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FINAL REPORT ON RIPARIAN PROPER FUNCTIONING CONDITION AND STANDARDS FOR RANGELAND HEALTH UPDATED INDEPENDENT EVALUATION FOR ALLOTMENT LIVESTOCK MANGEMENT FOR THE

COTTONWOOD, DEATH HOLLOW, LOWER CATTLE, MOLLIES NIPPLE, SCHOOL SECTION, SODA AND VERMILLION ALLOTMENTS IN THE

GRAND STAIRCASE/ESCALANTE NATIONAL MONUMENT

Garfield and Kane Counties, Utah

January 16, 2014

Prepared for Garfield and Kane Counties

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STAGER'S ENVIRONMENTAL CONSULTING, ROBERT STAGER
OVERGAARD, ARIZONA SOLE PROPRIETOR

Photo of Lizard Rock Located on the Paria Between Snake and Hog Eye Creeks

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Photo of Cottonwood Creek Near MH Spring

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I. BACKGROUND

The *Report on Riparian Proper Functioning Condition, Upland Conditions and Standards for Rangeland Health Updated Independent Evaluation* (referred to later as the Report) dated February 5, 2013, is co-authored by Bob Stager, Brent Owens, and Paul Curtis with technical input and document review by Elno Roundy, Gary Brackley and Steve Leonard. Mr. Stager, Mr. Owens, Mr. Leonard, Mr. Roundy and Mr. Curtis are retired from the BLM and Mr. Brackley is retired from the NRCS. These individuals have a combined experience of over 150 years in this

type data collection and/or interpretation and development of ecological sites and grazing management.

Robert D. Stager has been an instructor, a policy writer, co-author on publications, and collected data on millions of acres from 1976 to 2012 in Nevada, Montana, California, Utah, Arizona and Wyoming for the BLM in a variety of fields including inventory and monitoring methods, allotment management planning, MFP/RMP/EIS and NEPA for site specific EA's EIS (involved in writing 16 Management Framework Plans (MFP) or Resource Management Plans (RMP) and Environmental Impact Statement (EIS) documents and implemented 6 of these plans on the ground, and decisions, hearings and appeals. He has an AS, BS, and MS degrees in Biological Sciences and Range Management. He is familiar with and has worked extensively in Kane County and the GSENM from 1999 to 2012. The GSENM falls primarily within the Major Land Resource Area (MLRA) of D35, E47B and D36 of which Mr. Stager has extensive field experience. An MLRA has specific ecological sites or vegetative communities associated with it. He has helped implement in part, review and interpret every GSENM plan related to grazing since 1999. The technical field methods he has been an instructor on and collected data with or for include but are not limited to development of ecological sites, ecological reference worksheets, ecological site inventory, frequency, cover and density trend data, observed apparent trend, use pattern mapping, utilization data collection, riparian PFC and upland rangeland health. He helped the Natural Resources Conservation Service (NRCS) develop and refine many of the ecological sites in Nevada and in Utah and write and develop many of the Ecological Reference Worksheets for MLRA 35 and 47. The ecological sites in Nevada, Utah and Arizona are similar in many ways. He has served as a BLM expert witness or in case preparation on these methods and grazing management in hearings repeatedly from 1980 to 2011. Additionally, he has worked on geothermal, solar energy, rights of way, threatened and endangered species projects and RS 2477 efforts in Utah and Arizona to name a few. He is a certified Professional in Rangeland Management and a Certified Range Management Consultant with the Society for Range Management.

The following independent contractors assisted in this effort.

Mr. Roundy has worked in the Mojave desert biome as a rangeland professional for BLM and served on numerous public and agency committees dealing with resource management from 1963 to 2013. As lead Range Conservationist for the Kingman Field office for 18 years, he helped select the monitoring methods for trend and the grazed class utilization method that the Kingman BLM currently uses. After retiring, the Kingman BLM has contracted with him to collect monitoring data for their records on allotments using these methods. He has served as an instructor for the BLM on these methods throughout his career. In his work on the potential listing of the Sonoran Desert Tortoise in 2009 and 2010, he made extensive use of Mojave Counties soil survey data and ecological sites. He has extensive experience in grazing management and plant communities.

Mr. Brackley, in his employment with the NRCS or formerly the Soil Conservation Service (SCS), has had extensive experience in the development, interpretation and use of soil surveys and ecological site descriptions and reference sheets. In his position in the State Office for NRCS in Nevada, he authored and/or approved the ecological sites for the entire state and

correlated those sites with adjoining states. He has had extensive experience in the effects of fire on ecological sites and their recovery over time from fire. He is familiar with and has broad experience in collecting and training others on ecological condition data collection and had provided frequent assistance to the BLM in Nevada and Utah in his areas of expertise as recently as 2007. He also co-authored a report to the USFWS on the potential listing of the Sonoran Desert Tortoise in 2009 and 2010. In that report he made extensive use of soil survey data and ecological sites. He is a certified Professional in Rangeland Management.

Brent Owens is the primary person working with Mr. Stager collecting the data. Mr. Owens worked for over 30 years with the BLM and specifically is an expert on grazing and is familiar with the Monument where these allotments are located and the allotments themselves having spent his career working there. He has extensive experience monitoring, inventorying and working in the vegetation communities within the GSENM and working with and managing ecological sites and riparian areas. He has attended innumerable workshops and training sessions hosted by the BLM and other agency and academic entities on grazing, riparian and vegetation community management and monitoring. He worked on a team that collected riparian and rangeland health data for the Kanab Field Office (KFO) from 2000 till his retirement. The KFO is adjacent and to the west of the GSENM with similar vegetation communities and soils. He is an active rancher within Garfield and Kane Counties at this time.

Steve Leonard retired from the BLM where he served on the National Riparian Team and was one of the authors of TR 1737-16 1999 "A User Guide to Assessing Proper Functioning Condition and the Supporting Science for Lentic Areas" and TR 1737-15 1998 "A User Guide to Assessing Proper Functioning Condition and the Supporting Science for Lotic Areas". He has extensive experience in assessing, monitoring and managing riparian areas as well as uplands. He is currently a consultant and resides on his farm in Idaho. Mr. Leonard has developed numerous ecological sites, has served on a National Soils and Range Team publishing many professional papers on riparian assessment and management and is a Certified Range Management Consultant with the Society for Range Management.

Paul Curtis retired from BLM Monticello Field Office (MFO) and has worked in the Colorado Plateau Province most of his career. The MFO is adjacent and to the east of the GSENM. Mr. Curtis has extensive experience using MLRA 35 and 47 ecological sites and with the upland rangeland health and riparian PFC assessment methods. Mr. Curtis was responsible for all the riparian PFC and upland rangeland health data collected in the Monticello Field Office of the BLM from 1998 to 2010. He was also the BLM lead staff specialist for the Order 3 Soil Survey and Soil Vegetation Inventory Method (SVIM) for Monticello BLM. He is knowledgeable of effective grazing practices in uplands as well as riparian areas. He is very familiar with the NEPA process from the EIS to the EA level.

Figure 1 Grand Staircase Escalante National Monument

II. SUMMARY or ABSTRACT OF DATA ANALYSIS and REPORT

From June 20 to August 29, 2013 riparian proper functioning condition assessments were completed on all riparian areas of record within the Cottonwood, Death Hollow, Lower Cattle, Mollies Nipple and Soda allotments. From July 20 to August 13, 2012 riparian and uplands were visited on the School Section and Vermillion grazing allotments (parts of the Vermillion allotment were re-visited in 2013 to document site stability after fairly large flash flood events). All of these 7 allotments are located in the Grand Staircase Escalante National Monument (GSENM) (reference Figure 1) and the field work was completed by Stager and Owens in 2012 and 2013 with some assistance from Curtis in 2013. Others involved in some of the field assessments were Shane Green, NRCS State Office, Utah; Brian Bremner, Garfield County Engineer; and Drew Parkin, Escalante, Utah resident. These 7 allotments are a part of a group of allotments that the BLM monument management in their 2006 preliminary determinations indicated were not meeting 1 or more of Utah's Rangeland Health Standards. As such, the BLM determined that these allotments may require changes in grazing management after determining that grazing was at least one of the causes for not meeting standard(s).

In summary, it is our professional opinion and findings as a result of our extensive field work that the BLM has taken management action and is in the process of continuing positive management actions to facilitate meeting standards on all of these 7 allotments. They are doing this in a timely manner consistent within funding and workforce constraints. We arrived that this conclusion based upon our field work and research findings and our follow up meetings with the BLM. We are collecting this data for Garfield and Kane Counties.

Additionally, we determined that the way the water quality standard was applied by BLM in their 2006 Determinations may not be appropriate and is not a result of or associated with the existing livestock grazing practices.

Upon review of our 2012 and 2013 riparian proper function condition assessments and/or existing upland conditions, using photo documentation on all sites and our professional opinion on the uplands that the School Section allotment is likely not meeting standard 3 (Refer to page 19 of this report). Not meeting standard 3 is not due to existing livestock grazing but rather a long history of farming, plowing and seeding when the land was owned by the State of Utah. As a consequence, no change in grazing practices are required under 43 CFR 4180.

The Cottonwood, Death Hollow, Lower Cattle and Vermillion allotments are likely meeting Utah's Rangeland Health Standards as a result of good management by the BLM and the ranchers.

The Mollies Nipple and Soda allotments are likely not meeting standards and it is due to existing livestock grazing. On these two allotments the BLM and the ranchers have made measurable progress towards meeting standards through their management changes and has additional management scheduled to be implemented contingent on funding and work force constraints. As such, they appear to be consistent with the direction and intent of the 43 CFR 4180 regulations.

We do not presume the Agencies authority or responsibility for making determinations for specific allotments on whether they are meeting or not meeting Utah's Rangeland Health Standards. We merely reviewed the data and photos used by the BLM to make their 2006 Determinations. We used similar scrutiny in reviewing an allotment overall referring back to the BLM's narratives and compared our newer and more current 2012 and 2013 data's departures from the BLM's original data. From that we considered whether they likely were or were not meeting Utah's Standards.

III. DEFININITIONS RELEVANT TO REPORT, FIELD METHODS USED AND UTAH RANGELAND HEALTH STANDARDS

A. Riparian Area, Ecological Site and Water Quality Definitions

Riparian-wetland areas are some of the most productive resources in the world. They are used by people for recreation, fish and wildlife use them for habitat and they provide water supplies for animals and humans. Because of the importance of water and the associated habitats, there are usually important cultural, and historic values, as well as current economic values, resulting from riparian area use for livestock production, timber harvest, and mineral extraction.

A riparian-wetland area is an area that is saturated or inundated at a frequency and duration sufficient to produce vegetation typically adapted for life in saturated soil conditions. It is also the transitional area between permanently saturated wetlands and upland areas often referred to as a riparian area. This transition area has vegetation or physical characteristics

reflective of permanent surface or subsurface water influence. Wetlands and wetland transitions are usually managed as a unit. [1]

A riparian area is also described as lands adjacent to creeks, streams and rivers where vegetation is strongly influenced by the presence of water. [2] In other words, it is essentially the green zones close to streams and rivers.

Creeks, streams or rivers such as the Paria River and Cottonwood Creek are considered lotic riparian areas. Lotic riparian areas have flowing water and can be perennial, intermittent or seasonal, interrupted or ephemeral depending on the site specific characteristics[3].

> Perennial - A stream that flows continuously. Perennial streams are generally associated with a water table in the localities through which they flow.
> Intermittent or seasonal - A stream that flows only at certain times of the year when it receives water from springs or from some surface source such as melting snow in mountainous areas.
> Ephemeral - A stream that flows only in direct response to precipitation, and whose channel is above the water table at all times.
> Interrupted - A stream with discontinuities in space.

As noted above, by definition, a stream that flows only in direct response to precipitation, and whose channel is above the water table at all times is ephemeral. A drainage that does not receive a consistent continuous flow for at least 30 days a year is considered an ephemeral riparian area and we did not assess them using the PFC method [4]. A dry valley bottom or wash is not assessed using the PFC method either as they are not riparian.

A lentic riparian area is usually considered a spring or meadow type area.

The vegetation associated with the riparian area provides habitat and food for many wildlife species. It can shade the stream channel to cool the water to temperatures favorable to specific species of fish, other aquatic species and macroinvertebrate species.

Both lotic and lentic riparian sites are expected to have hydric soils which include soils developed under sufficiently wet conditions to support the growth and regeneration of hydrophytic vegetation (plants adapted to growing in wet soils or water). According to the Lentic Technical Reference TR 1737-16 on page 18 , "Areas with evident characteristics of wetland hydrology are those where the presence of water has an overriding influence on characteristics of vegetation and soils due to anaerobic and reducing conditions, respectively. Such characteristics are usually present in areas that are inundated or saturated to the surface for sufficient duration to develop hydric soils and support vegetation typically adapted for life in periodically anaerobic soil conditions." Additionally, on page 22 it states, " There are hydric soils indicators that will show that wetland hydrology is present or has been present at some

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[1] Prichard. D. *et. al.* TR 1737-16 1999.
[2] USFWS. 1995. Recovery Plan.
[3] Prichard. D. *et. al.* TR 1737-15 1998
[4] Prichard. D. *et. al.* TR 1737-15 1998

time. Histosols, Histic Epipedon, Black Histic, Hydrogen Sulfide Odor are usually saturated or inundated for much of most years for soil of all textures. Sandy Gleyed Matrix, Polyvalue Below Surface, Thin Dark Surface are the wetter hydric soil indicators for soil with sand or loamy sand soil textures. Loamy Gleyed Matrix, Thick Dark Surface are the hydric soil indicators for wetter soils of soil textures of sandy loam, sandy clay loam, clay loam, loam, silt loam, silty clay loam, sandy clay, and clay. While soils with all other hydric indicators will require a shorter duration of saturation or inundation, they will still have or have had wetland hydrology."

Riparian areas are assessed as Proper Functioning Condition (PFC), Functioning at Risk (FAR) or Non-Functional (NF). If a riparian-wetland area is not in PFC, it is placed into one of three other categories[5]:

> Functional—At Risk - Riparian-wetland areas that are in functional condition, but that have an existing soil, water, or vegetation attribute that makes them susceptible to degradation.
>
> Nonfunctional - Riparian-wetland areas that clearly are not providing adequate vegetation, landform, or woody debris to dissipate energies associated with flow events, and thus are not reducing erosion, improving water quality, etc.
>
> Unknown - Riparian-wetland areas for which there is a lack of sufficient information to make any form of determination.

Lentic riparian-wetland areas are functioning properly when adequate vegetation, landform, or debris is present to:

- dissipate energies associated with wind action, wave action, and overland flow from adjacent sites, thereby reducing erosion and improving water quality;
- filter sediment and aid floodplain development; improve flood-water retention and ground-water recharge;
- develop root masses that stabilize islands and shoreline features against cutting action; restrict water percolation;
- develop diverse ponding characteristics *to provide* the habitat and the water depth, duration, and temperature necessary for fish production, waterbird breeding, and other uses;
- and support greater biodiversity.

Lotic riparian-wetland areas are functioning properly when adequate vegetation, land form, or large woody debris is present to[6]:

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[5] Prichard. D. *et. al.* TR 1737-16 1999, Revised 2003.
[6] Prichard. D. *et. al.* TR 1737-15 1998

- dissipate stream energy associated with high waterflows, thereby reducing erosion and improving water quality;
- filter sediment, capture bedload, and aid floodplain development; improve flood-water retention and ground-water recharge;
- develop root masses that stabilize streambanks against cutting action;
- develop diverse ponding and channel characteristics *to provide* the habitat and the water depth, duration, and temperature necessary for fish production, waterfowl breeding, and other uses;
- and support greater biodiversity.

In wetlands, lentic and lotic areas, there are five categories in which plant species are placed. They are:

- Obligate (OBL)-Occur almost always (estimated probability >99 percent) under natural conditions in wetlands.
- Facultative Wetland (FACW)-Usually occur in wetlands (estimated probability 67-99 percent), but occasionally found in non-wetlands (estimated probability 1-33 percent).
- Facultative (FAC)-Equally likely to occur in wetlands or non-wetlands (estimated probability 34-66 percent).
- Facultative Upland (FACU)-Usually occur in non-wetlands (estimated probability 67-99 percent), but occasionally found in wetlands (estimated probability 1-33 percent).
- Upland (UPL)-Occur almost always (estimated probability >99 percent under natural conditions in non-wetlands

When assessing the riparian areas located within the Monument, the Paria and Escalante Rivers brought to mind a passage from Mark Twain's novel "Roughing It". In this book he wrote about his travels out west when the gold and silver frenzy was at its peak in California and the Nevada and Utah territories. I felt this small quote fit quite well for southern Utah just as it did for Nevada.

> "After leaving the Sink, we traveled along the Humbolt River a little way. People accustomed to the monster mile wide Mississippi, grow associating the term "river" with a high degree of watery grandeur. Consequently, such people feel rather disappointed when they stand on the shores of the Humbolt or the Carson and find that a "river" in Nevada is a sickly rivulet which is just the counterpart of the Erie Canal in all respects save that the canal is twice as long and four times as deep. One of the pleasantest and most invigorating exercises one can contrive is to run and jump across the Humbolt River till he is overheated, and then drink it dry."

In this book Mark Twain describes the tremendous flash floods associated with the Nevada Rivers just as flash floods are similarly associated with and are a natural and integral part of the rivers and creeks in Southern Utah.

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Historic Climax Plant Community (HCPC) is defined in BLM's Technical Reference 1734-7 [7] as "Ecological site development associated with climatic conditions and normal range of disturbances (e.g., occurrence of fire, grazing, unusually wet periods, flooding) produce a plant community in dynamic equilibrium with these conditions. This plant community is referred to as the historic climax plant community." The Technical Reference goes further by stating that, "The historic climax plant community for an ecological site is the plant community that existed before European immigration and settlement..... The HCPC is not a precise assemblage of species for which the proportions are the same from place to place or from year to year. Variability is apparent in productivity and occurrence of individual species." The Natural Resources Conservation Service's (NRCS) ecological site descriptions are of the HCPC.

General water quality standards for drinking water are:

pH 6.5 to 8.5 is safe to drink; ideal drinking water has a pH of 7.5 to 8.3

Alkalinity 150 to 200 ppm is ideal for drinking water[8]

Water with low levels of alkalinity (less than 150 mg/L) is more likely to be corrosive. It results primarily from dissolving limestone or dolomite minerals in the aquifer. High alkalinity water (greater than 150 mg/L) may contribute to scaling. Note that ppm and mg/L are about the same values. Alkalinity is a measure of the capacity of water or any solution to neutralize or "buffer" acids. This measure of acid-neutralizing capacity is important in figuring out how "buffered" the water is against sudden changes in pH[9].

Alkalinity and total hardness are usually nearly equal in concentration (when they are both reported in mg/L CaCO3 (calcium carbonate) because they form from the same minerals. If alkalinity is much less than total hardness it may signify elevated levels of chloride, nitrate or sulfate.

Acceptable results:

This is a test for overall water quality. There are no health concerns related to alkalinity. The value should be roughly 75% to 100% of the total hardness value in an un-softened sample for drinking or culinary uses.

As bicarbonates are usually the main contributor to alkalinity, high levels can cause soil problems by increasing soil sodicity. Highly sodic soils can reduce water availability to plant roots and reduce plant growth[10].

Levels of alkalinity which may cause problems are:

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[7] ESI. Habich. 2001.
[8] Interpreting Drinking Water Test Results, C. Mechenich et. al.
[9] Interpreting Drinking Water Test Results, C. Mechenich et. al.
[10] http://waterquality.montana.edu/docs/methane/basics_highlight.shtml & http://www.ext.colostate.edu/pubs/crops/00521.html

- < 90 mg/L - low risk of problems occurring
- 90–335 mg/L - moderate risk of soil problems (declining soil structure) and reduced plant growth from prolonged use, and accumulation of a white scale on plants spray-irrigated in high humidity weather
- > 335 mg/L - high risk of soil problems and reduced plant growth, and a build up of scale which blocks metal pipes
- > 500 mg/L - may be harmful to human health, but water develops an unpleasant taste well before this level.

Alkalinity is a quantity (capacity) factor, whereas pH is an intensity factor.

Typical Alkalinity Ranges in nature are[11]:

	(mg/L $CaCO_3$)
Rainwater	< 10
Typical surface water	20 - 200
Surface water in regions with alkaline soils	100 - 500
Groundwater	50 - 1000
Seawater	100 - 500

Alkalinity should not be confused with pH. pH is a measure of the hydrogen ion (H+) concentration, and the pH scale shows the intensity of the acidic or basic character of a solution at a given temperature. The reason alkalinity is sometime confused with pH is because the term alkaline is used to describe pH conditions greater than 7 (basic).

The most important compounds in water that determine alkalinity include the carbonate (CO32-) and bicarbonate (HCO3-) ions.

One source of alkalinity is calcium carbonate ($CaCO_3$), which is dissolved in water flowing through geology that has limestone and/or marble.

Alkalinity can increase the pH (make water more basic), when the alkalinity comes from a mineral source such as calcium carbonate ($CaCO_3$).

In addition to rocks and soils, the alkalinity of streams can be influenced by:

- salts,
- plant activity, and
- wastewater.

Hardness 0 to 60 mg/L is soft water, 61 to 120 mg/L is moderately hard, 121 to 180 is hard water and greater than 180 is very hard water[12]. Another source identified soft

[11] http://water.me.vccs.edu/exam_prep/alkalinity.html
[12] http://water.usgs.gov/owq/hardness-alkalinity.html

water as < 75 mg/L, Moderately Hard as 75-150 mg/L, Hard as 150-300 mg/L and Very hard as > 300 mg/L[13]. Ideal water for drinking is usually between 150 and 200 ppm or mg/L[14]

Hardness measures the amount of calcium and magnesium in water. Hardness is primarily caused by water slowly dissolving rocks that contain calcium and magnesium.

Alkalinity and hardness are related through common ions formed in aquatic systems. Specifically, the counter-ions associated with the bicarbonate and carbonate fraction of alkalinity are the principal ions responsible for hardness (usually Ca^{++} and Mg^{++} ions). As a result, the carbonate fraction of hardness (expressed as $CaCO_3$ equivalents) is chemically equivalent to the bicarbonates of alkalinity present in water in areas where the water interacts with limestone. Any hardness greater than the alkalinity represents non-carbonate hardness.

Hard water affects the behavior of domestic water, as it precipitates fatty acids, causing formations of scum's, yellowing of clothes and making it difficult to lather soap. It also caused encrustations which can block hot water systems, metal pipes and irrigation fittings, and can reduce soil structure.

Water with less than 100 mg/L $CaCO_3$ is generally regarded as suitable for most uses.

Suggested hardness limits are[15]:

- 150 mg/L :hot water systems and dairy equipment
- 200 mg/L :other domestic use
- 300 mg/L :for mixing chemical sprays and dips, and can have adverse effect on soil structure
- >500 mg/L :limit for most other uses

Water becomes hard by being in contact with soluble, divalent, metallic cations (positive ions having a valence of 2). The two main cations that cause water hardness are calcium (Ca) and magnesium (Mg). Calcium is dissolved in water as it passes over and through limestone deposits. Magnesium is dissolved as water passes over and through dolomite and other magnesium bearing formations.

Because groundwater is in contact with these geologic formations for a longer period of time than surface water, groundwater is usually harder than surface water.

The GSENM has limestone and dolomite in most of its geologic formations present in the watersheds[16].

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[13] Water Quality Notes: Alkalinity and Hardness, P. Chris Wilson, http://edis.ifas.ufl.edu & http://water.me.vccs.edu/exam_prep/hardness.html
[14] Interpreting Drinking Water Test Results, C. Mechenich et. al.
[15] http://www.dpi.nsw.gov.au/agriculture/resources/water/quality/publications/results
[16] Geology of Grand Staircase-Escalante National Monument, Utah. Hellmut H. Doelling et. al.. 2000. Utah Geological Assoc. Publ. 28.

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TDS Total Dissolved **Solids**

Electrical conductivity of water is directly related to the concentration of dissolved ionized solids in the water. Ions from the dissolved solids in water create the ability for that water to conduct an electrical current, which can be measured using a conventional conductivity meter or TDS meter. When correlated with laboratory TDS measurements, conductivity provides an approximate value for the TDS concentration, usually to within ten-percent accuracy. Gravimetric methods are the most accurate and involve evaporating the liquid solvent and measuring the mass of residues left. This method is generally the best, although it is time-consuming[17].

High TDS levels generally indicate hard water, which can cause scale buildup in pipes, valves, and filters, reducing performance and adding to system maintenance costs.

For terrestrial animals dairy cattle are measured to have a safe upper limit of about 7,100 mg/l.

Most aquatic ecosystems involving mixed fish fauna can tolerate TDS levels of 1000 mg/l[18].

Water can be classified by the amount of TDS per liter[19].

- Fresh water < 1,500 mg/L TDS
- Brackish water 1,500 to 3,000 mg/L TDS
- Saline water 3,000 to 5,000 mg/L TDS
- Brine > 5000 mg/L TDS

It should be noted that there are numerous similar but different classifications for TDS as some identify fresh water as < 1,000 mg/L TDS and brines typical range is 30,000 to 100,000 mg/L with 5,000 being the minimum threshold. The above is simply an example of one to use in relation to our water quality findings on TDS for the GSENM.

As for conversion from mg/L to ppm, they are close to the same with ppm being a little larger as the values increase. For example, 200 mg/L equals about 200.228 ppm and 1900 mg/L equals about 1902.17 ppm. For this report since we did not use the laboratory methods or laboratory accuracy we present ppm and mg/L as essentially equal values[20].

B. Field and Water Quality Methods Used Relative to this Report

We used the same methods for determining riparian Proper Functioning Condition (PFC) that the BLM currently uses and employed in their earlier efforts. These methods are identified in TR 1737-16 1999 "A User Guide to Assessing Proper Functioning Condition and the Supporting Science for Lentic Areas" and TR 1737-15 1998 "A User Guide to Assessing Proper Functioning

[17] http://en.wikipedia.org/wiki/Total_dissolved_solids

[18] Boyd, Claude E. (1999). *Water Quality: An Introduction*. The Netherlands: Kluwer Academic Publishers Group. ISBN 0-7923-7853-9.

[19] Ela, Wendell P., *Introduction to Environmental Engineering and Science*, Prentice Hall, 3rd ed. 2007. ISBN 0-13-148193-2

[20] http://www.unitconversion.org/concentration-solution/parts-per-million-ppm-to-milligrams-per-liter-conversion.html

Condition and the Supporting Science for Lotic Areas". Additionally, we age classed numerous trees and shrub species to better predict and bracket the timeframes that any management changes may have occurred. Our data documented measurable changes in respect to the BLM's earlier PFC assessments.

We classified some of the riparian communities as close as possible to their potential using the Forest Service technical document R4-Ecol-89-01 "Riparian Community Type Classification of Utah and Southeastern Idaho", 1989 by Padgett, Youngblood and Winward in conjunction with Technical Reference 1737-08- USFS GTR-47 "Monitoring the Vegetation Resources in Riparian Areas", 2000 by Alma H. Winward. The first reference helps identify the riparian community and the second reference assists in predicting the current communities' seral stage.

We did not complete formal health assessments in 2012 or 2013 for the uplands due to time and manpower constraints. We were contracted to collect data for the riparian areas identified as not meeting standards and make professional observations using ecological sites and rangeland reference sheets for some of the uplands.

For the uplands we referenced the Technical References 1734-6, 2000 Version 3 and 2005 Version 4 "Interpreting Indicators of Rangeland Health" in making our professional judgment on specific areas and augmented this with photo documentation. Additionally, we made use of Major Land Resource Area's (MLRA) 35 and 47 Ecological Site Descriptions and any available Ecological Reference Worksheets. Refer to Figure 2 depicting the MLRA's for Utah.

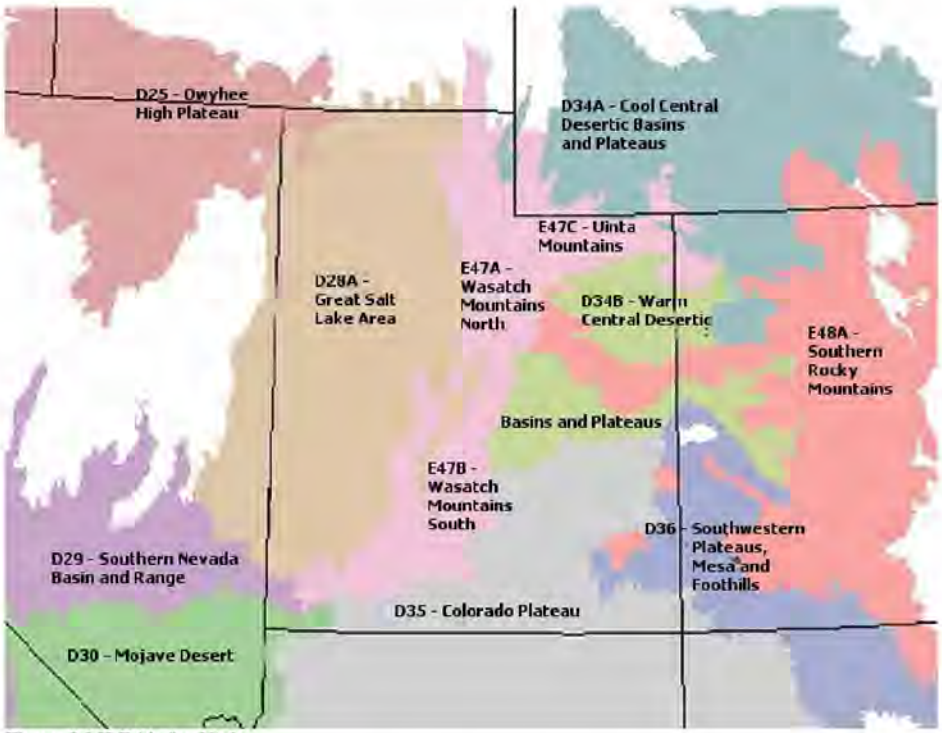

Figure 2 MLRA's for Utah

The water testing kit was a hth 6 Way test kit (commonly used in swimming pool and spas). This kit measures alkalinity by titrating for the acid neutralizing ability. It measures hardness by

titrating or measuring the calcium and magnesium carbonate present. It measures pH for the range of 6.8 to 8.2.

We used an HM Digital TDS-EZ Water Quality TDS Tester, 0-9990 ppm Measurement Range , 1 ppm Resolution, +/- 3% Readout Accuracy to measure the TDS for the following sample sites.

The water quality testing we conducted were not intended to be laboratory precision, however, the results do speak for themselves. We did not initiate water testing until we were assessing the Paria River riparian lotic. We would have liked to have collected samples for more of the areas and may do so in 2014.

C. Utah Rangeland Health Standards for Reference in Reviewing this Report

There are four (4) standards considered by the BLM consistent with the 43 CFR 4180 regulations "Fundamentals of Rangeland Health and Standards and Guidelines for Grazing Administration". For Utah they are:

Standard 1: UPLAND SOILS EXHIBIT PERMEABILITY AND INFILTRATION RATES THAT SUSTAIN OR IMPROVE SITE PRODUCTIVITY, CONSIDERING THE SOIL TYPE, CLIMATE AND LANDFORM.

As indicated by:

a) Sufficient cover and litter to protect the soil surface from excessive water and wind erosion, promote infiltration, detain surface flow, and retard soil moisture loss by evaporation.

b) The absence of indicators of excessive erosion such as rills, soil pedestals, and actively eroding gullies.

c) The appropriate amount, type, and distribution of vegetation reflecting the presence of 1) the Desired Plant Community (DPC), where identified in a land use plan conforming to these Standards, or 2) where the DPC is not identified, a community that equally sustains the desired level of productivity and properly functioning ecological conditions.

Standard 2: RIPARIAN AND WETLAND AREAS ARE IN PROPERLY FUNCTIONING CONDITION, STREAM CHANNEL MORPHOLOGY AND FUNCTIONS ARE APPROPRIATE TO SOIL TYPE, CLIMATE AND LANDFORM.

As indicated by:

a) Stream bank vegetation consisting of, or showing a trend toward, species with root masses capable of withstanding high stream flow events. Vegetative cover adequate to protect stream banks and dissipate stream flow energy associated with high water flows, protect against accelerated erosion, capture sediment, and provide for groundwater recharge.

b) Vegetation reflecting: DPC, maintenance of riparian and wetland soil moisture characteristics,

diverse age structure and composition, high vigor, large woody debris when site potential allows, and providing food, cover, and other habitat needs for dependent animal species.

c) Revegetating point bars; lateral stream movement associated with natural sinuosity; channel width, depth, pool frequency and roughness appropriate to landscape position.

d) Active floodplain

Standard 3: DESIRED SPECIES, INCLUDING NATIVE, THREATENED, ENDANGERED, AND SPECIAL STATUS SPECIES, ARE MAINTAINED AT A LEVEL APPROPRIATE FOR THE SITE AND SPECIES INVOLVED.

As indicated by:

a) Frequency, diversity, density, age class, and productivity of desired native species necessary to ensure reproductive capability and survival.

b) Habitats connected at a level to enhance species survival.

c) Native species reoccupy habitat niches and voids caused by disturbances unless management objectives call for introduction or maintenance of nonnative species.

d) Habitats for threatened, endangered, and special status species managed to provide for recovery and move species toward de-listing.

e) Appropriate amount, type, and distribution of vegetation reflecting the presence of 1) the DPC, where identified in a land use plan conforming to these Standards, or 2) where the DPC is not identified, a community that sustains the desired level of productivity and properly functioning ecological processes.

Standard 4: BLM WILL APPLY AND COMPLY WITH WATER QUALITY STANDARDS ESTABLISHED BY THE STATE OF UTAH (R3172) AND THE FEDERAL CLEAN WATER AND SAFE DRINKING WATER ACTS. ACTIVITIES ON BLM LANDS WILL FULLY SUPPORT THE DESIGNATED BENEFICIAL USES DESCRIBED IN THE UTAH WATER QUALITY STANDARDS (R317.2) FOR SURFACE AND GROUNDWATER.

As indicated by:

a) Measurement of nutrient loads, total dissolved solids, chemical constituents, fecal coliform, water temperature and other water quality parameters.

b) Macro invertebrate communities that indicate water quality meets aquatic objectives.

UTAH BLM's GUIDELINES FOR GRAZING MANAGEMENT

1. Grazing management practices will be implemented that:

a) Maintain sufficient residual vegetation and litter on both upland and riparian sites to protect the soil from wind and water erosion and support ecological functions;

b) Promote attainment or maintenance of proper functioning condition riparian/wetland areas, appropriate stream channel morphology, desired soil permeability and infiltration and appropriate soil conditions and kinds and amounts of plants and animals to support the hydrologic cycle, nutrient cycle, an energy flow;

c) Meet the physiological requirements of desired plants and facilitate reproduction and maintenance of desired plants to the extent natural conditions allow;

d) Maintain viable and diverse populations of plants and animals appropriate for the site;

e) Provide or improve, within the limits of site potentials, habitat for Threatened or Endangered Species;

f) Avoid grazing management conflicts with other species that have the potential of becoming protected or special status species;

g) Encourage innovation, experimentation and the ultimate development of alternatives to improve rangeland management practices; and

h) Give priority to rangeland improvement projects and land treatments that offer the best opportunity for achieving the Standards.

2. Any spring and seep developments will be designed and constructed to protect ecological process and functions and improve livestock, wild horse, and wildlife distribution.

3. New rangeland projects for grazing will be constructed in a manner consistent with the Standards. Considering economic circumstances and site limitations, existing rangeland projects and facilities that conflict with the achievement or maintenance of the Standards will be relocated and/or modified.

4. Livestock salt blocks and other nutritional supplements will be located away from riparian/wetland areas or other permanently located, or other natural water sources. It is recommended that the locations of these supplements will be moved every year.

5. The use and perpetuation of native species will be emphasized. However, when restoring or rehabilitating disturbed or degraded rangelands nonintrusive, nonnative plant species are appropriate for use where native species (a) are not available, (c) are not economically feasible, (c) can not achieve ecological objectives as well as nonnative species, and/or (d) can not compete with already establish nonnative species.

6. When rangeland manipulations are necessary, the best management practices, including

biological processes, fire and intensive grazing, will be utilized prior to the use of chemical or mechanical manipulations.

7. When establishing grazing practices and rangeland improvement, the quality of the outdoor recreation experience is to be considered. Aesthetic and scenic values, water, campsites and opportunities for solitude are among those considerations.

8. Feeding of hay and other harvested forage (which does not refer to miscellaneous salt, protein, and other supplements), for the purpose of substituting for inadequate natural forage will not be conducted on BLM lands other than in (a) emergency situations where no other resource exists and animal survival is in jeopardy, or (b) situations where the Authorized Officer determines such a practice will assist in meeting a Standard or attaining a management objective.

9. In order to eliminate, minimize, or limit the spread of noxious weeds, (a) only hay cubes, hay pellets, or certified weed-free hay will be fed on BLM lands, and (b) reasonable adjustments in grazing methods, methods of transport, and animal husbandry practices will be applied.

10. To avoid contamination of water sources and inadvertent damage to non-target species, aerial application of pesticides will not be allowed within 100 feet of a riparian/wetland area unless the product is registered for such use by EPA.

11. On rangelands where a Standard is not being met, and conditions are moving toward meeting the Standard, grazing may be allowed to continue. On lands where a Standard is not being met, conditions are not improving toward meeting the Standard or other management objectives, and livestock grazing is deemed responsible, administrative action with regard to livestock will be taken by the Authorized Officer pursuant to CFR 4180.2(c).

12. Where it can be determined that more than one kind of grazing animal is responsible for failure to achieve a Standard, and adjustments in management are required, those adjustments will be made to each kind of animal, based on interagency cooperation as needed, in proportion to their degree of responsibility.

13. Rangelands that have been burned, reseeded or otherwise treated to alter vegetative composition will be closed to livestock grazing as follows: (1) burned rangelands, whether by wildfire or prescribed burning, will be ungrazed for a minimum of one complete grazing season following the burn; (2) rangelands that have been reseeded or otherwise chemically or mechanically treated will be ungrazed for a minimum of two complete growing seasons following treatment.

14. Conversions in kind of livestock (such as from sheep to cattle) will be analyzed in light of Rangeland Health Standards. Where such conversions are not adverse to achieving a Standard, or they are not in conflict with BLM land use plans, the conversion will be allowed.

IV. DESCRIPTION OF THE SEVEN ALLOTMENTS

The 7 allotments are the Cottonwood, Death Hollow, Lower Cattle, Mollies Nipple, School Section, Soda and Vermillion allotments.

A. Cottonwood Allotment:

The Cottonwood allotment is located in Kane County, Utah at about 4,900 to 6,500 feet elevation. There are approximately 103,906 acres in the allotment with 27 potential sample sites. Eight (8) springs or lentic sites were assessed by us comprising about 4.9 total acres. There are approximately 42.31 miles of 17 reaches comprising 7 streams or lotic sites. Two sites, LO0007 and LE0017 were not riparian areas. Five sites had no previous BLM data and were not identified in BLM's official records. The uplands are predominately sagebrush, pinion juniper sites and seedings.

In 2006 the BLM determined that the riparian and water quality standards were not being met as some reaches and springs were FAR or NF (reference Table 1 for details on site specific BLM assessments). The 2006 determination noted that TDS and phosphorous were exceeding standards in the Paria and TDS for Lower Coyote but not due to grazing. The determination concluded,

> " It was determined that Standard # 4, water quality, is not being met due to natural background geologic and physiographic conditions unrelated to livestock grazing or other public land uses."

The BLM determined that the uplands were meeting standard.

B. Death Hollow Allotment:

The Death Hollow allotment is in Garfield County, Utah at about 5,400 to 6,200 feet elevation. There are 19,492 acres comprising the allotment and three (3) potential sample sites. Two (2) springs or lentic sites were assessed by us comprising about 700 square feet or .016 total acres. One site LE0517 or Chokum seep was not and likely never was riparian.

In 2006 the BLM determined that the riparian standard was not being met for these springs. Two springs were assessed at FAR with downward trend and one as Unknown. The determination indicated that existing livestock grazing management was a factor. Based on this, the BLM identified the entire allotment as not meeting standard.

The BLM determined that the uplands were meeting standard.

C. Lower Cattle Allotment

The Lower Cattle allotment is in Kane and Garfield Counties, Utah at about 4,800 to 5,500 feet elevation. There are 81,966 acres comprising the allotment with 11 potential BLM sample sites. Two (2) seeps or lentic sites were assessed by us comprising about .033 total acres. We re-

assessed approximately 1 mile of reach LO0006 comprising 1 stream or lotic site definitively within the Lower Cattle Allotment. Due to sketchy BLM records available to us, this allotment was challenging to re-assess.

In 2006 the BLM determined that the riparian standard was not being met for three springs LE0528, 0545 and 0546 and 6 lotic reaches. There was no original data available to us in BLM's records for lotic sites LO0004, 0005, 0027, 0028 or 0046. As such, we were not able to locate the sites on the ground with any degree of accuracy so we did not resample them in 2013.

However, based on fence lines and estimated locations with the rancher, there is some question as to whether the lotic sites LO0004, 0005, 0027 or 0028 are in the Lower Cattle allotment.

Lotic site LO0074, Scorpion Gulch, and lentic 25 Mile Corral Spring were assessed PFC by BLM and meeting standards so we did not re-assess them. It should be noted that the 25 Mile Corral Spring may not be in the Lower Cattle allotment according to our discussions with the rancher.

In summary, the BLM in 2006 determined that rangeland health standards

> " are not being met for standards #2 (riparian and wetland areas) and #3 (desired species)."

So, based on this the standards are not being met for upland vegetation and riparian only.

D. Mollies Nipple Allotment

The Mollies Nipple allotment is in Kane County, Utah at about 4,800 to 6,400 feet elevation. There are 103,724 acres comprising the allotment and eight (8) potential sample sites. Eight (8) springs or lentic sites were assessed by us comprising about 1.53 total acres.

In 2006 the BLM determined that the riparian standard was not being met for any of these springs. The BLM determination states,

> " Standards are not being met for #1 (upland soils), #2 (riparian and wetland areas), and #3 (desired species)."

The determination indicated that existing livestock grazing management was a factor.

E. School Section Allotment

School Section allotment is in Kane County at about 5,500 feet elevation. There are approximately 773 acres comprising the allotment. There are no riparian lentic or lotic areas on the allotment.

In 2006 the BLM determined that Standard number 3 for desired species was not being met for site number 254 due to a lack of species diversity and exotic species dominating the seeding. The BLM determined that this was due to existing grazing.

F. Soda Allotment

The Soda allotment is in Kane County, Utah at about 3,900 to 6,800 feet elevation. There are 69,773 acres comprising the allotment and sixteen (16) potential sample sites. Five (5) springs or lentic sites were assessed by us comprising about .14 total acres. The five (5) lotic sites, LO0213, 0215, 0069, 0070 and 0508 were at PFC in the 2006 Determination so we did not ground visit them. We did fly over them and photographed them from the air. Of the remaining six (6) un-sampled lentics BLM assessments they were: LE0530 was PFC in 2007, LE0531 was PFC in 2010, LE1513 was PFC in 2007, LE1700 was PFC in 2002, LE1704 (Cave Spring) was PFC in 2002 and the 2006 Determination and LE0533 was not assessed by the BLM as there was question as to it being riparian. We had no information from BLM that would assist us in locating LE0533 so we could not visit it. We determined later that the BLM had reassessed LE1704 in 2007 at FAR trend not apparent but it was too late for us to re-assess it then.

In 2006 the BLM determined that the riparian standard was not being met for any of the five (5) springs we re-assessed on 2013. The BLM determination states,

> "Standards and Guidelines for Rangeland Health are not being met for standards: #1 (upland soils) and #2 (riparian and wetland areas) "

The determination indicated that existing livestock grazing management was a factor.

G. Vermillion Allotment

Vermillion allotment and is in Kane County at about 5,400 to 5,800 feet elevation. There are approximately 44,586 acres comprising the allotment. There are five (5) riparian areas, Brown spring, Cole spring, Fin Little spring, Nephi spring and Sand Spring. All are lentic riparian areas. Five (5) springs or lentic sites were assessed by us comprising about 2.72 total acres.

In 2006 the BLM determined that the riparian standard was not being met for all of these springs. The BLM also determined that water quality for Nephi spring was not meeting standard. The BLM determination states,

> " Rangeland Health are not being met for any of the four standards (#1 upland soils, #2 riparian and wetland areas, #3 desired species, and #4 water quality).

The BLM found that 10 out of 34 upland sites were not meeting standard.

V. RIPARIAN HEALTH ASSESSMENT and WATER QUALITY 2012 and 2013 RESULTS

From June 20 to August 29, 2013 riparian proper functioning condition assessments were made on all riparian areas of record within the Cottonwood, Death Hollow, Lower Cattle, Mollies Nipple and Soda allotments. From July 20 to August 13, 2012 riparian and uplands were visited on the School Section and Vermillion grazing allotments (parts of the Vermillion allotment were re-visited in 2013 to document site stability after fairly large flash flood events). All of these 7 allotments are located in the Grand Staircase Escalante National Monument (GSENM) (reference Figure 1) and the field work was completed by Stager and Owens in 2012 and 2013 with some assistance from Curtis in 2013. Others involved in some of the field assessments were Shane Green, NRCS State Office, Utah; Brian Bremner, Garfield County Engineer; and Drew Parkin, Escalante, Utah resident. These 7 allotments are a part of a group of allotments that the BLM monument management in their 2006 preliminary determinations indicated were not meeting 1 or more of Utah's Rangeland Health Standards. As such, the BLM determined that these allotments may require changes in grazing management after determining that grazing was at least one of the causes for not meeting standard(s). Photographs were taken of each riparian area both lentic and lotic and selected upland rangeland health sites. Then our results were summarized and compared to the rationale used by the BLM in their 2006 preliminary determinations where the BLM in 2006 concluded they were not meeting standard.

We used the same methods for determining riparian PFC that the BLM employed in their efforts. These methods are identified in TR 1737-16 1999 "A User Guide to Assessing Proper Functioning Condition an the Supporting Science for Lentic Areas" and TR 1737-15 1998 "A User Guide to Assessing Proper Functioning Condition and the Supporting Science for Lotic Areas". Additionally, we age classed numerous trees and shrub species to better predict and bracket the timeframes that the changes occurred from the BLM's earlier PFC assessments. Many of these changes appear to be a result of good management practices implemented by the BLM and ranchers in the past 5 to 8 years. We noted numerous exclosures around spring sources that have been built facilitating many of the improved resource conditions since 2000.

The following Table 1 is summarizes the data we collected in both 2012 and 2013 for 7 allotments within the GSENM and compares the results with the various years of BLM riparian assessments. Note that where we found no evidence that the stream flows in a drainage were 30 continuous days or more in a year, we considered those areas to be ephemeral, a wash or a dry valley bottom and did not assess riparian characteristics because these types of sites do not support riparian vegetation or characteristics such as hydric soils.

Table 1
RIPARIAN ASSESSMENT RESULTS Garfield and Kane COUNTIES & BLM's
October 31, 2013 Updated December 4, 2013, December 21, 2013, January 5, 2013

Allotment	Riparian Area (82 Total Assessed)	Lotic or Lentic Size in Miles or Acres	Date of Counties Data	Site Developed Y or N BLM or Rancher Good Management To Date	Counties Management Recommendation Or Comments	Discussion on Results	Assessment If Less than PFC Due to Current Grazing Y or N	Counties Assessment And Trend 2012 or 2013	BLM Assessment And Trend Used for 2006 Determination	More Recent BLM Assessment And Trend	BLM Determination
1. Cottonwood	27 Sample sites										

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1.	Butler Valley Seeps	Lotic LO0206 .2 acres Assessed as a lentic.	2013	Y No water in trough.	This is likely a lentic stringer or long relatively narrow meadow on a drainage bottom with some seasonal and/or diurnal overland flow w/o channel formation. We did not see any indication that water flow is for 30 continuous days so not likely lotic. Water source fenced.		N No measurable utilization on grass species in area.	NF Naturally drying up due to drought conditions may be temporary	2003 PFC		2006 Determination Assessed it: PFC
2.	Cottonwood MH Spr. (Main header spring)	Lentic No BLM Data 1 acre	2013	N Livestock use in Cottonwood Ck area is reduced duration due to BLM management changes	Primary water source for Cottonwood Ck 20 to 40 gallons per minute			PFC			
3.	Cottonwood MH Stream (Main header)	Lotic No BLM Data .25 miles	2013	Livestock use in Cottonwood Ck area is reduced duration due to BLM management changes				PFC			
4.	Cottonwood Spr.	Lentic LE0501 number not clear **2** to **3** acres	2013	N Livestock use in Cottonwood Ck area is reduced duration due to BLM management changes	4 spring source noted			PFC	We had no BLM data sheets	2006 Determination Assessed it: FAR Downward	2006 Determination Assessed it: FAR Downward
5.	Cottonwood Wash	LO0007 Located above LO0008 this is a wash or dry valley bottom site not riparian & should not be assessed		Livestock use in Cottonwood Ck area is reduced duration due to BLM management changes	We did not have the BLM data until field work was done and the site is not on any BLM map we have. We did not collect data here. We did traverse the wash above LO0008 and determined it to be a wash or dry valley bottom on entire reach. Not Riparian.			Not Riparian		2007 FAR Upward	2006 Determination Assessed it: FAR Downward
6.	Cottonwood Wash Reach 1 Goulding Corral to Pump Cny	Lotic LO0008 1.4 miles	2013	Livestock use in Cottonwood Ck area is reduced duration due to BLM management changes	75% is a Wash or dry valley bottom 25% is Intermittent or Seasonal Riparian only assessed riparian		Note that for entire Cottonwood length road encroachment is identified by BLM We found the road to be minimal impact to sinuosity	PFC	2001 FAR Downward	2007 FAR Upward	2006 Determination Assessed it: FAR Downward

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7.	Cottonwood Wash Reach 2 Pump Cny To Cottonwood MH Spr. & Cottonwood LE0501	Lotic LO0009 1.8 miles	2013	Livestock use in Cottonwood Ck area is reduced duration due to BLM management changes	25% is a Wash or dry valley bottom 75% is Intermittent or Seasonal Riparian We only assessed riparian			PFC	2001 PFC		2006 Determination Assessed it: PFC
8.	Cottonwood Wash Reach 3 Cottonwood MH Spr. & Cottonwood LE0501 to To No Flow but Green	Lotic LO0010 2.2 miles	2013	Livestock use in Cottonwood Ck area is reduced due to BLM management changes duration				PFC	2001 FAR Not Apparent		2006 Determination Assessed it: FAR Not Apparent
9.	Cottonwood Wash Reach 4 SENE Sec 27 No Flow To NENW Sec 34	Lotic LO0011 1.25 miles	2013	Livestock use in Cottonwood Ck area is reduced duration due to BLM management changes				PFC	2001 NF Downward		2006 Determination Assessed it: NF
10.	Cottonwood Wash Reach 5 Sec 34 to Hackberry Wash	LO0012 3.25 miles	2013	Livestock use in Cottonwood Ck area is reduced duration due to BLM management changes	60% is Wash or dry valley bottom 40% is Intermittent or Seasonal Riparian Only assessed riparian			PFC	2001 FAR Downward	2007 FAR Upward	2006 Determination Assessed it: FAR Downward
11.	Cottonwood Wash Reach 6 Hackberry to Mouth at Paria	LO0014 3 miles	2013	Livestock use in Cottonwood Ck area is reduced duration due to BLM management changes	67% is Wash or dry valley bottom 33% is Intermittent or Seasonal Riparian Only assessed riparian			PFC	2001 FAR Upward		2006 Determination Assessed it: FAR Upward
12.	Cove Retention Dam	LE0017	2013		We did not assess this site as it is not a riparian area. It is only a flood retention dam and seldom holds water			Not Riparian		2007 BLM determined it to not be riparian	2006 Determination Assessed it: NF
13.	Goulding Corral Seep	Lentic No BLM Data .04 acres	2013	Livestock use in Cottonwood Ck area is reduced duration due to BLM management changes				PFC			
14.	Hog Eye Creek	Lotic LO0186 2 miles	2013	Livestock use in Paria River area is a reduced duration due to BLM management changes	Very heavily wooded area very stable			PFC	2001 PFC		2006 Determination Assessed it: PFC

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15.	Kitchen Canyon	Lotic LO0187 2.25 miles	2013	Livestock use in Paria River area is a reduced duration due to BLM management changes No measurable use on adjacent uplands	Sediment is from private land. May consider NRCS project on private to repair dikes on private to trap water and sediment. Good range & wildlife habitat effect.		N High sediment from sandy and sandy loam soils in Mollies Nipple Allotment private land not BLM	FAR Not Apparent	2001 FAR Not Apparent		2006 Determination Assessed it: FAR Not Apparent
16.	Lower Coyote Spr. Reach	Lentic LE0050 .25 miles We assessed as a Lotic	2013	Y	The water source or reach was not noted in BLM data. This is a lotic with defined channel not a lentic. We assessed as lotic.		N	FAR Upward	2001 NF	2007 PFC	2006 Determination Assessed it: NF
17 .	Owl Cave Seep	Lentic No BLM Data .01 acre	2013	N Livestock use in Cottonwood Ck area is reduced duration due to BLM management changes	Mating pair of Long Eared owl documented.			PFC			
18.	Paria River Reach 1 Deer Ck to .5 mile south of Snake Ck	Lotic LO0019 2.8 miles	2013	Livestock use in Paria River area is a reduced duration due to BLM management changes			N No evidence of measureable utilization on bench grasses or riparian grass likes or willows	PFC Laminar flow	2001 FAR Downward		2006 Determination Assessed it: FAR Downward
19.	Paria River Reach 2 .5 mile South of Snake Ck to Kitchen Canyon	Lotic LO0020 4.5 miles	2013	Livestock use in Paria River area is a reduced duration due to BLM management changes	Based on willow age class and vegetation/stable conditions, some management change in past 7 years has been implemented by BLM.		N No evidence of measurable utilization on bench grasses or riparian grass likes or willows	40% PFC 60% FAR Upward	2001 FAR Not Apparent		2006 Determination Assessed it: FAR Not Apparent
20.	Paria River Reach 3 Kitchen Canyon to Just East of Calico Pk above Paria Town site	Lotic LO0021 4 miles	2013	Livestock use in Paria River area is a reduced duration due to BLM management changes	Historically a cottonwood gallery with willow. Historic mining & settlement removed trees for wood & firewood may take 1to 200 years to re-establish woodland. willow 1-7 years old.		N No evidence of measurable utilization on bench grasses or riparian grass likes or willows	FAR Upward	2001 FAR Upward		2006 Determination Assessed it: FAR Upward
21.	Paria River Reach 4 Just East of Calico Pk above Paria Town site to Paria Box	Lotic LO0119 1.8 miles	2013	Livestock use in Paria River area is a reduced duration due to BLM management changes	Historically a cottonwood gallery with willow historic mining & settlement removed trees for wood & firewood may take 1to 200 years to re-establish woodland. willow 1-7 years old.		N No evidence of measureable utilization on bench grasses or riparian grass likes or willows	FAR Upward	2001 NF	2007 NF	2006 Determination Assessed it: NF

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October 31, 2013 Updated December 4, 2013, December 21, 2013, January 5, 2013

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22.	Paria River Reach 5 Paria Box	Lotic LO0120 1 mile	2013	Livestock use in Paria River area is a reduced duration due to BLM management changes	This canyon acts as a bottleneck and high flows concentrate down it from frequent flash floods. As the Cottonwood gallery re-establishes in the reach above the box (may take 100 to 200 years) over time the trees may help slow water flow a little. With 2 yr flows of 2,480 cfs and 5 yr flows of 5,290 cfs, riparian vegetation is unlikely to persist in the canyon except in protected areas. It is naturally stabilized by the physical characteristics of the narrow canyon.		No evidence of measurable utilization on bench	PFC	2001 FAR Not Apparent	2007 FAR Upward	2006 Determination Assessed it: FAR Not Apparent
23.	Paria River Reach 6 From Paria Box to Rimrock south	Lotic LO00118 9.5 miles	2013	Livestock use in Paria River area is a reduced duration due to BLM management changes	Willows 1-7 years and cottonwood re-establishing. May Need to determine active channel or bank full.		N No evidence of utilization on bench grasses or riparian grass likes or willows	PFC	FAR Upward		2006 Determination Assessed it: FAR Upward
24.	Powerline Spring	Lentic No BLM Data .1 acre	2013	N Livestock use in Cottonwood Ck area is reduced duration due to BLM management changes				PFC			
25.	Pump Canyon Spring	Lentic LE0502 1.5 acres	2013	N Livestock use in Cottonwood Ck area is reduced duration due to BLM management changes	Spring source located in adjacent Rush Bed Allotment			PFC			2006 Determination Assessed it: PFC
26.	Round Valley Seeps	Lentic LE0018 .05 acre	2013	Y BLM Rancher Management appears to have changed due to age class of willows	The 2001 assessment failed to note the two drainages where the riparian communities are located			PFC	2001 NF	2007 PFC	2006 Determination Assessed it: NF
27.	Snake Creek	Lotic LO0178 1.06 miles (LO0179 is not in allotment)	2013	Livestock use in Paria River area is a reduced duration due to BLM management changes	Riparian stabilized by canyon walls, bedrock bottom and riparian vegetation.			PFC	2002 FAR Not Apparent		2006 Determination Assessed it: FAR Not Apparent
TOTALS	**Lentic**	**8 lentics 4.9 acres**	**Lotic**	**7 lotics 42.31 miles**							
II. Death Hollow	3 Sample sites										

Table 1
RIPARIAN ASSESSMENT RESULTS Garfield and Kane COUNTIES & BLM's
October 31, 2013 Updated December 4, 2013, December 21, 2013, January 5, 2013

Allotment	Riparian Area (82 Total Assessed)	Lotic or Lentic Size in Miles or Acres	Date of Counties Data	Site Developed Y or N BLM or Rancher Good Management To Date	Counties Management Recommendation Or Comments	Discussion on Results	Assessment If Less than PFC Due to Current Grazing Y or N	Counties Assessment And Trend 2012 or 2013	BLM Assessment And Trend Used for 2006 Determination	More Recent BLM Assessment And Trend	BLM Determination
1.	Barney MineSeep	Lentic LE0518 400 sq ft or .009 acres	2013	Y	Naturally drying up due to drought still hydric soil conditions. High vigor herbaceous species & increase in cottonwoods. no management change needed		N	FAR Upward	2002 FAR Downward		2006 Determination Assessed it: FAR Downward
2.	Chokum Seep	Lentic LE0517	2013	Y	Not a riparian area			Not riparian Not assessed	2002 Assessed "Unknown" No riparian vegetation expected		2006 Determination Assessed it: BLM rated it "Unknown"
3.	Wire Corral Spr.	Lentic LE0519 300 sq ft or .007 acres	2013	N	Remove salt cedar to reduce evapotranspiration levels from spring. Spring source in drainage east of road.			PFC	2002 FAR Downward		2006 Determination Assessed it: FAR Downward
TOTALS	**Lentic**	**2 lentics .016 acres**	**Lotics**	**0 lotics**							
III. Lower Cattle	3 sample sites										
1.	25 Mile Wash	Lotic LO0006 1 mile	2013		The tamarisk beetle has killed 90% or more of the tamarisk allowing for improved riparian and native cottonwood and willow establishment last 2 years. Winter use allotment management good. no measurable use on riparian, upland vegetation on adjacent benches and uplands.			PFC	2001 FAR Upward	2010 PFC	2006 Determination Assessed it: FAR Upward
2.	NW Little Red Rock Seep By fenced water trough seep from hanging garden	Lentic LE0546 70 sq ft or .002 acres	2013	Y	Hanging garden seep with Muhlenbergia asperfolia or Scratchgrass which is a warm season perennial rhizomatous grass, which grows in moist alkaline (high in salts) meadows			PFC	2002 FAR Downward	2010 PFC	2006 Determination Assessed it: FAR Downward
3.	Slot Canyon Red Rock Seep	Lentic LE0545 & LE0528 same site 1,350 sq ft or .03 acres	2013	Y	Recommend an approximately 20-30 foot fence at opening to exclude Access to slot.			PFC	2002 FAR Downward	2010 PFC	2006 Determination Assessed it: FAR Downward
4.	SE Little Red Rock	Not Assessed also appears to be lumped in LE0528 at one time by BLM	2013	N	Recommend an approximately 20-30 foot fence to exclude Access. Not enough reliable seep water to support riparian vegetation or hydric soil conditions			Not Riparian. Not assessed	2002 FAR Downward		2006 Determination Assessed it: FAR Downward
TOTALS	**Lentic**	**2 lentics .032 acres**	**Lotic**	**1 lotic 1 mile**	25 Mile spring does not appear to be in the allotment						

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RIPARIAN ASSESSMENT RESULTS Garfield and Kane COUNTIES & BLM's
October 31, 2013 Updated December 4, 2013, December 21, 2013, January 5, 2013

Allotment	Riparian Area (82 Total Assessed)	Lotic or Lentic Size in Miles or Acres	Date of Counties Data	Site Developed Y or N BLM or Rancher Good Management To Date	Counties Management Recommendation Or Comments	Discussion on Results	Assessment If Less than PFC Due to Current Grazing Y or N	Counties Assessment And Trend 2012 or 2013	BLM Assessment And Trend Used for 2006 Determination	More Recent BLM Assessment And Trend	BLM Determination
IV. Mollies Nipple	8 sample sites										
1.	Box Elder Canyon	Lentic LE0009 1.2 acres	2013	N	Recommend some additional change in Season of use, duration, deferment or rest. This area has really improved from 2000 photos comparison but use on willows & trees fairly high.			PFC	2000 FAR Not apparent	2010 FAR Upward	2006 Determination Assessed it: FAR Not apparent
2.	Kitchen Corral Spr.	Lentic LE0010 .01 acres	2013	Y	Construct drift fence Below to exclude Access; repair/maintain Pipe & header box		Y	FAR Upward	2001 FAR Downward	2007 PFC	2006 Determination Assessed it: FAR Downward
3.	North Kitchen Corral Spr.	Lentic LE0011 .01 acres	2013	Y	Short drift fence below Riparian to restrict access.			PFC	2001 NF	2007 FAR Not apparent	2006 Determination Assessed it: NF
4.	Mine Spr. NE	Lentic LE0013 .2 acres	2013	N	Some change in Season of use, duration, deferment or rest Not clear that this area even has a spring source but may be a collection area to perch runoff water from 3 drainages Tamarisk stand recently dead in area allowing more water for native riparian species.		Y	FAR Not Apparent	2001 NF	2010 FAR Not apparent	2006 Determination Assessed it: NF
5.	Mine Spr. SW or Jenny Clay Hole Spr.	Lentic LE0007 300 sq ft or .007 acres	2013	N BLM has placed management structures to reduce head cuts and erosion in adjacent channel	There are two low producing seeps in the area that appear to naturally dry up most years in summer and fall		N	FAR Upward	2000 FAR Downward	2010 NF 2013 FAR upward	2006 Determination Assessed it: FAR Downward
6.	Rock House Spr.	Lentic LE0012 200 sq ft Or .005 acres	2013	Y	Recommend an Exclosure fence at source. Low producing spring.		Y	FAR Not Apparent	2001 FAR Downward	2007 PFC	2006 Determination Assessed it: FAR Downward
7.	Wildcat Spr.	Lentic LE0008 .1 acre	2013	Y	BLM has installed an exclosure and channel structures. This management has improved conditions		N	FAR Upward	2001 FAR Downward	2013 PFC	2006 Determination Assessed it: FAR Downward
8.	Wire Pass Buckskin Seep	Lentic LE2000 80 sq ft or .002 acres	2013	N	May want to exclude use in the area not much water or reliable feed		Y	NF	2004 FAR Downward		2006 Determination Assessed it: FAR Downward
TOTALS	**Lentic**	**8 lentics 1.534 acres**	**Lotic**	**0 Lotics**							
V. School Section											

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RIPARIAN ASSESSMENT RESULTS Garfield and Kane COUNTIES & BLM's
October 31, 2013 Updated December 4, 2013, December 21, 2013, January 5, 2013

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	No Riparian		2012		Upland site #254 Basin Big Sage bottom community. Recommend Vegetation Manipulation, Herbicide, seeding etc. to improve & management to move livestock when 50% use is reached on upland key species on site #255 where seeded & native species present		N Rangeland health a result of historic plowing, seeding & disturbance also very close to water trough source.				
TOTALS	**NO Riparian**										
VI. Soda	5 sample sites										
1.	40 Mile Spr.	Lentic LE0529 .1 acre	2013	Y	BLM recently installed new exclosure at spring source for management action.		N	FAR Not apparent	2002 FAR Downward	2007 FAR Not apparent 2010 FAR Not apparent	2006 Determination Assessed it: FAR Downward
2.	50 Mile Spr.	Lentic LE0533 .01 acre	2013	Y	Recommend a new about 2 acre Exclosure at spring source. water is already piped to two troughs		Y	NF	2002 NF	2007 NF 2010 FAR Upward	2006 Determination Assessed it: NF
3.	Cottonwood Spr.	LE1514 .01 acre	2013	Y	BLM has constructed an exclosure in 2011 as management action at spring source improving conditions. water piped to trough outside exclosure			PFC	2002 FAR Downward	2007 FAR Downward	2006 Determination Assessed it: FAR Downward
4.	Pole Well Spr.	Lentic LE1515 .01 acre	2013	Y	Repair exclosure, Maintain ponds, Maintain pipe & trough		Y	NF	2002 FAR Downward	2007 FAR Not apparent	2006 Determination Assessed it: FAR Downward
5.	Soda Seep	Lentic LE0532 .01 acre	2013	Y	Recommend repair exclosure at header box and new small exclosure below road. Water brackish high in salts.			FAR Downward	2002 FAR Downward	2007 NF 2010 FAR Downward	2006 Determination Assessed it: FAR Downward
TOTALS	**Lentic**	**5 lentics .14 acres**	**Lotic**	**0 lotics**	**We did not re-read 6 potential lentic sites as they were assessed at PFC in 2002, 2007 or 2010 by BLM. We did not re-read 5 lotic sites as they were assessed at PFC by the BLM. See Section IV narrative.**						
VII. Vermillion	5 sample sites										2006 Determination Assessed it:
1.	Brown Spr.	Lentic LE0004 .31 acres	2012 & 2013	Y	We recommended & discovered that BLM has scheduled new exclosure around spring source as management action.			PFC	2000 FAR Not apparent	2013 PFC	2006 Determination Assessed it: FAR Not Apparent
2.	Cole Spr.	Lentic LE0002 .21 acres	2012 & 2013	Y	BLM installed exclosure and structures for management. Good management action.			PFC	2000 NF	2013 PFC	2006 Determination Assessed it: NF
3.	Finn Little Spr. .2 acres	Lentic LE0006 .2 acres	2012 & 2013	Y	Recommend that site may benefit from exclosure at source			PFC	2000 NF	2007 FAR Upward	2006 Determination Assessed it: NF

Table 1 RIPARIAN ASSESSMENT RESULTS Garfield and Kane COUNTIES & BLM's October 31, 2013 Updated December 4, 2013, December 21, 2013, January 5, 2013											
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4.	Nephi Spr.	Lentic LE0003 .75 acres	2012 & 2013	Y	Recent BLM management action installed exclosure improving conditions. Storms in 2013 blew out fence and filled trough with sediment informed BLM scheduling repairs			PFC	2000 NF	2013 FAR Upward	2006 Determination Assessed it: NF
5.	Sand Spr.	Lentic LE0001 1.25 acres	2012 & 2013	Y	BLM management action installed exclosure and structures improving conditions.			PFC	2000 FAR Downward	2013 PFC	2006 Determination Assessed it: FAR Downward
TOTALS	**Lentic**	**5 lentics 2.72 acres**	**Lotic**	**0 lotics**							
SEVEN (7) Allotment TOTALS	**Lentic**	**30 lentics 9.342 acres**	**Lotic**	**8 lotics 43.31 miles**							

Allotments and their associated riparian sites are listed alphabetically in this narrative as they are in Table 1.

A. Cottonwood Allotment Results for Riparian Assessments and Uplands

Riparian 27 Sample Sites.

1. Butler Valley Seeps LO0206. This spring is a developed spring. The total size is approximately .2 acres. The elevation is 6,300 feet. This site was assessed on July 17, 2013.

Our findings for Butler Valley Seeps (refer to Figure 3) write up number LO0206 in 2013 is that it is Non Functional (NF) due to its aquifer source naturally drying up from a lowering in the water table reducing water available at the spring head or surface. This is due to natural fluctuations in climate and this is a dry period. Springs usually expand during wet periods and shrink during dry periods. There can also be a delay in the time it takes to recharge a particular aquifer of about 2 years for deeper aquifers. Consequently, a riparian area could be expanding during a drought following a series of good precipitation years or shrinking during above average years following a drought. Without detailed research, it is almost impossible to make an absolute conclusion on what is actually happening. We assessed it as NF based on current conditions but it really may be just going through a natural dynamic cycle and as such this could be considered FAR. Willow and rush species were dead or dying throughout the .2 acre site. It is not due to grazing or dewatering. There was no measurable utilization on willow or other riparian species nor on any of the adjacent upland site palatable species (Refer to Figure 4). The water troughs were dry and no water was coming out of the pipe from the spring source. The spring source is fenced with an exclosure.

The BLM had originally classified this site as a lotic. However, we did not see any evidence of a historic water channel or of 30 continuous days of surface flow. After a detailed survey of the site we determined that it is located in a drainage that may have surface flow during events or in peak outflow times from the spring itself (Refer to Figure 6). This would allow for some surface flow without channel or stream bed development that can occur on many meadows in sloped drainage bottoms. As a result, we assessed this site as a lentic or meadow site not a lotic or stream site.

Willow age class was from 1 to 13 years but most of the plants were dead or dying (refer to Figure 5).

Figure 3 Butler Valley Seep fenced spring source.

Figure 4 Adjacent to Seep showing no measurable use

Figure 5 Dead & dying Coyote Willow

Figure 6 Meadow bottom with salt grass & some rushes

Figure 7 Butler Valley Seeps terrain placement.

Figure 8 Area around the dry ring tank

The BLM assessed this site as PFC in 2003 so the naturally reduced aquifer appears to have occurred sometime in the past 10 years.

2. Cottonwood MH Spring. This spring or lentic is not developed. The total size is approximately 1 acre. The elevation is 5,250 feet. This site was assessed on June 23, 2013.

Our findings on Cottonwood MH Spring (Refer to Figures 9 and 10) are that it is at PFC. This spring does not have any previous BLM data or assessments completed for it. This site is the primary or main header for all the springs feeding into Cottonwood Creek in this location. The group of springs supplying most of the water that creates the portion of Cottonwood Creek with a perennial flow (for the lower small part of Cottonwood Reach LO0009 and most of Reach LO0010) includes MH Spring, a smaller drainage and spring adjacent to MH Spring (assessed with MH Spring), a complex of 4 lesser spring sources (Cottonwood Springs LE0501) about .4 miles south of MH Spring at a public campground and Powerline Spring (no previous BLM data or assessments) (Refer to Figure 11). Powerline Spring is a minor spring source of those listed. All of these springs will be addressed later in this report in alphabetical order.

As noted above, the actual small part of Cottonwood Creek with a reliable perennial flow relies on these water sources of which MH Spring is the primary spring. MH Spring originates upward on the slope on the west side of the canyon and is flowing at a rate in excess of an estimated 20 to 40 gallons per minute. The willows present are from 1 to 20 years old (majority from 1-10 years) and cottonwoods from 1 to 50+ years old. The riparian species are vigorous and dense with carex spp.(sedges), juncus spp. (rushes), equisetum spp. (horsetail), two willow species Yellow willow (Salix lutea) and Coyote Willow (Salix exigua), Scirpus spp. (bullrush), Typha spp. (cattail) etc. The area above and around this spring had a major localized storm event shortly before we surveyed it and it was already recovering and stabilizing. It is in very good condition due to good management by the BLM and the rancher.

Figure 9. Cottonwood MH Spring

Figure 10. Closer aspect photo of MH Spring source

Figure 11. Satellite Imagery of Cottonwood MH Spring in relation to Cottonwood Creek & other springs.

While the BLM did not assess this site in the past, the fact that the site is at PFC and considering the age class of the willows, some management change appears to have occurred within the past 5 to 7 or 8 years. The BLM and the rancher are doing a good job managing this area.

3. Cottonwood MH Stream. This lotic site receives its water from MH Spring. The length of the reach is approximately .25 miles. The elevation ranges from 5,120 to 5,250 feet. The elevation changes 130 feet over a distance of 1,320 feet. The slope was measured from 3 to 6 percent in different locations on the reach. The average calculated slope is 9.8 percent which shows that the spring is located on a steep slope. The reach was assessed on June 22 and 23, 2013.

Our findings for Cottonwood MH Stream are that it is at PFC. This stream does not have any previous BLM data or assessments completed for it. Figure 11 shows the placement of this stream and its two forks in relation their flow into Cottonwood Creek. The area above and around this spring and associated stream had a major localized storm event a short time before it was surveyed. It was already recovering and stabilizing as was Cottonwood Creek. Figures 12 and 13 depict the large boulders that came down MH Stream and deposited in Cottonwood Creek and the recovery and vegetative stabilization of Cottonwood Creek after the recent event. The stream channel has historically cut into the hillside to a depth reducing the stream bed slope and energy of the flowing water. That historic down cutting and the existing vegetation provide a stable riparian channel.

Figure 12. Boulders washed down from MH Stream Into Cottonwood Creek.

Figure 13. Looking down Cottonwood Ck from boulders showing Cottonwood Ck stability & recovery.

Figures 14 and 15 show the stable and recovered condition of MH Stream at its lower end. The riparian species are vigorous and dense with carex spp., Juncus spp., equisetum spp., two willow species Yellow willow (Salix lutea) and Coyote Willow (Salix exigua), Scirpus spp., Typha spp. etc. and the soils were saturated. The Juncus spp. and Scirpus spp. were from 24 to 30 inches tall and the willows from 6 to 15 feet tall and 1 to 10 years old. It is in very good condition due to good management by the BLM and the rancher.

Figure 14. Stabilized MH Stream.

Figure 15. Vigorous riparian vegetation MH Steam

While the BLM did not assess this site in the past, the fact that the site is at PFC and considering the age class of the willows, some management change appears to have occurred within the past 5 to 7 or 8 years. The BLM and the rancher are doing a good job managing this area.

4. Cottonwood Spring LE0501. This complex of 4 springs is not developed. The total size is approximately 2 to 3 acres for the 4 spring complex. The elevation is 5,120 feet. This site was assessed on June 22 and 23, 2013. The site is located by a historical camping site used by the publics for years.

Our findings for the Cottonwood Spring complex write up number LE0501 are that it is at PFC. The locations of the 4 spring sources are spaced out in different locations along this ¼ mile section of Cottonwood Creek from MH Spring to the camp ground area. The first spring source moving away from MH spring area is shown in Figure 16 and the second is depicted in Figures 17 and 18. Figure 18 shows visible soil deposits that have been trapped by the dense and stabilizing riparian vegetation community associated with the spring source along this section of Cottonwood Creek.

Figure 16. 1st spring source along Cottonwood Ck.

Figure 17. 2nd spring outlet showing dense willow that extends 10 to 30 + feet away from Cottonwood Ck.

Figure 18. 2nd spring source feeding Ck. Sediment

Figure 19. 3rd spring source with deep sediment trapping. Trapped by riparian vegetation.

Figure 20. 3rd spring source with dense vegetation.

Figure 21. 4th spring source outlet site into Cottonwood Creek showing sediment trapped by vegetation in the background.

Figures 19 and 20 show the 3rd spring source. Figure 19 shows the heavy sediment trapping as a result of a dense and stabilizing riparian community and Figure 20 shows the actual 3rd source where the individual in the photo background is standing with a dense and vigorous willow and rush spp., Eleocharis spp. (spikerush) and common three square or bullrush present. The ground was mushy and soggy making our trek into the spring source somewhat challenging. Figure 21 is the 4th spring sources actual outlet into Cottonwood Creek. Figure 22 shows the grass like species meadow and willow communities associated with the spring outlet that are adjacent to the narrow channeled Cottonwood Creek. On the far right of the Figure 22 the soils present are

AR0020214

trapped sediment on the alluvial floodplain associated with Cottonwood Creek and near the 4th spring source.

Figure 22. The 4th spring source as it feeds water into the Cottonwood Creek (stream in center of photo) with willow and grass like meadows. Note the narrow channeled Creek stabilized by dense riparian vegetation.

The riparian species are vigorous and dense with carex spp., juncus spp., equisetum spp., two willow species Yellow willow (Salix lutea) and Coyote Willow (Salix exigua), Scirpus spp., Eleocharis spp., Typha spp. etc. and the soils were saturated. Not surprisingly, the species make up is essentially the same as MH Spring and Stream. Both the willow species had age classes from 1 to 8 years indicating that a management change allowing the willow to prosper and expand may have occurred from 5 to 8 years ago. The willow are very dense and from 6 to 15 feet tall and the Sirpus spp. and Juncus spp. are thick allowing for stream channel narrowing in the adjacent Cottonwood Creek channel. The springs and this section of Cottonwood Creek are shaded by Cottonwoods and willows cooling the waters. From our observations of the alluvial deposits and vegetation trapped sediments the riparian area has measurably enlarged in recent times.

In the BLMs 2006 determination they identified this site as FAR with downward trend. The PFC assessment we assigned it and our finding shows that significant improvements have occurred in the last 5 to 8 years due to good management practices by the BLM and the rancher.

5. Cottonwood Wash Reach not numbered or LO0007. This is a dry valley bottom or wash not a riparian area. The total size is about 1.5 miles. The elevation ranges from about 5,320 to 5,480 feet. The average slope is about 2 percent. We did not identify any spring source associated with this reach, no riparian communities and no evidence of 30 continuous days of

water flow. The site gets periodic runoff from flash flood events. A few Cottonwood stands were present along the dry valley bottom or wash. Figure 23 shows a section of the wash from satellite imagery.

Figure 23. A section of Cottonwood Reach LO007 which is a non riparian dry valley bottom or wash.

We did not assess this site as it is not a riparian area.

The BLM assessed this site in 2001 and identified it in their 2006 determination as FAR with downward trend and in 2007 as FAR with upward trend. The BLM photos appear to be located within the northern part of reach LO0008 which begins just above Goulding Corral Seep. LO0007 should not have been assessed.

6. Cottonwood Creek (wash) Reach 1 or LO0008. This lotic is intermittent and may even be interrupted in expression. It extends from just above Goulding Corral seep to Pump Canyon Spring for about 1.4 miles. The elevation ranges from about 5,240 to 5,320. The average slope is about 1 percent. This site was assessed on June 22, 2013.

Our findings for Reach LO0008 assessed it as PFC. There is little to no perennial flow in this reach with the primary spring source being the very low producing Goulding Corral Seep. Most of the water supplied to this reach comes from runoff. Because the riparian vegetation was spotty and tended to come up periodically with no surface water noted we suggest that this may have interrupted characteristics. As such, the aquifer would periodically come closer to the surface allowing some hydric soil characteristics and a diminutive and spotty but still riparian communities in those areas along the reach. We determined that 25 percent of the reach was riparian and 75 percent was dry valley bottom or wash. This reach is not expected to ever be

densely vegetated as a riparian area since there is very little perennial or no reliable water sources to develop the conditions for it to occur. Figure 24 shows a section of dry valley bottom or wash with a cottonwood stand present but no riparian communities. Figure 25 shows a riparian section along the reach. When photographing this and other reaches with riparian and non riparian sections, we took more photos of the riparian portions since that is what we were going to assess.

Figure 24. LO0008 dry valley bottom or wash section.

Figure 25. LO0008 riparian section with Coyote Willow.

The Coyote willow ranged from 1 to 7 years old with periodic but rare patches of Baltic rush. Based on the debris captured by cottonwood trees, this channel receives up to 5 foot high flows of water during flash flood events. Figure 26 shows the amount of debris lodged against a cottonwood in the channel. We measured 12 to 24 inches of trapped sediment by digging next to cottonwood trees and willows on the floodplain. Figure 27 shows the deep sediment trapping on the floodplain.

Figure 26. Debris trapped by a cottonwood tree.

Figure 27. Deep sediment trapped by vegetation on Floodplain.

The BLM assessed this site as FAR with downward trend in 2001, restated this finding in their 2006 determination and then in 2007 assessed it at FAR with upward trend. The BLM did not break out the non-riparian dry valley bottom or wash sections from the riparian portions in their write ups. The change in assessment from 2001 to 2007 showed improvements occurring and our findings of PFC in 2013 are consistent with this. Some management change appears to have occurred in the past 5 to 7 or 8 years. The BLM and the rancher are doing a good job managing this area.

7. Cottonwood Creek Reach 2 or LO0009. This lotic is intermittent. It extends from Pump Canyon Spring to Cottonwood MH Spring for about 1.8 miles. The elevation ranges from about 5,120 to 5,240 feet. The average slope is about 1.3 percent. This site was assessed on June 23, 2013.

Our findings for Reach LO0009 assessed it at PFC. The riparian communities increase in vigor and density as we approached the MH Spring and stream location. We determined that 75 percent of the reach was riparian and 25 percent was dry valley bottom or wash. Figure 28 shows a section that was dry valley bottom or wash and Figure 29 (closer to MH Spring) shows a vigorous Coyote willow community along the Cottonwood Creek channel. This reach does not have a perennial flow but is intermittent with some spring and subsurface water augmented by runoff during storm events or spring thaw. It has more water influence than Reach LO0008 but still is fairly limited on water availability. This limits the degree of its riparian vegetation expression.

The alluvial floodplains show between 1 to 6 feet of deposition based upon how deep cottonwood tree trunks were buried. Willows were 1-7 years old.

Figure 28. Reach LO0009 dry valley bottom or wash.

Figure 29. Reach LO0009 Willow community.

The BLM assessed this site as PFC in 2001 and restated this finding in their 2006 determination. The BLM did not break out the non-riparian dry valley bottom or wash sections from the riparian portions in their write ups. Our findings of PFC in 2013 are consistent with this. The BLM and the rancher are doing a good job managing this area.

8. Cottonwood Creek Reach 3 or LO0010. This lotic has a perennial flow augmented by storm and thaw events. It extends from Cottonwood MH Spring with flowing Creek water to the non-flowing still riparian green portion of the reach for about 2.2 miles. The elevation ranges from about 5,040 to 5,120 feet. The average slope is about 0.69 percent or less than 1 percent. This is a fairly level section of the Cottonwood Creek. This site was assessed on June 23, 2013.

Our findings for Reach LO0010 assessed it as PFC. The riparian communities increase in vigor and density as we approached the MH Spring and stream and the Cottonwood 4 spring complex locations. All of this reach is riparian. The willow present was primarily Coyote willow except around the MH Spring and Cottonwood 4 spring complex where Yellow willow was present. Both the willow species had age classes from 1 to 8 years indicating that a management change allowing the willow to prosper and expand may have occurred from 5 to 8 years ago. Figure 30

shows a section (just north of MH Spring) with a vigorous Coyote willow community along the Cottonwood Creek channel at the start of this reach. Figure 31 is a picture located about in the middle of this reach showing a dense Coyote willow community lining both sides of the creek providing a stable riparian community.

Figure 30. LO0010 at the start of reach.

Figure 31. LO0010 in the middle of the reach.

Figure 32 shows the end of the reach with a highly mineralized soil on the left with little to no vegetation growing next to the Creek channel and Baltic rush on the right bank vigorous and growing back through sediment it trapped in an earlier flash flood event. The lack of vegetation growing next to soils that appear to be part of the highly mineralized shale and clayey Chinle or Wahweap formation derived soils will become more apparent in LO0011 or Reach 11. We identified the Woodhouse toad (Bufo woodhousei) as populating this reach of the Cottonwood Creek.

The BLM assessed this site as FAR with no apparent trend in 2001 and restated this finding in their 2006 determination. Our findings of PFC in 2013 indicate an improvement since 2001. Since the BLM record only has one photo for this reach we were not able to compare photo sites over time. This site is a highly functional and stable riparian community. Some management change appears to have occurred in the past 5 to 7 or 8 years based on the age class of the willows. The BLM and the rancher are doing a good job managing this area.

Figure 32. LO0010 end of reach with sediment trapped.

9. Cottonwood Creek Reach 4 or LO0011. This lotic is intermittent. It extends from the beginning of the non-flowing still riparian green portion of reach to T40 S R 1W NENW Section 34 for about 1.25 miles. The elevation ranges from about 5,000 to 5,040 feet. The average slope is about 0.61 percent or less than 1 percent. This is also a fairly level section of the Cottonwood Creek. This site was assessed on June 23, 2013.

Our findings for Reach LO0011 assessed it as PFC. The Coyote willow ranged from 1 to 8 years old. Scirpus spp., Eleocharis spp., Equisetum spp., Typha spp. and Juncus spp. comprised most of the grass like species stabilizing the Creeks banks. They were vigorous (16 to 20 inches tall) and displayed repeated examples of sediment trapping. There is one small area with a headcut where the channel narrowed and the slope increased noticeably from the rest of the reach. It was caused by a recent event but deposition and riparian vegetation had stabilized the site. Figure 33 shows the start of the reach. Figure 34 is about in the middle of the reach showing sediment trapping and deposition in the foreground of the photo. Figure 35 is at the end of the reach and also shows sediment trapping with vegetation growing back up out of the alluvium. The highly sinuous and low gradient characteristics of this reach would likely allow for fairly high sediment deposition once the water flows from events slowed down enough to release the alluvium.

The highly mineralized soil on the left bank in Figure 33 has little to no vegetation growing next to the Creek channel while Baltic rush and other species on the right bank are vigorous and growing back through sediment they trapped in an earlier flash flood event. The lack of vegetation growing next to soils that appear to be part of the highly mineralized shale of the Chinle or Wahweap formation is a recurring observation along this entire reach (and in other areas like the Paria River) wherever the Chinle or Wahweap formation derived soils touch the Cottonwood Creeks water bank. The Chinle Formation consists of highly erosive rounded hills

of soft gray to purple shale. These areas are high in naturally occurring salts, including gypsum and sodium, which generally limit use and management[21]. Vegetation growth in upland sites in areas influenced by this Chinle parent material is often minimal as most species can't tolerate the higher salts and pH of the soils. Whatever the soils or formation, riparian vegetation consistently does not grow wherever that soils touches the channel of the Cottonwood Creek.

Figure 33. LO0011 Start of reach.

Figure 34. LO0011 the middle of the reach.

Figure 35. LO0011 near the end of the reach.

In addition to storm or snow melt runoff events, this reach may have flowing water as the sun sets and the evapotranspiration demands of the vegetation are reduced in what would be a diurnal variation in water flow. We noticed this occurring as the sun dropped and finally set during our trek down the entire reach.

[21] United States Department of Agriculture, Natural Resources Conservation Service. 2012. Soil Survey of Little Colorado River, Arizona, Parts of Coconino and Navajo Counties. 278 pgs.

The BLM assessed this site as NF with downward trend in 2001 and restated this finding in their 2006 determination. Our findings of PFC in 2013 indicate an improvement since 2001. This site is a highly functional and stable riparian community. Some management change appears to have occurred in the past 5 to 7 or 8 years based on the age class of the willows. The BLM and the rancher are doing a good job managing this area.

10. Cottonwood Creek Reach 5 or LO0012. This lotic is intermittent. It extends downward from T40S R1W NENW Secton 34 to Hackberry Wash or Canyon for about 3.25 miles. The elevation ranges from about 4,760 to 5,120 feet. This reaches grade has an elevation drop of 360 feet over a distance of 17,160 feet which calculates to an average slope of about 2 percent. This site was assessed on June 30, 2013.

Our findings for Reach 5 or LO0012 assessed it as PFC. We determined that 40 percent of the reach was riparian and 60 percent was dry valley bottom or wash. Figure 36 shows a section that was dry valley bottom or wash and Figure 37 shows a riparian community along this reach of the Cottonwood Creek. This reach does not have a perennial flow but is intermittent with some spring and subsurface water augmented by runoff during storm events or spring thaw. It has less water influence than Reaches 3 or 4 and is fairly limited on water availability. This limits the degree of its riparian vegetation expression.

Figure 36. LO0012 dry valley bottom or wash portion.

Figure 37. LO0012 riparian portion.

The Coyote willow was from 1 to 7 years old and 8 to 12 feet tall and Cottonwood trees from 3 to 50+ years old. The Baltic rush was vigorous and dense where present and were trapping alluvial sediment as would be expected in a functional riparian area. The Cottonwood road (about 50 foot of road) affects about 150 feet of this reaches channel but does not effect the channel sinuosity overall (Refer to Figure 38). This reach is highly sinuous and it takes quite a while to navigate all the turns and twists.

Figure 38. LO0012 Reach 5 section of Creek affected by the Cottonwood road.

The BLM assessed this site as FAR upward trend in 2001 and restated this finding in their 2006 determination. In 2007 the BLM assessed the site as FAR with upward trend again. Our findings of PFC in 2013 indicate an improvement since 2001 and 2007. This site is a highly functional and stable riparian community but has a fairly low amount and not always reliable or consistent water source. As a result, the riparian communities are not as dense or vigorous as Reaches 3 and 4. The BLM did not break out the dry valley bottom or wash portions of the reach in their assessments. We only assessed the riparian parts of this reach. Some management change appears to have occurred in the past 5 to 7 or 8 years based on the age class of the willows. The BLM and the rancher are doing a good job managing this area.

11. Cottonwood Creek Reach 6 or LO0014 . This lotic is intermittent. It extends downward from Hackberry Wash or Canyon to where Cottonwood Creek drainage joins the Paria River for about 3 miles. The elevation ranges from about 4,680 to 4,760 feet. This reaches grade has an elevation drop of 80 feet over a distance of 15,840 feet which calculates to an average slope of about .51 percent or less than 1 percent. This site was assessed on June 22 and 30, 2013.

Our findings for Reach 6 or LO0014 assessed it as PFC. We determined that 33 percent of the reach was riparian and 67 percent was dry valley bottom or wash. Figure 39 shows a riparian Coyote willow community and Figure 40 shows a section that was dry valley bottom or wash along this reach of the Cottonwood Creek. This reach does not have a perennial flow but is intermittent with some spring and subsurface water augmented by runoff during storm events or spring thaw. It has less water influence than Reaches 3, 4 or 5 and is fairly limited on water availability. This naturally limits the degree of its riparian vegetation expression.

Figure 39. LO0014 riparian portion of reach.

Figure 40. LO0014 dry valley bottom or wash portion of reach

The willows were from 1 to 6 years old and 4 to 7 feet tall with cottonwoods 3 to 50+ years old. Figure 41 shows the dense stands of cottonwood trees along this section of the Cottonwood Creek and confirms that the creek came by its name honestly. Figure 42 shows the mouth of Cottonwood Creek where it empties into the Paria River, showing even at the mouth it is dry valley bottom or wash along this reach. Note the white salty crust on the surface of the Paria Rivers channel that shows that the Paria has watersheds that contribute a high dissolved mineral load (Refer to Section V. A. 9.).

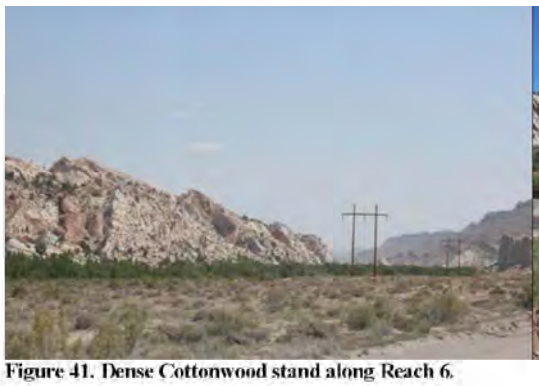

Figure 41. Dense Cottonwood stand along Reach 6.

Figure 42. Mouth of Cottonwood Ck. joining Paria R.

The BLM assessed this site as FAR upward trend in 2001 and restated this finding in their 2006 determination. Our findings of PFC in 2013 indicate an improvement since 2001. This site is also a highly functional and stable riparian community with a low natural water supply. As a result, the riparian communities are naturally not as dense or vigorous as Reaches 3, 4 or 5. The BLM did not break out the dry valley bottom or wash portions of the reach in their assessments. We only assessed the riparian parts of this reach. Some management change appears to have occurred in the past 5 to 7 or 8 years based on the age class of the willows. The BLM and the rancher are doing a good job managing this area.

12. Cove Retention Dam or LE0017. This is a flood retention reservoir and is not a riparian site. It is dry, rarely holds water and appears to be located on a Tropic shale formation which has a highly mineralized soil. We did not assess the site because it is not riparian. There are no hydric soil characteristics or riparian vegetation other than some spotty stands of sick and dying tamarisk trees. Figures 43 and 44 show the dry flood retention reservoirs face and dry non riparian surface. This dam was built in the late 1960's or early 1970's. It is impressive that the face and spillway are in such good state of repair.

Figure 43. Cove retention reservoir dam face. Figure 44. Cove retention reservoir behind dam face.

The BLM in their 2006 determination assessed this site as NF and in 2007 revisited the site and also determined that it was not a riparian area and did not re-assess it.

13. Goulding Corral Seep. This low producing seep or lentic is not developed. The total size is approximately .04 acres. The elevation is 5,320 feet. This site was assessed on June 22, 2013.

Our findings on Goulding Corral Seep (Refer to Figure 45) are that it is at PFC. This small seep does not have any previous BLM data or assessments completed for it. This site is the first and northern most lentic water source feeding into Cottonwood Creek. The site has both some Coyote willow and Yellow willow as do most of the springs and seeps along the Cottonwood Creek drainage. The willows are from 1 to 7 years old. The Cottonwood trees are from 5 to 15 years old and both Fremont and Narrowleaf are present (Populus fremontii and angustifolia, respectfully). Baltic rush is present and is 14 to 20 inches tall and vigorous. The Cottonwood creek is dry in this location but there is some riparian vegetation (Juncus balticus) at the junction between the spring source and the creek. Saltgrass (Distichlis spicata) is present on the site indicating a water source and/or soils higher in salts and minerals. The site is recovering very well and re-vegetating after experiencing the same storm event(s) that affected other locations along the Cottonwood Creek noted earlier (Refer to Figure 46). As previously noted, this storm occurred a short time before we assessed the sites along Cottonwood Creek.

Figure 45. Goulding Corral Seep. Figure 46. Shows the re-vegetating of the seep.

While the BLM did not assess this site in the past, the fact that the site is at PFC and considering the age class of the willows, some management change appears to have occurred within the past 5 to 7 or 8 years. The BLM and the rancher are doing a good job managing this area.

14. Hog Eye Creek or LO0186. This is a spring fed perennial stream or lotic and drains into the Paria River. The total size is approximately 2 miles. The elevation ranges from 4,920 to 5,000 feet. The average slope is approximately .76 percent or less than 1 percent however there are locations that are 2 or more percent slope in the channel. This site was assessed on July 15, 2013.

Our findings for Hog Eye Creek or LO0186 assessed it at PFC. This riparian area is very heavily wooded (Refer to Figure 47). It is dependent upon coarse wooded vegetation for stabilizing the riparian community. Adequate trees and shrubs are currently present. The trees and shrubs as shown in Figure 48 are providing the necessary stabilizing role for this functioning riparian ecosystem. Vegetation (tree and riparian herbaceous) sediment trapping and additional stabilization from the large boulders and rocks (Refer to Figure 49) present this Creek as a very functioning ecosystem.

The dominant tree present is the Box Elder (Acer negundo) with numerous Cottonwood trees (Populus fremontii) accompanying them. Virgin bower (Clemantis ligusticifolia), Coyote willow, Horsetail (Equisitum hyemale), Threesquare (Scirpus or Schoenoplectus pungens), Cattail (Typha latifolia), Carex aurea, Dogbane (Apocynum cannabinum) and Baltic rush were dense and vigorous throughout the length of the stream. We did not find any running water in this stream until about ½ mile up the drainage from the mouth at the Paria River. So the perennial flow noted above apparently goes subsurface before it reaches the Paria River except during storm events or spring snow melt. Figure 50 shows the mouth of Hog eye where it joins Paria River.

Figure 47. Heavily wooded Hog Eye Creek.

Figure 48. Down trees showing woody material dependence.

Figure 49. Boulders and rocks stabilizing Hog Eye.

Figure 50. Mouth of Hog Eye joining Paria River.

Figure 51 shows the extreme flows that travel down Hog Eye Creek during storm events and flash flooding with debris over six feet high lodged on this tree trunk located adjacent to the active stream channel. The humidity in Hog Eye canyon on this 100 degree Fahrenheit July day was oppressive!

Figure 51. Over 6 foot high water flows down Hog Eye shown by debris tapped representing a stable functioning riparian area.

The BLM assessed this site as PFC in 2001 and restated this finding in their 2006 determination. Our findings of PFC in 2013 are consistent with that finding. This site is a highly functional and stable riparian community with a perennial water supply along most of its length. The BLM and the rancher are doing a good job managing this area.

15. Kitchen Canyon or LO0187. This is an intermittent stream or lotic and drains into the Paria River. The total size is approximately 2.25 miles that may all be in the Cottonwood

Allotment and 4 miles total. It was unclear to us on how much of the canyon is within the Cottonwood allotment and if the cattle can get past Kitchen Falls located about 1.2 miles up the canyon. The elevation ranges from 4,880 to 5,520 feet. The length including a large portion located in the adjacent Mollies Nipple Allotment is 21,120 feet and the elevation drop calculated from a 1:24,000 contour map is 640 feet. The average slope is approximately 3 percent with some of the lower portion of the reach at 1 percent or less. This site was assessed on July 15, 2013.

Our findings for Reach LO0187 assessed it as FAR trend not apparent. This intermittent streams' source is located in the adjacent Mollies Nipple allotment on private land. There used to be two functional dams on private land above controlling the flow down this drainage but they are no longer functioning. The watershed feeding this stream is comprised of very fine sandy loam soils and numerous drainages including Starlight Canyon drain into it. This stream is clearly, based on ours and previous years photos, receiving a very high sediment load from this watershed. Figures 52 and 53 show the riparian vegetation present with deep sediment deposits filling the channel. Based upon Mr. Owen's and BLM's information, this stream historically receives heavy water flows with large sediment loads regularly that bury any vegetation trying to establish along the channel. We assessed this as FAR and not NF because some stabalizing riparian vegetation was observed along the channel (Refer to Figures 52 and 53) and there was no evidence of head cuts or down cutting present along the reach.

The age class of the willows were from 1 to 7 years old and the presence of Baltic rush, willow and young cottonwoods along some parts of the riparian channel indicate that management changes on the Cottonwood Allotment that have resulted in improved riparian conditions for the adjacent Paria River are likely facilitating this sites current and future recovery. The site may be in upward trend based upon the young cottonwoods and willows establishing in spots (Refer to Figure 54) but the sediment loads noted were so deep and large that we erred on the side of caution and stated not apparent trend. We were very concerned for our horses while traversing this area for fear that we would hit sink sand or mud and have a donnybrook with the mud and horses. The high sediment loads are likely slowing the healing process. We did not see any indication that vegetation was playing a measurable role in trapping sediment along the reach. Most of the reach did not have any riparian vegetation along it that was visible to us (Refer to Figure 55).

Figure 52. Kitchen Canyon sediment deposits.

Figure 53. Showing heavy sediment deposition from upper Watershed.

There was no measurable use by grazing on any willows, Baltic rush or upland herbaceous species noted during our survey efforts. Figure 56 is a common upland site along the stream that has no measurable use on grass species. These grasses have up to 3 years of growth still present on the plants. Livestock are not adversely affecting this riparian area and are not a factor in our FAR assessment finding.

Figure 54. One section had young cottonwoods & willow

Figure 55. Common part of reach with no riparian vegetation present just sediment deposition from upper watershed.

Figure 56. Upland site adjacent to Kitchen Canyon showing no measurable use on grass species by livestock.

16. Lower Coyote Spring/Creek LE0050. The BLM assessed this as a spring or lentic in 2001 and 2007. We determined that it is more appropriately classified as a perennial stream or lotic. From the BLM's photos and narratives, they did not sample the entire area in 2001 or 2007 and in doing so missed the opportunity to assess the entire reach from its actual source to where it goes underground. The total size is approximately .25 miles. The elevation does not change

measurably along the reach from 4,720 feet offering less than a 1 percent slope average. However, on short sections along this short reach we did note 1 + percent of slope. This site was assessed on July 2, 2013.

Our findings for Reach LE0050 assessed it as FAR with upward trend. We almost assessed it as PFC but did not due to a number of bare areas and the presence of non obligate species present. We did not document any evidence of existing livestock grazing effects on this site. Of the .25 mile riparian reach, about .1 mile appear to have a perennial flow with the remainder having an intermittent flow during peak spring output and runoff. The contour maps for this area identify a Lower Coyote spring and a Lower Coyote Creek. According to Mr. Owens who has worked in this area for over 30 years the site has always had a defined channel and running water. The 2001 and 2007 BLM sample sites were 700 to 900 feet below the primary water source for the riparian area and the where the majority of the water is present and the associated riparian vegetation is expressed.

The waters origin is by an old cement detention dam (Refer to Figure 57) that used to be part of a water development piping water to a ring tank about .4 of a mile downstream (Refer to Figure 58). However, due to the lack of grade or slope the water pipe was prone to frequent air locks and silt plugs that interrupted the flow so the rancher eventually abandoned collecting and piping water to troughs. The old ring tank set up on a low bench next to the drainage is full of debris showing the potential high water flows down this creek during flash flood events.

Figure 57. Water source for Lower Coyote Creek.

Figure 58. Old dry water ring tank filled with debris.

The species present include Fremont Cottonwood, Baltic rush, Reed Canarygrass (Phalaris arundinacea), Cattail (Typha latifolia), Scirpus pungens, saltgrass (Distichlis spicata), Western wheatgrass (Agropyron smithii) and Marsh Bristlegrass (Setaria parviflora), White Sweetclover (Melilotus albus) and Tamarisk (Tamarix ramosissima). The presence of saltgrass and marsh bristlegrass and the salts on the surface indicate the spring water may be naturally high in salts. We documented healthy populations of the Red-Spotted toad (Bufo punctatus) present here.

The cottonwoods are from 1 to 50 + years. There were numerous cottonwoods from 1 to 4 years old establishing and showing no sign of utilization by livestock (Refer to Figures 59 and 60). It appears that some good management change has occurred in the past 4 years based upon the apparent expansion of the riparian area and the age class of the cottonwoods.

The soils within the channel are covered with about a 1/8 to 1/4 inch of white crusting salts or minerals left when the water evaporated from that part of the channel when flows subsided (Refer to Figure 61). That and the presence of saltgrass and bristlegrass indicates that the creeks waters are naturally highly mineralized. We documented deer, antelope and big horn sheep tracks in the creeks muddy bottom.

Figure 59. Lower Coyote with young cottonwoods.

Figure 60. Young cottonwoods 1-4 years old establishing.

Figure 61. Showing white salts deposits.

Figure 62. Vigorous riparian vegetation re-establishing.

The low use historic Brigham Plains two track road crosses the Creek through the lower drier portion with no apparent measurable impact.

The BLM assessed this site as NF in 2001, PFC in 2007 and restated this 2001 finding in their 2006 determination. Our findings of FAR with trend not apparent in 2013 are not consistent with the BLM's 2007 finding. We documented that livestock grazing in the Cottonwood Allotment are not affecting the riparian area or associated uplands as we did not note any measurable use on upland grass species adjacent to the Creek and no measurable use on the riparian vegetation itself. As noted above, we almost assessed the site as PFC. The BLM and the rancher are doing a good job managing this area for the Cottonwood Allotment.

17. Owl Cave Seep. This low producing seep or lentic is not developed. The total size is approximately .01 acre rounded up (about 300 square feet). The elevation is 5,320 feet. This site was assessed on June 23 and 30, 2013.

Our findings on Owl Cave Seep are that it is at PFC. This low producing seep does not have any previous BLM data or assessments completed for it. This seep is located between Pump Canyon Spring and MH Spring along the Cottonwood Creek. It gets its water from a small seep and

runoff from the waterfall that pools and traps some of the water. It looks like a cave from the Cottonwood road but is actually a hollow sandstone waterfall drainage carved out over time by runoff water from the watershed above (Refer to Figures 63 and 64). There is a small hanging garden in the sheltered ledge deepest into the site (Refer to Figure 65). It gets its name because it's the home of a breeding pair of Long-eared Owls (Asio otus). We photographed them and identified them on our first visit to the cave on June 23, 2013 and came back again on June 30 and July 1, 2013 to find them still there (Refer to Figure 67). They perch up on the ledge where the hanging garden is and in the tall spindly cottonwoods in the drainage within the cave area.

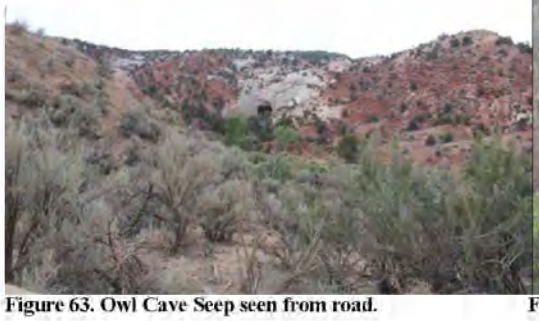

Figure 63. Owl Cave Seep seen from road.

Figure 64. Owl Cave Seep with zoom showing it is not a cave.

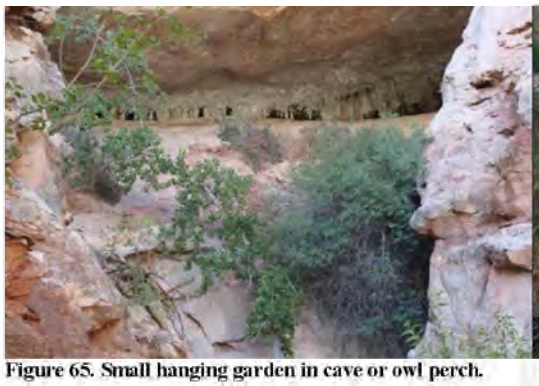

Figure 65. Small hanging garden in cave or owl perch.

Figure 66. The small riparian area in Owl Cave

The temperature in the Owl Cave Seep was a good 20 degrees cooler than the 100 degree plus Fahrenheit June day outside and we did not want to leave it. The site is in the process of recovering from the flash flooding that occurred recently affecting much of this area.

The species present were Baltic rush, Cattail (Typha latifolia), Fremont and Narrowleaf cottonwood are present (Populus fremontii and angustifolia, respectfully), Coyote willow,Virgin bower (Clematis ligusticifolia) and Stream orchid or giant helleborine (Epipactis gigantea) (a species we found in numerous riparian areas in Cottonwood Creek and the Paria River area in vigorous growth). The willows were between 1 to 7 years old. The site appears to be a favorite hiking spot based on the human tracks in the area.

While the BLM did not assess this site in the past, the fact that the site is at PFC and considering the age class of the willows, some management change appears to have occurred within the past 5 to 7 or 8 years. The BLM and the rancher are doing a good job managing this area.

AR0020232

Figure 67. One of the Long-eared Owls in the middle of photo on the boulder that lives in Owl Cave Seep.

18. Paria River Reach 1 or LO0019. This river or lotic is perennial and flows year round. It extends downward from where Deer Creek empties into the Paria south to about .1 mile south of where Snake Creek empties into the Paris or about 2.8 miles. The elevation ranges from about 5,040 to 5,160 feet. This reaches grade has an elevation drop of 120 feet over a distance of 14,784 feet which calculates to an average slope of about .81 percent or less than 1 percent. The entire Paria River except at the Box has an average slope of less than 1 percent. With this low gradient slope it allows for a more serpentine flow characteristic and fairly frequent changes in the river channel during high flow events. This site was assessed on horseback on July 14, 2013.

Our findings for Reach LO0019 assessed it as PFC. The Paria river has perennial flow augmented by snow melt and storm events. The entire Paria River may actually have had a dense stand of Cottonwood trees historically that provided coarse and large woody material in down trees to slow the water flow, absorb its energy and trap sediments. These upper reaches numbers 1 and 2 have fairly good stands of Cottonwoods and more being recruited.

The riparian communities primarily of Coyote Willow and Baltic rush are dense and vigorous all along the rivers bank. All of this reach is riparian. Willow had age classes from 1 to 4 years, Cottonwood from 1 to 11 years and Russian Olive (Elaeagnus angustifolia) trees from 1 to 7 years indicating that a management change has occurred allowing these species to express themselves. Figure 68 shows a section at the beginning of the reach with a vigorous Baltic rush and willow along the Paria River channel and a stable point bar. Figure 69 shows the bank and floodplain trapping sediment in step like layers in response to different flash flood water levels

this year. Figure 70 is taken in the middle of the reach showing the vigorous willow from 1 to 4 years old stabilizing the bank.

Figure 68. Paria R. start of reach & stable point bar. Figure 69. Sediment trapping showing varying flash flood flow levels.

Figure 70. Young vigorous willow stabilizing bank.

Figure 71. Bank close up showing willow & Juncus trapping sediment & laminar flow stabilizing bank.

Figure 71 also located about in the middle of this reach shows excellent sediment trapping and laminar flow. Laminar flow is where the heavily and densely rooted riparian species (in this case Juncus balticus) lay over in the direction of the water flow. This allows the water to flow smoothly in a streamline manner over the river banks surface in contrast to turbulent flow where the water flows with irregular fluctuations and mixing. This laminar flow reduces the water flows impact on the bank and provides bank stabilization, allows sediment trapping and riparian area expansion over time. This is what is occurring all along this reach of the Paria River.

No measureable use was noted by livestock in the riparian area of this Reach or on the adjacent benches. In response to any use that is likely to have occurred, the plants have exercised re-growth and shown excellent vegetation vigor. Figure 72 is towards the end of the reach showing dense willow and Baltic rush along the river bank with Russian olive and Cottonwood. The soils showing on the right bank were sediment trapped by the riparian community present.

Figure 72. Towards the end of LO0019 Reach 1.

The BLM assessed this site as FAR with downward trend in 2001 and restated this finding in their 2006 determination. Our findings of PFC in 2013 indicate an improvement since 2001. This Reach is a highly functional and stable River and riparian community. Some management change appears to have occurred based on the age class of the willows. The BLM and the rancher are doing a good job managing this area.

19. Paria River Reach 2 or LO0020. This has a perennial water flow. It extends downward from about .1 mile south of where Snake Creek empties into the Paria to where Kitchen Canyon empties into the river or about 4.5 miles. The elevation ranges from about 4,840 to 5,040 feet. This reaches grade has an elevation drop of 200 feet over a distance of 23,760 feet which calculates to an average slope of about .84 percent or less than 1 percent. This site was assessed on horseback on July 14 and 15, 2013.

Our findings for Reach LO0020 assessed it as 40 percent of the reach at PFC and 60 percent of the reach at FAR with upward trend. This reach is a composite of areas with dense 1-7 year old willows and Baltic rush stabilizing the banks (Refer to Figure 73) and Cottonwood trees (Refer to Figure 74) and areas with sparse willow and less bank stabilization. It was unclear to us as to why this was as the adjacent historic flood plains and benches are populated with palatable grass species of Indian ricegrass (Achnatherum hymenoides), Sand dropseed (Sporobolus cryptandrus) and blue gramma (Bouteloua gracilis) with no measurable use occurring (Refer to Figure 75). So, existing livestock grazing practices are not affecting or contributing to the FAR assessment as the upward trend indicates. Figure 76 is taken towards the end of the reach showing vigorous riparian vegetation stabilizing the banks of the river and cottonwoods (1 to 50+ years) and Russian Olive (most ranging from 1 to 7 years old) trees on the banks.

Figure 73. Start of reach with vegetation stabilized bank.

Figure 74. Middle of reach showing good riparian.

Figure 75. No measurable use on grasses next to River.

Figure 76. End of reach riparian vigorous.

The BLM assessed this site as FAR with no apparent trend in 2001 and restated this finding in their 2006 determination. Our findings of 40 percent at PFC and 60 percent FAR with upward trend in 2013 indicate an improvement since 2001. This Reach is a highly functional and stable River and riparian community. Some management change appears to have occurred in the past 3 to 5 years based on the predominant age class of the willows. The BLM and the rancher are doing a good job managing this area.

20. Paria River Reach 3 or LO0021. This has a perennial water flow. It extends downward from where Kitchen Canyon empties into the river to just east of Calico Peak above the Paria Town site or about 4 miles. The elevation ranges from about 4,740 to 4,840 feet. This reaches grade has an elevation drop of 100 feet over a distance of 21,120 feet which calculates to an average slope of about .47 percent or less than 1 percent. This site was assessed on horseback on July 15, 2013.

Our findings for Reach LO0021 assessed it as FAR with upward trend. The presence of cut banks along the rivers edge in various locations is the primary reason why we did not assess this at PFC (Refer to Figure 77). Figure 78 shows a spot at the beginning of the reach with willow stabilizing the rivers banks and cottonwood and Russian Olive fairly dense. The willow was from 1-7 years old. We noted numerous areas where young cottonwoods from 1 to 5 or 6 years old were re-vegetating wherever they could out compete any tamarisk present.

It is expected that this reach would have the potential of a Cottonwood gallery with the trees playing a role in stabilizing the riparian area and river channel by supplying coarse and large down woody material to trap sediment and slow flow rates. The Paria (Pahreah) Townsite

inhabited from 1870 to1929 (59 years) and mining camps (gold mine camp in 1911) in the area historically cut down and used the cottonwood for fire to keep warm and cook with. That is likely why there is little to no very old cottonwood trees and so few overall. It usually takes about 20 years for cottonwood to regenerate from seed and establish. Based on this, it will likely take 100 to 200 years for cottonwood to regain dominance in the area. These historical changes to the landscape are considered "Legacy Effects"[22] and are part of our countries and Utah's heritage in Man's efforts to tame and settle America.

In Figure 77 in the center of the cut bank and photo the area with a lighter colored sand is an old river channel that is no longer active. Figure 79 has a Kane County marker stating some of the history in the area and, in particular it notes the significant role flash floods and high water levels in the Paria influenced the longevity of the pioneers settlement here. The water flows down this river can rise to over 6 feet deep based on debris we noted lodged against willow and Cottonwoods.. This level and volume of runoff water can have a violent force behind it even with the reduced slope and wide channels characteristic of this river. The Paria River channel was a historical rural road that Utah residents used for over 100 years. It is currently closed to vehicle traffic by the GSENM. Based on the frequency of flash flooding and the waters habit of reshaping the entire riverbed yearly and often weekly during the summer monsoons, it is unlikely that vehicular traffic would have any measurable impact on the ecosystem here. This area is part of the Counties RS2477 claims for county historical roads and we suggest that it should rightfully be reopened to vehicular use.

Figure 77. Cut banks in Reach 3 & center of photo With lighter colored sand is an old water channel.

Figure 78. Start of Reach 3 with willow on banks.

[22] Legacy Effects: The Persistent Impact of Ecological Interactions. K. Cuddington. 2011. Biol. Theory, Vol. 6 (3) Springer Journals. 8 pgs.

Figure 79. Kane County marker on Paria townsite & the historical influence of flash flooding in the area.

Figure 80. No measurable use on saltgrass on benches.

The Paria River bed from this reach downward has a residual 1/8 to ¼ inch white mineral or salts crust wherever the water flowed then receded and evaporated. We measured the sediment load after one event on July 15, 2013 and after settling in the bottle for 2 weeks there was a 32 percent sediment load. Our horses would not drink the water it was so naturally murky and silty from the runoff. The water quality results measured here were as shown in Table 2 compared to Kanab drinking tap water:

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Table 2

pH, Alkalinity, Hardness & TDS Results From GSENM Riparian Assessments June to August 2013

Allotment	Sample Site	Date	pH	Alkalinity (ppm)	Hardness (ppm)	TDS (ppm)	Comments
1. City of Kanab	Tap water	2013	7.5	50	60	190	
2. Cottonwood	Paria River Reach LO0020	2013	7.5	90	280	1,340	Sediment settled to 42% after 3 days in sample and to 32% after 2 weeks. Naturally high sediment loads.

The high hardness and TDS shows that the water is naturally hard water with a high salts and mineral content in the reaches from Reach 3 on down. We did not note this in the upper reaches that had numerous fresh water springs and creeks (Deer Creek, Snake Creek and Hog Canyon Creek) flowing into the Paria River providing some dilution and less mineralized water to the watersheds runoff water. We noted that in the upper reaches the benches and older floodplains had Indian ricegrass, Sand dropseed and blue grama while Reach 3 has primarily saltgrass a species adapted to soils with a higher salts content.

The BLM assessed this site as FAR with no apparent trend in 2001 and restated this finding in their 2006 determination. The BLM map showing this reach show it as PFC however we do not have any data sheets from BLM showing this. Our findings of FAR with upward trend in 2013 indicate an improvement since 2001. This Reach has a functional and stable River and riparian community that should continue to improve under current grazing management. Some management change appears to have occurred in the past 3 to 5 years based on the predominant age class of the willows. The BLM and the rancher are doing a good job managing this area.

21. Paria River Reach 4 or LO0119. This has a perennial water flow. It extends downward just east of Calico Peak above the Paria Town site to the Paria box canyon or about 1.8 miles. The elevation ranges from about 4,720 to 4,740 feet. This reaches grade has an elevation drop of 20 feet over a distance of 9,504 feet which calculates to an average slope of about .2 percent or

less than 1 percent. This reach has a very wide channel from approximately 150 to 412 feet with floodplains that more than double the area flood waters can spread out on. This site was assessed on horseback on June 21 and 22, 2013.

Our findings for Reach LO0119 assessed it as FAR with upward trend. The headwaters for the Paria River originate in the Cannonville and Henrieville area where the blue clay soils with high salts and mineral contents serve as a component of the major watershed. As noted in the narrative for Paria Reach 3, the evaporated surface of the stream channel is covered with about 1/8 to ¼ inch layer of a white mineral or salts deposit (Refer to Figure 81). The salts are likely contributed primarily by this watershed. The Paria's normal perennial flow is not much larger than an irrigation ditch (note the earlier quote by Mark Twain) being 4 to 8 feet wide and a few inches deep. During flash flood events the water can be 1 to 4 feet deep in this section and 100 to 300 feet plus wide cutting out or depositing on the floodplain depending upon event intensity. This extreme fluctuation in water flow volumes and flooding is why the Paria town site inhabitants abandoned the town somewhere around 1929 after a 59 year unsuccessful attempt to tame the area. However, as noted earlier, they left the "Legacy Effect" in their brave attempts to settle this hostile environment. As noted under Reach 3's narrative, the Mormon pioneers and miners cut down the cottonwoods for heating and cooking. However, cottonwoods are starting to play a role in the riparian stabilization by trapping sediment albeit a small part now as shown in Figure 82 by this single uprooted tree on the channels floodplain.

Figure 81. Reach LO0119 near box with surface salts.

Figure 82. Downed cottonwood trapping sediment.

The Coyote willow was from 1 to 7 years old, dense and vigorous along most of this reach (Refer to Figure 83). Baltic rush was present in spots only (Refer to Figure 84). We did not see any measurable livestock use on the willow, Baltic rush, cottonwoods or upland grass species. As seen in Figure 85 on an old remnant fan upland slope near this reach of the Paria, the light tan colored plants in the photo are Indian ricegrass and Sand dropseed robust and having no measurable use on them from livestock.

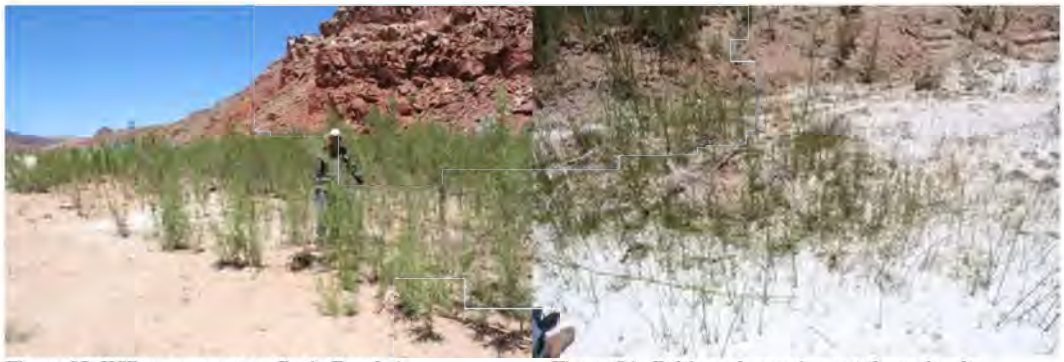

Figure 83. Willow common on Paria Reach 4. Figure 84. Baltic rush growing out through salts.

Figure 85. Older bench near Paria Reach 4 showing ricegrass and dropseed with no measurable livestock use.

The BLM assessed this site as NF in 2001 and restated this finding in their 2006 determination. The BLM re-assessed the reach in 2007 and again identified it as NF. Our findings of FAR with upward trend in 2013 indicate an improvement since 2001 and 2007. Livestock are not a factor in the FAR assessment as noted above. This Reach has a functional and stable River channel and riparian community that should continue to improve under current grazing management. Some management change appears to have occurred in the past 3 to 5 years based on the predominant age class of the willows. The BLM and the rancher are doing a good job managing this area.

22. Paria Box Canyon Reach 5 or LO0120. This has a perennial water flow. It extends downward from the north entrance into the Paria box canyon to where the Paria joins the Cottonwood Creek or about 1 mile. The elevation ranges from about 4,600 to 4,720 feet. This reaches grade has an elevation drop of 120 feet over a distance of 5,280 feet which calculates to an average slope of about 2.3 percent which is a significant change from the average slopes on the reaches above this narrow box canyon. The canyons active channel varies from approximately 23 feet to 89 feet. This site was assessed on June 21 and 22, 2013.

Our findings for Reach LO0120 assessed it as PFC with vegetation not being necessary to stabilize the stream channel. Figure 86 shows the northern entrance into the Paria Box canyon. This canyon acts as a bottleneck and high flash flood water flows concentrate down it from frequent flash floods. As the Cottonwood gallery re-establishes in the reach above the box (it may take 100 to 200 years) over time the cottonwood trees may help slow water flow a little.

Reach 4 LO0119 that feed into the Paria Box has approximately 150 to 412 feet channel widths with floodplains that more than double the area flood waters can spread out on and a slope of .2 percent. The Paria Box has active channels ranging from 23 to 89 feet wide with an average slope of 2.3 percent or approximately 18 percent of the channel width and 10 times the slope of the Paria reach feeding into it. As Figure 87 and 88 (satellite imagery) show, the Paria Box is a bottleneck and can experience violent water flows. With calculated two (2) year flows of 2,480 cubic feet per second (cfs) and 5 year flows of 5,290 cfs, riparian vegetation is unlikely to persist in the canyon. The Paria Box canyon is naturally stabilized as a non-vegetated narrow canyon and is stable at PFC.

Figure 86. North entrance into Paria Box canyon.

Figure 87. Narrow section of Paria Box bottleneck.

Figure 88. Satellite imagery showing the water flow bottleneck characteristics of the Paria Box canyon.

In the 1960's Hollywood filmed a movie staring Gregory Peck titled "MacKenna's Gold" released in 1969 and in the process dynamited the Paria box as a stunt blowing off the east canyon wall by the northern entrance into the box. Figure 89 is a remnant structure build for the movie that is still present in the Paria Box canyon. Figure 90 is just an interesting impression that can be seen with some imagination of a serpent like shape on a section of the west sandstone wall of the canyon.

Figure 89. 1969 movie set remains in canyon.

Figure 90. Imaginative serpent shape on canyon wall.

The BLM assessed this site as FAR with no apparent trend in 2001 and restated this finding in their 2006 determination. The BLM re-assessed the reach in 2007 and identified it as FAR with upward trend. Our findings of PFC in 2013 indicate an improvement since 2001 and 2007. However, in both 2001 and 2007 the BLM was expecting to see riparian vegetation and assessed the canyon low due to its absence. As our report shows, this was an incorrect expectation on the part of the BLM. Livestock are not a factor in the FAR assessment of the BLM as noted above.

This Reach has a functional and stable River channel that should remain stable under current grazing management. Based upon the frequent scouring and reshaping caused by flood waters, the use of this Kane County canyon's historical road by vehicles as has been done for about 100 years has not to date and should not cause in the future any noticeable adverse impacts. The BLM and the rancher are doing a good job managing this area.

23. Paria River Reach 6 or LO0118. This has a perennial water flow. It extends downward from where the Paria box canyon meets the Cottonwood Creek south to Rimrock or approximately 9.5 miles. The elevation ranges from about 4,440 to 4,720 feet. This reaches grade has an elevation drop of 280 feet over a distance of 50,160 feet which calculates to an average slope of about .56 percent or less than 1 percent receiving flows coming out of the Paria Box canyon. This wide and low gradient reach is able to absorb or dissipate the high energy and accelerated flows from the canyon. This fairly level highly sinuous reach has a wide channel from approximately 70 to 300 feet with floodplains that more than triple the area flood waters can spread out on (up to 1,000 foot wide area). This site was assessed on June 22 and July 17, 2013.

Our findings for Reach 6 or LO0118 assessed it as PFC. This reach also had willows from 1 to 7 years old. However, it also had sections with some 10 to 15 years old. Since this is a fair distance from the Paria town settlement, it is not surprising that there are more cottonwoods present and appear to be older based upon their thicker trunks. Figure 91 depicts the south exit end of the Paria Box as it empties into the Paria River Reach 6. Notice the dense willows, thick cottonwood stands and the ever present salty crust on the river bed present. The cottonwoods appear thicker than in the previous Reach 4 or LO0119 that was near the Paria town site. Figure 92 shows a site a short distance down the reach with dense willow and cottonwood stands. In Figure 93 you can see the dense stands of Coyote willow, the wide low gradient channel, Russian Olive trees and cottonwood trees lining the wide river channel in this middle section of the reach. In Figure 94 it is a picture of the end of Reach 6 and shows the telltale reddish color of dead and dying tamarisk in the lower left side of the picture. We would expect even more willow and cottonwood trees as the tamarisk subsides due to reduced water and shade competition.

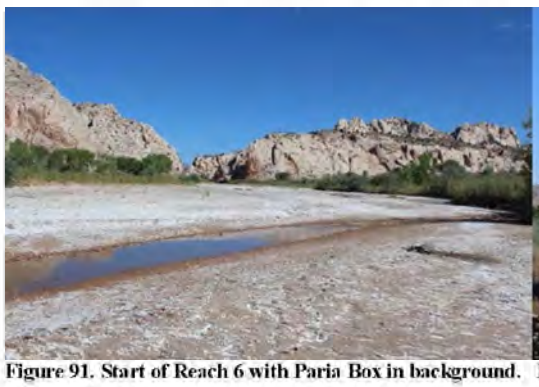

Figure 91. Start of Reach 6 with Paria Box in background.

Figure 92. Reach 6 showing dense willow & cottonwood trees.

Figure 93. Middle section of Reach 6.

Figure 94. The end of Reach 6 note dead tamarisk.

The BLM assessed this site as FAR with upward trend in 2001 and restated this finding in their 2006 determination. Our findings of PFC in 2013 indicate an improvement since 2001. The BLM and the rancher are doing a good job managing this area.

24. Powerline Spring. This spring or lentic is not developed. The total size is approximately .1 acre. The elevation is approximately 5,202 feet. This site was assessed on July 1, 2013.

Our findings on Powerline Spring are that it is at PFC. This spring does not have any previous BLM data or assessments completed for it. This spring is located between just south of the Cottonwood 4 spring complex located high up on the west side of the slope adjacent to Cottonwood Creek. Figure 95 shows the Powerline spring source and Figure 96 shows the meadow looking down from the spring source. The species present were Coyote willow, Cottonwood trees, Cattail, Baltic rush, white sweet clover, helleborine, virgin bower, horsetail, yellow willow, saltgrass and bentgrass (Agrostis stolonifera). The presence of saltgrass and bentgrass, salt tolerant species, indicates that the spring is likely high in salts. The willow were from 1 to 7 years old and the cottonwoods from 1 to 50 years plus. The Juncus was 10 to 18 inches tall and the cattail was from 2 to 4 feet. The spring has no apparent above ground flow into the Cottonwood Creek and the associated wash lower down is dry and non-riparian. We documented populations of the Red-Spotted toad (Bufo punctatus) at this spring. This toad appears to have an affinity for waters higher in salts as we have noted its presence primarily in such sites (Refer to narrative for Lower Coyote Creek).

Figure 95. Powerline spring source.

Figure 96. Powerline spring stringer meadow.

While the BLM did not assess this site in the past, the fact that the site is at PFC and considering the age class of the willows, some management change appears to have occurred within the past 5 to 7 or 8 years. The BLM and the rancher are doing a good job managing this area.

25. Pump Canyon Spring. This spring or lentic is not developed. The total size is approximately .1 acre. The actual spring source is located in the adjacent Rush Bed Allotment. The elevation is ranges from approximately 5,320 feet on the hillside. This site was assessed on June 23, 2013.

Our findings on Pump Canyon Spring are that it is at PFC. Pump Canyon Spring gets its name from an oil drill rig that was set up out on the Rushbed in the 1920's or 1930's. The drill was powered by a steam driven motor fueled by pinyon and juniper wood. The old wood pile was present and still intact in the early 1970's. Ken Goulding Sr. related to Brent Owens in the 1970's that the ground vibrations produced by the old drill could actually be felt miles away. Water for the boilers came from the Pump Canyon Spring.

The spring is located high up on the slope above the Cottonwood Creek. The Coyote and Yellow willow are from 1 to 8 years old. Cottonwood trees are thick in the area as well as willow. Debris from storm event flash flooding was trapped and piled up to 6 feet high on the cottonwood trees and willow in the drainage associated with the spring. Baltic rush and horsetail are fairly dense up the under the willows. Figure 97 shows the source of Pump Canyon Spring.

Figure 97. Pump Canyon Spring.

The BLM assessed this site as PFC 2001 and restated this finding in their 2006 determination. Our findings of PFC in 2013 are consistent with this. The BLM and the rancher are doing a good job managing this area.

26. Round Valley Seeps or LE0018. This low producing seep or lentic is developed. The total size is approximately .05 acre. The elevation is ranges from approximately 6,120 feet on the hillside. This site was assessed on July 1, 2013.

Our findings on Round Valley Seeps are that it is at PFC. The Coyote willow is from 1 to 7 years old and 6 to 14 feet tall and very vigorous. The willows have trapped 6 inches to 1 foot of sediment coming down the drainages. A very functional site.
The BLM's 2001 assessment erroneously only considered the fenced header box location off to the right side of the actual riparian drainage. The 2007 BLM assessment noted the drainage

directly to the left of the header box but did not consider the next drainage over that is also part of this Round Valley Seeps riparian area. Figure 98 shows the far left riparian drainage, the riparian drainage just to the close left of the fenced header box, the trough in the foreground and the fenced header box area above the trough on the side slope. It is highly likely that 6 years ago the willows in the far left drainage were not expressing themselves due to being grazed or some other reason and in 2001 that neither drainage had noticeable riparian vegetation. We can't be sure but the age class of the willows would support that hypothesis.

Figure 98. Round Valley Seeps.

Figure 99. Looking down on drainage to the left of header box.

Figure 100. The far left riparian drainage.

Figure 101. Fenced header box and project marker

Figure 99 shows us looking down on the dense willow and wild rose populating the drainage directly to the left of the header box. Figure 100 shows the tall and dense Coyote willow in the far left drainage associated with Round Valley Seeps and Figure 101 shows the fenced header or water collection box located to the right lower end of the drainage in Figure 99.

The water trough was dry with just a small amount of water coming out of the feeder pipe. This project was upgraded in 1967 from an early 1930's development that had used ¼ galvanized pipe. This older development is still present.

The BLM assessed this site as NF in 2001 and restated this finding in their 2006 determination. In 2007 the BLM re-assessed the site at PFC. Our findings of PFC in 2013 are consistent with this later assessment and both show an improvement in conditions due to some management changes since 2001. The BLM and the rancher are doing a good job managing this area.

27. Snake Creek or LO0178. This is a spring fed perennial stream or lotic and drains into the Paria River. The total size is approximately 1.06 miles. The elevation ranges from 5,040 to 5,200 feet. The change in elevation is 160 feet over a distance of 5,597 feet. The average slope is

approximately 2.9 percent however we did not notice an increase in slope until about ½ way up the canyon so the creek bed slope at the lower end is estimated to vary from 1 to 2 percent. This site was assessed on July 14, 2013.

Our findings on the Snake Creek or LO0178 are that it is at PFC. The creek goes up the drainage for a rugged 1.06 miles to a waterfall that restricts any further livestock access. The Coyote willow were from 1 to 7 years old and 7 to 15 feet tall. Most of the Box Elder trees were from 6 to 8 years old. At the bottom or lower end of the creek the willow had trapped from 2 to 5 feet of sediment from recent flash flood events allowing for a future riparian area expansion. Some of the species present were Coyote willow, Yellow willow, Box elder tree, Cottonwood trees, virgin bower, Three Square, licorice (Glycymbiza lepidota), Geranium spp., Cattail (Typha domingensis), single leaf ash (Fraxinus anomala), horsetail, Carex spp. and Reed Canarygrass.

Figure 102 shows the mouth of Snake Creek where it empties into the Paria River. Figure 103 is about 1/5 of the way up the canyon. Note the dense, vigorous and tall Coyote willow lining the creeks banks. As we moved up the canyon we noted running water and determined that the perennial surface flow of this creek ends about ¼ mile before reaching the Paria River. Figure 104 is in the perennial surface flow part of the reach and a steeper slope of 2 to 3 percent. This photo shows a dense Carex, horsetail and Three square community stabilizing this section.

We noted that the canyon is stabilized by a combination of the riparian vegetation, canyon walls, bedrock bottom and large boulders and rocks. Figure 105 shows one of many locations higher up the reach where boulders play a large part in the stabilization of the channel as the slope grade increases.

Figure 102. Mouth of Snake |Ck. joins Paria.

Figure 103. 1/5 way up Snake Creek with dense willow.

Figure 104. Stable riparian section higher up Snake creek.

Figure 105. Boulders playing a role in stabilization.

The BLM assessed this site as FAR with no apparent trend in 2002 and restated this finding in their 2006 determination. Our findings of PFC in 2013 indicate an improvement since 2002. Based on the age class of the willows, some positive management change has occurred in the past 5 to 8 years. The BLM and the rancher are doing a good job managing this area.

Uplands

No upland data was collected for the Cottonwood Allotment in 2012 or 2013 except that discussed under the riparian section.

B. Death Hollow Allotment Results for Riparian Assessments and Uplands

Riparian 3 Sample Sites.

1. Barney Mine Seep or LE0518. This spring or lentic is developed. The total size is .009 acres. The elevation is 5,600 feet. The site was assessed on July 26, 2013.

Our findings for Barney Mine Seep or LO0518 in 2013 assessed it as FAR with upward trend. The FAR assessment was due to a naturally declining aquifer or water table not due to livestock grazing. This decline is due to natural fluctuations in climate and this is a dry period. Springs usually expand during wet periods and shrink during dry periods. There can also be a delay in the time it takes to recharge a particular aquifer of about 2 years for deeper aquifers. Consequently, a riparian area could be expanding during a drought following a series of good precipitation years or shrinking during above average years following a drought. Without detailed research, it is almost impossible to make an absolute conclusion on what is actually happening.

The species present were cattail, Cottonwood trees, Baltic rush, Coyote willow, Black Willow (Salix nigra or gooddingii) and white sweetclover. According to Don Coleman, a retired BLM range technician very familiar with this seep, the cottonwood trees have increased in size and number since 2004 and even though some of the Coyote willow have died off, Mr. Coleman indicated that they were more numerous than in 2004. Based on a photo comparison of the site with the 2002 BLM photos with what is there in 2013, the riparian site now has denser vegetation, more and taller cottonwood trees thus the overall upward trend. No measurable use was noted on any riparian or upland plant species in the area or that were growing around the water troughs. Figure 106 shows the spring source as the green patch in the center of the photo and at the base of the white sandstone escarpment. The Cottonwood on the seep site and down the drainage range in age from 1 to 10+ years old. Figure 107 shows a closer look at the spring source and Figure 108 shows the troughs located about 80 feet from the spring source. The development could benefit from some maintenance on the collection box, pipeline and corroded ring tank troughs. The water troughs are leaking from numerous corrosion holes in the tanks sides. We plugged some with sticks of wood while there.

The road access to maintain this spring had a major rock and boulder slide blocking the road as shown in Figure 109. This should likely be cleared off by the BLM to provide the rancher access

to maintain the spring source. The current development was put in to replace the historic one in 1970's. The original development was probably done by the miners in the early 1950's or before to get culinary and washing water. This was an old mining and cowboy camp with some inactive uranium mine shafts above the site and an old decaying out house and box car bunk house still on site.

Figure 106. Barney Mine Seep center of photo.

Figure 107. Closer look a the seep source.

Figure 108. Troughs 80 ft from seep source.

Figure 109. Boulder slide blocking rancher seep maintenance road.

Table 3 summarizes the water data collected for Barney Mine Seep. The water appears to be as good or even a better quality than Kanab drinking water and the spring is producing a measured 35 ounces per minute at the trough. The demand on the seep does not seem to be dewatering however, a float valve on the troughs and repair or replacement of the corroded ring tanks may reduce the water escaping from trough overflow or leakage.

October 31, 2013 Updated December 4, 2013
Table 3
pH, Alkalinity, Hardness & TDS Results From GSENM
Riparian Assessments June to August 2013

Allotment	Sample Site	Date	pH	Alkalinity (ppm)	Hardness (ppm)	TDS (ppm)	Comments
1. City of Kanab	Tap water	2013	7.5	50	60	190	
2. Death Hollow	Barney Mine Seep LE0518	2013	6.8	40	50	137	Very good water. It is understandable that the miners relied upon it.

The BLM assessed this site as FAR with no apparent trend in 2002 and restated this finding in their 2006 determination. Our findings of FAR with upward trend in 2013 indicate an improvement since 2002. Our FAR was not due to existing livestock grazing as noted above. The site would have assessed at PFC if the water table was not naturally reduced. Based on the

age class of the cottonwood trees, some positive management change has occurred in the past 5 to 8 years. The BLM and the rancher are doing a good job managing this area.

2. Chokum Seep or LE0517. This is not a riparian site and it does have a water development. The troughs are dry and the site likely only produces water in the late winter or early spring. We did not assess the site because it is not riparian. There are no hydric soil characteristics or riparian vegetation other than two diminutive sickly tamarisk trees. The elevation is 5,520 feet. The site was visited on August 14, 2013.

Figure 110 shows where the very low producing seeps header box is located below the large boulder in the photos center as being a dry and non-riparian site. The soils had no indication that they were hydrated. This area is part of the Chinle formation and any water from the site is likely high in salts. Figure 111 shows the two more modern 10 foot ring tanks in the background that are dry and in a state of disrepair and the early 1920's troughs. The troughs were also recorded as dry by the BLM in 2002.

Figure 110. Chokum seep header box location.

Figure 111. Chokum seeps two different time periods troughs.

As we have noted throughout our careers, low producing seeps like this are usually chance discoveries by a cowboy out horseback looking for stray cattle noting a little moisture on a wet year. Since any and all water potential in an arid area is important, the cowboy and/or rancher comes out and endeavors to develop and make use of the water for his livestock to get better distribution. Sites like this were never riparian and are usually not a dependable water source as they dry up seasonally or every other year or so.

The BLM assessed this site as an unknown site 2002 and restated this finding in their 2006 determination. They state on their field form that, "It's difficult to rate this spring according to the standard indicators. There is virtually no riparian veg present or expected". Our 2013 findings show that it should not be assessed because it lacks riparian characteristics and is not a riparian area. This finding is what they likely should have concluded in 2002. It is not a riparian area. It is only a very low producing and not dependable water development.

3. Wire Corral Spring or LE0519. This spring or lentic is not developed. The total size is .007 acres. The elevation is approximately 5,440 feet. The site was assessed on July 26, 2013.

Our findings for Wire Corral Spring or LO0519 in 2013 assessed it as PFC. The road accessing this riparian area is not the riparian spring source. The spring source is located in the drainage or

small canyon east of and adjacent to the channel the road traverses. The species present include Carex spp., Baltic rush, Tamarisk, Cottonwood, Coyote willow, virgin bower, white sweetclover, saltgrass and bee plant (Cleome serrulata). There is a saltgrass community adjacent to the road and in the drainage that appears to get water from flash flood storm events. Figure 112 shows the actual spring source in the small canyon to the east of the road from above and Figure 113 is a closer look.

Figure 112. Wire Corral Spring from above.

Figure 113. A closer look at Wire Corral Spring.

Figure 114 shows the road in the adjacent channel and the saltgrass community present. This road is fairly level and has a sandstone bedrock base that can perch runoff waters when present in this very dry location within the GESNM. The road does not go through the actual spring source depicted in Figures 112 and 113. There is no measurable use on any of the willow or other riparian species nor on the adjacent uplands. If the tamarisk was removed from the spring source the reduced evapotranspiration would likely allow more water for native riparian and wooded species.

Figure 114. The adjacent access road & associated saltgrass community.

The BLM assessed this site as FAR with downward trend in 2002 and restated this finding in their 2006 determination. Our findings of PFC in 2013 indicate an improvement since 2002. We compared our 2013 conditions with the 2002 photos and noted denser more vigorous riparian vegetation, 2 foot plus leader growth on the cottonwood trees, no indication of recent downcutting or erosion at the spring and a vegetation stabilized riparian area. The BLM and the rancher are doing a good job managing this area.

C. Lower Cattle Allotment Results for Riparian Assessments and Uplands

Riparian 3 Sample Sites.

1. 25 Mile Wash or LO0006. This stream or lotic is an intermittent riparian area. The length of the reach that falls within the Lower Cattle Allotments boundaries is 1 mile long. The elevation ranges from 4,920 to 4,960 feet. The elevation changes 40 feet over a distance of 5,280 feet. The average slope is .76 percent or less than 1 percent. We measured a slope gradient of from 1 to 2 percent in a spot or two when in the channel but overall it was relatively close to level. The site was assessed on August 22, 2013

Our findings for 25 Mile Wash in 2013 assessed it as PFC. Some of the species present are Coyote willow, Cottonwood trees, Russian Olive, tamarisk (most plants are dead or dying from the tamarisk beetle), Baltic rush, three square and Reed canarygrass.

The tamarisk beetle has killed 90% or more of the tamarisk allowing for improved riparian and native cottonwood and willow establishment last 2 years according to the rancher. Figure 115 shows a large area of reddish brown that is all dead tamarisk within the Reach LO0006. In the foreground of that photo located on the upland site near this reach there is no measurable use on the sand dropseed, a palatable grass species (the light tan colored plants in the photo). Figure 116 shows no measurable use on Indian ricegrass, sand dropseed (both light tan plants in photo) and winter fat (the tall grayish shrub on the left side of the photo) near the reach. Existing livestock grazing practices are not an management issue.

From 2011 back the tamarisk was dominating most of this lotics reach. This is a winter use allotment which has grazing use on the plants during dormant period and allows for riparian area and upland vegetation re-growth during the spring and summer when the cattle are off the allotment. This is sound and effective management system initiated by the BLM and the rancher. The willow are from 1 to 5 years old and there are large areas with new cottonwoods from 1 to 5 years old also. The beetle time frames for weakening and killing of the tamarisk appears to coincide with the observed flush of willow and cottonwood new plant growth. Figure 117 shows a healthy patch of Coyote willow from 1 to 5 years old. Figure 118 shows one of a number of locations along this reach that 1 to 5 year old Cottonwood trees are exploding in growth as a response to the removal of tamarisk competition. Note in Figure 118 the dead tamarisk stand on the opposite side of 25 Mile Wash Reach LO006's channel to the young Cottonwood trees.

When the BLM assessed the site in 2001, the tamarisk was still dominating the site and competing for water, and minerals against the native species and shading them out. In 2010, when the BLM again assessed the site the tamarisk was still dominating but apparently the riparian vegetation was returning in sufficient amounts to allow a PFC assessment. Tamarisk appears to have been a major factor influencing why this reach was not assessed at PFC in 2002.

Figure 115. Dead reddish brown dead tamarisk.

Figure 116. No use on winerfat and ricegrass.

Figure 117. Willow 1 to 5 years of age.

Figure 118. Young Cottonwood growth exploding in front of dead tamarisk competitor.

The Baltic rush and three square provided excellent bank protection by laying over and allowing laminar water flow over the protective riparian vegetation and bank. Figures119 and 120 show this excellent example of laminar flow. Figure 119 also shows the dense Cottonwood trees lining the stream channel, Coyote willow and Russian Olive. Figure 120 is a close up of the same channel section shown in Figure 119.

Figure 119. Laminar flow & Cottonwoods in reach.

Figure 120 close up of laminar flow bank protection

We measured the water quality of 25 Mile Wash and the results are shown in Table 4. The water quality for pH, Alkalinity, Hardness and TDS appear to be quite good compared to Kanab city water which tastes very good. After a thunder storm and major flash flood event, the natural sediment load in this lotic was 40 percent. It was some pretty "dirty water" so to speak. We measured the TDS after the sediment had settled out of the water. This stream channel also has a white crust on it like the Paria River -after the flows subside and the water evaporates indicating a fairly high dissolved salts.

AR0020253

October 31, 2013 Updated December 4, 2013

Table 4

pH, Alkalinity, Hardness & TDS Results From GSENM Riparian Assessments June to August 2013

Allotment	Sample Site	Date	pH	Alkalinity (ppm)	Hardness (ppm)	TDS (ppm)	Comments
1. City of Kanab	Tap water	2013	7.5	50	60	190	
2. Lower Cattle	25 Mile Wash LO0006	2013	7.3	70	50	401	After a thunder storm with a sediment load measured at 40 percent after 2 weeks settling. Naturally high sediment loads.

The BLM assessed this site as FAR upward trend in 2001 and restated this finding in their 2006 determination. In 2010 the BLM re-assessed the reach as PFC. The upward trend in 2001 and the PFC in 2010 were likely due to good grazing management alone since the tamarisk was still alive. Our findings of PFC in 2013 are consistent with this. However, the explosion of riparian and Cottonwood species growth is directly related to the recent die off of the competitive dense tamarisk tree stands. The BLM and the rancher are doing a good job managing this area.

2. NW Little Red Rock Seep or LE0546. This spring or lentic is developed. The total size is .002 acres. The elevation is approximately 5,160 feet. The site was assessed on August 21, 2013.

Our findings for NW Little Red Rock Seep or LE0546 in 2013 assessed it as PFC. There was some confusion in interpreting the BLM records and site numbering for this and two adjacent potential lentic sites in the area. We corrected this numbering problem with BLM in November . Figure 121 is a satellite imagery showing this site and the one other riparian site in this area in relation to each other. The primary species present are Hackaberry trees, Juncus torreyi and Alkali muhly (Muhlenbergia asperfolia). We did not sample this water source unfortunately but the dominance of the salts tolerant Alkali muhly indicates this water is likely naturally fairly brackish as are a number of the waters in this area. With moderate to slight overland flows on this site, Alkali muhly's rhizomatous growth habit provides adequate stabilization.

Figure 122 shows the hanging Alkali muhly garden aspect view from the ground level. Note the pipe on the right side of it coming out from under the hanging garden that is perched on the historic ranchers cement slab. The rancher indicated that there is a historic cement slab (over 50 years) anchored into the sandstone wall by a rancher that is holding up the Alkali muhly community and trapping water to flow down the pipe to the trough. It is really a pretty efficient system as that garden has not changed much or fallen over all this time and serves as the primary water source for this livestock use area. Without the cement slab, there really isn't much to hold it there. Figure 123 is a close up of the riparian area and water development.

Figure 121. Satellite image of 2 adjacent lentics Slot Canyon Red Rock & Little Rock Seep NW.

Figure 122. LE00546 hanging garden development.

Figure 123. Close up of the stable riparian area and development.

The BLM assessed this site as FAR with downward trend in 2002 and restated this finding in their 2006 determination. In 2010 the BLM re-assessed the site at PFC. Our findings of PFC in 2013 indicate an improvement since 2002 and are consistent with BLM's 2010 assessment. The BLM and the rancher are doing a good job managing this area.

3. Slot Canyon Red Rock Seep or LE0545. This spring or lentic is developed. The total size is .03 acres. The elevation is approximately 5,160 feet. The site was assessed on August 22, 2013.

Our findings for Slot Canyon Red Rock Seep or LE0545 in 2013 assessed it as PFC. Figure 121 shows this sites placement on the landscape in relation to the Little Red Rock Seep NW. Some of the primary species present are Alkali muhly, Juncus torreyii, virgin bower, skunk brush and

white sweetclover. The dominant species is Alkali muhly. Both Alkali muhly and Juncus torreyii are adapted to soils and waters with fairly high salts content. With moderate to slight overland flows on this site, Alkali muhly's rhizomatous growth habit provides adequate stabilization. This seep water is likely somewhat high in salts and TDS or even brackish as are a number of the other waters in this area.

This riparian area is formed in a sandstone slot canyon (Refer to Figure 124) where alluvial deposits accumulated, the soils were hydrated by the runoff and seep water from the sandstone, then riparian vegetation got established with roots to hold the deposited soil from slipping on their slick sandstone foundation and a riparian habitat was established. This site has remained essentially unchanged for 20 plus years according to the rancher. He pipes water from the collection box historically placed in this seep source as a secondary source of livestock water in this use area. He has the entrance to the slot canyon blocked to keep the livestock out due to the fragile nature of the riparian area. However, to insure long-term exclusion of livestock, it might behoove the BLM to install a short 20 to 30 foot gated fence across the opening.

Figure 124. Entrance into the Slot Canyon Seep.

Figure 125. Dense & vigorous Alkali muhly community.

The BLM assessed this site as FAR with downward trend in 2002 and restated this finding in their 2006 determination. In 2010 the BLM re-assessed the site at PFC. Our findings of PFC in 2013 indicate an improvement since 2002 and are consistent with BLM's 2010 assessment. The BLM and the rancher are doing a good job managing this area.

4. Little Red Rock Seep SE or LE0528. This seep out of a horizontal crack about 12 feet high on a sandstone cliff wall has no riparian community on it or hydric soils below it on ground level. We did not consider this a riparian area and did not assess it. The elevation is approximately 5,160 feet. The site was visited on August 21, 2013.

As Figure's 126 and 127 show the horizontal crack seeping water with extremely an low output and the dry alluvial sandy loam below it on ground level. A 20 to 30 foot fence across the alcove opening by this formation might provide an opportunity to see if it was and can become again some small level of a riparian area. The rancher and BLM agreed that this might be worth doing.

Figure 126. Horizontal extremely low output seep.

Figure 127. Non-riparian community or soils below it.

Uplands

We did not collect any qualitative health data or quantitative data for the uplands in 2013. We are scheduled to do so in 2014 for Garfield and Kane Counties. However, we did traverse much of the uplands and were impressed with how good of shape the Black brush and grass communities were. Figure 128 shows a vigorous and healthy blackbrush community and Figure 129 shows a community dominated by Indian ricegrass and sand dropseed. Both of these communities are extensive within this allotment and showed no measurable use on the grass or shrub species from livestock when we traveled through the sites. This is likely because under a winter grazing system, the species are grazed when dormant and re-grow in the spring and summer when the livestock are gone. Deferred or rest rotation systems can offer the same good re-growth conditions.

Figure 128. Vigorous and healthy blackbrush site.

Figure 129. A healthy grass dominated sandy site

D. Mollies Nipple Allotment Results for Riparian Assessments and Uplands

Riparian 8 Sample Sites.

1. Box Elder or LE0009. This stringer meadow spring or lentic is not developed. The total size is approximately 1.2 acres for the lower meadow, .18 acre for the middle one more Box Elder trees and shrubs and .65 acres for the upper meadow (same type as the lower) for a total of approximately 2 acres. The elevation is approximately 5,700 feet at the lower, 5,720 feet at the middle and 5,760 feet for the upper meadow. The site was assessed on July 18, 2013.

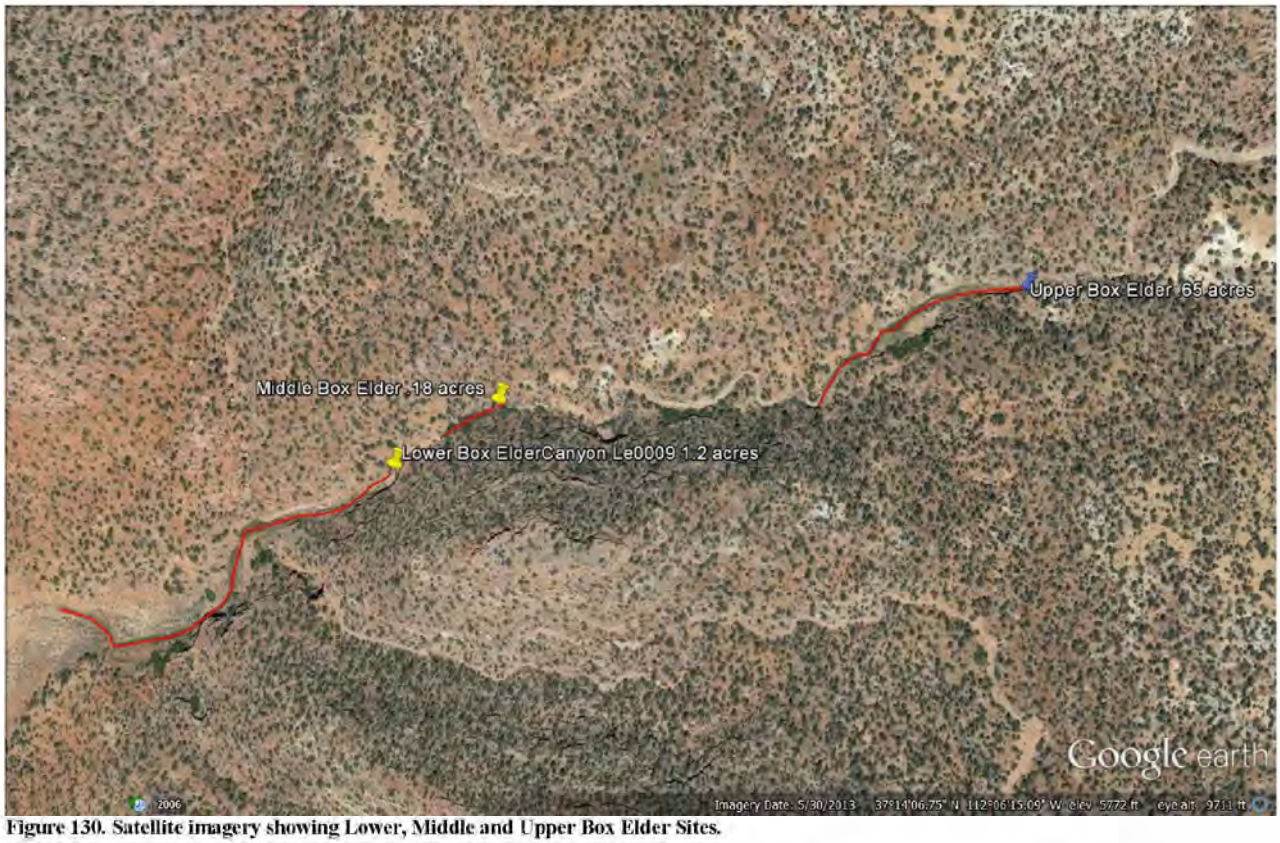

Figure 130. Satellite imagery showing Lower, Middle and Upper Box Elder Sites.

Our findings for Box Elder Canyon in 2013 assessed it as PFC. When we assessed Box Elder Canyon meadow we were not aware from the information we got from BLM that the meadow was a complex of two and potentially three sites (Refer to satellite Figure 130) with the upper most meadow approximately .54 miles farther up the drainage. As a consequence, we did not physically visit any but the lower site. The lower meadow is more accessible to cattle than the upper. Since we assessed the lower more accessible site as PFC and the BLM's assessment for the upper was FAR with no apparent trend, we feel comfortable extrapolating the improved conditions from the lower to the upper meadow. We will visit the upper meadow in 2014 to verify this extrapolation of our results. We would have preferred to assess the site completely in 2013 but, again, we did not know it was there.

Some of the species present are Gooseberry (Ribes leptanthum), Beeplant (Cleome serrulata), Buttercup (Ranunculus amoenus), Coyote willow, Box Elder Tree, Virgin Bower, Three Square (Scirpus pungens), Spikerush (Eleocharis palustris), Baltic rush, Nebraska sedge (Carex nebrascensis), Bull thistle (Cirsium vulgare), Tamarisk, Cocklebur (Xanthium strumarium), Lupine (Lupinus possibly pusillus), Rabbitsfoot grass (Polypogom mospeliensis) and Green rabbitbrush (Chrysothamnus viscidiflorus). The site was dominated by the riparian species Baltic rush, Nebraska sedge, spikerush and three square. In the lower naturally drier portions of the lentic, cocklebur was present. The Coyote willow and Box Elder had been grazed heavily by livestock and the willow were not in too good of shape as shown in Figure 131 with the stick like willow in the center of the photo. However, the overwhelmingly stable appearance, well hydrated soils, evidence of sediment trapping and dense riparian grass like species population

present, as shown in Figure 132, place this site at PFC. It is not at its potential community which is likely a Coyote willow community with Box Elder trees and an understory of the riparian herbaceous species listed above. We compared our photos with the one taken by the BLM in 2000 and 2010 and the improvement in conditions in 2013 is highly visible with the riparian area clearly having expanded in its extent. In Figure 133 it shows a more level and wet spot along the meadow site that was recently buried in vegetation trapped sediment with plants beginning to push up through the alluvial soils. This is an example of this system functioning properly. Figure 134 shows a patch of Spikerush (Eleocharis palustris) in a wetter spot that it is more suited for and Figure 135 is a close up of this riparian species. There was evidence that cattle still concentrate in this area from hoof prints and the use on the willow and Box Elder. Overall, the BLM and the rancher have made some significant changes in management to get the improved conditions and riparian expansion we observed.

Figure 131. Meadow with stick like willow stems.

Figure 132. Box Elder PFC meadow.

Figure 133. Sediment trapping by dense grass like riparian community.

Figure 134. Spikerush (Eleocharis palustris) in a wet spot. **Figure 135. Spikerush (Eleocharis palustris).**

The BLM assessed this site as FAR with no apparent trend in 2000 and restated this finding in their 2006 determination. In 2010 the BLM re-assessed the lower site at FAR with upward trend and the upper site FAR no apparent trend. Our findings of PFC in 2013 indicate an improvement since the BLM's 2000 and 2010 assessments. The BLM and the rancher are doing a good job managing this area.

2. Kitchen Corral Spring or LE0010. This spring or lentic is developed. The total size is approximately .01 acres. The elevation is approximately 5,720 feet and the spring source as shown in Figures 136 and 137 is located high up slope at the base of a sandstone cliff. The site was assessed on July 19, 2013.

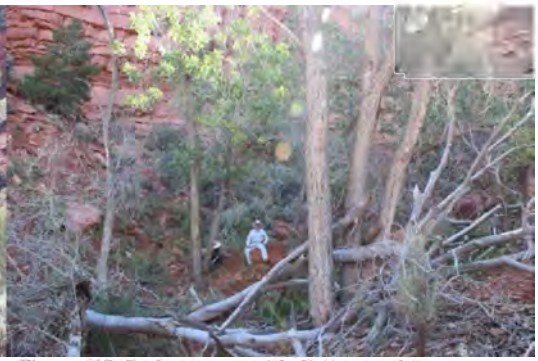

Figure 136. Spring located high up at base of cliff. **Figure 137. Spring source with Cottonwood trees.**

Our findings for Kitchen Corral Spring in 2013 assessed it as FAR upward trend. The species present include Cottonwood tree, Baltic rush, Slender Sedge (Carex lasiocarpa) (we did not expect to find this species here based on its official distribution for Utah), Virgin Bower, Bull thistle, Single leaf ash, Skunk brush (Rhus trilobata), Gambles oak (Quercus gambelii), Mountain Sagebrush (Artemisia tridentata Nutt. ssp. Vaseyana) and Utah Serviceberry (Amelanchier utahensis). No willow were noted in the area. This may not be a willow community.

The slope on this lentic site goes from 5,720 to 5,680 or 40 foot drop in elevation in about 128 feet giving an average slope of 31 percent. This is a steep lentic site stabilized by boulders, a rocky drainage and vegetation. Figure 138 shows the steep boulder strewn slope of this lentic with patches of herbaceous riparian green vegetation patches and Mountain sagebrush on the upland side slopes. Just a small number of cattle (based on the few number of tracks) are getting

into the spring source and removing the vegetation and have broken the pipeline that carries water to sites below the spring (Refer to Figure 139). The spring development needs maintenance.

We discussed the cattle access issue with the BLM and they indicated that due to funding and workforce constraints, they have implemented improved management on most of the allotments and sites not meeting standards but not all of them. They are scheduled to continue efforts on this allotment in the near future as they have already taken some actions. This is corroborated in the riparian area improvement documented on the Box Elder Canyon and, as we will discuss later on in this report, the North Kitchen Corral Spring, Jenny Clay Hole and the exclosure on Wildcat Spring both within the Mollies Nipple Allotment. We suggested a short inexpensive drift fence about 200 feet below the spring source to keep livestock out of the site (it may need a gate to allow maintenance). A small and steeply placed riparian site like this can experience impacts from even one cow for a short time period so excluding livestock from the source is a sound management action.

Figure 138. Boulder strewn slope & patchy vegetation.

Figure 139. Broken pipeline at spring source.

We noted good vigor in the Baltic rush and other riparian species in numerous locations and some young cottonwood trees re-establishing in the area (Refer to Figure 140). This is why we indicated an upward trend. The presence of bull thistle, rabbitbrush and sagebrush in small locations of this riparian area and the livestock disturbance at the springs source mentioned above are why we assessed it at FAR not PFC.

Figure 140. Young cottonwood trees re-establishing on the lentics' steep boulder strewn drainage.

The BLM assessed this site as FAR with downward trend in 2001 and restated this finding in their 2006 determination. In 2010 the BLM re-assessed it at PFC but the records we have do not

include any photographs to compare our findings with so we interpreted from the narrative on their field forms that conditions may have been a little better in 2010 than we experienced in 2013. Our findings of FAR with upward trend in 2013 indicate an improvement since the BLM's 2001 assessment and does not agree with the BLM's PFC finding in 2010. Both the 2013 and BLM's 2010 findings indicate the site is improving likely due to management changes since 2001. Livestock are affecting this site, we noticed recent hoof prints and noted that cattle have broken the pipeline from the spring source. We noted above and recommend a short inexpensive drift fence about 200 feet below the spring source to insure that livestock keep out of the riparian area and spring source. The BLM and the rancher should continue to work together to improve management of this area and the BLM indicated they are doing so.

3. North Kitchen Corral Spring or LE0011. This spring or lentic is developed. The total size is approximately .01 acres. The elevation is approximately 5,720 feet and the spring source as shown in Figures 141 and 142 is located high up the hillside on a steep slope. The site was assessed on July 19, 2013.

Figure 141. N. Kitchen Corral Spr. Source.

Figure 142. Steep 17 percent slope of lentic riparian site.

Our findings for North Kitchen Corral Spring in 2013 assessed it as FAR upward trend. The species present include Coyote willow, Baltic rush, Cottonwood trees, Cattail, Regals Rush (Juncus regellii) and Bentgrass. The willow establishing here may be related to the more gradual 17 percent versus the 31 percent slope of the adjacent (about .6 miles south) Kitchen Corral Spring.

The slope on this lentic site goes from 5,720 to 5,700 or 20 foot drop in elevation in about 120 feet giving an average slope of 17 percent. This is a fairly steep lentic site stabilized by boulders, a rocky drainage and vegetation. Figure 142 shows the steep boulder strewn slope of this lentic with vigorous Coyote willow 4 to 8 foot tall and 1 to 7 years old and young 1 to 6 years old Cottonwood trees present. Boulders along with the vegetation play a role in stabilizing the area. The riparian area appears to have significantly improved is expanding in extent compared to the BLM photos from 2001 (we have no BLM 2007 photos). The 2001 BLM photos show no willow or young Cottonwoods present only bare ground. We did not see any indication that this site was being dewatered. Livestock use on the site was not noted since there was no measurable use on the willow or young cottonwoods. To insure that a cow or two does not access the spring and riparian area and potentially affect the improving conditions, we suggest that the BLM consider an inexpensive short drift fence at the base of the riparian area (it may need a gate to allow maintenance.)

The water from this productive spring has historically been piped approximately 15 miles to multiple water troughs providing livestock and wildlife water. This improves livestock distribution and enhances wildlife populations and extent.

Water sources such as these provided by the rancher are used by birds, insects (pollinating types and others), amphibians (toads), reptiles (lizards, snakes etc), large ungulates (deer, antelope, elk), predator mammal species (Coyote etc.), to name a few. The watering system is controlled by series of float valves in float boxes. These float valves regulate flow and reduce the demands on the spring source facilitating good riparian area management.

Figure 142. Fairly steep lentic N. Kitchen Corral Spr.

Figure 143. Young willow & Baltic rush expanding the riparian area.

The BLM assessed this site as NF in 2001 and restated this finding in their 2006 determination. In 2010 the BLM re-assessed it at FAR with no apparent trend. The records we have do not include any photographs from 2010 to compare our finding with. Our findings of PFC in 2013 indicate an improvement since the BLM's 2001 and 2010 assessments. Our 2013 findings indicate the site has improve measurable and is likely due to management changes by the BLM and the Rancher since 2001. The BLM and the rancher should continue to work together to improve management of this area and the BLM indicated they are doing so.

4. Mine Spring NE or LE0013. This spring or lentic is not developed (the argument could be made that this could be considered an intermittent lotic but we remained with BLMs original determination). The total size is approximately .2 acres for the original BLM site and .3 acres for the adjacent saltgrass meadow that the BLM did not identify. The elevation is approximately 5,480 feet. The site was assessed on July 19, 2013.

Our findings for Mine Spring NE Spring or LE0013 in 2013 assessed it as FAR with no apparent trend. This assessment was for both the .2 acre original site and the additional .3 acre saltgrass meadow. The species present include saltgrass, Baltic rush (Juncus balticus), Jointed Rush (Juncus articulates), Bee plant, wild mustard spp., Cocklebur, Nebraska sedge and Bull thistle.

.2 acre Original BLM Site:

In the BLMs 2001 assessment they photographed and discussed head cuts and degraded conditions for the .2 acre riparian area within the main drainage channel. We could not see the dense tamarisk stands in the 2001 photos that are present in the 2010 and our 2013 photos. In 2010 and 2001, any tamarisk present was alive and vigorous based on their narratives. In 2013,

we documented that most if not all the tamarisk is dead due to the tamarisk beetle. Figure 144 shows the dead reddish brown tamarisk densely spread out around the LE0013 riparian lentic in the drainage. The death of tamarisk, an introduced species that uses large amounts of water, should help improve the conditions by releasing native riparian growth due to the reduced competition for water and other resources. Figure 145 shows the riparian area adjacent to wash drainage channel that has two Juncus species and some Nebraska sedge exhibiting laminar flow characteristics and sediment trapping in response to flash flood waters over the lentic community. Figure 146 is an aspect photo of the same site of the close up shown in Figure 145. This location is located in Kitchen Corral Wash. It has 2 major drainages feeding it a short distance north (1.5 miles) called the Park wash and Deer Spring wash and 1 minor drainage directly feeding it from the Vermillion Cliffs area to the southwest. The area is relatively flat without any noticeable grade in this specific small location in the channel and it appears to have a sandstone bedrock base overlain with sandy loam alluvial deposits. We scoured the area looking for a spring source and could not find one. That does not mean it is not there but the 3 of us sure were not successful in flushing it out.

We suggest that the site may get its riparian characteristics primarily or solely from seasonal runoff that collects and pools in the fairly flat segment of the wash located here saturating it to create riparian conditions. Once saturated from any single event, the excess overflow would then continue moving down hill in the wash or evaporating. We noted evidence of water pooling in this small area while surveying it.

Figure 144. Dead tamarisk along drainage lentic riparian.

Figure 145. Laminar flow.

Figure 146. .2 acre lentic in drainage channel.

Figure 147. Small slot canyon watering saltgrass meadow.

.3 Acre Saltgrass Meadow:

When we were looking for the spring source, we traversed the very dense or thick dead tamarisk stands to the south and north of the .2 acre riparian area discussed above. Just above the northern stand of dead tamarisk we discovered a saltgrass meadow that had a small slot canyon side drainage that cut through the sandstone bedrock bringing runoff water from the main Kitchen Corral Wash (Refer to Figure 147 and 150).

To prepare a photo for Figure 148, we climbed higher ground located to the east of the wash and the road to photograph the placement of the saltgrass meadow located just north of the riparian lentic that is adjacent to the wash channel. The two riparian areas, as noted above, are separated from each other by the dense stand of now dead tamarisk. Figure 149 shows a ground level view of the saltgrass meadow. While functional, this meadow is fairly degraded and heavily used by livestock.

Figure 148. Riparian lentic & Saltgrass meadow.

Figure 149. Saltgrass meadow.

Figure 150 is a satellite image of these two adjacent riparian areas labeled to identify the sites and drainages feeding them. The presence of saltgrass implies that the watershed feeding this area is likely naturally high in minerals/salts.

Figure 150. Satellite image of Mine Spring NE and adjacent Saltgrass meadow with drainages identified.

The BLM assessed this site as NF in 2001 and restated this finding in their 2006 determination. In 2010 the BLM re-assessed it at FAR with no apparent trend. The records we have do not include any photographs from 2010 to compare our findings with. Our findings of FAR with no apparent trend in 2013 indicate an improvement since the BLM's 2001 assessment and is consistent with their 2010 assessment. Our 2013 findings indicate the site has improved since 2001. This is likely due to management changes by the BLM and the Rancher since 2001. However, heavy use on the saltgrass meadow and livestock concentration is impacting the recovery of this portion of the assessed site. More improvement is needed to bring these two adjacent lentics to PFC. We recommend that the BLM and the rancher continue to work together to improve the management of this area and the BLM indicated they are doing so.

5. Jenny Clay Hole or Mine Spring SW or LE0007. This spring or lentic is not developed. The total size is approximately .007 acres. The saltgrass community next to the wash that this lentic feeds into are dry enough that they appear to be just an upland saltgrass vegetation community. The elevation is approximately 5,560 feet. The site was assessed on July 19, 2013.

Our findings for Jenny Clay Hole or Mine Spring SW lentic (LE0007) in 2013 assessed it as FAR with upward trend. The spring has two adjacent seepage areas on the west side of the wash as depicted in Figure 151 with Brent Owens by the seep on the left and Paul Curtis by the seep on the right. The species present include Coyote willow 1 to 3 years old (they were not mentioned in the BLMs 2000 data or photos), Baltic rush, Cottonwood trees, green rabbitbrush and tamarisk 1 to 8 years old (was as prevalent in the BLMs 2000 photos). Figure 152 is a close up of the riparian vegetation at one of the seeps showing the Baltic rush (darker green grasslike

plant), green rabbitbrush in the lower left, saltgrass in the photos lower center and a tamarisk branch in the right side of the photo.

Figure 151. Two seep sources Jenny Clay Hole Spr.

Figure 152. Close up of seeps vegetation.

In order to reduce the water demand on this apparently low producing seasonal spring or seep source, it may be advisable to remove the tamarisk from the site. It would likely help improve the seep sources riparian vegetation component and overall functionality. The tamarik were not as prevalent in the 2000 BLM photos. They appear to be growing larger and apparently more numerous since 2000. In the wash channel adjacent to Jenny Clay Hole's two seeps, the BLM has used dead junipers and juniper posts driven into the ground to dams up and trap sediment to reduce erosion. They did this sometime between 2010 and 2013 based upon our examination of the photos. Their purpose was to heal the down cuts in the wash. It has been a very successful management action on the part of the BLM as Figures 153 and 154 show. We noted non-measureable grazing use on the adjacent upland grass species the riparian species at the two seeps. Livestock are not affecting this site under the current grazing.

Figure 153. Dead juniper & juniper post healed down cuts.

Figure 154. Juniper & post structures.

The slope of the wash varies from 1 percent near the two lentic seep sources to 3 percent down the wash channel. That steeper slope portion of the wash would likely be more prone to develop down cutting periodically after a flash flood event. These management actions taken by the BLM since 2010 are very proactive and successful.

The BLM assessed this site as FAR with downward trend in 2001 due in large part to the down cutting in the adjacent wash channel. They restated this finding in their 2006 determination. In 2010 the BLM re-assessed it at NF due again in large part to the down cutting in the adjacent wash. In 2013 the BLM assessed the site as FAR with upward trend with the down cutting and

riparian vegetation at the seeps improved. Our findings of FAR with upward trend in 2013 indicate an improvement since the BLM's 2000 and 2010 assessments and is consistent with their 2013 assessment. Our 2013 findings indicate good riparian vegetation vigor. Our photo comparison with BLMs scanned photos indicate the site has improved measurably since 2001 and 2010. This is likely due to the management changes initiated by the BLM and the Rancher since 2001 and the structural improvements in the wash. More improvement is needed to bring these two seeps to PFC. Current livestock grazing is not a factor in our assessment of FAR with upward trend. Removal of the tamarisk would contribute to improving the native riparian vegetation at the seeps by eliminating the competition for a limited water resource. We recommend that the BLM and the rancher continue to work together to improve the management of this area and the BLM indicated they are doing so.

6. Rock House Spring or LE0012. This spring or lentic is developed. The total size is approximately .005 acres. The elevation is approximately 5,560 feet. The site was assessed on July 17, 2013.

Our findings for Rock House Spring or lentic (LE0012) in 2013 assessed it as FAR with no apparent trend. Some of the species present are Cottonwood trees, Three square, Spike rush (Eleocharis palustris), Baltic rush, Four wing saltbush (Atriplex canescens) and Alkali muhly. The presence of Alkali muhly and Four wing saltbush indicate the soils and/or the spring source is high in minerals/salts. There is either a historic water diversion built above the Rock house buildings and ponds or the dugout area is at the Rock House springs header box (Refer to Figure 155).

The ponds at the site were not assessed (Refer to Figure 156). They get most if not all of their water from the North Kitchen Corral Spring previously discussed and that pipeline is providing a measured 4.2 gallons per minute flow. There is evidence in animal tracks and direct observation that the ponds regularly provide water for wildlife species in the area and migratory birds such as ducks, geese and blue herons. We watched a blue heron drink and remain around the pond and ring trough the entire time we were at the site. These ponds appear to be a good multiple use project provided by the BLM and the rancher.

Figure 155. Dirt pile or diversion above cow camp.

Figure 156. Livestock ponds at Rock House.

The BLM assessed this site as FAR with downward trend in 2001. They restated this finding in their 2006 determination. In 2007 the BLM re-assessed it at PFC. Our findings of FAR with no apparent trend in 2013 indicate an improvement since the BLM's 2001 assessment. It is

inconsistent with BLMs 2007 PFC assessment. Upon reviewing the BLMs 2001 assessment and associated photos, it is unclear what they were really assessing. Most of the photos were of the pond area with one close up of vegetation from some unknown location. The 2007 BLM assessment did not have any photos to interpret or better understand what was actually being assessed. We stand by our assessment findings. While the spring source has a fence around it, it is used as a horse holding pasture and grazed regularly. This spring source would benefit from complete protection from livestock grazing. Since the water is piped to and augments the pond water from North Kitchen Spring (according to the BLM), excluding livestock from the source would not appear to affect the livestock operation or access to water. More improvement is needed to bring this spring source to PFC. Current livestock grazing is a factor in our assessment of FAR with no apparent trend. We recommend that the BLM and the rancher continue to work together to improve the management of this area and the BLM indicated they are doing so.

7. Wildcat Spring or LE0008. This spring or lentic is developed. The total size is approximately .1 acres. The elevation is approximately 5,800 feet. The measured slope varied from 2 to 6 percent in the drainage associated with the spring source. The site was assessed on July 18, 2013.

Our findings for Wildcat Spring or lentic (LE0008) in 2013 assessed it as FAR with upward trend. Some of the species present are Nebraska sedge, Coyote willow, Baltic rush, Bottlebrush Squirrel tail (Elymus multisetus or Sitanium hystrix), Indian ricegrass, Cheatgrass (Bromus tectorum), Great Basin Big Sagebrush (Artemisia tridentate), Indian paintbrush species (Castilleja spp.), Bluegrass species (Poa spp.) and Skunkbrush. The water development does not appear to be working as the water trough was dry and no water was going to it (Refer to Figure 157).

Figure 157. Empty old water trough.

Figure 158. Repaired with structures & healed head cuts.

The BLM sometime since 2001 and likely after 2006 has built an exclosure around the entire drainage associated with this spring source and riparian area, planted Coyote willow, buried juniper posts upright into the channel of the drainage to trap sediment and reduce erosion, blocked the upper elevation 2 track road from driving down the springs steep drainage with the exclosure fence and placed rock structures in the lower steeper slope to repair old head cuts and trap sediment. These actions have been very successful. The riparian area has expanded and stabilized visibly from the BLMs 2001 photo comparison with our 2013 pictures. We noted old head cuts repaired with structures as shown in Figure 158 and vigorous riparian vegetation

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growing on the site. The channel associated with the riparian lentic area have vigorous Coyote willow, Nebraska sedge and Baltic rush as the dominant species present along with some grass species. The juniper post structures placed by the BLM are trapping sediment that supports a vigorous riparian vegetation community. Figure 159 shows the channel above the spring development with healthy and dense willow and other riparian vegetation. Figure 160 shows one of the juniper post erosion control structures overgrown with vegetation in the riparian area.

Figure 159. Willow in riparian area.

Figure 160. Juniper post structure & dense vegetation.

We noted a toad that based upon its characteristics could be a Arizona toad (Bufo microscaphus microscaphus), a cross between the Arizona toad and a Woodhouse toad (Bufo woodhousei) or just the Woodhouse toad (Refer to Figure 163).

Figure 163. Toad at Wildcat Spring.

The BLM assessed this site as FAR with downward trend in 2001. They restated this finding in their 2006 determination. In 2013 the BLM re-assessed it at PFC. Our findings of FAR with upward trend in 2013 indicate an improvement since the BLM's 2001 assessment. Photo comparison between our 2013 photos and BLMs 2001 show measurable improvements in stability and riparian species density and vigor. Our assessment is on the surface inconsistent with BLMs 2013 PFC assessment. Our FAR assessment was due primarily to the naturally lowered water table or drying up of the riparian area and the amount of upland grass species present in the riparian area. It was not due to livestock grazing. We had seriously considered assessing it at PFC and BLMs assessment was rated close to FAR, consequently, we are not really too far apart in our findings. The riparian exclosure and associated management actions taken have had remarkable success in improving this riparian area. The BLM and the rancher are doing a good job managing this area.

8. Wire Pass Buckskin Gulch Seep or LE2000. This very low (1 to 2 feet from the ground surface) hanging garden was considered a lentic and is not developed. It has a very low producing seep. The total size is approximately .002 acres. The elevation is approximately 4,720. The site was assessed on July 24, 2013.

Our findings for Wire Pass Buckskin Gulch Seep or LE2000 in 2013 assessed it as NF. This assessment finding was due to the absence of stabilizing riparian vegetation and an associated reduced or non-existent riparian wetland area caused by livestock grazing.

On July 20, 2013, we hiked an approximately 3.5 mile round trip via Wire Pass Canyon to the upper narrows of the Buckskin Gulch. We encountered at first knee then up to waist high or deeper dense clay mud and water in the narrows. So we turned around and postponed assessing the Buckskin Seep. Then on July 24, 2013, we returned and it was again above 100 degrees Fahrenheit. We successfully hiked an approximately 8 mile round trip and were able to assess this riparian area.

Some of the species present are Western Hackberry (Celtis reticulate), Tamarisk, Cocklebur, Mustard spp. and Bee plant. None of these are obligate or facultative wetland species or are non-native (tamarisk). The site was highly degraded with evidence of livestock concentration in hoof prints and droppings. The tamarisk was not present in the 2004 BLM photos. Figure 164 show the cow trail leading to the Buckskin seep. Figure 165 shows the dense Cocklebur, cattle hoof prints and overall degraded conditions.

Figure 164. Cow trail to Buckskin seep.

Figure 165. Dense cocklebur and degraded seep.

Figure 166. Very small puddle below Buckskin seep.

Figure 167. Hanging garden at Buckskin seep.

Figure 166 shows the very small puddle of water formed below the hanging garden seepage at Buckskin seep. Figure 167 shows what is left of the hanging garden at the degraded Wire Pass Buckskin seep.

The BLM assessed this site as FAR with downward trend in 2004. They restated this finding in their 2006 determination. Our findings of NF in 2013 indicate a decline in conditions since the BLM's 2004 assessment and are consistent with their determination of downward trend. Upon reviewing the BLMs 2004 assessment and associated photos, it was apparent to us that the site had degraded further, the hanging garden vegetation had been all but removed and about one foot of alluvium had been deposited by flood waters since 2004. This seep does not appear to be a very reliable water source. While this may provide water it can't provide water to very many cattle and they appear to camp on the seep and drinking what they can get. We stand by our assessment finding of NF.

This spring source would benefit from complete protection from livestock grazing. Fencing close to the seep is not a likely solution due to its physical impact on the heavy public hiking traffic in the area. We suggest that excluding livestock from the source should include not allowing any livestock access to this site. This could be accomplished either by changing the allotment use boundaries or by a fence farther north up the Buckskin Gulch where it could be designed to exclude livestock but minimally impact the recreational hiking traffic. We shared this recommendation with the BLM. This area is scheduled for management action by the BLM in the near future depending upon funding and workforce limitations. Current livestock grazing is a factor in our assessment of NF. We recommend that the BLM and the rancher continue to work together to improve the management of this area and the BLM indicated they are doing so.

E. School Section Allotment Results for Riparian Assessments and Uplands

Riparian.

There are no riparian areas on the allotment.

Upland.

For BLM's site number 254 they identified it as a grassland meadow. It is not a grassland meadow. We agree that site number 254 is degraded. The plant species are dominated by introduced and native annual grasses and forbs expected on an early seral or disturbed site. The sampled area is located less than 600 feet or a 1/8th of a mile from the only water source for the allotment (reference Figure 168) and represents a small part of the allotment. Historically the site has been plowed, farmed, and seeded to crested wheatgrass at one time or the other. Whether it is meeting standards or not does not appear to be a related to the existing grazing management practices. As a consequence the allotment does not require changes due to not meeting standards.

It is our assessment that livestock management alone is not likely to improve site 254. The soils present are a loamy to clay loam. The sites location on the landform place it into a loamy bottom ecological site 35-11 and at HCPC would be expected to have basin big sagebrush, basin wildrye, Indian ricegrass and other site associated species. We do not find grazing as the cause for the current conditions, as noted above, and assess the site as being in a steady state disclimax

community. The only way that the site number 254 is likely to be improved in a reasonable and measurable time frame would be to employ vegetative treatments such as seeding with some form of grazing rest during the establishment period.

Figure 168. Site 254 showing water close & dis-climax Weedy annual forbs and grasses

Figure 169. Site 255 showing plant density & heavy use

BLM's site 255 adjacent to site 254 has measurable amounts of Indian ricegrass, squirrel tail, sand dropseed, crested wheatgrass(Agropyron cristatum), three awn (and cheatgrass. BLM's determination found this site meeting standards. Based upon our observations while traversing the allotment, the density of perennial herbaceous species on this seeding was good with perennial plants every 30 inches or so (refer to Figure 169). The soils here are different than in 254. The soils on 255 are a sandy loam. Sandy loams often produce more grass or herbaceous growth explaining why more grass is here than near the water trough, as well as the other reasons mentioned. It also explains why the area has had so much historical disturbance. The old pioneers would draw upon their experience to see this location as having the potential to grow cash crops or support a seeding.

This site is not a grassland meadow as BLM labeled it in the determination but rather it fits the loamy bottom Basin big sagebrush 35-11 ecological site based on its placement on the landform. This ecological site would be consistent with plant communities on similar sites on other adjacent allotments (refer to Figures 170 and 171). The following figures show a distant example of loamy bottom ecological site and its placement on the landform near the School Section allotment and a close up of a loamy bottom site close to the allotment.

Figure 170. Loamy Bottom Site placement on landform.

Figure 171. Loamy Bottom site near School Section

We observed heavy utilization as an issue on this site 255 but we did not find the lack of a desired plant community for the seeding (DPC), low herbaceous species diversity or the species present as a seeding assessment issue. We would recommend that grazing management be established not due to site 254 not meeting standard but simply to assure that overgrazing is not occurring under existing grazing management on site 255 and the rest of the allotment until some form of mechanical treatment is done on site 254. A use level of 50 percent could be established on key species and the livestock removed from the allotment when that is met at the site number 255 since it is far enough from the water to be a realistic management area.

The site is degraded as a result of the historical uses and the assessments close proximity to the allotments only water source. It is really not a good location to establish a rangeland health assessment or where the BLM would expect to get improvement from the management of livestock. It's condition is not a result of existing livestock use but a consequence of numerous historical disturbances that were and are out of the ranchers or the BLM's control. As such, while we agree it is not functional and not meeting Standard 3 for preferred species, it is not a site to properly assess rangeland health related to existing grazing, nor to assess the entire allotment as not meeting upland standards.

F. Soda Allotment Results for Riparian Assessments and Uplands

Riparian 5 Sample Sites.

1. 40 Mile Spring or LE0529. This spring or lentic is developed. The total size is .1 acres. The elevation is approximately 4,380 feet. The site was assessed on August 20, 2013.

Our findings for 40 Mile Spring or LE0529 in 2013 assessed it as FAR with no apparent trend. Some of the species present were Fremont Cottonwood, Black willow, Cattail (Typa latifolia), tamarisk, Baltic rush, Three Square, Green rabbitbrush, Astragalus spp., Rabbitsfoot grass, Saltgrass, Saltwort or Seep willow (Baccharis glutinosa), Alkali muhly, Common Reed (Phragmites australis) and Bassia hyssopifolia. This assessment finding was not due to livestock grazing but due to lack of plant vigor and the presence and amount of non-riparian species. It is possible that the site may be in upward trend as our comparison of photos with those taken in 2002 show measurable improvement. We erred on the side of caution and assessed it with no apparent trend which is an improved change from the 2002's downward trend findings. The BLM repaired the existing or constructed a new exclosure around the entire riparian area but, for some reason, the gate was not installed yet. The BLM indicated they are scheduled to install the gate.

The tamarisk are dead on the site. It is expected that this will allow the riparian community to expand due to reduced competition for water. Saltgrass, Saltwort or Seep willow (Baccharis glutinosa), Alkali muhly, Common Reed (Phragmites australis) and Bassia hyssopifolia are all highly adapted to soils and/or waters high in salts. Table 5 shows the water quality information for this spring to have a hardness of 680 and a TDS of 2,670. This also indicates that the spring water is high in minerals or salts. This site is likely a saline meadow. As such, our assessment of FAR with no apparent trend is expected to change to upward trend and/or PFC fairly quickly

with the exclosure and removal of competition with tamarisk. Table 5 also displays the water quality for all 5 springs in this allotment that we assessed.

October 31, 2013 Updated December 4, 2013
Table 5
pH, Alkalinity, Hardness & TDS Results From GSENM
Riparian Assessments June to August 2013

Allotment	Sample Site	Date	pH	Alkalinity (ppm)	Hardness (ppm)	TDS (ppm)	Comments
1. City of Kanab	Tap water	2013	7.5	50	60	190	
2. Soda							
	Forty Mile Spring LE0529	2013	7.2	90	680	2,670	
	50 Mile Spring LE0533	2013	8.2+	40	470	2,100	
	Cottonwood Spring LE1514	2013	6.8	70	80	500	This likely has a different aquifer and/or subsurface geologic layer it flows through as it is in the same general location as the other 4 springs in Soda Allotment but lower salts indicated.
	Pole Well LE1518	2013	7.2	140	860	3,150	
	Soda Spring LE0532	2013	8.2+	50	1,900	5,310	

The spring has had a historical pond built around the collection box and is protected from wash out from the main drainage by a dike system. We did not see any indication that the historical dike system was adversely affecting the spring but rather protecting it from being washed our during flood events. Figure 172 is a satellite image labeled to show the relative spatial layout of the meadow or spring location, dead tamarisk, water dike, main wash or dry valley bottom drainage, the well on the bench and the two dry ring tank troughs.

Figure 172. Satellite imagery showing relative location of sites on the ground

Figure 173 shows the full water collection box at the lowest point in the meadow. Figure 174 shows the saline meadow community with green rabbitbrush and Saltwort (green shrubs), Cattail (to the left center of photo) and Saltgrass and Alkali muhly.

Figure 173. Water collection or spring box. Figure 174. Saline Meadow ground view.

Figure 175 is a view of 40 Mile Spring from the bench showing the dark green Cattail with a salty white center where the collection box is, far right corner is the edge of the reservoir built to trap excess water (dry this year), the light green saline meadow with green shrubs (rabbitbrush and Saltwort), the exclosure fence line and the dike to the middle section of the photo. Figure 176 shows part of the exclosure fence, the dike and the dead tamarisk above the 40 Mile Spring but below the dike.

Figure 175. 40 Mile Spring from looking from bench. Figure 176. Dead tamarisk above spring.

The BLM assessed this site as FAR with downward trend in 2002. They restated this finding in their 2006 determination. In 2007 and 2013 the BLM reassessed the site as FAR with no apparent trend. Our findings of FAR with no apparent trend in 2013 indicate an improvement since the BLM's 2002 assessment. Photo comparison between our 2013 photos and BLMs 2002 show measurable improvements in stability and riparian species density and vigor. Our assessment is consistent with BLMs 2007 and 2013 assessments. Our FAR assessment was not due to existing livestock grazing and the spring shows no indication of being dewatered. We had seriously considered assessing it with upward trend but, as stated earlier, the lack of plant vigor and the presence and amount of non-riparian species placed it at no apparent trend. The riparian exclosure and dead tamarisk is expected to facilitate a rapid improvement in this riparian area. The BLM and the rancher are doing a good job managing this area.

2. 50 Mile Spring or LE0533. This spring or lentic is developed. The total size is .01 acres. The elevation is approximately 4,440 feet. The site was assessed on August 21, 2013.

Our findings for 50 Mile Spring or LE0533 in 2013 assessed it as NF. This was due primarily to a lack of a stabilizing riparian vegetation caused by livestock grazing and physical impacts.

Additionally, while the wash channel has cut down to a stable base level it has not widened enough to establish floodplains that would facilitate the spring source in developing a strong stable riparian community.

The existing BLM GPS coordinates are inaccurate and the 1:24,000 contour map has the spring located a little over 1 ground mile to the NW of the actual spring. We had some challenges finding the springs actual location and finally placed it at T 41S R8E NWSW Section 12. Some of the species present were Saltwort, Black willow, Cattail, tamarisk, Fremont cottonwood, Green rabbitbrush and cocklebur. Figure 177 shows the layout of 50 Miles Spring from a satellite viewpoint showing the original wash channel, the dike, the current wash channel, the spring or collection box for the water development, the current riparian wetland expression and the location of the 2 water toughs. While the dike has modified the channel location to protect the header box from flash flood events, the new channel appears to have down cut the channel bed to a level of stability. Figure 178 shows the riparian area where the spring source is draining into the wash channel and pooling. The bare ground and lack of riparian vegetation caused primarily by livestock grazing is apparent. There were no young cottonwoods anywhere. We noted hoof prints throughout the riparian area. Figure 179 shows the two full water troughs. The trough in the foreground had a rattle snake living under it rattling the entire time we were there. Not a very friendly snake.

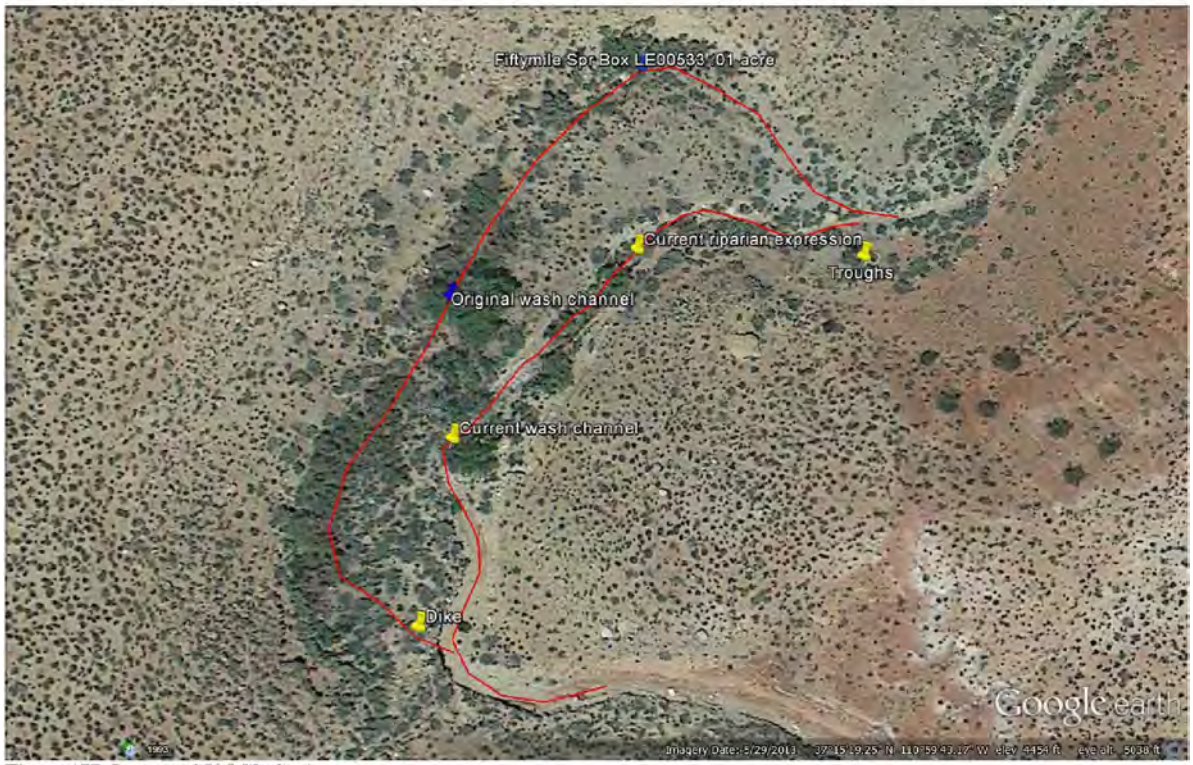

Figure 177. Layout of 50 Mile Spring.

Figure 178. Degraded spring riparian area.

Figure 179. 50 Mile Springs full water troughs.

Figure 180 shows an aspect view of the original channel, the dike and the existing wash channel. Figure 181 is a picture of the spring box location that we ferreted out while assessing the area. It does not have riparian conditions as the springs surface water has moved and started leaking out at the lower location in the current wash channel.

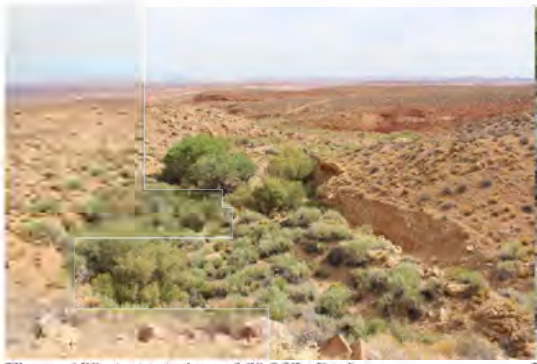

Figure 180. Aspect view of 50 Mile Spring.

Figure 181. Header or spring box location.

In Table2 the water quality values for 50 Mile Springs hardness is 470, TDS is 2,100 ppm and the pH is 8.2 + or fairly basic or colloquially known as alkaline. These values indicate a natural water source with fairly high mineral or salt content. Once the site begins to re-vegetate, we might expect to see some Alkali muhly and saltgrass along with young cottonwoods, three square and Baltic rush. Once vegetation gets established it should start trapping sediment and further stabilize the site. We recommended to the BLM that they consider building an exclosure around the spring source and header box to resolve the impact by livestock and remove the tamarisk to reduce vegetation competition for a limited water resource. This spring is scheduled to be addressed within their funding and workforce constraints. As noted earlier, the BLM has already built an exclosure around 40 Mile Spring in this allotment showing their commitment to pursuing sound and effective livestock grazing management.

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Figure 182. Stony & gravelly stabilized channel bed for 50 Mile Springs riparian.

The BLM assessed this site as NF in 2002. They restated this finding in their 2006 determination. In 2007 the BLM again assessed the site as NF with one photo of only showing the troughs making it difficult to compare to our findings. In 2010 the BLM reassessed the site as FAR upward trend but had no photos in the official record to compare our findings with. Our findings of NF in 2013 indicate no real change since BLM's 2002 assessment other than the current channel appears to have down cut 2 to 3 feet to its current stable bed level. The down cutting and channel appears to have stabilized at a stony and gravely channel bed (Refer to Figure 182). Our assessment is consistent with BLMs 2002 and 2007 assessments and in contrast to their 2010 findings. Our NF assessment was due to existing livestock physical impacts and their grazing removal of any stabilizing riparian vegetation. We stand by our NF assessment findings.

A future riparian exclosure is expected to facilitate a rapid improvement in this riparian area vegetation expression. It would be fairly inexpensive and have a minimal adverse effect on the ranchers operation because the water is available at troughs already. Exclosure design would be important to insure the maximum result with the minimal impact to the ranching operation. The uplands in our 2 + mile hike around the area looking for this spring did not show any excessive utilization on the Indian ricegrass plants indicating that the stocking and grazing practices here are within the carrying capacity. The BLM and the rancher should continue to coordinate and work together to do a good job managing this area. The BLM informed us they are.

3. Cottonwood Spring or LE1514. This spring or lentic is developed. The total size is .01 acres. The elevation is approximately 4,340 feet. The site was assessed on August 20, 2013.

Our findings for Cottonwood Spring or LE1514 in 2013 assessed it as PFC. Some of the species present are Cottonwood, Russian Olive, Cattail, Juncus baltcus, Alkali muhly, Nebraska sedge, Three Square, saltgrass, just a few cocklebur plants and one green rabbitbrush. The riparian vegetation was vigorous and expanding in extent. We documented evidence of sediment trapping by the increased expanse of riparian vegetation. There were young cottonwoods from 1

to 5 years old present showing recruitment. Figure 183 shows the sediment trapping by Baltic rush, Cattail and Three square at the spring source and some of the young cottonwood trees that are sprouting up throughout the site. Figure 184 is a close up photo of sediment trapping and Baltic rush which is an excellent riparian stabilizing species.

Figure 183. Sediment trapping by riparian vegetation.

Figure 184. Baltic rush desired riparian species.

Figure 185 shows the expansion of the riparian extent. In comparing this photos location to the 2007 photos, the extent has increased approximately 1 ½ times in size. Note that the wash or drainage bottoms channel here has less than a 1 percent slope and is naturally armored by the sandstone walls and bedrock. The riparian vegetation expansion is expected to continue trapping sediment and expanding across the channels bed inside the BLMs recent exclosure seen in the photo. Figure 186 is of the same expanding riparian site looking down on it from a ledge. Sediment trapping can be seen on the edges of the riparian vegetation as is evidenced by the sand buried riparian vegetation.

Figure 185. Riparian expanding in size.

Figure 186. Sediment trapping & expanding riparian area.

The BLM has apparently built an exclosure around Cottonwood Spring sometime after 2007 as there was no exclosure in the 2002 or 2007 photographs. The water is piped outside the exclosure to a ring tank trough (Refer to Figure 187). The expansion of the riparian habitat is notable when comparing our 2013 photos with BLMs 2002 and 2007 photos. The exclosure and BLMs and the ranchers management is working.

In Table 5 the water quality values for Cottonwood Springs hardness is 80 and TDS is 500 ppm. These values indicate a natural water source that is not real hard or salty water. This is in contrast to all the other 4 springs in Table 5 close to the area which are fairly high in salts to brackish. The name of the spring, Cottonwood, versus the name for Soda Spring (who's water is

high in salts to brackish) indicates that there really may be something in a name given by the old Mormon pioneers. We theorize that either the aquifer is different at Cottonwood than the other 4 springs or the subsurface geologic layer it flows through has less mineral or salt content. Either way, the water is not as high in salts. The spring at the outlet pipe is providing less than 10 ounces per minute (approximately 4.7 gallons per hour). A normal garden faucet can provide between 6 and 15 gallons per minute or 360 to 900 gallons per hour depending upon water pressure and water line diameter. So this spring is naturally and efficiently providing about .5 to 1 percent of the water volume you can get from your cities water supply. While it seems low, it is enough for the livestock and multitude of wildlife that utilize it as 4.7 gallons per hour equates to about 113 gallons per day. Not too bad if you are a thirsty animal.

Figure 187. Ring tank water trough Cottonwood Spring.

The BLM assessed this site as FAR with downward trend in 2002. They restated this finding in their 2006 determination. In 2007 the BLM reassessed the site as FAR with downward trend. Our findings of PFC in 2013 indicate an improvement since the BLM's 2002 and 2007 assessments. Photo comparison between our 2013 photos and BLMs 2002 and 2007 show visible improvements in riparian area expansion, stability and riparian species density and vigor. The spring shows no indication of being dewatered. The riparian exclosure is expected to continue facilitating a rapid improvement in this riparian area. The BLM and the rancher are doing a good job managing this area.

4. Pole Well Spring or LE1515. This spring or lentic is developed. The total size is .01 acres. The elevation is approximately 6,100 feet. The site was assessed on August 20, 2013.

Our findings for Pole Well Spring or LE1515 in 2013 assessed it as NF due to a lack of sufficient stabilizing riparian vegetation caused by livestock grazing and physical impacts. Some of the species present are Tamarisk, Cattail, Baltic rush, Common Reed, Alkali muhly and saltgrass. Riparian stabilizers like Cattail, Baltic rush and Common Reed are only marginally represented and not forming stable community types. The potential size of the springs riparian area was severely reduced in size. This water development has two seep sources. Figure 189 shows the layout of Pole Well Spring from a satellite viewpoint showing the vehicle parking area .1 mile from the spring, the upper and other seep and pond, Pole Well Spring and pond with dam face and the water trough downhill from Pole Well Spring.

Figure 190 shows the degraded riparian area associated with the Pole Well Spring source and the extensive tracks left by livestock. Figure 191 shows the upper other seep that also has a small

pond area associated with it. Note the cattle hoof prints throughout the degraded riparian area and the Alkali muhly patch in the lower right side of the photo. Figure 192 shows hoof prints within the Pole Well Springs associated pond and the heavy use on Cattail (light tan vegetation in the bottom of the photo). In this figure note the culvert in the foreground with a black pipe coming up out of the center of it. It appears to be a way to capture excess runoff and spring water when the pond is full for piping to the water trough. We were not certain of this, however. The culvert in the in the background is the valve system for water going to the trough. We checked the valve and it was open but on inspecting the trough, only a slight dribble was coming out. Spring flow appeared to be low at this time of the year.

Figure 189. Layout of the Pole Well Spring and Trough.

Figure 190. Source for Pole Well Spring.

Figure 191. Source for upper or the other seep.

Figure 193 is of the water trough located downhill from Pole Well Springs associated pond. Figure 194 shows the size of the ponds dam face to be an estimate 30 feet high with vegetation covering it that is at least 30 + years old. That the dam is still standing after all these years is

testament to the quality of workmanship that went into it. Both the upper other seeps dam and the Pole Well Springs primary dam are silted in. There was evidence of an old exclosure that existed around the Pole Well Spring source and pond that is currently in a state of disrepair.

Figure 192. Main pond and valve system.

Figure 193. Trough downhill from the Spring & pond.

Figure 194. Brent Owens standing on the top of the ponds estimated 30 foot high dam face.

In Table 5 the water quality values for Pole Well Springs hardness is 860 and TDS is 3,150 ppm. These values indicate a natural water source that is hard or salty water. This is not a water source that would taste very good.

We did not note any measurable livestock use on the surrounding upland grass species indicating that the area is being grazed within the carrying capacity present.

The BLM assessed this site as FAR with downward trend in 2002. They restated this finding in their 2006 determination. In 2007 the BLM reassessed the site as FAR no apparent trend. Our

finding of NF in 2013 indicates a decline in functionality since the BLM's 2002 and 2007 assessments. Photo comparison between our 2013 photos and BLMs 2002 and 2007 show more vegetation in 2002 than in 2013 and lower to no measurable use on the Cattail, Alkali muhly and Baltic rush. In the photo comparison with 2007, there was more riparian vegetation present in 2007 in both the upper other seep and Pole Well Spring and pond than in 2013. It was also more vigorous and less utilized. The primary species present in 2007 appear to be Baltic rush and Alkali muhly (comparing the site in photos to what we observed on specific location). Alkali muhly is a grass particularly adapted to water and soils high in salts and minerals. It should be noted that in 2002 the conditions in the photos looked better than in 2007 or 2013. As a result, since the riparian species were not so heavily used in 2002, they were able to identify quite a few more different species such as Juncus longistylus and 3 different sedge or carex species than we or the 2007 assessment team were able to do. Based on this discussion, our assessment of NF is supportable considering the previous years assessments and photo comparisons. We stand by our NF assessment.

We recommended to the BLM that they consider repairing the existing riparian exclosure around Pole Well Spring and pond, digging out the trapped sediment in the two ponds and have the rancher maintain the pipeline and trough so water would be available outside the repaired exclosure. A riparian exclosure is expected to facilitating a rapid improvement in this riparian area. The BLM has scheduled to consider some form of management action on this site contingent upon funding and workforce constraints. The BLM and the rancher will continue to work cooperatively to resolve management issues as they already have on other sites within this allotment.

5. Soda Spring or LE0532. This spring or lentic is developed. The total size is .01 acres. The elevation is approximately 4,280 feet. The site was assessed on August 20, 2013.

Our findings for Soda Spring or LE0532 in 2013 assessed it as FAR downward trend. Some of the species present are saltgrass, Alkali muhly, tamarisk, green rabbitbrush and Baltic rush.

The springs header box is fenced as shown in Figure 195. There was no riparian community within the exclosure or at the header box now or in the BLMs 2002, 2007 or 2010 assessments. It has been this way for at least 11 to 12 years. The upper end of the exclosure is exposed sandstone bedrock. Below the exclosure the road crosses an area where the sandstone bedrock is at the surface. On the down slope side of the road there is a small seep of water coming out of the sandstone forming a small .01 acre saltgrass meadow site. This site was assessed by the BLM in 2002 (to the best of our understanding) and 2010 (clearly assessed the area below the road). The BLM appeared to assess the dry sandstone area in the exclosure in 2007. As a result, the 2002, 2010 and our 2013 assessments can't accurately be compared to the 2007 results. This riparian site below the road is approximately 190 feet down from the springs fenced header box. We assessed this site and it is shown in Figure 196. It is likely that the upper header box and springs source simply taps into a spring seeping out of the sandstone and collects it to pipe down to the trough shown in Figure 197. We are not certain of that, however.

The riparian area we assessed had some head cutting and disturbance by livestock hoof action and grazing. These same management issues were identified in 2002 and 2010 by the BLM.

Figure 195. Fenced header box Soda Spring.

Figure 196. Small seep 190 ft below fenced spring box & road.

Figure 197. Soda Spring 20 ft ring tank trough.

In Table 5 the water quality values for Soda Springs hardness is 1,900 and TDS is 5,310 ppm with a pH of 8.2+ or a fairly high base. This water would be considered brine. These values indicate a natural water source that is hard or a high in salts. The plant species that would grow in a water this high in salts need to be very salt tolerant like salt grass and Alkali muhly. This is also not a water that would taste very good and is likely highly corrosive. The fact that the leaking ring tank trough has a poly lining to plug up corrosion leaks is a strong indictor or the spring waters naturally corrosive nature.

The BLM assessed this site as FAR with downward trend in 2002. They restated this finding in their 2006 determination. In 2007 the BLM reassessed the site as NF but assessed the dry bedrock spring source not the riparian area below the road so the assessment is not comparable to our 2013 results.

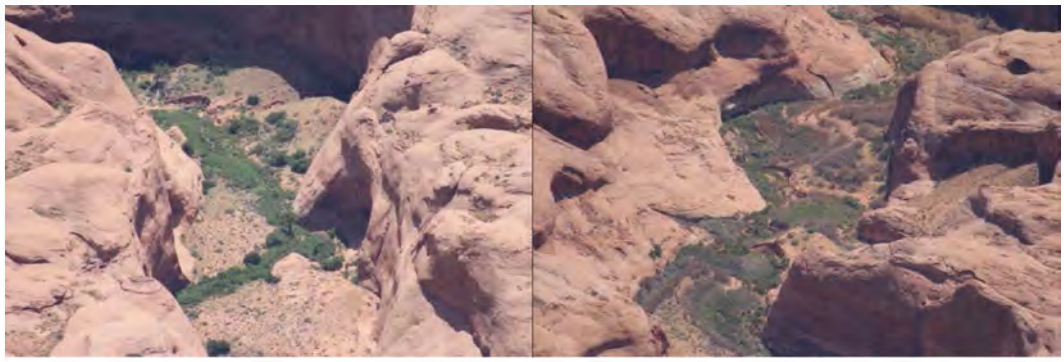
Our finding of FAR with downward trend in 2013 indicate no real decline or improvement in functionality since the BLM's 2002 and 2010 assessments. Photo comparison between our 2013 photos and BLMs 2002 and 2010 show a fairly static situation since 2002. Based on this discussion, our assessment of FAR with downward trend is consistent with the BLMs earlier findings and is supportable. We stand by our assessment.

We recommended to the BLM that they consider installing a small .25 acre or less riparian exclosure around the riparian area below the road at Soda Spring. A riparian exclosure is expected to facilitate a rapid improvement in this riparian area. The BLM has scheduled to consider some form of management action on this site contingent upon funding and workforce

constraints. The BLM and the rancher will continue to work cooperatively to resolve management issues as they already have on other sites within this allotment.

6. Some aerial photos of riparian areas taken on July 31, 2013 that are in the Soda Allotment on the Glen Canyon Recreation Area. All of these lotic riparian areas were assessed at PFC by the BLM for their 2006 determinations so we did not reassess them in 2013. We flew the sites and took telephoto pictures to document their current riparian appearance.

a. Cottonwood Gulch LO0508. Showing the dense riparian vegetation present in the left photo. Note the extent of the reddish brown color of the dead and dying tamarisk in the right photo.



b. Llewellyn Gulch LO0070. Dense and robust riparian vegetation in the left photo. Note the reddish brown vegetation on the edge of the green zone in the right photos enlargement of the same area in the left photo. We noted this in every site on the Recreation area. It is dead and dying tamarisk likely from the tamarisk beetle.

c. Davis Gulch LO0069. The robust riparian communities near Bement Arch located in the lower part of the gulch in the left photo. The right photo is little farther east of the arch.

d. Fiftymile Creek LO0215. Healthy riparian communities. Photo on the right is a close up of the area in middle of the photo on the left.

e. Willow Creek (down Sooner Gulch) LO0213. In the left photo the base of the inverted Y junction of canyons is the narrows in Willow Ck. and in the perpendicular distance is the Escalante River part of Lake Powel.
In the right photo the narrows are at the bottom of the photo and above that the green of the robust riparian community. Look closely at the right edge of the green line of vegetation and note the reddish brown of dead or dying tamarisk.
The third photo is a close up of the green riparian area in the middle of the photo on the right with dead or dying tamarisk trees on the edge of the riparian green strip.

Third Photo Willow Creek close up. Reddish brown trees on the edge of the green is dead or dying tamarisk.

G. Vermillion Allotment Results for Riparian Assessments and Uplands

This was the last allotment completed in 2012. It was often not accessible due to monsoon thunderstorms and flash flooding events. Brown, Fin Little, and Nephi springs needed to be re-visited to check our initial assessment against flash flood recovery and some rating criteria due to our limited access time frames. We had planned to re-visit them in 2012 along with a number of upland sites but personal responsibilities precluded it. The assessments were finalized in 2013 for this report.

Riparian 5 Sample Sites.

1. Brown Spring LE0004. This spring or lentic is developed. The total size is .31 acres. The elevation is approximately 5,940 feet. The site was assessed on August 13, 2012 and June 20, 2013.

Our findings for Brown Spring or LE0004 in 2012 and 2013 assessed it as PFC. We determined that Brown spring was PFC and upward trend towards potential. It is a Carex nebrascensis meadow community type. It is a low producing (estimated 1 gallon/minute or less) developed spring with a trough. The source is unfenced and accessible to livestock and wildlife. The area around the trough has some weedy non riparian species with Carex spp. and Juncus spp. dominate (reference Figure 198). The riparian stringer meadow goes down the drainage for about 830 feet or .15 miles. The farther down the drainage the riparian becomes naturally drier due to the distance from the springs water source.

The site was stable with no apparent accelerated erosion in 2013. We noted Carex nebrascensis and Baltic rush present indicating the maintenance of hydric soil characteristics (reference Figures 199 and 200). Hydric soils include soils developed under sufficiently wet conditions to support the growth and regeneration of hydrophytic vegetation which Carex spp. and Juncus spp. are. Carex spp. associated with springs in arid climates are obligate wetland species. Baltic rush (also called Juncus arcticus ssp.) is considered an obligate wetland species (Refer to our earlier discussion on page 7 and 8 of this report).[23]

The BLM in 2000 assessed Brown Spring at FAR and no apparent trend and in 2013 at PFC. We did not have a complete copy of their data to compare ours to until just before we wrote the report. They noted that there were non-riparian weedy species present in the riparian area in 2000. Based on the BLM standards, since this site is at PFC it is meeting standard. Simply fencing the spring source and piping the water outside to a trough would likely help improve this site towards the potential community and eliminate the few non-riparian weedy species present in the trough area. Grass species such as Poa spp. are present in the drier parts of the lentic.

Figure 198. Brown Spr showing weedy species

Figure 199. Brown Spr showing site stability

[23] USDA NRCS 2012 National Wetland Plant List

Figure 200 Brown Spring lentic

2. Cole Spring LE0002 . This spring or lentic is developed. The total size is .21 acres. The elevation is approximately 6,040 feet. The site was assessed on August 2, 2012.

Our findings for Cole Spring or LE0002 in 2012 assessed it as PFC. We assessed Cole spring as PFC and upward trend towards potential based on species vigor, diversity (richness), soil sediment trapping in riparian vegetation and increasing riparian extent. It is a Carex nebrascensis meadow community type. We documented Carex nebrascensis, Baltic rush, and some Coyote willow. The Carex had 1 1/2 to 2 inch bases and the Juncus were 8-12 inches tall producing seed. The riparian area is shallow to a sandstone rock base (Refer to Figure 201) with a sandy to sandy loam soil on the surface. Weedy and non riparian species were present but appear to be declining in presence and concentrated in the margins of the lentic area (Refer to Figure 202). Based on our findings in other locations we anticipate that there is a grey clay layer (Chinle formation) below the sandstone rock base in the drainage facilitating the retention of water for the site. The slope varies from 2 to 3 or 4 percent so is susceptible to scouring down to bedrock during flash flood events. The lentic is located at the drainages upper end and is fairly broad or wide allowing natural soils deposition with or without vegetation during light rainfall and runoff events. If the spring was father down the drainage and in a narrower confined channel where the watersheds runoff would have gained momentum and volume, it would not likely be able to trap and hold much sediment. The natural spring water seeping stimulates riparian vegetation growth and the vegetation helps trap additional alluvium or sediment from the watershed to build the riparian zone.

We were assessing this site on a day that the BLM was present doing riparian work. The BLM installed an exclosure around the spring source, installed sandbag structures to trap additional sediment on the drainage bedrock and piped the water out to a trough in 2002 to facilitate the sites recovery. Their efforts have contributed to the PFC assessment of the site today. The

riparian area is about 30 feet wide by 900 feet long or 9,000 square feet or approximately .21 acre in size. The spring has a number of sources and there is an upper lentic area separated by an area of sandstone rock then the lower lentic area (Refer to Figure 203). The middle exposed sandstone area is expected to continue filling in with sediment trapping and deposition as the riparian area continues to improve towards potential.

In 2000 the BLM assessed the spring as nonfunctional due to wetland area shrinking, gullies, reduced vigor of wetland vegetation, invading non riparian and weedy species, extent of bare ground in riparian lentic zone and sand deposition in the upper end of the site. Reviewing their photos and data, we would agree with those earlier findings. In 2013 the BLM re-assessed the site at PFC. Our PFC assessment is consistent with improved conditions and the BLMs 2013 assessment.

Figure 201. Upper Cole Spr showing bedrock middle

Figure 202. Cole Spr showing weedy plants on edges

Figure 203. Lower & Upper Lentic Cole Spr. with bedrock middle section.

3. Fin Little Spring LE0006. This spring or lentic is developed since at least 1980. The total size is .2 acres. The elevation is approximately 6,100 feet. The site was assessed on August 13, 2012 and June 20, 2013.

Our findings for Fin Little Spring LE0006 in 2012 and 2013 assessed it as PFC. We assessed Fin Little spring at PFC with upward trend towards potential. It is a Carex nebrascensis meadow community type about .2 acres in size. When we visited the lentic it was just after a major local thunderstorm and a large volume of water had come down the drainage where Fin Little spring is located. We noted that the existing riparian Carex nebrascensis and Baltic rush stabilized the site and showed laminar flow characteristics where the plants fall over in the direction of the flowing water and cover the surface preventing erosion and allowing sediment trapping (Refer to Figure 204). The riparian area has significantly increased in extent since 2000 with healthy riparian vegetation on locations that were bare ground in the 2000 photos.

BLM assessed Fin Little spring in 2000 as being non functional (NF) due to head cutting and presence of non-riparian species. In 2007 the BLM rated the site as FAR with upward trend with only two parameters out of 20 not being favorable. They assessed the trend by comparing the 2007 conditions and photos with the photos and data from 2000. They noted that the water development had a dam and dike and that there was "not enough in spots" of riparian-wetland vegetation. We did not have access to the 2007 riparian photos until just before preparing this report but the upward trend noted is consistent with our 2012/13 PFC findings. However, the photo documented head cuts and bare ground in the 2000 photos are contrasted by our data showing healthy riparian vegetation and a healed channel. We would agree with the findings as they existed in 2000. We are not aware of the management change or possible rest of the area that may have occurred but the BLM and the rancher have done something positive here based on our findings. Figure 205 shows riparian vegetation around the trough.

Figure 204. Fin Little area was bare ground in 2000 photos note laminar flow and sediment trapping on right side of photo

Figure 205. Finn Little riparian area around water trough.

4. Nephi Spring LE0003. This spring or lentic is developed. The total size is .75 acres. The elevation is approximately 5,940feet. The site was assessed on August 13, 2012 and June 20, 2013.

Our findings for Nephi Spring LE0003 in 2012 and 2013 assessed it as PFC. Nephi spring was assessed at PFC with upward trend towards potential. It is a Carex nebrascensis meadow community type. It is about ½ to ¾ of an acre in size now. We recorded Carex nebrascensis and Baltic rush present and vigorous. We visited the site just after a heavy thunderstorm and runoff event in August 2012. The riparian vegetation trapped 3 to 8 inches of sediment, vegetation fell over in the direction of the water current allowing laminar flow of the water and stabilizing and protecting the channel and riparian area (reference Figures 206 and 207). These are the same sites that were bare ground in 2000 and in yet in 2012 riparian vegetation is trapping sediment. This site has improved significantly from 2000.

In Figure 208 it is the same area in June 2013 for Nephi Spring riparian area that exhibited laminar flow with Carex and Juncus in August 2012. The site in 2013 had rocks and boulder covered up with trapped sediment and Carex and Juncus growing up through the sediment. We saw indications that another flash flood or two came through after the August 2012 event that we documented because the water trough outside the riparian exclosure was full of sediment and the riparian fence was down at both ends where it crosses the channel.

In 2000 the BLM rated Nephi spring as NF due to bare ground, presence of non riparian species in the riparian area such as sagebrush, trampling by cattle, discontinuous distribution of Carex spp. and Juncus spp., low plant vigor and presence of cow "dung". On June 25, 2013, the BLM reassessed the spring at FAR with upward trend. If the BLM had the same 2012 and 2013 information on riparian site stability and recovery, it is likely they would have assessed this site at PFC also. The reason we went to the site two times in sequential years was because we did have some initial reservations on whether the site was PFC or FAR. Obviously, we decided it was a PFC for the reasons previously stated.

Based upon our findings and a review of the BLM's data and photos for the same sites, we would agree with their NF assessment findings in 2000. Things have improved since then, as our assessment shows. We are not aware of all the management changes or rest that has occurred but BLM appears to have fenced the riparian area and piped the water out to a trough since 2000 allowing for the recovery. This exclosure needs to be maintained as cattle now have access to the riparian area. The BLM said they would be repairing the exclosure.

Figure 206. In 2012 Nephi Spr showing laminar flow & sediment trapping after a major flow event this was bare ground in BLM's 2000 photos.

Figure 207. Nephi Spr 2013 same site as 206 recovered.

Figure 208. Nephi Spr showing stabilizing laminar flow due to vigorous riparian vegetation. This was bare ground in BLM's 2000 photos.

Water Quality for Nephi Spring.

We did not measure water quality for Nephi spring. As noted previously, for springs such as this there are no clear standardized water quality standards established due to the overwhelming

variety in, complexity of and the strong influence of the contributing watershed and its parent materials and minerals on the waters makeup.

As previously addressed, we were very surprised that the BLM felt they should measure water quality here for Nephi Spring as it is usually limited to rivers, streams, creeks and lakes/dams where standards are usually established to be used as a yardstick to measure quality from.

In their 2006 determination the BLM indicated that the standards for phosphorus, dissolved oxygen, temperature, and total suspended solids were exceeded. Water from the spring source picks up the qualities and properties of the subsurface geologic formations they are in as noted earlier in our report. This can dictate the pH, minerals, TDS and alkalinity to name a few factors.

We take the position in this report that the BLM's water quality assessment is likely flawed because they lacked any realistic yardstick or standard for this watershed that they could use to compare the results to and properly assess the standard. Springs usually do not have a fresh exchange or recharge of water when sitting in a puddle so they can naturally accumulate higher turbidities, some extremes in pH and concentrated salts and minerals etc. and their water quality can vary significantly over time due to the variability in rainfall and the watersheds contribution. Without any overt reason to assume there are water quality issues, our position is that the water quality assessed for dissolved oxygen, phosphorous, temperature and suspended solids in this desert environment is not clearly related to livestock grazing but may be normal and consistent with the local parent materials and minerals in the aquifer and watershed, low perennial water flows, naturally less vegetation and high ambient temperatures. It should not have been a consideration on this allotment.

5. Sand Spring LE0001. This spring or lentic is developed. The total size is 1.5 acres. The elevation is approximately 5,920 feet. The site was assessed on August 2, 2012.

Our findings for Sand Spring in 2012 and 2013 assessed it as PFC. In 2012 we assessed Sand spring at PFC with upward trend towards potential based upon species vigor, diversity, seed production and site expansion from BLM's 2000 photos. There are two riparian communities on this site. They are the Carex nebrascensis meadow type (reference Figures 209 and 210) and a Coyote willow community (reference Figure 211). There was vigorous growth and density of Carex, Juncus and willow present. The bases of the Carex were 1 to 1 ½ inches wide. And Juncus was 12 to 20 inches tall with ample seed production. The riparian area was wet to the surface with standing water. The riparian zone is enlarging significantly from 2000 based upon photo comparison and the head cutting is healed and/or non-existent. There is a dense willow, Carex and Juncus riparian area above and outside the fenced exclosure that was not evident or noted in 2000 (Refer to Figure 211). The site has willows 1 to 6 years old. This is likely a result of the improved riparian in the fenced area storing and backing up water in the aquifer to provide more water up drainage allowing willows to grow.

In 2000 the BLM rated Sand spring as FAR with downward trend. They based this on a shrinking riparian area, gullies and hoof action, lower plant vigor and bare ground in riparian area. Based on our review of the 2000 data and photos, we would agree with the BLM's findings at that time. Their photos document severe head cutting, scouring, livestock concentration and

sizeable bare ground areas. In July 2, 2013, the BLM reassessed the site at PFC. We concur with that finding.

Our findings show that these areas described and photographed 2000 are healed, vegetated and inside an exclosure built in about 2007. The BLM built the exclosure to manage the site and piped the water outside to a trough. Some of the area that the 2000 BLM findings noted head cutting were actually 3 terraced cinderblock structures placed in the channel years ago to stabilize it and not actually head cuts (reference Figure 209). In 2012 this area has healed and is a step terrace of dense riparian vegetation and stable.

Figure 209. Sand Spr showing cinderblock terrace. Figure 210. Sand Spr Healed Riparian Area.

Figure 211. Willow Patch Outside & Above Sand Spring Exclosure.

Upland.

BLM in 2000 without ecological reference worksheets (they were not developed until 2007), ecological reference area or individuals that had ecological site experience appear to have made a

number of questionable negative upland health assessment findings. The 2006 BLM Determination identified that 10 out of 34 upland rangeland health assessment were not meeting the vegetation standard. They identified the need for biological soil crusts where they are there in adequate amounts already. Rills, flow patterns and gullies were often noted as being excessive when we observed that they were what would be expected for the sites based upon local experience and the ecological reference worksheets which Mr. Stager co-authored with the NRCS in 2007.

In the sites we visited while traversing the allotment we saw plant communities and plant species, vegetation cover, vigor, diversity and soils stability that appeared functional and consistent with what would be expected. Clearly the utilization levels varied and the similarity index for the locations varied and were not usually at HCPC, but they were functional communities that were sustaining the desired level of productivity and properly functioning ecological processes.

Two of the resource parameters they addressed for justification for not meeting standard were the incidence of cheatgrass and that biological crusts were not in the amounts expected. Cheatgrass is there not as a result of existing livestock grazing and invades an area regardless of use based on existing research.[24] It should not be used to identify livestock as the cause for not meeting a standard. Additionally, in our traverses we did not document measurable amounts of cheatgrass in most of the upland sites.

The importance of biological soil crusts is recognized by the scientific community and by BLM. However, science has not determined how much soil crust is needed in a certain soil type or ecological range site or woodland community so that ecological processes will operate in a healthy state. This was verified by personal communication with Dr. Neil West in 2007 (Professor of Range Science at Utah State University) and Jayne Belnap, the latter an ecologist, USGS, and a co-author of Technical Reference 1730-2 (Biological Soil Crusts: Ecology and Management). The NRCS ecological reference worksheets were not developed for these sites until 2007. The 2006 determination that there were not enough crusts in an area to rate it not meeting standard based upon the 2000 or 2001 health worksheets is not technically supportable and should not have been done by the field team.

We did not have the BLM's photographs of the upland sites so we could not exactly locate ourselves or compare things using two points in time. It is highly possible that things have improved over time as it has done in the riparian areas noted in this report due to the BLM's and ranchers good management efforts.

We will provide discussion in this report for BLM sites E0035, E0036, E0024, E0014, and E0011. These sites are identified in the BLM 2006 Determination as having a moderate departure due to erosion, rill and gully formation, compaction, decreased perennial grass, biological soil crust, shifts in dominance from cool season perennial grasses to warm season perennials or annual grasses (cheatgrass), reduced productivity, and vigor of perennial grasses and sagebrush and reduced litter retention.

[24] Hunter, 1991

But first we will provide some definitions and concepts on flow patterns, rills and gullies to help us clarify our points.

Flow patterns are essentially the downhill surface flow of runoff water. In areas with a slope of more than 1 percent gradient have the potential to develop defined water flow patterns. The greater the slope natural flow patterns are expected to more prevalent, frequent and defined. Vegetation cover and an armored or gravely/rocky soil surface help to reduce the erosive effect of flow patterns and help stabilize an area.

The following photos (reference Figures 212 and 213) are of at least moderate departure from the potential communities expected flow patterns in a PJ community with cryptobiotic crusts and a sagebrush plant community. These photos are not on the Vermillion allotment. They were taken and evaluated by Mr. Stager in an area north of Kanab, Utah for training purposes. The concern in these sites is the observation that the flow patterns are connected and extended taking the waters away from the site itself. This is just one indicator and there was no evidence of severe erosion in the area depicted in Figures 212 and 213.

Figure 212. Flow pattern PJ type N. of Kanab

Figure 213. Flow Patterns Sage Community

Figure 214. Stable and Natural Water Flow area stabilized by bedrock or parent material

The above photo Figure 214 shows a bedrock drainage with cryptobiotic crust covered soils adjacent with no apparent flow patterns assessed at a non to slight departure from potential not on the Vermillion allotment.

The definition of rills came from farming and agriculture. Rills are a natural product of soil erosion by water, and can be defined as small incised channels in the soil that result from the actions of flowing water over an un-vegetated or partially vegetated soil surface. They can be removed by tillage (plowing over the rills thus the agricultural origin). Where they are too large to be removed by tillage, they are referred to as gullies. Gullies are primarily stabilized by parent material eg. bedrock, rock outcrops, gravel, skeletal surface etc. and/or vegetation cover and root masses.

The following Figures 215 and 216 are of natural and normal rill and gullies located north of Kanab Utah taken and evaluated by Mr. Stager. The rills are on a 20 to 25 percent slope and stable. The gully is natural and currently stabilized by vegetation litter (dead PJ), bedrock, shrubby vegetation and crytobiotic crusts. There is no evidence of recent bank sloughing or other accelerated erosion. These were assessed as non to slight departures from potential.

Figure 215. Natural rills on steep slope

Figure 216. Stable Natural Gully in PJ type

The BLM site 0035 was identified as not meeting standards by BLM in 2006 as previously noted. We found no sign of compaction and that the flow patterns, vegetation cover, diversity and productivity were healthy. We noted Indian ricegrass, Poa spp., blue grama, sand dropseed, primrose, buckwheat (forb), squirrel tail, opuntia, bitterbrush, sagebrush, rabbitbrush, a very small amount of cheatgrass, and juniper providing a community that sustains the desired level of productivity and properly functioning ecological processes. The soils were a sandy loam and very productive and stable overall.

Figure 217 is of BLM site 0035. Figure 218 is a close up show how much vegetative cover is present to stabilize and protect the soils from wind and water erosion. We determined this location to be meeting standard 3.

Figure 217. Vermillion Allotment Site 0035

Figure 218. Vermillion Allotment Site 0035

For BLM site 0036 we documented stable soils, excellent species diversity, good species vigor, no indication of compaction, and little to no cheatgrass or other introduced species. We identified Indian ricegrass, primrose, sagebrush, rabbitbrush, blue grama, sandhill muhly, needle and thread grass, bitterbrush, Kanab yucca, Mormon tea, pea vine, globemallow, six weeks fescue, western wheatgrass and sand dropseed. This is a very productive and healthy site ecologically and it is meeting standard 3.

BLM site E0024 is an old 1960's pinion/juniper chaining. It is now a sagebrush dominated community with Indian rice grass, Galleta grass, shrubby buckwheat, rabbitbrush, broom snakeweed, and various forbs with a few junipers coming back in. Figure 219 is of the site showing two Indian rice grass and some Galleta grass in the foreground. The soils are very stable with good vegetative cover, diversity and short and disconnected flow patterns with no apparent

accelerated erosion. The existing historical gullies are vegetated, healing and stabilizing (reference Figure 220). This site is meeting Standard 3.

Figure 219. Chaining showing rice grass

Figure 220. Vegetation Stabilizing Historic Gully

BLM site E0014 is an old crested wheat seeding. This year is a very dry year with a low moisture and hot spring. Even so, the seeding produced about 8 to 14 inches of spring growth (refer to Figure 221). The surface soil texture was a silty clay loam to clay loam depending upon the location. The spacing between crested wheatgrass plants was about every 10 to 15 inches. The water movement on the soil was minimal with litter staying in place, flow patterns short and disconnected, soils drying and cracking from the clay influence in spots and the seeded species was still dominant comprising an estimated 80 percent of the current years growth (reference Figure 222). There are two historic 40 foot deep gullies adjacent to the seeding that have stabilized with native vegetation (Figures 223 and 224). Even the small gully observed coming down the side of the road was being stabilized with vegetation. This gully is over 100 years old according to Mr. Owens and is not a product of or appear to be effected by existing grazing practices. The road was impassable due to one water "piping hole" at one of the large gullies point of origin. It was almost like a sink hole. These types of soils are susceptible to erosion. This piping hole is outside the seeding.

Figure 221. Crested Seeding E0014

Figure 222. Seeding Stable Soils

Figure 223. Stable Historic Gully by seeding

Figure 224. Stable Historic Gully by seeding

The approximately one acre exclosure in the seeding had a denser stand of seeded species than outside the exclosure. The seeding itself appears to be a fairly confined and small area of 20 to 30 acres maximum. Only a very small amount of cheatgrass was observed. The small seeding is located in a large pasture of native vegetation communities and is adjacent to a reservoir watering source for the pasture. It is unclear why such a small area located very near a water source was used to help make an adverse determination that grazing was contributing to standards not being met. We found that the seeding is meeting standard 3 for a DPC of the seeded species.

BLM site E0011is a crested wheatgrass seeding that Mr. Owens was involved in. According to Mr. Owens, after it was seeded the spring was dry followed by a wet monsoon season. As a result, about 20 percent of the seeding was invaded by the warm season introduced annual forb Russian thistle (tumble weed). BLM management decided to have their staff burn the thistle trying to remove it. Based on the high composition of Russian thistle and density of cheatgrass now, the use of fire may have stimulated or at least facilitated the dominance of the site by tumbleweed and cheatgrass. Figure 226 shows a close up of how dense the tumble weed seedlings are. In Figure 225 the light tan color is the dense stand of cheatgrass. At this density the Russian thistle and cheatgrass will outcompete all other plants for moisture and nutrients and likely continue to dominate the site unless mechanical treatment is initiated and the site reseeded.

Figure 225. Historically failed 20 percent of seeding.

Figure 226. Close up of dense stand of Russian thistle seedlings.

The failed 20 percent of the seeding is located in a landform called an inset fan. The adjacent higher remnant fans have more of the seeded species and native herbaceous species. It appears that Russian thistle did well in the better watered, deeper and younger soils found in the lower inset fans. The presence of the seeded species in the adjacent fan remnants with shallow soils is

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another indicator that existing grazing is not the cause for or related to not meeting Standard 3 for this 20 percent of the seeding overall. Note the bunch grasses apparent in Figure 227 on the older remnant fans and the dense light tan cheatgrass in the younger inset fan. If grazing were a factor, the less productive remnant fans would have less seeded species due to livestock impacts than the more productive bottom or inset fan landform. However, the reverse is the case.

Figure 227. Inset & Remnant Fans.

We agree that E0011 is not meeting standard. Existing livestock grazing is not a factor in not meeting Standard 3 for this failed seeding.

The gullies adjacent to the seeding are historic having been established for over 100 years according to Mr. Owens and their presence is not related to existing livestock grazing. The gullies have been and are vegetated with native species helping naturally stabilize them (reference Figure 228).

Figure 228. Stable Gully By failed seeding

Figure229. Successful 80% of Seeding

The remaining approximately 80 percent of the seeding got established and is in very good production and condition with an estimated 85 + percent of the annual production comprised of the seeded crested wheat species (refer to Figure 229). There is an approximately one acre exclosure in the well established seeded area. The seeded species appears denser in the exclosure as would be expected. This seeded area is meeting Standard 3 for DPC.
Using a small portion of a seeding to make an adverse determination that an allotment is not meeting standard without researching the history behind the seeding or the age of gullies causes some reason for concern on this allotment and is a questionable practice.

VI. CONCLUSIONS

Introduction

Subsequent to our extensive field work, a detailed analysis of our data and findings and a thorough review of BLMs data and management accomplishments to date, it is our conclusion and professional opinion that the BLM has taken management action and is in the process of continuing positive management actions to facilitate meeting standards on all of these 7 allotments. They are doing this in a timely manner consistent within funding and workforce constraints. Our findings document this.

Our findings for the Cottonwood, Death Hollow, Lower Cattle, Mollies Nipple, School Section, Soda and Vermillion allotments in relation to proper functioning condition for riparian areas as it relates to BLMs 2006 Determinations and Utah Rangeland Health Standard 2 for Riparian and Wetland Areas (Refer to page 14 of this report) will be summarized by riparian area by allotment in this reports conclusions. In relation to Standards 1 and 3 we will address these for the School Section and Vermillion allotments in this report by site within each allotment. Standard 4 for Water Quality will be discussed for each allotment as it arises. Where the BLM used tables for Standard 2 for Riparian we will employ the same basic headers and format used in those 2006 BLM Determination tables in showing our conclusions.

In our Table 1 in this report we tabulate any data we had access to that the BLM collected subsequent to the 2006 Determinations and associated assessments. In this conclusion section, we focus on our 2012 and 2013 data and the BLM findings in their 2006 determinations. Any more recent BLM data is not considered. We cover the more recent BLM riparian PFC data in detail in the site specific data analysis in Section V and Table 1 of this report. In most instances, the more recent BLM data is corroborated by our 2013 riparian assessments.

As we stated earlier in this report, we do not presume the Agency's authority or responsibility for making determinations for specific allotments on whether they are meeting or not meeting Utah's Rangeland Health Standards. We merely reviewed the data and photos used by the BLM to make their 2006 Determinations, used similar scrutiny in reviewing an allotment overall referring back to the BLM's narratives, and compared our newer and more current 2012 and 2013 data's departures from the BLM's original data. From that we considered whether they likely were or were not meeting Utah's Standards.

We arrived at our conclusions based upon our knowledge of the history of the area , our review of our 2012 and 2013 riparian proper function condition assessments and/or existing upland conditions and the BLM data base. In doing so, we used photo documentation and photo comparison with available earlier photos on all sites and our professional opinion based upon our education and familiarity with riparian and uplands sites in the GSENM.

In summary, the School Section allotment is likely not meeting standard but it is not due to existing livestock grazing but rather a long history of farming, plowing and seeding when the land was owned by the State of Utah.

The Cottonwood, Death Hollow, Lower Cattle and Vermillion allotments are likely meeting Utah's Rangeland Health Standard 2 for riparian as a result of good management by the BLM and the ranchers.

The Mollies Nipple and Soda allotments are likely not meeting standard 2 for riparian and it is due to existing livestock grazing. On these two allotments the BLM has made measurable progress towards meeting standards through their management changes and has additional management being considered to be implemented contingent upon funding and work force constraints. As such, they appear to be consistent with the direction and intent of the 43 CFR 4180 regulations.

BLM 2006 Determination Guidelines

In the 2006 Determinations the BLM provides the following summary of the assessment, evaluation and determination process:

> **Assessment** is the estimation or judgment of the status of ecosystem structures, functions, or processes, within a specified geographic area at a specific time. An assessment is conducted by gathering, synthesizing, and interpreting information, from observations or data from inventories and monitoring. An assessment characterizes the status of resource conditions so that the status can be evaluated relative to land health standards. An assessment sets the stage for an evaluation. An assessment is not a decision.
>
> An **Evaluation** is conducted to arrive at two outcomes. **Firstly**, an evaluation conducts an analysis and interpretation of the findings resulting from the assessment, relative to land health standards, to evaluate the degree of achievement of land health standards. **Secondly**, an evaluation conducts an analysis and interpretation of information, be it observations or data from inventories or monitoring, on the causal factors for not achieving a land health standard. An evaluation of the causal factors provides the foundation for a determination.
>
> An evaluation goes further than an assessment because an evaluation takes what the assessment provides, which is the status of resource conditions characterized by the appropriate indicators, and evaluates them according to land health standards. Then, this leads to a prognosis of: land health standard achieved; making significant progress toward achieving a land health standard; or land health standard not achieved. If the land

health standard is not achieved, the evaluation of causal factors allows a determination to be made. In summary, an evaluation builds in the assessment, and the evaluation sets the stage for a determination.

A **Determination** is a document recording the authorized officer's finding that existing grazing management practices or levels of grazing use on public lands either are or are not significant factors in failing to achieve the standards and conform with the guidelines within a specified geographic area.

BLM's Handbook for Rangeland Health Standards (H-4180-1, page III-16) poses two questions to be answered in making a determination. The questions were addressed for each assessment point not meeting Standards and then a summary determination made for the allotment as a whole.

1. Is it more likely than not that existing grazing management practices or levels of grazing use are significant factors in failing to achieve the Standards or conform with the guidelines? (YES/NO)

2. Is it more likely than not that existing grazing management needs to be modified to ensure that the Fundamentals of rangeland health are met, or making significant progress toward being met? (YES/NO)

Evaluating whether Standards 1 and 3 are being met

Utilizing the Attribute Summaries for "Departure from Ecological Site Description/Ecological Reference Area" for Soil/Site Stability and Biotic Integrity prepared in the Assessment Evaluation process (Technical Reference 1734-6, App. 1), and reviewing existing additional data such as trend and utilization, an evaluation was made as to whether or not areas were meeting Standards based on the following criteria:

Attribute Summary Departure for Soil/Site Stability and/or Biotic Integrity was either "None to Slight" (5) or "Slight to Moderate" (4)

Area was found to be meeting Standard(s).

Attribute Summary Departure for Soil/Site Stability and/or Biotic Integrity was either "Moderate to Extreme" (2) or "Extreme" (1)

Area was found to not be meeting Standard(s).

Attribute Summary Departure for Soil/Site Stability and/or Biotic Integrity was "Moderate" (3).

1) If all individual indicator ratings were 3, 4 or 5, area was found to be meeting Standard(s) but considered to be Functioning-At-Risk.

2) If only one (1) individual indicator rating was 1 or 2, with all others 3, 4, or 5, area was found to be meeting Standard(s) but Functioning-At-Risk unless there is evidence that the Standard(s) are not being met. Such evidence might be the significance of the individual indicator to the Standard in question, additional trend or utilization data, or threatened/endangered/sensitive species data.

3) If two (2) individual indicator ratings were 1 or 2, with all others 3, 4, or 5, area was found to not be meeting Standard(s) unless there is evidence that the Standard(s) is being met. Such evidence might be the significance of the individual indicator to the Standard in question, additional trend or utilization data, or threatened/endangered/sensitive species data.

4) If three (3) or more individual indicators were 1 or 2 area was found to not be meeting Standard(s) without evidence to the contrary.

Evaluating whether Standard 2 is being met

Utilizing the Attribute Summary for "Departure from Ecological Site Description/Ecological Reference Area" for Hydrologic Function prepared in the Assessment Evaluation process (Technical Reference 1734-6, App. 1), and reviewing existing additional data such as prior riparian assessments, trend and utilization, an evaluation was made as to whether or not lentic or lotic riparian sites (springs or flowing waters) were meeting Standards based on the following criteria:

Site was evaluated as meeting Standard 2 if rated as either:

Proper Functioning Condition, or

Functioning-At-Risk with an upward trend.

Site was evaluated as not meeting Standard 2 if rated as either:

Functioning-At-Risk with no apparent trend, or

Functioning-At-Risk with a downward trend, or

Not Functioning.

As noted earlier in this report, the methods we used in the field for Riparian PFC are consistent with and the same as those used by the BLM for their assessments, evaluations and determinations. For uplands we also referenced and used their technical references and adhered to BLM protocols. In relation to water quality, we followed acceptable methods for measuring ph, alkalinity, hardness and TDS.

Allotment by Allotment Conclusions 2012 and 2013

1. Cottonwood Allotment. As noted earlier in this report, there are approximately 103,906 acres in the allotment with 27 potential sample sites. Eight (8) springs or lentic sites were assessed by us comprising about 4.9 total acres. There are approximately 42.31 miles of 17 reaches comprising 7 streams or lotic sites. Two sites, LO0007 and LE0017 were not riparian areas. Of the 27 potential sites, 25 were riparian and assessed.

Five sites (4 of the sampled springs or lentics and 1 lotic) had no previous BLM data and were not identified in BLM's official records.

As noted in Section V of this report, based on the age class of the willows and in some areas the Cottonwoods as well, some grazing management change appears to have occurred on the allotment within the pasts 5 to 8 years that has measurably improved riparian functioning conditions.

> In their 2006 Determination for the Cottonwood Allotment the BLM states, "The evaluation found that the Standards and Guidelines for Rangeland Health are not being met for two standards: #2 (riparian and wetland areas) and #4 (water quality)."
>
> "Four (4) of the five (5) springs and eleven (11) of the nineteen (19) stream reaches were either Not Functioning or Functioning at Risk with no apparent or a downward trend. Failure to exclude livestock from water sources and reductions in riparian vegetation as well as road encroachments were significant factors in not meeting standards."
>
> The BLM goes on the conclude, "It was determined that Standard # 4, **water quality, is not being met** due to natural background geologic and physiographic conditions **unrelated to livestock grazing or other public land uses**."
>
> "For this allotment it was determined that existing **grazing management practices** or levels of grazing use **were a significant factor** (#1 YES) **in not meeting the Rangeland Health Standard for riparian and wetland areas**. Additionally, it was determined that existing grazing management needs to be modified to ensure that the Fundamental of rangeland health can be met or significant progress made towards meeting them (#2 YES)."

BLM Riparian Results Compared to our 2013 Assessments

LENTICS OR SPRINGS

OBSID #	Pasture	2006 Determinations Riparian Name	BLM Riparian Assessment	Trend	Meeting Standard 2006 BLM Determination Yes or No	Counties 2013 Assessment	Currently Likely Meeting Standard 2 for Riparian Yes or No
LE0017	North Coyote	Lake Cove Res.	NF		No	Not a riparian area	N/A
LE0018	Butler Valley	Round Valley Seep	NF		No	PFC	Yes
LE0050	Wiggle Rim	Lower Coyote Spring	NF		No	FAR Upward Trend	Yes FAR Not due to existing grazing changes appear to

OBSID #	Pasture	2006 Determinations Riparian Name	BLM Riparian Assessment	Trend	Meeting Standard 2006 BLM Determination Yes or No	Counties 2013 Assessment	Currently Likely Meeting Standard 2 for Riparian Yes or No
							have been made by BLM & Rancher almost PFC
LE0501	Cottonwood Wash	Gratuitous Spring	FAR	Downward	No	PFC	Yes
LE0502	Cottonwood Wash	Pump House Spring	PFC		Yes	PFC	Yes

Additionally, 4 lentics that were not assessed previously by BLM, Cottonwood MH Spring, Goulding Corral Seep, Owl Cave Seep and Powerline Spring were all assessed at PFC in 2013 and likely meeting standards. So 8 out of 8 lentics are meeting standard 4. Lower Coyote LE0050 was FAR with upward trend. LE0050 as a result of some BLM/rancher management change has improved from NF. Existing livestock grazing is not a factor for FAR in 2013.

LOTICS OR STREAMS

OBSID #	Pasture	Riparian Name	BLM Riparian Assessment	Trend	Meeting Standard 2006 BLM Determination Yes or No	Counties 2013 Assessment	Currently Likely Meeting Standard 2 for Riparian Yes or No
LO0007	Cottonwood Wash	Cottonwood	FAR	Downward	No	Not a Riparian Area it is a Dry valley bottom or wash	N/A
LO0008	Cottonwood Wash	Cottonwood	FAR	Downward	No	PFC	Yes
LO0009	Cottonwood Wash	Cottonwood	PFC		Yes	PFC	Yes
LO0010	Cottonwood Wash	Cottonwood	FAR	Not Apparent	No	PFC	Yes
LO0011	Cottonwood Wash	Cottonwood	NF		No	PFC	Yes
LO0012	Cottonwood Wash	Cottonwood	FAR	Downward	No	PFC	Yes
LO0014	Cottonwood Wash	Cottonwood	FAR	Upward	Yes	PFC	Yes
LO0113	Cottonwood Wash	Hackberry	PFC		Yes	Not in the Cottonwood allotment	N/A
LO0019	Paria River	Paria	FAR	Downward	No	PFC	Yes
LO0020	Paria River	Paria	FAR	Not Apparent	No	40% PFC 60% FAR Upward	Yes FAR not due to existing grazing changes appear to have been made by BLM & Rancher
LO0021	Paria River	Paria	FAR	Upward	Yes	FAR upward	Yes FAR not due to existing grazing changes appear to have been made by BLM & Rancher
LO0118	Gravelly Hills	Paria	FAR	Upward	Yes	PFC	Yes
LO0119	Paria Box	Paria	NF		No	FAR upward	Yes FAR not due to existing grazing changes appear to have been made by BLM & Rancher
LO0120	Paria Box	Paria	FAR	Not Apparent	No	PFC	Yes
LO0178	Paria River	Snake	FAR	Not Apparent	No	PFC	Yes
LO0179	Paria River	Snake	PFC		Yes	Not in the Cottonwood allotment	N/A
LO0186	Paria River	Hog Eye	PFC		Yes	PFC	Yes
LO0187	Paria River	Kitchen Canyon	FAR	Not Apparent	No	FAR No apparent trend	No Not due to existing grazing. High sediment load from private land Mollies Nipple.
LO0206	Butler Valley	Butler Valley Seeps	PFC		Yes	NF	No Not caused by livestock grazing. Water table naturally dropped & drying up reducing extent.

The four lotic reaches evaluated by the BLM in their 2006 determinations within the Rush Beds allotment are not in the Cottonwood allotment and should not have been considered with it in the

2006 Determination. We will not re-consider these reaches in this report. The Rush Beds allotment is located west and adjacent to parts of the Cottonwood allotment.

Of the 19 reaches listed in the BLM's 2006 Determination for the Cottonwood allotment, 1 was not a riparian area and two were not in the allotment (Refer to above Lotic tabulation). They should no longer be a consideration.

One reach was FAR with no apparent trend and one was NF in 2013 as shown above. The functionality of both of these two sites was not related to existing livestock grazing but rather to high sediment loads from adjacent lands not on the allotment and an aquifer that is currently naturally drying up, respectively. The remaining 14 riparian reaches in BLMs 2006 determination are now meeting standard with 11 at PFC, 1 partially PFC and FAR upward trend and 2 FAR upward trend. The FAR assessments were not due to existing livestock grazing practices.

Additionally, we assessed 1 additional reach not considered by the BLM, Cottonwood MH Reach, and it assessed as PFC. Consequently, 15 reaches out of 17 actually on the allotment were meeting standards in 2013 and for those 2 that were not, the data shows that grazing on the Cottonwood allotment was not a factor.

SUMMARY CONCLUSIONS COTTONWOOD ALLOTMENT 2013

Standard 4 is being met in relation to all but two lotic riparian areas and those are not due to livestock grazing on the Cottonwood allotment.

The majority of the riparian areas are likely now meeting standards. The 2 that may not be meeting standards are not caused by livestock grazing but rather are considered to be a result of factors outside the control or influence of livestock grazing on the Cottonwood allotment. The standards are being met for the Cottonwood allotment with respect to livestock grazing practices. The BLM and the rancher have made some management changes in the recent 5 to 8 years allowing for the riparian conditions to improve. As such, the intent of the 43 CFR 4180 regulations appear to have been met by the BLM.

2. Death Hollow Allotment. As noted earlier in this report, there are approximately 19,492 acres in the allotment with three (3) potential sample sites. Two (2) springs or lentic sites were assessed by us comprising about 700 square feet or .016 total acres. One site LE0517 or Chokum seep was not and likely never was riparian.

> In their 2006 Determination for the Death Hollow Allotment the BLM states, " Two springs (LE0518, LE0519) were rated functioning at risk with a downward trend due to reduced cover and vigor of riparian plants, diminished wetland area, poor native tree recruitment, and increased sloughing and erosion of banks from hoof action. One other spring (LE0517) was rated "unknown" because it had been dewatered by a pipe and no longer supported riparian vegetation."

"An evaluation of the assessment data indicates that the Standards and Guidelines for Rangeland Health are being met for Standards #1 (upland soils), #3 (desired species) and #4 (water quality) but are not being met for Standards #2 (riparian and wetland areas)."

In 2013 we assessed LE0518 as FAR upward trend and LE0519 as PFC. Based on the BLMs 2006 Determinations guidelines, these two springs are now meeting standard 2 for riparian and wetlands. LE0517 is not a riparian area and can't and should never have been assessed as even an unknown. The FAR assessment in 2013 was due to an apparent natural decline in the aquifer not related to existing livestock grazing.

SUMMARY CONCLUSIONS DEATH HOLLOW ALLOTMENT 2013

The Death Hollow allotment is likely meeting standard 2 for riparian and the allotment as a whole is therefore meeting standards. The BLM appears to be in compliance with the intent of the 43 CFR 4180 regulations.

3. Lower Cattle Allotment. As noted earlier in this report, there are approximately 81,966 acres in the allotment with three (3) potential sample sites. There were Eleven (11) potential BLM riparian sample sites. Two (2) seeps or lentic sites were assessed by us comprising about .033 total acres. We re-assessed approximately 1 mile of reach LO0006 comprising 1 stream or lotic site definitively within the Lower Cattle Allotment. We visited 4 sites.

Based on fence lines and estimated locations with the rancher, there is some question as to whether 4 of the lotic sites LO0004, 0005, 0027 or 0028 are in the Lower Cattle allotment. At any rate, there was no original data available to us in BLM's records for 5 lotic sites LO0004, 0005, 0027, 0028 or 0046 so we could not definitively locate them. Consequently, we did not resample them. The 2 additional riparian sites, lotic site LO0074, Scorpion Gulch, and lentic 25 Mile Corral Spring were assessed PFC by BLM and meeting standards so we did not re-assess them. It should be noted that the 25 Mile Corral Spring may not be in the Lower Cattle allotment according to our discussions with the rancher.

In their 2006 Determination for the Lower Cattle Allotment the BLM states, "The evaluation of the assessment data indicates that the Standards and Guidelines for Rangeland Health are being met for standards #1 (upland soils) and #4 (water quality). However, they are not being met for standards #2 (riparian and wetland areas) and #3 (desired species)."

"For this allotment it was determined that existing grazing management practices or levels of grazing use were a significant factor (#1 YES) in not meeting the Rangeland Health Standard for riparian and wetland areas and desired species."

LENTIC AND LOTICS

OBS ID	PASTURE	SITE NAME	BLM Riparian Assessment	Trend	Meeting Standard 2006 BLM Determination Yes or No	Counties 2013 Assessment	Currently Likely Meeting Standard 2 for Riparian Yes or No
LE0041	Lower Cattle	Twentyfive Mile Corral Spring	PFC		Yes		Yes

OBS ID	PASTURE	SITE NAME	BLM Riparian Assessment	Trend	Meeting Standard 2006 BLM Determination Yes or No	Counties 2013 Assessment	Currently Likely Meeting Standard 2 for Riparian Yes or No
LE0528	Lower Cattle	Lower Cattle	FAR	Downward	No	Not Riparian	N/A
LE0545	Lower Cattle	Little Red Rock Spring	FAR	Downward	No	PFC	Yes
LE0546	Lower Cattle	Little Red Rock Spring II	FAR	Downward	No	PFC	Yes
LO0004	Twentyfive Mile Reach 1	FAR	Not Apparent		No	May not be in allotment	?
LO0005	Twentyfive Mile Reach 2	NF			No	May not be in allotment	?
LO0028	Twentyfive Mile Reach 5	FAR	Not Apparent		No	May not be in allotment	?
LO0027	Twentyfive Mile Reach 4	UNK			N/A	May not be in allotment	N/A
LO0006	Twentyfive Mile Reach 3	FAR	Upward		Yes	PFC	Yes
LO0074	Scorpion Gulch	PFC			Yes		Yes
LO0046	Coyote Gulch	FAR	Upward		Yes		Yes

For desired species standard 3, we did not collect any health or quantitative data. However, we did traverse much of the uplands and were impressed with how good the conditions were in the Black brush and grass communities present. Based upon our traverses and photographic documentation showing high plant species vigor and no measurable grazing use during the growing season, we suggest that the uplands have likely improved greatly under the current winter grazing system since 2006 if not before. We plan to collect upland data in 2014 to verify this professional judgment.

While we could not locate any BLM data or the exact site locations for LO0004, 0005 and 0028, if they are even in the allotment, it is likely that our assessments would be similar to LO0006 (PFC) also within the 25 Mile Wash. This is due in part to the lack of measurable utilization noted throughout the area around and in 25 Mile Wash. The existing winter grazing system use by cattle occurs during the plants dormant period and allows for re-growth during the growing season thereby often showing little to no measurable use once re-growth has occurred and allows for healthier plants. Additionally, it is due to the universal die off of tamarisk releasing vegetation competition that has occurred through most of the 25 Mile Wash allowing for improved riparian vegetation conditions.

SUMMARY CONCLUSIONS LOWER CATTLE ALLOTMENT 2013

The Lower Cattle allotment is likely meeting standard 2 for riparian. While we can't make a conclusive statement on standard 3 for desired species, the management changes apparently made by the BLM and the rancher *since 2001 have likely greatly improved the uplands as well as the riparian areas.* The BLM appears to be in compliance with the intent of the 43 CFR 4180 regulations.

4. Mollies Nipple Allotment. As noted earlier in this report, there are approximately 103,724 acres in the allotment with eight (8) potential sample sites. Eight springs or lentic sites were assessed by us comprising about 1.53 total acres.

> In their 2006 Determination for the Mollies Nipple Allotment the BLM states, "The evaluation of the assessment data indicates that the Standards and Guidelines for Rangeland Health are being met for #4 (water quality). However, Standards are not

being met for #1 (upland soils), #2 (riparian and wetland areas), and #3 (desired species)." "The RLH EVALUATION found that all riparian and 15 of 38 upland assessments were found to be Not Meeting RLH Standards."

" Box Elder (LE0009) and two unnamed springs (LE0011 and LE0013) were rated non-functioning and Wildcat, Kitchen Corral, Rockhouse, and Mine springs (LE0007, LE0008, LE0010, LE0012) were rated functioning at risk based on dewatering, headcuts, erosion from upstream, decreased wetland area, reduced vigor of wetland plants, and increasing dominance of Tamarisk."

"For this allotment it was determined that existing grazing management practices or levels of grazing use were a significant factor (#1 YES) in not meeting the Rangeland Health Standard for riparian and wetland areas and desired species."

In other words, grazing was considered a factor for standard 2 and 3 only.

OBS ID	SITE NAME	BLM Riparian Assessment	Trend	Meeting Standard 2006 BLM Determination Yes or No	Counties 2013 Assessment	Currently Likely Meeting Standard 2 for Riparian Yes or No
LE0009	Box Elder Canyon	FAR	Not apparent	No	PFC	Yes
LE0010	Kitchen Corral Spr.	FAR	Downward	No	FAR Upward	Yes
LE0011	North Kitchen Corral Spr.	NF		No	PFC	Yes
LE0013	Mine Spr. NE	NF		No	FAR Not Apparent	No
LE0007	Mine Spr. SW or Jenny Clay Hole Spr.	FAR	Downward	No	FAR Upward	Yes
LE0012	Rock House Spr.	FAR	Downward	No	FAR Not Apparent	No
LE0008	Wildcat Spr.	FAR	Downward	No	FAR Upward	Yes
LE2000	Wire Pass Buckskin Seep	FAR	Downward	No	NF	No

SUMMARY CONCLUSIONS MOLLIES NIPPLE ALLOTMENT 2013

As can be seen in the above tabulation and our earlier analysis in Section V of this report, 5 of the 8 lentics have improved in their functional assessments and are now likely meeting the riparian standard 2. The BLM has taken management steps to improve all 8 of these sites in the form of grazing season, duration, erosion structures and riparian exclosure. All the details of these actions were elaborated on in Section V. Improvement in riparian conditions as is visible in photographic comparisons with the BLMs earlier photos, implies that the same positive management changes are causing some improvements on the uplands and addressing standard 3 for desired species.

The BLM and the rancher, within funding and workforce constraints, are considering actions to improve the remaining 3 riparian areas not meeting standards and to continue improving the upland areas as well. The BLM appears to be in compliance with the intent of the 43 CFR 4180 regulations.

5. School Section Allotment. As noted earlier in this report, there are approximately 773 acres in the allotment. There are no riparian areas and 2 potential upland sample sites.

> In their 2006 Determination for the Lower Cattle Allotment the BLM states, " These assessments indicate that the Standards and Guidelines for Rangeland Health are being met for standards: #1 (upland soils), #2 (riparian and wetland areas), and #4 (water quality) but not being met for Standard #3 (desired species)."
>
> "Site number 254 was rated as Marginally Functioning and Responsive to Management based on 1999 assessments."
> " Community Diversity was "the old seeding is dominated by exotic species, specially Russian Thistle and other annuals", Community Structure and Root Distribution "The plant community is dominated by annual forbs in the majority of the seeding."
>
> "For this allotment it was determined that existing grazing management practices or levels of grazing use were a significant factor (#1 YES) in not meeting the Rangeland Health Standard for desired species."

SUMMARY CONCLUSIONS SCHOOL SECTION ALLOTMENT 2013

Of the two sites, numbers 254 and 255, BLM determined that 255 was meeting standards and that *254 was not. We concurred with that finding. However, their determination that existing grazing practices were a factor, as we previously analyzed in Section V of this report, is in error.*

The sampled area is located less than 600 feet from the only water source for the allotment (reference Figure 168) and represents a small part of the allotment. *Historically the site has been plowed, farmed, and seeded to crested wheatgrass at one time or the other. Whether it is meeting standards or not does not appear to be a related to existing grazing management practices. As a consequence the allotment does not require changes in grazing management due to not meeting standards.* The only way that the site number 254 is likely to be improved in a reasonable and measurable time frame would be to employ vegetative treatments such as seeding with some form of grazing rest during the seeding establishment period.

6. Soda Allotment. As noted earlier in this report, there are approximately 69,773 acres in the allotment. Five (5) springs or lentic sites were assessed by us comprising about .14 total acres.

The five (5) lotic sites 2013, LO0213, 0215, 0069, 0070 and 0508 were at PFC in the 2006 Determination so we did not ground visit them. However, our flight over them showed very dense riparian vegetation and dead or dying tamarisk trees.

As noted previously in Section V of this report: Of the remaining six (6) un-sampled lentic BLM assessments they were: LE0530 was PFC in 2007, LE0531 was PFC in 2010, LE1513 was PFC in 2007, LE1700 was PFC in 2002, LE1704 (Cave Spring) was PFC in 2002 and the 2006 Determination and LE0533 was not assessed by the BLM as there was a question as to it even being riparian. We had no information from BLM that would assist us in locating LE0533 so we could not visit it. We determined later that the BLM had reassessed LE1704 in 2007 at FAR trend not apparent but it was too late for us to re-assess it then.

In their 2006 Determination for the Soda Allotment the BLM states, " These assessments indicate that the Standards and Guidelines for Rangeland Health are not being met for standards: #1 (upland soils) and #2 (riparian and wetland areas) but are being met for standards #3 (desired species) and #4 (water quality). The RLH EVALUATION found that 12 of 23 riparian and 4 of 9 upland sites assessed were not meeting Standards."

"For this allotment it was determined that existing grazing management practices or levels of grazing use were a significant factor (#1 YES) in not meeting the Rangeland Health Standard for upland soils and riparian and wetland areas."

OBS ID	SITE NAME	BLM Riparian Assessment	Trend	Meeting Standard 2006 BLM Determination Yes or No	Counties 2013 Assessment	Currently Likely Meeting Standard 2 for Riparian Yes or No
LE0529	Fortymile Spring	FAR	Downward	No	FAR Not apparent	No
LE0530	Willow Gulch Spring	FAR	Downward	No		Yes BLM 2007
LE0531	Unnamed Spring in Sooner	NF		No		Yes BLM 2010
LE0532	Soda Spring	FAR	Downward	No	FAR Downward	No
LE0533	East Fiftymile Spring	NF		No	NF	No
LE0534	Fiftymile Spring	UNK			May not be riparian	N/A
LE1513	Sooner Water	FAR	Not Apparent	No		Yes BLM 2007
LE1514	Cottonwood Spring	FAR	Downward	No	PFC	Yes
LE1515	Pole Well Spring	FAR	Downward	No	NF	No
LE1700	Llellyn Spring	PFC		Yes		Yes
LE1704	Cave Spring	PFC		Yes		Yes
LO0213	Willow Gulch	PFC		Yes		Yes
LO0215	Fiftymile Gulch	PFC		Yes		Yes
LO0069	Davis Gulch	PFC		Yes		Yes
LO0070	Llewellen Canyon	PFC		Yes		Yes
LO0508	Cottonwood Gulch	PFC		Yes		Yes

SUMMARY CONCLUSIONS SODA ALLOTMENT 2013

BLM has taken management action since 2006 on this allotment to improve conditions. They have repaired and or built an exclosure around the Forty Mile Spring LE0529 and the tamarisk are dead and dying. An exclosure has been constructed around the Cottonwood Spring LE1514. They are considering additional management actions within the flexibility of the terms and conditions of the existing grazing permit for Soda LE0532, Fifty Mile LE0533 and Pole Well LE1515 riparian areas. These actions as all others are limited by BLM funding and workforce constraints.

The BLMs determinations identified issues of increased water flow and wind erosion, reduced soil surface stability, decreased cover of cool season perennial grasses and biological soil crust and increased cover and litter from annual exotic grasses. We did not observe any indication of these management issues during our hikes and traverses across the Soda allotment. Also, since the rangeland reference sheets were not developed for these sites until after 2007, it is

questionable that the determinations are technically correct in relation to cover, crusts, litter etc. because the reviewers had no useable frame of reference to gage their findings.

The allotment for riparian standard 2 is likely still not meeting standards but the BLM has taken some positive and effective actions since 2006 and is considering additional management actions as noted above. Based upon our traverses across the allotment in 2013, it appeared that the plant species, cover, litter and any potential biological soil crusts were as expected for the specific ecological sites were present in adequate and expected amounts. As such, *the uplands are likely meeting or moving towards meeting standard 3.*

The BLM appears to be in compliance with the intent of the 43 CFR 4180 regulations.

7. Vermillion Allotment. As noted earlier in this report, there are approximately 44,586 acres in the allotment. Five (5) springs or lentic sites were assessed by us comprising about 2.72 total acres.

> In their 2006 Determination for the Vermillion Allotment the BLM states, " The evaluation of the assessment data indicates that the Standards and Guidelines for Rangeland Health are not being met for any of the four standards (#1 upland soils, #2 riparian and wetland areas, #3 desired species, and #4 water quality)."
>
> "The RLH EVALUATION found that all riparian and 10 of 34 upland assessments were found to be Not Meeting RLH Standards."
>
> "Four seedings (E0011, E0012, E0020, E0028) and five non-seedings (E0023, E0025, E0027, E0035, E0036) were ranked at a moderate departure due to erosion, rill and gully formation, compaction, decreased perennial grass, biological soil crust, shifts in dominance from cool season perennial grasses to warm season perennials or annual grasses (especially Cheatgrass), reduced productivity and vigor of perennial grasses and sagebrush, and reduced litter production or retention."

OBS ID	SITE NAME	BLM Riparian Assessment	Trend	Meeting Standard 2006 BLM Determination Yes or No	Counties 2013 Assessment	Currently Likely Meeting Standard 2 for Riparian Yes or No
LE0004	Brown Spr.	FAR	Not apparent	No	PFC	Yes
LE0002	Cole Spr.	NF		No	PFC	Yes
LE0006	Finn Little Spr.	NF		No	PFC	Yes
LE0003	Nephi Spr.	NF		No	PFC	Yes
LE0001	Sand Spr.	FAR	Downward	No	PFC	Yes

We visited and photographed upland sites E0035, 0036, 0024 and 0014 and found them all to likely be functional and meeting standard 3. On seeding site E0011, we found it to not likely be meeting standard 3 but that it was not related to or resolvable by livestock grazing (Refer to Section V pg. 124 of this report). We traversed the remainder of the allotment and noted vigorous vegetation and naturally stable soils.

SUMMARY CONCLUSIONS VERMILLION ALLOTMENT 2013

Since 2006, the BLM and the rancher have taken tangible and, based upon the improved functionality of all 5 riparian springs, effective management actions in compliance with 43 CFR 4180. There has been some change in livestock season or duration and the BLM has built exclosures around LE0002, LE0003 and LE0001. They are considering additional management actions to continue the improved conditions. It is and was impressive to us that all 5 springs have improved in functionality from NF or FAR to PFC since 2006.

As for the uplands, as we noted in Section V of this report:

The BLM in 2000 were without ecological reference worksheets (they were not developed until 2007), reliable ecological reference areas or individuals that had ecological site description experience appear to have made a number of questionable negative upland health assessment findings. The 2006 BLM Determination identified that 10 out of 34 upland rangeland health assessment were not meeting the vegetation standard. They identified the need for biological soil crusts where they are likely already there in adequate amounts. Rills, flow patterns and gullies were often noted as being excessive when we observed that they were what would be expected for the sites based upon local experience and the ecological reference worksheets which Mr. Stager co-authored with the NRCS in 2007. Additionally, they noted gulley issues in the 2006 determinations in error. The gullies they identified were historic gullies that were and are stabilized and healing (Refer to Section V of this report).

Since the rangeland reference sheets were not developed for these sites until after 2007, it is questionable that the 2006 determinations are technically correct in relation to cover, crusts, litter etc. because the reviewers had no reliable frame of reference to gage their findings and often limited experience in the use and development of ecological site descriptions.

While we can't speak to every upland site, we did professionally visit and review BLM sites E0035, E0036, E0024, E0014, and E0011. We discussed these locations in detail in Section V of this report. In each location we found that the sites were stable and species present were what would be expected. We documented each of the sites photographically. In one seeding, we identified that the high composition of Russian thistle had no relationship to livestock grazing practices but rather a 1970s fire and some mechanical manipulation management actions that did not work back then.

As for the water quality at Nephi spring identified in the 2006 Determination as not meeting standard 4:

As we stated in Section V of this report, we take the position in this report that the BLM's water quality assessment is likely flawed because they lacked any realistic yardstick or standard for this watershed that they could use to compare the results to and properly assess the standard. Springs usually do not have a fresh exchange or recharge of water when sitting in a puddle so they can naturally accumulate higher turbidities, some extremes in pH and concentrated salts and minerals etc. and their water quality can vary significantly over time due to the variability in rainfall and the watersheds contribution. Without any overt reason to assume there are water quality issues, our position is that the water quality assessed for dissolved oxygen, phosphorous, temperature and suspended solids in this desert environment is not clearly related to livestock grazing but may be normal and consistent with the local parent materials and minerals in the aquifer and watershed, low

perennial water flows, naturally less vegetation and high ambient temperatures. It should not have been a consideration on this allotment's Nephi spring.

In short, *the 5 springs at PFC are likely now meeting standards due to positive management actions taken by the BLM and the rancher. These same management actions that have tangibly improved the 5 springs are likely improving the uplands as well. This is to be expected as riparian areas tend to be concentration locations for livestock and if they are improving, the lower concentrated use areas in the uplands are logically expected to experience improvement.* The BLM is considering additional management actions and along with the successful actions already taken, the BLM appears to be in compliance with the intent of the 43 CFR 4180 regulations