

***Ground Water Inventory, Monitoring & Assessment***

***Technical Guide Development***

**Date:** June 27, 2013 (Draft)

**Subject:** Steering Team Conference Call

**Participants:** Leslie Bach, Tony Erba, Linda Spencer, Chris Carlson, Pete Kilbourne, and Steve Solem

**Unable to Join Call:** John Allen, Tony Crump, Joe Gurrieri, Katherine Smith, Chris Savage, and Casey Giffen

**Discussion Topics and Action Items**

# **NOTE CHANGE IN DATE: Next Core Team Call on** September 5, 2013 @ 2:00 ET/12:00 MST

# ****Project Overview****

**Steve Solem discussed key tasks coming up in the project schedule and their status:**

* **Briefings for the SLMBOD/NFS Directors: Timed to describe purpose and timing of the upcoming internal FS and partner reviews. Will occur during late August or early September.**
* **Technical Guide Review: Moving towards internal Forest Service and partner review of v4.0 beginning in mid-September.**
* **Implementation planning (Tasks numbered 6.0): Will be part of the Core Team’s focus over the rest of FY13. This work consists of two primary groups of tasks shown at the bottom of the project schedule:**
	+ **NRM/GMO Database change requirements (Tasks 6.10 - 6.50): Result from comment provided during the FS Application Dependency Assessment and GIS Data Dictionary Change Management processes.**
	+ **Stakeholder Communication and Outreach (Tasks 6.60 – 6.90): Focused on users of the GW IM&A Technical Guide to engage in a broader understanding of changes in procedures and to identify training needs.**

**Work on these two tasks will use methods used for the Existing Vegetation Technical Guide revision. Linda Spencer commented that the FS Application Dependency Assessment and briefings of NRM staff were well received, with over 200 people participating in webinars. Tom Bobbe was very supportive of this approach, which includes NRM in the early stages of describing changes to NRM applications and the purpose of these changes.**

**The GIS Data Dictionary and geo-database design will also use the same process employed for the Existing Vegetation Technical Guide. Pete Kilbourne provided leadership to that effort and will be supporting development of the Data Dictionary and geo-database for this Technical Guide. We have worked closely with Deidre McClain, NFS account manager, who is also very supportive of the approach and working closely with Pete on setting up the review process for this Technical Guide.**

# ****Technical Reviewer and CT Comment Analysis and Reconciliation****

Steve Solem reviewed the Technical Evaluation process and its objectives. Technical reviewers included:

Tim Callahan, College of Charleston – Eastern groundwater systems

Terry Chute, Retired R4 District Ranger - NEPA and Planning Specialist

Jeanmarie Haney, TNC (AZ) – Western groundwater systems

Abe Springer, Northern Arizona University – Western groundwater systems

This group independently reviewed the draft Technical Guide and provided written responses to the questions outlined in the ***Evaluation and Review Plan***(v3.3 – 4/25/12), which include the following:

1. Is the overall structure and flow of information presented in the Technical Guide well conceived? Are there any major flaws?
2. Does the introductory section adequately describe the relationships between agency business requirements and the purposed methods described in the Technical Guide?
3. How well do the sections on classification, mapping, and inventory flow?  Are there any major flaws in presentation or approach?
4. Are there changes to the Technical Guide that should be considered? Are there missing components?
5. What effects to your organization may result from using the technical guidance?

Jeanmarie Haney, TNC, provided comments related to the review questions, while the other reviewers provided detailed comments on each of the Technical Guide sections. These technical comments will be addressed in concert with technical review comments from the Core Team. Abe Springer will submit additional comments by July 1, 2013 (completed).

***GWTG Summary* of *Technical Review Comments (*v1.3 – 6/3/13) –** This two-page document summarizes the Technical Reviewers’ responses to the five questions and **sets the framework for many of the other technical comments received on the guide. Technical Reviewer’s noted issues with the structure and flow of the document, concerns about placement of appendices, varying level of technical detail throughout the Technical Guide, and the need to identify the target audience. The varying level of technical detail throughout the document leads to different perceptions about who is the target audience.**

Steve reviewed the major comments for Questions 1 through 5. Many of the technical reviewer comments mirror those provided by Core Team members who provided review comments.

In terms of missing components some reviewers found: the Technical Guide lacks a groundwater primer; a section describing Forest Service long-term study sites, including experimental watersheds; an appendix describing the relevant State water laws and. Additionally, several reviewers found the cost estimates of sampling information very useful and suggested adding similar costs into different sections of the Technical Guide, such as in Section 3: Remote Sensing Techniques.

***Technical Reviewer and Core Team Comment Analysis and Proposed Reconciliation*** (v1.3 – 6/21/13) presents an analysis of comments provided by technical reviewers and members of the Core Team and recommended reconciliation by the Core Team.

Comments are organized into four categories: Substantive (Category A), Significant (Category B), technical comments/edits (Category C) and style/presentation edits or suggestions (Category D). The following is summarizes the results of this analysis:

* 11 Substantive comments with five that apply to the entire Technical Guide. Of these comments:
	+ 5 address concerns about presentation and/or order of discussion within the sections
	+ 4 revolve around the need to define a target audience and providing discussion detail consistent with the target audience’s level of expertise
	+ 2 raise concerns with policy statements and concepts
* 13 Significant comments distributed across all except section 6. Of these:
	+ 4 address technical points and offer suggested changes.
	+ 3 substantiate the need for 3 subsections not included in the review draft
	+ 3 focus on the need to restructure Section 3 to discuss the application of remote sensing to groundwater IM&A vs. technical information about remote sensing
	+ 3 propose inclusion of additional information
* 200 plus technical comments, with the bulk of the comments focused on sections 2 and 5
* Style/presentation comments were not tallied

The Core Team has reviewed the proposed reconciliation options and fully supports recommendations for reconciling each of the substantive and significant comments (Categories A and B). Review of proposed changes to technical comments and suggested editorial changes by Core Team members is underway. July 12 is the target date for resolution of Category C and D comments.

Tony Erba questioned whether the reconciliation options were truly “either/or” of if there were additional options as shown for some comments. Steve Solem responded that they were presented as either/or options because the reviewers provided suggested resolution of their concerns with proposed wording which defined the available choices for most comments.

Because of the limited level of participation on this call, a detailed discussion of the recommendations for substantive and significant comments is attached to these notes.

|  |  |
| --- | --- |
| **Action(s):**  | * **Steering Team members should submit their concerns with the Core Team’s recommended reconciliation of substantive and significant contents by email to Chris Carlson, Joe Gurrieri, and Steve Solem with a copy to the rest of the Steering Team members by July 12, 2013.**
 |

# ****Internal FS and Partner/Affiliate Review Process****

**Steve Solem provided an overview of the internal FS review and partner/affiliate review process. Both are currently scheduled to start on September 16. The FS internal review will be requested by the NFS Deputy Chief and run for 60 days. A draft letter outlining the process was provided as pre-work. This review is intended to accomplish (a) internal managerial and technical review, (b) conduct a FS Application Dependency Assessment, and (c) provided an opportunity to comment on FS Data Dictionary changes and Geo-Database design.**

**In preparing for this series of concurrent reviews, we will be developing information for the application dependency assessment and the GIS data dictionary and geo-data base design. Pete Kilbourne, who recently retired from the Manti-LaSal National Forest located in Utah, will be assisting with this effort. Pete is a forest geologist with extensive experience in GIS and geo-database design.**

**The partner and affiliate review process will be similar to that conducted by the technical reviewers and will be initiated by a message from Chris Carlson. We will provide a 60-day review period. A list of partner and affiliate reviewers was included a pre-work. This list will need review by the Core Team.**

|  |  |
| --- | --- |
| **Action(s):**  | * **Steering Team members should provide suggested additions and corrections to the partner and affiliate reviewer roster by July 12, 2013.**
* **Chris Carlson will notify partner/affiliate reviewers of the opportunity for review in late July or early August.**
 |

# ****Implementation – Communication and Training****

# **In preparation for the internal FS and partner reviews we will be developing presentation materials and talking points that can be used for stakeholder meetings/conference calls. The review process includes questions regarding training that will provide information for an evaluation of existing training and the identification of training needs associated with the IM&A Technical Guide.**

**Recommended Core Team Reconciliation of**

**Substantive and Significant Comments**

Substantive and Significant Comments are listed below followed by Core Team recommendations on an option for reconciliation. Key points raised during Core Team discussions are also noted.

S**ubstantive comments** apply to the entire Technical Guide or affect multiple sections and include:

1. **Statements providing policy and direction.** This concern focuses on the use of terms or phrases providing direction or creating standards of performance that may not always be practical or necessary, or are not appropriate in a Technical Guide.

Background: Technical Guides do not establish agency standards or policy; they provide guidance to agency staff. Policy and standards are established in the Forest Service Manual or Departmental and agency regulations.

***Option A (Proposed Reconciliation)*** *– Review all phrasing in the TG to address this issue. All language should be phrased as guidance and not direction unless they link to requirements. In these instances, the requirements will be specifically referenced in case they change over time.*

***Option B*** *– Retain existing language.*

1. **Purpose or intent of information presented in the Technical Guide and Appendices.** Reviewers identified concerns with the intent and purpose of providing technical instructions for groundwater inventory, monitoring, and assessment. Reviewers suggested adding common language to each section explaining the primary intent and value of the information presented.

Background: The information in the Technical Guide and associated Appendices is not intended to provide complete instructions on how to perform all groundwater inventory and monitoring activities. The intent is to provide guidance for how and when to apply techniques to inventory, monitoring, and assessment needs commonly encountered by FS staff. In some cases, references to more detailed procedures are provided within the Technical Guide, although there are inconsistencies within in the document as noted by some reviewers.

***Option A (Recommended)*** *– Address this concern in Section 1 and in a common introduction to all sections.*

***Option B*** *– Retain existing language.*

1. **The level of training or expertise required for understanding and applying the guide.** Reviewers suggested that the target audience or level of technical expertise required to understand and use the Technical Guide should be described in Section 1.0. Other reviewers commented that the level of basic groundwater knowledge required by the reader varies from section to section and the guide lacks a basic groundwater primer that puts all readers at the same level and suggests the addition of a basic groundwater primer as an Appendix.

Background: A determination will need to be made regarding the target audience for the Technical Guide. This issue will also need to be addressed in the pending revision of the “Managing Groundwater Resources” Technical Guide, so the approach used here should consider the target audience for both technical guides.

The need for a basic primer on groundwater principles is a function of the target audience for the Technical Guide. Adding an appendix or section on basic groundwater principles could serve as a foundational overview providing additional context for information presented in Sections 2 through 6.

***Option A (Recommended)*** *– Specify the target audience for the technical guide and basic knowledge requirements in Section 1. Consider referencing standard texts or information available from USGS or EPA on groundwater concepts.*

***Option B*** *– Develop an appendix that serves as a basic groundwater primer.*

CT Discussion Notes: Agreement to move forward with Option A. Rather than develop a primer, the proposed reconciliation should resolve the issue of who is the target audience. The assumption was that the TG is written for technical hydrologists and geologists (journey level employees GS 11/12 target), however, this may need to be expanded to include ecologists, biologists, and others. Apply the caveat that there is a set level of expertise, but identify/explain that some chapters (e.g., Chapters 5 and 6) require a higher level of expertise.

* The resolution of this comment involves developing a level of detail that addresses the target audience expertise.
* Each chapter has a different audience, so the introduction should provide an overview of the target audience.
* Describe the expected level of understanding in general terms, rather than FS terms to allow better understanding from our partners and other external users.
1. **Consistent presentation of content.** One reviewer suggested that the content and order of presentation be more consistent. The desk-based techniques (e.g., hydrogeologic conceptual model, hydrogeologic mapping) are a little confusing to read. Some begin with the data used in doing them, some start with what they are used for, etc. They could be organized to follow a consistent format. For example:
* A definition of the technique.
* Required data for doing the technique
* Steps for doing the technique
* An example
* Uses for the product / why it is important.
* More detailed description of technique (if this is available somewhere else in the manual)

A similar format could be used for types of available data that are useful for any kind of project (e.g., the borehole information):

* What is it?
* How were the data collected?
* How can the data be used? (and how to evaluate data quality)
* An example

Background: As noted by the reviewer different subsections discuss methods and techniques using varying outlines. This difference is the result of multiple authors and time constraints.

***Option A (Recommended)*** *– Review subsections and discussions on methods for consistent presentation.*

***Option B*** *– Retain existing language.*

1. **Definition of groundwater terms and concepts.** Reviewers identified terms and concepts throughout the Technical Guide that should be defined. For example:
* Groundwater-dependent ecosystems not defined in Section 1.
* Define groundwater models (in Section 2.1)
* Introduce concept of aquitard (in Section 2.1)
* Define hydraulic conductivity and storage (in Section 2.4)
* Define groundwater-surface water interactions concept (Section 2.7)

Reviewers identify numerous groundwater terms and concepts throughout the Technical Guide that they feel need to be defined, or in some cases introduced earlier in a particular section. Other Reviewers note because groundwater principles and definitions are spread throughout the document it is difficult to find the definition or reference.

Background: Agency Technical Guides typically use a glossary to define key terms and concepts. A glossary was not developed for this version of the Technical Guide because of time constraints.

***Option A (Recommended)*** *– Develop a glossary of terms and highlight terms included.*

***Option B*** *– Retain existing language.*

CT Discussion Notes: Will use the glossary from Managing Groundwater Resources Technical Guide and the GDE Level I and II Field Guide glossaries as a starting point. Terms and concepts not addressed will be defined using the NGWA Lexicon of Groundwater and Water Well System Terms as a starting point for terms/concepts (Online publication <http://info.ngwa.org/servicecenter/shopper/productdetail.cfm?prodcompanypassed=ngw&prodcdpassed=ngw-t1084&quantitypassed=1>)

1. **Placement of Appendix 1-A**. One reviewer suggests moving Appendix 1-A to the methodology section or adding it as the first appendix in Section 4.

Background: This appendix provides guidance on quality assurance and control information applicable to all sections of the Technical Guide, which is consistent with how this information is presented in other Technical Guides currently being developed.

***Option A (Recommended)*** *– Retain the existing placement in the Technical Guide.*

***Option B*** *– Align Appendix 1-A with Section 2, which includes basic concepts.*

1. **Location of Appendix 2.A (Technical Notes).** Several reviewers suggested the placement of Technical Notes should be either associated with specific sections or as a “stand alone” appendix not associated with a particular section. A number of reviewers suggested developing additional Technical Notes from content in the current version of the Technical Guide.

Background: Because the Technical Notes often apply to multiple sections, Section 2, which discusses the conceptual framework for inventory, monitoring, and assessment of groundwater resources, was identified as the “best” place to include the appendix containing Technical Notes.

***Option A (Recommended)*** *– Include Technical Notes as a general appendix not associated with a specific section(s).*

***Option B*** *– Maintain the appendix containing Technical Notes with Section 2.*

CT Discussion Notes: Agreement to move forward with Option A. This will be a general appendix not associated with a particular section. However, where the Technical Notes apply to both Inventory and Monitoring, use a cross-reference. In the future, there may be the need to add additional technical notes and standalone appendices are easier to add to rather than including the notes in a specific section.

1. **Placement of Section 3.** One reviewer suggested Section 3 should follow the discussion of the inventory (Section 4) because remote sensing is an inventory technique.

Background: Placement of Section 3 before the Inventory section was based on a combination of (a) the length of the section, and (b) that the use of this technique is a precursor to conducting inventory work.

***Option A*** *– Maintain Section 3 as a separate section. Address editorial suggestions to simplify content.*

***Option B******(Recommended)*** *– Integrate this information into Section 4 as an inventory method. Address editorial suggestions to simplify content and use a technical appendix to provide more detailed information on remote sensing background.*

***Option C*** *– Present this information as a separate technical appendix.*

CT Discussion Notes: Current placement of Section 3 was meant to address the use of the content as a precursor to inventory (Section 4) and monitoring (Section 5) design.

1. **Level of technical detail and relationships to groundwater IM&A presented in Section 3.** One reviewer suggested that the technical information presented in this section does not have a clear relationship to the application in groundwater inventory, monitoring and assessment. Suggestions include deletion of text that does not provide users with an understanding of the application of remote sensing to groundwater IM&A. Specific suggestions include:
2. Concentrating on how to obtain these data and how and when to use the data to detect/monitor groundwater. Reduce content by moving Section 3.4 Potential of New Sensors for Groundwater Inventory and Monitoring to Appendix 2-A.
3. Condensing Section 3.1 to focus on important aspects of the dataset for groundwater and emphasize where to get data.
4. Refocus subsection on Limitations and Future Opportunities under the section on Monitoring Change in Groundwater Storage with GRACE.

Background: This section was developed independently and has not benefited from previous Core Team review.

***Option A (Recommended)*** *– Eliminate technical discussions included in this section that do not have a clear relationship to how apply remote sensing techniques to groundwater inventory, monitoring, and assessment. Develop a technical appendix that includes deleted sections. (See Significant Comment B-8)*

***Option B*** *– Retain existing language.*

CT Discussion Notes: Agreement to move forward with Option A and to have additional review by Megan Lang once the edits have been made.

1. **Reorganization or consolidation of content in Section 6 and Shifting Content to other Sections.** This set of review comments suggests referencing or consolidating content/figures previously introduced (i.e., content in Section 5 Case Study appears in Section 6). Reorganization of content in this section may include: combining or removing redundant content within the section, moving or consolidating conceptual information with Section 2, incorporating the Large-Scale GDE Relationships discussion into Section 4, and moving Groundwater Contamination Investigation Methods (Section 6.4) to an earlier section in Section 6. Other examples include:
2. Potentiometric-Surface Maps subsection
3. Figure 6-4 (Section 6.2.3)
4. Flow Nets subsection
5. Model Conceptualization subsection
6. Combine 6.2.5 and 6.2.6 – both sections are titled “Geophysical Methods.”
7. Methods discussed in Sections 6.3.4 and 6.3.5 previously discussed in Section 6.
8. Understanding Large-Scale GDE Relationships
9. Groundwater Contamination Investigation Methods (Section 6.4)

Background: Content of this section includes information that was previously included in draft Technical Notes. This content was not edited for consistency with other content in the section.

***Option A (Recommended)*** *– Address suggestions regarding the reorganization of the section and movement of content to other sections.* ***(Note: This series of changes may warrant a specific Core Team call or opportunity to review before completing edits and will occur in late July.)***

***Option B*** *– Retain existing content, but edit for the consistency of technical detail within the section.*

1. **Varying level of technical detail within Section 6.** Comments expressed the need to adjust/balance the level of technical detail throughout this section. Another Reviewer comment suggests moving Modeling of Groundwater Systems and Natural Tracers: Environmental Isotopes subsections to Appendix 2-A (Technical Notes) to remove technical detail.

Background: Content of this section includes information that was previously included in draft Technical Notes. This content was not edited for consistency with other content in the section.

***Option A (Recommended)*** *– Remove the content on Modeling Groundwater Systems and Natural Tracers: Environmental Isotopes and present in Technical Notes. Review the remaining content for consistency in technical detail.*

***Option B*** *– Retain existing content, but edit for the consistency of technical detail within the section.*

CT Discussion Notes: Agreement to move forward with Option A and to move content related to Geophysics to a Technical Note as well. These changes will require summary text and references to the three new Technical Notes within Section 6.

The following **significant comments** were identified. Options available for resolution were discussed and the Core Team’s recommendation for reconciliation and discussion notes for each comment are noted below:

1. **Develop management questions for the beginning of each section of the Technical Guide.** Reviewers suggested adding management questions at the beginning of each section to help to illustrate what management questions can be addressed by the techniques described.

Background: The use of management questions to expand the description of the purpose of each section would provide additional information regarding the application of the methods and techniques described.

The structure of the Technical Guide provides a general overview of the purpose of each section followed by subsections that include a more complete description of those situations (i.e., management questions addressed) when the method or technique could be used. Because of the variability of management questions across the NFS, it is difficult to compile a definitive list of management questions and then match them to the appropriate method or technique.

***Option A (Recommended)*** *– Review each section’s introduction to ensure a similar level of discussion is provided regarding the purpose of the section. Within each subsection describing techniques or methods, include a description of the situations where the technique or method could be applied and provide examples of the management questions typically addressed.*

***Option B*** *– Retain existing language.*

1. **Develop cost information for techniques and methods presented.** Comments from two technical reviewers suggested adding cost information similar to that presented in Section 6 for other techniques and methods. Methods discussed in Section 3 were of particular concern.

Background: Cost information presented in Sections 4 and 6 was readily available for inclusion in this version of the Technical Guide. Collecting or developing additional cost information could result in significant delays and/or cost in developing the next version of the Technical Guide.

***Option A (Recommended)*** *– Include cost information for different methods and techniques if it is readily available.*

***Option B*** *– Collect or develop additional cost information to support methods and techniques presented within the Technical Guide.*

CT Discussion Notes: Agreement to move forward with Option A provided cost information is readily available. If not available, include a discussion on major cost elements that should be considered and a discussion of the relative differences in cost between different methods or techniques.

1. **Add an appendix or reference to State laws on water.** One reviewer suggests that because most water management policies/regulations are state based, describing the relevant State agencies to contact for water laws and regulations would be benefit users of the Technical Guide. A listing of agencies can be added as an appendix to Section 1, or if there is an existing document with this information, include hyperlink or reference publication information.

Background: State water law is complex and is not easily summarized. As noted by the reviewer providing the comment, a document that summarized this information was been prepared in 2004 by the FS, however it has not been maintained as a reference.

***Option A (Recommended)*** *– Reference the “best” information available for state laws regarding groundwater and groundwater uses.*

***Option B*** *– Do not respond to this comment.*

CT Discussion Notes: Agreement to move forward with Option A referencing the 2004 document and information available from other sources (e.g., TNC’s summary for Oregon). Information presented should be consistent with that presented in the ***Managing Groundwater Resources Technical Guide*** (FS-881) and it’s discussion of state water laws and regulation regarding groundwater resource management. This is an issue best addressed in the introductory sections of the Forest Service Manual dealing with surface and groundwater resource management and should not be addressed in detail in this Technical Guide.

1. **Quantifying groundwater use or extraction rates for Special Use Permits or other authorizations**. One reviewer indicated that many Special Use Permits authorizing water use lack basic information about groundwater use quantities or extraction for Forest Service or authorized uses and this need is not discussed.

Background: One purpose of the Technical Guide is to ensure the reliability and standardization of groundwater information; however, quantifying groundwater use or extraction rates for authorized uses would be most appropriately identified in the Forest Service Manual. It is unclear whether a requirement exists for quantification of groundwater use or extraction rates for authorized uses.

***Option A (Recommendation)*** *– Verify whether a requirement to quantify use or extraction exists. If a requirement exists modify the Business Requirements Analysis to reflect this requirement and provide a description of appropriate methods or techniques. Focus the discussion on “how to” vs. a discussion of “requirements” which is the focus of the draft FSM 2560 chapter.*

***Option B*** *– Do not respond to this comment.*

1. **Develop content for Section 1.4.3: Integrating Groundwater Resources into Project or Activity Administration**.

Background: Content for this section was not developed for the current version of the Technical Guide.

***Option A (Recommendation)*** *– Develop general content for this section and describe linkages to technical procedures described in the* ***Managing Groundwater Resources Technical Guide*** *(FS-881).*

***Option B*** *– Provide a cross reference to the* ***Managing Groundwater Resources Technical Guide*** *(FS-881) and rely on technical information in the “other” guide to address this topic.*

***Option C*** *– Delete this section because it is addressed in the* ***Managing Groundwater Resources Technical Guide*** *(FS 881).*

1. **Organization and format of Sections 2.4 and 2.5.** Reviewers found theorganization and formatting of these sections confusing.

Background: This section of the Technical Guide was compiled in response to previous Core Team comments and has not been reviewed.

***Option A (Recommendation)*** *–* Restructure these sections to follow a consistent format such as the approach suggested below.

* A definition of the technique.
* Required data for doing the technique
* Steps for doing the technique
* An example
* Uses for the product / why it is important.
* More detailed description of technique (if this is available somewhere else in the manual)

***Option B*** *– Do not respond to this comment.*

1. **Focus of Section 2.7: Groundwater - Surface Water Interactions.** Comments suggest removing or restructuringSection 2.7 to focus on how to evaluate Groundwater/Surface Water in the context of Inventory and Monitoring. Additional comments suggest adding a discussion on the difference in terminology between Groundwater/Surface Water interactions and GDEs. One reviewer recommends adding the gaining stream/losing stream conceptual diagrams by Winter and others (USGS efforts) as a preceding subsection or providing a reference these ideas in Technical Notes (Appendix 2-A).

Background: This subsection was originally a Technical Note and incorporated into the current version in response to previous Core Team comments and has not been reviewed.

***Option A (Recommendation)*** *– Address comments regarding evaluation techniques and differences in terminology between GW/SW interactions. Strengthen the discussion of relationships between GW/SW interactions and GDEs. Include a subsection or language in existing subsections that include the conceptual discussion as recommended (including conceptual diagrams).*

***Option B*** *– Remove content and include in a Technical Note. Make edits as suggested.*

***Option C*** *– Do not respond to these comments.*

1. **Develop Section 3.2 Groundwater Applications of Remotely Sensed Data.** Reviewers suggested structuring Section 3.2 to illustrate applications using remotely sensed data such as:
	* + Show examples of GDEs identified using remotely sensed data.
		+ Land-Atmosphere Interactions. Show examples from studies or describe how to use the data to complete this type of analysis.

Background: This section was not developed for the current review version of the Technical Guide.

***Option A (Recommendation)*** *– Develop general content for this section and provide examples of application.*

***Option B*** *– Eliminate this subsection.*

1. **Add a “how-to” Appendix to Section 3.** One reviewer suggested adding information in an appendix (similar to other sections) detailing which satellite system, obtaining data, processing, etc.

Background: This section was developed independently and has not benefited from previous Core Team review. (Note: This comment is related to the reconciliation of Substantive Comment A-7.)

***Option A (Recommendation)*** *– Address this suggestion in conjunction with the resolution of Substantive Comment A-7, which could result in a technical appendix to this section.*

***Option B*** *– Do not respond to this comment.*

CT Discussion Notes: Resolve consistent with comment A-7. Include a review by Megan Lang of suggested edits.

1. **Remote sensing techniques will not identify most springs in arid regions.** One reviewer suggests adding text to indicate that in arid regions, typically springs are much smaller than the resolution of most remote sensing techniques; therefore, these the techniques will not identify most springs because they are very small (compared to the resolution of most remote sensing techniques) or are under canopy or under overhanging topography or steep slopes and cannot be detected using these methods.

Background: This section was developed independently and has not benefited from previous Core Team review.

***Option A (Recommendation)*** *– Include a discussion of this limitation, if supported by technical experts, within the introduction to the section.*

***Option B*** *– If this suggestion is not technically accurate, do not respond to the comment.*

1. **Selecting an Inventory Protocol.** Comments indicate information in section 4.3.3 does not help users decide which protocol to use. Reviewers also suggested clarifying statements in Table 4-2 and bulleted list in subsection on “Selecting an Inventory Protocol” describing Level I-III inventories.

Background: Information regarding selection of the appropriate Field Guide or protocol was extracted from the GDE Business Requirements Analysis. As noted, the phrasing of this discussion can be improved to support users faced with deciding which Field Guide to select.

***Option A (Recommendation)*** *– Address comments within this subsection.*

***Option B*** *– Do not respond to this comment.*

1. **Develop content for “Use of Other Existing Monitoring Sites” subsection.**

Background**:** Content for this section was not developed for the current version of the Technical Guide.

***Option A (Recommendation)*** *– Develop general content for this section.*

***Option B*** *– Delete this subsection if the Core Team determines it is not warranted.*

1. **Create a Technical Note on suggested database standards for GW data.** A reviewer suggests identifying suggested database standards would help facilitate migrating data into a future database (see Section 5.4 Evaluation and Reporting).

Background: The need for database standards and linkages to FS database applications will be addressed during the “FS Application Dependency Assessment” concurrent with internal FS and partner review. Development of the suggested Technical Note would benefit from the assessment and comment.

***Option A (Recommendation)*** *– Defer a responding to this comment until the FS Application Dependency Assessment and internal FS/partner review has occurred.*

***Option B*** *– Develop the suggested Technical Note.*