravel	10	1,745
Clay, brown	20	1,765
Clay, sandy, brown	10	1,775
Clay, brown	35	1,810
Clay, sticky, brown	15	1,825
Clay, sandy, brown	15	1,840
Clay, brown, mixed with fine gravel, 1/8-inch gravel	30	1,870
Clay, brown, with streaks of fine gravel, 1/2-inch gravel	10	1,880
Sand and fine gravel with streaks of brown clay mixed	25	1,905
Sand, hard	9	1,913
Sand and fine gravel	12	1,925
Sand and gravel, 1/2-inch gravel	5	1,930
Clay, brown	5	1,935
Gravel	2	1,937

	Thickness	Depth
(C-6-2)15abb-1. Continued		
Clay, brown	3	960
Sand and fine gravel, 1/2-inch gravel	15	1,955
Sand and gravel, 3/4-inch gravel	10	1,965
Sand and gravel, 1-inch gravel	35	2,000
Sand, hard	5	2,005
Sand and gravel, [illegible]-inch gravel	20	2,025
Bentonite	5	2,030
Sand and gravel	5	2,035
Clay, sand, and gravel mixed	5	2,040
Gravel and gravel	2	2,042
Gravel, clay, and sand	3	2,045
Clay, black, and sand and shells	5	2,050
Clay, blue	6	2,056
Sand, hard	4	2,060
Shale, black, hard and sticky	5	2,065
Sand, hard, and gravel	5	2,070
Shale, blue, hard and sticky	5	2,075
Shale, blue, with hard sand shell	13	2,090
Limestone, gray, hard and sharp	18	2,128
Sand, hard and sharp	8	2,136
Lime, gray, hard	3	2,139
Sand, hard	9	2,148
Lime, gray, hard	53	2,20[illegible]
Limestone, different colors, extra hard	3	2,204
Limestone, hard, brown	3	2,207
Limestone, gray	12	2,219
Limestone, gray, extra hard and sharp	36	2,255
Shale, gray, with lime shells	18	2,273
Limestone, gray, hard	18	2,291
Fault, fractured zone, gray limestone	18	2,309
Gravel, 3/4-inch diameter	1	2,310
Fault zone, limestone	5	2,315
Lime, gray	31	2,366
(C-6-2)17dcc-1. Log by J. S. Lee and Sons. Alt. 4,913.6 ft		
Top soil	2	2
Clay	3	5
Gravel	3	10
Clay	50	60
Sand, surface water	5	65
Clay	82	147
Sand and gravel	8	155
Clay and gravel	20	175
Clay	35	210
Clay and gravel	15	225
Sand and gravel	10	235
Gravel, cemented	11	246
Clay	39	285
Gravel, cemented	10	295
Clay	20	315
Silt	30	345
Gravel	31	376
Clay	34	410
Clay and gravel	5	415
Conglomerate	10	423
Gravel	7	432
Clay and gravel	13	445
Gravel	16	461
Conglomerate	19	480
Gravel and boulders	12	492
Clay	29	521
Conglomerate	64	585
Clay	15	600
(C-6-2)26cbb-1. Log by Robinson Drilling Co. Alt. 4,844.1 ft		
Clay, gray	30	30
Clay, yellow	25	55
Clay, gray	13	68
Sand and gravel, small amount of water	2	70
Clay, gray	10	80
Clay, yellow	30	110
Clay and sand	15	125
Clay, yellow	35	160
Clay, blue	15	175
Clay, yellow	35	210
Clay, blue, and sand	40	250
Clay, yellow	5	255

Table 6 — Selected drillers' logs of wells in Cedar Valley — Continued

	Thickness	Depth
(C 6-2)26ьbb Continued		
Clay bl ıe and sand	17	272
Sand	6	278
Clay bl e and sand	27	105
Clay vellnw	2ͻ	330
Gravel	3	335
Clay yellow	35	370
Sand hard	10	380
Gravel	22	402
Clay hl a	8	410
Clay yellow	10	420
Clay yallow and sand	18	438
Sand hard	20	478
C ay yallow	7	485
Clay yal ow and sand	15	300
Clay yellnv	5	505
(C 6 2)29eac 2 Log by L N Helncac Alt 4 888 7 ft		
Clay and hardpan layara	110	110
Gravel black 1/4 to 1 inch	6	116
Clay	44	160
Hardpan on sandstona	1	161

	Thickness	Depth
(C 6 2)29cac 2 Continued		
Clay	47	208
Cravel black 1/4 to 1 inch	10	218
Hardpan	2	220
Quicksand		
(C 6 2)32bbd 1 Log by J ͻ Lae and Sons Alt 4 880 ft		
Clay brown	60	60
Sand	1	61
Clay brown	62	123
Clay and gravel	7	130
Clay brown	3	203
Craval	3	208
Clay sand and gravel	45	253
Conglomerata	7	260
Clay sand and gravel	37	297
Cravel	2	299
Clay and gravel	31	330
Cravel	3	333
Clay and gravel	21	354
Conglomcracc	10	364
Clay and gravel	68	432

	Thickness	Depth
(C A 2)32bod 1 Concinued		
Conglonerate	13	445
Clay brown	7	452
Gravel	11	463
Clay and gravel	22	485
Conglomcrara	2	487
Clay brown	1	490
Cnnglomerare	16	506
Clay	4	310
Conglomerate	23	535
Clay and gravel	13	548
Conglonerate	4	552
Craval	7	359
Conglonerata	16	575
Clay sand and gravel	11	586
Cravel	9	595
Clay and gravel	t0	605
Clay yeltow	9	613
(C 7 2)23bec 1 Log by J P Felghry Alt 4 833 ft		
Clay	180	180
Clay soft wtth water	15	193
Clay	23	220

Table 7. — Logs of test wells in Cedar Valley

(Logs by U S Geological Survey Surveyed altitudas of land sur ace at the well by U S Geological Survey are given in feet and tenths altitudes interpolated from topographic maps are given in feet)

Thickness Given in faet
Depth Given in feac balaw land aurface

	Thickness	Depth
(C 5 1120dde 1 Alt 4 795 fc		
Recant and P alatocana dapoalca		
Sand vary fina to vary coarse and vary clas gravel sllty Gravel is tubrounded to rouodad Composad ut sadlmantary and ignaoua rocka	12	12
Cravel vary fine to vary coarse and small cnhbles angular o rounded Composad of sadtnantary and ignaous rocks Slight caving	2	14
S lt brown and light gray sandy and clayev Cmtalns sone very fire to ncdlum gravel angular to subroundad Composed ot aedlmancary and ignaous rocka	29	43
Craval very fine to very coarse and scull cobbles angular to rounded Composad of sadımancary and ignaous rocka Interval concalna brown sandy silt matclx con 43 to 38 feat and yallow 6rova clayey silt iroa 38 to 60 feat Loac eırculatıon bacwaan 45 and 55 faat	17	60
Cohblas amall and coarse gravel moatly quarcalta but some llmaatona and ignaous rocks Slight lose of elrculation	10	70
Manning Canyon Shale of Pennsvlvanıan awl Mlsslsslpplan age		
Claystona gray gray brawn and olive and gray allty clay	21	91
Shala ruat-brown flsalle Loat circulacium while drilling	5	96
Claystona gray to dara gray gray brown ollva and black and gray to gray brown sand clay	46	142
Clay and elaystona dara gray to b ack Formatıon changed color o(drilling aud fron brown to black	63	205
Shale black	95	300
(C 3 2)24aab-1 Alt 4 989 7 ft		
Recent and Pleistocene deposits		
Silt brown and tan aandy and clayey	39	39
Sand varf flna to very coarse and very flna to coarse gravel Craval ls angular to rounded and ecmposed of sedi mantary and ıgnaoua rocha Loac circulation wotla drilling	4	43
Silc brown clayey and sandy	7	30
Craval very fine to very coarse angular cn rouodad Composed of aadlneocary and ignaous rocka	2	52
Silt brcawn sandy and clayey as a matrlx la vary fina to coarse graval Incarval ta about 50 percent atlt and 50 percent gravel Gravel la angular to aubcounlad and composed of aadlmantary and ignaous rocks	8	60
Ignaoua rock of Tertiary age Probably lower Tertiary andealte-cracnyce laclca flows (Stokes 1963)	87	147
Linesrone of Paleocolc age Probably Oqulrıh Formatlun of Permlan and Pannsylvanlan age	8	155
(C 6 2)1ace 1 Ale 4 891 3 ft		
Recant end Plalscoeana depoalta		
Silt and clay tea and light gray	8	8
Silt and vary fina tu oadlum aand tan and gray	14	22
Silt and clay tan and ilghl gray	13	35

	Thickness	Depth
(C 6 2)1ace 1 - Coacinued		
Racent and Pleistocene dapoalts Continued		
Silt and very fine to madium sand tan	14	49
Sand vary fine to madlus silty taa	7	56
Silt clayey and sandy can	7	63
Silt and vary flna to madlum sand brown Conralns flna gravel angular to rounded cowpoacd of quartzite and llmastone from 70 to 71 feat	10	73
Silc and clay brown	13	86
Silt nd ary fine to coarse sand light brown tn brown	12	98
Silt and clay brown	8	106
Silt and vary fine to madıum sand brnwn alightly clayay	9	113
Silt end clay brown	4	119
Silt and ery ine to aedlum aand brown Contalna vary fine to meditm gravel angular to subroundad composed of quarcsice and llmeatone from 131 to 132 feet Slightly clayey from 132 to 133 feet	22	141
Silt and clay brown	3	144
Cravel fine to coarse angular to subroundad composad of quarcsice and llmestone Contains brown silt	4	148
Silt brown clayey and oceaaionally sandy	54	202
Sand very fine to madium silty from 202 to 208 feet	11	213
Silt brown clayey Sandy fron 220 to 222 feet	18	231
Sand very fine to coarse silty	7	238
Silt brown clayey	12	250
Sand vary ina to andium silty	3	255
Silt brown clayey	10	265
Send very fine to madlum silty	2	267
Silt brown clayey fron 273 to 288 feet end aendy from 288 to 291 feat	33	300
(C 8 2)27ecc 1 Alt 4 843 2 ft		
Recent and Ploiatocene deposits		
Clay light gray silty	31	51
Clay dark gray to blue gray allty	39	90
Silt light grey end light to dark brown aandy and clayey	33	125
Clay gray silty	23	148
Silt brown sandy and clayey Color grades to gray-brown ac 163 to 170 feat	32	155
Clav gray allty Contains chin lass than 1 foot bade of white clay	41	226
Silt tan and brown sandy and clayey	38	264
Sand very flna to madium alley	8	272
Silt tea and brown sandy and clayey loterbadded with 2 to 6 foot beda of silty sand	40	312
Sand very floe to medlum silty	10	322
Silt gray aaody and clayey Contalna 2 to 6 foot thick beda of allty sand	86	408
Silc gray brown sandy and clayay Contalna 2 to 10 foot thick beds of stlty sand	36	464
Silc gray and blue gray aandy and clayey	41	505

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(*) — Out of Print

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*No 8 Consumptive use of water and irrigation requirements of crops in Utah, by C O Roskelly and Wayne D Criddle, 1952

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No 14 Water-resources appraisal of the Snake Valley area, Utah and Nevada, by J W Hood and F E Rush, U S Geological Survey, 1966

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WATER CIRCULAR

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No 1 Records and water-level measurements of selected wells and chemical analyses of ground water, East Shore area, Davis, Weber, and Box Elder Counties, Utah, by R E Smith, U S Geological Survey, 1961

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No 4 Selected hydrologic data, Jordan Valley, Salt Lake County, Utah, by I W Marine and Don Price, U S Geological Survey, 1963

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No 10 Quality of surface water in the Sevier Lake basin, Utah, by D C Hahl and R E Cabell, U S Geological Survey, 1965

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*No 1 Plan of work for the Sevier River Basin (Sec 6, P L 566), United States Department of Agriculture, 1960

No 2 Water production from oil wells in Utah, by Jerry Tuttle, Utah State Engineer's Office, 1960

No 3 Ground water areas and well logs, central Sevier Valley, Utah, by R A Young, United States Geological Survey, 1960

*No 4 Ground water investigations in Utah in 1960 and reports published by the United States Geological Survey or the Utah State Engineer prior to 1960, by H D Goode, United States Geological Survey, 1960

No 5 Developing ground water in the central Sevier Valley, Utah, by R A Young and C H Carpenter, United States Geological Survey, 1961

*No 6 Work outline and report outline for Sevier River basin survey, (Sec 6, P L 566), United States Department of Agriculture, 1961

No 7 Relation of the deep and shallow artesian aquifers near Lynndyl, Utah, by R W Mower, United States Geological Survey, 1961

No 8 Projected 1975 municipal water use requirements, Davis County, Utah, by Utah State Engineer's Office, 1962

No 9 Projected 1975 municipal water use requirements, Weber County, Utah, by Utah State Engineer's Office, 1962

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No 12 Test drilling in the upper Sevier River drainage basin, Garfield and Piute Counties, Utah, by R D Feltis and G B Robinson, Jr , United States Geological Survey, 1963

No 13 Water requirements of lower Jordan River, Utah, by Karl Harris, Irrigation Engineer, Agricultural Research Service, Phoenix, Arizona, prepared under informal cooperation approved by Mr William W Donnan, Chief, Southwest Branch (Riverside, California) Soil and Water Conservation Research Division, Agricultural Research Service, U S D A and by Wayne D Criddle, State Engineer, State of Utah, Salt Lake City, Utah, 1964

*No 14 Consumptive use of water by native vegetation and irrigated crops in the Virgin River area of Utah, by Wayne D Criddle, Jay M Bagley, R Keith Higginson, and David W Hendricks, through cooperation of Utah Agricultural Experiment Station, Agricultural Research Service, Soil and Water Conservation Branch, Western Soil and Water Management Section, Utah Water and Power Board, and Utah State Engineer, Salt Lake City, Utah, 1964

No 15 Ground-water conditions and related water administration problems in Cedar City Valley, Iron County, Utah, February, 1966, by Jack A Barnett and Francis T Mayo, Utah State Engineer's Office

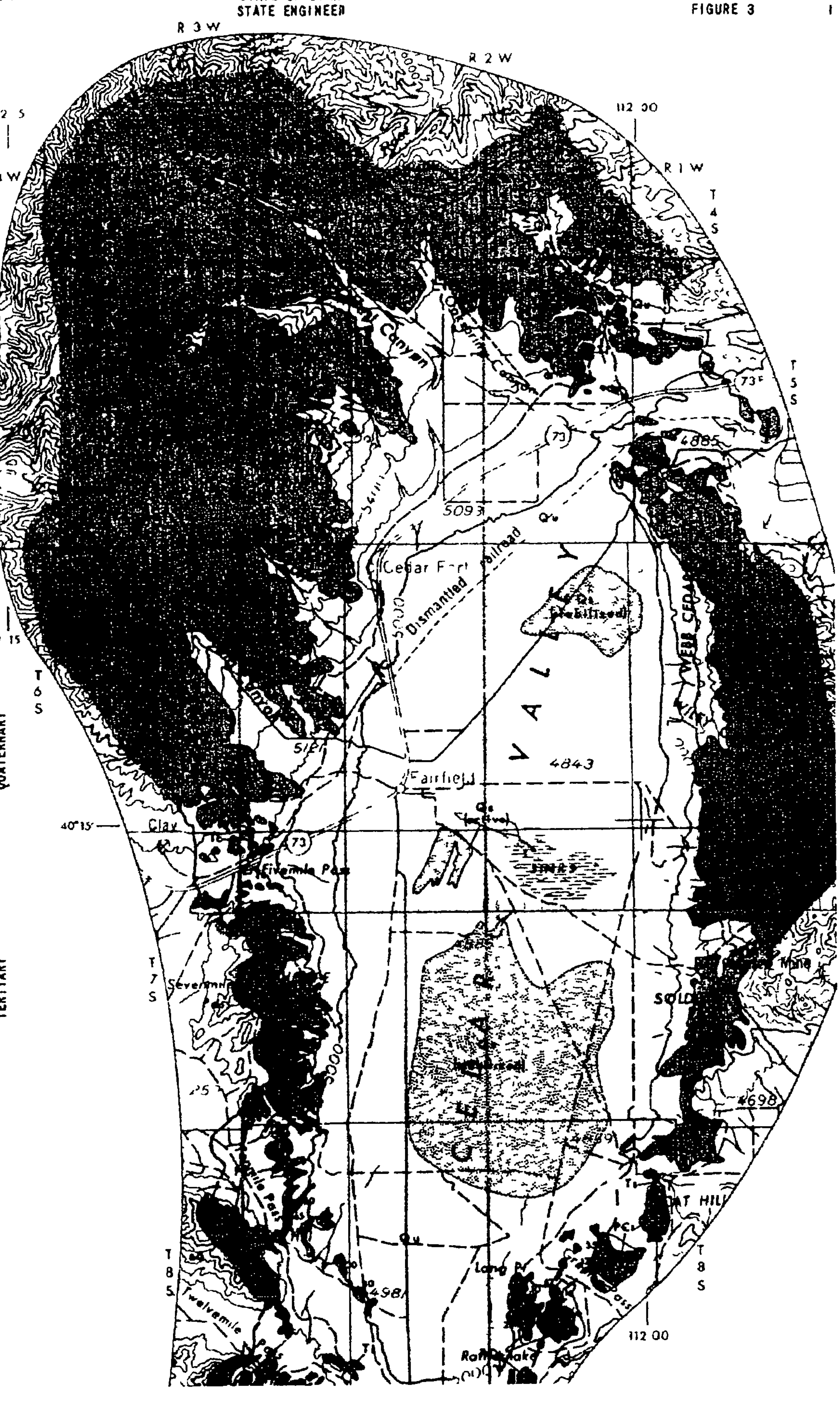
No 16 Summary of water well drilling activities in Utah, 1960 through 1965, compiled by Utah State Engineer's Office, 1966

No 17 Bibliography of U S Geological Survey Water Resources Reports for Utah, compiled by Olive A Keller, U S Geological Survey, 1966

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF UTAH
STATE ENGINEER

TECHNICAL PUBLICATION
FIGURE 3



EXPLANATION

Pleistocene and Recent — **QUATERNARY**

Sand dunes
Active dunes with maximum height of 15 feet and low stabilized dunes and shifting sand

Glacial moraine deposits of probable Wisconsin age

Unconsolidated deposits
Alluvial-fan debris colluvium Lake Bonneville Group and pre Lake Bonneville valley fill deposits

Eocene(?) — **TERTIARY**

Sedimentary rocks and tuffs
Limestone and fresh and argillized tuff

Eocene

Conglomerate
Poorly sorted boulders of limestone sandstone and quartzite embedded in a matrix of red-orange weathering clay grades upward into gray volcanic agglomerate (Disbrow 1957)

Igneous rocks
Includes intrusive bodies lava flows bedded tuffs breccias and agglomerates

Permian through Cambrian sedimentary rocks
Includes limestone dolomite quartzite conglomerate sandstone and shale

Contact
Dashed where approximate

Highest shoreline of Lake Bonneville on alluvial deposits

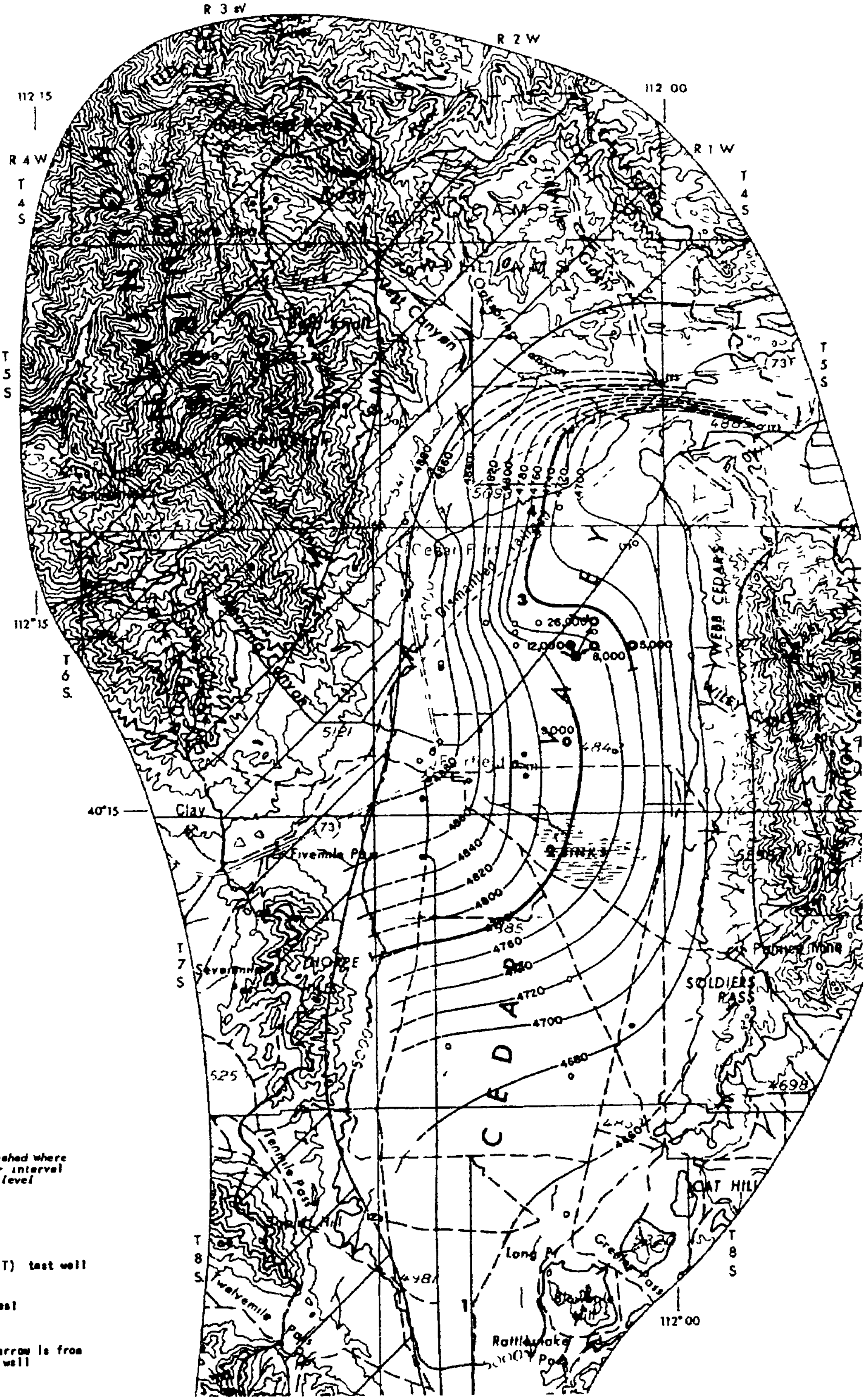
Strike-slip fault
Dashed to indicate continuation Arrows show relative movement

Anticline
Show ng trace of plane and d rec on of

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

STATE OF UTAH
STATE ENGINEER

TECHNICAL PUBLICATION
FIGURE N



EXPLANATION

4800
Water-table contour
Shows altitude of water table, dashed where approximate or doubtful. Contour interval 20 feet. Datum is mean sea level

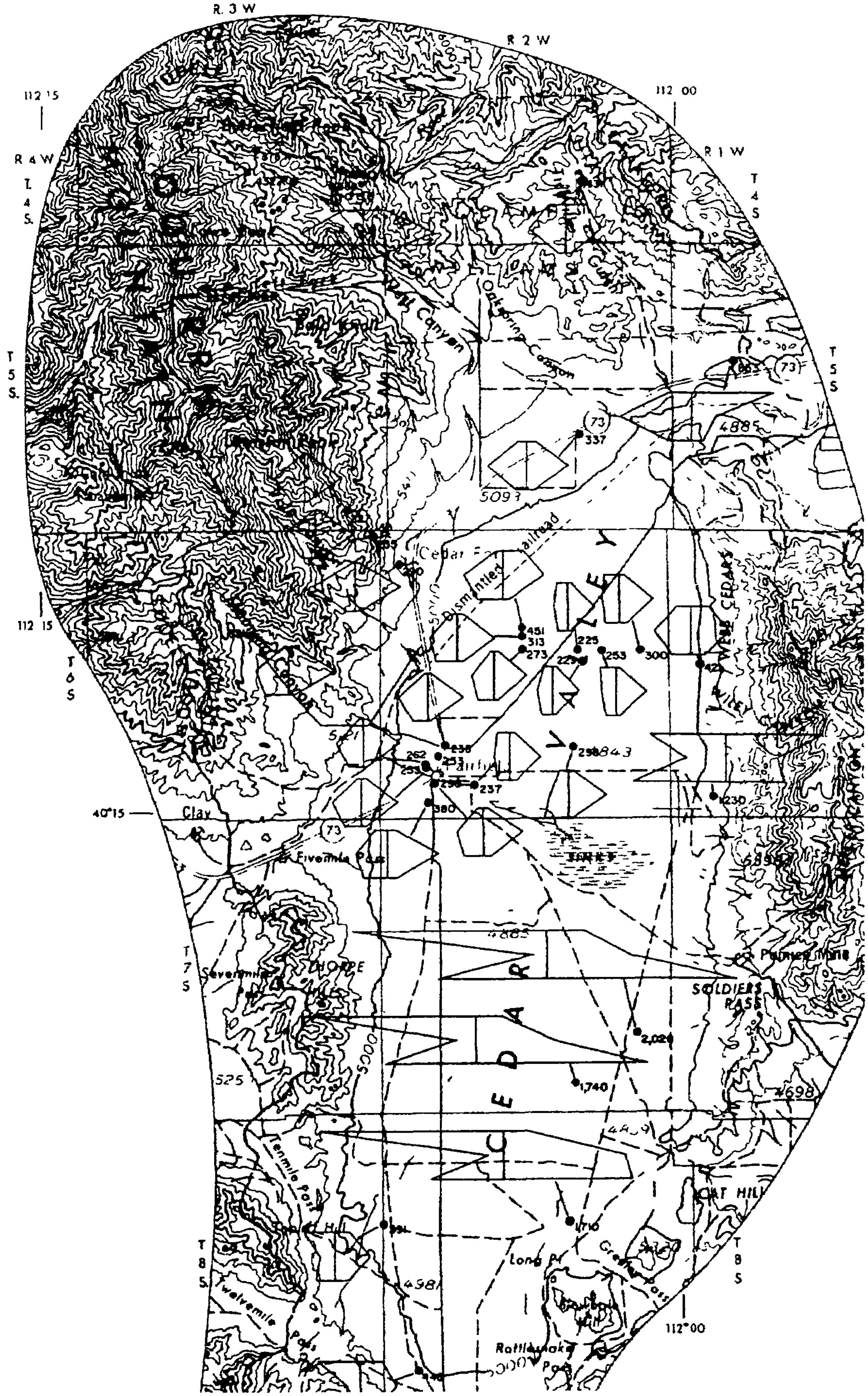
Well

Observation well for water levels (T) test well

Well pumped for aquifer test

8,000
Observation well for aquifer test, arrow is from pumped well to observation well

5,000



EXPLANATION

Sampling site

298
Well

323
Spring

APPENDIX J

HAND DELIVERED

SW177

JAN 04 2011

UTAH DIVISION OF
SOLID & HAZARDOUS WASTE

2011.00013

CENTRAL
BANK

IRREVOCABLE STANDBY LETTER OF CREDIT NO 125113803
DATE December 10, 2010
EXPIRATION DATE December 10, 2011
CORPORATION NAME Cedar Valley Landfill, LC
FACILITY NAME Cedar Valley Landfill
FACILITY PERMIT NO 0012R1

Executive Secretary Solid and Hazardous Waste Control Board of the State of Utah
PO Box 144880
Salt Lake City, Utah 84114-4880

We hereby issue our IRREVOCABLE STANDBY LETTER OF CREDIT No 125113803 in your favor on behalf of Cedar Valley Landfill hereinafter known as the Company, for a sum of One Hundred Five Thousand dollars and no/100's U S dollars $105,000 00, available by your drafts at sight drawn on our institutionCentral Bank Drafts must be marked "Drawn under 125113803,IRREVOCABLE STANDBY LETTER OF CREDIT No 125113803," dated today's date This IRREVOCABLE STANDBY LETTER OF CREDIT is issued to provide financial assurance to the Executive Secretary of the Solid and Hazardous Waste Control Board for the cost of closure, post-closure maintenance and monitoring, and if necessary, corrective action pursuant to Utah Code Annotated 19-6-108(9)(c) and Utah Administrative Code (UAC) R315-309-7, for the solid waste disposal facility known as

Cedar Valley Landfill LC
located at
Fairfield Utah

Requests to draw on this IRREVOCABLE STANDBY LETTER OF CREDIT must be accompanied by the following documents

1 Your signed statement as follows I, (Executive Secretary), certify that t have issued a Notice of Violation or other order to the Company indicating that the Company has failed to comply with the closure, post-closure maintenance and monitoring, or corrective action requirements of UAC R315-301 through 320

and

2 A copy of the Notice of Violation or other order issued to the Company by the Executive Secretary,

or

3 Your signed statement as follows I, (Executive Secretary), certify that the Company has failed to provide the Executive Secretary with an extension of Letter of Credit No 125113803, or with an acceptable replacement irrevocable standby letter of credit or other acceptable financial assurance within the 90 days of receipt of the expiration or cancellation notice by the issuing institution

and

4 Your sight draft, bearing reference to this IRREVOCABLE STANDBY LETTER OF CREDIT No 125113803

Partial drawings are permitted This original IRREVOCABLE STANDBY LETTER OF CREDIT No 125113803 must be submitted to us together with any drawings hereunder for our endorsement of any payments effected by us and/or cancellation

This IRREVOCABLE STANDBY LETTER OF CREDIT is effective as of 12/10/2010 and shall expire on 12/10/2011, but such expiration date shall be automatically extended for a penod of at least one year on 12/10/2011 and on each successive expiration date, unless the issuing institution has cancelled the IRREVOCABLE STANDBY LETTER OF CREDIT by sending notice of cancellation by certified mail to the Executive Secretary and the company 120 days in advance of cancellation

In the event the Executive Secretary is so notified, any unused portion of the credit shall be available upon presentation of a sight draft for 120 days after the date of receipt by both the Executive Secretary and Cedar Valley Landfill as shown on the signed return receipts

Whenever this IRREVOCABLE STANDBY LETTER OF CREDIT is drawn on under and in compliance with the terms of this credit, we shall duly honor such draft upon presentation to us, [insert, [we shall deposit the amount of the draft directly into a STANDBY TRUST of the [insert, owner's or operator's name]] or [we shall provide for partial drawings to third parties]] in accordance with the Executive

Secretary's instructions

The ISSUING INSTITUTION further warrants that this IRREVOCABLE STANDBY LETTER OF CREDIT conforms in all respects with the requirements Utah Administrative Code R315-309, as applicable and as such regulations were constituted on the date shown immediately below It is agreed that any provision of this IRREVOCABLE STANDBY LETTER OF CREDIT that is inconsistent with such regulations is hereby amended to eliminate such inconsistency

Type Name of Authorized Representative

Signature Institution
Jared V Peterson
Assistant Manager, 175 East Main Street, American Fork UT 84003

This IRREVOCABLE STANDBY LETTER OF CREDIT No 125113803 is subject to the most recent edition of the Uniform Customs and Practice for Documentary Credits, published and copyrighted by the International Chamber of Commerce," or "the Uniform Commercial Code

Cedar Valley Landfill
21.05 Acre
Phase Closure Bond

Item	Quantity	Unit	Unit Cost	Total Cost
2-foot Cap				
Soil (located on site)	67921 3	cu yd	$0 00	$0 00
Load / Haul	67921 3	cu yd	$0 95	$64,525 24
Spread and grade	67921 3	cu yd	$0 30	$20,376 39
Landscape				
Native Seed Mix	421 0	PLS lbs	$4 63	$1,949 23
Fourwing saltbush		10		
Wyoming big sagebrush		0 75		
Alksh sacabon		1		
Blue grama		2 5		
Bluebunch wheatgrass		14 25		
Streambank wheatgrass		13		
Smooth brome		15 5		
Intermediate wheatgrass		10		
Sandberg blusgrass		2		
Sheep fescue		3		
Slender wheatgrass		11		
Western wheatgrass		17		
		100%		
Planting *with* Grain Drill		hrs		
Post Closure Care				
Inspection *	60 0	ea	$150 00	$9,000 00
Fence Repair **	300 0	lf	$9 00	$2,700 00
Soil Repair ***	3000 0	sf	$1 25	$3,750 00
Total Bond Amount				$102,300 86

* Inspection assumes twice per year for 30 years

** Fence repair assumes 20 feet per year

*** Cap repair assumes 100 sq ft per year