Kaibab National Forest
Plan Revision Collaborwriting Meeting

Seeps and Springs

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Meeting Report

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	What are the most important changes (additions/ deletions/ modifications) that are needed to the statements (1st set) to ensure that they properly address the desired conditions for seeps, springs, and wetlands? Insert statements. • *Seeps, springs and wetlands have the necessary soil, water, and vegetation attributes to be in proper functioning condition. The necessary physical and biological components are present to support a variety of plant and wildlife species including cover, forage, available water, microclimate, and nesting/breeding habitat.* • *Native species occur in natural patterns of abundance and distribution. There is sufficient biodiversity to support sustainable natural processes. Hydrophytes and emergent vegetation are abundant in areas with persistent water.* • *Seep, springs, and wetlands are within the range of historic conditions and natural disturbance regimes.* • *The isolated features collectively contribute to habitat connectivity when viewed at the landscape scale.* • *There are opportunities for recreational, cultural, economic, spiritual, and scenic enjoyment within the landscape.*
#	**Comment**
1	TOH
2	What is sufficient biodiversity?
3	Proper functioning condition is very general. Needs to be more specific
4	Desired conditions should include an assessment of the condition of the surrounding forests. Are they too dense (reducing water yield and increasing fire/erosion risk)?
5	Proper functioning condition needs to be defined. Your present definition has to do with stream flow. It is not appropriate for all wetlands. And there are significant problems with that definition for stream flow.
6	Do we know enough about things like the historic range of variation?
7	For second bullet, springs should support native species (plants and wildlife) that are important for ceremonial/medicinal/traditional use for tribes.
8	The PFC definition is generally more related to streams, not necessarily appropriate for springs, particularly small seeps.
9	Restore original flow of seeps and springs that have been diverted.
10	Range of historic conditions needs to be defined.
11	Springs and wetland ecosystems have the necessary soil, water, species and processes to persist and function in an ecologically sustainable fashion in perpetuity.

12	How are "historic conditions" defined?
13	Non-native plant and animal species are very minor components if present and invasive species are not present (eliminated).
14	Restore and protect waters to allow reestablishment of native unique plant and animal species.
15	Second sentence, first bullet. Necessary is not defined. I would prefer that you use words that ensure that diversity is maintained. This is the most important attribute of these resources.
16	Tribes are concerned with contamination of springs/seeps from activities such as uranium exploration. Can we have DC that addresses water quality/contamination of springs and seeps?
17	Add the word "appropriate" to the last bullet.
18	Conduct active restoration and reestablishment of unique native plant and animal species associated with the waters.
19	Habitat for native amphibians, birds and other native species dependant on wetlands is increasing.
20	PFC language "vegetation, landform, or large woody debris is present to dissipate stream energy associated with high water flows..." doesn't apply for many small springs and seeps.
21	Second bullet, second sentence. “Sufficient” is a poor word choice. We want to maintain the diversity present prior to European influence.
22	Delete reference to proper functioning condition because it is not appropriate for springs inventory or assessment.
23	Rare and endemic plants and animals occur in native locations and in natural numbers.
24	Lump seeps with springs.
25	“Isolated features” is not a clear statement; need to reword for clearer understanding.
26	We shouldn't manage for hydrophytes and emergent vegetation if that structure of veg isn't naturally present.
27	Clarify connectivity in context of springs at landscape scale.
28	Bare ground and compaction are uncommon.
29	Springs are a cultural resource for tribes in addition to a natural resource. These have historic, religious, ceremonial significance

30	Third bullet. The historic needs to be defined. Ditto the comments from the grasslands section.
31	Emphasize trophic integrity within the ecosystem.
32	On bullet 3, the language should be “historic range of variability” not just “historic conditions”
33	Remaining springs are preserved in natural setting and altered springs are restored to natural setting.
34	Fifth bullet. Exclude the word economic. These habitats are too rare and precious to manage for economic values.
35	Springs are free of livestock trampling and pollution.
36	No reference to non-native species or weeds. Need to clearly define that absence of these is necessary for “proper functioning condition”
37	Springs are not contaminated by industrial activities such as uranium mining.
38	Springs often protect species and assemblages by virtue of their isolation; connectivity on local scales may allow non-native species to move among springs, to the detriment of native assemblages.
39	Second bullet, add that non-native species should either not be present, or not dominant.
40	Access to springs without barriers.
41	Spring flow is maintained and defended from water diversions.
42	Third bullet. Either eliminate "historic conditions" or better define it.
43	The cultural significance of springs is so enormous that specific analyses are needed. An additional DC involves developing the information base from which to manage intelligently. Few monitoring data exist to manage springs well at present.
44	Range of historic conditions is not known for most springs in the region.
45	4th bullet - One factor that protects springs and seeps is their isolation. Connectivity is not necessarily a desired condition (e.g.. crayfish cannot move between springs).
46	Springs exist and function at a microsite scale.
47	Need regional groundwater model.

	What language is more appropriate?
#	**Comment**
50	Proper functioning condition for springs and wetlands is not closely related to PFC for streams.

	What components are necessary to ensure sustainability?
#	**Comment**
51	Availability of water.
52	Diversity.
53	Vegetation cover.
54	Adequate protection of landscape around these systems, to protect from erosion, etc.
55	Soils that have not suffered compaction from exotic ungulates.
56	Water quality.
57	Protection from external impacts such as large-scale trampling.
58	Some quantitative measure of "over time."
59	Protection of springs and wetlands.
60	Protection from grazing.
61	Reduction of threat from catastrophic wildfire surrounding spring sites.
62	Maintenance of fences should not be required for sustainability.
63	Full life cycles of the plants are able to occur.
64	Any necessary reintroductions of species.
65	Water quality, flow, primarily natural native vegetation, primarily native invertebrates, balanced vertebrate interaction (predation). Geomorphic functionality.
66	Aquifer integrity; recharge; natural groundwater geochemistry; natural geomorphic processes and attributes; native microbial, algal, macrophyte, aquatic and riparian macroinvertebrates, and vertebrate populations; adjacent uplands integrity.
67	Maintain private settings for sustained ceremonial use.
68	Prevent establishment of non-native species.

69	Trophic integrity.
70	Decomposition occurs appropriately.
71	Sustainable and appropriate land use practices.
72	Reasonable recreation management.
73	Long-term human influence at springs challenges our western conservation perspective of managing for a non-human pristine condition.

	What measurable physical and biological components will inform whether we are meeting our desired conditions?
#	**Comment**
1	If fencing is present, we are not meeting our DCs.
2	If unnatural levels of soil compaction exist, we are not meeting our DCs.
3	Need baseline data on water quality.
4	Water quality, invertebrate abundance, diversity, and distribution, diverse vegetation.
5	Monitoring should include water levels and flows as related to weather and climate.
6	We don't know enough to inform management yet. First we need a systematic inventory and assessment of KNF springs, then a review of that information.
7	A comprehensive inventory would be critical to good decision-making, followed by prioritization and monitoring.
8	For wetlands: water table levels/hydroperiod; soil "redoximorphic" characteristics (mottling, etc.), soil organic content.
9	Groundwater model for each GW basin is the first priority.
10	Monitoring should include diversity and cover of floral components.
11	Flow monitoring, seasonally measured.
12	Water quantity; water quality; wetted area; vegetated area, plant species diversity; percent cover by plant species; geomorphic features.
13	Seasonally measured water quality monitoring.
14	Inventory of water quality by GW basin.

15	Extend your 'zero point' as far back in time as possible, even if based on anecdotal information.
16	Soil condition and type.
17	Vegetation cover (native vs. non-native) survey and monitoring.
18	Need baseline data on presence of plants used by tribes for medicinal/ceremonial purposes. For example, native tobacco, basketry materials, etc.
19	Even in 40 years there have been big changes.
20	Condition of contributing watershed and aquifer.
21	Invertebrate and vertebrate survey and monitoring (native and non-native abundance).
22	Need relatively complete species lists for invertebrates, vertebrates, flora, and which springs each taxon occur at.
23	Identify and monitor endemic species; endemism is quite high at springs due to their isolation.
24	Can we use residual soil properties to identify areas that were wetter in the past and may be suitable for restoration?
25	Are signs of exotic ungulates present?
26	Maintenance of cottonwood communities in wetlands.
27	The number of springs protected in natural condition is increased.
28	Recreational impact survey, mitigation, and monitoring.
29	Invasive and exotic vegetation is reduced.
30	Need to address cumulative impacts on a landscape scale.
31	Need to know the distribution of nonnative taxa and which nonnative species to expect in the future (e.g., quagga mussel).
32	For sample (test) springs and seeps, measure flows as a function of season, average rain fall. Determine lag effects. If this happens, how long for the effect.
33	Springs are free of livestock and recreation trampling.
34	Assessment and monitoring of aquifer functionality, analysis of long-term implications of climate change and aquifer depletion.
35	Monitor encroachment.

36	Native vegetation is abundant and bare ground minimal.
37	TMR may restrict access to some springs to general public. Need monitoring of public access to these places.
38	Document physical changes that are not adjacent to the springs.
39	A DC for the forest is to develop a comprehensive understanding of springs species and resources, their distribution, and status.
40	The ground within 100 feet of springs and wetlands minimally trampled.
41	Waterfowl.
42	What kinds of springs exist on the forest?
43	Springs provide quality native habitat and water for native wildlife.
44	Identification of natural and settings that is conducive to physical and spiritual healing.
45	Try to determine the sources that feed the springs so as to understand better what related things to monitor besides flow.
46	Need to know distribution and condition of non-springs wetlands as well.
47	Are non-native fish (trout) present?
48	Need to assemble the historical information on forest springs.

	What are the most important changes (additions/ deletions/ modifications) that are needed to the statements (2nd set) to ensure that they properly address the desired conditions for seeps and springs? Insert statements. • *Invasive plants animals and pathogens (i.e. chytrid fungus) are rare or absent.* • *Soils are free from compaction. Trampling and adverse impacts from grazing by large ungulates is minimal.* • *Adjacent vegetation types are free from uncharacteristic disturbances that could have adverse impacts. Forest litter is sufficient and well distributed that minimizes soil loss and promotes nutrient cycling.* • *Tree density in adjacent PNVTs provide adequate water input and flow, including winter snow melt.*
#	**Comment**
1	Need a new statement here: We need to upgrade our information base on springs to guide

	future management.
2	Second bullet. Place the word "exotic" between "large" and "ungulates."
3	Animals should include invertebrates.
4	Risks associated with adjacent uncharacteristic fire need to be addressed.
5	Risks associated with changes to the water table/aquifer (e.g., local wells) need to be considered.
6	Third bullet, second sentence, "distributed such that it minimizes."
7	Ensure dialogue among groundwater basin stakeholders to ensure aquifer sustainability.
8	Bullet one: non-native and native invasives occur. Need to define which term is meant.
9	Healthy/sustained populations of native species important to tribal traditional/medicinal/ceremonial use.
10	Develop groundwater models for each GW basin.
11	Identify which non-native species are critical.
12	The relation between prairie dog towns and the porosity needed to recharge shallow seeps and springs.
13	Several of the more action-type items that were provided under question 1 can be provided for this question.
14	Eliminate crayfish.
15	Cumulative impacts to springs on a landscape scale are addressed.
16	Employ a consistent, efficient inventory and assessment process for all springs on the forest.
17	Last bullet, many springs are in drainages, and additional inflow is part of the natural condition. Some are not, and adequate water input is not necessarily such a concern.
18	Emphasize understanding of all components of hydrologic system - aquifer condition, recharge and runoff processes.
19	Last bullet, again, this is more related to creeks than springs, which typically provide much of their own flow.
20	Prevent loss of integrated information by developing a consistent, comprehensive database.
21	An addition would be assessing the risks associated with fencing wetlands.

22	Springs maintain water quality/are free from contaminants.
23	A risk to wetlands is not knowing; need to inventory what they support now.
24	Consider land use and site conservation on a case-by-case basis to include consideration of how fencing, trails, and other site modifications are best used.
25	In some cases soil compaction may be a natural state that increases water retention. Bedrock, with clay soil interspaces is something that leads to a desirable compacted state.
26	Trophic dynamics should be in balance.
27	Protection of the source areas is most important for conserving springs-specialist taxa.
28	Adverse impacts of recreation should be minimal.
29	Roads to springs commonly are avenues for the introduction of non-native species.
30	Tunnel Springs on the southerly end of Observatory Mesa through the early 1980's flowed enough to maintain a tank 100 feet by 30 feet 3 feet deep. It has been dry for nearly 20 years. Is that associated with development in Baderville?
31	Natural geomorphic disturbance regime.
32	Is the tapping of perched aquifers a threat to local springs?
33	A longer term threat is climate change. Do we know what springs and wetlands would be the most vulnerable?
34	Wallowing, trampling and browsing by non-native ungulates should not impact these resources.
35	Include all comments that were submitted for question 1.
36	Similar comment for Old Town Springs which still flows but a barely.
37	Loss of large, native predators and their prey has likely caused considerable but poorly known changes in springs.
38	Addition to #1: Please strike "sufficient" in second bullet and replace with stronger description. Utilize suggestions already submitted.

	What work needs to be done to achieve these desired conditions?
#	**Comment**
1	Inventory.
2	Monitoring.
3	Need monitoring program.
4	Experimental approaches to fencing vs. not.
5	Forest-wide inventory and assessment of springs and wetlands.
6	Baseline inventory.
7	Need baseline data.
8	Eliminate exotic ungulates.
9	Come up with a prioritization system. Which wetlands/springs need attention first or would give the most bang for the buck?
10	Identification of rare springs and wetlands species forest-wide.
11	Conduct ethnographic/ethnohistoric research with tribes.
12	Initial survey and assessment --find out what is there, assessing geomorphology, flora, fauna, water quality, flow, condition, visitation, etc.
13	Development of compatible methodologies and metrics.
14	Compile all available data from studies & other agencies.
15	Livestock and bison should be effectively removed from all springs, ponds and wetlands.
16	If restoration is a goal, prioritize those "most rare" and "most important" first.
17	Comprehensive data management plan.
18	Integrated assessment of springs condition and risks to develop strategic planning and identify conservation and restoration priorities.
19	Assessment of soil conditions.
20	All springs, ponds and wetlands must be protected from ATV riders.
21	Based on comprehensive initial surveys, prioritize actions and monitoring based on desired conditions.

22	Exotic vegetation removed.
23	Coordinate with other agencies and entities.
24	Longer term need is to develop more cost effective restoration techniques for things like protection from elk, fixing downcut streams, etc.
25	Describe the types of springs on the forest, the abundance of each type, and their condition.
26	ATV use must be closely monitored and the forest.
27	Baseline data on water quality linked to uranium exploration concerns.
28	Each spring and seep has its own 'personality' and system that supports its viability. That must be understood in order to not affect it detrimentally.
29	Groundwater model for each GW basin on the forest, and understanding natural variation in GW quality and flow.
30	Consider management actions such as non-native eradication (plants, invertebrates, vertebrate species), limiting excessive browsing, education, closure if necessary.
31	Bring in some wolves.
32	Engage adjacent land managers in groundwater planning and conservation.
33	Education of local tribal values associate with water sources.
34	Assess all industrial proposals, such as uranium mining, or proximity to springs and wetlands.
35	Don't forget the importance of slowing surface runoff that eventually feeds seeps (prairie dog burrows).
36	Understand climate change implications on recharge and discharge.
37	Eliminate elk, as an exotic species.
38	Understand legal claims on springs.
39	Data on water flow via surface drainages into Cataract Canyon, by extension into Supai.
40	Monitor impacts of drought / climate change.
41	Communicate the findings with other entities for evaluation of the need for various conservation actions.
42	Assess aquifer integrity, and analyze implications of climate change and aquifer depletion that are affecting spring flow, and will continue to do so.

43	Reduce or eliminate water diversion structures and projects.
44	Base monitoring and inventory on sound conceptual and empirical models of springs and wetlands function.
45	Identify primary indicators of spring status and condition and base monitoring program on these. Ensure the program is achievable.
46	Assemble historical information on land use and springs use.
47	Look at agreement between Havasupai Tribe and City of Williams regarding water quality impacts to Cataract drainage.
48	Gather accurate georeferencing information.
49	In general, a spreadsheet of signatures for a healthy seep/spring should be begun for a selection of sites. Long term systematic monitoring. Volunteer work.

	Are there any design constraints or other issues that need to be considered when implementing restoration projects and activities?
#	**Comment**
1	Before fencing can be removed, exotic ungulates need to be removed.
2	Leave flow at the source.
3	If access is needed to the site on a continuing basis, build a stepping-stone trail.
4	Include historic or other previous uses.
5	Need to consider required maintenance. I've seen too many projects that were unsuccessful because they were not maintained.
6	Multi-party stakeholder planning must be implemented in order to ever come to agreement on controversial issues like removal of non-native ungulates.
7	Keep livestock away from the source.
8	LMP needs to recognize that springs are cultural resources and sacred sites to tribes. Need to consult with tribes in advance of restoration projects.
9	Researchers and other workers need to be mindful and take action to clean their clothing and tools after working one site and before moving on to the next site to make sure they are not vectors for exotic species transfer.
10	Appropriate species communities - both plant and other.

11	Need to consider the extreme events (100-year floods, long droughts, etc.) and how they will impact the project.
12	Law enforcement is inadequate to ensure that bait dumping and ATV riding is not occurring.
13	Understand natural range of flow variability.
14	Ditto, look before you leap.
15	It is important to develop a solid understanding of springs' ecosystem functionality in general, as well as the unique characteristics of a particular spring before taking action.
16	As knowledge of springs' ecosystem ecology is so poor, work to improve basic as well as applied science in the management program.
17	Maintain privacy for traditional religious practitioners.
18	Can the projects be turned into educational opportunities? (Interpretive signs, etc.)
19	Consider restoration of the disturbance regime as well as the geomorphology and species.
20	The fact that the North Kaibab and the park share boundaries will make management decisions perhaps more complicated.
21	Fencing is often used to protect springs, but are in fact detrimental to the associated microhabitats. Some browsing is natural; overgrowth of vegetation (particularly non-native) can dry up a spring.
22	Allow for enough time for restoration effects to become manifest before changing restoration practices.
23	Work with the 'human tide' because we can not stop it.
24	Review existing relevant information on springs and wetlands restoration during the panning process.
25	Create a plan for monitoring.
26	Base conservation and restoration priorities on proportional conservation by springs type - rare springs types should be higher priority than common types.
27	Comment 26, "rare" should be defined.
28	Some types of springs might be particularly rare on the landscape. A full inventory of springs might highlight these.
29	See Kodrick-Brown and Brown (ca. 2007 in Frontiers) about fencing impacts on springs.
30	Inventory should inform us in regards to what spring types are rare.

31	Are there restoration orders (sequence of rest. practices) that could be carried out?
32	Define clear objectives.
33	Each spring is unique, requiring a full survey and assessment, setting management objectives and creating a monitoring plan before an action is taken.
34	Identify minimum cost/resources strategy.
35	Assuming the reference/target conditions are understood, the next step with wetlands is to get the "hydrology" right, which may mean addressing downcutting, stream bank stability, etc.
36	1) Assemble background historical information; 2) develop a very refined landscape map of the site - look for old channels, etc; 3) paleo or dendro research on extent 4) engage all stakeholders; 5) plan, implement, monitor, refine land management.
37	Scientific method; observe, hypothesize, experiment, observe.
38	Commit to inclusion of monitoring program.
39	Removing exotic ungulates will have to take place before much restoration takes place.
40	Develop model of how that type of spring, at that aspect, should function.
41	Document plant species lists with voucher specimens deposited in herbaria.
42	Have knowledge (research) what other have done regionally, nationally, and globally.

	Are there any DC or guidance that are specific to the overland flow wetlands and in particular the ephemeral wetlands?
#	**Comment**
1	On North Kaibab - are the breccia pipes?
2	Determine the extent of springs' contribution to natural ponds.
3	Keep cattle out of the area.
4	Determine the biota of ephemeral wetlands - does it differ from springs?
5	Ensure they continue to be considered and managed as wetlands even when not wet.
6	Need to develop a conceptual model of natural ephemeral ponds in relation to geology, climate, and land use.
7	What are the benefits (and potential downsides) of manipulations of these systems to enhance their value for waterfowl and other birds in wet years (e.g., nesting islands,

	predator management)?
8	Need to monitor water presence at ephemeral wetlands, and changing water quality.
9	Keep bison out of these areas.
10	Need to understand the role of ephemeral wetlands in bird migration, as water sources for wildlife, and for seasonally rare invertebrates and plants.
11	Be alert to development and other activity in the associated 'water shed' that would divert or pollute, including mud.
12	Need to understand native tiger salamander distribution.

	Proper functioning condition needs to be defined. Your present definition has to do with stream flow. It is not appropriate for all wetlands. And there are significant problems with that definition for stream flow.
#	**Comment**
1	What language is more appropriate?
2	Spring flow dominated ecosystems are shaped by internal and geomorphic factors that are vastly different from surface flow (flood)-dominated ecosystems (streams). Therefore PFC is often inappropriate for assessing springs.

	Identify which non-native species are critical
#	**Comment**
1	Which invasive or nonnative species are most critical and why?
2	Bull frogs.
3	Crayfish.
4	Bison hybrids and cattle.
5	Crayfish are highly invasive predators in springs on the south KNF.
6	Species of particular concern are those that tend to dominate the landscape, choking out native species.
7	ATVs.
8	There may be several non-native plants that would be good to manage for. This will require some additional research.

9	Bison.
10	Invertebrate species such as crayfish tend to eat everything else. Springs can be protected from such invasions due to their isolation.
11	Cheat grass, which influences nearby fire regimes.
12	Cows, elk.
13	Elk.
14	Nonnative brome grasses, annual mustards, Ambrosia, Phalaris, and non-native arborescent shrugs; RM elk and cattle.
15	Too many elk. Not enough wolves.
16	Beefalo.
17	When a seep or spring dries up a number of non-natives take over.