APPENDIX B

Crosswalk between the Vermont Phase 1 Implementation Plan and EPA's BMP scenario identifying achievable phosphorus reductions

This document includes the following information:

1) A description of the level and type of BMPs simulated in the TMDL Scenario, presented in the form of a matrix with some additional text explanation;
2) References to where in the Phase 1 Implementation Plan or Vermont's Act 64 are the bases for the level and types of BMPs simulated; and
3) The estimated phosphorus reductions from the scenario used by EPA to determine what level of reductions was achievable in each watershed.

A matrix summarizing the level of BMP implementation simulated in the Scenario Tool (USEPA, 2016) for each phosphorus source sector is included near the end of this appendix (Table B1). The basis in the Phase 1 Plan for the type and level of BMP implementation entered into the Scenario Tool to estimate phosphorus reductions is described for each sector below. A summary of the resulting phosphorus reductions generated by the Scenario Tool for each lake segment watershed (Table B2) is included just below Table B1.

<u>Developed Lands</u>

The Phase 1 Implementation Plan (and Act 64, the new Vermont Clean Water Act) establishes several new permit programs that will require retrofits to reduce loadings from existing developed lands.

Roads

One permit program will address loads from all municipal roads, and another permit program will address loads from all state roads. The road permit programs will require retrofits to "achieve the necessary level of pollutant reduction to meet TMDL targets." For municipal roads, the Phase 1 Plan further indicates that the permit will require a management plan that will design BMP requirements that take into account factors such as hydrologic connectivity (via surface water flow) to waterbodies. The permit for state roads will similarly require development of a management plan specifying the type and extent of BMPs needed. Given these provisions in the Phase 1 Plan, EPA simulated the effect of retrofitting 65% of hydrologically connected portions of unpaved roads (a subset of the roads to be addressed by the municipal roads permit) in all lake segment watersheds other than Missisquoi Bay and South Lake B. For Missisquoi Bay and South Lake B watersheds, EPA simulated the effect of retrofitting 100% and 85% respectively of hydrologically connected unpaved road segments, as greater overall reduction is needed in these lake segment watersheds. For paved roads, in all lake segment watersheds other than Missisquoi Bay and South Lake B, EPA simulated surface infiltration retrofits to 25% of paved roads on A and B soils assuming treatment for a 0.5 inch runoff depth, which is a moderate level of retrofits considered well within the range of effort anticipated for the roads permit programs. Note that while paved roads over C soils were not included in this simulation, these roads could certainly be part of the phosphorus reduction strategy developed in response to the new roads permits, where opportunities are identified. For South Lake B, EPA simulated retrofits to 25% of paved roads on A and B soils (using the surface infiltration practice), and assumed a runoff depth of 0.9 inches. For Missisquoi Bay, EPA simulated retrofits to 50% of paved roads on A and B soils (using the surface infiltration practice) assuming a 0.9 inch runoff depth, and retrofits to 25% of paved roads over C soils (using the gravel wetland practice) assuming a 0.5 inch runoff depth, as greater phosphorus reductions are needed in this lake segment watershed. The Phase 1 Implementation Plan's statement that both road permit programs will "achieve the necessary level of pollutant reduction to meet TMDL targets" provides assurance that phosphorus load reductions equivalent to this level of retrofits will be required by the permit.

Non-road impervious

The existing developed lands general permit included in the Phase 1 Implementation Plan will require retrofits to all existing impervious surface parcels 3 acres or greater, and can include smaller parcels as needed to meet the TMDL allocations. Initial analyses indicate that the 3 acre and greater parcel universe specified in the Phase 1 Plan (and Act 64) represents about 13% of the non-road impervious surface (Tetra Tech, 2015e). This level of retrofits aligns well with the 13% of non-road impervious area simulated for retrofits in the Scenario Tool for the following lake segment watersheds: Otter Creek, Main Lake, Shelburne Bay, Burlington Bay, Mallets Bay, and St. Albans Bay. The following small direct drainage lake segment watersheds contain very little non-road impervious area and contain very few (if any) parcels that meet the 3 acre parcel definition in Act 64 and the Phase 1 Plan: Isle LaMotte, Northeast Arm, Port Henry, and South Lake A. Accordingly, EPA did not simulate any non-road impervious cover retrofits for these segments, and the developed land WLAs for these segments were set at a level that would require retrofits to reduce only the amount of phosphorus projected to be generated by new growth – a level significantly less than that equivalent to retrofitting 13% of impervious area in all cases. For South Lake B and Missisquoi Bay, EPA simulated a higher level of impervious area retrofits, as more overall reductions are needed in those lake segment watersheds. EPA simulated retrofits to 25% of impervious area in the South Lake B watershed and 60% for Missisquoi Bay, on A, B, and C soils, and assumed treatment of the 0.9 inch runoff depth. While this level of reduction will likely require retrofits of parcels smaller than 3 acres, Act 64 directs the VTANR to require permits (and retrofits) for any size impervious parcel needed to achieve the wasteload allocation of a TMDL, and directs the agency to require permits for stormshed areas (more densely developed areas outside MS4 areas) as needed as well. Note that the State also has the option of adjusting the amount of reductions needed through any individual permit program as long as the total reductions achieved across all stormwater permit programs results in the developed land wasteload allocations being met. As an example, the State could choose to achieve more reductions than EPA simulated from the permit programs that address paved roads, by choosing to include retrofit requirements for some road segments over C or D soils.

Agricultural Land

For all lake segment watersheds other than Missisquoi Bay, South Lake B, and South Lake A, EPA simulated reductions from agricultural land using the following suite of practices and levels of treatment,referred to here as the Enhanced BMP Scenario:.

1. Non-clay soils: the combination of cover crops, conservation tillage, grassed waterways, ditch buffers, and riparian buffers applied to 80% of cropland in continuous corn and corn-hay on A, B, and C soils.

2. Non-clay and clay soils: riparian buffer applied to 80% of hay areas.

3. Non-clay and clay soils: livestock exclusion and riparian buffer applied to 80% of pasture lands.

4. Clay soils: cover crops, conservations tillage, grassed waterways, ditch buffers and riparian buffers applied to 40% of corn and corn-hay cropland.

5. Clay soils: changes in crop rotation, grassed waterways, ditch buffers, and riparian buffers applied to another 40% of corn and corn-hay cropland.

6. Barnyard management applied to 90% of farmsteads.

For South Lake A, EPA simulated reductions from agricultural land using the Enhanced BMP Scenario described above, except for the following differences:

1. The suite of practices described in item 1 were applied to 100% of cropland (instead of 80%) in corn-hay rotation on C soils.

2. For clay soils, ditch buffer was applied (instead of the riparian buffer) to 85% of continuous hay areas.

3. Reduced P manure practice was applied to 75% of corn-hay rotation on clay soils.

For South Lake B, EPA simulated reductions from agricultural land using the following suite of practices and levels of treatment:

1. Cover crops, conservation tillage, grassed waterways, ditch buffer, and riparian buffer to 100% of cropland in continuous corn and corn-hay rotation on non-clay soils, and 40% of cropland in continuous corn and corn-hay rotation on clay soils. For another 40% of cropland in continuous corn and corn-hay rotation on clay soils: change in crop rotation, grassed waterways, ditch buffer and riparian buffer.

2. For A and B soils, riparian buffer applied to 80% of continuous hay with greater than 5% slope. For C and D soils, ditch buffer applied to 80% of continuous hay.

3. For all soils, livestock exclusion and riparian buffer applied to 80% of pasture.

4. For clay soils, conversion of cropland to continuous hay for 20% of corn and corn-hay rotation on 5-10% slopes.

5. Reduced P manure applied to 75% of corn and corn-hay rotation on all soils.

6. Barnyard management applied to 90% of farmsteads.

For Missisquoi Bay, EPA simulated phosphorus reductions from agricultural land using the following suite of practices and treatment levels:

1 For non-clay soils, cover crops, conservation tillage, grassed waterways, ditch buffer and riparian buffer to 100% of cropland in continuous corn and corn-hay rotation on A and B soils – this same combination of practices was applied to C soils except that for cropland in continuous corn, enhanced ditch buffers (25' wide) were substituted for ditch buffers (10' wide).

2. For A, B and D soils, riparian buffer applied to 100% of continuous hay. For C soils, riparian buffer and ditch buffer applied to 100% of continuous hay.[1]

3. For all soils, livestock exclusion and riparian buffer applied to 100% of pasture.

4. For clay soils, cover crops, conservation tillage, grassed waterways, enhanced ditch buffer, and riparian buffer applied to 100% of cropland in corn and corn-hay rotation.

5. Reduced P manure applied to 100% of corn and corn-hay rotations on all soils.

6. Barnyard management applied to 90% of farmsteads.

Definitions of these practices and explanations of the phosphorus reduction efficiency selected are included in Tetra Tech (2015c).

Linkage of the simulated agricultural practices to the Phase 1 Implementation Plan and Act 64

The Phase 1 Implementation Plan and Act 64 include a suite of new required agricultural practices ("RAPs"), including 10 foot ditch buffers, 25 foot ditch buffers where needed, 25 foot

[1] Because the scenario tool does not include the combined ditch and riparian buffer BMP system for hayland, EPA calculated the effects of this practice combination outside of the Scenario Tool using the same method built into the scenario tool for the other practice combinations. The reductions were then factored into the total agricultural phosphorus reduction for Missisquoi Bay entered into the Lake Model spreadsheet (VT DEC and US EPA, 2016).

riparian buffers, gully erosion control, livestock exclusion from waterways, and reduced field soil loss tolerance. The ditch buffer and riparian buffer practices were directly plugged into the scenario tool, assuming application to either 80% or 100% of cropland fields as indicated above. The livestock exclusion practice was also directly entered into the scenario tool, assuming application to either 80% or 100% of pasture land (as indicated above), based on the provision in the Phase 1 Plan and Act 64 that requires livestock exclusion to prevent erosion and adverse water quality impacts. The Phase 1 Plan indicates this provision will address a "major portion" of the phosphorus load associated with livestock access to streams. EPA represented this major portion in the scenario run by applying livestock exclusion to 80% of applicable areas in all watersheds except Missisquoi Bay. The effect of the new gully erosion requirement in the Phase 1 Plan (and effectively required by Act 64 through the new soil loss tolerance requirement) was simulated with application of the grassed waterways practice to 80% of cropland. While grassed waterways are sometimes used to stabilize fields and prevent gully erosion, the soil loss tolerance requirement in Act 64 will often translate to requirements for more elaborate stabilization practices that will control phosphorus runoff more effectively than grassed waterways. So the use of grassed waterways in this context is a conservative assumption. The reduced field erosion tolerance to "1T", is a new more stringent requirement pertaining to the amount of soil allowed to erode off fields. With the combination of Agency of Agriculture large and medium farm operation permits, Act 64, and the proposed RAPs, detailed nutrient management plans are now required for all but the very smallest dairy operations. Conservation tillage, cover crops, changes in crop rotation, and reduced P manure are examples of practices that are typically specified for applicable areas in nutrient management plans. Nutrient management (including compliance with soil loss stipulations) is already required under the existing Accepted Agricultural Practices, and these provisions have been strengthened in the proposed RAPs. For most watersheds, as indicated above, EPA simulated the use of cover crops and conservation tillage on 80% of the cropland in non-clay soils, and 40% of the cropland in clay soils (where these practices are more difficult to implement) to estimate the effect of these new requirements. The crop to hay practice was simulated on a very small percentage of fields (just 20% of those on clay soils with slopes above 5%, and only in the South Lake B watershed) as an important practice that will occasionally be needed (depending on site conditions) to comply with the new erosion control requirements. Lastly, EPA simulated the effect of runoff from 90% of barnyards (also referred to as farmsteads) being better managed. The basis for this practice is in several sections of the Phase 1 Plan and in Act 64, as well as in the existing AAPs. The new certification requirement for small farms, combined with small farm inspections, is expected to result in much greater compliance with existing elements of the AAPs that address barnyard management. In addition, the medium farm operation permit program, which was implemented toward the end of the TMDL modeling period (2001-2010), requires the barnyard management practice as part of permit compliance. EPA (in consultation with federal NRCS and VTAAFM staff in VT) interpreted the combination of these requirements to result in approximately 90% of barnyards being managed in accordance with the RAPs between the TMDL modeling period and the end of the TMDL implementation period.

The increased level of BMP implementation simulated in the Missisquoi Bay watershed (as enumerated above) is supported by a February 3, 2016 decision by the VT Secretary of Agriculture resulting from a settlement with CLF (VAAFM, 2016). In the decision, the Secretary determined that BMPs (above and beyond the RAPs) are generally needed on all farms in the

Missisquoi watershed to achieve water quality standards. The additional type or extent of practices simulated in the Missisquoi watershed (including expanded buffers and livestock exclusion) are among the examples of BMPs covered by the Secretary's decision.

The assumptions and calculations used to estimate the phosphorus load reductions from the practices simulated in the Scenario Tool are described in Tetra Tech (2015c).

Stream Corridors

As described in Tetra Tech (2015c), phosphorus reduction from streambank erosion was simulated by comparing the present load from eroding stream reaches with the estimated load associated with these same reaches once they are brought back to the more stable, equilibrium condition. For all lake segment watersheds other than Missisquoi Bay (where the restoration of all stream reaches was simulated), EPA simulated the effects of restoring eroding reaches above either the 25th or the 50th phosphorus loading percentile.

Linkage to the Phase 1 Plan

The basis for the simulation of restoration of eroding reaches at both these levels is in existing regulations and the commitments to stream corridor protection and restoration in the Phase 1 Plan. The Plan includes numerous measures that will enhance the natural evolution of unstable stream systems to the equilibrium condition, including floodplain protection and improved regulation of stream alterations.

The streambank source is unique in that loads are expected to decrease over time even without significant additional interventions, due to natural stream evolution processes. Therefore, the reasonable assurance measures are focused on actions designed to speed up these natural processes rather than on actions essential to achieving the reductions. In this case, the strong body of scientific data assembled by the State's geomorphic assessment program provides the assurance that most eroding stream reaches will eventually become stable if humans do not continue to further stress these systems with additional floodplain encroachments,etc. This is why the State's regulations that are designed to protect floodplains from further development and guard against stream channel alterations are part of the reasonable assurance provisions. There are also new regulatory measures in Act 64 and the Phase 1 Implementation Plan that will speed up the transition of stream reaches to a more stable condition. Examples include the riparian buffer and livestock exclusion requirements to be included in the new RAPs. Both the 25 foot buffer requirement for agricultural lands and the livestock exclusion requirement will lead to more stable (well vegetated) streambanks and eliminate erosion caused by livestock trampling. In addition, the State's recently revised stream alteration regulations require that failed culverts be replaced typically with larger structures, meeting design requirements and performance standards that will minimize channel erosion – this is another requirement that will speed the transition to more stable channel conditions.

In Missisquoi Bay, EPA simulated the restoration of all reaches in the watershed. EPA concluded that all reaches in the Bay watershed were in need of restoration/stabilization because an analysis of stream evolution stage of each reach indicated that virtually all reaches were in an unstable evolution stage and not yet at equilibrium conditions (Tetra Tech, 2015c). The State included additional stream corridor restoration commitments (in addition to those discussed above) specific to Missisquoi Bay in the Phase 1 Implementation Plan. For Missisquoi Bay, the Plan indicates that, in addition to the measures that apply state-wide, the State will: 1) put extra resources/effort into identification of opportunities for re-establishing connections to floodplains, and working with landowners to make these reconnections happen; and 2) invest extra resources/effort into identification of opportunities where active intervention in bank erosion processes could be most effective, and then implement practices as further described in Chapter 5, Section J of the revised Phase 1 Implementation Plan.

The assumptions and calculations used to estimate the phosphorus load reductions from the practices simulated in the Scenario Tool are described in Tetra Tech (2015c).

Forest land

EPA simulated a phosphorus reduction of 5% from forests in all lake segment watersheds other than South Lake B and Missisquoi Bay. It has been well documented that the primary sources of sediment/phosphorus export within the forest land sector are forest roads and harvest areas. The Phase 1 Plan specifies revisions to the accepted management practices (AMPs), which are required practices for forest activities on most forest land. The revisions include practices that require improved erosion control at forest roads and water crossings to avoid water quality impacts. The literature reports significant phosphorus reduction efficiencies for these types of practices (see discussion below on South Lake B and Missisquoi Bay); the 5% reduction assumed by EPA is easily supported by these measures.

For the South Lake B and Missisquoi Bay lake segment watersheds, where more overall phosphorus reduction is necessary, EPA took a close look at the break-down of this load among sub-categories within the forest sector, and then at the effectiveness of forest management practices to address these sources. Once the potential reduction amounts were estimated for each watershed, EPA looked to commitments in the Phase 1 Plan to ensure that the needed BMPs were specified for these watersheds. The details of this analysis are described below for both of these lake segment watersheds. More detail is included here for this forest sector analysis than for the other source sectors (such as agriculture and stream corridors) because this analysis was conducted after the Tetra Tech (2015c) report was completed. The Tetra Tech report includes the details of the how the reduction efficiencies were derived and applied for the other source sectors.

South Lake B: Partitioning forest phosphorus loads, and estimating achievable phosphorus reductions

The SWAT model developed for the Lake Champlain TMDLs by Tetra Tech (2015b) provided estimates of the total load from the forest sector in each lake segment watershed, but was not able to partition this total load into the forest sub-categories of forest roads (primarily truck roads, skidder/forwarder trails, and log landings) and non-road forest areas. The Total P base load from forests in the South Lake B watershed, estimated by the SWAT model = 16,345 kg/yr.

The total area of forestland in the South Lake B watershed is 44,985 ha. Based on Gucinsky et al. (2001), it was assumed that 4.5% of the total forest area is made up of some type of forest road. Applying 4.5% to 44,985 ha yields 2,024 ha in forest roads. Using the same loading rate used for unpaved roads in the TMDL analysis for the South Lake B watershed (derived from Wemple, 2013 and consistent with sediment loading rates measured from a variety of forest road types by Brown et al., 2013 and Sawyers et al, 2012), a phosphorus load from roads was calculated as follows: 2,024 ha x 5.6 kg/ha/yr = 11,334 kg/yr. Given that forest roads and skid trails make up much of the disturbed surface area within harvest areas, no additional phosphorus load was calculated for harvest areas beyond the total forest road load.

It is expected that some level of BMP implementation was in place prior to the TMDL modeling period, as the original version of the AMPs came out in 1987. While data on compliance with all forest AMPs prior to the TMDL modeling period is not available, the 1990 timber harvesting assessment (VT Department of Forests, Parks and Recreation, 1990) found that water quality was not impacted by stream crossings in 27% of study sites. Based on this finding, for this analysis AMP compliance was considered to be in place for at least 27% of the forest road acreage prior to the TMDL modeling period. The total load from forest roads was adjusted down to 8,733 kg/yr to take this into account, assuming that fully effective practices were already in place for 27% of the 11,334 kg/yr [11,334 kg/yr x 0.27 = 3,060 kg/yr; 11,334 kg/yr – 3,060 = 8,274 kg/yr]. The phosphorus load from non-road forest areas was calculated by subtracting the adjusted forest road load of 8,733 kg/yr from the total forest base load: 16,345 kg/yr – 8,274 kg/yr = 8,071 kg/yr.

The next step was to estimate reductions achievable from the forest roads portion, as the literature is clear that forest roads contribute the bulk of the sediment and phosphorus loading to waterbodies from forests. The few controlled watershed studies in forested watersheds that measured the effectiveness of BMPs on phosphorus reduction have found that a comprehensive application of forest management BMPs to harvest areas has resulted in an 85 – 86% reduction of phosphorus loads from these areas (Edwards and Williard, 2010). Comparable controlled watershed studies have not been conducted specifically to evaluate the effectiveness of the combined effects of multiple forest road BMPs. However, a number of studies have measured the effectiveness of individual forest road BMPs, and many of these BMPs were found to achieve similar reduction efficiencies to the harvest area BMPs. While most of these studies evaluated sediment reductions rather than nutrients, studies that have assessed the effectiveness of both sediment and phosphorus have found a high correlation between the two (Wynn et al., 2001; Arthur et al., 1998). As reported in a synthesis compiled by Edwards et al. (2015), Witt et al. (2011) found an 84% efficiency for portable bridges and a 77% efficiency for temporary culverts. The efficiencies of forest buffers between forest roads and waterbodies have not been well studied, but Packer (1967) calculated that forest buffers from 9 to 46 meters could retain 85% of sediment flows from cross drains. Damian (2003) found broad-based dips at approaches to water crossings to be 50% effective in modeling studies. The combined efficiencies would be higher than the individual BMP efficiencies, so an overall efficiency of 85% (consistent with Edwards and Williard, 2010) was used in the TMDL analysis for forest roads.

Applying the 85% efficiency rate to the 8,274 kg/yr from forest roads (the load coming from the portion of forest roads assumed not already in compliance with key AMPs prior to the TMDL modeling period, as described above) reduces the load to 1,241 kg/yr. Combined with the non-road forest area (8,071 kg/yr), the total post-BMP load from the forested portion of the South Lake B watershed would be 9,312 kg/yr, which is a 43% reduction from the total original baseload of 16,345 kg/yr. In the Scenario Tool, a 40% reduction level was selected, as this was the closest reduction level available to choose in the Tool.

Missisquoi Bay: Partitioning forest phosphorus loads and estimating achievable phosphorus reductions

The same procedure was applied to the total forest load in the Missisquoi watershed, starting with the overall existing source load of 22,222 kg/yr coming from 118,441 ha of forest. A slightly lower area percentage for forest roads of 4% (which is the low end of the range cited in Gucinsky et al., 2001) was used to add conservatism to the calculation, yielding a total forest road load of 17,292 kg/yr, following the adjustment to reflect the 27% BMP implementation rate prior to the modeling period. The existing load was apportioned among forest road and non-road forest areas as described for the South Lake B watershed (22,222 kg/yr – 17,292 kg/yr), resulting in a non-road forest area load of 4,930 kg/yr. Applying the same BMP reduction efficiency (85%) to the forest road load of 17,292 kg/yr yielded an overall percent reduction of 66% [17,292 kg/yr x .85 reduction = 2594 kg/yr; 2594 kg/yr + 4,930 kg/yr (non-road forest load) = 7,524 kg/yr; 22,222 kg/yr to 7,524 kg/yr equals a 66% reduction]. For conservative purposes, a 50% reduction level was selected in the Scenario Tool.

Examples of BMPs employed/simulated

BMPs used in the controlled watershed projects to achieve the 85% reduction from skid trails and log landings included: streamside buffer strips (at least 15 meters wide), minimization of road building impacts, use of water control structures (such as water bars) to divert water from skid trails to areas of undisturbed litter, seeding log landings with grass until replanting, and retirement of roads and skid trails after logging. Based on the literature synthesis prepared by Edwards et al. (2015), practices expected to achieve the 85% reduction from forest roads more broadly, when applied as part of a comprehensive forest road BMP program, include: portable bridges, temporary culverts, forest buffers, and properly constructed water control structures.

Linkage to the Phase 1 Plan

The revisions to the AMPs will require more effective use of water control structures on skid trails and truck roads, improved mulching and seeding procedures following soil disturbance, improvements to the forest buffer strip requirements (which are a minimum of 50 ft, and hence well aligned with the 15 m buffer width referenced above), temporary culvert requirements, and a number of more stringent standards pertaining to stream crossings and forest roads approaching stream crossings. The AMPs are required for about 60% of the forest land in Vermont – land that is in the current use program, forest legacy program, or under state or federal ownership. The Phase 1 Plan notes that the percentage of forest land in these categories is continuing to rise, so significantly more than 60% of forest land will be subject to mandatory AMPs over the next decade. In addition, the Phase 1 Plan indicates the State's portable bridge program (which provides portable skidder bridges to loggers) now has the capacity to cover the needs of the entire Missisquoi Bay watershed, and the State is increasing the capacity for other watersheds such as South Lake B. The State has also commenced an innovative LIDAR-based effort to identify erosion sites at abandoned forest roads, and prioritize these areas for restoration funding through NRCS or other sources. The program is being piloted in the Missisquoi watershed. The State is also committing two foresters to focus on the Missisquoi Bay watershed to conduct outreach on the new funding opportunities for BMPs supported through USDA's Regional Conservation Partnership Program. This suite of new or improved forest management requirements or initiatives includes many of the practices found to be 85% effective either individually or as part of a comprehensive forest BMP program. It is also important to keep in mind that a good portion of the 85% reduction has likely already been achieved, as improved AMP compliance rates since 2001 (VT Department of Forest, Parks and Recreation, 2014) count toward this overall 85% reduction.

Wastewater Treatment Facilities

The wastewater treatment facility loads used in the TMDL scenario were summed by lake segment watershed, based on the allocations proposed for each facility. The loads were calculated at design flow using effluent concentration limits described in the TMDL document and summarized in Table B1.

Table B1. Description of BMP level used in the scenario supporting the TMDL allocations

Lake Segment	Waste water	Developed Land	Back Roads*	Forest	Streams	Ag Prod. Areas	Agriculture**
1. South Lake B	Currently permitted loads	Retrofit treatment to 25% of non-road impervious cover (A, B and C soils), 25% of paved roads treated (A and B soils), all using the 0.9 inch runoff depth. Infiltration practice for A & B soils; wet ponds for C soils.	Treatment of 85% of hydrologically connected unpaved roads	40% reduction from forest land based on focused AMP impl. + measures as described in text	Streambank erosion control (management to the equilibrium condition) for reaches above the 25th percentile P loading level	80% reduction based on barnyard management BMP	see description in text Assoc. P reduction: 63%
2. South Lake A	Currently permitted loads	Retrofits for 25% of paved roads on A and B soils using infiltration practice and 0.5 inch runoff depth, Retrofits for non-road impervious cover would apply only to the amount of impervious area needed to account for the future growth allocation	Treatment of 65% of hydrologically connected unpaved roads	5% reduction from forest land – see text	N/A	80% reduction based on barnyard management BMP	see description in text Assoc. P reduction: 65%
3. Port Henry	Currently permitted loads	Retrofits for 25% of paved roads on A and B soils, using infiltration practice and 0.5 inch runoff depth. Retrofits for non-road impervious cover would apply only to the amount of impervious area needed to account for the future growth allocation	Treatment of 65% of hydrologically connected unpaved roads	5% reduction from forest land – see text	N/A	80% reduction based on barnyard management BMP	Enhanced BMP scenario (see description in text) Assoc. P reduction: 70%
4. Otter Creek	Currently permitted loads	Retrofit treatment for 13% of non-road impervious area, and 25% of paved roads on A and B soils, using infiltration practice and 0.5 in runoff depth	Treatment of 65% of hydrologically connected unpaved roads	5% reduction from forest land – see text	Streambank erosion control (or management to the equilibrium condition) only for eroding reaches above the 50th percentile P loading level	80% reduction based on barnyard management BMP	Enhanced BMP scenario (see description in text) Assoc. P reduction: 55%

5. Main Lake	Annual load limits calculated at 0.2/0.8 mg/L	Retrofit treatment for 13% of non-road impervious area and 25% of paved roads on A and B soils, using infiltration practice and 0.5 in runoff depth	Treatment of 65% of hydrologically connected unpaved roads	5% reduction from forest land – see text	Streambank erosion control (or management to the equilibrium condition) only for eroding reaches above the 50th percentile P loading level	80% reduction based on barnyard management BMP	Enhanced BMP scenario (see description in text) Assoc. P reduction: 56%
6. Shelburne Bay	Annual load limits calculated at 0.2/0.8 mg/L	Retrofit treatment for 13% of non-road impervious area, and 25% of paved roads on A and B soils, using infiltration practice and 0.5 in runoff depth	Treatment of 65% of hydrologically connected unpaved roads	5% reduction from forest land – see text	Streambank erosion control (or management to the equilibrium condition) for eroding reaches above the 25th percentile P loading level	80% reduction based on barnyard management BMP	Enhanced BMP scenario (see description in text) Assoc. P reduction: 61%
7. Burlington Bay	Annual load limits calculated at 0.2/0.8 mg/L	Retrofit treatment for 13% of non-road impervious area in both CSO and direct drainage areas, and 25% of paved roads on A and B soils, using infiltration practice and 0.5 in runoff depth	Treatment of 65% of hydrologically connected unpaved roads	N/A	N/A	N/A	N/A
9. Malletts Bay	Currently permitted loads	Stormwater retrofits for 13% of non-road impervious area on A and B soils, and 25% of paved roads on A and B soils. All using infiltration practice and the 0.5 inch runoff depth	Treatment of 65% of hydrologically connected unpaved roads	5% reduction from forest land – see text	Streambank erosion control (or management to the equilibrium condition) only for eroding reaches above the 50th percentile P loading level	80% reduction based on barnyard management BMP	Enhanced BMP scenario (see description in text) Assoc. P reduction: 55%
10. Northeast Arm	Currently permitted loads	Retrofits for 25% of paved roads on A and B soils using infiltration practice and the 0.5 inch runoff depth. Retrofits for non-road impervious cover would apply only to the amount of impervious area needed to account for the future growth allocation	Treatment of 65% of hydrologically connected unpaved roads	5% reduction from forest land – see text	N/A	80% reduction based on barnyard management BMP	Enhanced BMP scenario (see description in text) Assoc. P reduction: 64%

11. St. Albans Bay	Annual load limits calculated at 0.2/0.8 mg/L	Stormwater retrofits for 13% of non-road impervious area, and 25% of paved roads on A and B soils. Using infiltration practice and the 0.5 inch runoff depth	Treatment of 65% of hydrologically connected unpaved roads	5% reduction from forest land – see text	Streambank erosion control (or management to the equilibrium condition) for eroding reaches above the 25th percentile P loading level	80% reduction based on barnyard management BMP	Enhanced BMP scenario (see description in text) Assoc. P reduction: 75%
12. Missisquoi Bay	Annual load limits calculated at 0.2/0.8 mg/L	Stormwater retrofits to 60% of non-road impervious cover on A, B and C soils, 50% of paved roads treated on A and B soils, and 25% of paved roads over C soils, all at the 0.9 inch runoff depth except for the 0.5 inch runoff depth for paved roads over C soils Infiltration practice for A & B soils; wetponds for C soils.	Treatment of 100% of hydrologically connected unpaved roads	50% reduction from forest land based on focused AMP impl. + measures as described in text	Extra streambank erosion reduction such that a 75% reduction is achieved from highly eroding reaches (above the 25th percentile) and a 55% reduction from less eroding reaches (below the lowest 25th percentile), which = 68.5% reduction overall	80% reduction based on barnyard management BMP	See description in text Assoc. P reduction: 83%
13. Isle LaMotte	Currently permitted loads	Retrofits for 25% of paved roads on A and B soils using infiltration practice and the 0.5 inch runoff depth. Retrofit treatment for non-road impervious cover would apply only to the amount of impervious area needed to account for the future growth allocation	Treatment of 65% of hydrologically connected unpaved roads	5% reduction from forest land – see text	N/A	80% reduction based on barnyard management BMP	Enhanced BMP scenario (see description in text) Assoc. P reduction: 71%

*Back roads are part of the developed land category, but described separately in this chart for ease of displaying the scenario information

**Used to determine maximum feasible reductions. Actual agricultural load allocations were set to the amount needed to attain standards, taking into account reductions from other sectors.

Table B2. Percent Phosphorus reductions generated by the TMDL scenario summarized in Table B1. Note that these reductions are not always identical to the allocations in the TMDL: They are the reductions generated by the scenario, and were used to help derive the allocations. For example, the developed land reductions were adjusted (to derive the final developed land WLAs) using the results of the future growth analysis completed by VTDEC, as described in the TMDL document.

Lake Segment	Wastewater[1]	CSO	Developed Land	Forest	Streams	Agriculture
01. South Lake B	0.0%		20.6%	40.0%	46.7%	63%
02. South Lake A	0.0%		18.1%	5.0%		65%
03. Port Henry			7.6%	5.0%		70%
04. Otter Creek	0.0%		12.9%	5.0%	40.1%	55%
05. Main Lake	61.1%		16.2%	5.0%	28.9%	56%
06. Shelburne Bay	64.1%		10.2%	5.0%	55.0%	61%
07. Burlington Bay	66.7%	10.0%	11.0%	0.0%		0.0%
09. Malletts Bay	0.2%		16.5%	5.0%	44.9%	55%
10. Northeast Arm			6.4%	5.0%		64%
11. St. Albans Bay	59.4%		7.9%	5.0%	55.0%	75%
12. Missisquoi Bay	51.9%		32.2%	50.0%	68.5%	83%
13. Isle La Motte	0.0%		6.8%	5.0%		71%
TOTAL	42.1%	10.0%	20.7%	18.7%	45.4%	65%

[1]Percent change from current permitted loads

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