

Landscape Assessment Tool Workplan

Table of Contents

A. Introduction and Overview.....	2
B. Oversight Structure and Healthy Watershed Partnership Participation	4
C. Continuous Tasks (CT).....	5
D. Discrete Tasks (DT)	6
1. Data Compilation	6
2. Develop Methodology	6
3. Implement Methodologies (“Backend”).....	8
4. User Interface or UI (“Frontend”).....	8
5. Testing and Feedback	10
6. Application Hosting and Security	10
7. Integration into Regional Water Board Projects.....	11
E. Products and Deliverables (PD).....	12
1. Data Compilation	12
2. Develop Methodology	13
3. Backend.....	14
4. Frontend.....	15
5. Testing and Feedback	15
6. Application Hosting and Security	15
7. Integration into Regional Water Board Projects.....	16
F. Proposed Division of Labor	17
G. Schedule	20
H. References	22

A. Introduction and Overview

The 2018 Triennial Review of the Water Quality Control Plan of the North Coast Region (Basin Plan) listed two projects in its workplan:

- Assess climate change impacts to water quality predicted in the North Coast Region using a *landscape assessment tool* (emphasis added)
- Establish an Outstanding National Resource Water (ONRW) term and definition in the Basin Plan as well as identify ONRW eligible waters

ONRW designation of a water body requires a Tier 3 anti-degradation review of any permitted discharge, which affords that water body with the highest protection in the nation (40 CFR § 131.12). ONRW designation can be viewed as a mechanism to protect water bodies that either demonstrate resilience to projected climate change impacts or require additional protection because impacts could irreparably jeopardize water quality. The landscape assessment tool is a vehicle by which (a) agency staff may assess water bodies for climate change vulnerability and eligibility for ONRW status and (b) the general public may participate in the process of ONRW designation and the development of a climate change strategy. The Healthy Watersheds Partnership (HWP) is a multi-disciplinary, multi-agency group that coordinates to answer questions related to watershed health. The nexus for HWP in the landscape assessment tool development is that such a tool can also assess watershed health; indeed, the tool *must* address watershed health for the Triennial Review projects to succeed.

The landscape assessment tool is currently envisioned as a web-based platform, toolbox or “dashboard” with various tools or modules available to the user. Through this dashboard, the public and agency staff can leverage relevant datasets to better understand the health of their local water bodies and to subject these data to analyses tailored to a specific outcome (i.e. the purposes describe above). Each module need not be mutually exclusive; the results from one module may feed into the another. For example, a tool that identifies eligible water bodies for ONRW designation would benefit from an assessment of those water bodies’ health, however health or the eligibility criteria are defined. The watershed health assessment would be a separate tool, but the results of using that tool are saved in a user profile and can feed into another tool. This set-up requires a web hosting solution that addresses user information storage and security, as detailed in a data management plan and strategy. Regardless, a user should not be required to create an account and profile to use this dashboard; instead, the testing portion of the workplan should result in a robust “default” dataset that allows a user to access all other tools without having a profile.

The following workplan for the development of the landscape assessment tool or dashboard is divided into two task categories: continuous and discrete. Continuous tasks are ongoing and do not have a defined end. Discrete tasks have defined deliverables. While the discrete task deliverables can and should be updated at some interval with new information, once the task is completed, we can move on to the next. That said, discrete tasks can be worked on concurrently by different staff. We expect the following entities/groups to be involved in this project:

- North Coast Regional Water Board (Regional Water Board) supervising staff
- Regional Water Board technical staff
- Water Boards’ Office of Information Management and Analysis (OIMA) supervising staff

Landscape Assessment Tool Workplan

- OIMA technical staff
- Division of Information Technology (DIT) staff
- Healthy Watersheds Partnership participants

Milestones are identified as deliverables in section E of this Workplan. While usually, but not always explicit in the Workplan, the project will have three phases. For the first phase, Discrete Tasks No. 1, 2, and 6 will be completed, while Discrete Tasks No. 3, 4, and 5 will be partially complete. The product of the first phase is a usable dashboard with a hosting solution identified and implemented; however, the dashboard will not have features related to creating a user account and profile. The second phase dashboard will allow users to create accounts and profiles, as well as completing remaining sub-tasks for Discrete Task No. 3, 4, and 5. Finally, once officially launched, the third phase incorporates the dashboard into the Regional Water Board basin planning process, which constitutes Discrete Task No. 7.

DRAFT

B. Oversight Structure and Healthy Watershed Partnership Participation

Because the development of this dashboard is a public, software development, and scientific process overlapping many disciplines and backgrounds, an oversight advisory committee is a necessary entity. The Healthy Watersheds Partnership (HWP) is already a multi-disciplinary, multi-agency, public-private group, and thus an ideal starting point for an advisory committee. Because of the many different facets of this project, we should create advisory sub-committees that oversees these different facets. The following are the proposed subcommittees' functions: (1) science review; (2) software or otherwise IT-related review. The IT review sub-committee may include members outside of HWP, specifically members or staff of the Data Management Innovation Advisory Panel. The larger advisory committee should act as final approvers of the products through a simple majority vote, but the sub-committees would make specific recommendations.

An attachment to this workplan is an Excel spreadsheet detailing the proposed division of labor between the different entities involved in this project. The columns with "HWP" in their names indicate where I believe HWP can participate. However, the level of participation will vary with each HWP participant. The initial asks to HWP participants for or after the first meeting discussing this project are:

1. Review and provide feedback to workplan, including proposing new tasks or modifications
2. HWP participants download a local copy of the division of labor spreadsheet. Participants replace "HWP" columns with their organization (or corresponding acronym). Participants indicate which of the sub-tasks they would like to participate in, using the same symbol convention of the spreadsheet. That is, clear the columns and add "O" if indicating an advisory role and "X" if indicating a technical or otherwise staff-level role.
3. If HWP participants have staff, IT, or other resources to dedicate to this project:
 - a. Describe type of resources available in the "Comment" column of the spreadsheet
 - b. Describe desired level of participation, also under the "Comment" column; e.g. how many hours can a staff person commit to any of the Discrete Tasks. HWP participants may replace the "O" or "X" with number of hours to dedicate, if they have that level of granularity.
4. HWP's most significant role is in Discrete Task No. 2 or the body of tasks related to literature review. For the sub-tasks in the spreadsheet, indicate in the comment column the participants' specific field of expertise. This initial survey allows us to identify areas where we lack expertise.
5. Send the modified spreadsheet to: Lance.Le@waterboards.ca.gov

C. Continuous Tasks (CT)

1. Data Management

Once datasets or data sources are compiled, there will be routine work to maintain and update them. For data sources with public APIs, this task will be simple and includes only maintaining the reference file (see DT-1.3), which should not be updated unless there have been changes to the API or data source. Locally maintained datasets are unavoidable and will require regular upkeep so that they remain up to date; the frequency of these upkeep will likely depend on the source, but at a minimum, local datasets should be inspected quarterly to see if source entity has made any changes. Once ready, assuming no privacy issues present, and if the data are relatively small (<100MB), local datasets should be uploaded to the GitHub page or wherever the code will be hosted. Larger datasets will have to be addressed later, but we expect wherever the Tool lives, these local datasets will also be found. Data management also includes managing in a secure way any data users save in the dashboard.

2. Coordination

Because this project requires both a technical advisory group as well as a potential user group, coordination is necessary. The Healthy Watersheds Partnership (HWP) is an excellent forum for high level coordination of advisory and user groups. HWP is already run by OIMA staff and the group meets quarterly, but updates to the HWP from technical staff will be based on progress. Technical staff will communicate more frequently. See collaboration resources provided to Data Management Innovation Team (DMIT); resources include Slack, GitHub, etc.

3. Code Maintenance

The main vehicles for hosting code and version control will be GitHub. The GitHub repository should mirror a folder in the Water Boards' servers. However, documentation describing the project goals should not be public (e.g. draft staff report and technical memoranda) and be in a separate folder.

4. Outreach

Once application dashboard is launched or ready for general public use, outreach and/or marketing is necessary for the dashboard's continued use. Sub-tasks may include identifying and coordinating with interested parties. This task is different from CT-2 in that the individuals, groups, or entities we wish to communicate with were not part of the development process. The task can be carried out via word-of-mouth, public notice, conference presentations, peer-review publications—just to name a few avenues.

D. Discrete Tasks (DT)

1. Data Compilation

- 1.1. Define and categorize data sources
- 1.2. Write data management strategy in the form of a technical memorandum or wiki
- 1.3. Create wiki containing documentation for each data source
- 1.4. Develop datasets lacking APIs for local maintenance and storage

2. Develop Methodology

2.1. Literature Review

2.1.1. Healthy Watershed Assessment. This series of tasks will greatly depend on an advisory committee, ideally composed from participants in the Healthy Watershed Partnership (HWP). HWP published a report (The Cadmus Group, 2013), which forms the basis of this literature review. Advisory committee will be expected to finalize any findings from the literature review.

2.1.1.1. Review existing work and literature incorporated from the *California Integrated Assessment of Watershed Health* (The Cadmus Group, 2013). Determine what areas require updating and/or revision. Outcome is a short and concise memo dictating the direction for executing DT-2.1.1.2 thru DT-2.1.1.5.

2.1.1.2. Collect, evaluate, and synthesize (c.e.s.) literature for defining “healthy” w.r.t. water quality and streams. The outcome of this step will be an annotated list of variables/parameters that together define watershed health, contained in a technical memorandum. The annotations shall link data sources from DT-1 to the parameters.

2.1.1.3. Assuming the parameters defined in 2.1.1.2 vary geographically in data availability, c.e.s. literature on methods for data imputation, with emphasis on spatial data gaps. Outcome is an annotated list contained in a technical memorandum.

2.1.1.4. For assessing absolute watershed health, c.e.s. literature related to data aggregation and dimensional reduction. We expect the outcome to be multiple metrics of watershed health that are reproducible, transparent, and informative. That is, metrics can be identically calculated by any person once given the same data. Parameters composing the metrics are well justified in their inclusion and manipulation. Lastly, the metrics should make intuitive sense and give the user an immediate sense of what they are representing. Outcome is an annotated list of methods contained in a technical memorandum.

2.1.1.5. For relative watershed health (i.e. for the purpose of sorting or prioritizing resources) assessment, c.e.s. literature related to ranking algorithms, with focus on incorporating subjective opinions. That is, unless health parameters are equally weighted, we expect users to weigh certain parameters over others; e.g. water quality agencies would tilt toward water quality parameters and resource agencies would tilt toward habitat parameters. Any ranking method(s) chosen should address these differences. This task is likely to overlap with DT-2.1.1.4

w.r.t. incorporating subjective opinion. Outcome is an annotated list of methods contained in a technical memorandum.

- 2.1.2. Outstanding National Resource Water (ONRW). Evaluate how other States and jurisdictions define ONRWs and determine common criteria and/or processes
- 2.1.3. Climate change vulnerability and impacts. C.e.s. literature that details reproducible and data-driven methods to assess climate change vulnerability. Summarize in memorandum. Because of such a broad category, focus this task to:
 - 2.1.3.1. Water quality impacts
 - 2.1.3.2. Impacts to Beneficial Uses (BU); still broad, but we can at least itemize literature to each BU
- 2.2. Following DT-2.1.1.3, narrow down data imputation methodologies such that the recommended list is representative of various classes. For example, decision tree learning is a family of machine learning methods that feature a classification or decision tree; random forest could be the chosen specific method for decision tree learning. Another example: mixed effects models come from the regression class, which are usually more explicit (i.e. not “black box” like). Classes may not be clear cut, so some overlap is expected.
- 2.3. Following DT-2.1.1.4, narrow down data aggregation methods such that the recommended list is representative of various classes. See DT-2.2.
- 2.4. Following DT-2.1.1.5, narrow down ranking algorithms such that the recommended list is representative of various classes. See DT-2.2.
- 2.5. Following the DT-2.1.1 and DT-2.1.2, evaluate whether methodologies identified are at all applicable to ONRW designation. The most basic approach for determining ONRW eligibility would be simple intersection with spatial boundaries of National Parks, wildlife refuge and similarly publicly managed land. This basic approach should form the basis upon which other methodologies can build. The recommended list of methods identified should be narrow and representative of classes, as described in DT-2.2. The outcome of this task is a technical memorandum, likely to be a part of memorandum from DT-2.1.2.
- 2.6. Following DT-2.1.3, narrow down number of climate change vulnerability assessment methods. In this case, we’d like to have each BU and water quality parameter (or related set thereof) to have their own assessment methodology. Methods selected may cover multiple BUs or water quality parameter. Outcome is an annotated list contained in the technical memorandum for DT-2.1.3.
- 2.7. Following previous tasks, identify the most accepted and current software or code implementation for each methodology identified. Summarize into short and concise memorandum.
- 2.8. Compile the memorandums and technical literature review, present before the advisory committee, and give committee this product ahead of time to evaluate. Advisory committee members should provide written and oral feedback.
- 2.9. Following feedback in DT-2.9, finalize selected methodologies into an annotated list, which would be included in a cover page or executive summary of the compilation memorandum generated in DT-2.9.

3. Implement Methodologies (“Backend”)

Skills necessary for this task group include experience using R, Python, SQL, and other similar languages.

3.1. Using all identified methodologies, perform pilot analyses with at least two watersheds or water body systems that differ in quantity and/or quality of data, w.r.t. parameters identified in DT-2.1.1.2. The goal of this task is to evaluate whether quantity/quality of data are a significant factor in a given methodology. Compare the results of the two or more analyses and document in a technical memorandum. Memorandum should provide commentary on whether a given methodology would give significantly different results if data quality/quantity are also significantly different.

3.2. **Phase 1** modules includes:

- Watershed or water body health assessment (absolute)
- Watershed or water body health assessment (relative)
- Climate change vulnerability to water quality and Beneficial Uses
- Outstanding National Resource Water eligibility
- Data visualization of input and output data, including a mapping sub-module

3.2.1. Flow charts or similar diagrams for dashboard modules and methods

3.2.1.1. If not already created in the data management plan (DT-1.2), generate an overview diagram of how the various data inputs flow into each dashboard modules and how outputs are generated.

3.2.1.2. Produce flow charts for each module that shows the internal steps/processes the module produces.

3.2.2. For each module, write or adapt existing code using either R or Python. The code will form a library, ideally as an R package or Python library, though the library need not be “official” in the sense that they are hosted on CRAN (the repository for all R packages) and other similar channels. Each code “book” should fit neatly into the flow chart diagrams created in DT-3.2.1.1. Code should live on GitHub or similar system.

3.2.3. Integrate backend code into UI

3.3. **Phase 2** modules includes:

- User account and profile IT backend
- Data imputation for sparse datasets

3.3.1. Flow charts or similar diagrams for dashboard modules and methods

3.3.1.1. Generate diagram of how user data are generated (including creation of account and profile) and feed into both Phase 1 and Phase 2 modules

3.3.1.2. Revise flow charts for Phase 1 module to incorporate DT-3.3.1.1

3.3.1.3. Produce flow chart for Phase 2 modules

3.3.2. See DT-3.2.2; write/adapt code for new modules

3.3.3. See DT-3.2.3; integrate backend code into UI

4. User Interface or UI (“Frontend”)

This task will be iterative in nature and an advisory committee will weigh in when applicable. Skills necessary for this task group include experience using JavaScript, HTML/CSS, and PHP.

4.1. **Phase 1** Frontend

Landscape Assessment Tool Workplan

- 4.1.1. Convene testing user group for a user-centered design workshop
- 4.1.2. Create a series of sketches or graphic designs; all UI's should be grouped together. That is, the UI for the dashboard and its modules should be one set, and another series of sketches would be another set, etc. There should be at least three sets of sketches.
 - 4.1.2.1. Sketch potential UI's of the *dashboard* (not modules) as well as the placement and look (icon/image) representing the module. The dashboard UI should accord with current standards and practices of modern web design.
 - 4.1.2.2. Sketch potential UI's of each analysis modules (i.e. not visualization), in accordance with the flow-chart diagrams created in DT-3.2.1.
 - 4.1.2.3. Sketch potential UI's for the data visualization module, including mapping sub-module.
- 4.1.3. Collate sketches into a portfolio with a section for each set, each with a short narrative. Then submit the portfolio to the advisory committee and others for review and evaluation.
- 4.1.4. Following review, evaluation, and any comments related, choose the UI set for dashboard and modules.
- 4.1.5. Write code for the chosen UI set. This series of tasks will be iterative as advisory committee see a version, make recommendations, technical staff make revisions, and repeat until product is ready for launch. Interim products are expected throughout the process for testing the Backend components.
 - 4.1.5.1. Code for dashboard UI's
 - 4.1.5.2. Code for analysis module UI's
 - 4.1.5.3. Code for visualization UI 's
- 4.1.6. Integrate frontend and backend code
- 4.2. **Phase 2 Frontend**

Phase 2 should build upon Phase 1, so sketches should work within the design chosen in Phase 1.

 - 4.2.1. Convene testing user group for a user-centered design workshop
 - 4.2.2. See DT-4.1.2, except only focus on Phase 2 modules and features
 - 4.2.2.1. See DT-4.1.2.1; sketch potential UI's of the *dashboard* (not modules), including options for creating a user profile and account, revising UI as necessary.
 - 4.2.2.2. See DT-4.1.2.2; sketch UI for new modules and in accordance with the flow-chart diagrams created in DT-3.3.1.
 - 4.2.2.3. Revise existing modules as needed or directed by advisory committee
 - 4.2.3. See DT-4.1.3
 - 4.2.4. See DT-4.1.4
 - 4.2.5. See DT-4.1.5
 - 4.2.5.1. New or updated code for dashboard, account/profile UI's
 - 4.2.5.2. New or updated code for additional analysis module UI's
 - 4.2.5.3. New or updated code for existing modules
 - 4.2.6. Integrate new frontend and backend code

5. Testing and Feedback

This group of tasks involve testing the dashboard with a test user group (ideally, the advisory committee, agency staff, and select members of the public). This step is somewhat analogous to A/B testing in software development, where one version is different from another, but in this case, we're looking at how users actually use the dashboard instead of different versions.

5.1. **Phase 1** testing and feedback

- 5.1.1. Write a manual on how to use the dashboard, its modules, and other components
- 5.1.2. Generate performance metrics and two evaluation forms, the former to be defined by the advisory committee. One evaluation is for guided use of the dashboard and the other is for free-form use.
- 5.1.3. Write specific instructions for a sub-set of the test user group to use the dashboard in a pre-determined or otherwise guided manner to systematically evaluate the dashboard and its modules performance.
- 5.1.4. Allow test user group to use dashboard. One sub-set is given instructions for guided use and another subset use dashboard freely
- 5.1.5. Collect evaluation forms, analyze their data, and write technical memorandum detailing findings and recommendations. Findings should include summary statistics and trends as well as recommendations for revisions to the dashboard. Findings should be integrated into Phase 2.

5.2. **Phase 2** testing and feedback

- 5.2.1. Revise and update manual to include additional modules
- 5.2.2. Revise evaluation forms and performance metrics as needed
- 5.2.3. Have test user group members register account and profiles, with assurances that such data are secure and anonymized. Exception to anonymization would be user's background; that is, what sector of the economy the user is in (government, private, etc.) and what field the user is in (e.g. fisheries biologist, environmental scientist). This exception must be approved by advisory committee.
- 5.2.4. Repeat DT-5.1.3.
- 5.2.5. Repeat DT-5.1.4
- 5.2.6. Repeat DT-5.1.5

6. Application Hosting and Security

Because this dashboard is expected to be public-facing and that Phase 2 features a database of user information, securing the database along with the application itself (i.e. not allow malicious users to abuse or otherwise threaten the application's server and network infrastructure).

- 6.1. Identify entities or IT solutions that can host the web application
- 6.2. Evaluate whether entities can provide adequate IT security to (a) safeguard user data and (b) prevent malicious users from abusing dashboard.
- 6.3. Evaluate the costs for each hosting entity/ solution.
- 6.4. Coordinate or, if necessary, develop a contract with entity/solution for viable long-term hosting

7. Integration into Regional Water Board Projects

This series of tasks is specific to the Regional Water Board's Triennial Review projects.

- 7.1. ONRW. Phase I of this project would add language to the Basin Plan that outlines the (a) process of and (b) criteria for designation. The process would presumably incorporate the ONRW module or at least reference the methodology implemented in the module.
 - 7.1.1. Compile all technical memoranda and communications with advisory committee into a draft staff report. The outcome of this draft staff report should detail how exactly the dashboard should be used (or its outputs used) in the basin planning process.
 - 7.1.2. Review and revise staff report according to Regional Water Board management staff recommendations
 - 7.1.3. Hold public workshops to inform the Board and public
 - 7.1.4. Submit staff report to the scientific peer-review process provided to State agencies
 - 7.1.5. Revise staff report in accordance with peer review comments
 - 7.1.6. Draft basin plan amendment language and subsequent internal review process
 - 7.1.7. Release staff report and draft language for public review
 - 7.1.8. Comment period, response to comments, and any subsequent revisions to draft basin plan amendment language
 - 7.1.9. Regional Water Board hearing and adoption
 - 7.1.10. State Board approval
 - 7.1.11. Office of Administrative Law (OAL) approval
- 7.2. Climate change strategy. This outcome of this project—be it a basin plan amendment, Board resolution, policy statements, directive to permitting staff, etc.—is yet undetermined, but the climate change vulnerability module should at least help with the technical side of the decision making process.
 - 7.2.1. Compile all technical memoranda and communications with advisory committee w.r.t. climate change into a draft staff report.
 - 7.2.2. Present findings before the Board in an information item with request from the Board for future direction
 - 7.2.3. Hold public workshops over dashboard provided that the Board is satisfied with the work
 - 7.2.4. Present findings from workshops and recommend to Board a pathway to an appropriate climate change strategy

E. Products and Deliverables (PD)

The following products and deliverables (PD) are outcomes of the Discrete Tasks as defined in the previous section. Note that multiple discrete tasks may aggregate to one product. Numbering convention for the products roughly follow the discrete task numbering convention, but please refer to the product description for exact linkage. Some products (e.g. memoranda) would at first be static documents, but they should transform into wikis if that format makes sense and is agreeable with the advisory committee. The product description will note if wiki format is recommended. Product names are *italicized*.

1. Data Compilation

1.1. *Data Source Memorandum or Wiki*

Initial memorandum should describes data sources with focus on the following topics: (a) data access with emphasis on API availability; (b) presence/absence of a projected (i.e. forecasted based on future scenario) dataset paired with a current dataset; and (c) spatial scale. Memorandum should be transformed into a wiki once updated.

1.2. *Data Management Strategy*

Elements of a strategy includes, but are not limited to:

- Narrative description of data to be collected or compiled and why
- Organization strategy of collected or compiled data
- Access, sharing, and licensing protocols and rights
- Metadata describing datasets and attributes
- Format and data structure
- Storage, archiving and backup, particularly for local datasets (local defined as not maintained by origin entity)
- Access, sharing, and licensing protocols and rights
- Guide to updating and maintain code created to use data (for Water Boards DIT consumption)

1.3. *Wiki of API-Enabled Datasets*

The wiki is a reference for datasets or data sources with APIs. Each entry in the wiki should contain the following components:

- Short and concise description in narrative form
- Hosting entity (e.g. California Environmental Protection Agency)
- Sub-entity, if applicable (e.g. State Water Resources Control Board)
- Program within (sub-)entity (e.g. SWAMP)
- Name of database or service (e.g. CEDEN)
- Short description of data source (e.g. "water quality")
- Long description of data source, if applicable (e.g. "Grab sample water quality measurements submitted by participating entities in SWAMP.")
- URL link to service/database description (e.g. https://www.waterboards.ca.gov/water_issues/programs/swamp/). Use URL shortener if necessary
- URL link to API documentation

- Example script demonstrating how to query, retrieve, and write data using API
- Date when reference was last updated for a given source
- Citation in APA style
- Any other important notes for users

1.4. *Locally Maintained Datasets*

For each locally maintained dataset, create database, table, or other applicable structure. Format of the dataset will depend on data type and information it conveys. For example, spatial data should be stored in a geodatabase with appropriate meta-data. Each database or dataset should also be entries in the wiki for PD-1.3, with the following additional components:

- Long description of dataset, why it is not API-enabled, and why we should have a local copy
- Date when data source was last updated
- Contact information of person (or help desk-equivalent) assigned to answer questions about data source; person or entity should represent the data source
- Date of retrieval
- Storage location (either URL or link to internal shared storage)
- Name of staff performing retrieval and documentation

2. Develop Methodology

2.1. *Literature Review Compilation*

Several sub-tasks in the Discrete Tasks section describe technical memoranda as an outcome. Except for the ONRW memorandum (DT-2.1.2), those memoranda will be interim products to track progress. The product to be reviewed by the advisory committee shall include a compilation of all memoranda from DT-2.1.1 through DT-2.1.3, as well as recommendations following DT-2.2 through DT-2.8. The proposed structure of the Literature Review Compilation is as follows:

- a. Executive Summary
- b. Annotated list of recommended parameters (see DT-2.1.1.2) and literature review summary (see interim memoranda or DT-2.1.1.2)
- c. Annotated list of recommended methods to assess absolute watershed health (see DT-2.1.1.4 and DT-2.3) and literature review summary
- d. Annotated list of recommended methods to assess relative watershed health (see DT-2.1.1.5 and DT-2.4) and literature review summary
- e. Annotated list of recommended methods for data imputation (see DT-2.1.1.3 and DT-2.2) and literature review summary
- f. Discussion of methods and parameters as they relate to ONRW eligibility criteria and designation process (see DT-2.1.1.2; DT-2.1.2; DT-2.5)
- g. Discussion of methods and parameters as they relate to climate change vulnerability. Each sub-section should discuss applicable methods for water quality parameters and each Beneficial Use of water (see DT-2.1.3)
- h. List of software implementation for each method listed in sections 2 through 5 of this proposed structure.

- i. References, citations, and acknowledgments.
 - j. List or summary of comments from advisory committee, once final
- 2.2. *ONRW Geodatabase*
- The outcome of DT-2.1.2 is a geodatabase and technical memorandum containing meta-data existing ONRWs and equivalently designated waters. The memorandum should also make findings and recommendations for ONRW criteria, which should incorporate conclusions stated in PD-2.1, particularly those related to DT-2.1.1.2; -2.1.1.4, and -2.1.1.5. The geodatabase should also contain relevant attributes (e.g. percent of watershed in a National Park). If APIs exist for spatial datasets, those should be added as entries into the wiki from PD-1.3. See PD-1.4 for managing a locally maintained dataset and requirements.
3. Backend
- 3.1. *Data Disparity Analysis*
- Deliverables include technical memorandum (or, if analysis is novel, a manuscript for publication) and associated data plus meta data documentation. The elements of the technical memo should include:
- a. Overview and introductory language about analysis (see DT-3.1)
 - b. Description and justification of watersheds or water body systems selected for analysis; also include maps and related diagrams for input data
 - c. List of methods implemented; at least one method for the following: (a) absolute health; (b) relative health; (c) ONRW eligibility and criteria; and (d) climate change vulnerability of water quality and Beneficial Uses
 - d. Results of analyses including any plots, diagrams, or visualizations
 - e. Discussion, conclusions and recommendations
 - f. References, citations, and acknowledgements
- 3.2. **Phase 1 Product**
- Following elements comprise the end-product of each phase:
- 3.2.1. *Annotated List of Proposed Dashboard Modules*
- Eventually, this list will be updated through the dashboard's official documentation, which will be in the form of a wiki (but a report form can also be prepared upon advisory committee request)
- 3.2.2. *Flowchart Compilation*
- Alternative diagram styles are acceptable if agreeable with advisory committee. Each entry in the compilation should feature a concise summary. See DT-3.3 for more details. This compilation will eventually be merged into the dashboard official documentation
- 3.2.3. *Code Library*
- Depending on how extensive this dashboard becomes, it may be useful to write an R package or Python library to service the dashboard. In any case, all code should migrate to GitHub or an equivalent hosting solution.
- 3.3. **Phase 2 Product**
- See PD-3.2 elements. Phase 2 Product should be styled as an updated Phase 1 Product, not an independent deliverable. Phase 2 Product should note which modules are new and whether existing modules have been modified.

4. Frontend

4.1. **Phase 1 Design Options Portfolio**

See DT-4 for more details. Each entry in the compilation should contain the following elements. Element *g* is not necessary for the review period where advisory committee chooses a design. *PD-4.1-review* is the interim product.

- a. Summary of workshop for user-centered design
- b. Sketch for main dashboard page
- c. Sketch for any auxiliary page that is not a module (e.g. sign-in, user profile, etc.)
- d. Sketch for every analysis module and sub-module, as proposed in DT-3 and PD-3.2
- e. Sketch for non-GIS visualization module
- f. Sketch for GIS module
- g. URL to code that elements the UI design

4.2. **Phase 2 Design Options Portfolio**

See PD-4.1. *PD-4.2-review* is the interim product for advisory committee. Phase 2 Portfolio should be styled as an updated Phase 1 Portfolio. Portfolio should note which modules are new and whether existing modules have modified.

5. Testing and Feedback

5.1. **Phase 1** deliverables for this Task should comprise:

5.1.1. *Dashboard Documentation*

Documentation is recommended to be in a wiki format, but a report format can be prepared at the request of advisory committee members. Documentation should include the workplan and all products and deliverables (URLs in case of datasets or code).

5.1.2. *Evaluation Forms for Guided Use and Free Use*

See DT-5.1.2

5.1.3. *Instructions for Guided Use*

See DT-5.1.3

5.1.4. *Memorandum Summarizing Evaluation and Feedback*

See DT-5.6

5.2. **Phase 2** deliverables for this Task. Deliverables should be styled as an updated Phase 1. See PD-5.1 for elements.

6. Application Hosting and Security

Deliverables for DT-6 are dependent on the IT path the dashboard will take, but at a minimum include:

- a. Narrative describing need for a hosting solution
- b. Review including cost analysis of hosting solutions
- c. Security and data management plan specific to hosting solution
- d. Long-term plans for dashboard (i.e. where can it reside on a permanent basis)

Landscape Assessment Tool Workplan

7. Integration into Regional Water Board Projects

Phase 3 is all of Task 7. This series of tasks are to be completed by Regional Water Board staff.

7.1. ONRW

7.1.1. *Staff Report*

Compilation of all memoranda and documentation, as they apply to the ONRW project.

7.1.2. *Regional Water Board Meeting: Information Item Materials*

7.1.3. *Peer Review Package*

7.1.4. *Draft Basin Plan Amendment Language*

7.1.5. *Public Workshop Materials*

7.1.6. *Response to Comments*

7.1.7. *Regional Water Board Hearing Package*

7.1.8. *State Water Board Hearing Package*

7.1.9. *OAL Approval Package*

7.2. Climate Change Strategy

7.2.1. *Internal Staff Report*

7.2.2. *Regional Water Board Meeting: Information Item Materials*

7.2.3. *Public Workshop Materials*

7.2.4. *Regional Water Board Meeting II: Information Item Materials*

F. Proposed Division of Labor

The following are proposed division of labor between participating entities. Table A describes acronyms and symbols used in Table B. Table B corresponds with the outline of Discrete Tasks. Columns indicate which entity participates in which task. Currently, HWP participants are lumped into one category, but once participating entities agree with the workplan, their carve-out will be updated here. These tables are also found in the MS Excel spreadsheet on OneDrive.

Table A: Symbol and Acronym Description

Symbol/Acronym	Description
tRWB	Regional Water Board technical staff
sRWB	Regional Water Board supervising staff
tOIMA	OIMA technical staff
sOIMA	OIMA supervising staff
sHWP	Healthy Watersheds Partnership participant, supervising staff
tHWP	Healthy Watersheds Partnership participant, technical staff
X	Entity is assigned to perform task
O	Entity is assigned to supervise task and review draft work products

Table B: Proposed Division of Labor

Phase	Task Type	Task Number	sRWB	tRWB	sOIMA	tOIMA	sHWP	tHWP
-	CT	1.		X	O	X		
-	CT	2.	X		X		X	
-	CT	3.		X	O	X		X
-	CT	4.	X	X	X	X	X	X
1	DT	1.1.		X	O	X		X
1	DT	1.2.	O	X	O	X		X
1	DT	1.3.		X	O	X		X
1	DT	1.4.		X	O	X		X
1	DT	2.1.1.1.	X,O	X			O	X
1	DT	2.1.1.2.	O	X	O		O	X
1	DT	2.1.1.3.	O	X			O	X
1	DT	2.1.1.4.	O	X			O	X
1	DT	2.1.1.5.	O	X			O	X
1	DT	2.1.2.	O	X	O		O	O
1	DT	2.1.3.1.	O	X			O	X
1	DT	2.1.3.2.	X	X			O	X
1	DT	2.2.	X	X			O	X
1	DT	2.3.	X	X			O	X
1	DT	2.4.	X	X			O	X
1	DT	2.5.	X	X			O	
1	DT	2.6.	X	X			O	X
1	DT	2.7.		X	O	X	O	X
1	DT	2.8.	O	X			O	X

Landscape Assessment Tool Workplan

Phase	Task Type	Task Number	sRWB	tRWB	sOIMA	tOIMA	sHWP	tHWP
1	DT	2.9.	O	X	O		O	X
1	DT	3.1.	O	X		X	O	X
1	DT	3.2.1.1.	O	X	O	X	O	X
1	DT	3.2.1.2.	O	X	O	X	O	X
1	DT	3.2.2.		X	O	X		X
2	DT	3.2.3		X	O	X		X
2	DT	3.3.1.1.	O	X	O	X	O	X
2	DT	3.3.1.2.	O	X	O	X	O	X
2	DT	3.3.2.		X	O	X		X
1	DT	3.3.3		X	O	X		X
1	DT	4.1.1.	X	X	X	X	X	X
1	DT	4.1.2.1	O	X	O	X	O	X
1	DT	4.1.2.2.	O	X	O	X	O	X
1	DT	4.1.2.3.	O	X	O	X	O	X
1	DT	4.1.3.		X		X		X
1	DT	4.1.4	X		X		X	
1	DT	4.1.5.1		X		X		X
1	DT	4.1.5.2		X		X		X
1	DT	4.1.5.3		X		X		X
2	DT	4.1.6		X		X		X
2	DT	4.2.1.	X	X	X	X	X	X
2	DT	4.2.2.1		X		X		X
2	DT	4.2.2.2.		X		X		X
2	DT	4.2.2.3.		X		X		X
2	DT	4.2.3.		X		X		X
2	DT	4.2.4	X		X		X	
2	DT	4.2.5.1		X		X		X
2	DT	4.2.5.2		X		X		X
2	DT	4.2.5.3		X		X		X
1	DT	4.2.6		X		X		X
1	DT	5.1.1.	O	X	O	X	O	X
1	DT	5.1.2.	O	X	O	X	X	X
1	DT	5.1.3.		X		X		X
1	DT	5.1.4.	X	X	X	X	X	X
1	DT	5.1.5.	O	X	O	X	O	X
2	DT	5.2.1.	O	X	O	X	O	X
2	DT	5.2.2.	X	X	X	X	X	X
2	DT	5.2.3.	O	X	O	X	X	X
2	DT	5.2.4.		X		X		X
2	DT	5.2.5.	X	X	X	X	X	X
2	DT	5.2.6.	O	X	O	X	O	X
1	DT	6.1.		X	X,O	X		X
1	DT	6.2.		X	X,O	X		
1	DT	6.3.		X	X,O	X		
1	DT	6.4.	X		X,O	X		X

Landscape Assessment Tool Workplan

Phase	Task Type	Task Number	sRWB	tRWB	sOIMA	tOIMA	sHWP	tHWP
3	DT	7.1.1	O	X				
3	DT	7.1.2	X	X				
3	DT	7.1.3	X	X				
3	DT	7.1.4	X					
3	DT	7.1.5	O	X				
3	DT	7.1.6	O	X				
3	DT	7.1.7	X	X				
3	DT	7.1.8	X	X				
3	DT	7.1.9	O	X				
3	DT	7.1.10	O	X				
3	DT	7.1.11	O	X				
3	DT	7.2.1	O	X				
3	DT	7.2.2	X	X				
3	DT	7.2.3	X	X				
3	DT	7.2.4	X	X				

DRAFT

H. References

Antidegradation policy and implementation methods. 40 C.F.R. § 131.12 (2015).

North Coast Regional Water Quality Control Board (2018). *2018 Triennial Review of the Water Quality Control Plan for the North Coast Region*.

<https://www.waterboards.ca.gov/northcoast/water_issues/programs/basin_plan/triennial_review/>

The Cadmus Group, Inc. (2013). *California Integrated Assessment of Watershed Health*. Report prepared for U.S. Environmental Protection Agency. <https://www.epa.gov/sites/production/files/2015-11/documents/ca_hw_report_111213_0.pdf>

DRAFT