CALIFORNIA COASTAL COMMISSION
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Th 11b

MEMORANDUM

Date: December 13, 2010

To: Commissioners and Interested Parties

From: Peter Douglas, Executive Director
Robert Merrill, North Coast District Manager
Melissa Kraemer, North Coast District Planner

Subject: **Addendum to Commission Meeting for Thursday, December 16, 2010**
North Coast District Item Th-11b, CDP Application No. 1-10-005 (CDFG)

Staff is proposing to make minor changes to the December 3, 2010 staff recommendation on Coastal Development Permit Application No. 1-10-005. The project involves, over a 10-year period, conducting on-going, region-wide surveys for dwarf eelgrass (*Zostera japonica*), temporarily demarcating (with 2-foot-long, 1-inch-diameter plastic PVC piping left in place for up to one-year post-eradication) and sampling each identified patch, and manually removing the invasive species wherever it is found using various manual removal techniques.

Since publication of the staff recommendation, staff from the State Lands Commission (SLC) contacted Coastal Commission staff to inquire about the status of SLC approval for the proposed project, specifically for the temporary placement of the PVC piping to mark invasive species removal sites within estuarine habitats of the bay and Eel River estuary. The applicant (CDFG) subsequently informed staff that it has applied for, but not yet obtained, an amendment to an existing lease (number PRC 7153) granted to CDFG by the SLC for tidelands within the CDFG's Ocean Ranch Unit adjacent to McNulty Slough. The SLC's approval of the lease amendment is pending. Therefore, staff recommends adding Special Condition No. 5, which would require that the applicant submit evidence of SLC's approval of the proposed project prior to permit issuance.

Staff continues to recommend that the Commission approve the project with the special conditions included in the staff recommendation of December 3, 2010, as modified by the revisions described below.

I. REVISIONS TO THE STAFF RECOMMENDATION

The revisions to the staff report dated December 3, 2010, including the addition of special condition language and related findings, are shown below. Text to be deleted is shown in ~~strikethrough~~; text to be added appears in **bold double-underline**.

- *Add Special Condition No. 5 as follows:*

5. State Lands Commission Review

PRIOR TO ISSUANCE OF COASTAL DEVELOPMENT PERMIT NO. 1-10-005, the applicant shall submit to the Executive Director a written determination from the State Lands Commission that:

A. No State or public trust lands are involved in the development; or

B. State or public trust lands are involved in the development and all permits required by the State Lands Commission have been obtained; or

C. State or public trust lands may be involved in the development, but pending a final determination an agreement has been made with the State Lands Commission for the approved project as conditioned by the Commission to proceed without prejudice to that determination.

- *Add the following Finding No. IV-E on page 15 prior to the current finding IV-E "Other Approvals." Renumber the current finding IV-E and IV-F to findings IV-F and IV-G respectively:*

E. State Waters

The project site is located in an area subject to the public trust. Therefore, to ensure that the applicant has the necessary authority to undertake all aspects of the project on these public lands, the Commission attaches Special Condition No. 5, which requires that the project be reviewed and where necessary approved by the State Lands Commission prior to the issuance of a permit.

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Date Filed:	April 30, 2010
49th Day:	June 18, 2010
180th Day:	October 27, 2010
Staff:	Melissa B. Kraemer
Staff Report:	December 3, 2010
Hearing Date:	December 16, 2010
Commission Action:	

STAFF REPORT: REGULAR CALENDAR

APPLICATION NO.:	**1-10-005**
APPLICANT:	**CALIFORNIA DEPARTMENT OF FISH & GAME**
PROJECT LOCATION:	At various sites within the intertidal zone of Humboldt Bay and the Eel River estuary, Humboldt County
PROJECT DESCRIPTION:	Over a 10-year period, conduct on-going, region wide surveys for dwarf eelgrass (*Zostera japonica*), temporarily demarcate (with 2-foot-long, 1-inch-diameter plastic PVC piping left in place for up to one-year post-eradication) and sample each identified patch, and manually remove the invasive species wherever it is found using manual removal techniques. In addition, allow 29 cubic meters of extracted invasive plant material and associated mud spoils removed from mudflats adjacent to Indian Island and placed in an upland location on the western side of island under Emergency Permit No. 1-03-017-G to permanently remain.

LOCAL APPROVALS RECEIVED:	(1) City of Arcata Nature Area Entrance Permit dated April 29, 2009; and (2) Humboldt Bay Harbor, Recreation & Conservation District Administrative Permit No. 2003-03 (issued October 30, 2003 including Amendment No. 1 issued July 29, 2009 and Amendment No. 2 issued May 27, 2010).
OTHER APPROVALS RECEIVED:	(1) U. S. Fish & Wildlife Service Special Use Permit (for access to the Humboldt Bay National Wildlife Area via boat and/or vehicle); (2) NOAA-Fisheries Informal Consultation No. I/SWR/2009/07010; (3) North Coast Regional Water Quality Control Board WDID No. 1B09081WNHU Waiver; and (4) U.S. Army Corps of Engineers Permit No. 2003-276780 dated November 2, 2010.
OTHER APPROVALS REQUIRED:	None
SUBSTANTIVE FILE DOCUMENTS:	(1) Emergency Permit File No. 1-02-053-G (authorized November 1, 2002); (2) Emergency Permit File No. 1-03-017-G (authorized March 28, 2003); (3) Waiver De Minimis No. 1-08-014-W (dated September 3, 2008); (4) Waiver De Minimis No. 1-08-040-W (dated October 17, 2008); (5) Waiver De Minimis No. 1-09-019-W (dated June 12, 2009); (6) Waiver De Minimis No. 1-10-024-W (dated August 5, 2010); (7) Humboldt County Local Coastal Program; (8) City of Arcata Local Coastal Program; and (9) City of Eureka Local Coastal Program.

SUMMARY OF STAFF RECOMMENDATION

Staff recommends that the Commission approve, with special conditions, the coastal development permit for the Department of Fish and Game's (DFG's) dwarf eelgrass eradication program.

Dwarf eelgrass (*Zostera japonica*) is a mostly annual, grass-like aquatic plant native to shallow water, bays, and estuaries of the Asian Pacific that was first detected in Humboldt Bay in June of 2002 and in the Eel River estuary south of the bay in 2008 (Exhibit Nos. 1-2). The dwarf eelgrass detected in Humboldt County estuaries constitutes the southern extent of the species' (introduced) range in the Eastern Pacific, and its

detection in Humboldt Bay in 2002 marked the first time the species was encountered in California.

After the initial discovery of the nonnative plant in 2002, representatives from NOAA-Fisheries, the U.S. Fish & Wildlife Service, DFG, University of California Sea Grant, Humboldt State University, and U.C. Davis met to assess the available information on *Z. japonica* and the extent of its occurrence in Humboldt Bay. A survey was initiated that covered over 47 km of shoreline and found no additional areas containing dwarf eelgrass beyond the original population discovered along the western shoreline of Indian Island. Unlike several major estuaries in the Pacific Northwest, Humboldt Bay does not have a major infestation of dwarf eelgrass, which makes the prospects for complete eradication achievable. It was the consensus of this group and additional marine scientists that a dwarf eelgrass eradication program needed to be undertaken to guard against the ecological risks associated with a proliferation of dwarf eelgrass in the region and to ensure the protection of habitat for the region's native eelgrass, *Zostera marina*, which also grows on intertidal mudflats in the area.

Due to the potential ecological impacts that could result from the unchecked spread of dwarf eelgrass in the region, the Executive Director authorized the DFG to undertake emergency eradication work of dwarf eelgrass in 2002 and 2003, soon after its initial discovery in the bay, under Emergency Permit Nos. 1-02-153-G and 1-03-017-G (Exhibit No. 5). Bay-wide surveys for dwarf eelgrass have occurred every year since the species' initial detection in the bay in 2002. To date, the nonnative plant has been discovered at a handful of additional sites in northern Humboldt Bay and the Eel River estuary including Manila, Mad River Slough, Wallace Ranch, the Arcata Marsh and Wildlife Sanctuary, the Arcata Wastewater Treatment Plant, and McNulty Slough (Exhibit No. 2). Additional eradication work has been authorized in these areas under various de minimis waivers granted over the past three years (see Substantive File Documents, Page 2).

The applicant proposes to continue to survey for dwarf eelgrass in Humboldt Bay and the Eel River estuary, to eradicate the species wherever it is found using a variety of eradication techniques, as described in Finding IV-B below, and to monitor for revegetation in affected areas (Exhibit No. 3). Surveys, monitoring, and eradication efforts would be conducted between the months of April and December for a period of 10 years.

The purpose of the proposed project is to protect and restore the native species and natural functions of the intertidal habitats of Humboldt Bay and Eel River estuaries through the eradication of an exotic plant using various eradication methods. Thus, as the project is inherently for restoration purposes, staff believes that the proposed exotic plant removal activities within the environmentally sensitive intertidal habitats are for a use dependent on the resources of the ESHA, consistent with Section 30240 of the Coastal Act. Furthermore, the primary purpose of the project is to maintain native marine species and habitats, including native eelgrass beds and open mudflat intertidal habitat, consistent with Section 30230 of the Coastal Act.

As discussed below in Finding IV-C, Section 30230 of the Coastal Act requires that uses of the marine environment be carried out in a manner that will sustain the biological productivity of coastal waters and maintain healthy populations of all species of marine organisms adequate for long-term commercial, recreational, scientific, and educational purposes. In addition, Section 30240(a) requires that ESHA shall be protected against any significant disruption of habitat values. Therefore, staff recommends **Special Condition No. 1** to require adherence to the various best management practices proposed by the applicant, among others, including (a) surveyors shall access *Z. japonica* sites at low tides wearing "mudders" or equivalent footwear designed to reduce mudflat compaction; (b) field crew members shall be trained to recognize and avoid rare plants and shall avoid trampling of native plants to the maximum extent feasible; (c) hand trowels shall be used for excavation where feasible in locations where the native vegetation (e.g., native eelgrass) is in dense association with *Z. japonica* to minimize the uprooting of native vegetation; (d) when removing material through excavation, bags of spoils shall be carried rather than dragged through the mud; (e) all tools, garage bags, and staking materials shall be removed from the project site after treatment has been completed; and (f) all spoils generated from excavation activities shall be hauled off-site for disposal; no additional spoils shall be placed at the upland spoils disposal site on Indian Island previously authorized under emergency permits in 2002 and 2003. Staff further recommends **Special Condition No. 2** to require submittal of annual monitoring reports and a final monitoring report to ensure the proposed exotic plant removal will be successful in restoring native estuarine habitat values as proposed.

Staff believes that the proposed project, as conditioned, is consistent with all applicable Chapter 3 policies of the Coastal Act. **The motion to adopt the staff recommendation of Approval with Special Conditions is shown below on Page 5.**

STAFF NOTES

1. Standard of Review

The proposed project area is located within the boundaries of the cities of Arcata and Eureka as well as in unincorporated areas of the County of Humboldt. The County and cities each have a certified local coastal program (LCP), but the project is within areas shown on State Lands Commission maps over which the state retains a public trust interest. Therefore, the standard of review that the Commission must apply to the project is the Chapter 3 policies of the Coastal Act. The policies of the certified LCPs may be used as guidance.

I. MOTION, STAFF RECOMMENDATION & RESOLUTION

The staff recommends that the Commission adopt the following resolution:

MOTION

I move that the Commission approve Coastal Development Permit No. 1-10-005 pursuant to the staff recommendation.

STAFF RECOMMENDATION OF APPROVAL

Staff recommends a **YES** vote. Passage of this motion will result in approval of the permit as conditioned and adoption of the following resolution and findings. The motion passes only by affirmative vote of a majority of the Commissioners present.

RESOLUTION TO APPROVE THE PERMIT

The Commission hereby approves a coastal development permit for the proposed development and adopts the findings set forth below on grounds that the development as conditioned will be in conformity with the policies of Chapter 3 of the Coastal Act. Approval of the permit complies with the California Environmental Quality Act because feasible mitigation measures and/or alternatives have been incorporated to substantially lessen any significant adverse effects of the development on the environment.

II. STANDARD CONDITIONS: See Appendix A.

III. SPECIAL CONDITIONS

1. Best Management Practices & Project Restrictions

(a) Surveyors shall access *Z. japonica* sites at low tides wearing "mudders" or equivalent footwear designed to reduce mudflat compaction;

(b) Field crew members shall be trained to recognize and avoid rare plants and shall avoid trampling of native plants to the maximum extent feasible;

(c) Hand trowels shall be used for excavation where feasible in locations where the native vegetation (e.g., native eelgrass) is in dense association with Z. japonica to minimize the uprooting of native vegetation;

(d) When removing material through excavation, bags of spoils shall be carried rather than dragged through the mud;

(e) All tools, garage bags, and staking materials shall be removed from the project site after treatment has been completed; and

(f) All spoils generated from excavation activities shall be hauled off-site for disposal. No additional spoils shall be placed at the upland spoils disposal site on Indian Island previously authorized under emergency permits in 2002 and 2003.

2. Submittal of Annual and Final Monitoring Reports

(a) The applicant shall provide an annual report to the Executive Director of the Coastal Commission (care of the North Coast District office) by March 1 of each year. The report shall discuss compliance with Special Condition No. 1 above. In addition, the report shall describe:

(i) the locations of all dwarf eelgrass patches discovered to date, including any new patches located in the current monitoring year;

(ii) the method(s) of eradication implemented at each dwarf eelgrass patch;

(iii) a quantitative summary of the amount of dwarf eelgrass removed from each location each year; and

(iv) a recovery assessment of each treatment site to assess whether the dwarf eelgrass has been successfully eliminated from the site and whether or not native estuarine habitat values (e.g., recolonization of the site by native eelgrass and/or benthic fauna) have been restored in the area following dwarf eelgrass eradication.

(b) A final monitoring report prepared by a qualified biologist shall be submitted to the Executive Director at the end of the 10-year reporting period, by March 1, 2021. The final report must evaluate whether the restoration project has been unsuccessful, in part, or in whole, in eliminating dwarf eelgrass from each treatment site or has resulted in habitat degradation at any of the treatment sites. The report must address all of the monitoring data collected over the 10-year period.

(c) If the final monitoring report indicates that the restoration project has been unsuccessful, in part or in whole, in eliminating dwarf eelgrass from each treatment site or has resulted in habitat degradation at any of the treatment sites, the applicant shall submit a revised or supplemental restoration program to compensate for those portions of the original program which did not meet the approved goals and objectives. The revised restoration program shall be processed as an amendment to this coastal development permit, unless the Executive Director determines that no amendment is legally required.

3. Coastal Development Permit Termination Date

Coastal Development Permit No. 1-10-005 only authorizes invasive plant survey and removal activities through December 16, 2020 (10 years from the date of the Commission's approval of CDP No. 1-10-005). Additional invasive plant removal activities after that date shall require a new coastal development permit.

4. Submittal of Army Corps of Engineers Approval

PRIOR TO COMMENCEMENT OF ANY WORK AUTHORIZED BY THIS COASTAL DEVELOPMENT PERMIT BETWEEN THE DATES OF NOVEMBER 1, 2015 AND DECEMBER 16, 2020, the permittee shall provide to the Executive Director a copy of a permit issued by U.S. Army Corps of Engineers for the proposed work during the referenced time period, a letter of permission, or evidence that no permit or permission is required. The applicant shall inform the Executive Director of any changes to the project required by the U.S. Army Corps of Engineers. Such changes shall not be incorporated into the project until the applicant obtains a Commission amendment to this coastal development permit, unless the Executive Director determines that no amendment is legally required.

IV. FINDINGS & DECLARATIONS

The Commission hereby finds and declares as follows:

A. Environmental Setting & Background

Dwarf eelgrass (*Zostera japonica*) is a mostly annual, grass-like aquatic plant native to shallow water, bays, and estuaries of the Asian Pacific that was first detected in Humboldt Bay in June of 2002 and in the Eel River estuary south of the bay in 2008, at various sites in McNulty Slough (Exhibit Nos. 1-2). The plant is well established in Oregon and Washington across thousands of acres of intertidal mudflats and sandflats that lack permanent macrophyte cover. The dwarf eelgrass detected in Humboldt County estuaries constitutes the southern extent of the species' (introduced) range in the Eastern Pacific, and its detection in Humboldt Bay in 2002 marked the first time the species was encountered in California.

After the initial discovery of the nonnative plant in 2002, representatives from NOAA-Fisheries, the U.S. Fish & Wildlife Service, the Department of Fish and Game (DFG), University of California Sea Grant, Humboldt State University, and U.C. Davis met to assess the available information on *Z. japonica* and the extent of its occurrence in Humboldt Bay. A survey was initiated that covered over 47 km of shoreline and found no additional areas containing dwarf eelgrass beyond the original population discovered along the western shoreline of Indian Island. Unlike several major estuaries in the Pacific Northwest, Humboldt Bay does not have a major infestation of dwarf eelgrass, which makes the prospects for complete eradication achievable. It was the consensus of this group and additional marine scientists that a dwarf eelgrass eradication program needed to be undertaken to guard against the ecological risks associated with a proliferation of dwarf eelgrass in the region and to ensure the protection of habitat for the region's native eelgrass, *Zostera marina*, which also grows on intertidal mudflats in the area.

Patches, or "beds," of native eelgrass serve as important shelter and foraging habitat for a variety of fish and wildlife species and constitute environmentally sensitive habitat under the Coastal Act. The beds provide cover for juvenile fish, including threatened and endangered salmonids, and in some locations serve as a spawning ground for herring. Native eelgrass beds are classified as "Essential Fish Habitat" under the Magnuson-Stevens Fishery Conservation and Management Act because they are considered necessary for fish to spawn, breed, feed, or grow to maturity. In addition, the beds provide foraging habitat for numerous species of shorebirds and waterfowl, including Pacific black brant, small migratory geese that feed almost exclusively on the native eelgrass.

Because the invasive dwarf eelgrass is capable of rapid expansion over non-vegetated mudflats once established in an estuary, the species is capable of displacing native eelgrass, which in turn directly impacts available shelter and foraging habitat for a variety of fish and wildlife species. Although dwarf eelgrass may provide habitat for some

species (e.g., black brant and other migratory waterfowl are known to feed on dwarf eelgrass as well as native eelgrass), studies have shown that key invertebrate species, such as the burrowing ghost shrimp, a favored prey of a variety of native shorebird species, are not found in dwarf eelgrass beds as frequently as they are found in native eelgrass beds. In addition, the growth habit of dwarf eelgrass is such that the physical structure of the mid- to upper-intertidal zones is altered where the invasive plant occurs. Dwarf eelgrass often forms a dense, sod-like root matrix that completely covers the substrate surface. This sod-like macrophyte cover, in turn, detrimentally impacts (displaces) the feeding grounds of several species of resident and migratory shorebirds, including whimbrel, long-billed curlews, willets, marbled godwits, and others, that forage on the diversity of benthic fauna that inhabit the open mudflats of Humboldt Bay. Herring, smelt, sardines, and anchovies also feed on the benthic invertebrates, and these species are in turn the prey base of green sturgeon as well as rearing and returning salmonids.

Due to the potential ecological impacts that could result from the unchecked spread of dwarf eelgrass in the region, the Executive Director authorized the DFG to undertake emergency eradication work of dwarf eelgrass in 2002 and 2003 soon after its initial discovery in the bay under Emergency Permit Nos. 1-02-153-G and 1-03-017-G (Exhibit No. 5). Approximately 29 m^3 of dwarf eelgrass beds were removed from the western shoreline of Indian Island by manually excavating the plants to a depth below the rhizomes (approximately 10 cm). Spoils were transported to an upland disposal site on Indian Island above Mean Higher High Water (MHHW) and on the interior side of a man-made berm (see location map in Exhibit No. 5). Yearly monitoring of dwarf eelgrass along the Indian Island shoreline by a team of scientists and volunteers coordinated by DFG and U.C. Sea Grant has shown a steady decrease in population size since 2007, after a period of exponential growth between 2002 and 2003.

Bay-wide surveys for dwarf eelgrass have occurred every year since the species' initial detection in the bay in 2002. To date, the nonnative plant has been discovered at a handful of additional sites in northern Humboldt Bay including Manila, Mad River Slough, Wallace Ranch, the Arcata Marsh and Wildlife Sanctuary, and the Arcata Wastewater Treatment Plant (Exhibit No. 2). In addition, dwarf eelgrass was detected in the Eel River estuary south of the bay in 2008, at various sites in McNulty Slough (Exhibit No. 2). Additional eradication work has been authorized in these areas under various de minimis waivers granted over the past three years (see Substantive File Documents, Page 2).

In addition to survey and eradication efforts, DFG and U.C. Sea Grant have monitored the known dwarf eelgrass populations to assess the success of the eradication program, the efficacy of the various manual removal techniques that have been employed (described in more detail below), and the ability of native eelgrass to recolonize areas where dwarf eelgrass has been eradicated. A quantitative summary of the amount of dwarf eelgrass removed from Humboldt Bay from 2004-2009 is shown in Exhibit No. 4. Results of a study designed to test the efficacy of different eradication methods are shown in Exhibit No. 6. Essentially, an "early detection, rapid response" strategy is believed to

be the most effective way to combat the invasive species. However, early detection of dwarf eelgrass is challenging because (a) the habitat it occupies is only exposed at tides of 2.0 ft MLLW or lower, (b) these intertidal mudflats where the habitat occurs are not easily traversed, and (c) the very narrow blades of the nonnative eelgrass make the plant easy to miss. The surveys are therefore quite labor-intensive, as is removal of the plant, since the heavy bags of excavated mud and plant material must be hauled off site for disposal.

B. Proposed Project Description

The applicant proposes to continue to survey for dwarf eelgrass in Humboldt Bay and the Eel River estuary, to eradicate the species wherever it is found using a variety of eradication techniques, as described below (and in Exhibit No. 3), and to monitor for revegetation in affected areas. Surveys, monitoring, and eradication efforts would be conducted between the months of April and December for a period of 10 years.

Survey teams would consist of two to four persons, and surveys would be conducted at low tides of 2 ft MLLW or lower. All locations of dwarf eelgrass are proposed to be marked using GPS coordinates and 2-foot-long, 1-inch-diameter plastic PVC piping. The PVC stakes would remain in place for one-year post-eradication to monitor for re-growth of dwarf eelgrass. Prior to removing any dwarf eelgrass plants, data would be collected on patch diameter and percent cover. Two-inch-deep core samples would be taken from each patch for subsequent lab analysis of vegetative and reproductive shoot density and biomass. These data would allow for comparison of the amount of material removed to previous years.

The various removal and eradication methods to be employed are described below. The preferred removal method or combination of methods to be used at any given dwarf eelgrass occurrence would be selected to achieve maximum eradication effectiveness based on patch size, density, location, site accessibility, and other factors (see Exhibit No. 3). All plant material and associated mud removed would be placed in heavy-gauge plastic bags and transported off-site for disposal at a permitted landfill. The removal and eradication methods include the following:

1. Excavation

The proposed excavation method involves manually excavating dwarf eelgrass patches with shovels to a depth below the rhizomes (approximately 4 inches). Spoils are proposed to be placed in heavy-gauge plastic bags and hauled off site for disposal.

2. Covering

The proposed covering method involves placing squares of perforated black plastic and carpet across patches of dwarf eelgrass, securing each corner of the carpet and plastic to four wooden corner stakes to ensure the materials stay in place, and placing large river rock on top of the carpet to further secure materials in place with adequate weight. The method kills the invasive plant by light deprivation. The covering would be left in place for approximately four weeks, after which point all materials would be removed.

3. Heat Treatments

Thermal heat control, when effective, offers several advantages: less physical disruption than excavation, no chemical discharges, no temporary fill placed in the estuary (as is necessary with the proposed covering treatment, as described above), and minimal, short-term impacts to non-target organisms. There are four different methods of heat treatment proposed, as follows:

a) Flame Heat

The flame heat method proposes to use a hand-held propane flame weeder to produce a controlled and directed flame to sear above-ground plant material. The intense heat sears the leaves, causing the cells to expand and burst. Evidence of treatment effectiveness takes one to three days. The flame weeder would be administered for approximately 5 minutes at each site to effectively kill the invasive weed. This method is proposed for drier sites, such as Indian Island.

b) Hot Water

The hot water method proposes to deliver hot water (205-208° F, just below the boiling point) to dwarf eelgrass patches via a supply hose and treatment wand. The hot water is generated from a computer-controlled boiler mounted on a trailer operated from the boat ramp or levee. Thus, this method can only be implemented at sites that are relatively accessible (e.g., portions of McNulty Slough population). An advantage of this method over flame weeders is that has demonstrated effectiveness in wet environments.

c) Infrared Radiant Heat

The infrared radiant heat method involves the use of a hand-held propane burner aimed at a ceramic element or steel plate that radiates heat up to 1,800° F. Advantages of this method are portability (and thus an option for less accessible locations) and absence of open flame.

d) Cartridge Heaters

This proposed method involves inserting small (ranging from 6-inches-long to 2-feet-long) cartridge heaters into the mud to heat up the top six inches of substrate (where the shallow root system of dwarf eelgrass is located). Heaters would be outfitted with waterproof connectors and cables and powered by a generator. A barge may be used to access infested sites using this method.

As discussed above, the applicant is requesting authorization for the proposed work for a period of 10 years. In addition, the applicant is requesting permanent authorization for the extracted plant material and associated mud spoils placed at the disposal site above MHHW and on the interior side of an existing man-made berm on the western side of Indian Island under the emergency permit issued in 2003. The site has not been used for disposal since 2003; however, the spoils remain from the initial excavation work. Although the applicant is requesting permission to allow the spoils site to persist, the applicant does not propose to utilize the site for spoils disposal in the future.

The following measures, among others, have been proposed by the Department to minimize potential impacts to coastal resources (see Exhibit No. 3):

- Surveyors will access *Z. japonica* sites at low tides wearing "mudders" to reduce mudflat compaction;
- Field crew members will be trained to recognize and avoid rare plants and will avoid trampling of native plants to the maximum extent feasible;
- If possible hand trowels will be used for excavation in locations where the native vegetation (e.g., native eelgrass) is in dense association with *Z. japonica* to minimize the uprooting of native vegetation;
- When removing material through excavation, bags of spoils will be carried rather than dragged through the mud;
- All tools, garage bags, and staking materials will be removed from the project site after treatment has been completed.

C. Protection of Marine Resources & ESHA

Coastal Act Section 30107.5 defines "environmentally sensitive habitat area" as:

> *…any area in which plant or animal life or their habitats are either rare or especially valuable because of their special nature or role in an ecosystem and which could be easily disturbed or degraded by human activities and developments.*

Coastal Act Section 30240 states as follows:

> *(a) Environmentally sensitive habitat areas shall be protected against any significant disruption of habitat values, and only uses dependent on such resources shall be allowed within such areas.*
>
> *(b) Development in areas adjacent to environmentally sensitive habitat areas and parks and recreation areas shall be sited and designed to prevent impacts which would significantly degrade those areas, and shall be compatible with the continuance of those habitat and recreation areas.*

Coastal Act Section 30230 states as follows:

> *Marine resources shall be maintained, enhanced, and where feasible, restored. Special protection shall be given to areas and species of special biological or economic significance. Uses of the marine environment shall be carried out in a manner that will sustain the biological productivity of coastal waters and that will maintain healthy populations of all species of marine organisms adequate for long-term commercial, recreational, scientific, and educational purposes.*

Section 30240(a) of the Coastal Act limits activities within environmentally sensitive habitat areas (ESHAs) only to uses that are dependent on the resources of the ESHA. In addition, ESHA must be protected against any significant disruption of habitat values. Section 30230 requires that marine resources be maintained, enhanced, and, where feasible restored and uses of the marine environment be carried out in a manner that will sustain the biological productivity of coastal waters and maintain healthy populations of

all species of marine organisms adequate for long-term commercial, recreational, scientific, and educational purposes.

As discussed above, the intertidal mudflats of Humboldt Bay and the Eel River estuaries constitute environmentally sensitive habitat under the Coastal Act for a variety of reasons. The native eelgrass beds that inhabit the intertidal mudflats serve as important shelter and foraging habitat for a variety of fish and wildlife species. The eelgrass beds provide cover for juvenile fish, including threatened and endangered salmonids, and in some locations serve as a spawning ground for herring. In addition, the eelgrass beds provide foraging habitat for numerous species of shorebirds and waterfowl, such as Pacific black brant. Furthermore, the non-vegetated, open mudflats of the bay and estuaries serve as vital feeding grounds for several species of resident and migratory shorebirds and waterfowl that forage on the diversity of benthic fauna that inhabit these areas. Herring, smelt, sardines, and anchovies also feed on the benthic invertebrates, and these species are in turn the prey base of green sturgeon as well as rearing and returning salmonids.

The purpose of the proposed project is to protect and restore the native species and natural functions of the intertidal habitats of Humboldt Bay and Eel River estuaries through the eradication of an exotic plant using various eradication methods. Thus, as the project is inherently for restoration purposes, the Commission finds that the proposed exotic plant removal activities within the environmentally sensitive intertidal habitats are for a use dependent on the resources of the ESHA, consistent with Section 30240 of the Coastal Act. Furthermore, the primary purpose of the project is to maintain native marine species and habitats, including native eelgrass beds and open mudflat intertidal habitat, consistent with Section 30230 of the Coastal Act.

As discussed above, Section 30230 of the Coastal Act requires that uses of the marine environment be carried out in a manner that will sustain the biological productivity of coastal waters and maintain healthy populations of all species of marine organisms adequate for long-term commercial, recreational, scientific, and educational purposes. In addition, Section 30240(a) requires that ESHA shall be protected against any significant disruption of habitat values. Through the Army Corps of Engineers permitting process for the proposed project, the Corps consulted informally with NOAA-Fisheries on the project's potential effects on threatened and endangered salmonids (Southern Oregon/Northern California Coast (SONCC) coho salmon, California Coastal (CC) Chinook salmon, Northern California (NC) Steelhead), Southern District Population Segment (DPS) North American green sturgeon, salmon and sturgeon critical habitats, and Essential Fish Habitat (EFH) for Pacific Coast Salmon, Pacific Coast Groundfish, and Coastal Pelagic Fish. The NOAA-Fisheries informal consultation concluded that "Based on the proposed timing and location of the project, which will occur at low tide when the Project sites are dewatered, the limited amount and short-term nature of sediment release, the ability of benthic invertebrates to rapidly re-colonize intertidal habitat, and the expectation that no further or future negative impacts to the area will occur as a result of this project…the Project is not likely to adversely affect threatened SONCC coho salmon CC Chinook salmon, NC steelhead, Southern DPS green sturgeon,

or their critical habitats. In addition, the Project is expected to allow for the recolonization of native eelgrass due to the removal of invasive vegetation." NOAA-Fisheries further concluded that EFH for Pacific Coast Salmon, Pacific Coast Groundfish, and Coastal Pelagic Fish "will improve due to the removal of invasive vegetation and subsequent recolonization of native eelgrass." NOAA-Fisheries found that no EFH conservation recommendations were necessary "to avoid, minimize, mitigate, or otherwise offset the adverse effects to EFH" since the anticipated adverse effects of the proposed project are so minimal.

The applicant has proposed various mitigation measures and best management practices to protect sensitive species and habitats through the course of the proposed dwarf eelgrass eradication program. These include the following: (a) surveyors will access *Z. japonica* sites at low tides wearing "mudders" or equivalent footwear designed to reduce mudflat compaction; (b) field crew members will be trained to recognize and avoid rare plants and will avoid trampling of native plants to the maximum extent feasible; (c) hand trowels will be used for excavation where feasible in locations where the native vegetation (e.g., native eelgrass) is in dense association with *Z. japonica* to minimize the uprooting of native vegetation; (d) when removing material through excavation, bags of spoils will be carried rather than dragged through the mud; and (e) all tools, garage bags, and staking materials will be removed from the project site after treatment has been completed. The Commission attaches **Special Condition No. 1** to require adherence to the best management practices proposed by the applicant as well as the following additional measure: (f) all spoils generated from excavation activities shall be hauled off-site for disposal; no additional spoils shall be placed at the upland spoils disposal site on Indian Island previously authorized under emergency permits in 2002 and 2003.

As discussed above, the spoils site has not been used for disposal since 2003 and is not proposed for continued disposal activities; however, the spoils remain from the initial excavation work, and the applicant is requesting permission to allow the spoils site to persist. A rare plant survey and wetland survey was conducted at the site by a DFG biologist in 2003 prior to placement of the spoils from the initial dwarf eelgrass removal work (see Exhibit No. 5). At that time the site was described as "degraded" and dominated by European beach grass (*Ammophila arenaria*). The site was revisited in February of 2009 to discern how the site has recovered since the initial spoils placement. The area was completely recolonized with additional European beach grass vegetation, thereby disguising any evidence of spoils placement at that location (see photos, Exhibit No. 3).

The finding that the proposed project constitutes "a use dependent on the resources of the ESHA" is based, in part, on the assumption that the proposed exotic plant removal will be successful in restoring native estuarine habitat values as proposed. Should the project be unsuccessful, or worse, if the proposed impacts of the project actually result in long term degradation of the habitat, the proposed development would not be for "restoration purposes" and therefore not a use dependent on the resources of the ESHA. Monitoring the effectiveness of the restoration activities is essential to ensuring protection of the habitat. Therefore, **Special Condition No. 2** requires that an annual monitoring report be

submitted to the Executive Director to demonstrate how the objectives of Special Condition No. 1 are being met. In addition, the annual monitoring report must describe: (a) the locations of all dwarf eelgrass patches discovered to date, including any new patches located in the current monitoring year; (b) the method(s) of eradication implemented at each dwarf eelgrass patch; (c) a quantitative summary of the amount of dwarf eelgrass removed from each location each year; and (d) a recovery assessment of each treatment site to assess whether the dwarf eelgrass has been successfully eliminated from the site and whether or not native estuarine habitat values (e.g., recolonization of the site by native eelgrass and/or benthic fauna) have been restored in the area following dwarf eelgrass eradication. Special Condition No. 2 also requires submittal of a final monitoring report, prepared by a qualified biologist, at the end of the 10-year reporting period to evaluate whether the restoration project has been unsuccessful, in part, or in whole, in eliminating dwarf eelgrass from each treatment site or has resulted in habitat degradation at any of the treatment sites. If the final monitoring report indicates that the restoration project has been unsuccessful, the applicant shall submit a revised or supplemental restoration program to compensate for those portions of the original program which did not meet the approved goals and objectives. The revised restoration program shall be processed as an amendment to this coastal development permit, unless the Executive Director determines that no amendment is legally required

The applicant has requested permit authorization for a period of 10 years. **Special Condition No. 3** specifies that the permit termination date will be 10 years from the date of Commission action on the CDP application. Additional invasive plant removal activities after that date will require a new coastal development permit. Information from the annual monitoring reports required by Special Condition No. 2, including the required assessments of the recovery of native habitat values at each treatment site, will help inform the Commission's decision in its consideration of a future permit or permit amendment application for additional dwarf eelgrass eradication work in these environmentally sensitive habitat areas.

For all of the reasons discussed above, the Commission finds that the proposed project, as conditioned, is consistent with Sections 30240 and 30230 of the Coastal Act, as: (1) the development approved within ESHA is for a use dependent on the resources of the environmentally sensitive intertidal habitats and as conditioned will not result in a significant disruption to ESHA; and (2) the uses of the marine environment as conditioned will be carried out in a manner that will sustain the biological productivity of coastal waters and maintain healthy populations of all species of marine organisms adequate for long-term commercial, recreational, scientific, and educational purposes.

D. Public Access

Coastal Act Sections 30210, 30211, and 30212 require the provision of maximum public access opportunities, with limited exceptions. Coastal Act Section 30210 requires, in applicable part, that maximum public access and recreational opportunities be provided when consistent with public safety, private property rights, and natural resource protection. Section 30211 requires, in applicable part, that development not interfere

with the public's right of access to the sea where acquired through use (i.e., potential prescriptive rights or rights of implied dedication). Section 30212 requires, in applicable part, that public access from the nearest public roadway to the shoreline and along the coast be provided in new development projects, except in certain instances, such as when adequate access exists nearby or when the provision of public access would be inconsistent with public safety. In applying Sections 30211 and 30212, the Commission is limited by the need to show that any denial of a permit application based on these sections, or any decision to grant a permit subject to special conditions requiring public access, is necessary to avoid or offset a project's adverse impact on existing or potential public access.

The proposed project will be conducted during periods of low tide on public trust tidelands of Humboldt Bay and the Eel River estuary. The proposed invasive species eradication work will not interfere with use of these public trust lands. Furthermore, the proposed work will not interfere with boat traffic in the bay, as work will not occur within the navigable channels.

Therefore, the Commission finds that the proposed project does not have any significant adverse effect on public access, and the project as proposed without new public access is consistent with the requirements of Coastal Act Sections 30210, 30211, and 30212.

E. Other Approvals

The applicant has received various other approvals for the proposed project, as listed on Page 2. As noted, the project requires review and approval by the U.S. Army Corps of Engineers (Corps) pursuant to Section 404 of the Federal Clean Water Act (PL 95-217). The Corps has issued Permit No. 2003-276780 dated November 2, 2010, which expires on October 31, 2015. Thus, additional authorization from the Corps will be required to conduct the project during the remainder of the time period that the invasive plant survey and removal activities are authorized by CDP No. 1-10-005, for the period from November 1, 2015 through December 16, 2020.

Pursuant to the Federal Coastal Zone Management Act, any permit issued by a federal agency for activities that affect the coastal zone must be consistent with the coastal zone management program for that state. Under agreements between the Coastal Commission and the USACE, the Corps will not issue a permit until the Coastal Commission approves a federal consistency certification for the project or approves a permit. To ensure that any additional permit ultimately approved by the Corps for additional eradication work after October 31, 2015 is the same as the project authorized herein, the Commission attaches **Special Condition No. 4**. This special condition requires the applicant to submit to the Executive Director, prior to commencement of any development between the dates of November 1, 2015 and December 16, 2020, evidence of the Corps' approval of the project. The condition also requires that any project changes resulting from the Corps' approval not be incorporated into the project until the applicant obtains any necessary amendments to this coastal development permit.

F. California Environmental Quality Act (CEQA)

The Department of Fish & Game served as the lead agency for the project for CEQA purposes. The Department determined the proposed project to be subject to the "Class 7" categorical exemption pursuant to CEQA Guidelines Section 15307 (CCR Tit. 14, § 15307).

Section 13906 of the California Code of Regulation requires Commission approval of a coastal development permit application to be supported by findings showing that the application, as modified by any conditions of approval, is consistent with any applicable requirements of the CEQA. Public Resources Code Section 21080.5(d)(2)(A) of CEQA prohibits a proposed development from being approved if there are feasible alternatives or feasible mitigation measures available, which would significantly lessen any significant effect that the activity may have on the environment.

The Commission incorporates its findings on conformity with Coastal Act policies at this point as if set forth in full. These findings address and respond to all public comments regarding potential significant adverse environmental effects of the project that were received prior to preparation of the staff report. As discussed herein in the findings addressing the consistency of the proposed project with the Coastal Act, the proposed project has been conditioned in order to be found consistent with the policies of the Coastal Act. As specifically discussed in these above findings which are hereby incorporated by reference, mitigation measures which will minimize all adverse environmental impact have been required. As conditioned, there are no feasible alternatives or feasible mitigation measures available, beyond those required, which would substantially lessen any significant adverse impact that the activity would have on the environment. Therefore, the Commission finds that the proposed project, as conditioned to mitigate the identified impacts, can be found consistent with the requirements of the Coastal Act and to conform to CEQA.

V. EXHIBITS

1. Regional Location Map
2. Known *Zostera japonica* Locations in Humboldt Bay & the Eel River Estuary
3. Proposed Project Description
4. Amount of Dwarf Eelgrass Removed from Humboldt Bay 2004-2009
5. Copies of Emergency Permit Nos. 1-02-053-G & 1-03-017-G
6. Results of Treatment Method Effectiveness Study

APPENDIX A

STANDARD CONDITIONS

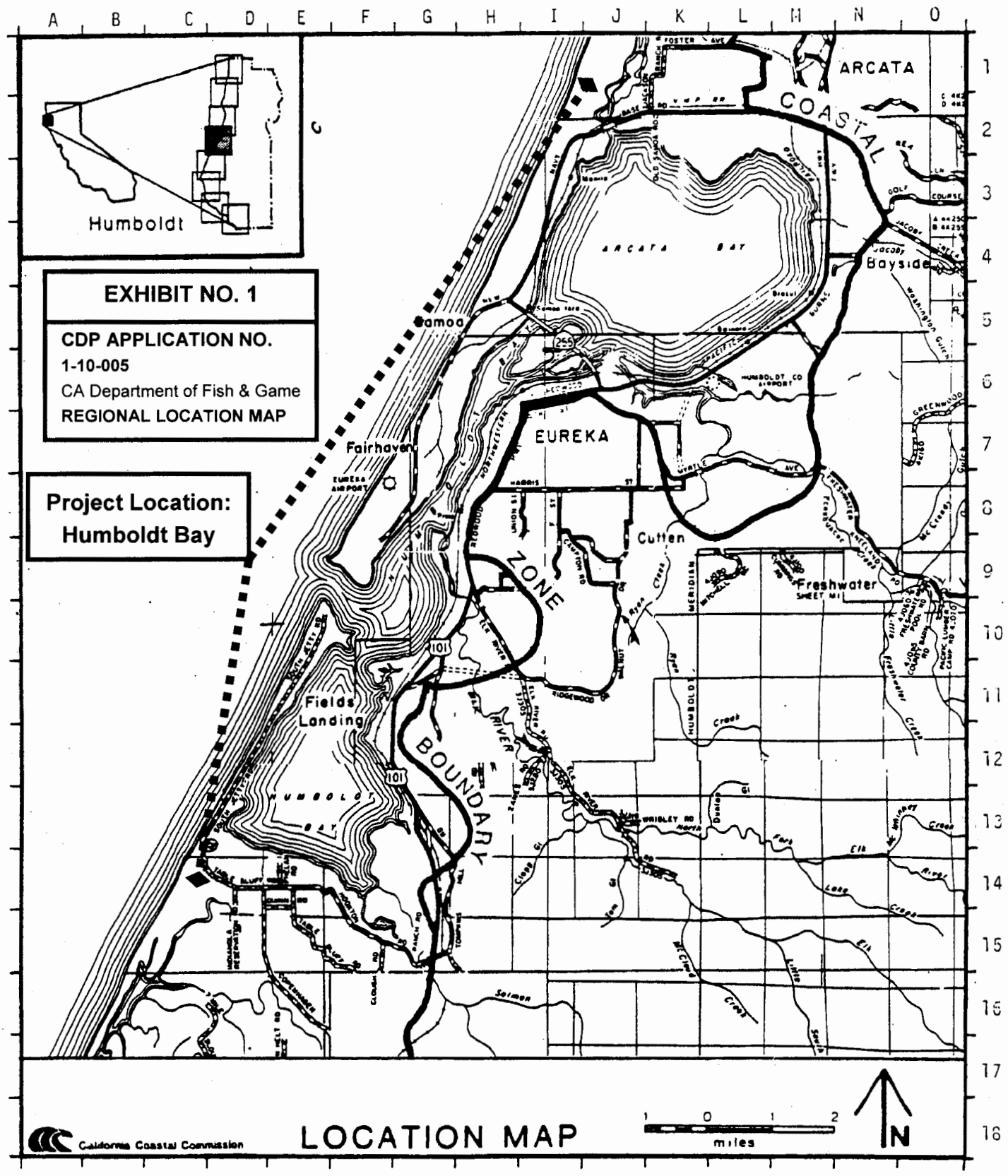
1. Notice of Receipt and Acknowledgment. The permit is not valid and development shall not commence until a copy of the permit, signed by the permittee or authorized agent, acknowledging receipt of the permit and acceptance of the terms and conditions, is returned to the Commission office.

2. Expiration. If development has not commenced, the permit will expire two years from the date on which the Commission voted on the application. Development shall be pursued in a diligent manner and completed in a reasonable period of time. Application for extension of the permit must be made prior to the expiration date.

3. Interpretation. Any questions of intent of interpretation of any condition will be resolved by the Executive Director or the Commission.

4. Assignment. The permit may be assigned to any qualified person, provided assignee files with the Commission an affidavit accepting all terms and conditions of the permit.

5. Terms and Conditions Run with the Land. These terms and conditions shall be perpetual, and it is the intention of the Commission and the permittee to bind all future owners and possessors of the subject property to the terms and conditions.



County of Humboldt

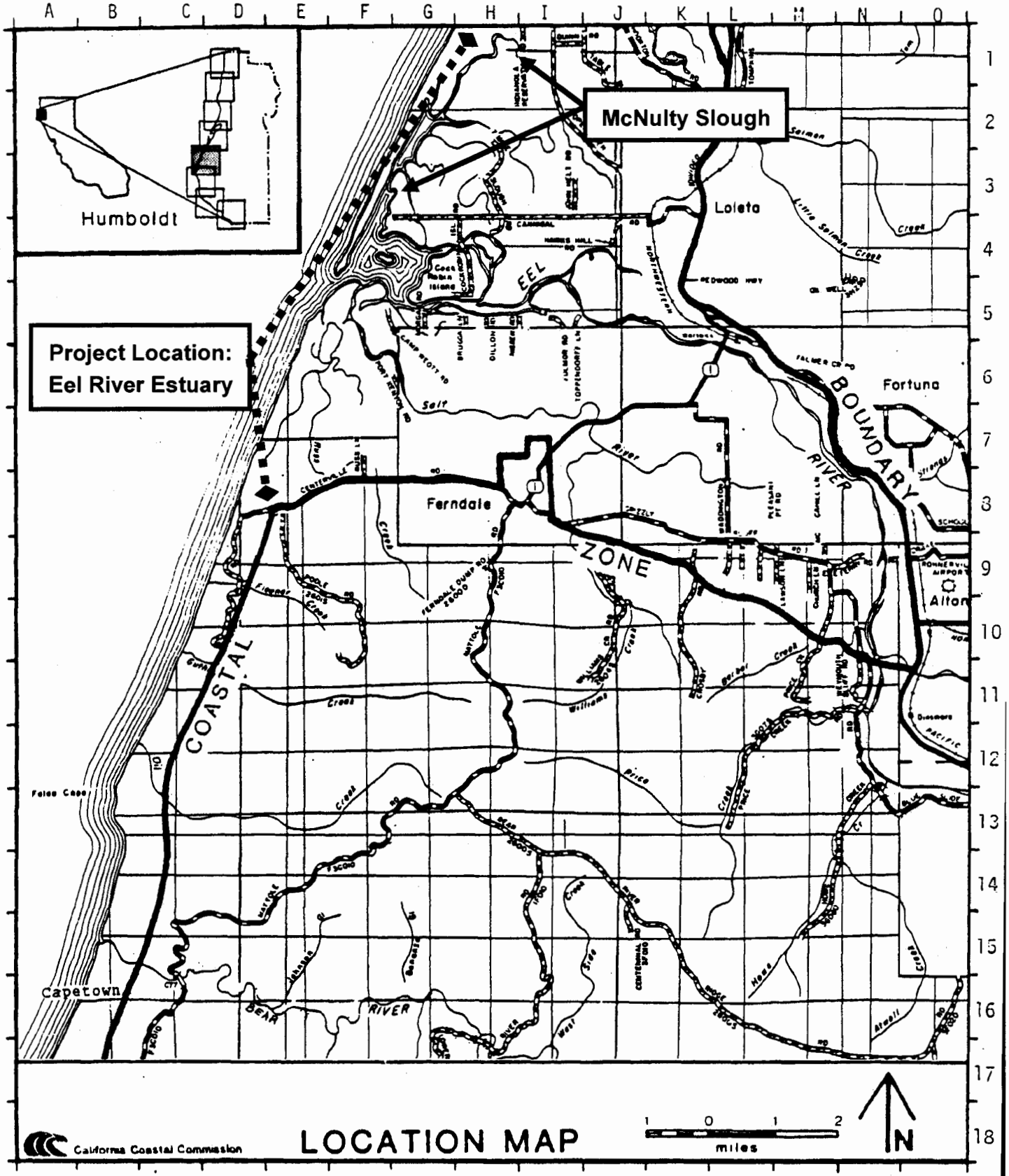


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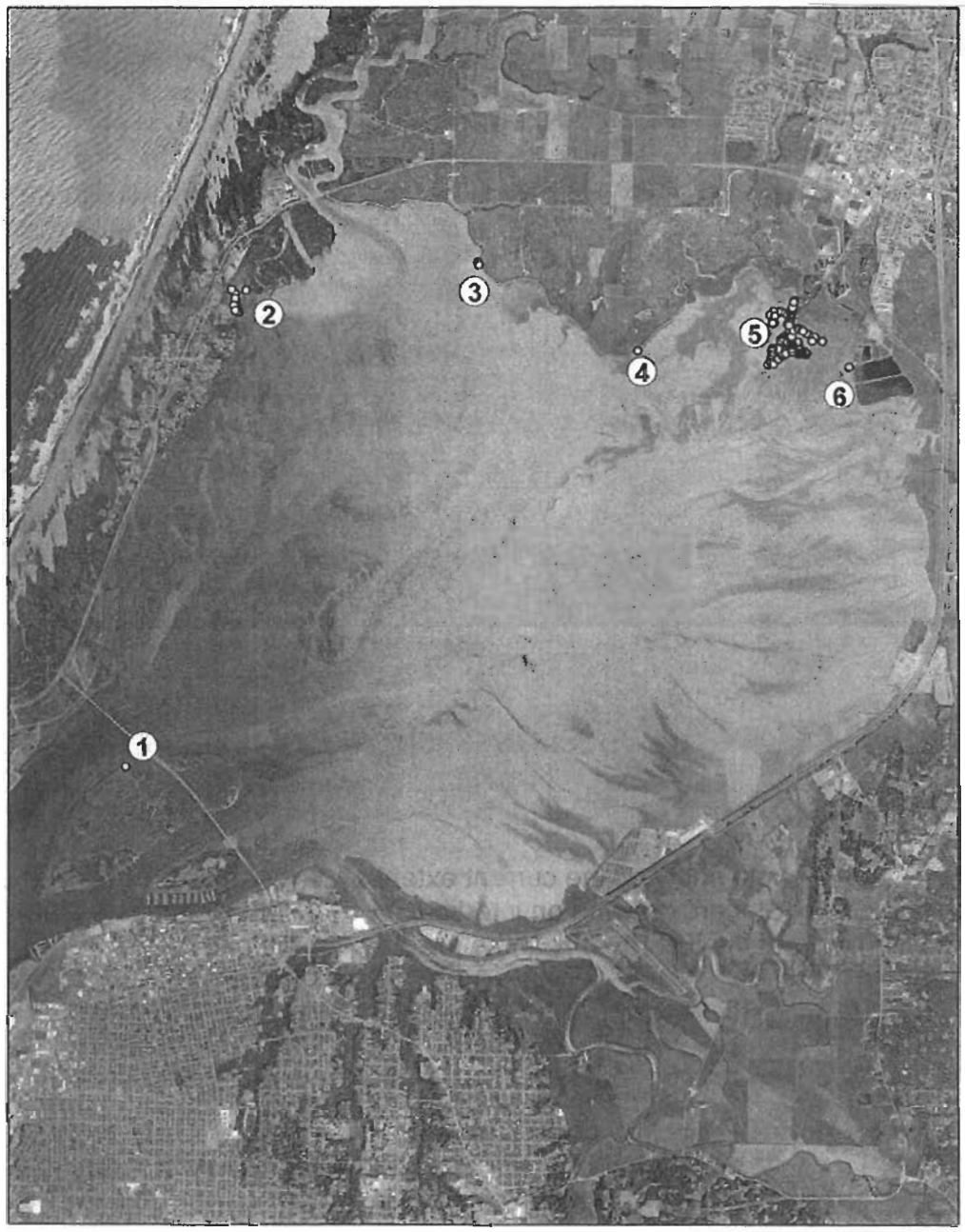
EXHIBIT NO. **2**

APPLICATION NO.

1-10-005 - CA. DEPT. OF FISH & GAME

KNOWN DWARF EELGRASS LOCATIONS IN HUMBOLDT BAY & THE EEL RIVER ESTUARY (1 of 2)

North Bay, Humboldt Bay



Yellow dots represent the positions of *Zostera japonica* patches in Humboldt Bay in 2009.

Miles
0 0.25 0.5 1 1.5 2

N

Figure 1. Six locations in North Humboldt Bay where *Zostera japonica* was removed in 2009. 1) Indian Island; 2) Manila; 3) Mad River Slough; (4) Wallace Ranch; (5)Arcata Marsh; and (6) AWTP.


McNulty Slough Project Map
Project Site
N
0 0.25 0.5 1 Miles

Zostera japonica Eradication In Humboldt Bay and Eel River Estuary

Project Description

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January 26, 2010

Introduction

Dwarf eelgrass (*Zostera japonica* Aschers and Graebn) is a bright green, grass-like, aquatic plant that grows in soft sediments of sheltered bays and estuaries. In its native range, *Z. japonica* forms dense, monospecific beds in shallow littoral areas from subtropical Vietnam to cold temperate Kamchatka Peninsula (den Hartog 1970; Mukai et al. 1980). In the Pacific Northwest, *Z. japonica* colonizes intertidal mud and sand flats that lack permanent macrophyte cover (Harrison and Bigley 1982; Posey 1988; Thom 1990; Larned 2003). Bando (2006) reported that in Washington, *Z. japonica* is also invading vegetated flats historically dominated by the native eelgrass *Z. marina*. *Z. japonica* generally occurs higher in the intertidal than the native eelgrass, *Z. marina*, but the two are sometimes intermixed with each other and/or various algal species (Harrison 1982; Thom 1990; Baldwin and Lovvorn 1994; Bulthuis 1995). Expansion of *Z. japonica* is characterized by rapid growth and spread during spring and summer (Harrison 1982). In British Columbia, *Z. japonica* increased its coverage 17-fold between 1970 and 1991 (Baldwin and Lovvorn 1994). Oregon and Washington each have well-established *Z. japonica* populations that cover thousands of acres. In Willapa Bay, WA, Harrison and Bigley (1982) reported that all substrates except those with excessive clay or gravel support dense populations of *Z. japonica*.

The detection of dwarf eelgrass in Humboldt Bay, California, in June 2002, represents the southern extent of its range in the Eastern Pacific. It is also the first time this introduced species has been encountered in California. After this initial discovery, representatives from NOAA Fisheries, United States Fish and Wildlife Service (FWS), California Department of Fish and Game (DFG), University of California Sea Grant (U.C. Sea Grant), Humboldt State University (HSU), and University of California Davis, assembled to assess the available information on *Z. japonica* and the extent of its introduction into Humboldt Bay. It was the consensus of this group and additional marine scientists that an eradication program should be undertaken.

The *Z. japonica* population found on Indian Island in Humboldt Bay was monitored from June 2002 through April 2003, and the plants exhibited exponential growth (Schlosser and Eicher 2007). Several eradication methods including excavation, burning, covering, and hand weeding were tested. Excavation was determined to be the most effective method for removal of patches. A team of volunteers coordinated by U.C. Sea Grant and DFG initiated eradication efforts in April 2003. Since April 2004, DFG staff, U.C. Sea Grant staff, HSU students, and volunteers (Team) conduct annual monitoring and eradication efforts bay-wide. Indian Island remained the only known location of *Z. japonica* until November 2006 when a small patch was found on the northeast shoreline of North Bay. Subsequently, the Team found two additional populations in North Bay during surveys conducted spring/summer 2007. In May 2009, two new locations of infestation were found, both with only a few very small patches, located on the north shore of North Humboldt Bay, between Mad River Slough and Arcata Marsh (Figure 1).

In addition this past year, numerous small patches were located about a half-mile from the shoreline along Arcata Marsh. The location of these patches presented a new challenge for removal of this invasive plant. Based on our experience with excavation in other areas of the bay and given the distance from shore, it was too labor intensive to manually excavate these patches of *Zostera japonica*. Thus, we acquired a new

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propane flame weeder and established experimental plots to test repeated burning of the plants. All of the burn plots are being closely monitored to determine effectiveness and efficiency.

On April 28, 2008, a DFG crew working in McNulty Slough in the Eel River Delta (Figure 2) discovered a new population of *Z. japonica*. McNulty Slough winds along the eastern boundary of the Department of Fish and Game Eel River Wildlife Area north of the mouth of the Eel River.

The McNulty Slough population is larger than anything found in Humboldt Bay. It is likely that several methods of treatment used in combination may be the most effective for the control of *Z. japonica*. Overall, our goal will be to select the most effective combination of methods with minimal environmental impact.

Project Location

Humboldt Bay (N 40° 46', W 124° 14') is a marine dominated embayment linked to the Pacific Ocean by a narrow (0.5 mi) entrance channel. Humboldt Bay is one of California's largest estuaries, covering 24 mi^2 (MHW), second only to San Francisco Bay, which is located approximately 230 miles to the south. Intertidal mudflats cover 65-70% of the total bay area and extend from MHW to MLLW over approximately 6.5 ft relief (Barnhart et al. 1992). Humboldt Bay temperatures range from 48-68°F. Salinities range from 25-34 ppt with true estuarine conditions occurring only near the mouth of the six tributaries entering Humboldt Bay.

The bay consists of three regions: North Bay, Entrance Bay, and South Bay. North Bay is farthest from the entrance channel resulting in a mud-dominated system. Entrance Bay links North Bay to the entrance and contains two islands, Indian Island and Woodley Island. South Bay receives significant sediment from ocean currents resulting in sand and silty substrates in the western portion and with soft, mud substrates in the east. *Z. marina* forms extensive meadows in North and South Bay, whereas in Entrance Bay, narrow fringing beds occupy the edges of dredged channels with steeply sloping walls. Around the perimeter of Humboldt Bay are remnant salt marshes.

The Eel River Estuary is the fourth largest estuary in California, located approximately nine miles south of the entrance of Humboldt Bay. McNulty Slough (N 40° 38', W 124° 18') is the northern arm of the Eel River estuary. Tidal influence extends upstream of the estuary to just below Fernbridge, approximately seven miles from the mouth (Higgins 1991). The estuary is composed of three main channels: the Eel River, North Bay, and Salt River (California Department of Water Resources 1977). Mean temperature in McNulty Slough is 57°F and mean salinity is 19.28 ppt (Wiyot Tribe 2008).

Methods

Indian Island Spoils Site

In April 2003, a team of volunteers excavated the *Z. japonica* population on Indian Island. The excavated vegetation and sediments were transported to an upland vegetated disposal site on the island. The disposal site is on the southwest section of Indian Island above MHHW and on the interior of a man-made berm. According to navigational maps prepared in the mid 1800s, the site historically contained wetlands.

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However, due to the historical placement of dredge spoils, wetlands are no longer present.

In March 2003, a survey of the area by California Department of Fish & Game botanist, Tony LaBanca, found no protected plant species and described the site as a disturbed and degraded natural habitat (Attachment A). The proposed disposal site and adjacent areas were also surveyed for native and non-native plant assemblages. Species composition of the disposal site consists mostly of non-native plant species, primarily the European beachgrass *Ammophila arenari.*

The disposal site was originally authorized by the Coastal Commission in 2003 through an emergency permit. A Coastal Development Permit is still required to authorize this site. The site has not been used as a depository since 2003, however, the spoils remain from the initial excavation. We are requesting permission to allow the spoils site to persist on Indian Island, however, do not intend to utilize it in the future.

We visited the spoils site on February 3, 2009 to evaluate how the area has recovered since 2003. There is no longer a worn pathway from the mudflat to the spoils site (Figure 3) and the existing vegetation (*Ammophila arenari)* has expanded, thus disguising any evidence of spoils (Figure 4).

Shoreline Surveys

In Humboldt Bay, the Team has conducted shoreline surveys every year since the first detection of *Z. japonica* in 2002. We propose to continue shoreline surveys of Humboldt Bay and to expand our surveys to include the Eel River Estuary. We will intensively survey previously infested sites each spring and will record, sample and remove all new occurrences of *Z. japonica*. All surveys will be conducted at low tides of 2 ft MLLW or lower. Handheld GPS units will record our survey tracks.

We will map the location of all *Z. japonica* removed using GIS and enter the data into the existing spatial database. GPS coordinates and PVC piping will mark the location of each *Z. japonica* patch detected. The PVC staking will remain in place for one year after eradication to monitor if there is re-growth of *Z. japonica*.

Prior to removing any *Z. japonica* plants, we will collect patch diameter (based on the longest measurement of the patch) and percent cover (based on an ocular estimate of cover within a circle defined by the diameter). To determine the density of vegetative and reproductive shoots and the biomass, we will collect a core sample from each patch (two inches deep).

In the laboratory, we will rinse all core samples using a 2mm sieve and again using a .25mm sieve to separate the plant material based on vegetative shoots, reproductive shoots, and rhizomes. All vegetative shoots and reproductive shoots will be counted and weighed to determine aboveground biomass. Rhizomes plus roots will be weighed to determine belowground biomass. The material will be dried at 122°F for approximately 14 days and re-weighed to calculate percentage dry matter. Finally, we will compare the amount of material removed to previous years.

In spring through fall 2009, the Team intensively surveyed known infestation sites and other nearby areas of suitable intertidal mudflat habitat in Humboldt Bay. We surveyed the entire shoreline of Indian Island (the original site of infestation), and found only one patch of dwarf eelgrass—encouragement that six years of diligent treatment has been effective. At the Arcata Marsh site, however, we found the range of

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infestation to be larger this year than noted previously, with plants extending as far as 0.25 mile offshore. At the Manila site, plants were found in approximately the same location as in the previous two years. At the Arcata Wastewater Treatment Plant (AWTP), we found about 20 very small patches of dwarf eelgrass.

In May, we found two new locations of infestation, both with only a few very small patches, located on the north shore of North Humboldt Bay, between Mad River Slough and Arcata Marsh. The plants were growing very close to the levee.

In the Eel River estuary, we are continuing to monitor the McNulty Slough population, including periodic sampling and laboratory analysis of biomass.

Removal Methods

It is likely that several methods of removal used in combination may be the most effective. The criteria used to determine which treatment method may be used can be found in Figure 5. The method of eradication is largely dependent on access to the patches. Figure 5 prioritizes the eradication methods based on the accessibility by vehicle or boat. Further prioritization will be dependent on staff and equipment availability and patch size, which is difficult to determine in advance. It may be most efficiently to treat small, isolated patches in a different manner than large, dense infestations.

Excavation

We have found manual excavation using shovels to be an effective means of controlling *Z. japonica* in Humboldt Bay. While some follow-up monitoring and removal has been required annually at infested sites, the total amount of *Z. japonica* occurring in Humboldt Bay has been reduced dramatically since 2003 as a result of manual excavation (Ramey 2008). In our fall 2008 experiments at McNulty Slough, the excavation method resulted in a 96% reduction of *Z. japonica* cover (Ramey et al. 2009).

Dudoit et al. (2006) investigated the feasibility of manually controlling the spread of *Z. japonica* in the Coquille Estuary, OR through excavation. A large-scale removal experiment was designed along a 1,400-ft section of shoreline. The treatment area remained free of any patches > four inches, and researchers concluded annual excavation could control *Z. japonica* in the Coquille Estuary.

We plan to continue manual excavation by using hand shovels when and where it is feasible to remove *Z. japonica* (Figure 6). To ensure removal of rhizomes, we remove an area of substrate four inches below the surface. All plant material and mud will be placed in heavy-gauge plastic bags and transported off-site for disposal at a landfill.

In 2009, using our standard methodology of manual excavation, we removed 26 patches of dwarf eelgrass nearshore the Arcata Marsh site, but we estimate 50-100 more patches offshore. At the Manila site, we removed 26 patches—all of the plants growing out on open mudflats, but there are still plants remaining in the upper intertidal where dwarf eelgrass grows in association with bulrush. At the two new point locations (found in May) between the Arcata Marsh and Manila, where access is a limiting factor, we were able to remove all of one and a portion of the second. We have not yet removed the patch on Indian Island because the DFG boat has been inoperable since

July 1.

Covering

In terrestrial eradications, the covering method kills undesirable plant species by light deprivation. In our fall 2008 experiments at McNulty Slough, the covering method resulted in a 94% reduction of *Z. japonica* cover (Ramey et al. 2009). In Hong Kong, where *Z. japonica* is native, shading from increased sedimentation during airport construction resulted in decreased above ground biomass (Lee 1997).

In Yaquina Bay, Newport, Oregon, Patton (2007), covered 10 ft^2 patches of *Z. japonica* with perforated black plastic and carpet and securely weighted it with stakes and rocks. The plots remained covered for four weeks. Researches collected mud cores in control and treatment plots before and after treatment to evaluate presence of invertebrates. After a period of one month, plots were bare of eelgrass and no re-growth was evident. However, the *Z. japonica* shoot density increased in control plots, possibly explained by the experiment conducted during the growing season (spring). No invertebrates were found in any control plot cores. In treatment plots, one each of dead *Neotrypaea* (mudshrimp), *Hemigrapsus nudus* (crab) was found and two dead clams were found (species not given) (Patton 2007).

We may use covering to eradicate *Z. japonica* in some situations, following the method developed by Patton (2007). We will place squares of black plastic on top of *Z. japonica* patches followed by squares of carpet. To ensure the materials stay in place, wire will secure each corner of the carpet and plastic to four wooden corner stakes. We will place large river rock on top of the carpet to ensure adequate weight (Figure 7). When all *Z. japonica* has been killed, we will remove all materials and dispose of them at an approved facility.

Heat Treatments

There are a few methods available for applying heat to kill weeds. They all work on the same principle: intensive heat causes the plant cell contents to expand and burst cell walls, resulting in the plant wilting and dying. Thermal heat control, when effective, offers several advantages: less physical disruption than excavation; no chemical discharges; nothing placed in the estuary (as would be needed for a covering treatment); the impacts to non-target organisms would likely be minimal and short-term; and cost and time investments would likely be less or equal to all other methods considered.

<u>Flame Heat</u>

A propane flame weeder is a handheld unit that uses propane gas to produce a controlled and directed flame to sear above-ground plant material (Figure 8). It is not necessary to ignite the plants for the treatment to be effective. The intense heat sears the leaf, causing the cells to expand and burst. Evidence of treatment effectiveness takes 1-3 days.

In 2003, we tested the viability of using a propane torch to control *Z. japonica* occurring on Indian Island. In the higher, drier sample plots, the plants died, but in wetter plots, the method was less effective. In fall 2008, we tested the efficacy of flame heat on *Z. japonica* for two different time durations (1 minute and 5 minutes) in McNulty

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Slough. Results showed that the 1-minute flame treatment was not effective at controlling *Z. japonica*. However, the 5 minute duration displayed a 49% decrease in percent cover two months following treatment (Ramey et al. 2009). Ascard (1998) showed the efficacy of flaming is determined by the amount of heat transferred from the burner and the duration of exposure to the heat. This suggests that a longer duration of treatment or repeat treatment with flame heat has the potential to be effective at controlling *Z. japonica* and is worth further investigation.

In 2009, we acquired a new propane flame weeder through a donation from Flame Engineering. At the Arcata Marsh, excavation of the offshore plants was not feasible because off access constraints, so experimental plots were established to test repeated burning of the plants using the backpack propane torch. We are closely monitoring experimental plots to determine effectiveness and efficiency.

We are also experimenting with repeated burning at the AWTP site.

Hot Water

Hot water also controls weed growth. Advantages over flame weeders include safety (no open flame) and the method works well in wet environments. A computer-controlled boiler mounted on a trailer delivers hot water through a hose and treatment wand. The system delivers water at 205-208 degrees Fahrenheit, just below the boiling point, for maximum effect.

We tested the hot water treatment in November 2008, on several plots of *Z. japonica* present in McNulty Slough. We rented the Bureau of Land Management's hot water weed control system, called the Waipuna, to conduct the treatment (Figure 9). The Waipuna consists of a computer-controlled boiler mounted on a trailer. A supply hose delivers hot water and dispenses it through a treatment wand. The hot water treatment was found to be the most effective of all methods at reducing the percent cover of *Z. japonica* over the experimental period (Ramey et al. 2009). However, the accessibility of the Waipuna to infested areas will be the main deciding factor for when we can implement this treatment method.

Infrared Radiant Heat

Infrared weed control is a third option. This method also has the advantage of no open flame. A propane torch heats the unit and directs the flame toward a ceramic element or steel plate that subsequently radiates temperatures up to 1800°F (Figure 10). The intense heat causes the plants cells to explode with a few seconds of treatment. Both the flame weeders and the infrared application methods have the advantage over hot water treatment of better portability, allowing access to more remote locations; also, they would not require the transportation of fresh water to the site nor any discharge into the slough. In our fall 2008 experiments at McNulty Slough, the infrared treatments were not effective in controlling *Z. japonica*, however, we think that more powerful units may yield better results and are worthy of further investigation.

Potential Environmental Impacts

No Action Alternative

The physical structure of the mid to upper intertidal zones is altered where *Z. japonica* occurs, often forming a dense, sod-like root mat that may completely cover the

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substrate surface (Posey 1988). The narrow blades trap fine sediments. Posey (1988) documented that particle size was significantly smaller in *Z. japonica* patches after six years. Substrate particle size affects which invertebrates can inhabit the sediment and this change in invertebrate community structure can influence shorebird populations that feed on invertebrates (Quammen 1984; Baldwin and Lovvorn 1994; Danufsky and Colwell 2003). Although studies have shown an overall increase of invertebrate species diversity and biomass in areas colonized by *Z. japonica* (Fong et al. 1998; Lee et al. 2001), a decrease in the burrowing ghost shrimp (*Neotrypaea californiensis*) and other large epifauna was also found (Harrison 1987; Posey 1988). *N. californiensis* is a favored prey for the long-billed curlew and found in the diets of the marbled godwit and willet (Dr. Nils Warnock, pers. comm., Point Reyes Bird Observatory).

Additionally, the sediment accretion associated with *Z. japonica* could enhance extension of the invasive dense-flowered cordgrass, *Spartina densiflora*, further reducing mudflat habitat and foraging area for shorebirds. The open mudflats of Humboldt Bay are vital feeding grounds for important resident and migrating shorebirds such as whimbrel, long-billed curlews, willets, and marbled godwits (Long and Ralph 2001; Danufsky and Colwell 2003; Leeman and Colwell 2005)

Eradication Impacts

Plants

All removal methods will affect non-target plant species. The main plants present in the project area are seaweeds. The occurrence of these species on the mudflat is ephemeral, and we expect that re-colonization following treatment would occur.

In Manila, we have found *Zostera japonica* growing within the bulrush, *Scirpus pungens*. We have used hand trowels in the past to remove the Z. japonica at this location to avoid uprooting large areas of *S. pungens*. We have also scheduled removal at this location during times when the *S. pungens* has died back and there is less of an impact. In subsequent surveys following the year after removal, there is no evidence of excavation and *S. pungens* has successfully re-colonized the area.

If left untreated, *Z. japonica* could have a greater impact on seaweed species through competition. We occasionally find the native eelgrass *Z. marina* growing with *Z. japonica*. These plants would be affected by any method of treatment. However, after the first eradication on Indian Island, over 3230 ft^2 of native eelgrass, *Z. marina*, re-colonized the area. The no-action alternative could pose an even greater impact through inter-species competition.

Invertebrates

Polychaetes, crustaceans, and mollusks are the significant invertebrates of the high intertidal mudflats (Barnhart et al. 1992). Control methods may kill, disturb or displace these non-target invertebrate species during the duration of the treatment.

Physical disturbance impacts on macrofaunal invertebrates due to recreational clam digging has been investigated (Peterson et al. 1987; Boese 2002). In Yaquina Bay, OR, there was no statistical difference in the number of species or abundance of macrofauna between control and clam digging plots one month after the final treatment (Boese 2002). This suggests that invertebrates quickly re-colonize the mudflat environment following excavation activities.

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In Yaquina Bay, OR, Patton (2007) investigated the impact of the covering treatment on invertebrate populations. The study showed that invertebrates underneath the carpet pieces appeared to move away except for a very small number of clams (Patton 2007).

No data is available on the impact that thermal control methods may have on the benthic invertebrate community. However, earthworms are not reportedly harmed by the treatment in agricultural settings. We anticipate there will be short-term impacts to the benthic community during the experimental treatments, but re-colonization of the mudflat would occur by larval recruitment or immigration of organisms from adjacent areas.

Birds

The impacts from this project on shorebirds and waterfowl are limited to the disturbance caused by human activity during shoreline surveys and removal procedures. All methods would involve traversing the infested area. Human presence may affect shorebird foraging areas; however, these impacts are minimal and short term.

Water Quality

Potential impacts to water quality may include leaching of contaminants from the materials used to cover the *Z. japonica* patches, discharge of fresh water during use of the hot water method, and a small increase in sedimentation due to the disturbed substrate. We will conduct all shore surveys and removal activities during low tide while the project area is dewatered.

Habitat

An unintended side effect during this project by field staff is intense trampling of the mudflats. Johnson et al. (2007) conducted a study on the recovery of the meiofauna community of intertidal mudflats in the United Kingdom following trampling disturbance. Results showed that recovery occurred in 12-36 hours following disturbance. We anticipate short-term impacts to the meiofauna community during the field activities; however, re-colonization would occur quickly.

Listed/Proposed Threatened and Endangered Species (Table 2)

Plants

The Menzies' wallflower (*Erysimum menziesii*) and beach layia (*Layia carnosa*) occur in nearshore dunes and swales. The project site is located in the intertidal mudflats of Humboldt Bay and Eel River estuary. There is no habitat present for dune species in the surveyed or treated areas.

The western lily (*Lilium occidentale*) typically occurs in early successional bogs or coastal scrub on poorly drained soils. There is no habitat in the project area for this species.

Two sensitive plant species occur in salt marshes in Humboldt Bay and the Eel River estuary. Humboldt Bay owl's clover (*Castilleja ambigua* ssp. *humboldtiensis*) and Point Reyes bird's beak (*Cordylanthus maritimus* ssp. *palustris*) are both on List 1B of the California Native Plant Society as fairly endangered in California. Neither taxon has

federal or state status. These two closely related plants are small annuals that bloom in late spring to early summer. We see them when we traverse salt marshes to access intertidal mudflat for shore surveys and/or treatment of *Z. japonica*. We train all field crew members to recognize rare plants and to avoid walking on them, placing field gear on them, or impacting them in any other way.

Invertebrates

Black abalone (*Haliotis cracherodii*) cling to rock surfaces in the low intertidal zone. There is no suitable habitat present in surveyed or treated areas.

Fish

The Department of Fish and Game Natural Stocks Assessment Program has been monitoring water quality and conducting fish sampling in Humboldt Bay tributaries and McNulty Slough since September 2006. Longfin smelt (*Spirinchus thaleichthys*), juvenile and adult Chinook salmon (*Oncorhynchus tshawytscha*), juvenile and adult steelhead trout (*Oncorhynchus mykiss*), and juvenile coho salmon *(Oncorhynchus kisutch)* have been captured during the three-year sampling period. We will conduct all proposed treatments during low tide while the project site is dewatered. These fish species are not expected to be in the project area during operations.

The FWS in cooperation with DFG sampled for tidewater gobies (*Eucyclogobius newberryi*) in the Eel River Estuary system on September 23, 2008. Tidewater gobies were captured in an unnamed slough located between Mosley Slough and Sevenmile Slough on the DFG Eel River Wildlife Area (Figure 11). Tidewater gobies prefer stillwater habitats, such as marshes and backwater areas of lagoons, and appear to avoid areas of flowing water (Swenson 1999). No tidewater gobies are expected in the project area given the current velocity of the channel and the nearest known goby located is approximately three miles downstream from the McNulty Slough project site.

Reptiles

The loggerhead turtle (*Caretta caretta*), green turtle (*Chelonia mydas* (incl. *agassizi*)), leatherback turtle (*Dermochelys coriacea*), and olive ridley turtle (*Lepidochelys olivacea*) are all sea turtles that inhabit the ocean. These species do not occur in surveyed or treated areas.

Birds

The marbled murrelet (*Brachyramphus marmoratus*) nests in old-growth forests or on the ground at higher latitudes where trees cannot grow. It feeds at sea both in pelagic offshore areas and inshore in protected bays.

The western snowy plover (*Charadrius alexandrinus nivosus*) prefers habitat with sandy, gravelly substrates. Plovers typically forage in wet or dry beach-sand, among tide-cast kelp, and within low foredune vegetation.

The Western yellow-billed cuckoo (*Coccyzus americanus*) prefers open woodlands with clearings and dense scrubby vegetation, often along water. Their breeding habitat is deciduous woods from southern Canada to Mexico.

The brown pelican (*Phoebastris albatrus*) is found in warm coastal marine and estuarine environments. This species nest in colonies, usually on islands.

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The northern spotted owl (*Strix occidentalis caurina*) primarily inhabits old growth forests in the northern part of its range (Canada to southern Oregon) and landscapes with a mix of old and younger forest types in the southern part of its range (Klamath region and California). This species prefers to nest in cavities or on platforms of large trees and uses abandoned nests of other species.

Short-tailed albatrosses (*Phoebastris albatrus*) nest on sloping grassy terraces on two rugged, isolated, windswept islands in Japan. After breeding, short-tailed albatrosses move to feeding areas in the North Pacific.

Xantus's murrelet (*Synthliboramphus hypoleucus*) breeds on islands in the Channel Islands of California. After the breeding season, it disperses north at sea, usually to offshore waters, as far as British Columbia.

There is no suitable habitat present in surveyed or treated areas.

Mammals

The sei whale (*Balaenoptera borealis*), blue whale (*Balaenoptera musculus*), fin whale (*Balaenoptera physalus*), Steller sea lion (*Eumetopias jubatus*), humpback whale (*Megaptera novaengliae*), and sperm whale (*Physeter macrocephalus*) live in the open ocean and do not occur in surveyed or treated areas.

Mitigation Measures

To reduce the impacts from trampling in the mud, researchers will wear "mudders"—overshoes designed to reduce how much one sinks into the mud when walking on mudflat. During shore surveys and treatment, trampling of native plants will be avoided to the fullest extent possible.

When removing material through excavation, the bags will be carried rather than dragged through the mud. All tools, garbage bags, and extra stakes will be removed from the project site after treatment has been completed.

All field crew members will be trained to recognize rare plants and to avoid walking on them, placing field gear on them, or impacting them in any other way.

There may be minimal impacts to native eelgrass during the shore surveys and removal methods; however, after the first eradication on Indian Island, over 3230 ft^2 of native eelgrass, *Z. marina*, recolonized the area. If at all possible, hand trowels will be used for excavation in locations where the native vegetation is in dense association with *Z. japonica* to prevent from uprooting large areas of the native vegetation.

Discussion

The benefits of our work include removal of an introduced, invasive eelgrass, passive restoration of native eelgrass habitat, detailed mapping of *Z. japonica* removed, and monitoring of re-vegetation in affected areas. The mud and sand flats that we are restoring are important feeding grounds for resident and migrating shorebirds such as whimbrel, long-billed curlews, willets, and marbled godwits.

To the fullest extent possible, we plan to monitor all suitable habitat to enable early detection of any new occurrences of *Z. japonica* should they arise. It is our intent to prevent the spread of this invasive plant species and maintain the natural and ecological diversity of Humboldt Bay and the Eel River estuary. The project will be determined successful when *Z. japonica* is no longer found anywhere.

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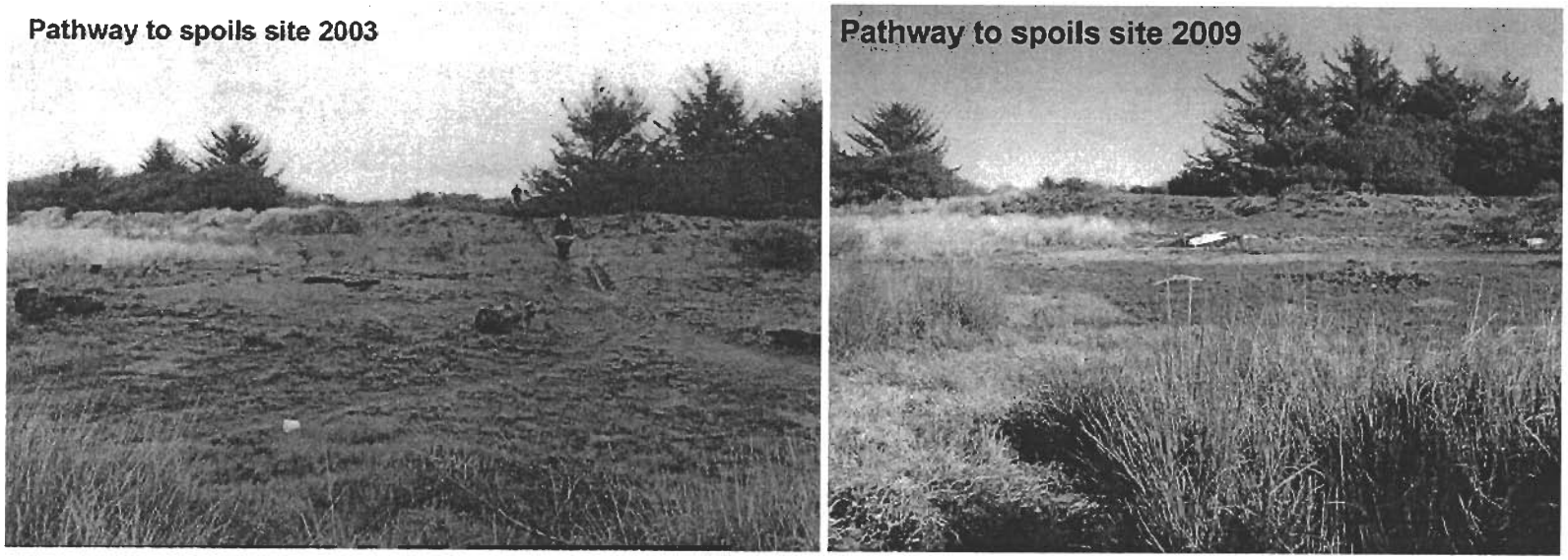

Figure 3. The pathway that was followed from the mudflat to the spoils site as seen in 2003 and 2009.

Figure 4. The location of spoil deposits as seen in 2003 and 2009.

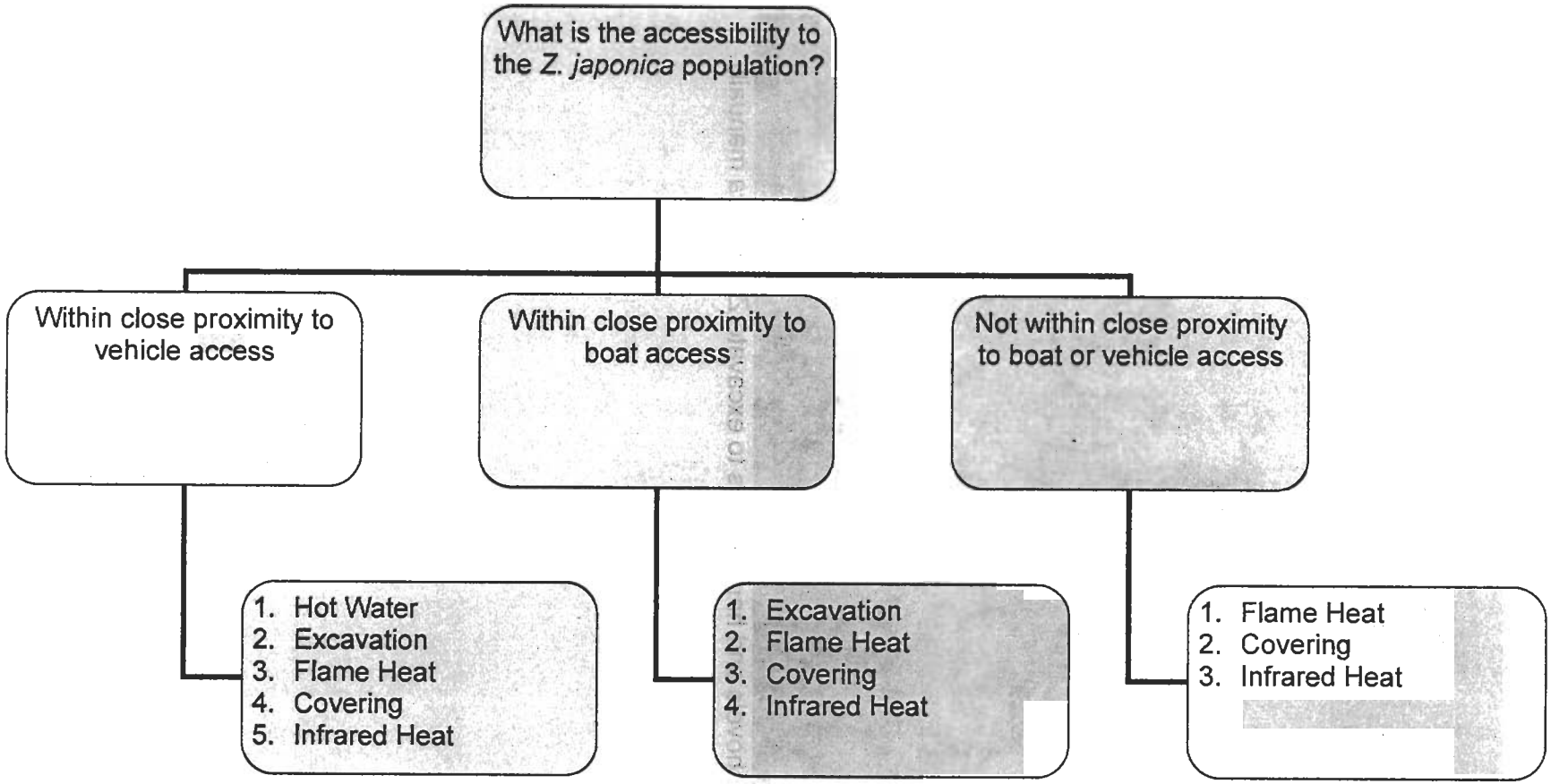

Figure 5. Criteria used to determine which eradication method is appropriate for removal of Zostera japonica.

Figure 6. We use shovels and hand trowels to excavate *Z. japonica* manually.

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Figure 7. Small-scale example of the covering method.

Figure 8. A propane torch is used to apply heat treatment to *Z. japonica*.

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Figure 9. The Bureau of Land Management's hot water weed control system, called the Waipuna.

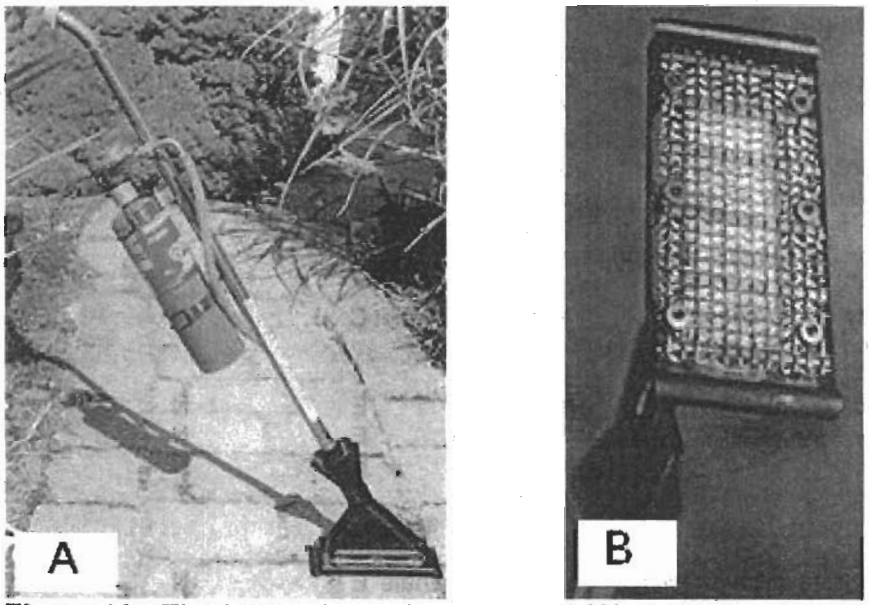

Figure 10. The infrared weed control unit (A) emanates temperatures up to 1800°F from the element at the base of the unit (B).

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Table 3. Quantitative summary of the amount of *Zostera japonica* removed from Humboldt Bay 2004 to 2009.

		Number of Patches	Area (m^2)	Dry Weight of Aboveground Biomass, Vegetative (kg)	Dry Weight of Aboveground Biomass, Reproductive (kg)	Dry Weight of Belowground Biomass (kg)	Total Biomass Dry Weight (kg)
Indian Island	**2004**	188	186.86	5.24	4.13	8.50	17.87
	2005	149	26.06	0.71	0.15	2.53	3.39
	2006	23	6.62	0.23	0.12	0.23	0.58
	2007	19	5.92	0.33	0.11	0.16	0.60
	2008	4	1.93	0.03	0.01	0.01	0.05
	2009	1	*Plant material has not been removed from this location yet*				
AWTP	**2007**	4	1.02	< 0.01	0.00	0.03	0.04
	2008	0	0.00	0.00	0.00	0.00	0.00
Arcata Marsh	**2007**	33	10.56	0.34	< 0.01	0.14	0.49
	2008	36	1.87	0.25	0.05	0.25	0.55
	2009	24	4.25	0.36	0.03	0.36	0.76
Manila	**2007**	60	6.73	0.07	< 0.01	0.04	0.12
	2008	15	0.25	0.02	0.00	0.06	0.08
	2009	27	5.36	0.49	0.12	0.23	0.84
Mad R. Slough	**2009**	4	6.07	0.41	0.00	0.37	0.78

EXHIBIT NO. 4
APPLICATION NO.
1-10-005
CA. DEPT. OF FISH & GAME
AMOUNT OF DWARF EELGRASS REMOVED 2004 – 2009

CALIFORNIA COASTAL COMMISSION
NORTH COAST DISTRICT OFFICE
710 E STREET • SUITE 200
EUREKA, CA 95501-1865
VOICE (707) 445-7833
FACSIMILE (707) 445-7877

MAILING ADDRESS:
P. O. BOX 4908
EUREKA, CA 95502-4908

COPY

EMERGENCY PERMIT

California Department of Fish and Game
619 Second Street
Eureka, CA 95501

Date: November 1, 2002
Emergency Permit: **1-02-153-G**

LOCATION OF EMERGENCY WORK:

Along the west side of Indian Island in the mid to high intertidal zone of Humboldt Bay, Humboldt County.

WORK PROPOSED:

Removal of non-native eelgrass (*Nanozostera japonica*) from two sections along approximately 514 meters of shoreline by burning the above-ground vegetation and/or removing the plants by excavation. The excavation work would be done by hand using post hole diggers and shovels. The proposed work includes monthly monitoring following eradication to determine the effectiveness of the removal efforts.

This letter constitutes approval of the emergency work you or your representative has requested to be done at the location listed above. I understand from your information that an imminent threat to property (a portion of the intertidal area of Humboldt Bay) exists in the form of potential spreading of a non-native species of seagrass creating an ecological risk to the flora and fauna resources of Humboldt Bay. The situation requires immediate action before the non-native seagrass spreads because greater resource damage to the physical structure and biological composition of the bay may occur if the problem is not immediately addressed. Therefore, the situation requires immediate action to prevent or mitigate loss or damage to life, health, property, or essential public services: 14 Cal. Administrative Code, Section 13009. The Executive Director of the Coastal Commission hereby finds that:

(a) An emergency exists which requires action more quickly than permitted by the procedures for administrative or ordinary permits, and the development can, and will be, completed by December 30, 2002 unless otherwise specified by the terms of this permit;

(b) Public comment on the proposed emergency action has been reviewed if time allows;

(c) As conditioned, the work proposed would be consistent with the requirements of the California Coastal Act of 1976.

The work is hereby approved, subject to the conditions listed on the attached page.

EXHIBIT NO. **5**
APPLICATION NO.
1-10-005
CA. DEPT. OF FISH & GAME
COPIES OF EMERGENCY PERMIT NOS. 1-02-043-G & 1-03-017-G (1 of 7)

Sincerely,

PETER M. DOUGLAS
Executive Director

By: ROBERT MERRILL
North Coast District Manager

Enclosure: Acceptance Form

cc: David Hull, Humboldt Bay Harbor District

CONDITIONS OF APPROVAL:

1. The enclosed Emergency Permit Acceptance form must be signed by the APPLICANT and returned to our office within 15 days.
2. Only that work specifically described in this permit and for the specific property listed above is authorized. Project activities must conform to the description of project work submitted to the Commission on October 23, 2002. Any additional work requires separate authorization from the Executive Director.
3. The work authorized by this permit must be completed no later than December 30, 2002.
4. The applicant shall obtain authorization from the Commission for any additional eradication work to be performed after December 30, 2002, at another location, or not otherwise covered by this emergency permit (1-02-153-G).
5. In exercising this permit, the applicant agrees to hold the California Coastal Commission harmless from any liabilities for damage to public or private properties or personal injury that may result from the project.
6. This permit does not obviate the need to obtain necessary authorizations and/or permits from other agencies (i.e. U.S. Fish & Wildlife, U.S. Army Corps of Engineers, State Lands Commission.) The permittee shall provide the Commission copies of all authorizations and/or permits obtained from other agencies for this project.

If you have any questions about the provisions of this emergency permit, please call the Commission's North Coast District Office at the address and telephone number listed on the first page.

STATE OF CALIFORNIA -- THE RESOURCES AGENCY

GRAY DAVIS, GOVERNOR

CALIFORNIA COASTAL COMMISSION
NORTH COAST DISTRICT OFFICE
710 E STREET • SUITE 200
EUREKA, CA 95501-1865
VOICE (707) 445-7833
FACSIMILE (707) 445-7877

MAILING ADDRESS:
P. O. BOX 4908
EUREKA, CA 95502-4908

EMERGENCY PERMIT

California Department of Fish and Game
Attn: John Mello, Associate Biologist
619 Second Street
Eureka, CA 95501

Date: March 28, 2003
Emergency Permit: **1-03-017-G**

LOCATION OF EMERGENCY WORK:

Along the southwest side of Indian Island in the mid to high intertidal zone of Humboldt Bay, Humboldt County.

WORK PROPOSED:

Removal of 27 small patches of non-native eelgrass (*Nanozostera japonica*) by excavation (by hand with shovels) along a 272 meter stretch of mid-intertidal and sandy/silty beach. The total area of excavation is approximately 156 m^2 and the patch sizes range from 0.21-14.5 m^2. Excavation would be 0.1 meter deep and would result in approximately 30.36 cubic yards of excavated material. The excavated substrate and plant material would be moved up slope out of the tidal zone into an approximately 200-square-foot upland area adjacent to the beach behind an existing levee. The material would be covered to kill the rhizomes and seeds and prevent wind dispersal of plant material.

This letter constitutes approval of the emergency work you or your representative has requested to be done at the location listed above. I understand from your information that an imminent threat to property (a portion of the intertidal area of Humboldt Bay) exists in the form of potential spreading of a non-native species of seagrass creating an ecological risk to the flora and fauna resources of Humboldt Bay. The situation requires immediate action before the non-native seagrass is in full flower and seed production and causes greater resource damage to the physical structure and biological composition of the bay. Therefore, the situation requires immediate action to prevent or mitigate loss or damage to life, health, property, or essential public services: 14 Cal. Administrative Code, Section 13009. The Executive Director of the Coastal Commission hereby finds that:

(a) An emergency exists which requires action more quickly than permitted by the procedures for administrative or ordinary permits, and the development can, and will be, completed by May 1, 2003 unless otherwise specified by the terms of this permit;

(b) Public comment on the proposed emergency action has been reviewed if time allows;

(c) As conditioned, the work proposed would be consistent with the requirements of the California Coastal Act of 1976.

The work is hereby approved, subject to the conditions listed on the attached page.

Sincerely,

By: ROBERT MERRILL
North Coast District Manager

PETER M. DOUGLAS
Executive Director

Enclosure: Acceptance Form

cc: David Hull, Humboldt Bay Harbor District

CONDITIONS OF APPROVAL:

1. The enclosed Emergency Permit Acceptance form must be signed by the APPLICANT and returned to our office within 15 days.
2. Only that work specifically described in this permit and for the specific property listed above is authorized. Project activities must conform to the description of project work submitted to the Commission on March 7, 2003 and March 13, 2003. Any additional work requires separate authorization from the Executive Director.
3. The work authorized by this permit must be completed no later than May 1, 2003.
4. Within 60 days of the date of this permit (i.e. by May 27, 2003) the permittee shall submit a complete coastal development permit application to have the emergency placement of excavated substrate and material in the upland area adjacent to the beach considered permanent. If the application is not complete by that date, the emergency work shall be removed in its entirety within 180 days of the date of this permit unless this requirement is waived in writing by the Executive Director.
5. The applicant shall obtain authorization from the Commission for any additional eradication work to be performed after May 1, 2003, at another location, or not otherwise covered by this emergency permit (1-03-017-G).
6. In exercising this permit, the applicant agrees to hold the California Coastal Commission harmless from any liabilities for damage to public or private properties or personal injury that may result from the project.
7. This permit does not obviate the need to obtain necessary authorizations and/or permits from other agencies (i.e. U.S. Fish & Wildlife, U.S. Army Corps of Engineers, State Lands Commission.) The permittee shall provide the Commission copies of all authorizations and/or permits obtained from other agencies for this project.

As noted in Condition No. 4, the emergency work carried out under this permit is considered to be TEMPORARY work done in an emergency situation. If the property owner wishes to have the emergency work become a permanent development, a coastal permit must be obtained. A regular permit would be subject to all of the provisions of the California Coastal Act and may be conditioned accordingly. These conditions may include provisions for public access (such as an offer to dedicate an easement) and/or a requirement that a deed restriction be placed on the property assuming liability for damages incurred from storm waves.

If you have any questions about the provisions of this emergency permit, please call the Commission's North Coast District Office at the address and telephone number listed on the first page.

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Addendum to Emergency Permit
California Department of Fish & Game
Humboldt Bay *Zostera japonica* Eradication Project
Submitted: March 13, 2003

Justification for placing fill material adjacent to excavation site. The option of transporting excavated soil and plant material to some site completely away from the *Zostera japonica* infestation area was considered by Eradication Team members. However, this option was not chosen due to the excessive cost of transportation, labor, and disposal of excavated material. Because this excavated material has basically the same silt-clay makeup of the substrate on which it will be deposited, we predict no negative impact to the fill area.

How will excavated material be prevented from reentering the bay: Excavated soil with plant material will be placed upslope well out of the intertidal zone behind a previously constructed, manmade levee. This levee isolates the disposal site from high-high tides and storm currents, and also prevents fill material returning to the bay in rain runoff during storm events. Fill material will also be covered for a period of time to kill *Zostera japonica* rhizomes and seeds and prevent wind dispersal of plant material.

Description of Disposal Area: The disposal site on the southwest section of Indian Island, according to navigational maps prepared in the mid 1800s, historically contained wetlands. Due to the placement of fill (which appears to be composed of dredge spoils) no wetlands are now present in this area. A survey of the area by California Department of Fish & Game botanist, Tony LaBanca, found no protected plant species. The proposed fill site and adjacent areas were also surveyed for native and non-native plant assemblages. Areas which are representative of health- native plant communities are not to be disturbed. Species composition of the fill disposal site consists mostly of non-native plant species, primarily European beachgrass, *Ammophila arenaria*, and is considered a disturbed and degraded natural habitat.

Contact:
John J. Mello, Associate Biologist
Calif. Dept of Fish and Game
619 Second Street
Eureka, CA 95501
(707) 441-5755
FAX 445-7883
jmello@dfg.ca.gov

California Department of Fish and Game
Zostera japonica Eradication Project
(Site Map)

0.1 0 0.1 0.2 Miles

California Department of Fish and Game
619 Second Street
Eureka, CA 95501
Contact: John Mello
(707) 441-5755

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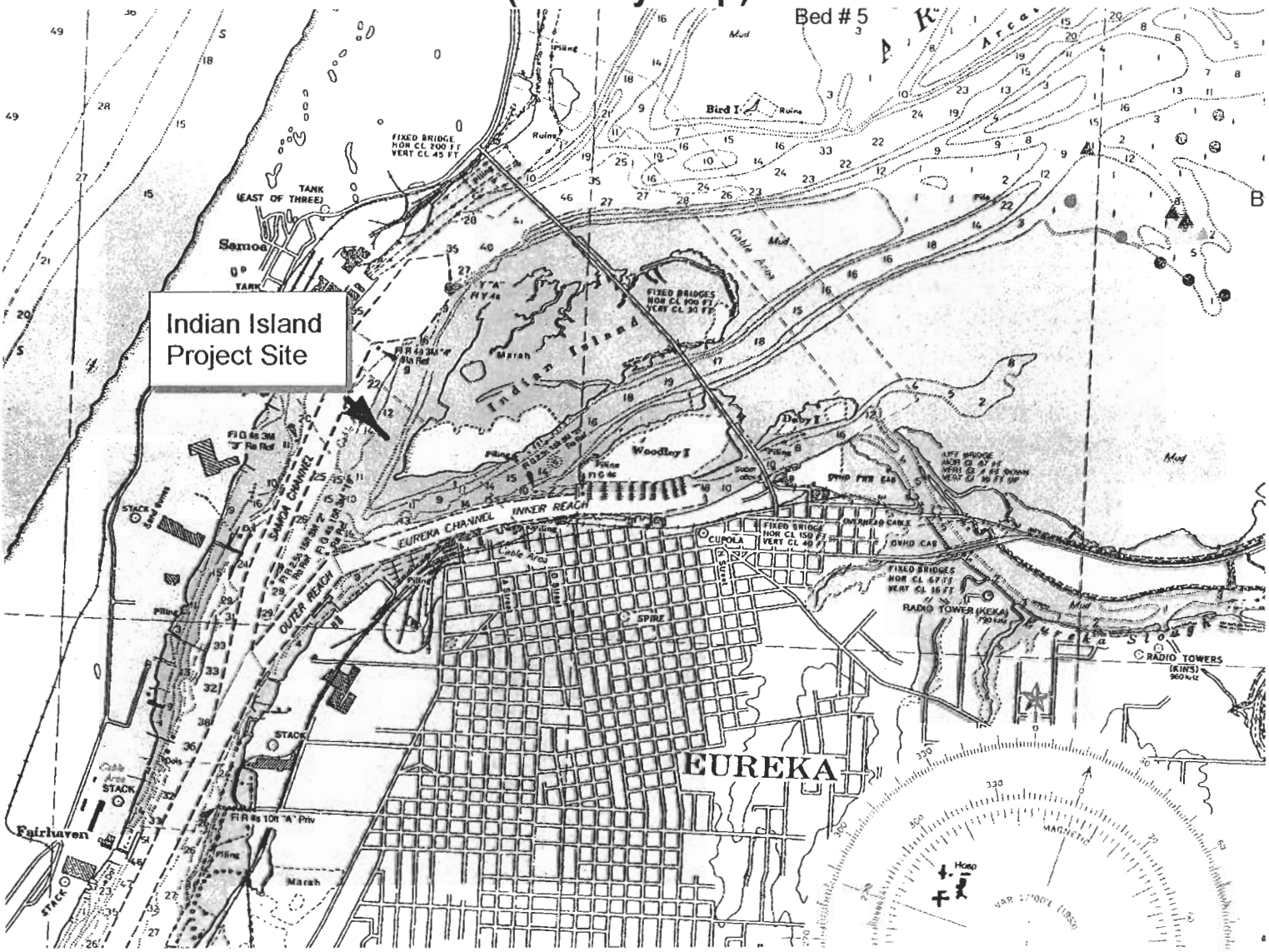
Califo a Department of Fish a J Game
Zostera japonica Eradication Project
(Vicinity Map)



California Department of Fish and Game
619 Second Street
Eureka, CA 95501
Contact: John Mello
(707) 441-5755

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7 of 7

Experimentation for Control of *Zostera japonica* in McNulty Slough Project
WDID No. 1B08144WNHU

Monitoring Report: 2008

prepared by

Kirsten Ramey
Associate Marine Biologist
Aquaculture and Bay Management Project
California Department of Fish and Game
619 Second Street
Eureka, CA 95501

and

Susan Schlosser
Marine Advisor
U.C. Sea Grant Extension
2 Commercial Street, Suite 4
Eureka, California 95501

and

Annie Eicher
Staff Research Associate
U.C. Sea Grant Extension
2 Commercial Street, Suite 4
Eureka, California 95501

January 29, 2009

Introduction

This report summarizes the activities and accomplishments of the Experimentation for Control of *Zostera japonica* in McNulty Slough Project (Project) conducted under Regional Water Quality Control Board WDID No. 1B08144WNHU. The Project was a cooperative effort involving University of California Sea Grant Extension staff, California Department of Fish and Game staff, and Humboldt State University student interns.

Project Background

Dwarf eelgrass, *Zostera japonica,* is a grass-like plant that grows on soft mud or sand in the sheltered waters of bays and estuaries (Harrison and Bigley 1982; Posey 1988; Thom 1990; Larned 2003). Native to Asia, it is capable of rapid expansion over non-vegetated mudflats, and the species has become well established in estuaries throughout Washington and Oregon (Baldwin and Lovvorn 1994; Dudoit 2006). Dwarf eelgrass was officially first documented in North America in 1957 in Willapa Bay, Washington and was likely introduced with imported oyster seed. No known infestations occurred in California until 2002, when a small patch was discovered on Indian Island in Humboldt Bay.

After this discovery, a team of state and local scientists, including representatives from NOAA Fisheries, United States Fish and Wildlife Service (FWS), California Department of Fish and Game (CDFG), University of California Sea Grant (U.C. Sea Grant), Humboldt State University, and University of California Davis, was assembled to assess the available information on *Z. japonica* and the extent of its introduction into Humboldt Bay. It was the consensus of the team and additional marine scientists that an eradication program should be undertaken. Since April 2004, annual monitoring and eradication have been conducted bay-wide.

On April 28, 2008, a new population of *Z. japonica* was discovered by a CDFG crew in McNulty Slough in the Eel River Delta. McNulty Slough winds along the eastern boundary of the Department of Fish and Game Eel River Wildlife Area north of the mouth of the Eel River (Figure 1).

When *Z. japonica* was first detected in Humboldt Bay, several removal methods were tested including; covering, on-site sieving, burning, and excavation. The McNulty Slough population is larger than anything found in Humboldt Bay. It is likely that several methods of control used in combination may be the most effective. Small, isolated patches may be treated most efficiently in a different manner than large, dense infestations. This project offered us an opportunity to test the combination of thermal treatments, excavation and covering methods in small patches.

Goals and Objectives

Overall, our goal is to select the most effective combination of methods with minimal environmental impact. Once we have selected the best combination of treatments based on the results of experimentation, we can proceed with completion of developing a comprehensive management plan and applying for the full scope of permits.

For the Project period, our objectives were:

1. Test several methods of control, including; covering, excavation, hot water, flame, and infrared (Table 1).
2. Gather data through monitoring to determine the most effective combination of methods to eradicate *Z. japonica*.

Methods

To accomplish these objectives, we used the following methods:

1. Field staff established 54-half meter treatment plots in a systematic fashion along the intertidal mudflats of McNulty Slough.
2. Each plot was marked with two PVC stakes so that precise location of the treatment could be re-located for evaluation.
3. Plots were stratified by elevation. Half of the plots for each treatment type were placed in the low intertidal zone and the other half of the plots were in the high intertidal zone (Figure 2).
4. The plots were staggered to provide a sufficient buffer such that treatment effects would not overlap.
5. Photos, GPS coordinates, and an ocular estimate of total percent cover were recorded for each plot before treatment.
6. For the excavation treatment plots, all *Z. japonica* was excavated by hand using shovels. An area of substrate four inches below the surface was excavated to ensure removal of rhizomes. All plant material and mud was placed in heavy-gauge plastic bags and transported off-site for disposal at a landfill.
7. For the covering treatment plots, squares of perforated black plastic measuring ½ m x ½ m were placed on each plot. Identically sized pieces of carpet were placed directly over the plastic. Each corner of the carpet and plastic was wired to four corner stakes to ensure the materials were not swept away. Large river rock was placed on top of the carpet to further ensure adequate weight.
8. The hot water treatment was applied through the use of the Bureau of Land Management's hot water weed control system, called the Waipuna System. A supply hose and a treatment wand were used to deliver hot water generated from a computer-controlled boiler mounted on a trailer. Half of the hot water treatment plots were treated for duration of one minute and the other half for duration of five minutes.
9. For the flame weeder, a handheld propane gas flame weeder was used to produce a controlled flame that was passed over the plants by the operator. Half of the flame weeder treatment plots were treated for duration of one minute and the other half for duration of five minutes.
10. The infrared weed control treatment was applied in a similar manner as the flame weeder. A handheld unit, heated by a propane burner that produced temperatures up to 2000°F from a steel plate was passed over the plants by the operator. Half of the infrared weed control treatment plots were treated for duration of one minute and the other half for duration of five minutes.
11. Photos, an ocular estimate of total percent cover, and an evaluation of plot condition were recorded approximately weekly for the first month (schedule determined by availability of suitable low tides during daylight hours), except for the covering treatment plots. Plots with the covering treatment were checked to ensure the cover was in place; however, percent cover was not assessed until the cover was removed after one month.
12. A final evaluation, consisting of photos and an ocular estimate of total percent cover, of each treatment plot was conducted two months after the initial treatment.
13. Data were recorded on datasheets while in the field and subsequently entered into a Microsoft Access database. Microsoft Excel was used to analyze and graphically represent the results.

Results

Pre-treatment cover of *Z. japonica* ranged from 58% to 85% in the experimental plots. Post-treatment cover at two months following treatment was determined to be the most meaningful representation of treatment effectiveness.

The average percent change of cover was calculated to compare before and after treatment for each method, using the following formula: % change = (y2-y1)/y1, where y1 = pre-treatment cover and y2 = post-treatment cover (Table 2).

The most effective treatment methods were covering, excavation, and hot water – 5 minute, all resulting in a greater than 94% decrease in *Z. japonica* cover over the experimental period. The hot water – 1 minute treatment also had an impact, with an 84% reduction in dwarf eelgrass cover.

The infrared and flame treatments were not effective in controlling *Z. japonica.* It has been found that the sensitivity to heat is determined by the growth stage of the weeds (Cisneros and Zandstra 2008). Specifically, flame weeding is most effective on most weeds at an early growth stage (Ascard 1995). Based on the timing of our experiment (late fall) and the growth habits of *Z. japonica*, the population was most likely in a mature growth stage, possibly resulting in less effective heat treatments. In addition to growth stage, the efficacy of flaming is determined by the amount of heat transferred from the burner and the duration of exposure to the heat (Ascard 1998). Perhaps the duration of the heat treatments in our experiment were not sufficient enough to suppress growth after two months time. It may be worth further experimentation with these methods.

The control plots, which did not receive treatment, displayed a slight decrease in cover (8%), possibly explained by the plants naturally senescing.

Representative photos of before and after treatment for each control method can be seen in Figure 3. Percent cover of *Z. japonica* before and after treatment was compared graphically for each control method in Figure 4.

Discussion

The *Z. japonica* population found this year in the Eel River estuary is larger than anything that has been found to date in Humboldt Bay. If left unchecked, this population represents a threat to Humboldt Bay as a source of re-infestation.

Based on the results of the experimentation, our goal is to select the best combination of methods to control *Z. japonica* with minimal environmental impact. A combination of control methods, e.g. by excavating or covering the smaller patches and using an extended heat treatment on the larger areas, may be advantageous.

Our next steps are to discuss the results with regulatory agencies and proceed with developing a comprehensive management plan to eradicate *Z. japonica* in the Eel River Estuary. It is our intent to stop the spread of this invasive plant species and maintain the natural and cultural diversity of California's estuarine environment.

References

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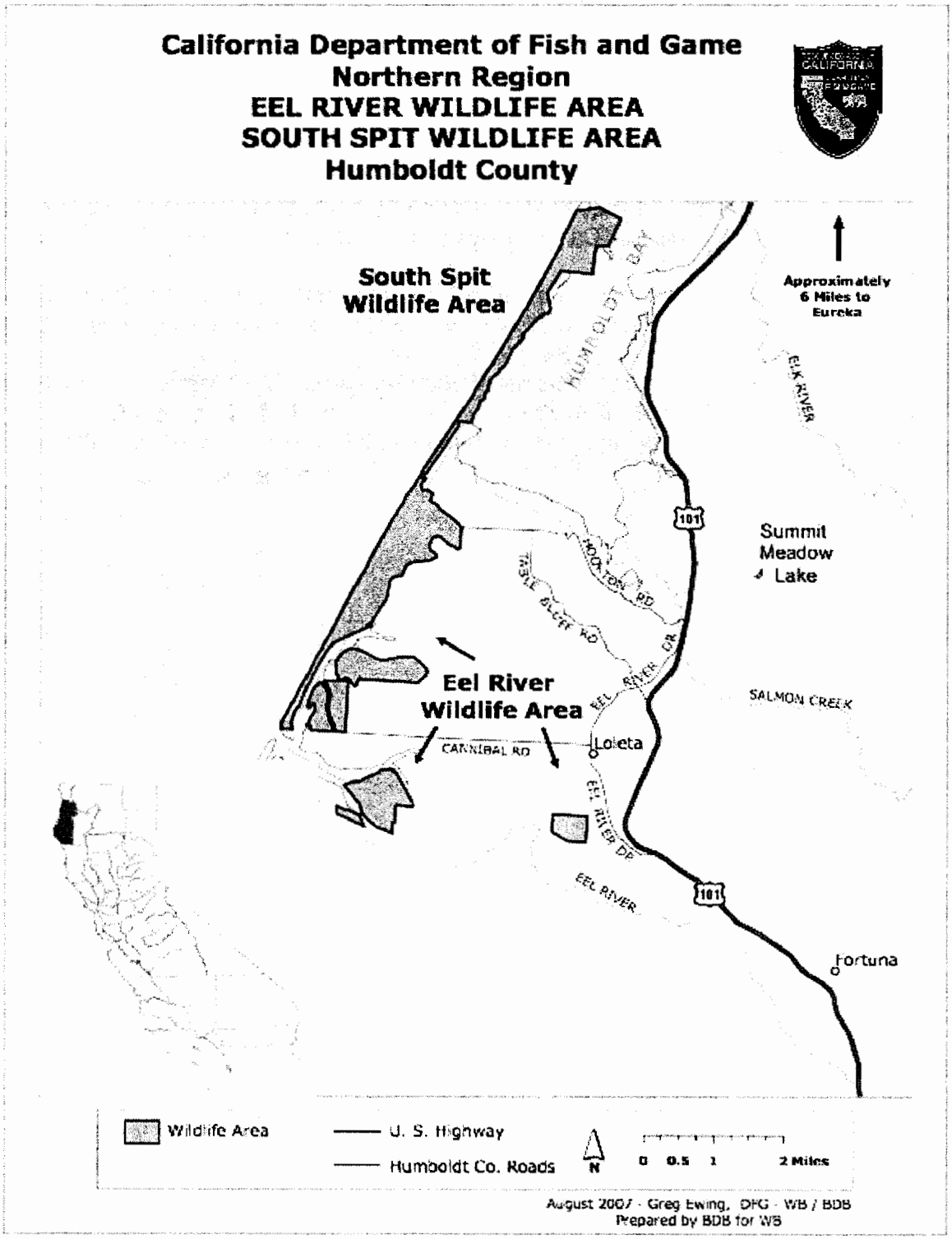

Figure 1. Eel River Wildlife Area. McNulty Slough winds along the eastern boundary of the Wildlife Area north of the mouth of the Eel River.

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Table 1. Proposed experimental plots for control of *Zostera japonica* at McNulty Slough.

Treatment Type	**Method**	**Treatment Duration**	**Number of Experimental Plots**
Control	No treatment	N/A	6
Excavation	Manual	N/A	6
Thermal	Hot Water	1 minute / m^2	6
		5 minutes / m^2	6
	Flame Weeder	1 minute / m^2	6
		5 minutes / m^2	6
	Infrared Treatment	1 minute / m^2	6
		5 minutes / m^2	6
Covering	Plastic + Carpet	1 month	6
Total # Plots:			**54**

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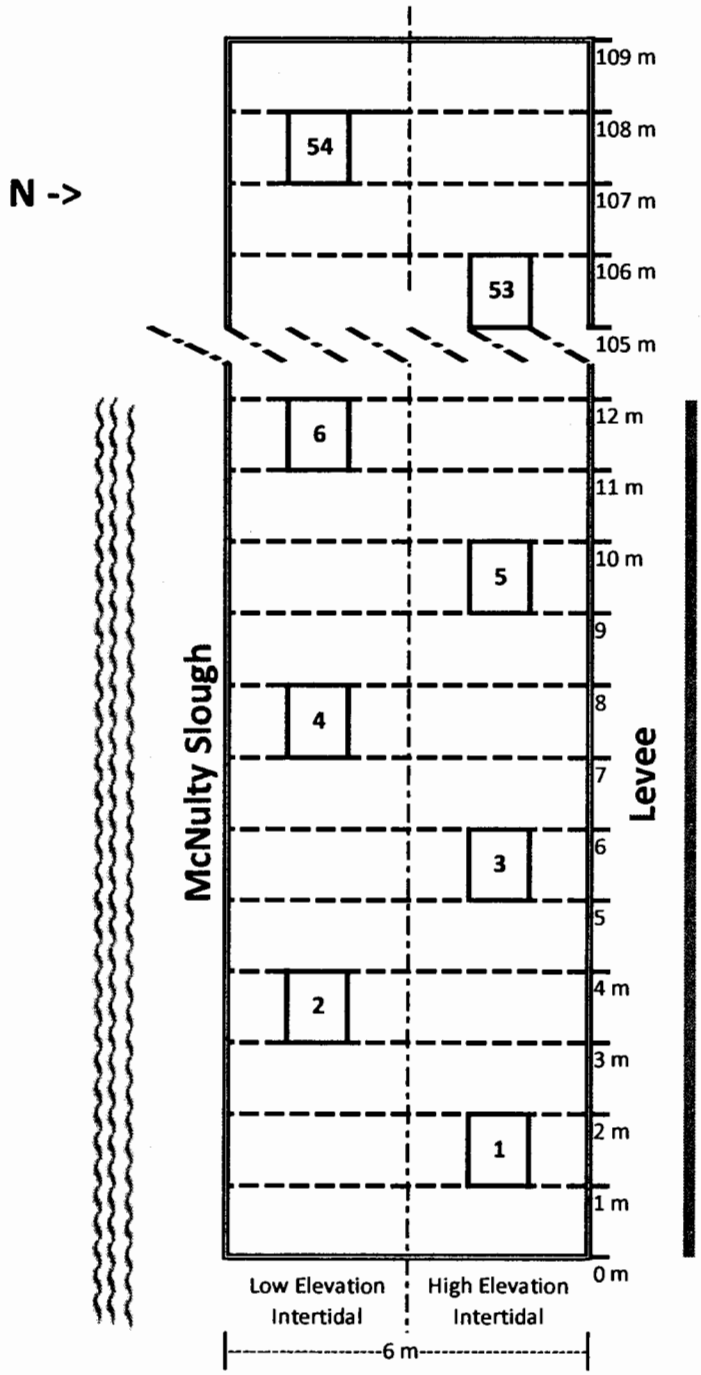


Figure 2. Experimental plot design for control of *Zostera japonica* at McNulty Slough.

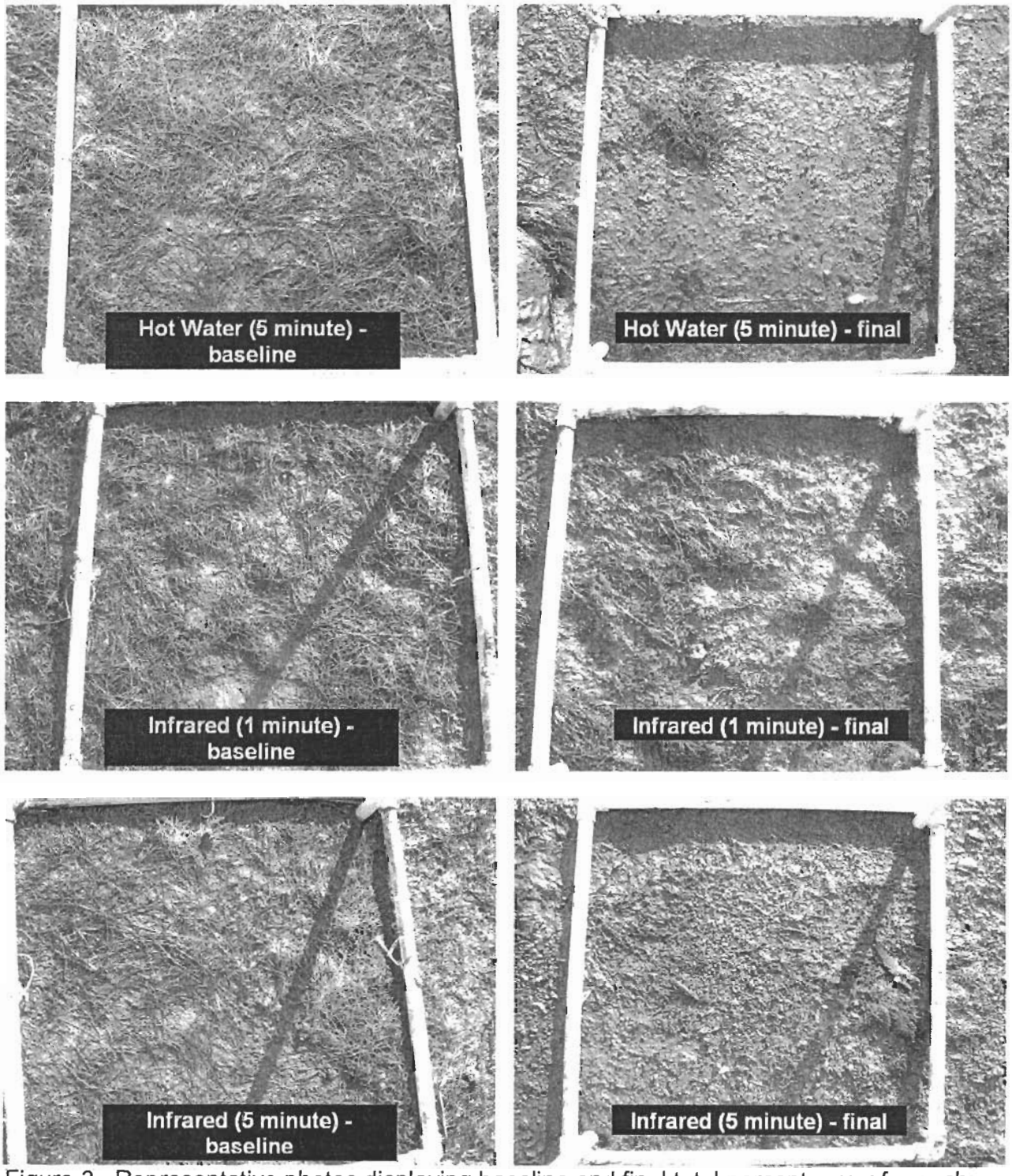
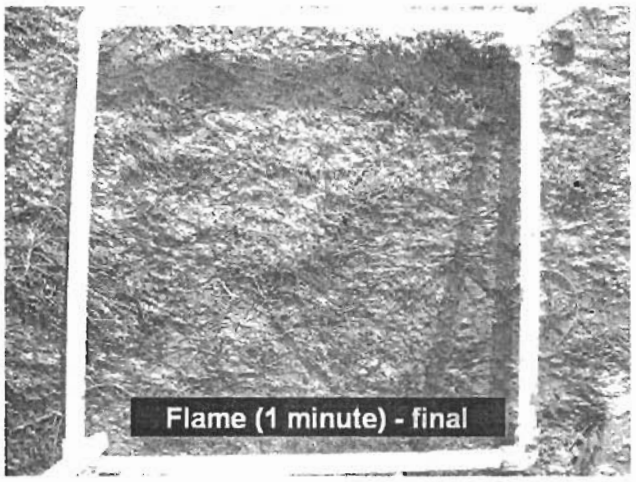
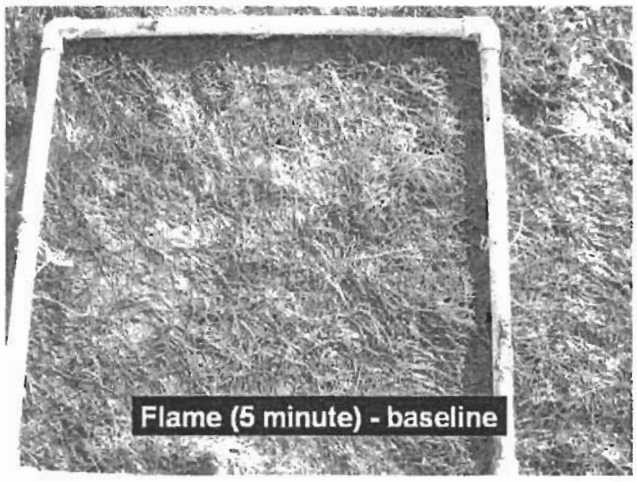
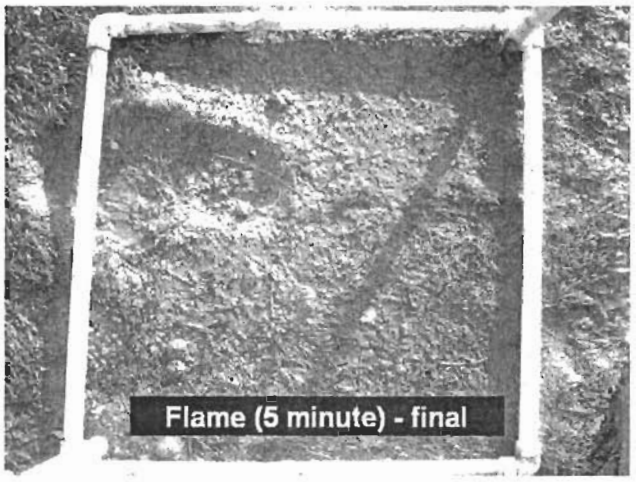


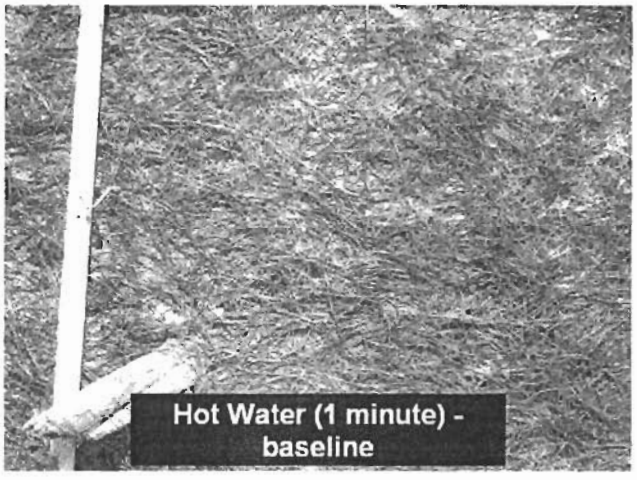
Figure 3. Representative photos displaying baseline and final total percent cover for each method of control.

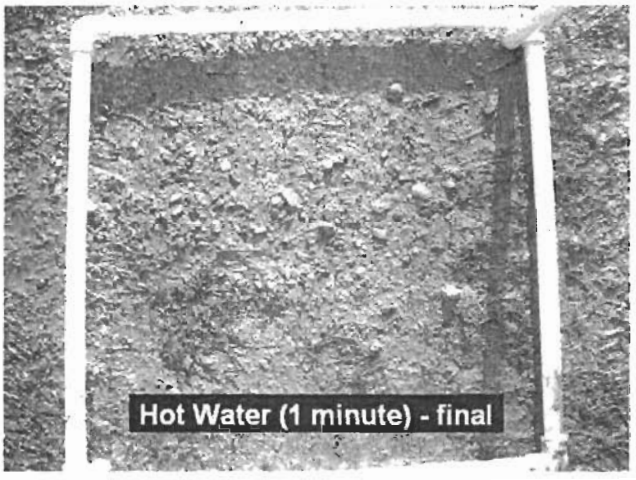

Flame (1 minute) - baseline


Flame (1 minute) - final


Flame (5 minute) - baseline


Flame (5 minute) - final


Hot Water (1 minute) - baseline


Hot Water (1 minute) - final

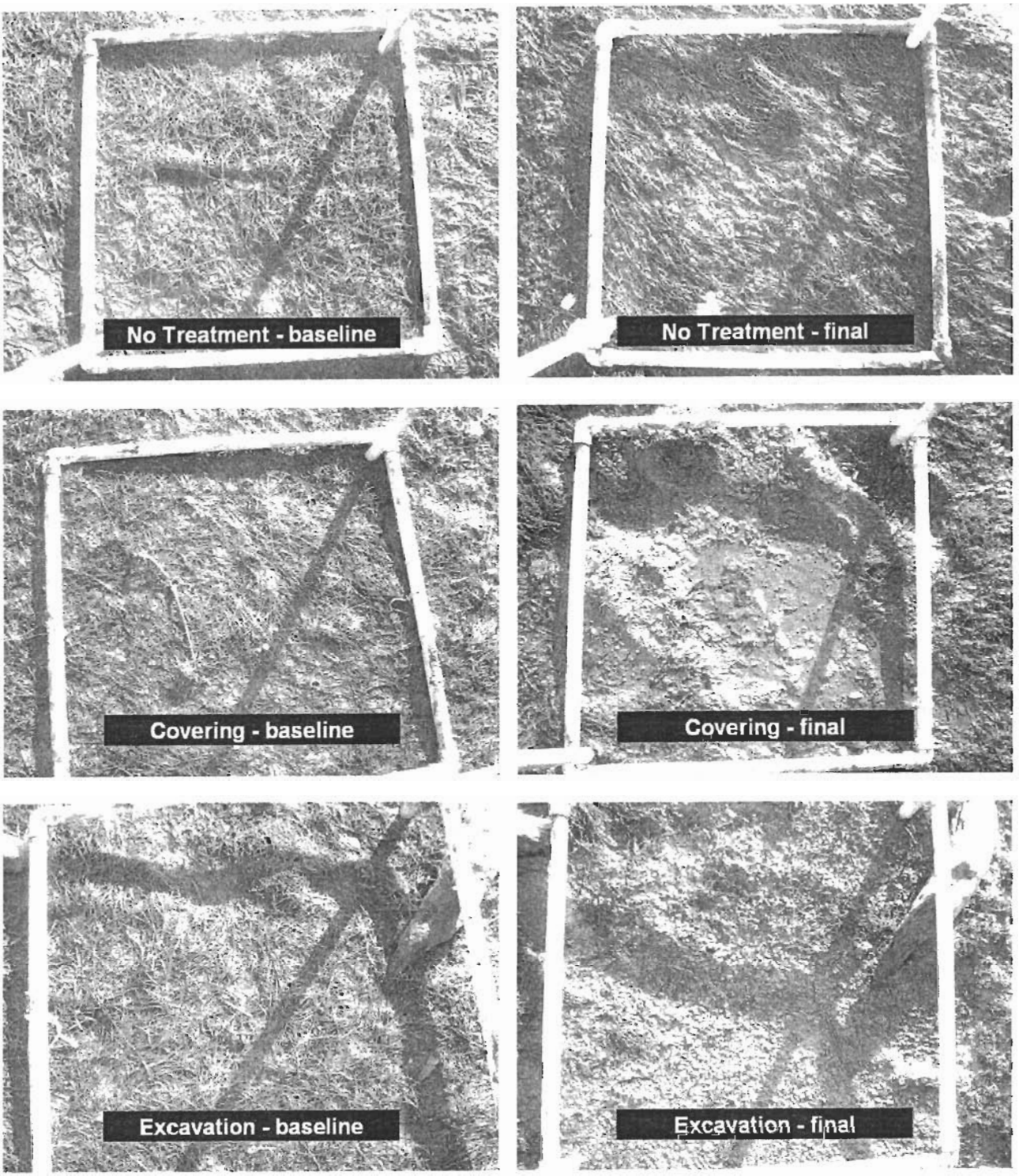

No Treatment - baseline
No Treatment - final
Covering - baseline
Covering - final
Excavation - baseline
Excavation - final

Table 2. Average percent cover before and after treatment and average percent change of *Zostera japonica*.

Treatment Type	***Average Percent Cover Before Treatment***	***Average Percent Cover after 2 months***	***Average Change in Cover***
Covering	68%	4%	-94%
Excavation	84%	3%	-96%
Flame – 1 min	58%	61%	5%
Flame – 5 min	85%	43%	-49%
Hot Water – 1 min	61%	10%	-84%
Hot Water – 5 min	58%	1%	-98%
Infrared – 1 min	58%	57%	-2%
Infrared – 5 min	77%	61%	-21%
No Treatment	74%	68%	-8%

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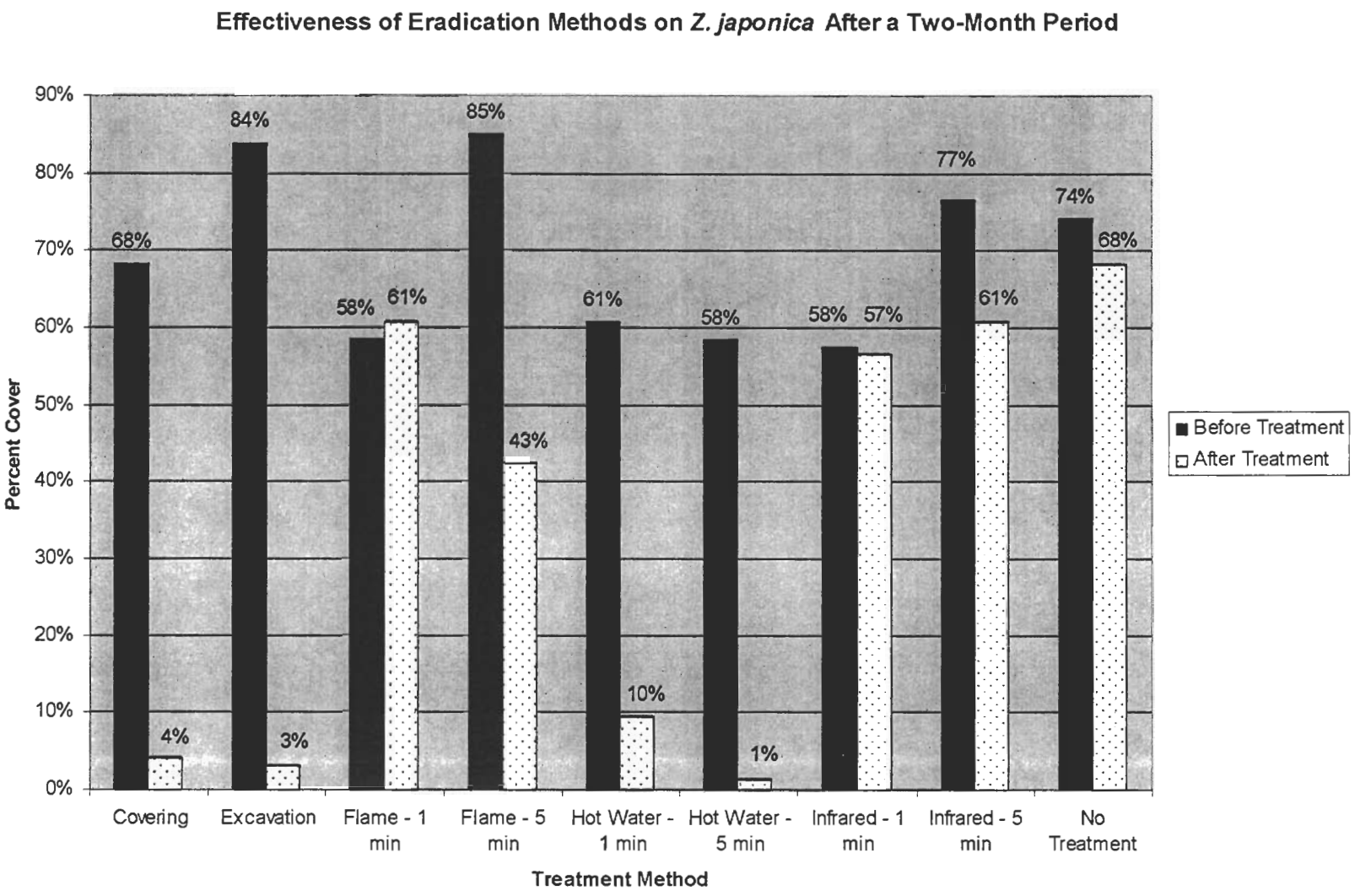

Figure 4. Covering, excavation, and the hot water treatments were the most effective at reducing the percent cover of *Zostera japonica*.