8.0 CAD ENGINEERING AND CONSTRUCTION

This section describes the basis for conceptual engineering for CAD disposal of Gloucester Harbor UDM and a description of potential construction sequencing associated with the implementation of the aquatic preferred alternative, as identified in this DEIR. Included in the discussion of the construction measures are the steps necessary to minimize negative environmental impacts associated with the disposal of UDM in the marine environment.

8.1 Conceptual Engineering

In order to evaluate the practicability of the preferred alternative, conceptual engineering of potential CAD pit aquatic disposal cells needed to be conducted. Inherent in this exercise is a set of assumptions based upon the level of data collected. The results of this exercise are not intended to provide a specific final design. The results of the conceptual engineering exercise are for illustrative purposes only, final CAD cell designs and specifics will be developed in the FEIR based upon detailed site specific information.

8.1.1 Planning Horizon UDM Volumes

To evaluate the phasing of UDM disposal for Gloucester Harbor over the DMMP's twenty year planning horizon, the volume of UDM identified in the dredging inventory was apportioned, as reported by the facilities, to the five (years 0-5), ten (years 6-10), fifteen (years 11-15) or twenty (years 16-20) year planning horizons. A contingency of 20% was added to the total UDM volume of 330,840 c.y. identified in the dredging inventory and distributed to the various planning horizons to determine the capacity necessary to dispose of UDM associated with dredging projects on a phased basis. An assumption was made that the five-year and ten-year horizons', UDM dredging volumes were more certain than the fifteen and twenty-year horizons' volumes. The contingency volume was distributed as 1/6 and 1/6 of the total contingency to five and ten year planning horizons and 1/3 and 1/3 to fifteen and twenty year planning horizons. Table 8-1 shows the planning horizon UDM volume total volumes.

Table 8-1: Planning Horizon UDM Volumes

DMMP Planning Horizon (Years Covered)	5 Year (0-5)	10 Year (6-10)	15 Year (11-15)	20 Year (16-20)	
UDM Identified in Inventory (c.y.)	150,505	117,000	4,195	4,000	275,700
Contingency Totals (c.y.)	9,190	9,190	18,380	18,380	55,140
Planning Horizon UDM Totals (c.y.)	***159,695***	***126,190***	***22,575***	***22,380***	***330,840***

Note: Contingency total distributed 1/6 & 1/6 to 5 and 10 year horizons and 1/3 & 1/3 to 15 and 20 year horizons

8.1.2 Cell Capacity Calculation

In order to contrast the planning horizon UDM volumes requiring disposal with the preferred alternative disposal sites identified in Section 4.0, site capacity calculations were conducted to determine the extent of the predicted disposal volumes occupying the preferred alternative disposal sites. The footprints of the preferred alternative disposal sites identified through the site screening process for Gloucester were used to determine the areal extent of the Cell Footprint. Assuming a 3 to 1 side slope within the disposal cell, the area of the Cell Bottom was calculated. ArcView Geographic Information System (GIS) software was used to determine the areas of the Cell Footprints and Cell Bottoms.

To calculate the Total Capacity for the disposal cells, volumes were determined by using an average end area calculation method. The Cell Footprints and Cell Bottom areas were averaged and then multiplied by the cell depth. Accounting for potential variability in both surface and depth to bedrock contours and limitations of existing data, five feet were subtracted from the average depth to bedrock determined for each site. This assumption resulted in a conservative value for cell depth. For conceptual engineering and planning purposes, the maximum capacity values take into account the variability of seafloor elevations and depth to bedrock to the extent practicable based upon the level of data available for the sites. The maximum cell capacities were then adjusted further to accommodate a three (3) foot thick cap. The cap volume was calculated by multiplying the Cell Footprint Area by three (3) feet. To determine the UDM Capacity for each cell, the cap volume calculated was subtracted from the maximum capacity value for each cell.

Table 8-2: Cell Capacity Calculation

	G-Cell-1	G-Cell-2	G-Cell-3	G-Cell-4
Cell Footprint (sq. ft.)	526,949	247,146	325,113	673,759
Cell Bottom Area (sq. ft.)	349,115	164,500	238,969	517,039
Average Depth to Bedrock (ft.)	20.9	18.0	18.4	19.6
Cell Depth (ft.)	15.9	13.0	13.4	14.6
Total Capacity (cy)	257,952	99,100	139,976	321,956
Cap Volume (cy)	58,550	27,461	36,124	74,862
UDM Capacity (cy)	***199,402***	***71,639***	***103,852***	***247,094***

Assumption:
Cell Depth = Average depth to bedrock - 5 feet (accounting for potential variability of seafloor and depth to bedrock)

8.1.3 Disposal Cell Phasing Scenario

The final phase of the conceptual engineering exercise is the contrasting of calculated cell UDM capacities with planning horizon UDM volumes to develop a potential cell phasing scenario. To account for possible additional UDM, an assumption was made that the footprints of G-Cell-1 and G-Cell-4 were UDM (three feet thick). This additional UDM, was subtracted from the UDM Capacity volume calculated above to determine an Adjusted UDM Capacity. Table 8-3 shows the results of this adjustment.

Table 8-3: Capacity Adjustment for potential UDM in Cell Footprints

	G-Cell-1	G-Cell-2	G-Cell-3	G-Cell-4
UDM Capacity (cy)	199,402	71,639	103,852	247,094
UDM Footprint Adjustment (cy)	58,550	0	0	74,862
Adjusted UDM Capacity (cy)	**140,852**	**71,639**	**103,852**	**172,232**

Table 8-4: Planning Horizon Volumes Disposal Cells can Accommodate

Disposal Cell	Planning Horizon
G-Cell-1	10, 15 & 20
G-Cell-2	15 & 20
G-Cell-3	15 & 20
G-Cell-4	5, 10, 15 & 20

By contrasting ability of each disposal cell to accommodate planning horizon UDM volumes with the adjusted UDM capacities (Table 4), the following potential phasing sequence was developed:

- ***G-Cell-4*** - Five Year Planning Horizon
- ***G-Cell-1*** - Ten Year Planning Horizon
- ***G-Cell-3*** - Fifteen Year Planning Horizon
- ***G-Cell-2*** - Twenty Year Planning Horizon

The locations and configurations of the disposal area cells for the preferred alternative are shown on Figure 8-1. The graphic indicates the cell footprint, cell bottom and side slope contours. In addition, a cell profile corresponding with Table 8-2 is also included on Figure 8-1.

Please note that for each five year phase, the DMMP is proposing that each CAD disposal cell be open for UDM disposal for <u>one</u> dredging season within each five year phase. The five year duration of each phase is intended to provide ample notice of availability of a disposal facility, providing facilities an opportunity to secure the necessary permits and funding to conduct dredging projects. This planned opening of a disposal facility on a regular basis should also provide opportunities for coordinating various harbor projects.

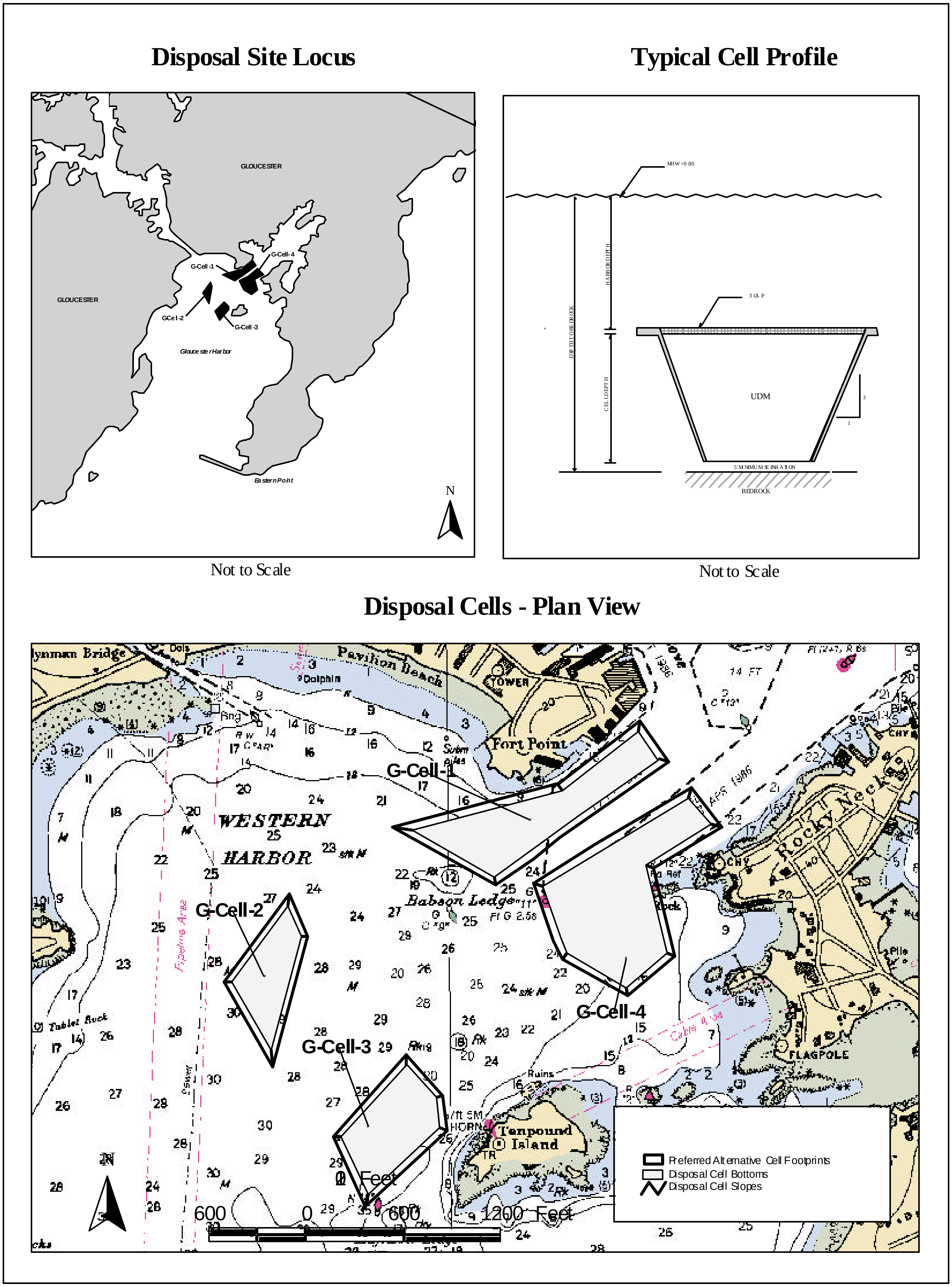

Figure 8-1: Conceptual engineering for Gloucester Harbor UDM disposal cells

8.1.4 Gloucester's Cell Phasing Preference

The results of the conceptual engineering exercise and the disposal cell phasing was presented to the City of Gloucester. The Dredging Subcommittee, see Appendix B, ranks the City's preference for use of the preferred alternative disposal cells as follows:

- ***G-Cell-4*** - Five Year Planning Horizon
- ***G-Cell-2*** - Ten Year Planning Horizon
- ***G-Cell-3*** - Fifteen Year Planning Horizon
- ***G-Cell-1*** - Twenty Year Planning Horizon

The proposed cell phasing scenario described above in Section 8.1.3, is based upon matching the projected volumes of UDM identified in the dredging inventory with the estimated cell capacities, based upon the current configurations. Both the DMMP's and the City's preference is to use G-Cell-4 to accommodate the UDM volume identified for the 5 year planning horizon, the planning horizon projection with the greatest level of confidence. As the DMMP moves into the 10, 15 and 20 year planning horizons, the level of confidence in the projections are less certain. The City's preferred approach will determine the design and location of the CAD cells as additional site specific data is developed and out-year disposal volumes are determined.

In the FEIR, detailed site specific data will be collected for the G-Cell sites. These data will be examined and revised cell capacities will be calculated based upon site-specific data and engineered designs. The results of the final design of the disposal cells will be determined by the City's cell phasing preference in developing the both the configuration of the final alternative disposal cell footprints and the phasing sequence proposed in the FEIR.

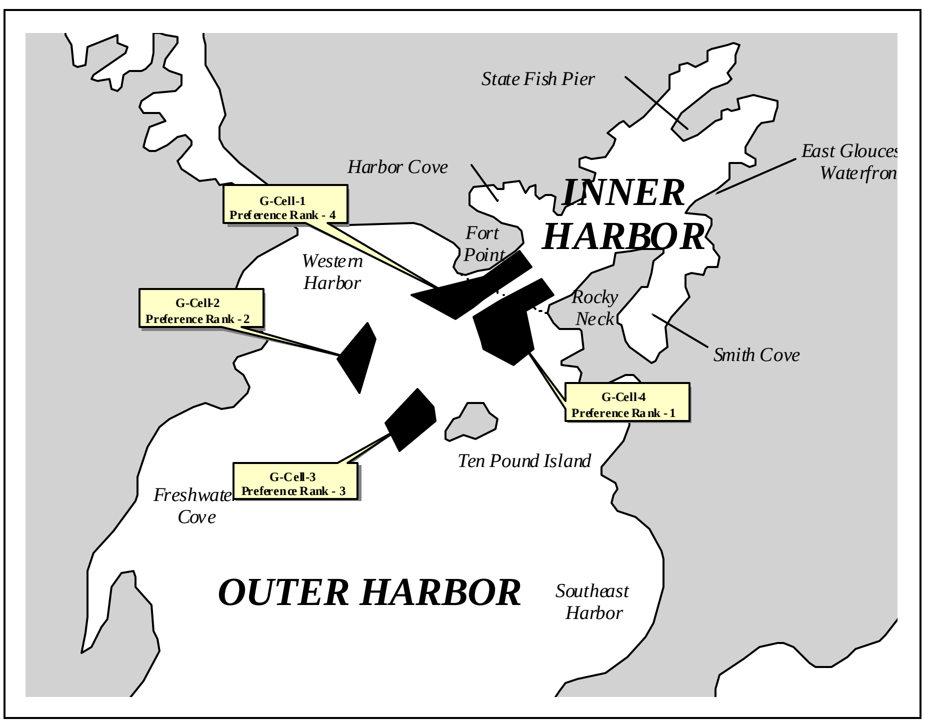

Figure 8-2: Disposal cell preferred ranking

8.2 CAD Cell Construction

8.2.1 Construction Sequencing

The general construction phasing proposed in this report is divided into four major steps: cell construction, UDM disposal, cell closure, and management. Prior to the commencement of dredging projects, the construction of the CAD disposal cell needs to be completed first. Dredging of the disposal cells will be completed during an environmentally favorable window to reduce the disturbance to marine life. Cell construction involves the following actions: conducting a pre-dredge survey, project mobilization, dredging the cell footprint, dredging to create cell capacity and final cell contouring. During this step, dredged material suitable for open ocean disposal would be taken to MBDS and UDM (if footprint material determined to be UDM) would be stockpiled for disposal in the cell being constructed.

To construct each cell, dredge limits and locations will be located by Geodetic Positioning System (GPS), which is a satellite positioning system, accurate to within a foot of the intended horizontal design limits. The dredge machinery will most likely be a large barge mounted crane with a clamshell bucket. Bucket size will likely be in excess of ten cubic yards. The material will be removed to the intended depth and side slopes. The Dredging contractor will also be compensated for an allowable over-dredge limit to ensure that the intended depths are achieved. The material is removed by a bucket and deposited within a transport barge called a scow. The scow will deliver the material to the Massachusetts Bay Disposal Site where it is positioned prior to dumping using GPS. A bottom dumping or split hull scow will most likely be used. These barges open from the bottom allowing the material to drop out through the water column to the seafloor below. This material is clean and will therefore not need to be capped.

Following the completion of the disposal cell, the dredging of UDM from the facilities in the Harbor will be completed by mechanical means, using siltation curtains to minimize turbidity impacts. After being dredged, the UDM will be placed on a dump scow and transported to the disposal cell, where the material will be deposited. If UDM from the footprint had been stockpiled, it would also be placed in the CAD disposal cell.

To close or "cap" the cell, clean material would be placed over the UDM to achieve a thickness of three (3) feet deep to sequester the UDM from the marine environment. By conducting a post capping survey, the need to perform final contouring or placement of additional cap material would be determined. The end result of the capping will be a surface that mimics the ambient seafloor elevations and pre-construction contours.

The final step in the cell construction process is management. To ensure long-term environmental protection, a CAD cell monitoring plan would be implemented. A proposed monitoring plan for consideration is described in Section 9.0. The CAD aquatic disposal cell construction management sequence is illustrated in Figure 8-3.

CELL CONSTRUCTION/MANAGEMENT SEQUENCE

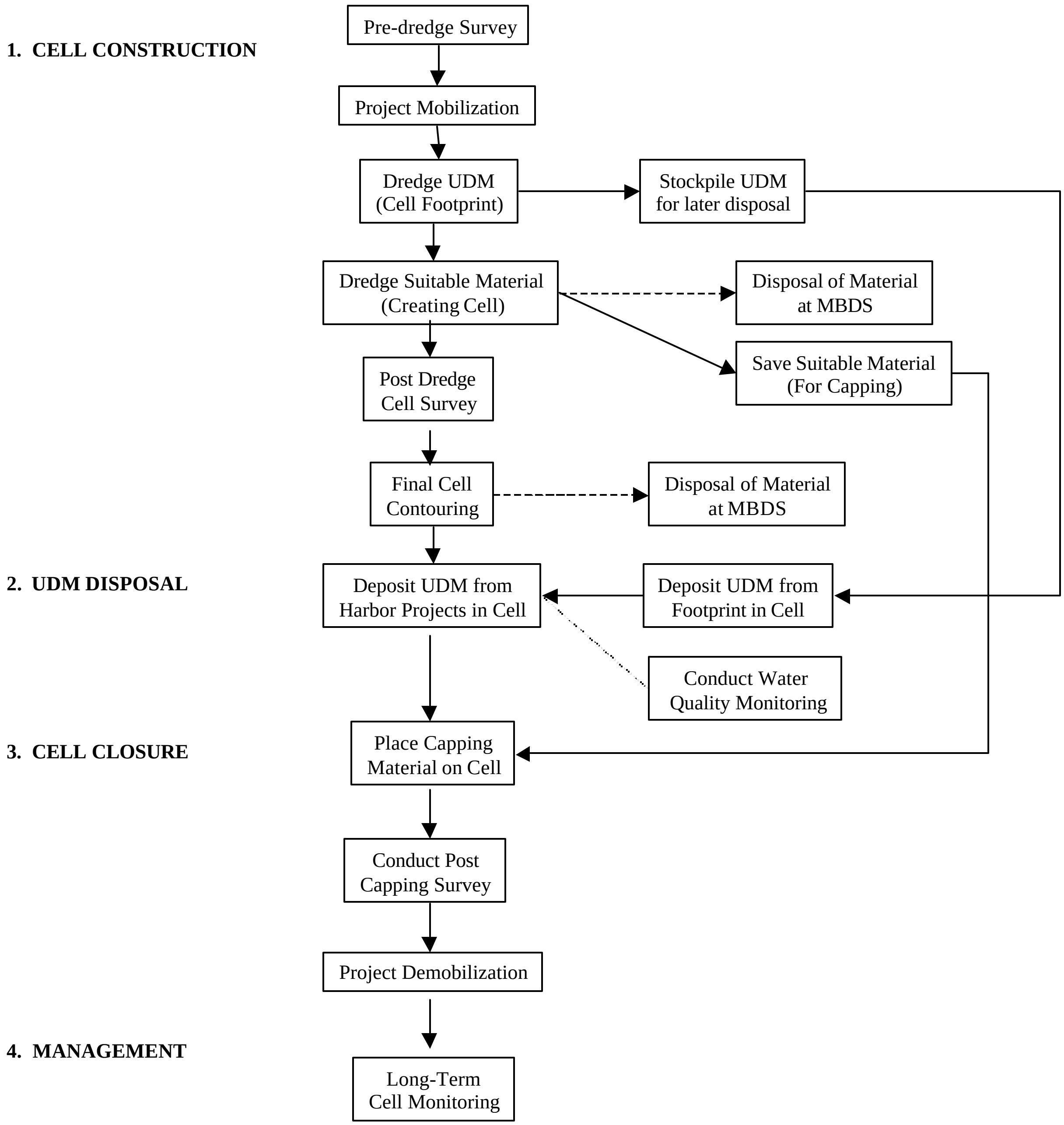

Figure 8-3: Aquatic disposal cell construction management sequence

8.3 CAD Cell Best Management Practices

MCZM is developing Best Management Practices (BMPs) for CAD of UDM in Gloucester Harbor based on the experiences and data from the Boston Harbor Navigation Improvement Project (BHNIP). The BMPs will be developed to be applicable as 1) stand alone guidelines, 2) the basis for new dredged material disposal regulations, and 3) the basis for site management recommendations in the DMMP FEIR. The BMPs will be developed to meet state and federal water quality criteria and standards under CWA s. 404, 314 CMR 9.00, other applicable regulations.

The BMPs will be designed to be effective regulatory tools, where ‘effective’ means:

- Appropriately protective of resources and uses;
- Cost-effective;
- Yield unambiguous results to the maximum extent practicable;
- Contribute directly to performance review (decision-making); and
- Applicable by non-specialist regulatory agency staff.

MCZM is also developing a model Water Quality Certificate (WQC) building upon the experiences of the BHNIP. This WQC will be applicable to future CAD projects for UDM. The WQC will include provisions for baseline monitoring and monitoring both during and post construction. Both the CAD BMPs and model WQC are being developed with input and participation of applicable state and federal agencies.