



Roadmap to Compliance With Oregon Administrative Rules: Chapter 340 Division 300

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State of Oregon
Department of Environmental Quality

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Acronyms and abbreviations

API	American Petroleum Institute
ASCE	American Society of Civil Engineers
BLG	Buildings, Structures, and ancillary components
BMS	Berms
COE	Control Equipment
COPRI	Coasts, Oceans, Ports & Rivers Institute
DE	Design Earthquake
DEQ	Department of Environmental Quality
FPS	Fire Protection/Suppression System
FTSS	Fuel Tank Seismic Stability
GEO	Geotechnical Analysis/Reports
LNG	Liquefied Natural Gas tanks & associated pipeline systems
LOR	Loading Racks
MOT	Marine Oil Terminal
OAR	Oregon Administrative Rules
OPC	Operating conditions, safe shutdown procedures, spill prevention
PIANC WG	Permanent International Commission for the Navigational Congresses, now World Association for Waterborne Transport Infrastructure
PIP	Pipelines
RMIP	Risk Mitigation Implementation Plan
SPL	Spill Containment Measures/Structures
SVA	Seismic Vulnerability Assessment
TNK	Tanks (for each tank with a separate identifier)

Purpose

This is a roadmap for facilities to use to develop Seismic Vulnerability Assessments to comply with the Oregon Department of Environmental Quality's Fuel Tank Seismic Stability Program rules OAR 340-300. It provides direction about the content of assessment and organization of assessment reports to complement the DEQ rules, along with scheduling and coordination processes with DEQ. Each step in the process requires the leadership of professional engineers registered in Oregon. There are ten forms attached that provide more details on these steps.

- Form 1 Geotechnical Assessment
- Form 2 Tanks Checklist
- Form 3 Pipeline Checklist
- Form 4 Piers and Wharves Checklist
- Form 5 Liquified Natural Gas Tanks and Pipelines Checklist
- Form 6 Berms and Dikes Checklist
- Form 7 Building and Building Structures Checklist
- Form 8 Fire Detection and Suppression
- Form 9 Control Systems Checklist
- Form 10 Assessment Findings Statement

This document will be available on the Oregon Department of Environmental Quality's [Fuel Tank Seismic Stability page](#).

Contact information

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General guidelines

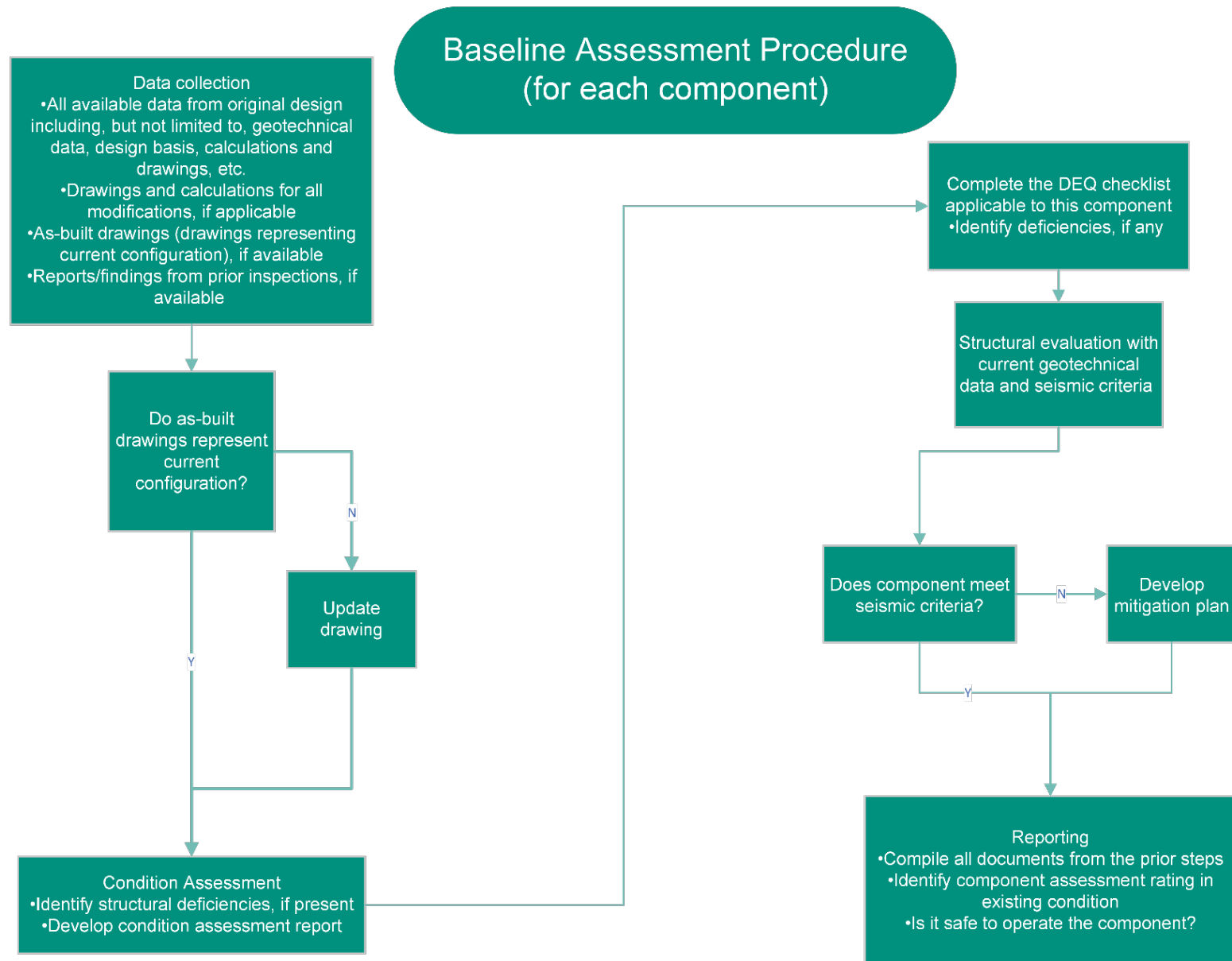
1. See OAR 340-300-0000 to 0007 for objectives, requirements, and general guidelines.
2. Assessment team required qualifications are provided in OAR 340-300-0002(3).
3. General site information and site-specific seismic criteria:

- a. Using ASCE7 definition of Design Earthquake, describe methodology and procedures to establish the seismic criteria.
 - b. Perform above or below ground geotechnical assessment to determine site-class, D-F.
 - c. Prepare report with references per OAR 340-300-0002 including but not limited to ASCE7, API 650, PIANC WG 153, etc.
 - d. Submit geotechnical report for review per OAR 340-300-0003 (6)(a).
 - e. Include a site plan in the submittal that identifies locations of all components subjected to a seismic evaluation to comply with the rules.
4. Optional task: Pre-submittal review of the site-specific seismic vulnerability study parameters. The assessment team may choose to submit the site-specific seismic criteria to DEQ for review and feedback prior to the assessment of individual components at the facility. This review cycle may add time to the assessment schedule, but it may expedite the approval process.
 - a. Form 1 Geotechnical Assessment Checklist provides detailed guidance for the development of site-specific criteria. The assessment team can proceed with the assessment of individual components at the facility if the site-specific seismic criteria meet the OAR 340-300 objectives and the requirements of the Form 1 Geotechnical Assessment Checklist.
5. Seismic Vulnerability Assessment of individual components at the facility
 - a. Seismic Vulnerability Assessment will be performed for all components subject to OAR 340-300.
 - b. Each assessment will follow one of the following procedures:
 - **Baseline assessment**, the first assessment per OAR 340-300, without a reportable incident.
 - **Subsequent assessment**, if a baseline assessment was performed previously, and the current assessment is to satisfy the OAR 340-300 requirement without a reportable incident.
 - **Post-event evaluation**, triggered by a reportable incident per OAR 340-300-0005(1)(f).
 - c. Assessments will follow guidelines in forms 1-9 checklists appropriate for each component.
 - d. Assessment ratings as shown in Table 1 may be provided for each component.
 - e. Mitigation plan will be developed for identified deficiencies.
6. The Seismic Vulnerability Assessment submittal for the overall facility must include the following:
 - a. General site information including geotechnical data, site-specific seismic criteria and a site plan.
 - b. List of all assessed components and their assessment ratings.
 - c. List of all deficiencies with prioritization, corresponding mitigation plan and proposed timeline.
 - d. Overall facility assessment rating.
 - e. Documentation in the appendices of each component assessment.
 - f. Professional engineer stamp, which is required for the overall report and its appendices.
 - g. OAR 340-300-0003(3)(b) (B) allows owners to complete assessments in phases. The initial assessment report due June 1, 2024, must include a summary of remaining work to be completed and a proposed schedule with a schedule justification.

- h. **Electronic Data:** Facility geotechnical and structural information might include extensive numerical data, tables and maps. Much of it can be managed in a Geographical Information system such as ArcGIS. DEQ review and comment reporting can be expedited and made more straightforward through the use of systematic data formatting, organized as indicated in forms 19. Owners and their consultants are encouraged to consult with DEQ about data management and submittal plan(s).
- 7. DEQ will review the submittals and provide a response to the owner. If the assessment approach or the provided documentation is deemed insufficient to demonstrate compliance with OAR 340-300-0003 assessment requirements, DEQ may request additional information or documentation.
- 8. The owner may provide a revised assessment document or an assessment addendum to address the identified deficiencies following the DEQ initial review.
- 9. The owner will perform subsequent assessments if one or more of the following apply:
 - a. An earthquake of magnitude 5 or more occurs within 100 miles of the facility [OAR 340-300-0003 (3)(c)];
 - b. DEQ notifies the owner of new scientific or technical findings that may affect the assessment [OAR 340-300-0003 (4)];
 - c. Routine inspection as specified for mitigation measures included in an approved Risk Mitigation Implementation Plan.
 - d. Each of the components (e.g. tanks, marine terminals, piping systems, etc.) will be assessed following the instructions provided in the appropriate checklists and references. An example is for tanks with the inspection procedures outlined and checklists provided in API 653. One of the objectives for the assessments is to compile all available documentation since the design of the components. If there are no historical inspection records, or structural drawings showing the current configurations are not available, new drawings may be developed with adequate structural detail to identify all deficiencies.

Baseline assessment

Figure 1: Baseline assessment procedure flowchart



All identified deficiencies should be listed along with proposed mitigation and the target completion dates. Following the completion of component assessments, the assessment team will assign ratings for the components (6 = good to 1 = critical) which may then be used to assign an overall assessment rating for the entire facility. DEQ may confirm or modify these ratings and use judgment to provide a condition assessment rating (6 to 1) for the entire facility. A sample table is shown in Table 1. The completed deficiencies and checklists shared with DEQ will expedite the approval process. This step can be iterative, until DEQ finds the assessment complete. In some cases, the facility may have to reduce operations, limit loads, or have some other method to immediately implement minimal corrective actions to remain operational. Once the SVA is approved, the operator will submit the Risk Mitigation Implementation Plan in accordance with OAR 340-300-0004.

Table 2 suggests the follow-up action to any deficiencies identified during the assessment.

Table 1: Condition assessment ratings

Condition Assessment Rating	
Rating	Description of Structural Systems
Good (6)	No problems or only minor problems noted. Structural elements may show very minor deterioration, but no overstressing observed. The capacity of the structure meets the requirements of this standard. The structure should be considered fit-for-purpose. No repairs or upgrades are required.
Satisfactory (5)	Limited minor to moderate defects or deterioration observed, but no overstressing observed. The capacity of the structure meets the requirements of this standard. The structure should be considered fit-for-purpose. No repairs or upgrades are required.
Fair (4)	All primary structural elements are sound; but minor to moderate defects or deterioration observed. Localized areas of moderate to advanced deterioration may be present, but do not significantly reduce the load bearing capacity of the structure. The capacity of the structure is no more than 15 percent below the structural requirements of this standard, as determined from an engineering evaluation. The structure should be considered as marginal. Repair and/or upgrade measures may be required to remain operational. May remain operational provided a plan and schedule for remedial action is presented to DEQ.
Poor (3)	Advanced deterioration or overstressing is observed on widespread portions of the structure, but it does not significantly reduce the load-bearing capacity of the structure. The capacity of the structure is no more than 25 percent below the structural requirements of this standard, as determined by an engineering evaluation. The structure is not fit-for-purpose. Repair and/or upgrade measures may be required to remain operational. The facility may be allowed to remain operational on a restricted or contingency basis until the deficiencies are corrected, provided a plan and schedule for such work is presented to DEQ.

Condition Assessment Rating	
Rating	Description of Structural Systems
Serious (2)	<p>Advanced deterioration, overstressing or breakage may have significantly affected the load-bearing capacity of primary structural components. Local failures are possible and loading restrictions may be necessary. The capacity of the structure is more than 25 percent lower than the structural requirements of this standard, as determined from an engineering evaluation.</p> <p>The structure is not fit-for-purpose. Repairs and/or upgrade measures may be required to remain operational. The facility may be allowed to remain operational on a restricted basis until the deficiencies are corrected, provided a plan and schedule for such work is presented to and accepted by DEQ.</p>
Critical (1)	<p>Very advanced deterioration, overstressing or breakage has resulted in localized failure(s) of primary structural components. More widespread failures are possible or likely to occur and load restrictions should be implemented, as necessary. The capacity of the structure is critically deficient relative to the structural requirements of this standard.</p> <p>The structure is not fit-for-purpose. The facility shall cease operations until deficiencies are corrected and accepted by DEQ.</p>

Table 2: Follow-up actions based on ASCE/COPRI Waterfront Facilities Inspection/Assessment Standard Practice Manual, Table 2-16

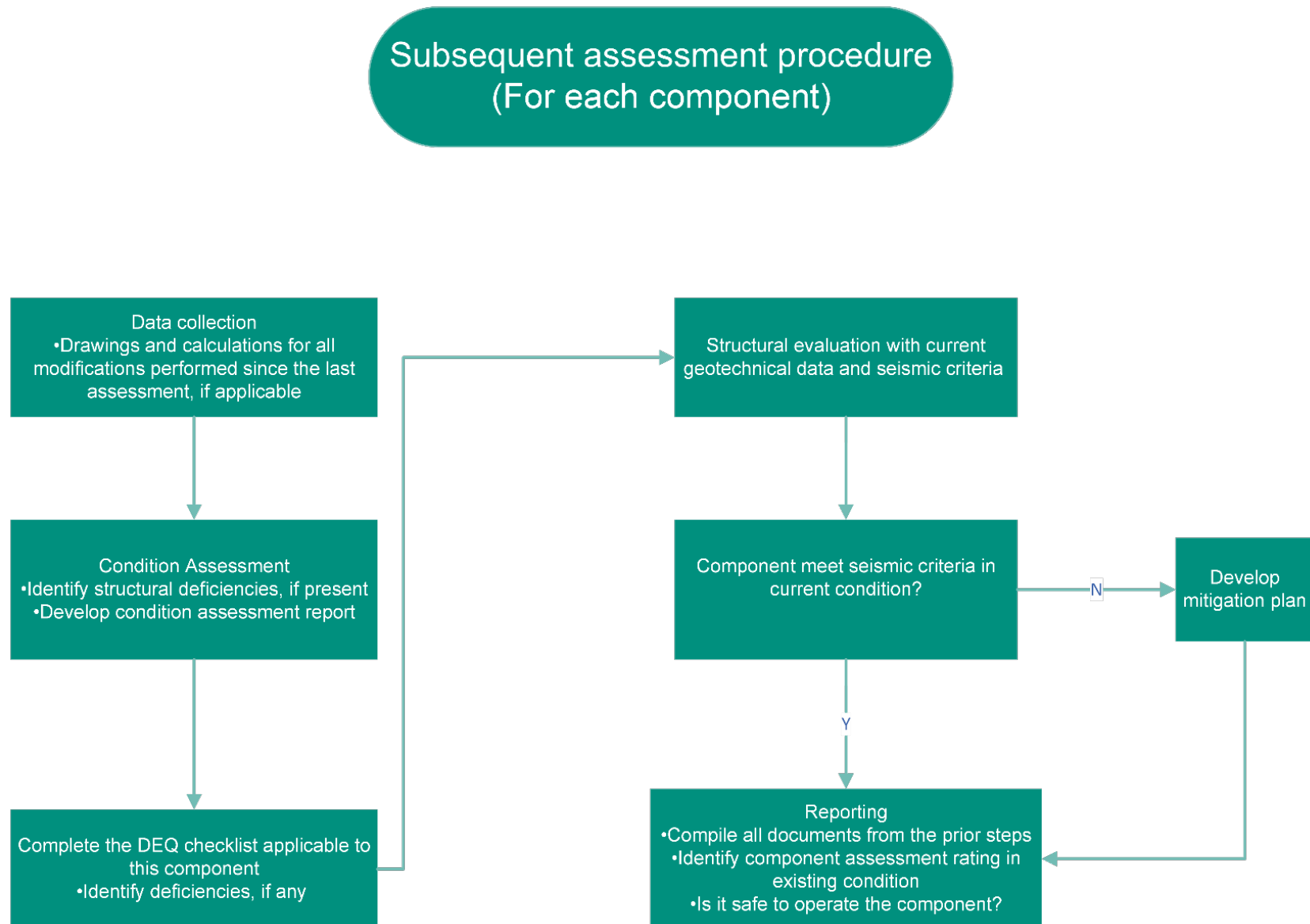
Structural Follow-up Actions	
Follow-up Action	Description
Emergency Action	Specified whenever a condition which poses an immediate threat to public health, safety or the environment is observed. Emergency actions may consist of barricading or closing all or portions of the facility, component(s), etc.
Engineering Evaluation	Specified whenever structural damage or deficiencies are observed which require further investigation or evaluation, to determine appropriate follow-up actions.
Repair Design Inspection	Specified whenever damage or defects requiring repair are observed. The repair design inspection is performed to the level of detail necessary to prepare appropriate repair plans, specifications and estimates.
Upgrade Design and Implementation	Specified whenever the structural system requires upgrading in order to comply with the requirements of these standards and current applicable codes.
Special Inspection	Typically specified to determine the cause or significance of non-typical deterioration, usually prior to designing repairs. Special testing, laboratory analysis, monitoring or investigation using non-standard equipment or techniques are typically required.
Develop and Implement Repair Plans	Specified when the Repair Design Inspection and required Special Inspections have been completed. Indicates that the structure is ready to have repair plans prepared and implemented.
No Action	Specified when no further action is necessary until the next scheduled inspection.

DEQ review

This step is for DEQ to review and approve the mitigation plan – engineering, drawings and documents that support the proposed mitigation actions. In this step, there is a question and response procedure between the facility operator and DEQ until DEQ is satisfied with the engineering, drawings and related documents. DEQ will provide a comprehensive review of all mitigation measures; however, DEQ and any DEQ peer review consultants are NOT the engineer of record and the review does NOT check submitted analyses and duplicate the results. DEQ provides an engineering review, but not at the most detailed level. The process continues until DEQ and the operator agree to the mitigation measures, ratings, and the time or schedule to implement the mitigation measures. Until all of the implementation activities are completed, DEQ may limit the facility's operations in some appropriate manner. Table 2 outlines the corrective activities that should be taken as appropriate.

Subsequent assessment procedure

Figure 2: Subsequent Assessment flowchart



DEQ review

Each component (e.g., marine terminals, tanks, pipelines) may be subject to continuous inspections as scheduled by the appropriate codes and standards manuals. DEQ will review these inspection/mitigation measures/engineering and keep records of all deficiencies, mitigation measures and compliance with OAR 340-300. In addition, OAR 340-300-0003(2) provides the requirement that SVA updates be provided to DEQ whenever either of the following two events occur:

1. Application for any permits for retrofit or reconstruction of any part of the facility, or
2. When notified by DEQ of the availability of new scientific, technical findings, best management practices or industry standards are updated; each facility must comply, but not more than once every three years.

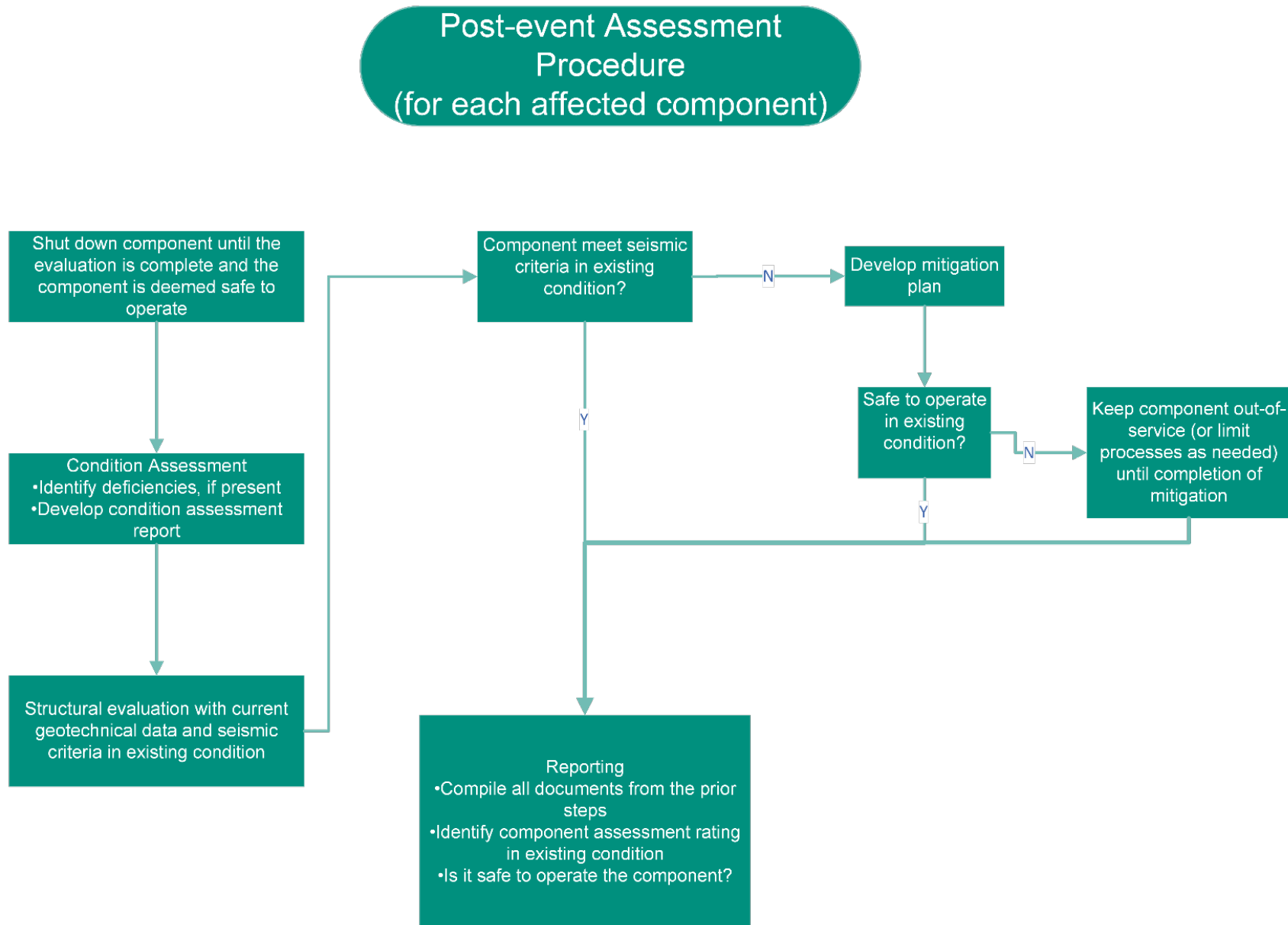
Note that the two events above are independent of the requirements of each component to perform routine inspections as specified in their respective codes, standards and recommended practice (e.g. API 653, ASCE/COPRI Waterfront Facilities Inspection and Assessment Standard Practice Manual). Table 3 provides an example of required routine inspections underwater for marine structures. Other components (e.g. API 653) require other inspection activities at regular intervals.

Table 3: Example of required routine inspections underwater for marine structures.

Maximum Interval Between Underwater Inspections (years) ¹ Ref: ASCE/COPRI Standard Practice Manual						
Condition Rating from Previous Inspection	CONSTRUCTION MATERIAL				Channel Bottom or Mudline – Scour ⁴	
	Unwrapped Timber or Unprotected Steel (no coating or cathodic protection) ⁴		Concrete, Wrapped Timber, Protected Steel or Composite Materials (FRP, plastic, etc.) ⁴			
	Benign ² Environnent	Aggressive ³ Environnent	Benign ² Environnent	Aggressive ³ Environnent	Benign ² Environnent	Aggressive ³ Environnent
6 (Good)	6	6	6	6	6	5
5 (Satisfactory)	6	4	6	6	6	6
4 (Fair)	5	3	5	5	6	6
3 (Poor)	4	3	4	4	6	6
2 (Serious)	2	1	2	2	2	2
1 (Critical)	N/A5	N/A5	N/A5	N/A5	N/A5	N/A5
<div>1. The maximum interval between Underwater Audit Inspections shall be reduced as appropriate based on the extent of deterioration observed on a structure, the rate of further anticipated deterioration, or other factors.</div> <div>2. Benign environments include fresh water and maximum current velocities less than 0.75 knots for the majority of the days in a calendar year.</div> <div>3. Aggressive environments include brackish or salt water, polluted water, or waters with current velocities greater than 0.75 knots for the majority of the days in the calendar year.</div> <div>4. For most structures, two maximum intervals will be shown in this table, one for the assessment of construction material (timber, concrete, steel, etc.) and one for scour (last 2 columns). The shorter interval of the two should dictate the maximum interval used.</div> <div>5. Facilities/Components rated “Critical” will not be operational; and Emergency Action shall be required.</div>						

Post-event assessment

Figure 3: A flowchart showing the post-event assessment procedure after a 5.0M+ earthquake, or other event outlined above, within 100 miles.



Following an earthquake, fire or other severe environmental event, a follow-up engineering inspection and further mitigation may be required. An assessment is required after a magnitude 5 event within 100 miles and should be considered after any smaller event, fire or accident. A post-event assessment rating of A-D is provided in Table 4. All follow-up action plans should be submitted to DEQ with all drawings, calculations, and reports, with a proposed schedule. Figure 3 outlines the procedure to submit the post-event assessment. Table 4 provides a sample of post-event assessment ratings.

Table 4: Post-event Rating, based on ASCE/COPRI Waterfront Facilities Inspection/Assessment Standard Practice Manual, Table 2-15

Post-event Ratings		
Rating	Summary of Damage	Remedial Actions
A	No significant event-induced damage observed.	No further action required. The facility may continue operations.
B	Minor to moderate event-induced damage observed but all primary structural elements and electrical or mechanical systems are sound.	Repairs or mitigation may be required to remain operational.
C	Moderate to major event-induced damage observed which may have significantly affected the load bearing capacity of primary structural elements or the functionality of key electrical or mechanical systems.	Repairs or mitigation may be necessary to resume or remain operational. The facility may be allowed to resume limited operations.
D	Major event-induced damage has resulted in localized or widespread failure of primary structural components; or the functionality of key electrical/mechanical systems has been significantly affected. Additional failures are possible or likely to occur.	The facility may not resume operations until the deficiencies are corrected.

Seismic Vulnerability Assessment flowchart

Figure 4: Flowchart providing an overview of steps

