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POTENTIAL FOR DEVELOPMENT OF A MARKET FOR TOPSOIL PRODUCT FROM BIOSOLIDS AT THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

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POTENTIAL FOR DEVELOPMENT OF A MARKET FOR TOPSOIL PRODUCT FROM BIOSOLIDS AT THE METROPOLITAN WATER RECLAMATION DISTRICT OF GREATER CHICAGO

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INTRODUCTION

Many wastewater treatment districts that compost their biosolids have a long history of successfully marketing their compost to private citizens, commercial entities, and other governmental agencies. Compost is made to meet the Class A exceptional quality criteria of the U.S. Environmental Protection Agency Part 503 rule, making it acceptable for unrestricted use. Examples of successful compost programs include the city of Coeur D'Alene, Idaho, King County, Washington, and Los Angeles, California. Compost from Coeur D'Alene is used in the city parks. King County compost, Groco, is used by commercial landscapers. Kellogg Supply produces compost from Los Angeles biosolids that is sold in retail markets. One of the primary reasons for the large number of successful composting operations is the high demand from each of the sectors mentioned for a high quality soil material. Biosolids compost, as a stable soil material with a defined market niche, is well accepted by the public.

It is also possible to produce biosolids products that meet Class A quality criteria without composting. Some examples of the treatment technologies that are used to produce Class A biosolids include pelletization, lime stabilization, drying, and two-phased aerobic/anaerobic digestion. While each of these technologies produces a product that meets the same health criteria (pathogen reduction and metal concentrations) as compost, not all are as consumer friendly. In addition, the market base available for the material produced by these technologies can be considerably different.

The use of wet Class A centrifuge cake biosolids is not a common practice. However, Class A centrifuge cake has the potential to become the most economically viable beneficial use option for many municipalities. As costs of Class A technologies and hauling of biosolids increase, local use of Class A centrifuge cake biosolids becomes more attractive. Some of the major challenges affecting the feasibility of local marketing of Class B centrifuge cake are odor potential and handling characteristics of the material.

This review presents the approach that various municipalities took to successfully market alternative types of Class A biosolids products. Details are provided on the following:

1. Impetus for the development of new products
2. The process of product development
3. Challenges encountered in developing the product and market
4. Program costs
5. Targeted markets
6. Challenges for future development costs

The city of Tacoma, Washington has one of the most successful programs for utilization of Class A centrifuge cake biosolids, and has served as a model for other municipalities. Therefore, most of the information presented in this review focus on the Tacoma program. Other municipalities that have attempted to or are in the process of adopting the Tacoma model of biosolids management are also described.

TACOMA, WASHINGTON

Impetus for New Biosolids Products

The city of Tacoma, Washington serves less than 200,000 people and produces about 4,000 dry tons of biosolids annually. The city produces a Class A biosolids cake using a two-phased aerobic/anaerobic digestion system. This system produced a cake that was much more odorous than biosolids produced through conventional anaerobic digestion, but the treatment process was adjusted to reduce odor significantly. The finished cake is similar in appearance, odor, and moisture content to a typical anaerobically stabilized biosolids cake dewatered using belt filter press, with solids content of approximately 22 to 24 percent.

When the water reclamation plant (WRP) was upgraded in 1987 to the production of Class A biosolids, the program managers initiated the attempt to market the material locally because Class A quality might be attractive to the local market. The cake was given a product name in anticipation of developing this local market. The first efforts to market the dewatered cake were not successful. Public acceptance and demand for the material was very low, primarily because of the odor, appearance, and poor consistency.

Process of Product Development

The program managers began experimenting by mixing the cake with other materials. The idea to mix the cake with other materials was inspired by a local soil dealer who mixed manures with other materials to make marketable products. These initial trials were done manually, using a shovel to scoop from the various piles of materials. The ideas for the materials to be used in the mixture, which included sand and sawdust, were also borrowed from the local soil dealer. The development of the final formulation, which is currently used, took several iterations over a one-year period.

Customer feedback was an essential part of the development process. When Tacoma began making the TAGRO product, the city used poor quality sand that was delivered to its facility at no cost. This poor quality sand resulted in a blended product that lacked uniformity in size and contained weed seeds. To overcome the challenge of non-uniformity, the customers screened the material before use in their gardens, but the weed seeds were still a source of customer dissatisfaction. TAGRO switched to a sand that is more expensive, but is uniform in size and guaranteed weed-free. As TAGRO developed their product in response to customer feedback, they realized the importance of making a uniform soil mix to meet the requirements of their customer base. This blend, consisting of 40 percent biosolids cake, 40 percent sawdust, and 20 percent sand, is still produced and is marketed as *TAGRO Classic*.

TAGRO recently funded research at Washington State University to develop additional soil products. This research resulted in the development of TAGRO mulch and TAGRO potting soil products. The mulch is a blend containing 20 percent cake and 80 percent aged wood chips. The wood chips are purchased from a local dealer. The potting soil contains 20 percent cake, 20 percent sawdust and by volume 60 percent wood chips. The source of sawdust is the same as

used in *TAGRO Classic*. The mulch needs to be aged for a few weeks after mixing to improve the stability before it is marketed.

Challenges in Product Development

The mulch is the most popular of the three products now produced using the anaerobic cake. One of the challenges facing the marketing of the new products is that customer demand for the different mixes is unpredictable. In 2005, the demand for mulch was much greater than supply. Once this product was offered, TAGRO has had a waiting list for the mulch during most of the year. Supply of cake exceeded demand for the end of 2005. In 2006 for example, the TAGRO had a large tarped pile (15,000 cubic yards) of a mixture of cake and sand. The decision to store surplus cake as a blend with the sand helped to reduce odor. However, during the 2005-2006 winter, Tacoma did not have a good estimate of the demand for the different products. The demands for both the potting soil and the mulch were much greater than the demand for *TAGRO Classic*. Since sand is not included in the mulch, the stockpile of blended biosolids cake and sand could not be used for production of mulch. Therefore, customers had a long wait before the mulch could be available. The supply of mulch is also restricted by the city's lack of space for production of mulch. The mulch is a mix of one part cake to four parts woodwaste, and requires a relatively large area for mixing and storage. One of the salesmen at TAGRO indicated that a landscaper requested up to 500 cubic yards of mulch, but it was not available at the time. This is a perfect example, which shows that it is difficult to keep commercial clients, if the product is not available when it is needed.

TAGRO is evaluating an approach for making a base mixture that can be stored then used to make all three products. This would give additional flexibility to the program and capture a wider range of commercial clients. Dan Thompson, the Wastewater Treatment Division manager, also recognized that the viability of *TAGRO Classic* market is dwindling. The demand for the two other products is much higher and the revenue from selling those products is also higher than from the *TAGRO Classic*. It appears that the newer products have good market niches and have effectively made the basic product, *TAGRO Classic*, obsolete.

Program Costs

Dan Thompson, the Wastewater Treatment Division manager prepared a cost/revenue analysis of the program for the Northwest Biosolids Management Association (NBMA) annual meeting in 2005 (Table 1). He calculated costs for the program, beginning at the sludge processing stage of wastewater treatment. A high percentage of the production costs are due to labor associated with eight full time operators. Wage costs for 2003-2005 averaged almost $600,000. The wage costs include personnel for mixing, delivery, and marketing. In addition to wages, there are costs for purchasing the different components of the product mixtures. The materials used in the mixtures include a uniform weed-free high quality sand, sawdust, and aged wood waste. The cost of these materials used in 2004 and 2005 averaged about $200,000. In 2004 and 2005, the total program costs, which include fuel and vehicle maintenance, were about $840,000. Product sales, however, have increased during the 2003 through 2005 period, with total revenue of $341,000 in 2003 and $438,000 in 2004. Expected revenue for 2005 was $530,000.

Table 1: Costs ($) for the Tacoma biosolids program for 2003-2005

	2003	2004	2005
Biosolids Production (dry tons)	3,379	3,465	4,109
Production Cost ($)[1]			
Cost per dry ton	240.62	241.67	244.17
Total	**813,065**	**837,396**	**1,003,274**
Revenue ($)			
Product Sales	224,088	327,052	400,000
Revenue from Product Delivery	117,066	111,423	130,000
Total	**341,154**	**438,475**	**469,805**
Net Loss ($)			
Loss per Dry Ton	139.66	126.54	130.11
Total	**471,910**	**398,921**	**533,469**

[1] Includes costs from sludge processing through distribution of final products.

TAGRO has revised its pricing schedule because of the development of new products and the growth of off-site customer demand. The *TAGRO Classic* was initially available at no cost to residents that picked up the material from the plant. However, these new products are sold. The cost and revenue for each of the different TAGRO products are summarized in Table 2.

Liquid application to agricultural fields has been the backbone of Tacoma's biosolids management program. It now accounts for only about 12 percent of the total biosolids production with the remainder going to retail customers. The initial target for the retail portion of their biosolids program was people coming directly to the plant, but this approach was not successful for marketing cake. The material began to develop a market niche only when the cake was mixed with sand and sawdust to make *TAGRO Classic*.

Targeted Markets

The city has developed both a delivery business as well as a client base that includes high volume clients and homeowners. One of their high volume clients has a bark blowing business that came to the plant for TAGRO products for use in a small landscaping project. This company has since purchased truckloads of TAGRO products for large projects. Within the city, the Streets and Grounds Division, and the Department of Transportation are regular customers. The Department of Parks operates somewhat independently of the city and generally buys pure

bark instead because the cost per cubic yard is $3.00 less than for TAGRO. In general, one of the primary marketing strategies adopted by the city is, "Make the best and most competitively priced product in the business."

Table 2: Costs and fees for each of the three TAGRO products[1]

		TAGRO Product		
		Mix	**Mulch**	**Potting Soil**
Materials	---------- $/cubic yard ----------			
Sand	10.00	2.00 (20)[2]	---	---
Sawdust	2.50	1.00 (40)	2.00(80)	0.63(25)
Wood Chips	12.00	---	---	6.00(50)
Cake	0.00	0.00(40)	0.00(20)	0.00(25)
Total		**3.00**	**2.00**	**6.63**
Labor				
Blending	35.57	1.64	0.33	0.32
Turning	35.57	---	3.77	1.62
Loading	35.57	0.21	0.17	0.32
Total		**1.85**	**4.27**	**2.26**
Equipment				
Loader	30.00	1.38	3.49	1.91
Shredder	25.00	0.38	0.24	0.23
Total		**1.77**	**3.73**	**2.14**
Marketing and Distribution		**1.89**	**1.89**	**1.89**
Total Cost		**8.51**	**11.89**	**12.92**
Price		**10.00**	**14.00**	**30.20**
Margin		**1.49**	**2.11**	**17.08**

[1] Data provided by Daniel Thompson, Wastewater Treatment Manager, city of Tacoma.
[2] Values in parentheses represent percent of raw material in TAGRO product (volume basis).

In 2006, TAGRO began an aggressive attempt to market their materials to large-scale users. This has been done by targeting different types of operations, including the local military base, Fort Lewis. They have also started to identify large land developers as potential clients. Much of this has been done with cold calls. However, a portion has also been done by aggressively pursuing previous occasional clients. TAGRO staff has started looking in the local business journal to identify large construction projects that might become TAGRO customers. One potentially viable local market that they are yet to determine how to penetrate is the small landscaping companies. They also try to follow gardening and landscaping trends. They always put tremendous effort in their displays at the local garden show. In 2006, their display focused on container gardening. This type of gardening is gaining popularity and may provide a market

for the TAGRO potting soil. The mark-up on the potting soil is substantially higher than on *TAGRO Classic*, so additional sales of potting soil would increase profitability. In 2006, TAGRO started bagging their potting soil and selling it to a local nursery. The bagged material has been very profitable, but the potential of this market is uncertain.

TAGRO maintains a web site (http://www.tagro.com) to promote its biosolids management program and advertise its products. The web site has sections for the home user as well as the commercial user. The home page starts with the question, "How does your garden grow?" which is followed by the reply, "With TAGRO premium soil products, it will grow faster, greener, better." There is a section on the web site called 'What's in TAGRO'. Here the emphasis is on the beneficial plant nutrients in the TAGRO products. It notes that research at two local universities have shown that TAGRO is better for plants than commercial or chemical products. The web site also mentions that TAGRO is made from Class A biosolids (USEPA's highest rating), sawdust, and other gardening elements.

The initial target customer for *TAGRO Classic* was the home gardener. New homes with new lawns were seen as the ideal end use for *TAGRO Classic*. Most of the customers came directly to the plant to pick up the product. In 1992, the WRP established a demonstration garden at its facility, in which a wide selection of vegetables and flowers are grown in the *TAGRO Classic*. The garden serves as an advertisement for the product as well as a community resource. It is a source of ideas for gardeners that come into the plant to pick up the different products. The vegetables from the garden are donated to a community food bank every year.

During the first year of operation of the TAGRO garden, the watermelon from the garden won a first prize in the Puyallup Fair. The market for *TAGRO Classic* increased considerably during 1993-1994. This increase was due to TAGRO's marketing activities, which included adding promotional inserts to home utility bills, participation in the Tacoma Home and Garden Show, and speaking to gardening clubs and other potential customers.

In 2006, TAGRO targeted the container gardening market. To reach this market base, the TAGRO team geared their exhibit at the Home Show to container gardening using TAGRO potting soil. The head of the TAGRO program became a certified Master Gardener in 1997, and this helped to boost the results in the container gardening market. Attempts to advertise in print media and radio have not been successful. The approach that has been most fruitful is to target gatekeepers including master gardeners and the Rose Society and let them effectively become marketing agents for the product.

The Tacoma program has been nationally recognized on a number of occasions:

- Association of Metropolitan Sewerage Agencies - Research & Technology Award, 2004
- Northwest Biosolids Management Association - The Golden Gourd Award, 2003, 2002, 2000
- National Biosolids Partnership - Code of Good Practice Club Certificate, 2000

- U.S. Environmental Protection Agency (USEPA) - Technology Innovation or Development Activities Award, 2004

- USEPA - First Place, Biosolids Recycling Program, 1998

- USEPA - Second Place, Biosolids Recycling Program, 1996, 1995

These awards served as significant recognitions of TAGRO's innovations and help to improve public acceptance of the program, although there were no problems with public acceptance for the range of biosolids products. Program manager, Dan Thompson emphasized that if the odors are minimized, public concerns are essentially eliminated. The single instance of a public acceptance problem occurred when the Tacoma City School District ordered a TAGRO delivery for one of its school grounds. The procurement officer, who has an aversion to biosolids, forced the school to return the TAGRO product. Generally, the Tacoma public is very familiar with TAGRO and uses the products with pride. In classes that I have taught at the University of Washington, when we discuss wastewater treatment and biosolids, I use Tacoma as an example. Many students give testimonials that their relatives or friends use TAGRO products and are very satisfied with the performance of the products.

The number of blue ribbons that TAGRO has won at the Puyallup Fair and the word of mouth from satisfied customers for this home-grown product might have contributed most to high public acceptance. Other promotional efforts include distribution of TAGRO logo on hats, pens, and tattoos.

Challenges and Future Development

There is a well-defined seasonal aspect to the production and marketing of the TAGRO products. The wet winters are a very difficult time to sell products. For example, in spring 2006, there was quite a large stockpile of products due to 27 consecutive days of rain experienced in the Northwest. Demand for biosolids products would be highest in the spring and fall, lower in the summer, and almost no demand in the winter. The sales of TAGRO (through both delivered and pick up at the plant) are shown in Figures 1 and 2. The data in the figures show the seasonal variability. However, all the TAGRO products are not equally available throughout the year. For example, if the mulch was available throughout the year, it would represent a larger portion of the distribution during the year.

Dan Thompson, who heads the Tacoma program pointed out that there are some challenges associated with running a commercial operation under a municipal infrastructure. To handle those challenges, he adopted an approach to operate the TAGRO division independent of the municipal structure where possible. For example, he recently worked with the city to give the TAGRO division the leverage to set prices of new products. This has been a very successful approach, because a minor change in some of the standard products is generally sufficient to classify them as new. As the TAGRO program developed into a more commercial retail structure, better record keeping, such as, tracking production costs, product sales, revenues, and clients were required. These activities were much more challenging under the municipal structure.

An important aspect of the operation is to have the flexibility to determine how the biosolids are utilized or developed into new products in order to improve the overall cost-effectiveness of the biosolids management program. This is especially important as the TAGRO line of soil mixes replace the program of liquid biosolids application to farmland.

Figure 1: Deliveries of TAGRO products by month for calendar year 2005

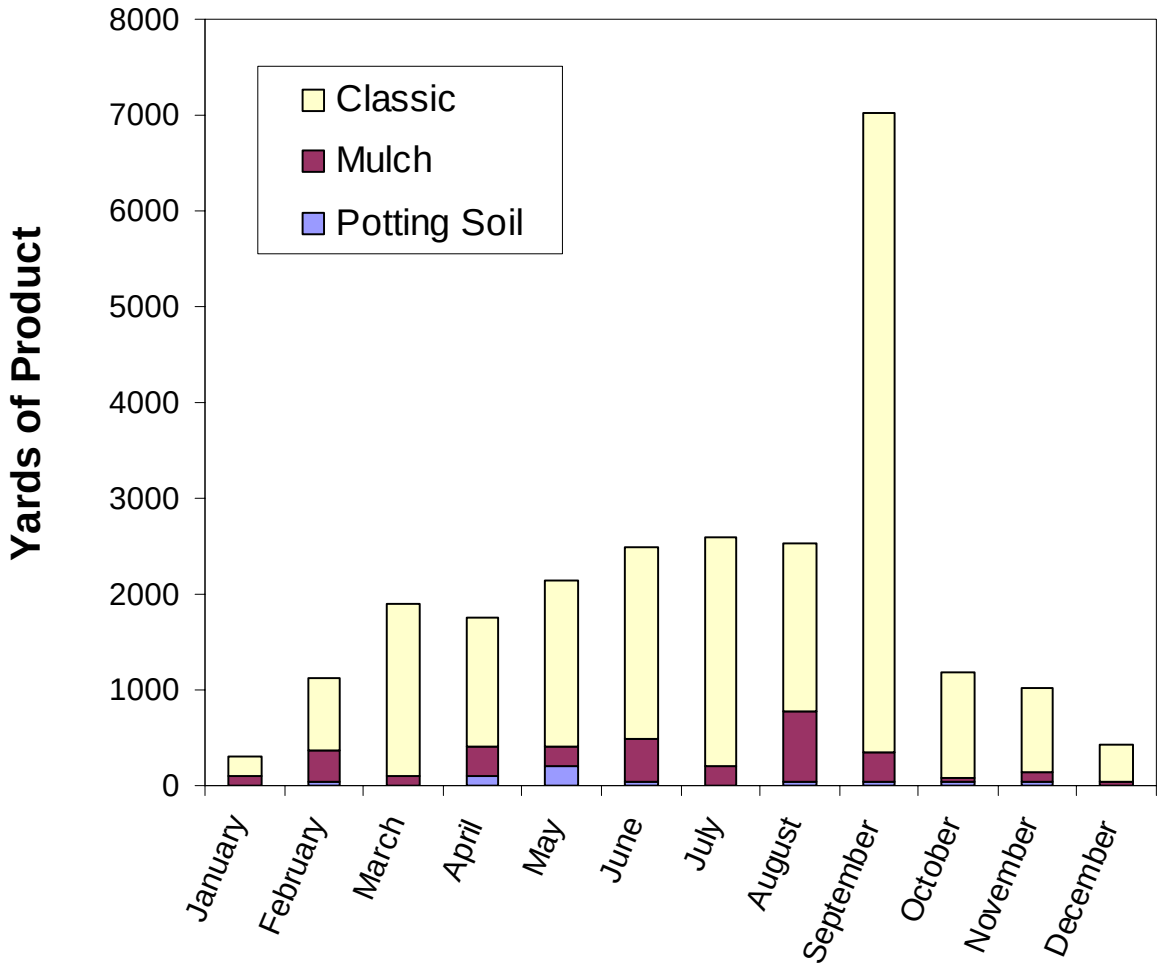
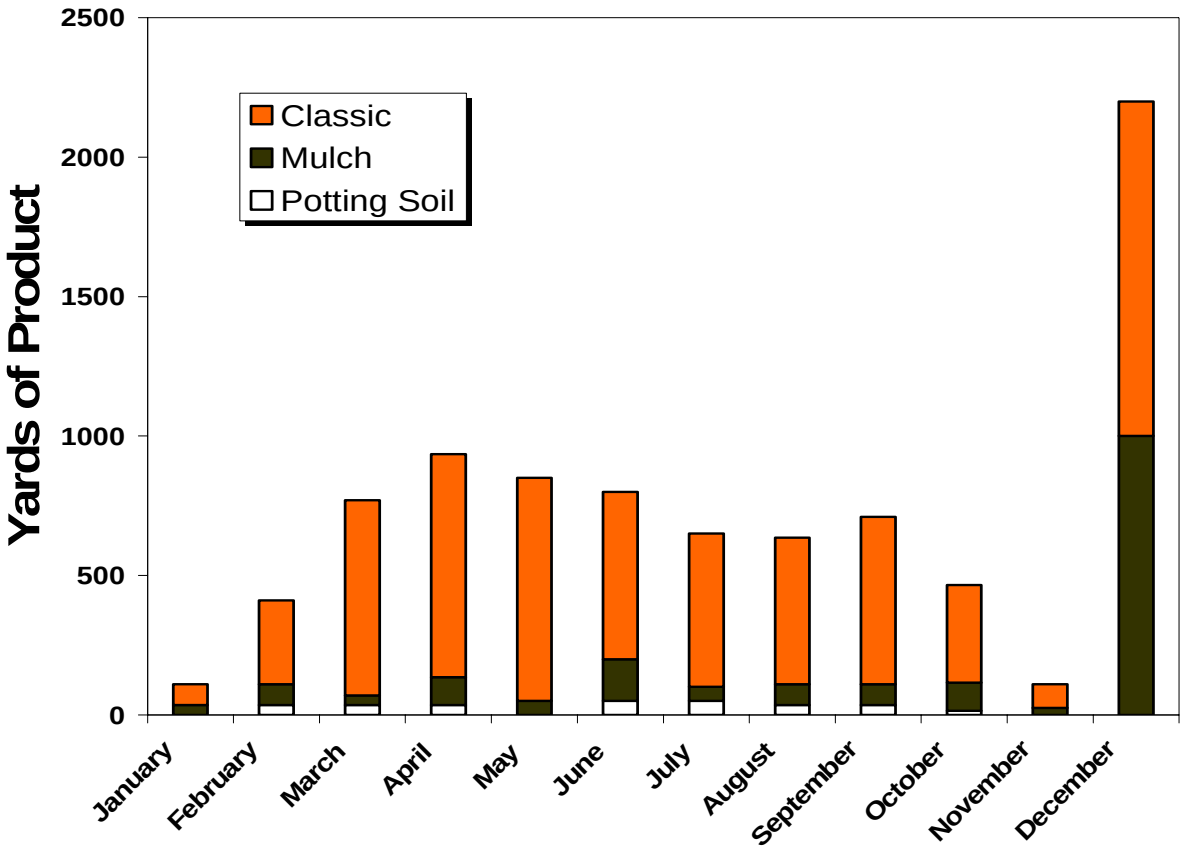


Figure 2: In plant sales of TAGRO products by month for calendar year 2005



Mr. Thompson was given the authority from the city for the TAGRO division to approve the landscaping products that are used at the plant. Although the TAGRO retail and wholesale operations are run somewhat independently of the remainder of the plant operation, there is a great deal of interaction with plant operations, because small changes in plant processes can impact the final product. All employees at the WRP take pride in their biosolids program and are aware that their job is to produce clean water and the biosolids cake that will make the best TAGRO products.

In 2006, the increase in biosolids cake due inadvertently to higher moisture content, the wet winter, and the inflexibility under municipal operation have made the production and marketing of the TAGRO products a challenge. These resulted in large stockpiles of materials at the plant. Due to the lack of adequate tools and space for mixing, the TAGRO division was unable to prepare the blended products, especially mulch in a timely manner to meet the market demands. The TAGRO program manager was dissatisfied with the municipal restrictions that prevented the operation from operating more commercially to improve the profitability of the operation.

ABBOTSFORD, BRITISH COLUMBIA

Impetus for New Biosolids Products

The municipality of Abbotsford in British Columbia, Canada treats wastewater from approximately 160,000 residences with a plant capacity of up to 240,000 residences. The plant uses a dual digestion system that includes a high temperature aerobic pasteurization as well as mesophilic anaerobic digestion to produce a Class A biosolids cake. When plans to produce a Class A cake were developed, the goal was also to make a product that could be distributed locally. Production of materials for local use was viewed as a method of reducing costs and diversify operations.

The concept to make a soil product originated in 1997. Abbotsford retained the services of SYLVIS Environmental in 2003 to design a product that would comply with provincial regulations. In 2004, a facilities plan was developed for the topsoil manufacturing. This included request for proposals for all of the necessary structures and equipment. The manufacturing plant was completed by the end of 2004, and in 2005 a marketing plan was developed along with a name, logo and website. Marketing of the product was started in line with the plan in 2005.

Process of Product Development

The cake is mixed with other materials to create a *Val-E-Gro* soil product. This product was developed by SYLVIS Environmental using the TAGRO mix as a model. SYLVIS designed the mix for the *Val-E-Gro* soil using the British Columbia Organic Matter Recycling Regulation (OMRR) requirements as well as aesthetic features for their target market as guidelines. The BC OMRR regulations specify metal concentrations, total organic matter, C:N ratio, and total Kjeldahl N for the soil mixture. Materials that were locally available and potentially suitable for the final soil product were mixed with the biosolids cake at different ratios. A total of three carbon sources and two types of sand were evaluated along with the biosolids. The final blend includes washed sand, composted bark and biosolids mixed at a 1:1:1 volume ratio. The components are mixed using a front end loader and then put through a Royer Soil Mixer.

The city of Abbotsford also worked with SYLVIS to develop the product name, logo, and brochure. The product name *Val-E-Gro* was selected, as the material is produced by a municipality located in the Frasier River Valley. According to Joe Vurzinger, who runs the biosolids program for the city, 2005 was the first year of production for Val-E-Gro. For the six month period from May to October, 1,500 yards of product (equivalent to 500 yards of Class A cake) were sold or given away. Total production of cake for the municipality is 8,000 yards. The soil product was marketed to local municipal agencies and distributed by “word of mouth” to local landscapers. Mr. Vurzinger has developed a marketing strategy which lists potential markets and divides them into primary and secondary categories. During a tour of the operation in fall 2005, the Northwest Biosolids Management Association met at the Abbotsford city hall then toured the WRP. As we left the municipal building, *Val-E-Gro* soil was being spread on the neighboring fire house lawn. At the treatment plant, our tour of the mixing operations was

interrupted when someone from the city Parks Department arrived with a pickup truck to collect a load of soil.

The city of Abbotsford maintains a website to promote *Val-E-Gro* (www.Val-E-Gro.com). The web site is well designed to market the product. The text in a portion of the site states that: 'Landscape and horticultural professionals know the quality of their work is only as good as their soil. And soil quality is as critical to plant performance as the planting stock and proper maintenance'. The website also mentions that *Val-E-Gro* is a growing media made from biosolids, compost, and washed sand that has been designed to meet horticultural and landscape standards. They also provide a product information sheet with certified analysis. This includes information on macro and micro nutrient content, and on chemical characteristics, such as, organic matter, C:N ratio, pH, EC, bulk density, and cation exchange capacity. Certified testing results are also available. There is no mention of trace element or toxic organic concentrations. As the *Val-E-Gro* soil meets all provincial standards, a listing of these elements in their product sheet is probably unnecessary.

Challenges in Product Development

On the NBMA visit to the *Val-E-Gro* facility, Mr. Vurzinger said that production of the soil would be put on hold for several months. There was a problem with the plant and while that was being repaired, the cake that would be produced would only meet Class B pathogen standards. As this was early in the *Val-E-Gro* soil production, this will probably not have a long-term effect on the sales of the product. However, problems in production and inconsistent availability of a product can become significant hurdles to overcome.

Program Costs

The accounting for the *Val-E-Gro* programs suggests that any sales of product result in significant savings over the land application program. According to Mr. Vurzinger, the *Val-E-Gro* (equal volumes of biosolids, composted bark, and washed sand) production costs and revenues as of October 2005 are summarized as follows:

Class A Biosolids (1 cubic yard)	$ 0.00
Washed Sand (1 cubic yard)	$14.64
Composted Bark (1 cubic yard)	$16.00
Labor Costs	$ 1.24
Capital Costs	$ 0.06
Total Cost (3 cubic yards)	$31.94
Total cost per cubic yard	**$10.65**
Val-E-Gro retail price per cubic yard	$12.00
Net Gain per cubic yard	**$ 1.35**

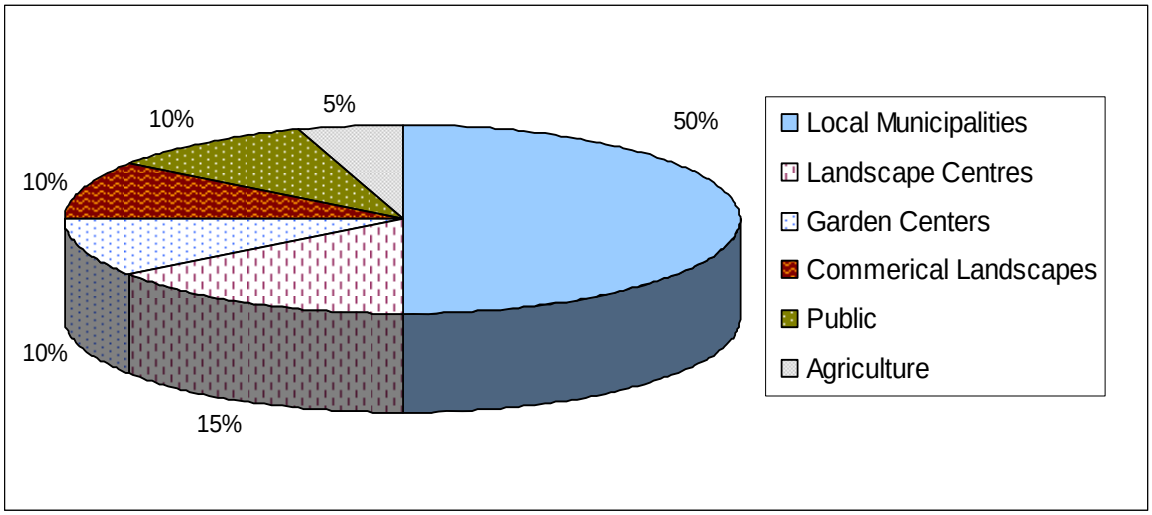
The labor costs are based on 1 hour per 3 cubic yards of soil produced, and includes benefits costs. The capital cost is based on 20-year straight line depreciation of equipment and fixed assets.

The diversion of biosolids to the manufacture of *Val-E-Gro* instead of utilization for mine reclamation, which cost $28.20 per cubic yard, provides additional cost savings to the biosolids management program. Therefore, the diversion of biosolids to *Val-E-Gro* production results in a total savings of $29.55 per cubic yard.

Targeted Markets

Val-E-Gro developed a marketing strategy along with their product. As this operation is "cutting-edge" for both the Fraser Valley and the Greater Vancouver area, the goal for the first year involved educating the potential market base with an emphasis on customer service. The target market for the product is shown in Figure 3.

Figure 3: Utilization of *Val-E-Gro* soil mix produced by the city of Abbotsford



According to Mr. Vurzinger, "Our growth plan would ultimately be to produce all of our biosolids into a profitable product, but I don't think that will happen nor do I think it's prudent for our biosolids program to be dependent on one option. I would like to see at least half of our annual production of biosolids developed into a soil product and work on other utilization programs for the other half." While he did not provide a cost breakdown, Mr. Vurzinger said that the soil product is a much more cost effective alternative than application to farmland. Most of the cake is used for mine land reclamation at the Highland Valley copper mine.

MADISON, WISCONSIN

Madison, Wisconsin has a highly successful Class B farmland application program. However, they are in the process of developing a soil product from Class A cake using the TAGRO program as a model. Although the Madison program is highly successful, the cold winters limit the window when agricultural field applications are available. With this narrow window for land application, Madison has had to maintain large storage facilities for the biosolids cake. As the city population is growing, the available storage capacities at their facilities are diminishing. Wet weather conditions during the period of the year when land applications are generally feasible will further exacerbate the available storage capacity. The primary drivers for developing a Class A soil mix from their biosolids are to eliminate the need for extra storage facilities and reduce the dependence of their program on factors that are beyond the city's control, such as weather.

Dave Taylor, the director of the Madison biosolids program had initially intended to contract out their product development to a company that was familiar with manufactured soils. He has since decided to make a product in-house. The municipality has a very successful Class B program with high public acceptance. As information about future production of a biosolids-based soil product is circulated by word of mouth, demand for the product is already building. At the 2005 NBMA annual conference, Mr. Taylor predicted that demand for the biosolids soil product will be high enough to utilize most of their biosolids through this outlet, to the extent that it might be difficult to maintain the agricultural land application program.

GREATER VANCOUVER REGIONAL DISTRICT, BRITISH COLUMBIA

The Greater Vancouver Regional District (GVRD) treats wastewater from approximately 2 million households and produces about 20,000 dry tons of biosolids annually. The district operates five WRPs, with the largest treating about 50 percent of the total wastewater flow. Class A biosolids using anaerobic thermophilic digestion is produced only at the large WRP. The other plants use a mixture of treatment technologies, including anaerobic mesophillic digestion and lagoon stabilization.

At the WRPs where the biosolids cake is stabilized in lagoons, GVRD had a "give away" program for the lagooned cake, but stopped that practice because of public safety concerns. Residents still go to the plants requesting for biosolids. Most of their biosolids are used for mine land reclamation and rangeland fertilization. Using TAGRO as a model, GVRD has experimented with blending their Class A cake with other materials to make soil products. They have developed a number of soil mixes, but have a limited distribution for these materials. The concerns of upper management staff regarding the safety of biosolids have limited the ability of GVRD to aggressively manufacture and market their soil products.

The municipality is planning to upgrade all its WRPs to secondary treatment, so it is conducting an extensive review of its biosolids management program to evaluate options for the future. Landfilling and incineration are being considered, along with land application as end use alternatives. In this evaluation, the soil products have been grouped with mined land application and range application. Potential savings associated with local distribution and sales of the soil products have not been taken into account. Concerns about the safety of biosolids and public acceptance have made the municipality hesitant to fully endorse its products.

RECOMMENDATIONS FOR MWRDGC

Type and Quantity of Biosolids

The Metropolitan Water Reclamation District of Greater Chicago (MWRDGC) produces about 180,000 dry tons of biosolids annually. A high percentage of these biosolids are processed to Class A through a USEPA-certified Process to Further Reduce Pathogens, which includes lagoon aging and air drying. Since these Class A biosolids are relatively dry, it is more consumer friendly than the cake produced in the cities of Tacoma and Abbottsford. If MWRDGC blends its air-dried biosolids with other materials, this might help to increase its current customer base for bulk distribution and provide an opportunity to develop a retail customer market. This has the potential to reduce program costs, diversify utilization options, and increase public acceptance of municipal biosolids. This also has the potential to contribute to MWRDGC's environmental stewardship and public relations. In evaluating the economic feasibility of blending biosolids with other materials at its facilities, MWRDGC should consider the costs associated with handling the other materials used in blending. Based on the experience of the TAGRO Program, up to four cubic yards of other materials will need to be handled per cubic yard of biosolids.

Potential Challenges in Product and Market Development

One of the main challenges that might affect the expansion of MWRDGC's efforts to manufacture and market topsoil material from its air-dried biosolids is the climatic conditions, which provide a relatively narrow window for production and utilization of biosolids and manufactured products. It is quite likely that MWRDGC could market biosolids-based soil products that would utilize a high portion of its biosolids. Compared to the smaller municipalities, MWRDGC biosolids production is very high and even as little as 10 percent of its annual production would require a large footprint for operation of a soil manufacturing facility.

The other municipalities that have successfully built businesses based on biosolids cake have been considerably smaller than the MWRDGC. The TAGRO program operated by the City of Tacoma has a successful track record for manufacture of materials from it biosolids cake. Changes in available technology, increasing transport costs, and improved biosolids quality make the potential for adoption of the TAGRO model more realistic for other municipalities. If MWRDGC adopts approaches similar to TAGRO, MWRDGC would be a leader in the topsoil manufacture business. The large number of successful compost operations operated by larger municipalities (similar to this in that a recognizable product is produced) suggests that larger municipalities can also successfully market biosolids-based soil blends.

Customer Base

To successfully develop a market for their products, MWRDGC has to first develop products and then slowly build a reputation and a consumer base for their products. This part of the operation has to be given enough independence and resources to do this successfully. The success of this type of operation will depend mainly on the ability of MWRDGC staff to provide

technical assistance to the landscapers, home gardeners and developer. Other requirements that should be considered for a cost-effective topsoil manufacture operation are a realistic accounting system and the flexibility of program staff in managing the operation.

Future Development

Based on the quality of biosolids marketed or used in manufacture of topsoil, there is potential for odor when the materials are rewetted. There can also be problems with material that is too dry. Dan Thompson from Tacoma suggested that it might be possible to create a soil mix with some wetter ingredients and then let the material cure for a short period with mixing to let any odors dissipate.

There are many approaches that MWRDGC can implement to develop a successful and profitable topsoil manufacture program. One option for MWRDGC would be to work in cooperation with a private company, such as a soil manufacturer that will use the biosolids to blend with other materials. Under such arrangement, the primary responsibility of MWRDGC would be to make high quality Class A biosolids consistently. The private company will have more experience with soil manufacture and the marketing of topsoil and could gradually take increasing quantities of biosolids. Other options that can be considered in this type of arrangement is that the cost of the biosolids to the contractor can be variable based on the demand for the manufactured product. An additional approach can be that MWRDGC pays partial funding for the start-up costs for this project. The feasibility of these options will depend largely on MWRDGC's administrative and budgetary constraints.