We followed the process outlined in Figure 5 to assign sites to disturbance categories. Each of the seven metrics was scored based on their value in relation to the thresholds in Table 6. For example, if a site had an IWI of 0.9, it received an IWI score of +3; or if it had an IWI score of 0.55, it received an IWI score of -1. The metric scores were then considered in combination, using the 'combination rules' described in Table 6. Sites were assigned to one of seven preliminary disturbance categories, ranging from Best Reference to Highly Stressed, which were then collapsed into three broader categories (reference, medium stress, and stressed). The preliminary designations were then reviewed by staff from MassDEP and RI DEM, who either confirmed or changed the designations. Sites were then mapped and color-coded by disturbance category to ensure that their spatial distribution matched with expectations (Figures 6 and 7). Of the 109 sites, 26 were designated as reference sites, 23 as stressed sites, and 60 as medium stress sites. Figure 8 shows the range of disturbance represented in the reference and stressed dataset, as measured by the ICI, IWI, percent urban, and percent agricultural land cover. Appendix D contains additional box plots with disturbance variables as well as natural variables (such as drainage area, slope, temperature, and elevation). Appendix E has additional maps of natural variables. Attachment C contains the site list with preliminary and final disturbance category assignments.
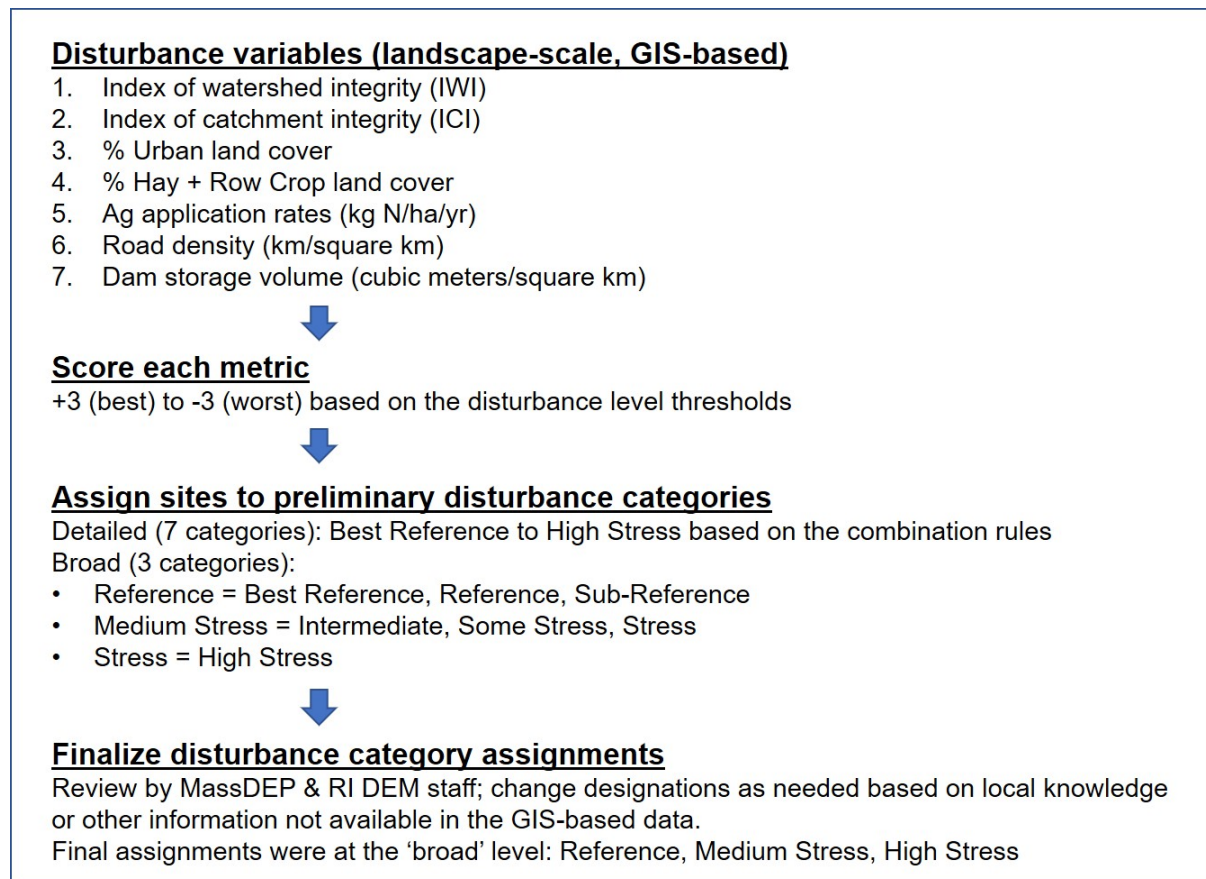

Figure 5. Process for assigning sites to disturbance categories. Information on variable selection and development of the disturbance gradient can be found in Jessup and Stamp (2020).

Table 6. Metric scoring thresholds and combination rules that were used to assign sites to preliminary disturbance categories. More detailed information on how metrics and scoring thresholds were selected can be found in the MassDEP riffle habitat IBI report (Jessup and Stamp 2020). Metrics scores of +3 represent least disturbed conditions, while -3 represents the most highly disturbed conditions.

Metric Scores	IWI (2.1)	ICI (2.1)	% Urban	% Hay/Crop	Fertilizer application	Road density	Dam storage volume
+3	≥ 0.85	≥ 0.85	≤ 1	≤ 1	≤ 0.5	≤ 1.5	≤ 0.1
+2	< 0.85 and ≥ 0.80	< 0.85 and ≥ 0.80	> 1 and ≤ 2	> 1 and ≤ 2	> 0.5 and ≤ 1	> 1.5 and ≤ 2	> 0.1 and ≤1,000
1	< 0.80 and ≥ 0.70	< 0.80 and ≥ 0.70	> 2 and ≤ 5	> 2 and ≤ 5	> 1 and ≤ 2.5	> 2 and ≤ 3	> 1000 and ≤ 10,000
0	< 0.70 and > 0.60	< 0.70 and > 0.60	> 5 and < 10	> 5 and < 10	> 2.5 and < 5	> 3 and < 5	> 10,000 and < 50,000
-1	≤ 0.60 and > 0.50	≤ 0.60 and > 0.50	≥ 10 and < 40	≥ 10 and < 15	≥ 5 and < 7.5	≥ 5 and < 7.5	≥ 50,000 and < 100,000
-2	≤ 0.50 and > 0.40	≤ 0.50 and > 0.40	≥ 40 and < 60	≥ 15 and < 20	≥ 7.5 and < 10	≥ 7.5 and < 10	≥ 100,000 and < 200,000
-3	≤ 0.40	≤ 0.40	≥ 60	≥ 20	≥ 10	≥ 10	≥ 200,000
Combination rules for assigning sites to preliminary disturbance categories							
Best Reference: all metrics meet the +2 scoring thresholds or better							
Reference: all metrics meet the +1 scoring thresholds or better							
Sub Reference: All metrics meet the 0 scoring thresholds and at least five metrics receive positive scores (> 0)							
Intermediate: All metrics meet the 0 scoring thresholds and ≤ four metrics receive positive scores							
Some Stress: One or two metrics receive a score of -1 and the rest (at least five) receive positive scores or scores of 0; OR One metric receives a score of -2, another receives a score of -1, and the rest receive scores of 0 or higher							
Stressed: Three or more metrics receive scores of -1 or -2; OR At least one metric receives a score of -3, and no more than three metrics receive negative scores							
High Stress: At least one metric receives a score of -3, and at least four other metrics receive negative scores							